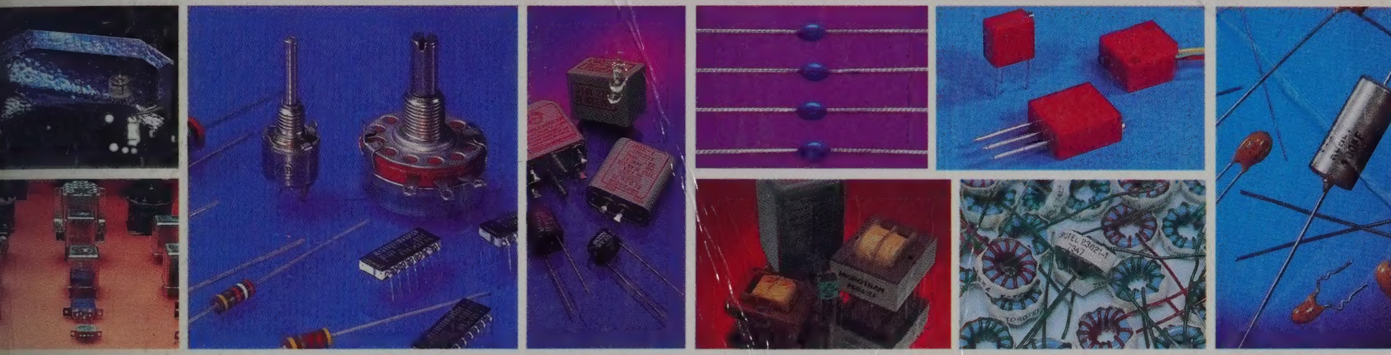
eem 84 85

electronic engineers master catalog

VOLUME 1A



electronic components

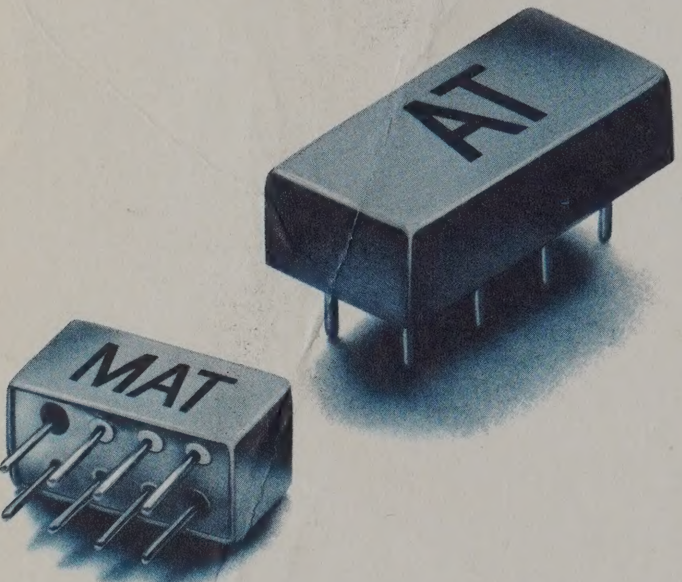
27th EDITION

1500	Capacitors
1800	Coils, Chokes, & Inductors
2300	Crystals, Oscillators, Crystal & Piezoelectric Filters
2350	Delay Lines
2700	Filters (Excl. Crystal & Piezo Filters)
3130	Integrated Circuits, Hybrid Circuits, & Function Modules
3450	Microwave Components
4700	Resistors
4750	Potentiometers, Trimmers, Controls, & Rheostats
4800	Discrete Semiconductors
5600	Transformers
5700	Electron Tubes

volume 1B	Electromechanical, electro-optical, and military components
volume 2	Interconnections, packaging, and hardware
volume 3	Power sources, instrumentation, computer products, and equipment

BPA Hearst HEARST BUSINESS COMMUNICATIONS, INC.

gain from attenuators ?



AT Series	MAT Series	Attenuati (dB)
AT-1	MAT-1	1
AT-3	MAT-3	3
AT-6	MAT-6	6
—	MAT-9	9
AT-10	MAT-10	10
—	MAT-12	12
—	MAT-15	15
AT-20	MAT-20	20
AT-30	MAT-30	30
AT-40*	MAT-40*	40

AT Series $3.95 (10-49)
MAT Series $4.95 (10-49)

Frequency Range DC-1500 MHz
power (max.) MAT = 0.5W, AT = 1W
*Frequency Range DC-500 MHz

YES Gain system reliability and improved performance using Mini-Circuits' low-cost, DC to 1500 MHz attenuators. Minimize interaction between subsystems (for example, mixer and amplifier) and eliminate spurious signals and oscillation by proper input/output matching. And only $1.95 (AT-Series, 1000 qty.)

Choose from over a dozen models (1 to 40 dB) in the compact AT-Series (0.8 X 0.21 X 0.2 in.) or tiny MAT-Series (0.5 X 0.21 X 0.25 in.) housed in a rugged, hermetically-sealed metal case meeting MIL-STD-202. VSWR is less than 1.2:1 (typ.), frequency response is flat ±0.3 dB (typ.), and nominal attenuation is within ±0.3 dB (typ.). Exceptional repeatability is achieved by laser trimming internal resistors.

No waiting, immediate delivery. One-year guarantee. Call or write for 64-page catalog or see our catalog in the Gold Book, EBG, EEM or Microwave Directory.

DESIGNERS KIT AVAILABLE:

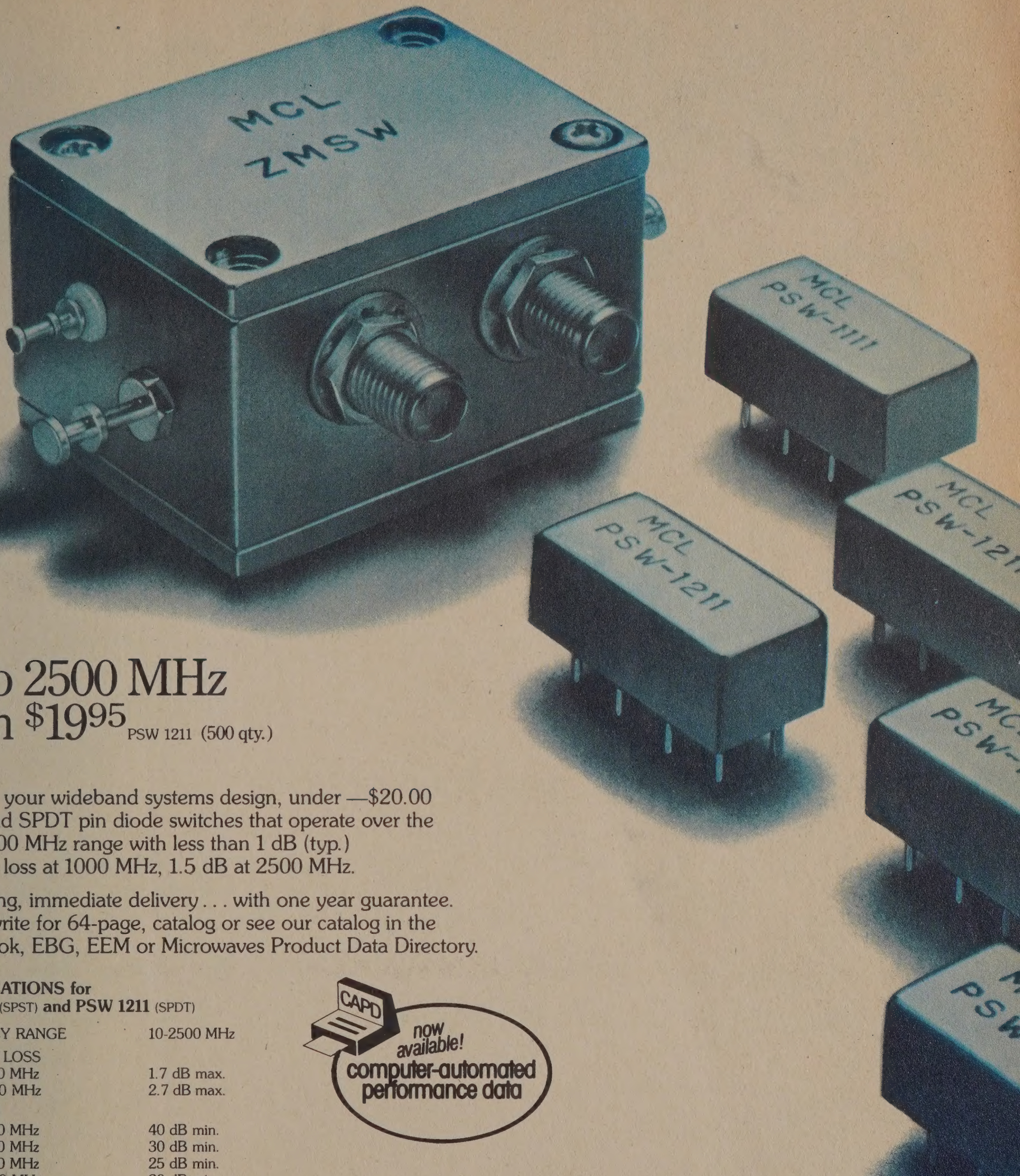
KAT-1 . . . 4 of each AT (3,6,10,20 dB), only $39.95
KMAT-1 . . . 2 of each MAT (3,6,9,10,12,15,20 dB), only $39.95

finding new ways . . .
setting higher standards

Mini-Circuit
A Division of Scientific Components Corporat
World's largest manufacturer of Double Balanced Mix
P.O. Box 166, Brooklyn, New York 11235 (212) 934-45
Domestic and International Telex 125460 International Telex 6201

C81 REV. OR

RF switches



0 to 2500 MHz
rom $\$19^{95}$ PSW 1211 (500 qty.)

ow, for your wideband systems design, under —$20.00
PST and SPDT pin diode switches that operate over the
0 to 2500 MHz range with less than 1 dB (typ.)
nsertion loss at 1000 MHz, 1.5 dB at 2500 MHz.

o waiting, immediate delivery . . . with one year guarantee.
all or write for 64-page, catalog or see our catalog in the
old Book, EBG, EEM or Microwaves Product Data Directory.

PECIFICATIONS for
SW 1111 (SPST) **and PSW 1211** (SPDT)

REQUENCY RANGE	10-2500 MHz
SERTION LOSS	
10-2000 MHz	1.7 dB max.
2000-2500 MHz	2.7 dB max.
OLATION	
10-500 MHz	40 dB min.
500-1000 MHz	30 dB min.
1000-2000 MHz	25 dB min.
2000-2500 MHz	20 dB min.
WR	1.5 max. ("on" state)
WITCHING SPEED	1 μsec. (max.)
AXIMUM RF INPUT	+20 dBm
ONTROL	+5 V (5 mA max.)
PERATING TEMPERATURE	−54°C to +100°C
TORAGE TEMPERATURE	−54°C to +100°C
RICE (6-24)	
PSW 1111	$29.95
PSW 1211	$29.95

CAPD
now available!
computer-automated performance data

finding new ways . . .
setting higher standards

Mini-Circuits
A Division of Scientific Components Corporation
World's largest manufacturer of Double Balanced Mixers
P.O. Box 166, Brooklyn, New York 11235 (212) 934-4500
Domestic and International Telex 125460 International Telex 620156

C80 REV. ORIG.

SRA-1
SBL-
SBL-1
LMX-113
TFM-2
ASK-1

pick a mixer

500 KHz to 1 GHz from $3⁹⁵ hi-rel and industrial miniature, flatpack, and low profile

MODEL	FEATURES	Freq. (MHz)		†Conversion Loss (dB)		L-R Isolation (dB)			Price/Q
		LO-RF	IF	one octave bandedge	total range	lower bandedge	mid range	upper bandedge	
SRA-1*	the world's standard . . . HTRB tested hi-rel 3 year guarantee	.5-500	DC-500	5.5 typ.	6.5 typ.	50 typ.	45 typ.	35 typ.	11.95 (1-
TFM-2*	world's tiniest hi-rel mixer only 4 pins for plug-in/flatpack mouting,	1-1000	DC-1000	6.0 typ.	7.0 typ.	50 typ.	40 typ.	30 typ.	11.95 (6-
SBL-1	world's lowest cost industrial mixer, only $4.50, metal case	1-500	DC-500	5.5 typ.	6.5 typ.	50 typ.	45 typ.	35 typ.	3.95 (1 4.50 (10-
SBL-1X	industrial grade, rugged all-metal construction	10-1000	5-500	6.0 typ.	7.0 typ.	50 typ.	40 typ.	30 typ.	5.95 (1
ASK-1	world's smallest DBM flatpack mounting, plastic case	1-600	DC-600	5.5 typ.	6.0 typ.	50 typ.	35 typ.	30 typ.	5.95 (10-
LMX-113*	rugged flatpack, hermeticity tested thermal shocked to MIL-STD-202	5-1000	DC-1000	6.5 typ.	7.0 typ.	50 typ.	40 typ.	35 typ.	14.95 (6-

***meets MIL-M-28837/1A performance**
units are not QPL listed

†LO = +7 dBm

CAPD
now available!
computer-automated performance data

finding new ways . . .
setting higher standards

Mini-Circuit
A Division of Scientific Components Corpora
World's largest manufacturer of Double Balanced Mix
P.O. Box 166, Brooklyn, New York 11235 (212) 934-45
Domestic and International Telex 125460 International Telex 6201

C74 REV

eem 84 85

contents

How to use EEM .... 1A•2
Alphabetical Index of Manufacturers' Catalog Data Pages .... 1A•4
Alphabetical Index of Distributors' Advertisements .... 1A•8
Product Index & Directory .... 1A•9
Manufacturers & Sales Offices Directory .... Yellow Pages 601
Trademark and Logofinder Directories .... 1B•901
Manufacturers' Catalog Data Pages .... 1A•1001

product sections

1500 Capacitors .... 1A•1002
1800 Coils, Chokes, & Inductors .... 1A•1218
2300 Crystals, Oscillators, Crystal & Piezoelectric Filters .... 1A•1308
2350 Delay Lines .... 1A•1444
2700 Filters (Excl. Crystal & Piezo Filters) .... 1A•1576
3130 Integrated Circuits, Hybrid Circuits, & Function Modules .... 1A•1643
3450 Microwave Components .... 1A•1684
4700 Resistors .... 1A•1788
4750 Potentiometers, Trimmers, Controls, & Rheostats .... 1A•2016
4800 Discrete Semiconductors .... 1A•2086
5600 Transformers .... 1A•2114
5700 Electron Tubes .... 1A•2366

publisher
WILLIAM F. MULLIN

editor
ASTRID M. SPECTOR

production director
DAN CHILLAK

manager/catalog production
LANNY LEVIN

catalog design director
MICHELLE LANTON ARNOLD

assistant catalog design director
BILL HENNESSEY

art/production supervisor
CHARLOTTE NEWMAN

art staff
GEOFFREY BARTER
CAROL HANSEN
ELLENANN PERSICO
MARIE SANTONASTASO

assistant production manager
BRENDA BUFF

production assistant
LYNN GIARDINA

typography consultant
DON BURCHELL

director of circulation
GEORGEANN JOHNSON

directory coordinators
THERESA MANCUSO
DAVID KIPNES

sales billing supervisor
ALINE LEWIN

sales services
RUTH PFALLER

Hearst Business Communications, Inc./ UTP Division

president
MANLEY P. LUDWIG

vice president
ROBERT J. MALES

director of editorial planning and research
DON SENTER

Hearst Business Communications, Inc.

president
ROBERT J. MALES

The Hearst Corporation

president
FRANK A. BENNACK, JR.

chairman
RANDOLPH A. HEARST

group vice president
books and business publishing
GORDON L. JONES

publishing consultant
RICHARD E. DEEMS

Hearst

Published annually by
Hearst Business Communications, Inc./UTP Division
645 Stewart Ave., Garden City, NY 11530
(516) 222-2500—TWX 510-222-1673 (UTP GRCY)

© Hearst Business Communications, Inc./UTP Division 1984 BPA

CIRCULATION POLICY

EEM/Electronic Engineers Master is distributed on a controlled basis to qualified electronic product specifiers in the United States. An official subscription form is available upon request. Electronic Engineers Master is available to non-qualified personnel in the United States at $65.00 per four-volume set.

Important Notice

Some manufacturers supply pricing information in Electronic Engineers Master. Any such pricing is included solely as a guide and is not intended to be a quotation. All participating manufacturers reserve the right to change specifications and/or prices or to discontinue items without prior notice. While every precaution has been taken to ensure accuracy in content, the publisher cannot be responsible for manufacturers' claims or representations. Nor, can any guarantee be made against the possiblity of error or omission. No portion of EEM may be reproduced by any means without the prior written permission of the publisher.

Cover Photographs Courtesy of

ALLEN-BRADLEY CO.
BLILEY ELECTRIC CO.
LEACH CORP.
ALLEN-BRADLEY CO.
TRW INDUCTIVE PRODUCTS DIVISION
AVX
TECHNO COMPONENTS
MICROTRAN
TOROTEL
KEMET

how to use eem

The 27th edition of EEM has been further arranged, beyond the well-known EEM Product Sections, into four volumes, each composed of related Product Sections. And, for user convenience, each volume contains its own Product Index and Directory (green pages) and its own Manufacturers and Sales Offices Directory (yellow pages). Every Product Heading and every Manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other than that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and find the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the detailed instructions on the first page of this section. Manufacturers with catalog data in this edition of EEM appear in bold face type and page numbers are shown. Manufacturers appearing in light face type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 33 Product Selection Guides included in this edition of EEM! They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

product selection index

Product Selection Index		Vol. 1A	Vol. 1B	Vol. 2	Vol. 3
1100	Amplifier Assemblies, Instrumentation				3•1002
1300	Audio Equipment & Accessories				3•1026
1400*	Cabinets, Enclosures, Racks & Chassis			2•1002	
1500*	Capacitors	1A•1002			
1600	Chemical Compounds (Adhesives, Cleaners, Coatings)			2•1080	
1700*	Circuit Boards (Printed), Materials & Accessories			2•1088	
1800*	Coils, Chokes, & Inductors	1A•1218			
1900	Communications & Telemetry Equipment				3•1064
2000	Computer Peripheral Equipment				3•1068
2025	Computers (Mini/Micro)				3•1105
2050	Computer Software				3•1119
2100*	Connectors, Terminals, & Sockets			2•1096	
2200	Control Systems & Components				3•1120
2300*	Crystals, Oscillators, Crystal & Piezoelectric Filters	1A•1308			
2325	Data Acquisition/Handling Systems & Accessories				3•1140
2350*	Delay Lines	1A•1444			
2400*	Panel Hardware (Bezels, Dials, Knobs, etc.)			2•1756	
2440*	Military Components		1B•1002		
2450*	Displays, Readouts, Lamps, & Lights		1B•1020		
2475	Fiber Optic Equipment & Accessories		1B•1109		
2500	Mechanical Components (Bearings, Cores, Magnets, etc.)			2•1787	
2550	Environmental Test Equipment				3•1173
2600*	Fans, Blowers, Cooling Equipment, & Heat Exchangers			2•1800	
2700*	Filters	1A•1576			
2800	Hardware (Electrical/Electronic)			2•1858	
2825	Hardware (Mechanical)			2•1866	
2900*	Instruments, Test & Measuring				3•1182
2950*	Panel Meters (Analog & Digital)				3•1320
2975*	Instruments, Oscilloscopes				3•1360
3000*	Instruments, Graphic Recording				3•1380
3100	Insulators & Insulating Materials			2•1869	
3130	Integrated Circuits, Hybrid Circuits, & Function Modules	1A•1643			
3200*	Interconnection Systems (Backpanels, Card Holders, Packaging Systems)			2•1872	
3400	Microwave Systems & Subsystems				3•1390
3450*	Microwave Components	1A•1684			
3475	Military Systems & Equipment				3•1394
3500*	Motors, Drives, & Rotating Components		1B•1120		
3700	Electro-optical Equipment		1B•1211		
3800	Packing, Shipping, & Storage Containers & Materials			2•1897	
3900*	Batteries				3•1398
4000*	Power Supplies, DC				3•1438
4050*	Power Supplies, AC				3•1814
4100	Production Equipment, & Manufacturing Services				3•1923
4200	Prototype Boards, Kits & Design Aids			2•1900	
4300*	Protective Components (Fuses, Circuit Breakers, etc.)		1B•1254		
4500*	Relays		1B•1288		
4525	Shields & Shielding			2•1902	
4550*	Solenoids		1B•1480		
4600	Soldering & Desoldering Equipment			2•1924	
4700*	Resistors	1A•1788			
4750*	Potentiometers, Trimmers, Controls, & Rheostats	1A•2016			
4800*	Discrete Semiconductors	1A•2086			
4900	Servomechanisms & Robotic Equipment				3•1929
5100*	Switches		1B•1498		
5150*	Keyboards & Keypads		1B•1758		
5300	Thermal Components		1B•1793		
5400	Tools (Manual & Power)			2•1931	
5500*	Transducers & Encoders		1B•1826		
5600*	Transformers	1A•2114			
5700	Electron Tubes (Including CRT)	1A•2366			
6000*	Wire & Cable			2•1934	

*Product Selection Guide

eem sales offices

Main Sales Office
Hearst Business Communications, Inc.
645 Stewart Avenue
Garden City, New York 11530
(516) 222-2500
TWX: 510-222-1673
CABLE: UNITECH GARDENCITYNY

New England
Hearst Business Communications, Inc.
645 Stewart Avenue
Garden City, New York 11530
(516) 222-2500

New York, New Jersey & Southern Connecticut
The Druker Company
1101 State Road, Building N
Princeton, New Jersey 08540
(609) 921-3686

Pennsylvania & Southeast
The Gittelman Company
Summit Office Centre
7266 Summit Avenue
Philadelphia Suburb
Fort Washington, PA 19034
(215) 646-5700 Atlanta Office (404) 523-1252

Upper Midwest
The Pattis Group
4761 W. Touhy Avenue
Lincolnwood, IL 60646
(312) 679-1100
TWX: 910-223-0736

Lower Midwest
LeBeau Associates
5934 Royal Lane
Preston Center, Suite 230
Dallas, TX 75230
(214) 987-4094

Southern California/ Nevada, Arizona & Utah
Media West
202 Fashion Lane
Suite 207
Tustin, California 92680
(714) 832-5005
TWX: 910-595-1581

Northern California/Pacific Northwest
Hearst Business Communications, Inc.
1333 Lawrence Expressway
Santa Clara, CA 95051
(408) 248-8044

eem 84 85

advertisers' index

To find a specific manufacturer's data pages, an alphabetical index of EEM participants appears in EEM starting on page 1A•4 of Volume 1A and on pages 1B•4, 2•4 and 3•4 of the other volumes.

trademark and logofinder directories

A comprehensive trademark directory is included at the end of the EEM green pages in Volume 1B. NEW in this edition, the EEM logofinder shows the symbols and graphics used by manufacturers as identifiers on their products. Use these pages to locate manufacturers of specific trademarks and logos.

manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System has been revised and updated. The new EEM File System contains a complete Product Index. This Index tells you where to file which catalog. It also contains a cross-reference so you'll know where catalogs are filed.

In order to use the new EEM File System all you need is a supply of standard letter size, third-cut, manila file folders which are available locally. You then use the pressure sensitive labels which are supplied with the File System to go into as much detail as you want (or need).

Each label fits the third-cut file folder exactly. There are 308 of these labels in one System: 1 for the Index, 1 each for the 61 EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus 222 additional labels for System expansion.

The System also includes 61 Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. The price? Only $25.00. Send a check to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $2.00 for postage and handling. NY and CA residents, please add sales tax.

technical information: codes . . . miniglossaries . . . charts . . .

Abbreviations/Acronyms	**1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code	**3**•1103
Capacitors	**1A**•1069
Capacitor Formulas	**1A**•1093
Connectors	**2**•1264
EBCDIC Code	**3**•1153
Encapsulation	**2**•1082
Opto Semiconductors	**1B**•1218
Power Supplies	**3**•1455
Relays	**1B**•1292
Relay Contact Forms	**1B**•1317
Resistor Color Codes	**1A**•1791
Servo Components	**3**•1935
Thyristors & High Power Diodes	**1A**•1652

84 85 Alphabetical Index of Manufacturers Catalog Pages

This index provides an alphabetical listing of manufacturers pages and where to find them

A

Manufacturer	Page No.
Abacus Controls Inc.	3•1818-1820
Abbott Transistor Labs., Industrial Products Div.	3•1441, 1822, 1823
Abbott Transistor Labs., Power Supply Div.	3•1441-1454
Abbott Transistor Labs., Transformer Div.	1A•2117-2123
ACC Electronics	1A•1643
ACDC Electronics	3•1456-1458
Acopian Corp.	3•1461-1495
Active Control Instrmn.	3•1120
ADAC Corp.	3•1143
Advance Conversion Devices Co.	3•1824, 1825
Advanced Interconnections Corp.	2•1102-1104
Advanced Sys. Concepts	1B•1501
Advanced Transformers Inds., Inc.	1A•2264, 2265, 1B•1473
Ad-Vance Magnetics, Inc.	2•1902
Aeroflex Labs., Magnetic Prods. Div.,	1B•1123, 1829
Aeroflex Labs., Microelctrns. Div.	1A•1644
Aerospace Optics Inc.	1B•1503
AirBorn, Inc.	2•1105-1112
Airflyte Elctrns. Co.	1B•1124-1129
Airpax Corporation	1B•1256
Airpax Corporation, Cheshire Div.,	1B•1131, 3•1121
Airpax/NA Philips Controls Corp., Ft. Lauderdale Div.	3•1929
Airpax Corp., Frederick Div., A North American Philips Co.	1B•1291, 1793
Alberox	2•1787
Alco Elctrn. Prods., Inc.	1B•1029, 1504-1514, 2•1758, 3•1122
Alden Products Co.	2•1113-1119
Allen Avionics	1A•1446-1449, 1578-1583, 2124
Allen-Bradley Co.	1A•1788, 1792-1802, 2019-2021, 2088, 2089, 2•1788-1791
Allied Systems Corp.	2•1874
Alpha Wire Corp.	2•1940, 1941
Alps Electric (USA), Inc.	3•1068
Amco Engrg.	2•1006, 1007, 1803
Amecon, Inc.	1A•2125-2130
AME Corp.	1B•1515
Amerex	2•1005
American Aerospace Controls	1B•1830, 1831
American HV Test Systems Inc.	3•1188
American Insulated Wire Corp., Leviton Mfg. Co.	2•1942
American Microsemiconductor	1A•1645, 2090, 2091
American Research & Engineering	1B•1516-1518
American Switch Corp.	1B•1519
American Tech. Ceramics	1A•1007-1009
American Zettler	1B•1522-1530, 1826, 2•1644, 1645
Amlan, Inc.	2•1153-1159
AMP Incorporated	1A•1584, 1B•1109-1111, 1532-1536, 1761, 2•1121-1148, 1869, 1944
AMP Products Corp.	1B•1531, 2•1120, 1858, 1945
Amplifier Research	3•1002, 1003
Amuneal Mfg.	2•1903
Analogic Corp., Data Conversion Prods. Grp.	3•1140, 1141
Analog Modules, Inc.	3•1004
AND	1B•1023-1025
Andersen Labs.	1A•1450
Anderson Elctrns.	1A•1313
Ango Electronics Corp.	2•1008
APA Division	2•1924
A. P. Circuit Corp.	1A•1585
Apex Microtechnology Corp.	3•1005
Apollo Magnetics Corp.	3•1069
Appleton Papers Inc.	3•1070
Applied Electro Technlg., Int., STI Company	1B•1293
Applied Research Inc.	1A•1686, 1687
Applied Solar Energy Corp., Photosensor Div.	1B•1211
AP Products Incorporated	2•1900, 1901
Aptronics Corporation	2•1160, 1161
Arcolectric Corp.	1B•1026-1028, 1538-1542
Aries Elctrns.	2•1149-1152
Armtec Industries, Inc., Daven Components Grp.	1B•1543
Arnold Magnetics	3•1496-1499
Aromat Corp.	1B•1294-1309
Arra Inc.	1A•1689
Arrow Hart Div., Cooper Inds.	1B•1568-1573
Arstan Products Intl. Ltd.	1A•2132-2134
Astec USA, Ltd., A BSR Intl. Co.	3•1500
Astro-Med, Inc.	3•1382
Astron Corp.	3•1501
Astrosystems	3•1189, 1504, 1817
Atlantic Scientific Corp.	1B•1257
Atlas Energy Sys.	3•1826
Atlee Inc.	1B•1259, 2•1009, 1859, 1875, 1904
ATR Elctrns., Inc.	3•1827
Augat Inc.	2•1162, 1163, 1876-1879
Ault, Incorporated	3•1502, 1503
Austron, Inc.	1A•1314, 1315
Automatic Coil Corp., Sub. Designatronics, Inc.	1A•1221-1223, 1451-1453
Automatic Timing & Controls Co.	3•1123
Auto-Swage Prods.	2•1860
Avex Elctrns.	3•1403
Avionic Instrs.	3•1828, 1829
Avtel Div., Unitron Inc.	3•1831, 1832
AVX Corporation	1A•1002, 1010-1014, 1B•1002, 1008, 1009
Axis, Inc.	2•1010

B

Manufacturer	Page No.
Ballantine Labs.	3•1191
B & K Precision Prod. Grp., Dynascan	3•1182, 1198-1202, 1362-1364, 1509
Barnes Engrg.	2•1011-1013
Basic Measuring Insts.	3•1830
BBC-Metrawatt/Goerz	3•1192, 1193
Beau Products Div.	2•1164-1166
Behlman Engineering Corporation	3•1834-1839
BEI Motion Systems Co., Corporate Off.	1B•1832
BEI Motion Sys. Co., General Control Systems Div.	1B•1832
BEI Motion Sys. Co., Industrial Encoder Div.	1B•1832
BEI Motion Sys. Co., Position Controls Div.	1B•1832
Belden, Electronic Wire & Cable	2•1934, 1946-1985
Bel Fuse	1A•1454-1465, 1B•1260-1262
Bell, Floyd, Assocs., Inc.	3•1026-1028
Bell, F. W., Inc.	3•1194-1197
Bell Inds., J. W. Miller Div.	1A•1224-1229
Berkeley Nucleonics Corp.	3•1203
Bertan Assocs.	3•1506, 1507
Bertsch U.S., Sycamore Resch. Ctr.	1B•1132-1134
Best Electrics Div.	1B•1794
B-G Instruments	3•1071
B. H. Elctrns.	1A•2136, 2137
Bikor	3•1508
Birtcher Corp.	2•1015-1017
Bivar, Inc.	2•1018
Blatek Inds.	1B•1835
Bliley Elec. Co.	1A•1316-1323
Blue M, A Unit of General Signal	3•1173
Bodine Elec. Co.	1B•1135
Boonton Elctrns. Corp.	3•1204
Bosch, Robert, Corp.	1B•1310, 1311
Boschert Inc.	3•1510, 1511
Bourns, Inc., Resistive Components Group	1A•1804-1807, 2022-2035
Bowmar Instrument Corp., Aerospace Div.	1B•1762, 1763, 3•1124
Breeze-Illinois, TransTechnology Corp.	2•1986, 1987
Bren-Tronics, Inc.	3•1404-1406
Brevel Motors, Inc., Sub. Vernitron Corp.	1B•1136
Brim Elctrns.	2•1988-1995
Bruel & Kjaer Instrs. Inc.	1B•1836, 1837, 3•1205
Buckeye Stamping Co.	2•1019
Buehler Prods.	1B•1137
Buggie H. H./Caton Connector Corp.	2•1167
Bumper Products Corp.	2•1866
Burgess Switch Co., Inc.	1B•1544-1546

C

Manufacturer	Page No.
Cabtron Sys., Inc.	2•1020
Caddell-Burns Mfg.	1A•1233
Caddock Electronics, Inc.	1A•1808-1827
Calex Mfg. Co., Inc.	3•1006, 1512, 1513
California Avionics Labs.	3•1206
California DC	3•1514
California Instruments, A Div. of Amstar Tech. Prods. Co., Inc.	3•1840, 1841
Calmark Corp.	2•1021
Cal-R, Inc.	1A•1829-1831, 1B•1795-1797
Cambridge Technology, Inc.	3•1207
C & K Components, Inc.	1B•1565
Canon U.S.A., Elctrn. Comps. Div.	1B•1138
Canyon Elctrns.	1B•1030
Capacitor Technology, Inc.	1A•1015
Capar Components Corp., Div. of Diplomat Electronics	1A•1016-1019, 1828, 2092, 1B•1102
Carborundum Co., Electric Prods. Div.	1A•1832-1835, 1B•1798, 1799
Carborundum Co., Semiconductor Prods. Div.	1A•1020
Carlingswitch, Inc.	1B•1548, 1549
Carol Cable Co., Inc., Columbia Elctrn. Cables Div.	2•1997-2019
Carroll Touch Technology	3•1072, 1073

Manufacturer	Page No.
Catalyst Research	3•1407
Caton Connector Corp.	2•1167
CEA Division of Berkleonics, Inc.	3•1515
Celesco Transducer Prods., Inc.	1B•1838, 1839
Centronic Inc.	1B•1212, 1213
Ceramaseal	2•1168
Ceta Corp.	3•1516
Chassis-Trak	2•1032, 1033
Chatsworth Data Corp, Cablemaster Div.	3•1208
Chatsworth Data Corp, Impact-o-Graph Div.	3•1208
Cherry Electrical Prods. Corp.	1B•1551-1563, 1758, 1764-1769
Chessell Corp.	3•1383
Chesterfield Prods.	1A•1586
Chicago Lock Co.	1B•1564
Christie Elec. Corp.	3•1517
Chrono-log Corp.	3•1074
Cincinnati Sub-Zero Prods.	3•1175
Ciprico Inc.	3•1075
Clairex Elctrns.	1B•1214-1217
Clare Division, General Instrument Corp.	1B•1288, 1312-1316
Clary Corp., Precision Instrs. Div.	3•1842
Clifton Precision	1B•1139
CML MACARR Div., Marine Electric RPD, Inc.	3•1843-1845
Coilcraft	1A•1230-1232
Colber Corp.	1A•1845
Cole Instr.	1B•1567
Colorado Crystal Corp.	1A•1324, 1364
Comclock Inc.	1A•1328
Communications Instrs., Inc.	1B•1318-1321
Compac	1A•1587, 1690, 1691, 2•1023-1027
Component Research Co. Inc.	1A•1022-1063
Compower Div., Div. of Computer Prods., Inc.	3•1701-1704
Computer Components, Inc.	1B•1323
Computer Conversions Corp.	3•1144, 1145
Computer Devices Corp.	1A•1466
Computer Power	3•1847
Computer Prods. Inc., Power Conversion Grp.	3•1438, 1518
Comstron Corp.	1A•1325-1327, 1588, 3•1210, 1211
Concord Elctrns.	2•1170-1243
Condor	3•1519-1534
Connector Corp.	2•1244, 1245
Connor-Winfield Corp.	1A•1329-1332
Consolidated Electronic Wire & Cable Corp.	2•2021-2075
Contact Electronics Inc.	2•1169
Continental Resources, Inc.	3•1212
Control Concepts Corp.	1B•1263
Control Elctrns. Co., Inc.	1A•1467-1469
Controlled Power Co.	3•1814, 1848-1853
Control Prods. Div., Amerace Corp.	3•1125
Control Sciences, Inc.	3•1146-1148
Control Technology Co.	3•1930, 1931
Converter Concepts, Inc.	3•1536-1539
Cooner Wire Co.	2•2076-2081
Corcom, Inc.	1A•1589
Coto Corporation	1B•1324-1330
CPS Inc.	3•1540
Crosspoint, Div. of Info-Lite	1B•1574
Crouzet Controls, Inc.	1B•1140, 1332, 1333, 1575
Croven Crystals	1A•1346
Crystaloid Elctrns.	1B•1031
CSI Capacitors, CSI Technlgs.	1A•1021
C-Tek Inc.	3•1126, 1127
CTS of Berne	1A•1836, 1838-1844, 2036
CTS Electronics Corp., Paso Robles Div., Electromechanical Gp.	1B•1576-1580
CTS Fabri-Tek, Inc., Connector Div.	2•1246-1248
CTS Knights	1A•1333-1345
CTS Microelectronics, Inc.	1A•1646-1651
Curtis Instrs., Inc.	3•1128
Custom Connector	2•1249
CYTEC Corp.	3•1213

D

Manufacturer	Page No.
Daburn Elctrns. & Cable	2•2083-2093
Daico Inds., Inc.	1A•1692-1703
Dai-Ichi Shoji of Amer., Inc.	1A•1064, 1B•1583, 2•1254
Dale Electronics, Inc., Columbus Div.	1B•1032-1034
Dale Electronics, Inc., El Paso Div.	1A•1846-1868
Dale Electronics, Inc., Norfolk Div.	1B•1800, 1801
Dale Electronics, Inc., Tempe Div.	1A•1348, 1349
Dale Electronics, Inc., Yankton Div.	1A•1234-1242, 2139-2150, 2•1250-1253
Damon/Elctrns. Div.	1A•1347
D & B Power, Inc.	3•1542, 1543
DataCon, Inc.	3•1923
Data Delay Devices	1A•1471-1482, 1592
Data Instruments Inc.	1B•1840
Datak Corp.	2•1090, 1759, 2095
Datametrics • Dresser Inds., Inc.	1B•1841
Data Precision Corporation	3•1214, 1215
Datel	3•1076, 1105, 1150-1152, 1323, 1545
Datum Inc., Timing/Aacom Divisions	3•1154, 1155
DCI, Inc.	3•1324
Deak Technology, Inc.	3•1216
Dearborn Wire & Cable Co.	2•2096-2101
Delbert Blinn Co.	1A•2093
Del Elctrns. Corp.	1A•2151, 3•1546, 1547
Delevan Div., American Precision Inds. Inc.	1A•1243
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd.	1A•1590, 1591
Deltrol Controls	1B•1334, 1335, 1482, 1483
Densitron Corp.	1B•1036, 1037, 1485
Dialight Corp.	1B•1038, 1039
DigiMax Instrs. Corp.	3•1217
Digital Power Corp.	3•1549
Digitec Corp.	3•1077, 1156, 1157, 1326, 1327
Dio-Rey, Div. of Info-Lite	1B•1040-1047, 3•1159
Displex, Inc.	3•1860
Diversified Elctrns., Inc., Indl. Controls Div.	1B•1336
Dixson, Inc., Instrument Div.	3•1325
Douglas Randall	1B•1337-1345
Dow Corning Corp.	2•1080, 1081
Dow Key Div., Kilovac Corp.	1B•1346, 1347
Dranetz Technologies, Inc.	3•1218
Dreefs Switch Inc.	1B•1585-1587

E

Manufacturer	Page No.
Eagle Magnetic Company, Inc.	2•1905
EAO Switch Corp.	1B•1589
E-A-R Div., Cabot Corp.	2•1867
Eastern Air Devices Motor Div.	1B•1141
Eaton Corp./Cutler-Hammer Prods., Aerospace/Commercial Controls Div.	1B•1590-1611
ebm Inds., Inc.	2•1255, 1806, 1807
Eby Co.	2•1256, 1257
Ectron Corp.	3•1007
Edac Inc.	2•1258-1263
EECO Incorporated	1B•1612-1615
EFRATOM, a division of Ball Corp.	1A•1350
EG & G Almond Instruments	3•1550, 1551
EG & G Rotron, Commercial Div.	2•1800, 1808-1813
EG & G Rotron, Custom Div.	2•1814, 1815
EG & G Vactec	1B•1253
Elantec, Inc.	1A•1653
Electrical Instr. Svc.	3•1296-1298
Electric Switches, Inc.	1B•1616, 1617
Electro-Craft	1B•1143-1145
Electrodynamics, Inc., A Talley Inds. Co.	3•1129
Electro-Films, Inc.	1A•1870, 1871
Electro Impulse	2•1817, 3•1220
Electro Industries, Div. E.I. Elctrns. Inc.	3•1328, 1329
Elec-Trol, Inc.	1B•1352-1362
Electro Mechanical Design Services, Inc.	3•1221
Electro-Mechanisms	1B•1486, 1487
Electro-Mech Comps.	1B•1618, 1619
Electronic Components Groupe	1B•1621
Electronic Concepts, Inc.	1A•1065-1068
Electronic Dev. Corp.	3•1223-1225
Electronic Instr. & Specialty Corp.	1B•1364, 1365
Electronic Measurements	3•1552, 1553
Elctrn. Molding Corp.	2•1268-1270, 1872, 1880-1886
Electronic Navigation Inds.	3•1008, 1009
Elctrn. Precision Comps.	1A•1593, 1869, 3•1226, 1227
Electronic Research Co.	1A•1351
Electronic Solutions	3•1106-1109
Electronic Specialty Div., ElecSpec Corp.	1B•1348-1350
Electro Space Fabricators	2•1028, 1029
Electro Switch	1B•1010, 1622, 1623
Electrovert Inc.	2•1266, 1267
Elfab Corp.	2•1271-1274
Elgar Corp.	3•1854-1859
Elgenco, Inc.	3•1228-1233
Elmwood Sensors	1B•1802
Elpac Comps.	1A•1070, 1071
Elpac Power Sys.	3•1554-1559
Elpower	3•1408-1410
EMCO High Voltage Co.	3•1560
Emcor Products, Crenlo, Inc.	2•1030
EMICO Inc.	3•1330, 1331
Empro Mfg. Co., Inc.	3•1234
Endicott Coil	1A•1244, 2152
Endicott Resch. Grp., Inc.	1B•1049-1051, 3•1561
Engineered Comps. Co.	1A•1444, 1484-1508
Entran Devices	1B•1842, 1843
Epsco	3•1563
Equipto Elctrns. Corp.	2•1031
ESC Elctrns. Corp.	1A•1510-1520, 1594
E-Systems, Memcor Div.	1A•1872, 2037
ETI Systems, Polaris Indl. Entprs.	1A•2038, 1B•1146-1149
ETRI	2•1818-1820
EWC, Inc.	1A•2154-2163
Excel Technology Intl. Corp.	1B•1053-1055

F

Manufacturer	Page No.
Fabricast	1B•1150-1155
Fairchild Weston, Data Recorders	3•1235
Fair-Rite Prods.	2•1907
Fenwal Elctrns.	1B•1803
Ferrotran Elctrns. Co., Inc.	3•1564, 1565
FIC Corp.	1B•1265
Fifth Dimension, Inc.	1B•1366, 1624
Fil-Coil Economy Intl., Inc.	1A•1595
Filter Concepts Inc.	1A•1596, 1597
Fincor	3•1566-1569
Fischer-America Inc.	2•1275
Flex-Core Div., Morlan & Assocs., Inc.	1A•2165
Flex-Key Corp.	1B•1770, 1771
Fox Elctrns.	1A•1352-1355
Franek, John, Co., Inc.	3•1394, 1395, 1570, 1571, 1862-1877
Frederick Components Intl.	2•1821, 3•1572, 1573
Freed Transformer	1A•2166-2169, 3•1236
Frequency and Time Systems, Inc.	3•1154
Frequency Control Prods., Inc., American Time Prods. Div.	1A•1356, 1357, 3•1010
Frequency Devices, Inc.	1A•1624, 3•1237
Frequency Elctrns.	1A•1358, 1359
Frequency Selective Networks, Inc.	1A•1361
Fujitsu America, Inc.	1B•1367-1385, 2•1276-1292

G

Manufacturer	Page No.
Gamma High Voltage Resch. Inc.	3•1574, 1575
Gardiner Solder Co., Div. of Gardiner Metal Co.	2•1927
Gemini	2•1897-1899
General Devices	2•1032-1035
General Electric Co., Power Elctrns. Semiconductor Dept.	1A•2094, 2095
General Instr., Lamp Div.	1B•1056
General Microwave Corp.	1A•1704, 3•1238
General Resistance, Inc., A Prime Technology Company	1A•1873, 3•1239
Genicom Corp.	1B•1386, 1387
Georator Corp.	3•1878-1880
GFC/Hammond Elctrns., Inc.	3•1583
GIC Systems	3•1078-1081
Gilway Technical Lamp	1B•1057
Glassman High Voltage Inc.	3•1578-1581
Golden Pacific Elctrns., Inc.	1B•1058, 3•1029, 1582
Gordos Corp.	1B•1396-1399, 1401-1403, 1625, 2•1888, 1889
Gordos Arkansas, Inc.	1A•1654-1657, 1B•1388-1395, 1400
Gould Inc., Industrial Controls Div.	1B•1404-1413
Gould Inc., Recording Systems Div.	3•1380, 1384
Graphite Metallizing Corp.	1B•1156
Grayhill Inc.	1B•1414, 1415, 1629-1645, 1772-1779, 2•1294
GRIM Corporation	3•1064
GSI Corp.	2•2102
Guardian Elec. Mfg. Co.	1B•1417-1431

H

Manufacturer	Page No.
Hamilton Std. Controls, United Technologies	1B•1474
Hamlin	1B•1063, 1433, 1646, 1844
Hammond Mfg. Co.	1A•2171, 2•1036, 1037
H&T Components Inc., H&T Components Ltd.	2•1318-1328
Harrel, Inc.	3•1131
Hasco Comps., Inc.	1B•1436-1442, 1647

INDEX OF MANUFACTURER'S CATALOG PAGES

Manufacturer	Page No.
HEI, Inc.	1B•1219
Heinemann Elec. Co.	1B•1266, 1267
Hermetic Switch	1B•1648
Hertz Filter	1A•1598
Heurikon Corp.	3•1082-1084
Hewlett-Packard Co.	3•1585-1588
Hexacon Elec.	2•1928
Heyco Molded Products	2•1861
Hipotronics	1A•2171, 2173, 2174, 3•1240-1242, 1590, 1591, 1882, 1883
Hiram Jones Elctrns.	2•1314-1317
Hisonic, Inc.	1A•1599, 2175
Hi-Tech, Inc.	2•1822
Hitran Corp., Agex	1A•2176, 3•1592, 1884, 1885
Holmberg Elctrns.	2•1295-1310
Honeywell Optoelectronics	1B•1112, 1113, 1220-1230
Hughes Solid State Products	1A•1362, 1363, 1365
HumiSeal Div.	2•1083
HyComp Inc.	1A•1658, 1874, 1875
Hypertronics Corp.	2•1311-1313
Hytek Microsystems	1A•1522-1527, 1659
I	
IET Labs, Inc.	3•1244, 1245
ILC Data Device Corp.	3•1160, 1161
Illinois Capacitor, Inc.	1A•1072, 1073
Illinois Lock Co., The Eastern Co.	1B•1655, 2•1332, 1333
IMC Magnetics Corp., Eastern Div.	1B•1157, 2•1823
Industrial Computer Designs, Inc.	3•1110, 1111
Industrial Control Co.	3•1932
Industrial Devices, Inc.	1B•1020, 1064-1083
Industrial Elctrn. Engrs., Inc.	1B•1084, 1085, 1781
Industrial Elctrn. Hardware Corp.	2•1329
Industrial Test Equip.	3•1886-1888
InfoCap, Inc.	3•1085
Infodex, Inc.	1B•1086, 1087
Information Transfer Indl.	3•1162, 1163, 1246
Injectorall Elctrns.	2•1091
Instruments for Industry, Inc.	3•1011
Instrument Specialties Co.	2•1908, 1909
Integrated Circuits, Inc.	1A•1660, 3•1593-1597
Interconnection Technology, Inc.	2•1890
Interelectronics Corp.	3•1598
Interface Engrg.	3•1164, 1165
Interlok	2•1038, 1039, 1334-1337, 1761
Inter-Market	1B•1088, 1649
International Comps. Corp.	1A•1074, 1876, 2096, 2•1338, 3•1030
International Crystal Mfg.	1A•1367
International Electro Magnetics, Inc.	3•1031
International High Voltage Elctrns., Inc.	3•1599-1601
International Sensor Systems, Inc.	1A•1661
Interoptics, Purdy Group	1B•1114, 1115
Interswitch	1B•1650
Inter-Technical Grp.	1A•1075-1079
Intronics, Inc.	3•1602, 1603
Iskra Electronics, Inc.	1A•1080, 1081, 1877, 2039, 2097, 1B•1443
ISL Products Intl. Ltd.	1A•1082, 1083, 2098
Isotemp Research, Inc	1A•1368, 1369
Itek Measurement Sys., Div. Litton Inds.	1B•1845
ITT Cannon	2•1339-1354
ITT Comps. Electromechanical Grp.	1B•1444-1448, 1450, 1489
ITT Comps. Passive Grp.	1A•1084-1089, 1371, 1B•1449
ITT Jennings, Div. ITT Corp.	1A•1090-1092, 1B•1452-1454, 1651, 3•1247
ITT Pomona Electronics	2•1355-1454, 1456-1470
ITT Schadow	1B•1652-1654
ITW Switches, Tool Works Co.	1B•1656-1667
Iwatsu Instruments, Inc.	3•1366-1368
IXYS Corp.	1A•1663, 1B•1231, 3•1605
J	
Janco Corp.	1B•1668, 1669
Jan Hardware Mfg. Co.	2•1756, 1762-1779
Japanese Prods. Corp.	1B•1158
JBM Electronics, Inc.	1A•1529-1536
J-B-T Instrs.	3•1332
JDK Controls, Inc.	1A•2040
Jensen Tools, Inc., Axia, Inc.	2•1931
Jerome Industries Corp., Power Supply Div.	3•1606, 1607
Jerome Industries Corp., Transformer Div.	1A•2177
Jettron Prods.	2•1471
Jewell Electrical Instrs.	3•1333
JFW Inds., Inc.	1A•1705-1707
JMJ Technical Prods.	2•1780
JMK, Inc.	1A•1600
JM Transformer Co., Inc.	1A•2178-2181
Jobmaster Corp.	2•1792
Johanson Dielectrics	1A•1094
Johanson Mfg. Corp.	1A•1095
JSC Wire & Cable	2•2103
Judco Mfg. Inc.	1B•1671
Judd Wire, High Voltage Engrg.	1B•1011, 2•2104, 2105
Judd Wire, High Voltage Engrg.	1B•1011, 2•2104, 2105
Julie Resch. Labs.	1A•1878, 3•1248-1252
K	
Kahgan Elctrns. Corp.	1A•1119
Kaiser Systems, Inc.	3•1608-1610
Kalmus & Assocs., Inc.	2•1093
K & M Elctrns.	1A•1883
Kappa Networks	1A•1538-1553
Kavlico Corp.	1B•1846
Kaye Instruments	3•1166
Kay Elemetrics Corp.	1A•1708
KDI Electronics, Inc.	1A•1879
KEC Elctrns., Inc.	3•1613-1616
Kel-Am	2•1472-1483
Keltec Florida	3•1617-1619
Kelvin	1A•1880-1882
Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept.	1A•1096-1118
Kepco	3•1621-1644
Kessler-Ellis Prods.	3•1132, 1133
Kester Solder Div.	2•1084, 1929
Keystone Carbon, Thermistor Div.	1B•1804-1807
Keystone Elctrns. Corp.	2•1484-1495
KGS Electronics, Inc., GAR Entprs.	3•1890, 1891
Kikusui Intl. Corp.	3•1370, 1371, 1645
Kilovac Corp.	1B•1456, 1457
KOA Speer Elctrns.	1A•1885-1888
KR Electronics, Inc.	1A•1601
Krohn-Hite Corp.	3•1254, 1255
Krystinel Corp.	2•1793
KSI	3•1646-1648
Kulite Semiconductor Prods. Inc.	1B•1847
Kulka Smith, Inc.	2•1496-1501
L	
Lansing Research Corp.	2•1040
L-Com Inc.	2•2106-2108, 3•1649
LDJ Incorporated	3•1256
Leach Corp., Control Prods. Div.	1A•1372, 1373, 1664, 1665, 1B•1458, 1459
Leach Corp., Relay Div.	1B•1460-1465
Lear Siegler, Inc., Elctrn. Instr. Div.	2•1502
Ledex Inc.	1B•1480, 1490-1492, 1672-1674
Leecraft Mfg.	1B•1089
Lemo U.S.A. Inc.	2•1503-1512
Lenco Elctrns., Inc.	1A•2182, 2183
LH Research, Inc.	3•1650-1653
Liberty Controls	1B•1494, 1495
Lincoln Instrs.	3•1334
Lindgren RF Enclosures, Inc.	2•1041
Linseis, Inc.	3•1385
Littelfuse, Inc.	1B•1062, 1254, 1268-1274
Litton Encoder Div.	1B•1848
Logitek Inc.	1B•1466, 1467
Lorain Prods.	3•1654
LuTechnology, Inc.	3•1657
M	
3M-Electronic Products Division	2•1514, 1515
3M Co., Static Control Sys. Div.	3•1924, 1925
Mabuchi Motor America Corp.	1B•1159
Mac Panel Co.	2•1891
Magnecraft Elec. Co.	1B•1469
Magnetic Coils Inc.	1A•2186-2191
Magnetic Instrumentation	3•1261
Magnetico Inc.	1A•2185
Magnetic Shield Div., Perfection Mica Co.	2•1911-1913
Magnetic Technology	1B•1160, 1161
Magnet Sales & Mfg. Co. Inc.	2•1794
Magnum Elec.	2•1516-1518
Magnum Opus Custom Elctrn. Engrg.	3•1112
Maida Development Co.	1A•1121-1123
Malco, Div. Microdot Connector Grp.	2•1520-1522
Mallory Capacitor Co., Mallory Comps. Grp.	1A•1124-1133, 3•1032-1035
Mantex Corp.	1B•1783
Marconi Instrs.	3•1258-1260
Marquardt Switches Inc.	1B•1675
Marway Prods. Inc.	3•1892, 1893
Matrix Corp.	3•1086
Matrix Sys. Corp.	1A•1709
Maurey Instr. Corp.	1A•2041-2045, 1B•1162
Maxon Precision Motors, Inc.	1B•1163
McCoy Electronics Co., Sub. Oak Technology Inc.	1A•1374-1382
MCG Elctrns.	1B•1277-1280
McGill Mfg. Co., Inc., Electrical Div.	1B•1676
MCL, Inc.	3•1390, 1391
McLean Engrg., Div. of Zero Corp.	2•1824, 1825
McLean Midwest	2•1826, 1827
MDF Products Inc.	3•1262
Measurement Sys., Inc.	3•1134
Mechanical Entprs.	1B•1677, 1784, 1785
Mechanized Electronic Assembly Div., Universal Instrs. Corp.	3•1926
Meissner Inds.	1A•1889
Melcor/Materials Elctrn. Prods.	2•1828, 1829
Memodyne	3•1087
Memory Protection Devices Inc.	2•1519
Mepco/Electra, Inc., North American Philips Corp.	1A•2046, 1B•1012
Mepco/Electra, Inc., North American Philips Corp.	1A•1134, 1B•1013
Mepco/Electra, Inc., North American Philips Corp.	1A•1136, 1890, 1891, 1B•1012
Mepco/Electra, Inc., North American Philips Corp.	1A•1134-1136, 1B•1013
Mepco/Electra, Inc., North American Philips Corp.	1A•1891, 1B•1012
MERET, Inc.	1B•1116
Metuchen Capacitors, Inc.	1A•1138-1146, 1602, 1603, 2•1524-1527
MF Elctrns. Corp.	1A•1384-1386
MG Electronics	3•1037
Michigan Magnetics	3•1038, 1039
Microavionics Corp.	2•1781
Microcap	1A•1186-1188
Micro Devices Product Group, Therm-O-Disc, Inc.	1B•1823
Micro Mo Electronics, Inc.	1B•1164, 1165, 1849, 3•1135
Micronel U.S.	2•1830-1838
Micro-Ohm Corp.	1A•1892-1895
Microplex, Inc.	1A•1897
Microsonics Inc.	1A•1383
Micro Switch, A Honeywell Div.	1B•1679-1722, 1786, 1787, 1809, 1850-1852
Micro Technical Inds., Micro-Ohm Corp.	3•1176, 1177
Microtran Co. Inc.	1A•1245, 2114, 2192-2205
Midwest Comps.	1B•1810-1817
Millivac Instrs.	3•1263
Mill-Max Mfg. Corp.	2•1523
Milwaukee Resistor Corp.	1A•1898-1901
Mini-Circuits Lab.	1A•1684, 1710-1773
Mini-Systems, Inc.	1A•1902
Mini-Systems, Inc., Electronic Package Div.	1A•1666
Mizar Inc.	3•1113
Modular Audio Prods., Modular Devices Inc.	3•1012
Modular Devices	3•1012, 1933
Modutec	3•1335-1337
Monitor Prods. Co., Inc.	1A•1387-1389
Monsanto Co.	2•1085-1087
Motorola, Inc., Compt. Divs. Clock Oscillator Dept.	1A•1390, 1391, 3•1413
Motorola Semiconductor Prods. Sector	1A•1667-1677, 2086, 2099-2105, 1B•1117, 3•1114-1116
Motor-Tronics, Inc.	1B•1166, 1167
Motronics Corp.	1B•1169
MTE Corp.	1A•2208
M-Tron Inds.	1A•1393
Mueller Elec. Co.	2•1528, 1529, 3•1264, 1265
Multi Prods. Intl.	1A•1147, 2206, 2207, 3•1658
Mura Corp.	1A•2047, 1B•1090, 2•2109, 3•1040, 1041
Murata Erie North America, Inc.	1A•1148-1151, 1394, 1395, 1576, 1604, 1605, 1903-1905, 2016, 2048, 2049, 2107, 2209, 3•1042, 1659
MuShield Co., Div. Bomco, Inc.	2•1915
MWS Wire Inds.	2•2110, 2111
N	
Natel Engrg. Co., Inc.	1A•1678, 1679
National Capacitor	1A•1180
National Electric Cable	2•2114, 2115
National Instruments	3•1266
National Power Technlg., Natl. Technlg.	3•1660
National Tel-Tronics	2•1530, 1531
National Wire & Cable Corp.	2•2116-2132
N.C.E.	3•1420, 1421

Manufacturer **Page No.**

NES, Inc. 1B•1091, 3•1088, 1136, 1167, 1338-1341
Newman, M. M., Corp., Heli-Tube Div. 2•2133
Newport Electronics 3•1342, 1343
NIC Components Corp. 1A•1152, 1153, 1906
Nichicon (America) Corp. 1A•1154-1159
NJE Corporation 3•1661
NKK Switches of America, Inc. 1B•1723-1731
North American Soar Corp. 3•1267-1275, 1360, 1372-1374
North Atlantic Inds., Instrument Div. 3•1277, 1345
North Hills Elctrns. 1A•1247, 1774, 2210, 3•1393, 1662
Nova Elec. 3•1895
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc. 1A•1396, 1397, 1B•1853, 3•1043
NWL Transformers 1A•2211, 3•1663
NWL Transformers, Megatran Electronic Power 3•1663
Nytronics Comps. Group Inc. 1A•1160-1172, 1218, 1248-1267, 1554-1557, 1907-1909

O

Oak Switch Sys. 1B•1092, 1732, 1733, 1789
Oaktron Inds. 3•1045
Odell, M. P., Co. 3•1927
Ohio Semitronics, Inc. 1B•1854-1867, 3•1278-1283
Ohmite Mfg. Co. 1A•1910-1917, 2050, 2051
Ohmtek, Inc. 1A•1919-1921
Omega Engrg. 1B•1735, 1818, 1819, 1868, 1869, 2•2135, 3•1013, 1089, 1137, 1168, 1284, 1346, 1347, 1386
Opamp Labs, Inc. 3•1046
Optek, Crown Semi 1B•1232
Optima Enclosures 2•1047-1052
OPT Inds. Inc. 1A•1268, 1269, 1398, 2212, 2213, 3•1665
Opto 22 1B•1470, 1471
Orbit Instrument Corp. 1B•1790, 1791, 3•1138
Oscillatek Corp. 1A•1399
Oshino Electric Lamp Works, Ltd. 1B•1093
Oslo Controls 1B•1736, 1737
Otto Engrg. 1B•1738, 1739
Ovenaire 1A•1400-1403

P

Pacific Instrs. Inc. 3•1015
Pacific Power Source Corp. 3•1897-1901
Pacific Resistor Co. 1A•1922, 1923
PacTec Div., LaFrance Corp. 2•1002, 1042, 1043
Paine Instrs. 1B•1870
Pamotor 2•1840-1850
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div. 3•1414-1419
Panduit Corp. 2•1532-1534, 2136-2139
Panel Components Corp. 1A•1606-1610, 1B•1282, 1283, 2•1536-1539, 2140, 2141
Pan-Magnetics Intl., Inc. 1A•2215-2221
Paraline Transformer Corp. 1A•2223-2225
PCA Elctrns. 1A•1558-1564
PC Transformer Corp. 1A•2226-2229
Pearson Elctrns. 1A•2230
Perkin-Elmer Corp., Elctrn. Prods. Dept. 1A•2231
Perma Power Elctrns. 1B•1284, 2•1862, 1863
PHI Technologies, Inc. 3•1090
Phoenix Contact 2•1540-1542
Photodyne 1B•1118, 1119

Manufacturer **Page No.**

Pico Elctrns. 1A•1271-1275, 2233-2255
Piconics 1A•1277, 1611, 1680
Piezo Elec. Prods., Inc. 1B•1820, 1821, 1871
Piezo Technology Inc. 1A•1308, 1404-1409
Pioneer Magnetics 3•1666, 1667
Pittman Corp. 1B•1170, 1171
PolyPhaser Corporation 1B•1285
Portescap Transicoil 1B•1172, 1185
Portescap U.S. 1B•1172, 1873
Potter Co. 1A•1612
Power Comps. Co., Vanguard Elctrns. Co. 3•1668, 1669
Power Designs, Inc. 3•1672-1675, 1677-1679, 1976
Power Dynamics 1B•1286, 1287, 1740, 2•1544-1546, 1782, 1783
Power General 3•1680-1691
Power Group International 3•1420, 1421
Powermark 3•1904-1906
Power-One, Inc. 3•1692-1695
Power Pac 3•1696-1700
Power Products Div., Computer Products, Inc. 3•1701, 1706-1716, 1725
Power-Sonic 3•1422
Power Systems 3•1726, 1727
Powertec, Inc. 3•1728-1745
Power Technology, Inc. 3•1746
POWR-UPS Corp. 1B•1173
PPD, Inc. 1A•1173-1179
PPM, Inc. 3•1285
Precicontact, Inc., Ultra Precision 2•1547, 1892
Precision Components, Inc. 3•1747
Precision Elctrn. Comps. Ltd. 1A•2052
Precision Filters 1A•1613-1617, 3•1016-1020, 1286
Precision Resistive Prods., Inc. 1A•1925
Precision Resistor Co., Inc. 1A•1926, 1927
Premier Metal Prods. Co. 2•1044, 1045
Premier Microwave 1A•1775
Prem Magnetics 1A•2257-2259
Pres-Air-Trol Corp. 1B•1741
Presidio Comps., Inc. 1A•1181
Preston Scientific 3•1169
PrimeLine-Soltec Distbn., Soltec Corp. 3•1387
Prime Power, Inc., Prime Technology Co. 3•1671
Probe Master, Inc. 3•1287
Programmed Test Sources 3•1288
Prototek, Inc. 2•1893

Q

Q-Tech Corp. 1A•1410, 1411
Qualidyne Sys. 3•1748-1750
Quam-Nichols Co. 3•1048, 1049
Quantum Data, Inc. 3•1289

R

Radio Switch Corp. 1B•1743
Ransco Inds. 3•1178
Rayovac Corporation 3•1423
RCD Components, Inc. 1A•1928, 1929
RCL Electronics, Inc. 1A•1930-1936
RDI/Reed Devices Inc. 2•1548-1551
Reeves-Hoffman Div. 1A•1413-1417, 2•1795-1797
Refac Elctrns. Corp. 1B•1094
Regdon Corp. 1B•1497
RE Instruments Corp. 3•1291
Reliability Inc. 3•1752-1755
Renco 1B•1874, 1875, 3•1139
Renco Elctrns. 1A•1278-1280, 2260, 2261
REPCO 3•1065
Reproduction Technologies Inc. 3•1050, 1051
Republic Elctrns. Corp. 1A•1182
Resistors, Inc. 1A•1937

Manufacturer **Page No.**

Res-Net 1A•1938
RFI Corporation 1A•1618
RIFA Inc. 3•1756, 1757
Risk, George, Inds. 1B•1792
RMF Prods., Inc. 2•1785
RO Assocs. 3•1758
Robbins & Meyers, Inc., Motor & Control Sys. Div. 1B•1175
Robinson-Nugent, Inc. 2•1552-1555
Robison Elctrns. 2•1870, 1887
ROD-L Electronics, Inc. 3•1292-1295
Rogan 2•1786
Rogers Corp. 2•1894
Rose Enclosures Sys., Inc. 2•1046
Ross Engrg. Corp. 1B•1472
Rowe Industries, Inc. 2•1556-1558, 2143
RTE Aerovox Inc. 1A•1619-1621
RTE Deltec Corp. 3•1907
RTS Systems, Inc., Compact Video, Inc. 3•1066
Ryan Intl. Corp. 3•1219

S

SAFT America Inc., Power Sources Div. 3•1398, 1424-1429
Samarius, Inc. 1A•2053
S & H Inds. 3•1767, 1908, 1928
Sanyo Elec. Inc. 3•1430
SaRonix 1A•1418, 1419
Sawtek Inc. 1A•1420, 1565, 1622, 1623
Saxton Prods. 2•2144-2149
Schroff Inc. 2•1053
Scientific Columbus, Inc., Esterline Corp. 1B•1876, 1877
Seacor, Inc. 1A•1183
Sealectro 2•1561
Seiko Instrs. U.S.A., Inc. 1A•1421, 1B•1095, 3•1091
Semiconductor Circuits 2•1865, 3•1759-1766
Sensitive Research Instrs. 3•1296-1298
Servo-Tek Prods. Co. 1B•1177
SGL Waber 2•1864, 3•1909
Shallco 1B•1744-1747, 3•1052, 1053
Shallcross, Inc. 1A•1930-1936
Shalltronix Corp. 3•1299
Shape Magnetronics, Inc. 3•1910, 1911
Shelly Associates, Inc. 1B•1096
Shinano Kenshi Corp. (SKC) 1B•1181
Shogyo Intl. Corp. 1A•2055, 2263, 1B•1097, 2•1562-1564, 2150, 3•1054, 1348, 1349
Shokai Far East Ltd. 3•1055
Sierracin/Magnedyne 1B•1178, 1179
Sierracin/Power Systems 3•1768-1770
Sigma Systems Corp. 3•1179
Signal Transformer 1A•2267-2279
Silonex Inc. 1B•1233
Simpson Elec. Co. 3•1302, 1350
Skydyne Division, AAR/Brooks & Perkins 2•1054
Slaughter Co. 3•1300, 1301
Sloan Co. 1B•1098-1101
Kulka Smith, Inc. 2•1565, 3•1303
Sokol Crystal Prods. Inc. 1A•1422-1425
Sola Elec. 3•1772, 1773, 1912-1915
Soltec Corp. 3•1388, 1389
Sonnenschein Batteries Inc., ebm Inds. 3•1431
Sorenson Lighted Controls 1B•1102, 1103
Soshin Elec. Co. 1A•1184
Souriau, Inc. 2•1566, 1567
Spectrol Elctrns. 1A•2056-2062
Spectrum Control, Inc. 1A•1625-1627, 2•1569-1573
Spectrum Technology, Inc. 1A•1426, 1427
Spellman High Voltage Elctrns. Corp. 3•1774-1776
Sperry, A. W., Instrs. 3•1304

Manufacturer **Page No.**

Sprague-Goodman Elctrns., Inc. 1A•1185
Staco Energy Prods. Co. 1A•2280, 2281
Staco Transpower 1A•2283
Stancor/Hamilton Standard Controls 1A•2284-2292, 1B•1474
Stantard Energy, Div. WBH Scientific, Inc. 3•1777-1779
Standard Grigsby, Inc. 1B•1626, 1627
Standard Power, Inc. 3•1780-1783
Standard Reference Labs, Inc. 3•1305
Standex Elctrns. 1A•1628, 1629, 1B•1475
Stantron Div. 2•1055
Star Micronics, Inc., Components Div. 3•1056-1059, 1092, 1093
Statek Corp. 1A•1429-1431
Staver Co., Inc. 1B•1105
Sterling Transformer Corp. 1A•2293-2297
Stevens-Arnold Div., Computer Prods., Inc. 3•1705, 1717-1724
STRONGBOX 2•1056, 1057
Struthers-Dunn 1B•1477
Suckle Corp. 2•1058
Sullins Elctrns. Corp. 2•1574, 1575
Summit Elctrns. 3•1784, 1785
Sunshine Sci. Instr. 3•1290
Superior Elec. Co. 1A•2298, 2299, 1B•1182, 1183, 2•1577, 3•1917
Switchcraft, Inc. 1B•1498, 1748-1752, 2•1096, 1578-1585
Sylvania Control Devices 1B•1822
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co. 1A•2108, 2109
Sylvania Miniature Lighting 1B•1059-1061
Symbex Corp. 2•1586, 1587, 1895
Symtron Corp. 2•1896
Syntest Corp. 3•1094

T

TA Instr. Case Co. 2•1059
Tapeswitch Corp. of America 1B•1753
Tauber Elctrns. Inc. 3•1433
Taurus Corp. 3•1095
Taylor Electronics 3•1786
T-Bar Incorporated, Switching Components Div. 3•1308
TDJ Co., Inc. 2•1060, 1061
TDK Corporation of America 1A•1189, 1281, 1567, 1630, 2300, 2•1798, 1799, 3•1061, 1787
TECA, ThermoElectric Cooling America Corp. 2•1805
Teccor Elctrns. 1A•2110, 2111
Tech Labs., Inc. 1B•1754, 1755
Techmar Corp. 2•1062, 1063
Technical Research & Mfg., Inc. 1B•1014
Technipower, A Penril Co. 1A•1863, 2301
Technitrol 1A•1568-1574, 1B•1015-1017
Techno-Components Corp. 1A•1939, 2064, 2065
Technology Dynamics 3•1790-1795
Techtrol Cyclonetics, Inc. 1A•1432, 1433
Tecknit (Eastern Facility) 2•1588-1591, 1916-1923
Tecron Industrial Prods., Crown Intl., Inc. 3•1022-1025, 1306, 1307
Tedea USA 1B•1878, 3•1172
Tektronix, Inc. 3•1376, 1377
Tel Labs, Inc. 1A•1941-1943
Telonic/Berkeley 1A•1777
Telpar, Inc. 3•1096
Tenney Engrg. 3•1181
Test Probes, Inc. 3•1379
Tettex Instruments, Inc. 3•1309

INDEX OF MANUFACTURER'S CATALOG PAGES

Manufacturer **Page No.**

Texmate, Inc. 3•1351-1355
Therm-O-Disc, Inc., Sub. Emerson Elec. Co. 1B•1823
Thermometrics, Inc. 1B•1825
Thomas & Betts, Electronics Group Hdqtrs. 2•1593-1612
Thordarson Meissner 1A•2302-2307
THORN EMI Gencom Inc. 1A•2366, 2367
THORN EMI Technology Inc. 3•1310
TII Electronics, Inc., Div. TII Industries 3•1796, 1797
Todd Prods. Corp. 3•1798-1801
Todd Systems 1A•2308-2311
Toko America, Inc. 1A•1282, 1575, 1631
Toroid Corp. of Maryland 1A•2312, 2313
Torotel Prods. Inc. 1A•1283-1297, 2314-2320
Torotron 3•1311
Torwico Elctrns. Inc. 1A•2322, 2323
Tracewell Enclosures 2•1065-1067
TRAK Systems, Div. TRAK Microwave Corp. 1A•1778-1783, 3•1097-1102
Trans American Transformer 1A•2325
Transducers and Systems Inc., A Prime Technology Company 1B•1880
Transducer Systems, Inc. 1B•1879
Transduktor Inc. 1A•2326-2328
Transformation Elctrns. Corp. 3•1802
Transistor Devices 3•1312, 1313
Transmagnetics 3•1170, 1171
Triad-Utrad 1A•2330-2337, 3•1918, 1919
Triplett Corp.—A Penril Co. 3•1314, 1315, 1320, 1356, 1357
TRW Capacitor Div. 1A•1191-1199
TRW Connector Div., TRW Electronic Components Grp. 2•1613-1643, 1646-1692, 1695-1715

Manufacturer **Page No.**

TRW Cylindrical Connector Div., TRW Electronic Components Grp. 2•1716-1735
TRW Fiber Optic Prods., Connector Div., TRW Elctrn. Comps. Grp. 2•1693, 1694
TRW Inductive Products Div. 1A•1298-1305, 1642, 2338-2363
TRW Motor Division, Industrial/Commerical Products 1B•1120
TRW Motor Div. (Military) 1B•1186-1204, 2•1852, 1853
TRW Optoelectronics Div. 1B•1234-1251
TRW Resistive Products Div., TRW Electronic Components Grp. 1A•1944-1991
T S Products 3•1119
TTE, Inc. 1A•1632-1641
Tusonix, Inc. 1A•1201-1207

U

Ultronix, Inc. 1A•1992-1999
Unibox, Div. of Amerex 2•1005
Unicorp 2•1868
Unimax Switch Corp. 1B•1756
Union Carbide Corporation, Battery Prods. Div. 3•1434, 1435
Union Carbide Corp., Elctrns. Div., Component Dept. 1A•1096-1118
United Chemi-Con Inc. 1A•1208, 1209
UNITRACK Div., Calabro Inds., Inc. 2•1068
Unitrode Corp. 1A•1681-1683
Unitron Inc. 3•1831, 1832
Universal Voltronics 3•1803
U.S. Digital 1B•1881
U S Microtek Components Corporation 1A•1211
U.S. Toyo Fan Corp. 2•1854, 1855

Manufacturer **Page No.**

V

Valpey-Fisher 1A•1434-1436
Vanguard Elctrns. Co. 1A•1276
Vann Instruments 3•1316
Varo Semiconductor, Inc. 1A•2112
Varta Batteries, Inc. 3•1436
Vector Electronic Co., Inc. 2•1069, 1088, 1094, 1095, 3•1117
Vectron Labs. 1A•1438-1442
Veetronix, Inc., Sub. Reach Electronics 1B•1757
Velonex, Display Prods. 3•1359
Velonex, Instr. Div. 3•1359
Vent-Rak Div. 2•1034, 1035
Venus Scientific, Inc. 3•1804
Vernitech 1A•2066, 2067, 1B•1019, 1206, 1207, 1882, 1883, 3•1934
Vernitron Corp., Control Comps. Div. 1B•1208, 1209
Vernitron Piezoelectric Div. 1A•1437
Vibro-Meter Corp. 1B•1885
Victoreen, Inc., Component Div. 1A•2000-2003
Viking Connectors 2•1737
Villarreal Electronics 2•1064
Virginia Plastics Co. 2•1738-1740, 2151
Vishay Resistive Sys. Grp. 1A•2004-2015, 2070
Vishay-Mann, Vishay Resistive Systems Group 1A•2014, 2015
Vishay Angstrohm 1A•2011-2013
Vistar Corp. 3•1317
Visual Communications Co. 1B•1106-1108
Voltage Multipliers, Inc. 1A•2113
Voltex 3•1805
VRN International, Div. Vernitron 1A•2068, 2069, 3•1067

W

Wabash Relay & Elctrns. 1B•1478, 1479

Manufacturer **Page No.**

Wall-Able Manufacturing Corp. 2•1742, 1743
Wavetek Indiana, Inc. 1A•1784, 1785, 3•1318
Wayne Transformer Co., Inc. 1A•2365
Weco Elctrl. Connectors Inc. 2•1745-1747
Weidmuller Terminations 2•1748
Weinschel Engrg. 1A•1787, 3•1319
Wells Elctrns. 2•1750-1755
Wesco Electrical Co. 1A•1212-1217
Wes-Garde Components Group, Inc. 1B•1742
Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc. 1A•2071-2084
Wilco Corp. 1A•1306, 1307
Wilcoxon Resch. 1B•1886
Wilmore Elctrns. Co. 3•1807-1809, 1920, 1921
Wintek Corp. 3•1118

X

Xentek, Inc. 3•1810, 1811
Xico, Inc. 3•1104
Xsis Electronics, Inc. 1A•1443
Xylog Corp. 3•1813, 1922

Y

Yuasa Battery (America), Inc. 3•1437

Z

Zero Corp. 2•1070-1079
Zeus Indl. Prods. Inc. 2•1871

84
85 Product Index and Directory

All products are listed alphabetically by their generic names and then by subclassification. For example, look for "Fiber Optic Connectors" under "Connectors, Fiber Optic" or for "Digital Panel Meters" under "Meters, Panel (Digital)."

Following each product heading is a four-digit number directing you to the Product Section where these products are usually cataloged. If that Product Section is not in the EEM volume you are using, a "See Vol.1A, 1B, 2, or 3" will direct you to the proper volume for your product classification. No numbers appear with cross-reference headings.

Under each product heading whose Product Section appears in the volume you are using, the names of the manufacturers who supply the product are shown in alphabetical order with EEM catalogers shown first in boldface type with appropriate page numbers. Other manufacturers are shown in light face type. The symbol (§) indicates that these products are available from local distributors. The symbol (†) indicates that the product is available to MIL specifications.

Abrasive Belts, Compounds, Cords, Powders, etc.-5400 — *See Vol. 2*

Absorbers, Microwave-3400 — *See Vol. 3*

Accelerometers-5500 — *See Vol. 1B*

Acoustic CM Equipment (MIL), Airborne-3475 — *See Vol. 3*

Acoustic Systems (MIL)-3475 — *See Vol. 3*

AC Power Protection Equipment — See Line Conditioners (Vol. 3)

Actuators, Servo, Linear-4900 — *See Vol. 3*

Actuators, Servo, Rotary-4900 — *See Vol. 3*

Adapters — See Connector Adapters (Vol. 2), Plug Adapters (Vol. 2), Socket Adapters (Vol. 2), etc.

Adapters, Fiber Optic-2475 — *See Vol. 1B*

Adapters, Wall Plug-in — See Power Supplies, Plug-in (Vol. 3)

Adapters, Waveguide-3450

Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 .617-935-8610
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Deutsch Co., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045 213-649-1400
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 ...619-449-3844
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Uniform Tubes, Collegeville, PA 19426 215-539-0700
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Adapters, RF (MIL)-2440 — *See Vol. 1B*

Adhesives, Conducting-1600 — *See Vol. 2*

Adhesives, General Purpose-1600 — *See Vol. 2*

Adhesives, Insulating-1600 — *See Vol. 2*

Adhesives, Liquid Spray-1600 — *See Vol. 2*

Adhesives, Optical-1600 — *See Vol. 2*

Adhesives, UV Curing-1600 — *See Vol. 2*

Adhesives, Wire Tacking-1600 — *See Vol. 2*

Air Cleaners & Filters (Shielded & Unshielded)-2600 — *See Vol. 2*

Air Conditioners (For Equipment)-2600 — *See Vol. 2*

Alarms & Alarm Systems-2200 — *See Vol. 3*

Alarms, Controls, Photoelectric-3700 — *See Vol. 1B*

Alloys, Brazing-5400 — *See Vol. 2*

Alloys, Metal/Ceramic-1600 — *See Vol. 2*

Alphanumeric Readouts — See Tubes, Readout (Vol. 1A)

Alternators-4050 — *See Vol. 3*

Aluminizers, Vacuum — See Deposition Equip. (Vol. 3), Evaporation Equipment, Electronic Beam (Vol. 3),

Amplifiers, AF-1300 — *See Vol. 3*

Amplifiers, Antenna-1900 — *See Vol. 3*

Amplifiers, Compressor-1100 — *See Vol. 3*

Amplifiers, Current, AC-1100 — ***See Vol. 3***

Amplifiers, DC-1100 — ***See Vol. 3***

Amplifiers, Data — See Amplifiers, Instrumentation (Vol. 3)

Amplifiers, Decade-1100 — ***See Vol. 3***

Amplifiers, Deflection-1100 (Also See Yokes, Deflection, Oscilloscopes, etc.) — ***See Vol. 3***

Amplifiers, Differential-1100 — ***See Vol. 3***

Amplifiers, Distribution-1100 — ***See Vol. 3***

Amplifiers, Equalization-1300 — ***See Vol. 3***

Amplifiers, Fiber Optic-1100 — ***See Vol. 3***

Amplifiers, IF-1100 — ***See Vol. 3***

Amplifiers, Instrumentation-1100 — ***See Vol. 3***

Amplifiers, Integrating-1100 (Also See Amplifiers, perational; Integrators, Electronic) — ***See Vol. 3***

Amplifiers, Isolation-1100 — ***See Vol. 3***

Amplifiers, Klystron-3400 — ***See Vol. 3***

Amplifiers, Limiting-1100 — ***See Vol. 3***

Amplifiers, Line-1100 — ***See Vol. 3***

Amplifiers, Lock-in-1100 — ***See Vol. 3***

Amplifiers, Logarithmic-1100 — ***See Vol. 3***

Amplifiers, Magnetic-1100 — ***See Vol. 3***

Amplifiers, Master Antenna — See Amplifiers, Distribution (Vol. 3)

Amplifiers, Microphone — See Amplifiers, AF (Vol. 3)

Amplifiers, Microwave-3400 — ***See Vol. 3***

Amplifiers, Mixing-1300 — ***See Vol. 3***

Amplifiers, Multichannel-1100 — ***See Vol. 3***

Amplifiers, Narrow Band-1100 — ***See Vol. 3***

Amplifiers, Null-1100 — ***See Vol. 3***

Amplifiers, Operational-1100 — ***See Vol. 3***

Amplifiers, Parametric-3400 — ***See Vol. 3***

Amplifiers, Peak Limiting-1100 — ***See Vol. 3***

Amplifiers, Phase-Lock Loop-1100 — ***See Vol. 3***

Amplifiers, Photocell — See Amplifiers, Transducer (Vol. 3)

Amplifiers, Power-1100 — ***See Vol. 3***

Amplifiers, Programmable Gain-1100 — ***See Vol. 3***

Amplifiers, Public Address — See Amplifiers, AF (Vol. 3)

Amplifiers, Pulse-1100 — ***See Vol. 3***

Amplifiers, Pulse Limiting-1100 — ***See Vol. 3***

Amplifiers, Recording — See Amplifiers, AF (Vol. 3)

Amplifiers, Resolver — See Amplifiers, Servo (Vol. 3)

Amplifiers, RF-1100 — ***See Vol. 3***

Amplifiers, Sample & Hold-1100 — ***See Vol. 3***

Amplifiers, Servo-4900 — ***See Vol. 3***

Amplifiers, Single Sideband-1900 — ***See Vol. 3***

Amplifiers, Strain Gauge — See Amplifiers, Transducer (Vol. 3)

Amplifiers, Sweep-1100 — ***See Vol. 3***

Amplifiers, Synchro-4900 — ***See Vol. 3***

Amplifiers, Telemetering-1900 — ***See Vol. 3***

Amplifiers, Thermocouple — See Amplifiers, Transducer (Vol. 3)

Amplifiers, Transducer-1100 (Also See Signal Conditioners) — ***See Vol. 3***

Amplifiers, Travelling Wave Tube-1100 — ***See Vol. 3***

Amplifiers, Ultrasonic-1100 — ***See Vol. 3***

Amplifiers, Video-1100 — ***See Vol. 3***

Amplifiers, Voltage Reference-1100 — ***See Vol. 3***

Amplifiers, Wideband-1100 — ***See Vol. 3***

Analyzers, AF-2900 — ***See Vol. 3***

Analyzers, Antenna Pattern-2900 — ***See Vol. 3***

Analyzers, Differential — See Analyzers, Phase & Voltage (Vol. 3)

Analyzers, Digital Signal-2900 — ***See Vol. 3***

Analyzers, Distortion — See Analyzers, AF (Vol. 3)

Analyzers, Frequency — See Analyzers, Spectrum (Vol. 3)

Analyzers, Frequency Stability — See Meters, Frequency Deviation (Vol. 3)

Analyzers, Harmonic-2900 — ***See Vol. 3***

Analyzers, Impedance-2900 — ***See Vol. 3***

Analyzers, Interference-2900 — ***See Vol. 3***

Analyzers, Intermodulation-2900 — ***See Vol. 3***

Analyzers, Logic-2900 — ***See Vol. 3***

Analyzers, Magnetic-2900 — ***See Vol. 3***

Analyzers, Microwave-3400 — ***See Vol. 3***

Analyzers, Modulation-2900 — ***See Vol. 3***

Analyzers, Network-2900 — ***See Vol. 3***

Analyzers, Noise-2900 — ***See Vol. 3***

Analyzers, Phase & Voltage-2900 — ***See Vol. 3***

Analyzers, Protocol-2900 — ***See Vol. 3***

Analyzers, Pulse-2900 — ***See Vol. 3***

Analyzers, Servo-4900 — ***See Vol. 3***

Analyzers, Signature-2900 — ***See Vol. 3***

Analyzers, Sonic & Subsonic-2900 — ***See Vol. 3***

Analyzers, Spectrum-2900 — ***See Vol. 3***

Analyzers, Transfer Function-2900 — ***See Vol. 3***

Analyzers, Transient-2900 — ***See Vol. 3***

Analyzers, Ultrasonic-2900 — ***See Vol. 3***

Analyzers, Vibration-2900 — ***See Vol. 3***

Analyzers, Video — See Analyzers, Spectrum (Vol. 3)

Analyzers, Waveform-2900 — ***See Vol. 3***

Analyzers, Wow & Flutter-2900 — ***See Vol. 3***

Analyzers (MIL), Antenna Pattern-3475 — ***See Vol. 3***

Analyzers (MIL), Pulse-3475 — ***See Vol. 3***

Analyzers (MIL), Spectrum-3475 — ***See Vol. 3***

Annunciators-2200 — ***See Vol. 3***

Antenna Dummy Loads — See Dummy Loads (Vol. 3)

Antenna Feed Systems-3450

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
Datron Sys., 20700 Plummer St., Chatsworth, CA 91311 818-882-9616
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ....207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
§† E-Systems, Garland Div., Box 226118, Dallas, TX 75266 214-272-0515
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
† Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-Com Cable/Home Communication Prodelin Satellite Antenna Systems, M/A-Com, Inc., P.O. Box 468, Newton, NC 28658 .800-222-1195;704-464-4141

Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
† Milliflect, 7752 B Enterprise Dr., Newark, CA 94560 415-791-5188
† Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
§ Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
† Power Sys. Grp., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311 818-885-8223
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Sanders Assocs., Flexprint Prods. Div., Grenier Fld.; Manchester, NH 03103 603-669-4615
§† Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 914-698-5600
† Sylvania Sys. Grp., Comm. Sys. Div., GTE Prods. Corp., 77 A St., Needham Hgts., MA 02194 617-449-2000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Tasker Systems, 20131 Sunburst St., Chatsworth, CA 91311 213-341-3010
† Tecom Inds., 21526 Osborne St., Canoga Pk., CA 91304 213-341-4010
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 619-583-3525
Ten-Tec, Industrial Park, Sevierville, TN 37862 615-453-7172
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800

Antenna Groups (MIL)-3475 — *See Vol. 3*

Antenna Groups (MIL), Elint-3475 — *See Vol. 3*

Antenna Rotators-1900 — *See Vol. 3*

Antenna Sets (MIL), DF-3475 — *See Vol. 3*

Antenna Switching Matrices-1900 — *See Vol. 3*

Antenna Towers-1900 — *See Vol. 3*

Antennas, Airborne-1900 — *See Vol. 3*

Antennas, Citizens Band — See Antennas, Whip & Accessories (Incl. Marine & Mobile Types) (Vol. 3)

Antennas, Direction Finding-1900 — *See Vol. 3*

Antennas, Ground Plane-1900 — *See Vol. 3*

Antennas, Helical-1900 — *See Vol. 3*

Antennas, Log Periodic-1900 — *See Vol. 3*

Antennas, Loop-1900 — *See Vol. 3*

Antennas, Microwave-1900 — *See Vol. 3*

Antennas, Multiband, UHF/VHF-1900 — *See Vol. 3*

Antennas, Phased Array-1900 — *See Vol. 3*

Antennas, Rhombic-1900 — *See Vol. 3*

Antennas, Spiral-1900 — *See Vol. 3*

Antennas, Telescopic-1900 — *See Vol. 3*

Antennas, Whip & Accessories (Incl. Marine & Mobile Types-1900 — *See Vol. 3*

Antennas (MIL)-2440 — *See Vol. 1B*

Antennas (MIL), DF-3475 — *See Vol. 3*

Antennas (MIL), ECM-3475 — *See Vol. 3*

Antennas (MIL), EW-3475 — *See Vol. 3*

Antennas (MIL), Multibeam-3475 — *See Vol. 3*

Antennas (MIL), Phased Array-3475 — *See Vol. 3*

Antenna Systems (MIL)-3475 — *See Vol. 3*

Antenna Systems (MIL), DF-3475 — *See Vol. 3*

Antistatic Devices, Blowers, Guns, etc.-4100 — *See Vol. 3*

Antistatic Packaging Materials — See Packaging Materials, Antistatic (Vol. 2)

Antitheft Devices — See Alarms & Alarm Systems (Vol. 3)

Armatures — See Motor & Generator Armatures, Rotors, Stators (Vol. 1B)

Arms & Manipulators, Robotic-4900 — *See Vol. 3*

Array Processors-2025 — *See Vol. 3*

Arresters, Electrical Surge — See Protectors, Surge (Vol. 1B)

Arresters, Electrical Surge/Lightning (MIL)-2440 — *See Vol. 1B*

Artificial Loads — See Dummy Loads (Vol. 3)

Assembly & Fabrication Services (Incl. R & D) — See Services, Assembly & Fabrication (Vol. 3)

Attenuators, Audio-1300 — *See Vol. 3*

Attenuators, Audio (T, L, LL Pads)-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ....1A•2028
§ **VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ....3•1067**
§† JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Trimm, Inc., Div. of Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048 312-362-3700

Attenuators, Coaxial-3450

† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ....1A•1689**
§ **Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ....1A•1690**
† **Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ....1A•1699,1700**
† **General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ....1A•1704**
§ **ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ....2•1393**
§ **JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203, 317-783-9875 .1A•1705 1707**
† **Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ..1A•1713, 1714,1762,1764,1765**
§ **Test Probes, Inc., Box 2113, La Jolla, CA 92038, 619-459-4197 ....3•1379**
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ....1A•1785
† **Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877, 301-948-3434; 800-638-2048 ....1A•1787**
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Artech Corp., 2901 Telestar Ct., Falls Church, VA 22042 703-560-3292
§ Astrolab, 345 Dalziel Rd., Linden, NJ 07036 201-862-0022
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ....207-655-4555;800-341-9678
§ Eaton Corp., Elctrn. Instrmn. Div., 2070 Fifth Ave., Ronkonkoma, NY 11779 516-588-3600
† Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
§† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 914-793-5000
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406 ....
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Matrix Sys. Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 .213-992-6776
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ...703-971-8606; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 ...619-449-3844
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 212-892-6700
§ Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 914-698-5600
§ Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, CA 91311 818-882-1020
Uniform Tubes, Collegeville, PA 19426 215-539-0700
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Attenuators, Fiber Optic-2475 — *See Vol. 1B*

Attenuators, Fixed-3450

Alco Elctrn. Prods., Inc., 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ... 1B•1504
† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ... 1A•1689**
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ... 1A•2028
Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ... 1A•1690
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ... 1A•1646,1651
§ **ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ... 2•1393**
§ **JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203, 317-783-9875 . 1A•1705 1707**
Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 .. 1A•1713, 1714,1764,1765
§ **Shallco, Box 1089, Smithfield, NC 27577, 919-934-3135 ... 3•1052,1053**
† **Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ... 1B•1755**
† **Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 ... 1A•1777**
§ **Test Probes, Inc., Box 2113, La Jolla, CA 92038, 619-459-4197 ... 3•1379**
VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ... 3•1067
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ... 1A•1785
† **Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877, 301-948-3434; 800-638-2048 ... 1A•1787**
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 ... 812-372-8869
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 ... 516-248-8080
Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 ... 414-671-2000
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 ... 516-349-9200
Baytron, 344 Salem St., Medford, MA 02155 ... 617-391-1550
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 ... 216-248-1200
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 ... 201-797-9655
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 ... 617-275-0850
† Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 ... 305-994-1774
Electro Impulse, Box 870, Red Bank, NJ 07701-0870 ... 201-741-0404
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-664-2333
§† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 ... 609-429-7800
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-5700
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 ... 212-424-7500
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 ... 203-481-5721
GRIM Corporation, Box 67, Medford, NJ 08055 ... 609-267-7950
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 ... 516-364-0400
Hyletronics, Newtown Rd., Littleton, MA 01460 ... 617-486-8911
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ... 401-683-9700
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 ... 818-782-6662
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 ... 914-793-5000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 ... 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 ... 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ... 315-437-4529; 800-448-1666
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 ... 617-695-0203
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 ... 516-231-1700
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 ... 312-364-6038
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
† Piconics, Cummings Rd., Tyngsboro, MA 01879 ... 617-649-7501
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 ... 914-939-8900
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 ... 212-892-6700
Ross Engrg. Corp., 559 Westchester Dr., Campbell, CA 95008 ... 408-377-4621
§ Solitron/Microwave, Box 278, Port Salerno, FL 33492 ... 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 ... 818-786-1760
Tektronix, Inc., P.O. Box 500, V3-314, Beaverton, OR 97077 ... 800-547-1512; Oregon only 800-452-1877
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 ... 317-545-4196
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
Vermont Precision Resistor, Box 1170, Stowe, VT 05672 ... 802-253-8567
§† Waveline, Box 718, W. Caldwell, NJ 07006 ... 201-226-9100

Attenuators, IF-1900 — *See Vol. 3*

Attenuators, Impedance Matching-3450

Applied Research Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ... 1A•1687
Shallco, Box 1089, Smithfield, NC 27577, 919-934-3135 ... 3•1052,1053
† **Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ... 1B•1755**
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 ... 812-372-8869
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 ... 617-935-8610
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 ... 516-248-8080
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 ... 414-671-2000
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 ... 201-797-9655
Compac, 279 Skidmore Rd., Deer Park, NY 11729 ... 516-667-3933
† Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 ... 305-994-1774
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-664-2333
§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766 ... 714-623-3463
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 ... 317-783-9875
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797 ... 201-227-2000
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 ... 818-782-6662
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 ... 914-793-5000
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 ... 201-992-7700
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 ... 312-364-6038
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 ... 312-675-2600
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 ... 914-939-8900
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 ... 312-866-2200
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada ... 416-669-1244
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 ... 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 ... 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 ... 317-545-4196
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, CA 91311 ... 818-882-1020
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 ... 215-644-1300
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 ... 317-787-3332
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ... 301-948-3434; 800-638-2048
§ Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ... 813-371-4242

Attenuators, Logarithmic-3450

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 ... 414-671-2000
§ Arenberg Sage Inc., P.O. Box 250, 57 Cornwall St., Jamaica Plain, MA 02130 ... 617-522-8640
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 ... 516-231-8400
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 . 516-694-3600
Shallco, Box 1089, Smithfield, NC 27577 ... 919-934-3135
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 ... 617-358-2777

Attenuators, Microwave-3450

† **Applied Research Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ... 1A•1687**
† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ... 1A•1689**
Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ... 1A•1690
† **Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ... 1A•1698-1700**
† **Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ... 1A•1871**
† **Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 ... 3•1220**
† **General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ... 1A•1704**
§ **ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ... 2•1393**
§ **JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203, 317-783-9875 . 1A•1705 1707**
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 ... 1A•1708
Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 .. 1A•1713, 1714,1762,1764,1765
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ... 3•1393
† **Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 ... 1A•1777**
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ... 1A•1785
† **Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877, 301-948-3434; 800-638-2048 ... 1A•1787**
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 ... 617-681-8520
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 ... 315-432-8909
§ Astrolab, 345 Dalziel Rd., Linden, NJ 07036 ... 201-862-0022
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 ... 408-496-6710
Baytron, 344 Salem St., Medford, MA 02155 ... 617-391-1550
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 ... 216-248-1200
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 ... 617-935-8600
† Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 ... 305-994-1774
§† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 ... 609-429-7800
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 ... 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ... Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ... 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
Hyletronics, Newtown Rd., Littleton, MA 01460 ... 617-486-8911
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 ... 914-793-5000

M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .... 315-437-4529; 800-448-1666
† Mitec Elctrns., 16 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vilg., IL 60007 312-364-6038
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§ Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 603-627-6000
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
§ Tucker Elctrns., Box 461060, Garland, TX 75046 .... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377
Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 415-969-6500

Attenuators, Programmable-3450

† Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750, 305-339-4356/4355 .... 3•1004
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 .... 1A•1698,1700
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 .... 1A•1704
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203, 317-783-9875 .1A•1705 1706
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 .... 1A•1708
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 .... 3•1317
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 .... 1A•1785
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
§ Hobart Engrg., 4143 Cheshire Dr., Cypress, CA 90630 714-827-2135
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
§ Marconi Instrs., 100 Stonehurst Ct., Northvale, NJ 07647 201-767-7250
Matrix Sys. Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 213-992-6776
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 212-769-0200
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vilg., IL 60007 312-364-6038
† Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Tucker Elctrns., Box 461060, Garland, TX 75046 .... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 415-969-6500

Attenuators, RF-1900 — *See Vol. 3*

Attenuators, Turret-3450

Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 .... 1A•1708
Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 .... 1B•1755
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 .... 1A•1777
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 .... 1A•1785
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048

Attenuators, Variable-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 .... 1A•1689
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 .... 1A•2028
Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 .... 3•1220
Grayhill Inc., 569 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... 1B•1632
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203, 317-783-9875 .1A•1705 1707
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9797, 201-227-2000 .... 1A•1708
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 .... 1B•1755
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 .... 3•1067
† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877, 301-948-3434; 800-638-2048 .... 1A•1787
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 516-248-8080
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Artech Corp., 2901 Telestar Ct., Falls Church, VA 22042 703-560-3292
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
§ Eaton Corp., Elctrn. Instrmn. Div., 2070 Fifth Ave., Ronkonkoma, NY 11779 516-588-3600
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 .516-694-3600
† GRIM Corporation, Box 67, Medford, NJ 08055 609-267-7950
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
§ Leader Instrs. Corp., 380 Oser Ave., Hauppauge, NY 11788-3694 516-231-6900
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
§ Marconi Instrs., 100 Stonehurst Ct., Northvale, NJ 07647 201-767-7250
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .... 315-437-4529; 800-448-1666
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 212-769-0200
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RCI/Data, 1992 Lakewood Rd., Toms River, NJ 08753 201-341-8361
† RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 212-892-6700
§ Shallco, Box 1089, Smithfield, NC 27577 919-934-3135
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196

§ Tucker Elctrns., Box 461060, Garland, TX 75046 ......214-348-8800;800-527-4642
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Attenuators, Voltage Controlled-3450

† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ......1A•1699,1700
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ......1A•1704
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
† Amplifonix Inc., 220 Rte. 13, Bristol, PA 19007 215-788-2350
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Atlantic Research, 5390 Cherokee Ave., Alexandria, VA 22312 703-642-4000
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
§ JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377

Attenuators (MIL)-2440 — ***See Vol. 1B***

Attenuators (MIL), Inductive-2440 — ***See Vol. 1B***

Audible Alarms & Transducers-1300 (Also see Piezoelectric Ceramics; Transducers, Audio) — ***See Vol. 3***

Audio Equipment — See Amplifiers (Vol. 3), Microphones (Vol. 3), Speakers (Vol. 3), etc.

Awls-5400 — ***See Vol. 2***

Backpanel Interconnect Systems-3200 — ***See Vol. 2***

Backplane Wiring Services — See Services, Backplane Wiring (Vol. 3)

Baffles, Speaker-1300 — ***See Vol. 3***

Ballasts — See Resistors, Ballast (Vol. 1A)

Baluns — See Transformers, Matching (Vol. 1A)

Barrier Blocks & Strips — See Terminal Blocks (Vol. 2), Terminal Strips (Vol. 2),

Bargraphs — See Meters, Bargraph (Vol. 3)

Bars, Shorting-3200 — ***See Vol. 2***

Baths, Controlled Temperature (Air & Liquid)-4100 — ***See Vol. 3***

Baths, Ultrasonic — See Cleaners, Ultrasonic (Vol. 3)

Batteries, Alkaline Manganese-3900 — ***See Vol. 3***

Batteries, Carbon Zinc-3900 — ***See Vol. 3***

Batteries, Gelled Electrolyte-3900 — ***See Vol. 3***

Batteries, Lead Acid-3900 — ***See Vol. 3***

Batteries, Lead Dioxide-3900 — ***See Vol. 3***

Batteries, Lithium-3900 — ***See Vol. 3***

Batteries, Lithium Manganese Dioxide-3900 — ***See Vol. 3***

Batteries, Lithium Thionyl Chloride-3900 — ***See Vol. 3***

Batteries, Mercury-3900 — ***See Vol. 3***

Batteries, Mercury Oxide-3900 — ***See Vol. 3***

Batteries, Nickel Cadmium-3900 — ***See Vol. 3***

Batteries, Rechargeable-3900 — ***See Vol. 3***

Batteries, Silver Cadmium-3900 — ***See Vol. 3***

Batteries, Silver Oxide-3900 — ***See Vol. 3***

Batteries, Silver Zinc-3900 — ***See Vol. 3***

Batteries, Solar — See Cells, Photovoltaic (Vol. 1B)

Batteries, Standard Cell-3900 — ***See Vol. 3***

Batteries, Thermal-3900 — ***See Vol. 3***

Batteries, Zinc Air-3900 — ***See Vol. 3***

Batteries, Zinc Carbon-3900 — ***See Vol. 3***

Batteries, Zinc Chloride-3900 — ***See Vol. 3***

Battery Chargers — See Chargers, Battery (Vol. 3), Power Supplies, Plug-in (Vol. 3),

Battery Holders — See Connectors, Battery (Vol. 2), Retainers, Battery (Vol. 2),

Battery Plugs — See Connectors, Battery (Vol. 2)

Bearings-2500 — ***See Vol. 2***

Beepers — See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices (Vol. 3)

Bells, Buzzers, Gongs, Sirens & Aural Warning Devices-2200 — ***See Vol. 3***

Belts, Dial Drive — See Cords & Cable, Dial Drive (Vol. 2)

Belts, Drive-2500 — ***See Vol. 2***

Benches, Consoles, Tables (Work Stations, Lab & Shop)-1400 (Also See Enclosures, Equipment and Panel Mounting) — ***See Vol. 2***

Bends & Twists, Microwave-3450

Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Bezels, Shielded & Unshielded-2400 — ***See Vol. 2***

Bimetals, Thermostatic-5300 — ***See Vol. 1B***

Bins, Part Storage-3800 — ***See Vol. 2***

Blackbody Radiation Sources-2900 — ***See Vol. 3***

Blowers, Centrifugal-2600 — ***See Vol. 2***

Board Computers & Subassemblies, Multibus Compatible-2025 — ***See Vol. 3***

Board Computers & Subassemblies, Q Bus/Unibus Compatible-2025 — ***See Vol. 3***

Board Computers & Subassemblies, S100 Bus Compatible-2025 — ***See Vol. 3***

Board Computers & Subassemblies, STD Bus Compatible-2025 — ***See Vol. 3***

Boards, Circuit, Clad-1700 — ***See Vol. 2***

Boards, Circuit, Unclad-1700 — ***See Vol. 2***

Boards, Display, Graphic-2450 — ***See Vol. 1B***

Boards, Integrated Circuit — See Boards, Plug-in (Vol. 2)

Boards, Plug-in-3200 — ***See Vol. 2***

Boards, Plug-in, Extender-3200 — ***See Vol. 2***

Boards, Plug-in, Interface-3200 — ***See Vol. 2***

Boards, Plug-in, Memory-3200 — ***See Vol. 2***

Boards, Plug-in Processor-1900 — ***See Vol. 2***

Boards, Plug-in, Prototype-4200 — ***See Vol. 2***

Boards, Prewired, High Density-3200 — ***See Vol. 2***

Boards, Printed Circuit — See Circuits, Printed, Rigid (Vol. 2)

Boards, Programming-3200 — ***See Vol. 2***

Bobbins, Winding, Coil & Transformer-2500 (Also See Coil Assemblies & Forms) — ***See Vol. 2***

Bolometers, Infrared-2900 — ***See Vol. 3***

Bolometers, Microwave-2900 — *See Vol. 3*

Bolts-2825 — *See Vol. 2*

Books — See Technical Books (Vol. 3)

Boosters, Low Line Voltage, Automatic — See Regulators & Stabilizers, Voltage (Vol. 3)

Boxes, Decade — See Decade Boxes (Vol. 3)

Boxes, Junction, Outlets & Wall Plates-1400 — *See Vol. 2*

Boxes, Metal & Plastic — See Enclosures (Various types) (Vol. 2)

Boxes, Power Outlet — See Boxes, Junction, Outlets & Wall Plates (Vol. 2)

Boxes, Shipping (Reusable) — See Enclosures, Shipping (Vol. 2)

Brackets, Antenna — See Mounts, Antenna (Vol. 3)

Braid, Cable-6000 (Also See Wire Shielding) — ***See Vol. 2***

Brakes, Magnetic-3500 — *See Vol. 1B*

Brakes, Mechanical-3500 — *See Vol. 1B*

Breadboard Assemblies-4200 — *See Vol. 2*

Breadboards & Breadboard Kits — See Kits, Breadboarding (Vol. 2)

Bridge Rectifiers, Silicon-4800 (Also See Rectifiers, Bridges & Assemblies)

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566

§† Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400

§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089

Bridges, Admittance-2900 — *See Vol. 3*

Bridges, Antenna — See Bridges, RF (Vol. 3)

Bridges, Audio-2900 — *See Vol. 3*

Bridges, Calorimeter-2900 — *See Vol. 3*

Bridges, Capacitance-2900 — *See Vol. 3*

Bridges, Deviation-2900 — *See Vol. 3*

Bridges, Impedance-2900 — *See Vol. 3*

Bridges, Inductance-2900 — *See Vol. 3*

Bridges, Kelvin-2900 — *See Vol. 3*

Bridges, LCR-2900 — *See Vol. 3*

Bridges, Limit — See Bridges (Specific Types) (Vol. 3)

Bridges, Megohm — See Bridges, Resistance (Vol. 3)

Bridges, Power, RF-2900 — *See Vol. 3*

Bridges, Programmable — See Bridges (Specific Types) (Vol. 3)

Bridges, Q-2900 — *See Vol. 3*

Bridges, Ratio — See Meters, Ratio (Vol. 3)

Bridges, Resistance-2900 — *See Vol. 3*

Bridges, RF-2900 — *See Vol. 3*

Bridges, Silicon Cell-4800

A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800

§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484

§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589

§† Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 .201-335-6723

§ General Instr., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802 516-733-3333

§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000

NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800

Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900

§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392

Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530. 914-681-0700

§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511

§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

Bridges, Strain Gauge-2900 — *See Vol. 3*

Bridges, Synchro & Resolver-2900 — *See Vol. 3*

Bridges, Telephone/Data-1900 — *See Vol. 3*

Bridges, Temperature-2900 — *See Vol. 3*

Bridges, Wheatstone-2900 — *See Vol. 3*

Brushes & Brush Assemblies-3500 — *See Vol. 1B*

Buffers, Data — See Spoolers, Printer Buffers (Vol. 3)

Bulbs — See Lamps, Miniature & Subminiature (Vol. 1B)

Bumpers-2825 — *See Vol. 2*

Burnishers, Contact-5400 — *See Vol. 2*

Bus Bars & Systems-3200 — *See Vol. 2*

Bus Compatible Instruments — See Instruments, Test and Measuring, GPIB Compatible (Vol. 3)

Bushings, Glass, Plastic, Metal, Rubber, etc.-2500 — *See Vol. 2*

Busses, Multibus, Q Bus, S100 Bus, STD Bus — See Board Computers & Subassemblies (Vol. 3)

Buzzers, Electronic — See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices (Vol. 3)

Cabinets, Plastic — See Enclosures, Nonmetallic (Vol. 2)

Cabinets & Accessories, Metal — See Enclosures, Equipment & Panel Mounting (Vol. 2)

Cable, Audio-6000 — *See Vol. 2*

Cable, Battery Booster-6000 — *See Vol. 2*

Cable, Coaxial-6000 — *See Vol. 2*

Cable, Dial — See Cords & Cable, Dial Drive (Vol. 2)

Cable, FEP Insulated-6000 — *See Vol. 2*

Cable, Fiber Optic-2475 — *See Vol. 1B*

Cable, Flame Retardant-6000 — *See Vol. 2*

Cable, Flat-6000 — *See Vol. 2*

Cable, Heater-6000 — *See Vol. 2*

Cable, High Temperature (Over 125)-6000 — *See Vol. 2*

Cable, High Voltage (1,000 Volts & Over)-6000 — *See Vol. 2*

Cable, Instrumentation & Control-6000 — *See Vol. 2*

Cable, Intercommunication & Sound System — See Cable, Audio (Vol. 2)

Cable, Irradiated-6000 — *See Vol. 2*

Cable, Low Capacitance-6000 — *See Vol. 2*

Cable, Microphone-6000 — *See Vol. 2*

Cable, Multiconductor-6000 — *See Vol. 2*

Cable, Plenum-6000 — *See Vol. 2*

Cable, Power-6000 — *See Vol. 2*

Cable, Retractile — See Cords, Retractile (Vol. 2)

Cable, Ribbon — See Cable, Flat (Vol. 2)

Cable, Rotator Antenna — See Cable, Multiconductor (Vol. 2)

Cable, Security-6000 — *See Vol. 2*

Cable, Shielded-6000 — *See Vol. 2*

Cable, Telephone-6000 — *See Vol. 2*

Cable, TFE Insulated-6000 — *See Vol. 2*

Cable, Thermocouple-6000 — *See Vol. 2*

Cable, Transmission Line-6000 — *See Vol. 2*

Cable, Triaxial-6000 — *See Vol. 2*

Cable, TV (Incl. Camera)-6000 — *See Vol. 2*

Cable, Twisted Pair-6000 — *See Vol. 2*

Cable, Woven Conductor-6000 — *See Vol. 2*

Cable & Assemblies (MIL)-2440 — *See Vol. 1B*
Cable Assemblies & Harnesses-6000 — *See Vol. 2*
Cable Assemblies, Microwave-6000 — *See Vol. 2*
Cable Fault Locators-2900 — *See Vol. 3*
Cable (MIL), Flat-2440 — *See Vol. 1B*
Cable (MIL), RF-2440 — *See Vol. 1B*
Cable Retractors-1400 — *See Vol. 2*
Cages, Card — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. 2)
Calculators, Electronic, Desk Top-4200 — *See Vol. 2*
Calculators, Electronic, Hand Held-4200 — *See Vol. 2*
Calibration & Instrument Repair Services — See Services, Calibration & Instrument Repair (Vol. 3)
Calibrators, Accelerometer-2900 — *See Vol. 3*
Calibrators, Attenuation-2900 — *See Vol. 3*
Calibrators, Crystal-2900 — *See Vol. 3*
Calibrators, Current-2900 — *See Vol. 3*
Calibrators, Frequency-2900 — *See Vol. 3*
Calibrators, LVDT-2900 — *See Vol. 3*
Calibrators, Magnetic Field-2900 — *See Vol. 3*
Calibrators, Meter — See Testers, Meter (Vol. 3)
Calibrators, Sound Level-2900 — *See Vol. 3*
Calibrators, Sweep — See Generators, Sweep (Vol. 3)
Calibrators, Synchro-2900 — *See Vol. 3*
Calibrators, Time Base-2900 — *See Vol. 3*
Calibrators, Transducer-2900 — *See Vol. 3*
Calibrators, Voltage-2900 — *See Vol. 3*
Calibrators, VSWR-2900 — *See Vol. 3*
Calorimeters, Microwave-2900 — *See Vol. 3*
Cameras, Data Recording-2325 — *See Vol. 3*
Cameras, Image Converter-1900 — *See Vol. 3*
Cameras, Infrared-2325 — *See Vol. 3*
Cameras, Oscilloscope-2975 — *See Vol. 3*
Cameras, Television-1900 — *See Vol. 3*
Cans & Flat Packs, Integrated Circuit — See Packages, Integrated Circuit (Vol. 1A)
Cans, Capacitor, Relay, Semiconductor, Transformer, etc-2500 — *See Vol. 2*
Capacitance Comparators — See Bridges, Capacitance (Vol. 3)
Capacitor Hardware-2800 — *See Vol. 2*
Capacitor Leakage Indicators — See Testers, Capacitor (Vol. 3)

Capacitors, Energy Storage-1500

Carborundum Co., Semiconductor Prods. Div., 3425 Hyde Park Blvd., Niagara Falls, NY 14302, 716-276-2731 ... 1A•1020
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ... 1A•1021
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 ... 904-796-3561
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 ... 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 ... 212-961-6750
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 ... 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 ... 201-481-1600
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705 ... 714-979-4440
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 ... 201-779-2240
High Energy, Lower Valley Rd., Parkesburg, PA 19365 ... 215-593-2800
ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122 ... 408-292-4025
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 ... 814-362-5536
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 ... 619-279-5100
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 ... 312-489-2229
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 ... 413-664-4411
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 ... 617-828-3366
Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 ... 901-235-2218
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 ... 213-463-5618
§ Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 ... 818-889-4120

Capacitors, Chip (For Microcircuits)-1500

† American Tech. Ceramics, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ... 1A•1007-1009
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ... 1A•1002,1014, 1B•1009
† Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 213-848-4465 ... 1A•1094
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ... 1A•1879
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ... 1A•1096,1097,1108,1109,1111,1114
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ... 1A•1122
† Mepco/Electra, Inc., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, 305-842-3201 ... 1A•1134,1B•1013
Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ... 1A•1134,1B•1013
† Microcap, 11120 Roselle St., San Diego, CA 92121, 619-452-9812 ... 1A•1186-1188
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ... 1A•1147
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ... 1A•1148,1151
Presidio Comps., Inc., 7185 Construction Ct., San Diego, CA 92121, 619-578-9390 ... 1A•1181
† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524, 201-279-0300 ... 1A•1182
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan, (03) 775-2111 ... 1A•1184
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ... 1A•1189
§† Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ... 1A•1096,1097,1108,1109,1111,1114
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ... 1A•1211
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 ... 516-864-7000
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 ... 408-988-3500
§ Capar Components Corp., Div. of Diplomat Electronics, 26 Dubon Ct., Farmingdale, NY 11735 ... 516-454-6390
§ Centralab, Inc., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039 ... 818-240-4880
§ Centre Engrg., 2820 E. College Ave., State College, PA 16801 ... 814-237-0321
† Compex Corp., 35A East Main St., Marlton, NJ 08053 ... 609-596-9388
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 ... 201-256-2000
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 ... 607-974-9000
† Dielectric Labs., 69 Albany St., Cazenovia, NY 13035 ... 315-655-8710
† Dionics, 65 Rushmore St., Westbury, NY 11590 ... 516-997-7474
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 ... 212-961-6750
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 ... 516-293-1500
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 ... 312-297-5435
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 ... 619-454-1800
§ Matsuo Elctrns., 12831 Western Ave., Ste. A, Garden Grove, CA 92641 ... 714-898-0707
3M Co., Tech Ceramic Resources, 3M Center 225-4W, St. Paul, MN. 55101 ... 617-736-0601
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861 ... 201-442-0500
† Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan ... 075-921-9111
National Micronetics, Route 28, West Hurley, NY 12136 ... 914-338-0333
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 ... 408-745-6520
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 ... 201-348-7000
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 ... 312-478-3600
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 ... 213-628-5392
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 ... 213-365-9411
SMD Technology Svc. Ctr., North American Philips, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 ... 800-431-4444
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 ... 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 ... 413-664-4481
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 ... 615-892-0291
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 ... 802-442-5473
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 ... 214-995-6611
Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 ... 617-861-6540
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 ... 619-292-1411
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 ... 203-268-6261
Wright Capacitors, 3000 So. Orange, Santa Ana, CA 92707 ... 714-546-2490

Capacitors, Fixed, AC (Incl. Motor Start)-1500

§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ... 1A•1022-1043,1055,1056,1058,1059,1062,1063
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ... 1A•1021
§ Inter-Technical Grp., Box 23, Irvington, NY 10533, 914-591-8822 ... 1A•1075
ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ... 1A•1092

§ **Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 .... 1A•1132,1133**
Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 .... 1A•1135
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195, 312-843-7500 .... 1A•1157
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675, 201-666-5600 .... 1A•1183
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705 714-979-4440
F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§ Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
RTE Aerovox Inc., P.O. Box B-970, 740 Belleville Ave., New Bedford, MA 02741 617-994-9661
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Thomson-CSF Comps. Corp., Passive Comp. Div., 6660 Variel Ave., Canoga Park, CA 91303 818-887-1010
Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358
§ Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Air-1500

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Fixed, Aluminum Electrolytic-1500

Capacitor Technology, Inc., 5015 Speedway Dr., Ft. Wayne, IN 46825, 219-484-9054 .... 1A•1015
§ **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 .... 1A•1016**
§ **Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 .... 1A•1064**
§ **Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 .... 1A•1072**
§ **International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 .... 1A•1074**
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 .... 1A•1082
§ **ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 .... 1A•1084,1087-1089**
Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550, 516-538-2300 .... 1A•1119
§ **Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 .... 1A•1131,1132**
Mepco/Electra, Inc., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, 305-842-3201 .... 1B•1013
§† **Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 .... 1A•1135,1B•1013**
§ **NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 .... 1A•1152**
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195, 312-843-7500 .... 1A•1154-1159
§ **United Chemi-Con Inc., 9801 W. Higgins Rd., Rosemont, IL 60018, 312-696-2000 .... 1A•1208,1209**
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 .... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Elna America, Inc., 153 E. Savarona Way, Carson, CA 90746 213-327-6090
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
§ Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§† Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
§† Sangamo Capacitor Div., Box 128, Pickens, SC 29671 803-878-6311
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
§ SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 .... 516-957-8700;800-645-5516
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Tran-Spectra, Inc., Rte. 1-Box 27A, Greenfield, TN 38230 901-235-2218

Capacitors, Fixed, Ceramic, Disc & Tubular-1500

AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 .... 1A•1002,1010-1012,1014,1B•1008
§ **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 .... 1A•1016**
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 .... 1A•1064
§ **Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 .... 1A•1073**
§ **International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 .... 1A•1074**
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 .... 1A•1080
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 .... 1A•1083
§† **Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 .... 1A•1096,1097**
§ **Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 .... 1A•1121,1122**
† **Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 .... 1A•1138-1144**
§ **Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 .... 1A•1147**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1148-1150**
§ **NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 .... 1A•1153**
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195, 312-843-7500 .... 1A•1154,1158,1159
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 .... 1A•1189
§ **TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153, 308-284-3611 .... 1A•1199**
§† **Tusonix, Inc., 7741 N. Business Park Drive, P.O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 .... 1A•1201-1203,1206,1207**
§† **Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606, 803-963-6348 .... 1A•1096.1097**
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 .... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
§ Centralab, Inc., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Emcon Inc., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138 619-459-4355
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122 408-292-4025
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
KD Components, Inc., 3016 S. Orange Ave., Santa Ana, CA 92707 714-545-7108
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
§† Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291

Capacitors, Fixed, Ceramic-1500 (Cont'd)

§ Thomson-CSF Comps. Corp., Passive Comp. Div., 6660 Variel Ave., Canoga Park, CA 91303 818-887-1010
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5618
§† Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 .312-585-1212

Capacitors, Fixed, Ceramic, Monolithic-1500

† American Tech. Ceramics, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ....1A•1007-1009
AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ... 1A•1002,1010-1014,1B•1008,1009
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ....1A•1017
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 213-848-4465 ....1A•1094
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 .... 1A•1096,1097,1110-1113,1115
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ....1A•1122
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 .... 1A•1138-1146
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ....1A•1147
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1148,1150
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ....1A•1153
Presidio Comps., Inc., 7185 Construction Ct., San Diego, CA 92121, 619-578-9390 ....1A•1181
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524, 201-279-0300 ....1A•1182
§† Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606, 803-963-6348 .... 1A•1096,1097,1110-1113,1115
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ....1A•1211
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ....213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§† Centralab, Inc., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039 818-240-4880
§ Centralab, Inc., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
§ Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Emcon Inc., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138 619-459-4355
ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
† ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122 408-292-4025
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
† Microcap, 11120 Roselle St., San Diego, CA 92121 619-452-9812
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5618
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 .312-585-1212
Wright Capacitors, 3000 So. Orange, Santa Ana, CA 92707 714-546-2490

Capacitors, Fixed, Feedthru-1500

Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•1080
§ ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ....1A•1083
† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 .... 1A•1142-1144
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505, 814-455-0966 .. 1A•1625-1627
§† Tusonix, Inc., 7741 N. Business Park Drive, P.O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ....1A•1203,1206,1207
§ Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
§† AVX Corporation, Box 867, Myrtle Bch., SC 29577 803-448-9411
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
Compac, 279 Skidmore Rd., Deer Park, NY 11729 516-667-3933
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404 213-829-3615
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705 714-979-4440
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148 Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
† ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122 408-292-4025
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
† Microcap, 11120 Roselle St., San Diego, CA 92121 619-452-9812
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Presidio Comps., Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† S & EI Mfg., Box 832, Northridge, CA 91324 818-349-4111
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5618
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352 818-767-6770
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 .312-585-1212
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358

Capacitors, Fixed, Film, Metallized & Nonmetallized-1500

§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ....1A•1016
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 .... 1A•1022-1063
† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ....1A•1021
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ....1A•1064
† Electronic Concepts, Inc., Box 627 E, Eatontown, NJ 07724, 201-542-7880 .... 1A•1065-1068
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ....1A•1070,1071
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645, 312-675-1760 ....1A•1073
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ....1A•1074
Inter-Technical Grp., Box 23, Irvington, NY 10533, 914-591-8822 .... 1A•1076-1079
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•1081
§ ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ....1A•1083
Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550, 516-538-2300 ....1A•1119
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ....1A•1879
§† Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 .... 1A•1096,1097,1116-1118

§ **Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... 1A•1133**
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ..... 1A•1136
§ **Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ..... 1A•1136**
§ **NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ..... 1A•1153**
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195, 312-843-7500 ..... 1A•1154,1158,1159
§† **Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ..... 1A•1160-1168**
PPD, Inc., Hwy. 70W, Resco Ct., P.O. Box 31347, Raleigh, NC 27612, 919-781-3955 ..... 1A•1173-1179
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675, 201-666-5600 ..... 1A•1183
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... 3•1055
§† **TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153, 308-284-3611 ..... 1A•1191-1198**
§† **Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... 1A•1096,1097,1116,1117**
† **Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301, 413-774-4358 ..... 1A•1212-1217**
§† Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
AT&T, 475 South St., Morristown, NJ 07960 201-631-6790
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Capco, Box 1028, Grand Junction, CO 81502 303-243-8751
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 904-796-3561
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Custom Elctrns., Browne St., Oneonta, NY 13820 607-432-3880
§ Datak Corp., 65 Seventy-First St., Guttenberg, NJ 07093 201-869-2200
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148 Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Interelectronics Corp., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920 ..... 914-EL8-8000
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Matsuo Elctrns., 12831 Western Ave., Ste. A, Garden Grove, CA 92641 714-898-0707
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
§† Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§† RTE Aerovox Inc., P.O. Box B-970, 740 Belleville Ave., New Bedford, MA 02741 617-994-9661
† S & EI Mfg., Box 832, Northridge, CA 91324 818-349-4111
§† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
§ Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Glass-1500

† **ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ..... 1A•1092**
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§† Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
Presidio Comps., Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Fixed, Laboratory Standard-1500

ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ..... 1A•1092
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
Blanck, A. R., Co., Box 249, Rutherford, NJ 07070 201-933-2091
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404 213-829-3615
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§ Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 312-843-7500
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 201-933-2091
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§ Tucker Elctrns., Box 461060, Garland, TX 75046 ..... 214-348-8800;800-527-4642
§† Tusonix, Inc., 7741 N. Business Park Drive, P.O. Box 37144, Tucson, AZ 85740-7144 602-744-0400
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358

Capacitors, Fixed, Mica-1500

§† **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... 1A•1018,1019,1B•1102**
§† **Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550, 516-538-2300 ..... 1A•1119**
§† **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... 1A•1151**
§† **Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan, (03) 775-2111 ..... 1A•1184**
§ Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ..... 213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§† Custom Elctrns., Browne St., Oneonta, NY 13820 607-432-3880
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
† Micap Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§† Sangamo Capacitor Div., Box 128, Pickens, SC 29671 803-878-6311
§† SEMCO, Rte. 6, No. Windham, CT 06226 203-423-6316
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Spruce Pine Mica Co., Mtn. Laurel Dr., Spruce Pine, NC 28777 704-765-4241
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
§ Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Monolithic-1500

§† **AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... 1A•1002,1010-1014,1B•1008,1009**
§ **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ..... 1A•1017**
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ..... 1A•1083
§† **Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... 1A•1096,1097,1110-1113,1115**
† **Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 ..... 1A•1144-1146**
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ..... 1A•1147
§† **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ..... 1A•1148,1151**
§ **NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ..... 1A•1153**
§† **Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524, 201-279-0300 ..... 1A•1182**
§† **Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ..... 1A•1096,1097,1110-1113,1115**

† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ....1A•1211
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 .....213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
† American Tech. Ceramics, 1 Norden La., Huntington Sta., NY 11746 516-271-9600
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
§† Centralab, Inc., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039 818-240-4880
§ Centralab, Inc., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
§ Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Emcon Inc., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138 619-459-4355
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505 213-848-4465
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
§† KD Components, Inc., 3016 S. Orange Ave., Santa Ana, CA 92707 .714-545-7108
§ Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§ Matsuo Elctrns., 12831 Western Ave., Ste. A, Garden Grove, CA 92641 714-898-0707
† Microcap, 11120 Roselle St., San Diego, CA 92121 619-452-9812
Presidio Comps., Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5618
§ Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§† Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 .312-585-1212
Wright Capacitors, 3000 So. Orange, Santa Ana, CA 92707 714-546-2490

Capacitors, Fixed, Mylar — See Capacitors, Fixed, Film (Vol. 1A)

Capacitors, Fixed, Oil Filled-1500

† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ....1A•1021
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ....1A•1167,1171,1172
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404 213-829-3615
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 904-796-3561
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705 714-979-4440
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
§ High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
Nichicon (America) Corp., 927 E. State Pkwy., Schaumburg, IL 60195 312-843-7500
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§† RTE Aerovox Inc., P.O. Box B-970, 740 Belleville Ave., New Bedford, MA 02741 617-994-9661
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Paper, Metallized & Nonmetallized-1500

† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ....1A•1021
Inter-Technical Grp., Box 23, Irvington, NY 10533, 914-591-8822 ....1A•1075
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ....1A•1083
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ....1A•1136
Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ....1A•1136
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ....1A•1169-1172
TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153, 308-284-3611 ....1A•1198
§ Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 .....213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† American Capacitor, 2080 Central Ave, Duarte, CA 91010 818-357-8806
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
† Condenser Prods., P.O. Box 997, Brooksville, FL 33512 904-796-3561
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
§ Elpac Comps., 3131 S. Standard Ave., Santa Ana, CA 92705 714-979-4440
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 516-294-5445
§† Film Capacitors, 100 8th St., Passaic, NJ 07055 201-779-2240
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
§ Illinois Capacitor, Inc., 3757 W. Touhy Ave., Lincolnwood, IL 60645 312-675-1760
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§† RTE Aerovox Inc., P.O. Box B-970, 740 Belleville Ave., New Bedford, MA 02741 617-994-9661
§† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458
§ SPECO Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ....516-957-8700;800-645-5516
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301 413-774-4358
§ Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Plastic — See Capacitors, Fixed, Film (Vol. 1A)

Capacitors, Fixed, Polycarbonate — See Capacitors, Fixed, Film (Vol. 1A)

Capacitors, Fixed, Polyester — See Capacitors, Fixed, Film (Vol. 1A)

Capacitors, Fixed, Polypropylene — See Capacitors, Fixed, Film (Vol. 1A)

Capacitors, Fixed, Polysulfone — See Capacitors, Fixed, Film (Vol. 1A)

Capacitors, Fixed, Polystyrene — See Capacitors, Fixed, Film (Vol. 1A)

Capacitors, Fixed, Porcelain-1500

† American Tech. Ceramics, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ....1A•1007-1009
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Dielectric Labs., 69 Albany St., Cazenovia, NY 13035 315-655-8710
High Energy, Lower Valley Rd., Parkesburg, PA 19365 215-593-2800
† Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505 213-848-4465
§ KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435

§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Presidio Comps., Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
§† Vitramon N.A., P. O. Box 544, Bridgeport, CT 06601 203-268-6261

Capacitors, Fixed, Tantalum Electrolytic-1500

§ **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ....1A•1016**
§ **Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 ....1A•1064**
§ **International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ....1A•1074**
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ....1A•1083
§ **ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 ....1A•1085,1086**
§† **Kemet, Union Carbide Corporation, Elctrns. Div., Components Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ....1A•1096-1109**
§† **Mallory Capacitor Co., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ....1A•1124-1130**
§† **Mepco/Electra, Inc., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, 305-842-3201 ....1A•1134,1B•1013**
§† **Mepco/Electra, Inc., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, 803-772-2500 ....1A•1134,1B•1013**
§ **NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ....1A•1152**
§† **Union Carbide Corp., Elctrns. Div., Component Dept., Box 5928, Greenville, SC 29606, 803-963-6348 ....1A•1096-1109**
§† Acushnet Capacitor Co., Inc., 720 Belleville, New Bedford, MA 02741 617-999-3291
Acushnet Elctrns. Co., Inc., 8700 E. Thomas Rd., Scottsdale, AZ 85252 602-947-7474
§ Air Electro Supply, Inc., 7700 Gloria Ave., Van Nuys, CA 91406 ....213-873-6400; 818-988-4400
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
§ Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
§ Elna America, Inc., 153 E. Savarona Way, Carson, CA 90746 213-327-6090
Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
Hilton Industries, Inc., Div. of Core Industries, 1177 Cattlemen Road, Sarasota, FL 33582 813-371-2600
Hunter Stanley Elec., 208 Russell St., Nashville, TN 37213 615-254-6532
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
Lawrence-Crow Elctrns. Inc., 2100 Stemmons, Dallas, TX 75207 214-749-5440
§ Matsuo Elctrns., 12831 Western Ave., Ste. A, Garden Grove, CA 92641 714-898-0707
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
§† Thomson-CSF Comps. Corp., Passive Comp. Div., 6660 Variel Ave., Canoga Park, CA 91303 818-887-1010
† Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Capacitors, Fixed, Vacuum-1500

† **ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ....1A•1090**
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474

Capacitors, Variable, Air-1500

§† **Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ....1A•1095**
§† **Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ....1A•1185**
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
Hopt, Karl, Co., 118 First Ave., Atlantic Highlands, NJ 07716 201-291-0633
§ Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

§† Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5478
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§ Trim-Tronics, Inc., 67 Albany St., Cazenovia, NY 13035 315-655-9528
§† Voltronics, West St., P.O. Box 366, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Ceramic-1500

Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•1080
§† **Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ....1A•1095**
§ **Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ....1A•1185**
§† **Tusonix, Inc., 7741 N. Business Park Drive, P.O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ....1A•1204,1205**
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131 408-946-6000
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Compex Corp., 35A East Main St., Marlton, NJ 08053 609-596-9388
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
§ Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Piher Intl., 565 W. Golf Rd., Arlington Hgts., IL 60005 ....312-640-8300; 800-323-6693
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
§ Trim-Tronics, Inc., 67 Albany St., Cazenovia, NY 13035 315-655-9528

Capacitors, Variable, Film-1500

§ **Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ....1A•1185**
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
§ Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
Voltronics, West St., P.O. Box 366, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Gas Filled-1500

† **ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ....1A•1091**
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Variable, Glass-1500

§† **Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ....1A•1185**
† ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122 408-292-4025
§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005 201-334-2676
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
§† Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473
§† Voltronics, West St., P.O. Box 366, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, HV (Lab Type)-1500 (Also See Decade Boxes, Capacitance)

ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ....1A•1090,1091
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1151
§† **Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ....1A•1185**
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651

Capacitors, Variable, HV (Lab Type)-1500 (Cont'd)

† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000

† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431

§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005 201-334-2676

† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458

Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050

Capacitors, Variable, Mica-1500

§ Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ....1A•1185

§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000

ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000

§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000

Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777

Capacitors, Variable, Padders & Trimmers-1500

Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•1080

§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ....1A•1095

§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1151

§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ....1A•1185

§† Tusonix, Inc., 7741 N. Business Park Drive, P.O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ....1A•1204,1205

Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131 408-946-6000

§ Arco Elctrns., 400 Moreland Rd., Commack, NY 11725 516-864-7000

§ Johnson, E. F., Co., 299 Johnson Ave., Waseca, MN 56093 507-835-6222

§ Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785

Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120

Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

§ Tansitor Elctrns., West Rd., Bennington, VT 05201 802-442-5473

§† Voltronics, West St., P.O. Box 366, E. Hanover, NJ 07936 201-887-1517

Capacitors, Variable, Vacuum-1500

† ITT Jennings, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, 408-292-4025 ....1A•1090,1091

† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050

§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474

Capacitors (MIL)-2440 — *See Vol. 1B*

Caps, Connector-2100 — *See Vol. 2*

Caps, Forms & Tapes, Heat Shrinkable-3100 (Also See Tubing, Heat Shrinkable) — ***See Vol. 2***

Caps, Lenses, Indicator Light-2450 — *See Vol. 1B*

Caps, Wire Splicing — See Splicers, Wire (Vol. 2)

Caps (MIL)-2440 — *See Vol. 1B*

Card Equipment, Mark Sense-2000 — *See Vol. 3*

Card Equip., Punch-2000 — *See Vol. 3*

Card Equip., Reader-2000 — *See Vol. 3*

Card Equip., Reader/Punch-2000 — *See Vol. 3*

Card Holders, Circuit Board — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. 2)

Cards, Data Communication/Interfaces-2000 — *See Vol. 3*

Cards, Linear Function-2000 — *See Vol. 3*

Cards, Memory — See Memory Devices (Vol. 3), Memory Systems (Vol. 3),

Cards, Logic-2000 — *See Vol. 3*

Carriers — See Holders & Carriers, Chip (Vol. 2)

Carts & Dollies, Instrument & Equipment-3800 — *See Vol. 2*

Cases, Equipment, Instrument, Meter (Portable) — See Enclosures, Portable, Metallic & Nonmetallic (Vol. 2)

Cases, Equipment, Instrument, Meter (Stationary) — See Enclosures, Equipment & Panel Mounting (Vol. 2)

Cases, Shielded — See Enclosures, Shielded (Vol. 2)

Cases, Transit — See Enclosures, Shipping (Vol. 2)

Casters-1400 — *See Vol. 2*

Cathode-Ray Readout Tubes — See Tubes, Readout (Vol. 1A)

CATV Systems & Equipment-1900 — *See Vol. 3*

Cavities, Microwave-3450

§ Eaton Corp., Elctrn. Instrmn. Div., 2070 Fifth Ave., Ronkonkoma, NY 11779 516-588-3600

† EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500

§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400

Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515

Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800

† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282

Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715

† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350

† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700

Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000

Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41

§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060

† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900

† Reeve Elctrns., 444 N. Orleahs, Chicago, IL 60610 312-670-0150

† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411

† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009

Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Zero Corp., 777 Front St., Burbank, CA 91503 213-846-4191

Cells, Electrolytic (Timing) — See Timers, Electrolytic Cell (Vol. 3)

Cells, Load-5500 — *See Vol. 1B*

Cells, Photoconductive-3700 — *See Vol. 1B*

Cells, Photoemissive-3700 — *See Vol. 1B*

Cells, Photovoltaic-3700 — *See Vol. 1B*

Cells, Solar — See Cells, Photovoltaic (Vol. 1B)

Cements — See Adhesives, (All Types) (Vol. 2)

Chaff Systems (MIL)-3475 — *See Vol. 3*

Chambers, Altitude-2550 — *See Vol. 3*

Chambers, Environmental-2550 — *See Vol. 3*

Chambers, Explosion-2550 — *See Vol. 3*

Chambers, Fluid Conditioner-2550 — *See Vol. 3*

Chambers, Humidity-2550 — *See Vol. 3*

Chambers, Magnetic, Degaussing Coil-4525 — *See Vol. 3*

Chambers, Pressure-2550 — *See Vol. 3*

Chambers, Radiation-2550 — *See Vol. 3*

Chambers, Shock-2550 — *See Vol. 3*

Chambers, Space Simulation-3475 — *See Vol. 3*

Chambers, Temperature-2550 — *See Vol. 3*

Chambers, Vacuum-2550 — *See Vol. 3*

Chambers, Vibration-2550 — *See Vol. 3*

Character Recognition Equip., Magnetic Ink-2000 — *See Vol. 3*

Character Recognition Equip., Optical-2000 — *See Vol. 3*

Chargers, Battery-4000 — *See Vol. 3*

Chargers, Magnet — See Magnetizers (Vol. 3)

Chassis, Circuit Board Mounting-1400 — *See Vol. 2*

Chassis Marking Kits — See Kits, Marking (Vol. 2)

Chassis, Metal-1400 — *See Vol. 2*

Chassis (MIL), Electrical-2440 — *See Vol. 1B*

Chassis Slides — See Slides, Cabinet, Chassis (Vol. 2)

Checkers — See Analyzers (Vol. 3), Testers (Vol. 3),

Chemicals, Antistatic — See Coatings, Antistatic (Vol. 2)

Chemicals, Electroplating-1600 — *See Vol. 2*

Chemicals, Epoxy Stripping-1600 — *See Vol. 2*

Chemicals, Etching-1700 — *See Vol. 2*

Chemicals, Fungicidal — See Coatings, Fungicidal (Vol. 2)

Chemicals, Tin Plating-1700 — *See Vol. 2*

Chemicals, Wire Stripping-1600 — *See Vol. 2*

Chestsets — See Handsets, Chestsets (Vol. 3)

Chips, Integrated Circuit — See Integrated Circuits, Silicon Monolithic, Unpackaged Chips (Vol. 1A)

Chokes, AF — See Coils, AF (Vol. 1A)

Chokes, Filter-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... 1A•2127,2128
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 .... 1A•2134
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 .... 1A•1224,1226,1228,1229
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... 1A•1233
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 .... 1A•1234-1242
Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 .... 1A•1596,1597
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225, 716-894-5710 .... 1A•2171
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .... 1A•2175
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 .... 1A•2176
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 1A•2177
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 . 1A•2182, 2183
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .. 1A•2210
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 1A•2211,3•1663
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 3•1663
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 .... 1A•2215,2220
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•1274
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 . 1A•1278-1280
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2267,2277
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ... 1A•2283
Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 .... 1A•2310
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•2314,2315,2320
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 .... 1A•2327,2328
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•1304,1305,2338-2343,2349,2350,2353,2356
Wilco Corp., 4030 W. Tenth St., Indianapolis, IN 46222, 317-241-2516 .... 1A•1306, 1307
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
§ Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 . 602-287-5851
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
§† Midland-Ross Corp., Cambion Div., One Alrwife Place, Cambridge, MA 02140 617-491-5400
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 . 516-593-2025;Outside NY 800-645-5900
Schaffner EMC Inc., Component Div., 825 Lehigh Ave., Union, NJ 07083 201-851-0644
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan .... Tokyo 03-402-6161
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Chokes, RF — See Coils, RF (Vol. 1A)

Chokes, Swinging-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... 1A•2127,2128
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 .... 1A•2162
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 .... 1A•2176
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 . 1A•1278-1280
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2356
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 .. 612-788-9161
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
§ E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Todd Systems, 50 Ash St., Yonkers, NY 10701 914-963-3400
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Chokes, Waveguide-3450

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Chokes (MIL)-2440 — *See Vol. 1B*

Choppers-4050 (Also See Light Choppers) — *See Vol. 3*

Choppers (MIL)-2440 — *See Vol. 1B*

Circuit Analyzers — See Testers, Signal Tracing (Vol. 3)

Circuit Board Holders, Jig Type — See Holders, Circuit Board (Vol. 3)

Circuit Breakers-4300 — *See Vol. 1B*

Circuit Breakers, Boxes, Panel Boards, Enclosures (MIL)-2440 — *See Vol. 1B*

Circuit Testers — See Testers, Signal Tracing (Vol. 3)

Circuits, Hybrid, Custom-3130

ACC Electronics, 1300 W. Oak, Independence, KS 67301, 316-331-1000 .1A•1643
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700 ......1A•1644
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ...... 1A•1646-1650
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ......1A•1658,1874
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ......1A•1659
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ...... 3•1161
§† Integrated Circuits, Inc., 10301 Willows Road, Redmond, WA 98052, 206-882-3100 ......1A•1660
International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ......1A•1661
Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ...... 1A•1373,1664,1665,1B•1458,1459
Modular Devices, 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 ...... 3•1933
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ......1A•1680
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ......1A•2003
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Aeroflex Labs., Magnetic Prods. Div., , So. Service Rd., Plainview, NY 11803 516-694-6700
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd., Towson, MD 21204 301-583-4000
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
American Elctrn. Labs., Inc., Hybrid/MIC Div., P.O. Box 552, Lansdale, PA 19446
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
Array Technology, 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129 408-252-9900
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., 00, Santa Clara, CA 95051 408-748-1200
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Box 328, Newtown, PA 18940 215-968-4271
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Boeing Microelectronics, PCB OPNS., M/S: 88-34, Box 24666, Seattle, WA 98124 206-773-1083
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
Centralab, Inc., A North American Philips Co., 5855 N. Glen Park Rd., Milwaukee, WI 53209 414-228-7380
§ Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94089 408-734-8150
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Computer Avionics, 740 Market, Mt. Carmel, IL 62863 618-263-4343
† CTS Halex, 1202 McGaw Ave., Irvine, CA 92714 714-556-2850
§ Dynamic Measurements, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Electrostatic Consltg. Assocs., 556 Lowell Rd., Groton, MA 01450 ..617-448-5485
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 904-252-0411
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 ...714-557-7800
§† Film Microelectronics, 17 A St., Burlington, MA 01803 617-272-5650
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu America, Inc., 918 Sherwood Dr., Lake Bluff, IL 60044 312-295-2610
† Gentex, Box 315, Carbondale, PA 18407 603-434-0311
HEI, Inc., 1495 Steiger Lake La., Victoria, MN 55386 612-443-2500
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
† Hybrid Elctrns., 142 Adams St., Newton, MA 02158 617-527-2711
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Interconics, BMC Industries, Inc., 610 Bremer Tower, St. Paul, MN 55101 612-228-6512
Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051 408-733-4045
† Kates Sci. Instrs., 142 Adam St., Newton, MA 02158 614-527-2711
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Leach Corp., Relay Div., 5915 Avalon Blvd., Los Angeles, CA 90003 213-232-8221
† Litton Applied Technology, 645 Almanor Ave., P.O. Box 3478, Sunnyvale, CA 94088-3478 408-773-0777
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
Micronel U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083 619-727-7400
Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
† Micropac Inds., Inc., General Sensors Div., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ......714-979-8833; 714-634-1535
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
† Northwest Microcircuits, 2115 N. College, Newburg, OR 97132 503-538-7081
Optical Electronics, Inc., Box 11140, Tucson, AZ 85734 602-624-8358
† Parlex Corp., 145 Milk St., Methuen, MA 01844 617-685-4341
Radix Microelectronics Inc., 4182 Sandberg Dr., Colorado Springs, CO 80911 303-390-5168
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Signatron, 12 Hartwell Ave., Lexington, MA 02173 617-861-1500
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402
† Zenith Components & Sys. Grp., Zenith Radio Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Circuits, Hybrid, Thick Film-3130

ACC Electronics, 1300 W. Oak, Independence, KS 67301, 316-331-1000 .1A•1643
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700 ......1A•1644
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ......1A•1829
† CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ...... 1A•1646-1650
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ...... 1A•1846-1852
Datel, 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 ...... 3•1150,1151
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ......1A•1659
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ...... 3•1160,1161
§† Integrated Circuits, Inc., 10301 Willows Road, Redmond, WA 98052, 206-882-3100 ......1A•1660
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ......1A•1661
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ......1A•1879
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ...... 1A•1373,1664,1665,1B•1458,1459
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ......1A•1902
Modular Devices, 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 ...... 3•1933
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ......1A•1680
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ......1A•1944,1975
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ......1A•2003
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Aeroflex Labs., Magnetic Prods. Div., , So. Service Rd., Plainview, NY 11803 516-694-6700
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd., Towson, MD 21204 301-583-4000
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
American Elctrn. Labs., Inc., Hybrid/MIC Div., P.O. Box 552, Lansdale, PA 19446
§† American Microsignal, 8431 Monroe Ave., Stanton, CA 90680 714-761-1222
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Aptek Microsystems, Inc., Hillsboro Plaza, 700 N.W. 12th Ave., Deerfield Beach, FL 33441 305-421-8450
† Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100

Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Box 328, Newtown, PA 18940 215-968-4271
§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Boeing Microelectronics, PCB OPNS., M/S: 88-34, Box 24666, Seattle, WA 98124 206-773-1083
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
§ Centralab, Inc., A North American Philips Co., 5855 N. Glen Park Rd., Milwaukee, WI 53209 414-228-7380
Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94089 408-734-8150
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Computer Avionics, 740 Market, Mt. Carmel, IL 62863 618-263-4343
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† CTS Halex, 1202 McGaw Ave., Irvine, CA 92714 714-556-2850
† Dynamic Measurements, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 904-252-0411
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
§† Film Microelectronics, 17 A St., Burlington, MA 01803 617-272-5650
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu America, Inc., 918 Sherwood Dr., Lake Bluff, IL 60044 312-295-2610
General Instrument Corp., Microelectronics Div., 600 W. John St., Hicksville, NY 11802 516-733-3107
§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
GTE Automatic Elec., 400 N. Wolf Rd., Northlake, IL 60164 312-681-7071
HEI, Inc., 1495 Steiger Lake La., Victoria, MN 55386 612-443-2500
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
† Hybrid Elctrns., 142 Adams St., Newton, MA 02158 617-527-2711
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† Interconics, BMC Industries, Inc., 610 Bremer Tower, St. Paul, MN 55101 612-228-6512
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051 408-733-4045
† Kates Sci. Instrs., 142 Adam St., Newton, MA 02158 614-527-2711
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Lambda Electronics, 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
Leach Corp., Relay Div., 5915 Avalon Blvd., Los Angeles, CA 90003 213-232-8221
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
Micronel U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083 619-727-7400
† Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Micropac Inds., Inc., General Sensors Div., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ....714-979-8833; 714-634-1535
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
† Northwest Microcircuits, 2115 N. College, Newburg, OR 97132 503-538-7081
† Omnitek, Inc., P.O. Box 102, 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-4443
Optical Electronics, Inc., Box 11140, Tucson, AZ 85734 602-624-8358
Opto Technlg., 1674 S. Wolf Rd., Wheeling, IL 60090 312-537-4277
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Parlex Corp., 145 Milk St., Methuen, MA 01844 617-685-4341
PCK Technlg. Div./Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747 516-454-4400
Plessey Ceramic Div., 8th & Harrison Sts., Frenchtown, NJ 08825 201-996-2121
Radix Microelectronics Inc., 4182 Sandberg Dr., Colorado Springs, CO 80911 303-390-5168
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Zenith Components & Sys. Grp., Zenith Radio Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Circuits, Hybrid, Thin Film-3130

Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700 ....1A•1644
§ **Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1799**
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 .... 1A•1646-1650
† **HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ....1A•1658,1874**
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 .... 3•1160,1161
† **Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ....1A•1680**
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ....1A•2003
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Argo Transdata Corp., Box 554, Clinton, CT 06413 203-669-2233
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† CTS Halex, 1202 McGaw Ave., Irvine, CA 92714 714-556-2850
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Essex Group, 9933 13th St., Ft. Wayne, IN. 46809 219-478-1521
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§† Film Microelectronics, 17 A St., Burlington, MA 01803 617-272-5650
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Fujitsu America, Inc., 918 Sherwood Dr., Lake Bluff, IL 60044 312-295-2610
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
† Hybrid Elctrns., 142 Adams St., Newton, MA 02158 617-527-2711
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
† Kates Sci. Instrs., 142 Adam St., Newton, MA 02158 614-527-2711
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
† Micro Networks, 324 Clark St., Worcester, MA 01606 617-852-5400
Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Micropac Inds., Inc., General Sensors Div., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Optical Electronics, Inc., Box 11140, Tucson, AZ 85734 602-624-8358
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Staffall Inc., 7 Woodland St., Providence, RI 02908 401-351-8282
§ Tau-Tron Inc., 27 Industrial Ave., Chelmsford, MA 01824 617-256-9013
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Circuits, Integrated — See Integrated Circuits (Specific Types) (Vol. 1A)

Circuits, Printed Flexible-1700 — ***See Vol. 2***

Circuits, Printed, Multilayer-1700 — ***See Vol. 2***

Circuits, Printed, Rigid, One & Two Sided-1700 — ***See Vol. 2***

Circuits, Printed (With Components) — See Cards, Linear Function (Vol. 3)

Circuits, Thick Film, Thin Film — See Circuits, Hybrid (Vol. 1A)

Circulators, Ferrite-3450

TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1778,1779
AERCOM, 405 Tasman Dr., Sunnyvale, CA 94086 408-744-1320
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Clamps & Clips, Cable-2800 (Also See Wire & Cable Ties) — ***See Vol. 2***

Clamps & Clips, Component-2825 — ***See Vol. 2***

Clamps & Clips, Ground-2825 — ***See Vol. 3***

Clamps, Synchro & Servo-2800 — ***See Vol. 2***

Clamps (MIL), Cable-2440 — ***See Vol. 1B***

Cleaners, Magnetic Medium-1600 — ***See Vol. 2***

Cleaners, Ultrasonic-4100 — ***See Vol. 3***

Cleaners & Degreasers, Machine — See Machines, Cleaning & Degreasing (Vol. 3)

Cleaners & Solvents-1600 — ***See Vol. 2***

Clean Room Equipment & Supplies-2550 — ***See Vol. 3***

Clips, Alligator-2100 — ***See Vol. 2***

Clips & Holders, Fuse-4300 (Also See Panels, Fuse) — ***See Vol. 1B***

Clips, Battery-2100 — ***See Vol. 2***

Clips, Board, Harness-1700 — ***See Vol. 2***

Clips, Breadboard-4200 — ***See Vol. 2***

Clips, Fahnestock-2100 — ***See Vol. 2***

Clips, Logic Test-2900 — ***See Vol. 3***

Clips, Test-2100 — ***See Vol. 2***

Clips, Transistor & Diode — See Retainers, Transistor & Diode (Vol. 2)

Clips (MIL), Electrical-2440 — ***See Vol. 1B***

Clocks, Time Keeping — Also See Oscillators, Clock-2200 — ***See Vol. 3***

Clutches, Friction-3500 — ***See Vol. 1B***

Clutches, Magnetic-3500 — ***See Vol. 1B***

Clutches, Positive-3500 — ***See Vol. 1B***

Coating Services — See Services, Coating (Vol. 3)

Coatings, Antistatic-1600 — ***See Vol. 2***

Coatings, Compounds, Lubricants, etc., Heat Conductive-1600 — ***See Vol. 2***

Coatings, Conductive, Electric-1600 — ***See Vol. 2***

Coatings, Corrosion Resistant-1600 — ***See Vol. 2***

Coatings, Electromagnetic Wave Absorbing-1600 — ***See Vol. 2***

Coatings, Fungicidal-1600 — ***See Vol. 2***

Coatings, High Temperature, Ceramic, Plasma Spray — See Services, Coating (Vol. 3)

Coatings, Insulating-3100 — ***See Vol. 2***

Coatings, Moisture Repellant & Waterproofing-1600 — ***See Vol. 2***

Coatings, Protective-1600 — ***See Vol. 2***

Coatings, Radioactive-1600 — ***See Vol. 2***

Code Actuated Switches — See Switches, Data (Vol. 3)

Code & Tab Markers — See Wire Markers (All Types) (Vol. 2)

Coded Discs, Optical — See Encoders, Shaft Angle, Optical (Vol. 1B)

Coders, AF-1300 — ***See Vol. 3***

Coders, Telephone, Dial-1900 — ***See Vol. 3***

Coders, Transponder-3400 — ***See Vol. 3***

Coil Assemblies & Forms-1800 (Also See Bobbins, Winding, Coil & Transformer)

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905, 607-797-1263 1A•1244
§ **Krystinel Corp., 126 Pennsylvania Ave., Paterson, NJ 07509, 201-345-8900 .... 2•1793**
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ....1A•1280
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† A.P.W. Co., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
Berg Elctrns., Du Pont Co., 30 Hunter La., Camp Hill, PA 17011 ....800-237-BERG
Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Cortec, Inc., 15811 Chemical La., Huntington Bch., CA 92649 714-897-2529
Cosmo Plastics Co., 3239 W. 14th St., Cleveland, OH 44109 216-861-5594
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† D & L Sales Co. Inc., 296 Preakness Ave., Paterson, NJ 07502 ....201-684-8223/8224
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
Dia-Netics Inc., 18823 Napa St., Northridge, CA 91324 213-886-2616
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
§† Electronic Coil Corp., 347 New Britain Ave., Plainville, CT 06062 203-747-1213
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
Gries/Dynacast, Div. Coats & Clark Inc., 162 Beechwood Ave., New Rochelle, NY 10801 914-633-8600
High Voltage Engrg. Corp., S. Bedford St., Burlington, MA 01803 617-272-1313
§ Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
ITT Thermotech, Div. IT & T, 1203 S. 5th St., Hopkins, MN 55343 ..612-933-9400

§† Jaidinger Mfg., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetic Systems, 1021 Pecten Ct., Milpitas, CA 95035 408-263-6680
Micrometals, 1190 N. Hawk, Anaheim, CA 92807 714-630-7420
† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
† Milton Ross Co., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 818-849-4543
Plessey Ceramic Div., 8th & Harrison Sts., Frenchtown, NJ 08825 .. 201-996-2121
§† PTS Electronics Inc., Box 272, Bloomington, IN 47401 812-824-9331
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Staffall Inc., 7 Woodland St., Providence, RI 02908 401-351-8282
† Stevens Products, Inc., 128 N. Park St., E. Orange, NJ 07019 201-672-2140
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 ... 615-867-4100
† Telectro Sys., 96-18 43rd Ave., Corona, NY 11368 212-651-8900
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
§ Vector Electronic Co., Inc., 12460 Gladstone Ave., Dept. EP, Box 4336, Sylmar, CA 91342 818-365-9661
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 . 312-585-1212
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Coil/Lens Aligners, Micropositioner-1800

† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123

Coil Standards — See Standards, Inductance (Vol. 3)

Coil-Winding Equipment — See Machines, Coil Winding (Vol. 3)

Coils, AF-1800

Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 .... 1A•1221
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... 1A•1233
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 .... 1A•1236-1239**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•1245,2203**
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .. 1A•1247
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•1268,1269
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•1271-1273,2235,2237,2239**
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ... 1A•1278
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 .... 3•1055
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 .... 1A•1281
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•1289-1297**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•1298-1302,2338-2343**
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
§† Perfect Gear & Instr., 55 S. Denton Ave., New Hyde Park, NY 11040 516-328-3300
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ..... (03) 775-2111
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997

Coils, Antenna (Incl. Loading Type)-1800

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... 1A•1233
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ..... (03) 775-2111
Sparkomatic, Rte. 6 & 209, Milford, PA 18337 717-296-6444
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Broadcast-1800

§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 .... 1A•1227**
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... 1A•1233
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
§ Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 818-849-4543
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Coils, Chip-1800

Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-6400 .... 1A•1230,1231
§† **Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 .... 1A•1243**
† **Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 .... 1A•1277**
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Compex Corp., 35A East Main St., Marlton, NJ 08053 609-596-9388
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301

Coils, Chip-1800 (Cont'd)

§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 .602-287-5851
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Coils, Degaussing-1800

Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† E M S Development Corp., 200 Allen Blvd., Farmingdale, NY 11735 516-694-2886
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .516-561-6050
† Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ...814-355-1521
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674

Coils, Field-1800

Advanced Kinetics, 1231 Victoria St., Costa Mesa, CA 92627 714-646-7165
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† A.P.W. Co., 72 W. Main, Rockaway, NJ 07866 201-627-0643
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
§ Magnos, Old School House Rd., Harvard, MA 01451 617-456-8880
Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 .312-585-1212
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674

Coils, Focusing-1800

† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 516-433-5900 ....1A•2367
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co, Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ...814-355-1521
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 ..312-543-6444
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Foil Wound-1800

§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
§ Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 818-849-4543
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
§ Tapecon, Inc., 10 Latta Rd., Rochester, NY 14612 716-621-8400
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 .312-585-1212
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Coils, High Q, Low Frequency-1800

Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1228
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•1236-1239
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ....1A•2175
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ....1A•2185
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ....1A•2206
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..1A•1247
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ....1A•1271-1273
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•1298
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
† Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
† Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
§† Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300

§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532 803-393-5421
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 ..213-463-5120
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 818-849-4543
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Coils, Hum Eliminating — See Hum Eliminators (Vol. 1A)

Coils, Hybrid & Repeater-1800

§† ADC Prods., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 ...203-828-6379
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Coils, IF-1800

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-6400 ....1A•1230
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•1236-1239
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ....1A•1282
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•1298
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050

† Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
§† PTS Electronics Inc., Box 272, Bloomington, IN 47401 812-824-9331
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Metallized Ceramic-1800

Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291

Coils, Metallized Glass-1800

Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040 516-746-1385
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Coils, Molded-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ....1A•2126
§† Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1224,1225,1227,1228
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ....1A•1021
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•1234
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ....1A•1243
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2168
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ....1A•2175
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•1245
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ....1A•1254-1267
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•1268,1269
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ....1A•1277
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ....1A•1282
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•1300,1304,1305,2338,2356
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 ....1A•1276
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† American Plasticraft Co., 814 N. Sacramento Blvd., Chicago, IL 60622 312-722-7727
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Cosmo Plastics Co., 3239 W. 14th St., Cleveland, OH 44109 216-861-5594
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrical Plastics Corp., 500 Long Branch Ave., Long Branch, NJ 07740 201-870-9500
§ Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895 401-769-3800
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080

Coils, Molded-1800 (Cont'd)

§† Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 ...602-287-5851
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 ...201-541-1600
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 ...818-798-0786
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 ...201-756-1164
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ...612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ...516-654-1166
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 ...617-438-6951
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 ...516-935-3640
Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 ...216-946-9900
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 ...516-671-5700
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ...503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 ...213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 ...818-892-0761
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 ...619-268-2400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ...603-669-0054
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 ...516-586-5566
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 ...612-475-1173
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 ...312-679-8200
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 ...816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 ...914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 ...516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 ...219-259-8535
Wabash, First & Webster Sts., Wabash, IN 46992 ...219-563-3111

Coils, RF-1800

† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ...1A•1221-1223
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ...1A•1224-1228
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ...1A•1233
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-6400 ...1A•1232
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ...1A•1234,1235
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ...1A•1243
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ...1A•2175
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ...1A•2182
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ...1A•1245
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ...1A•1247
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ...1A•1254-1267
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ...1A•2215
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ...1A•1271-1273
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ...1A•1282
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ...1A•1283-1297
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ...1A•2338
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 ...1A•1276
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 ...615-244-9024
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 ...914-246-2811
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada ...416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Rd., Los Angeles, CA 90057 ...213-381-2500
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 ...516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 ...305-492-5196
Blanck, A. R., Co., Box 249, Rutherford, NJ 07070 ...201-933-2091
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 ...714-781-5433
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 ...802-287-4055
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 ...201-227-4222
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 ...914-337-4775
† Compex Corp., 35A East Main St., Marlton, NJ 08053 ...609-596-9388
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 ...414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ...415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ...816-331-4911
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 ...505-865-6700
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 ...619-420-2351
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 ...415-494-7303
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 ...312-478-7300
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ...201-245-3200;800-526-4048
† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 ...516-294-5445
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 ...212-386-1300
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 ...815-968-9661
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ...213-537-4750
§† Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 ...716-532-2234
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 ...716-894-5710
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ...213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ...714-752-3800
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 ...203-792-7820
§† Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 .602-287-5851
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 ...201-541-1600
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 ...201-756-1164
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 ...512-546-1625
† Lepel, 59-21 Queens-Midtown Expwy., Maspeth, NY 11378 ...212-426-4580
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ...516-654-1166
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ...617-491-5400
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 ...617-438-6951
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan ... 489-5333
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 ...516-935-3640
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ...609-298-7300
Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 ...213-463-5120
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 ...818-892-0761
Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ...814-355-1521
† Piconics, Cummings Rd., Tyngsboro, MA 01879 ...617-649-7501
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 ...815-385-2700
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ...603-669-0054
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 ...516-586-5566
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 ...516-231-6400
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 ...201-933-2091
§† SFE Technologies, 1501 1st St., San Fernando, CA 91341 ...213-365-9411
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 ...516-466-0911
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ...914-681-0700
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 ...516-239-4510
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ...(03) 775-2111
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 ...408-980-1600
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 ...615-892-0291
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 ...312-679-8200
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 ...215-672-7800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 ...516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ...813-371-4242
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 ...415-968-9176

Coils, Relay-1800

American Magnetics, P.O. Box 8, Carterville, IL 62918 ...618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada ...416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Rd., Los Angeles, CA 90057 ...213-381-2500
† A.P.W. Co., 72 W. Main, Rockaway, NJ 07866 ...201-627-0643
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 ...516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 ...305-492-5196
§ ATR Elctrns., Inc., 280 E. Lafayette Frontage Rd., St. Paul, MN 55107 ...612-222-3791
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 ...305-883-5311
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 ...203-828-6379
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 ...914-738-1611
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 ...401-943-2686
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ...614-452-6973
Dia-Netics Inc., 18823 Napa St., Northridge, CA 91324 ...213-886-2616
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 ...312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 ...203-599-2075
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 ...619-420-2351
§† Electronic Coil Corp., 347 New Britain Ave., Plainville, CT 06062 ...203-747-1213
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 ...312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 ...607-797-1263
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ...213-537-4750
Grand Transformers, Box 188, Grand Haven, MI 49417 ...616-842-5430
GTE Automatic Elec., 400 N. Wolf Rd., Northlake, IL 60164 ...312-681-7071
Guardian California, 16100 S. Figueroa St., Gardena, CA 90240 ...213-532-3092
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 ...201-892-5881
§† Jaidinger Mfg., 1921 W. Hubbard St., Chicago, IL 60622 ...312-421-1090
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 ...201-541-1600
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 ...815-725-2241
Line Elec. Prods., G. General Electro-Components, Inc., 122 Naubuc Ave., Glastonbury, CT 06033 ...203-659-3573
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ...612-633-8820
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 ...516-587-0510
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 ...507-625-6521
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ...503-238-2440
† Piconics, Cummings Rd., Tyngsboro, MA 01879 ...617-649-7501
† Regdon Corp., 3713 Grand Blvd., Brookfield, IL 60513 ...312-485-5152
Relay Service Co., 1310 N. Pulaski Rd., Chicago, IL 60651 ...312-AL2-2700
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 ...516-586-5566
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 ...213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ...914-681-0700
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209 ...513-871-3777

Struthers-Dunn, Lamb's Rd., Pitman, NJ 08071 609-589-7500
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, NY 11757 516-226-5000
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111

Coils, Saturable Reactor-1800

Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ... 1A•1279
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•1304,1305
§ Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532 803-393-5421
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Oram Elctrns., Rte. 22, Brewster, NY 10509 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan .... Tokyo 03-402-6161
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Coils, Shielded-1800

§† Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 .... 1A•1225,1227
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 .... 1A•1233
§† Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 .... 1A•1234
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 .... 1A•1243
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .... 1A•2175
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .. 1A•1247
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 .... 1A•1248,1249,1254-1267
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ... 1A•1278
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 .... 1A•1281
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•1299
Wilco Corp., 4030 W. Tenth St., Indianapolis, IN 46222, 317-241-2516 .... 1A•1306, 1307
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§† Jeffers Elctrns., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 . 602-287-5851
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† Lenox-Fugle Elctrns., 100 Sylvania Pl., S. Plainfield, NJ 07080 201-756-1164
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Coils, Solenoid-1800

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 .... 1A•1236-1239
Advanced Kinetics, 1231 Victoria St., Costa Mesa, CA 92627 714-646-7165
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Magnetics, Box R, Oak Ridge, TN 37830 615-482-1056
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 .. 203-828-6379
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Coto Corporation, 55 DuPont Drive, Providence, RI 02907 401-943-2686
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Cryomagnetics, Inc., 795 Oak Ridge Tpk., Oak Ridge, TN 37830 615-482-9551
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 614-452-6973
Dia-Netics Inc., 18823 Napa St., Northridge, CA 91324 213-886-2616
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
§† Electronic Coil Corp., 347 New Britain Ave., Plainville, CT 06062 203-747-1213
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§† Jaidinger Mfg., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
Line Elec. Prods., G. General Electro-Components, Inc., 122 Naubuc Ave., Glastonbury, CT 06033 203-659-3573
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700

Coils, Solenoid-1800 (Cont'd)

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Magnos, Old School House Rd., Harvard, MA 01451 617-456-8880
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Regdon Corp., 3713 Grand Blvd., Brookfield, IL 60513 312-485-5152
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† SR Engineering Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Trinetics Inc., 55807 Currant Rd., Mishawaka, IN 46545-4899 219-259-8535
Vanguard Relay Corp., 225 Cortland St., Lindenhurst, NY 11757 516-226-5000
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Coils, Telephone-1800

§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•2140,2141**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•2200-2202**
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2215,2217
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 213-281-0222 ....1A•2224
§ Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
§† ADC Magnetic Controls Co., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
§† ADC Prods., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Apollo Magnetics Corp., 2720 W. Beverly Rd., Los Angeles, CA 90057 213-381-2500
† A.P.W. Co., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-338-8100
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
§† Daburn Elctrns. & Cable, 70 Oak St., Norwood, NJ 07648 201-768-5400
Dia-Netics Inc., 18823 Napa St., Northridge, CA 91324 213-886-2616
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Coil Corp., 347 New Britain Ave., Plainville, CT 06062 203-747-1213
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
GTE Automatic Elec., 400 N. Wolf Rd., Northlake, IL 60164 312-681-7071
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
† Regdon Corp., 3713 Grand Blvd., Brookfield, IL 60513 312-485-5152
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 212-255-3500

Coils, Telephone Pickup (For Recording) — See Pickups, Telephone (Vol. 3)

Coils, Toroidal-1800

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ....1A•2125-2128
† **Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ....1A•1221**
§† **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1224**
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ....1A•2137
§† **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•1235,2150**
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ....1A•1243
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905, 607-797-1263 1A•1244
† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2168**
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ....1A•2175**
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ....1A•2182
† **Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ....1A•2185**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•1245**
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2215,2220
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ....1A•1280
Ross Engrg. Corp., 559 Westchester Dr., Campbell, CA 95008, 408-377-4621 ....1B•1472
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ....1A•1286-1297,2320**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•1298,1300-1303**
§† **Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 ....1A•1276**
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048 312-680-7400
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ....213-EX7-9668
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
† El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma

Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan ....Tokyo 03-402-6161
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Coils, Transducer-1800

§ Ametek, 2 Station Square, Paoli, PA 19301 215-355-6900
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 ...203-828-6379
Dia-Netics Inc., 18823 Napa St., Northridge, CA 91324 213-886-2616
§† Electronic Coil Corp., 347 New Britain Ave., Plainville, CT 06062 203-747-1213
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
§ Rye Inds., Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 914-698-0080
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
§ Waldom Elctrns., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629 .312-585-1212
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Coils, Transformer-1800

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ....1A•2134
Avionic Instrs., 943 E. Hazelwood Ave., Rahway, NJ 07065, 201-388-3500 .... 3•1828
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•2140,2141,2150**
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..1A•1247
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•1268,1269**
† **Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 ....1A•1276**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
† A.P.W. Co., 72 W. Main, Rockaway, NJ 07866 201-627-0643
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 ...203-828-6379
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ...614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
Dia-Netics Inc., 18823 Napa St., Northridge, CA 91324 213-886-2616
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electronic Coil Corp., 347 New Britain Ave., Plainville, CT 06062 203-747-1213
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§ Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Oram Elctrns., Rte. 22, Brewster, NY 10509 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 818-849-4543
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997

Coils, TV (All Types)-1800

§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1227**

Coils, TV (All Types)-1800 (Cont'd)

§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•1235
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ....1A•1282
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Coils, Variable-1800

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ....1A•2134
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1227,1228
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
Coilcraft, 1102 Silver Lake Rd., Cary, IL 60013, 312-639-6400 ....1A•1232
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ....1A•2175
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ....1A•2182
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ....1A•1247
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ....1A•1248,1252,1253
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ....1A•1277
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ....1A•1282
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•1298
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 ....1A•1276
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
Anro Elctrn. Inds., 300 Wildcat Rd., Downsview, ON Canada 416-661-2600
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electro Design Sys., 100 W. 35th St., Ste. S, National City, CA 92050 619-420-2351
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
§ Mechanical Techn., 968 Albany Shaker Rd., Latham, NY 12110 518-785-2353
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Permaluster, Inc., 1844 N. Keystone St., Burbank, CA 91504 818-849-4543
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
§ SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
§† Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040 516-746-1385
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Coils, Vidicon Alignment-1800

† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref., Japan 0534-34-3311
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 814-355-1521
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566

Coils (MIL), RF-2440 — *See Vol. 1B*

Cold-Cathode Readout Tubes — See Tubes, Readout (Vol. 1A)

Cold Plates — See Thermal Platforms (Vol. 3)

Collection Systems (MIL)-3475 — *See Vol. 3*

Collimators-2900 — *See Vol. 3*

Combiners, Microwave — See Couplers, Microwave (Vol. 1A)

Communications Intelligence (Comint) Systems (MIL)-3475 — *See Vol. 3*

Communications Systems, FM-1900 — *See Vol. 3*

Communications Systems, Laser-1900 — *See Vol. 3*

Communications Systems, Microwave-3400 — *See Vol. 3*

Communications Systems, Multiplex-1900 — *See Vol. 3*

Communications Systems, Telemetering-1900 — *See Vol. 3*

Communications Systems, Telephone-1900 — *See Vol. 3*

Commutators-3500 — *See Vol. 1B*

Comparators, Analog — See Comparators, Voltage (Vol. 3)

Comparators, Attenuation-3400 — *See Vol. 3*

Comparators, Capacitance — See Bridges, Capacitance (Vol. 3)

Comparators, Digital-2900 — *See Vol. 3*

Comparators, Dimension Calibrators-4100 — *See Vol. 3*

Comparators, Frequency-2900 — *See Vol. 3*

Comparators, Impedance — See Bridges, Impedance (Vol. 3)

Comparators, Inductance — See Bridges, Inductance (Vol. 3)

Comparators, Optical-2900 — *See Vol. 3*

Comparators, Phase-2900 — *See Vol. 3*

Comparators, Resistance — See Bridges, Resistance (Vol. 3)

Comparators, Voltage-2900 — *See Vol. 3*

Compounds, Encapsulating, Molding, Potting-1600 (Also See Plastic Raw Materials) — ***See Vol. 2***

Compounds, Insulating-3100 — *See Vol. 2*

Computer-Aided Design Services — See Computers, CAD, CAM, & CAD/CAM (Vol. 3), Services, Computer-Aided Design (Vol. 3),

Computer Logic Circuits — See Cards, Logic (Vol. 3), Circuits, Hybrid (Vol. 1A), Integrated Circuits (Vol. 1A), Modules, Logic (Vol. 1A),

Computer Tape Recorders — See Recorders, Computer Data (Vol. 3)

Computer Type Indicators — See Displays, Indicator Lights (Vol. 1B)

Computers, Analog-2025 — *See Vol. 3*

Computers, CAD, CAM, & CAD/CAM-2025 — *See Vol. 3*

Computers, Digital, Mini-2025 — *See Vol. 3*

Computers, Digital, Micro-2025 — *See Vol. 3*

Computers, Hybrid, Analog/Digital-2025 — *See Vol. 3*

Computers, Mainframe-2025 — *See Vol. 3*

Computers, Micro-2025 — *See Vol. 3*

Computers, Mini, High End-2025 — *See Vol. 3*

Computers, Mini, Low End-2025 — *See Vol. 3*

Computers, Mini, Midrange-2025 — *See Vol. 3*

Computers, Personal-2025 — *See Vol. 3*

Computers, Small Business-2025 — *See Vol. 3*

Computer Sets (MIL), Digital Data-3475 — *See Vol. 3*

Computer Systems (MIL)-3475 — *See Vol. 3*

Computing Equipment, Peripheral — See Converters, Digital To Paper Tape (Vol. 3), Printers (Vol. 3), Terminals, Data Display (Vol. 3), etc.

Concentrators, Communications-1900 — *See Vol. 3*

Conditioners, Power Line — See Regulators & Stabilizers, Voltage (Vol. 3), Line Conditioners (Vol. 3),

Conductive Elastomers-4525 — *See Vol. 2*

Conductive Fabrics, Films & Tapes — See Fabrics, Conductive (Vol. 2)

Conductive Plastic Materials & Parts-4525 — *See Vol. 2*

Conduit, Electrical-6000 — *See Vol. 2*

Connector Adapters-2100 — *See Vol. 2*

Connector Backshells-2100 — *See Vol. 2*

Connector Blocks, Mother Board-2100 — *See Vol. 2*

Connector Boxes & Strips, Power Outlet-2800 — *See Vol. 2*

Connectors, Antenna — See Connectors, RF, Coaxial & Triaxial (Vol. 2)

Connectors, Audio-2100 — *See Vol. 2*

Connectors, Back Panel — See Connectors, Wirewrap (Z-3 Level) (Vol. 2)

Connectors, Battery-2100 — *See Vol. 2*

Connectors, Cable-2100 — *See Vol. 2*

Connectors, Circular, MS/AN-2100 — *See Vol. 2*

Connectors, DIN-2100 — *See Vol. 2*

Connectors, D Subminiature-2100 — *See Vol. 2*

Connectors, Edgeboard — See Connectors, Printed Circuit, Card Edge (Vol. 2)

Connectors, Elastomeric-2100 — *See Vol. 2*

Connectors, Fiber Optic-2475 — *See Vol. 1B*

Connectors, Filtered-2100 — *See Vol. 2*

Connectors, Flat Cable (Incl. Flexible)-2100 — *See Vol. 2*

Connectors, Fused-2100 — *See Vol. 2*

Connectors, Heavy Duty, Power-2100 — *See Vol. 2*

Connectors, Hermetically Sealed, Pressurized, or Waterproof-2100 — *See Vol. 2*

Connectors, High Voltage (1,000 Volts & Over)-2100 — *See Vol. 2*

Connectors, Integrated Circuit — See Sockets, Integrated Circuit (Vol. 2)

Connectors, LCD-2100 — *See Vol. 2*

Connectors, Magnetron-2100 — *See Vol. 2*

Connectors, Miniature, Subminiature & Microminiature-2100 — *See Vol. 2*

Connectors, Missile (Umbilicals, Interstage, Post Boost)-3475 — *See Vol. 3*

Connectors, Piggy Back — See Connectors, Wirewrap (Z-3 Level) (Vol. 2)

Connectors, Plug-in, Program Board-2100 — *See Vol. 2*

Connectors, Printed Circuit, Card Edge-2100 — *See Vol. 2*

Connectors, Printed Circuit (Other than Card Edge)-2100 — *See Vol. 2*

Connectors, Rack & Panel-2100 — *See Vol. 2*

Connectors, RF, Coaxial & Triaxial-2100 — *See Vol. 2*

Connectors, Solderless-2100 — *See Vol. 2*

Connectors, Stripline-2100 — *See Vol. 2*

Connectors, Test-2100 — *See Vol. 2*

Connectors, Thermocouple-2100 — *See Vol. 2*

Connectors, Wirewrap (Z-3 Level)-2100 — *See Vol. 2*

Connectors, Wire — See Wire Nuts (Vol. 2)

Connectors, Zero & Low Insertion Force-2100 — *See Vol. 2*

Connectors & Terminals, Push-on, Quick Disconnect-2100 — *See Vol. 2*

Connectors (MIL), Flat Cable-2440 — *See Vol. 1B*

Connectors (MIL), Power-2440 — *See Vol. 1B*

Connectors (MIL), Printed Circuit-2440 — *See Vol. 1B*

Connectors (MIL), RF-2440 — *See Vol. 1B*

Consoles, Cabinet — See Benches, Consoles etc. (Vol. 2)

Consoles (MIL), ECCM-3475 — *See Vol. 3*

Contact Cleaners — See Cleaners & Solvents (Vol. 2), Burnishers, Contact (Vol. 2),

Contact Strips, Finger-4525 — *See Vol. 2*

Contactors (MIL)-2440 — *See Vol. 1B*

Contactors — See Relays, Power (Vol. 1B)

Contacts, Electrical-2800 — *See Vol. 2*

Contacts (MIL), Assemblies & Holders-2440 — *See Vol. 1B*

Containers, Shielded (All Types) — See Enclosures, Shielded (Vol. 2)

Containers, Shipping, Metal & Fiberglass — See Enclosures, Shipping, Metallic & Nonmetallic (Vol. 2)

Containers, Storage-3800 — *See Vol. 2*

Controllers, Card Reader/Punch, Add-in-2000 — *See Vol. 3*

Controllers, Card Reader/Punch, Standalone-2000 — *See Vol. 3*

Controllers, Energy Conservation-2200 — *See Vol. 3*

Controllers, Error-1900 — *See Vol. 3*

Controllers, Floppy Disk Drive, Add-in-2000 — *See Vol. 3*

Controllers, Floppy Disk Drive, Standalone-2000 — *See Vol. 3*

Controllers, Hard Disk Drive, Add-in-2000 — *See Vol. 3*

Controllers, Hard Disk Drive, Standalone-2000 — *See Vol. 3*

Controllers, IEEE 488 (GPIB) Bus-2900 — *See Vol. 3*

Controllers, Magnetic Tape Drive, Add-in-2000 — *See Vol. 3*

Controllers, Magnetic Tape Drive, Standalone-2000 — *See Vol. 3*

Controllers, Memory Device, Add-in-2000 — *See Vol. 3*

Controllers, Memory Device, Standalone-2000 — *See Vol. 3*

Controllers, Paper Tape Reader/Punch, Add-in-2000 — *See Vol. 3*

Controllers, Paper Tape Reader/Punch, Standalone-2000 — ***See Vol. 3***

Controllers, Plotter, Add-in-2000 — ***See Vol. 3***

Controllers, Plotter, Standalone-2000 — ***See Vol. 3***

Controllers, Printer, Add-in-2000 — ***See Vol. 3***

Controllers, Printer, Standalone-2000 — ***See Vol. 3***

Controllers, Programmable-2200 — ***See Vol. 3***

Controllers, Protocol, Communications-2000 — ***See Vol. 3***

Controllers, Terminal, Add-in-2000 — ***See Vol. 3***

Controllers, Terminal, Standalone-2000 — ***See Vol. 3***

Controls, Audio System Consoles-2200 — ***See Vol. 3***

Controls, Capacitance Operated-2200 — ***See Vol. 3***

Controls, Carbon — See Potentiometers (Vol. 1A), Rheostats (Vol. 1A),

Controls, Computer Input, Joysticks, Mouse Devices, etc.-2000 — ***See Vol. 3***

Controls, Constant Impedance — See Attenuators (Vol. 1A)

Controls, Counting & Sorting-2200 — ***See Vol. 3***

Controls, Density-2200 — ***See Vol. 3***

Controls, Dimension-4100 — ***See Vol. 3***

Controls, Environmental Test Equipment-2550 — ***See Vol. 3***

Controls, Fader-1300 — ***See Vol. 3***

Controls, Fluid Conductivity-2200 — ***See Vol. 3***

Controls, Fluid Flow-2200 — ***See Vol. 3***

Controls, Frequency-2200 — ***See Vol. 3***

Controls, Gas-2200 — ***See Vol. 3***

Controls, Humidity-2200 — ***See Vol. 3***

Controls, Ignitron Firing-2200 — ***See Vol. 3***

Controls, Joystick, Mouse Devices, etc. — See Controls, Computer Input (Vol. 3)

Controls, Lamp Dimming, Flashing-2200 — ***See Vol. 3***

Controls, Level, Dry Material-2200 — ***See Vol. 3***

Controls, Level, Liquid-2200 — ***See Vol. 3***

Controls, Machine Tool-2200 — ***See Vol. 3***

Controls, Moisture — See Controls, Humidity (Vol. 3)

Controls, Motor Speed-2200 — ***See Vol. 3***

Controls, Oscillator-2200 — ***See Vol. 3***

Controls, Photoelectric-2200 — ***See Vol. 3***

Controls, Positioning-4100 — ***See Vol. 3***

Controls, Pressure-2200 — ***See Vol. 3***

Controls, Proportional-2200 — ***See Vol. 3***

Controls, Proximity-2200 (Also See Controls, Capacitance Operated) — ***See Vol. 3***

Controls, Remote-2200 — ***See Vol. 3***

Controls, Run, Shutdown Command, Start-2200 — ***See Vol. 3***

Controls, SCR-2200 — ***See Vol. 3***

Controls, Sensing/Monitoring-Voltage, Phase, Frequency-2200 — ***See Vol. 3***

Controls, Servo System-4900 — ***See Vol. 3***

Controls, Stepping Motor-2200 — ***See Vol. 3***

Controls, Temperature-2200 — ***See Vol. 3***

Controls, Timing — See Timers (Vol. 3)

Controls, Torque, Electronic-2200 — ***See Vol. 3***

Controls, Vibrator-2200 — ***See Vol. 3***

Controls, Voltage Regulating — See Regulators & Stabilizers, Voltage (Vol. 3)

Controls, Volume & Tone — See Potentiometers (Vol. 1A), Rheostats (Vol. 1A),

Control Systems, Air Traffic-3475 — ***See Vol. 3***

Control Systems, Robotics-4900 — ***See Vol. 3***

Convection Cooling Packages, Semiconductor — See Heat Sinks, Semiconductor (Vol. 2)

Converters, AC to DC (Nonrotary) — See Power Supplies, AC Input, DC Output (Vol. 3)

Converters, Analog to Digital-2325 — ***See Vol. 3***

Converters, Analog to Pulse-2325 — ***See Vol. 3***

Converters, ASCII to Baudot-2325 — ***See Vol. 3***

Converters, ASCII to BCD-2325 — ***See Vol. 3***

Converters, BCD to ASCII-2325 — ***See Vol. 3***

Converters, Binary to BCD-2325 — ***See Vol. 3***

Converters, Binary to Decimal-2325 — ***See Vol. 3***

Converters, Card to Tape-2000 — ***See Vol. 3***

Converters, CRT Display-2000 — ***See Vol. 3***

Converters, DC to DC, Less Than 30 VDC Output-4000 — ***See Vol. 3***

Converters, DC to DC, 30 to 300 VDC Output-4000 — ***See Vol. 3***

Converters, DC to DC, 300 to 1,000 VDC Output-4000 — ***See Vol. 3***

Converters, DC to DC, Greater Than 1,000 VDC Output-4000 — ***See Vol. 3***

Converters, DC to Sine/Cosine-2325 — ***See Vol. 3***

Converters, DC to Synchro-2325 — ***See Vol. 3***

Converters, Digital to Analog-2325 — ***See Vol. 3***

Converters, Digital to Paper Tape-2000 — ***See Vol. 3***

Converters, Digital to Resolver-2325 — ***See Vol. 3***

Converters, Digital to Synchro-2325 — ***See Vol. 3***

Converters, Frequency to Frequency-1900 — ***See Vol. 3***

Converters, Frequency to Voltage-2325 — ***See Vol. 3***

Converters, Frequency, Logarithmic-4050 — ***See Vol. 3***

Converters, Frequency Shift Keying-1900 — ***See Vol. 3***

Converters, Frequency to DC-4000 (Also See Power Supplies, AC Input, DC Output) — ***See Vol. 3***

Converters, Graphic to Digital-2000 — ***See Vol. 3***

Converters, Multiplying, Analog to Digital & Digital to Analog-2325 — ***See Vol. 3***

Converters, Paper Tape to Magnetic Tape-2000 — ***See Vol. 3***

Converters, Phase-4050 — ***See Vol. 3***

Converters, Polar to Rectangular Coordinates-2325 — ***See Vol. 3***

Converters, Power Frequency, Electronic-4050 — ***See Vol. 3***

Converters, Power Frequency, Rotary-4050 — ***See Vol. 3***

Converters, Pressure to DC, Pressure to Frequency — See Transducers, Pressure (Vol. 1B)

Converters, Rectangular to Polar-2325 — ***See Vol. 3***

Converters, Resolver to Digital-2325 — ***See Vol. 3***

Converters, Rotary — See Motor Generator Sets (Vol. 3)

Converters, Serial to Parallel/Parallel to Serial-2000 — ***See Vol. 3***

Converters, Synchro to Digital-2325 — ***See Vol. 3***

Converters, Synchro to Linear DC-2325 — ***See Vol. 3***

Converters, Synchro to Sine/Cosine-2325 — ***See Vol. 3***

Converters, Tape to Card-2000 — ***See Vol. 3***

Converters, Telemetry-1900 — ***See Vol. 3***

Converters, UHF to VHF-1900 — ***See Vol. 3***

Converters, VLF to HF-1900 — ***See Vol. 3***

Converters, Voltage to Frequency-2325 — ***See Vol. 3***

Converters (MIL) DC to DC-3475 — ***See Vol. 3***

Converters (MIL), Frequency-3475 — ***See Vol. 3***

Coolants, Circuit & Component — See Refrigerants, Spray (Vol. 2)

Cooling Equipment — See Air Conditioners (Vol. 2), Blowers & Fans (Vol. 2), Heat Exchangers & Systems (Vol. 2),

Cooling/Heating Modules, Thermoelectric-5300 — ***See Vol. 1B***

Cooling Sprays — See Refrigerants, Spray (Vol. 2)

Cords & Tapes, Lacing-6000 — ***See Vol. 2***

Cords, Communication, Control, Microphone, etc. — See Cable, Specific Type (Vol. 2)

Cords, Line & Set, Extension-6000 — ***See Vol. 2***

Cords, Line (Lamp) — See Cable, Multiconductor (Vol. 2)

Cords, Line, Resistance-6000 — ***See Vol. 2***

Cords, Patch-2100 — ***See Vol. 2***

Cords, Power — See Cable, Power (Vol. 2)

Cords, Retractile-6000 — ***See Vol. 2***

Cords, Speaker Extension — See Cable, Audio (Vol. 2)

Cords, Telephone, Modular — See Cable, Telephone (Vol. 2)

Cords, Twin Lead — See Cable, Multiconductor (Vol. 2)

Cords & Cable, Dial Drive-2400 — ***See Vol. 2***

Cords & Cord Sets, International-6000 — ***See Vol. 2***

Cores, Ceramic-2500 — ***See Vol. 2***

Cores, Magnetic, Ferrite, L, E, etc.-2500 — ***See Vol. 2***

Cores, Magnetic, Ferrite, Pot/Cup-2500 — ***See Vol. 2***

Cores, Magnetic, Ferrite, Slug-2500 — ***See Vol. 2***

Cores, Magnetic, Ferrite, Toroid-2500 — ***See Vol. 2***

Cores, Magnetic, Ferrite, Yoke Section-2500 — ***See Vol. 2***

Cores, Magnetic, Metal Alloy (Other Than Silicon & Nickel-Iron)-2500 — ***See Vol. 2***

Cores, Magnetic, Nickel-Iron, L, EE, F, & Ring Laminations-2500 — ***See Vol. 2***

Cores, Magnetic, Nickel-Iron, Toroid-2500 — ***See Vol. 2***

Cores, Magnetic, Powdered Iron, Pot/Cup-2500 — ***See Vol. 2***

Cores, Magnetic, Powdered Iron, Slug-2500 — ***See Vol. 2***

Cores, Magnetic, Powdered Iron, Toroid-2500 — ***See Vol. 2***

Cores, Magnetic, Powdered Permalloy, Toroid-2500 — ***See Vol. 2***

Cores, Magnetic, Silicon C-2500 — ***See Vol. 2***

Cores, Magnetic, Silicon EI, EE, & F Laminations-2500 — ***See Vol. 2***

Cores, Magnetic, Silicon, Toroid-2500 — ***See Vol. 2***

Corners, Waveguide — See Bends & Twists, Microwave (Vol. 1A)

Coulometers — See Timers, Electrolytic Cell (Vol. 3)

Countermeasures (CM) Sets (MIL), Airborne-3475 — ***See Vol. 3***

CM Sets (MIL), Internal-3475 — ***See Vol. 3***

CM Sets (MIL), Mobile-3475 — ***See Vol. 3***

CM Sets (MIL), Conformal plus RWR-3475 — ***See Vol. 3***

Counter/Timers-2900 — ***See Vol. 3***

Counters, Bidirectional-2200 — ***See Vol. 3***

Counters, Coil Winding-2200 — ***See Vol. 3***

Counters, Decade-2200 — ***See Vol. 3***

Counters, Directional-2200 — ***See Vol. 3***

Counters, Electromagnetic-2200 — ***See Vol. 3***

Counters, Event-2200 — ***See Vol. 3***

Counters, Frequency-2900 — ***See Vol. 3***

Counters, Mechanical-2200 — ***See Vol. 3***

Counters, Particle-2900 — ***See Vol. 3***

Counters, Photoelectric-2200 — ***See Vol. 3***

Counters, Predetermining — See Counters, Preset (Vol. 3)

Counters, Preset-2200 — ***See Vol. 3***

Counters, Printing-2200 — ***See Vol. 3***

Counters, Proportional — See Counters, Particle (Vol. 3)

Counters, Pulse-2200 — ***See Vol. 3***

Counters, Reversible — See Counters, Bidirectional (Vol. 3)

Counters, Revolution-2200 — ***See Vol. 3***

Counters, Universal-2900 — ***See Vol. 3***

Couplers, Acoustic-1900 — ***See Vol. 3***

Couplers, Antenna-1900 — ***See Vol. 3***

Couplers, Communications, Acoustic, Telephone-1900 — ***See Vol. 3***

Couplers, Directional-3450

Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990, 215-723-8181 .... 3•1003
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 .... 1A•1689
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 .. 1A•1713, 1714,1738-1751
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Aiken Advanced Sys., 5901 Edsall Rd., Alexandria, VA 22304 703-370-0900
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. – TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
C-COR Elctrns., 60 Decibel Rd., State College, PA 16801 814-238-2461
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Connecticut Microwave Corp., 106 Powder Mill Rd., Box 389, Canton, CT 06019 203-693-4247
§ Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 .... 207-655-4555;800-341-9678
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282

M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 ... 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 ... 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 ... 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 ... 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ... 315-437-4529; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 ... 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 ... 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 ... 516-234-1200
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 ... 516-671-5700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 ... 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 ... 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 ... 603-627-6000
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 ... 213-822-0800
§ Tucker Elctrns., Box 461060, Garland, TX 75046 ... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 ... 818-882-3010
§† Waveline, Box 718, W. Caldwell, NJ 07006 ... 201-226-9100
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 ... 602-254-1570
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 ... 415-969-6500

Couplers, Fiber Optic-2475 — *See Vol. 1B*

Couplers, Microwave-3450

† **Applied Research Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ... 1A•1686**
† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ... 1A•1689**
† **Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 .. 1A•1713, 1714,1723,1738-1749**
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 . 1A•1774, 3•1393
† **Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103, 603-627-6000 ... 1B•1014**
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 ... 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 ... 215-822-2929
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 ... 215-723-8181
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 ... 315-432-8909
§ Augat Fiberoptics, 40 Perry Ave., Attleboro, MA 02703 ... 617-222-2202
Baytron, 344 Salem St., Medford, MA 02155 ... 617-391-1550
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 ... 216-267-2233
† Connecticut Microwave Corp., 106 Powder Mill Rd., Box 389, Canton, CT 06019 ... 203-693-4247
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ... 207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 ... 617-935-8600
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 ... 305-994-1774
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 ... 201-741-0404
Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 ... 516-794-4500
Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 ... 207-883-5161
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 ... 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ... Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ... 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 ... 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
Hyletronics, Newtown Rd., Littleton, MA 01460 ... 617-486-8911
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ... 213-889-4030;805-497-4421
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 ... 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 ... 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 ... 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 ... 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ... 315-437-4529; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 ... 802-864-0064
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 ... 516-234-1200
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 ... 312-670-0150
† RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 ... 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 ... 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 ... 603-669-4615
Sivers Lab, Box 90339, Los Angeles, CA 90009 ... 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 ... 818-786-1760
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 ... 213-822-0800
§ Tucker Elctrns., Box 461060, Garland, TX 75046 ... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 ... 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 ... 818-882-3010
§† Waveline, Box 718, W. Caldwell, NJ 07006 ... 201-226-9100
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ... 301-948-3434; 800-638-2048

Couplers, Multiset — See Couplers, Antenna (Vol. 3)

Couplers, Optoelectronic — See Isolators, Optoelectronic (Vol. 1B)

Couplers, Rotary-3450

Concord Elctrns., 30 Great Jones St., Dept. JE, New York, NY 10012, 212-777-6571 ... 2•1214
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 ... 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 ... 617-935-8600
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 ... 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 ... 714-987-4715
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
§ Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 ... 617-438-6951
Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060 ... 703-552-3014
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 ... 914-939-8900
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 ... 617-653-0844
§† Waveline, Box 718, W. Caldwell, NJ 07006 ... 201-226-9100

Couplers (MIL), Directional-2440 — *See Vol. 1B*

Couplings, Quick-disconnect, Liquid or Gas-2500 — *See Vol. 2*

Couplings, Shaft, Rigid & Flexible-2400 — *See Vol. 2*

Covers, Protective (Incl. Dustcovers)-3800 — *See Vol. 2*

Crimping Services — See Services, Crimping (Vol. 3)

Crossbars — See Scanners, Crossbar (Vol. 3)

Crystal Blanks-2300

Croven Crystals, 500 Beech St., Whitby, ON L1N 5S5 Canada, 416-668-3324 ... 1A•1346
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126, 405-236-3741 ... 1A•1367
† **Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ... 2•1797**
§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 ... 814-695-4428
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506 ... 814-838-3571
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ... 714-991-1580; 800-854-XTAL
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 ... 815-786-8411
Harshaw Filtrol Partnership, 1945 E. 97th St., Cleveland, OH 44106 ... 216-721-8300
† Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 ... 717-243-2011
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ... 301-749-2424
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada ... 416-447-8531
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 ... 414-763-3591
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078 ... 605-665-9321
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 ... 717-249-2151
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ... 305-563-1333; 800-327-1282
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan ... 03-436-2180
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 ... 619-279-4500
§† United States Crystal Corp., 3605 McCart St., Ft. Worth, TX 76110 ... 817-921-3014
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 ... 617-435-6831

Crystals, Frequency Control-2300

§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ... 1A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ... A•1316-1320
† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537, 303-667-9248 ... 1A•1324
† Croven Crystals, 500 Beech St., Whitby, ON L1N 5S5 Canada, 416-668-3324 ... 1A•1346
† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ... 1A•1333-1339
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ... 1A•1352
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 ... 1A•1356
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126, 405-236-3741 ... 1A•1367
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 ... 1A•1371
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ... 1A•1374-1376
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ... 1A•1387-1389
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ... 1A•1390
§† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ... 1A•1393
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ... 1A•1394
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ... 1A•1413,1414
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ... 1A•1418
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ... 1A•1421
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ... 1A•1422,1425
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ... 1A•1429,1430
† Valpey-Fisher, 75 South St, Hopkinton, MA 01748, 617-435-6831 ... 1A•1435,1436
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 ... 201-356-7787; 800-526-3935
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ... 714-991-1580; 800-854-XTAL
† Cirtech, 15237 Cherry St., Stanley, KS 66223 ... 913-681-2801
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 ... 813-936-2109
CTS Corp., 905 North West Blvd., Elkart, IN 46514 ... 219-293-7511
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 ... 617-449-0800
Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 ... 201-361-2222
Frequency and Time Systems, Inc., 34 Tozer Rd., Beverly, MA 01915 ... 617-927-8220
Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 ... 717-243-2011
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ... 602-272-7944
† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 ... 312-297-5435
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada ... 416-447-8531
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 ... 516-582-3400
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 ... 414-763-3591
Pathcom, Inc., Pace Two-Way Radio Prods., 24105 S. Frampton Ave., Harbor City, CA 90710 ... 213-325-1290
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 ... 717-249-2151
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 ... 305-298-2000
§† Pioneer Comps., 2352 E. 66th St., Brooklyn, NY 11234 ... 212-444-3880
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 ... 714-545-8233
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 ... 213-820-4921
Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 ... 714-833-1234
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ... 305-563-1333; 800-327-1282
† Sentry Mfg., Crystal Park, Chickasha, OK 73018 ... 405-224-6780;800-654-8850
SFE Technologies, 1501 1st St., San Fernando, CA 91341 ... 213-365-9411
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan ... 03-436-2180
§† United States Crystal Corp., 3605 McCart St., Ft. Worth, TX 76110 ... 817-921-3014
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 ... 216-232-8600

Crystals, Microprocessor-2300

Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ... 1A•1320
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ... 1A•1337-1339
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 ... 1A•1356
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 ... 1A•1371
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ... 1A•1387
M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ... 1A•1393
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ... 1A•1394
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ... 1A•1418
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ... 1A•1421
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ... 1A•1422,1425
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748, 617-435-6831 ... 1A•1434
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ... 714-991-1580; 800-854-XTAL
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550 ... 516-538-2300
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 ... 414-763-3591
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. 05, Richardson, TX 75081 ... 214-235-8332
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 ... 717-249-2151
† Savoy Elctrns.; P.O. Box 5727, Ft. Lauderdale, FL 33310 ... 305-563-1333; 800-327-1282
§† Statek Corp., 512 N. Main St., Orange, CA 92668 ... 714-639-7810

Crystals, Piezoelectric-2300

§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 ... 814-695-4428
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 ... 513-522-3300
BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 ... 312-298-1420
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 ... 201-356-7787; 800-526-3935
Burleigh Instrs., Burleigh Pk., Fishers, NY 14453 ... 716-924-9355
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ... 714-991-1580; 800-854-XTAL
† Channel Inds., 839 Ward Dr., Santa Barbara, CA 93111 ... 805-967-0171
† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537 ... 303-667-9248
† Croven Crystals, 500 Beech St., Whitby, ON L1N 5S5 Canada ... 416-668-3324
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 ... 813-936-2109
CTS Corp., 905 North West Blvd., Elkart, IN 46514 ... 219-293-7511
§† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 ... 815-786-8411
Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 ... 201-361-2222
† EDO Western Corp., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115 ... 801-486-7481/3846
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910 ... 813-482-7212
Gulton Inds., Inc., Piezo Prods. Div., Box 4300, Fullerton, CA 92634 ... 714-871-2150
Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 ... 612-870-5186
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 ... 405-236-3741
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ... 301-749-2424
K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ... 602-272-7944
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada ... 416-447-8531
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 ... 717-486-3411
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 ... 414-763-3591
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
§† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078 ... 605-665-9321
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 ... 404-952-9777
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. 05, Richardson, TX 75081 ... 214-235-8332
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 ... 717-249-2151
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 ... 305-298-2000
§† Pioneer Comps., 2352 E. 66th St., Brooklyn, NY 11234 ... 212-444-3880
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 ... 714-545-8233
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 ... 213-820-4921
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 ... 717-243-5929
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 ... 415-856-6900
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ... 305-563-1333; 800-327-1282
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 ... 201-666-5600
† Sentry Mfg., Crystal Park, Chickasha, OK 73018 ... 405-224-6780;800-654-8850
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 ... 608-987-3363
Star Micronics, Inc., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854 ... 201-572-9512
§† Statek Corp., 512 N. Main St., Orange, CA 92668 ... 714-639-7810
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan ... 03-436-2180
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 ... 619-279-4500
§† United States Crystal Corp., 3605 McCart St., Ft. Worth, TX 76110 ... 817-921-3014
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 ... 617-435-6831
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 ... 216-232-8600

Crystals, Quartz-2300

§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ... 1A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ... A•1316-1320

Crystals, Quartz-2300 (Cont'd)

† Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537, 303-667-9248 .... 1A•1324
† Croven Crystals, 500 Beech St., Whitby, ON L1N 5S5 Canada, 416-668-3324 .... 1A•1346
§† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1333-1339
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1352
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 .... 1A•1356
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126, 405-236-3741 .... 1A•1367
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 .... 1A•1371
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1374-1376
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 .... 1A•1387-1389
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... 1A•1390
§† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 .... 1A•1393
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1413,1414
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 .... 1A•1418
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 .... 1A•1421
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 .... 1A•1422,1425
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... 1A•1429,1430
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748, 617-435-6831 .... 1A•1435,1436
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 513-522-3300
§ Bomar Crystal, 201 Blackford Ave., Middlesex, NJ 08846 .... 201-356-7787; 800-526-3935
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .... 714-991-1580; 800-854-XTAL
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
§† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
§† CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Frequency and Time Systems, Inc., 34 Tozer Rd., Beverly, MA 01915 617-927-8220
† Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§ Inficon Leybold-Heraeus, Inc., 6500 Fly Rd, E. Syracuse, NY 13057 315-437-0377
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
KLC/Karl Lambrecht Corp., 4204 N. Lincoln Ave., Chicago, IL 60618 312-472-5442
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 414-763-3591
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Optics International, Box 101, Tenafly, NJ 07670 201-567-4799
§ Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 305-298-2000
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 .... 305-563-1333; 800-327-1282
† Sentry Mfg., Crystal Park, Chickasha, OK 73018 .... 405-224-6780;800-654-8850
SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
§ Sloan Technology, P.O. Box 4608, Santa Barbara, CA 93103 805-963-4431
Thermal Amer. Fused Quartz, Change Bridge Rd., Montville, NJ 07045 201-334-7770
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan 03-436-2180
§† United States Crystal Corp., 3605 McCart St., Ft. Worth, TX 76110 817-921-3014

Crystals, Quartz, for Watches-2300

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1352
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 .... 1A•1421
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 513-522-3300
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .... 714-991-1580; 800-854-XTAL
Hoffman, P. R., Co., Materials Processing Div., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013 717-243-2011
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
§ Statek Corp., 512 N. Main St., Orange, CA 92668 714-639-7810
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan 03-436-2180
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831

Crystals, Semiconductor(Ingots & Wafers)-2300

Capintec Instrs., 6 Arrow Rd., Ramsey, NJ 07446 201-825-9500
Dow Corning Corp., Box 1767, Midland, MI 48640-0994 517-496-4000
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
Laser Diode Labs, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
M/A-COM Laser Diode, Inc., M/A-COM, Inc., 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
Materials Resch., Route 303, Orangeburg, NY 10962 914-359-4200
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Saphikon, 51 Powers St., Milford, NH 03055 603-673-5831
§ Tennelec, 601 Turnpike, Oak Ridge, TN 37830 615-483-8405
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Thomson-CSF Comps. Corp., Metals & Chemicals Div., 6660 Variel Ave., Canoga Pk., CA 91303 213-887-1010
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500

Crystals, YIG-2300

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan .... Tokyo 03-402-6161

Crystals (MIL)-2440 — *See Vol. 1B*

Cups, Encapsulation-1600 — *See Vol. 2*

Current Limiters (MIL)-2440 — *See Vol. 1B*

Current Sensors-2200 (Also See Transducers, Volt, etc.) — ***See Vol. 3***

Current Sources-4000 — *See Vol. 3*

Custom Molding Services, Plastics — See Services, Custom Molding, Plastics (Vol. 3)

Cutters, Diagonal — See Cutters, Manual (Vol. 2)

Cutters, Wire, Automatic — See Machines, Wire Measuring & Cutting (Vol. 3)

Cutters, Wire, Manual-5400 — *See Vol. 2*

Dampers, Servo-4900 — *See Vol. 3*

Dampers, Structural, Chassis, Panel, etc. — See Mounts, Shock & Vibration (Vol. 2)

Data Collection Equipment, Hand Held-2000 — *See Vol. 3*

Data Collection Equipment, Modular-2000 — *See Vol. 3*

Data Collection Equipment, Portable-2000 — *See Vol. 3*

Data Acquisition & Reduction Systems-2325 (Also See Modules, Data Acquisition) — ***See Vol. 3***

Data Compressors, Digital-2000 — *See Vol. 3*

Data Display Indicators — See Displays Indicator Lights (Vol. 1B)

Data Display Systems — See Displays, CRT (Vol. 1A), Terminals, Data Display (Vol. 3),

Data Links, Fiber Optic-2475 — *See Vol. 1B*

Data Links, Optical-2000 — *See Vol. 3*

Data Loggers-2325 — *See Vol. 3*

Data Switches — See Switches, Data (Vol. 3)

Data Systems (MIL), Naval Tactical-3475 — *See Vol. 3*

Decade Boxes, Capacitance-2900 — *See Vol. 3*

Decade Boxes, Inductance-2900 — *See Vol. 3*

Decade Boxes, Resistance-2900 — *See Vol. 3*

Decade Boxes, Transformer-2900 — *See Vol. 3*

§—Product sold through distributors †—Product meets MIL specs

Decalcomania-2400 (Also See Labels, Pressure Sensitive) — ***See Vol. 2***

Decapsulation Services — See Services, Decapsulation (Vol. 3)

Decoders, Binary To Decimal — See Converters, Binary To Decimal (Vol. 3)

Decoders, Digital To Analog — See Converters, Digital To Analog (Vol. 3)

Decoders, Pulse-1900 — ***See Vol. 3***

Decoders, Readout — See Drivers & Decoders For Readouts (Vol. 1B)

Decoders, Telemetry — See Decoders, Tone (Vol. 3)

Decoders, Tone-1900 — ***See Vol. 3***

Decoders, Video-1900 — ***See Vol. 3***

Decontaminants — See Cleaners & Solvents (Vol. 2)

Decoys (MIL), Buoy-3475 — ***See Vol. 3***

Decoys (MIL), IR Flare-3475 — ***See Vol. 3***

Degaussers — See Demagnetizers (Vol. 2), Coils, Degaussing (Vol. 1A),

Degreasers & Cleaners, Machine — See Machines, Cleaning & Degreasing (Vol. 3)

Degreasing Chemicals — See Cleaners & Solvents (Vol. 2)

Dehumidifiers (For Equipment)-2600 — ***See Vol. 2***

Dehydrators-4100 — ***See Vol. 3***

Delay Lines, All Types-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... 1A•1448
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ... 1A•1221
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ... 1A•1454-1465
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ... 1A•1233
Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 ... 1A•1466
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ... 1A•1467-1469
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 ... 1A•1484-1499
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... 1A•1510
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 ... 1A•1361
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ... 1A•1522-1527
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ... 1A•1529-1536
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 . 1A•1538 1553
KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ... 1A•1601
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ... 1A•1383
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ... 1A•2206
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ... 1A•1554-1557
PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... 1A•1558-1560,1562-1564
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ... 1A•1567
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1A•1568-1574,1B•1016,1017
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ... 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 ... 203-242-0761
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 ... 607-563-8444
† Columbia Comps., 9 Division St., Sidney, NY 13838 ... 607-563-3520
† Daico Inds., Inc., Box 5225, Compton, CA 90224 ... 213-631-1143
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 ... 617-449-0800
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 ... 201-772-1106
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ... 415-785-5231;415-785-5235
Fischer-America Inc., 13756 Glenoaks Blvd., Sylmar, CA 91342 ... 818-362-9393
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ... 603-669-0054
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 ... 312-677-3640
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 ... 714-540-9261

Delay Lines, Cable-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 ... 516-248-8080
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 ... 607-563-8444
† Astrolab, 345 Dalziel Rd., Linden, NJ 07036 ... 201-862-0022
Automatic Coil Corp., Sub, Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 ... 305-883-5311
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 ... 201-432-0463
Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 ... 203-239-3311
† Columbia Comps., 9 Division St., Sidney, NY 13838 ... 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 ... 516-543-4220
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 ... 516-694-0125
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 ... 201-772-1106
Fischer-America Inc., 13756 Glenoaks Blvd., Sylmar, CA 91342 ... 818-362-9393
Flexco Microwave, Inc., P.O. Box 174, Karrville Rd., Port Murray, NJ 07865 ... 201-689-3020
Gore, W. L., & Assocs., 555 Paper Mill Rd., Newark, DE 19714 ... 302-738-4880
† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111
Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 ... 619-449-3844
Precision Tube, Church Rd. & Wissahickon, N. Wales, PA 19454 ... 215-699-5801
† Times Fiber Communications, Inc., 358 Hall Ave., Wallingford, CT 06492 ... 203-265-8500
§† Uniform Tubes, Collegeville, PA 19426 ... 215-539-0700
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 ... 414-482-4100

Delay Lines, Digital-2350

Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ... 1A•1452,1453
§ Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. 1A•1454-1463, 1465
Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 ... 1A•1466
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ... 1A•1471,1473-1482
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 ... 1A•1484-1499
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... 1A•1510,1513-1520
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ... 1A•1522-1525
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ... 1A•1529-1533
§† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 . 1A•1538 1552
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ... 1A•1554,1555
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... 1A•1558-1560
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1A•1569-1574,1B•1016,1017
§ AKG Acoustics, Inc., 77 Selleck St., Stamford, CT 06902 ... 203-348-2121
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ... 305-973-8620
Columbia Comps., 9 Division St., Sidney, NY 13838 ... 607-563-3520
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ... 415-785-5231;415-785-5235
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 . 914-425-2000
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 ... 617-272-3000
† Piconics, Cummings Rd., Tyngsboro, MA 01879 ... 617-649-7501
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 ... 619-268-2400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ... 603-669-0054
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 ... 714-898-0960
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 ... 312-679-8200
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 ... 714-540-9261

Delay Lines, Distributed, Constant (Fixed)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... 1A•1446,1447
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ... 1A•1451,1453
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. 1A•1454-1458, 1460-1465
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 ... 1A•1467,1469
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ... 1A•1476-1482
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 ... 1A•1485-1499
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... 1A•1510-1518
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 ... 1A•1522-1527
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ... 1A•1529-1536
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 . 1A•1538 1547,1550-1552
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ... 1A•1554-1557
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ... 1A•1558-1560,1562-1564
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ... 1A•1567
Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1A•1568-1574,1B•1016,1017
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ... 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 ... 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 ... 607-563-8444
† Columbia Comps., 9 Division St., Sidney, NY 13838 ... 607-563-3520

† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Daico Inds., Inc., Box 5225, Compton, CA 90224 213-631-1143
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .....415-785-5231;415-785-5235
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Distributed, Constant (Variable)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .....1A•1448
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 .....1A•1468,1469
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 .....1A•1478,1480
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .....1A•1510
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 .1A•1553
Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 .....1A•1565
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Glass & Quartz-2350

† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 .....1A•1450
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .....1A•1347
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ....1A•1383
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
Corning Glass Works, Memory Prods Dept., 3900 Electronic Dr., Raleigh, NC 27604 919-876-1100
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666

Delay Lines, Liquid-2350

Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444

Delay Lines, Lumped Constant (Electrically Variable)-2350

† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 .....1A•1466
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 .....1A•1469
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .....1A•1510
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 .1A•1553
Allen Avionics, 224 E. 2nd St., Mineola, NY 11501 516-248-8080
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Daico Inds., Inc., Box 5225, Compton, CA 90224 213-631-1143
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 ...805-544-3800
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, Lumped Constant (Fixed)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .....1A•1447,1449
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .....1A•1464
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 .....1A•1466
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 .....1A•1469
† Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .....1A•1485
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .....1A•1510
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .....1A•2175
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 .....1A•1556,1557
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 ..... 1A•1562-1564
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 .....1A•1567
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1A•1568
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 .....1A•1575
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Daico Inds., Inc., Box 5225, Compton, CA 90224 213-631-1143
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .....415-785-5231;415-785-5235
† El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, Lumped Constant (Mechanically Variable)-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .....1A•1449
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 .....1A•1469
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .....1A•1510
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Magnetostrictive-2350

† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 .....1A•1469
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 ..... 1A•1529,1534-1536
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400

Delay Lines, Miniature & Subminiature-2350 (Also See Specific Types Of Delay Lines)

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .... 1A•1446-1449
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 .....1A•1450
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ..... 1A•1451-1453
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ... 1A•1454-1465

† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725, 516-543-4220 .... 1A•1466
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 .... 1A•1467,1469
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 .... 1A•1471,1473-1482
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1485-1499
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .... 1A•1510-1520
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030, 408-395-2300 .... 1A•1522-1527
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 .... 1A•1529-1536
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 .1A•1538 1553
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 .... 1A•1554-1557
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343, 818-892-0761 .... 1A•1558-1560,1562-1564
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 .... 1A•1565
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 .... 1A•1567
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ..... 1A•1568-1574,1B•1016,1017
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 .... 1A•1575
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Daico Inds., Inc., Box 5225, Compton, CA 90224 213-631-1143
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Fischer-America Inc., 13756 Glenoaks Blvd., Sylmar, CA 91342 818-362-9393
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
GraphTec Services, Inc., 1600 N.W. Madrid Way, Boca Raton, FL 33432 305-392-3373
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
§† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
Tasker Systems, 20131 Sunburst St., Chatsworth, CA 91311 213-341-3010
† Uniform Tubes, Collegeville, PA 19426 215-539-0700
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, Programmable-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .... 1A•1448
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .... 1A•1462,1463
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 .... 1A•1471,1473-1475
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1484,1494-1499
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .... 1A•1510,1519,1520
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 .1A•1548 1549
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ...... 1A•1571, 1572
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Delay Lines, Strip-2350

† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735, 516-694-0125 .... 1A•1468
JBM Electronics, Inc., 531 Front St., Manchester, NH 03102, 603-623-0222 .... 1A•1529
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532 803-393-5421
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893

Delay Lines, Trimmer-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .... 1A•1448
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008, 201-541-1600 .1A•1553
AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
† Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 ... 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§ Lenco Elctrns., Inc., 300 N. Maryland St., Jackson, MO 63755 314-243-3147
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Delay Lines, Ultrasonic-2350

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .... 1A•1448
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .... 1A•1510
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 .... 1A•1565
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Columbia Comps., 9 Division St., Sidney, NY 13838 607-563-3520
Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
Corning Glass Works, Memory Prods Dept., 3900 Electronic Dr., Raleigh, NC 27604 919-876-1100
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333

Delay Lines, Video — See Delay Lines, Ultrasonic (Vol. 1A)

Delay Lines, Waveguide-2350

Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302 201-432-0463
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Uniform Tubes, Collegeville, PA 19426 215-539-0700
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

Demagnetizers-4525 — *See Vol. 2*

Demodulators-1900 — *See Vol. 3*

Demodulators, Magnetic-2200 — *See Vol. 3*

Deposition Equipment, Vacuum & Accessories-4100 (Also See Evaporation Equipment, Electron Beam) — *See Vol. 3*

Desiccators — See Dehumidifiers (Vol. 2)

Desks, Data Terminal — See Benches, Consoles, Tables (Vol. 2)

Desoldering Tools & Equipment — See Soldering Accessories (Vol. 2), Soldering Equip. (Vol. 2), Soldering Guns (Vol. 2), etc.

Detection & Ranging Systems (MIL)-3475 — *See Vol. 3*

Detection Sets (MIL), IR-3475 — *See Vol. 3*

Detection Systems (MIL), Passive-3475 — *See Vol. 3*

Detection Systems (MIL), Submarine-3475 — *See Vol. 3*

Detectors, Air Flow-2900 — *See Vol. 3*

Detectors, AM/FM-2900 — ***See Vol. 3***

Detectors, Bar Code — See Readers, Bar Code (Vol. 3)

Detectors, Coaxial-2900 — ***See Vol. 3***

Detectors, Corona — See Testers, Corona (Vol. 3)

Detectors, Crystal-2300

Advanced Devices, 1618 Camino Uva, Los Alamos, NM 87544 505-662-7729
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 .617-935-8610
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 .516-694-3600
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
§† JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† 3M Co., Static Control Sys. Div., 3M Center, Bldg. 225-4S-04, St. Paul, MN 55144 612-733-9420
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 415-969-6500

Detectors, Fiber Optic-3700 (Also See Diodes, PIN) — ***See Vol. 1B***

Detectors, Flaw & Defect-2900 — ***See Vol. 3***

Detectors, GaAs-3450

Detectors, Ground Fault-4300 — ***See Vol. 3***

Detectors, Impedance — See Meters, Impedance (Vol. 3)

Detectors, Infrared-3700 — ***See Vol. 1B***

Detectors, Light Intensity — See Meters, Light, Nonphotographic (Vol. 3)

Detectors, Magnetic — See Meters, Gauss (Vol. 3)

Detectors, Microwave-3400 — ***See Vol. 3***

Detectors, Null — See Indicators, Null (Vol. 3)

Detectors, Phase Sensitive-2900 — ***See Vol. 3***

Detectors, Photovoltaic — See Cells, Photovoltaic (Vol. 1B)

Detectors, RF-2900 — ***See Vol. 3***

Detectors, Radiation-2900 — ***See Vol. 3***

Detectors, Resistance Temperature (RTDs) — See Thermometers, Resistance (Vol. 3)

Detectors, Standing Wave-2900 — ***See Vol. 3***

Detectors, Synchronous-2900 — ***See Vol. 3***

Detectors, Tone-1900 — ***See Vol. 3***

Detectors, Ultraviolet-2900 — ***See Vol. 3***

Detectors, Vacuum-4100 — ***See Vol. 3***

Detectors,Vibration — See Transducers, Vibration (Vol. 1B)

Detectors, Video-2900 — ***See Vol. 3***

Detectors, Voltage-2900 — ***See Vol. 3***

Detectors (MIL), IR-3475 — ***See Vol. 3***

Detectors (MIL), Radar-3475 — ***See Vol. 3***

Diacs-4800

Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2109
§ Teccor Elctrns., P.O. Box 619009, Dallas, TX 75261-9009, 214-252-7651 ..1A•2110, 2111
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089

Dials, Instrument, Metal, Plastic, etc.-2400 — ***See Vol. 2***

Dials, Turns Counting-2400 — ***See Vol. 2***

Dielectric Heating Equipment-4100 — ***See Vol. 3***

Dielectrics — See Films (Vol. 2), Insulation Materials (Vol. 2),

Differentials, Mechanical — See Gears & Gear Mechanisms (Vol. 1B)

Digital Panel Meters — See Meters, Panel (Digital) (Vol. 3)

Digital Tape Recorders — See Recorders, Computer Data (Vol. 3)

Digitizers, Audio-2000 — ***See Vol. 3***

Digitizers, Video-2000 — ***See Vol. 3***

Digitizers, Pencil Follower (Incl. Coordinate & Graphic)-2000 — ***See Vol. 3***

Digitizers, Transient & Waveform-2900 — ***See Vol. 3***

Dimmers, Light — See Controls, Lamp Dimming, Flashing (Vol. 3)

Diode Arrays (Incl. Photo)-3700 — ***See Vol. 1B***

Diodes, Avalanche-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Applied Solar Energy Corp., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749 818-968-6581
Central Microwave Co., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Centronic Inc., 5 Eastmans Rd., Parsippany, NJ 07054 201-233-7200
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 .201-335-6723
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§† ITT Electro-Optical Prods., 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 ..714-979-8220
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Standard Reference Labs, Inc., Coan Pl., Metuchen, NJ 08840 201-549-9280
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 516-433-5900
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511

Diodes, Backward-4800

American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074

International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ... 714-557-9394; 800-854-7651
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 ... 609-541-3636
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 ... 213-921-9660
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 ... 408-732-0880

Diodes, Breakdown — See Diodes, Avalanche (Vol. 1A)

Diodes, Chip, Unpackaged-4800

Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
American Power Devices, 7 Andover St., Andover, MA 01810 ... 617-475-4074
† Applied Solar Energy Corp., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749 ... 818-968-6581
BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 ... 312-298-1420
Centronic Inc., 5 Eastmans Rd., Parsippany, NJ 07054 ... 201-233-7200
† Dionics, 65 Rushmore St., Westbury, NY 11590 ... 516-997-7474
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 ... 408-733-3883
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 ... 516-543-0200
General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 ... 602-968-3101
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 ... 408-292-6404
§† ITT Electro-Optical Prods., 7635 Plantation Rd., Reanoke, VA 24019 ... 703-563-0371
† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 ... 714-979-8220
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ... 44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 ... 602-244-6900
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 ... 212-672-6500
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ... 415-968-9211
RCA Solid State Div., Route 202, Somerville, NJ 08876 ... 201-685-6000
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ... 201-685-6000
Semicon, 10 North Ave., Burlington, MA 01803 ... 617-272-9015
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 ... 608-935-2707
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 ... 213-921-9660
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 ... 617-491-1670
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 ... 213-887-1010
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 ... 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 ... 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 ... 415-493-4000
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 ... 214-271-8511

Diodes, Electroluminescent (Radiating)-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 ... 201-722-9800
§ Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ... Call Local Sls. Off.
† Laser Diode Labs, 1130 Somerset St., New Brunswick, NJ 08901 ... 201-249-7000
§† Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 ... 212-392-8800
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 ... 213-828-7496
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 ... 609-541-3636
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 ... 213-882-4100
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700

Diodes, Frequency Multiplier-4800

§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 ... 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 ... 408-733-3883
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 ... 213-517-6000
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ... 714-557-9394; 800-854-7651
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ... 44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 ... 602-244-6900
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 ... 213-628-5392
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 ... 201-438-2300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 ... 408-732-0880
§† Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 ... 214-271-8511

Diodes, Germanium-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ... 1A•2090
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 ... 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ... 714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 ... 201-482-6518
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 ... 617-688-1881
McGuirk Electronics Co. Inc., York St. P.O. Box 101 S.V., Andover, MA 01810 ... 617-933-3500
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ... 603-246-3362/3363
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ... 201-748-5089
Optoelectronics, Inc., 1309 Dynamic St., Petaluma, CA 94952 ... 707-763-4181
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 ... 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 ... 609-541-3636
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 ... 305-283-4500
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 ... 201-429-8700
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 ... 617-890-6107
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 ... 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 ... 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 ... 408-732-0880

Diodes, Gunn-4800

§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
Central Microwave Co., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 ... 213-517-6000
Marconi Instrs., 100 Stonehurst Ct., Northvale, NJ 07647 ... 201-767-7250
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ... 44-(582) 60-14-41
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 ... 516-231-1700
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 ... 201-438-2300
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 ... 201-486-3300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 ... 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 ... 415-493-4141

Diodes, High Voltage (1,000 Volts & Over)-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ... 1A•2090
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ... 1A•2096
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ... 1A•2097
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ... 1A•1883
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ... 1A•2108
† **Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ... 1A•2113**
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 ... 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 ... 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 ... 401-762-3800
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 ... 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 ... 214-233-1589
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 ... 201-335-6723
§ Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 ... 914-965-4400
§† General Instr., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802 ... 516-733-3333
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 ... 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ... 714-557-9394; 800-854-7651
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 ... 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 ... 213-772-2000
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 ... 714-979-8220
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 ... 602-244-6900
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ... 201-748-5089
Oram Elctrns., Rte. 22, Brewster, NY 10509 ... 914-279-2966
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 ... 609-541-3636
§ RCA Solid State Div., Route 202, Somerville, NJ 08876 ... 201-685-6000
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan ... 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 ... 213-540-2209
§ Semicon, 10 North Ave., Burlington, MA 01803 ... 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 ... 305-283-4500
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 ... 603-883-8102
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 ... 213-628-5392
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 ... 201-429-8700
§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 ... 213-921-9660
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 ... 812-332-1435
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 ... 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 ... 201-486-3300
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 ... 214-271-8511
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 ... 412-925-7272

Diodes, Hot Carrier-4800

§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511

Diodes, Impatt-4800

† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Diodes, Laser-4800

A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
† General Optronics, 3005 Hadley Rd., So. Plainfield, NJ 07080 201-549-9000
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Laser Diode Labs, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
§† M/A-COM Laser Diode, Inc., M/A-COM, Inc., 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 213-281-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Light Emitting (LEDs)-3700 — *See Vol. 1B*

Diodes, Limiting-4800

§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ....603-246-3362/3363
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§ Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Liquid Crystal (LCDs)-3700 — *See Vol. 1B*

Diodes, Matched Pairs-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§† Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 .201-335-6723
Datacopy Corp., 1215 Terra Bella Ave., Mountain View, CA 94043 ..415-965-7900
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75080 214-234-4271
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
McGuirk Electronics Co. Inc., York St. P.O. Box 101 S.V., Andover, MA 01810 617-933-3500
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 ..714-979-8220
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 212-672-6500
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

Diodes, Matched Quads-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 .201-335-6723
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 212-672-6500
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291 209-651-1402

Diodes, Microwave Detector-4800

TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1778
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§† Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 .516-694-3600
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Microwave Mixer-4800

TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1778
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§† Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ....603-246-3362/3363
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Noise-4800

† Standard Reference Labs, Inc., Coan Pl., Metuchen, NJ 08840, 201-549-9280 ....3•1305
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
† MDF Products Inc., 7 Johnson Dr., Danbury, CT 06810 203-743-3579
§ Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Photoelectric-3700 — *See Vol. 1B*

Diodes, PIN-4800

§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ....1B•1253
Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ....1A•1763
† Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901, 518-561-3160 ....1B•1233
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Solar Energy Corp., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749 818-968-6581
BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
† Centronic Inc., 5 Eastmans Rd., Parsippany, NJ 07054 201-233-7200
† CO-ORD Switch Div., LVC Inds., Inc., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† Hughes Aircraft Co., 6155 El Camino Real, Carlsbad, CA 92008 619-438-9191
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ....714-557-9394; 800-854-7651
§† ITT Electro-Optical Prods., 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
† LVC Inds., Inc., CO-ORD Switch Div., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 212-672-6500
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, CA 91320 805-498-6737
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
United Detector Tech., 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

Diodes, Schottky-4800

§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2105
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ....714-557-9394; 800-854-7651
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
United Detector Tech., 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516
§ Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511

Diodes, Selenium — See Rectifiers, Selenium (Vol. 1A)

Diodes, Silicon-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ....1A•2090
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ....1A•2096
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•2097
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ....1A•2098
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2105
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ....3•1663
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ....3•1663
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ....1A•2113
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Applied Solar Energy Corp., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749 818-968-6581
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
BEA electro-optics, Inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
† Centronic Inc., 5 Eastmans Rd., Parsippany, NJ 07054 201-233-7200
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132 314-423-4900
§† Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 212-651-7200
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321

§† General Instr., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802 516-733-3333
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75080 214-234-4271
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
McGuirk Electronics Co. Inc., York St. P.O. Box 101 S.V., Andover, MA 01810 617-933-3500
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 ..714-979-8220
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ....603-246-3362/3363
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ Optek, Crown Semi, 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ..415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Thyristors & Rectifiers, Rte. 202, Somerville, NJ 08876 201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, CA 91320 805-498-6737
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
† Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901 518-561-3160
SMD Technology Svc. Ctr., North American Philips, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 800-431-4444
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
Standard Reference Labs, Inc., Coan Pl., Metuchen, NJ 08840 201-549-9280
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
United Detector Tech., 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Diodes, Step Recovery-4800

A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Switching-4800

§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ....1A•2092
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ....1A•2096
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 .201-335-6723
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 ..212-651-7200
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§ General Instr., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304 415-493-0400
§† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 ..714-979-8220
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 ....603-246-3362/3363
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§† NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511

Diodes, Temperature Compensating-4800

Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 ..714-979-8220
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900

§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Diodes, Trigger — See Diodes, Avalanche (Vol. 1A)

Diodes, Tunnel-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .. 714-557-9394; 800-854-7651
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 .. 714-979-8220
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Diodes, Varactor-4800

§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•2099**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 .... 1A•2108
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .. 714-557-9394; 800-854-7651
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England .... 44-(582) 60-14-41
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 212-672-6500
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 .. 201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Diodes, Video Detector — See Diodes, Microwave Detector (Vol. 1A)

Diodes, Zener & Stabistors (Forward Reference Diodes)-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 .... 1A•2090
§ **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 .... 1A•2092**
§ **International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 .... 1A•2096**
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 .... 3•1250
§† **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•2099,2102**
† **Standard Reference Labs, Inc., Coan Pl., Metuchen, NJ 08840, 201-549-9280 .... 3•1305**
§ **Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 .... 1A•2108**
TRW Optoelectronics Div., 1201 Tappan Circle, Carrollton, TX 75006, 214-323-2200 .... 1B•1246,1250,1251
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
American Power Devices, 7 Andover St., Andover, MA 01810 617-475-4074
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 .. 212-651-7200
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ Frequency Sources, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824 617-256-8101
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 .. 714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-942-0810
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 .. 714-979-8220
§ Microwave Diode Corp., Washington St-Box 250, W. Stewartstown, NH 03597 .... 603-246-3362/3363
§† NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 .. 201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 . 305-283-4500
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Diodes (MIL)-2440 — *See Vol. 1B*

Diplexers, Antenna-1900 — *See Vol. 3*

Direction Finders (MIL), High Frequency-3475 — *See Vol. 3*

Direction Finders (MIL), Radio-3475 — *See Vol. 3*

Direction Finding Sets & Systems (MIL)-3475 — *See Vol. 3*

Discharge Systems, Energy-4000 — *See Vol. 3*

Discriminators-1900 — *See Vol. 3*

Disks, Computer Memory — See Memory Systems, Disk (Vol. 3)

Disks, Magnetic, 5¼″ Flexible-2000 — *See Vol. 3*

Disks, Magnetic, 8″ Flexible-2000 — *See Vol. 3*

Disks, Magnetic, Front-loading Cartridge-2000 — *See Vol. 3*

Disks, Magnetic, Pack-2000 — *See Vol. 3*

Disks, Magnetic, Sub-4″-2000 — *See Vol. 3*

Disks, Magnetic, Top-loading Cartridge-2000 — *See Vol. 3*

Disks, Magnetic, Winchester Module-2000 — *See Vol. 3*

Disks, Memory, Flexible — See Memory Systems, Disk, Flexible (Vol. 3)

Disks, Optical Encoder — See Encoders, Shaft Angle, Optical (Vol. 1B)

Dispensers, Adhesive-1600 — *See Vol. 2*

Dispensers, DIP & IC — See Machines, Component Handling (Vol. 3)

Dispensers (MIL), Chaff-3475 — *See Vol. 3*

Dispensers (MIL), Drone, Chaff/IR-3475 — *See Vol. 3*

Dispensers (MIL), IR Flare-3475 — *See Vol. 3*

Dispensers (MIL), Wing Chaff-3475 — *See Vol. 3*

Dispenser Sets (MIL)-3475 — *See Vol. 3*

Dispensing Pods (MIL), Chaff-3475 — *See Vol. 3*

Display Power Supplies — See Converters, DC to DC (Vol. 3), Power Supplies, AC Output (Vol. 3),

Displays, CRT-5700

† Infodex, Inc., 395 W. Main St., Waterbury, CT 06702, 203-757-9291 ....1B•1086, 1087
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 .... 3•1318
ADAC Corp., 70 Tower Office Pk., Woburn, MA 01801 617-935-6668
§ Ann Arbor Terminals, 6175 Jackson Rd., Ann Arbor, MI 48103 313-663-8000
Applied Sys., 26401 Harper Ave., St. Clair Shores, MI 48081 313-779-8700
Aspect Elctrns., 725 San Aleso, Sunnyvale, CA 94086 408-737-2290
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., 00, Santa Clara, CA 95051 408-748-1200
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† Audiotronics Corp., 7428 Bellaire Ave., N. Hollywood, CA 91605 818-765-2645
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§† Aydin Controls, 414 Commerce Dr., Ft. Washington, PA 19034 215-542-7800
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Collins Avionics Divisions, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498 319-395-1000
Computer System Assocs., 7562 Trade St., San Diego, CA 92121 ..619-566-3911
† Conrac Corp., System Comps. Div., 1700 S. Mountain Ave., Duarte, CA 91010 213-359-9141
§ Conrac Div., Conrac Corp., 600 N. Rimsdale Ave., Covina, CA 91722 213-966-3511
CPS Inc., 110 Wolfe Rd., Sunnyvale, CA 94086 408-738-0530
† Custom Prods. Grp., Sys. Dev. Corp.-A Burroughs Co., P.O. Box 517, Paoli, PA 19301 215-648-2241
Data Ray Corp., 8401 Baseline Rd., Boulder, CO 80303 303-494-4444
§ Data Rentals/Sls., Inc, P. O. Box 3257, Culver City, CA 90230 213-559-3822
Daytronic Corp., 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Digital Equip., One Iron Way, Marlborough, MA 01752 ....
§† Digitech Inds., Inc., 66 Grove St., Ridgefield, CT 06877 203-438-3731
§ Dotronix, 160 First St. SE, New Brighton, MN 55112 612-633-1742
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Facit, Inc., 66 Field Point Rd., Greenwich, CT 06830 203-622-9150
§ Fan-S Corp., 7158 Industrial Pk. Blvd., Mentor, OH 44060 216-951-3300
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Kaiser Elctrns., Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134 408-946-3000
Kikusui Intl. Corp., 17819 S. Figueroa St., Gardena, CA 90248 ......213-515-6432; 800-421-5334
Kratos Display Systems, 101 Cooper Court, Los Gatos, CA 95030 ..408-395-3700
§ Leader Instrs. Corp., 380 Oser Ave., Hauppauge, NY 11788-3694 ...516-231-6900
§ LogE/Spatial Data Sys., 508 S. Fairview, Goleta, CA 93017 805-967-2383
Lundy Elctrns. and Systems, Inc., 1 Robert La., Glen Head, NY 11545 516-671-9000
Matrix Corp., 1639 Green St., Raleigh, NC 27603 919-833-2837
Matrox Elctrn. Sys., 5800 Andover Ave., Montreal, QU H4T 1H4 Canada 514-735-1182
Metra Instrs., 2056 Bering Dr., San Jose, CA 95131 408-297-8530
Microsystems Dev. Corp. Inc., 1560 Teaneck Rd., Teaneck, NJ 07666 201-837-0051
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 213-515-3993
§ Ramtek, 2211 Lawson Lane, Santa Clara, CA 95050 408-988-2211
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
SEKAI Elctrns. of Amer., Inc., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638 714-670-1854
§ Summit CAD Corp., 5222 FM 1960 W100, Houston, TX 77069 713-440-1468
† Systems Resch. Labs., Inc., 2800 Indian Ripple Rd., Dayton, OH 45440 513-426-6000
Teletype, 5555 Touhy Ave., Skokie, IL 60076 312-982-2000
§† TeleVideo Sys., Inc., 1170 Morse Ave., Sunnyvale, CA 94086 408-745-7760
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 516-433-5900
Vu-Data, 7122 Convoy Ct., San Diego, CA 92111 619-279-6572
Zenith Components & Sys. Grp., Zenith Radio Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Displays, Dot Matrix-2450 — *See Vol. 1B*

Displays, Edge Lighted & Back Lighted-2450 — *See Vol. 1B*

Displays, Electroluminescent-2450 — *See Vol. 1B*

Displays, Electromagnetic-2450 — *See Vol. 1B*

Displays, Electromechanical-2450 — *See Vol. 1B*

Displays, Fiber Optic-2450 — *See Vol. 1B*

Displays, Graphic-2450 — *See Vol. 1B*

Displays, Indicator Lights-2450 — *See Vol. 1B*

Displays, Graphic Systems-2000 — *See Vol. 3*

Displays, Laser-2450 — *See Vol. 1B*

Displays, Light-emitting Diode (LED)-2450 — *See Vol. 1B*

Displays, Lighted Segment-2450 — *See Vol. 1B*

Displays, Liquid Crystal (LCD)-2450 — *See Vol. 1B*

Displays, Planar Gas Discharge-2450 — *See Vol. 1B*

Displays, Plasma-2450 — *See Vol. 1B*

Displays, Projection Type (CRT; Electromechanical; ilm; Light Valve)-2450 — *See Vol. 1B*

Displays, Status-2450 — *See Vol. 1B*

Displays, Storage Tube — See Displays, CRT (Vol. 1A)

Displays, Touch Sensitive (Infrared & Membrane)-2450 — *See Vol. 1B*

Displays, Tube — See Tubes, Readout (Vol. 1A)

Displays, Vacuum Fluorescent-2450 — *See Vol. 1B*

Display Sets (MIL), Computer-3475 — *See Vol. 3*

Dissipators, Heat — See Heat Sinks, Semiconductor (Vol. 2), Heat Sinks, Soldering (Vol. 2),

Distortion Analyzers, Indicators — See Analyzers, AF (Vol. 3)

Dividers, Analog-3130

Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ...1A•1723
Action Instrs., 8601 Aero Dr., San Diego, CA 92123 619-279-5726
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
§† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
Intronics, Inc., 57 Chapel St., Newton, MA 02158 617-964-4000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Rochester Instr. Sys., 255 N. Union St., Rochester, NY 14605 716-263-7700
Teledyne Philbrick, Allied Dr. Rte 128, Dedham, MA 02026 617-329-1600
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100

Dividers, Frequency-3450

† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ....1A•1358,1359
Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ...1A•1723
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Global Specialties Corp., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509 203-624-3103
§† Luff Research, Box 449, Jackson Hgts., NY 11372 212-429-5900
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
§ Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086 408-739-7700
Spectracom, 320 N. Washington St., Rochester, NY 14625 716-381-4827
Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-694-4400

Dividers, Power (LF, HF, VHF, UHF)-3450

† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ..1A•1713, 1714,1723,1738-1749
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..1A•1774
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103, 603-627-6000 ....1B•1014
† Aiken Advanced Sys., 5901 Edsall Rd., Alexandria, VA 22304 703-370-0900
† Alan Inds., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 .617-935-8610
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775

† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 .... 207-655-4555;800-341-9678
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ KLM Electronics, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037 408-779-7363
† Locus, Box 740, State College, PA 16801 814-466-6275
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406 ....
M/A-Com Cable/Home Communication Prodelin Satellite Antenna Systems, M/A-Com, Inc., P.O. Box 468, Newton, NC 28658 . 800-222-1195;704-464-4141
† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, CA 91311 818-882-1020
Uniform Tubes, Collegeville, PA 19426 215-539-0700
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Dividers, Power, Microwave-3450

† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 .... 1A•1689**
† **Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 .. 1A•1713, 1714,1723,1738-1749**
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 . 1A•1774, 3•1393
† **Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103, 603-627-6000 .... 1B•1014**
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877, 301-948-3434; 800-638-2048 .... 1A•1787
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 . 516-694-3600
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Locus, Box 740, State College, PA 16801 814-466-6275
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .... 315-437-4529; 800-448-1666
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, CA 91311 818-882-1020
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Dividers, Voltage-2900 (Also See Networks, Resistance; Transformers, Voltage Dividing) — *See Vol. 3*

Doublers, Frequency — See Multipliers, Frequency (Vol. 1A)

Doublers, Voltage-4800 (Also See Rectifiers, Bridges & Assemblies)

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Megatran Electronic Power, Rising Sun Rd., Bordentown, NJ 08505 609-298-7300
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 .. 201-748-5089
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191

Down Converters-3400 — *See Vol. 3*

Drafting Machines-4200 — *See Vol. 2*

Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)-4200 — *See Vol. 2*

Drawers, Sliding-1400 — *See Vol. 2*

Drills & Accessories, Manual & Power-5400 — *See Vol. 2*

Drives, Disc, Flexible and Rigid-2000 — *See Vol. 3*

Drivers & Decoders For Readouts-2450 — *See Vol. 1B*

Drivers, Chopper-1100 — *See Vol. 3*

Drivers, Nut-5400 — *See Vol. 2*

Drivers, Solenoid-4550 — *See Vol. 1B*

Drivers, Speaker-1300 — *See Vol. 3*

Drivers, Switch-3450

American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 . 516-694-3600
Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 .. 603-627-6000

Drivers, Tube — See Drivers & Decoders for Readouts (Vol. 1B)

Drives & Drive Mechanisms (Dial)-2400 — *See Vol. 2*

Drives/Subsystems, Core Disk Emulator-2000 — *See Vol. 3*

Drives/Subsystems, Disk, 3½ Diskette-2000 — *See Vol. 3*

Drives/Subsystems, Disk, 5¼″ Diskette-2000 — *See Vol. 3*

Drives/Subsystems, Disk, 5¼″ Winchester-2000 — *See Vol. 3*

Drives, Subsystems, Disk, 8″ Diskette-2000 — *See Vol. 3*

Drives/Subsystems, Disk, 8″ Winchester-2000 — *See Vol. 3*

Drives/Subsystems, Disk, 14″ Winchester-2000 — *See Vol. 3*

Drives/Subsystems, Disk, Fixed-2000 — *See Vol. 3*

Drives/Subsystems, Disk, Fixed/Removable-2000 — *See Vol. 3*

Drives/Subsystems, Magnetic Tape, ¼″ Cartridge-2000 — *See Vol. 3*

Drives/Subsystems, Magnetic Tape, Cassette-2000 — *See Vol. 3*

Drives/Subsystems, Magnetic Tape, Reel-to-Reel-2000 — *See Vol. 3*

Drives/Subsystems, Semiconductor Emulator-2000 — ***See Vol. 3***

Dry Transfer Letters & Numbers — See Kits, Marking (Vol. 2)

Ducts, Wiring-6000 — ***See Vol. 2***

Dummy Loads, Electronic-2900 — ***See Vol. 3***

Dummy Loads, Microwave-2900 — ***See Vol. 3***

Dummy Loads, Power-2900 — ***See Vol. 3***

Dummy Loads, Resistive-2900 — ***See Vol. 3***

Dummy Loads (MIL), RF-2440 — ***See Vol. 1B***

Duplexers, Microwave-3400 — ***See Vol. 3***

Duplexers, Nonmicrowave-1900 — ***See Vol. 3***

Duplicators, Magnetic Tape-1300 — ***See Vol. 3***

Dust Covers — See Covers, Protective (Vol. 2)

DVMs — See Meters, Volt, Digital (Vol. 3)

Earphones — See Headphones (Vol. 3)

Earth Stations, TV, Receive Only-1900 — ***See Vol. 3***

Editing Equipment, Tape-1300 — ***See Vol. 3***

Ejectors & Extractors, PC Boards — See Pullers, Circuit Board (Vol. 2)

Elastomers, Conductive — See Conductive Elastomers (Vol. 2)

Elastomers, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. 2)

Electret — See Microphones, Condenser (Vol. 3)

Electrical Measurement & Test Services — See Services, Electrical Measurement & Test (Vol. 3)

Electrodes, Electroplating — See Electroplating Equipment & Supplies (Vol. 3)

Electrodes, High Voltage-2900 — ***See Vol. 3***

Electronic Counter Countermeasures (ECCM) Fixes (MIL)-3475 — ***See Vol. 3***

Electronic Countermeasures (ECM) (MIL), Cruise Missiles-3475 — ***See Vol. 3***

ECMs (MIL), Torpedo Defense-3475 — ***See Vol. 3***

ECM Sets (MIL)-3475 — ***See Vol. 3***

ECM Sets (MIL), Close Air Support-3475 — ***See Vol. 3***

ECM Sets (MIL), Shipboard-3475 — ***See Vol. 3***

ECM Systems (MIL)-3475 — ***See Vol. 3***

ECM Systems (MIL), Deceptive-3475 — ***See Vol. 3***

Electronic Intelligence (Elint) (MIL)-3475 — ***See Vol. 3***

Electronic Loads — See Dummy Loads (Vol. 3)

Electronic Support Measures (ESM) Sets (MIL)-3475 — ***See Vol. 3***

ESM (MIL), Digitally Controlled-3475 — ***See Vol. 3***

ESM (MIL), Ships-3475 — ***See Vol. 3***

ESM Suites (MIL)-3475 — ***See Vol. 3***

ESM Systems (MIL), Automated-3475 — ***See Vol. 3***

ESM Systems (MIL), IFM Receiver-3475 — ***See Vol. 3***

Electronic Warfare (EW) Sets (MIL)-3475 — ***See Vol. 3***

EW Sets (MIL), Ground Multitarget-3475 — ***See Vol. 3***

EW Sets (MIL), Portable-3475 — ***See Vol. 3***

EW Suites (MIL), Ships-3475 — ***See Vol. 3***

EW Systems (MIL), Advanced Airborne Multitarget-3475 — ***See Vol. 3***

Electroplating Equipment & Supplies-4100 — ***See Vol. 3***

Electrostatic Discharge Guns — Also See Generators, ESD-2900 — ***See Vol. 3***

Electrostatic Discharge (MIL)-2440 — ***See Vol. 1B***

Elements, Sensing — See Transducers (Vol. 1B)

Eliminators, Battery — See Power Supplies, AC to DC Adapter (Vol. 3)

Emitter Location & Identification System (MIL), Automatic Ground Transportable-3475 — ***See Vol. 3***

Emitters, Fiber Optic-2475 (Also See Diodes, Laser) — ***See Vol. 1B***

Emulators, RTS-2900 — ***See Vol. 3***

Encapsulating Materials — See Compounds, Encapsulating, Molding, Potting (Vol. 2)

Encapsulation Services — See Services, Encapsulation (Vol. 3)

Enclosures, Circuit Board, Module, & Relay Mounting-1400 — ***See Vol. 2***

Enclosures, Equipment & Panel Mounting-1400 — ***See Vol. 2***

Enclosures, Keyboard-1400 — ***See Vol. 2***

Enclosures, Nonmetallic-1400 — ***See Vol. 2***

Enclosures, Portable, Metallic & Nonmetallic-1400 — ***See Vol. 2***

Enclosures, Shielded-1400 — ***See Vol. 2***

Enclosures, Shipping, Metallic & Nonmetallic-3800 — ***See Vol. 2***

Encoders, Digital — See Encoders, Shaft Angle (Vol. 1B)

Encoders, Displacement, Linear-5500 — ***See Vol. 1B***

Encoders, Fiber Optic-2475 — ***See Vol. 1B***

Encoders, Magnetic Strip-5500 — ***See Vol. 1B***

Encoders, Proof-2000 — ***See Vol. 3***

Encoders, Shaft Angle, Contacting-5500 — ***See Vol. 1B***

Encoders, Shaft Angle, Magnetic-5500 — ***See Vol. 1B***

Encoders, Shaft Angle, Optical-5500 — ***See Vol. 1B***

Encoders, Shaft Position — See Encoders, Shaft Angle (Vol. 1B), Resolvers, Synchro (Vol. 3),

Encoders, Tone-1900 — ***See Vol. 3***

Engineering Reference Books — See Technical Books (Vol. 3)

Energy Management Systems-2200 — ***See Vol. 3***

Environmental Testing Services — See Services, Environmental Testing (Vol. 3)

Epoxies — See Compounds, Enscapsulating, Molding, Potting (Vol. 2), Adhesives (Vol. 2),

Equalizers, Audio-1300 — ***See Vol. 3***

Equalizers, Delay-1900 — ***See Vol. 3***

Equalizers, Phase-1900 — ***See Vol. 3***

Erasers, Magnetic Tape (Bulk)-1300 — ***See Vol. 3***

Erasing Equipment, EPROM-3130

Ango Electronics Corp., Post Office Box 112, Harrison, NJ 07029 .212-685-6336; 201-483-7116
Digelec, Inc., Affil. Wavetek Corp., 586 Weddell Drive, Suite 1, Sunnyvale, CA 94089 408-745-0722
International Instrumentation, 31131-602 Via Colinas, Westlake Vlg., CA 91362 213-991-9614
International Microsystems, 11554 C Ave., Auburn, CA 95603 916-885-7262
Oliver Advanced Engrg., 676 W. Wilson Ave., Glendale, CA 91203 .818-240-0080
§ Spectronics Corp., 956 Brush Hollow Rd., Westbury, NY 11590 516-333-4840
§ Turner Designs, 2247 Old Middlefield Way, Mountain View, CA 94043-2489 415-965-9800
UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123

Escutcheons-2400 — ***See Vol. 2***

Etchants, Fluorocarbon-1600 — ***See Vol. 2***

Etchants, Printed Circuit-1700 — ***See Vol. 2***

Etching & Engraving — See Services, Metal Etching, Engraving (Vol. 3)

Evaporation Equipment, Electron Beam-4100 — ***See Vol. 3***

Exciters — See Oscillators (Vol. 1A)

Exciters, Vibration — See Testers, Vibration (Vol. 3)

Expanders, Data-3475 — ***See Vol. 3***

Expanders, Meter — See Multipliers, Meter (Vol. 3)

Extractors, Circuit Board, Tube — See Pullers, Circuit Board (Vol. 2)

Extractors, DIP, IC, & Pin Grid Array-5400 — ***See Vol. 2***

Eyelets-2825 — ***See Vol. 2***

Fabrics, Conductive-4525 — ***See Vol. 2***

Facsimile Equipment, Receive Only-1900 — ***See Vol. 3***

Facsmile Equipment, Send Only-1900 — ***See Vol. 3***

Facsimile Equipment, Send/Receive-1900 — ***See Vol. 3***

Fans, Axial-2600 — ***See Vol. 2***

Fasteners, Cable & Wire — See Wire & Cable Ties (Vol. 2)

Fasteners, Metal-2825 — ***See Vol. 2***

Fasteners, Nonmetallic-2825 — ***See Vol. 2***

Fault Locators — See Detectors (Vol. 3)

Feedthrus & Seals, Environmental-2500 — ***See Vol. 2***

Ferrite Material & Parts-2500 — ***See Vol. 2***

Ferrules, Cable-end-2825 — ***See Vol. 2***

Fiber Optic Components — See Adapters (Vol. 1B), Attenuators (Vol. 1B), Cable (Vol. 1B), Connectors (Vol. 1B), Couplers (Vol. 1B), Detectors (Vol. 1B), Isolators (Vol. 1B), Light Sources (Vol. 1B), Receivers (Vol. 1B), Transmitters (Vol. 1B),

Fiber Optic Scanners — See Scanners, Fiber Optic (Vol. 1B)

Fiber Optics (MIL)-2440 — ***See Vol. 1B***

Fiber Optic Test Equipment — See Test Equipment, Fiber Optic (Vol. 1B), Testers, Fiber Optic (Vol. 3),

Films, Masking (Incl. Photographic)-3100 — ***See Vol. 2***

Films, Resistance-4700

† Acheson Colloids, P.O. Box 288, Port Huron, MI 48060 313-984-5581
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
Datak Corp., 65 Seventy-First St., Guttenberg, NJ 07093 201-869-2200
Electrostatic Consltg. Assocs., 556 Lowell Rd., Groton, MA 01450 617-448-5485
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
Lehighton Elctrns., Inc., Box 328, Dept M, Lehighton, PA 18235 .... 717-386-4156; 215-377-5990
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
Metavac, Inc., 45-68 162nd St., Flushing, NY 11358 .... 212-HJ5-0400
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025

Filters, Active (All Types)-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 .... 1A•1585
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1327,1588
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 .... 1A•1592
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 .... 1A•1593
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 .... 3•1237
Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... 1A•1359
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 .... 1A•1361
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 .... 3•1255
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .. 1A•1613-1617, 3•1016-1020,1286
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 .... 1A•1422-1425
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 .... 1A•1631
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 .... 1A•1783
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 .... 1A•1638-1641
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 .... 1A•1437
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
§ AMF Inc., AMF Cuno/General Filter Products Division, 400 Research Pkwy., Meriden, CT 06450 203-237-5541
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 617-246-0300
† Aptek Microsystems, Inc., Hillsboro Plaza, 700 N.W. 12th Ave., Deerfield Beach, FL 33441 305-421-8450
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94089 408-734-8150
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 607-724-2484
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
CTS Halex, 1202 McGaw Ave., Irvine, CA 92714 714-556-2850
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
EDMAC Corp., 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750 716-924-4000
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910 813-482-7212
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Marel Instr. Co., 907 South East 13th Pl., Cape Coral, FL 33904 813-574-8788
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 .... 703-971-8606; 703-971-7082
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
§ Pall Ultrafine Filtration Corp., 30 Sea Cliff Ave., Glen Cove, NY 11542 516-759-1900
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan .... (03) 775-2111
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
Tustin Elctrns. Co., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705 714-549-0391
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, AF-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 .... 1A•1585
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1327,1588
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 .... 1A•1593
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .... 1A•1594
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 .... 3•1237
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1363

§—Product sold through distributors †—Product meets MIL specs

Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 .... 3•1255
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1377
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•1398**
Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 .... 1A•1611
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .... 1A•1615
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 .... 1A•1631
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 .... 1A•1632-1641
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 .... 617-655-1532; 800-225-4876
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
§ Inmac, 2465 Augustine Dr., Santa Clara, CA 95051 408-727-1970
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
§ Pall Ultrafine Filtration Corp., 30 Sea Cliff Ave., Glen Cove, NY 11542 516-759-1900
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-540-7640
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan .... (03) 775-2111
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 212-255-3500
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, Air — See Air Cleaners & Filters (Vol. 2)

Filters, Analog — See Filters, Continuously Variable (Vol. 1A)

Filters, Antenna-2700

† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-563-6000
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 .... 617-655-1532; 800-225-4876
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .... 315-437-4529; 800-448-1666
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 305-298-2000
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan .... (03) 775-2111
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Uniform Tubes, Collegeville, PA 19426 215-539-0700
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Band Elimination-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .... 1A•1583
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 .... 1A•1585
† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 .... 1A•1689**
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 .... 1A•1586
† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1327,1588**
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 .... 1A•1651
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347**
† **Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 .... 1A•1592**
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 .... 1A•1593
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .... 1A•1594**
§† **Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1354**
† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2167**
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 .... 1A•1624,3•1237
† **Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... 1A•1359**
† **Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 .... 1A•1361**
† **Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1363**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... 1A•1601**
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 .... 3•1255
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383**
† **North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .... 3•1393**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•1398**
† **Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 .... 1A•1611**
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 .... 1A•1404,1405
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .... 1A•1613-1615, 3•1016,1286
† **Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1415**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•1642**
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 .... 1A•1641
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 .... 3•1317
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 .... 1A•1784
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024

† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
† Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ....213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
Ealing Optics Co., Ealing Corp., 22 Pleasant St., S. Natick, MA 01760 617-655-7000
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300
EDMAC Corp., 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750 716-924-4000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electro-Metrics, 100 Church St., Amsterdam, NY 12010 518-843-2600
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Marconi Instrs., 100 Stonehurst Ct., Northvale, NJ 07647 201-767-7250
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ....703-971-8606; 703-971-7082
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860 305-886-8860
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ....405-224-6780;800-654-8850
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 ..608-987-3363
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ....(03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, Bandpass-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ....1A•1579,1581, 1583
Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ....1A•1450
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ....1A•1585
† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ....1A•1689**
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ....1A•1586
† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1327,1588**
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ....1A•1651
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ....1A•1347**
† **Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ....1A•1592**
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ....1A•1593
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ....1A•1594**
§† **Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ....1A•1354**
† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2167**
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ....1A•1624,3•1237
† **Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ....1A•1359**
† **Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 ....1A•1361**
† **Hertz Filter, 3 Aerial Way, Syosset, NY 11791, 516-822-4770 ....1A•1598**
† **Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 ....1A•1363**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ....1A•1601**
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 .... 3•1255
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ....1A•1377,1378**
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ....1A•1383**
§† **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1395**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•1398**
† **Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ....1A•1611**
† **Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ....1A•1404**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .. 1A•1613-1615, 3•1016,1020,1286
† **Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ....1A•1415**
† **Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ....1A•1622**
† **Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 ....1A•1777**
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1783
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•1642**
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 .... 1A•1632-1634,1638
† **Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ....1A•1437**
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 .... 3•1317
† **Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ....1A•1784**
† Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Aiken Advanced Sys., 5901 Edsall Rd., Alexandria, VA 22304 703-370-0900
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§ American Microsignal, 8431 Monroe Ave., Stanton, CA 90680 714-761-1222

† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Aptek Microsystems, Inc., Hillsboro Plaza, 700 N.W. 12th Ave., Deerfield Beach, FL 33441 305-421-8450
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000
† Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ....213-EX7-9668
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300
EDMAC Corp., 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750 716-924-4000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
§ Furman Sound, Inc., 30 Rich St., Greenbrae, CA 94904 415-927-1225
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ...703-971-8606; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .....315-437-4529; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
Resdel Engrg., 300 E. Live Oak Ave., Arcadia, CA 91006 213-684-2600
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 ...714-540-7640
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505 213-530-8777
Sentry Mfg., Crystal Park, Chickasha, OK 73018 .... 405-224-6780;800-654-8850
Signatron, 12 Hartwell Ave., Lexington, MA 02173 617-861-1500
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 ..608-987-3363
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ......(03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ...212-782-4200
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Tektronix, Inc., P.O. Box 500, V3-314, Beaverton, OR 97077 ....800-547-1512; Oregon only 800-452-1877
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan .... Tokyo 03-402-6161
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
§ Tucker Elctrns., Box 461060, Garland, TX 75046 ...... 214-348-8800;800-527-4642
† Uniform Tubes, Collegeville, PA 19426 215-539-0700
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Filters, Bandpass, SAW (Surface Acoustic Wave)-2700

† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ....1A•1450
McCoy Electronics Co., Sub. (ak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, '17-486-3411 ....1A•1379
Sawtek Inc., P.O. Box 18000, rlando, FL 32860, 305-886-8860 ....1A•1420,1622, 1623
† Damon/Elctrns. Div., 80 Wils Way, Westwood, MA 02090 617-449-0800
† Dontech Inc., 601-606 Airpc Indl. Blvd., Doylestown, PA 18901 215-348-5010
Engelmann Microwave Co., DI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75234 214-233-2903
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Filters, Band Reject, Band Stop — See Filters, Band Elimination (Vol. 1A)

Filters, Ceramic-2700

Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 .... 1A•1064
§† **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1395,1576**
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. 05, Richardson, TX 75081, 214-235-8332 .... 1A•1397
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 .... 1A•1631
† **U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 .... 1A•1211**
A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
AMP Incorporated, Box 3608, Harrisburg, PA 17105 717-564-0100
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
AVX Corporation, Box 867, Myrtle Bch., SC 29577 803-448-9411
Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† Norton, One New Bond St., Worcester, MA 01606 617-853-1000
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
§† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Star Porcelain, 71 Muirhead Ave., Trenton, NJ 08638 609-392-3154
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
† Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600
Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411

Filters, Coaxial-2700

† **Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 .... 1A•1689**
Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 .... 1A•1611
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406 ....
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .... 315-437-4529; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§ Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 914-698-5600
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Telco Products Co., 44 Sea Cliff, Glen Cove, NY 11542 516-759-0300
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Uniform Tubes, Collegeville, PA 19426 215-539-0700
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Veeco Instruments Inc., Terminal Dr., Plainview, NY 11803 516-349-8300
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Filters, Color, Panel Light-2450 — *See Vol. 1B*

Filters, Comb-2700

† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .... 1A•1615
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 .... 1A•1781,1783
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-540-7640
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Toretron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Filters, Continuously Variable-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 .... 1A•1585

Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 .... 3•1255

Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .1A•1615,3•1016

† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 .... 1A•1777

Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 .... 3•1317

Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 .... 1A•1784

§ AMF Inc., AMF Cuno/General Filter Products Division, 400 Research Pkwy., Meriden, CT 06450 203-237-5541

† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900

Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233

Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700

† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522

† Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222

§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281

† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094

§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300

EDMAC Corp., 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750 716-924-4000

ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400

Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883

Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761

Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500

ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640

† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424

Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501

† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282

Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715

† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700

§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .... 315-437-4529; 800-448-1666

† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700

† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900

RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460

Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929

RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400

§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760

Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196

TRAK Microwave, 735 Palomar Ave., Sunnyvale, CA 94086 408-735-9660

Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100

† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085

† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, Crystal (Incl. Monolithic Devices)-2300

† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1327,1588

† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1354

† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... 1A•1359

† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 .... 1A•1361

Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .... 1A•1599

† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1363

† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1377-1379

† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383

§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394

† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•1398

† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 .... 1A•1308,1404,1405,1407

† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1415

Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 .... 1A•1422-1425

† Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074

† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595

Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .... 714-991-1580; 800-854-XTAL

† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801

CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511

† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411

§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874

† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750

Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351

† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424

† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944

† KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435

† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531

† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510

† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100

† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151

§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233

RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400

† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 .... 305-563-1333; 800-327-1282

Sentry Mfg., Crystal Park, Chickasha, OK 73018 .... 405-224-6780;800-654-8850

Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan .... (03) 775-2111

Filters, Digital-2700

Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1500

Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 .... 1A•1624,3•1237

Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 .... 1A•1631

† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700

† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348

Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000

† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911

Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700

† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424

Mathematical Systems Design, Inc., 2850 Ocean Park Blvd., Ste. 300, Santa Monica, CA 90405 213-450-9851

McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411

§ Panelgraphic Corp., 10 Henderson Dr., W. Caldwell, NJ 07006 201-227-1500

Precision Filters, 240 Cherry St., Ithaca, NY 14850 607-277-3550

RCI/Data, 1992 Lakewood Rd., Toms River, NJ 08753 201-341-8361

RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400

Signatron, 12 Hartwell Ave., Lexington, MA 02173 617-861-1500

Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893

† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401

† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261

Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Filters, Display-2450 — *See Vol. 1B*

Filters, EMI/RFI-2700

Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... 1A•2127,2128

AMP Incorporated, Box 3608, Harrisburg, PA 17105, 717-564-0100 .... 1A•1584

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 .... 1A•1229

§ Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 .... 1A•1587

§ Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048, 312-680-7400 .1A•1589

§ Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545, 415-785-5231;415-785-5235 .... 1A•1590,1591

Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1484,1500

† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530, 516-294-5445 .... 1A•1595

Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 .... 1A•1596,1597

§† JMK, Inc., 15 Caldwell Dr., Amherst, NH 03060, 603-886-4100 .... 1A•1600

† Metuchen Capacitors, Inc., 420 Park Ave., Perth Amboy, NJ 08861, 201-442-0500 .... 1A•1144,1602,1603

§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1576,1604,1605

NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 3•1663

† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 3•1663

Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406, 707-523-0600 .... 1A•1606-1610

Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 .... 1A•2215,2220

Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•1274,1275

Potter Co., P.O. Box 337, North Hwy. 51, Wesson, MS 39191, 601-643-2215 .... 1A•1612

Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ...1A•1278

† **RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706, 516-231-6400 ...... 1A•1618**
RTE Aerovox Inc., P.O. Box B-970, 740 Belleville Ave., New Bedford, MA 02741, 617-994-9661 ...... 1A•1619-1621
§† **Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505, 814-455-0966 .. 1A•1625-1627**
Standex Elctrns., 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ...... 1A•1628,1629
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ...... 1A•1281,1630
† **U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ...... 1A•1211**
§ Amtek Sys., Inc., 1400 S. Sherman, 02, Richardson, TX 75081 214-238-5300
† Ark Elctrns. Corp., 1325 Industrial Hwy., Southampton, PA 18966 .. 215-322-6510
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Brady Co., 574A Somerset St., N. Plainfield, NJ 07060 201-753-7988
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
† Circle Electronics, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407 305-844-1310
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Curtis Inds., 8000 West Tower Ave., Milwaukee, WI 53223 414-354-1500
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ...... 213-EX7-9668
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ...... 617-655-1532; 800-225-4876
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
Ericson Mfg. Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
† Evaporated Coatings, 798 Welsh Rd., Huntingdon Valley, PA 19006 215-947-1465
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
§ Fan-S Corp., 7158 Industrial Pk. Blvd., Mentor, OH 44060 216-951-3300
† F-Dyne Elctrns., 449 Howard Ave., Bridgeport, CT 06605 203-367-6431
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148 Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
§† Inductive Prods. Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Inter-Technical Grp., Box 23, Irvington, NY 10533 914-591-8822
ITT Cannon, 10550 Talbert Avenue, P.O. Box 8040, Fountain Valley, CA 92708 714-964-7400
Kalgio Elctrns. Co., Inc., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017 215-837-0700
Keene Ray Proof, Keene Corp., 50 Keeler Ave., Norwalk, CT 06878 203-838-4555
Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ...... 201-291-0500; 800-631-2165
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Lambda Electronics, 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
§ LEA, Inc., A Dynatech Co., 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990 818-944-0916
Lindgren RF Enclosures, Inc., 1228 Capitol Drive, Addison, IL 60101 312-628-9100
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Metavac, Inc., 45-68 162nd St., Flushing, NY 11358 ...... 212-HI5-0400
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Optical & Conductive Coatings, Meridian Inds., Inc., 428 N. Buchanan Cir., , Pacheco, CA 94553 415-798-6066
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27408 919-379-9773
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Research Prods., 1015 E Washington Ave., Madison, WI 53701 608-257-8801
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Schaffner EMC Inc., Component Div., 825 Lehigh Ave., Union, NJ 07083 201-851-0644
SGL Homalite, Div. of SGL Inds., 11 Brookside Dr., Wilmington, DE 19804 302-652-3686
SGL Waber, 300 Harvard Ave., Westville, NJ 08093 . 609-456-5400;800-257-8384
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
† Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 213-845-2458
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
§ Sun-Flex Co., Inc., 20 Pimentel Ct., Novato, CA 94947 415-883-1221
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan ...... Tokyo 03-402-6161
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 . 212-255-3500
TWP, Inc., 2133 4th St., Berkeley, CA 94710 415-548-4434
Universal Electronics Inc., 3475 A. Victor St., Santa Clara, CA 95050 408-970-0455
Viclan, 7373A Engineers Rd., San Diego, CA 92138 619-292-1411
§ Vidaire Elctrns., 150 Buffalo Ave., Freeport, NY 11520 516-623-6696
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Filters, Equalizer-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ...... 1A•1580
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ...... 1A•1593
† **Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 ...... 1A•1361**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ...... 1A•1601**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ...... 3•1016,1018, 1019
† **Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ...... 1A•1415**
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
§ Cermetek Microelectronics Inc., 1308 Borregas Ave., Sunnyvale, CA 94089 408-734-8150
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 ... 714-540-7640
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
Television Equip. Assocs., Box 393, So. Salem, NY 10590-0393 914-763-8893
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Filters, Harmonic-2700

Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ...... 1A•1615
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§ Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910 813-482-7212
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500

† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ....315-437-4529; 800-448-1666
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Telco Products Co., 44 Sea Cliff, Glen Cove, NY 11542 516-759-0300
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 212-255-3500
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Uniform Tubes, Collegeville, PA 19426 215-539-0700
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

Filters, High Pass-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ....1A•1578,1580,1583
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ....1A•1585
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ....1A•1586
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ....1A•1347**
† **Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ....1A•1592**
† **Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ....1A•1593**
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ....1A•1594**
§† **Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ....1A•1354**
† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2167**
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ....1A•1624,3•1237
† **Hertz Filter, 3 Aerial Way, Syosset, NY 11791, 516-822-4770 ....1A•1598**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ....1A•1601**
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 .... 3•1255
† **North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .... 3•1393**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•1398**
† **Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ....1A•1611**
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .. 1A•1613-1615, 3•1016,1286
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ....1A•1415
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•1642**
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 ....1A•1636, 1637,1639,1640
† **U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ....1A•1211**
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 .... 3•1317
† **Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ....1A•1784**
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000
† Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ....213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Drake, R. L., Co., 540 Richard St., Miamisburg, OH 45342 513-866-2421
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ....617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gra-Mar Inc., 8165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Kappa Networks, 165 Roosevelt Ave., Garteret, NJ 07008 201-541-1600
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ....703-971-8606; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ....315-437-4529; 800-448-1666
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100

Optics International, Box 101, Tenafly, NJ 07670 201-567-4799
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ....405-224-6780;800-654-8850
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ....(03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
§ Tucker Elctrns., Box 461060, Garland, TX 75046 ....214-348-8800;800-527-4642
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Filters, Hybrid-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ....1A•1585
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1327,1588
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 ....1A•1361
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Filters, IF-2700

† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1327,1588**
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ....1A•1347**
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ....1A•1593
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ....1A•1594**
Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ....1A•1354
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ....1A•1601**
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ....1A•1378**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1394**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•1398**
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ....1A•1308,1405
† **Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ....1A•1420,1622,1623**
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 ....1A•1632,1633,1635-1637
† Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ....405-224-6780;800-654-8850
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan 03-436-2180
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Filters, LC-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ....1A•1448,1578-1583
† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1327,1588**
† **Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ....1A•1593**
† **ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ....1A•1594**
† **Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 ....1A•1361**
† **Hertz Filter, 3 Aerial Way, Syosset, NY 11791, 516-822-4770 ....1A•1598**
† **KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ....1A•1601**
† **Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ....1A•1383**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•1398**
† **Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ....1A•1611**
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 ....1A•1424
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ....1A•1631
† **U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ....1A•1211**
† **Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ....1A•1784**
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 ...213-537-5200
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 ...914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 ...201-797-9655
† Cirtech, 15237 Cherry St., Stanley, KS 66223 ...913-681-2801
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 ...714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 ...602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 ...617-449-0800
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 ...209-292-1111
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 ...201-772-1106
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 ...516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 ...219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 ...818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ...201-942-2222
† Elmag, 54 Clark St., Newark, NJ 07104 ...201-481-1600
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 ...805-544-3800
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 ...714-557-7800
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ...213-537-4750
§ Hartley Prods., 620 Island Rd., Ramsey, NJ 07446 ...201-327-4443
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 ...913-782-0012
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 ...213-361-8691
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 ...312-577-0120
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 ...619-457-0277
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ...213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ...301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ...602-272-7944
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 ...201-541-1600
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 ...714-493-9501
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 ...303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ...516-654-1166
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 ...617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ...703-971-8606; 703-971-7082
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ...619-433-4510
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan ...075-921-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 ...312-564-5100
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ...215-643-6950
† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27408 ...919-379-9773
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 ...301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 ...516-231-6400
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 ...312-679-7180
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ...213-32-Sigma
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 ...814-455-0966
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 ...413-664-4411
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 ...408-980-1600
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 ...714-494-9401
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 ...215-672-7800
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan ...Tokyo 03-402-6161
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 ...213-478-8224
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 ...414-482-4100
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 ...213-323-4100
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 ...415-968-9176

Filters, Line — See Filters, EMI/RFI (Vol. 1A)

Filters, Linear Phase-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ...1A•1582
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ...1A•1594
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 ...1A•1361
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ...1A•1601
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ...1A•1383
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ...1A•1398
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ...1A•1611
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ...1A•1308,1404
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ...1A•1613,1615, 3•1016,1286
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 ...1A•1635-1637
† Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 ...619-438-2074
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 ...615-244-9024
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ...717-697-8595
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 ...203-242-0761
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 ...212-737-1348
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 ...607-563-8444
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 ...212-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 ...914-664-5591
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 ...201-797-9655
† Cirtech, 15237 Cherry St., Stanley, KS 66223 ...913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 ...213-936-6188
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 ...516-546-9700
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 ...602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 ...617-449-0800
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 ...203-743-9241
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 ...201-772-1106
Datel, 11 Cabot Blvd., Mansfield, MA 02048 ...617-339-9341
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 ...213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ...816-331-4911
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 ...818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 ...516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 ...219-232-2743
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ...914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ...201-942-2222
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 ...617-374-0761
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 ...516-794-4500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ...213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 ...516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 ...913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 ...714-759-2411
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 ...619-457-0277
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 ...607-272-7640
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ...301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ...602-272-7944
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 ...201-541-1600
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 ...617-580-1660
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 ...714-493-9501
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada ...416-447-8531
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 ...201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ...516-654-1166
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 ...717-486-3411
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 ...617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ...703-971-8606; 703-971-7082
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ...203-866-8000
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ...617-655-0060
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 ...312-564-5100
† North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 ...516-671-5700
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ...215-643-6950
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 ...301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 ...516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 ...714-540-7640
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860 ...305-886-8860
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 ..608-987-3363
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 ...408-980-1600
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 ...714-494-9401
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 ...312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 ...914-664-2050
Uniform Tubes, Collegeville, PA 19426 ...215-539-0700
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 ...201-922-1009
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 ...818-882-3010
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 ...317-787-3332
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 ...201-767-7900

Filters, Low Pass-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ...1A•1578,1580, 1582,1583
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ...1A•1585
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ...1A•1586
§ Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ...1A•1587
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ...1A•1327,1588
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ...1A•1651
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ...1A•1347

† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 .... 1A•1592
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 .... 1A•1593
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .... 1A•1594
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2167
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 .... 1A•1624,3•1237
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 .... 1A•1361
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791, 516-822-4770 .... 1A•1598
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 .... 1A•1601
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 .... 3•1255
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•1398
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 .... 1A•1611
Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .. 1A•1613-1615, 3•1016,1286
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1415
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 .... 1A•1777
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•1642
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 .... 1A•1635, 1636,1639,1640
† U S Microtek Components Corporation, 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 .... 1A•1211
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 .... 3•1317
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 .... 1A•1784
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Aeroflex Labs., Microelctrns. Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
AMP Incorporated, Box 3608, Harrisburg, PA 17105 717-564-0100
§ Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 .... 617-777-4500; 17-246-0300;800-451-1816
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
† Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Captor Corp., 5040 S. County Rd. (25A), Tipp City, OH 45371 513-667-8484
Centre Engrg., 2820 E. College Ave., State College, PA 16801 814-237-0321
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 607-724-2484
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 .... 207-655-4555;800-341-9678
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Drake, R. L., Co., 540 Richard St., Miamisburg, OH 45342 513-866-2421
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 505-865-6700
§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 .... 617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elmag, 54 Clark St., Newark, NJ 07104 201-481-1600
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Engelmann Microwave Co.; KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .... 201-245-3200;800-526-4048
† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 516-294-5445
Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 312-577-0120
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Marel Instr. Co., 907 South East 13th Pl., Cape Coral, FL 33904 813-574-8788
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 .... 703-971-8606; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .... 315-437-4529; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Optics International, Box 101, Tenafly, NJ 07670 201-567-4799
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805 714-776-6400
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Sentry Mfg., Crystal Park, Chickasha, OK 73018 .... 405-224-6780;800-654-8850
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan .... (03) 775-2111
§ Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403 801-392-7531
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan .... Tokyo 03-402-6161
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
§ Tucker Elctrns., Box 461060, Garland, TX 75046 .... 214-348-8800;800-527-4642
Uniform Tubes, Collegeville, PA 19426 215-539-0700

† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

Filters, Mechanical-2700

Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ......1A•1631
A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ AMF Inc., AMF Cuno/General Filter Products Division, 400 Research Pkwy., Meriden, CT 06450 203-237-5541
† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 516-294-5445
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Pall Trinity Micro, Rte. 281, Cortland, NY 13045 607-753-6041
† Penfield, Inc., West & W. Main Sts., Plantsville, CT 06479 203-621-9141
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-540-7640
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505 213-530-8777
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan ......Tokyo 03-402-6161
TWP, Inc., 2133 4th St., Berkeley, CA 94710 415-548-4434
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

Filters, Microwave-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ......1A•1689
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ......1A•1327,1588
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ......1A•1594
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ......1A•1378
Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ......1A•1611
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ......1A•1404
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 ......1A•1777
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ......1A•1783
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ......1A•1784
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-563-6000
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
† Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ......Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Integra, Inc., 2368 Walsh Ave., Santa Clara, CA 95051 408-727-9601
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ......213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ......703-971-8606; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ......315-437-4529; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
TRAK Microwave, 735 Palomar Ave., Sunnyvale, CA 94086 408-735-9660
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
Uniform Tubes, Collegeville, PA 19426 215-539-0700
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Filters, Miniature, Subminiature, Microminiature — Also see specific types of filters-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ......1A•1580,1583
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ......1A•1585
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011, 201-772-1106 ......1A•1592
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ......1A•1594
Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ......1A•1354
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. 05, Richardson, TX 75081, 214-235-8332 ......1A•1397
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ......1A•1611
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ......213-889-4030;805-497-4421
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Lenox Laser, 615 Pittsfield Rd., Lenox, MA 01240 413-499-4477
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ......703-971-8606; 703-971-7082
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-540-7640
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Filters, Notch — See Filters, Band Elimination (Vol. 1A)

Filters, Optical-2700

§ Alan Gordon Entprs., Inc., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91605 818-985-5500
Angenieux Inc., 120 Derry Rd., Hudson, NH 02051 603-889-2116
† Applied Instrs., Inc., 25 Will Place, Brooklyn, NY 11207 212-257-0885
† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Burleigh Instrs., Burleigh Pk., Fishers, NY 14453 716-924-9355
† Dontech Inc., 601-606 Airport Indl. Blvd., Doylestown, PA 18901 215-348-5010
Ealing Optics Co., Ealing Corp., 22 Pleasant St., S. Natick, MA 01760 617-655-7000
† Evaporated Coatings, 798 Welsh Rd., Huntingdon Valley, PA 19006 215-947-1465
† Hoffman Engrg. Corp., 183 Sound Beach Ave., Old Greenwich, CT 06870 203-637-1719
Infrared Inds., Inc., P.O. Box 14200, Orlando, FL 32857 305-282-7700
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† JMJ Technical Prods., P.O. Box 26, Kendall Park, NJ 08824 201-589-4257
† Lenox Laser, 615 Pittsfield Rd., Lenox, MA 01240 413-499-4477
3M Co., Carbonless/Related Prods Div Ind'l Optics, 3M Center, Bldg. 225-3S, St. Paul, MN. 55144 612-733-4403
† Melles Griot, 1770 Kettering St., Irvine, CA 92714 714-556-8200
† Optical & Conductive Coatings, Meridian Inds., Inc., 428 N. Buchanan Cir., Pacheco, CA 94553 415-798-6066
Optics for Research, Inc., P.O. Box 82, Caldwell, NJ 07006 201-228-4480
Panelgraphic Corp., 10 Henderson Dr., W. Caldwell, NJ 07006 201-227-1500
† Plumer Precision Optics, 601 Montgomery Ave., Pennsburg, PA 18073 215-679-6272
† Pomfret Research Optics, 817 Long Ridge Rd., Stamford, CT 06902 203-322-6386
Schott Optical Glass Inc., York Ave., Duryea, PA 18642 717-457-7485

SGL Homalite, Div. of SGL Inds., 11 Brookside Dr., Wilmington, DE 19804 ... 302-652-3686
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 ... 608-935-2707
§ Sun-Flex Co., Inc., 20 Pimentel Ct., Novato, CA 94947 ... 415-883-1221

Filters, Programmable — See Filters, Variable (Vol. 1A)

Filters, RF-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... 1A•1580,1583
Applied Research Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ... 1A•1686
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ... 1A•1228
Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ... 1A•1587
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ... 1A•1327,1588
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ... 1A•1347
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ... 1A•1594
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ... 1A•1359
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791, 516-822-4770 ... 1A•1598
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ... 1A•1599
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ... 1A•1601
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ... 1A•1378,1379
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ... 1A•1394,1395
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ... 1A•1398
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ... 1A•1611
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ... 1A•1308,1405
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ... 1A•1420,1622, 1623
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 ... 1A•1777
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ... 1A•1631
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ... 1A•1783
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 ... 1A•1632, 1633,1635-1637
† Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ... 1A•1784
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 ... 619-438-2074
Air-Maze Div., 25000 Miles Rd., Cleveland, OH 44128 ... 216-292-6800
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 ... 717-697-8595
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 ... 215-822-1311
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 ... 203-242-0761
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 ... 212-737-1348
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 ... 516-231-8400
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 212-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 ... 914-664-5591
† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 ... 216-248-1200
† Brady Co., 574A Somerset St., N. Plainfield, NJ 07060 ... 201-753-7988
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 ... 516-746-2310
Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 ... 201-797-9655
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 ... 617-935-4850
† Cirtech, 15237 Cherry St., Stanley, KS 66223 ... 913-681-2801
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 ... 216-267-2233
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 ... 914-337-4775
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 ... 214-381-7161
§ Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048 ... 312-680-7400
Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 ... 201-256-2000
CTS Corp., 905 North West Blvd., Elkart, IN 46514 ... 219-293-7511
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 ... 815-786-8411
† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 ... 714-770-1522
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 ... 602-967-7874
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 ... 201-772-1106
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
Displex, Inc., Alexander Place, Glen Cove, NY 11542 ... 516-671-4400
§ Dyma Engrg., Box 1535, Los Lunas, NM 87031 ... 505-865-6700
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 ... 516-595-3094
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 ... 818-882-6333
§ Electro-Metrics, 100 Church St., Amsterdam, NY 12010 ... 518-843-2600
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-664-2333
† Elmag, 54 Clark St., Newark, NJ 07104 ... 201-481-1600
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-5700
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 ... 714-557-7800
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 ... 408-263-1216
§† Fil-Coil Economy Intl., Inc., 800 Axinn Ave., Garden City, NY 11530 ... 516-294-5445
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148 Sweet Hollow Rd., Old Bethpage, NY 11804 ... 516-752-1144
§ Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910 ... 813-482-7212
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 ... 617-374-0761
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 ... 212-424-7500
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 ... 815-968-9661
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ... 213-537-4750
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 ... 213-533-1228
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 ... 305-894-3351
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 ... 213-361-8691
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ... 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 ... 714-759-2411
Industrial Midwec Capacitors, 4902 Tollview Dr., Rolling Meadows, IL 60008 ... 312-577-0120
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 ... 619-457-0277
ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 ... 607-272-7640
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ... 213-889-4030;805-497-4421
Kalglo Elctrns. Co., Inc., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017 ... 215-837-0700
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 ... 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 ... 602-272-7944
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 ... 201-541-1600
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 ... 617-580-1660
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 ... 619-454-1800
Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 ... 714-493-9501
§† Lectro Magnetics, Inc., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 ... 213-870-9383;800-325-9814
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 ... 201-569-8282
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ... 516-654-1166
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 ... 714-987-4715
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ... 703-971-8606; 703-971-7082
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ... 617-491-5400
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 ... 619-433-4510
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 ... 312-564-5100
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 ... 516-671-5700
Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 ... 213-463-5120
Pathcom, Inc., Pace Two-Way Radio Prods., 24105 S. Frampton Ave., Harbor City, CA 90710 ... 213-325-1290
Peca, Inc., 4957 Pearson Ave., Philadelphia, PA 19114 ... 215-824-1550
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ... 914-699-5514;800-431-1064
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 ... 717-249-2151
Potter Co., P.O. Box 337, North Hwy. 51, Wesson, MS 39191 ... 601-643-2215
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 ... 914-939-8900
RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 ... 408-737-2460
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 ... 301-279-5535
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 ... 717-243-5929
Resdel Engrg., 300 E. Live Oak Ave., Arcadia, CA 91006 ... 213-684-2600
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 ... 516-231-6400
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 ... 214-996-5000
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 ... 312-679-7180
§ Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 ... 914-698-5600
Sentry Mfg., Crystal Park, Chickasha, OK 73018 ... 405-224-6780;800-654-8850
† SFE Technologies, 1501 1st St., San Fernando, CA 91341 ... 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 ... 608-987-3363
§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ... (03) 775-2111
§† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 ... 814-455-0966
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 ... 413-664-4411
§† Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 ... 413-664-4481
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 ... 408-980-1600
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 ... 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 ... 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 ... 317-545-4196
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan ... 03-436-2180
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 ... 213-822-0800
§ Tucker Elctrns., Box 461060, Garland, TX 75046 ... 214-348-8800;800-527-4642
Uniform Tubes, Collegeville, PA 19426 ... 215-539-0700
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 ... 213-323-4100

Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600
Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Filters, Single Sideband-2700

† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1327,1588
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... 1A•1359
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377, 212-424-7500 .... 1A•1361
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1415
Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282 602-967-7874
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 .... 213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Netcom, 3002 Commercial Ave., Northbrook, IL 60062 312-564-5100
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-540-7640
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 .... 305-563-1333; 800-327-1282
Sentry Mfg., Crystal Park, Chickasha, OK 73018 .... 405-224-6780;800-654-8850
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224

Filters, Synchronous Tracking-2700

Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 .... 1A•1615,3•1016 1017,1020
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021
§ Endevco, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675 714-493-8181
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hobart Engrg., 4143 Cheshire Dr., Cypress, CA 90630 714-827-2135
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322 617-580-1660
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Scientific-Atlanta, Inc., New Jersey Div., Randolph Park W., Rte 10, Randolph Township, NJ 07801 201-361-3100
† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
TRAK Microwave, 735 Palomar Ave., Sunnyvale, CA 94086 408-735-9660
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Unholtz-Dickie Corp., 6 Brookside Dr., Wallingford, CT 06492 203-265-3929
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085

Filters, Telemetering-1900 — *See Vol. 3*

Filters, Tone, Telegraph-2700

Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 .... 1A•1593
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348
† Aptek Microsystems, Inc., Hillsboro Plaza, 700 N.W. 12th Ave., Deerfield Beach, FL 33441 305-421-8450
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Data Signal Corp., 149 California St., Newton, MA 02158 617-926-5080
§ De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148 Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Rockwell Filter Prods., 2990 Airway Ave., Costa Mesa, CA 92626 714-540-7640
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Solar Elctrns. Co., 901 N. Highland, Hollywood, CA 90038 213-462-0806
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 212-255-3500
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224

Filters, Tunable — See Filters, Continuously Variable (Vol. 1A)

Filters, Tuning Fork-2300

† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111

Filters, UHF & VHF-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 .... 1A•1578,1580, 1581
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1327,1588
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347
ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 .... 1A•1594
§ Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1354
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... 1A•1359
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1378
OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•1398
† Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 .... 1A•1611
Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 .... 1A•1308,1404,1407
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565, 608-987-3363 .... 1A•1422,1424,1425
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 .... 1A•1783
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064, 213-478-8224 .... 1A•1632, 1633,1635-1637

Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ....1A•1784

Advanced Filter Devices Inc., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008 619-438-2074

† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024

† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595

† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028 212-737-1348

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400

Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900

† Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200

Chesterfield Prods., 37 Midland Ave., Elmwood Park, NJ 07407 201-797-9655

† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801

Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233

† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522

Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106

† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ....207-655-4555;800-341-9678

† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094

† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333

† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500

§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661

† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770

Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012

† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411

† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277

Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421

† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424

Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600

† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900

§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800

Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501

† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282

Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715

† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350

† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700

Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000

Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060

§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ....315-437-4529; 800-448-1666

Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777

North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700

Oxley Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5120

† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900

† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535

† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929

† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400

RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334

† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860 305-886-8860

† Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600

Sentry Mfg., Crystal Park, Chickasha, OK 73018 ....405-224-6780;800-654-8850

§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244

§ Soshin Elec. Co., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan ....(03) 775-2111

§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760

† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211

† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401

Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196

Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan 03-436-2180

† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800

Uniform Tubes, Collegeville, PA 19426 215-539-0700

† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Vitek Elctrns., 4 Gladys Ct., Edison, NJ 08817 201-287-3200

† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Filters, Variable-2700

A. P. Circuit Corp., 513 East 86th St., P.O. Box 1350, New York, NY 10028, 212-737-1348 ....1A•1585

Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 ....1A•1624,3•1237

Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ....3•1255

Precision Filters, 240 Cherry St., Ithaca, NY 14850, 607-277-3550 ....1A•1613-1615, 3•1016,1286

† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, 714-494-9401 ....1A•1777

Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 ....3•1317

† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761

† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900

† Balzers Optical Grp., 170 Locke Dr., Marlboro, MA 01752 617-481-9860

Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611

† Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111

Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233

Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775

Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700

Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850

† Daden Assocs., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653 714-770-1522

† Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222

§ Dynamics, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311 818-998-8281

† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094

§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300

† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021

† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216

Fogg Sys., 15592 E. Batavia Dr., Aurora, CO 80011 303-344-1883

Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691

Integra, Inc., 2368 Walsh Ave., Santa Clara, CA 95051 408-727-9601

ITHACO, Inc., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437 607-272-7640

† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424

Lark Engineering Co., 26401 Calle Rolando, San Juan Capistrano, CA 92675 714-493-9501

† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282

Marel Instr. Co., 907 South East 13th Pl., Cape Coral, FL 33904 813-574-8788

Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715

McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 717-486-3411

† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508

† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700

§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060

† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ....315-437-4529; 800-448-1666

Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

§ Optics International, Box 101, Tenafly, NJ 07670 201-567-4799

† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900

RACOM Corp., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086 408-737-2460

RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400

Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477

§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760

Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800

§ Tucker Elctrns., Box 461060, Garland, TX 75046 ....214-348-8800;800-527-4642

† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Voltex, 3460 Great Neck Rd., Amityville, NY 11701 516-842-2772

† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107 317-787-3332

† Wavetek Rockland Scientific, Inc., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647 201-767-7900

† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Filters, Vestigial Sideband-2700

† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1327,1588

Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ....1A•1611

† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900

† Cirtech, 15237 Cherry St., Stanley, KS 66223 913-681-2801

† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400

† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500

† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012

Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515

Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800

† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424

† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900

Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060

† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950

RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400

† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860 305-886-8860

TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224

Filters, Video-2700

Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077, 312-677-3640 ....1A•1631

† Filtron Co., Inc., Div. of Aeroflex Labs., Inc., 148 Sweet Hollow Rd., Old Bethpage, NY 11804 516-752-1144

† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501

Filters, Waveguide-3450

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400

† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094

† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Metropole Products Inc., P.O. Box 10275, Alexandria, VA 22310 ...703-971-8606; 703-971-7082
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .....315-437-4529; 800-448-1666
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
† Wavecom, 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Filters (MIL), Electrical & Networks-2440 — *See Vol. 1B*

Flanges, Waveguide-3450

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Flanges (MIL), Waveguide-2440 — *See Vol. 1B*

Flare Sets (MIL), ECM-3475 — *See Vol. 3*

Flashers-2200 — *See Vol. 3*

Flashers (MIL)-2440 — *See Vol. 1B*

Flashlights & Lanterns-4000 — *See Vol. 3*

Flat Packages, Integrated Circuit — See Packages, Integrated Circuit (Vol. 1A)

Fluid Flow Indicators — See Meters, Fluid Flow (Vol. 3)

Flux, Brazing & Soldering Materials-4600 — *See Vol. 2*

Foil, Magnetic-2500 — *See Vol. 2*

Foil, Magnetic Shielding — See Shields, Magnetic (Vol. 2)

Forks, Tuning — See Tuning Forks (Vol. 1A)

Forms, Coil — See Coil Assemblies & Forms (Vol. 1A)

Frames, Cabinet & Rack-1400 — *See Vol. 2*

Freeze Spray — See Refrigerants, Spray (Vol. 2), Coolants, Circuit & Component (Vol. 2),

Freezer Cabinets — See Refrigerators, Environmental Test (Vol. 3)

Frequency Analyzers — See Analyzers, Spectrum (Vol. 3)

Frequency Extenders — See Dividers, Frequency (Vol. 1A)

Frequency Sources — See Oscillators (Vol. 1A)

Frequency Standards — See Standards, Frequency (Vol. 3)

Furnaces, Electric-4100 — *See Vol. 3*

Furnaces, Gas (Production)-4100 — *See Vol. 3*

Furnaces, Vacuum-4100 — *See Vol. 3*

Furniture, Electronic Lab. — See Benches, Consoles, Stools, Tables (Lab & Shop) (Vol. 2)

Fuse Clips — See Clips & Holders, Fuse (Vol. 1B)

Fuse Elements-4300 — *See Vol. 1B*

Fuses-4300 — *See Vol. 1B*

Fuses, Failure Indicating-4300 — *See Vol. 1B*

Fuses, Fuseholders, Boxes & Panels (MIL)-2440 — *See Vol. 1B*

Fuses, Thermal-4300 — *See Vol. 1B*

Gauges, Displacement, Linear-5400 — *See Vol. 2*

Gauges, Humidity-2900 — *See Vol. 3*

Gauges, Ionization-2900 — *See Vol. 3*

Gauges, Pressure-2900 (Also See Transducers, Pressure) — ***See Vol. 3***

Gauges, Strain-5500 — *See Vol. 1B*

Gauges, Temperature-2900 — *See Vol. 3*

Galvanometers — See Meters, Galvanometer (Vol. 3)

Gaskets — See Seals (Vol. 2)

Gaskets, Shielding, RF-4525 (Also See Shields, RF) — ***See Vol. 2***

Gates, Computer Circuit (AND, OR, NOR, etc.) — See Cards, Logic (Vol. 3)

Gearheads & Speed Reducers-3500 — *See Vol. 1B*

Gears & Gear Mechanisms (Precision)-2500 — *See Vol. 2*

Generator Groups (MIL), Signal-3475 — *See Vol. 3*

Generators, AM-2900 — *See Vol. 3*

Generators, AM/FM-2900 — *See Vol. 3*

Generators, Arbitrary Waveform-2900 — *See Vol. 3*

Generators, Audio-2900 — *See Vol. 3*

Generators, Bar, Dot & Crosshatch-2900 — *See Vol. 3*

Generators, Baud Rate-1900 — *See Vol. 3*

Generators, Character-2325 — *See Vol. 3*

Generators, Color Bar-2900 — *See Vol. 3*

Generators, Digital Delay — See Generators, Timing, Digital (Vol. 3)

Generators, Electrical Power-4000 — *See Vol. 3*

Generators, Electrostatic Discharge — Also See Electrostatic Discharge Guns-2900 — *See Vol. 3*

Generators, FM-2900 — *See Vol. 3*

Generators, FM/Stereo-2900 — *See Vol. 3*

Generators, Function-2900 — *See Vol. 3*

Generators, Gating/Timing-2900 — *See Vol. 3*

Generators, Hall-5500 — *See Vol. 1B*

Generators, Harmonic-2900 — *See Vol. 3*

Generators, Infrared — See Lamps, Infrared (Vol. 1B)

Generators, Low Frequency-2900 — *See Vol. 3*

Generators, Light Pulse-2900 — *See Vol. 3*

Generators, Marker-2900 — *See Vol. 3*

Generators, Microwave-3400 — *See Vol. 3*

Generators, Noise, Random (Electrical)-2900 — *See Vol. 3*

Generators, Phase-2900 — *See Vol. 3*

Generators, Programmable, Function-2900 — *See Vol. 3*

Generators, Programmable, Pulse-2900 — *See Vol. 3*

Generators, Programmable, Synthesizers-2900 — *See Vol. 3*

Generators, Pulse-2900 — *See Vol. 3*

Generators, Pulse, Nuclear Instrumentation Module (NIM)-2900 — *See Vol. 3*

Generators, RF-2900 — *See Vol. 3*

Generators, Sawtooth, Sine — See Generators, Function (Vol. 3)

Generators, Signal-2900 (Also See Generators, Specific Type) — ***See Vol. 3***

Generators, Sine/Cosine Function (Module)-3130

Ballantine Labs., 90 Fanny Rd., Boonton, NJ 07005 201-335-0900
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
Hameg, Inc., 88-90 Harbor Rd., Port Washington, NY 11050 516-883-3837
§† Harris Circuits Mfg., 2706 Colley Ave., Norfolk, VA. 23517 804-467-1116
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072 617-344-7383
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611
§ VIZ Test Equipment, Div. VIZ Mfg., 335 E. Price St., Philadelphia, PA 19144 215-844-2626
Wavetek San Diego, Div. of Wavetek, 9045 Balboa Ave., P.O. Box 85265, San Diego, CA 92123 619-279-2200

Generators, Spectrum — See Generators, Sweep (Vol. 3)

Generators, Square Wave — See Generators, Function (Vol. 3)

Generators, Sweep-2900 — *See Vol. 3*

Generators, Time Code-2000 — *See Vol. 3*

Generators, Timing, Digital-2000 — *See Vol. 3*

Generators, Tone-2900 — *See Vol. 3*

Generators, Tone Burst-2900 — *See Vol. 3*

Generators, UHF/VHF-2900 — *See Vol. 3*

Generators, Ultrasonic-2900 — *See Vol. 3*

Generators, White Noise-2900 — *See Vol. 3*

Generators, Word-2900 — *See Vol. 3*

Generators (MIL), Deception-3475 — *See Vol. 3*

Geophysical Equip. — See Transducers (Vol. 1B)

Germanium — See Crystals, Semiconductor (Vol. 1A)

Glues — See Adhesives (Vol. 2)

Glass Parts-2500 — *See Vol. 2*

Graphic Recording Instruments — See Recorders (Vol. 3)

Graphic Recording Paper & Supplies-3000 — *See Vol. 3*

Graphite Parts-2500 — *See Vol. 2*

Grilles & Accessories, Speaker-1300 — *See Vol. 3*

Grilles, Metal, Plastic-1400 — *See Vol. 2*

Grommets & Bushings-2800 — *See Vol. 2*

Ground Fault Detectors & Accessories — See Detectors, Ground Fault (Vol. 3)

Guides, Circuit Board-1400 — *See Vol. 2*

Gyros (All Types)-2200 — *See Vol. 3*

Hall Effect Devices — See Generators, Hall (Vol. 1B), Magnetoresistors, Hall (Vol. 1A), Multipliers, Hall (Vol. 1A), Probes, Hall (Vol. 1A), Switches, Hall Effect (Vol. 1B),

Handlers, Integrated Circuit (Automatic)-4100 — *See Vol. 3*

Handles For Cabinets, Circuit Boards, Racks, etc.-1400 — *See Vol. 2*

Handsets, Chestsets, Headsets, etc.-1300 — *See Vol. 3*

Hardware — See Fasteners (Vol. 2), Clamps (Vol. 2), Terminals (Vol. 2), etc.

Hardware (MIL), Connector-2440 — *See Vol. 1B*

Harnesses, Wire — See Cable Assemblies & Harnesses (Vol. 2)

Headers, Connector — See Connectors, Cable (Vol. 2), Connectors, Flat Cable (Vol. 2), etc.

Headers, Hermetic — See Seals, Hermetic (Vol. 2), Services, Hermetic Sealing (Vol. 3),

Headers, Relay & Transformer-2500 — *See Vol. 2*

Headers, Shrouded-2500 — *See Vol. 2*

Headers, Transistor & Diode-2500 — *See Vol. 2*

Headphones-1300 — *See Vol. 3*

Heads, Magnetic Recording-1300 — *See Vol. 3*

Heads, Reflective-3700 — *See Vol. 1B*

Headsets (MIL)-2440 — *See Vol. 1B*

Heat Dissipators — See Heat Sinks, Semiconductor (Vol. 2), Heat Sinks, Soldering (Vol. 2),

Heaters, Immersion-4100 — *See Vol. 3*

Heaters & Heating Elements (For Components & Equipment)-5300 (Also See Ovens) — ***See Vol. 1B***

Heat Exchangers & Systems-2600 — *See Vol. 2*

Heat Guns, Production-5400 — *See Vol. 2*

Heating Elements, Infrared-5300 — *See Vol. 1B*

Heat Pumps — See Cooling/Heating Modules, Thermoelectric (Vol. 1B)

Heat Shrinkable Elastomers, Plastics — See Caps, Forms & Tapes, Heat Shrinkable (Vol. 2), Tubing, Heat Shrinkable (Vol. 2),

Heat Sinks, Semiconductor-2600 — *See Vol. 2*

Heat Sinks, Soldering-4600 — *See Vol. 2*

Heat Sinks (MIL)-2440 — *See Vol. 1B*

Hermetic Sealing — See Machines, Hermetic Sealing (Vol. 3), Seals, Hermetic (Vol. 2), Services, Hermetic Sealing (Vol. 3),

High Vacuum Services — See Services, High Vacuum (Vol. 3)

Hinges-2825 — *See Vol. 2*

Holders, Battery — See Retainers, Battery (Vol. 2), Connectors, Battery (Vol. 2),

Holders, Brush — See Brushes & Brush Assemblies (Vol. 1B)

Holders, Circuit Board (Production Type)-4100 — *See Vol. 3*

Holders, Crystal-2300

§ Atlee Inc., One Gill St., Woburn, MA 01801, 617-933-3510 .... 1B•1259
Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... 1A•1321
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126, 405-236-3741 .... 1A•1367
† M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 .... 1A•1393
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 2•1797
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 .... 1A•1418
Valpey-Fisher, 75 South St, Hopkinton, MA 01748, 617-435-6831 .... 1A•1435

Accurate Elctrns., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 ... 216-365-1211
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 ... 617-222-2202
Colorado Crystal Corp., 2303 W. 8th St., Loveland, CO 80537 ... 303-667-9248
Connector Corp., 6025 N. Keystone Ave., Chicago, IL 60646 ... 312-539-3108
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 ... 815-786-8411
Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895 ... 401-769-3800
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-5700
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 ... 212-458-5811
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ... Call Local Sls. Off.
† Jettron Prods., P.O. Box 337, E. Hanover, NJ 07936 ... 201-887-0571
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 ... 714-987-4715
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065 ... 717-486-3411
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 ... 617-653-0844
§ Schott Elctrns., Hershey Dr., Ansonia, CT 06401 ... 203-736-2677
§† Waveline, Box 718, W. Caldwell, NJ 07006 ... 201-226-9100

Holders, Diode-2500 — *See Vol. 2*

Holders, Fuse — See Clips & Holders, Fuse (Vol. 1B), Panels, Fuse (Vol. 1B),

Holders, Lamp — See Sockets, Lamp & Lamp Assemblies (Vol. 1B)

Holders, Test Lead-2900 — *See Vol. 3*

Holders, Tube — See Retainers, Tube (Vol. 1A)

Holders & Carriers, Chip (Capacitor, IC, LSI)-2100 — *See Vol. 2*

Holders & Carriers, IC, LSI (Packaged)-3130

§ **Bivar, Inc., 4 Thomas, Irvine, CA 92714, 714-951-8808 ... 2•1018**
Robinson-Nugent, Inc., 800 East 8th St., New Albany, IN 47150, 812-945-0211 ... 2•1553,1554
Thomas & Betts, Electronics Group Hdqtrs., 920 Route 202, Raritan, NJ 08869, 201-469-4000 ... 2•1611
§ **Wells Elctrns., 1701 S. Main St., South Bend, IN 46613, 219-287-5941 ... 2•1755**
§† Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510 ... 516-546-1751
Accurate Elctrns., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 ... 216-365-1211
Acme Model Engrg. Co., 654 Bergen Blvd., Ridgefield, NJ 07657 ... 201-943-7650
§ Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 ... 617-222-2202
Burndy Corporation, Richards Ave., Norwalk,, CT 06852 ... 203-838-4444
Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895 ... 401-769-3800
Garry Mfg. Co., Div. of Brand-Rex Co., 9 Queen Anne Ct., Laghorne, PA 19047 ... 215-949-2300
Gibson/Egan, 2666 East Huntington Dr., Duarte, CA 91010 ... 818-358-0191
† Gordon, L., Packaging, 1050 S. Paca St., Baltimore, MD 21230 ... 301-539-6537
† Jettron Prods., P.O. Box 337, E. Hanover, NJ 07936 ... 201-887-0571
Jonard Inds. Corp., 134 Marbledale Rd., Tuckahoe, NY 10707 ... 914-793-0700
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ... 617-491-5400
† Milton Ross Co., 511 Second St. Pike, Southampton, PA 18966 ... 215-355-0200
Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 ... 914-698-5600
§ Simco Co., 2257 North Penn Rd., Hatfield, PA 19440 ... 215-822-2171
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 ... 408-980-1600

Honeycomb Sheets, Panels, etc.-2500 — *See Vol. 2*

Hoods, Oscilloscope-2975 — *See Vol. 3*

Housings, Circuit Module — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. 2)

Housings, Photomultiplier Tube — See Photomultiplier Tube Housings (Vol. 1A)

Housings, Terminal-1400 — *See Vol. 2*

Hum Eliminators-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ... 1A•2124

Hybrid Circuits — See Circuits, Hybrid (Vol. 1A)

Hybrid Voltage Regulators-3130

ACC Electronics, 1300 W. Oak, Independence, KS 67301, 316-331-1000 ... 1A•1643
† American Plasticraft Co., 814 N. Sacramento Blvd., Chicago, IL 60622 ... 312-722-7727
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 ... 516-589-5656
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 ... 617-263-9100
† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 ... 714-871-4848
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 ... 516-293-8686
CTS Corp., 905 North West Blvd., Elkart, IN 46514 ... 219-293-7511
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 ... 415-962-5011
§† Film Microelectronics, 17 A St., Burlington, MA 01803 ... 617-272-5650
Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752 ... 714-832-0290;800-854-9420
§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 ... 414-351-1660
§† Integrated Circuits, Inc., 10301 Willows Road, Redmond, WA 98052 ... 206-882-3100
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 ... 402-694-6111
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051 ... 408-733-4045
Lambda Electronics, 515 Broad Hollow Rd., Melville, NY 11747 ... 516-694-4200
Lambda Semiconductors, 121 International Dr., Corpus Christi, TX 78410 ... 512-289-0403;800-255-9606
† Megatran Electronic Power, Rising Sun Rd., Bordentown, NJ 08505 ... 609-298-7300
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 ... 617-329-1508
† Micro Networks, 324 Clark St., Worcester, MA 01606 ... 617-852-5400
Micropac Inds., 905 E. Walnut St., Garland, TX 75040 ... 214-272-3571
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 ... 516-567-9620
† Northwest Microcircuits, 2115 N. College, Newburg, OR 97132 ... 503-538-7081
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan ... 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 ... 213-540-2209
Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 ... 201-429-8700
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 ... 301-375-8666
† Trio Labs., 80 Dupont St., Plainview, NY 11803 ... 516-349-0400
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 ... 312-391-7733

Identification, Friend or Foe (IFF) ESM (MIL)-3475 — *See Vol. 3*

Imagers, Thermal-2900 — *See Vol. 3*

IEEE 488 (GPIB) Bus — See Controllers, IEEE 488 (GPIB) (Vol. 3)

Impedance Comparators — See Bridges, Impedance (Vol. 3)

Impedance Converters, Microwave-3400 — *See Vol. 3*

Incremental Magnetic Recorders — See Recorders, Computer Data (Vol. 3)

Indicator Lights — See Lights, Indicator (Vol. 1B)

Indicators, Angle-5500 (Also See Encoders, Shaft Position) **— *See Vol. 1B***

Indicators, Azimuth-5500 — *See Vol. 1B*

Indicators, Capacitor Leakage — See Testers, Capacitor (Vol. 3)

Indicators, Circuit Condition, On, Off, etc. (Electromechanical)-2450

(Also See Indicators, Instrument, Flag, Pointer, etc.) **— *See Vol. 1B***

Indicators, Computer Type & Data Display — See Lamps, Dial, Panel, Pilot Incandescent & Accessories (Vol. 1B)

Indicators, Distortion — See Analyzers, AF (Vol. 3)

Indicators, Elapsed Time-2200 — *See Vol. 3*

Indicators, Electromechanical — See Indicators, Circuit Condition, On / Off (Vol. 1B)

Indicators, Frequency — See Meters, Frequency (Vol. 3)

Indicators, Directional-2200 — *See Vol. 3*

Indicators, Illumination — See Meters, Light (Nonphotographic) (Vol. 3)

Indicators, Instrument, Flag, Pointer, etc.-2450 — *See Vol. 1B*

Indicators, Liquid Level-2200 — *See Vol. 3*

Indicators, Null-2900 — *See Vol. 3*

Indicators, Numeric Readout — See Tubes, Readout (Vol. 1A)

Indicators, Positioning-2200 — *See Vol. 3*

Indicators, Power Level — See Monitors, Power (Vol. 3)

Indicators, Pressure — See Gauges, Pressure (Vol. 3)

Indicators, Proximity — See Sensors, Proximity (Vol. 3)

Indicators, RF — See Meters, Frequency (Vol. 3)

Indicators, Rotary Shaft Position — See Encoders, Shaft Angle (Vol. 1B)

Indicators, Servo-4900 — *See Vol. 3*

Indicators, Shorted Turn — See Testers, Coil (Vol. 3)

Indicators, Sound Level — See Meters, Audio Level (Vol. 3)

Indicators, Speed-3500 — *See Vol. 1B*

Indicators, Temperature — See Meters, Temperature (Vol. 3)

Indicators, Temperature (Not Meter Type)-5300 — *See Vol. 1B*

Indicators, VSWR — See Meters, Standing Wave Ratio (Vol. 3)

Indicators (MIL), Fault Locating-3475 — *See Vol. 3*

Inductance Comparators — See Bridges, Inductance (Vol. 3)

Inductance Standards — See Standards, Inductance (Vol. 3)

Induction Potentiometers — See Resolvers, Synchro (Vol. 3)

Inductors — See Coils (Vol. 1A)

Inductors (MIL)-2440 — *See Vol. 1B*

Infrared (IF) Equipment (MIL)-3475 — *See Vol. 3*

Inks for Thick Film Microcircuits-1700 — *See Vol. 2*

Input/Output Equipment, Voice-2000 — *See Vol. 3*

Input/Output Switching Modules — See Modules, Control & Switching (Vol. 3)

Inserters, DIP & IC — See Extractors, DIP & IC (Vol. 2)

Insertion Loss Measurement Systems-2900 — *See Vol. 3*

Inserts — See Bushings, etc. (Vol. 2)

Installation Equipment, Fiber Optic-4100 — *See Vol. 3*

Instrumentation, Fiber Optic-4100 — *See Vol. 3*

Instrument Design Services (Industrial) — See Services, Instrument Design (Industrial) (Vol. 3)

Instrument Parts, Precision — See Bearings (Vol. 2), Gears & Gear Mechanisms (Precision) (Vol. 2),

Instruments, Test & Measuring, GPIB (IEEE 488) Compatible-2900 — *See Vol. 3*

Insulation Materials-3100 — *See Vol. 2*

Insulation Parts, Fabricated-3100 — *See Vol. 2*

Insulators, Antenna-3100 — *See Vol. 2*

Insulators, Bushing (Metallized) — See Bushings, etc. (Vol. 2)

Insulators, Clip, Test & Battery-3100 — *See Vol. 2*

Insulators, Mica-3100 — *See Vol. 2*

Integrated Circuit Handlers — See Handlers, Integrated Circuit (Automatic) (Vol. 3)

Integrated Circuit Interconnect Systems-3200 — *See Vol. 2*

Integrated Circuit Design Aids-4200 — *See Vol. 2*

Integrated Circuits, Custom/Semicustom-3130

Cherry Electrical Prods. Corp., 3623 Sunset Ave., Waukegan, IL 60087, 312-578-3500 .... 1B•1758
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd., Towson, MD 21204 301-583-4000
Citel, Inc., 3060 Raymond St., Santa Clara, CA 95050 408-727-6562
Gould-AMI, Sub. Gould Inc., 3800 Homestead Rd., Santa Clara, CA 95051 408-554-2150
International Microelectronic Prods., 2830 North First Street, San Jose, CA 95134 408-262-9100
Linear Technlg., P.O. Box 489, Sta. "A", Burlington, ON L7R 3Y3 Canada 416-632-2996
MCE Semiconductor, 1111 Fairfield Dr., West Palm Beach, FL 33407 305-845-2837
† Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086 408-245-2500
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
§† Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090 215-657-8400
† Sprague Elec. Co., Semiconductor Div., 115 Northeast Cutoff, Worcester, MA 01606 617-853-5000
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
VLSI Technology, Inc., 1101 McKay Dr., San Jose, CA 95131 408-942-1810
ZyMOS Corp., 477 N. Mathilda Ave., Sunnyvale, CA 94086 .... 408-730-8800; 408-730-5400

Integrated Circuits, Digital-3130

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 .... 1A•1645
Cherry Electrical Prods. Corp., 3623 Sunset Ave., Waukegan, IL 60087, 312-578-3500 .... 1B•1758
§† **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•1667,1672,1673**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 .... 1A•2109
§† Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051 408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd., Towson, MD 21204 301-583-4000
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Array Technology, 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129 408-252-9900
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., 00, Santa Clara, CA 95051 408-748-1200
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
§ Data General, 4400 Computer Dr., Westboro, MA 01581 617-366-8911
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Exar Integrated Sys., P.O.B. 62229, Sunnyvale, CA 94088 408-732-7970
Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ General Instrument Corp., Microelectronics Div., 600 W. John St., Hicksville, NY 11802 516-733-3107
§ GTE Microcircuits, 2000 West 14th St., Tempe, AZ 85281 602-968-4431
§† Harris Semiconductor, Box 883, Melbourne, FL 32901 305-724-7400
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Holt Inc., 8 Chrysler Ave., Irvine, CA 92714 714-859-8800
§† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
§† Integrated Device Technlg., Inc., 3236 Scott Blvd., Santa Clara, CA 95051 408-727-6116
† Interdesign, Inc., 1500 Green Hills Rd., Scotts Valley, CA 95066 408-438-2900
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
† Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
Leach Corp., Relay Div., 5915 Avalon Blvd., Los Angeles, CA 90003 213-232-8221
§ LSI Computer Sys., 1235 Walt Whitman Rd., Melville, NY 11747 516-271-0400
Master Logic, 761 E. Evelyn, Sunnyvale, CA 94086 408-732-7777
MCE Semiconductor, 1111 Fairfield Dr., West Palm Beach, FL 33407 305-845-2837
§† McGuirk Electronics Co. Inc., York St. P.O. Box 101 S.V., Andover, MA 01810 617-933-3500
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086 408-245-2500
Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
§† Mitel Semiconductor, P.O. Box 13089, Kanata, ON K2K 1X3 Canada 613-592-5280
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Nitron, 10420 Bubb Rd., Cupertino, CA 95014 408-255-7550
§ Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
Polycore Elctrns., 1107 Tourmaline Dr., Newbury Pk., CA 91320 213-991-1061
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 201-685-6000
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505 213-530-8777
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
§† Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086 408-739-7700
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
SMD Technology Svc. Ctr., North American Philips, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 800-431-4444
§† Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090 215-657-8400
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11787 516-273-3100
Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086 408-744-0100
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611

Texas Instrs., Data Sys. Group, P.O. Box 2909 MS 2222, Austin, TX 78769 214-995-6611
† Third Domain, P.O. Box 35400, Tucson, AZ 85740-5400 602-293-6310
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† TRW LSI Products, PO Box 2472, La Jolla, CA 92038 619-457-1000
VLSI Technology, Inc., 1101 McKay Dr., San Jose, CA 95131 408-942-1810
§ Western Digital Corp., 2445 McCabe Way, Irvine, CA 92714 714-557-3550

Integrated Circuits, Interface-3130

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 .... 1A•1645
Datel, 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 .... 3•1152
§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•1667**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 .... 1A•2108,2109
§† Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051 408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Analog Systems, P.O. Box 35879, Tucson, AZ 85740-5879 602-293-4923
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., 00, Santa Clara, CA 95051 408-748-1200
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Exar Integrated Sys., P.O.B. 62229, Sunnyvale, CA 94088 408-732-7970
Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ GTE Microcircuits, 2000 West 14th St., Tempe, AZ 85281 602-968-4431
§† Harris Semiconductor, Box 883, Melbourne, FL 32901 305-724-7400
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Holt Inc., 8 Chrysler Ave., Irvine, CA 92714 714-859-8800
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
† Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
Lambda Semiconductors, 121 International Dr., Corpus Christi, TX 78410 .... 512-289-0403;800-255-9606
Leach Corp., Relay Div., 5915 Avalon Blvd., Los Angeles, CA 90003 213-232-8221
§ LSI Computer Sys., 1235 Walt Whitman Rd., Melville, NY 11747 516-271-0400
MCE Semiconductor, 1111 Fairfield Dr., West Palm Beach, FL 33407 305-845-2837
Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086 408-245-2500
§† Mitel Semiconductor, P.O. Box 13089, Kanata, ON K2K 1X3 Canada 613-592-5280
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
Polycore Elctrns., 1107 Tourmaline Dr., Newbury Pk., CA 91320 213-991-1061
§† Precision Monolithics, 1500 Space Dr., Santa Clara, CA 95050 408-727-9222
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 201-685-6000
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
§† Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086 408-739-7700
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
§† Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090 215-657-8400
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Elec. Co., Semiconductor Div., 115 Northeast Cutoff, Worcester, MA 01606 617-853-5000
Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11787 516-273-3100
Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086 408-744-0100
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Texas Instrs., Data Sys. Group, P.O. Box 2909 MS 2222, Austin, TX 78769 214-995-6611
† Third Domain, P.O. Box 35400, Tucson, AZ 85740-5400 602-293-6310
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Western Digital Corp., 2445 McCabe Way, Irvine, CA 92714 714-557-3550

Integrated Circuits, Linear-3130

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 .... 1A•1645
† **Apex Microtechnology Corp., 1130 E. Pennsylvania St., Tucson, AZ 85714, 602-746-0849 .... 3•1005**
Cherry Electrical Prods. Corp., 3623 Sunset Ave., Waukegan, IL 60087, 312-578-3500 .... 1B•1758
† **Datel, 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 .... 3•1152**
Elantec, Inc., 1996 Tarob Ct., Milpitas, CA 95035, 408-945-1323 .... 1A•1653
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051, 408-733-4045 .... 1A•1663
§† **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•1667,1674-1677**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 .... 1A•2109
§† **Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173, 617-861-6540 .... 1A•1681-1683**
§† Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051 408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
† Analog Systems, P.O. Box 35879, Tucson, AZ 85740-5879 602-293-4923
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Array Technology, 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129 408-252-9900
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., 00, Santa Clara, CA 95051 408-748-1200
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Exar Integrated Sys., P.O.B. 62229, Sunnyvale, CA 94088 408-732-7970
Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† Harris Semiconductor, Box 883, Melbourne, FL 32901 305-724-7400
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† Holt Inc., 8 Chrysler Ave., Irvine, CA 92714 714-859-8800
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663 714-759-2411
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† Interdesign, Inc., 1500 Green Hills Rd., Scotts Valley, CA 95066 408-438-2900
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
† Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
Leach Corp., Relay Div., 5915 Avalon Blvd., Los Angeles, CA 90003 213-232-8221
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-942-0810
Linear Technlg., P.O. Box 489, Sta. "A", Burlington, ON L7R 3Y3 Canada 416-632-2996
§ LSI Computer Sys., 1235 Walt Whitman Rd., Melville, NY 11747 516-271-0400
MCE Semiconductor, 1111 Fairfield Dr., West Palm Beach, FL 33407 305-845-2837
§† McGuirk Electronics Co. Inc., York St. P.O. Box 101 S.V., Andover, MA 01810 617-933-3500
§† Mitel Semiconductor, P.O. Box 13089, Kanata, ON K2K 1X3 Canada 613-592-5280
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 777 N. Pastoria Ave., Sunnyvale, CA 94086 408-730-5900
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
Polycore Elctrns., 1107 Tourmaline Dr., Newbury Pk., CA 91320 213-991-1061
§† Precision Monolithics, 1500 Space Dr., Santa Clara, CA 95050 408-727-9222
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 201-685-6000
§ RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
§† Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086 408-739-7700
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680 714-979-0941
Siltronics Ltd., P.O. Box 456, Dover, MA 02030 617-329-4068
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Elec. Co., Semiconductor Div., 115 Northeast Cutoff, Worcester, MA 01606 617-853-5000
Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11787 516-273-3100
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Texas Instrs., Data Sys. Group, P.O. Box 2909 MS 2222, Austin, TX 78769 214-995-6611
† Third Domain, P.O. Box 35400, Tucson, AZ 85740-5400 602-293-6310
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Integrated Circuits, Memory-3130

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 .... 1A•1645
§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•1668,1669**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 .... 1A•2108
Advanced Electronic Packaging, 2159 Bay St., Los Angeles, CA 90021 213-622-9042

§—Product sold through distributors †—Product meets MIL specs

§† Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051	408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088	408-732-2400
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716	516-589-5656
Catalyst Research, 1421 Clarkview Rd., Baltimore, MD 21209	301-296-7000
§ Data General, 4400 Computer Dr., Westboro, MA 01581	617-366-8911
Electronic Arrays, 550 E. Middlefield Rd., Mtn. View, CA 94043	415-964-4321
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014	305-556-4000
Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042	415-962-5011
§ General Instrument Corp., Microelectronics Div., 600 W. John St., Hicksville, NY 11802	516-733-3107
§† GTE Microcircuits, 2000 West 14th St., Tempe, AZ 85281	602-968-4431
§† Harris Semiconductor, Box 883, Melbourne, FL 32901	305-724-7400
Hitachi America, 1800 Bering Dr., San Jose, CA 95112	408-292-6404
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663	714-759-2411
§† Inmos Corp., P.O. Box 16000, Colorado Springs, CO 80935	303-630-4000 Ext. 4454
§† Integrated Device Technlg., Inc., 3236 Scott Blvd., Santa Clara, CA 95051	408-727-6116
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014	408-996-5000
† Isotronics, Industrial Park, New Bedford, MA 02745	617-998-2000
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841	617-688-1881
Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086	408-245-2500
§† Mitel Semiconductor, P.O. Box 13089, Kanata, ON K2K 1X3 Canada	613-592-5280
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 777 N. Pastoria Ave., Sunnyvale, CA 94086	408-730-5900
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003	201-748-5089
† Nitron, 10420 Bubb Rd., Cupertino, CA 95014	408-255-7550
§ Paccom, 3928 148th NE, Redmond, WA 98052	206-883-9200;800-426-6254
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043	415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096	609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876	201-685-6000
§† RCA Solid State Div., Micro Processors, Route 202, Somerville, NJ 08876	201-685-6000
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660	800-854-8099
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154	617-890-6688
§† Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086	408-739-7700
§† Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090	215-657-8400
§ Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11787	516-273-3100
Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086	408-744-0100
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265	214-995-6611
Texas Instrs., Data Sys. Group, P.O. Box 2909 MS 2222, Austin, TX 78769	214-995-6611
† Third Domain, P.O. Box 35400, Tucson, AZ 85740-5400	602-293-6310
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304	213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036	201-486-3300
VLSI Technology, Inc., 1101 McKay Dr., San Jose, CA 95131	408-942-1810

Integrated Circuits, Microprocessor-3130

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566	**1A•1645**
§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900**	**1A•1670,1671**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107	**1A•2108**
§† Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051	408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088	408-732-2400
§ Data General, 4400 Computer Dr., Westboro, MA 01581	617-366-8911
Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042	415-962-5011
§† Fairchild Microprocessor Div., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042	415-962-3838
General Instrument Corp., Microelectronics Div., 600 W. John St., Hicksville, NY 11802	516-733-3107
Gould-AMI, Sub. Gould Inc., 3800 Homestead Rd., Santa Clara, CA 95051	408-554-2150
§ GTE Microcircuits, 2000 West 14th St., Tempe, AZ 85281	602-968-4431
§† Harris Semiconductor, Box 883, Melbourne, FL 32901	305-724-7400
Hitachi America, 1800 Bering Dr., San Jose, CA 95112	408-292-6404
§† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663	714-759-2411
§† Inmos Corp., P.O. Box 16000, Colorado Springs, CO 80935	303-630-4000 Ext. 4454
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014	408-996-5000
† Isotronics, Industrial Park, New Bedford, MA 02745	617-998-2000
§ LSI Computer Sys., 1235 Walt Whitman Rd., Melville, NY 11747	516-271-0400
§† Mitel Semiconductor, P.O. Box 13089, Kanata, ON K2K 1X3 Canada	613-592-5280
Mitsubishi Elctrns. America, Inc., Semiconductor Div., 777 N. Pastoria Ave., Sunnyvale, CA 94086	408-730-5900
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003	201-748-5089
§ Paccom, 3928 148th NE, Redmond, WA 98052	206-883-9200;800-426-6254
Photobell, 26 Just Rd., Fairfield, NJ 07006	201-227-3613
§ Pro-Log, 2411 Garden Rd., Monterey, CA 93940	408-372-4593
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043	415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096	609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876	201-685-6000
§† RCA Solid State Div., Micro Processors, Route 202, Somerville, NJ 08876	201-685-6000
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660	800-854-8099
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154	617-890-6688
§ Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086	408-739-7700
Silicon Systems Inc., 14351 Myford Rd., Tustin, CA 92680	714-979-0941
§ Standard Microsystems, 35 Marcus Blvd., Hauppauge, NY 11787	516-273-3100
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265	214-995-6611
Texas Instrs., Data Sys. Group, P.O. Box 2909 MS 2222, Austin, TX 78769	214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304	213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036	201-486-3300
§ Western Digital Corp., 2445 McCabe Way, Irvine, CA 92714	714-557-3550

Integrated Circuits, Silicon Monolithic, Unpackaged Chips-3130

Array Technology, 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129	408-252-9900
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., 00, Santa Clara, CA 95051	408-748-1200
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051	408-496-6710
Gould-AMI, Sub. Gould Inc., 3800 Homestead Rd., Santa Clara, CA 95051	408-554-2150
§ GTE Microcircuits, 2000 West 14th St., Tempe, AZ 85281	602-968-4431
† Holt Inc., 8 Chrysler Ave., Irvine, CA 92714	714-859-8800
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035	408-942-0810
Linear Technlg., P.O. Box 489, Sta. "A", Burlington, ON L7R 3Y3 Canada	416-632-2996
§ LSI Computer Sys., 1235 Walt Whitman Rd., Melville, NY 11747	516-271-0400
MCE Semiconductor, 1111 Fairfield Dr., West Palm Beach, FL 33407	305-845-2837
Micrel, Inc., 1235 Midas Way, Sunnyvale, CA 94086	408-245-2500
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003	201-748-5089
Polycore Elctrns., 1107 Tourmaline Dr., Newbury Pk., CA 91320	213-991-1061
§† Precision Monolithics, 1500 Space Dr., Santa Clara, CA 95050	408-727-9222
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876	201-685-6000
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054	408-988-8000
§† Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090	215-657-8400
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247	413-664-4411

Integrators, Electronic-2325 — *See Vol. 3*

Integrators, Mechanical & Electromechanical-2200 — *See Vol. 3*

Intensifiers, Image-5700

A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876	201-722-9800
Aiphone, 1700 130th St. NE, Bellevue, WA 98005	206-455-0510
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876	401-762-3800
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523	914-592-6050
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110	201-667-2262
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan	0534-34-3311
Interelectronics Corp., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920	914-EL8-8000
Microscience, Inc., 110A Jerusalem Rd., Cohasset, MA 02025	617-383-1622
Penn Video Inc., 929 Sweitzer Ave., Akron, OH 44311	216-762-4840
RCA Solid State Div., Route 202, Somerville, NJ 08876	201-685-6000
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830	201-494-1000
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303	415-493-4000
† Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75040	214-272-3561
Whittaker Corp., 10880 Wilshire Blvd., Los Angeles, CA 90024	213-475-9411

Intercom Systems — See Switching Systems, Audio (Vol. 3)

Interfaces, Computer/Peripheral-2000 — *See Vol. 3*

Interrupters, Ground Fault-4300 — *See Vol. 1B*

Interrupters, Power-4300 — *See Vol. 1B*

Interrupters, Vacuum-4300 — *See Vol. 1B*

Intervalometers — See Timers (Vol. 3)

Inverters, DC to AC — See Power Supplies, AC Output (Vol. 3)

Isolators, Antenna-1900 — *See Vol. 3*

Isolators, Ferrite-3450

AERCOM, 405 Tasman Dr., Sunnyvale, CA 94086	408-744-1320
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801	617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801	617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802	516-931-6200
Baytron, 344 Salem St., Medford, MA 02155	617-391-1550

Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
† Emerson & Cuming, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021 617-828-3300
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Isolators, Line-4050 — *See Vol. 3*

Isolators, Microwave (All Types)-3450

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
† Emerson & Cuming, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021 617-828-3300
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Isolators, Optoelectronic-3700 — *See Vol. 1B*

Isolators, Source — See Isolators, Line (Vol. 3)

Jack Adapters (All Types)-2100 — *See Vol. 2*

Jack Covers-2100 — *See Vol. 2*

Jack Panel Assemblies & Access. — See Panels, Jack (Vol. 2)

Jacks (All Types)-2100 — *See Vol. 2*

Jacks (MIL)-2440 — *See Vol. 1B*

Jammers (MIL)-3475 — *See Vol. 3*

Jammers (MIL), Acoustic-3475 — *See Vol. 3*

Jammers (MIL), Advanced Self Protection-3475 — *See Vol. 3*

Jammers (MIL), Chaff, Flares-3475 — *See Vol. 3*

Jammers (MIL), Communications (Commjam)-3475 — *See Vol. 3*

Jammers (MIL), Commjam, Truck Mounted-3475 — *See Vol. 3*

Jammers (MIL), Drone Borne-3475 — *See Vol. 3*

Jammers (MIL), Expendable-3475 — *See Vol. 3*

Jammers (MIL), Fuze-3475 — *See Vol. 3*

Jammers (MIL), High Band-3475 — *See Vol. 3*

Jammers (MIL), Integrated Command-3475 — *See Vol. 3*

Jammers (MIL), J-band-3475 — *See Vol. 3*

Jammers (MIL), Low Band-3475 — *See Vol. 3*

Jammers (MIL), Multipurpose-3475 — *See Vol. 3*

Jammers (MIL), Portable-3475 — *See Vol. 3*

Jammers (MIL), Radar-3475 — *See Vol. 3*

Jammers (MIL), Shipboard-3475 — *See Vol. 3*

Jammers (MIL), Standoff-3475 — *See Vol. 3*

Jammers (MIL), Tactical-3475 — *See Vol. 3*

Jamming Pods (MIL), ECM-3475 — *See Vol. 3*

Jamming Sets (MIL), Multipurpose-3475 — *See Vol. 3*

Jamming Systems (MIL)-3475 — *See Vol. 3*

Jamming Systems (MIL), Mobile-3475 — *See Vol. 3*

Jamming Systems (MIL), Multipurpose-3475 — *See Vol. 3*

Jamming Systems (MIL), Tactical Communications (TACJAM)-3475 — *See Vol. 3*

Jigs And Fixtures, Chassis & Circuit Board-4100 — *See Vol. 3*

Joint Compounds, Semiconductor — See Coatings, Compounds, Lubricants, etc., Heat Conductive (Vol. 2)

Joints, Rotary, Fiber Optic-2475 — *See Vol. 1B*

Joints, Rotary, Microwave-3450

Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Graphite Metallizing Corp., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702 914-968-8400
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Joysticks — See Controls, Computer Input (Vol. 3)

Jumpers, Bonding-2100 — *See Vol. 2*

Jumpers, Circuit Board-2100 — *See Vol. 2*

Jumpers, Wire, Terminated — See Cords, Patch (Vol. 2)

Junctions, Hybrid, Microwave-3450

† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
§ CES Elctrns., 2968 Avenue Z, Brooklyn, NY 11235 ....
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
Hades Mfg. Corp., 151-A Verdi St., Farmingdale, NY 11735 516-249-4244

Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 ..603-627-6000
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Keyboard Legends and Symbols-5150 — *See Vol. 1B*

Keyboards, Address Encoded-5150 — *See Vol. 1B*

Keyboards, Capacitive-5150 — *See Vol. 1B*

Keyboards, Ferrite Core-5150 — *See Vol. 1B*

Keyboards, Full Travel-5150 — *See Vol. 1B*

Keyboards, Hall Effect-5150 — *See Vol. 1B*

Keyboards, Hard Contact-5150 — *See Vol. 1B*

Keyboards, Low Profile-5150 — *See Vol. 1B*

Keyboards, Membrane-5150 — *See Vol. 1B*

Keyboards, Modular-5150 — *See Vol. 1B*

Keyboards, Pad-5150 — *See Vol. 1B*

Keyboards, Photo-optical-5150 — *See Vol. 1B*

Keyboards, Reed-5150 — *See Vol. 1B*

Keyboards, Solid State-5150 — *See Vol. 1B*

Keyers, Tone-1900 — *See Vol. 3*

Keypads-5150 — *See Vol. 1B*

Kits, Breadboarding (For Engineers)-4200 — *See Vol. 2*

Kits, Connector-2100 — *See Vol. 2*

Kits, Enclosure Prototyping-1400 — *See Vol. 2*

Kits, Fiber Optic-2475 — *See Vol. 1B*

Kits, Marking (Dial, Instrument, Equipment, etc.)-2400 — *See Vol. 2*

Kits, Potentiometer, Rheostat-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ....1A•2029
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300

Kits, Printed Circuit-1700 — *See Vol. 2*

Kits, Programming Board-4200 — *See Vol. 2*

Kits, Shielding-4525 — *See Vol. 2*

Kits, Terminal-2100 — *See Vol. 2*

Kits, Training Aid-4200 — *See Vol. 2*

Knobs & Dials-2400 — *See Vol. 2*

Knobs, Limit Stop-2400 — *See Vol. 2*

Knobs, Locking, Control Shaft-2400 — *See Vol. 2*

Knobs, Slip Clutch-2400 — *See Vol. 2*

Knobs, Torque, Incremental, Ratio Drive-2400 — *See Vol. 2*

Labels, Pressure Sensitive, Adhesive-2400 — *See Vol. 2*

Labels, Coatings, Crayons, Pellets, etc., Temperature Indicating-5300 — *See Vol. 1B*

Laboratories, Testing — See Services, Electrical Measurement & Test (Vol. 3)

Lacing, Cable — See Cords & Tapes, Lacing (Vol. 2)

Laminates, Metal Clad (Including Copper)-2500 — *See Vol. 2*

Laminates, Plastic Impregnated (Unclad)-2500 — *See Vol. 2*

Laminates, Plastic (With Integral Heating Elements)-5300 — *See Vol. 1B*

Lamp Adapters-2450 — *See Vol. 1B*

Lamp Assembly Color Filters, Lens Mountable-2450 — *See Vol. 1B*

Lamp Drivers-2450 — *See Vol. 1B*

Lamp Holders — See Sockets, Lamp & Lamp Assemblies (Vol. 1B)

Lamps, Arc-2450 — *See Vol. 1B*

Lamps, Edge Lighting, Panel-2450 — *See Vol. 1B*

Lamps, Electroluminescent-2450 — *See Vol. 1B*

Lamps, Exciter, Photographic-2450 — *See Vol. 1B*

Lamps, Flashtube-2450 — *See Vol. 1B*

Lamps, Fluorescent-2450 — *See Vol. 1B*

Lamps, Glow — See Lamps, Neon (Vol. 1B)

Lamps, Incandescent-2450 — *See Vol. 1B*

Lamps, Indicator — See Lamps, Miniature & Subminiature (Vol. 1B)

Lamps, Infrared-2450 — *See Vol. 1B*

Lamps, LED & LCD — See Diodes, Light Emitting (Vol. 1B), Diodes, Liquid Crystal (Vol. 1B),

Lamps, Magnifying, Inspection-4100 — *See Vol. 3*

Lamps, Mercury Vapor-2450 — *See Vol. 1B*

Lamps, Miniature & Subminiature-2450 — *See Vol. 1B*

Lamps, Neon-2450 — *See Vol. 1B*

Lamps, Oil Tight-2450 — *See Vol. 1B*

Lamps, Press-to-Test-2450 — *See Vol. 1B*

Lamps, Projection-2450 — *See Vol. 1B*

Lamps, Solid State — See Diodes, Light Emitting (Vol. 1B), Diodes, Liquid Crystal (Vol. 1B),

Lamps, Stroboscopic Source-2450 — *See Vol. 1B*

Lamps, Tritium (Hydrogen 3) Powered-2450 — *See Vol. 1B*

Lamps, Tungsten Halogen-2450 — *See Vol. 1B*

Lamps, Ultraviolet-2450 — *See Vol. 1B*

Lamps, Xenon-2450 — *See Vol. 1B*

Laser Systems-4100 — *See Vol. 3*

Laser Components & Laser Accessories-3700 — *See Vol. 1B*

LCDs — See Diodes, Liquid Crystal (Vol. 1B)

Lead Assemblies, High Voltage-6000 (Also See onnectors; Cable Assemblies & Harnesses) — ***See Vol. 2***

Leads, Test & Adapters-2900 — *See Vol. 3*

LEDs — See Diodes, Light Emitting (LEDs) (Vol. 1B)

Lenses, Filters, Windows, Infrared-3700 — *See Vol. 1B*

Lenses, Optical & Camera-3700 — *See Vol. 1B*

Lenses, Readout & Display-2450 — *See Vol. 1B*

Light Choppers-3700 — *See Vol. 1B*

Light Pens-2000 — *See Vol. 3*

Light Sources, Fiber Optic-2475 — *See Vol. 1B*

Light Sources, Photoelectric-3700 — *See Vol. 1B*

Light Sources, Stroboscopic-3700 — *See Vol. 1B*

Light Sources, Ultraviolet-3700 — *See Vol. 1B*

Lights, Indicator-2450 — *See Vol. 1B*

Lights, Panel — See Lights, Indicator (Vol. 1B)

Lights, Pilot — See Lights, Indicator (Vol. 1B)

Limit Stops — See Knobs, Limit Stop (Vol. 2)

Limit Stops, Mechanical-2500 — *See Vol. 2*

Limiters, Current-4300 — *See Vol. 1B*

Limiters, Microwave-3450

† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ..1A•1713, 1714,1753
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 .516-694-3600
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Limiters, Surge-4300 — *See Vol. 1B*

Line Assemblies (MIL), RF Transmission-2440 — *See Vol. 1B*

Line Conditioners-4050 — *See Vol. 3*

Line Controlled Switches — See Switches, Data (Vol. 3)

Line Stretchers, Microwave-3450

Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 .617-935-8610
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Astrolab, 345 Dalziel Rd., Linden, NJ 07036 201-862-0022
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Liners, Tube Shield — See Shields, Tube (Vol. 2)

Loads, Electronic, Variable-2900 (Also See Dummy Loads) — ***See Vol. 3***

Locators, Open Short-2900 — *See Vol. 3*

Locks, Dial & Shaft-2400 — *See Vol. 2*

Logic Cards (without Components) — See Boards, Plug-in (Vol. 2)

Logic Circuits — See Cards, Logic (Vol. 3), Modules, Logic (Vol. 1A),

Loudspeakers — See Speakers (Vol. 3)

Louvers, Vents, & Windows (For Equipment) — See Enclosures, Equipment & Panel Mounting (Vol. 2)

Lubricants-1600 — *See Vol. 2*

Lugs, Terminal — See Terminals, Lug (Vol. 2)

LVDTs — See Transducers, Displacement (Vol. 1B)

Machines & Accessories, Semiconductor Manufacturing-4100 — *See Vol. 3*

Machines & Tools, Crimping — See Tools, Crimping & Swaging (Vol. 2)

Machines, Cleaning & Degreasing-4100 (Also See Cleaners, Ultrasonic) — ***See Vol. 3***

Machines, Coil Winding-4100 — *See Vol. 3*

Machines, Component Handling, Feeding, Insertion & Sorting-4100 — *See Vol. 3*

Machines, Hermetic Sealing-4100 — *See Vol. 3*

Machines, Induction Heating (Electronic)-4100 — *See Vol. 3*

Machines, Lead Cutting & Forming-4100 — *See Vol. 3*

Machines, Marking & Numbering-4100 — *See Vol. 3*

Machines, Mask Alignment & Exposure-4100 — *See Vol. 3*

Machines, Metallizing, Vacuum — See Deposition Equipment, Vacuum & Accessories (Vol. 3)

Machines, Plastic Molding-4100 — *See Vol. 3*

Machines, Plating-4100 — *See Vol. 3*

Machines, Printed Circuit Drilling, Etching & Punching-4100 — *See Vol. 3*

Machines, Terminal Installing-4100 — *See Vol. 3*

Machines, Ultrasonic Bonding-4100 — *See Vol. 3*

Machines, Vibration Fatigue Testing — See Testers, Vibration (Vol. 3)

Machines, Wafer Alignment — See Machines, Mask Alignment & Exposure (Vol. 3)

Machines, Wire Marking, Manual & Automatic-4100 — *See Vol. 3*

Machines, Wire Measuring & Cutting-4100 — *See Vol. 3*

Machines, Wire Wrapping — See Tools, Wire Wrapping (Vol. 2)

Magnetic Materials — See Cores, Magnetic (All Types) (Vol. 2), Ferrite Material & Parts (Vol. 2),

Magnetizers-4100 — *See Vol. 3*

Magnetodiodes — See Magnetoresistors, Hall (Vol. 1A)

Magnetometers-2900 — *See Vol. 3*

Magnetoresistors, Hall-4800

Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ....1B•1867
† American Aerospace Controls, 570 Smith St., Farmingdale, NY 11735 516-694-5100
§ Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000

Magnetrons — See Tubes, Microwave (Vol. 1A)

Magnets, Focusing — See Magnets, Permanent (Vol. 2)

Magnets (Lab. Type)-2500 — *See Vol. 2*

Magnets, Permanent-2500 — *See Vol. 2*

Magnets, Superconducting-2500 — *See Vol. 2*

Magnets (MIL), Permanent-2440 — *See Vol. 1B*

Magnifying Glasses, Inspection-4100 — *See Vol. 3*

Mappers (MIL), IR Recon.-3475 — *See Vol. 3*

Markers, Dry Transfer — See Kits, Marking (Vol. 2)

Markers, Identification — See Labels (Vol. 2), Nameplates (Vol. 1B), Machines, Marking and Numbering (Vol. 3),

Markers, RF — See Generators, Marker (Vol. 3)

Markers, Terminal — See Kits, Marking, etc. (Vol. 2)

Markers, Wire, Tab & Sleeve — See Wire Markers (Vol. 2)

Mark Recognition Equipment, Optical-2000 — *See Vol. 3*

Mask Alignment & Exposure Systems — See Machines, Mask Alignment & Exposure (Vol. 3)

Materials, Shock, Noise, & Vibration Control-2500 — ***See Vol. 2***

Matrices, Switching-2000 (Also See Boards, Programming) — ***See Vol. 3***

Measuring Equipment, Fiber Optic, Attenuation & Bandwidth-2200 — ***See Vol. 3***

Media, Magnetic — See Disks, Magnetic (Vol. 3), Tape, Magnetic (Vol. 3),

Megaphones — See Amplifiers (Vol. 3)

Memory Devices/Controllers, Bipolar, Add-in-2000 — ***See Vol. 3***

Memory Devices/Controllers, Bipolar, Add-on-2000 — ***See Vol. 3***

Memory Devices/Controllers, Bubble, Add-in-2000 — ***See Vol. 3***

Memory Devices/Controllers, Bubble, Add-on-2000 — ***See Vol. 3***

Memory Devices/Controllers, CCD, Add-in-2000 — ***See Vol. 3***

Memory Devices/Controllers, CCD, Add-on-2000 — ***See Vol. 3***

Memory Devices/Controllers, Magnetic Core, Add-in-2000 — ***See Vol. 3***

Memory Devices/Controllers, Magnetic Core, Add-on-2000 — ***See Vol. 3***

Memory Devices/Controllers, MOS, Add-in-2000 — ***See Vol. 3***

Memory Devices/Controllers, MOS, Add-on-2000 — ***See Vol. 3***

Memory Systems, Bubble-2000 — ***See Vol. 3***

Memory Systems, Core-2000 — ***See Vol. 3***

Memory Systems, Delay Line-2000 — ***See Vol. 3***

Memory Systems, Disk-2000 — ***See Vol. 3***

Memory Systems, Disk, Flexible-2000 — ***See Vol. 3***

Memory Systems, Tape-2000 — ***See Vol. 3***

Memory Systems, Semiconductor-2000 — ***See Vol. 3***

Meter Cases — See Enclosures, Equipment & Panel Mounting (Vol. 2)

Meter Controllers — See Relays, Meter (Vol. 1B)

Meter Expanders — See Multipliers, Meter (Vol. 3)

Meters, Acceleration-2900 — ***See Vol. 3***

Meters, Admittance-2900 — ***See Vol. 3***

Meters, Ampere, AC-2900 — ***See Vol. 3***

Meters, Ampere, DC-2900 — ***See Vol. 3***

Meters, Ampere, RF-2900 — ***See Vol. 3***

Meters, Ampere, True RMS-2900 — ***See Vol. 3***

Meters, Ampere Hour-2900 — ***See Vol. 3***

Meters, Attenuation-2900 — ***See Vol. 3***

Meters, Audio Level-2900 — ***See Vol. 3***

Meters, Bar Graph-2950 — ***See Vol. 3***

Meters, Capacitance, Inductance-2900 — ***See Vol. 3***

Meters, Clamp-on-2900 — ***See Vol. 3***

Meters, Conductance-2900 — ***See Vol. 3***

Meters, Counting Rate, Nuclear-2900 — ***See Vol. 3***

Meters, Decibel Indicating-2900 — ***See Vol. 3***

Meters, Deviation-2900 — ***See Vol. 3***

Meters, Digital ESR-2900 — ***See Vol. 3***

Meters, Digital, 2-wire, 4-20 mA Current Loop-2950 — ***See Vol. 3***

Meters, Distortion & Noise-2900 — ***See Vol. 3***

Meters, Edgewise-2950 — ***See Vol. 3***

Meters, Elapsed Time — See Indicators, Elapsed Time (Vol. 3)

Meters, Electrometer-2900 — ***See Vol. 3***

Meters, EMC — See Meters, RFI (Vol. 3)

Meters, FM Deviation-2900 — ***See Vol. 3***

Meters, Field Strength-2900 — ***See Vol. 3***

Meters, Fluid Flow-2200 — ***See Vol. 3***

Meters, Flux-2900 — ***See Vol. 3***

Meters, Frequency-2900 — ***See Vol. 3***

Meters, Frequency Deviation-2900 — ***See Vol. 3***

Meters, Galvanometer-2900 — ***See Vol. 3***

Meters, Gauss-2900 — ***See Vol. 3***

Meters, Hand Held-2900 — ***See Vol. 3***

Meters, Humidity-2900 — ***See Vol. 3***

Meters, Illuminated Scale-2950 — ***See Vol. 3***

Meters, Impedance-2900 — ***See Vol. 3***

Meters, Kilovolt-2900 — ***See Vol. 3***

Meters, Laser Energy — See Monitors, Laser Energy (Vol. 3)

Meters, Light (Nonphotographic)-2900 — ***See Vol. 3***

Meters, Megohm-2900 — ***See Vol. 3***

Meters, Microampere — See Meters, Ampere (Vol. 3)

Meters, Microwave-2900 — ***See Vol. 3***

Meters, Modulation-2900 — ***See Vol. 3***

Meters, Moving Coil-2950 — ***See Vol. 3***

Meters, Moving Iron-2950 — ***See Vol. 3***

Meters, Moving Scale-2950 — ***See Vol. 3***

Meters, Multifunction (Analog)-2900 — ***See Vol. 3***

Meters, Multifunction (Digital)-2900 — ***See Vol. 3***

Meters, Noise & Sound Level-2900 — ***See Vol. 3***

Meters, Null-2950 — ***See Vol. 3***

Meters, Ohm-2900 — ***See Vol. 3***

Meters, Panel (Analog)-2950 — ***See Vol. 3***

Meters, Panel, Bargraph — See Meters, Bargraph (Vol. 3)

Meters, Panel (Digital)-2950 — ***See Vol. 3***

Meters, Peak Power-2900 — ***See Vol. 3***

Meters, PH-2900 — ***See Vol. 3***

Meters, Phase-2900 — ***See Vol. 3***

Meters, Power-2900 — ***See Vol. 3***

Meters, Power Factor-2900 — ***See Vol. 3***

Meters, Power, RF-2900 — ***See Vol. 3***

Meters, Q-2900 — ***See Vol. 3***

Meters, Ratio-2900 — ***See Vol. 3***

Meters, Reflectometer-2900 — ***See Vol. 3***

Meters, Relay — See Relays, Meter (Vol. 1B)

Meters, RFI-2900 — ***See Vol. 3***

Meters, S Unit-2900 — ***See Vol. 3***

Meters, Snap-around — See Meters, Clamp-on (Vol. 3)

Meters, Standing Wave Ratio-2900 — ***See Vol. 3***

Meters, Taut Band-2950 — ***See Vol. 3***

Meters, Temperature (Contacting)-2900 — ***See Vol. 3***

Meters, Temperature, Dial type (Noncontacting) — See Pyrometers (Vol. 3)

Meters, Temperature, Infrared-2900 — *See Vol. 3*

Meters, Thermal Transfer-2900 — *See Vol. 3*

Meters, Time Interval — See Timers, Interval (Vol. 3)

Meters, Vacuum Tube Volt (VTVM)-2900 — *See Vol. 3*

Meters, VAR-2900 — *See Vol. 3*

Meters, Vibration-2900 — *See Vol. 3*

Meters, Volt, AC-2900 — *See Vol. 3*

Meters, Volt, DC-2900 — *See Vol. 3*

Meters, Volt, Differential — See Meters, Volt (Vol. 3)

Meters, Volt, Digital-2900 — *See Vol. 3*

Meters, Volt, Potentiometric-2900 — *See Vol. 3*

Meters, Volt, RF-2900 — *See Vol. 3*

Meters, Volt, Sampling-2900 — *See Vol. 3*

Meters, Volt, True RMS-2900 — *See Vol. 3*

Meters, VU-2900 — *See Vol. 3*

Meters, Watt-2900 — *See Vol. 3*

Meters, Watt Hour-2900 — *See Vol. 3*

Meters, Watt, RF Directional-2900 — *See Vol. 3*

Meters, Wave-2900 — *See Vol. 3*

Meters, Waveguide — See Meters, Microwave (Vol. 3)

Meters (MIL)-2440 — *See Vol. 1B*

Microcircuit Production Equip.-4100 — *See Vol. 3*

Microcircuits — See Integrated Circuits (Specific Types) (Vol. 1A)

Microcircuits, Thick Film — See Circuits, Hybrid, Thick Film (Vol. 1A)

Microcircuits (MIL)-2440 — *See Vol. 1B*

Microcircuits (MIL), Linear-2440 — *See Vol. 1B*

Microcircuits (MIL), Low Power Schottky-2440 — *See Vol. 1B*

Microcircuits (MIL), Memories, CMOS, Hybrids-2440 — *See Vol. 1B*

Microcircuits (MIL), TTL, Schottky, Microprocessor-2440 — *See Vol. 1B*

Microcomputer Boards-3130

Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 602-622-8605
Distributed Computer Sys., 223 Crescent St., Waltham, MA 02154 .617-899-6619
§† Fairchild Microprocessor Div., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042 415-962-3838
§ General Robotics Corp., 57 N. Main St., Hartford, WI 53027 414-673-6800
§ Industrial Computer Designs, Inc., 31121 Via Colinas 1005, Westlake Village, CA 91362 818-889-3179
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
Pacific Microcomputers, Inc., 119 Aberdeen, Cardiff, CA 92007 619-436-8649
Quartic Systems, Inc., 3575 South West Temple , Salt Lake City, UT 84115 801-268-9264
Zendex Corp., 6700 Sierra La., Dublin, CA 94566 415-828-3000

Microfilm, Computer Output (COM) Equipment-2000 — *See Vol. 3*

Micrometers — See Testers, Thickness (All Types) (Vol. 3)

Microphone Accessories (Incl. Stands, Holders, Booms)-1300 — *See Vol. 3*

Microphones, Bone Conduction-1300 — *See Vol. 3*

Microphones, Carbon-1300 — *See Vol. 3*

Microphones, Cardioid-1300 — *See Vol. 3*

Microphones, Ceramic-1300 — *See Vol. 3*

Microphones, Condenser (Incl. Electret)-1300 — *See Vol. 3*

Microphones, Crystal-1300 — *See Vol. 3*

Microphones, Dynamic-1300 — *See Vol. 3*

Microphones, Lavalier-1300 — *See Vol. 3*

Microphones, Magnetic-1300 — *See Vol. 3*

Microphones, Omnidirectional-1300 — *See Vol. 3*

Microphones, Subminiature-1300 — *See Vol. 3*

Microphones, Velocity-1300 — *See Vol. 3*

Microphones, Wireless-1300 — *See Vol. 3*

Microphones (MIL)-2440 — *See Vol. 1B*

Microprocessor — See Integrated Circuits, Microprocessor (Vol. 1A)

Microprocessor Development Systems-3130

Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895, 401-769-3800 .... 2•1885
Heurikon Corp., 3001 Latham Dr., Madison, WI 53713, 608-271-8700 .... 3•1084
Wintek Corp., 1801 South St., Lafayette, IN 47904-2993, 317-742-8428 .... 3•1118
§ Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051 408-732-2400
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
American Automation, 14731 Franklin Avenue, Tustin, CA 92680 714-731-1661
† Applied Data Communications, 14272 Chambers Rd., Tustin, CA 92680 714-731-9000
Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 602-622-8605
Applied Sys., 26401 Harper Ave., St. Clair Shores, MI 48081 313-779-8700
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
§ Boston Systems Office, 469 Moody St., Waltham, MA 02154 617-894-7800
Bridge Computer Co., Sea Data Corp., 1 Bridge St., Newton, MA 02158 617-244-8190
Data I/O Corp., 10525 Willows Rd. N.E., C-46, Redmond, WA 98052 206-881-6444
Digital Equip., One Iron Way, Marlborough, MA 01752 ....
Dolch Logic Instrs., 3052 Orchard Dr., San Jose, CA 95134 408-998-5730
Emulogic, 3 Technology Way, Norwood, MA 02062 617-329-1031
Fairchild Microprocessor Div., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042 415-962-3838
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
§ GMR Inc., Computer Elctrns., 1048 E. Burgrove St., Carson, CA 90746 213-639-4663
Gould Inc., Design & Test Sys. Div., 4600 Old Ironsides Dr., Santa Clara, CA 95050 408-988-6800
Hilevel Tech., Inc., 18902 Bardeen Way, Irvine, CA 92715 714-752-5215
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Information Control, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Innotronics, Brooks Rd., Lincoln, MA 01773 617-678-8720
Innovatek Microsystems, Inc., Smithfield Rd., Millerton, NY 12546 ..914-373-9003
† Intech, Instruments Div., 282 Brokaw Rd., Santa Clara, CA 95050 ...408-727-0500
§ Integrated Computer Systems, 6305 Arizona Pl., P.O. Box 45405, Los Angeles, CA 90045 213-417-8888
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
Kontron Elctrns., 630 Price Ave., Redwood City, CA 94062 415-361-1012
Matrix Corp., 1639 Green St., Raleigh, NC 27603 919-833-2837
Matrox Elctrn. Sys., 5800 Andover Ave., Montreal, QU H4T 1H4 Canada 514-735-1182
Micro/sys, 1011 Grand Central Ave., Glendale, CA 91201-3010 818-244-4600
Monolithic Sys., 84 Inverness Circle E., Englewood, CO 80112 303-790-7400
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
Mupac, 10 Mupac Dr., Brockton, MA 02401 617-588-6110
Omnibyte Corp., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185 312-231-6880
Pacific Microcomputers, Inc., 119 Aberdeen, Cardiff, CA 92007 619-436-8649
Photobell, 26 Just Rd., Fairfield, NJ 07006 201-227-3613
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
RCA Solid State Div., Micro Processors, Route 202, Somerville, NJ 08876 201-685-6000
Signum Sys., 726 Santa Monica Blvd., Santa Monica, CA 90401 213-451-5382
Standard Engrg., 44800 Girmmer, Fremont, CA 94538 415-657-7555
Step Engineering, P.O. Box 61166, Sunnyvale, CA 94088 408-733-7837
Tektronix, Inc., P.O. Box 500, V3-314, Beaverton, OR 97077 ....800-547-1512; Oregon only 800-452-1877
§ Zax Corp., 2572 White Rd., Irvine, CA 92714 ....714-474-1170;800-421-0982

Microscopes-3700 — *See Vol. 1B*

Microscopes, Measuring-2900 — *See Vol. 3*

Microwave Comb Generator — See Generators, Microwave (Vol. 3)

Microwave Integrated Circuits (MICs)-3450

† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ...... 1A•1692-1696, 1698,1699,1701
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ....1A•1704
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .... 3•1393
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Central Microwave Co., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Compact Software, Inc., Comsat Corp., 1131 San Antonia Rd., Palo Alto, CA 94303 415-966-8440
Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Harris Microwave Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035 408-262-2222
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
§† 3M-Electronic Products Division, 3M Center, Bldg. 225-1N-06, St. Paul, MN 55144 612-733-7408
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377

Mixers, Audio-1300 — *See Vol. 3*

Mixers, Microwave-3450

† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ..1A•1713, 1714,1716,1720-1722,1724-1737
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .... 3•1393
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Eaton Corp., Elctrn. Instrmn. Div., 2070 Fifth Ave., Ronkonkoma, NY 11779 516-588-3600
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
† Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Micro-Now Instr. Co., Inc., 8260 N. Elmwood St., P.O. Box 856, Skokie, IL 60077 312-677-4700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 ..603-627-6000
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377
§ Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mixers, RF-3450

† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ..1A•1713, 1714,1716,1720-1722,1725-1737
REPCO, 2421 N. Orange Blossom Trail, Box 7065, Orlando, FL 32854, 305-843-8484 .... 3•1065
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ Eaton Corp., Elctrn. Instrmn. Div., 2070 Fifth Ave., Ronkonkoma, NY 11779 516-588-3600
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406 ....
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .....315-437-4529; 800-448-1666
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 .....301-948-3434; 800-638-2048

Modems — See Modulator/Demodulators, Data (Vol. 3)

Modems, Communications, Eliminator/Line Driver-1900 — *See Vol. 3*

Modems, Communications, Line Receivers-1900 — *See Vol. 3*

Modems, Communications, Long Haul-1900 — *See Vol. 3*

Modems, Communications, Short Haul (Limited Distance)-1900 — *See Vol. 3*

Modular Telephone Cords — See Cable, Telephone (Vol. 3)

Modulation Transfer Analyzers — See Analyzers, Transfer Function (Vol. 3)

Modulator/Demodulators, Data-2000 — *See Vol. 3*

Modulator/Demodulators, Laser-3700 — *See Vol. 1B*

Modulators, AM-1900 — *See Vol. 3*

Modulators, FM-1900 — *See Vol. 3*

Modulators, Light-3700 — *See Vol. 1B*

Modulators, Magnetic-2200 — *See Vol. 3*

Modulators, Microwave-3400 — *See Vol. 3*

Modulators, Phase-1900 — *See Vol. 3*

Modulators, Pulse-3400 — *See Vol. 3*

Modulators, RF-1900 — *See Vol. 3*

Modules, Amplifier-3130 (Also See Amplifiers, Specific Types)

† **Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750, 305-339-4356/4355 ... 3•1004**
† **Datel, 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 ... 3•1152**
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 ... 3•1012
Modular Devices, 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 ... 3•1012,1933
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 ... 215-822-1311
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 ... 617-681-8520
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 ... 401-762-3800
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 ... 215-723-8181
† Analog Devices, P.O. Box 280, Norwood, MA 02062 ... 617-329-4700
Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 ... 617-777-4500; 17-246-0300;800-451-1816
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 ... 617-246-0300
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 ... 408-496-6710
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 ... 602-746-1111
Canberra Ind., One State St., Meriden, CT 06450 ... 203-238-2351
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 ... 201-327-1123
Control Prods., Devar Inc., P.O. Box 589, Bridgeport, CT 06601 ... 203-368-6751
E-H Electronics, Sub. E-H Intl., Inc., 7303 Edgewater Dr., Oakland, CA 94621 ... 415-638-5656
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 ... 617-667-8700
Infodex, Inc., 395 W. Main St., Waterbury, CT 06702 ... 203-757-9291
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 ... 213-641-8520
† Inland Motor Specialty Prods. Div., Kollmorgen Corp., 501 First St., Radford, VA 24141 ... 703-639-9045
Instruments for Industry, Inc., 151 Toledo St., Farmingdale, NY 11735 ... 516-694-1414
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 ... 408-988-4930
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 ... 402-694-6111
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 ... 213-828-7496
MVP Elctrns., 1161 N. Tustin, Orange, CA 92667 ... 714-639-9246
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ... 201-748-5089
Pulse Instrs. Co., 1536 W. 25th St., San Pedro, CA 90732 ... 213-548-1327
Skan-A-Matic, Box S, Elbridge, NY 13060 ... 315-689-3961
§ Tennelec, 601 Turnpike, Oak Ridge, TN 37830 ... 615-483-8405
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 ... 619-481-7177
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 ... 813-884-1411
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 ... 516-293-3100
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 ... 408-732-0880
TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 ... 213-536-0888
Tustin Elctrns. Co., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705 ... 714-549-0391
Wescom, PO Box 1458, Downers Grove, IL 60515 ... 312-985-9000

Modules, Analog Multiplier-3130

† **Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ... 3•1170**
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 ... 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 ... 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880 ... 617-246-0300
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 ... 602-746-1111
§ Control Prods., Devar Inc., P.O. Box 589, Bridgeport, CT 06601 ... 203-368-6751
§† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 ... 201-743-2700
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ... 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 ... 617-667-8700
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 ... 408-988-4930
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 ... 805-581-3950
Phoenix Data, 3384 W. Osborn Rd., Phoenix, AZ 85017 ... 602-278-8528

Modules, Analog-to-Digital Conversion-3130

ADAC Corp., 70 Tower Office Pk., Woburn, MA 01801, 617-935-6668 ... 3•1143
Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, 617-246-0300 ... 3•1140
† **Datel, 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 ... 3•1105,1152**
† **ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ... 3•1160**
Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805, 714-776-6400 ... 3•1169
† **Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ... 3•1170**
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 ... 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 ... 617-329-4700
§ Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 ... 617-777-4500; 17-246-0300;800-451-1816
Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 ... 602-622-8605
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 ... 414-447-8200
† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 ... 714-871-4848
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 ... 602-746-1111
Canberra Ind., One State St., Meriden, CT 06450 ... 203-238-2351
CmC Instr. Div., Connecticut microComputer Inc., 36 Del Mar Dr., Brookfield, CT 06804 ... 203-775-4595
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 ... 516-261-3300
Cybersystems, Inc., 7540 South Memorial Pkwy., Huntsville, AL 35802 ... 205-883-4410
§ Data Translation, 100 Locke Dr., Marlboro, MA 01752 ... 617-481-3700
Digital Equip., One Iron Way, Marlborough, MA 01752 ...
§† Dynamic Measurements, 8 Lowell Ave., Winchester, MA 01890 ... 617-729-7870
§ Giddings & Lewis Elctrns., A Unit of AMCA Intl., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 ... 414-921-7100
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 ... 617-667-8700
§ Industrial Computer Designs, Inc., 31121 Via Colinas 1005, Westlake Village, CA 91362 ... 818-889-3179
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 ... 213-641-8520
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 ... 408-988-4930
† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072 ... 617-344-7383
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 ... 402-694-6111
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 ... 815-838-0005
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 ... 914-425-2000
LeCroy Resch. Sys. Corp. (Cal.), 1806 Embarcadero Rd., Palo Alto, CA 94303 ... 415-856-1800
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 ... 213-828-7496
† Micro Networks, 324 Clark St., Worcester, MA 01606 ... 617-852-5400
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 ... 805-581-3950
§ NES, Inc., 1536 Brandy Pkwy., Streamwood, IL 60103 ... 312-289-8820
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 ... 201-227-4800
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649 ... 714-891-5861
Phoenix Data, 3384 W. Osborn Rd., Phoenix, AZ 85017 ... 602-278-8528
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 ... 413-568-2301
§ RCA Solid State Div., Micro Processors, Route 202, Somerville, NJ 08876 ... 201-685-6000
† Rolm Corp., 1 River Oaks Pl., San Jose, CA 95134 ... 408-988-2900
Serial Lab Prods., Inc., 50 Brigham St., P.O. Box 766, Marlboro, MA 01752 ... 617-481-1684
Standard Engrg., 44800 Girmmer, Fremont, CA 94538 ... 415-657-7555
SYMBICON, 89 Route 101A, Amherst, NH 03031 ... 603-673-8898
§ Tennelec, 601 Turnpike, Oak Ridge, TN 37830 ... 615-483-8405
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 ... 619-481-7177
Tustin Elctrns. Co., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705 ... 714-549-0391
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 ... 203-527-7201
Xycom, 750 N. Maple Rd., Saline, MI 48176 ... 313-429-4971

Modules, Control & Switching-2200 — *See Vol. 3*

Modules, Data Acquisition-2325 — *See Vol. 3*

Modules, Digital-to-Analog Conversion-3130

Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, 617-246-0300 ... 3•1141
† **Datel, 11 Cabot Blvd., Mansfield, MA 02048, 617-339-9341 ... 3•1105**
† **ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ... 3•1160**
† **Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072, 617-344-7383 ... 3•1164**
Preston Scientific, 805 E. Cerritos Ave., Anaheim, CA 92805, 714-776-6400 ... 3•1169
Acromag, 30765 Wixom Rd., Wixom, MI 48096 ... 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 ... 617-329-4700
§ Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 ... 617-777-4500; 17-246-0300;800-451-1816
Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 ... 602-622-8605

† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
CmC Instr. Div., Connecticut microComputer Inc., 36 Del Mar Dr., Brookfield, CT 06804 203-775-4595
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Cybersystems, Inc., 7540 South Memorial Pkwy., Huntsville, AL 35802 205-883-4410
§ Data Translation, 100 Locke Dr., Marlboro, MA 01752 617-481-3700
Digital Equip., One Iron Way, Marlborough, MA 01752 ....
§† Dynamic Measurements, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§ Industrial Computer Designs, Inc., 31121 Via Colinas 1005, Westlake Village, CA 91362 818-889-3179
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§† Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
Kinetic Sys., 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
LeCroy Resch. Sys. Corp. (Cal.), 1806 Embarcadero Rd., Palo Alto, CA 94303 415-856-1800
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
† Micro Networks, 324 Clark St., Worcester, MA 01606 617-852-5400
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649 714-891-5861
Phoenix Data, 3384 W. Osborn Rd., Phoenix, AZ 85017 602-278-8528
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
§ PrimeLine-Soltec Distbn., Soltec Corp., P.O. Box 818, Sun Valley, CA 91353-0818 .... 800-525-5554;818-764-5400
§ RCA Solid State Div., Micro Processors, Route 202, Somerville, NJ 08876 201-685-6000
† R. C. Elctrns. Inc., 5386 Hollister Ave., Santa Barbara, CA 93111 805-964-6708
† Rolm Corp., 1 River Oaks Pl., San Jose, CA 95134 408-988-2900
Serial Lab Prods., Inc., 50 Brigham St., P.O. Box 766, Marlboro, MA 01752 617-481-1684
Standard Engrg., 44800 Girmmer, Fremont, CA 94538 415-657-7555
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Tustin Elctrns. Co., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705 714-549-0391
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Modules, Encoding/Decoding-3130

† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 .... 3•1144
† Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 .... 3•1146-1148
† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072, 617-344-7383 .. 3•1164
Xico, Inc., 120 Ocean Way, Santa Monica, CA 90402, 213-454-0302 .... 3•1104
Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
§ Giddings & Lewis Elctrns., A Unit of AMCA Intl., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 414-921-7100
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Interswitch, 770 Airport Blvd., Burlingame, CA 94010 415-347-8217
§ NES, Inc., 1536 Brandy Pkwy., Streamwood, IL 60103 312-289-8820
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Modules, Filter-3130

Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1484,1500
Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
§ Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 .... 617-777-4500; 17-246-0300;800-451-1816
† Aptek Microsystems, Inc., Hillsboro Plaza, 700 N.W. 12th Ave., Deerfield Beach, FL 33441 305-421-8450
† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
Schaffner EMC Inc., Component Div., 825 Lehigh Ave., Union, NJ 07083 201-851-0644
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Modules, I/O Relay-3130

Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 .... 1B•1362
§ Gordos Arkansas, Inc., 1000 N. Second St., Rogers, AR 72756, 501-636-5000 .... 1A•1654-1657
ITT Comps. Electromechanical Grp., 3201 So. Standard St., Santa Ana, CA 92705, 714-751-3900 .... 1B•1450
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649, 714-891-5861 .... 1B•1470
Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 602-622-8605
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
Electronic Prods. Corp., Interstate Indl. Plaza, R. D. , York, PA 17402 717-767-6517
§ GIC Systems, 2324 A Ridgepoint Dr., Austin, TX 78754 512-926-8840
§ Gordos Corp., 250 Glenwood Ave., Bloomfield, NJ 07003 201-743-6800
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany 0911/65521
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§ Standard Grigsby, Inc., 920 Rathbone Ave., Aurora, IL 60507 312-844-4300

Modules, Logic-3130 (Also See Cards; Circuits; Networks)

Catalyst Research, 1421 Clarkview Rd., Baltimore, MD 21209, 301-296-7000 .... 3•1407
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1484
Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 3•1114-1116
Antona Corp., 13600 Ventura Blvd.,, Sherman Oaks, CA 91423 213-986-6651
Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 602-622-8605
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Automatic Test Systems, 23 Poplar St., Malden, MA 02148 617-322-1107
§ Circuit Assembly Corp., 18 Thomas St., Irvine, CA 92714 714-540-5490
Datel, 11 Cabot Blvd., Mansfield, MA 02048 617-339-9341
Digital Equip., One Iron Way, Marlborough, MA 01752 ....
Douglas Elctrns., 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
Dynage, Inc., Control Prods Grp., 135 Prestige Park Circle, E. Hartford, CT 06108 203-289-6831
§ Dynamic Measurements, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
E-H Electronics, Sub. E-H Intl., Inc., 7303 Edgewater Dr., Oakland, CA 94621 415-638-5656
Elgenco, Inc., Box 460, Hurricane, UT 84737 801-635-4954
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
Information Control, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ Interswitch, 770 Airport Blvd., Burlingame, CA 94010 415-347-8217
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
LeCroy Resch. Sys. Corp. (Cal.), 1806 Embarcadero Rd., Palo Alto, CA 94303 415-856-1800
Matrix Sys. Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 213-992-6776
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
Micro/sys, 1011 Grand Central Ave., Glendale, CA 91201-3010 818-244-4600
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Monolithic Sys., 84 Inverness Circle E., Englewood, CO 80112 303-790-7400
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
§ NES, Inc., 1536 Brandy Pkwy., Streamwood, IL 60103 312-289-8820
Penn Airborne Prods., Industrial Hwy., Southampton, PA 18966 215-355-3400
Precicontact, Inc., Ultra Precision, 1150 Wheeler Way, Langhorne, PA 19047 215-757-1202
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
RCI/Data, 1992 Lakewood Rd., Toms River, NJ 08753 201-341-8361
Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Skan-A-Matic, Box S, Elbridge, NY 13060 315-689-3961
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Standard Engrg., 44800 Girmmer, Fremont, CA 94538 415-657-7555
§ Struthers-Dunn, Lamb's Rd., Pitman, NJ 08071 609-589-7500
§† Superior Elec. Co., 383 Middle St., Bristol, CT 06010 203-582-9561
Sylvania Electronic, Box 360, Muncy, PA 17756 717-546-3191
† Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Tri-Tronics Co. Inc., 13420 Wright Cir., Tampa, FL 33624 813-855-4453
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Modules, Oscillator-2300

§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 .... 1A•1348,1349
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1505-1507
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... 1A•1391

† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ...... 1A•1432,1433
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
† Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761 512-251-2313
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
Wescom, PO Box 1458, Downers Grove, IL 60515 312-985-9000

Modules, RMS-to-DC Conversion-3130

Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102

Modules, Sample & Hold-3130

Analogic Corp., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, 617-246-0300 ...... 3•1141
† Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750, 305-339-4356/4355 ...... 3•1004
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ...... 3•1160
† Acromag, 30765 Wixom Rd., Wixom, MI 48096 313-624-1541
† Analog Devices, P.O. Box 280, Norwood, MA 02062 617-329-4700
Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 602-622-8605
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
§ Dynamic Measurements, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Information Control Corp., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045 213-641-8520
§ Intech, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050 408-988-4930
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
LeCroy Resch. Sys. Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
Standard Engrg., 44800 Girmmer, Fremont, CA 94538 415-657-7555

Modules (MIL), Electronic-2440 — *See Vol. 1B*

Modules (MIL), Standard Electronic-2440 — *See Vol. 1B*

Molding Services — See Services, Molding (Vol. 3)

Monitors, Current-2200 — *See Vol. 3*

Monitors, Data Link-1900 — *See Vol. 3*

Monitors, Error Rate-1900 — *See Vol. 3*

Monitors, Frequency-2900 — *See Vol. 3*

Monitors, Laser Energy-2200 — *See Vol. 3*

Monitors, Line & Program-1900 — *See Vol. 3*

Monitors, Modulation-2900 — *See Vol. 3*

Monitors, Phase & Phase Angle-2900 — *See Vol. 3*

Monitors, Phase Sequence & Loss-2200 — *See Vol. 3*

Monitors, Power, AC & DC-2200 — *See Vol. 3*

Monitors, Power, AF-1300 — *See Vol. 3*

Monitors, Power Failure-2200 — *See Vol. 3*

Monitors, Power, Microwave-2900 — *See Vol. 3*

Monitors, Power, RF-2900 — *See Vol. 3*

Monitors, Response Time-2900 — *See Vol. 3*

Monitors, Temperature-5300 (Also See Controls, Temperature) — ***See Vol. 1B***

Monitors, Video-1900 — *See Vol. 3*

Monitors, Voltage — See Meters, Volt (Vol. 3)

Monitors, Waveform — See Oscilloscopes (Vol. 3)

Monitors (MIL), Data-3475 — *See Vol. 3*

Motor & Generator Armatures, Rotors, Stators-3500 — *See Vol. 1B*

Motor Generator Sets-4000 — *See Vol. 3*

Motor Speed Drives — See Controls, Motor Speed (Vol. 3)

Motors, Brushless, DC-3500 — *See Vol. 1B*

Motors, Clock & Timing-3500 — *See Vol. 1B*

Motors, Control-3500 — *See Vol. 1B*

Motors, DC Timing-3500 — *See Vol. 1B*

Motors, Drag Cup-3500 — *See Vol. 1B*

Motors, Fractional Horsepower-3500 — *See Vol. 1B*

Motors, Gearhead-3500 — *See Vol. 1B*

Motors, Gyro-3500 — *See Vol. 1B*

Motors, Hysteresis-3500 — *See Vol. 1B*

Motors, Incremental, Stepping — See Motors, Stepping (Vol. 1B)

Motors, Induction-3500 — *See Vol. 1B*

Motors, Linear-3500 — *See Vol. 1B*

Motors, Miniature — See Motors, Fractional HP (Vol. 1B)

Motors, Permanent Magnet-3500 — *See Vol. 1B*

Motors, Selsyn — See Motors, Synchronous (Vol. 1B)

Motors, Servo-4900 — *See Vol. 3*

Motors, Squirrel Cage-3500 — *See Vol. 1B*

Motors, Stepping-3500 — *See Vol. 1B*

Motors, Synchronous-3500 — *See Vol. 1B*

Motors, Synchronous, Polarized — See Motors, Synchronous (Vol. 1B)

Motors, Timing — See Motors, Clock & Timing (Vol. 1B)

Motors, Torque (Incl. Torquers)-3500 — *See Vol. 1B*

Motors, Universal, AC or DC Operation-3500 — *See Vol. 1B*

Mounts, Antenna-1900 — *See Vol. 3*

Mounts, CRT & Accessories-2500 — *See Vol. 2*

Mounts, Crystal-2300

Accurate Elctrns., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-365-1211
§ Atlee Inc., One Gill St., Woburn, MA 01801 617-933-3510
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ...... Call Local Sls. Off.
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
§ Methode Electronics, Inc., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008 312-392-3500
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Milton Ross Co., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
§ Schott Elctrns., Hershey Dr., Ansonia, CT 06401 203-736-2677
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mounts, Integrated Circuit — See Sockets, Integrated Circuit (Vol. 2), Boards, Plug-In (Vol. 2),

Mounts, Microwave-3450

Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
CGTI, 2 Windward Ave., White Plains, NY 10605 914-949-3719
Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161

§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Microflect, 3575 25th S.E., Salem, OR 97302-0985 503-363-9267
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro-Mounting Devices, 4092 Keith Dr., Campbell, CA 95008 408-866-4626
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Mounts, Mobile Antenna — See Mounts, Antenna (Vol. 3)

Mounts, Shock & Vibration-2825 — *See Vol. 2*

Mounts, Thermistor-5300 — *See Vol. 1B*

Mounts, Transistor (Incl. Kits) — See Pads, Transistor Mounting (Vol. 2)

Mouse Devices — See Controls, Computer Input (Vol. 3)

Multibus — See Board Computers & Subassemblies, Multibus (Vol. 3)

Multiplexers, Analog-2325 — *See Vol. 3*

Multiplexers, Digital-2325 — *See Vol. 3*

Multiplexers, Fiber Optic-2475 — *See Vol. 1B*

Multiplexers, Frequency Division-1900 — *See Vol. 3*

Multiplexers, Statistical-1900 — *See Vol. 3*

Multiplexers, Time Division-1900 — *See Vol. 3*

Multiplexers, Transmission-1900 — *See Vol. 3*

Multiplexers, Video-1900 — *See Vol. 3*

Multipliers, Analog-2325 — *See Vol. 3*

Multipliers, Channel Electron-2325 — *See Vol. 3*

Multipliers, Crystal-1900 — *See Vol. 3*

Multipliers, Diode-1900 — *See Vol. 3*

Multipliers, Frequency-3450

† Applied Research Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 .... 1A•1686
DigiMax Instrs. Corp., 5625 Kearny Villa Rd., San Diego, CA 92123, 619-569-6582 .... 3•1217
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1484,1508
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 .. 1A•1713, 1714,1766,1767
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 .... 1A•1433
† Ajax Magnethermic Corp., 1745 Overland Ave., N.E., Warren, OH 44482 216-372-8511
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
† Eaton Corp., Microwave Comps. Div., 783 Palomar Ave., Sunnyvale, CA 94086 408-245-6810
† Electrac, Inc., 1614 Orangethrope Way, Anaheim, CA 92801 714-879-6021
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Integrated Microwave, 11526 Sorrento Valley Rd., San Diego, CA 92121 619-457-0277
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Micro-Now Instr. Co., Inc., 8260 N. Elmwood St., P.O. Box 856, Skokie, IL 60077 312-677-4700
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England .... 44-(582) 60-14-41
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 201-685-6000
Resdel Engrg., 300 E. Live Oak Ave., Arcadia, CA 91006 213-684-2600
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 .. 603-627-6000
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Tucker Elctrns., Box 461060, Garland, TX 75046 .... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046 214-271-8511
† Vibration Instrs. Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Multipliers, Hall-4800

§ Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807 305-678-6900
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212 614-486-9561

Multipliers, Magnetic Analog-2200 — *See Vol. 3*

Multipliers, Meter-2900 — *See Vol. 3*

Multipliers, Servo-4900 — *See Vol. 3*

Nameplates-2450 — *See Vol. 1B*

Networks, Computer, Local Area-2000 — *See Vol. 3*

Networks, Crossover, Attenuator (Audio)-1300 — *See Vol. 3*

Networks, Directional Antenna Phasing-1900 — *See Vol. 3*

Networks, Hybrid-2000 — *See Vol. 3*

Networks, Hybrid Substrates-3130

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 .... 1A•1800,1801
HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 .... 1A•1874
Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 .... 1A•1680
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1961-1965,1967-1971
ACC Electronics, 1300 W. Oak, Independence, KS 67301 316-331-1000
Corning Glass Works, Main Plant, MS 2136, Corning, NY 14831 607-974-4102
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886 401-738-9150
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 .... 714-979-8833; 714-634-1535
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Natel Engrg. Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Northwest Microcircuits, 2115 N. College, Newburg, OR 97132 503-538-7081
Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
§ Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 216-795-8200
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, Ladder-4700

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 .... 1A•1801
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 .... 1A•1829
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 .... 1A•1846-1850,1852
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 .... 1A•1870
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 .... 1A•1879
KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 .... 1A•1886,1887
† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1964
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .... 1A•1993
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2010
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100

§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Burr-Brown, P.O. Box 11400, Tucson, AZ 85734 602-746-1111
Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ......603-668-3210; 800-257-3300
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ......714-979-8833; 714-634-1535
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Res-Net, 110 Route 10, Whippany, NJ 07981 ...... 201-887-2260;out of state 800-526-0704
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Shallco, Box 1089, Smithfield, NC 27577 919-934-3135
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650 201-944-2221
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 216-232-8600
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, LC-2700

Allen Avionics, 224 E. 2nd St., Mineola, NY 11501, 516-248-8080 ......1A•1580
§† **Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ......1A•1858**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ......1A•1398**
Piconics, Cummings Rd., Tyngsboro, MA 01879, 617-649-7501 ......1A•1611
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
Design Automation, 809 Massachusetts Ave., Lexington, MA 02173-3992 617-862-8998
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001 201-636-1900
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 516-561-6050
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Thinco Div., Hull Corp., Davisville Rd., Hatboro, PA 19040 215-672-7800
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224

Networks, Matching-1900 — *See Vol. 3*

Networks, Phase-2700

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
† Alpha Comps., 1106 E. Simpson Rd., Mechanicsburg, PA 17055 717-697-8595
† Applied Electro Technlg., Int., STI Company, 2220 So. Anne St., Santa Ana, CA 92704 714-556-6570
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Theta Instr. Corp., 24 Dwight Pl., Fairfield, NJ 07006 201-227-1700
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Networks, Pulse Forming-2700

§† **Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ......1A•1858**
Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
Kappa Scientific Corp., Box 30585, Santa Barbara, CA 93105 805-687-9648
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 619-279-5100
† Micap Elctrns., Inc., 592 Oak St., Copiague, NY 11726 516-842-8866
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Television Microtime, Inc., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-4242
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 617-828-3366
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Networks, Rejection — See Filters (Vol. 1A)

Networks, RC-2000 — *See Vol. 3*

Networks, Resistance-4700

Alco Elctrn. Prods., Inc., 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ......1B•1504
§ **Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ...... 1A•1788,1794-1801**
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 ...... 3•1068
§ **Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ...... 1A•1804-1806**
§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ...... 1A•1808,1809,1818-1821,1823,1826**
Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ......1A•1829
§ **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ......1A•1828**
§ **CTS of Berne, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ...... 1A•1836,1838-1844**
† **CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ......1A•1646**

§† **Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253** .... **1A•1846-1850,1852**
† **Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150** .... **1A•1870,1871**
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 .... **1A•1869**
HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 .... **1A•1874**
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 .... **1A•1876**
† **Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727** .... **1A•1878**
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 .... **1A•1883**
§ **KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100** .... **1A•1879**
§ **KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536** .... **1A•1885-1887**
§† **Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000** .... **1A•1891,1B•1012**
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 .... **1A•1895**
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 .... **1A•1902**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777** .... **1A•1903**
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ... **1A•1919-1921**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054** .... **1A•1929**
Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 .... **1A•1938**
§† **Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405, 818-781-1642** .... **1A•1939**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900** .... **1A•1944,1961-1971,1975**
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ... **1A•1993, 1997**
§ **Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200** .... **1A•2001**
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... **1A•2008,2010**
§† **Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500** .... **1A•2072,2073**
ACC Electronics, 1300 W. Oak, Independence, KS 67301 316-331-1000
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., McClure Pk., West Lafayette, IN 47906 317-463-2536
† Circuit Techn., 160 Smith St., Farmingdale, NY 11735 516-293-8686
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
§ CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† CTS Halex, 1202 McGaw Ave., Irvine, CA 92714 714-556-2850
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hy-Cal Engrg., 9650 Telstar Ave., El Monte, CA 91731 213-444-4000
† Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 .... 603-668-3210; 800-257-3300
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 .... 714-979-8833; 714-634-1535
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735 .... 516-694-0060; 800-645-9333
† Northwest Microcircuits, 2115 N. College, Newburg, OR 97132 503-538-7081
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
RFL Inds.; A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
† Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650 201-944-2221
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Networks, Video-2700

Null Detectors — See Indicators, Null (Vol. 3)

Nuts, Metal-2825 — *See Vol. 2*

Nuts, Plastic — See Fasteners, Nonmetallic (Vol. 2)

Oils — See Lubricants (Vol. 2)

Optical Component Mounts & Accessories-3700 — *See Vol. 1B*

Optical-Coupler Isolators — See Isolators, Opto (Vol. 1B)

Optical Signal Sources — See Generators, Light Pulse (Vol. 3)

Oscillators, Audio (Module)-2300

Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... **1A•1362,1363**
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411** .... **1A•1380-1382**
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 .... **3•1012**
Modular Devices, 50 Orville Dr., Bohemia, NY 11716, 516-567-9620 .... **3•1012**
§ **Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566** .... **3•1046**
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 .... **1A•1399**
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... **1A•1401, 1402**
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 .... **3•1317**
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 .... 312-231-3511; 312-932-9380
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 516-883-1700
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
Star Micronics, Inc., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854 201-572-9512
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 717-774-2746
Telesis Laboratory, Box 1972, Chillocothe, OH 45601 614-642-5000
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433
§ Wilson, H. M., Co., 11501 Chimney Rock Rd., Houston, TX 77035 713-729-1183

Oscillators, Audio (Test) — See Generators, Audio (Vol. 3)

Oscillators, Beat Frequency (BFO)-2300

Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752 617-481-7000
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700

Oscillators, Beat Frequency (BFO)-2300 (Cont'd)

Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100

Oscillators, Bias-2300

§ Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566 ....3•1046
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257

Oscillators, Bridge (Test)-2900 — *See Vol. 3*

Oscillators, Cavity-2300

TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1783
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
† EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95050 408-727-8500
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England ....44-(582) 60-14-41
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 717-774-2746
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Oscillators, Clock-2300

Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ....1A•1313
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ....1A•1322
Comclock Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580; 800-854-XTAL ....1A•1328
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ....1A•1329-1332
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ....1A•1344, 1345
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ....1A•1348
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 ....1A•1484,1505-1507
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ....1A•1353
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 ....1A•1356
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 ....1A•1362,1363
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 ....1A•1371
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ....1A•1372,1664
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ....1A•1380-1382
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 ....1A•1384-1386
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ....1A•1383
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ....1A•1387-1389
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ....1A•1391
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1394
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ....1A•1399
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ....1A•1410,1411
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ....1A•1416,1417
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ....1A•1419
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ....1A•1421
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ....1A•1426,1427
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748, 617-435-6831 ....1A•1434
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ....1A•1438, 1440
† Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ....1A•1443

† Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761 512-251-2313
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 513-522-3300
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ....714-991-1580; 800-854-XTAL
Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 414-763-3591
Pulse Instrs. Co., 1536 W. 25th St., San Pedro, CA 90732 213-548-1327
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ....305-563-1333; 800-327-1282
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
§† Statek Corp., 512 N. Main St., Orange, CA 92668 714-639-7810

Oscillators, Crystal Controlled (Module)-2300

§† Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ....1A•1313
Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2313 ....1A•1314
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ....A•1322,1323
Comclock Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580; 800-854-XTAL ....1A•1328
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1325,1326
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ....1A•1329-1332
† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ....1A•1340-1343
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ....1A•1348,1349
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ....1A•1347
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806, 714-533-6333 ....3•1154
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ....1A•1351
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ....1A•1353
Frequency and Time Systems, Inc., 34 Tozer Rd., Beverly, MA 01915, 617-927-8220 ....3•1154
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 ....1A•1356,1357
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ....1A•1359
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 ....1A•1362,1363
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 ....1A•1368,1369
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 ....1A•1371
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ....1A•1372,1664
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ....1A•1380-1382
§† MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 ....1A•1384-1386
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ....1A•1383
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ....1A•1387-1389
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 ....1A•1390
§ M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ....1A•1393
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1394
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ....1A•1399
† Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ....1A•1400-1402
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ....1A•1404,1408
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ....1A•1411
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ....1A•1416,1417
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ....1A•1419
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 ....1A•1421
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ....1A•1426,1427
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ....1A•1429,1431
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ....1A•1432,1433
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1780,1781,1783
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748, 617-435-6831 ....1A•1434

§—Product sold through distributors †—Product meets MIL specs

† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ....1A•1438, 1439,1441,1442
† Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ....1A•1443
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
† B-D Crystal Entprs., Inc., 1727 W. Galbraith Rd., Cincinnati, OH 45239 513-522-3300
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, CA 94710 415-527-1121
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 ....714-991-1580; 800-854-XTAL
† California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111 ....619-279-8620;800-356-2244;800-821-1634
Chronomite Labs, 21011 S. Figueroa St., Carson, CA 90745 213-320-9452
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111 619-565-1155
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 ....312-231-3511; 312-932-9380
§† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 414-763-3591
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§ Q-Matic Corp., 3194-D Airport Loop Dr., Costa Mesa, CA 92626 714-545-8233
† Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
† Savoy Elctrns., P.O. Box 5727, Ft. Lauderdale, FL 33310 ....305-563-1333; 800-327-1282
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Standard Logic, 2215 S. Standard Ave., Santa Ana, CA 92707 714-979-4770
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan 03-436-2180
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Oscillators, Decade (Test)-2900 — *See Vol. 3*

Oscillators, LC-2300

Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ....1A•1402
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185 312-231-5270
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 717-774-2746
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Oscillators, Low Frequency (Module)-2300

Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ....1A•1313
Behlman Engineering Corporation, 1142 Mark Ave., Carpinteria, CA 93013, 805-684-8311 .... 3•1834,1835
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... 1A•1322
† California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111, 619-279-8620;800-356-2244;800-821-1634 .... 3•1841
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, 212-857-2400 .... 3•1843
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1325,1326
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... 1A•1329-1332
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1341-1345
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111, 619-565-1155 .... 3•1859
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 ....1A•1357
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ....1A•1359
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 ....1A•1362,1363
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700 .... 3•1886
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ....1A•1372
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1380-1382
M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ....1A•1393
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1394
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ....1A•1399
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... 1A•1400-1402
Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 14-898-2691;800-854-2433 .... 3•1901
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ....1A•1419
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 ....1A•1429,1431
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910 813-482-7212
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 ....312-231-3511; 312-932-9380
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801 914-576-6570
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625 813-855-6611

Oscillators, Microwave-3450

Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1325,1326,3•1210
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ....1A•1359
Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ....1A•1411
Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ....1A•1420,1623
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ....1A•1432,1433
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1780,1781,1783
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002 203-242-0761
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
Central Microwave Co., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
Continental Resources, Inc., 175 Middlesex Tpke., Bedford, MA 01730 617-275-0850
† Deltronic Crystal Inds., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869 201-361-2222

Oscillators, Microwave-3450 (Cont'd)

† Eaton Corp., Microwave Comps. Div., 783 Palomar Ave., Sunnyvale, CA 94086 408-245-6810
§ Eaton Corp., Elctrn. Instrmn. Div., 2070 Fifth Ave., Ronkonkoma, NY 11779 516-588-3600
§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
† EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
† Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95050 408-727-8500
Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
† HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
Marconi Instrs., 100 Stonehurst Ct., Northvale, NJ 07647 201-767-7250
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801 914-576-6570
† Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
Microwave Assocs. Ltd., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX England .... 44-(582) 60-14-41
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542 516-671-5700
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
Ovenaire, 706 Forrest St., Charlottesville, VA 22901 804-977-8050
† Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
† Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
§ REI Sls., 19525 Business Centre Dr., Northridge, CA 91324 617-938-0900
† RFD, Inc., 5024 Nassau St., Tampa, FL 33607 813-872-1502
† Rodale Elctrns. Corp., 603 Chestnut St., Garden City, NY 11530 516-222-0050
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
§ Tucker Elctrns., Box 461060, Garland, TX 75046 .... 214-348-8800;800-527-4642
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Oscillators, Oven-2300

Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2313 .... 1A•1314
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1325,1326
† **Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... 1A•1332**
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1342, 1343
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 .... 1A•1351
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 .... 1A•1357
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1380
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... 1A•1400
† **Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 .... 1A•1404,1408**
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1416,1417
† **Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... 1A•1441, 1442**
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806 714-533-6333
Frequency and Time Systems, Inc., 34 Tozer Rd., Beverly, MA 01915 617-927-8220
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 717-774-2746

Oscillators, Power (Module)-2300

Behlman Engineering Corporation, 1142 Mark Ave., Carpinteria, CA 93013, 805-684-8311 .... 3•1834,1835
† **California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111, 619-279-8620;800-356-2244;800-821-1634 .... 3•1841**
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, 212-857-2400 .... 3•1843
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700 .... 3•1886
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 .... 3•1252
Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 14-898-2691;800-854-2433 .... 3•1901
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111 619-565-1155
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
§ REI Sls., 19525 Business Centre Dr., Northridge, CA 91324 617-938-0900
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433
§ Wilson, H. M., Co., 11501 Chimney Rock Rd., Houston, TX 77035 713-729-1183

Oscillators, Pulse (Module)-2300

Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2313 .... 1A•1314
† **Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... 1A•1329-1332**
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1340-1342,1344,1345
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1501-1503
Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1353
† **Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1362,1363**
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 .... 1A•1368,1369
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1380**
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 .... 1A•1384-1386
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 .... 1A•1387
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... 1A•1391
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 .... 1A•1399
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... 1A•1400, 1401
† **Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 .... 1A•1410,1411**
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1417
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 .... 1A•1419
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 .... 1A•1421
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 .... 1A•1426,1427
§† **Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... 1A•1429,1431**
† **Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... 1A•1438, 1440,1442**

§ Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 814-695-4428
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, CA 94710 415-527-1121
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
EPSCO Microwave, 411 Providence Hwy., Westwood, MA 02090 617-329-1500
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 414-763-3591
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
Power Functions Engrg., 3831 Cavalier Dr., Garland, TX 75042 214-278-0996
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Oscillators, Pulse (Test) — See Generators, Pulse (Vol. 3)

Oscillators, RC (Module)-2300

† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ....1A•1332
Krohn-Hite Corp., Avon Indl. Pk., Bodwell St., Avon, MA 02322, 617-580-1660 ....3•1254
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ....1A•1402
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 ....3•1317
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111 619-565-1155
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Tektronix, Inc., P.O. Box 500, V3-314, Beaverton, OR 97077 ....800-547-1512; Oregon only 800-452-1877

Oscillators, Reed-2300

Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150

Oscillators, RF (Module)-2300

Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 ....1A•1313
Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2313 ....1A•1314
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ....A•1322,1323
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1325,1326
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ....1A•1329-1332
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ....1A•1341, 1342
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ....1A•1348
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ....1A•1347
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 ....1A•1351
§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ....1A•1353
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ....1A•1359
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 ....1A•1362,1363
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 ....1A•1368,1369
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ....1A•1372
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ....1A•1380-1382
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 ....1A•1384-1386
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 ....1A•1383
§ M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ....1A•1393
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1394
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ....1A•1399
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ....1A•1400-1402
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ....1A•1404
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ....1A•1411
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ....1A•1416,1417
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ....1A•1419
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 ....1A•1432,1433
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 ....1A•1780,1783
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ....1A•1438, 1439
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Eaton Corp., Microwave Comps. Div., 783 Palomar Ave., Sunnyvale, CA 94086 408-245-6810
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 805-544-3800
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95050 408-727-8500
§† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
† MCL, Inc., 10 North Beach Ave., La Grange, IL 60525 312-354-4350
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
§ Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† NSD, 10936 Portal Dr., Los Alamitos, CA 90720 714-527-4896
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Oscillators, RF (Test) — See Generators, RF (Vol. 3)

Oscillators, Sinusoidal (Module)-2300

Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 .... 1A•1313
Behlman Engineering Corporation, 1142 Mark Ave., Carpinteria, CA 93013, 805-684-8311 .... 3•1834,1835
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... A•1322,1323
California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111, 619-279-8620;800-356-2244;800-821-1634 .... 3•1841
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1326
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... 1A•1329-1332
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1340-1343
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347
Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204, 913-631-6700 .... 1A•1351
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111, 619-565-1155 .... 3•1859
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 .... 1A•1357
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830, 617-374-0761 .... 1A•1624
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1362,1363
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050, 516-883-1700 .... 3•1886
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 .... 1A•1368,1369
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 .... 1A•1372
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1380-1382
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 .... 1A•1388,1389
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... 1A•1390
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 .... 1A•1399
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... 1A•1400-1402
Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 14-898-2691;800-854-2433 .... 3•1901
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 .... 1A•1419
† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... 1A•1429,1431
Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 .... 1A•1432,1433
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... 1A•1439-1442
Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 .... 1A•1443
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 .... 312-231-3511; 312-932-9380
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
§† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 617-329-1508
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801 914-576-6570
Modular Audio Prods., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716 516-567-9620
Modular Devices, 50 Orville Dr., Bohemia, NY 11716 516-567-9620
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Real Time Sys., 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550 914-667-0425
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
Telesis Laboratory, Box 1972, Chillocothe, OH 45601 614-642-5000
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323

Oscillators, Sinusoidal (Test) — See Generators, Function (Vol. 3)

Oscillators, Square Wave (Module)-2300

Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2313 .... 1A•1314
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... A•1322,1323
Comclock Inc., 1142 N. Gilbert St., Anaheim, CA 92801, 714-991-1580; 800-854-XTAL .... 1A•1328
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... 1A•1329-1332
§ CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1340-1342
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 .... 1A•1348,1349
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 .... 1A•1504,1505,1507
† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1353
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1362,1363
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 .... 1A•1368,1369
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 .... 1A•1372
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1380
† MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 .... 1A•1384-1386
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 .... 1A•1387
§† Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... 1A•1391
§ M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 .... 1A•1393
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 .... 1A•1399
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... 1A•1400-1402
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 .... 1A•1410,1411
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1417
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 .... 1A•1419
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 .... 1A•1421
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 .... 1A•1426,1427
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... 1A•1429,1431
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... 1A•1438, 1440,1442
† Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 .... 1A•1443
§ Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648 814-695-4428
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Berkeley Nucleonics Corp., 1198 Tenth St., Berkeley, CA 94710 415-527-1121
Cal Crystal Lab., Inc., 1142 N. Gilbert, Anaheim, CA 92801 .... 714-991-1580; 800-854-XTAL
† California Instruments, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111 .... 619-279-8620;800-356-2244;800-821-1634
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520 516-546-9700
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
ECO Instrs. Div., Sea Data Corp., 1 Bridge St., Newton, MA 02158 617-964-8360
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
† FSI/Fork Standards Inc., 666 Western Ave., Lombard, IL 60148 .... 312-231-3511; 312-932-9380
Genstar Rental Elctrns., 2445 Faber Pl., Palo Alto, CA 94303 415-856-7600
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 516-883-1700
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531

§ Midland-Ross Corp., NEL Unit, 357 Beloit St., Burlington, WI 53105 414-763-3591
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048

Oscillators, Square Wave (Test) — See Generators, Function (Vol. 3)

Oscillators, Sweep — See Generators, Sweep (Vol. 3)

Oscillators, Telemetry-1900 — *See Vol. 3*

Oscillators, Temperature Compensated-2300

† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... 1A•1323
† Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1325,1326
† Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... 1A•1331
† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1340, 1341
§ Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 .... 1A•1349
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 .... 1A•1357
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... 1A•1359
† Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1362
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 .... 1A•1368,1369
† McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1380,1382
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... 1A•1383
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 .... 1A•1387,1388
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... 1A•1390
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 .... 1A•1399
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... 1A•1400, 1401
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 .... 1A•1404
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1416,1417
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 .... 1A•1427
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... 1A•1440
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090 617-449-0800
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Frequency Devices, Inc., 25 Locust St., Haverhill, MA 01830 617-374-0761
† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770
† Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Toyo Comm. Equip. Co., Ltd., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105 Japan 03-436-2180
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Oscillators, Test Equipment — See Generators (Specific Types) (Vol. 3)

Oscillators, Tuning Fork Controlled-2300

Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, 212-458-5811 .... 1A•1357
§† Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... 1A•1429,1431
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Philamon, Inc., 33 Dubon Ct., Farmingdale, NY 11735 516-249-2700
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064 213-820-4921
§ SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303 415-856-6900
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
† T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323

Oscillators, UHF/VHF (Module)-2300

Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 .... 1A•1450
Anderson Elctrns., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, 814-695-4428 .... 1A•1313
Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, 512-251-2313 .... 1A•1314
† Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 .... 1A•1322
Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 .... 1A•1325,1326
Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 .... 1A•1329-1332
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 .... 1A•1344, 1345
† Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 .... 1A•1347
† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1353
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 .... 1A•1359
Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 .... 1A•1362,1363
Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901, 804-295-3101 .... 1A•1368,1369
† Leach Corp., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 .... 1A•1372
McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 .... 1A•1380-1382
MF Elctrns. Corp., 10 Renewal Pl., New Rochelle, NY 10801, 914-576-6570 .... 1A•1384-1386
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, 312-451-1000 .... 1A•1391
§† Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 .... 1A•1400-1401
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 .... 1A•1404
† Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 .... 1A•1410,1411
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 .... 1A•1416,1417
Seiko Instrs. U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-530-8777 .... 1A•1421
Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 .... 1A•1426,1427
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070, 717-774-2746 .... 1A•1432,1433
TRAK Systems, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, 813-884-1411 .... 1A•1783
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 .... 1A•1438-1441
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95050 408-727-8500
† Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
International Crystal Mfg., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126 405-236-3741
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151

Racal-Dana Instrs., 18912 Von Karman Ave., Irvine, CA 92715 714-833-1234
Sokol Crystal Prods. Inc., 121 Water St., Mineral Point, WI 53565 ..608-987-3363
§ Syntest Corp., 40 Locke Dr., Marlboro, MA 01752 617-481-7827
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Oscillators, UHF/VHF (Test) — See Generators, UHF/VHF (Vol. 3)

Oscillators, Ultrasonic (Module)-2300

M-Tron Inds., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ....1A•1393
§ Electronic Navigation Inds., 3000 Winton Rd. S., Rochester, NY 14623 716-473-6900
† Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 312-932-9380
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013 717-243-5929
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Vectron Labs., 166 Glover Ave., Norwalk, CT 06850 203-853-4433

Oscillators, Ultrasonic (Test) — See Generators, Ultrasonic (Vol. 3)

Oscillators, Voltage Controlled (Module)-2300

† **Bliley Elec. Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ....1A•1323**
† **Comstron Corp., 200 E. Sunrise Hwy., Freeport, NY 11520, 516-546-9700 ....1A•1325,1326**
† **Connor-Winfield Corp., 109 Turner Ct., POB L, W. Chicago, IL 60185, 312-231-5270 ....1A•1330,1331**
† **CTS Knights, 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ...... 1A•1340-1342**
† **Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ....1A•1347**
† **Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ....1A•1359**
† **Hughes Solid State Products, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, 714-759-2411 ....1A•1363**
† **McCoy Electronics Co., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ....1A•1382**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1394**
Oscillatek Corp., 620 North Lindenwood Dr., Olathe, KS 66062, 913-829-1777 ....1A•1399
Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ....1A•1402
† **Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804, 305-298-2000 ....1A•1408**
† **Q-Tech Corp., 2201 Carmelina Ave., Los Angeles, CA 90064, 213-820-4921 ....1A•1410,1411**
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ....1A•1416,1417
† **Vectron Labs., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ....1A•1442**
Vistar Corp., 13740 McCormick Dr., Tampa, FL 33625, 813-855-6611 ....3•1317
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
Central Microwave Co., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† Data-Control Sys., Commerce Dr., Box 860, Danbury, CT 06810 203-743-9241
† Electronic Research Co., 7618 Wedd St., Overland Park, KS 66204 913-631-6700
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
§ EMR Data Systems, Div. Sangamo- Weston, Box 3041, Sarasota, FL 33578 813-371-0811
Frequency and Time Systems, Inc., 34 Tozer Rd., Beverly, MA 01915 617-927-8220
† Frequency West, Inc., 3140 Alfred St., Santa Clara, CA 95050 408-727-8500
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Industrial Test Equip., 21 Yennicock Ave., Port Washington, NY 11050 516-883-1700
§ ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705 714-751-3900
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Leigh Instrs. Ltd., Frequency Control Div.; C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
§† Luff Research, Box 449, Jackson Hgts., NY 11372 212-429-5900
† M/A-COM OSW, Inc., 2626 S. Hardy Dr., Tempe, AZ 85282 602-966-1471
§† Magnum Microwave Corp., 365 Ravendale Dr., Mountain View, CA 94043 415-968-9281
† Micropac Inds., 905 E. Walnut St., Garland, TX 75040 214-272-3571
† Microsonics Inc., 60 Winter St., Weymouth, MA 02188 617-337-4200
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
§† MITEQ Inc., 100 Ricefield La., Hauppauge, NY 11788 516-543-8873
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
§† Omni Spectra, Inc., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282 602-966-1471
† Piezo Crystal, 100 "K" St., Box 619, Carlisle, PA 17013 717-249-2151
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
Struthers-Dunn, Lamb's Rd., Pitman, NJ 08071 609-589-7500
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Techtrol Cyclonetics, Inc., 815 Market St., New Cumberland, PA 17070 717-774-2746
Teledyne/Geotech, 3401 Shiloh Rd., Garland, TX 75041 214-271-2561
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Zeta Labs., 3265 Scott Blvd., Santa Clara, CA 95051 408-727-6001

Oscillators (MIL), Crystal & Ovens-2440 — *See Vol. 1B*

Oscillators (MIL), VCO, Solid State, RF-2440 — *See Vol. 1B*

Oscillographs, Direct Writing-3000 — *See Vol. 3*

Oscilloscope Plug-ins-2975 — *See Vol. 3*

Oscilloscopes, Digital-2975 — *See Vol. 3*

Oscilloscopes, General Purpose-2975 — *See Vol. 3*

Oscilloscopes, High Frequency (Above 200 MHz)-2975 — *See Vol. 3*

Oscilloscopes, Low Frequency (DC to 3 MHz)-2975 — *See Vol. 3*

Oscilloscopes, Mid Frequency (DC to 200 MHz)-2975 — *See Vol. 3*

Oscilloscopes, Multibeam-2975 — *See Vol. 3*

Oscilloscopes, Multiple Channel-2975 — *See Vol. 3*

Oscilloscopes, Portable, Battery Operated-2975 — *See Vol. 3*

Oscilloscopes, Programmable-2975 — *See Vol. 3*

Oscilloscopes, Sampling-2975 — *See Vol. 3*

Oscilloscopes, Storage-2975 — *See Vol. 3*

Oscilloscopes, Triggered Sweep-2975 — *See Vol. 3*

Outlets, Electrical — See Boxes, Junction, Outlets & Wall Plates (Vol. 2)

Ovens, Aging, Burn-in, Life Test-2550 — *See Vol. 3*

Ovens, Crystal & Component-2300

DigiMax Instrs. Corp., 5625 Kearny Villa Rd., San Diego, CA 92123, 619-569-6582 ....3•1217
† **Ovenaire, 706 Forrest St., Charlottesville, VA 22901, 804-977-8050 ....1A•1403**
Acme Elec. Heating Corp., 4685 E. 11th, Hialeah, FL 33013 305-685-8326
† Blue M, A Unit of General Signal, 138th & Chatham Sts., Blue Island, IL 60406 312-385-9000
§† Casso-Solar, 3 Pearl Ct., Allendale, NJ 07401 201-825-4600
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
† Frequency Elctrns., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553 516-794-4500
International Instrumentation, 31131-602 Via Colinas, Westlake Vlg., CA 91362 213-991-9614
† Isotemp Research, Inc, Box 3389, Charlottesville, VA 22901 804-295-3101
Leigh Instrs. Ltd., Frequency Control Div., C. R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2 Canada 416-447-8531
† Monitor Prods. Co., Inc., 502 Via Del Monte, Oceanside, CA 92054 619-433-4510
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† Oven Inds., 191 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055 717-766-0721
† Sawyer Inds., 5649 Peck Rd., Arcadia, CA 91006 213-442-5981

Spectrum Technology, Inc., 300 Lopez Rd., Goleta, CA 93116 805-964-7791
Texas Instrs., Matls. & Controls Grp., 34 Forrest St., Attleboro, MA 02703 617-699-3800
† Trent, Inc., 201 Leverington Ave., Philadelphia, PA 19127 215-482-5000

Ovens, Electric — See Furnaces, Electric (Vol. 3)

Ovens, Vacuum-4100 — *See Vol. 3*

Packages, Integrated Circuit-3130

Mini-Systems, Inc., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, 617-695-2000 ....1A•1666
Reeves-Hoffman Div., 400 W. North St., Carlisle, PA 17013, 717-243-5929 ....2•1795-1797
§ Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510 .516-546-1751
Airpax Corporation, Woods Rd., Cambridge, MD 21613 301-228-4600
Aromat Corp., 250 Sheffield St., Mountainside, NJ 07092 201-232-4260
Aura Mfg., 50 McDermott Rd., New Haven, CT 06473 203-777-2541
† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Bivar, Inc., 4 Thomas, Irvine, CA 92714 714-951-8808
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
Douglas Elctrns., 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
Elctrn. Molding Corp., 96 Mill St., Woonsocket, RI 02895 401-769-3800
§† Garry Mfg. Co., Div. of Brand-Rex Co., 9 Queen Anne Ct., Laghorne, PA 19047 215-949-2300
† Hermetic Seal, 4232 Temple City Blvd., Rosemead, CA 91770 818-283-0411
Hudson Tool & Die Co., Inc., 18 Malvern St., Newark, NJ 07105 201-589-1800
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Industrial Elctrn. Engrs., Inc., 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
Interconics, BMC Industries, Inc., 610 Bremer Tower, St. Paul, MN 55101 612-228-6512
International Instrumentation, 31131-602 Via Colinas, Westlake Vlg., CA 91362 213-991-9614
† Isotronics, Industrial Park, New Bedford, MA 02745 617-998-2000
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Linear Technlg., P.O. Box 489, Sta. "A", Burlington, ON L7R 3Y3 Canada 416-632-2996
3M-Electronic Products Division, 3M Center, Bldg. 225-1N-06, St. Paul, MN 55144 612-733-7408
† Milton Ross Co., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
† National Beryllia Corp., Greenwood Ave., Haskell, NJ 07420 201-839-1600
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. 05, Richardson, TX 75081 214-235-8332
Plessey Ceramic Div., 8th & Harrison Sts., Frenchtown, NJ 08825 ..201-996-2121
† Stevens Products, Inc., 128 N. Park St., E. Orange, NJ 07019 201-672-2140
† Thomson-CSF Comps. Corp., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070 201-438-2300

Packaging Materials, Antistatic-3800 — *See Vol. 2*

Packaging Materials, Foam & Plastic-3800 — *See Vol. 2*

Packaging Panels, Integrated Circuits — See Boards, Plug-in (Vol. 2)

Packaging Services — See Services, Packaging (Vol. 3)

Pads, L, T, & H — See Attenuators, Audio (Vol. 3)

Pads, Transistor Mounting-2100 — *See Vol. 2*

Paints, Conductive, Electric — See Coatings, Conductive, Electric (Vol. 2)

Paints, Finishing-1600 — *See Vol. 2*

Paints, Metallic, Conductive-1600 — *See Vol. 2*

Paints, Radioactive — See Coatings, Radioactive (Vol. 2)

Paints, Resistive-1600 (Also See Inks for Thick Film Microcircuits) — ***See Vol. 2***

Panel Equipment — See Dials (Vol. 2), Connectors (Vol. 2), Jacks (Vol. 2), Lights, Indicator (Vol. 1B), etc.

Panel Marking Kits — See Kits, Marking (Vol. 2)

Panels, Back Lighted & Edge Lighted-2450 — *See Vol. 1B*

Panels, Electroluminescent-2450 — *See Vol. 1B*

Panels, Fuse-4300 — *See Vol. 1B*

Panels, IC Packaging — See Boards, Plug-in (Vol. 2)

Panels, Jack-2100 — *See Vol. 2*

Panels, Metal — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. 2)

Panels, Meter — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. 2)

Panels, Patch — See Panels, Jack (Vol. 2)

Panels, Power BUS for ICs-3200 — *See Vol. 2*

Panels, Relay Rack — See Enclosures, Circuit Board, Module, & Relay Mounting (Vol. 2)

Paper Tape Equipment, Punch-2000 — *See Vol. 3*

Paper Tape Equipment, Reader-2000 — *See Vol. 3*

Paper Tape Equipment, Reader/Punch-2000 — *See Vol. 3*

Paper, Graphic Recording-3000 — *See Vol. 3*

Paper, Thermal-2000 — *See Vol. 3*

Patch Boards — See Boards, Programming (Vol. 2)

Peltier (Thermoelectric) Heat Pumps — See Cooling/Heating Modules, Thermoelectric (Vol. 1B)

Perforators, Paper Tape (Electrically Powered)-2000 — *See Vol. 3*

Phones — See Handsets, Chestsets, Headphones, Headsets, etc. (Vol. 3)

Photocells & Phototubes — See Cells, Photoconductive (Vol. 1B)

Photodetectors, GaAs-3700 — *See Vol. 1B*

Photoelectric Equipment — See Alarms, Controls, Photoelectric (Vol. 1B)

Photoelectric Tubes — See Cells, Photoconductive (Vol. 1B)

Photoemissive Detectors — See Cells, Photoemissive (Vol. 1B)

Photographic Services — See Services, Photographic (Vol. 3)

Photometers — See Meters, Light (Vol. 3)

Photomultiplier Tube Housings-5700

Bunting Magnetics, 500 So. Spencer Rd., Newton, KS 67114 316-284-2020
Corning Glass Works, Main Plant, MS 2136, Corning, NY 14831 607-974-4102
Gamma Scientific Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan 0534-34-3311
Pacific Instrs. Inc., 2355 Whitman Rd., Concord, CA 94518 415-827-9010
Products for Resch., 88 Holten St., Danvers, MA 01923 617-774-3250
§ Stanton Magnetics, Inc., Terminal Dr., Plainview, NY 11803 516-349-0200
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 516-433-5900

Pickups, Magnetic, Proximity, Torque, Vibration, etc. — See Transducers, Specific Type (Vol. 1B)

Pickups, Telephone (For Recording)-1300 — *See Vol. 3*

Piezoelectric Ceramics-2300

Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1394,1395
Piezo Elec. Prods., Inc., 212 Durham Ave., CN-15, Metuchen, NJ 08840, 201-548-2800 ....1B•1820,1821
Star Micronics, Inc., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854, 201-572-9512 ....3•1059
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ....1A•1437
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
Burleigh Instrs., Burleigh Pk., Fishers, NY 14453 716-924-9355
† Channel Inds., 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† EDO Western Corp., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115 ....801-486-7481/3846
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Norton, One New Bond St., Worcester, MA 01606 617-853-1000
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. 05, Richardson, TX 75081 214-235-8332
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Unilator Technical Ceramics Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 213-463-5618

Pilot Lights — See Lights, Indicator (Vol. 1B)

Pin Straighteners, Tube-5700

§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 ..215-825-4990

Pins, Cotter, Dowel, Taper, etc.-2825 — *See Vol. 2*

Pins, Electrically Conductive-2100 — *See Vol. 2*

Pins, Mechanical-2825 — *See Vol. 2*

Plastic Raw Materials, Liquids, Pellets, Powders, Resins-1600 — *See Vol. 2*

Plastics, Encapsulating — See Compounds, Encapsulating, Molding, Potting (Vol. 2)

Plastics Fabrication — See Services, Plastics Fabrication (Vol. 3)

Plastics, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. 2), Tubing, Heat Shrinkable (Vol. 2),

Plastics, Custom Molding — See Services, Custom Molding, Plastic (Vol. 3)

Plated Wire Memory Systems — See Memory Systems (Vol. 3)

Plates, Instructional, Name, Silk Screen — See Nameplates (Vol. 1B)

Platforms, Thermal — See Thermal Platforms (Vol. 3)

Plating Services — See Services, Plating (Vol. 3)

Players, Magnetic Tape — See Recorders, Magnetic Tape (Vol. 3)

Pliers-5400 — *See Vol. 2*

Plotters/Hard-Copy Devices-2000 — *See Vol. 3*

Plotters, X-Y, & Accessories-3000 — *See Vol. 3*

Plug & Jack Sets-2100 — *See Vol. 2*

Plug Adapters-2100 — *See Vol. 2*

Plug Buttons-2825 — *See Vol. 2*

Plug Caps & Shells-2100 — *See Vol. 2*

Plugboard Programming Systems — See Boards, Programming (Vol. 2)

Plugs, Electrical (All Types)-2100 — *See Vol. 2*

Plugs, Fused-2100 — *See Vol. 2*

Plugs (MIL)-2440 — *See Vol. 1B*

Pods (MIL), Chaff Rocket-3475 — *See Vol. 3*

Pods (MIL), First Generation-3475 — *See Vol. 3*

Pods (MIL), Multiband Smart-3475 — *See Vol. 3*

Pods (MIL), Two Faired, Cut in Half-3475 — *See Vol. 3*

Pointers, Dial-2400 — *See Vol. 2*

Position Control Systems, Servo — See Controls, Servo Systems (Vol. 3)

Positioning Systems, Multiple Axis, Computer Guided-4100 — *See Vol. 3*

Posts, Binding-2100 — *See Vol. 2*

Posts, Harness Board-6000 — *See Vol. 2*

Potentiometer Elements-4750

† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ....1A•2040
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ....1B•1207
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Carbon Ceramic-4750

Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•2039
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131 408-946-6000
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Potentiometers, Carbon Film-4750

Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 ....3•1068
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•2039
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ....1A•2055
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Potentiometers, Ceramic Metal (CERMET)-4750

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1788,2019-2021
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 ....3•1068
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ....1A•2022-2027,2033,2034
CTS of Berne, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ....1A•2036
CTS Electronics Corp., Paso Robles Div., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ....1B•1580
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•2039
Mepco/Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ....1A•2046,1B•1012
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•2016,2048
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON M6M 2V6 Canada, 416-249-7103 ....1A•2052
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ....1A•2056,2057,2060
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ....1A•1999
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500 ....1A•2074,2078-2081
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
§† CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 212-691-9050
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
§† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333

Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181

Potentiometers, Composition, Carbon-4750

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•2019-2021
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 ....3•1068
CTS of Berne, 406 Parr Rd., Berne, IN 46711, 219-589-3111 ....1A•2036
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ....1A•2047
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•2016,2048
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•2051
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ....1A•2055
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ....3•1055
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
§ CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
§ Paccom, 3928 148th NE, Redmond, WA 98052 ....206-883-9200;800-426-6254
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Piher Intl., 565 W. Golf Rd., Arlington Hgts., IL 60005 ....312-640-8300; 800-323-6693
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Potentiometers, Conductive Plastic-4750

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1788,2020,2021
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ....1A•2033,2034
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ....1A•2038,1B•1146-1148
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ....1A•2040
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 1A•2041-2045
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•2016,2048
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 ....1A•2057,2060
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 1A•2067,1B•1019, 1207,1883
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§† Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
PIC Design, P.O. Box 1004, Middlebury, CT 06762 203-758-8272
Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Potentiometers, Hot Molded-4750

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1788,2020,2021
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•2051
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON M6M 2V6 Canada, 416-249-7103 ....1A•2052
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Potentiometers, Hybrid-4750

ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ....1A•2038,1B•1146,1147
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Dynamic Measurements, 8 Lowell Ave., Winchester, MA 01890 617-729-7870
Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038

Potentiometers, Lab Type-4750

IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 ....3•1244,1245
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ....3•1250
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 ....1A•2053
Biddle Instruments, A Thorn EMI Co., 510 Township Line Rd., Blue Bell, PA 19422 215-646-9200
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Bristol Babcock Inc., 40 Bristol St., Waterbury, CT 06708 203-575-3000
† Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
§ Guildline Instrs., 2 Westchester Plaza, Elmsford, NY 10523 914-592-9101
Leeds & Northrup Instrs., A Unit of General Signal Corp., Sumneytown Pike, North Wales, PA 19454 215-643-2000
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Penn Airborne Prods., Industrial Hwy., Southampton, PA 18966 215-355-3400
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
§ West Instrs, Gulton Inds, M. C. S. Div., Gulton Indl Pk, E. Greenwich, RI 02818 401-884-6800
Yokogawa Corp. of America, 2 Dart Rd., Shenandoah, GA 30265 404-253-7000

Potentiometers, Linear-4750

Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ....1A•2032,2034
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ....1A•2038,1B•1146-1148
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 .... 2•1763
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 ....1A•2040
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 1A•2041-2043
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ....1A•2047
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•2048
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•2051
Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788, 516-435-8300 ....3•1138
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON M6M 2V6 Canada, 416-249-7103 ....1A•2052
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ....1A•2055
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ....1A•2066,2067, 1B•1019,1207,1883,3•1934
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 ....1A•2069
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500 ....1A•2074-2081
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131 408-946-6000
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161

Potentiometers, Linear-4750 (Cont'd)

† Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 .....914-YO3-5900
§† CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Mepco/Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121 619-453-0332
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
Singer Co., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424 201-785-6000
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
§ Temposonics, 131 East Ames Ct, Plainview, NY 11803 516-349-1950
§ Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Metal Film-4750

Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 .....1A•1808
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 .....3•1245
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
§† Mepco/Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121 619-453-0332
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Metal, Glazed — See Potentiometers, Ceramic Metal (Vol. 1A)

Potentiometers, Motorized-4750

§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 .....1A•2038,1B•1146-1148
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955, 305-259-7105 .....3•1932
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 .....1A•2040
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 .....1B•1207,3•1934
Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555

Potentiometers, Multiturn-4750

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 .....1A•1788,2019,2020
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 .....3•1068
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 .....1A•2022-2025,2032,2033
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 .....1A•2038,1B•1146-1148
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 .....2•1763
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 .....1A•2045
Mepco/Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 .....1A•2046,1B•1012
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .....1A•2016,2049
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 .....1A•2053
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 .....1A•2061
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .....1A•1999
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 .....1B•1207,1883
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 .....1A•2069
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500 .....1A•2074-2081
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
§ CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
CTS of Berne, 406 Parr Rd., Berne, IN 46711 219-589-3111
§† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642

Potentiometers, Nonlinear-4750

§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 .....2•1763
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 .....1A•2040
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 .....1A•2055
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 1A•2067,1B•1019, 1883
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
† CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777

Potentiometers, Rectilinear-4750

CTS of Berne, 406 Parr Rd., Berne, IN 46711, 219-589-3111 .....1A•2036
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 .....1A•2039
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 .....1A•2040
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 .....1A•2047
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 .....1B•1883
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500 .....1A•2074-2081
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
§ Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
§ Bourns Instrs., Inc., Industrial Div., 1960 Chicago Ave., Unit F, Riverside, CA 92503 714-781-5147
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 .....914-YO3-5900
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850

§—Product sold through distributors †—Product meets MIL specs

§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054 619-757-7770
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749 818-964-6565
§ Temposonics, 131 East Ames Ct, Plainview, NY 11803 516-349-1950
§ Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181

Potentiometers, Servo Mount-4750

† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 .... 1A•2033
§ ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 .... 1B•1146-1148
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, 805-499-7779 .... 1A•2040
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 .1A•2041, 2044,2045
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 .... 1A•2053
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 .... 1A•2058-2061
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 .... 1B•1207
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 212-361-0800
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Potentiometers, Trimmer-4750

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 .... 1A•1788,2019,2020
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 .... 3•1068
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 .... 1A•2022-2027
§ CTS of Berne, 406 Parr Rd., Berne, IN 46711, 219-589-3111 .... 1A•2036
§ CTS Electronics Corp., Paso Robles Div., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 .... 1B•1580
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 .... 1A•2039
§† Mepco/Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 .... 1A•2046,1B•1012
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 .... 1A•2047
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•2048,2049
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON M6M 2V6 Canada, 416-249-7103 .... 1A•2052
† Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 .... 1A•2055
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 .... 1A•2056,2057
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405, 818-781-1642 .... 1A•2064,2065
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .... 1A•1999
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2070
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 .... 1A•2068
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500 .... 1A•2072,2073,2082-2084
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 .... 914-YO3-5900
§ CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
CTS Halex, 1202 McGaw Ave., Irvine, CA 92714 714-556-2850
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
§ Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Potentiometers, Trimmer, Carbon Composition — See Potentiometers, Trimmer (Vol. 1A)

Potentiometers, Trimmer, Carbon Film — See Potentiometers, Trimmer (Vol. 1A)

Potentiometers, Trimmer, Ceramic Metal (CERMET) — See Potentiometers, Trimmer (Vol. 1A)

Potentiometers, Trimmer, Conductive Plastic — See Potentiometers, Trimmer (Vol. 1A)

Potentiometers, Trimmer, Hot Molded — See Potentiometers, Trimmer (Vol. 1A)

Potentiometers, Trimmer, Metal Film — See Potentiometers, Trimmer (Vol. 1A)

Potentiometers, Trimmer, Wirewound — See Potentiometers, Trimmer (Vol. 1A)

Potentiometers, Wirewound-4750

§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 .... 1A•2022,2024,2026,2032,2033
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 .... 1A•2037
§† ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 .... 1A•2038,1B•1146-1148
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 .... 2•1763
§† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 1A•2041-2043,2045
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ...1A•2050, 2051
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, 203-735-7405 .... 1A•2053
§† Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 .... 1A•2057-2059,2061
§† VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 .... 1A•2069
§† Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500 .... 1A•2075-2077
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
† Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
§† Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 .... 914-YO3-5900
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
† Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
† Electronic Controls, Inc., 561 Tamarack Ave., Brea, CA 92621 714-990-0850
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
† Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786

§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650 ..201-944-2221
§† Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Potentiometers (MIL)-2440 — ***See Vol. 1B***

Power Line Monitor Printers — See Printers, Event (Vol. 3)

Power Supplies, AC to DC Adapter-4000 — ***See Vol. 3***

Power Supplies, AC Input, Up to 30 VDC Output-4000 — ***See Vol. 3***

Power Supplies, AC Input, 31 to 300 VDC Output-4000 — ***See Vol. 3***

Power Supplies, AC Input, 301 to 1,000 VDC Output-4000 — ***See Vol. 3***

Power Supplies, AC Input, Greater than 1,000 VDC Output-4000 — ***See Vol. 3***

Power Supplies, AC Output-4050 — ***See Vol. 3***

Power Supplies, Bipolar-4000 — ***See Vol. 3***

Power Supplies, Constant Current-4000 — ***See Vol. 3***

Power Supplies, Constant Voltage — See Power Supplies, Linear (Vol. 3)

Power Supplies, DC Input, AC Output — See Power Supplies, AC Output (Vol. 3)

Power Supplies, DC Input, DC Output — See Converters, DC to DC (Vol. 3)

Power Supplies, Encapsulated-4000 — ***See Vol. 3***

Power Supplies, Enclosed-4000 — ***See Vol. 3***

Power Supplies, Ferroresonant-4000 — ***See Vol. 3***

Power Supplies, High Voltage — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. 3)

Power Supplies, Isolated-4000 — ***See Vol. 3***

Power Supplies, Lab (Including Metered Units)-4000 — ***See Vol. 3***

Power Supplies, Laser — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. 3)

Power Supplies, Linear-4000 — ***See Vol. 3***

Power Supplies, Logic Level (Including Microprocessor) — See Power Supplies, AC Input, Up to 30 VDC Output (Vol. 3)

Power Supplies, Microwave — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. 3)

Power Supplies, Multiple Output-4000 — ***See Vol. 3***

Power Supplies, Open Frame-4000 — ***See Vol. 3***

Power Supplies, Photomultiplier — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. 3)

Power Supplies, Plug In-4000 — ***See Vol. 3***

Power Supplies, Printed Circuit Card-4000 — ***See Vol. 3***

Power Supplies, Programmable-4000 — ***See Vol. 3***

Power Supplies, Standby (Emergency)-4000 — ***See Vol. 3***

Power Supplies, Submodular-4000 — ***See Vol. 3***

Power Supplies, Switching-4000 — ***See Vol. 3***

Power Supplies, Switching, Battery Backup-4000 — ***See Vol. 3***

Power Supplies, Uninterruptable (UPS)-4050 — ***See Vol. 3***

Power Supplies, Wall Plug-in — Power Supplies, Plug-in (Vol. 3)

Power Supplies, Welding, Electroplating — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. 3)

Power Supplies (MIL), DC-3475 — ***See Vol. 3***

Power Supplies for Displays — See Converters, DC to DC (Vol. 3), Power Supplies, AC Output (Vol. 3),

Power Supply Interfaces & Accessories-4000 — ***See Vol. 3***

Preamplifiers-1100 — ***See Vol. 3***

Prebonding Etchants — See Chemicals, Etching (Vol. 2)

Preforms, Precious Metal-2825 — ***See Vol. 2***

Prescalers-2900 — ***See Vol. 3***

Preselector-Mixers-3450

§† Eaton Corp, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086 408-737-7300
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
FG Engrg., Box 476, Fredonia, AZ 86022 602-643-7375
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 .....315-437-4529; 800-448-1666
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Preselectors-1900 — ***See Vol. 3***

Pressure Vessels — See Chambers, Pressure (Vol. 3)

Pressure Indicators — See Gauges, Pressure (Vol. 3)

Pressurization Units — See Chambers, Pressure (Vol. 3)

Printed Circuits & Printed Circuit Materials (MIL)-2440 — ***See Vol. 1B***

Printer/Plotters-2000 — ***See Vol. 3***

Printers, Daisywheel-2000 — ***See Vol. 3***

Printers, Digital-2000 — ***See Vol. 3***

Printers, Dot Matrix Impact-2000 — ***See Vol. 3***

Printers, Event-3000 — ***See Vol. 3***

Printers, Thermal-2000 — ***See Vol. 3***

Printers, Line — See Printers, Digital (Vol. 3)

Printers, Page-2000 — ***See Vol. 3***

Printers, Serial-2000 — ***See Vol. 3***

Printing, Dry Transfer — See Kits, Marking (Vol. 2)

Probe Cards, Semiconductor Testing-4100 — ***See Vol. 3***

Probes, Hall-4800

§ Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 305-678-6900 .... 3•1194,1197
North American Soar Corp., 11126 Cornell Ave., Cherry Hill, NJ 08002, 609-488-1060 .... 3•1270
† Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ....1B•1867
Active Control Instrmn., P.O. Box 243-Wildwood Circle, Key Largo, FL 33037 305-451-1000
§ Fluke, John, Mfg. Co., Box C9090, MS 250C, Everett, WA 98206 ...206-356-5400
LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102
§ Magnos, Old School House Rd., Harvard, MA 01451 617-456-8880
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
RFL Inds., A Dowty Grp. Co./Instr. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ Sunshine Sci. Instr., 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Walker Scientific, Rockdale St., Worcester, MA 01606 617-852-3674

Probes, High Voltage (1,000 Volts & Over)-2900 — ***See Vol. 3***

Probes, Logic Test-2900 — ***See Vol. 3***

Probes, Microwave-3450

Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§ Nu-Concept Computer Sys., Rte. 309 & Advance La., Colmar, PA 18915 215-822-8400
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Probe-Rite, Inc., 2725 Lafayette St., Santa Clara, CA 95050 408-727-0100

Probes, Oscilloscopes-2975 — *See Vol. 3*

Probes, RF-2900 — *See Vol. 3*

Probes, Temperature-2900 — *See Vol. 3*

Probes, Test Lead-2900 — *See Vol. 3*

Process Control Systems-2200 — *See Vol. 3*

Processors, Array — See Array Processors (Vol. 3)

Processors, Communications, Front End-1900 — *See Vol. 3*

Processors, Communications, Message Switching-1900 — *See Vol. 3*

Processors, Communications, Network Node-1900 — *See Vol. 3*

Processors, Communications, Standalone-1900 — *See Vol. 3*

Processors, Image-2000 — *See Vol. 3*

Processors, Remittance-2000 — *See Vol. 3*

Program Board Connectors — See Connectors, Plug-in, Program Board (Vol. 2)

Programmers, Cam & Drum-2200 — *See Vol. 3*

Programmers, Matrix Boards — See Boards, Programming (Vol. 2)

Programmers, PROM & Logic Array-3130

Allied Systems Corp., Box 18077, Greensboro, NC 27419 919-299-2294
Ango Electronics Corp., Post Office Box 112, Harrison, NJ 07029 .... 212-685-6336; 201-483-7116
Applied Micro Technlg., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745 602-622-8605
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
Citel, Inc., 3060 Raymond St., Santa Clara, CA 95050 408-727-6562
§ Curtis Electro Devices, Inc., Box 4090, Mountain View, CA 94040 415-964-3846
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Data I/O Corp., 10525 Willows Rd. N.E., C-46, Redmond, WA 98052 206-881-6444
† Datron Instrs., Inc., 3401 SW 42nd Ave., Stuart, FL 33497 305-283-0935
Digelec, Inc., Affil. Wavetek Corp., 586 Weddell Drive, Suite 1, Sunnyvale, CA 94089 408-745-0722
Digital Equip., One Iron Way, Marlborough, MA 01752 ....
Digital Media, 3178 Gibraltar Ave., Costa Mesa, CA 92626 714-751-1373
Dynatec International, 3594 West 1820 South, Salt Lake City, UT 84104 .... 801-973-9500;800-722-7425
GMR Inc., Computer Elctrns., 1048 E. Burgrove St., Carson, CA 90746 213-639-4663
Harrel, Inc., 16 Fitch St., E. Norwalk, CT 06855 203-866-2573
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Innovatek Microsystems, Inc., Smithfield Rd., Millerton, NY 12546 914-373-9003
† International Microsystems, 11554 C Ave., Auburn, CA 95603 916-885-7262
§ Klockner Moeller, 4 Strathmore Rd., Natick, MA 01760 617-655-1910
§ Kontron Elctrns., 630 Price Ave., Redwood City, CA 94062 415-361-1012
Matrix Corp., 1639 Green St., Raleigh, NC 27603 919-833-2837
§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
Oliver Advanced Engrg., 676 W. Wilson Ave., Glendale, CA 91203 818-240-0080
Onset Computer Corp., 199 Main St., P.O. Box 1016, N. Falmouth, MA 02556 617-563-2267
PCM-PAC Cyber-Metric, 6800 Sierra Ct., Dublin, CA 94568 415-829-8700
PPM, Inc., 23945 Mercantile Rd., Cleveland, OH 44122 216-292-6006
Pro-Log, 2411 Garden Rd., Monterey, CA 93940 408-372-4593
§† Rockwell Int'l., 4311 Jamboree Rd., Newport Beach, CA 92660 800-854-8099
Southern Computer Corp., 3720 N. Stratford Rd. N.E., Atlanta, GA 30342 404-231-5363
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740 818-914-1924
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

Programmers, Punched Card-2000 — *See Vol. 3*

Programmers, Tape-2000 — *See Vol. 3*

PROM Programmers — See Programmers, PROM & Logic Array (Vol. 1A)

Protectors, Brownout-4300 — *See Vol. 1B*

Protectors, Surge-4300 (Also See Suppressors, Transient Voltage) — ***See Vol. 1B***

Public Address Systems-1300 — *See Vol. 3*

Pullers, Circuit Board-5400 — *See Vol. 2*

Pullers, Tube-5400 — *See Vol. 2*

Pulleys-2500 — *See Vol. 2*

Pulsers, Diode — See Power Supplies, AC Input, Greater than 1,000 VDC Output (Vol. 3)

Pulsers, Logic Test-2900 — *See Vol. 3*

Pumps, Vacuum-4100 — *See Vol. 3*

Punches, Chassis-5400 — *See Vol. 2*

Pyrometers, Infrared-2900 — *See Vol. 3*

Pyrometers, Optical, Noninfrared-5300 — *See Vol. 1B*

Pyrometers, Recording-2900 — *See Vol. 3*

Q Bus — See Board Computers & Subassemblies (Vol. 3)

Quartz, Fused-2500 — *See Vol. 2*

Quartz, Raw — See Crystals, Quartz (Vol. 1A)

Racks, Aging — See Ovens, Aging, Burn-in, Life Test (Vol. 3)

Racks, Cabinet — See Enclosures, Equipment & Panel Mounting (Vol. 2)

Racks, Circuit Board — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. 2)

Racks, Desk & Console — See Enclosures, Equipment & Panel Mounting (Vol. 2)

Racks, Module — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. 2)

Racks, Relay & Mounting — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. 2)

Radar Homing & Warning (RHAW) Systems (MIL)-3475 — *See Vol. 3*

Radar Forward-Looking Infrared (FLIR) Sets (MIL)-3475 — *See Vol. 3*

Radar Intercept (MIL)-3475 — *See Vol. 3*

Radar (MIL), Tail Warning-3475 — *See Vol. 3*

Radar Systems (MIL), Elint-3475 — *See Vol. 3*

Radar System Components-3450

† Interface Engrg., 386 Lindelof Ave., Stoughton, MA 02072, 617-344-7383 .. 3•1164
American Electronic Labs., Box 552, Lansdale, PA 19446 215-822-2929
† Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Cardion Elctrns., Div. of Gen. Sig. Conts., Inc. Unit of Gen. Sig. Corp., Long Island Expwy., Woodbury, NY 11797 516-921-7300
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-563-6000
Cober Elctrns., 102 Hamilton Ave., Stamford, CT 06902 203-327-0003
Continental Electronics Mfg. Co., P.O. Box 270879, Dallas, TX 75227 214-381-7161
Datron Sys., 20700 Plummer St., Chatsworth, CA 91311 818-882-9616
† Eaton Corp., A.I.L. Div., Comac Rd., Deer Park, NY 11729 516-595-3094
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000

§—Product sold through distributors †—Product meets MIL specs

† ITT Gilfillan, 7821 Orion Ave., Van Nuys, CA 91409 818-988-2600
Kaiser Systems, Inc., 33 Cherry Hill Drive, Danvers, MA 01923 617-777-5102
KSI, 33 Cherry Hill Dr., Danvers, MA 01923 617-777-5102
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
Mathematical Systems Design, Inc., 2850 Ocean Park Blvd., Ste. 300, Santa Monica, CA 90405 213-450-9851
† Metric Sys., 645 Anchors St., Ft. Walton Beach, FL 32548 904-244-9600
† Microwave/Sys., 1 Adler Dr., E. Syracuse, NY 13057 315-437-9951
† Milliflect, 7752 B Enterprise Dr., Newark, CA 94560 415-791-5188
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
RHG Electronics Lab., Inc., 161 E. Industry Ct., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
† Signatron, 12 Hartwell Ave., Lexington, MA 02173 617-861-1500
Singer Co., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424 201-785-6000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tasker Systems, 20131 Sunburst St., Chatsworth, CA 91311 213-341-3010
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 619-583-3525
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Texscan Instruments, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
† TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
† Whittaker Corp., 10880 Wilshire Blvd., Los Angeles, CA 90024 213-475-9411

Radio Communications Systems — See Communications Systems (Vol. 3)

Radiographic Equip. — See X-ray Inspection Equip. (Vol. 3)

Radiometers-2900 — *See Vol. 3*

Radomes & Windows, Microwave-3450

Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
Electronic Space Sys. Corp., Old Powder Mill Rd., Concord, MA 01742 617-369-7200
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
† Milliflect, 7752 B Enterprise Dr., Newark, CA 94560 415-791-5188
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
† Rogers Corp., One Technology Dr., Rogers, CT 06263 203-774-9605
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 619-583-3525
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800

Reactors, Charging-5600

Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Reactors, Epitaxial — See Machines & Accessories, Semiconductor Manufacturing (Vol. 3)

Reactors, Filter-5600

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ....1A•2176
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ....1A•2211,3•1663
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ....3•1663
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ....1A•1274
Wilco Corp., 4030 W. Tenth St., Indianapolis, IN 46222, 317-241-2516 ....1A•1306, 1307
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§ Alltech Assocs. Inc., Applied Science Labs., 2051 Waukegan Rd., Deerfield, IL 60015 312-948-8600
§ American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, 50 Ash St., Yonkers, NY 10701 914-963-3400
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Reactors, Loading-5600

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Reactors, Saturable-1800

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ....1A•2176
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ....1A•2211
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820

† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oram Elctrns., Rte. 22, Brewster, NY 10509 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Sigma Instrs., 170 Pearl St., Braintree, MA 02184 617-843-5000
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134 215-426-9105
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Reactors (MIL)-2440 — *See Vol. 1B*

Readers, Badge-2000 — *See Vol. 3*

Readers, Bar Code-2000 — *See Vol. 3*

Readers, Character-2000 — *See Vol. 3*

Readers, Magnetic Card-2000 — *See Vol. 3*

Readers, Magnetic Stripe Card-2000 — *See Vol. 3*

Readers, Punched Card-2000 — *See Vol. 3*

Readers, Punched Tape-2000 — *See Vol. 3*

Readers, Static Card-2000 — *See Vol. 3*

Readers, Time Code-2000 — *See Vol. 3*

Readouts — See Tubes, Readout (Vol. 1A)

Reamers-5400 — *See Vol. 2*

Receivers, AM/FM (Incl. Precision Test)-2900 — *See Vol. 3*

Receivers, Communication-1900 — *See Vol. 3*

Receivers, Fiber Optic-2475 — *See Vol. 1B*

Receivers, Field Intensity, Microwave — See Receivers, Microwave (Vol. 3)

Receivers, Fixed Frequency-2900 — *See Vol. 3*

Receivers, Frequency Shift-1900 — *See Vol. 3*

Receivers, Headphone — See Handsets, etc. (Vol. 3)

Receivers, Loran & Omega-1900 — *See Vol. 3*

Receivers, Microwave-3400 — *See Vol. 3*

Receivers, Monitoring, Communications-1900 — *See Vol. 3*

Receivers, NBS-2900 — *See Vol. 3*

Receivers, Telemetry-1900 — *See Vol. 3*

Receivers, Tone-1900 — *See Vol. 3*

Receivers, TV — See Monitors, Video (Vol. 3)

Receivers (MIL)-3475 — *See Vol. 3*

Receivers (MIL), Acoustic Intercept-3475 — *See Vol. 3*

Receivers (MIL), Compass Sail/Clockwise-3475 — *See Vol. 3*

Receivers (MIL), Digital Warning-3475 — *See Vol. 3*

Receivers, (MIL), ECM-3475 — *See Vol. 3*

Receivers (MIL), Elint-3475 — *See Vol. 3*

Receivers (MIL), ESM-3475 — *See Vol. 3*

Receivers (MIL), Handoff-3475 — *See Vol. 3*

Receivers (MIL), IFM-3475 — *See Vol. 3*

Receivers (MIL), IR Warning-3475 — *See Vol. 3*

Receivers (MIL), Missile Launch Warning-3475 — *See Vol. 3*

Receivers (MIL), Radar Warning-3475 — *See Vol. 3*

Receivers (MIL), Radio-3475 — *See Vol. 3*

Receivers (MIL), Recon-3475 — *See Vol. 3*

Receivers (MIL), Search-3475 — *See Vol. 3*

Receivers (MIL), Shipboard-3475 — *See Vol. 3*

Receivers (MIL), Submarine-3475 — *See Vol. 3*

Receivers (MIL), Surveillance-3475 — *See Vol. 3*

Receivers (MIL), Warning-3475 — *See Vol. 3*

Receptacles — See Connectors (Vol. 2), Jacks; Sockets

Recognition Equipment, Speech-2000 — *See Vol. 3*

Recorders, Computer Data-2000 — *See Vol. 3*

Recorders, Electrostatic-3000 — *See Vol. 3*

Recorders, Event/Multievent-3000 — *See Vol. 3*

Recorders, FM — See Recorders, Magnetic Tape (Vol. 3)

Recorders, Graphic — See Recorders, Specific Types (Vol. 3)

Recorders, Magnetic Tape-2000 — *See Vol. 3*

Recorders, Polar-3000 — *See Vol. 3*

Recorders, Program Loading-2000 — *See Vol. 3*

Recorders, Pyrometer — See Pyrometers, Recording (Vol. 3)

Recorders, Sound Level-1300 — *See Vol. 3*

Recorders, Strip Chart-3000 — *See Vol. 3*

Recorders, Transient-3000 — *See Vol. 3*

Recorders, Vibration-3000 — *See Vol. 3*

Recorders, Video-1900 — *See Vol. 3*

Recorders, X-Y — See Plotters X-Y (Vol. 3)

Recorders (MIL), Infrared-3475 — *See Vol. 3*

Recorders (MIL), Magnetic Tape-3475 — *See Vol. 3*

Recorders (MIL), RHAW-3475 — *See Vol. 3*

Recording Systems (MIL)-3475 — *See Vol. 3*

Rectifiers, Bridges & Assemblies-4800

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1788,2089
Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ....1A•2092
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ....1A•2096
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•2097
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ....1A•2098
§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2105**
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 3•1663
† **NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 3•1663**
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108
TRW Optoelectronics Div., 1201 Tappan Circle, Carrollton, TX 75006, 214-323-2200 .... 1B•1246-1249
§ **Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046, 214-271-8511 ....1A•2112**
† **Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ....1A•2113**
A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† Basic Elctrns., 11762 Western Ave. "Q", Stanton, CA 90680 714-530-2400
§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§† Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 .201-335-6723
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
§† Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
Lambda Electronics, 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200

Lambda Semiconductors, 121 International Dr., Corpus Christi, TX 78410 ......512-289-0403;800-255-9606
Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430
† Megatran Electronic Power, Rising Sun Rd., Bordentown, NJ 08505 609-298-7300
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

Rectifiers, Copper Oxide-4800

Rectifiers, Copper Sulfide-4800

Rectifiers, Electron Tube — See Tubes, Rectifying (Vol. 1A)

Rectifiers, Germanium-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ......1A•2090
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Rectifiers, Selenium-4800

A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
Power Conversion Prods., 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300

Rectifiers, Silicon-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ......1A•2090
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ......1A•2092
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ......1A•2096
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ......1A•2097
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ......1A•2098
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ......1A•2099,2105
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ......1A•2107
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ......1A•2108
TRW Optoelectronics Div., 1201 Tappan Circle, Carrollton, TX 75006, 214-323-2200 ......1B•1246-1249
§ Varo Semiconductor, Inc., 2800 W. Kingsley Dr., Garland, TX 75046, 214-271-8511 ......1A•2112
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ......1A•2113
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Christie Elec. Corp., 20665 Manhattan Pl., Torrance, CA 90501 213-320-0808
§ Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 .201-335-6723
§ Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 ..212-651-7200
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† General Instr., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802 516-733-3333
§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430
§† NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Teccor Elctrns., P.O. Box 619009, Dallas, TX 75261-9009 214-252-7651
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§ Vidaire Elctrns., 150 Buffalo Ave., Freeport, NY 11520 516-623-6696
† Westcode Semiconductors, Inc., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410 201-791-3020
§† Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Rectifiers, Silicon Controlled — See Thyristors (Vol. 1A)

Rectifiers (MIL), Semiconductor-2440 — *See Vol. 1B*

Reducers, Speed-3500 (Also See Gears & Gear Mechanisms) — *See Vol. 1B*

Reels, Tape — See Tape Recording Accessories (Vol. 3)

Reference Books — See Technical Books (Vol. 3)

References, DC Voltage-2900 — *See Vol. 3*

Refrigerants, Spray-1600 — *See Vol. 2*

Refrigerated Cooling Equipment — See Air Conditioners (Vol. 2)

Refrigerators, Environmental Test-2550 — *See Vol. 3*

Regulators, Current-4000 — *See Vol. 3*

Regulators, Frequency-4050 — *See Vol. 3*

Regulators & References, Silicon-4800 (Also See Diodes, Zener & Stabistors)

Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 .... 3•1250
§ **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•1674-1676**
§† ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
§† Advanced Micro Devices, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088 408-732-2400
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§† Codi Semiconductor, Inc., 350 Hurst Ave., Linden, NJ 07036 201-862-8484
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Linear Technology Corp., 1630 McCarthy Blvd., Milpitas, CA 95035 408-942-0810
§† Micro Semiconductor, 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† Northwest Microcircuits, 2115 N. College, Newburg, OR 97132 503-538-7081
Power Designs, Inc., 1700 Shames Dr., Westbury, NY 11590 516-333-6200
§ Semicon, 10 North Ave., Burlington, MA 01803 617-272-9015
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Standard Reference Labs, Inc., Coan Pl., Metuchen, NJ 08840 201-549-9280
§ St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Sunshine Sci. Instr., 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
§† Teledyne Semiconductor, 1300 Terra Bella Ave., Mountain View, CA 94040 415-968-9241
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
† Trio Labs., 80 Dupont St., Plainview, NY 11803 516-349-0400

Regulators & Stabilizers, Voltage-4000 (Also See Transformers, Voltage Regulating; Hybrid Voltage Regulators) ***— See Vol. 3***

Relays, Antenna — See Relays, RF (Incl. Antenna & Coaxial) (Vol. 1B)

Relays, Audio Operated — See Relays, Frequency Selective (Vol. 1B)

Relays, Coaxial — See Relays, RF (Vol. 1B)

Relays, Contact — See Relays, Power (Vol. 1B)

Relays, Cradle-4500 — *See Vol. 1B*

Relays, Crystal Can, 1/2 Crystal Can-4500 — *See Vol. 1B*

Relays, Current Sensing-4500 — *See Vol. 1B*

Relays, Differential-4500 — *See Vol. 1B*

Relays, Frequency Selective-4500 — *See Vol. 1B*

Relays, General Purpose-4500 — *See Vol. 1B*

Relays, High Voltage (500 Volts & Over)-4500 — *See Vol. 1B*

Relays, Hybrid-4500 — *See Vol. 1B*

Relays, Impulse — See Relays, Stepping (Vol. 1B)

Relays, I/O Modules — See Modules, I/O Relays (Vol. 1A)

Relays, Latching-4500 — *See Vol. 1B*

Relays, Mercury-Wetted Contacts-4500 — *See Vol. 1B*

Relays, Meter-4500 — *See Vol. 1B*

Relays, Motor Start-4500 — *See Vol. 1B*

Relays, Phase Sensing-4500 — *See Vol. 1B*

Relays, Plug-in-4500 — *See Vol. 1B*

Relays, Power-4500 — *See Vol. 1B*

Relays, Printed Circuit Mounting (Including Transistor & DIP Case Types)-4500 — *See Vol. 1B*

Relays, Programmable-4500 — *See Vol. 1B*

Relays, RF (Incl. Antenna & Coaxial)-4500 — *See Vol. 1B*

Relays, Reed-4500 — *See Vol. 1B*

Relays, Sealed-4500 — *See Vol. 1B*

Relays, Sensitive-4500 — *See Vol. 1B*

Relay, Solid State-4500 — *See Vol. 1B*

Relays, Stepping-4500 — *See Vol. 1B*

Relays, Telephone-4500 — *See Vol. 1B*

Relays, Thermal-4500 — *See Vol. 1B*

Relays, Time Delay-4500 — *See Vol. 1B*

Relays, Transistor & DIP Case Types — See Relays, Printed Circuit Mounting (Vol. 1B)

Relays, Vacuum-4500 — *See Vol. 1B*

Relays, Voltage Sensitive-4500 — *See Vol. 1B*

Relays (MIL)-2440 — *See Vol. 1B*

Repeaters, Pulse — See Transponders (Vol. 3)

Repeaters, Servo-4900 — *See Vol. 3*

Resins, Encapsulating — See Compounds, Encapsulating, Molding & Potting (Vol. 2)

Resins, Synthetic — See Plastic Raw Materials (Vol. 2)

Resistance Comparators — See Bridges, Resistance (Vol. 3)

Resistor Hardware-2800 — *See Vol. 2*

Resistors, Adjustable-4700 (Also See Potentiometers; Rheostats)

Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 .... 3•1068
† **Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 .... 1A•2022-2027**
§ **CTS of Berne, 406 Parr Rd., Berne, IN 46711, 219-589-3111 .... 1A•2036**
§† **E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 .... 1A•1872**
IET Labs, Inc., 534 Main St., Westbury, NY 11590, 516-334-5959 .... 3•1244
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 212-361-0800 .... 2•1763
Mepco/Electra, Inc., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 .... 1A•2046,1B•1012
† **Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 .... 1A•1898-1900**
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 .... 1A•2047
§† **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 .... 1A•1916**
Precision Elctrn. Comps. Ltd., 1919 Hafis Rd., Toronto, ON M6M 2V6 Canada, 416-249-7103 .... 1A•2052
† **Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 .... 1A•1937**
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 .... 1A•2055
§† **Spectrol Elctrns., 17070 East Gale Ave., City of Industry, CA 91749, 818-964-6565 .... 1A•2056,2057**
§† **Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405, 818-781-1642 .... 1A•2064,2065**
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1985
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .... 1A•1999
§ **Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2070**
§† **VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, 813-347-2181 .... 1A•2068**
§† **Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, 717-876-1500 .... 1A•2072,2073,2082-2084**
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§† Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 .... 914-YO3-5900
§† CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286

Resistors, Adjustable-4700 (Cont'd)

† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
† New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Resistors, Ballast (Incl. Tube & Solid State Devices)-4700

Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148, 312-620-8394 .... 3•1911
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 414-271-9900
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900

Resistors, Beryllia Core — See Resistors, Integral Heat Dissipator (Vol. 1A)

Resistors, Bulk Ceramic-4700

Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 .... 1A•1832-1834
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ....714-979-8833; 714-634-1535
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234

Resistors, Carbon Film-4700

§ **Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 ....1A•1828**
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ....1A•1860
§ **International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ....1A•1876**
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 ....1A•1877
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-822-9601 ....1A•2098
§ **KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ....1A•1885,1886**
§ **Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ....1A•1891**
§† **Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ....1A•1893**
§ **NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ....1A•1906**
§ **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•1917**
§ **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ....1A•1946,1947**
§ **Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ....1A•2000,2002**
§ Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 717-938-1451
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 ...212-691-9050
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§† Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
§† Paccom, 3928 148th NE, Redmond, WA 98052 ....206-883-9200:800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Piher Intl., 565 W. Golf Rd., Arlington Hgts., IL 60005 ....312-640-8300; 800-323-6693
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Roederstein Elctrns., Inc., P.O. Box 5588, Statesville, NC 28677 704-872-8101
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Ceramic Core-4700

† **Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 .... 1A•1898-1900**
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ....1A•1906
§† **Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 .... 1A•1907-1909**
§† **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ...1A•1910, 1912,1915,1916**
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ....1A•1920
§ **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1946-1952**
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ....201-DE4-0700
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Colber Corp., 26A Buffington St., Irvington, NJ 07111 201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
§ Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ....818-442-3310; 213-686-0535
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
† Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205 ..201-926-3036
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
† Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Ceramic Metal (Cermet)-4700

Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ....1A•1829
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929**
Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655

§† CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS of Berne, 406 Parr Rd., Berne, IN 46711 219-589-3111
§ CTS Electronics Corp., Paso Robles Div., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
† CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ....818-442-3310; 213-686-0535
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ....714-979-8833; 714-634-1535
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500

Resistors, Chip (For Microcircuits)-4700

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1800,1802
Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95131, 408-946-6000 ....3•1068
§ Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ....1A•1829
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ....1A•1853,1854
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ....1A•1870,1871
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ....1A•1875
KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ....1A•1888
† Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ....1A•1890,1B•1012
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ....1A•1902
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ....1A•1920, 1921
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ....1A•1944,1953,1966
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ....1A•2007
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
Assembly Specialists, 914 Main St., Box 965, Acton, MA 01720 617-263-9100
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 904-252-0411
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
§† Film Microelectronics, 17 A St., Burlington, MA 01803 617-272-5650
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
Hy-Tec Industries, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786 516-744-5062
† International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ....714-979-8833; 714-634-1535
Morris Entprs., 16799 Schoenborn St, Sepulveda, CA 91343 213-894-9103
National Micronetics, Route 28, West Hurley, NY 12136 914-338-0333
§ NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735 ....516-694-0060; 800-645-9333
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
SMD Technology Svc. Ctr., North American Philips, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 800-431-4444
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
§ Techno-Components Corp., 7803 Lemona, Van Nuys, CA 91405 818-781-1642
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666

Resistors, Composition, Carbon-4700

§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•1917
§ TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ....1A•1944,1945
§ Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Decade-4700

General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ....3•1239
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ....3•1251
Tech Labs., Inc., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, 201-944-2221 ....1B•1755
§ AEMC, 99 Chauncy, Boston, MA 02111 ....617-451-0227;800-343-1391
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 303-762-1640
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ....818-442-3310; 213-686-0535
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shalltronix Corp., Preston St., P.O. Box 235, Selma, NC 27576 919-965-6346
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Deposited Carbon-4700

§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ....818-442-3310; 213-686-0535
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201

Resistors, Disk, Rod & Tube-4700

Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 .... 1A•1832-1834
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 .... 1A•1872
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 .... 1A•1883
§ **KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 .... 1A•1879**
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 414-271-9900
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Film, Metallized & Nonmetallized-4700

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 .... 1A•1788,1793
§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 .... 1A•1808-1817,1822,1824,1825,1827**
Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, 516-454-6390 .... 1A•1828
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011, 212-691-9050 .... 1A•1064
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 .... 1A•1854-1859
† **Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 .... 1A•1870**
† **HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 .... 1A•1874**
§ **International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 .... 1A•1876**
§ **KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 .... 1A•1879**
§† **KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 .... 1A•1885,1886,1888**
§† **Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 .... 1A•1890,1B•1012**
§† **Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 .... 1B•1012**
§† **Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 .... 1A•1893**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1905**
§ **NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 .... 1A•1906**
§† **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 .... 1A•1917**
§ **Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 .... 1A•1925**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 .... 1A•1929**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 .... 1A•1933
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 .... 1A•1933
Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 .... 1A•1938
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053, 603-625-8994 .... 1A•1941-1943
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1948,1949,1955-1960,1973,1974,1987-1989**
§ **Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 .... 1A•2000,2002**
§† **Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2011**
§† **Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740, 301-739-8722 .... 1A•2011**
§† Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 904-252-0411
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
§† Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
§† Vamistor Corp., 115 Industrial Park, Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
Vishay-Mann, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Flame Retardant-4700

§ **International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 .... 1A•1876**
Iskra Electronics, Inc., 8 Greenfield Rd., Syosset, NY 11791, 516-364-2616 .... 1A•1877
§ **Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 .... 1A•1894**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1904**
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 .... 1A•1906
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 .... 1A•1911
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 .... 1A•1929**
§ Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
Colber Corp., 26A Buffington St., Irvington, NJ 07111 201-371-9500
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
§† Kahgan Elctrns. Corp., 556 Peninsula Blvd., Hempstead, NY 11550 516-538-2300
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 .... 603-668-3210; 800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§† Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
Vamistor Corp., 115 Industrial Park, Sevierville, TN 37862 615-453-0001
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Flux Sensitive-4700

Resistors, Foil, Ultraprecision-4700
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ...1A•1992, 1993
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ...1A•2011
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740, 301-739-8722 ...1A•2011
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 ...714-788-1700

Resistors, Fuse-4300 — *See Vol. 1B*

Resistors, Glass-4700
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 ...813-855-6655
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 ...904-252-0411
Solitron/Microwave, Box 278, Port Salerno, FL 33492 ...305-287-5000
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 ...216-795-8200
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 ...301-739-8722
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ...813-371-4242

Resistors, Heat Sink Encased — See Resistors, Integral Heat Dissipator (Vol. 1A)

Resistors, High Frequency-4700
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 ...414-671-2000
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ...818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ...305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 ...603-669-0940
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 ...717-938-1451
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 ...714-788-1700
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ...201-DE4-0700
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 ...716-278-2383
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 ...813-855-6655
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ...402-371-0080
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 ...219-356-0778
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 ...617-443-4631
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ...401-683-9700
† Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 ...619-438-6876
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 ...201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ...603-668-3210; 800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 ...303-243-8480
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 ...213-598-2454
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 ...617-695-0203
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 ...404-952-9777
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 ...603-669-0054
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 ...603-627-3831
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 ...919-934-5181
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650 ...312-652-7555
Res-Net, 110 Route 10, Whippany, NJ 07981 ... 201-887-2260;out of state 800-526-0704
Solitron/Microwave, Box 278, Port Salerno, FL 33492 ...305-287-5000
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 ...603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 ...301-375-8666
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 ...215-922-8900
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 ...303-242-0810
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 ...216-795-8200
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 ...215-644-1300
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 ...301-739-8722

Resistors, High Megohm (Over 22 Megohms)-4700
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ...1A•1792
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ... 1A•1809-1814,1816,1817,1822
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ...1A•1856,1859,1860,1868
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ...1A•1883
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ...1A•1879
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ...1A•1880
† Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806, 714-979-8833; 714-634-1535 ...1A•1897
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ...1A•1902
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ...1A•1905
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ...1A•1929
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ...1A•1944,1989
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ....1A•1996
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ...1A•2001,2002
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ...818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ...305-973-8620
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 ...717-938-1451
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ...201-DE4-0700
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 ...813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ...914-YO3-5900
CTS Corp., 905 North West Blvd., Elkart, IN 46514 ...219-293-7511
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ...402-371-0080
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 ...904-252-0411
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 ...617-667-8700
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ...401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 ... 305-771-7000
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 ...619-438-6876
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ...603-668-3210; 800-257-3300
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 ...201-539-2000
§† Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 ... 817-325-7871
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan ... 075-921-9111
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 ...716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 ...201-348-7000
Penn Airborne Prods., Industrial Hwy., Southampton, PA 18966 ...215-355-3400
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 ...603-627-3831
Stackpole, Carbon Div., St. Marys, PA 15857 ...814-781-1234
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 ... 919-828-6201
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 ...603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 ...301-375-8666

Resistors, High Temperature (Over 125)-4700
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ...1A•1792,1793
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ... 1A•1808-1814,1816,1817,1824,1825
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 ... 1A•1832-1834
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ...1A•1856
KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ... 1A•1886-1888
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ...1A•1893,1894
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ... 1A•1898-1900
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ... 1A•1907-1909
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•1913
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 ...1A•1922,1923
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ...1A•1929
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ... 1A•1930-1935
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ... 1A•1930-1935
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ...1A•1944
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .. 1A•1992-1954
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ...818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 ... 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 ...603-669-0940
Colber Corp., 26A Buffington St., Irvington, NJ 07111 ...201-371-9500
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 ...813-855-6655
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 ...402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 ...402-371-0080
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 ...914-664-2333
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 ...904-252-0411
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300
§† Fenwal Elctrns., 63 Fountain St., Framingham, MA 01701 ...617-872-8841
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 ...609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 ...219-356-0778
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 ...617-443-4631
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 ...201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ...401-683-9700
Jordan Elec., 2380 Camino Vida Roble, Carlsbad. CA 92008 ...619-438-6876

§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ....603-668-3210; 800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205 ..201-926-3036
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650 312-652-7555
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, High Voltage (1,000 Volts & Over)-4700

Alden Products Co., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, 617-583-0160 ......2•1115
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ......1A•1808-1814,1822
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 ......1A•1832-1834
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ......1A•1859,1860
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ......1A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ......1A•1883
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ......1A•1879
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ......1A•1880,1881
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ......1A•1892,1893
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ......1A•1905
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 ......1A•1922,1923
† Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205, 201-926-3036 ......1A•1926,1927
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ......1A•1929
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053, 603-625-8994 ....1A•1941, 1942
† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ......1A•1944,1955,1972-1974,1989
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ......1A•2001,2002
Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 717-938-1451
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
† CTS Microelectronics, Inc., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hybrid Svcs. Inc., 38 Main St., North Reading, MA 01864 617-664-5500
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ......603-668-3210; 800-257-3300
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
Sensitive Research Instrs., 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Hot Molded-4700

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ......1A•1788,1792
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•1913
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 ......1A•1922
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ......1A•1944,1954,1976,1977
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ......603-668-3210; 800-257-3300
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
Res-Net, 110 Route 10, Whippany, NJ 07981 ...... 201-887-2260;out of state 800-526-0704
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

Resistors, Integral Heat Dissipator-4700

Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ......1A•1815
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ......1A•1861,1868
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ......1A•1869
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ......1A•1881
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ......1A•1892,1893
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ......1A•1908,1909
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 ......1A•1922,1923
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ......1A•1929
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ......1A•1931,1932,1934,1935
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ......1A•1931, 1932,1934,1935
§ Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ....1A•1996
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ......1A•2009
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 414-271-9900
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Res-Net, 110 Route 10, Whippany, NJ 07981 ...... 201-887-2260;out of state 800-526-0704
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994

Resistors, Low Temperature Coefficient-4700

§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ......1A•1808-1817,1822,1824,1825
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 ......1A•1832-1834
Colber Corp., 26A Buffington St., Irvington, NJ 07111, 201-371-9500 ......1A•1845
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ......1A•1859
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ......1A•1871
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ......1A•1869
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ......1A•1873
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ......1A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ......1A•1883
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ......1A•1880-1882

§† **KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 .... 1A•1886,1888**
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 .... 1A•1889
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 .... 1A•1890,1B•1012
§† **Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 .... 1A•1891,1B•1012**
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 .... 1A•1892,1894
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 .... 1A•1906
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 .... 1A•1908,1909
§ **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 .. 1A•1911-1913**
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 .... 1A•1922,1923
Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 .... 1A•1925
† **Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205, 201-926-3036 .... 1A•1926,1927**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 .... 1A•1930-1936
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 .... 1A•1930-1936
† **Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 .... 1A•1938**
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1950-1960,1980,1981
§† **Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .. 1A•1992-1996**
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 .... 1A•2000
§† **Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2004-2007,2009,2010,2014,2015**
Vishay-Mann, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2014,2015
§ Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct.; Farmingdale, NY 11735 516-454-6390
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 .... 914-YO3-5900
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
§† CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 904-252-0411
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 .. 219-356-4300
§† Fenwal Elctrns., 63 Fountain St., Framingham, MA 01701 617-872-8841
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ Guildline Instrs., 2 Westchester Plaza, Elmsford, NY 10523 914-592-9101
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 201-892-5881
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
§† KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 .... 603-668-3210; 800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Piher Intl., 565 W. Golf Rd., Arlington Hgts., IL 60005 .... 312-640-8300; 800-323-6693
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650 312-652-7555
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
§ Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§† Vamistor Corp., 115 Industrial Park, Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Metal Glazed-4700

Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 .... 1A•1893
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 .... 1A•1929**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1950-1954,1974**
§ Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
§† Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Res-Net, 110 Route 10, Whippany, NJ 07981 .... 201-887-2260;out of state 800-526-0704
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§ Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 216-795-8200

Resistors, Microwave-4700

§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 .... 1A•1929**
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637 319-394-9131
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Negative Temperature Coefficient-4700

Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 .... 1B•1798,1799
§ **Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 .... 1B•1800,1801**
Fenwal Elctrns., 63 Fountain St., Framingham, MA 01701, 617-872-8841 . 1B•1803
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 .... 1A•1876
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ... 1B•1804,1805,1807
§ **Midwest Comps., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 .... 1B•1810,1811,1817**
Piezo Elec. Prods., Inc., 212 Durham Ave., CN-15, Metuchen, NJ 08840, 201-548-2800 .... 1B•1820,1821
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 .... 1A•1929**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 .... 1A•1936
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 .... 1A•1936
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1957**
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 717-938-1451
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700

§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ....201-DE4-0700
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886 401-738-9150
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Eltec Instrs., P.O. Box 9610, Daytona Bch., FL 32020 904-252-0411
E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
§† KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637 319-394-9131
† Res-Net, 110 Route 10, Whippany, NJ 07981 .... 201-887-2260;out of state 800-526-0704
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
† Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
§ Victory Engrg. Corp., Victory Rd., Springfield, NJ 07081 201-379-5900
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Noninductive-4700

§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ....1A•1808,1810-1814,1816,1817,1824,1825**
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 ....1A•1832-1834
† **Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ....1A•1880,1881**
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ....1A•1889
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ....1A•1892
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ....1A•1898
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ....1A•1906
§† **Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ....1A•1907,1908**
§† **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ....1A•1910**
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 ....1A•1922,1923
Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ....1A•1925
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ....1A•1933
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ....1A•1933
† **Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ....1A•1937**
† **Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ....1A•1938**
§† **Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ....1A•1995**
† **Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ....1A•2014,2015**
Vishay-Mann, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ....1A•2014,2015
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 717-938-1451
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ....201-DE4-0700
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ...219-356-4300
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ....603-668-3210; 800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067 817-325-7871
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205 ..201-926-3036
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
† Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104 216-795-8200
Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Oil Filled-4700

† **Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ....1A•1878**
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ....603-668-3210; 800-257-3300
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502 303-242-0810
§ Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Plug-in-4700

§ **ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ....2•1359**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929**
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Colber Corp., 26A Buffington St., Irvington, NJ 07111 201-371-9500
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
§ CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ....603-668-3210; 800-257-3300
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
Vishay-Mann, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740 301-739-8722

Resistors, Positive Temperature Coefficient-4700

§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ....1A•1815**
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ....1A•1880,1882
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ...1B•1806, 1807
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ....1A•1889
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ....1A•1893
§ **Midwest Comps., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ....1B•1811,1815**
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1904
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ....1A•1944,1957,1986-1988**
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ....1A•1997
Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406 213-450-1761
Colber Corp., 26A Buffington St., Irvington, NJ 07111 201-371-9500
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926 915-592-3253
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886 401-738-9150
§ Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750 ..219-356-4300
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
Julie Resch. Labs., 211 West 61st St., New York, NY 10023 212-245-2727
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
§† KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ....603-668-3210; 800-257-3300
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960 201-539-2000
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ....714-979-8833; 714-634-1535
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637 319-394-9131
† Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205 ..201-926-3036
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102 603-627-3831
† Res-Net, 110 Route 10, Whippany, NJ 07981 ....201-887-2260;out of state 800-526-0704
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Sylvania Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
† Vermont Precision Resistor, Box 1170, Stowe, VT 05672 802-253-8567
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Power-4700

Alden Products Co., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, 617-583-0160 ....2•1115
Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1792
§ **Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ....1A•1808-1815**
§† **Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ....1A•1830, 1831**
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 ....1A•1832-1834
Colber Corp., 26A Buffington St., Irvington, NJ 07111, 201-371-9500 ....1A•1845
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ....1A•1861-1868
§† **Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ....1A•1869**
§† **E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ....1A•1872**
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ....1A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ....1A•1883
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ....1A•1881
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ....1A•1889
§† **Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ....1A•1892-1894**
† **Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ....1A•1898-1901**
§ **Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•1905**
§† **Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ....1A•1907-1909**
§† **Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..1A•1910-1914,1916,1917**
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 ....1A•1922,1923
† **Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205, 201-926-3036 ....1A•1926,1927**
§† **RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929**
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ....1A•1930-1932,1934,1935
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ....1A•1930-1932,1934,1935
† **Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ....1A•1937**
Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ....1A•1938
† **Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053, 603-625-8994 ....1A•1941, 1943**
§† **TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ....1A•1944,1978-1985,1989**
§† **Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ...1A•1995, 1996,1998**
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ....1A•2001,2002
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ....1A•2009
§ Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 717-938-1451
Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 216-248-1200
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ....603-668-3210; 800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761 617-695-0203
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405

Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Vishay-Mann, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Precision-4700

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ......1A•1793,1802
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ...... 1A•1808-1817,1822,1824,1825
§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ......1A•1830, 1831
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ......1A•1852,1854-1856,1858,1859,1861-1863,1868
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ......1A•1871
† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ......1A•1869
General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ......1A•1873
† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776, 617-443-4631 ......1A•1874
International Comps. Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ......1A•1876
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ......1A•1878
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089, 413-781-1350 ......1A•1883
KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981, 201-887-8100 ......1A•1879
† Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ...... 1A•1880-1882
§† KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ......1A•1886,1888
Meissner Inds., 551 Rte. 10, Dover, NJ 07801, 201-366-1700 ......1A•1889
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ......1A•1890,1B•1012
§ Mepco/Electra, Inc., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ......1B•1012
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ......1A•1892,1894,1895
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ......1A•1902
NIC Components Corp., 238 Rte. 109, Farmingdale, NY 11735, 516-694-0060; 800-645-9333 ......1A•1906
Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532, 803-393-5421 ......1A•1908,1909
Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ......1A•1912
Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 ......1A•1922,1923
§ Precision Resistive Prods., Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ......1A•1925
† Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205, 201-926-3036 ......1A•1926,1927
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ......1A•1929
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 ...... 1A•1934-1936
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 ...... 1A•1934-1936
Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ......1A•1937
† Res-Net, 110 Route 10, Whippany, NJ 07981, 201-887-2260;out of state 800-526-0704 ......1A•1938
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053, 603-625-8994 ... 1A•1941-1943
† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ...... 1A•1944,1950-1960,1980,1981
§† Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .. 1A•1992-1996
Victoreen, Inc., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, 216-795-8200 ......1A•2000,2001
§† Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ......1A•2004-2007,2009-2011,2014,2015
Vishay-Mann, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ......1A•2014,2015
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740, 301-739-8722 ......1A•2011
§ Airco Speer Electrns., Resistor Plant, Bolivar Rd., Box 547, Bradford, PA 16701 814-362-5536
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Beckman Instrs., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
§ Beckman Instrs., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634 714-871-4848
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 717-938-1451
Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ......914-YO3-5900
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
† CTS Halex, 1202 McGaw Ave., Irvine, CA 92714 714-556-2850
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
† Environmental Comm., 3150 Pullman St., Costa Mesa, CA 92627 714-557-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 201-892-5881
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ......603-668-3210; 800-257-3300
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
Stackpole Components Co., 3400 Yonkers Rd., Raleigh, NC 27604 919-828-6201
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
§† Vamistor Corp., 115 Industrial Park, Sevierville, TN 37862 615-453-0001

Resistors, Pressure Sensitive-4700

† HyComp Inc., 75 Union Ave., Box 377, Sudbury, MA 01776 617-443-4631
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Rectilinear-4700

§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
§ Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
§ Bourns Instrs., Inc., Industrial Div., 1960 Chicago Ave., Unit F, Riverside, CA 92503 714-781-5147
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ......201-DE4-0700
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ......914-YO3-5900
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 ......603-668-3210; 800-257-3300
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Res-Net, 110 Route 10, Whippany, NJ 07981 ...... 201-887-2260;out of state 800-526-0704
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300

Resistors, Standards — See Standards, Resistance (Vol. 3)

Resistors, Strip-4700

Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 401-683-9700
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733

§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Suppressor-4700

Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ....1A•2009
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Surge-4700

Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ....1B•1804
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ....1A•1944,1981
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ....1A•2009
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806 714-630-0081
Beman Mfg., P.O. Box 370, New Cumberland, PA 17070 717-938-1451
§ Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507 714-788-1700
Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302 716-278-2383
§ Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
§ Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electrostatic Consltg. Assocs., 556 Lowell Rd., Groton, MA 01450 ..617-448-5485
Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ....818-442-3310; 213-686-0535
Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204 414-271-9900
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Tapped-4700

§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ....1A•1872
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ....1A•1898-1900
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 ....1A•1937
TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 ....1A•1944,1985
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Component General, Inc., 13620 Wright Cir., Tampa, FL 33625 813-855-6655
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 ....914-YO3-5900
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
† Hybrid Systems Corp., 22 Linnell Circle, Billerica, MA 01821 617-667-8700
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
K & M Elctrns., 123 Interstate Dr., W. Springfield, MA 01089 413-781-1350
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
† Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731 ....818-442-3310; 213-686-0535

§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Ohmtek, Inc., 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Quality Thermistor, 2147 Centurion Pl., Boise, ID 83705 208-377-3373
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577 919-934-5181
† Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053 603-625-8994
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
§ Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Resistors, Temperature Sensitive — See Thermistors (Vol. 1B)

Resistors, Tin Oxide-4700

Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ....1A•1894
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 ....1A•1929
§ Capar Components Corp., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735 516-454-6390
§† Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
§ KOA Speer Elctrns., Bolivar Dr., P.O. Box 547, Bradford, PA 16701 814-362-5536

Resistors, Variable — See Potentiometers (Vol. 1A), Rheostats (Vol. 1A), Resistors, Adjustable (Vol. 1A),

Resistors, Voltage Sensitive-4700

Carborundum Co., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, 716-278-2383 ....1A•1834,1835
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021, 315-253-7321 ....1A•2094
§ Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ....1A•1121,1123
Mepco/Electra, Inc., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, 201-539-2000 ....1A•1891
§ Midwest Comps., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ....1B•1816
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108,2109
§ Carbone Lorraine Inds., 400 Myrtle Ave., Boonton, NJ 07005 ....201-DE4-0700
Electrostatic Consltg. Assocs., 556 Lowell Rd., Groton, MA 01450 ..617-448-5485
GTE Automatic Elec., 400 N. Wolf Rd., Northlake, IL 60164 312-681-7071
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
KCK America Inc., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018 312-297-5435
Kelvin, 5919 Noble Ave., Van Nuys, CA 91411 818-782-6662
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101 603-669-0054
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
§ Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Thickfilm Int'l., Rt. 1-Box 85-0, Indian Head, MD 20640 301-375-8666
Thomson-CSF Comps. Corp., Passive Comp. Div., 6660 Variel Ave., Canoga Park, CA 91303 818-887-1010
§ Victory Engrg. Corp., Victory Rd., Springfield, NJ 07081 201-379-5900
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors, Wirewound-4700

§† Cal-R, Inc., P.O. Box 1397, Santa Monica, CA 90406, 213-450-1761 ....1A•1830, 1831
Colber Corp., 26A Buffington St., Irvington, NJ 07111, 201-371-9500 ....1A•1845
Dale Electronics, Inc., El Paso Div., P.O. Box 26950, El Paso, TX 79926, 915-592-3253 ....1A•1861-1868
§† Elctrn. Precision Comps., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ....1A•1869
§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 ....1A•1872
§ General Resistance, Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ....1A•1873
Julie Resch. Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ....1A•1878
† Kelvin, 5919 Noble Ave., Van Nuys, CA 91411, 818-782-6662 ....1A•1880-1882
† Micro-Ohm Corp., 4900 Santa Anita Ave., El Monte, CA 91731, 818-442-3310; 213-686-0535 ....1A•1892
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ....1A•1898-1900
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..1A•1910-1917

Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 213-345-7811 .... 1A•1922,1923
† Precision Resistor Co., Inc., 109 U.S. Hwy. 22, Hillside, NJ 07205, 201-926-3036 .... 1A•1926,1927
§† RCD Components, Inc., 330 Bedford St., Manchester, NH 03101, 603-669-0054 .... 1A•1929
RCL Electronics, Inc., 195 McGregor St., Manchester, NH 03102, 603-627-3831 .... 1A•1930-1935
Shallcross, Inc., U.S. 70 East, Smithfield, NC 27577, 919-934-5181 .... 1A•1930-1935
† Resistors, Inc., 5226 W. 26th St., Chicago, IL 60650, 312-652-7555 .... 1A•1937
† Tel Labs, Inc., 154 Harvey Rd., Londonderry, NH 03053, 603-625-8994 ... 1A•1941-1943
§† TRW Resistive Products Div., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, 215-922-8900 .... 1A•1944,1976-1981,1983-1986
Ultronix, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 .. 1A•1994-1996,1998
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2014,2015
Vishay-Mann, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2014,2015
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 818-765-8300
§† AMF/Electro Comps. Div., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060 305-973-8620
Armtec Industries, Inc., Daven Components Grp., Manchester Airport, Manchester, NH 03103 603-669-0940
Bowmar/TIC, Inc., 850 Lawrence Dr., Newbury Park, CA 91320 805-498-2161
§ Clarostat Mfg., Washington St., Dover, NH 03820 603-742-1120
Consolidated Resistance Co. America, 222 Lake Ave., Yonkers, NY 10701 .... 914-YO3-5900
CSI Capacitors, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069 619-747-4000
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ CTS Corporation, Asheville Division, P.O. Box 100, Skyland, NC 28776 704-684-6451
§† Dale Electronics, Inc., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601 402-564-3131
Dynaplex Inc., Interplex, 120-12 28th Ave., Flushing, NY 11354 212-961-6750
† Engelhard Corp., 70 Wood Ave. S., Iselin, NJ 08830 201-321-5900
§† Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
Huntington Electric Inc., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750 219-356-0778
INRESCO/Instr. Resistor, 2106 Bridge Ave., Pt. Pleasant, NJ 08742 201-892-5881
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† Jordan Elec., 2380 Camino Vida Roble, Carlsbad, CA 92008 619-438-6876
† KRL Elctrns., 160 Bouchard St., Manchester, NH 03103 .... 603-668-3210; 800-257-3300
Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Meissner Inds., 551 Rte. 10, Dover, NJ 07801 201-366-1700
† Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
§ Mills Resistor Co., 3840 Catalina St., Los Alamitos, CA 90720 213-598-2454
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
§† Nytronics Comps. Group Inc., Orange St., Darlington, SC 29532 803-393-5421
§† Paccom, 3928 148th NE, Redmond, WA 98052 .... 206-883-9200;800-426-6254
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Samarius, Inc., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418 203-735-7405
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
§† Tepro of Florida, 2608 Enterprise Rd., Clearwater, FL 33575 813-796-1044
§† Ward Leonard Elec., 31 South St., Mt. Vernon, NY 10550 914-664-1000
Waters Mfg., Longfellow Ctr., Wayland, MA 01778 617-358-2777
Weston Controls/Pots Div., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403 717-876-1500
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Resistors (MIL)-2440 — *See Vol. 1B*

Resolvers, Synchro-4900 — *See Vol. 3*

Resonators, Ceramic-2700

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 .... 1A•1355
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•1394
NTK Technical Ceramics, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. 05, Richardson, TX 75081, 214-235-8332 .... 1A•1396
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 .... 1A•1437
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
Radio Materials Corp., 4242 W. Bryn Mawr, Chicago, IL 60646 312-478-3600
Sawtek Inc., P.O. Box 18000, Orlando, FL 32860 305-886-8860
§ Stettner Elctrns., 6135 Airways Blvd., Chattanooga, TN 37421 615-892-0291
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Resonators, SAW-2300

Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 .... 1A•1420,1623
RF Monolithics, Inc., 4441 Sigma Rd., Dallas, TX 75234 214-233-2903
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Retainers, Battery-2800 — *See Vol. 2*

Retainers, Relay-4500 — *See Vol. 1B*

Retainers, Tube-5700

§† IERC, 135 W. Magnolia Blvd., Burbank, CA 91502 818-849-2481
Intl. Elctrn. Resch., 135 W. Magnolia Blvd., Burbank, CA 91502 213-849-2481
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Retractors & Carriers — See Cable Retractors (Vol. 2)

RFI Measuring Equipment-2900 — *See Vol. 3*

RFI Shielding — See Shields, RF (Vol. 2)

RFI Testing Services — See Services, Electrical Measurement & Test (Vol. 3)

Rheostats-4750

§† E-Systems, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, 219-356-4300 .... 1A•2037
§† Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ... 1A•2050, 2051
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 .... 1A•2055
Vishay Resistive Sys. Grp., 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 .... 1A•2012,2013
§† Vishay Angstrohm, 1 Precision Pl., Hagerstown, MD 21740, 301-739-8722 .... 1A•2012,2013
§ Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204 414-671-2000
Biddle Instruments, A Thorn EMI Co., 510 Township Line Rd., Blue Bell, PA 19422 215-646-9200
Carter Mfg., Sugar Rd., Bolton, MA 01740 617-779-5501
Centralab, Inc., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Cole Hersee, 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
CTS Corp., 905 North West Blvd., Elkart, IN 46514 219-293-7511
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
† Maurey Instr. Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, 42974 M-43 Hwy., Paw Paw, MI 49079 616-657-2527
New England Instr., 14 Kendal Lane, Natick, MA 01760 617-875-9711
Noble U.S.A., Inc., 151 Stanley St., Elk Grove Vllg., IL 60007 312-364-6038
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Wilbrecht Elctrns., 240 Plato Blvd., St. Paul, MN 55107 612-222-2791

Rings, Retaining-2500 — *See Vol. 2*

Rivets-2825 — *See Vol. 2*

Robotics — See Arms & Manipulators, Robotic (Vol. 3), Control Systems, Robotic (Vol. 3),

Rods, Ground-2800 — *See Vol. 2*

Rotators — See Antenna Rotators (Vol. 3)

Rotors, Motor & Generator — See Motor & Generator Armatures, Rotors, Stators (Vol. 1B)

Rubber, Conductive-1600 — *See Vol. 2*

Rubber Guards (For Equipment) — See Bumpers (Vol. 2)

Rubber, Silicone-1600 — *See Vol. 2*

Scale Expanders, Meter — See Multipliers, Meter (Vol. 3)

Scalers, Binary, Decade-2325 — *See Vol. 3*

Scales, Dial-2400 — *See Vol. 2*

Scanners, Bar Code-2000 — *See Vol. 3*

Scanners, Crossbar-1900 — *See Vol. 3*

Scanners, Fiber Optic-2475 — *See Vol. 1B*

Scanners, Flying Spot-1900 — *See Vol. 3*

Scanners, Infrared-2900 — *See Vol. 3*

Scanners, Instrument, Input/Output-2900 — *See Vol. 3*

Scanners, Optical-2900 — *See Vol. 3*

Scanners, Reed-2900 — *See Vol. 3*

Scissors-5400 — *See Vol. 2*

Scope Dollies — See Carts & Dollies, Instrument & Equipment (Vol. 2)

SCRs — See Thyristors (Vol. 1A)

SCR Firing Controls — See Controls, SCR (Vol. 3)

Scramblers, Data-2325 — *See Vol. 3*

Scramblers, Speech-1900 — *See Vol. 3*

Screens, Printed Circuit-1700 — *See Vol. 2*

Screwdrivers-5400 — *See Vol. 2*

Screws, Lead, Feed & Translatory — See Drives & Drives Mechanisms (Dial) (Vol. 2)

Screws, Fastening-2825 — *See Vol. 2*

Scribers-5400 — *See Vol. 2*

Scribers, Wafer-4100 (Also See Machines & Accessories, Semiconductor Manufacturing) — ***See Vol. 3***

Sealers — See Coatings (Vol. 2)

Sealing Equipment, Metal to Glass/Ceramic-4100 — *See Vol. 3*

Seals & Feedthrus, Environmental — See Feedthrus & Seals, Environmental (Vol. 2)

Seals, Ceramic To Metal-2500 — *See Vol. 2*

Seals, Glass To Metal-2500 — *See Vol. 2*

Seals, Hermetic-2500 (Also See Services, Hermetic Sealing) — ***See Vol. 2***

Seals, Microwave — See Gaskets, Shielding, RF (Vol. 2), Seals, Waveguide (Vol. 1A),

Seals, Pressure Sensitive-2500 — *See Vol. 2*

Seals, Waveguide-3450

† Bacon Inds., 192 Pleasant St., Watertown, MA 02172-2399 617-926-2550
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
Microflect, 3575 25th S.E., Salem, OR 97302-0985 503-363-9267
Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
§ Parker Seal Grp., P.O. Box 11751, Lexington, KY 40512 606-269-2351
† SRS Industries, Inc., 903 S. Alta Vista Ave., Monrovia, CA 91016 ...213-357-3287
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Tecknit (Eastern Facility), 129 Dermody St., Cranford, NJ 07016 201-272-5500
Vernay Laboratories, Inc., S. College St., Yellow Springs, OH 45387 513-767-7261
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Search, Interceptor Set (MIL)-3475 — *See Vol. 3*

Search Unit, Magnetic Tape — See Tape Search Equipment (Vol. 3)

Security Systems, Data-2325 — *See Vol. 3*

Seizers-5400 — *See Vol. 2*

Selsyns — See Motors, Synchronous (Vol. 1B)

Semiconductor Material — See Crystals, Semiconductor (Vol. 1A)

Semiconductor Wafer Fabrication, Assembling (Packaging)-4100 — *See Vol. 3*

Semiconductor Wafer Fabrication, Designing (Topological)-4100 — *See Vol. 3*

Semiconductor Wafer Fabrication, Maskmaking (Tooling)-4100 — *See Vol. 3*

Semiconductor Wafer Fabrication, Processing-4100 — *See Vol. 3*

Semiconductor Wafer Fabrication, Testing-4100 — *See Vol. 3*

Semiconductors — See Diodes (Vol. 1A), Rectifiers (Vol. 1A), Transistors (Vol. 1A),

Sensors — See Transducer Listings (Vol. 1B)

Sensors, Acoustic-2200 — *See Vol. 3*

Sensors, Chemical-2200 — *See Vol. 3*

Sensors, Fiber Optic-2475 — *See Vol. 1B*

Sensors, Light-3700 — *See Vol. 1B*

Sensors, Proximity-2200 — *See Vol. 3*

Sensors, Temperature — See Bolometers (Vol. 3), Thermistors (Vol. 1B), Transducers (Vol. 1A),

Sensors (MIL), Tactical Electronic Reconnaissance-3475 — *See Vol. 3*

Sequence Controllers — See Controllers, Programmable (Vol. 3)

Services, Assembly & Fabrication (Incl. R&D)-4100 — *See Vol. 3*

Services, Backplane Wiring-4100 — *See Vol. 3*

Services, Calibration & Instrument Repair-4100 — *See Vol. 3*

Services, Coating (All Types)-4100 — *See Vol. 3*

Services, Computer-Aided Design (CAD)—Also See Computers, CAD, CAM, & CAD/CAM-4200 — *See Vol. 3*

Services, Computer Programming-2050 — *See Vol. 3*

Services, Computer Systems, Builders-2050 — *See Vol. 3*

Services, Computer Systems, Consulting-2050 — *See Vol. 3*

Services, Computer Systems, Integrators-2050 — *See Vol. 3*

Services, Computer Systems, Turnkey-2050 — *See Vol. 3*

Services, Crimping-4100 — *See Vol. 3*

Services, Custom Molding, Plastics-4100 — *See Vol. 3*

Services, Data Processing, Consulting-2050 — *See Vol. 3*

Services, Decapsulation-4100 — *See Vol. 3*

Services, Electrical Measurement & Test-4100 — *See Vol. 3*

Services, EMI/RFI Testing-4100 — *See Vol. 3*

Services, Encapsulation-4100 — *See Vol. 3*

Services, Environmental Testing-4100 — *See Vol. 3*

Services, Hermetic Sealing-4100 — *See Vol. 3*

Services, High Vacuum-4100 — *See Vol. 3*

Services, Instrument Design (Industrial)-4100 — *See Vol. 3*

Services, Metal Etching, Engraving-4100 — *See Vol. 3*

Services, Metal Parts Fabrication-4100 — *See Vol. 3*

Services, Metallizing (Incl. Electroforming)-4100 — *See Vol. 3*

Services, Microprocessor-4100 — *See Vol. 3*

Services, Molding-4100 — *See Vol. 3*

Services, Packaging-4100 — *See Vol. 3*

Services, Photographic-4100 — *See Vol. 3*

Services, Plastics Fabrication-4100 — *See Vol. 3*

Services, Plating-4100 — *See Vol. 3*

Services, Precious Metal Refining-4100 — *See Vol. 3*

Services, Precious Metal Resmelting-4100 — *See Vol. 3*

Services, PROM & Array Programming-4100 — *See Vol. 3*

Services, Qualification — See Services, Environmental Testing (Vol. 3)

Services, RFI Measuring — See Services, Electrical Measurement & Test (Vol. 3)

Services, Silk Screening-4100 — *See Vol. 3*

Services, Computer Systems Integration-2025 — *See Vol. 3*

Services, Training/Education-4100 — *See Vol. 3*

Services, Vibration Surveys-4100 — *See Vol. 3*

Services, Wire Cutting & Stripping-4100 — *See Vol. 3*

Services, Wirewrapping-4100 (Also See Services, Backplane Wiring) — ***See Vol. 3***

Servo Systems-4900 — *See Vol. 3*

Shaft Encoders, Shaft Position — See Encoders, Shaft Angle (Vol. 1B)

Shaft Locks — See Knobs, Locking, Control Shaft (Vol. 2)

Shafts & Adapters-3500 (Also See Couplings, Shaft, Rigid & Flexible) — ***See Vol. 1B***

Shake Tables — See Testers, Vibration (Vol. 3)

Shells, Encapsulation — See Cups, Encapsulation (Vol. 2)

Shielding, EMI/RFI-4525 — *See Vol. 2*

Shielding Beads, Ferrite-4525 — *See Vol. 2*

Shields, Cable — See Braid, Cable (Vol. 2)

Shields, Cathode-Ray Tube-4525 — *See Vol. 2*

Shields, Coil-4525 — *See Vol. 2*

Shields, Corona-4525 — *See Vol. 2*

Shields, Electrostatic — See Shields, Tube (Vol. 2)

Shields, Indicator Light-4525 — *See Vol. 2*

Shields, Magnetic-4525 — *See Vol. 2*

Shields, Photomultiplier-4525 — *See Vol. 2*

Shields, RF-4525 (Also See Gaskets, Shielding, RF) — ***See Vol. 2***

Shields, Transformer-4525 — *See Vol. 2*

Shields, Tube-4525 — *See Vol. 2*

Shields, Wire — See Braid, Cable (Vol. 2)

Shift Registers-2325 — *See Vol. 3*

Shifters, Frequency — See Converters, Frequency to Frequency (Vol. 3)

Shifters, Phase, Microwave-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 .... 1A•1689
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 .... 1A•1699
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ... 3•1393, 1082
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 .617-935-8610
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 .516-694-3600
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 ..603-627-6000
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Shifters, Phase, RF-3450

North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .... 3•1393
Ryan Intl. Corp., 4800 Evanswood Dr., Columbus, OH 43229, 614-885-3303 .... 3•1219
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 .617-935-8610
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Daico Inds., Inc., Box 5225, Compton, CA 90224 213-631-1143
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 .516-694-3600
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Universal Ad-Yu Elctrns., Inc., 2517 E. Norwich St., Milwaukee, WI 53207 414-482-4100
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Shifters, Phase 60/400 Hz-4050 — *See Vol. 3*

Shrinkable Plastics & Elastomers — See Caps, Forms & Tapes, Heat Shrinkable (Vol. 2), Tubing, Heat Shrinkable (Vol. 2),

Shunts, Meter-2900 — *See Vol. 3*

Shutters, Microwave-3450

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Signal Averagers-2900 — *See Vol. 3*

Signal Conditioners & Equipment-1100 — *See Vol. 3*

Signal Generators — See Generators, Specific Type (Vol. 3)

Signal Systems, Fiber Optic-2325 — *See Vol. 3*

Signal Tracers — See Testers, Signal Tracing (Vol. 3)

Silica, Fused-2500 — *See Vol. 2*

Silk Screening Services — See Services, Silk Screening (Vol. 3)

Simulators, Data-2900 — *See Vol. 3*

Simulators, Motion-2550 — *See Vol. 2*

Simulators, Power Failure-2900 — *See Vol. 3*

Simulators, Powerline Disturbance-2900 — *See Vol. 3*

Simulators, Radar-3475 — *See Vol. 3*

Simulators, Solar-2900 — *See Vol. 3*

Simulators (MIL), EW-3475 — *See Vol. 3*

Simulators (MIL), EW Quick Reaction Capability-3475 — *See Vol. 3*

Simulators (MIL), RHAW-3475 — *See Vol. 3*

Simulators (MIL), Weapon-3475 — *See Vol. 3*

Sinks, Heat — See Heat Sinks, Semiconductor (Vol. 2), Heat Sinks, Soldering (Vol. 2),

Sleeves — See Tubing (Vol. 2)

Slides, Cabinet & Chassis-1400 — *See Vol. 2*

Slip Clutch — See Knobs, Slip Clutch (Vol. 2)

Slip Rings & Assemblies-3500 — *See Vol. 1B*

Slotted Lines, Microwave-3450

† Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 .617-935-8610
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.

Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§ Tucker Elctrns., Box 461060, Garland, TX 75046 ....214-348-8800;800-527-4642

Socket Adapters-2100 — *See Vol. 2*
Sockets, Capacitor-2100 — *See Vol. 2*
Sockets, Crystal-2100 — *See Vol. 2*
Sockets, Diode-2100 — *See Vol. 2*
Sockets, DIP and DIL-2100 — *See Vol. 2*
Sockets, Integrated Circuit-2100 — *See Vol. 2*
Sockets, Lamp & Lamp Assemblies-2450 — *See Vol. 1B*
Sockets, Leadless Carrier-2100 — *See Vol. 2*
Sockets, LIF & ZIF-2100 — *See Vol. 2*
Sockets, Miniature & Subminiature — See Sockets, Diode (Vol. 2)
Sockets, Relay-2100 — *See Vol. 2*
Sockets, SIP-2100 — *See Vol. 2*
Sockets, Test-2100 — *See Vol. 2*
Sockets, Transistor-2100 — *See Vol. 2*
Sockets, Tube-2100 — *See Vol. 2*
Sockets (MIL)-2440 — *See Vol. 1B*
Software, Applications-2050 — *See Vol. 3*
Software, Communications-2050 — *See Vol. 3*
Software, Compilers/Languages-2050 — *See Vol. 3*
Software, Computer Performance Measurement-2050 — *See Vol. 3*
Software, Data Base Management-2050 — *See Vol. 3*
Software, Data Base Management Dictionaries-2050 — *See Vol. 3*
Software, Data Base Query Language-2050 — *See Vol. 3*
Software, Data Communications Control-2050 — *See Vol. 3*
Software, Disk/Tape File Utilities-2050 — *See Vol. 3*
Software, Emulation/Simulation-2050 — *See Vol. 3*
Software, Information Storage & Retrieval-2050 — *See Vol. 3*
Software, Job Scheduling/Accounting-2050 — *See Vol. 3*
Software, Librarians-2050 — *See Vol. 3*
Software, Operating Systems-2050 — *See Vol. 3*
Software, Operating Systems Enhancement-2050 — *See Vol. 3*
Software, Programming/Systems Development Aids-2050 — *See Vol. 3*
Software, Program Translators-2050 — *See Vol. 3*
Software, Report Generators-2050 — *See Vol. 3*
Software, Security-2050 — *See Vol. 3*
Software, Sort/Merge-2050 — *See Vol. 3*
Software, Spoolers-2050 — *See Vol. 3*
Software, Utilities-2050 — *See Vol. 3*
Solar Cells — See Cells, Photovoltaic (Vol. 1B)
Solder (All Types)-4600 — *See Vol. 2*
Solder Lugs — See Terminals, Lug (All Types) (Vol. 2)
Solder Pots & Baths-4600 — *See Vol. 2*
Soldering Accessories-4600 — *See Vol. 2*
Soldering Equipment, Induction Heating-4100 — *See Vol. 3*
Soldering Equipment, Printed Circuit-4100 — *See Vol. 3*
Soldering Equipment, Resistance-4100 — *See Vol. 3*
Soldering Systems, Temperature Controlled-4100 — *See Vol. 3*
Soldering Equipment, Ultrasonic-4100 — *See Vol. 3*
Soldering Guns, Irons & Desoldering Tools-4600 — *See Vol. 2*
Soldering (MIL)-2440 — *See Vol. 1B*
Solenoids, Linear-4550 — *See Vol. 1B*
Solenoids, Proportional-4550 — *See Vol. 1B*
Solenoids, Rotary-4550 — *See Vol. 1B*
Solenoids (MIL)-2440 — *See Vol. 1B*
Solvents — See Cleaners & Solvents (Vol. 2)
Sonar Systems-3475 — *See Vol. 3*
S100 Bus — See Board Computers & Subassemblies (Vol. 3)
Sound Absorbing Materials-2825 — *See Vol. 2*
Sound Level Indicators — See Meters, Audio Level (Vol. 3)
Sound Recording Equip. — See Microphones (Vol. 3), Recorders (Vol. 3), etc.
Spacers-2825 — *See Vol. 2*
Space Surveillance Systems-3475 — *See Vol. 3*
Spaghetti — See Tubing, Spaghetti (Vol. 2)
Spark Gaps-4300 — *See Vol. 1B*
Speakers, Explosion & Flame Proof-1300 — *See Vol. 3*
Speakers, Horn-1300 — *See Vol. 3*
Speakers, Intercom-1300 — *See Vol. 3*
Speakers, Midrange-1300 — *See Vol. 3*
Speakers, Musical Instrument-1300 — *See Vol. 3*
Speakers, Paging — See Speakers, Intercom (Vol. 3)
Speakers, Pillow-1300 — *See Vol. 3*
Speakers, Public Address-1300 — *See Vol. 3*
Speakers, Replacement (Including Aircraft, Automotive & TV)-1300 — *See Vol. 3*
Speakers, Submergence Proof-1300 — *See Vol. 3*
Speakers, Subminiature-1300 (Also See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices) — ***See Vol. 3***
Speakers, Tweeter-1300 — *See Vol. 3*
Speakers, Weatherproof-1300 — *See Vol. 3*
Speakers, Woofer-1300 — *See Vol. 3*
Speakers (MIL)-2440 — *See Vol. 3*
Speaker Systems-1300 — *See Vol. 3*
Spectrometers-2900 — *See Vol. 3*
Speech Compression & Synthesis Equipment-2325 — *See Vol. 3*
Speed Drives, Motor — See Controls, Motor Speed (Vol. 3)
Spiral Wrap — See Tubing, Spiral Wrap (Vol. 2)
Splicers, Coaxial Cable-5400 — *See Vol. 2*
Splicers, Wire (Incl. Butt & Cap Types)-5400 — *See Vol. 2*
Splicing Equipment, Magnetic Tape-1300 — *See Vol. 3*
Splicing Equipment, Fiber Optic-5400 — *See Vol. 2*
Splicers, Fiber Optic-2475 — *See Vol. 1B*

Splitters/Combiners, Power — See Dividers, Power (Vol. 1A)

Spoolers, Printer Buffers-2325 — *See Vol. 3*

Spoolers, Punched Tape — See Readers, Punched Tape (Vol. 3)

Springs (All Types)-2500 — *See Vol. 2*

Stabilizers, Current — See Current Sources (Vol. 3), Regulators, Current (Vol. 3),

Stabilizers, Line Impedance-4050 — *See Vol. 3*

Stabilizers, Voltage — See Regulators & Stabilizers, Voltage (Vol. 3), Transformers, Voltage Regulating (Vol. 1A), Voltage Sources (Vol. 3),

Stabilizers, Voltage/Current, Automatic — See Power Supplies, Constant Current (Vol. 3)

Stalos (Stabilized Local Oscillators) — See Oscillators, Microwave (Vol. 1A)

Standards, Atomic Beam-2900 — *See Vol. 3*

Standards, Capacitance-2900 — *See Vol. 3*

Standards, Current-2900 — *See Vol. 3*

Standards, Delay Line-2350
† Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666
† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220

Standards, Frequency-2900 — *See Vol. 3*

Standards, Inductance-2900 — *See Vol. 3*

Standards, Noise-2900 — *See Vol. 3*

Standards, Phase-2900 — *See Vol. 3*

Standards, Resistance-2900 — *See Vol. 3*

Standards, Temperature-2900 — *See Vol. 3*

Standards, Time-2900 — *See Vol. 3*

Standards, Voltage-2900 — *See Vol. 3*

Standards, Voltage Ratio-2900 — *See Vol. 3*

Standoffs — See Bushings, Glass, Plastic, Metal, etc. (Vol. 2)

Stands, Instruments-1400 — *See Vol. 2*

Stands, Printer/Terminal-1400 — *See Vol. 2*

Static Eliminating Materials, Devices, & Equipment-4525 — *See Vol. 2*

Stators, Motor & Generator — See Motor & Generator Armatures,Rotors, Stators (Vol. 1B)

STD Bus — See Board Computers & Subassemblies (Vol. 3)

Steppers, Indexing, Motor-3500 — *See Vol. 1B*

Steppers, Indexing, Switch-5100 — *See Vol. 1B*

Storage Euipment, Cartridge/Cassette-3800 — *See Vol. 2*

Storage Equipment, Disk-3800 — *See Vol. 2*

Storage Equipment, Flexible Disk-3800 — *See Vol. 2*

Storage Equipment, Magnetic Card-3800 — *See Vol. 2*

Storage Equipment, Media Transport-3800 — *See Vol. 2*

Storage Equipment, Microform-3800 — *See Vol. 2*

Storage Equipment, Multifunctional-3800 — *See Vol. 2*

Storage Equipment, Paper Tape-3800 — *See Vol. 2*

Storage Equipment, Printout-3800 — *See Vol. 2*

Storage Equipment, Punched Card-3800 — *See Vol. 2*

Storage Equipment, Reel-to-Reel Tape-3800 — *See Vol. 2*

Strain Reliefs, Cable & Wire-2800 — *See Vol. 2*

Strip-Line Components, Microwave-3450
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .... 3•1393
Wavetek Indiana, Inc., 5808 Churchman, Beech Grove, IN 46107, 317-787-3332 ....1A•1785
Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† American Etching & Mfg., 13730 Desmond St., Pacoima,, CA 91331 213-896-1187
§† Anaren Microwave, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057 315-432-8909
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Centerflex Techn. Corp., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507 201-423-0505
Central Microwave Co., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
† Electro-Magnetic Processes, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311 818-882-6333
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735 516-694-3600
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
§ 3M-Electronic Products Division, 3M Center, Bldg. 225-1N-06, St. Paul, MN 55144 612-733-7408
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Rogers Corp., One Technology Dr., Rogers, CT 06263 203-774-9605
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 305-287-5000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 603-627-6000
Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 714-494-9401
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880

Strips, Ground-1900 — *See Vol. 3*

Strips, Marker & Fanning-6000 — *See Vol. 2*

Stroboscopes — See Lamps, Stroboscopic Source (Vol. 1B)

Substrates, Ceramic-2800 — *See Vol. 2*

Substrates, Flexible-2800 — *See Vol. 2*

Substrates, Glass-2800 — *See Vol. 2*

Substrates, Metallic-2800 — *See Vol. 2*

Substrates, Sapphire-2800 — *See Vol. 2*

Surface Acoustic Wave, Delay Line-2350
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500

Surface Acoustic Wave, Filter-2700
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640

Suppressors, Arc — See Protectors, Surge (Vol. 1B)

Suppressors, Noise-2700
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ....1A•2134
Basic Measuring Insts., 402 Lincoln Centre Dr., Foster City, CA 94404, 415-570-5355 .... 3•1830
† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380, 607-724-2484 ....1B•1263
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084, 313-528-3700 ....3•1850-1852
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542, 516-671-4400 .... 3•1860
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406, 805-544-3800 ....1A•1484,1500
Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752, 14-832-0290;800-854-9420 ....3•1862-1866,1870,1872,1875
Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 .... 3•1882,1883
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..1A•2183
MCG Elctrns., 12 Burt Dr., Deer Park, NY 11729, 516-586-5125 ....1B•1277,1279, 1280
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2215,2220
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ....1A•1274
† RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706, 516-231-6400 ....1A•1618
RTE Aerovox Inc., P.O. Box B-970, 740 Belleville Ave., New Bedford, MA 02741, 617-994-9661 .... 1A•1619-1621

SGL Waber, 300 Harvard Ave., Westville, NJ 08093, 609-456-5400;800-257-8384 ...... 3•1909
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148, 312-620-8394 ...... 3•1910,1911
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069, 619-744-3346 ...... 3•1810
§ Amperex Electronic Corp., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477 914-246-2811
§ Brooks Mfg. Co., 2016/24 Amber St., Philadelphia, PA 19125 ......215-425-3395; 800-523-0130
† Chomerics, Inc., 77 Dragon Ct., Woburn, MA 01888 617-935-4850
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
Corcom, Inc., 1600 Winchester Rd., Libertyville, IL 60048 312-680-7400
§ Eaton Corp./Cutler-Hammer Prods., Aerospace/Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
† Estes Engrg. Co., 930 Marine Dr., Port Angeles, WA 98362 206-457-0904
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
† Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Hopkins Engrg., 12900 Foothill Blvd., San Fernando, CA 91342 213-361-8691
Kalglo Elctrns. Co., Inc., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017 215-837-0700
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703 714-973-1800
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Potter Co., P.O. Box 337, North Hwy. 51, Wesson, MS 39191 601-643-2215
† Rtron Corp., 7324 Lawndale, Skokie, IL 60076 312-679-7180
Schaffner EMC Inc., Component Div., 825 Lehigh Ave., Union, NJ 07083 201-851-0644
Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Kulka Smith, Inc., 1913 Atlantic Ave., Manasquan, NJ 08736 201-223-9400
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Standard Condenser Corp., 1065 W. Addison St., Chicago, IL 60613 312-327-5440
Superior Elec. Co., 383 Middle St., Bristol, CT 06010 203-582-9561
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877 ......301-948-3434; 800-638-2048
§ Westlake Capacitors Inc., 5334 Sterling Center Dr., Westlake Village, CA 91361 818-889-4120

Suppressors, Transient Voltage (All Types)-4300 — *See Vol. 1B*

Surveillance (MIL), EW Drone-3475 — *See Vol. 3*

Surveillance Sets (MIL)-3475 — *See Vol. 3*

Surveillance Systems (MIL), Optical-3475 — *See Vol. 3*

Surveillance Systems (MIL), Radio Frequency-3475 — *See Vol. 3*

Surveillance/Warning Systems (MIL), Control-3475 — *See Vol. 3*

Surface Acoustic Wave Devices-2350

† Andersen Labs., 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ......1A•1450
Damon/Elctrns. Div., 80 Wilson Way, Westwood, MA 02090, 617-449-0800 ......1A•1347
† Sawtek Inc., P.O. Box 18000, Orlando, FL 32860, 305-886-8860 ......1A•1420,1565, 1622,1623
† Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† Kyocera Intl., Inc., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138 619-454-1800
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
† Union Carbide Corporation, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123 619-279-4500
Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Switches, Backup-5100 — *See Vol. 1B*

Switches, Cam-5100 — *See Vol. 1B*

Switches, Capacitive — See Switches, Touch Actuated (Vol. 1B)

Switches, Coaxial — See Switches, RF (Vol. 1B)

Switches, Coded-5100 — *See Vol. 1B*

Switches, Crossbar — See Switches, Matrix (Vol. 1B)

Switches, Data, Manual-2325 — *See Vol. 3*

Switches, Data, Programmable-2325 — *See Vol. 3*

Switches, Decade-5100 — *See Vol. 1B*

Switches, Diode-3450

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ......1A•1689
† Daico Inds., Inc., Box 5225, Compton, CA 90224, 213-631-1143 ...... 1A•1692-1696
† General Microwave Corp., 155 Marine St., Farmingdale, NY 11735, 516-694-3600 ......1A•1704
Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ...1A•1763
† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
§ AMP Products Corp., P.O. Box 1776, Paoli, PA 19301 215-647-1000
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Capitol Machine & Switch Co., Box 890, Danbury, CT 06810 203-744-3300
Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 216-267-2233
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
§† Digitran Co., 3100 New York Dr., Pasadena, CA 91107 818-791-5600
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Eaton Corp., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086 408-733-3883
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ...... Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hyletronics, Newtown Rd., Littleton, MA 01460 617-486-8911
§† JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203 317-783-9875
M/A-COM Microwave Circuits, Inc., South Ave., Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
† Norsal Inds., 85 D Hoffman Lane So., Central Islip, NY 11722 516-234-1200
† Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 617-653-0844
Sanders Assocs., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103 603-669-4615
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 213-822-0800
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Vectronics Microwave Corp., 276 Lincoln Blvd., Middlesex, NJ 08846 201-356-2377

Switches, DIP-5100 — *See Vol. 1B*

Switches, Fiber Optic-2475 — *See Vol. 1B*

Switches, Foot Pedal, Mat, Ribbon, etc.-5100 — *See Vol. 1B*

Switches, Hall Effect-5100 — *See Vol. 1B*

Switches, High Voltage (Over 250 Volts)-5100 — *See Vol. 1B*

Switches, Interlock-5100 — *See Vol. 1B*

Switches, Keyboard-5150 — *See Vol. 1B*

Switches, Key Lock-5100 — *See Vol. 1B*

Switches, Lever-5100 — *See Vol. 1B*

Switches, Limit-5100 — *See Vol. 1B*

Switches, Lock — See Switches, Key Lock (Vol. 1B)

Switches, Matrix-5100 — *See Vol. 1B*

Switches, Membrane-5150 — *See Vol. 1B*

Switches, Mercury Displacement-5100 — *See Vol. 1B*

Switches, Microwave — See Switches, Diode (Vol. 1A)

Switches, Momentary Action-5100 — *See Vol. 1B*

Switches, Multiposition-5100 — *See Vol. 1B*

Switches, Paddle Handle-5100 — *See Vol. 1B*

Switches, Peripheral-5100 — *See Vol. 1B*

Switches, Photoelectric-3700 — *See Vol. 1B*

Switches, Port Sharing-5100 — *See Vol. 1B*

Switches, Power-5100 — *See Vol. 1B*

Switches, Pressure-5100 — *See Vol. 1B*

Switches, Program-5100 — *See Vol. 1B*

Switches, Proximity-5100 — *See Vol. 1B*

Switches, Pushbutton, Illuminated-5100 — *See Vol. 1B*

Switches, Pushbutton, Nonilluminated-5100 — *See Vol. 1B*

Switches, Reed-5100 — *See Vol. 1B*

Switches, RF-5100 — *See Vol. 1B*

Switches, Rocker-5100 — *See Vol. 1B*

Switches, Rotary-5100 — *See Vol. 1B*

Switches, Sealed-5100 — *See Vol. 1B*

Switches, Slide-5100 — *See Vol. 1B*

Switches, Snap Action (All Types)-5100 — *See Vol. 1B*

Switches, Solid State-5100 — *See Vol. 1B*

Switches, Step Type-5100 — *See Vol. 1B*

Switches, Tap — See Switches, Rotary (Vol. 1B)

Switches, Thermally Actuated-5300 — *See Vol. 1B*

Switches, Thumbwheel-5100 — *See Vol. 1B*

Switches, Tilt — See Switches, Mercury Displacement (Vol. 1B)

Switches, Toggle-5100 — *See Vol. 1B*

Switches, Touch Actuated-5100 — *See Vol. 1B*

Switches (MIL), Non-RF-2440 — *See Vol. 1B*

Switches (MIL), RF-2440 — *See Vol. 1B*

Switch Hardware-2800 — *See Vol. 2*

Switching Systems, Audio-1300 — *See Vol. 3*

Switching Systems, Test & Measurement-2900 — *See Vol. 3*

Switch Seals, Environmental-2800 — *See Vol. 2*

Swivel Units, Data Entry Terminals-1400 — *See Vol. 2*

Synchronizers (MIL), Antenna-3475 — *See Vol. 3*

Synchro Transmitters, Solid State-4900 — *See Vol. 3*

Synchros-4900 — *See Vol. 3*

Synchros & Resolvers (MIL)-2440 — *See Vol. 1B*

Synthesizers, Delay Line-2350

† Computer Devices Corp., 63 Austin Blvd., Commack, NY 11725 516-543-4220
† Control Elctrns. Co., Inc., 107-B Allen Blvd., Farmingdale, NY 11735 516-694-0125
† Data Delay Devices, 385 Lakeview Ave., Clifton, NJ 07011 201-772-1106
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600

Synthesizers, Frequency-2900 — *See Vol. 3*

Synthesizers, Speech-2325 — *See Vol. 3*

Synthesizers, Waveform-2900 — *See Vol. 3*

Systems Integration — See Services, Systems Integration (Vol. 3)

Tables, X-Y Axis — See Simulators, Motion (Vol. 3)

Tachometers, Pulse-4900 — *See Vol. 3*

Tachometers, Generator-4900 — *See Vol. 3*

Tachometers, Stroboscopic-4900 — *See Vol. 3*

Tape Decks — See Recorders, Magnetic Tape (Vol. 3), Transports, Tape (Vol. 3),

Tape Duplicators — See Duplicators, Magnetic Tape (Vol. 3), Perforators,Paper Tape (Vol. 3),

Tape Recording Accessories-1300 — *See Vol. 3*

Tape Search Equipment-2000 — *See Vol. 3*

Tape Winders-2000 — *See Vol. 3*

Tapes, Electrical Insulation-3100 — *See Vol. 2*

Tapes, Films & Foils, Pressure Sensitive-4525 — *See Vol. 2*

Tapes, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. 2)

Tapes, Recording, Magnetic (All Types)-1300 — *See Vol. 3*

Tapes, Magnetic, ¼", 140' Cartridge-2000 — *See Vol. 3*

Tapes, Magnetic, ¼", 300' Cartridge-2000 — *See Vol. 3*

Tapes, Magnetic, ½", 2400' Reel-2000 — *See Vol. 3*

Tapes, Magnetic, ½", 3600' Reel-2000 — *See Vol. 3*

Tapes, Magnetic, Digital Cassette-2000 — *See Vol. 3*

Technical Books-4200 — *See Vol. 2*

Tees, Coaxial-3450

§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... 2•1383,1387
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
§† Astrolab, 345 Dalziel Rd., Linden, NJ 07036 201-862-0022
§ CES Elctrns., 2968 Avenue Z, Brooklyn, NY 11235 .....
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§ Sealectro, 225 Hoyt St., Mamaroneck, NY 10543 914-698-5600
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
† Trompeter Electronics, Inc., 8936 Comanche, Chatsworth, CA 91311 818-882-1020

Tees, Waveguide-3450

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§ CES Elctrns., 2968 Avenue Z, Brooklyn, NY 11235 .....
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ..... Call Local Sls. Off.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
† Sylvania Sys. Grp., Comm. Sys. Div., GTE Prods. Corp., 77 A St., Needham Hgts., MA 02194 617-449-2000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Telecommunication Systems & Equipment — See Communications Systems, Telephone (Vol. 3)

Telemetering Systems, Electronic — See Communications Systems, Telemetering (Vol. 3)

Telephone Handsets — See Handsets, etc. (Vol. 3)

Telephone Systems, Telephones Sound Powered — See Communications Systems, Telephone (Vol. 3)

Teleprinters, Auto Send/Receive-1900 — *See Vol. 3*

Teleprinters, Keyboard Send/Receive-1900 — *See Vol. 3*

Teleprinters, Receive Only-1900 — *See Vol. 3*

Teletypewriters & Equipment-1900 — *See Vol. 3*

Television Systems & Equipment, Cable (CATV) & Master Antenna (MATV) — See CATV Systems & Equipment (Vol. 3)

Television Systems & Equipment Closed Circuit-1900 — *See Vol. 3*

Temperature Indicators — See Meters, Temperature (Vol. 3), Labels, Temperature Indicating (Vol. 1B),

Temperature Sensors — See Transducers, Temperature (Vol. 1B)

Tensile Testers — See Testers, Material (Vol. 3)

Terminal Blocks (Incl. Barrier Types)-2100 — *See Vol. 2*

Terminal Boards-2100 — *See Vol. 2*

Terminal Equipment, Digital-2000 — *See Vol. 3*

Terminal Strips (Including Barrier Types)-2100 — *See Vol. 2*

Terminals, Credit Authorization-2000 — *See Vol. 3*

Terminals, Data Display (including Alphanumeric & Graphic)-2000 — *See Vol. 3*

Terminals, Data Entry, Multimedia-2000 — *See Vol. 3*

Terminals, Display-2000 — *See Vol. 3*

Terminals, Feedthru-2800 — *See Vol. 2*

Terminals, Financial-2000 — *See Vol. 3*

Terminals, Ferrule, Cable-End-2100 — *See Vol. 2*

Terminals, Intelligent/Programmable, Batch-2000 — *See Vol. 3*

Terminals, Intelligent/Programmable, Interactive-2000 — *See Vol. 3*

Terminals, Intelligent/Programmable, Multiprogramming-2000 — *See Vol. 3*

Terminals, Intelligent/Programmable, Multiuser-2000 — *See Vol. 3*

Terminals, Intelligent/Programmable, Real Time-2000 — *See Vol. 3*

Terminals, Intelligent/Programmable, Transaction Processing-2000 — *See Vol. 3*

Terminals, Lug (All Types)-2100 — *See Vol. 2*

Terminals, Miniature & Subminiature-2100 — *See Vol. 2*

Terminals, Printed Circuit Board-2100 — *See Vol. 2*

Terminals, Point-of-Sale-2000 — *See Vol. 3*

Terminals, Push-on — See Connectors & Terminals, Push-on, Quick Disconnect (Vol. 2)

Terminals, Solderless-2100 — *See Vol. 2*

Terminals, Standoff-2100 — *See Vol. 2*

Terminals, Threaded-2100 — *See Vol. 2*

Terminals, Turret-2100 — *See Vol. 2*

Terminals, Wirewrap-2100 — *See Vol. 2*

Terminals (MIL), Ground Data-3475 — *See Vol. 3*

Terminations, Antenna-2800 (Also See Dummy Loads) — ***See Vol. 2***

Terminations, Fiber Optic-2475 — *See Vol. 1B*

Terminations, Microwave-3450

Applied Research Inc., 160 Dupont St., Plainview, NY 11803, 516-349-9200 ... 1A•1687

† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706, 516-231-8400 ... 1A•1689

† Compac, 279 Skidmore Rd., Deer Park, NY 11729, 516-667-3933 ... 1A•1690

§ ITT Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ... 2•1381,1393

§† JFW Inds., Inc., 2719 E. Troy Ave., Indianapolis, IN 46203, 317-783-9875 ... 1A•1705

North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ... 1A•1774

† Weinschel Engrg., One Weinschel La., Gaithersburg, MD 20877, 301-948-3434; 800-638-2048 ... 1A•1787

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 ... 201-539-5500

Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 ... 617-935-8610

Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 ... 617-935-5150

American Electronic Labs., Box 552, Lansdale, PA 19446 ... 215-822-2929

§† Astrolab, 345 Dalziel Rd., Linden, NJ 07036 ... 201-862-0022

Baytron, 344 Salem St., Medford, MA 02155 ... 617-391-1550

Bird Elctrn., 30303 Aurora Rd., Cleveland, OH 44139 ... 216-248-1200

§ CES Elctrns., 2968 Avenue Z, Brooklyn, NY 11235 ...

§ Coastcom, 2312 Stanwell Dr., Concord, CA 94520 ... 415-825-7500

Coaxial Dynamics, 13110 Enterprise, Cleveland, OH 44135 ... 216-267-2233

† Connecticut Microwave Corp., 106 Powder Mill Rd., Box 389, Canton, CT 06019 ... 203-693-4247

§ Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ... 207-655-4555;800-341-9678

† Eastern Microwave, 4 Gill St., Woburn, MA 01801 ... 617-935-8600

† Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 ... 305-994-1774

† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 ... 201-741-0404

† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 ... 609-429-7800

Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-5700

§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 ... 516-364-0400

Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ... Call Local Sls. Off.

Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ... 213-670-1515

Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800

International Mfg. Svcs., 50 Schoolhouse La., Portsmouth, RI 02871 ... 401-683-9700

§ KDI Electronics, Inc., 60 S. Jefferson Rd., Whippany, NJ 07981 ... 201-887-8100

§† Kings Elctrns., 40 Marbledale Rd., Tuckahoe, NY 10707 ... 914-793-5000

M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 ... 617-272-3000

§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 ... 603-424-4111

† Manger Elec. Co., Inc., W. Henry St., Stamford, CT 06902 ... 203-348-7761

Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 ... 714-987-4715

† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 ... 201-575-1300

Metavac, Inc., 45-68 162nd St., Flushing, NY 11358 ... 212-HI5-0400

† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 ... 201-992-7700

† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 ... 619-449-3844

§† Micronetics, 36 Oak St., Norwood, NJ 07648 ... 201-767-1320

† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 ... 805-928-5711

§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 ... 617-655-0060

Microwave Filter Inc., 6743 Kinne St., East Syracuse, NY 13057 ... 315-437-4529; 800-448-1666

† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 ... 802-864-0064

† Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11788 ... 516-231-1700

† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 ... 914-939-8900

RLC Elctrns., Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334

† Rowe Industries, Inc., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612 ... 419-729-9761

† Sage Laboratories, Inc., 3 Huron Dr., Natick, MA 01778 ... 617-653-0844

Sivers Lab, Box 90339, Los Angeles, CA 90009 ... 213-390-7477

§† Solitron/Microwave, Box 278, Port Salerno, FL 33492 ... 305-287-5000

§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 ... 818-786-1760

† Telonic/Berkeley, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652 ... 714-494-9401

† Transco Prods., 4241 Glencoe Ave., Marina del Rey, CA 90291 ... 213-822-0800

Uniform Tubes, Collegeville, PA 19426 ... 215-539-0700

Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 ... 914-241-1300

Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 ... 415-493-4000

§† Waveline, Box 718, W. Caldwell, NJ 07006 ... 201-226-9100

§ Wiltron, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290 ... 415-969-6500

Terminations, VHF, Video, Pulse-1900 — *See Vol. 3*

Test Assemblies (MIL)-3475 — *See Vol. 3*

Test Benches (MIL), ECM-3475 — *See Vol. 3*

Test Benches (MIL), Shop-3475 — *See Vol. 3*

Test Equipment — See Meters, Acceleration, Admittance, etc. (Vol. 3)

Test Equipment, Closed Circuit TV-2900 (Also See Television Systems & Equipment, Closed-Circuit) — ***See Vol. 3***

Test Equipment, Color TV-2900 — *See Vol. 3*

Test Equipment, Fiber Optic-2475 — *See Vol. 1B*

Test Equipment, Mechanical Impedance-2900 — *See Vol. 3*

Test Equipment, Memory Systems, Disk-2900 — *See Vol. 3*

Test Equipment, Rental-2900 (Also See Services, Electrical Measurement & Test) — ***See Vol. 3***

Test Equipment (MIL)-3475 — *See Vol. 3*

Test Fixtures, ATC-2900 — *See Vol. 3*

Test Methods (MIL)-2440 — *See Vol. 3*

Test Sets (MIL)-3475 — *See Vol. 3*

Test Sets (MIL), Airborne Radar-3475 — *See Vol. 3*

Test Sets (MIL), ECM-3475 — ***See Vol. 3***

Test Sets (MIL), EW-3475 — ***See Vol. 3***

Test Sets (MIL), Flight Line-3475 — ***See Vol. 3***

Test Sets (MIL), IRCM-3475 — ***See Vol. 3***

Test Sets (MIL), TJS-3475 — ***See Vol. 3***

Test Systems, Automatic DC-2900 — ***See Vol. 3***

Test Systems, Board-2900 — ***See Vol. 3***

Test Systems, Component-2900 — ***See Vol. 3***

Test Systems, Computer Controlled (Automatic)-2900 — ***See Vol. 3***

Test Systems, Development Engineering — See Services, Assembly & Fabrication (Vol. 3)

Test Systems, Functional-2900 — ***See Vol. 3***

Test Systems, IC-2900 — ***See Vol. 3***

Testers, Accelerometer — See Calibrators, Accelerometer (Vol. 3)

Testers, Armature-2900 — ***See Vol. 3***

Testers, Battery-2900 — ***See Vol. 3***

Testers, Bit Rate-2900 — ***See Vol. 3***

Testers, Burn-in, Aging-2550 — ***See Vol. 3***

Testers, Cable-2900 — ***See Vol. 3***

Testers, Capacitor-2900 — ***See Vol. 3***

Testers, Circuit — See Testers, Signal Tracing (Vol. 3)

Testers, Coil & Transformer-2900 — ***See Vol. 3***

Testers, Communication Equipment (Automatic)-2900 — ***See Vol. 3***

Testers, Component Linearity-2900 — ***See Vol. 3***

Testers, Corona-2900 — ***See Vol. 3***

Testers, Diode-2900 — ***See Vol. 3***

Testers, Electrical Parameter-2900 — ***See Vol. 3***

Testers, Electric Power — See Monitors, Power, AC & DC (Vol. 3)

Testers, Encoder-2900 — ***See Vol. 3***

Testers, Fiber Optic-2900 — ***See Vol. 3***

Testers, Ground Resistance — See Meters, Ohm (Vol. 3)

Testers, Heat, Manual-2550 — ***See Vol. 3***

Testers, Hipot — See Testers, Insulation Breakdown (Vol. 3)

Testers, Insulation Breakdown-2900 — ***See Vol. 3***

Testers, Integrated Circuit (Automatic)-2900 — ***See Vol. 3***

Testers, Integrated Circuit (Manual)-2900 — ***See Vol. 3***

Testers, Interface-2900 — ***See Vol. 3***

Testers, LED & LED Arrays-2900 — ***See Vol. 3***

Testers, Life, Component-2550 — ***See Vol. 3***

Testers, Logic Card-2900 — ***See Vol. 3***

Testers, Loopback-2900 — ***See Vol. 3***

Testers, Magnetic Core-2900 — ***See Vol. 3***

Testers, Magnetic Medium-2900 — ***See Vol. 3***

Testers, Magnetron-2900 — ***See Vol. 3***

Testers, Material-2550 — ***See Vol. 3***

Testers, Memory Board-2900 — ***See Vol. 3***

Testers, Meter-2900 — ***See Vol. 3***

Testers, Microwave-2900 — ***See Vol. 3***

Testers, Modem-2900 — ***See Vol. 3***

Testers, Motor-2900 — ***See Vol. 3***

Testers, Potentiometer-2900 — ***See Vol. 3***

Testers, Power Supply-2900 — ***See Vol. 3***

Testers, Pulse Jitter-2900 — ***See Vol. 3***

Testers, Relay-2900 — ***See Vol. 3***

Testers, Resistivity-2900 — ***See Vol. 3***

Testers, Resistor-2900 — ***See Vol. 3***

Testers, Servo — See Analyzers, Servo (Vol. 3)

Testers, Shock-2550 — ***See Vol. 3***

Testers, Short Turn — See Testers, Coil (Vol. 3)

Testers, Signal Tracing-2900 — ***See Vol. 3***

Testers, Solderability-4100 — ***See Vol. 3***

Testers, Synchro/Resolver-2900 — ***See Vol. 3***

Testers, Thickness (all types)-2900 — ***See Vol. 3***

Testers, Thyristor-2900 — ***See Vol. 3***

Testers, Tracking & Erosion Resistance (Insulation)-2900 — ***See Vol. 3***

Testers, Transistor-2900 — ***See Vol. 3***

Testers, Transmission & Delay-2900 — ***See Vol. 3***

Testers, Tube-2900 — ***See Vol. 3***

Testers, Vibration-2900 (Also See Services, Environmental Test) — ***See Vol. 3***

Testers, Voltage-2900 — ***See Vol. 3***

Testers, Voltage Breakdown-2900 — ***See Vol. 3***

Testers, (MIL), ECM Pod-3475 — ***See Vol. 3***

Testers, (MIL), ECM-3475 — ***See Vol. 3***

Testers, (MIL), ESM-3475 — ***See Vol. 3***

Testing, Environmental — See Services, Environmental Testing (Vol. 3)

Thermal Platforms-2900 — ***See Vol. 3***

Thermal Imagers — See Imagers, Thermal (Vol. 3)

Thermistors-5300 — ***See Vol. 1B***

Thermocouple Devices & Materials — See Cooling/Heating Modules, Thermoelectric (Vol. 1B)

Thermocouples, Elements & Accessories-5300 — ***See Vol. 1B***

Thermoelectric, Modules — See Cooling/Heating Modules, Thermolectric (Vol. 1B)

Thermographs-2900 — ***See Vol. 3***

Thermometers, Electronic (All Types) — See Meters, Temperature (Vol. 3)

Thermometers, Resistance-2900 — ***See Vol. 3***

Thermostats-5300 (Also See Switches, Thermally ctuated; Controls, Temperature) — ***See Vol. 1B***

Thin-Film Memory Systems, Planar — See Memory Systems (Vol. 3)

Thyristors (Incl. Silicon Controlled Rectifiers)-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 .... 1A•2091
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021, 315-253-7321 .... 1A•2095
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 .... 1A•2099,2104
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 .... 1A•2108,2109
§ Teccor Elctrns., P.O. Box 619009, Dallas, TX 75261-9009, 214-252-7651 .. 1A•2110, 2111
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 . 201-335-6723
§ Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hutson Inds., 1000 Hutson Cir., Frisco, TX 75034 214-377-3557

International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
NAE, 69 Bennett St., Lynn, MA 01905 617-598-4800
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Raytheon/TAG Semiconductors Ltd., 43 Third Ave., Burlington, MA. 01803 ....617-272-3704 (3705)
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ RCA Solid State Div., Thyristors & Rectifiers, Rte. 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Research, Inc., Box 24064, Minneapolis, MN 55424 612-941-3300
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† St-Semicon, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402 812-332-1435
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
† Westcode Semiconductors, Inc., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410 201-791-3020
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272

Thyristors (MIL)-2440 — *See Vol. 1B*

Ties, Wire & Cable — See Wire & Cable Ties (Vol. 2)

Time Delays, Precision-2900 — *See Vol. 3*

Timer/Counters-2900 — *See Vol. 3*

Timers, Counting-2200 — *See Vol. 3*

Timers, Cycle & Reset-2200 — *See Vol. 3*

Timers, Delay-2200 — *See Vol. 3*

Timers, Electrolytic Cell-2200 — *See Vol. 3*

Timers, Interval-2200 — *See Vol. 3*

Timers, Programmed-2200 — *See Vol. 3*

Timers, Sequence-2200 — *See Vol. 3*

Timers, Solid State-2200 — *See Vol. 3*

Timing Systems, Oscillators-2300

† Austron, Inc., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761 512-251-2313
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
CTS Knights, 400 Reimann Ave., Sandwich, IL 60548 815-786-8411
Datachron Inc., 3186 J Airway Ave., Costa Mesa, CA 92626 714-751-2211
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806 714-533-6333
Engineered Comps. Co., P.O. Box Y, San Luis Obispo, CA 93406 ...805-544-3800
Frequency and Time Systems, Inc., 34 Tozer Rd., Beverly, MA 01915 617-927-8220
K-Systems, Inc., 3902 Lilac, Las Cruces, NM 88005 505-526-3209
§ Master Elctrn. Controls, P.O. Box 25905, Los Angeles, CA 90025 ...213-452-1336
Northwest Microcircuits, 2115 N. College, Newburg, OR 97132 503-538-7081
Ovenaire, 706 Forrest St., Charlottesville, VA 22901 804-977-8050
Stanford Telecommunications, Inc., 2421 Mission College Blvd., Santa Clara, CA 95050 408-748-1010

Tool Kits & Sets-5400 — *See Vol. 2*

Tools & Kits, Contact Insertion/Removal-5400 — *See Vol. 2*

Tools, Alignment & Tuning-5400 — *See Vol. 2*

Tools, Cable Tie-5400 — *See Vol. 2*

Tools, Connector-5400 — *See Vol. 2*

Tools, Crimping & Swaging-5400 — *See Vol. 2*

Tools, Heat Sealing-5400 — *See Vol. 2*

Tools, Lead Bending & Insertion-5400 — *See Vol. 2*

Tools, Magnetic Pickup-5400 — *See Vol. 2*

Tools, Marking, Numbering, Engraving-5400 — *See Vol. 2*

Tools, Parts Handling, Vacuum Operated-5400 — *See Vol. 2*

Tools, Relay Servicing-5400 — *See Vol. 2*

Tools, Resistance Soldering — See Soldering Equip., Resistance (Vol. 2)

Tools, Wire Wrapping-5400 — *See Vol. 2*

Torches, Soldering, Welding & Accessories-4600 — *See Vol. 2*

Toroids — See Coils, Toroidal (Vol. 1A)

Torque Control — See Knobs, Torque, Incremental, Ratio Drive (Vol. 2)

Torquers, Gyro — See Motors, Torque (Vol. 1B)

Totalizers, Digital-2200 — *See Vol. 3*

Touch Panels — See Displays, Touch Sensitive (Vol. 1B)

Touch Terminals — See Displays, Touch Sensitive (Vol. 1B)

Tracers, Curve-2900 — *See Vol. 3*

Tracers, Signal — See Testers, Signal Tracing (Vol. 3)

Trackballs, XY Positioning-2200 — *See Vol. 3*

Track Breaker (MIL), I-band-3475 — *See Vol. 3*

Trackers (MIL), Laser-3475 — *See Vol. 3*

Tracking Systems (MIL)-3475 — *See Vol. 3*

Trainers (MIL), ECM-3475 — *See Vol. 3*

Trainers (MIL), Elint-3475 — *See Vol. 3*

Trainers (MIL), EW-3475 — *See Vol. 3*

Trainers (MIL), IR Detection-3475 — *See Vol. 3*

Trainers (MIL), Maritime-3475 — *See Vol. 3*

Training Systems (MIL)-3475 — *See Vol. 3*

Transceivers-1900 — *See Vol. 3*

Transducer Elements-5500 — *See Vol. 1B*

Transducers, Acceleration — See Accelerometers (Vol. 1B)

Transducers, Audio-5500 — *See Vol. 1B*

Transducers, Ceramic-5500 — *See Vol. 1B*

Transducers, Displacement-5500 — *See Vol. 1B*

Transducers, Flow-5500 — *See Vol. 1B*

Transducers, Force-5500 — *See Vol. 1B*

Transducers, Frequency — See Transducers, Volt, Watt, Current, etc. (Vol. 1B)

Transducers, Incremental Digital Position, Rotary — See Encoders, Shaft Angle (Vol. 1B)

Transducers, Magnetic Pickup-5500 — *See Vol. 1B*

Transducers, Piezoelectric-5500 — *See Vol. 1B*

Transducers, Position, Linear-5500 — *See Vol. 1B*

Transducers, Position, Rotary-5500 — *See Vol. 1B*

Transducers, Power — See Transducers, Volt, Watt, Currents, etc. (Vol. 1B)

Transducers, Pressure-5500 — *See Vol. 1B*

Transducers, Proximity-5500 — *See Vol. 1B*

Transducers, Sonic-5500 — *See Vol. 1B*

Transducers, Strain Gauge-5500 — *See Vol. 1B*

Transducers, Temperature-5500 — *See Vol. 1B*

Transducers, Thermoelectric — See Transducers, Temperature (Vol. 1B)

Transducers, Torque-5500 — *See Vol. 1B*

Transducers, Ultrasonic-5500 — *See Vol. 1B*

Transducers, Velocity-5500 — *See Vol. 1B*

Transducers, Vibration-5500 — *See Vol. 1B*

§—Product sold through distributors †—Product meets MIL specs

Transducers, Volt, Watt, Current VAR, Power Factor, Frequency-5500 — *See Vol. 1B*

Transformers, Audio-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ....1A•2134
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ....1A•2136
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•2150
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2166
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225, 716-894-5710 ....1A•2171
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ....1A•2175
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .1A•2182, 2183
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•2114,2199,2203,2204
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 ....1A•2208
§ Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ....1A•2206,2207
Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038, 213-934-3566 .... 3•1046
† Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2216
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 213-281-0222 ....1A•2225
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•2233-2249
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ....1A•2263
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 .... 3•1055
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ...1A•2283
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 ....1A•2296,2297
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•2314-2316
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ....1A•2334, 2335
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2338-2344,2347-2353
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
† ADC Magnetic Controls Co., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
§† ADC Prods., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ Atlas Sound Div., 10 Pomeroy Rd., Parsippany, NJ 07054 201-887-7800
§† Audiosone, Inc., 617 Fan Hill Rd., Monroe, CT 06468 ....203-268-4372; 800-243-8160
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ...614-452-6973
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 ...212-691-9050
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St.; Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
§ Neutrik Products, 77 Selleck St., Stamford, CT 06902 203-348-2121
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 ...516-491-3300
Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§† Primo, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 0422-43-3121
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§ Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637 312-488-5800
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ Rye Inds., Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 914-698-0080
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069 619-744-3346
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Autotransformer-5600

Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084, 313-528-3700 .... 3•1848
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ....1A•2162
§† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2169
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..1A•2182
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ....1A•2229
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2267,2277
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ....1A•2280,2281
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ...1A•2283
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 ....1A•2293
Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 ....1A•2298, 2299
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810, 203-748-7001 ....1A•2301
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
§ Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 ....1A•2311
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 ....1A•2327,2328
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ....1A•2333
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2346,2357
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260

§ AC Transformer, 89 Madison St., Newark, NJ 07105 201-589-8574
§ AEMC, 99 Chauncy, Boston, MA 02111 .... 617-451-0227;800-343-1391
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Carson Mfg. Co., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220 317-257-3191
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
§ Frazier, 1930 Valley View La., Dallas, TX 75234 214-241-3441
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex. Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§ Hughey & Phillips, Inc., 3050 N. California St., Burbank, CA 91504 818-849-1104
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735 516-293-0475
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 516-561-6050
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§ Relay Specialties, 1300 Plaza Rd., Fair Lawn, NJ 07410 .... 201-797-3313; 800-526-5376
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037 301-464-2100
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069 619-744-3346
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Bias — See Transformers, Power (Vol. 1A)

Transformers, Bridging — See Transformers, Matching (Vol. 1A)

Transformers, Chopper-5600

† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2347,2348
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 516-561-6050
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
† Solid State Elctrns. Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100

Transformers, Constant Voltage-5600

† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2169
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 1A•2177
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .1A•2182, 2183
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 .... 1A•2208
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•2212
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 .... 1A•2226
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148, 312-620-8394 .... 3•1910,1911
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... 1A•2267
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 .... 1A•2365
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260

ADC Magnetic Controls Co., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 ..612-788-9161
† Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
C-E Elgin Elctrns., 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ......617-655-1532; 800-225-4876
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111 619-565-1155
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752 ......714-832-0290;800-854-9420
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§ Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
Jerome Industries Corp., Power Supply Div., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ......303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
§ Oaktron Inds., 1000 30th St., Monroe, WI 53566 608-328-5560
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Ratelco, 1260 Mercer, Dept. EEM, Seattle, WA 98109 206-624-7770
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 .203-265-2110
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sola Elec., 1717 Busse Rd., Elk Grove Village, IL 60007 312-439-2800
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
§ Sun Research Inc., Phase-R, Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
§ University Sound, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069 619-744-3346
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Control — See Transformers, Power (Vol. 1A), Transformers, Synchro, Control (Vol. 1A),

Transformers, Converter, DC To DC-5600

B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ......1A•2136
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ......1A•1233
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ......1A•2139,2150
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ......1A•2175
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..1A•2183
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ......1A•2198
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ......1A•2215
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ......1A•2233,2252,2253
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ......1B•1015
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ......1A•2355
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Alpha Comps., 115 Eucalyptus Dr., El Segundo, CA 90245 213-322-7780
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 ..612-788-9161
† Applied Electro Technlg., Int., STI Company, 2220 So. Anne St., Santa Ana, CA 92704 714-556-6570
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Bikor, 1504 W. 228th St., Torrance, CA 90501 213-539-6320
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† Endicott Resch. Grp., Inc., 2601 Wayne St., P.O. Box 269, Endicott, NY 13760 607-754-9187
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ......303-443-6250; 800-525-6478
§ Love Controls, 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Novatronics, Box 878, Pompano Beach, FL 33061 305-942-5200
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pacific Electro Dynamics, Inc., 11465 Willows Rd. N.E., Redmond, WA 98052 206-881-1700
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400

Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 .203-265-2110
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Current — See Transformers, Instrument (Vol. 1A)

Transformers, Data — See Transformers, Telephone Coupling (Vol. 1A)

Transformers, Decade-5600

† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Transformers, Differential-5600

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ....3•1145
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ....3•1161
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
Transducers and Systems Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ....1B•1880
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
§ Ametek, 2 Station Square, Paoli, PA 19301 215-355-6900
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ....215-337-5500;800-441-8245
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-532-9464
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
§† Robinson-Halpern, One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engrg., U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Transformers, Discriminator-5600

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1227
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Donut — See Transformers, Toroidal (Vol. 1A)

Transformers, Driver-5600

† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•2213
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..1A•2260, 2261
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ....1A•2314-2316
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541

† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .. 212-255-3500
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Transformers, Ferroresonant-5600

Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2169
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 .... 1A•2176
Jerome Industries Corp., Power Supply Div., B 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 3•1607
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 1A•2177
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 .... 1A•2208
§ **Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148, 312-620-8394 .... 3•1910,1911**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015**
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
ADC Magnetic Controls Co., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
Framar Metal Prods., 124 W. Main St., Dept. 1201, High Bridge, NJ 08829 201-638-6688
Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752 .... 714-832-0290;800-854-9420
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 . 212-255-3500
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Filament-5600

† **Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 .... 1A•2117-2122**
§† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2166,2169**
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 .... 1A•2176
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .. 1A•2183
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 213-281-0222 .... 1A•2223,2224
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 .... 1A•2226
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•2254**
§ **Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 .... 1A•2284-2286**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015**
§ **Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 .... 1A•2308,2309**
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 .... 1A•2325**
§ **Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 .... 1A•2330, 2331**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2338,2354,2356,2357,2359**
† **Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 .... 1A•2365**
Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 .. 612-788-9161
† Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735 . 516-293-0475
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Oram Elctrns., Rte. 22, Brewster, NY 10509 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Flyback-5600

B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 .... 1A•2136
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 .... 1A•2206
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 .... 1A•2209
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 .... 1A•2304
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 .... 1A•2325**
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ... 814-355-1521
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 . 203-265-2110
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Foil Wound — See Coils, Foil Wound (Vol. 1A)

Transformers, 400 Hz-5600

† **Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 .... 1A•2117-2123**
† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2166**
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .... 1A•2175**
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .. 1A•2183
† **Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 .... 1A•2185**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2198**
† **NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 1A•2211**
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•2233,2255
† **Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2267,2272,2273,2278**
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 .... 1A•2294,2295
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015**
Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 .... 1A•2308,2309
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•2319**
† **Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701, 201-364-1800 ... 1A•2322,2323**
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 .... 1A•2325**
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 .... 1A•2327,2328
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... 1A•2336
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2338,2354,2357-2360**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 .. 612-788-9161
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Crompton Instrs., 2763 Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§† Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735 . 516-293-0475
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 516-491-3300
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334

Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
§† Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810 203-748-7001
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, High Voltage (1,000 Volts & Over)-5600

† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ....1A•2151
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2166
† Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ....1A•2171,2173, 2174
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ....1A•2176
Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067, 404-952-9777 ....1A•2209
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ....1A•2211
Pearson Elctrns., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ....1A•2230
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ....1A•2304
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2338
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ....1A•2365
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084 313-528-3700
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
ENI Power Sys., 3000 Winton Rd. S., Rochester, NY 14623 716-473-7330
Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 201-534-9007
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
§ Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Kaiser Systems, Inc., 33 Cherry Hill Drive, Danvers, MA 01923 617-777-5102
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
KSI, 33 Cherry Hill Dr., Danvers, MA 01923 617-777-5102
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ....303-443-6250; 800-525-6478
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Oram Elctrns., Rte. 22, Brewster, NY 10509 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Designs, Inc., 1700 Shames Dr., Westbury, NY 11590 516-333-6200
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Ross Engrg. Corp., 559 Westchester Dr., Campbell, CA 95008 408-377-4621
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 201-933-2091
S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
Simco Co., 2257 North Penn Rd., Hatfield, PA 19440 215-822-2171
Spellman High Voltage Elctrns. Corp., 7 Fairchild Ave., Plainview, NY 11803 516-349-8686
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 312-679-8200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Horizontal Sweep-5600

Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ....1A•2303,2304

Transformers, Hybrid-5600

Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•2200-2202
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2217
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2345
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700

Transformers, IF-5600

§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1227
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ....1A•2206
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
† Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Engelmann Microwave Co., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-5700
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Merrimac Inds., 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300

Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ... 617-491-5400
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 ... 212-769-0200
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ... 503-238-2440
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 ... 516-491-3300
† Piconics, Cummings Rd., Tyngsboro, MA 01879 ... 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 ... 516-466-0911
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 ... 618-262-5121
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 ... 312-677-3640
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 ... 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 ... 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 ... 219-356-6500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 ... 213-323-4100
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 ... 415-493-4141
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ... 813-371-4242

Transformers, Input-5600

Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ... 1A•2183
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ... 1A•2199,2204**
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ... 1A•2229
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ... 1A•2233-2249,2254**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1B•1015**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ... 1A•2314-2316**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ... 1A•2338,2346-2353**
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 ... 213-571-6260
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 ... 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 ... 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 ... 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 ... 618-654-2341
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 ... 203-824-5125
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 ... 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 ... 802-287-4055
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 ... 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 ... 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 ... 914-337-4775
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 ... 213-283-0015
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ... 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 ... 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 ... 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 ... 213-828-9541
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 ... 212-386-1300
Grand Transformers, Box 188, Grand Haven, MI 49417 ... 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 ... 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 ... 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 ... 201-782-5525
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 ... 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 ... 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
† Kenyon Magnetics, 1040 Grand St., Hoboken, NJ 07030 ... 201-798-6511
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ... 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 ... 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 ... 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ... 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 ... 713-785-4202
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ... 617-491-5400
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 ... 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 ... 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 ... 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 ... 215-794-7411
§ Neutrik Products, 77 Selleck St., Stamford, CT 06902 ... 203-348-2121
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 ... 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ... 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 ... 201-454-2600
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 ... 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 ... 213-281-0222
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 ... 203-762-4786
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 ... 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 ... 201-672-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 ... 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ... 213-32-Sigma
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 ... 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 ... 618-262-5121
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 ... 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 ... 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 ... 516-293-3100
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 ... 219-356-6500

Transformers, Instrument-5600

§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ... 1A•2150**
† **Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ... 1A•2151**
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 ... 1A•2177
† **Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ... 1A•2185**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ... 1A•2192-2194**
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 ... 1A•2208
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ... 1A•2211
Pearson Elctrns., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ... 1A•2230
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ... 1A•2283
§ **Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ... 1A•2287,2288**
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ... 1A•2300
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1B•1015**
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281, 215-539-6050 ... 3•1309
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 ... 1A•2327,2328
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 ... 818-841-3630
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 ... 213-571-6260
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 ... 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 ... 618-985-4838
Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807 ... 305-678-6900
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 ... 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 ... 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 ... 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 ... 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 ... 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 ... 213-283-0015
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 ... 914-738-1611
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 ... 414-377-7040
Crompton Instrs., 1562 Parkway Loop, Units A & B, Tustin, CA 92680 ... 714-731-2333
Crompton Instrs., 2763 Higgins Rd., Elk Grove Village, IL 60007 ... 312-593-1107
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ... 614-452-6973
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 ... 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 ... 203-599-2075
Electrical Instr. Svc., 25 Dock St., Mt. Vernon, NY 10550 ... 914-699-9717
Electromatic Comps. Ltd., 1531 Burgundy Pkwy., Streamwood, IL 60103 ... 312-837-4600
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 ... 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 ... 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 ... 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 ... 716-968-2400
Epoch Entpr., 3541 N. Olive Rd., Tucson, AZ 85719 ... 602-887-1970
Esterline Angus, Box 24000, Indianapolis, IN 46224 ... 317-244-7611
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 ... 212-691-3610

Flex-Core Div., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43085 614-889-6152
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
JAMB Inds., Box 281, Rockaway Valley Rd., Boonton, NJ 07005 201-263-9295
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
§ Larson Instr., Greenbush Rd., Orangeburg, NY 10962 914-359-3800
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212 614-486-9561
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 ...516-491-3300
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ......914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Designs, Inc., 1700 Shames Dr., Westbury, NY 11590 516-333-6200
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 .203-265-2110
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Sensitive Research Instrs., 25 Dock St., Mt. Vernon, NY 10550 914-699-9717
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Simpson Elec. Co., 853 Dundee Ave., Elgin, IL 60120 312-697-2260
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, 50 Ash St., Yonkers, NY 10701 914-963-3400
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
Western Electro. Mech. Co. Inc., 300 Broadway, Oakland, CA 94607 415-452-1936
§ Yokogawa Corp. of America, 2 Dart Rd., Shenandoah, GA 30265 ...404-253-7000
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Interstage-5600

§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ......1A•2199,2204**
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ......1A•2229
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..1A•2260, 2261
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ......1B•1015**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ......1A•2314-2316**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ......1A•2338-2353,2361**
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ...614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ......415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ......914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

Transformers, Inverter-5600

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ......1A•1233
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..1A•2260, 2261
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ......1B•1015**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ......1A•2338,2354-2356**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Alpha Comps., 115 Eucalyptus Dr., El Segundo, CA 90245 213-322-7780
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 ..612-788-9161
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ......415-785-5231;415-785-5235
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111 619-565-1155
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
† Endicott Resch. Grp., Inc., 2601 Wayne St., P.O. Box 269, Endicott, NY 13760 607-754-9187
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234

† Hisonic, Inc., 249 N. Troost; P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Pacific Electro Dynamics, Inc., 11465 Willows Rd. N.E., Redmond, WA 98052 206-881-1700
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
§† Powermark, 3855 Ruffin Rd., San Diego, CA 92123 619-565-8363
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
§ Sun Research Inc., Phase-R, Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
§† Terado, 1068 Raymond Ave., St. Paul, MN 55108 612-646-2868
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan .... Tokyo 03-402-6161
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Isolation-5600

Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084, 313-528-3700 .... 3•1814,1850
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 .... 1A•2142-2149**
† **Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 .... 1A•2151**
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111, 619-565-1155 .... 3•1854
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 .... 1A•2162
† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2169**
Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... 1A•2173,3•1591
§ **Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 .... 1A•2176**
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 1A•2177
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 .... 1A•2178,2179,2181
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .. 1A•2183
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2199,2204**
† **North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .. 1A•2210**
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 .... 1A•2217
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 .... 1A•2229
† **RTE Deltec Corp., 2727 Kurtz St., San Diego, CA 92110, 619-291-4211 ...... 3•1907**
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148, 312-620-8394 .... 3•1910,1911
† **Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2267,2278**
§† **Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .... 1A•2281**
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ... 1A•2283
§ **Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 .... 1A•2290-2292**
† **Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 .... 1A•2293**
§† **Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 .... 3•1917**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015**
§ **Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 .... 1A•2310**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•2314-2316**
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 .... 1A•2327,2328
§ **Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... 1A•2335**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2339-2344,2357,2359-2361**
† **Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 .... 1A•2365**
Xentek, Inc., 279 S. Pacific St., San Marcos, CA 92069, 619-744-3346 .... 3•1810
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
§ ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 .. 612-788-9161
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
§ B & K Precision Prod. Grp., Dynascan, 6460 W. Cortland, Chicago, IL 60635 312-889-9087
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 .. 614-452-6973
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
§ Electronic Navigation Inds., 3000 Winton Rd. S., Rochester, NY 14623 716-473-6900
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752 .... 714-832-0290.800-854-9420
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
§ Hughey & Phillips, Inc., 3050 N. California St., Burbank, CA 91504 . 818-849-1104
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
Jerome Industries Corp., Power Supply Div., B 730 Division St., Elizabeth, NJ 07201 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods,, 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc,, 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 212-769-0200

Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038 213-934-3566
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Oram Elctrns., Rte. 22, Brewster, NY 10509 914-279-2966
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Conversion Prods., 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Rutherford Resch. Prods., Box 249, Rutherford, NJ 07070 201-933-2091
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
§ Sun Research Inc., Phase-R, Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§ VIZ Test Equipment, Div. VIZ Mfg., 335 E. Price St., Philadelphia, PA 19144 215-844-2626
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Line-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 .... 1A•2132
Avionic Instrs., 943 E. Hazelwood Ave., Rahway, NJ 07065, 201-388-3500 .... 3•1828
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084, 313-528-3700 .... 3•1814,1848,1850
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 .... 1A•2151
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111, 619-565-1155 .... 3•1854
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 1A•2177
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 .... 1A•2178,2179,2181
Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637, 312-488-5800 .... 3•1049
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 .... 1A•2263
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .... 1A•2283
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 .... 1A•2296,2297
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 .... 1A•2335
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2347,2348
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
§ American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 .. 612-788-9161
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
ERA Transpac Div., Sub. Elctrn. Research Assocs., 311 B East Park St., Dept. 1202, Moonachie, NJ 07074 201-641-3650
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§ Martin Sound Prods., 28 Alpha Park, Cleveland, OH 44143-2297 216-442-2286
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§ Todd Systems, 50 Ash St., Yonkers, NY 10701 914-963-3400
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transformers, Linear Variable-Differential — See Transformers, Differential (Vol. 1A)

Transformers, Magnetic Amplifier-5600

† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566

† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ....303-443-6250; 800-525-6478
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetic Specs., 10 Albemarle Ave., Trenton, NJ 08638 ....
† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674

Transformers, Matching-5600

Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ....1A•1221
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ....1A•1233
† **Electro Impulse, Box 870, Red Bank, NJ 07701-0870, 201-741-0404 .... 3•1220**
† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ....1A•2175**
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ..1A•2183
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•2199,2204**
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ....1A•2206,2207
† **North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..1A•2210**
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2217
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 213-281-0222 ....1A•2225
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•2233-2249**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2345,2346**
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
Applied Research Inc., 160 Dupont St., Plainview, NY 11803 516-349-9200
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electronic Navigation Inds., 3000 Winton Rd. S., Rochester, NY 14623 716-473-6900
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
ENI Power Sys., 3000 Winton Rd. S., Rochester, NY 14623 716-473-7330
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
§ GC Elctrns., 400 S. Wyman St., Rockford, IL 61101 815-968-9661
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
ISL Products Intl. Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-822-9601
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
§ Oaktron Inds., 1000 30th St., Monroe, WI 53566 608-328-5560
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 ...516-491-3300
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
RFL Inds., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005 201-334-3100
§ RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 212-892-6700
† Sabre Comms. Corp., 117 Main St., Soiux City, IA 51102 712-258-6690
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
§ Sitco Antennas, 10330 N.E. Marx St., Portland, OR 97220 503-253-2000
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
† Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 ..603-627-6000
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
Uniform Tubes, Collegeville, PA 19426 215-539-0700
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transformers, Microminiature-5600

§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1227**
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•2139**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•2199,2203,2204**
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..1A•2210
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•2233-2255**
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 ....1A•2297
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•2314-2316**
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ....1A•2335

Transformers, Microminiature-5600 (Cont'd)

† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 .... 1A•1276
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 212-769-0200
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
SFE Technologies, 1501 1st St., San Fernando, CA 91341 213-365-9411
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 . 212-255-3500

Transformers, Microphone-5600

§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2199
Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•2233
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 .... 1A•2296,2297
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2346
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., New York, NY 10011 ... 212-691-9050
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Neutrik Products, 77 Selleck St., Stamford, CT 06902 203-348-2121
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
§ Paso Sound Prods., 14 First St, Pelham, NY 10803 914-738-4800
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60204 312-866-2200
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

Transformers, Mixing-5600

North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .. 1A•2210
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2347,2348
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 212-769-0200
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Modulation-5600

Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 .... 1A•2176
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
† General Magnetics, 211 Grove St., Bloomfield, NJ 07003 201-743-2700
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500

§—Product sold through distributors †—Product meets MIL specs

§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 ... 212-255-3500
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 ... 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 ... 415-968-9176

Transformers, Output-5600

JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ... 1A•2178,2179,2181
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 ... 1A•2183
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ... 1A•2199,2204**
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ... 1A•2229
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ... 1A•2263
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1B•1015**
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ... 1A•2314-2316**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ... 1A•2338-2344,2346,2349-2353**
† **Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ... 1A•2365**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 ... 201-526-6010
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 ... 213-571-6260
§ Altec Lansing, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806 ... 714-632-7117
American Magnetics, P.O. Box 8, Carterville, IL 62918 ... 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 ... 612-788-9161
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 ... 516-333-8100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 ... 618-654-2341
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 ... 714-657-5195
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 ... 716-538-4421
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 ... 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 ... 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 ... 914-337-4775
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ... 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 ... 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 ... 203-599-2075
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 ... 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 ... 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ... 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 ... 212-386-1300
Grand Transformers, Box 188, Grand Haven, MI 49417 ... 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 ... 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 ... 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 ... 201-782-5525
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 ... 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 ... 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 ... 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 ... 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ... 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 ... 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 ... 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ... 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 ... 713-785-4202
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ... 617-491-5400
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 ... 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 ... 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 ... 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 ... 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 ... 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ... 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 ... 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 ... 213-281-0222
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 ... 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ... 914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 ... 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 ... 815-385-2700
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 ... 203-265-2110
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 ... 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 ... 219-722-2244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ... 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 ... 618-262-5121
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 ... 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 ... 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 ... 219-356-6500

Transformers, Plate-5600

† **Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 ... 1A•2296,2297**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1B•1015**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ... 1A•2338,2347,2348,2354,2356**
† **Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 ... 1A•2365**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 ... 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 ... 818-841-3630
American Magnetics, P.O. Box 8, Carterville, IL 62918 ... 618-985-4838
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 ... 617-445-7100
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 ... 618-654-2341
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 ... 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 ... 213-936-6188
Computer Power, 124E W. Main St., High Bridge, NJ 08829 ... 201-735-8000
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ... 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 ... 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-699-2000
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 ... 203-599-2075
Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 ... 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 ... 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 ... 213-828-9541
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 ... 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 ... 201-635-6566
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 ... 212-386-1300
Grand Transformers, Box 188, Grand Haven, MI 49417 ... 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 ... 716-894-5710
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 ... 201-782-5525
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 ... 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 ... 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 ... 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 ... 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ... 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 ... 303-442-6700
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 ... 617-458-1487
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ... 516-561-6050
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 ... 312-395-5710
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ... 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 ... 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 ... 313-368-4136
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 ... 213-281-0222
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 ... 312-489-2229
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 ... 201-672-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 ... 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 ... 513-253-1191
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 ... 219-722-2244
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 ... 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 ... 618-262-5121
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 ... 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 ... 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 ... 219-356-6500
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 ... 914-241-1300
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 ... 415-968-9176

Transformers, Power-5600

† **Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ... 1A•2117-2123**

Advanced Transformers Inds., Inc., 114 Center St., El Segundo, CA 90245, 213-322-4249 .... 1A•2264,2265
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... 1A•2129,2130
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 .... 1A•2132
Avionic Instrs., 943 E. Hazelwood Ave., Rahway, NJ 07065, 201-388-3500 .... 3•1828
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 .... 1A•2136, 2137
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084, 313-528-3700 .... 3•1814,1848
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 .... 1A•2142-2150
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111, 619-565-1155 .... 3•1854
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905, 607-797-1263 1A•2152
§† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 .... 1A•2154-2161,2163
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2166,2169
Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 .... 1A•2171,2173, 2174
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .... 1A•2175
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 .... 1A•2176
Jerome Industries Corp., Power Supply Div., B 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 3•1607
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 .... 1A•2177
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 .... 1A•2178,2179,2181
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .1A•2182, 2183
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 .... 1A•2191
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 .... 1A•2185
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2114,2192-2198
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 .... 1A•2208
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 .... 1A•2206
NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 1A•2211,3•1663
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 .... 3•1663
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 .... 1A•2212,2213
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 .... 1A•2215,2218,2219
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 213-281-0222 .... 1A•2223-2225
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 .... 1A•2226-2228
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 .... 1A•2233,2255
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 .... 1A•2257-2259
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148, 312-620-8394 .... 3•1911
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 .... 1A•2263
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2267-2278
† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 .... 1A•2280,2281
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ...1A•2283
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 .... 1A•2284-2286,2289
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 .... 1A•2293-2295
Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 .... 1A•2298, 2299
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 .... 1A•2300
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 .... 1A•2305-2307
§ Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 .... 1A•2308-2311
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 .... 1A•2312,2313
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•2317-2320
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701, 201-364-1800 ...1A•2322,2323
Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 .... 1A•2325
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 .... 1A•2327,2328
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... 1A•2330-2337
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2338,2354,2355,2358-2360
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503, 201-278-7674 .... 1A•2365

Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
ADC Magnetic Controls Co., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 ..612-788-9161
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ ATR Elctrns., Inc., 280 E. Lafayette Frontage Rd., St. Paul, MN 55107 612-222-3791
§ Ault, Incorporated, 1600 Freeway Blvd., Minneapolis, MN 55430 612-560-9300
§ Avel-Lindberg Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06810 203-797-8698
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 714-781-5050
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Brown Boveri Elec., Norristown Rd., Spring House, PA 19477 215-628-7400
Bryant Circuit Devices Div., Westinghouse Elec. Corp., 500 Sylvan Ave., Bridgeport, CT 06606 203-334-5561
C-E Elgin Elctrns., 5533 New Perry Hwy., Erie, PA 16509-3570 814-864-4921
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 ...614-452-6973
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Diversified Elctrns., Inc., Indl. Controls Div., 119 N. Morton Ave., Evansville, IN 47711 812-426-2806
Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
§ Eaton Corp./Cutler-Hammer Prods., Aerospace/Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Edwards Co., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06032 203-678-0410
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
Ericson Mfg. Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752 .... 714-832-0290;800-854-9420
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 .617-486-9483
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Merrimack Magnetics Corp., 121 Hale St., Lowell, MA 01851 617-458-1487
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan 489-5333
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411

† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Terado, 1068 Raymond Ave., St. Paul, MN 55108 612-646-2868
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan ....Tokyo 03-402-6161
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 201-361-6622
Tran-Trol Co., 2525 N. Alvernon Way, C-6, Tucson, AZ 85712 602-795-8008
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Power Distribution-5600

Golden Pacific Elctrns., Inc., 1020 N. Batavia St., Ste. Q, Orange, CA 92667, 714-538-9752/9753 ....3•1582
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ....1A•2176
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 ....1A•2326
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2357
Advanced Transformers Inds., Inc., 114 Center St., El Segundo, CA 90245 213-322-4249
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084 313-528-3700
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 .617-486-9483
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ....303-443-6250; 800-525-6478
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831

Transformers, Printed Circuit Mounting-5600

Advanced Transformers Inds., Inc., 114 Center St., El Segundo, CA 90245, 213-322-4249 ....1A•2264,2265
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ....1A•2134
§ **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, 213-537-5200 ....1A•1227**
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ....1A•2136, 2137
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•2139,2142-2150**
§ **EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ....1A•2154-2161**
† **Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ....1A•2166**
Golden Pacific Elctrns., Inc., 1020 N. Batavia St., Ste. Q, Orange, CA 92667, 714-538-9752/9753 ....3•1582
§ **Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225, 716-894-5710 ....1A•2171**
Jerome Industries Corp., Power Supply Div., B 730 Division St., Elizabeth, NJ 07201, 201-353-5700 ....3•1607
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 ....1A•2177
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 ....1A•2178,2179,2181
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .1A•2182, 2183
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ....1A•2186-2191
† **Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ....1A•2185**
§† **Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ....1A•2192-2204**
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 ....1A•2208
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ....1A•2206
† **North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..1A•2210**
† **OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865, 201-454-2600 ....1A•2213**
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2215-2219
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 213-281-0222 ....1A•2223-2225
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ....1A•2226-2229
† **Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ....1A•2231**
† **Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ....1A•2233-2255**
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050, 815-385-2700 ....1A•2257-2259
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729, 516-586-5566 ..1A•2260, 2261
† **Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ....A•2267-2270,2272,2273**
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ...1A•2283
§ **Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ....1A•2287-2289**
† **Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 ....1A•2296,2297**
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076, 312-679-8200 ....1A•2300
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015**
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 ....1A•2305-2307
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 ....1A•2314-2320**
† **Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701, 201-364-1800 ...1A•2322,2323**
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ....1A•2325**
Transformation Elctrns. Corp., 170 Wilbur Pl., Bohemia, NY 11716, 516-563-1117 ....3•1802
§ **Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... 1A•2334-2337**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2338-2344,2347-2353,2357,2358,2360-2363**
† **Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 ....1A•1276**
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
§ Avel-Lindberg Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06810 203-797-8698
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† BG Elctrns., 30 South St., Mt. Vernon, NY 10551 914-664-5591
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 614-452-6973
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ....415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 ... 212-691-3610
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600

† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 ... 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 ... 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 ... 512-546-1625
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 ... 213-539-6452
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ... 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 ... 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 ... 408-757-8752
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 ... 713-785-4202
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ... 617-491-5400
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 ... 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 ... 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 ... 414-438-5300
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 ... 212-769-0200
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 ... 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 ... 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ... 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 ... 313-368-4136
Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ... 814-355-1521
† Piconics, Cummings Rd., Tyngsboro, MA 01879 ... 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 ... 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 ... 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 ... 413-568-2301
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 ... 201-672-2400
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 ... 619-268-2400
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 ... 714-898-0960
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 ... 203-265-2110
Schaffner EMC Inc., Component Div., 825 Lehigh Ave., Union, NJ 07083 ... 201-851-0644
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 ... 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ... 213-32-Sigma
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 ... 408-980-1600
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 ... 214-424-1581
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 ... 312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 ... 914-664-2050
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 ... 203-661-5726
† Transistor Devices, 274 S. Salem St., Randolph, NJ 07869 ... 201-361-6622
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 ... 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 ... 201-664-7997
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 ... 415-968-9176

Transformers, Programmable Ratio-5600

Astrosystems, 6 Nevada Dr., Lake Success, NY 11042, 516-328-1600 ... 3•1189

Transformers, Pulse-5600

† B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ... 1A•2136
§† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 ... 1A•2166
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225, 716-894-5710 ... 1A•2171
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ... 1A•2175
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ... 1A•2206
† North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ... 1A•2210
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ... 1A•2215,2216
Pearson Elctrns., 1860 Embarcadero Rd., Palo Alto, CA 94303, 415-494-6444 ... 1A•2230
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 14-699-5514;800-431-1064 ... 1A•2233,2250,2251
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ... 1B•1015
§† TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ... 1A•2338,2361-2363
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 ... 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 ... 618-985-4838
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 ... 215-723-8181
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 ... 516-333-8100
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 ... 607-563-8444
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 ... 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 ... 617-445-7100
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 ... 305-883-5311
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 ... 212-291-3900
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 ... 203-824-5125
Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507 ... 714-781-5050
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 ... 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 ... 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 ... 516-746-2310
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 ... 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 ... 213-936-6188
Cober Elctrns., 102 Hamilton Ave., Stamford, CT 06902 ... 203-327-0003
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 ... 213-283-0015
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 ... 414-377-7040
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 ... 914-699-2000
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 ... 716-652-3600
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 ... 816-331-4911
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 ... 617-745-3200
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 ... 219-232-2743
§ Electronic Navigation Inds., 3000 Winton Rd. S., Rochester, NY 14623 ... 716-473-6900
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 ... 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 ... 805-964-0751
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 ... 213-828-9541
† El-Rad Mfg., 4300 N. California, Chicago, IL 60618 ... 312-478-7300
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 ... 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 ... 716-968-2400
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 ... 201-947-0400
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ... 201-245-3200;800-526-4048
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 ... 305-894-3351
Grand Transformers, Box 188, Grand Haven, MI 49417 ... 616-842-5430
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 ... 201-782-5525
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 ... 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 ... 516-567-5600
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 ... 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 ... 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 ... 201-353-5700
† Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 ... 201-541-1600
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 ... 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 ... 815-344-2900
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 ... 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 ... 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 ... 303-442-6700
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 ... 516-587-0510
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 ... 516-654-1166
Maxwell Labs., 8835 Balboa Ave., San Diego, CA 92123 ... 619-279-5100
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ... 516-561-6050
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 ... 617-491-5400
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 ... 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 ... 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 ... 414-438-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 ... 503-238-2440
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 ... 201-454-2600
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 ... 818-892-0761
† Piconics, Cummings Rd., Tyngsboro, MA 01879 ... 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 ... 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 ... 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 ... 619-268-2400
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 ... 203-792-6666
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 ... 516-586-5566
† Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 ... 714-898-0960
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 ... 612-475-1173
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 ... 603-883-8102
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Simmonds Precision, P.O. Box 310, Norwich, NY 13815 ... 607-335-5000
§† Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 ... 413-664-4411
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 ... 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ... 212-782-4200
TDK Corporation of America, 4711 Golf Rd., Skokie, IL 60076 ... 312-679-8200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 ... 618-262-5121
† Tobe Deutschmann Labs., Inc., 550 Turnpike St., Canton, MA 02021 ... 617-828-3366

§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan ....Tokyo 03-402-6161
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
U.S. Scientific Instrs., 61 North Beacon St., Boston, MA 02134 617-787-2411
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, RF-5600

† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ....1A•2175**
† **Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 ..1A•1713, 1714,1723,1754,1755**
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 ....1A•2206
† **North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .1A•1774, 2210**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015**
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2338
† **Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 ....1A•1276**
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Alpha Inds., Inc.-Microelectronic Div., 3015 Advance Lane, Colmar, PA 18915 215-822-1311
Amplifier Research, 160 School House Rd., Souderton, PA 18964-9990 215-723-8181
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010 305-883-5311
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052 716-652-3600
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Elcom Systems, Inc., 4032 Clint Moore Rd., Boca Raton, FL 33431 305-994-1774
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
§ Electronic Navigation Inds., 3000 Winton Rd. S., Rochester, NY 14623 716-473-6900
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 201-534-9007
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
International High Voltage Elctrns., Inc., 98 Mill Plain Rd., Danbury, CT 06810 203-792-7820
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
§ KLM Electronics, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037 408-779-7363
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
§ Macom Inds., 8230 Haskell Ave., Van Nuys, CA 91406
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§ Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
Rhombus Inds., 15801 Chemical Ln., Huntington Bch., CA 92649-1595 714-898-0960
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Technical Research & Mfg., Inc., R.F.D. 0, Manchester, NH 03103 ..603-627-6000
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Uniform Tubes, Collegeville, PA 19426 215-539-0700
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Reactor — See Reactors, Filter (Vol. 1A)

Transformers, Rectifier-5600

† **Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ....1A•2120-2122**
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ....1A•2142-2149**
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ....1A•2176
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201, 201-353-5700 ....1A•2177
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 ....1A•2208
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 ....1A•2218,2219
Shogyo Intl. Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ....1A•2263
† **Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ....A•2267,2270,2272-2276**
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ...1A•2283
§ **Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 ....1A•2284-2286**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015**
Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 ....1A•2308,2309
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 ....1A•2312,2313
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 ....1A•2327,2328
§ **Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ....1A•2332, 2334**
§† **TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ....1A•2354,2355,2359,2360**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
Abbott Transistor Labs., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352 818-504-0644
§ ACD-Elcor Products, P.O. Box 244, Bethel, CT 06801 203-743-3510
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Alpha Comps., 115 Eucalyptus Dr., El Segundo, CA 90245 213-322-7780
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 ..612-788-9161
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
§† Bendix Corp., Electric Power Div., Hwy. 35, Eatontown, NJ 07724 ..201-542-2000
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 614-452-6973
D & B Power, Inc., 204 N. Fehr Way, Bayshore, NY 11706 516-586-5955
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Eastern Delta Corp., 29-09 S. Broadway, Fair Lawn, NJ 07410 201-797-4200
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111 619-565-1155
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Field Electronics, 1416 Commerce St., Chatham, NJ 07928 201-635-6566
Grand Transformers, Box 188, Grand Haven, MI 49417 616-842-5430
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735 .516-293-0475
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
§ Liberty Intl. Corp., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704 516-587-0510
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050

Transformers, Rectifier-5600 (Cont'd)

Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704 516-491-3300
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 .203-265-2110
S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .516-593-2025;Outside NY 800-645-5900
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Reference-5600

† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ....1A•2231
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ....1A•2333
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
North Atlantic Inds., Instrument Div., 60 Plant Ave., Hauppauge, NY 11788 516-582-6500
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† TRW Inductive Products Div., 150 Varick St., New York, NY 10013 .212-255-3500
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Rotary-5600

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ....1A•2185
Transducers and Systems Inc., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ....1B•1880
Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Schaevitz Engrg., U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Transformers, Scott T-5600

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ....1A•2185
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ....1A•2231
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ....1A•2325
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elma Engrg., 1066 E. Meadow Circle, Palo Alto, CA 94303 415-494-7303
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..201-245-3200;800-526-4048
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822 201-782-5525
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
§ Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ....213-32-Sigma
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 ..212-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Servo-5600

† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ....1A•2185
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 ....1A•2231
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 .... 3•1170
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† Ferrotran Elctrns. Co., Inc., 11 W. 25th St., New York, NY 10010 212-691-3610
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 ..516-561-6050
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 .203-265-2110
Singer Co., Kearfott Div., 1150 McBride Ave.. Little Falls, NJ 07424 201-785-6000
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Xylog Corp., 150 Tillman St., Westwood, NJ 07675 201-664-7997
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Split Bobbin-5600

Advanced Transformers Inds., Inc., 114 Center St., El Segundo, CA 90245, 213-322-4249 ....1A•2264,2265
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 ....1A•2132
Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 ....1A•1221
B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 ....1A•2136
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ....1A•2156,2160,2162,2163

Golden Pacific Elctrns., Inc., 1020 N. Batavia St., Ste. Q, Orange, CA 92667, 714-538-9752/9753 .... 3•1582
JM Transformer Co., Inc., 112 Florida St., Farmingdale, NY 11735, 516-293-0475 .... 1A•2178,2179,2181
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 .. 1A•2183
Magnetic Coils Inc., 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 .... 1A•2186-2188,2191
Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2192,2194
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 .... 1A•2215,2219
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 .... 1A•2226,2228
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2267,2268,2271,2274,2275
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ... 1A•2283
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 .... 1A•2287,2288
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ... 1A•2336, 2337
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Rt. 2, Box 305, Danville, VA 24540 804-685-7073
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 .... 303-443-6250; 800-525-6478
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Schauer Mfg., 4500 Alpine Ave., Cincinnati, OH 45242 513-791-3030
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
† Torotel Prods, Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Step Down, Step Up — See Transformers, Power (Vol. 1A)

Transformers, Synchro Control-5600

Astrosystems, 6 Nevada Dr., Lake Success, NY 11042, 516-328-1600 .... 3•1189
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 .... 3•1145
Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 .... 3•1148
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .... 1A•2175
ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 .... 3•1161
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 .... 1A•2185
Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 .... 1A•2231
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 .... 3•1170
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Clifton Precision, Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Muirhead, 1101 Briston Rd., Mountainside, NJ 07092 201-233-6010
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Portescap Transicoil, Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
Singer Co., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424 201-785-6000
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Vernitron Corp., Control Comps. Div., 1601 Precision Park La., San Diego, CA 92073 619-428-5581

Transformers, Telephone Coupling-5600

Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753, 516-333-8100 .... 1A•2134
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 .... 1A•2140,2141
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2199-2202
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746, 213-532-1790 .... 1A•2215,2217
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803, 213-281-0222 .... 1A•2224,2225
PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 .... 1A•2229
§ Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, 219-722-2244 .... 1A•2290-2292
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 .... 1A•2335
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2338,2345
AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Cramer Coil & Transformer Co., Inc., 1121 15th Ave., Grafton, WI 53024 414-377-7040
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Midland-Ross Corp., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001 507-625-6521
Midland-Ross Corp., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001 507-625-6521
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009 201-239-8183
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880

Transformers, Toroidal-5600

† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 .... 1A•2122
Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... 1A•2127,2129,2130
† Automatic Coil Corp., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, 305-883-5311 .... 1A•1221
Endicott Coil, 22 E. Charlotte St., Binghamton, NY 13905, 607-797-1263 1A•1244
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2168
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 .... 1A•2175
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050, 815-344-2900 . 1A•2182, 2183
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 .... 1A•2185
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2198,2200-2202
North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .. 1A•2210
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, 203-762-4786 .... 1A•2231
Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 .... A•2267,2269

† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
Toroid Corp. of Maryland, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, 301-464-2100 .... 1A•2312,2313
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030, 816-761-6314 .... 1A•2320
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701, 201-364-1800 ... 1A•2322,2323
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 .... 1A•2325
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830, 203-661-5726 .... 1A•2326-2328
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... 1A•2337
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2358
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, 213-323-4100 .... 1A•1276
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
Airpax/NA Philips Controls Corp., Ft. Lauderdale Div., 6801 W. Sunrise Blvd., Ft. Lauderdale, FL 33313 305-587-1100
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Artronic Instr. Co., Inc., 9 Division St., Sidney, NY 13838 607-563-8444
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Atlas Engrg. Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
§ Avel-Lindberg Inc., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06810 203-797-8698
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101 612-228-6463
Bicron Elctrns., Box 807, Barlow St., Canaan, CT 06018 203-824-5125
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Cross Elctrns., 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
De Coursey Engrg. Lab., 11828 W. Jefferson, Culver City, CA 90230 .... 213-EX7-9668
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
† El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
§† E-Tronics, 16774 Schoenborn St., Sepulveda, CA 91343 213-892-7279
† EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
Genisco Technlg. Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§ Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
James Electronics, 4050 N. Rockwell, Chicago, IL 60618 312-463-6500
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Leonard Elec. Prods., 85 Industrial Dr., Brownsville, TX 78521 512-546-1625
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
Magnetic Specs., 10 Albemarle Ave., Trenton, NJ 08638 ....
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235 212-769-0200
MPC Sys., Div. of Consulting Systems, RFD Box 441, Fremont, NH 03044 603-642-5913
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Novatronics, Box 878, Pompano Beach, FL 33061 305-942-5200
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Precision Components, Inc., 1110 W. National Ave., Addison, IL 60101 312-543-6400
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
Renco Elctrns., 60 Jefryn Blvd., E., Deer Park, NY 11729 516-586-5566
† Sawyer Inds., 5649 Peck Rd., Arcadia, CA 91006 213-442-5981
† Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 .... 213-32-Sigma
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco Inc., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Valor Electronics, Inc., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626 714-540-9261
† Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563 516-887-9443
§† Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Transistor-5600

B. H. Elctrns., 331 Bremer Bldg., St. Paul, MN 55101, 612-228-6463 .... 1A•2136
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385, 212-386-1300 .... 1A•2166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 .... 1A•2199,2203,2204
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211, 212-782-4200 .... 1A•2296,2297
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 .... 1B•1015
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... 1A•2333
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 .... 1A•2338-2344,2347-2354,2356,2357,2359,2362,2363
† Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
§ Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224 213-537-5200
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
Custom Coil & Transformer Co., Box 2369, Zanesville, OH 43701 614-452-6973
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 .... 415-785-5231;415-785-5235
Electrocom Inds., 1105 N. Ironwood Dr., S. Bend, IN 46615 219-232-2743
§ Electromech, Inc., 528 Elm Street, Kearney, NJ 07032 201-997-0950
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Transformer Div., 730 Division St., Elizabeth, NJ 07201 201-353-5700
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
Paraline Transformer Corp., 511 South Palm Ave., Alhambra, CA 91803 213-281-0222
† PCA Elctrns., 16799 Schoenborn St., Sepulveda, CA 91343 818-892-0761
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 .... 914-699-5514;800-431-1064
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950

Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
Stancor/Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Torelco Inc., 14 Paine Ave.; P.O. Box 108, Irvington, NJ 07111 201-374-8641
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
Wabash, First & Webster Sts., Wabash, IN 46992 219-563-3111
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Trigger — See Transformers, Pulse (Vol. 1A)

Transformers, Variable-5600

† **Hipotronics, P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ....1A•2171,2173, 2174**
§† **Staco Energy Prods. Co., 301 Gaddis Blvd., Dayton, OH 45403, 513-253-1191 ....1A•2280,2281**
§† **Superior Elec. Co., 383 Middle St., Bristol, CT 06010, 203-582-9561 ....1A•2298, 2299**
§† **Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810, 203-748-7001 ....1A•2301**
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Atlantic Magnetics, Inc., P.O. Box 4127, Margate, FL 33063 305-492-5196
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501 516-746-2310
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-532-9464
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Diamond Magnetics, P.O. Box 4736, San Luis Obispo, CA 93403 805-544-4019
Gowanda Elctrns., 1 Industrial Pl., Gowanda, NY 14070 716-532-2234
Gra-Mar Inc., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803 305-894-3351
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ....303-443-6250; 800-525-6478
Midland-Ross Corp., Cambion Div., One Airwife Place, Cambridge, MA 02140 617-491-5400
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Piconics, Cummings Rd., Tyngsboro, MA 01879 617-649-7501
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
Todd Systems, 50 Ash St., Yonkers, NY 10701 914-963-3400
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers, Voltage Dividing-5600

† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015**
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
† Abbott Transistor Labs., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506 818-841-3630
American HV Test Systems Inc., Central Garrett Ind'l. Pk., Accident, MD 21520 301-826-8651
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
Crompton Instrs., 2763 Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 02891 203-599-2075
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
† Elnetic Elctrns., 1730 21st St., Santa Monica, CA 90404 213-828-9541
Engd. Prod., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727 716-968-2400
Guildline Instrs., 2 Westchester Plaza, Elmsford, NY 10523 914-592-9101
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130 913-782-0012
Lenco Elctrns., Inc., 1330 Belden St., McHenry, IL 60050 815-344-2900
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ....303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Oram Elctrns., Rte. 22, Brewster, NY 10509 914-279-2966
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856 203-762-4786
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ....914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, 3521 N. Chapel Hill Rd., McHenry, IL 60050 815-385-2700
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
Ronor Systems, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492 203-265-2110
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
† Signal Transformer, 500 Bayview Ave., Inwood, NY 11696 516-239-4510
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 212-782-4200
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030 816-761-6314
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Transduktor Inc., 600 Steamboat Rd., Greenwich, CT 06830 203-661-5726
Venable Industries, Inc., 3555 Lomita Blvd., Torrance, CA 90505 213-539-2522
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Voltage Regulating-5600 (Also See Regulators & Stabilizers, Voltage)

Ault, Incorporated, 1600 Freeway Blvd., Minneapolis, MN 55430, 612-560-9300 ....3•1502
§ **Hitran Corp., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, 201-782-5525 ....1A•2176**
§ **Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148, 312-620-8394 ....3•1910,1911**
† **Signal Transformer, 500 Bayview Ave., Inwood, NY 11696, 516-239-4510 ....1A•2267**
§† **Technipower, A Penril Co., P.O. Box 222, Commerce Pk., Danbury, CT 06810, 203-748-7001 ....1A•2301**
† **Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ....1B•1015**
Todd Systems, 50 Ash St., Yonkers, NY 10701, 914-963-3400 ....1A•2311
Abacus Controls Inc., 89 Readington Rd., Somerville, NJ 08876 201-526-6010
§† Able Power and Engineering Inc., 419 S. Alhambra Ave., Monterey Park, CA 91754 213-571-6260
Adtech Power Inc., 1620 S. Sunkist St., Anaheim, CA 92806 714-634-9211
Albar, Inc., 19013 36th Ave. W., Lynnwood, WA 98036 206-771-4006
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
American Monarch, 2801-37th Ave., N.E., Minneapolis, MN 55421 612-788-9161
† Applied Electro Technlg., Int., STI Company, 2220 So. Anne St., Santa Ana, CA 92704 714-556-6570
Behlman Div., California Instrs., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111 619-279-8620
† Bourns Instrs., Inc., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5433
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
§ Computer Power, 124E W. Main St., High Bridge, NJ 08829 201-735-8000
Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48084 313-528-3700
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
§ Displex, Inc., Alexander Place, Glen Cove, NY 11542 516-671-4400
Dormeyer Inds., 3418 N. Milwaukee, Chicago, IL 60641 312-283-4000
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
Electro-Pacific, 5782 Thornwood Dr., Goleta, CA 93017 805-964-0751
Elgar Corp., 8225 Mercury Ct., San Diego, CA 92111 619-565-1155
Elin Div., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111 619-279-8620
ERA Transpac Div., Sub. Elctrn. Research Assocs., 311 B East Park St., Dept. 1202, Moonachie, NJ 07074 201-641-3650
Ericson Mfg. Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
§† E-Tronics, 16774 Schoenborn, Sepulveda, CA 91343 213-892-7279
Franek, John, Co., Inc., P.O. Box 11752, Santa Ana, CA 92711-1752 ....714-832-0290;800-854-9420
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300

§ Hammond Mfg. Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§ HDR Power Sys., Inc., 600 Oakland Park Ave., Columbus, OH 43214 614-262-6832
Hipotronics, P.O. Drawer A, Brewster, NY 10509 914-279-8091
§ ISOREG Corp., 410 Great Rd., P.O. Box 486, Littleton, MA 01460 . 617-486-9483
§ Jefferson Elec., Litton Inds., 840 25th Ave., Bellwood, IL 60104 312-626-7700
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
Lestronics, Inc., 1840 Industrial Circle, Longmont, CO 80501 ...... 303-443-6250; 800-525-6478
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Magnetran Corp., 5701 Savoy Lane, Houston, TX 77036 713-785-4202
§ Micron Inds., 1830 N. 32nd Ave., Stone Park, IL 60165 312-345-0788
§ Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582 .. 516-561-6050
Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-438-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† Northlake Engrg., 999 Anita Ave., Antioch, IL 60002 312-395-5710
Nortran, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867 603-332-3334
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
† NWL Transformers, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
§ Ohmite Mfg. Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
† OPT Inds. Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Osborne Transformer, 19636 Derby St., Detroit, MI 48203 313-368-4136
Power Conversion Prods., 42 East St., Box 380, Crystal Lake, IL 60014 815-459-9100
Power Elctrns., 96 Milton Rd., Rochester, NH 03867 603-332-3334
Preferred Elctrns., Inc., Main Line Dr, P.O. Box 954, Westfield, MA 01086 413-568-2301
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
† RTE Deltec Corp., 2727 Kurtz St., San Diego, CA 92110 619-291-4211
S & H Inds., 119 Glen Cove Dr., Glen Head, NY 11545 516-671-5600
Schott Corp., 1000 Parkers Lk. Rd., Wayzata, MN 55391 612-475-1173
§ Sola Elec., 1717 Busse Rd., Elk Grove Village, IL 60007 312-439-2800
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Staco Transpower, 301 Gaddis Blvd., Dayton, OH 45403 513-253-1191
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
§† Superior Elec. Co., 383 Middle St., Bristol, CT 06010 203-582-9561
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 .. 215-825-4990
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§† Topaz Electronics, 9192 Topaz Way, San Diego, CA 92123-1164 619-279-0831
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers, Wall Plug-in — See Power Supplies, Plug-in (Vol. 3)

Transformers, Wideband-5600

Caddell-Burns Mfg., 40 E. 2nd St., Mineola, NY 11501, 516-746-2310 ...... 1A•1233
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, 913-782-0012 ...... 1A•2175
§† Microtran Co. Inc., 145 E. Mineola Ave., Valley Stream, NY 11582, 516-561-6050 ...... 1A•2199
† Mini-Circuits Lab., 2625 E. 14th St., Brooklyn, NY 11235, 212-769-0200 .. 1A•1713, 1714,1754,1755
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, 14-358-5300;800-558-4332 ...... 1A•2208
† North Hills Elctrns., Alexander Pl., Glen Cove, NY 11542, 516-671-5700 .. 1A•2210
† Technitrol, 1952 E. Allegheny, Philadelphia, PA 19134, 215-426-9105 ...... 1B•1015
TRW Inductive Products Div., 150 Varick St., New York, NY 10013, 212-255-3500 ...... 1A•2338
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
American Magnetics, P.O. Box 8, Carterville, IL 62918 618-985-4838
† Axel Elctrns., 134-20 Jamaica Ave., Jamaica, NY 11418 212-291-3900
† Bourns Magnetic Div., Technical Products Group, Box 1398, Romoland, CA 92380 714-657-5195
† Caddell Coil Corp., 35M Main St., Poultney, VT 05764 802-287-4055
† Chloride Electro Networks, Maple St., Caledonia, NY 14423 716-538-4421
CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 212-857-2400
Coast Coil Co., 5333 W. Washington Blvd., Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., 340 Bronxville Rd., Bronxville, NY 10708 914-337-4775
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
Dantel, 2991 N. Argyle Ave., Fresno, CA 93727 209-292-1111
Delta Electronic Ind. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545 ...... 415-785-5231;415-785-5235
† Dietz Design, Inc., 100 Electronics Pkwy., Belton, MO 64012 816-331-4911
§ Electronic Navigation Inds., 3000 Winton Rd. S., Rochester, NY 14623 716-473-6900
† Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222
El-Rad Mfg., 4300 N. California, Chicago, IL 60618 312-478-7300
† ESC Elctrns. Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 .. 201-245-3200;800-526-4048
† Frequency Selective Networks, Inc., 69-20 Garfield Ave., Woodside, NY 11377 212-424-7500
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† JB Elctrn. Transformers, 2300 W. Armitage Ave., Chicago, IL 60647 312-342-0080
Kappa Networks, 165 Roosevelt Ave., Carteret, NJ 07008 201-541-1600
† Kenyon Magnetics, 1040 Grand St, Hoboken, NJ 07030 201-798-6511
KGS Electronics, Inc., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103 818-798-0786
† Lorch Elctrns., 105 Cedar La., Englewood, NJ 07631 201-569-8282
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
† Magnetek, 7315 Red Deer Dr., Boulder, CO 80301-4696 303-442-6700
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Oeco Corp., 712 S.E. Hawthorne Blvd., Portland, OR 97214 503-238-2440
Pan-Magnetics Intl., Inc., 455-A Carson Plaza Dr., Carson, CA 90746 213-532-1790
† Pico Elctrns., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ...... 914-699-5514;800-431-1064
† Polyphase Instr., 175 Commerce Dr., Ft. Washington, PA 19034 215-643-6950
† Prototype Transformer Corp., 545 N. Arlington Ave, East Orange, NJ 07017 201-672-2400
§ Pulse Engrg. Inc., A Varian Sub., P.O. Box 12235, San Diego, CA 92112 619-268-2400
§ Sinclair Radio Labs., 122 Rayette Rd., Concord, ON Canada 416-669-1244
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95050 408-980-1600
† Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 .. 212-782-4200
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Toko America, Inc., 5520 W. Touhy Ave., Skokie, IL 60077 312-677-3640
† Torotron, 230 E. 7th St., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Rte. 70, Lakewood, NJ 08701 201-364-1800
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
TTE, Inc., 2214 S. Barry Ave., Los Angeles, CA 90064 213-478-8224
† Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wayne Transformer Co., Inc., 99 Hazel St., Paterson, NJ 07503 201-278-7674
Wide Band Engrg. Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 415-968-9176

Transformers (MIL), Audio, Power, RF-2440 — *See Vol. 1B*

Transformers (MIL), Pulse & Variable-2440 — *See Vol. 1B*

Transistor Arrays-4800

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
Andrich Sys., Inc., 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818 402-694-6111
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 .. 201-685-6000
Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§† Sprague Elec. Co., Semiconductor Div., 115 Northeast Cutoff, Worcester, MA 01606 617-853-5000
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086 408-744-0100
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Thor Elctrns., 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
§ Western Digital Corp., 2445 McCabe Way, Irvine, CA 92714 714-557-3550

Transistor, Diode, Thyristor Heat Dissipators — See Heat Sinks, Transistor (Vol. 2)

Transistors, Bipolar-4800 (Also See Transistors, Silicon)

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ...... 1A•2099-2101,2103
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ...... 1A•2108
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566

§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 ...305-848-9606
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ..415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 .213-536-0888

Transistors, Chip, Unpackaged-4800

§ Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2101
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
§ Clairex Elctrns., 560 S. 3rd Ave., Mt. Vernon, NY 10550 914-664-6602
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132 314-423-4900
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ....Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
Lambda Semiconductors, 121 International Dr., Corpus Christi, TX 78410 ....512-289-0403;800-255-9606
§ Micro Power Sys. Inc., 3100 Alfred St., Santa Clara, CA 95050 408-727-5350
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 ...305-848-9606
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ..415-968-9211
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086 408-744-0100
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

Transistors, Darlington-4800

Allen-Bradley Co., 1201 S. Second St., Milwaukee, WI 53204, 414-671-2000 ....1A•1788,2088
EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 .....1B•1253
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2100,2103
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108
TRW Optoelectronics Div., 1201 Tappan Circle, Carrollton, TX 75006, 214-323-2200 ....1B•1246,1247
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Centronic Inc., 5 Eastmans Rd., Parsippany, NJ 07054 201-233-7200
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75080 214-234-4271
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
Lambda Electronics, 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
Lambda Semiconductors, 121 International Dr., Corpus Christi, TX 78410 ....512-289-0403;800-255-9606
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ..415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Dual-4800

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2100
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Fairchild Camera & Instr. Corp., 464 Ellis St., MS15-1035, Mountain View, CA 94042 415-962-5011
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
§† Micro Power Sys. Inc., 3100 Alfred St., Santa Clara, CA 95050 408-727-5350
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
§† Precision Monolithics, 1500 Space Dr., Santa Clara, CA 95050 408-727-9222
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ..415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660

§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540

Transistors, Field Effect-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ....1A•2091
§ **General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021, 315-253-7321 ....1A•2095**
§† **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2100**
Telpar, Inc., P.O. Box 796, 4132 Billy Mitchell Rd., Addison, TX 75001, 214-233-6631 ....3•1096
§ AND, 770 Airport Blvd., Burlingame, CA 94010 415-347-9916
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051 408-733-4045
§† Micro Power Sys. Inc., 3100 Alfred St., Santa Clara, CA 95050 408-727-5350
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ..415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
† RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086 408-744-0100
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Germanium-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ....1A•2091
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Low Noise, GaAs, FETs — Also See Transistors, Microwave-4800

Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099-2101
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
§† TRW, RF Devices Div., 14520 Aviation Blvd.. Lawndale, CA 90260 .213-536-0888
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Transistors, Microwave-4800

Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099-2101
Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
Central Microwave Co., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Texas Instrs., Data Sys. Group, P.O. Box 2909 MS 2222, Austin, TX 78769 214-995-6611
TRAK Microwave Corp., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614 813-884-1411
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 .213-536-0888
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Transistors, Photo (Incl. Arrays)-3700 — *See Vol. 1B*

Transistors, Power-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ....1A•2091
§ **General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021, 315-253-7321 ....1A•2095**
§† **Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2101,2103**
§ **Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108**
TRW Optoelectronics Div., 1201 Tappan Circle, Carrollton, TX 75006, 214-323-2200 ....1B•1246,1247
§ A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 ..212-651-7200
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051 408-733-4045
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 ...305-848-9606
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000

§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 ..305-283-4500
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 213-628-5392
§ SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086 408-744-0100
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 .213-536-0888
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Power, Bipolar-4800

§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021, 315-253-7321 ......1A•2095
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ......1A•2099,2101
TRW Optoelectronics Div., 1201 Tappan Circle, Carrollton, TX 75006, 214-323-2200 ......1B•1246,1247
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ...... Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 ...305-848-9606
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
Sanken Elec. U.S.A. Corp., 3848 Carson St., Ste. 105, Torrance, CA 90503 213-540-2209
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ SemiKron Intl., Inc., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051 603-883-8102
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
† Westcode Semiconductors, Inc., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410 201-791-3020

Transistors, Power, FET-4800

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ......1A•2099,2101,2103
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
† Dexcel, Div. of Gould, 2285C Martin Ave., Santa Clara, CA 95050 ..408-727-9833
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
† Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ...... Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051 408-733-4045
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321

Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086 408-744-0100
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§ Tohoku Metal Inds., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan ...... Tokyo 03-402-6161
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Transistors, Pressure Sensitive-4800

Stow Labs., Inc., Kane Ind'l. Dr., Hudson, MA 01749 617-562-9347

Transistors, RF-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ......1A•2091
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ......1A•2099-2101
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ......1A•2108
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 ..212-651-7200
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 ...... Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§† Plessey Semiconductors, 1641 Kaiser Ave., Irvine, CA 92714 714-540-9979
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§ Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§ SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§ Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 .213-536-0888
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Silicon-4800

American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940, 201-377-9566 ......1A•2091
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021, 315-253-7321 ......1A•2095
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ......1A•2099-2101,2103
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ......1A•2108
A E G Telefunken, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876 201-722-9800
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
§† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95051 408-496-6710
† California Eastern Labs. Inc., 3005 Democracy Way, Santa Clara, CA 95050 408-988-3500
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881

† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-469-3311
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 ...305-848-9606
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
SMD Technology Svc. Ctr., North American Philips, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209 800-431-4444
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 .213-536-0888
§† Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Switching-4800

§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2100
TRW Optoelectronics Div., 1201 Tappan Circle, Carrollton, TX 75006, 214-323-2200 ....1B•1246,1247
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Cherry Semiconductor Corp, 2000 S. County Trail, East Greenwich, RI 02818 401-885-3600
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Electronic Transistors, 112-15 Northern Blvd., Flushing, NY 11368 ..212-651-7200
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
§ General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§† General Semiconductor Inds., Inc., 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§ International Diode, 229 Cleveland Ave., Harrison, NJ 07029 201-482-6518
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Intersil, 10710 N. Tantau Ave., Cupertino, CA 95014 408-996-5000
ITT Semiconductors, 500 Broadway, Lawrence, MA 01841 617-688-1881
IXYS Corp., 3685 Enochs, Santa Clara, CA 95051 408-733-4045
Lambda Electronics, 515 Broad Hollow Rd., Melville, NY 11747 516-694-4200
Lambda Semiconductors, 121 International Dr., Corpus Christi, TX 78410 ....512-289-0403;800-255-9606
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§ PPC Prods., 7516 Central Industrial Dr., Riviera Beach, FL 33404 ...305-848-9606
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 ...415-968-9211
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000
§ Rohm Corp., 8 Whatney, Irvine, CA 92714 714-855-2131
§ Sanken Elec. Co., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan 03-986-6151
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
§ Semicoa, 333 McCormick Ave., Costa Mesa, CA 92626 714-979-1900
§† Semiconductor Technlg., Inc., 3131 S.E. Jay St., Stuart, FL 33494 .305-283-4500
§ SGS-ATES Semiconductor Corp., 240 Bear Hill Rd, Waltham, MA 02154 617-890-6688
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Silicon Transistor Corp., Katrina Rd., Chelmsford, MA 01824 617-256-3321
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
† Solid State Devices, 14830 Valley View Ave., La Mirada, CA 90638 213-921-9660
§ Solitron Devices, 8808 Balboa Ave., San Diego, CA 92123 619-278-8780
§ Sprague Elec. Co., 481 Marshall St., No. Adams, MA 01247 413-664-4411
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
§† Teledyne-Crystalonics, 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† Texas Instrs., Inc., Box 225012-MS-84, Dallas, TX 75265 214-995-6611
§ Thomson-CSF Comps. Corp., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304 213-887-1010
§ Westinghouse Elec. Corp., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697 412-925-7272
† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors, Unijunction-4800

§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2109
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
§† General Electric Co., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021 315-253-7321
§ General Transistor Corp., 216 W. Florence Av., Inglewood, CA 90301 213-673-8422
International Devices Inc., 3200 Pendleton, Santa Ana, CA 92704 ..714-557-9394; 800-854-7651
§† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036 602-244-6900
§ New-Tone Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 ..201-748-5089
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§ Solid State, Inc., 46 Farrand St., Bloomfield, NJ 07003 201-429-8700
§ Sprague Products Co., 481 Marshall St., No. Adams, MA 01247 413-664-4481
§ Unitrode Corp., 5 Forbes Rd., Lexington, MA 02173 617-861-6540
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Transistors (MIL)-2440 — *See Vol. 1B*

Translators, Data-2325 — *See Vol. 3*

Translators, Time Code-2000 — *See Vol. 3*

Transmission Line, Wire & Cable — See Cable, Transmission Line (Vol. 2)

Transmission Lines (MIL), RF-2440 — *See Vol. 1B*

Transmission Systems, Data-2000 — *See Vol. 3*

Transmitters, Fiber Optic-3700 — *See Vol. 1B*

Transmitters, Fixed Frequency-1900 — *See Vol. 3*

Transmitters, Laser-3700 — *See Vol. 1B*

Transmitters, Pressure & Flow-5500 — *See Vol. 1B*

Transmitters, Radar — See Radar System Components (Vol. 1A)

Transmitters, Telemetry-1900 — *See Vol. 3*

Transmitters, Tone-1900 — *See Vol. 3*

Transmitters (MIL), ECM-3475 — *See Vol. 3*

Transmitters (MIL), Shipboard Jamming-3475 — *See Vol. 3*

Transmitters (MIL), TWTs-3475 — *See Vol. 3*

Transponders-1900 — *See Vol. 3*

Transports, Tape (all kinds)-2000 — *See Vol. 3*

Triacs-4800

† Motorola Semiconductor Prods. Sector, Adv. 72, Box 20912, Phoenix, AZ 85036, 602-244-6900 ....1A•2099,2104
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ....1A•2108,2109
§ Teccor Elctrns., P.O. Box 619009, Dallas, TX 75261-9009, 214-252-7651 ..1A•2110, 2111
§ AEMC, 99 Chauncy, Boston, MA 02111 ....617-451-0227;800-343-1391
American Microsemiconductor, 133 Kings Rd., Madison, NJ 07940 201-377-9566
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Gentron Corp., 6667 N. Sydney Pl., Milwaukee, WI 53209 414-351-1660
Hutson Inds., 1000 Hutson Cir., Frisco, TX 75034 214-377-3557
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 ..201-685-6000

Triggers, SCR — See Controls, SCR (Vol. 3)

Tube Heat Dissipators-5700

† IERC, 135 W. Magnolia Blvd., Burbank, CA 91502 818-849-2481
Intl. Elctrn. Resch., 135 W. Magnolia Blvd., Burbank, CA 91502 213-849-2481
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes, Backward Wave-5700

† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300

Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Ballast — See Resistors, Ballast (Vol. 1A)

Tubes, Cathode Ray, General Purpose-5700

† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 516-433-5900 .... 1A•2367
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 213-515-3993
Rauland-Zenith Radio Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-345-4700
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Thomas Elctrns., 100 Riverview Dr., Wayne, NJ 07470 201-696-5200
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Tubes, Cathode Ray, Special Purpose-5700

† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 516-433-5900 .... 1A•2367
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
Corning Glass Works, Telecomm Prods Dept., BH-5, Corning, NY 14830 607-974-9000
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., 6155 El Camino Real, Carlsbad, CA 92008 619-438-9191
† Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 213-515-3993
Rauland-Zenith Radio Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-345-4700
Thomas Elctrns., 100 Riverview Dr., Wayne, NJ 07470 201-696-5200
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Tubes, Counting-5700

§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 516-433-5900

Tubes, Electrometer-5700

Tubes, Electron Multiplier-5700

§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan 0534-34-3311
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 516-433-5900

Tubes, Flash-5700

† Amglo, 5265 Michigan Ave., Rosemont, IL 60018 312-671-4321
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
U.S. Scientific Instrs., 61 North Beacon St., Boston, MA 02134 617-787-2411
§ Xenon Corp., 66 Industrial Way, Wilmington, MA 01887 617-658-8940

Tubes, Gas-5700

§† Alltech Assocs. Inc., Applied Science Labs., 2051 Waukegan Rd., Deerfield, IL 60015 312-948-8600
§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† ITT Electron Tube, Box 100, Easton, PA 18042 215-252-7331
Lightning Protection Corp., Box 6086, Santa Barbara, CA 93160 .... 805-967-5089/4577

§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123

Tubes, Ignitron-5700

† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§ Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300

Tubes, Image Converter-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110 201-667-2262
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan 0534-34-3311
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., 6155 El Camino Real, Carlsbad, CA 92008 619-438-9191
Industrial Elctrn. Engrs., Inc., 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75040 214-272-3561

Tubes, Indicator — See Tubes, Readout (Vol. 1A)

Tubes, Magnetron — See Tubes, Microwave (Vol. 1A)

Tubes, Microwave-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Amperex Electronic Inds., Smithfield Div., George Washington Hwy., Smithfield, RI 02917 401-232-0500
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509 213-517-6000
§† ITT Electron Tube, Box 100, Easton, PA 18042 215-252-7331
† Litton Inds., Electron Tube Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
Mictron Inc., 6050 Porter Way, Sarasota, FL 33582 813-371-6659
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
§ Siemens Corp., 186 Wood Ave., S., Iselin, NJ 08830 201-494-1000
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
§ Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† VTM Microwaves, Inc., 4975 W. 80 Ave., Westminster, CO 80030 303-426-6866
Wall, A. T., Co., 55 Service Ave., Warwick, RI 02886 401-739-0740
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Noise Source-5700

Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Photomultiplier-5700

§† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 516-433-5900 .... 1A•2366
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
Centronic Inc., 5 Eastmans Rd., Parsippany, NJ 07054 201-233-7200
Gamma Scientific Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan 0534-34-3311
Microscience, Inc., 110A Jerusalem Rd., Cohasset, MA 02025 617-383-1622
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Thomson-CSF Comps. Corp., DuMont Div., 750 Bloomfield Ave., Clifton, NJ 07015 201-773-2000
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-5700

Infodex, Inc., 395 W. Main St., Waterbury, CT 06702, 203-757-9291 .... 1B•1086, 1087
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 516-433-5900 .... 1A•2367
§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
Ball Elctrn., Systems Div., 1950 33rd St., Boulder, CO 80302 303-441-5400
§ Clinton Elctrns., 6701 Clinton Rd., Rockford, IL 61111 815-633-1444

† Day-light Display Corp., 4 Barnet Rd., P.O. Box 694, Pine Brook, NJ 07058 201-575-1045
§† Digitech Inds., Inc., 66 Grove St., Ridgefield, CT 06877 203-438-3731
Displays, Inc., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044 717-242-2541
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§† Industrial Elctrn. Engrs., Inc., 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§ Mitsubishi Elctrns., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502 213-515-3993
§ NEC Elctrns. USA Inc., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086 408-745-6520
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
Rauland-Zenith Radio Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-345-4700
† Refac Elctrns. Corp., P.O. Box 809, Winsted, CT 06098 203-379-2731
Shelly Associates, Inc., 2942 Dow Ave., Tustin, CA 92680 714-544-9970
Stanley/AC Interface, 2925 College Ave., Unit A 1, Costa Mesa, CA 92626 714-979-9830
† Thomson-CSF Comps. Corp., DuMont Div., 750 Bloomfield Ave., Clifton, NJ 07015 201-773-2000
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300

Tubes, Receiving-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11302 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ Goldwell Comps., 1815 W. 205th St. Ste. 201, Torrance, CA 90501 213-533-1228
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

Tubes, Rectifying-5700

§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§ Conditioning Semiconductor Devices, Box 2116, Wayne, NJ 07470 201-335-6723
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† Elctrn. Devices, 21 Gray Oaks Ave., Yonkers, NY 10710 914-965-4400
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes, Strobe — See Lamps, Stroboscopic Source (Vol. 1B)

Tubes, Switching-5700

§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
† EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes, TV Camera Pickup-5700

Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan 0534-34-3311
Hitachi America, 1800 Bering Dr., San Jose, CA 95112 408-292-6404
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 516-433-5900

Tubes, Transmitting-5700

§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ETI Electronics, 5751 Miami Lakes Dr., Miami Lakes, FL 33014 305-556-4000
§ International Comps. Corp., 105 Maxess Rd., Melville, NY 11747 516-293-1500
§† ITT Electron Tube, Box 100, Easton, PA 18042 215-252-7331
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
§ RCA Distr. & Special Prods. Div., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
RCA Solid State Div., Route 202, Somerville, NJ 08876 201-685-6000
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes, Voltage Reference or Regulating-5700

§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
Thermosen, P.O. Box 1254, Stamford, CT 06904 203-324-6125
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes, X-ray-5700

§ A E G Telefunken, Semiconductor Grp., Rte. 22, Somerville, NJ 08876 201-722-9800
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan 0534-34-3311
Spectro Equipment, Inc., 6021 Royalton Rd., N. Royalton, OH 44133 216-237-8910
Thomson-CSF Comps. Corp., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070 201-438-2300
Varian Associates, Inc., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

Tubes (MIL), Indicator & Pickup-2440 — *See Vol. 1B*

Tubes (MIL), Microwave-2440 — *See Vol. 1B*

Tubes (MIL), Power & Gas, Planar-2440 — *See Vol. 1B*

Tubes (MIL), Receiving, & Tube Shields-2440 — *See Vol. 1B*

Tubing, Ceramic-2500 — *See Vol. 2*

Tubing, Fiberglass-2800 — *See Vol. 2*

Tubing, Glass-2500 — *See Vol. 2*

Tubing, Heat Shrinkable-2800 (Also See Caps, Forms & Tapes, Heat Shrinkable) — *See Vol. 2*

Tubing, Metal-2500 — *See Vol. 2*

Tubing, Paper-2800 — *See Vol. 2*

Tubing, Plastic-2800 (Also See Tubing, Spaghetti) — *See Vol. 2*

Tubing, Spaghetti-2800 — *See Vol. 2*

Tubing, Spiral Wrap-2800 — *See Vol. 2*

Tubing, Waveguide-3450

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc. - TRG Millimeter Comp., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
General Electric Co., Lamp Comps. & Technical Prods. Div. Sls. Oper., 21800 Tungsten Rd., Cleveland, OH 44117 216-266-2451
Markel Corp., P.O. Box 752, Norristown, PA 19404 215-272-8960
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
Thielex Plastics Corp., 201 11th St., Piscataway, NJ 08854 201-968-5300
† Uniform Tubes, Collegeville, PA 19426 215-539-0700
Wall, A. T., Co., 55 Service Ave., Warwick, RI 02886 401-739-0740
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Tubing, Zipper-6000 — *See Vol. 2*

Tuners, AM/FM-1300 — *See Vol. 3*

Tuners, Microwave-3450

§† Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ....1A•1095
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Ferretec Inc., 1701A Fortune Dr., San Jose, CA 95131 408-263-1216
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
HDS Inc., 12310 Pinecrest Rd., Reston, VA 22091 703-620-6200
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715

† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 203-866-8000
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Rockwell Intl., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† TRW Microwave, 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Tuning Forks-2300

§† Fox Elctrns., P.O. Box 1078, Cape Coral, FL 33910, 813-482-7212 ....1A•1352
ITT Comps. Passive Grp., 3201 S. Standard St., Santa Ana, CA 92705, 714-751-3900 ....1A•1371
SaRonix, 4010 Transport at San Antonio, Palo Alto, CA 94303, 415-856-6900 ....1A•1418
Frequency Control Prods., Inc., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377 212-458-5811
§ Murata Erie North America, Inc., 1148 Franklin Rd., S.E., Marietta, GA 30067 404-952-9777
§ Murata Mfg. Co. Ltd., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan 075-921-9111
† Philamon, Inc., 33 Dubon Ct., Farmingdale, NY 11735 516-249-2700
T-F Elctrns., 9415 Neils Thompson Dr., Austin, TX 78759 512-836-7323

Tweezers, Manual & Vacuum-5400 — *See Vol. 2*

Ultraviolet Inspection Lighting-4100 (Also See Microscopes, Ultraviolet) ***— See Vol. 3***

Urea Formaldehyde — See Plastic Raw Materials (Vol. 2)

Valves, Solenoid-4550 — *See Vol. 1B*

Valves, Vacuum-4100 — *See Vol. 3*

Varactors — See Diodes, Varactor (Vol. 1A)

Varistors — See Resistors, Voltage Sensitive (Vol. 3;1A)

VHF Equipment — See Generators (Vol. 3), Receivers (Vol. 3), etc.

Vibration Surveys — See Services, Vibration Surveys (Vol. 3)

Vibration Test Systems — See Testers, Vibration (Vol. 3)

Vibrators-4050 — *See Vol. 3*

Video Components & Equipment — See Specific Component: Amplifiers (Vol. 3), Cameras (Vol. 3), Networks (Vol. 3), etc.

Viewers (MIL), Infrared-3475 — *See Vol. 3*

Viewing Hoods, Cathode Ray Tube-2975 — *See Vol. 3*

Vinyl Compounds — See Plastic Raw Materials (Vol. 2)

Vises-5400 — *See Vol. 2*

VLF Equipment — See Receivers (Vol. 3), Transmitters (Vol. 3), etc.

Voice Recognition Equipment — See Recognition Equipment, Speech (Vol. 3)

Voltage Sources-4000 — *See Vol. 3*

Wafer Fabrication, Semiconductor — See Semiconductor Wafer Fabrication (Vol. 3)

Wall Plates — See Boxes, Junction, Outlet & Wall Plates (Vol. 2)

Warning Systems, Lightning-4300 — *See Vol. 1B*

Warning Systems (MIL), Computerized-3475 — *See Vol. 3*

Warning Systems (MIL), EW-3475 — *See Vol. 3*

Warning Systems (MIL), IR-3475 — *See Vol. 3*

Warning Systems (MIL), Laser-3475 — *See Vol. 3*

Warning Systems (MIL), SAM Launch-3475 — *See Vol. 3*

Washers, Lock-2825 — *See Vol. 2*

Washers, Plain-2825 — *See Vol. 2*

Wave Soldering Equipment — See Soldering Equip, Printed Circuit (Vol. 2)

Waveguide-Coax Adapters-3450

† Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alford Mfg. Co., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888 617-935-8610
Andrew Corp., 10500 W. 153rd St., Orland Pk., IL 60462 312-349-3300
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
§† Astrolab, 345 Dalziel Rd., Linden, NJ 07036 201-862-0022
Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
§† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ....207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
§† Harris Corp., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791 516-364-0400
Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303 .... Call Local Sls. Off.
Junction Devices, Inc., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594 ....213-889-4030;805-497-4421
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., 1870 John Towers Ave., El Cajon, CA 92020 619-449-3844
† Microwave Applications Grp., 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
Nurad, Inc., 2165 Druid Pk. Dr., Baltimore, MD 21211 301-462-1700
§† Omni Spectra, 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
Sivers Lab, Box 90339, Los Angeles, CA 90009 213-390-7477
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† UTE Microwave, 3500 Sunset Ave., Asbury Park, NJ 07712 201-922-1009
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Waveguides-3450

Airtron, 200 E. Hanover Ave., Morris Plains, NJ 07950 201-539-5500
Alpha Inds., Inc.-MSD Div., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Andrew Corp., 10500 W. 153rd St., Orland Pk., IL 60462 312-349-3300
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Astrolab, 345 Dalziel Rd., Linden, NJ 07036 201-862-0022
† Baytron, 344 Salem St., Medford, MA 02155 617-391-1550
Cablewave Sys., 60 Dodge Ave., North Haven, CT 06473 203-239-3311
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-9000
† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ....207-655-4555;800-341-9678
† Eastern Microwave, 4 Gill St., Woburn, MA 01801 617-935-8600
† Electro Impulse, Box 870, Red Bank, NJ 07701-0870 201-741-0404
† Gabriel Elctrns., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074 207-883-5161
Hughes Aircraft Co, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009 213-670-1515
Hughes Aircraft Co., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
M/A-COM Millimeter Prods., Inc., South Ave., Burlington, MA 01803 617-272-3000
Maury Microwave, 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
§ Microwave Development Labs., 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Elctrns., 15 Commerce St., Williston, VT 05495 802-864-0064
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Resch. Instr. Co., Inc., Two Lake Ave. Extension, Danbury, CT 06811-5295 203-792-6666
Reeve Elctrns., 444 N. Orleans, Chicago, IL 60610 312-670-0150
† Sylvania Sys. Grp., Comm. Sys. Div., GTE Prods. Corp., 77 A St., Needham Hgts., MA 02194 617-449-2000
§† Systron-Donner Microwave Div., 14844 Oxnard St., Van Nuys, CA 91409 818-786-1760
† Uniform Tubes, Collegeville, PA 19426 215-539-0700
§† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100

Waveguides (MIL)-2440 — *See Vol. 1B*

Wave Traps — See Filters, Antenna (Vol. 1A), Filters, Microwave (Vol. 1A), etc.

Welding Equipment & Accessories (Excl. Equipment for Semiconductor Devices)-5400 — *See Vol. 2*

Windows, Sapphire-2500 — *See Vol. 2*

Windows, Shielded — See Shields, RF (Vol. 2)

Wire & Cable Ties-2825 — *See Vol. 2*

Wire, Airframe-2440 — *See Vol. 1B*

Wire, Antenna (All Types)-6000 — *See Vol. 2*

Wire, Bare, Copper-6000 — *See Vol. 2*

Wire, Bare, Nickel-6000 — *See Vol. 2*

Wire, Bare, Nickel-Chrome-6000 — *See Vol. 2*

Wire, Braid (Excluding Shielding)-6000 — *See Vol. 2*

Wire, Braid (Shielding) — See Braid, Cable (Vol. 2)

Wire, Ceramic Insulated-6000 — *See Vol. 2*

Wire, Clad (All Types)-6000 — *See Vol. 2*

Wire Cutting & Stripping — See Services, Wire Cutting & Stripping (Vol. 3)

Wire, Enamel Insulated — See Wire, Hookup (All Types) (Vol. 2)

Wire, Fiberglass Insulated — See Wire, Glass Insulated (Vol. 2)

Wire, Flame Retardant-6000 — *See Vol. 2*

Wire, Flat Strip — See Cable, Flat (Vol. 2)

Wire, Glass Insulated-6000 — *See Vol. 2*

Wire, Guy-6000 — *See Vol. 2*

Wire, Heater — See Cable, Heater (Vol. 2)

Wire, High Temperature (Over 125)-6000 — *See Vol. 2*

Wire, High Voltage (1000 Volts & Over)-6000 — *See Vol. 2*

Wire, Hookup (All Types)-6000 — *See Vol. 2*

Wire, Irradiated-6000 — *See Vol. 2*

Wire, Lead-in & Ground-6000 — *See Vol. 2*

Wire, Litz-6000 — *See Vol. 2*

Wire, Magnet-6000 — *See Vol. 2*

Wire Markers (All Types)-6000 (Also See Strips Marker & Fanning) — ***See Vol. 2***

Wire, Multiconductor — See Cable, Multiconductor (Vol. 2)

Wire Nuts-2800 — *See Vol. 2*

Wire, Plastic Insulated — See Wire, Hookup (All Types) (Vol. 2)

Wire, Plated (All Types)-6000 — *See Vol. 2*

Wire, Radiation Resistant-6000 — *See Vol. 2*

Wire, Resistance-6000 — *See Vol. 2*

Wire, Ribbon-6000 — *See Vol. 2*

Wire, Semiconductor Lead-6000 — *See Vol. 2*

Wire, Shielded-6000 — *See Vol. 2*

Wire Shielding-4525 (Also See Braid, Cable) — ***See Vol. 2***

Wire, Strain Gauge-6000 — *See Vol. 2*

Wire Strippers, Automatic-4100 — *See Vol. 3*

Wire Strippers, Chemical — See Chemicals, Wire Stripping (Vol. 2)

Wire Strippers, Manual-5400 — *See Vol. 2*

Wire Strippers, Thermal-5400 — *See Vol. 2*

Wire, Test Lead-6000 — *See Vol. 2*

Wire, TFE Insulated-6000 — *See Vol. 2*

Wire, Thermocouple-6000 — *See Vol. 2*

Wire, Transmission — See Cable, Transmission Line (Vol. 2)

Wire, Twisted Pair — See Cable, Twisted Pair (Vol. 2)

Wire (MIL)-2440 — *See Vol. 1B*

Wire Twisters, Automatic-5400 — *See Vol. 2*

Wire Twisters, Manual-5400 — *See Vol. 2*

Wire Ways-6000 — *See Vol. 2*

Wirewrapping Services — See Services, Wirewrapping (Vol. 3)

Wiring Panels & Boards, Computer — See Boards, Programming (Vol. 2)

Word Processors, Shared Logic Systems-2025 — *See Vol. 3*

Word Processors, Standalone Systems-2025 — *See Vol. 3*

Work Positioners, Circuit Board & Chassis — See Holders, Circuit Board (Vol. 3), Jigs (Vol. 3),

Work Stations/Decks, Data Entry-1400 — *See Vol. 2*

Work Room, Shielded-1400 — *See Vol. 2*

Wrenches-5400 — *See Vol. 2*

X-ray Inspection Equipment-4100 — *See Vol. 3*

X-Y Axis Tables — See Simulators, Motion (Vol. 3)

Yokes, Deflection, Oscilloscope-1800

Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 .... 1A•2302,2303
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ... 814-355-1521
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 .. 312-543-6444

Yokes, Deflection, Radar PPI-1800

Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 .... 1A•2302,2303
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 516-433-5900 .... 1A•2367
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ... 814-355-1521
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 .. 312-543-6444

Yokes, Deflection, CRT-1800

Multi Prods. Intl., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, 201-239-8183 .... 1A•2206
Thordarson Meissner, Electronic Center, Mt. Carmel, IL 62863, 618-262-5121 .... 1A•2302,2303
† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006, 516-433-5900 .... 1A•2367
Amperex Elctrn. Corp., Slatersville Div., Providence Pike, Slatersville, RI 02876 401-762-3800
Arstan Products Intl. Ltd., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
† Astronautics Corp. of America, P.O. Box 523, Milwaukee, WI 53201 414-447-8200
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75234-3335 214-233-1589
§ Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ... 814-355-1521
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sylvania Electronic Components, Philips ECG Inc., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 .. 312-543-6444
§ Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Yokes, Deflection, TV Camera-1800

ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† EEV Inc., 7 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Panasonic, Ind'l. Elctrn. Comps., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094 201-348-7000
† Penn Transformer Co., Box 1321, Rte. 144N, Wingate, PA 16880 ... 814-355-1521
Shokai Far East Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Syntronic Instruments, Inc., 100 Industrial Rd., Addison, IL 60101 .. 312-543-6444
Triad-Utrad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Zone Boxes, Thermocouple — See Thermocouples, Elements & Accessories (Vol. 1B)

eem

MINIGLOSSARY
CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	−1
Brown	1	10	±0.1pF	±1%		−33		−10
Red	2	100		±2%		−75	1.0	−100
Orange	3	1000		±3%		−150	1.5	−1000
Yellow	4	10000			+100% −0%	−220	2.0	−10000
Green	5		±0.5pF	±5%	±5%	−330	3.3	+1
Blue	6					−470	4.7	+10
Violet	7					−750	7.5	+100
Gray	8	0.01	±0.25pF		+80% −20%	+150 to −1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to −750		+10000
Silver								
Gold								

eem

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta$ (loss angle) $= \frac{ESR}{X_c} =$ $(2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\,\delta$ (loss angle) $= \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(X_C) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^x \left(\frac{T_t}{T_o}\right)^y$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1 C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

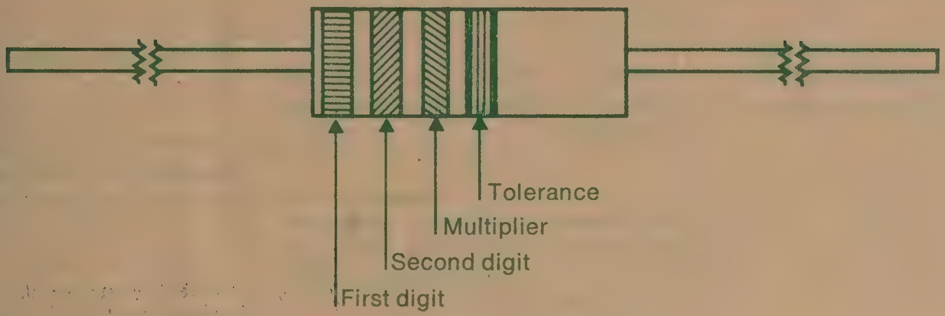
Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_s = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
ϕ = Phase angle
x + y = Exponent effect of voltage and temp
L_o = Operating life
L_t = Test life
V_t = Test voltage
V_o = Operating voltage
T_t = Test temperature
T_o = Operating temperature

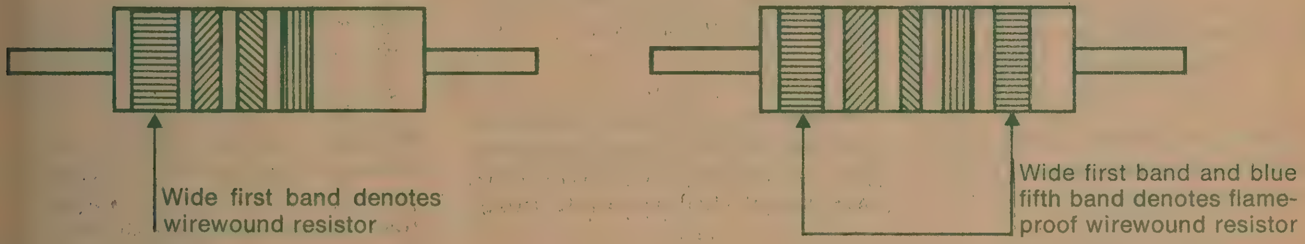
eem

MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes


Tolerance
Multiplier
Second digit
First digit

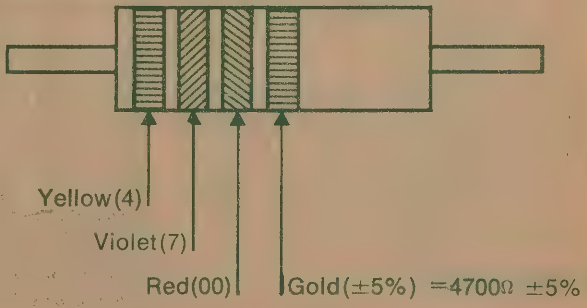
Color code for general-purpose industrial resistors


Wide first band denotes wirewound resistor
Wide first band and blue fifth band denotes flame-proof wirewound resistor

Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:


Yellow(4)
Violet(7)
Red(00)
Gold(±5%) =4700Ω ±5%

eem

MINIGLOSSARY
ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

eem

MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	Digit Punches
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							i	r	z		I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	|	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1
②	12-11-9-8-1
③	11-0-9-8-1
④	12-11-0-9-8-1
⑤	No-Punches
⑥	12
⑦	11
⑧	12-11-0
⑨	12-0
⑩	11-0
⑪	0-8-2
⑫	0
⑬	0-1
⑭	11-0-9-1
⑮	12-11

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

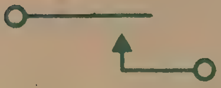
¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

eem

MINIGLOSSARY
RELAY CONTACT FORMS

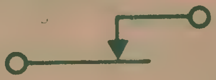
A

Make
SPST-NO



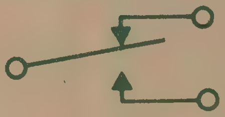
B

Break
SPST-NC



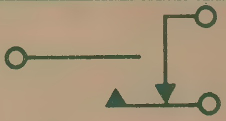
C

Break, Make
(Transfer)
SPDT



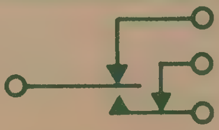
D

Make, Break
(Continuity
Transfer)



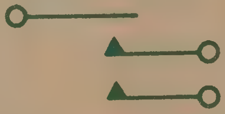
E

Break,
Make,
Break



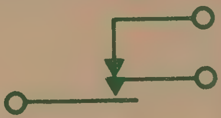
F

Make,
Make



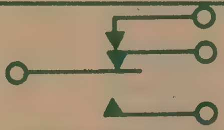
G

Break,
Make



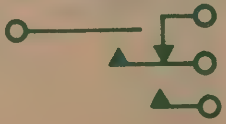
H

Break,
Break,
Make



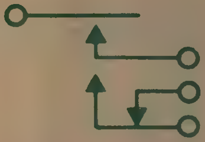
I

Make,
Break,
Make



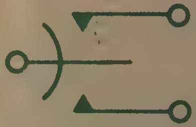
J

Make,
Make,
Break



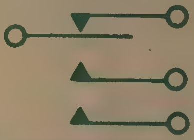
K

Center off
SPDT



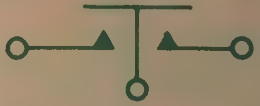
L

Break,
Make,
Make



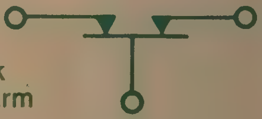
U

Double
make
Contact
on arm



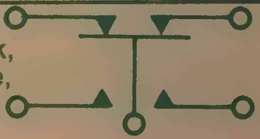
V

Double break
Contact on arm



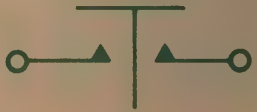
W

Double break,
Double make,
Contact
on arm



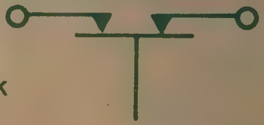
X

Double
make



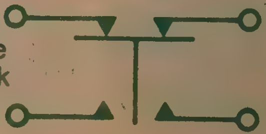
Y

Double break



Z

Double make
Double break
SPDT-DB



84
85 Manufacturers and Sales Offices Directory

Each manufacturer is listed alphabetically with complete address and telephone number of main offices. The names of those with data pages in this edition of EEM are shown in boldface.

Many manufacturers also show TWX and Telex numbers, FSC (Federal Supply Code), other pertinent company data, their sales and/or local distributor offices and phones. The page numbers of their data pages in this edition are shown in all volumes.

AABA COMPONENTS CORP., P.O. Box 171, Baldwin Place, NY 10505, Tel: 914-628-6952; Empl.: 15; *Sls. Mgr.:* D. McVey; *Dist. Mgr.:* D. McVey

AAK CORP, 747 River St., Haverhill, MA 01830, Tel: 617-373-3769; FSC No.: 04 26 3109-1; Empl.: 10; *Sls. Mgr.:* N. Blye

Local Sales Offices & Reps

CA	Pasadena, A-F Sales Engrg.	213-681-5631
OH	Cleveland, Tiby Co.	216-371-5335

A & B TECHNICAL SERVICES, 11300 Hartland St., N. Hollywood, CA 91605, Tel: 213-769-6772, Telex: 66-2497, TWX: 910-499-2675; Empl.: 40; *Sls. Mgr.:* V. A. Littlefield; *Dist. Mgr.:* C. Cloud

A & D ELEC. INSTRS., 73-07 88th St., Glendale, NY 11385, Tel: 212-275-6516; Empl.: 7

A&M INSTRUMENT, INC., 5 Nassau St., Rockville Centre, NY 11571, Tel: 516-678-6960

AAVID ENGRG., 30 Cook Ct., Laconia, NH 03246, Tel: 603-524-4443, TWX: 510-298-1127; FSC No.: 30161; Empl.: 180; *Sls. Mgr.:* Philip Johnson; *Dist. Mgr.:* Philip Johnson

abacus controls inc.

ABACUS CONTROLS INC., 89 Readington Rd., Somerville, NJ 08876, Tel: 201-526-6010; FSC No.: 54241; Empl.: 45; *Sls. Mgr.:* George O'Sullivan .... **3•**1818-1820

Local Sales Offices & Reps

CT	New London, Elctrn. Sls. of New England	203-443-2646
MA	Wareham, Elctrn. Sls. of New England	617-295-7634
NY	Rochester, BKT Assocs.	716-586-5814
TX	Dallas, True Techn.	214-691-7870

ABA ELECTROMECHANICAL SYS. INC., Box 500, Pinellas Pk., FL 34290-0500, Tel: 813-541-6681, TWX: 810-866-0433; FSC No.: 26795; Empl.: 485; *Sls. Mgr.:* Bruce W. Harting

ABALON PRECISION MFG., 540 Casanova St., Bronx, NY 10474, Tel: 212-589-5682; Empl.: 25; *Sls. Mgr.:* Norman C. Orent

abbott

WHEN RELIABILITY IS IMPERATIVE

ABBOTT TRANSISTOR LABS., Industrial Products Div., 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, Telex: 75-2972; FSC No.: 58980; Empl.: 30; *Sls. Mgr.:* Peter Batte .... **3•**1441, 1822, 1823

Local Sales Offices & Reps

CT	Stamford, Dynamic Sls.	203-693-6567
MA	Burlington, Dynamic Sls. of New England	617-272-5676
NJ	Fort Lee, Abbott Transistor Labs.	201-461-4411
TX	Richardson, Abbott Transistor Labs.	214-437-0697
VT	S. Burlington, Dynamic Sls.	802-863-6665

ABBOTT TRANSISTOR LABS., Power Supply Div., 5200 W. Jefferson Blvd., Los Angeles, CA 90016, Tel: 213-936-8185, Telex: 69-1398; FSC No.: 15755; Empl.: 500; *Sls. Mgr.:* Fred Silver .... **3•**1441-1454

Local Sales Offices & Reps

CT	Stamford, Dynamic Sls.	203-693-6567
FL	Altamonte Springs, Gugel-Tuttle Assocs. Inc.	305-788-0845
MA	Burlington, Dynamic Sls.	617-272-5676
NJ	Ft. Lee, Abbott Transistor Labs.	201-461-4411
TX	Richardson, Abbott Transistor Labs.	214-437-0697
VT	S. Burlington, Dynamic Sls.	802-863-6665

ABBOTT TRANSISTOR LABS., Transformer Div., 639 So. Glenwood Pl., Burbank, CA 91506, Tel: 818-841-3630, Telex: 69-6282; FSC No.: 58910; Empl.: 50; *Sls. Mgr.:* W. Lovett .... **1A•**2117-2123

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-881-2207
CT	Stamford, Dynamic Sls.	203-693-6567
FL	Altamonte Springs, Gugel-Tuttle Assocs. Inc.	305-788-0845
MA	Burlington, Dynamic Sls.	617-272-5676
NJ	Ft. Lee, Abbott Transistor Labs.	201-461-4411
TX	Richardson, Abbott Transistor Labs.	214-437-0697
VT	S. Burlington, Dynamic Sls.	802-863-6665

ABLE POWER AND ENGINEERING INC., 419 S. Alhambra Ave., Monterey Park, CA 91754, Tel: 213-571-6260; *Sls. Mgr.:* Joe Chou

Advertisement

Transformers, Chokes, Inductors & Coils to meet UL, VDE, & MIL Spec.: • Power • Audio • Constant Voltage • Pulse • Current • Potential RF • Switching Power Supply & Converter • Matching • Plug-In Adaptor • PCB type • Low-Profile • Isolation • Toroids • Telephone Coupling

*****Catalog Available*******

*****One Week Fast Delivery******

ABLESTIK LABORATORIES, 833 W. 182nd St., Gardena, CA 90248, Tel: 213-532-9341, TWX: 910-346-7606; FSC No.: 21109; Empl.: 100; *Sls. Mgr.:* D. W. Lefever

ABRAMS INSTR. CORP., P.O. Box 26007, Lansing, MI 48909, Tel: 517-332-6405, TWX: 810-251-0785; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ACCARDI LABORATORIES, 66-45 69th St., Middle Village, NY 11379, Tel: 212-326-0570; *Sls. Mgr.:* Leonard Carney

ACC ELECTRONICS, 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, Telex: 436483; FSC No.: 316-331-0660; Empl.: 1000; *Sls. Mgr.:* Leon Allen .... 1A•1643

Local Sales Offices & Reps

MI	Troy, C. B. Jensen & Assoc.	313-643-0506
TX	Dallas, Lively Sales	214-245-6012

ACCESSORIES FOR ELCTRNS., INC., 800 Merrick Rd., Baldwin, NY 11510, Tel: 516-546-1751; FSC No.: 54355; Empl.: 19; *Sls. Mgr.:* Gary Sod

ACCUDYNE CORP., P.O. Box 1429, Janesville, WI 53547, Tel: 608-752-9081; FSC No.: 18356; Empl.: 276; *Sls. Mgr.:* R. E. Mowris; *Dist. Mgr.:* R. E. Mowris

ACCUMET ENGRG., 518 Main St., Hudson, MA 01749, Tel: 617-568-8311; *Sls. Mgr.:* J. B. Snook

Local Sales Offices & Reps

CA	Los Altos, Stout Inds.	415-949-0440
CA	Marina Del Rey, R. L. Comps.	213-823-1048
MD	Pasadena, Spectro-Lambda	301-437-7633
NJ	East Windsor, Micro-Lambda	609-443-3113
NY	Chappaqua, Micrel	914-238-4961

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 617-745-7878; Empl.: 18; *Sls. Mgr.:* Dana B. Lee; *Dist. Mgr.:* T. H. Murphy

ACCURASSEMBLY, 9525 Cozycroft Ave., Chatsworth, CA 91311, Tel: 818-700-0708

ACCURATE ELCTRNS., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-365-1211, Telex: 469705; FSC No.: 11375; Empl.: 35

ACCURIDE, Div. Standard Precision, 12311 S. Shoemaker, Santa Fe Springs, CA 90670, Tel: 213-944-0921

ACCUTEST, 25 Industrial Ave., Chelmsford, MA 01824, Tel: 617-256-8124, TWX: 710-347-0620; Empl.: 300; *Sls. Mgr.:* Eldon Scott

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

acdc electronics EMERSON®

ACDC ELECTRONICS, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880, TWX: 910-322-1470; Empl.: 750; *Sls. Mgr.:* Warren Ives; *Dist. Mgr.:* Ray Brown .... 3•1456-1458

Local Sales Offices & Reps

CA	Santa Clara, ACDC Elctrns.	408-727-1626
FL	Tampa, ACDC Elctrns.	813-962-2537
IL	Naperville, ACDC Elctrns.	312-355-8444
IN	Carmel, Tech. Mktg. Corp.	317-844-8462
IN	Fort Wayne, Tech. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, J. R. Sls. Engrg.	319-393-2232
KY	Louisville, Tech. Mktg. Corp.	502-239-2747
MA	Sudbury, ACDC Elctrns.	617-443-9903
MI	Detroit, Rathsburg Assoc.	313-882-1717
NY	East Syracuse, Ossmann Instrs.	315-437-6666
NY	Rochester, Ossmann Instrs.	716-473-5720
NY	Saratoga Springs, Ossmann Instrs.	518-377-8604
NY	Smithtown, ACDC Elctrns.	516-360-3740
NY	Vestal, Ossmann Instrs.	607-785-9947
OH	Dayton, Lyons Corp.	513-278-0714
OH	Highland Hgts., Lyons Corp.	216-461-8288
OH	Westerville, Lyons Corp.	614-890-2743
TX	Austin, ACDC Elctrns.	512-250-1011
TX	Kingwood, Coulomb Elctrns.	713-358-9595

Local Distributors

AZ	Phoenix, R. V. Weatherford	602-272-7144
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Anaheim, R. V. Weatherford	714-634-9600
CA	Glendale, R. V. Weatherford	213-849-3451
CA	Pomona, R. V. Weatherford	213-966-8461
CA	San Diego, R. V. Weatherford	619-695-1700
CA	Santa Barbara, R. V. Weatherford	805-965-8551
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Sunnyvale, R. V. Weatherford	408-738-8694
CA	Torrance, Time Elctrns.	213-320-0880
CO	Englewood, R. V. Weatherford	303-770-9762
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
GA	Atlanta, Milgray Elctrns.	404-393-9666
IN	Carmel, Altex Elctrns.	317-848-1323
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Columbia, Time Elctrns.	301-964-3090
MD	Rockville, Milgray Elctrns.	801-468-6400
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Woburn, Time Elctrns.	617-935-8080
MI	Livonia, R.S. Elctrns.	313-525-1155
MO	St. Louis, Time Elctrns.	314-391-6444
NY	Freeport, Milgray Elctrns.	516-546-6000
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Rochester, Modutex Corp.	716-424-1620
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Columbus, Hughes-Peters	614-294-5351
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Beaverton, Almac Elctrns.	503-641-9076
PA	Broomall, Time Elctrns.	215-359-1200
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Seattle, R. V. Weatherford	206-575-1340
WI	Mequon, Taylor Elec.	414-241-4321

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, P.O. Box 288, Port Huron, MI 48060, Tel: 313-984-5581, TWX: 810-231-5265; Empl.: 150; *Sls. Mgr.:* Richard Doehring

A.C. INTERFACE, 2925 College Ave., Costa Mesa, CA 92626, Tel: 714-979-9830, Telex: 655-328; Empl.: 10; *Sls. Mgr.:* P. Marchetti

ACME CHEM. & INSULATION, 166 Chapel St., New Haven, CT 06513, Tel: 203-562-2171; Empl.: 75; *Sls. Mgr.:* Marvin Leonard

ACME ELEC. HEATING CORP., 4685 E. 11th, Hialeah, FL 33013, Tel: 305-685-8326; Empl.: 12

ACME MODEL ENGRG. CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650; Empl.: 29

ACOPIAN CORP., Box 638, Easton, PA 18042, Tel: 215-258-5441, TWX: 510-651-4919; FSC No.: 14749; *Sls. Mgr.:* T. Skopal .... 3•1461-1495

Local Sales Offices & Reps

FL	Melbourne, Acopian	305-727-1172
MD	Ellicott City, Doss Elctrns.	301-465-1336

ACOUSTIC POWER SYS., 2151 Las Palmas Dr., Ste. G, Carlsbad, CA 92008, Tel: 619-438-4848, Telex: 67-8401; Empl.: 5

ACQUIS COMMUNICATIONS, 17192 Gillette Ave., Irvine, CA 92714, Tel: 714-545-3732; *Sls. Mgr.:* Patrice Garner

ACRODYNE CONTROLS, See Accudyne Corp.

ACROMAG, 30765 Wixom Rd., Wixom, MI 48096, Tel: 313-624-1541, Telex: 230-505; Empl.: 100; *Sls. Mgr.:* Bill Carey

ACROMARK, 60 Locust/Dept. 397, Berkeley Hgts., NJ 07922, Tel: 201-464-6474; Empl.: 50; *Sls. Mgr.:* W. H. Schmidt

ACTION INSTRS., 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726, TWX: 910-335-2030; Empl.: 260; *Sls. Mgr.:* Frank Williams

ACTIVE CONTROL INSTRMN., P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000; FSC No.: 55116; Empl.: 6 .... 3•1120

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574; Empl.: 13; *Sls. Mgr.:* George Giangrande

ACUREX-AUTODATA, 555 Clyde, Mountain View, CA 94039, Tel: 415-964-3200, Telex: 34-6391, TWX: 910-379-6593; Empl.: 1000; *Sls. Mgr.:* Don Willett

ACUSHNET CAPACITOR CO., INC., 720 Belleville, New Bedford, MA 02741, Tel: 617-999-3291, TWX: 710-344-6451; FSC No.: 61152; Empl.: 300

ACUSHNET ELCTRNS. CO., INC., 8700 E. Thomas Rd., Scottsdale, AZ 85252, Tel: 602-947-7474, TWX: 910-950-1320

ADAC CORP., 70 Tower Office Pk., Woburn, MA 01801, Tel: 617-935-6668, Telex: 951802; Empl.: 80; *Sls. Mgr.:* Les Silvern .... 3•1143

Local Sales Offices & Reps

AZ	Phoenix, PLS Assocs.	602-246-6614
CA	Los Angeles, ADAC Corp.	213-476-6535
CA	Redwood City, ADAC Corp.	415-366-4300
CO	Englewood, PLS Assocs.	303-799-4260
FL	Orlando, E. G. Holmes & Assocs.	305-894-8901
GA	Chamblee, E. G. Holmes & Assocs.	404-451-6161
IL	Hoffman Estates, Carvel Engrg. & Sls. Co.	312-885-8800
KS	Overland Park, Ramsey Assocs.	913-649-6996
MI	Madison Hgts., WKM Assocs.	313-588-2300
MN	Edina, Carvel Engrg. & Sls. Co.	612-835-7929
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Pennsauken, Sci-Reps	609-662-5222
NM	Albuquerque, PLS Assocs.	505-345-5501
NY	DeWitt, DB Assocs.	315-446-0220
NY	White Plains, Cane Tech Sls.	914-694-9240
NC	Carey, E. G. Holmes & Assocs.	919-469-8850
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Portland, Brett-Ross	503-256-9727
PA	Pittsburgh, WKM Assocs.	412-892-2953
TX	Dallas, SCI Sales	214-931-1487
TX	Houston, SCI Sales	713-224-6128
UT	Midvale, PLS Assocs.	801-566-0671
VA	Fairfax, Sci-Reps	703-385-0600
WA	Redmond, Brett-Ross	206-822-4822
WI	New Berlin, Carvel Engrg. & Sls. Co.	414-784-7007

ADALET-PLM DIV, Div. Scott & Fetzer Co., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, Telex: 98-5349; FSC No.: 73389; Empl.: 177; *Sls. Mgr.:* J. L. Smelko

ADAMS RITE PRODS., INC., 540 W. Chevy Chase Dr., Glendale, CA 91209, Tel: 213-241-5121, TWX: 910-497-2276; Empl.: 130

ADAMS-RUSSELL, Antenna & Microwave Div., Haverhill Rd., Amesbury, MA 01913, Tel: 617-388-5210, TWX: 710-347-6360; Empl.: 300

ADAMS-RUSSELL, Anzac Div., 80 Cambridge St., Burlington, MA 01803, Tel: 671-273-3333, Telex: 200155, TWX: 710-332-0258; FSC No.: 21912; Empl.: 300; *Sls. Mgr.:* Julian D. Parker

ADAMS RUSSELL, Modpak Div., 80 Cambridge St., Burlington, MA 01803, Tel: 617-273-3333, TWX: 710-332-0258; FSC No.: 21912; Empl.: 1; *Sls. Mgr.:* Pat Corrigan

ADAMS-RUSSELL, Parisi Div., 280 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-0055, TWX: 710-324-6450; FSC No.: 27965; Empl.: 8; *Sls. Mgr.:* J. M. Caputo

ADAPTER/CHARGER PRDTS., Box 3218, Peoria, IL 61614; Tel: 309-691-0810; Empl.: 50

ADAPTIVE INTELLIGENCE, 2944 Scott Blvd., Santa Clara, CA 95050, Tel: 408-970-0777; *Sls. Mgr.:* Jim Breen

ADAPTIVE SCIENCE, 4700 San Pablo Ave., Emeryville, CA 94608, Tel: 415-652-1805; FSC No.: 7379; Empl.: 26; *Sls. Mgr.:* Jesse Huffman

ADATEK, INC., P.O. Box 1339, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343; Empl.: 13; *Sls. Mgr.:* Kim Jones or Ray Pelland; *Dist. Mgr.:* Janis Chilton

ADC MAGNETIC CONTROLS CO., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-835-6800, Telex: 290321; Empl.: 2000; *Sls. Mgr.:* Ken Nicholls

ADCOTECH, 1980 Tarob St., Milpitas, CA 95035, Tel: 408-943-9430, TWX: 910-338-2333; Empl.: 82; *Sls. Mgr.:* Bill Sendell

ADC PRODS., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-835-6800, TWX: 910-576-2832; Empl.: 1,435

ADDACON, INC., 3708 Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, TWX: 510-922-7361; *Sls. Mgr.:* Lynn Cummings

A.D. DATA SYS., 200 Commerce Dr., Rochester, NY 14623, Tel: 716-334-9649, TWX: 510-253-3246; Empl.: 45; *Sls. Mgr.:* Jack Petz

ADDELCO CORP., Advanced Dev. Elctrns. Div., 20 Freeman Pl., Needham, MA 02192, Tel: 617-444-4754, TWX: 710-325-0370; Empl.: 23; *Sls. Mgr.:* C. J. Schmaling; *Dist. Mgr.:* M. B. Polayes

ADDINGTON LABS. INC., SOLID STATE PRODS DIV., See Eaton Corp. Comm. Prods. Div.

ADDITIVE PRODUCTS DIV., Kollmorgen Corp., P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, TWX: 510-220-0022; Empl.: 450

ADDMASTER CORP., 416 Junipero Serra Dr., San Gabriel, CA 91776, Tel: 213-285-1121, Telex: 67-4770; Empl.: 200; *Sls. Mgr.:* Louis Doshay

ADDRESSOGRAPH FARRINGTON INC., Datatrol Div., Brent Dr., Hudson, MA 01749, Tel: 617-568-1411; Empl.: 350; *Sls. Mgr.:* Tom Galloway

ADE, INC., 1560 E. 98th St., Chicago, IL 60628, Tel: 312-221-3400; FSC No.: 62049

ADEC, 12 Kulick Rd., Fairfield, NJ 07006, Tel: 201-575-1570; FSC No.: 5965; Empl.: 45; *Sls. Mgr.:* D.L. Wiesen

ADI ELECTRONICS, INC., 160 Wilbur Place, Bohemia, NY 11716, Tel: 516-567-3555

ADHESIVE PRODS., 1660 Boone Ave., Bronx, NY 10460, Tel: 212-542-4600; *Sls. Mgr.:* M. S. Peters

ADRET/COMSTRON, See Comstron/Adret

ADTECH POWER INC., 1620 S. Sunkist St., Anaheim, CA 92806, Tel: 714-634-9211, Telex: 68-1498; FSC No.: 56410; Empl.: 70; *Sls. Mgr.:* Fred Weishar; *Dist. Mgr.:* Fred Weishar

ADTEK, Geophysical Survey Sys., Inc., 15 Flagstone Dr., Hudson, NH 03051, Tel: 603-889-4841, Telex: 953038; Empl.: 35; *Sls. Mgr.:* J. V. Rosetta, Jr.

ADVANCE CONVERSION DEVICES CO., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-989-0095; FSC No.: 52298; Empl.: 24; *Sls. Mgr.:* C. C. Applegate .... 3•1824, 1825

ADVANCED AUTOMATION CONCEPTS, INC., 3760 Lower Roswell Rd., Marietta, GA 30067, Tel: 404-973-0027, Telex: 703452; Empl.: 12; *Sls. Mgr.:* Bob Pap

ADVANCED CIRCUITRY, Litton Inds., 4811 W. Kearney, Springfield, MO 65803, Tel: 417-862-0751, TWX: 910-775-4705; Empl.: 1000; *Sls. Mgr.:* Steve Fadler

ADVANCED CIRCUIT TECHNLG., 118 N. Eastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, TWX: 710-228-8961; FSC No.: 57034; Empl.: 125

ADVANCED COATINGS & CHEM., 4343 Temple City Blvd., Temple City, CA 91780, Tel: 818-579-6270, Telex: 675594

ADVANCED COLOR TECHNLG., 21 Alpha Rd., Chelmsford, MA 01824, Tel: 617-256-1222, Telex: 951-419; *Sls. Mgr.:* Jack Flynn

ADVANCED CONTROL SYS., 24 Teed Dr., Randolph, MA 02368, Tel: 617-963-4543; Empl.: 6; *Sls. Mgr.:* Kenneth Egan

ADVANCED DEVICES, 1618 Camino Uva, Los Alamos, NM 87544, Tel: 505-662-7729

ADVANCED ELCTRNS. DESIGN, 440 Potrero Ave., Sunnyvale, CA 94086, Tel: 408-733-3555, Telex: 357-498; *Sls. Mgr.:* Michael J. Long; *Dist. Mgr.:* Randy Fitzpatrick

ADVANCED ELECTRONIC PACKAGING, 2159 Bay St., Los Angeles, CA 90021, Tel: 213-622-9042; *Sls. Mgr.:* Douglas A. Hill

ADVANCED FILTER DEVICES INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92008, Tel: 619-438-2074; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HIGH VOLTAGE CO., INC., P.O. Box 2136, Lancaster, CA 93539-2136, Tel: 213-997-7222; *Sls. Mgr.:* J. Richardson

Local Sales Offices & Reps

CA	Mountain View, Energy Devices	415-969-0330
VA	Fairfax, Schibley Assoc.	703-591-3008

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, TWX: 510-776-0584; FSC No.: 95666; Empl.: 550; *Sls. Mgr.:* Peter Wezeman

ADVANCED INTERCONNECTIONS CORP., 5 Division St., Warwick, RI 02818, Tel: 401-885-0485; *Sls. Mgr.:* Max E. Rice .... 2•1102-1104

Local Sales Offices & Reps

AR	Hot Springs, Automation Supplies	501-525-4588
CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	Rancho San Diego, Van Gott & Assoc.	619-286-3633
CA	Sunnyvale, M2 Mktg. Grp.	408-733-1361
CO	Denver, Control Agency	303-936-6641
FL	Melbourne, EMS, Inc.	305-724-1027
IL	Barrington, Richard Fisk Mktg.	312-381-0653
MD	Pikesville, Imagitron Sls. Co.	301-521-2020
MN	Minneapolis, Electro-Tech Assocs.	612-927-5878
NJ	Avalon, Imagitron Sls. Co.	609-368-5790
NJ	Fairfield, TAM	201-575-4390
NY	Fairport, Net Sales Co.	716-467-4538
NY	So. Hauppauge, TAM	516-348-0800
OH	Akron, B. J. Davis Corp.	216-645-0517
PA	Camphill, Imagitron Sls. Co.	717-763-9577
TX	Carrollton, Paulsen Elect. Sls.	214-386-4785
UT	Salt Lake City, Control Agency	801-972-8788
WA	Lynnwood, The Ransom Co.	206-775-0222

Local Distributors

AZ	Tempe, Elctrn. Hardware, Ltd.	602-967-1691
CA	Belmont, Lo Dan Elctrns., Inc.	415-592-4600; 800-541-1001
CA	No. Hollywood, Elctrn. Hardware, Ltd.	213-982-6100
CA	Santa Clara, Elctrn. Hardware, Ltd.	408-988-1000
CA	Sunnyvale, Sierra West Elctrn. Distrs.	408-747-1188
CO	Aurora, Elctrn. Hardware, Ltd.	303-363-6100
CT	East Haven, J. V. Elctrns. of Boston	203-469-2321
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Palm Bay, Action Elctrns.	305-725-4920
IL	Arlington Heights, Lo Dan Elctrns., Inc.	312-398-5311; 800-323-5207
MD	Gaithersburg, Axis Elctrns. Inc.	301-840-9640
MD	Owings Mills, Cameo Elctrns. Co.	301-363-6161
MA	Burlington, J. V. Elctrns. of Boston	617-273-4300
NJ	Nutley, Vantage Comps., Inc.	201-667-1840
NJ	Whippany, Tonar Inds., Inc.	201-884-1400
NY	Commack, Vantage Comps., Inc.	516-543-2000
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
RI	Warwick, Cal-Greg Comps.	401-738-6170
TX	Austin, Active Comp. Tech.	512-452-5254
TX	Dallas, Active Comp. Tech.	214-980-1888
TX	Houston, Active Comp. Tech.	713-496-4000
UT	No. Salt Lake, Western Controls	801-292-5900
WA	Lynnwood, Oman & Assocs.	206-774-1887

ADVANCED KINETICS, 1231 Victoria St., Costa Mesa, CA 92627, Tel: 714-646-7165; Empl.: 32; *Sls. Mgr.:* R. L. Gradishar

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED MICROCOMPUTERS, 3340 Scott Blvd., Santa Clara, CA 95051, Tel: 408-732-2400, Telex: 34-6306, TWX: 910-339-9280; *Sls. Mgr.:* Steve Zelencik; *Dist. Mgr.:* Rick Marz

ADVANCED MICRO DEVICES, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088, Tel: 408-732-2400, Telex: 34-6306, TWX: 910-339-9280; Empl.: 11000; *Sls. Mgr.:* Steve Zelencik; *Dist. Mgr.:* Len Brown

ADVANCED SYS. CONCEPTS, 435 N. Lake Ave., Pasadena, CA 91101, Tel: 818-793-8971, Telex: 701 215 ASCI; *Sls. Mgr.:* Wesley Ferris; *Dist. Mgr.:* Laurie Kalnin .... 1B•1501

Local Sales Offices & Reps

IA	Des Moines, Beams Co.	515-255-1148
MN	Edina, Integrated Peripheral Sys.	612-831-0349
OH	Dayton, Ashby Assocs.	513-252-5627
VA	Vienna, Advanced Technlg. Assocs.	703-556-0500

ADVANCED TECHN. RESEARCH LABS., 5645 K General Washington Dr., Alexandria, VA 22312, Tel: 703-750-2920; *Sls. Mgr.:* Bob Palma, Sr.; *Dist. Mgr.:* Bob Palma, Sr.

ADVANCED TECHN. SYS., 17-01 Pollitt Drive, Fair Lawn, NJ 07410, Tel: 201-794-0200, TWX: 710-988-2262; Empl.: 250; *Sls. Mgr.:* R. R. Draudin

ADVANCED TOOL TECHNOLOGY, INC., Sub. of Alliance Resch. Corp., 18217 Parthenia St., Northridge, CA 91325, Tel: 213-993-1202, Telex: 181011; *Sls. Mgr.:* Lou Davis

ADVANCED TRANSFORMERS INDS., INC., 114 Center St., El Segundo, CA 90245, Tel: 213-322-4249; *Sls. Mgr.:* Irma Spreitzer .... 1A•2264, 2265; 1B•1473

ADVANCE ENGRG., 18225 So. Hoover St., Gardena, CA 90248, Tel: 213-321-3100

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, TWX: 810-290-0294; FSC No.: 50788; Empl.: 30; *Sls. Mgr.:* Kay Nixon .... 2•1902

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	El Cajon, A-Tronics	619-444-1501
CA	Los Altos, Frauman Assoc.	415-941-0660
CA	Woodland Hills, A-Tronics	213-703-7212
CT	Meriden, A. Allison	203-237-9232
FL	Orlando, Gillum Sales	305-857-2110
GA	Atlanta, Remco	404-447-6937
IL	Westchester, Brouillette	312-345-6500
NY	Commack, RC Engrg.	516-543-3325
NC	Raleigh, Remco	919-847-5079
OH	Cincinnati, Makin Assocs.	513-871-2424
PA	W. Conshohocken, Eastern Comps.	215-825-8610
TX	Houston, Space Elctns.	713-266-9245
TX	Irving, Space Elctns.	214-251-3636
VA	Herndon, Eastern Comps.	703-471-1025

ADVANCE WIRE & CABLE, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, Telex: 334475; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

Local Sales Offices & Reps

AL	Decatur, Tenn Tech Inc.	205-350-0630
AZ	Phoenix, Advance Electrical Sls.	602-243-4326
CA	Belmont, Advance Electrical Sls.	415-592-4550
CO	Denver, Advance Electrical Sls.	303-388-0923
FL	Ft. Lauderdale, Hollingsworth & Still	305-748-8964
FL	Winter Pk., Hollingsworth & Still	305-699-0505
GA	Atlanta, Tenn Tech Inc.	404-622-5784
IL	Highland Pk., Bransky Sls.	312-433-2375
KY	Fort Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, Marketing Technology	301-465-5944
MA	Sharon, Adcour Inc.	617-784-8123
MN	St. Paul, SKOR Inc.	612-426-1160
NJ	Haddonfield, Mill-Brown Assoc.	609-429-1005
NJ	Parlin, JMR Sls.	201-727-5335
NY	Rochester, Ontec	716-464-8636
NC	Raleigh, Tenn-Tech.	919-266-3610
TN	Nashville, Tenn Tech Inc.	615-646-9811
TX	Houston, Advance Electrical Sls.	713-956-5436
WA	Seattle, Advance Electrical Sls.	206-575-4323
WI	Cedarburg, Bransky Sls.	414-377-6837

A E CORP., 65 Wellesley Ave., Needham, MA 02194, Tel: 617-449-3142; Empl.: 10; *Sls. Mgr.:* H. Harrison

A E G TELEFUNKEN, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876, Tel: 201-722-9800, Telex: 833409; *Sls. Mgr.:* John Szafranski

A E G TELEFUNKEN, Semiconductor Grp., Rte. 22, Somerville, NJ 08876, Tel: 201-722-9800, Telex: 833409; *Sls. Mgr.:* Carl Golasa; *Dist. Mgr.:* Carl Golasa

AEL, INC, See American Electronic Labs

AEMC, 99 Chauncy, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, Telex: 95-1073; *Sls. Mgr.:* Jon Henderson

AERCOM, 405 Tasman Dr., Sunnyvale, CA 94086, Tel: 408-744-1320, TWX: 910-339-9308; Empl.: 50; *Sls. Mgr.:* H. Putnam

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, Telex: 51-9209; FSC No.: 81535; Empl.: 100; *Sls. Mgr.:* Thomas A. Coleman

AEROFLEX LABS., INTEGRATED MICROSYSTEMS DIV., See Aeroflex Labs., Microelectronics Div.

AEROFLEX LABS., MAGNETIC PRODS. DIV., So. Service Rd., Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; Empl.: 490; *Sls. Mgr.:* Herbert S. Kulik .... 1B•1123, 1829

Local Sales Offices & Reps

EXP	New York, Frathom Co.	212-687-9390

AEROFLEX LABS., MICROELCTRNS. DIV., 35 S. Service Rd., Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; FSC No.: 88379; Empl.: 100; *Sls. Mgr.:* Melvin D. Schwartz .... 1A•1644

Local Sales Offices & Reps

AZ	Phoenix, The Knight Co.	602-994-1311
CA	Los Altos Hills, HB Mktg.	415-941-4080

CA	Los Angeles, The Knight Co.	213-670-2833
CA	San Diego, The Knight Co.	714-451-0529
CO	Parker, Parker Webster Co.	303-841-4888
CT	Simsbury, Multitronics Sls. Co.	203-651-0140
FL	Altamonte Springs, R. W. Mitscher Co., Inc.	305-788-6844
FL	Boca Raton, R. W. Mitscher Co., Inc.	305-482-5649
IL	Northfield, Feller Assocs., Inc.	312-446-8065
IA	Cedar Rapids, Feller Assocs., Inc.	319-364-0566
MD	Baltimore, Micro Comp, Inc.	301-247-0400
MN	Minneapolis, International Elctrns, Inc.	612-571-0000
NJ	Cherry Hill (Southern N.J.), Danco Elctrn. Sls. Corp.	609-424-5590
NJ	Teaneck (Northern N.J.), Spectrum Sls., Inc.	201-692-8314
NY	Hartsdale, Spectrum Sls, Inc.	914-472-8600
TX	Garland, Tesco Inc.	214-681-1376
UT	Salt Lake City, Parker Webster Co.	801-266-9939
EXP	New York City, New York, Henley & Co.	212-687-9390

AEROSPACE OPTICS INC.

AEROSPACE OPTICS INC., 3201 Sandy La., Dept. E-83, Fort Worth, TX 76112, Tel: 817-451-1141, Telex: 75-8461; Empl.: 83; *Sls. Mgr.:* R. E. Borkowski .... **1B**•1503

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125; Empl.: 125; *Sls. Mgr.:* Robert Mitchell

AEROTRONIC ASSOCS., INC., Riverside Dr., Contoocook, NH 03229, Tel: 603-746-4631; FSC No.: 67272; Empl.: 225; *Sls. Mgr.:* Gary Moravchik

AERTECH INDS., See TRW Microwave

AES CORP., 285 Newbury St., P.O. Box 2093, Peabody, MA 01960, Tel: 617-531-8886; *Sls. Mgr.:* Michael Sherman

AETNA ENGRG., P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-341-9409; Empl.: 10; *Sls. Mgr.:* T. W. Collins

AETNA TELECOMMUNICATIONS LABS., P.O. Box 723, 131 Flanders Rd., Westborough, MA 01581, Tel: 617-366-0400, Telex: 951356; *Sls. Mgr.:* Marjorie Katz

AGFA-GEVAERT, INC., 275 North St., Teterboro, NJ 07608, Tel: 201-288-4100, TWX: 710-990-6137; Empl.: 750

AHAM TOR INC (ATI), 999, 27901 Front St., Rancho California, CA 92390, Tel: 714-676-4151, Telex: 910-332-6201

AIE MAGNETICS, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210, Tel: 615-244-9024, Telex: 554466; FSC No.: 06978; Empl.: 300; *Sls. Mgr.:* J. Holeman

Local Sales Offices & Reps

AL	Huntsville, Glen White Assoc.	205-533-5272
CA	Culver City, De Angelo, Rothman & Co.	213-827-2202
CA	Santa Clara, Novatronix	408-727-9530
CO	Thronton, E & C Johnson Co.	303-457-2247
FL	Ft. Lauderdale, Donato & Assoc.	305-352-0727
FL	Tampa, Glen White Assocs.	813-886-6980
GA	Duluth, Glen White Assoc.	404-447-1825
IL	Chicago, M. Gottleib Assoc,	312-775-1151
IN	Indianapolis, Gottleib Assoc.	317-846-5788
IA	Cedar Rapids, Seltec Sales Corp.	319-393-1114
MD	Timonium, Glen White & Assoc.	301-252-6360
MA	Waltham, AIE-Eastern Region	617-899-5900
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MO	Kansas City, A.G.E.S.	816-421-0426
NY	Great Neck, Tylinski Assoc.	516-466-9070
NY	Rochester, Canavan-Scanlon	716-424-1830
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Raleigh, Glen White Assoc.	919-848-1931
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OK	Tulsa, MGR, Inc.	918-369-5186
OR	Beaverton, W^3 Associates, Inc.	503-641-5790
PA	Pittsburgh, Luebbe Sales Co.	412-931-0414
PA	Washington Crossing, DVS Co.	215-493-4642
TN	Gray, Glen White Assocs.	615-477-8850
TX	Austin, MGR, Inc.	512-250-0926
TX	Dallas, MGR, Inc.	214-357-3173
VA	Charlottesville, Glen White Assoc.	804-295-0435
VA	Lynchburg, Glen White Assoc.	804-237-6291
WA	Seattle, W^3 Associates, Inc.	206-285-2663

AIKEN ADVANCED SYS., 5901 Edsall Rd., Alexandria, VA 22304, Tel: 703-370-0900, TWX: 710-832-0612; Empl.: 175; *Sls. Mgr.:* C. G. Gilmer

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., 4000-4024 22nd Ave. W., Seattle, WA 98199-0056, Tel: 206-284-5563, TWX: 910-444-1333; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* E. Chadwick

AIPHONE, 1700 130th St. NE, Bellevue, WA 98005, Tel: 206-455-0510, Telex: 32-0288; Empl.: 27; *Sls. Mgr.:* Jim Morrison

AIRBORN, INC., 4321 AirBorn Dr.; Addison, TX 75001, Tel: 214-931-3200, Telex: 79-4200, TWX: 910-860-5230; FSC No.: 10400; Empl.: 350; *Sls. Mgr.:* J. L. Wolbrink .... 2•1105-1112

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Los Angeles, Air Born	213-670-7983
CA	Mountain View, Serra Assocs.	415-964-4300
CA	No. Hollywood, R. A. Strassner	213-761-1231
CA	San Diego, Ohm Spun Elctrns.	619-695-8102
FL	Cocoa Beach, Reynolds & Assoc.	305-259-7000
IL	Chicago, ESCO Assoc.	312-763-0800
MN	Edina, PWC	612-831-5999
MO	Bridgeton, Dytronics, Inc.	314-731-5799
NH	Nashua, Solla - Tronics	603-882-7146
NJ	Manville, Dynorep	201-685-0135
NY	Coxackie, R.P. Kennedy Co.	914-876-2700
NY	Rochester, R.P. Kennedy Co.	716-271-6322
OH	Dayton, Electro-Com	513-898-5140
PA	Doylestown, Monteiro Assocs.	215-345-5855
WA	Bellevue, Dillenbeck Sls.	206-747-4323

Local Distributors

TX	Addison, AirBorn Distribution Service	214-931-3200

AIRCO SPEER ELCTRNS., Resistor Plant, Bolivar Rd.; Box 547, Bradford, PA 16701, Tel: 814-362-5536, Telex: 914404, TWX: 510-695-5921; Empl.: 1000; *Sls. Mgr.:* Larry Holzwarth; *Dist. Mgr.:* John Petersen

AIRCRAFT & ELCTRN. SPEC., Box 248, Plainfield, IN 46168, Tel: 317-272-2551; FSC No.: 00529; Empl.: 150; *Sls. Mgr.:* Harry Newburg

AIR ELECTRO SUPPLY, INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, Telex: 66-2459, TWX: 910-495-1794

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060; FSC No.: 22782; *Sls. Mgr.:* Karl Thorp

airflyte ELECTRONICS CO.

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., Bayonne, NJ 07002, Tel: 201-436-2230, TWX: 710-729-4489; Empl.: 70; *Sls. Mgr.:* John Piret .... **1B**•1124-1129

Local Sales Offices & Reps

CA	Culver City, Westaironics	213-641-4122
CA	Los Altos, Poltronics	415-941-3020
CT	No. Haven, Kitchen & Kutchin	203-239-0212
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, R. P. Kennedy Co.	716-271-6322
PA	Philadelphia, R. P. Luce & Co.	215-884-8365
TX	Dallas, Jacobson Co.	214-363-7584

AIR LAND SYS., 2710 Prosperity Ave., Fairfax, VA 22031, Tel: 703-573-1100, Telex: 710-833-1174, TWX: Airland Frax; Empl.: 35; *Sls. Mgr.:* William C. Axe

AIRMATIC-ALLIED, 185 Park Dr., Wilmington, OH 45177, Tel: 513-382-1691; Empl.: 150

AIR-MAZE DIV., 25000 Miles Rd., Cleveland, OH 44128, Tel: 216-292-6800, Telex: 98-5413; *Sls. Mgr.:* John Cummings; *Dist. Mgr.:* Bob Glasier

AIR-O-TRONICS PRODS., Box K, Morrisville, NY 13408, Tel: 315-684-3705; FSC No.: 16663; Empl.: 10; *Sls. Mgr.:* G. M. Trush

AIRPAX CORPORATION, Woods Rd., Cambridge, MD 21613, Tel: 301-228-4600, Telex: 8-7715, TWX: 710-865-9655; FSC No.: 81541; Empl.: 550; *Sls. Mgr.:* D. Marshall .... **1B**•1256

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Phoenix, Westrep	602-997-8899
CA	Pico Rivera, Westrep	213-949-2551
CA	San Diego, Westrep	714-276-0751
CO	Littleton, Lange Sls.	303-795-3600
CT	Wallingford, Selmark Assocs.	203-573-9088
FL	Ft. Lauderdale, ElectroComp	305-491-4141
GA	Chamblee, BCI	404-455-0405
IL	Palatine, Somers-Reagan, Inc.	312-991-1108
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Marion, Rep Assocs.	319-373-0152
MD	Baltimore, Pro-Rep, Inc.	301-653-3600
MA	Millis, Selmark	617-376-2914
MI	Troy, Pine Sls.	313-589-0350
MN	Hopkins, Peterson & Wolff	612-941-5400
MO	St. Louis, Delltron	314-869-4779
NY	Jericho, Airpax Corp.	516-822-2410
NY	Poughkeepsie, C. W. Floring	914-471-2973
NY	Rochester, Electra Sls.	716-461-5252
NY	Syracuse, C.W. Floring & Assoc.	315-478-2144
NC	Winston-Salem, L.G. White	919-725-3612
OH	Cincinnatti, Baehr, Greenleaf	513-891-3826
OH	Cleveland, Baehr, Greenleaf	216-221-9030
OH	Columbus, Baehr, Greenleaf	614-486-4046
PA	Harleysville, T. Jackson	215-643-5560
PA	Pittsburgh, Russell F. Clark	412-242-9500
SC	Greenville, L.G. White	803-271-0630
TX	Dallas, Airpax Corp.	214-733-4377
UT	Salt Lake City, Lange Sls.	801-487-0843
VA	Richmond, L.G. White	804-740-7093
WA	Seattle, Don Smith	206-633-3160
WI	Wauwatosa, Larsen Assocs.	414-258-0529

AIRPAX CORPORATION, CHESHIRE DIV., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-272-0301, Telex: 962421, TWX: 710-455-4048; Empl.: 800; *Sls. Mgr.:* Robert Chlebek .... **1B**•1131; **3**•1121

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Airpax Corp.	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
CT	Wallingford, Selmark Assocs.	203-573-9088
FL	Ft. Lauderdale, Electrocomp Assocs.	305-491-4141
GA	Chamblee, B.C.I.	404-455-0405
IL	Palatine, Somers-Reagan, Inc.	312-991-1108
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Marion, Rep Assocs.	319-373-0152
MD	Baltimore, Pro-Rep, Inc.	301-653-3600
MA	Millis, Selmark Assocs.	617-376-2914
MI	Madison Heights, Pine Sls, Inc.	313-589-0350
MN	Bloomington, PWC	612-831-5999
MO	St. Louis, Delltron	314-869-4779
NH	Hopkinton, Selmark Assocs.	603-746-3299
NY	Jericho, Airpax Corp.	516-822-2410
NY	Rochester, Electra Sls.	716-461-5252
NY	Syracuse, C.W. Floring & Assocs.	315-478-2149
NC	Winston Salem, L.G. White Southern, Inc.	919-725-3612
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OR	Beaverton, Don Smith Sls. Co.	503-643-8020
PA	Harleysville, Thomas Jackson Assocs.	215-256-8877
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
SC	Greenville, L.G. White Southern, Inc.	803-271-0630
TX	Dallas, Airpax Corp.	214-733-4377
UT	Salt Lake City, Lange Sls.	801-487-0843
WA	Seattle, Don Smith Sls Co.	206-633-3160
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX/NA PHILIPS CONTROLS CORP., Ft. Lauderdale Div., 6801 W. Sunrise Blvd., Ft. Lauderdale, FL 33313, Tel: 305-587-1100, Telex: 51-4448, TWX: 510-955-9866; Empl.: 200 .... **3**•1929

Local Sales Offices & Reps

AZ	Scottsdale, Martech Assoc.	602-994-1285
CA	Buena Park, Pactec	213-921-8381

CA	Mountain View, Manco	415-964-7281
CO	Lafayette, Spectrum Sls.	303-759-4007
CT	Madison, S.I.R. Assoc.	203-245-2242
FL	Ft. Lauderdale, Bredesen Assoc.	305-566-3289
IL	Chicago, Somers Reagan Inc.	312-991-1108
IN	Indianapolis, Electro Dev. Engrg.	317-547-5274
LA	Kenner, D & W System Sls.	504-466-1692
MD	Phoenix, Rebco Sls.	301-592-8907
MA	Lexington, S.I.R. Assoc.	617-862-1812
MI	Detroit, Automatic Controls Co.	313-533-8890
MN	St. Paul, Kencotronics	612-645-7717
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Spring Lakes Hgts., Neville & Vespo	201-974-1520
NY	Buffalo, Process Mgmt.	716-847-0450
NY	Montgomery, Vespo Mktg.	914-457-9209
NC	Charlotte, MacGuire & Crawford Inc.	704-366-3454
OH	Cincinnati, J. W. Murray & Assoc.	513-574-8500
OH	Cleveland, Automatic Controls Corp.	216-631-0333
OR	Portland, Fry Controls	503-226-2620
PA	Harleysville, T. Jackson & Assocs.	215-643-5560
PA	Pittsburgh, Friday Engrg. Sls.	412-341-1444
TX	Dallas, Automatic Sys.	214-688-1810
TX	Houston, Haltom Co.	713-782-5625
VA	Salem, Process Specialties	703-345-5683
WI	Wauwatosa, Larsen Assocs.	414-258-0529

AIRPAX CORP., FREDERICK DIV., A North American Philips Co., Husky Park P.O. Box 500, Frederick, MD 21701, Tel: 301-663-5141, TWX: 710-862-0901; Empl.: 600; *Sls. Mgr.:* Robert Chlebek; *Dist. Mgr.:* B. L. Reeder ....**1B**•1291, 1793

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Scottsdale, TC Elctrns.	602-994-5153
CA	Brea, Masco	714-529-0866
CA	Los Angeles, Masco	213-295-7781
CA	Santa Clara, Airpax/NAPCC	408-980-0410
CA	Santee, Masco	714-448-6400
CO	Littleton, Lange Sls.	303-795-3600
CT	Cheshire, Selmark Assoc.	203-573-9088
FL	Lauderhill, B.C.I.	305-731-5851
FL	Orlando, B.C.I.	305-851-5747
GA	Doraville, B.C.I.	404-455-0405
IL	Palatine, Somers-Reagan	312-991-1108
IN	Indianapolis, Leslie M. De Voe Co.	317-842-3245
MA	Millis, Selmark Assocs.	617-376-2914
MI	Troy, C.B. Jensen & Assocs.	313-643-0506
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	St. Louis, Delltron Co.	314-869-4779
NH	Concord, Selmark Assocs.	603-623-5774
NJ	Parsippany, NAPCC/Airpax	201-887-6074
NJ	Pitman, Colrud Co.	609-589-5866
NY	Poughkeepsie, C.W. Floring Assocs.	914-471-2973
NY	Rochester, J.G. Welch Assocs.	716-266-2798
NY	Syracuse, C.W. Floring Assocs.	315-478-2149
NC	Raleigh, B.C.I.	919-781-9426
OH	Columbus, Rockford Controls Ohio	614-231-5890
OH	Dayton, Rockford Controls Ohio	513-898-5452
OH	Euclid, Rockford Controls Ohio	216-731-5250
TX	Austin, R.F. Kimball Co.	512-443-5284
TX	Houston, R.F. Kimball Co.	713-840-0590
TX	Richardson, R.F. Kimball Co.	214-231-3447
UT	Salt Lake City, Lange Sls.	801-487-0843
WA	Bellevue, Paul-Hilty Company	206-747-5767
WA	Renton, B&P Assocs.	206-454-6571

Local Distributors

CA	Santa Ana, Norstan Elctrns.	714-540-4165
OK	Tulsa, Altair	918-665-0524
TX	Houston, Altair	713-462-3029
TX	Richardson, Altair	214-231-5166

AIRPOT, 27 Lois St., Norwalk, CT 06851, Tel: 203-846-2021, Telex: 643-688; *Sls. Mgr.:* Mark A. Gaberman

AIRTRON, 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473; FSC No.: 80006; Empl.: 350

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541; Empl.: 30

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44482, Tel: 216-372-8511, Telex: 098-2482; Empl.: 500

AKG ACOUSTICS, INC., 77 Selleck St., Stamford, CT 06902, Tel: 203-348-2121; Empl.: 40; *Sls. Mgr.:* Peter Wellikoff

Local Sales Offices & Reps

CA	Culver City, Marshank Sls. Co.	213-559-2591
CA	San Francisco, L.P. Mktg.	415-532-5600
CO	Denver, Brake & Assoc.	303-431-5791
DC	Washington, Taub Sls. Inc.	301-942-3100
FL	Miami, World Wide Prods.	305-754-5475
GA	Atlanta, Elrep Sls. Co.	404-938-7108
IL	Chicago, Steffey Mktg.	312-480-3575
IN	Fort Wayne, N. Browning & Co.	219-432-9738
KY	Louisville, N. Browning & Co.	502-955-6473
MA	Boston, VF Sls. Inc.	617-237-6544
MI	Detroit, VF Sls. Inc.	313-453-8720
MN	Minnetonka, Clark Gibb Co.	612-938-5050
MO	Ballwin, Throckmorton Sls.	314-227-7222
MO	Kansas City, Throckmorton Sls.	816-333-0303
NE	Omaha, Throckmorton Sls.	402-346-7500
NY	Stamford, J. B. Anthony Co.	203-322-9209
NY	Syracuse, B. Darmstedter Assoc.	315-638-1261
PA	Erie, N. Browning & Co.	814-456-6453
TX	Dallas, Dimension Mktg.	214-348-9657
TX	Houston, Dimension Mktg.	713-870-9094
WA	Redmond, Luppnow Assoc.	206-883-3205

AKRO-MILS, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, Telex: 98-6321; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

Local Sales Offices & Reps

CA	Cerritos, Akro-Mils, Inc.	213-926-0465

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN GORDON ENTPRS., INC., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91605, Tel: 818-985-5500, Telex: 662532 A-GB FOTO. LSA, TWX: 910-321-4526 GORDON NT LSA; *Sls. Mgr.:* D. Sahlenn

ALAN INDS., P.O. Box 1203, Columbus, IN 47201, Tel: 812-372-8869; FSC No.: 52750; Empl.: 36

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
CA	Los Angeles, RF Assocs.	213-478-1586
CA	Mountain View, Mark V Assoc.	415-964-6275
FL	Bradenton, Saber Assocs.	800-327-0853
FL	Longwood, Saber Assocs.	800-327-0853
FL	Melbourne, Saber Assoc.	800-327-0853
GA	Griffin, Saber Assocs.	800-327-0853
IN	Columbus, Chambers Mktg.	812-372-0272
MD	Randallstown, C. L. Malinow & Co.	301-922-2092
MA	Needham, Addelco Corp.	617-444-4754
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	Liverpool, R. & D. Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NC	Clayton, Saber Assocs.	800-327-0853
OH	Dayton, Frederic L. Ohmer	513-434-1454
PA	Lafayette Hill, M. Lader Co.	215-825-3177
SC	Columbia, Saber Assoc.	800-327-0853
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-944-2055
EXP	CT, Stamford, Dage Corp.	203-324-3123

ALARM CONTROLS, 19 Brandywine Dr., Deer Park, NY 11729, Tel: 516-586-4220; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* Howard Berger

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006; *Sls. Mgr.:* Ronald B. Bradshaw

ALBEROX, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 617-995-1725; Empl.: 140 ....**2**•1787

Local Sales Offices & Reps

CA	Los Gatos, Alberox Corp.	408-358-1714
IL	Chicago, Karl D. Engle Co.	312-539-1820
IN	Indianapolis, Butler Components	317-253-5143
MA	Weston, J. Goode Assocs.	617-235-3900
MI	Birmingham, Clifford Armstrong Co.	313-851-1404
MN	Minneapolis, Magner & Assocs.	612-483-0656
NY	Fayetteville, S. F. Foster Co.	315-637-5427
NY	Valley Stream, Levison Sls.	516-561-9696
OH	Cleveland, Greenleaf & Assocs.	216-333-5480
PA	Philadelphia, Shelton Sls. Corp.	215-248-0131
TX	Dallas, C. M. Farmer Co., Inc.	214-339-4970
WA	Seattle, Demarest Assocs.	206-523-3210

ALCO ELCTRN. PRODS., INC., 1551 Osgood St., N. Andover, MA 01845, Tel: 617-685-4371, TWX: 710-342-0552; Empl.: 300 .... **1B**•1029, 1504-1514; **2**•1758; **3**•1122

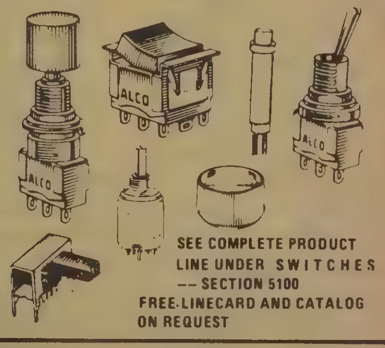
Local Sales Offices & Reps

AL	Huntsville, Glen White Assocs. Inc.	205-883-7938
AZ	Phoenix, Knight Co.	602-582-8506
CA	Los Angeles, Knight Co.	213-670-2833
CA	Redwood City, J. Heaton Co.	415-367-9000
CA	San Diego, Knight Co.	619-571-7903
CO	Littleton, Simpson & Assocs.	303-794-8381
FL	Safety Harbor, Augat/ALCO	813-725-1037
FL	Tamarac, Augat/ALCO	305-721-6021
GA	Norcross, Glen White Assocs. Inc.	404-441-1447
IN	Indianapolis, Rockford Controls	317-248-2518
MA	Norwood, Augat Sls.	617-762-3164
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	Blue Springs, Kathrinus-Kelly-Baumhauer-Co.	816-229-0001
MO	St. Louis, Kathrinus-Kelly-Baumhauer-Co.	314-647-2400
NM	Albuquerque, C. T. Carlberg & Assoc.	505-888-3883
NY	E. Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, Cooper-Simon & Co. Inc.	516-487-1142
NC	Raleigh, Glen White Assocs. Inc.	919-787-7023
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OR	Beaverton, D. Smith Sls. Co.	503-643-8020
PA	Pittsburgh, Luebbe Sls. Co.	412-931-0414
PA	Trevose, P.S.A., Inc.	215-245-0513
TN	Gray, Glen White Assocs. Inc.	615-477-8850
TX	Dallas, Augat/ALCO	214-788-4211
TX	Georgetown, Augat/ALCO	512-479-9447
TX	Houston, Augat/ALCO	713-495-3100
UT	Midvale, Simpson Assocs. Inc.	801-566-3691
VA	Lynchburg, P.S.A. Inc.	800-233-4242
VA	McLean, P.S.A. Inc.	800-233-4242
WA	Seattle, D. Smith Sls. Co.	206-633-3160

Local Distributors

AL	Huntsville, Hall-Mark Elexs.	205-837-8700
AL	Huntsville, Arrow Elctrns.	205-882-2730
AZ	Phoenix, Hall-Mark Elexs.	602-437-1200
AZ	Phoenix, Kachina Elctrns.	602-269-6201
AZ	Tempe, Acacia Sls.	602-894-2874
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Burbank, Switching Devices	213-849-3211
CA	Chatsworth, Arrow Elexs.	213-701-7500
CA	Gardena, CA Switch & Signal	213-770-2330
CA	Hollywood, Yale Radio Electric	213-465-3186
CA	Irvine, Acacia Sales	714-660-0834
CA	Los Angeles, Electric Switch	213-664-1141
CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	Newport Beach, Arrow Elexs.	714-851-8961

ALCO
ELECTRONIC PRODUCTS, INC
FULL LINE
AUTHORIZED DISTRIBUTOR
E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Pasadena, Dow Radio	213-793-1195
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	San Diego, Arrow Elexs.	619-565-4800
CA	San Diego, Hall-Mark Elexs.	619-268-1201
CA	San Diego, Acacia Sls.	619-565-4365
CA	San Diego, El-Com Inc.	619-578-0900
CA	San Francisco, Steven Engrg.	415-588-9200
CA	San Jose, Ratel Inc.	408-946-4300
CA	San Jose, Hall-Mark Elexs.	408-946-0900
CA	Santee, Mouser Elexs.	619-449-2300
CA	Sunnyvale, Arrow Elexs.	408-745-6600
CA	Sunnyvale, Acacia Sls.	408-745-7200
CA	Van Nuys, Pacific Switch Controls	213-873-4802
CO	Denver, Arrow Elexs.	303-758-2100
CO	Denver, Ragon Elexs.	303-744-1992
CO	Englewood, Hall-Mark Elexs.	303-694-1662
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Greenwich, Wise Comps.	203-531-4880
CT	Hartford, Wes-Garde	203-525-6907
CT	Stratford, Utronics	203-378-4201
CT	W. Hartford, Atlantic Switch Controls	203-527-7705
CT	Wallingford, Arrow Elexs.	203-265-7741
FL	Ft. Lauderdale, Arrow Elexs.	305-776-7790
FL	Ft. Lauderdale, Hall-Mark Elexs.	305-971-9280
FL	Lakeland, Switch Controls	813-644-7564
FL	Miami, Elctrn, Equip.	305-871-3500
FL	Orlando, Hall-Mark Elexs.	305-855-4020
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Palm Bay, Arrow Elexs.	305-725-1480
FL	Pompano Beach, Components South	305-971-0350
GA	Norcross, Hall-Mark Elexs.	404-447-8000
GA	Norcross, Arrow Elexs.	404-449-8252
IL	Arlington Heights, Lo Dan Elctrns.	312-398-5311
IL	Bensenville, Diplomat/Illinois	312-595-1000
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Glen Ellyn, Rockford Controls Co.	312-469-6016
IL	Itasca, Voyager Elexs. Corp.	312-773-4900
IL	Palatine, OHM Elexs.	312-359-5500
IL	Rockford, Midwest Assocs. Inc.	815-962-8036
IL	Rosemont, Advent Elctrns.	312-298-4210
IL	Schaumberg, Arrow Elexs.	312-397-3440
IL	Wheaton, Conectrix	312-653-1460
IN	Indianapolis, Neunier Elex. Supply	317-635-3511
IN	Indianapolis, Arrow Elexs.	317-243-9353
IN	Indianapolis, Graham Elexs.	317-634-8202
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Deeco Inc.	319-365-7551
IA	Cedar Rapids, Arrow Elexs.	319-395-7230
KS	Lenexa, Hall-Mark Elexs Corp.	913-888-4747
KS	Witchita, Lee Products	316-264-2172
MD	Baltimore, Arrow Elexs	301-247-5400
MD	Baltimore, A. S. I.	301-265-5100
MD	Gaithersburg, Pioneer Wash.	301-921-0660
MD	Kensington, Marine Air Supp.	301-949-9560
MD	Rockville, Arrow Elexs	301-251-0644
MA	Burlington, Heilind Elexs	617-272-5610
MA	Canton, Impact Sls.	617-821-1500
MA	Canton, H. Young Jr. Co.	617-828-4880
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Lynn, Land Elctrns.	617-592-2220
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Woburn, Arrow Elexs	617-933-8130
MA	Woburn, CNC	617-933-5017
MI	Ann Arbor, Arrow Elexs	313-971-8220
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Arrow Elexs	616-243-0912
MI	Zeeland, Tubergen & Assocs. Inc.	616-772-1548
MN	Edina, Arrow Elexs	612-830-1800
MN	Minneapolis, Newark Elexs	612-331-6350
MN	St. Paul, Ragon	612-642-2828
MO	Kansas City, Walter's Radio Supply	816-531-7015
MO	Maryland Heights, Hall-Mark Elexs.	314-291-5350
MO	St. Louis, Van Sickle Elexs.	314-621-5000
MO	St. Louis, Arrow Elexs.	314-426-4500
MO	St. Louis, Olive Elctrn. Supp.	314-426-4500
NH	Manchester, Arrow Elexs.	603-668-6968
NJ	Bellmawr, Mid Atlantic Elctrns.	609-931-5303
NJ	Camden, General Radio	609-961-8560
NJ	Clifton, J-Mar Elexs. Inc.	201-772-6400
NJ	E. Marlton, Arrow Elexs.	609-596-8000
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Mt. Laurel, Jerseyswitch	609-778-8190
NJ	Springfield, Federated Purchaser	201-272-0505
NM	Albuquerque, Walker Elex. Sup.	505-242-2288
NM	Albuquerque, Arrow Elexs.	505-243-4566
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Arrow Elctrns.	516-293-4020
NY	Hauppauge, Broadline Elexs.	516-231-4100
NY	Hauppauge, Arrow Elexs.	516-231-1000
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Liverpool, Arrow Elexs.	315-652-1000
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Melville, Arrow Elexs.	516-694-6800
NY	Rochester, Arrow Elexs.	716-275-0300
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Vestal, Pioneer/Harvey	607-748-8211
NC	Raleigh, Hall-Mark Elex. Inc.	919-722-9131
NC	Raleigh, Arrow Elexs.	919-725-8711
NC	Winston-Salem, Arrow Elexs.	919-725-8711
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Centerville, Arrow Elexs.	513-435-5563
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Pruitt Energy Sources Inc.	216-566-1545
OH	Columbus, Ohioswitch	614-885-0319
OH	Columbus, Arrow Elexs.	614-885-8362
OH	Columbus, Hughes-Peter	614-294-5351
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Solon, Arrow Elexs.	216-248-3990
OK	Tulsa, Arrow Elexs.	918-665-7700
OK	Tulsa, Hall-Mark Elexs.	918-665-3200
OR	Beaverton, Component Resources Inc.	503-641-8188
OR	Beaverton, Acacia Sales	503-646-3377
PA	Allentown, A.A. Peters	215-434-5237
PA	Braddock, Leff Elexs.	412-351-5000
PA	McKean, Advacom	814-476-7774
PA	Monroeville, Arrow Elexs.	412-856-7000
PA	Norristown, Century Elctrns.	215-631-5400
PA	Philadelphia, Philadelphia Elexs.	215-568-7400
PA	Philadelphia, Almo Elctrns.	215-698-4000
TN	Knoxville, Indl. Elctrns.	615-573-7135
TX	Austin, Arrow Elexs.	512-835-4180
TX	Austin, Hall-Mark Elex. Corp.	512-258-8848
TX	Dallas, Hall-Mark Elex. Corp.	214-341-1147
TX	Dallas, Arrow Elexs.	214-386-7500
TX	Dallas, Texaswitch	214-357-1768
TX	El Paso, Ideal Industrial Elexs.	915-779-6643
TX	Garland, Newark Elexs.	214-494-5911
TX	Houston, Hall-Mark Elexs. Corp.	713-781-6100
TX	Midland, E.S.I.	915-694-9657
TX	Stafford, Arrow Elexs.	713-491-4100
TX	Stafford, Southwest Elctrns.	713-240-4000
UT	Salt Lake City, Arrow Elexs.	801-539-1135
UT	Salt Lake City, Standard Supply	801-486-3371
VA	Arlington, Arrow Elexs.	804-282-0413
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Bellevue, Arrow Elexs.	206-643-4800
WA	Bellevue, Almac/Stroum Elctrns.	206-643-9992
WA	Seattle, Zepher Elctrns.	206-241-1980
WI	Madison, Arrow Elexs.	608-273-4977
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Oak Creek, Arrow Elexs.	414-764-6600

ALCOSWITCH, See Alco Elctrn. Prods., Inc.

ALDEN COMPUTER SYSTEMS, 27 Strathmore Rd., Natick, MA 01760, Tel: 617-655-6610; *Sls. Mgr.:* Bob Whitten

ALDEN ELCTRNS. INC., Washington St., Westboro, MA 01581, Tel: 617-366-8851, Telex: 94-8404; Empl.: 125; *Sls. Mgr.:* L. A. Farrington

ALDEN

ALDEN PRODUCTS CO., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, Tel: 617-583-0160, Telex: 92-4451; FSC No.: 01009; Empl.: 135; *Sls. Mgr.:* Donald J. Paul .... **2**•1113-1119

Local Sales Offices & Reps

CA	Tarzana, High Voltage Sales	213-881-9194

ALDEN SYS., 262 N. Main St., P.O. Box 860, Brockton, MA 02403, Tel: 617-583-0160, Telex: 92-4451; Empl.: 5; *Sls. Mgr.:* G. Morrison

A.L. DESIGN INC., 2070 Niagara Falls Blvd., Tonawanda, NY 14150, Tel: 716-692-6272; Empl.: 9

ALESSI INDS., INC., 3195-C Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-979-8912, TWX: 910-595-1528; *Sls. Mgr.:* Tim McFadden

ALFORD MFG. CO., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01888, Tel: 617-935-8610, TWX: 710-348-1063; FSC No.: 07177; Empl.: 30; *Sls. Mgr.:* Fred Abel

ALGO, INC., 9451 Sohap Lane, Columbia, MD 21045, Tel: 301-730-7442; *Sls. Mgr.:* C.W. "Chuck" Alexander

Local Sales Offices & Reps

AL	Huntsville, Ram-Z Assoc. Inc.	205-532-7808
CA	Novato, Ed Driscoll Assoc.	415-883-0353
FL	Sarasota, Ram-Z Assoc.	813-921-5561
GA	Atlanta, Ram-Z Assoc.	404-898-9091
IL	Park Ridge, Adtech Inc.	312-692-7320
MA	Framingham, J.M. Lancaster Assoc.	617-875-8893
MO	Grandview, Digital Sys. Sls.	316-685-9725
NJ	Englewood Cliffs, Sci. Dvs. East	201-871-3916
OH	Chesterland, EQS, Sys. Inc.	216-729-2222
TX	Houston, Knox Mktg.	713-780-2516
VA	Alexandria, Dyna-Repco	703-354-1222
WA	Bellevue, Gerry Mara Assoc.	206-614-3535

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, TWX: 710-462-1178; Empl.: 255

ALLACO PRODS. DIV., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518; FSC No.: 99098; Empl.: 23; *Sls. Mgr.:* R.S. Cass

ALLEN AVIONICS, INC.

ALLEN AVIONICS, 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080 .... **1A**•1446-1449, 1578-1583, 2124

Local Sales Offices & Reps

AZ	Tempe, J. F. Hurlbut Co.	602-968-5962
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Adtek Assocs.	415-323-5414
CA	San Diego, Van Gott & Assocs.	619-272-8452
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Ft. Lauderdale, Reynolds & Assocs.	305-581-6611
FL	Melbourne, Reynolds & Assocs.	305-259-7000
FL	St. Petersburg, Reynolds & Assocs.	813-360-1484
GA	Atlanta, Reynolds & Assocs.	404-393-9113
MA	Wayland, High-Tech Sls.	617-653-3838
MN	Anoka, Ken Haugen & Assocs.	612-421-3395
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	Bloomingdale, Eastern Metro Assocs.	201-492-1747
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NY	Rochester, J. G. Welch Assocs.	716-244-1100
NY	Utica, J. G. Welch Assocs.	315-736-7821
OR	Portland, Components West	503-643-5588
PA	Huntingdon Valley, Rabal Assocs.	215-947-4825
TX	Dallas, Bradenco Corp.	214-243-7261
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
WA	Redmond, Components West	206-885-5880
EXP	CT, Stamford, Dage Corp.	203-324-3123

ALLEN-BRADLEY

ALLEN-BRADLEY CO., 1201 S. Second St., Milwaukee, WI 53204, Tel: 414-671-2000, TWX: 910-262-3451; Empl.: 6500; *Sls. Mgr.:* C. Grimsley; *Dist. Mgr.:* Dale Van Scoyk .... **1A**•1788, 1792-1802, 2019-2021, 2088, 2089; **2**•1788-1791

Local Sales Offices & Reps

AL	Birmingham, A-B Co.	205-879-4641
AK	Anchorage, J. A. Tudor & Assoc.	907-243-4641
AZ	Scottsdale, A-B Co.	602-994-9547
AR	Little Rock, C. H. Stout Inc.	501-372-2555
CA	City of Commerce, A-B Co.	213-724-5713
CA	S. San Francisco, A-B Co.	415-871-0200
CA	San Diego, A-B Co.	619-292-4016
CO	Denver, A-B Co.	303-985-8787
CT	Stratford, A-B Co.	203-378-7364
FL	Ft. Lauderdale, A-B Co.	305-771-0400
FL	Jacksonville, Van & Smith Co.	904-384-2376
FL	Orlando, Van & Smith Co.	305-898-8520
FL	Tampa, Van & Smith Co.	813-877-8393
GA	Doraville, A-B Co.	404-455-7422
HI	Honolulu, J. M. Elec. Sls.	808-833-1744
IL	Chicago, A-B Co.	312-922-9302
IL	Rockford, A-B Co.	815-965-8795
IN	Fort Wayne, A-B Co.	219-432-9538
IN	Indianapolis, A-B Co.	317-293-5223
IN	Merrillville, A-B Co.	219-769-7770
IA	Bettendorf, A-B Co.	319-355-5316
KS	Wichita, A-B Co.	316-686-9631
KY	Louisville, A-B Co.	502-893-2571
LA	Baton Rouge, A-B Co.	504-927-5955
LA	Metairie, A-B Co.	504-888-2281
LA	Shreveport, C. H. Stout	318-221-5555
ME	Portland, A-B Co.	207-772-3555
MD	Baltimore, A-B Co.	301-265-5600
MA	Agawam, A-B Co.	413-785-1984
MA	Framingham, A-B Co.	617-879-5900
MI	Flint, A-B Co.	313-733-3560
MI	Grand Rapids, A-B Co.	616-455-2250
MI	Kalamazoo, A-B Co.	616-344-6163

MI	Lansing, A-B Co.	517-351-4560
MI	Madison Heights, A-B Co.	313-583-9400
MN	Minneapolis, A-B Co.	612-781-3406
MS	Jackson, A-B Co.	601-981-4191
MO	Kansas City, A-B Co.	816-421-4595
MO	Maryland Heights, A-B Co.	314-567-6326
NE	Omaha, A-B Co.	402-592-2010
NJ	Bloomfield, A-B Co.	201-338-4600
NM	Albuquerque, A-B Co.	505-265-7723
NY	Albany, A-B Co.	518-869-5373
NY	Buffalo, A-B Co.	716-634-2711
NY	Rochester, A-B Co.	716-461-3660
NY	Syracuse, A-B Co.	315-463-4501
NC	Charlotte, A-B Co.	704-394-9341
NC	Greensboro, A-B Co.	919-272-5870
OH	Akron, A-B Co.	216-253-2106
OH	Cincinnati, A-B Co.	513-793-7580
OH	Cleveland, A-B Co.	216-442-0000
OH	Columbus, A-B Co.	614-882-7722
OH	Dayton, A-B Co.	513-294-4466
OH	Toledo, A-B Co.	419-841-7726
OK	Tulsa, J. W. Elder Co.	918-583-9149
OR	Eugene, J. A. Tudor & Assoc.	503-686-1252
OR	Portland, J. A. Tudor & Assoc.	503-288-5154
PA	Allentown, A-B Co.	215-437-2401
PA	Erie, A-B Co.	814-868-8214
PA	King of Prussia, A-B Co.	215-337-1990
PA	Pittsburgh, A-B Co.	412-923-1844
PA	York, A-B Co.	717-848-2239
SC	Greenville, A-B Co.	803-235-1280
TN	Knoxville, A-B Co.	615-588-0591
TN	Memphis, C. H. Stout	901-362-1616
TN	Nashville, A-B Co.	615-834-1860
TX	Dallas, A-B Co.	214-243-3665
TX	Houston, A-B Co.	713-445-8474
TX	San Antonio, A-B Co.	512-732-4362
UT	Salt Lake City, Stevens Sls. Co.	801-487-8971
VA	Richmond, A-B Co.	804-282-4285
WA	Pasco, J. A. Tudor & Assoc.	509-547-8414
WA	Seattle, J. A. Tudor & Assoc.	206-682-7444
WA	Spokane, J. A. Tudor & Assoc.	509-327-3328
WV	Charleston, S. C. Payne	304-755-8193
WI	Appleton, A-B Co.	414-731-3202

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, Telex: 18-2699; *Sls. Mgr.:* Carl M. Witas

ALLEN DATAGRAPH, INC., 24 Keewaydin Dr., Salem, NH 03079, Tel: 603-893-1983, TWX: 710-366-0504; *Sls. Mgr.:* David Colinan

ALLEN MFG., 22 E. Dudley Town Rd., Bloomfield, CT 06002, Tel: 203-242-8511, Telex: 710-425-0099; Empl.: 420; *Sls. Mgr.:* M. Kubick; *Dist. Mgr.:* M. Kubick

ALLIED CORP. AEROSPACE SECTOR, Bendix Communications Div., East Joppa Rd., Towson, MD 21204, Tel: 301-583-4000, TWX: 710-232-1823; Empl.: 1350; *Sls. Mgr.:* Palmer H. Arnold

ALLIED SYSTEMS CORP., Box 18077, Greensboro, NC 27419, Tel: 919-299-2294; Empl.: 25; *Sls. Mgr.:* E. V. Saude 2•1874

Local Sales Offices & Reps

CA	Seal Beach, Texel Engr. Sls. Rep.	213-596-9411
NY	New Hook, R. P. Kennedy Co.	914-876-2700
NY	Rochester, R. P. Kennedy Co.	716-271-6322
NC	Bladenboro, Everette Bolte	919-294-4141
VA	Arlington, H. J. Heffernan Co.	703-522-6666

ALLMETAL SCREW PRODUCTS CO., INC., 821 Stewart Ave., Garden City, NY 11530, Tel: 516-222-1200, TWX: 510-222-8132; Empl.: 200; *Sls. Mgr.:* Fred C. Sidebotham

ALL-STATES, INC., 1801 W. Foster Ave., Chicago, IL 60640, Tel: 312-728-0525; FSC No.: 26863; *Sls. Mgr.:* E. B. Phillips; *Dist. Mgr.:* E. B. Phillips

ALLTECH ASSOCS. INC., Applied Science Labs., 2051 Waukegan Rd., Deerfield, IL 60015, Tel: 312-948-8600, Telex: 687-1132; FSC No.: 36-2696920; *Sls. Mgr.:* Pat Krebs

ALMOND INSTRUMENTS, See EG & G Almond Instruments

ALMOR CO., INC., PO Box 1790, 155 Crescent St., Brockton, MA 02403, Tel: 617-586-5406; *Sls. Mgr.:* Bill Wolfreys

ALPHA COMPS., 115 Eucalyptus Dr., El Segundo, CA 90245, Tel: 213-322-7780; Empl.: 12

ALPHA COMPS., 1106 E. Simpson Rd., Mechanicsburg, PA 17055, Tel: 717-697-8595, TWX: 510-650-4930; FSC No.: 52748

Local Sales Offices & Reps

CO	Boulder, Herb Bass Assocs.	303-499-7509
MD	Towson, Dickison Sls. Co.	301-823-0923
NY	Rochester, H. C. Johnson Agencies	716-586-8777

ALPHA INDS., INC.-MICROELECTRONIC DIV., 3015 Advance Lane, Colmar, PA 18915, Tel: 215-822-1311, TWX: 510-661-7370; FSC No.: 17540; *Sls. Mgr.:* Joe Diesso

ALPHA INDS., INC., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843, Tel: 617-681-8520, Telex: 949436, TWX: 710-342-8033; FSC No.: 17540; *Sls. Mgr.:* Frank Tarr

ALPHA INDS., INC.-MSD DIV., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; *Sls. Mgr.:* Peter K. Butler; *Dist. Mgr.:* Nicholas Bishop

ALPHA INDS., INC., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; Empl.: 1200

ALPHA INDS., INC. - TRG MILLIMETER COMP., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; *Sls. Mgr.:* Peter K. Butler; *Dist. Mgr.:* Nicholas Bishop

ALPHA-M CORP., 3009 Wildflower Dr., Dallas, TX 75229, Tel: 214-620-0021; Empl.: 8; *Sls. Mgr.:* W. L. Cowley

ALPHA MERICS CORP., 20931 Nordhoff St., Chatsworth, CA 91311, Tel: 213-709-1155, Telex: 182314, TWX: ALPHA-MER-CHCA 910-494-1931; *Sls. Mgr.:* Geoffrey Groom; *Dist. Mgr.:* Geoffrey Groom

ALPHA METALS, 600 Rte 440, Jersey City, NJ 07304, Tel: 201-434-6778, Telex: 12-5798; Empl.: 400; *Sls. Mgr.:* D. Zerfoss

ALPHA PRODUCTS, INC., 5740 Corsa Ave. #104, Westlake Village, CA 91362, Tel: 818-889-9304

ALPHA WIRE CORP., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207, Tel: 201-925-8000, Telex: 6853017, TWX: 710-996-5895; Empl.: 450; *Sls. Mgr.:* Paul Dietlian 2•1940, 1941

ALPS ELECTRIC (USA), INC., 3553 N. First St., San Jose, CA 95131, Tel: 408-946-6000, Telex: 157061; Empl.: 21 3•1068

Local Sales Offices & Reps

AL	Huntsville, Jack Harvey & Assocs.	205-536-4414
AZ	Phoenix, Eltron	602-266-2164
CA	Garden Grove, West Electronic Sls. Co.	714-829-0120
CA	San Diego, Harvey King, Inc.	619-566-5252
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Englewood, Nelligan Co.	303-761-2121
CT	Yalesville, Technology Sls.	203-269-8853
FL	Clearwater, Jack Harvey & Assocs.	813-725-1841
FL	Ft. Lauderdale, Jack Harvey & Assocs.	305-763-1945
GA	Norcross, Jack Harvey & Assocs.	404-449-4643
IL	Arlington Hgts., Micro Sls.	312-956-1000
IN	Indianapolis, Jack Harvey & Assocs.	317-872-1031
IN	Indianapolis, Alps Elec. (USA)	317-248-2577
IN	Kokomo, Jack Harvey & Assocs.	317-453-4260
KS	Kansas City, BC Electronic Sls.	913-342-1211
KS	Wichita, BC Elctrn. Sls.	316-942-9840
KY	Prospect, Jack Harvey & Assocs.	502-228-4100
MD	Baltimore, Burgin-Kreh Assocs., Inc.	301-265-8500
MA	Waltham, Technology Sls.	617-647-5700
MI	Oak Park, A. Blumenberg Assoc.	313-968-3230
MN	Minneapolis, PSI	612-944-8545
MO	St. Louis, BC Elec. Sls.	314-291-1101
NJ	Boonton, PAF Assoc.	201-335-0680
NY	Albany, Reagan/Compar Albany	518-489-4777
NY	Endwell, Reagan/Compar	607-723-8743
NY	Fairport, Reagan/Compar	716-271-2230
NY	New Hartford, Reagan/Compar	315-732-3775
NY	Rockville Centre, Alps Elec. (USA)	516-766-3636
NY	Smithtown, PAF Assocs.	516-360-0940
NC	Greensboro, Wallace Elctrn. Sls.	919-996-2742
OH	Rocky River, Norm Case Assocs.	216-333-0400
OK	Tulsa, Norcom	918-832-7747
OR	Aloha, Venture Elctrns.	503-642-9090
PA	Willow Grove, Harry Nash Assocs.	215-657-2213
TN	Johnson City, Jack Harvey & Assocs.	615-928-7588
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Salt Lake City, Nelligan Co.	802-261-1121
VA	Lynchburg, Burgin-Kreh Assocs., Inc.	804-239-2626
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Milwaukee, Micro Sales, Inc.	414-782-1171

ALTEC LANSING, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806, Tel: 714-632-7117, Telex: 665415; Empl.: 200; *Sls. Mgr.:* Gayle Campbell

ALTEK CO., P.O. Box 1128, Torrington, CT 06790, Tel: 203-482-7626; FSC No.: 53939; Empl.: 34; *Sls. Mgr.:* Stephen Altschuler

ALTEK CORP., 2150E Indl. Pkwy., Silver Spring, MD 20904, Tel: 301-622-3906, TWX: 710-825-0422; Empl.: 55; *Sls. Mgr.:* Lowell Nerenberg; *Dist. Mgr.:* Lowell Nerenberg

ALUMINUM FILTER, P.O. Box 1311, Santa Barbara, CA 93102, Tel: 805-684-7651, Telex: 658325, TWX: 910-336-1113; FSC No.: 17504; Empl.: 40; *Sls. Mgr.:* B. L. Baker

Local Sales Offices & Reps

AZ	Tucson, Windcliff Service Co.	602-624-2272
CA	Fremont, Vontek	415-651-7966
CA	Reseda, Jerry Budenz & Assoc.	818-342-4276
CA	San Diego, Aluminum Filter	805-684-7651
CO	Louisville, X-O Sales Inc.	303-666-7690
MA	Brookline, Harman & Assocs.	617-232-6687
MN	Edina, Peterson & Wolff	612-941-5400
OK	Tulsa, NTR/Data Comp Inc.	918-664-2180

ALZBEAR CORP., 15411 Red Hill Ave., Unit F, Tustin, CA 92680, Tel: 714-557-0910; Empl.: 45; *Sls. Mgr.:* Al Robinson; *Dist. Mgr.:* Al Robinson

AMATOM ELCTRN. HARDWARE, 446 Blake St., New Haven, CT 06515, Tel: 203-397-3311, Telex: 963-419; FSC No.: 06540; Empl.: 55; *Sls. Mgr.:* Vince Maida

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Phoenix, Gabriel & Assoc.	602-866-3622
AR	Ft. Smith, Electra Reps.	501-452-4030
CA	Costa Mesa, Gabriel & Assoc.	714-957-1981
CA	El Monte, MITE/Western	213-686-1354
CA	San Francisco, Tom Boyd	408-727-4401
CO	Englewood, Dynatech, Inc.	303-773-2830
CT	Bethany, Reps. Corp.	203-393-0024
FL	Ft. Lauderdale, Electrocomp Assoc.	305-491-4141
FL	Melbourne, Electrocomp Assoc.	305-242-0621
FL	St. Petersburg, Electrocomp Assoc.	813-327-9677
GA	Atlanta, Remco	404-447-6937
IL	Elk Grove Village, Control Sls.	312-595-2110
IN	Ft. Wayne, Aktron Corp.	219-747-3650
IA	Marion, M.S.B. Assocs.	319-377-6261
KS	Shawnee Mission, M.S.B. Assocs.	913-432-2131
MA	Wellesley, Reps. Corp.	617-237-6476
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	St. Louis Pk., C. E. Bohlig Co.	612-922-7011
MO	St. Charles, M.S.B. Assocs.	314-946-5577
NY	Bayside, Robert Diamond, Inc.	212-423-7330
NY	Syracuse, Lenard Co.	315-479-9191
NC	Raleigh, Remco	919-847-5079
OH	Cincinnati, J. O. Olsen Co.	513-574-7711
OH	Cleveland, J. O. Olsen Co.	216-662-3454
PA	Birchrunville, Jadelectronics Assocs.	215-296-3800
PA	Pittsburgh, J. O. Olsen Co.	412-279-2550
TX	Dallas, Electra Reps.	214-387-3594
TX	Houston, Electra Reps.	713-988-9022
WA	Seattle, Blum & Assocs.	206-285-2590
WI	Thiensville, Control Sls.	414-242-4580
EXP	NY, North Babylon, EIM	516-643-5700

AMBI-TECH INDS., 319 Knickerbocker Ave., Hillsdale, NJ 07642, Tel: 201-666-0504; Empl.: 20; *Sls. Mgr.:* Al Nagler; *Dist. Mgr.:* Al Nagler

AMBROID CO., P.O. Box 1089, Taunton, MA 02780, Tel: 617-823-1726; Empl.: 10; *Sls. Mgr.:* J. F. Strauss

AMCO ENGRG., 3801 N. Rose St., Schiller Pk., IL 60176, Tel: 312-671-6670, TWX: 910-227-3152; Empl.: 280; *Sls. Mgr.:* F. A. Johnson ... 2•1006, 1007, 1803

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Phoenix, Gramer & Co.	602-995-9455
CA	Burlingame, Polach & Bensinger	415-697-2525
CA	Los Angeles, Knight Co.	213-670-2833
CA	Orange County, Knight Co.	714-833-8250
CA	San Diego, Knight Co.	619-693-1806
CO	Englewood, FG Mktg. Co.	303-795-9176
CT	Stratford, Instr. Dynamics	203-378-6019
FL	Altamonte Springs, WMM Assocs.	305-831-4530
FL	Clearwater, WMM Assocs.	813-442-3913

FL	Davie, WMM Assocs.	305-581-7036
FL	Indialantic, WMM Assocs.	305-773-1157
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Schiller Park, R. L. Lang & Assocs.	312-671-3228
IN	Ft. Wayne, Aktron Corp.	219-747-3650
IA	Davenport, Ensco-Rep	319-386-6600
KS	Overland Park, Ensco-Rep	913-381-7557
KS	Wichita, Ensco-Rep	316-683-1070
LA	Lafayette, Kemp Engrg.	318-269-9452
MD	Silver Spring, L. G. White & Co.	301-434-1555
MA	Wakefield, Instr. Dynamics	617-245-5100
MI	Livonia, Electro Sls. Assocs.	313-474-7320
MN	St. Paul, Bonament Heyda Co.	612-484-8531
MO	Maryland Heights, Ensco-Rep	314-423-3935
NJ	Woodcliff Lake, J. Freid & Assocs.	201-391-6792
NM	Albuquerque, C. T. Carlberg Assocs.	505-888-3883
NY	Fairport, Naco Elctrns.	716-223-4490
NY	Great Neck, F & F Metro Inc.	516-482-4080
NY	Syracuse, NACO Elctrns.	315-699-2651
NY	Utica, Naco Elctrns.	315-732-1801
NC	Winston Salem, L. G. White & Co.	919-725-3612
OH	Cleveland, Electro Sls. Assocs.	216-261-5440
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Tulsa, Don Shuhart Co.	918-747-4136
OR	Beaverton, Barrett/Squibb & Assocs.	503-642-1661
PA	Allison Park, Electro Sls. Assocs.	412-487-3801
PA	Broomall, White-Whiddett	215-353-6343
SC	Greenville, L. G. White & Co.	803-271-0630
TX	Dallas, Don Shuhart Co.	214-349-6000
TX	Houston, Kemp Engrg.	713-466-1465
VA	Richmond, L. G. White & Co.	804-740-7093
WA	Redmond, Barrett/Squibb & Assocs.	206-885-6991
EXP	NJ, Mahwah, Intl. Sls. Div.	201-825-0473

AMDAHL. COMMUNICATIONS SYS. DIV., Amdahl Corp., 2500 Walnut Ave., Marina del Rey, CA 90291, Tel: 213-822-3202; Empl.: 350

AMECON

AMECON, INC., 1900 S. Chris La., Anaheim, CA 92805, Tel: 714-634-2220, 800-392-2292; *Sls. Mgr.:* Frank Carleone .... **1A**•2125-2130

AME CORP., 101 E. Main St., Little Falls, NJ 07424, Tel: 201-256-3939; Empl.: 12; *Sls. Mgr.:* Edward Dimitry .... **1B**•1515

Local Sales Offices & Reps

FL	Orlando, EAB Inc.	305-898-7444
NJ	Wyckoff, Chandler Co.	201-891-7866
TX	Dallas, Control Comps. Corp.	214-559-4090

AMERACE CORP., Elastimold Div., Newburg Rd., P.O. Box 503, Hackettstown, NJ 07840, Tel: 201-852-1122

AMEREX, P.O. Box 2815, Riverside, CA 92516, Tel: 714-686-1400; *Sls. Mgr.:* Roger D. Orton .... **2**•1005

AMERICAN AEROSPACE CONTROLS, 570 Smith St., Farmingdale, NY 11735, Tel: 516-694-5100; Empl.: 37; *Sls. Mgr.:* Gregory D'Abramo .... **1B**•1830, 1831

Local Sales Offices & Reps

CA	Los Angeles, Dyna Sls. Co.	213-268-1175
WA	Bellevue, Al Smith Co.	206-746-6770

AMERICAN ALUMINUM, 230 Sheffield St., Dept. EEM, Mountainside, NJ 07092, Tel: 201-233-3500; Empl.: 125

AMERICAN AUTOMATION, 14731 Franklin Avenue, Tustin, CA 92680, Tel: 714-731-1661, TWX: 910-595-2670 AMAUTO TSTN; *Sls. Mgr.:* Paul Niquette

AMERICAN CAPACITOR, 2080 Central Ave, Duarte, CA 91010, Tel: 818-357-8806; FSC No.: 59366; Empl.: 50

AMERICAN CHEMICAL ETCHING, See American Etching & Mfg.

AMERICAN COMPUTER HARDWARE CORP., 2205 S. Wright St., Santa Ana, CA 92705, Tel: 714-549-2688

AMERICAN CYANAMID CO., Metal Coated Fibers Dept., One Cyanamid Plaza, Wayne, NJ 07470, Tel: 201-831-3148, Telex: 130-400, TWX: 710-988-3045; *Sls. Mgr.:* James Tonges;Dave Molnar

AMERICAN ELECTRIC CABLE CO., 181 Appleton St., Holyoke, MA 01040, Tel: 413-539-9893; Empl.: 100; *Sls. Mgr.:* P. Tutschek

AMERICAN ELECTRONIC LABS., Box 552, Lansdale, PA 19446, Tel: 215-822-2929, TWX: 510-661-4976; Empl.: 1300

AMERICAN ELCTRN. LABS., INC., Antenna Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRN. LABS., INC., Govt. Grp. Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRN. LABS., INC., Hybrid/MIC Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRN. LABS., INC., Special Prods. Div., P.O. Box 552, Lansdale, PA 19446

AMERICAN ELCTRNS., 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 200; *Sls. Mgr.:* B. G. Guy

AMERICAN ETCHING & MFG., 13730 Desmond St., Pacoima,, CA 91331, Tel: 213-896-1187; Empl.: 90

Local Sales Offices & Reps

AZ	Tucson, Clemick & Assoc.	602-749-4003
CA	San Diego, The Rep. Co.	619-292-9001
CA	San Mateo, Halbar Assoc.	415-349-4700
CT	Guilford, Hamer Assocs.	203-457-1634
MA	W. Boylston, Compatible Comps.	617-835-3614
TX	Plano, Precision Devices	214-596-7379

AMERICAN
HV TEST SYSTEMS, INC.

AMERICAN HV TEST SYSTEMS INC., Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-826-8651, Telex: 86223; Empl.: 45; *Sls. Mgr.:* Rolf B. Persson .... **3**•1188

AMERICAN INSULATED WIRE CORP., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, Tel: 401-726-0700, TWX: 710-384-0150; *Sls. Mgr.:* Stanton D. Ose; *Dist. Mgr.:* Gilbert R. DuBois .... **2**•1942

Local Sales Offices & Reps

CA	Los Angeles, Leviton/American	213-949-6575
GA	Atlanta, Leviton/American	404-691-9303
IL	Chicago, Leviton/American	312-766-4100
MA	Boston, Associated Agencies	617-423-9880
MI	Detroit, Jim Groff Sls. Co.	313-933-3100
NY	New York, Leviton Mfg. Co.	212-229-4040
OH	Cleveland, Leviton/American	216-831-0615
WA	Seattle, Leviton/American	206-576-0242

AMERICAN LASER SYS., INC., 106 Fowler Rd., Goleta, CA 93117, Tel: 805-967-0423, Telex: 364412 INTR; *Sls. Mgr.:* L. Shallenberger

AMERICAN MAGNETICS, 740 Watson Center Rd., Carson, CA 90745, Tel: 213-775-8651, TWX: 910-345-6258; Empl.: 175; *Sls. Mgr.:* Robert Mos

AMERICAN MAGNETICS, P.O. Box 8, Carterville, IL 62918, Tel: 618-985-4838; Empl.: 120

AMERICAN MAGNETICS, Box R, Oak Ridge, TN 37830, Tel: 615-482-1056, Telex: 557-482; Empl.: 16

AMERICAN MICROSEMICONDUCTOR, 133 Kings Rd., Madison, NJ 07940, Tel: 201-377-9566, TWX: 710-986-8500; Empl.: 15; *Sls. Mgr.:* W. M. Foley; *Dist. Mgr.:* D. B. Wilson . **1A**•1645, 2090, 2091

AMERICAN MICROSIGNAL, 8431 Monroe Ave., Stanton, CA 90680, Tel: 714-761-1222, TWX: 910-591-1202; Empl.: 80; *Sls. Mgr.:* Pat Nelson

AMERICAN MICROSYSTEMS, INC., See GOULD AMI

AMERICAN MONARCH, 2801-37th Ave., N.E., Minneapolis, MN 55421; Tel: 612-788-9161; Empl.: 300; *Sls. Mgr.:* B. Sutherland

AMERICAN PHOTONICS INC., 71 Commerce Dr., Brookfield Center, CT 06805, Tel: 203-775-8950; *Sls. Mgr.:* James A. Walyus

AMERICAN PLASTICRAFT CO., 814 N. Sacramento Blvd., Chicago, IL 60622, Tel: 312-722-7727, Telex: 910-221-6068; Empl.: 250; *Sls. Mgr.:* Larry J. Ferguson

AMERICAN POWER DEVICES, 7 Andover St., Andover, MA 01810, Tel: 617-475-4074, Telex: 951206; Empl.: 140; *Sls. Mgr.:* Robert Dimodana

AMERICAN RADIO RELAY LEAGUE, 225 Main St., Newington, CT 06111, Tel: 203-666-1541; Empl.: 120; *Sls. Mgr.:* Bobbie Chamalian

AMERICAN RESEARCH & ENGINEERING, 1500 Executive Dr., Elgin, IL 60120, Tel: 312-888-7245, TWX: 910-251-3008 .... **1B**•1516-1518

ASC American Switch Corp.

AMERICAN SWITCH CORP., 134 Water St., Wakefield, MA 01880, Tel: 617-246-1007, TWX: 710-348-6756; FSC No.: 54659; Empl.: 40; *Sls. Mgr.:* Mike Palmerino; *Dist. Mgr.:* Mike Palmerino .... **1B**•1519

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assoc.	602-994-3813
CA	Mountain View, Serra Assocs.	415-964-4300
CA	Temple City, HMC Inc.	818-285-0485
CO	Aurora, Sage Sls.	303-750-3501
CT	Madison, Eastronix, Inc.	203-421-4514
FL	Tampa, J-R Controls, Inc.	813-961-9478
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
IL	Wheaton, Chadra-Schilke & Assoc.	312-653-8126
IN	Ft. Wayne, Augnat Assoc.	219-483-0259
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs.	913-432-2131
MA	Bedford, Eastronix	617-275-5775
MI	Detroit, Burcaw Co.	313-533-7700
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Charles, M-S-B Assocs.	314-946-5577
NJ	Englewood, ABS Assocs.	201-871-0020
NY	Macedon, M. M. Hare Co.	315-986-3742
OH	Medina, Augnat Assocs.	216-273-1211
PA	Elkins Park, Arnold Assocs.	215-742-0600
PA	Pittsburgh, Augnat Assocs.	412-281-8283
TX	Dallas, TPC, Inc.	214-357-8207
UT	Salt Lake City, Sage Sls.	801-467-5451
VT	Shelburne, Eastronix	802-985-3743
WA	Bellevue, Comtec	206-453-1188
EXP	CT, Litchfield, Intrade	203-567-5901

Local Distributors

AL	Huntsville, RM Alabama	205-852-1550
AL	Mobile, Specialty Distrbg.	205-344-0450
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Kachina Elctrn. Distrs.	602-269-6201
CA	Buena Park, RPS Elctrns.	213-744-0355
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Sierra West	408-747-1188
CA	Tustin, Western Switch & Controls	714-731-4333
CA	Van Nuys, Patane Avionics	818-988-4455
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Indl. Elctrns.	303-771-2636
CT	Greenwich, Wise Comps.	203-531-4880
CT	Wallingford, Mid-State Elctrns.	203-265-9900
FL	Casselberry, Afcom Inc.	305-831-6630
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Northbrook, Rayal Elctrns.	312-498-0935
IN	Terre Haute, Indl. Elctrns.	812-232-5328
IA	Cedar Rapids, Iowa Radio Supply	319-393-4510
IA	W. Des Moines, Ramco Co.	515-225-6933
KS	Wichita, Radio Inc.	316-264-2798
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Newton Upper Falls, In-Stock Prods. Co.	617-964-6200
MA	Woburn, Abbott Elctrns.	617-935-2040
MN	Eden Prairie, Cassidy Elctrns.	612-944-0100
MN	Minneapolis, Tortec Corp.	612-866-3662
NE	Omaha, Radio Equip. Co.	402-341-7700
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Mt. Laurel, P.A.C. Elctrns.	609-778-1526
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NY	Bohemia, Key Comps.	516-567-7500
NY	E. Syracuse, Add Elctrns.	315-437-0300

NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Mt. Vernon, QAR	914-699-2224
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Dayton, Stotts-Friedman	513-298-5555
OK	Tulsa, Radio Inc.	918-587-9123
PA	Norristown, Kimberly James Co.	215-666-7286
PA	Philadelphia, Shap Elctrns.	215-969-3300
RI	Pawtucket, MAJOR/Edwards	401-725-7400
TN	Knoxville, Industrial Elctrns.	615-573-7135
TX	Austin, Galtronics	512-837-7470
TX	Dallas, Force/Solid State	214-438-5700
TX	Dallas, Wholesale Elctrn. Supp.	214-824-3001
TX	El Paso, Intl. Elctrns.	915-598-3406
TX	Ft. Worth, Industrial Elctrns.	817-731-7321
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Kent, Pyramid/Interface	206-872-5800
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Mequon, Lakeview Elctrns.	414-377-8250

american technical ceramics

AMERICAN TECH. CERAMICS, 1 Norden La., Huntington Sta., NY 11746, Tel: 516-271-9600, Telex: 221201, TWX: 510-226-6993; FSC No.: 29990; Empl.: 482; *Sls. Mgr.:* R. Blumkin ... **1A**•1007-1009

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AZ	Scottsdale, Faser Tech. Sls.	602-948-4404
CA	El Segundo, Fetty/Schoenduve	213-322-4991
CA	Mtn. View, Fetty/Schoenduve	415-962-8330
CA	San Diego, Fetty/Schoenduve	619-292-5136
CO	Englewood, FC Mktg.	303-795-9176
DC	Washington, M. Lader Co.	202-296-2497
FL	Lighthouse Point, R. C. Simon & Co.	305-941-2757
GA	Norcross, Interep Assocs.	404-449-8680
IL	Chicago, Tech. Sls.	312-237-7210
MA	Topsfield, R.F. Assocs.	617-887-9762
MN	New Brighton, TWC Sls.	612-636-1770
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NY	Rochester, Sweetco Assocs.	716-225-2383
NY	Utica, Sweetco Assocs.	315-797-6721
OH	Chagrin Falls, Crest Comp. Sls. Co.	216-543-9808
PA	Lafayette Hill, M. Lader Co.	215-825-3177
TX	Richardson, Vector Sls. Co.	214-234-4291
WA	Bellevue, SD-R²	206-747-9424

AMERICAN TIME PRODS. DIV., See Frequency Control Prods., Inc.

AMERICAN ULTRAVIOLET, 320 Commerce St., Chatham, NJ 07928, Tel: 201-635-8355, Telex: 13-9266; Empl.: 14; *Sls. Mgr.:* M. C. Stines; *Dist. Mgr.:* M. C. Stines

AMERICAN VOLPI CORP., 26 Aurelius Ave., Auburn, NY 13021, Tel: 315-255-1105

AMERICAN ZETTLER, 16881 Hale Ave., Irvine, CA 92714, Tel: 714-660-1670, Telex: 67-8472; Empl.: 200; *Sls. Mgr.:* D. O. Barkhurst ... **1B**•1322, 1520-1530

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Fullerton, Groh Assocs.	714-738-7105
CA	Mountain View, G.C. Woempner	415-964-5454
CA	San Diego, Addem/San Diego	619-729-9216
CO	Englewood, Delta Sls. Assoc.	303-799-0646
CT	Madison, Forsberg Sls.	800-343-9610
FL	Clearwater, Perrott Assoc.	813-443-5214
FL	Orlando, Perrott Assoc.	305-298-7748
FL	Sunrise, Perrott Assoc.	305-792-2211
GA	Norcross, McKay, Smith & Assoc.	404-449-7444
IL	Rolling Meadows, KMA Sls.	312-398-5300
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Wichita, Baka Corp.	316-262-0179
MA	Brockton, Forsberg Sls.	617-522-6300
MI	Union Lake, Imtech	313-363-7129
MN	Minneapolis, R.W. Marshall Co.	612-929-0457
MO	Ferguson, Baka Corp.	314-878-4224
NJ	Cherry Hill, Danco Elctrn. Sls.	609-424-5590
NJ	Parlin, Martech	201-721-2200
NM	Albuquerque, Thorson Desert States, Inc.	505-293-8555
NY	Alexander, B.H. Tollefson Assoc.	716-591-1219
NY	Auburn, B.H. Tollefson Assocs.	315-253-4109
NY	Manhasset, Martech	516-627-1151
NY	Rochester, B.H. Tollefson Assoc.	716-271-4141
NC	Raleigh, J & B Sales	919-878-8600
OH	Cincinnati, Makin Assocs.	513-871-2424
OR	Beaverton, Thorson Co. N.W.	503-644-5900
TX	Houston, AID Elctrns.	713-955-6204
TX	Irving, AID Elctrns.	214-259-4761
UT	Salt Lake City, Delta Sls. Assocs.	801-487-7571
WA	Bellevue, Thorson Co. N.W.	206-455-9180
WI	Milwaukee, KMA Sales Company	414-259-1771

Local Distributors

AZ	Tempe, Acacia Sls.	602-894-2874
CA	Irvine, Acacia Sls.	714-660-0834
CA	Los Angeles, Master Distrs.	213-452-1229
CA	San Diego, Acacia Sls.	619-565-4365
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Clara, Components Center	408-988-3751
CA	Santa Monica, Distr. Spec.	213-393-9666
CA	Torrance, Cypress Elctrns.	213-533-6005
CO	Lakewood, Acacia Sls.	303-232-2882
CT	New Haven, The Green-Shaw Co.	203-397-0710
IL	Northbrook, Classic Comps.	312-272-9650
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Woburn, Time Elctrns./New England	617-935-8080
NV	Reno, Elec. Dist. Co. of Nev.	702-323-2766
NJ	Fairlawn, Relay Specialties	201-797-3313
NY	Farmingdale, Pride Elctrns.	516-293-4020
OR	Beaverton, Acacia Sls.	503-646-3377
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Dallas, Wallace Elctrns.	214-340-0400
WA	Seattle, Westlake Elec. Supp.	206-622-6600
Can	Vancouver, B.C., Intek	604-324-6831
Can	Winnipeg, Manitoba, L. A. Varah, Ltd.	204-633-6190

AMETEK, 2 Station Square, Paoli, PA 19301, Tel: 215-355-6900; Empl.: 100

AMETEK, INC, Hunter Spring Division, 1 Spring Ave., Hatfield, PA 19440, Tel: 215-822-2971, TWX: 510-661-4888; Empl.: 270; *Sls. Mgr.:* F. J. York

AMETEK/RODAN DIV., 2905 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081, TWX: 910-591-1684; FSC No.: 15454; Empl.: 100; *Sls. Mgr.:* Steve Iovin

Local Sales Offices & Reps

AL	Huntsville, Alpha Marketing	205-533-0766
CA	Mountain View, Gene Woempner Co.	415-964-5454
CO	Westminster, Straube Assocs.	303-426-0890
FL	Coral Springs, H.A. Inc.	305-752-7520
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Ft. Wayne, Menze Sls. Co.	219-747-5616
IA	Cedar Rapids, Snider Sls.	319-362-4410
KS	Overland Park, S. W. Wollard Co.	913-898-6552
MA	Hopkinton, Marathon Sls.	617-435-6984
MI	Lathrup Village, R. C. Nordstrom Co.	313-559-7373
MI	Southfield, R. A. Casalou	313-559-0350
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Cherry Hill, Danco Elctrn. Sls.	609-424-5590
NM	Albuquerque, Straube Assocs.	505-265-7759
NY	Fayetteville, Henry G. Richter, Inc.	315-637-6713
NY	Melville, Comtronic Assoc.	516-249-0505
NY	Rochester, Henry G. Richter, Inc.	716-436-0300
TX	Dallas, Cunningham Components Corp.	214-233-4303
TX	Houston, Cunningham Components Corp.	713-461-4197
UT	Salt Lake City, Straube Assocs.	801-486-5473
VA	Gladys, Ralley Entprs.	804-283-5656
WA	Vancouver, R. Over Sls.	206-695-6179
EXP	NY, Westbury, CPS Intl.	516-334-8500

AMF INC., AMF Cuno/General Filter Products Division, 400 Research Pkwy., Meriden, CT 06450, Tel: 203-237-5541, Telex: 962457; Empl.: 700; *Sls. Mgr.:* Gregg Samal

AMF/ELECTRO COMPS. DIV., AMF, 2713 Gateway Dr., Pompano Beach, FL 33060, Tel: 305-973-8620, TWX: 510-956-9400; Empl.: 900; *Sls. Mgr.:* C. Smith; *Dist. Mgr.:* C. Smith

AMF POTTER & BRUMFIELD, See Potter & Brumfield

AMGLO, 5265 Michigan Ave., Rosemont, IL 60018, Tel: 312-671-4321; Empl.: 21

AMI/COAST MAGNETICS, AMI Div., 1207 North La Brea Ave., Inglewood, CA 90302, Tel: 213-673-3245

AMICON CORP., 25 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-9600; Empl.: 300; *Sls. Mgr.:* James Gilliland

AMILON CORP., 49-12 30th Ave., Woodside, NY 11377, Tel: 212-274-1794; Empl.: 50; *Sls. Mgr.:* L. Rosenblatt

AMKEY, INC., Sub. American Pwr. Dvs., Inc., 220 Ballardvale St., Wilmington, MA 01887, Tel: 617-658-7800; *Sls. Mgr.:* P. D. Prevett

amlan inc.

AMLAN, INC., 97 Thornwood Rd., Stamford, CT 06903, Tel: 203-322-1913, Telex: 643647; *Sls. Mgr.:* Mark Landeweer; *Dist. Mgr.:* Mark Landeweer ... **2**•1153-1159

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs., Inc.	205-533-1730
CA	Escondido, Cirolia Elctrn. Sls., Inc.	619-489-9607
CA	Santa Cruz, Krippner & Assocs.	408-429-9798
CA	Ventura, Astralonics	213-706-0488
FL	Tampa, J-R Controls	813-961-9478
GA	Norcross, Interep Assocs. Inc.	404-449-8680
IL	Chicago, Electro-Tech Mktg. Assoc.	312-588-4535
MA	Scituate, Marketing Svcs.	617-545-0899
MN	St. Paul, Complete Sls.	612-644-0484
NJ	Parlin, JMR Sales	201-727-5335
NY	E. Setauket, JMR Sales	516-689-8871
NY	N. Syracuse, JMR Sales, Inc.	315-458-6576
NC	Raleigh, Interep Assocs. Inc.	919-872-1401
TN	Greeneville, Interep Assocs. Inc.	615-639-3491
VA	Reston, Tytronics Tech. Sls.	703-471-0440
WA	Mukilteo, Krippner & Assocs.	206-743-3579

Local Distributors

CT	New Haven, Greene-Shaw Co., Inc.	203-397-0710
CT	Torrington, Northeast Connectors	203-482-2817
MA	Chelmsford, Dynamic Engrg.	617-250-0200
MA	Norwood, Emtel Elctrns.	617-769-9500
MA	Waltham, Vantage Elctrns. Corp.	617-894-8690
MA	Woburn, EPC	617-935-0400
WA	Seattle, Pacific Elctrns.	206-575-1057

AMP

AMP INCORPORATED, Box 3608, Harrisburg, PA 17105, Tel: 717-564-0100, TWX: 510-657-4110; Empl.: 19,650 ... **1A**•1584; **1B**•1109-1111, 1532-1536, 1761; **2**•1121-1148, 1869, 1944

Local Sales Offices & Reps

CA	Compton	213-537-4490
CA	Cupertino	408-255-3830
CO	Englewood	303-773-0422
CT	Windsor	203-683-2715
FL	Altamonte Springs	305-869-6766
GA	Atlanta	404-934-6363
IL	Edwardsville	618-656-5081
IL	Schaumburg	312-351-7811
IN	Carmel	317-848-1250
MA	Boston	617-891-7500
MA	Framingham	617-879-3255
MI	Southfield	313-645-5590
MN	Minneapolis	612-831-8242
NJ	Parsippany	201-334-6664
NY	Holbrook	516-585-4430
NY	Pittsford	716-385-2860
NC	Winston- Salem	919-725-8968
OH	Dublin	614-764-8866
PA	Berwyn	215-647-6060
PA	Malvern	215-296-5303
TN	Knoxville	615-691-5711
TX	Irving	214-258-1114
VA	Alexandria	703-683-5955
WA	Renton	206-255-0064

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2626
CA	Buena Park, RPS Elctrns.	213-744-0355
CA	Canoga Park, Marshall Elctrns. Grp., LA Div.	213-999-5001
CA	Fullerton, Pyramid Elctrns., Fullerton Div.	714-773-0781
CA	Hawthorne, Electro-Sonic Comps.	213-679-9781
CA	Irvine, Marshall Elctrns. Grp., Irvine Div.	714-556-6400
CA	San Diego, Marshall Elctrns. Grp., San Diego Div.	619-578-9600
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Denver, CSID, Inc.	303-893-9594
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Norcross, Schweber Elctrns. Corp.	404-449-9170
IL	Elk Grove, Schweber Elctrns. Corp.	312-364-3750
IL	Elmhurst, Semiconductor Spec.	312-279-1000
IN	Indianapolis, Graham Elctrns.	317-634-8202
KS	Edwardsville, C. Tennant, Sons & Co.	913-441-1801
MD	Columbia, Powell Elctrns.	301-621-4070
MD	Rockville, MS Elctrns.	301-621-4070
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Winchester, Rush Industries, Inc.	617-729-5800
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, RS Elctrns.	313-525-1155
MO	St. Charles, Lectronix	314-946-6424
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Buffalo, Summit Distrs.	716-884-3450
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Farmingdale, Harrison Radio Corp.	516-293-7990
NY	Lynbrook, Peerless Elctrns.	516-593-2121
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Akron Elctrn. Supp. Co.	216-762-8818
OH	Columbus, Hughes-Peters Inc.	614-294-5351
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
TX	Austin, Kent Elctrns. Corp.	512-834-1900
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Kent Elctrns. Corp.	214-669-2600
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WA	Kent, Interface Elctrns. Corp.	206-872-5800

AMP PRODUCTS CORP., P.O. Box 1776, Paoli, PA 19301, Tel: 215-647-1000; Empl.: 20,000 …… **1B**•1531; **2**•1120, 1858, 1945

Local Sales Offices & Reps

CA	Los Angeles	213-639-1691
CA	San Francisco	415-573-7722
CO	Denver	303-773-1885
GA	Atlanta	404-939-7604
IL	Chicago	312-439-7800
KS	Kansas City	913-642-9800
MA	Boston	617-879-8221
MI	Detroit	313-646-0090
NJ	Cranford	201-272-4600
NC	Winston-Salem	919-725-9222
OH	Cincinnati	513-984-5302
PA	Philadelphia	215-647-3250
PA	Pittsburgh	412-344-7900
TX	Dallas (Irving)	214-258-1911

Local Distributors

AMP Standard Distributors

AL	Birmingham, Forbes Elctrn. Distr.	205-251-3941
AL	Decatur, Forbes Elctrn. Distr.	205-353-4546
AZ	Tucson, Inland Elctrns.	602-889-5301
AR	Little Rock, Electro Entprs.	501-664-9207
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Cerritos, El-Com	213-404-2961
CA	Costa Mesa, Mar Vac Elctrns.	714-540-3280
CA	Fountain Valley, Comps. Center	714-979-0433
CA	Fresno, Jack C. Arbuckle Co.	209-264-6554
CA	Gardena, California Switch & Signal	213-538-9830
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	Monrovia, Erik-A-Elctrn. Distr.	213-574-1020
CA	North Hollywood, Alatec Prods.	213-875-1790
CA	Northridge, Acort Inds.	213-993-6444
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Sacramento, Dunlap Elctrns.	916-442-5801
CA	Sacramento, Sacramento Elctrn. Supp. Co.	916-441-4821
CA	San Diego, Western Radio	619-239-0361
CA	San Diego, El-Com	619-578-0900
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Ana, C R Elctrns.	714-556-2040
CA	Santa Clara, Cypress Elctrns.	408-945-8400
CO	Commerce City, Waco Elctrns.	303-289-4743
CO	Denver, Denver Wintronics	303-934-2406
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	E. Hartford, R & S Elctrn Distrs.	203-528-9901
CT	Norwalk, Park Distrs.	203-853-2010
CT	Stratford, Electro Comp.	203-375-5811
FL	Casselberry, AFCOM	305-831-6630
FL	Dania, Summit Distrs.	305-920-6263
FL	Ft. Lauderdale, EMSCO Div. Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Southeastern Elctrns.	305-563-4131
FL	Jacksonville, EMSCO Div. Hammond Elctrns.	904-356-4851
FL	Miami, Elctrn. Equip. Co.	305-871-3500
FL	Miami, Electro Std. Labs.	305-633-6973
FL	Orlando, EMSCO Div. Hammond Elctrns.	305-849-6362
FL	Pensacola, Pensacola Elctrns.	904-478-3771
FL	Sarasots, Dow Elctrns.	813-365-3393
FL	Tampa, EMSCO Div. Hammond Elctrns.	813-253-0104
FL	Tampa, Leader Elctrns.	813-870-3315
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
GA	Atlanta, Specialty Distrbg. Co.	404-873-2521
HI	Honolulu, Tech. Mktg. Corp.	808-841-4175
HI	Honolulu, Elctrl. Equip. Co.	808-533-3884
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Pocatello, Kimball Elctrns.	208-232-2201
ID	Spirit Lake, A-I Elctrn. Supp.	208-623-3111
IL	Addison, L-Comp	312-628-1400
IL	Berwyn, B-B&W Elctrns.	312-749-1710
IL	Chicago, Elctrn. Connector Corp.	312-767-2200
IL	Chicago, Stranco Prods.	312-738-1580
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Harvey, George Elctrns.	312-331-1983
IL	Melrose Park, Belford Elctrns.	312-865-2400
IL	Mt. Prospect, Tri-State Elctrn. Corp.	312-255-0600
IL	Niles, Joseph Elctrns.	312-297-4200
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Warren Radio Co.	309-674-5998
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Villa Pk., Melvin Elctrns.	312-279-5015
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Evansville, Hutch & Son	812-425-7201
IN	Fort Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Meunier Elctrns.	317-635-3511
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Deeco	319-365-7551
KY	Louisville, Peerless Elctrn. Equip. Co.	502-637-7674
LA	Lafayette, Ralph's Elctrns. Supp.	318-233-0105
LA	Marrero, AFG Elctrn. Supp.	504-368-9696
LA	New Orleans, Radio Parts	504-581-5959
LA	New Orleans, Southern Radio Supp. Co.	504-524-2343
LA	New Orleans, W. B. Allen Supp. Co.	504-525-8222
LA	Shreveport, Industrial Elctrn. Supp.	318-222-9459
MD	Aberdeen, Harco Elctrns.	301-838-7990
MD	Baltimore, Whitney Distrs.	301-944-8080
MD	Rockville, Capitol Radio Wholesalers	301-881-2270
MA	Burlington, J. V. Elctrns. of Boston	617-273-4300
MA	Burlington, Heiland Elctrns.	617-272-5610
MA	Burlington, QPL Elctrn Distrs.	617-891-0460
MA	Cambridge, Apollo Elctrns.	617-868-3120
MA	Canton, Impact Sls. Co.	617-821-1500
MA	Lynn, Land Elctrns. Supp.	617-592-2220
MA	Mendon, ADD Elctrns. Corp.	617-478-4200
MA	Middleboro, Glynn Elctrns.	617-947-4262
MA	N. Chelmsford, Pilgrim Elctrns.	617-251-8746
MA	Needham, You Do It Elctrns.	617-449-1005
MA	Newton, In-Stock Prods. Co.	617-964-6200
MA	S. Boston, Controller Svc & Sls. Co.	617-269-1300
MA	Waltham, March Elctrns.	617-899-4220
MA	Waltham, Vantage Elctrns. Corp.	617-894-8690
MA	Westboro, Future Elctrns. Corp.	617-366-2400
MA	Westborough, Powell Elctrns.	617-366-6100
MA	Wilmington, Aved Elctrns.	617-657-8310
MA	Woburn, AFCOM	617-935-3200
MA	Woburn, A.C.I. Elctrns. Corp.	617-935-7230
MA	Woburn, Abbot Elctrns.	617-935-2040
MA	Woburn, Semtex Indl. Corp.	617-935-2466
MI	Flint, Shand Elctrns.	313-743-8940
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Grand Rapids, S-F Elctrn. Supp.	616-459-0219
MI	Livonia, Camelot Elctrns.	800-482-3905
MI	Troy, Northern Wire & Cable	313-589-0510
MN	Minneapolis, Stark Elctrns. Supp.	612-332-1325
MN	Minneapolis, Elctrn. Center	612-371-5200
MN	St. Paul, Gopher Elctrns. Co.	612-483-3322
MS	Pascagoula, Hooper Elctrns. Supp. Co.	601-762-9383
MO	Kansas City, Electrn. Supp. Co.	816-931-0250
MO	St. Louis, Olive Elctrns.	314-426-4500
MO	St. Louis, Van Sickle Radio-Elctrns.	314-621-5000
NE	Lincoln, Scott Elctrns. Supp. Corp.	402-466-8221
NV	Las Vegas, CRW, Inc.	702-451-5490
NH	Manchester, Yankee Elctrn. Supp.	603-625-9746
NJ	Edison, William Elctrns. Supp.	201-985-3700
NJ	Hanover, State Elctrns. Parts Corp.	201-887-2550
NJ	Pine Brook, Alatec Prods.	201-227-8140
NJ	Prospect Park, Kappe Inds.	201-790-1999
NJ	Springfield, Route Elctrns. 22	201-379-7710
NM	Albuquerque, Elctrn. Parts	505-293-6161
NY	Binghamton, Help Elctrns.	607-729-3528
NY	Brooklyn, Brooklyn Elctrns.	212-748-1300
NY	Buffalo, Genesee Radio & Parts Co.	716-873-9661
NY	Elmsford, Ancar Elctrns. Supp.	914-592-7100
NY	Hempstead, Davis Elctrns. Corp.	516-483-9200
NY	Port Chester, Wise Components	914-939-8600
NY	Poughkeepsie, Chief Elctrns.	914-471-1300
NY	Rochester, Rochester Radio Supp. Co.	716-454-7800
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rome, Rome Elctrns.	315-337-5400
NY	West Babylon, Delman Elctrns.	516-420-1234
NY	West Hempstead, March Elctrns.	516-486-6511
NC	Cary, Powell Elctrns.	919-467-1212
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cincinnati, U.R.I. Elctrns.	513-761-4030
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Columbus, Thompson Elctrn. Supplies	614-228-6191
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Dayton, E.S.C.O., Inc.	513-226-1133
OH	Lima, LRP Elctrns.	419-228-1220
OH	Marion, Servex Elctrns. Distrib.	614-383-3117
OH	Solon, Repco Elctrns.	216-248-8900
OH	Solon, Target Elctrns. Corp.	216-248-7930
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OH	Warren, REM Elctrns. Supp. Co.	216-373-1300
OK	Oklahoma City, Elctrn. Supp. Co.	405-232-5215
OK	Oklahoma City, Electro Engerprises	405-478-1752
OK	Tulsa, Combined Technlog. Cos.	918-582-8242
OK	Tulsa, Radio, Inc.	918-587-9123
PA	Allentown, P.A. Peters, Inc.	215-434-5237
PA	Altoona, Allegheny Elctrns.	814-946-0871
PA	Braddock, Leff Radio Parts Co.	412-351-5000
PA	Drexel Hill, Kass Elctrns. Distrib.	215-449-2300
PA	Essington, Tri-Com Inc.	215-521-3080
PA	Folcroft, Delphi Wire and Cable	215-534-3900
PA	Philadelphia, Arch Elctrns. Co.	215-563-4660
PA	Reading, Barbey Elctrns. Corp.	215-376-6116
PA	Wayne, Peak Elctrns. Corp.	215-293-9000
RI	Pawtucket, Major Elctrn. Supp.	401-725-7400
RI	Pawtucket, Jabbour Elctrn. Supplies	401-728-4600
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Chattanooga, Curle Elctrns.	615-266-4727
TN	Nashville, Electra Distrib. Co.	615-329-3971
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Dallas, LBI Electro-Optics Corp.	214-358-4151
TX	Dallas, Wallace Elctrns. Co.	214-340-0400
TX	Dallas, Target Elctrns. Ind.	214-350-6853
TX	El Paso, Ideal Indl. Elctrn.	915-779-6647
TX	Fort Worth, Indl. Elctrns.	817-731-7321
TX	Fort Worth, Swieco, Inc.	817-335-6521
TX	Fort Worth, Texas Connector Corp.	817-246-0109
TX	Houston, Electrotex	713-526-3456
TX	Houston, Geophysical Supp. Co.	713-666-4100
TX	Houston, Elctrn. Packaging Comp.	713-447-5800
TX	Houston, Powerline Products	713-461-9791
TX	Midland, ESI Supp.	915-694-9657
UT	Provo, Central Utah Elctrns.	801-373-7522
VT	Rutland, S.A.I. Semispecial of Amer.	802-775-7126
VA	Norfolk, Priest Elctrns.	804-855-0105
VA	Richmond, Sterling Elctrns.	804-226-2190
VA	Richmond, Avec Elctrns. Corp.	804-359-6071
VA	Roanoke, Mexitronics	703-342-4444
WA	Seattle, Radar Electric Co.	206-282-2511
WA	Seattle, Pacific Elctrns.	206-575-1050
WA	Seattle, Connector World Supp.	206-767-6773
WV	Dunbar, State Electric Supp.	304-523-7491
WV	Kenova, Burco Distrs.	304-292-1641
WV	Morgantown, State Elctrns. Co.	304-292-1641
WI	Fond du Lac, Fedco Elctrns.	414-922-6490
WI	Madison, Superior Elctrns.	608-257-1477
WI	Milwaukee, Indl. Elctrns. Corp. of WI	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Oshkosk, Elctrn. Inds.	414-235-8930

AMP Industrial Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2626
CA	Buena Park, RPS Elctrns.	213-744-0355
CA	Canoga Park, Marshall Elctrns. Grp.	213-999-5001
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Hawthorne, Electro-Sonic Comps.	213-679-9781
CA	Irvine, Marshall Elctrns. Grp.	714-556-6400
CA	San Diego, Marshall Elctrns. Grp.	619-578-9600
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elctrns. Supp.	408-727-9810
CO	Denver, CSID	303-292-9594
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Norcross, Schweber Elctrns. Corp.	404-449-9170
IL	Elmhurst, Semiconductor Specialists	312-279-1000

IN	Indianapolis, Graham Elctrns.	317-634-8202
KS	Edwardsville, C. Tennant Sons & Co.	913-441-1801
MD	Rockville, MS Elctrns.	301-340-6400
MA	Needham, Cronin Elctrns.	617-449-0500
MA	Winchester, Rush Inds.	617-729-5800
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Livonia, RS Elctrns.	313-525-1155
MO	St. Charles, Lectronix	314-946-6424
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Harrison Radio Corp.	516-293-7990
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Akron Elctrn. Supp. Co.	216-762-8818
OH	Columbus, Hughes-Peters	614-294-5351
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
TX	Austin, Kent Elctrns. Corp.	512-834-1900
TX	Houston, Kent Elctrns. Corp.	713-780-7770
TX	Richardson, Kent Elctrns. Corp.	214-669-2600
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WA	Kent, Interface Elctrns.	206-872-5800

AMPEREX ELECTRONIC CORP., Ferroxcube Div., 5083 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410; Empl.: 1200; *Sls. Mgr.:* R. Denison; *Dist. Mgr.:* Ed Hellenschmidt

Refer to Amperex, Slatersville Div. for sales office information.

AMPEREX ELECTRONIC CORP., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802, Tel: 516-931-6200, TWX: 510-221-1839; Empl.: 270; *Sls. Mgr.:* Robert Carlin; *Dist. Mgr.:* Robert Carlin

AMPEREX ELCTRN. CORP., Slatersville Div., Providence Pike, Slatersville, RI 02876, Tel: 401-762-3800, Telex: 927584, TWX: 710-382-6332; FSC No.: 73445; Empl.: 565; *Sls. Mgr.:* Robert Carlin

AMPEREX ELECTRONIC INDS., Smithfield Div., George Washington Hwy., Smithfield, RI 02917, Tel: 401-232-0500, Telex: 92 76 43

Refer to Amperex, Slatersville Div. for sales office information.

AMPERITE CO., INC., 600 Palisade Ave., Union City, NJ 07087, Tel: 201-864-9503, TWX: 710-992-8834; FSC No.: 70563; Empl.: 76; *Sls. Mgr.:* T. Whalen; *Dist. Mgr.:* T. Whalen

AMPEX CORP., 401 Broadway, Redwood City, CA 94063, Tel: 415-367-2011, TWX: 910-364-9034; Empl.: 9,800

AMPHENOL, 2801 South 25th Ave., Broadview, IL 60153, Tel: 312-345-9000

AMPHENOL, An Allied Co., 2122 York Rd., Oak Brook, IL 60521, Tel: 312-986-2300, TWX: 910-651-0191; Empl.: 3600

AMPHENOL R F OPERATIONS, 33 E. Franklin St., Danbury, CT 06810, Tel: 203-743-9272

amplifier research

AMPLIFIER RESEARCH, 160 School House Rd., Souderton, PA 18964-9990, Tel: 215-723-8181, TWX: 510-661-6094; FSC No.: 30639; Empl.: 27; *Sls. Mgr.:* D.W. Roth .... **3**•1002, 1003

Local Sales Offices & Reps

AZ	Tempe, Mar Tech Assocs.	602-968-4944
CA	N. Hollywood, O'Halloran Assoc.	213-877-0173
CA	Palo Alto, O'Halloran Assoc.	415-326-1493
CA	Santa Ana, Shoshin, U.S.A.	714-641-0417
CO	Boulder, H. Bass. Assoc.	303-499-7509
CT	Hamden, J.B.L. Assoc.	203-281-3161
FL	Orlando, E.G. Holmes & Assocs.	305-894-8901
GA	Chamblee, E.G. Holmes & Assocs.	404-451-6161
IL	Park Ridge, Elctrn. Instr. Assocs.	312-298-2290
IN	Indianapolis, Elctrn. Instr. Assocs.	317-257-7231
MD	Severna Park, Delmarva Eng. Assoc. Ltd.	301-647-8007
MA	Lexington, R.J. Sickles	617-862-5100
NJ	Denville, Metro-Mics	201-625-5959
NJ	Westfield, Metro Mics	201-233-6116
NM	Albuquerque, Don Hewitt & Assocs.	505-299-7746
NY	Melville, Metro Mics	516-433-3333
NC	Cary, E.G. Holmes & Assocs.	919-469-8850
OH	Centerville, Micro Sls.	513-433-8171
OH	North Olmsted, Micro Sls.	216-734-3080
PA	Philadelphia, R. Meyers Assoc.	215-224-1663
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-944-2055
UT	Bountiful, Herb Bass Assoc.	801-295-0469
UT	Salt Lake City, Herb Bass Assoc.	801-268-0262
WA	Seattle, J. B. Jolly	206-938-4166

AMPLIFONIX INC., 220 Rte. 13, Bristol, PA 19007, Tel: 215-788-2350, TWX: 510-667-0501; *Sls. Mgr.:* Jason A. Day; *Dist. Mgr.:* Jason A. Day

AMPROBE INSTR., 630 Merrick Rd., Lynbrook, NY 11563, Tel: 516-LY3-5600, TWX: 510-225-8403; Empl.: 230; *Sls. Mgr.:* W. Eagle

AMPTEK, INC., 6 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-2242; Empl.: 11; *Sls. Mgr.:* George Kobaly, Jr.

Local Sales Offices & Reps

EXP	MA, Plainville, Teknis	617-695-3591

AMPTEK INC., Teksys Inc., 11103 Dennis Rd., P.O. Box 59841, Dallas, TX 75229, Tel: 214-241-2511, Telex: 730338; *Sls. Mgr.:* Don Stephens

AMRAD, Div. Transcon Mfg. Co., Box 876, Paris, TX 75460, Tel: 214-785-4544; FSC No.: 55943; Empl.: 17; *Sls. Mgr.:* Curtis Vining; *Dist. Mgr.:* Curtis Vining

AMTEK DIGITAL SYSTEMS, INC., 12740 28th N.E., Seattle, WA 98125, Tel: 206-363-0217, Telex: 329473 (Burgess Sea); Empl.: 18; *Sls. Mgr.:* Fred Graham

AMTEK SYS., INC., 1400 S. Sherman, #202, Richardson, TX 75081, Tel: 214-238-5300; *Sls. Mgr.:* Barry Epstein; *Dist. Mgr.:* Peter Diamond

AMUNEAL MFG., 4737 Darrah St., Philadelphia, PA 19124, Tel: 215-535-3000; FSC No.: 23740; Empl.: 120; *Sls. Mgr.:* S. M. Kamens; *Dist. Mgr.:* S. M. Kamens .... **2**•1903

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Fremont, William Parks Assocs.	415-490-2011
CA	San Diego, C.E.M., Inc.	619-692-3551
CA	Santa Ana, C.E.M., Inc.	714-835-2702
CO	Wheatridge, Waugaman Assocs.	303-423-1020
GA	Stone Mountain, Dixie Tech. Mktg.	404-962-2530
IL	Chicago, Brock & Cushman, Inc.	312-622-4110
KS	De Soto, Midtec Assocs.	913-441-6565
MD	Baltimore, Muncy Sls.	301-484-6376
MA	Norwood, MPS Elctrns.	617-769-8700
MI	Ann Arbor, Metal-Tronics	313-437-7530
MN	Hamel, Hedtke Mktg.	612-478-2120
MO	Florissant, Midtec Assocs.	314-837-5200
NM	Albuquerque, Shefler Kahn Co.	505-296-0749
NY	Queens Village, L.A. Buscaglia Co.	212-468-3666
OH	Akron, Imtech Inc.	216-666-1185
OH	Dayton, Imtech Inc.	513-278-6507
OK	Tulsa, Barry Sls.	918-749-7775
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Waugaman Assocs. Utah, Inc.	801-261-0802
WA	Seattle, Rep-West	206-283-8351
WI	Menomonee Falls, Brock & Cushman, Inc.	414-255-2166
EXP	NJ, Oradell, Sylvan Ginsbury	201-261-3200

ANACONDA-ERICSSON INC., Continental Wire & Cable, P.O. Box 1863, York, PA 17405, Tel: 717-767-4434

ANADEX, 1001 Flynn Rd., Camarillo, CA 93010, Tel: 805-987-9660, TWX: 910-494-2761; Empl.: 350

ANADYNE, 14830 Valley View Ave., La Mirada, CA 90638, Tel: 714-522-8924, TWX: 910-583-4807; Empl.: 100

ANAHEIM AUTOMATION, 910 E. Orangefair Lane, Anaheim, CA 92801, Tel: 714-992-6990; Empl.: 25; *Sls. Mgr.:* Bud McNally

ANALOG & DIGITAL PERIPHERALS, INC. (ADPI), 815 Diana Dr., Troy, OH 45373, Tel: 513-339-2241, TWX: 810-450-2685; FSC No.: 31-0949-745; Empl.: 19; *Sls. Mgr.:* Alan Kuebier

ANALOG DEVICES, P.O. Box 280, Norwood, MA 02062, Tel: 617-329-4700, TWX: 710-394-6577; FSC No.: 24355; Empl.: 4,000

ANALOGIC CORP., 8 Centennial Dr., Peabody, MA 01961, Tel: 617-777-4500, 617-246-0300, 800-451-1816, Telex: 94-9307, TWX: 710-348-0425; Empl.: 2000; *Sls. Mgr.:* M. E. Culverhouse; *Dist. Mgr.:* D. Vermilyea

Local Distributors

AL	Mobile, Brownell Electro	205-479-8581
AZ	Phoenix, Metermaster	602-243-4111
CA	Costa Mesa, F.L.W.	714-751-7512
CA	Gardena, Instr. Lab.	213-327-3279
CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CA	Los Angeles, Metermaster	213-685-4340
CA	North Hollywood, B. J. Wolfe Entprs.	213-877-5518
CA	Palo Alto, Metermaster	415-968-0313
CA	Redwood City, Marchi Assoc.	415-364-3411
CA	San Diego, Metermaster	714-560-4841
CA	Santa Clara, Fisher Brownell	408-988-6041
CA	Santa Clara, E.I.L. Instrs.	408-727-0396
CO	Denver, E.I.L. Instrs.	303-534-4160
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Miami, Brownell Electro.	305-591-3215
FL	Orlando, Brownell Electro.	305-843-6770
FL	Palm Bay, E.I.L. Instrs.	305-725-8300
GA	Atlanta, Brownell Electro	404-762-5181
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, Metermaster	312-593-8650
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
LA	Kenner, Breard-Gardner	504-466-3401
LA	Slidell, Mid-South Sls.	504-641-7480
MD	Gaithersburg, Pioneer Instr.	301-948-0710
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Waltham, Calibron Corp.	617-894-6440
MA	Woburn, Brownell Electro	617-935-7820
MI	Farmington Hills, Star-Tronic Dist.	313-477-7586
MI	Royal Oak, George Instr. Co.	313-280-1111
MN	Minneapolis, Process Meas. Co.	612-544-4035
MO	St. Louis, Instr. & Control Sls.	314-535-5760
NJ	Fairfield, Ampower Elctrn. Instr.	201-227-7720
NJ	Plainfield, Brownell Electro.	201-753-4600

ANALOGIC
DIGITAL PANEL METERS & CONTROLLERS
AUTHORIZED DISTRIBUTORS
METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration
METERMASTER LOCATIONS:
ARIZONA
Phoenix .... (602) 437-1425
Tucson .... (602) 792-3411
CALIFORNIA
Los Angeles .... (213) 685-4340
Palo Alto .... (415) 968-0313
San Diego .... (619) 560-4841
GEORGIA
Atlanta .... (404) 446-0166
ILLINOIS
Chicago .... (312) 593-8650
MASSACHUSETTS
Boston .... (617) 523-2580
MINNESOTA
Minneapolis .... (612) 332-6117
MISSOURI
St. Louis .... (314) 454-0241
NEW MEXICO
Albuquerque .... (505) 292-3330
OHIO
Cleveland .... (216) 651-4100
OKLAHOMA
Tulsa .... (918) 582-1444
PENNSYLVANIA
Pittsburgh .... (412) 261-4548
TEXAS
Austin .... (512) 473-8876
Dallas .... (214) 271-5671
Houston .... (713) 733-9814
WISCONSIN
Milwaukee .... (414) 643-0554
ALL OTHER STATES .... (800) 962-8128

NY	Clarence, Trott Elctrns.	716-634-8500
NY	Hauppauge, E.I.L. Instrs.	516-231-6333
NY	Rochester, E.I.L. Instrs.	716-424-5750
NC	Charlotte, Trott Elctrns.	704-376-2237
NC	Charlotte, Brownell Electro	704-597-1270
OH	Cleveland, Pioneer/Instr. Div.	216-587-3600
OH	Dayton, Pioneer/Dayton Div.	513-236-9900
OH	Dayton, E.I.L. Instrs.	513-435-2134
OR	Portland, Branom Instr.	503-283-2555
PA	Philadelphia, Sunshine Sci. Instr.	215-673-5600
PA	Pittsburgh, E.I.L. Instrs.	412-731-5230
TN	Knoxville, Brownell Electro	615-966-3441
TN	Memphis, Brownell Electro	901-795-8487
TN	Nashville, Brownell Electro	615-889-8230
TX	Allen, Prime Distrib. Co.	214-231-0170
TX	Dallas, Economy Gauge & Instr. Supp.	214-243-8370
TX	Garland, Metermaster	214-271-5671
TX	Houston, Quality Instr.	713-524-0528
TX	Houston, E.I.L. Instrs.	713-271-3100
UT	North Salt Lake, Western Controls	801-292-5900
VA	Alexandria, E.I.L. Instrs.	703-354-4330
VA	Virginia Beach, E.I.L. Instrs.	804-499-3746
WA	Seattle, Eicher-Richards	206-523-7888
WA	Seattle, Branom Instr.	206-762-6050
WA	Seattle, E.I.L. Instrs.	206-762-0880

ANALOGIC CORP., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, Tel: 617-246-0300, Telex: 94-9307, TWX: 710-348-0425; *Sls. Mgr.:* Leonard D. Sacon .... **3**•1140, 1141

Local Sales Offices & Reps

AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Carson, AMASCO	213-516-8561
CA	San Jose, Analogic Corp.	408-247-6401
CA	Sunnyvale, AMASCO	408-733-8690
CO	Denver, Westek Data Prods., Inc.	303-232-2250
CT	Portland, BBI	203-342-0648
GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Rosemont, Synmark Sls. Co.	312-825-3455
MA	Holbrook, McLellan Assocs.	617-767-4771
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	Montville, PAF Assocs.	201-335-0680
NY	Smithtown, PAF Assocs.	516-360-0940
OH	Cincinnati, Analogic Corp.	606-371-0064
OH	Dayton, Midwest Mktg. Assocs.	513-433-2511
PA	Ambler, Denco Data Equip. Corp.	215-542-9876
TX	Dallas, Norcom	214-386-4888

ANALOG MODULES, INC., 126 Baywood Avenue, Longwood, FL 32750, Tel: 305-339-4356/4355, Telex: ANALOG MOD C1 467617; FSC No.: 61651; Empl.: 20; *Sls. Mgr.:* Ian D. Crawford .... **3**•1004

ANALOG SYSTEMS, P.O. Box 35879, Tucson, AZ 85740-5879, Tel: 602-293-4923, TWX: 910-952-1185; FSC No.: 58976; Empl.: 13; *Sls. Mgr.:* Sharon Raban; *Dist. Mgr.:* Julie Kosmata

ANALOG TECHNOLOGY CORP., 15859 E. Edna Pl., Irwindale, CA 91706, Tel: 213-960-4004, TWX: 910-584-1855; *Sls. Mgr.:* James L. Lawrence, Jr.

ANALYTICAL MEAS., 31 Willow St., Chatham, NJ 07928, Tel: 201-273-7500; Empl.: 35

ANALYTICS COMMUNICATIONS SYS., 1820 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-0892, Telex: 710-833-0326; Empl.: 35; *Sls. Mgr.:* Paul G. Jones

ANAREN MICROWAVE, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057, Tel: 315-432-8909, Telex: 937351, TWX: 710-541-1507; FSC No.: 31597; Empl.: 310

ANCHOR SPECIALTY MFG. INC., 300 Hollister Rd., Teterboro, NJ 07608, Tel: 201-288-1939; Empl.: 10

AN/COM INDUSTRIES, P.O. Box 530, 5521 Cleon Ave., N. Hollywood, CA 91603, Tel: 818-769-5518, TWX: 910-498-5713; *Sls. Mgr.:* E. J. Wubben; *Dist. Mgr.:* E. J. Wubben

AND, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-9916, TWX: 910-374-2353; Empl.: 30; *Sls. Mgr.:* Dean Ransom .... **1B**•1023-1025

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak, Frazier	205-536-1506
AZ	Tempe, Foley, Tallent & Lee	602-438-1564
AR	Little Rock, J. Y. Schoonmaker	501-375-2168
CA	Burlingame, William J. Purdy	415-347-7701
CA	Costa Mesa, Berman-Gravely Co.	714-549-2122
CO	Denver, William J. Purdy	303-777-1411
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Orlando, Currie, Peak, Frazier	305-855-0843
IL	Elmhurst, Hill-Gray Assocs.	312-832-4101
MD	Baltimore, S. K. MacDonald	301-924-5880
MA	Needham Heights, Sturgeon Co.	617-444-6603
MI	Detroit, R. P. Urban Assoc.	313-535-2355
MI	Grand Rapids, R. P. Urban Assoc.	616-245-0511
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Englewood, Harold Gray Assocs.	201-894-0894
NM	Albuquerque, William J. Purdy	505-266-7959
NY	Syracuse, Paston-Hunter Co.	315-437-2843
NC	Greensboro, Currie, Peak, Frazier	919-273-3040
OH	Columbus, McFadden Sls.	614-459-1280
OR	Beaverton, W. J. Purdy Co.	503-641-9373
PA	Philadelphia, Samuel K. MacDonald	215-545-1205
TX	Austin, J. Y. Schoonmaker	512-467-8809
TX	Dallas, J. Y. Schoonmaker	214-349-1650
TX	Houston, J. Y. Schoonmaker	713-738-2427
UT	Salt Lake City, W. J. Purdy Co.	801-486-8557
WA	Seattle, William J. Purdy	206-284-8020

Local Distributors

CA	Burlingame, Rose Elctrn.	415-348-2740
CA	Chatsworth, Panel Parts Co.	213-998-5991
CA	Sacramento, Dunlap Elctrns.	916-442-5801
CA	Sacramento, Zackit	916-446-3131
CA	San Diego, Pro-Am	619-274-4120
CA	Santa Clara, Waltronic Sls.	408-727-1200
CA	Sunnyvale, Sierra West Elctrns.	408-747-1188
CA	Van Nuys, Patane Avionics	213-988-4455
CO	Denver, Denver Wintronics	303-934-2406
CO	Denver, Integrated Elctrns.	303-534-6121
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Miami, ESL Elctrn. Distr.	305-633-6973
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Chicago, Newark/Chicago	312-638-4411
IL	Rosemont, Advent Elctrns.	312-298-4210
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MI	Farmington Hills, Advent Elect.	313-447-1650
MN	Minneapolis, Elctrn. Center	612-371-5200
MN	Minneapolis, The Joel Co.	612-545-5669
NJ	Cranford, Garden State Elect.	201-272-6400
NY	Buffalo, Genessee Radio & Parts Co., Inc.	716-873-9661
NY	East Syracuse, ADD Elctrns.	315-437-0300
NY	Farmingdale, Midway Indl. Elctrns. Inc.	516-293-6800
NY	Rochester, Simcona	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Warren, REM Elect.	216-373-1300
OR	Beaverton, Almac/Stroum	503-641-9070
OR	Lake Oswego, Rose Elctrns.	503-635-8823
PA	Drexel Hill, Kass Elect.	215-449-2300
PA	Philadelphia, Almo Elctrns.	215-698-4000
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Richardson, Southwest Elect.	214-234-3050
TX	Stafford, Southwest Elctrns.	713-491-4900
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bellevue, Almac/Stroum	206-643-9992
WA	Seattle, United Products	206-682-5025
WI	Milwaukee, Industrial Elect.	414-276-1212

ANDERS, INC., 77 Wolcott Rd., Simsbury, CT 06070, Tel: 203-658-7666; FSC No.: 52045; Empl.: 18; *Sls. Mgr.:* R. A. Grover

ANDERSEN LABS., 1280 Blue Hills Ave., Bloomfield, CT 06002, Tel: 203-242-0761, TWX: 710-425-2390; FSC No.: 03947; Empl.: 125; *Sls. Mgr.:* Donald Lowcavage .... **1A**•1450

Local Sales Offices & Reps

AL	Huntsville, Beacon	205-881-5031
AR	Little Rock, Beacon	501-224-5449
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CA	Sherman Oaks, Midwin & Olifson	213-996-9093
FL	Clearwater, Beacon	813-796-2378
FL	Ft. Lauderdale, Beacon	305-491-1054
FL	Maitland, Beacon	305-647-3498
FL	Melbourne, Beacon	305-724-8010
GA	Atlanta, Beacon	404-256-9640
IL	Northfield, Feller Assocs.	312-446-8065
IA	Cedar Rapids, Feller Assocs.	319-364-0566
MD	Randallstown, Beacon	703-591-1300
MA	Wayland, High-Tech Sls.	617-653-3838
NY	Melville, Carnes Assocs.	516-694-1600
NC	Greensboro, Beacon	919-275-9997
PA	Huntingdon Valley, Rabal Assoc.	215-947-4825
TN	Johnson City, Beacon	615-282-2421
TX	Fort Worth, McDonald Assocs.	817-429-4272
VA	Fairfax, Beacon North	703-591-1300

ANDERSON ELCTRNS., 310 Penn St., P.O. Box 89, Hollidaysburg, PA 16648, Tel: 814-695-4428, TWX: 510-691-2516; Empl.: 85; *Sls. Mgr.:* W. H. Anderson .... **1A**•1313

Local Sales Offices & Reps

AZ	Scottsdale, Fryco	602-945-3281
CA	Fullerton, GRU Assocs.	714-738-0903
CA	Santa Clara, Logan Sls	408-496-0660
GA	Lawrenceville, B. T. Funderburk, Inc.	404-963-9495
IL	South Elgin, R.K. Elctrn.	312-695-8552
IN	Indianapolis, Wilson Techn. Sls.	317-259-4032
MA	Plymouth, Newby, Inc.	617-746-3869
MI	Lathrup Village, R. C. Nordstrom & Co.	313-559-7373
NY	Smithtown, Long Island, PAF Assocs.	516-360-0940
NC	Apex, Wolff's Elctrn Sls.	919-362-5022
OH	Dayton, Dynel Co.	513-434-6467
OR	Hillsboro, Western Techn. Sls,	503-640-4621
PA	Rydal, Espy Sls.	215-576-0780
TX	Plano, GW Prods.	214-422-1746
WA	Bellevue, Western Techn. Sls.	206-641-3900

ANDERSON POWER PRODS., Div. of High Voltage Engrg., 145 Newton St., Boston, MA 02135, Tel: 617-787-5880, Telex: 940453; *Sls. Mgr.:* Robert G. Maxwell; *Dist. Mgr.:* Robert G. Maxwell

ANDREW CORP., 10500 W. 153rd St., Orland Pk., IL 60462, Tel: 312-349-3300, Telex: 25-3897, TWX: 910-651-3340; *Sls. Mgr.:* Carl Van Hecke

ANDRICH SYS., INC., 1699 Roosevelt Ave., Bohemia, NY 11716, Tel: 516-589-5656; *Sls. Mgr.:* Robert G. Andrews

ANDROMEDA SYS., 9000 Eton Ave., Canoga Park, CA 91304, Tel: 818-709-7600, TWX: 910-444-1248; Empl.: 23; *Sls. Mgr.:* Mike Morgan; *Dist. Mgr.:* J. William Graham

ANDROTEK/DMI, Box 29098, Columbus, OH 43229, Tel: 614-882-7821; *Sls. Mgr.:* James M. Shively

ANGENIEUX INC., 120 Derry Rd., Hudson, NH 02051, Tel: 603-889-2116, Telex: 94-3469; *Sls. Mgr.:* Edward A. Wollensak

ANGO ELECTRONICS CORP., Post Office Box 112, Harrison, NJ 07029, Tel: 212-685-6336, 201-483-7116, Telex: 421531; *Sls. Mgr.:* Brian K. Yuen .... **2**•1008

ANN ARBOR TERMINALS, 6175 Jackson Rd., Ann Arbor, MI 48103, Tel: 313-663-8000, TWX: 810-223-6033; Empl.: 50; *Sls. Mgr.:* Gary DeLuca

ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1990, TWX: 510-227-9894; Empl.: 200

ANRO ELCTRN. INDS., 300 Wildcat Rd., Downsview, ON , Canada, Tel: 416-661-2600; Empl.: 85; *Sls. Mgr.:* E.H. Jones

ANSLEY ELECTRONICS, DIVISION OF THOMAS & BETTS, See Thomas & Betts

ANTENNACRAFT, Box 1005, Burlington, IA 52601

ANTENNA RESCH. ASSOCS., 11317 Frederick Ave., Beltsville, MD 20705, Tel: 301-937-8888, Telex: 908754; Empl.: 25; *Sls. Mgr.:* H.W. Rapalus

ANTENNA SPECIALISTS, 12435 Euclid Ave., Cleveland, OH 44106, Tel: 216-791-7878, Telex: 980-732, TWX: 810-421-8149; Empl.: 1000; *Sls. Mgr.:* Patti Fritz

ANTEX DIV., 7 Hawkes St., Marblehead, MA 01945, Tel: 617-631-7100; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel

ANTONA CORP., 13600 Ventura Blvd., Sherman Oaks, CA 91423, Tel: 213-986-6651

ANTRONIC CORP., 7755 E. Redfield Rd., Ste. 300, Scottsdale, AZ 85260, Tel: 312-287-5110

APAHOUSER-ELCOM, INC., 101 Walnut St., Watertown, MA 02172, Tel: 617-924-1500; FSC No.: 53721; Empl.: 90; *Sls. Mgr.:* Fred Gately

APA DIVISION, 399 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-7322, Telex: 646186; *Sls. Mgr.:* Carl Gruenberg 2•1924

Local Distributors

AZ	Phoenix, Scottsdale Tool & Supply	602-273-7376
AZ	Tempe, Marshall Claude Michael	602-894-2188
CA	El Monte, Marshall Claude Michael	213-442-7204
CA	Fullerton, Bertech	714-526-3700
CA	Irvine, Marshall Claude Michael	714-556-6500
CA	Sunnyvale, Marshall Claude Michael	408-739-8720
CA	Sunnyvale, Com-Kyl	408-734-9660
CO	Denver, Marshall Claude Michael	305-841-1878
FL	Clearwater, Tartan Tools	813-447-5364
GA	Norcross, Marshall Claude Michael	404-925-1895
IL	Chicago, McMaster-Carr Supp.	312-834-9600
IL	Chicago, EMF Co. Inc.	312-889-8323
IL	Chicago, Addison Int'l Soldering Sy. Inc.	312-628-8083
IL	Hillside, Miltex Sls. Co.	312-449-0420
MA	Burlington, Marshall Claude Michael	617-272-1234
MI	Royal Oak, Murray Percival Co.	313-548-1971
MN	Excelsior, Tonka Elctrn. Supp.	612-474-5414
NJ	Fairfield, Marshall Claude Michael	201-882-0320
NJ	Mt. Laurel, Marshall Claude Michael	609-778-8720
NM	Alberquerque, Betatron Elctrns.	505-344-2381
NY	Hauppauge, Marshall Claude Michael	516-273-1515
OR	Portland, Murphy Indl. Supp.	503-620-8680
OR	Portland, MPI Assocs.	503-641-6624
TX	Dallas, Marshall Claude Michael	214-233-7650
TX	Dallas, Roy E. Davis Co.	214-688-0652
TX	Houston, Specialized Prods.	713-995-0595
UT	Salt Lake City, Indl. Supp.	801-484-8644
Can	Markham, ON, Brock Elctrns. Ltd.	416-294-8080

A. P. CIRCUIT CORP., 513 East 86th St., P.O. Box 1350, New York, NY 10028, Tel: 212-737-1348, Telex: 428759 1A•1585

Local Sales Offices & Reps

MI	Detroit, Comtel Instrs.	313-255-1970
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573

APEX MICROTECHNOLOGY CORP., 1130 E. Pennsylvania St., Tucson, AZ 85714, Tel: 602-746-0849, TWX: 910-952-1176; Empl.: 30; *Sls. Mgr.:* Rita Olschewski; *Dist. Mgr.:* Rita Olschewski 3•1005

Local Sales Offices & Reps

CA	Los Altos, Kolm Mktg.	415-948-2635
CA	San Diego, California Elctrn. Mktg.	619-692-3551
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
CO	Denver, W. H. Howard Assocs.	303-426-3499
IL	La Grange Park, Bierhaus Sls.	312-354-5100
IN	Indianapolis, J & B Sales	219-483-2813
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	Malden, J.K. Assocs.	617-321-2922
MN	Bloomington, Merril Franklin Co.	612-854-9446
NJ	Upper Saddle River, Bob Cameron Assocs., Inc.	201-825-1304
NY	Smithtown, T & K Sls.	516-724-3456
OH	Fort Wayne, TX Sales	219-489-4447
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
TX	Dallas, Repmasters	214-247-6236
TX	Houston, Repmaster	713-692-8204
WI	Elm Grove, Bierhaus Sls.	414-963-0318

Local Distributors

Intl	Finland, Helsinki, Turion Oy	90-372144
Intl	France, Orsay, Microel	907-08-24
Intl	Germany, Nauheim, Emtron Vertriebs GmbH	(06152) 6003
Intl	India, Bombay, Elmatronic Dvs.	362421
Intl	Israel, Giuataim, EIM	03-77-40-41
Intl	Italy, Milan, Disprel	02-284-0539
Intl	Japan, Tokyo, Kyokuto Boeki Kaisha	244-3511
Intl	Netherlands, Oosterhout, Klaasing Elctrns.	01620-51400
Intl	Norway, Oslo, Eltron	02-462-870
Intl	South Africa, Johannesburg, Advanced Semiconductor	27/11802-4107
Intl	Sweden, Stockholm, Scancopter AB	046-828-9425
Intl	Switzerland, Zug, Anatech AG	042-315-477
Intl	Taiwan, Taipei, Hitek Co. Ltd.	536-1157
Intl	UK, Sunbury-on-Thames, Pascall Elctrns.	09327-87418

API INSTRS., 1601 Trapelo Rd., Waltham, MA 02254, Tel: 617-890-2000, Telex: 92-3445, TWX: 710-324-0681; FSC No.: 20905; Empl.: 350; *Sls. Mgr.:* R. Yates; *Dist. Mgr.:* G. Wood

APM-HEXSEAL, 44 Honeck St., Englewood, NJ 07631, Tel: 201-569-5700, Telex: 13-3403; Empl.: 80; *Sls. Mgr.:* Riva Solins; *Dist. Mgr.:* Riva Solins

APOLLO LASERS, INC., 9201 Independence Ave., Chatsworth, CA 91311, Tel: 213-709-1111, Telex: 66-2278; Empl.: 82; *Sls. Mgr.:* John Q. Adams

APOLLO MAGNETICS CORP., 2720 W. Beverly Rd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348; Empl.: 420 3•1069

Local Sales Offices & Reps

CT	Stratford, Gerald Rosen	203-375-5456
MA	Framingham, Gerald Rosen	617-879-5505
NH	Hollis, Gerald Rosen	603-465-7902
NY	Rochester, J. W. Welch	716-244-1100
NY	Utica, J. W. Welch	716-244-1100
OK	Oklahoma City, MGR Elctrns.	918-366-0125
TX	Dallas, MGR Elctrns.	214-349-9940

APPLETON PAPERS INC., P.O. Box 359, Appleton, WI 54912, Tel: 414-734-9841 3•1070

APPLIED CIRCUITS, INC., 36-06 43rd. Ave., Long Island City, NY 11101, Tel: 212-786-7200; Empl.: 20

APPLIED CIRCUIT TECHNLG. (ACT), 2931 La Jolla St., Anaheim, CA 92806, Tel: 714-632-9230; *Sls. Mgr.:* Hank Pselos

APPLIED COMMUNICATIONS, Amstar Tech. Prods. Co., 9125 Gaither Rd., Gaithersburg, MD 20877, Tel: 301-948-5210, TWX: 710-828-9706; Empl.: 200; *Sls. Mgr.:* Joseph Rock

APPLIED COMMUNICATIONS, 9125 Gaither Rd., Gaithersburg, MD 20877, Tel: 301-948-5210, TWX: 701-828-9706; Empl.: 200; *Sls. Mgr.:* Joseph Rock

APPLIED CONTROL, 1275 Bloomfield Ave., Fairfield, NJ 07006-2828, Tel: 201-227-5454; FSC No.: 4A725; Empl.: 26; *Sls. Mgr.:* Monica E. Merel

APPLIED DATA COMMUNICATIONS, 14272 Chambers Rd., Tustin, CA 92680, Tel: 714-731-9000; Empl.: 75

APPLIED DIGITAL DATA SYSTEMS INC., 100 Marcus Blvd., Hauppauge, NY 11787, Tel: 516-231-5400, TWX: 510-227-9886; Empl.: 760; *Sls. Mgr.:* Dennis O'Donnell

APPLIED ELECTRO TECHNOLOGY, INT.
AN Sti COMPANY

APPLIED ELECTRO TECHNLG., INT., STI Company, 2220 So. Anne St., Santa Ana, CA 92704, Tel: 714-556-6570, TWX: 910-595-1797; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Deborah Core 1B•1293

Local Sales Offices & Reps

CA	Mountain View, Scientific Technlg.	415-965-0910
OR	Eugene, Dennis Ellingsen	503-484-5564
TX	Richardson, Dwain Lawhon	214-231-2289

APPLIED ENGRG. PRODS., P.O. Box A-D, Amity Sta., New Haven, CT 06525, Tel: 203-387-5282, TWX: 710-465-1173; FSC No.: 19505; Empl.: 65; *Sls. Mgr.:* C. Goff; *Dist. Mgr.:* C. Goff

APPLIED INSTRS., INC., 25 Will Place, Brooklyn, NY 11207, Tel: 212-257-0885; *Sls. Mgr.:* I. L. Litty

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, TWX: 910-334-1195; FSC No.: 11935; Empl.: 4000; *Sls. Mgr.:* O. M. Fundingsland

APPLIED MICRO TECHNLG., A Burr Brown Co., 2430 N. Hauchuca, Ste. A, Tucson, AZ 85745, Tel: 602-622-8605, TWX: 910-952-1164; Empl.: 15; *Sls. Mgr.:* Lee Davis

APPLIED MICROWAVE DIV. EPSCO, See Epsco Microwave

APPLIED RESEARCH INC., 160 Dupont St., Plainview, NY 11803, Tel: 516-349-9200; Empl.: 50; *Sls. Mgr.:* S. Klipper 1A•1686, 1687

Local Sales Offices & Reps

CA	Los Angeles, EBA Microwave	213-822-7510
CA	Orange, E. Bell Assocs.	714-857-6079
MA	Lowell, Russell Engrg.	617-458-7146
NY	Great Neck, Industron Assocs.	516-487-2620

Applied
Solar
Energy
Corporation

APPLIED SOLAR ENERGY CORP., Photosensor Div., 15251 E. Don Julian Rd., City of Industry, CA 91749, Tel: 818-968-6581, TWX: 910-584-4890; Empl.: 160; *Sls. Mgr.:* George Pankau 1B•1211

Local Sales Offices & Reps

CA	Lomita, Component Mkt. Assoc.	213-326-1460
CA	Mountain View, Weseloh Swanson	415-961-0565
CT	Hartford, Sturgeon Co.	203-249-7800
GA	Stone Mountain, Dixie Tech.	404-962-2530
IL	Chicago, Hill Sls.	312-541-0661
MA	Needham, Sturgeon Co.	617-444-6603
MI	Brooklin, Engineered Comps.	517-592-3236
MN	Minneapolis, Furber Sales	612-881-3620
OH	Centerville, Engrg. Mktg. Assocs.	513-433-2800
PA	Lancaster, Supra Tech.	717-569-0243

APPLIED SYS., 26401 Harper Ave., St. Clair Shores, MI 48081, Tel: 313-779-8700; Empl.: 15; *Sls. Mgr.:* Marty Wyrod

AP PRODUCTS
INCORPORATED

A P PRODUCTS INCORPORATED, 9450 Pineneedle Dr., Box 540, Mentor, OH 44060, Tel: 216-354-2101, TWX: 810-425-2250; Empl.: 84; *Sls. Mgr.:* Kathy M. Dusa 2•1900, 1901

Local Sales Offices & Reps

AZ	Tempe, Electronic Development & Sls.	602-829-9699
AR	Little Rock, Erickson Sls.	501-225-7379
CA	Anaheim, Westrep	714-527-2822
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CA	San Diego, D² Sales, Inc.	619-560-6266
CO	Englewood, Computech Mktg.	303-773-3981
FL	Clearwater, Hutto-Hawkins-Peregoy	813-797-4447
FL	Ft. Lauderdale, Hutto-Hawkins-Peregoy	305-971-5750
FL	Maitland, Hutto-Hawkins-Peregoy	305-831-2474
GA	Roswell, Henry W. Philips Co.	404-992-3070
IL	Lombard, RMP/McBride Corp.	312-932-9090
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
LA	Chalmette, Erickson Sls.	504-271-1976
MA	Norwood, MacInnis Co.	617-762-8090
MN	Minneapolis, Donald Luger & Assocs.	612-553-1122
MO	Blue Springs, Kathrinus Kelly Baumhauer	816-229-0001
MO	St. Louis, Kathrinus Kelly Baumhauer	314-647-2400
NJ	Englewood, ABS Assocs.	201-871-0020
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Buffalo, R. W. Mitscher Co.	716-633-7970
NC	Matthews, Henry W. Phillips Co.	704-882-2878
OH	Dayton, Shamrock Elctrn. Sls.	513-258-1227
OH	Mentor, K. W. Braund Co.	216-255-2334
OK	Oklahoma City, Erickson Sls.	405-682-2947
OR	Portland, Dussault & Assocs. Inc.	503-641-8540
TX	Austin, Erickson Sls.	512-244-3068
TX	Dallas, Erickson Sls.	214-739-5833
TX	Houston, Erickson Sls.	713-980-9609
UT	Salt Lake City, Meridian Mktg.	801-968-4177
WA	Seattle, Dussault & Assocs. Inc.	206-527-5454
WI	Colgate, Rep 1 & Assocs.	414-628-4016

Local Distributors

AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Phoenix, Tri-Tek	602-995-9352
CA	Burlingame, Rose Elctrn. Dist.	415-348-2740
CA	Chatsworth, Priority One Elctrns.	213-709-5464
CA	Concord, Pacific Radio Supp.	415-682-4700
CA	El Monte, Marshall Inds.	213-442-7204
CA	Laguna Hills, M P Systems	714-770-6411
CA	Mountain View, Haltek Elctrns.	415-969-0510
CA	Palo Alto, Zack Elctrns. of Palo Alto	415-326-5432

CA	Redwood City, HDB Elctrns.	415-368-1388
CA	San Diego, Mock III Sls. Co.	619-560-0515
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Advanced Computer	408-946-7010
CA	San Jose, Ratel Elctrns.	408-946-4300
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Clara, R.G.B. Electro-Industrial	408-980-1300
CA	Santa Clara, Quest Elctrns.	408-988-1640
CA	Santa Clara, Anchor Elctrns.	408-727-3693
CA	Sun Valley, Richey Western	213-768-3800
CA	Sunnyvale, Sunnyvale Elctrns.	408-736-1324
CO	Colorado Springs, Centennial Elctrns.	303-633-4666
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	East Hartford, E. J. Stephens Inc.	203-568-1927
CT	Hartford, Hatry Elctrns.	203-527-1881
CT	New Haven, Hatry Elctrns.	203-787-5921
CT	New London, Jan Elctrn. Supplies	203-442-4386
CT	New London, Aikens Elctrn.	203-442-4406
CT	Norwalk, Park Distributors	203-853-2010
CT	Old Lyme, Electronics Warehouse	203-434-8308
CT	Stratford, Hatry Elctrns.	203-375-5886
CT	West Hartford, Signal Elctrn. Ctr.	203-233-8551
FL	Ft. Lauderdale, Southeastern Elect.	305-563-4131
FL	Melbourne, H.I.S. Computermation Inc.	305-254-9399
FL	Miami, Electronic Equip.	305-871-3500
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, Sun Elctrn. Supp. Inc.	305-841-4650
FL	W. Palm Beach, Nurmi Elctrn. Supp.	305-686-8553
GA	Atlanta, Atlanta Computer Mart	404-455-0647
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
IL	Champaign, Klaus Radio, Inc.	217-356-1896
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Semiconductor Specialists	312-279-1000
IL	Mt. Prospect, Tri State Elect. Corp.	312-255-0600
IL	Niles, Joseph Elctrns., Inc.	312-297-4200
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Evansville, Ohio Valley Sound, Inc.	812-425-6173
IN	Fort Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Pioneer/Indiana	317-849-7300
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco	319-365-7551
.KY	Louisville, Peerless Elctrn. Equip. Co.	502-637-7677
LA	New Orleans, Wm. B. Allen Supp. Co., Inc.	504-525-8222
MD	Aberdeen, Harco Elctrns., Inc.	301-838-7990
MD	Rockville, Capitol Radio Wholesalers	301-881-2270
MA	Burlington, Contact East	617-272-5051
MA	Lowell, Frank P. McCartin Co.	617-454-9101
MA	Lowell, A B Company	617-452-6120
MA	Needham, YDI Elctrn. Corp.	617-449-1005
MA	Needham, Cronin Elctrns.	617-449-0500
MA	Newton, In-Stock Products Co.	617-964-6200
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Somerville, Solid State Sls.	617-547-7053
MA	Westboro, Future Elctrns. Corp.	617-366-2400
MA	Wilmington, R C Components	617-273-1860
MA	Woburn, Pacer Elctrns.	617-935-8330
MA	Worcester, RM Elctrns.	617-756-8311
MI	Livonia, RS Elctrns.	313-525-1155
MI	Westland, Westland Elctrns.	313-728-0650
MN	Burnsville, Electronic Tool Supp.	612-894-3700
MN	Minneapolis, Acme Elctrns.	612-338-4754
MN	St. Paul, Ragon Elctrns.	612-642-2828
MN	Thief River Falls, Digi-Key Corp.	800-346-5144
MO	Columbia, Alpha Labs	314-874-1514
MO	St. Louis, Van Sickle Radio	314-621-5000
MO	St. Louis, Olive Elctrns.	314-426-4500
NH	Hudson, C & H Elctrns.	603-882-1133
NH	Manchester, Yankee Elctrns.	603-625-9746
NJ	Camden, General Radio Supp.	609-964-8560
NJ	East Brunswick, Brothers Elctrns.	201-238-2200
NJ	East Hanover, State Elctrns. Parts	201-887-2550
NJ	Greenbrook, Greenbrook Elect.	201-968-3500
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Rahway, R.S.R./Elctrns.	201-381-8777
NJ	Springfield, Route Elctrns.	201-467-0166
NM	Albuquerque, Electronic Devices Co.	505-884-2950
NY	Astoria, S. L. Jack	212-545-8843
NY	Bohemia, Car Lac Elctrns.	516-567-4200
NY	Buffalo, Summit Distributors	716-887-2800
NY	Hempstead, Davis Elctrns. Corp.	516-483-9200
NY	Mamaroneck, Logicomp Elctrns.	914-698-9332
NY	Plainview, ACI Elctrns. Corp.	516-293-6630
NY	Pleasantville, Electronic Tool Co.	914-769-8070
NY	Rochester, Compuworld	716-473-5790
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Schenectady, Grimmer's Elect. Supp.	518-374-8480
NY	Troy, Trojan Elctrn. Supp.	518-274-4481
NY	Yorktown Hts., ABL Elctrn. Supp.	914-962-2253
OH	Cincinnati, United Radio	513-761-4030
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Englewood, Argent/Electra	513-836-8633
OH	Reynoldsburg, Hydun Lab Assocs.	614-861-7779
OR	Beaverton, Norvac Elctrns.	503-644-1025
PA	Allentown, P. A. Peters, Inc.	215-434-5237
PA	Colmar, A. B. Computers	215-822-7727
PA	Drexel Hill, Kass Elctrns.	215-449-2300
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Reading, Barbey Elctrns.	215-376-7451
PA	York, Alvo Elctrns.	814-238-0506
PA	York, E.C.I. Inc.	717-843-8971
RI	Pawtucket, Major Elctrn. Supp.	401-724-7100
RI	Pawtucket, Jabbour Elctrn. Supplies	401-728-4600
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Chattanooga, Curle Elctrns.	615-266-4727
TN	Nashville, Eddie Warner's, Inc.	615-254-1224
TX	Dallas, Specialized Prods. Co.	214-358-4663
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Dallas, Redco	214-688-0652
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Fort Worth, Allied Elctrns.	817-336-5401
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
UT	Salt Lake City, Standard Supply Co.	801-486-3371
VT	Essex Junction, I.E.S. Elctrns. Inc.	802-878-5369
VA	Annandale, Arcade Elctrns.	703-256-4610
VA	Arlington, Arlington Elctrn. Wholesalers	703-524-6256
VA	Fairfax, Nine Assocs.	703-273-1803
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Seattle, United Products	206-682-5025
WI	Madison, Schrenk Sls. Co.	608-255-7400
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Industrial Elctrns.	414-276-1212
WI	Oshkosh, Electronic Inds.	414-235-8930

APTEK MICROSYSTEMS, INC., Hillsboro Plaza, 700 N.W. 12th Ave., Deerfield Beach, FL 33441, Tel: 305-421-8450, Telex: 441020; Empl.: 250; *Sls. Mgr.:* Joseph F. Centeno

APT APTRONICS
CORPORATION

APTRONICS CORPORATION, 9450 Pineneedle Dr., P.O. Box 270, Mentor, OH 44060, Tel: 216-354-9239, TWX: 810-425-2250; FSC No.: 30146; *Sls. Mgr.:* Phillip F. Fram; *Dist. Mgr.:* Debra L. Kardum .... **2**•1160, 1161

Local Sales Offices & Reps

AL	Huntsville, Electronic Sls.	205-533-1735
AZ	Tempe, Electronic Dev. & Sls.	602-438-1547
AR	Little Rock, Erickson Sls.	501-225-7379
CA	Anaheim, Westrep	714-527-2822
CA	Mountain View, Brooks Tech. Grp.	415-960-3880
CA	San Diego, D² Sales	619-560-6266
CA	Santa Clara, Ross Mktg. Assocs.	408-988-8111
CO	Denver, West Inc.	303-692-0131
FL	Ft. Lauderdale, Interface Dynamics	305-565-5075
GA	Norcross, Electronic Sls.	404-448-6554
IL	Lombard, RMP/McBride Corp.	312-932-9090
IN	Indianapolis, M & L Elctrn. Sls., Inc.	317-359-4742
LA	Chalmette, Erickson Sls.	504-271-1976
MA	Burlington, Omni-Rep	617-938-0039
MI	St. Joseph, I. E. Hampton & Assocs.	616-983-0862
MO	Blue Springs, Kathrinus-Kelly-Baumhauer	816-229-0001
MO	St. Louis, Kathrinus-Kelly-Baumhauer	314-647-2400
NJ	Englewood, ABS Assocs.	201-871-0020
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NY	Buffalo, R. W. Mitscher Co.	716-633-7970
OH	Rocky River, Norm Case Assocs.	216-333-0400
OK	Oklahoma City, Erickson Sls.	405-682-2947
TX	Austin, Erickson Sls.	512-445-2952
TX	Dallas, Erickson Sls.	214-739-5833
TX	El Paso, Epec, Inc.	915-593-8481
TX	Houston, Erickson Sls.	713-980-9606
UT	Salt Lake City, West, Inc.	801-466-2888
WA	Seattle, ECCO Mktg.	206-364-0200

Local Distributors

AL	Huntsville, Marshall Inds.	205-381-9235
AZ	Phoenix, Arizona Comps.	602-279-9446
AZ	Tempe, Marshall Inds.	602-968-6181
AZ	Tempe, Richey Elctrns.	602-894-9251
CA	Burlingame, Rose Elctrn. Distributing	415-348-2740
CA	Canoga Park, Marshall Inds.	213-999-5001
CA	El Monte, Marshall Inds.	213-442-7204
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	Irvine, Marshall Inds.	714-556-6400
CA	Irvine, Ratel Elctrns.	714-549-8611
CA	San Diego, Mock III Sls. Co.	619-560-0515
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, Richey Elctrns.	408-946-6611
CA	San Jose, Ratel Elctrns.	408-946-4300
CA	Sun Valley, Richey Elctrns.	213-768-3800
CA	Sunnyvale, Marshall Inds.	408-732-1100
CO	Denver, Integrated Elctrns.	303-534-6121
CO	Denver, Marshall Inds.	303-427-1818
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	Norwalk, Park Distrs.	203-853-2010
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Orlando, Marshall Inds.	305-841-1878
GA	Norcross, Marshall Inds.	404-923-5750
IL	Chicago, Semiconductor Specialists	312-279-1000
IL	Rosemont, Advent Elctrns.	312-298-4210
IL	Schaumberg, Marshall Inds.	312-490-0155
IN	Indianapolis, Pioneer/Indiana	317-849-7300
MD	Gaithersburg, Marshall Inds.	301-840-9450
MA	Burlington, Marshall Inds.	617-272-8200
MA	Newton, In-Stock Products	617-964-6200
MA	Newton Upper Falls, Greene-Shaw Co.	617-969-8900
MA	Westboro, Future Elctrns.	617-366-2400
MA	Wilmington, RC Components	617-273-1860
MN	Minneapolis, Semiconductor Specialists	612-854-8841
MN	Plymouth, Marshall Inds.	612-559-2211
MO	Kansas City, Semiconductor Specialists	816-452-3900
MO	St. Charles, Finnigan Elctrns., Inc.	314-946-6201
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Camden, General Radio Supp.	609-964-8560
NJ	East Brunswick, Brothers Elctrns.	201-238-2200
NJ	East Hanover, State Elctrns. Parts	201-887-2550
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NY	Bohemia, Car Lac Elctrn. Indl. Sls.	516-567-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Endwell, Marshall Inds.	607-754-1570
NY	Hauppauge, Marshall Inds.	516-273-2424
NY	Mamaroneck, Logicomp Elctrns.	914-698-9332
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
NY	Rochester, Marshall Inds.	716-235-7620
NY	Troy, Trojan Elctrn. Supp.	518-274-4481
NY	Yorktown Hgts., ABL Elctrn. Supp.	914-962-2253
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Dayton, Marshall Inds.	513-236-8088
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Portland, Radar Elec. Co.	503-232-3404
PA	Pittsburgh, Semiconductor Specialists	412-963-7241
PA	York, E.C.I., Inc.	717-843-8971
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Dallas, Marshall Inds.	214-233-5200
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Houston, Marshall Inds.	713-789-6600
WA	Bellevue, Marshall Inds.	206-747-9100
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Seattle, Carlyle Technical Sls.	206-575-6750
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Milwaukee, Marsh Elctrns.	414-475-6000

A.P.W. CO., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643; Empl.: 18

AQ SYS., 1736 Front St., Yorktown Hgts., NY 10598, Tel: 800-431-2104; Empl.: 15; *Sls. Mgr.:* Charles E. Fitzsimmons; *Dist. Mgr.:* Charles E. Fitzsimmons

ARCO CABLE, 7361 Ethel Ave., North Hollywood, CA 91605, Tel: 818-982-2832; Empl.: 10; *Sls. Mgr.:* J. R. Parke

ARCO ELCTRNS., 400 Moreland Rd., Commack, NY 11725, Tel: 516-864-7000, TWX: 510-226-0241; FSC No.: 84171; Empl.: 40; *Sls. Mgr.:* Abe Kosakowsky

ARCOLECTRIC CORP., 9001 Canoga Ave., Canoga Park, CA 91304, Tel: 818-700-1933, Telex: 65-1349; Empl.: 20; *Sls. Mgr.:* L. Lewis; *Dist. Mgr.:* G. Miller .... **1B**•1026-1028, 1538-1542

Local Distributors

AZ	Tucson, Electronic City	602-622-1173
CA	Berkeley, Al Lashers Elctrns.	415-843-5915
CA	Fullerton, Orvac Elctrns.	714-871-1020
CA	Los Angeles, Electric Switches	213-664-1141
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Pasadena, Dow Radio	213-681-3416
CA	Riverside, Material Techniques	714-686-6186
CA	San Diego, Western Radio	619-239-0361
CA	San Jose, Quement Elctrns.	408-998-5900
FL	Hialeah, Hialeah Elctrns.	305-887-5936
ID	Caldwell, A Gem Supply	208-537-5291
IL	Rockford, GC Elctrns.	815-968-9661
LA	Harvey, AFG Elctrns.	504-368-9696
MA	Needham, YDI Elctrns.	617-449-1005
NJ	Denville, Lashen Elctrns.	201-627-3783
NJ	Springfield, Route Elctrns.	201-379-7710
NY	Bronx, CAM Elctrns.	212-893-8300
NY	Bronx, Wescon Elctrns.	212-584-6325

NY	New Hyde Park, Electronic City	516-352-7145
NC	Raleigh, Capital Elctrns.	919-832-2811
OH	Ashtabula, Sesco Sims Elctrns.	216-997-8391
OR	Eugene, Larsco	503-484-7491
PA	Willow Grove, Resco Elctrns.	215-659-4575
RI	Newport, J. S. Elctrns.	401-847-2991
TX	Houston, City Elctrns.	713-621-1060

ARC SYSTEMS, INC., 400 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-9261, Telex: 230199 SWIFT UR ARC; *Sls. Mgr.:* Robert Miller

AREMCO PRODS., Box 429, Ossining, NY 10562, Tel: 914-762-0685, Telex: 13-7442; Empl.: 30; *Sls. Mgr.:* Mark Wandzilak

ARENBERG SAGE INC., P.O. Box 250, 57 Cornwall St., Jamaica Plain, MA 02130, Tel: 617-522-8640; FSC No.: 04-2593524; Empl.: 9; *Sls. Mgr.:* R. J. Toronto

A.R.F. PRODS., 2559 75th St., Boulder, CO 80301, Tel: 303-443-4844, TWX: 910-940-3446; Empl.: 65; *Sls. Mgr.:* R. C. Lloyd, Jr.

ARGA CONTROLS, 35 E. Glenarm St., Pasadena, CA 91105, Tel: 213-682-3314; FSC No.: 50290; Empl.: 20; *Sls. Mgr.:* Linda Galman

Local Sales Offices & Reps

AL	Atlanta, A.P. Beamish & Assocs.	404-394-0077
AZ	Phoenix, RLS Instrs.	602-892-9329
CA	Santa Ana, Brooks-Moore & Assoc.	714-544-8900
GA	Atlanta, A.P. Beamish & Assocs.	404-394-0077
MA	Boston, Adcour	617-784-8123

ARGENT ELCTRNS., 3245 S. County Rd., 25A, Troy, OH 45373, Tel: 513-335-0031; FSC No.: 55901; Empl.: 20; *Sls. Mgr.:* W. Zickafoose

ARGOS PRODS., 600 S. Sycamore St., Genoa, IL 60135, Tel: 815-784-5118; Empl.: 50; *Sls. Mgr.:* Ron Evers

Local Sales Offices & Reps

CA	Burlingame, Meyer, Ross & Fleming	415-348-6800
CA	Culver City, W. Alderson	213-837-1398
CO	Wheatridge, Bill Newman & Co.	303-425-9503
FL	Ocala, Bencsik Assoc.	904-732-9775
GA	Atlanta, Murphy & Cota	404-875-2525
IL	Chicago, G. McI. Cole	312-774-3535
IN	Mulberry, Maish Sls.	317-296-2322
MA	North Scituate, W.A. Hendrickson	617-545-0652
MI	Pontiac, Ted Firaneck Sls.	313-373-9595
MN	Edina, Foster Tech. Sls.	612-941-9800
MO	Kansas City, Nevco	816-421-1751
NJ	Fort Lee, TMC Sls.	201-944-5665
NY	Syracuse, Lewis & Dunnigan	315-446-5522
OH	Dayton, Shamrock Elctrn	513-258-1227
PA	Wynnewood, Stinson Assocs.	215-896-7378
WA	Lynnwood, Pacnor Mktg.	206-284-8020
EXP	N.Y., New York, Roburn Agencies	212-989-5939

ARGO TRANSDATA CORP., Box 554, Clinton, CT 06413, Tel: 203-669-2233; Empl.: 15

ARIES®
ELECTRONICS, INC.

ARIES ELCTRNS., Box 130, Frenchtown, NJ 08825, Tel: 201-996-6841, TWX: 510-235-3391; FSC No.: 51167; Empl.: 110; *Sls. Mgr.:* Frank Folmsbee .... 2•1149-1152

Local Sales Offices & Reps

AL	Huntsville, CSR	205-533-2444
AZ	Glendale, Adtek, Inc.	602-931-9289
CA	Los Angeles, Universal Comp.	213-641-4255
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Aurora, Mountain View Mktg.	303-360-9641
CT	Canton, Bell Controls	203-693-8926
FL	Ft Lauderdale, APM Assoc.	305-565-0056
FL	Longwood, APM Assoc.	305-869-6831
FL	Merritt Island, APM Assoc.	
FL	Tampa, APM Assoc.	813-886-2457
GA	Atlanta, CSR	404-396-3720
ID	Boise, Doran Sls. Assoc.	208-343-9969
IL	Elk Grove Village, Carlson Sls. Assoc.	312-956-8240
IN	Indianapolis, J and W Sls.	317-842-3740
IA	Cedar Rapids, Carlson Sls. Assoc.	319-377-6341
KS	Gladstone, Delltron Co.	816-436-6445
MD	Lutherville, J. A. Dougherty Sls.	301-321-7890
MI	St. Joseph, OBE Inc.	616-429-7788
MI	W. Bloomfield, OBE Inc.	313-332-4900
MI	West Bloomfield, OBE Inc.	313-332-4900
MN	Bloomington, Northport Engrg.	612-854-5556
MO	Gladstone, Delltron Co.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NH	Nashua, Bell Controls	603-882-6984
NJ	Ho-Ho-Kus, DJ Fisher Co.	201-652-0090
NM	Albuquerque, Varigon Assoc.	505-344-5503
NY	Morrisville, Promark Elect.	315-662-3310
NC	Raleigh, CSR	919-878-9200
OH	Akron, Augnat Assoc.	216-273-1211
OH	Dayton, Augnat Assoc.	513-298-1507
OH	Mansfield, Augnat Assoc.	419-526-1488
OK	Tulsa, Advance Technical Sls.	918-664-0482
OR	Forest Grove, Doran Sls. Assoc.	503-357-3333
PA	Harleysville, Thomas Jackson Assoc.	215-643-5560
PA	Harrison City, Augnat Assoc.	412-281-8283
SC	Matthews, CSR	704-847-1927
TX	Austin, Advance Tech. Sls.	512-459-1351
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
UT	Murray, Mountain View Mktg.	801-261-4867
WA	Greenacres, Doran Sales Assoc.	509-922-2317
WA	Redmond, Doran Sls. Assoc.	206-885-1885
WI	Milwaukee, Carlson Sls. Assoc.	414-476-2790

Local Distributors

AL	Huntsville, Comp. Dist.	205-993-7501
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Scottsdale, Fiesta Elctrns.	602-861-1141
AZ	Tempe, Circuit Specialists	602-966-2878
AR	Little Rock, Component Distrs.	501-227-6278
CA	Canoga Park, Tim-Co	213-992-5040
CA	Fullerton, Pyramid Elctrns.	213-691-0561
CA	San Diego, Sigma Elec.	619-565-2000
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Santa Clara, Peters De-Laet	408-727-9440
CO	Englewood, Industrial Elctrns.	303-694-9444
CT	Danbury, Pilgrim Elect.	203-792-7274
CT	Norwalk, Cobra Comps.	203-847-6442
CT	Wallingford, Cronin	203-265-3134
FL	Ft. Lauderdale, Comp. Dist.	305-971-4950
GA	Atlanta, KSM Elect.	800-554-9227; 404-458-2013
GA	Norcross, CDI	404-441-3320
IL	Northbrook, Classic Comps. Supply	312-272-9650
IN	Indianapolis, Meunier Elctrn. Supply	317-635-3511
LA	Lafayette, Ralph's	318-234-4507
MD	Baltimore, A S I Elctrns.	301-265-5100
MA	Burlington, OPL Elctrns.	617-229-2424
MA	Middleboro, Glynn Elctrns.	617-947-4262
MA	Wilmington, Cronin Elctrns.	617-449-5000
MI	Grand Rapids, T & W Elctrns.	616-241-3645
MN	Minneapolis, The Joel Co.	612-545-5669
MO	Valley Park, Beckwith Computer Elctrns.	314-825-2237
NH	Salem, Cronin	603-898-4440
NM	Albuquerque, Intl. Elctrns.	505-345-8120
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Pruitt Energy	216-566-1545
OH	Columbus, Wedemeyer Elect. Supp.	614-436-9600
OH	Warren, REM Elctrns.	216-373-1300
OR	Portland, Carlyle	503-292-2053
PA	Erie, REM Elctrns.	814-453-5626
PA	McKeesport, Barno Radio	412-751-5966
PA	Philadelphia, Shap Elctrns.	215-969-3300
TX	Addison, Connec-Tek	214-239-7552
TX	Arlington, Bell Comp. Sls.	817-461-5303
TX	Austin, Quality/Components	512-835-0220
TX	El Paso, Intl. Elctrns.	915-598-3406
TX	Fort Worth, Indl. Elctrns.	817-731-7321
TX	Houston, Ralph's	713-748-4909
TX	Richardson, Air Quip Sls.	214-234-3285
VA	Falls Church, Comp. Dist.	703-533-3500
WA	Seattle, Pacific Elctrns	206-575-1050
WA	Seattle, Carlyle Wire & Cable	206-575-6750
WI	Mequon, Taylor	414-241-4321
WI	New Berlin, Classic	414-786-5300

ARISTO GRID LAMP PRODS., 65 Harbor Rd., Port Washington, NY 11050, Tel: 516-944-3030; Empl.: 21

ARK ELCTRNS. CORP., 1325 Industrial Hwy., Southampton, PA 18966, Tel: 215-322-6510; *Sls. Mgr.:* S. Kalos

ARMIGER & ASSOCS., INC., Daniel Woodhead, Inc., 2525 Ridgmar Blvd., Fort Worth, TX 76116, Tel: 817-737-2900; *Sls. Mgr.:* Dave Forcey; *Dist. Mgr.:* Dave Forcey

ARK-LES, 51 Water St., Watertown, MA 02172, Tel: 617-924-2330, Telex: 92-2441; Empl.: 700; *Sls. Mgr.:* Stephen Glorioso

ARMEL ELCTRNS., 1601 75th St., N. Bergen, NJ 07047, Tel: 201-869-4201, TWX: 710-992-8842; FSC No.: 91663; Empl.: 55; *Sls. Mgr.:* V. A. Pasqualino

ARMSTRONG WORLD INDS., W. Liberty St., Lancaster, PA 17604, Tel: 717-397-0611, TWX: 717-560-4405; Empl.: 24,000

ARMTEC INDUSTRIES, INC., Daven Components Grp., Manchester Airport, Manchester, NH 03103, Tel: 603-669-0940, TWX: 710-220-1747; FSC No.: 58880; Empl.: 400; *Sls. Mgr.:* Dave Richards .... 1B•1543

Local Sales Offices & Reps

AL	Huntsville, Technlg. Mktg. Assoc.	205-883-7893
AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Fullerton, Groh Assoc.	714-738-7105
CA	Santa Clara, Fischer Assoc.	408-733-7350
CO	Lakewood, Trembly Assoc.	303-233-9544
FL	Pompano Beach, Techlg. Mktg. Assoc.	305-942-0774
GA	Atlanta, Technlg. Mktg. Assoc.	404-257-0374
IL	Northfield, Imex	312-446-8934
IN	Ft. Wayne, J&B Eng. Sls.	219-483-2813
KS	Shawnee Mission, Technical Sls.	913-888-3330
MD	King of Prussia, Freedman-Malta Assoc.	215-337-9211
MA	Norwood, MPS Elctrns.	617-769-8700
MN	Minneapolis, R-J Inc.	612-866-3661
MO	St. Louis, Technical Sls.	314-725-5361
NV	Las Vegas, Trembly Assoc.	702-739-9770
NJ	New Providence, Al Robinson Assoc.	201-464-4812
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Clarence Center, Nu-Tekneex Inc.	716-741-9138
NY	Guilderland, Nu-Tekneex Inc.	518-355-1829
NY	Lynbrook, HLJ Comp-Tech	516-599-2999
NC	Burlington, P. J. Nahser	919-226-8053
OH	Englewood, Allen Nace Co.	513-836-0931
OH	Richfield, Allen Nace Co.	216-659-7178
OR	Portland, Comp. Technlg. Inc.	503-292-1518
PA	King of Prussia, Freedman-Malta Assoc.	215-337-9211
TX	Dallas, Oeler & Menelaides	214-361-8876
TX	Houston, Oeler & Menelaides	713-772-0730
UT	Salt Lake City, Trembly Assoc.	801-486-5292
WA	Seattle, Comp. Technlg. Inc.	206-789-4555
EXP	NY, Islip, Lothar-Sanford	516-581-3662

ARNOLD ENGRG., Box "G", Marengo, IL 60152, Tel: 815-568-2000, Telex: 25-7448, TWX: 910-642-2790; Empl.: 900; *Sls. Mgr.:* C. F. Templeton, V.P.

ARNOLD MAGNETICS

ARNOLD MAGNETICS, 11520 W. Jefferson Blvd., Culver City, CA 90230, Tel: 213-390-3537/8837, TWX: 910-343-6468; FSC No.: 04879; Empl.: 105; *Sls. Mgr.:* Phil Kite; *Dist. Mgr.:* Phil Kite .... 3•1496-1499

Local Sales Offices & Reps

AZ	Phoenix, Faser Tech. Sls.	602-948-4404
CA	El Segundo, L. L. Stoakes	213-640-2178
CA	Los Altos, Kolm Mktg. Assocs.	415-948-2635
CA	San Diego, L. L. Stoakes	619-452-1600
FL	DeBary, DJE Assocs.	305-668-6827
MD	Silver Springs, Youth Assocs.	301-598-5740
MA	Andover, Bee Assocs.	617-475-2124
NY	New Rochelle, Ascor Elctrns.	914-235-8838
TX	Houston, Spectra Sls.	713-747-2798
TX	Richardson, Spectra Sls.	214-234-3600

Aromat
Member of Matsushita Group

AROMAT CORP., 250 Sheffield St., Mountainside, NJ 07092, Tel: 201-232-4260, TWX: 710-997-9536; Empl.: 150 .... 1B•1294-1309

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns. Assoc.	205-881-5031
AZ	Tempe, Sys. Sls. of Arizona, Inc.	602-829-9338
AR	Little Rock, Beacon Elctrns. Assoc.	501-224-5449
CA	Cupertino, Aromat Corp.	408-446-5000
CA	Garden Grove, Aromat Corp.	714-895-7707
CA	Garden Grove, Elsco	213-533-1255

CA	Santa Clara, Westrep	408-988-8833
CO	Littleton, Omega Ltd.	303-798-7040
CT	Madison, United Comps.	203-245-4810
FL	Fern Park, EIR	305-830-9600
FL	Orlando, Aromat Corp.	305-855-1075
GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IL	Elk Grove Village, Aromat Corp.	312-593-8535
IN	Indianapolis, J & W Sls. Co.	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
MD	Pikesville, Imagitron Sls.	301-521-2020
MA	Gilman, United Comps.	203-889-4050
MA	Norwood, United Comps.	617-226-0556
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MI	Redford, R. P. Urban & Assocs.	313-535-2355
MN	Bloomington, Northport Engrg.	612-854-5556
MO	Independence, Repco	816-254-3410
NJ	Hackensack, Meg Elctrn. Sls.	201-489-7700
NJ	Mountainside, Aromat Corp.	201-232-4260
NM	Albuquerque, SSA Inc. of New Mexico	505-881-8877
NY	Binghamton, Rochester Comps.	607-772-9292
NY	W. Henrietta, Rochester Comp.	716-546-4766
NC	Raleigh, Beacon Elctrns. Assoc.	919-787-0330
OH	Cleveland, J. R. Thornberry Co.	216-321-3328
OH	Kettering, J. R. Thornberry Co.	513-258-1863
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
TX	Austin, C. R. Colvin & Assocs.	512-474-8698
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, C. R. Colvin & Assocs.	713-961-1262
TX	Richardson, Aromat Corp.	214-235-0415
WA	Bellevue, Sls. & Engrg.	206-883-4999
WA	Vancouver, Sls. & Engrg.	206-573-5161
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

Local Distributors

AL	Huntsville, Contact Elctrns.	205-881-9321
AZ	Tempe, Bell Inds.	602-966-7800
CA	Chatsworth, Mil-Com Dist.	213-998-3111
CA	Mountain View, U.S.I.	415-969-5420
CA	Santa Clara, Patane Selectronics	408-496-6151
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Van Nuys, Patane Avionics	213-988-4455, 213-873-5541
CO	Denver, Ragon Elctrns.	303-744-3601
CO	Englewood, Industrial Elctrns.	303-694-9444

ARROW-HART
AUTHORIZED DISTRIBUTOR

E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310

TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640

TWX 910-321-2971

SEE COMPLETE PRODUCT
LINE UNDER SWITCHES
— SECTION 5100
FREE LINECARD AND
CATALOG ON REQUEST

CT	Naugatuck, SCR Elec. Co.	203-729-8274
FL	Longwood, Intertec Comps.	305-834-7777
IL	Lombard, R. M. Elctrns.	312-932-5150
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IN	Indianapolis, R. M. Elctrns.	317-247-9701
IN	Indianapolis, Magnuson Elctrns.	317-247-5108
IA	Cedar Rapids, Bergquist Co.	319-366-8733
IA	Cedar Rapids, Ragon Elctrns.	816-254-3410
KS	Derby, Ragon Elctrns.	816-254-3410
MA	Canton, Impact Sls. Co.	617-821-1500
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Grand Rapids, R. M. Elctrns.	616-531-9300
MN	Minneapolis, Joel Co.	612-545-5669
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	St. Paul, Ragon Elctrns.	612-642-2828
MO	Berkeley, Ragon Elctrns.	319-254-3410
MO	Independence, Ragon Elctrns.	816-254-3410
NJ	Bellmawr, Mid-Atlantic Elctrns. Corp.	609-931-5303, 215-923-6868
NJ	Fair Lawn, Relay Specialties	201-797-3313
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, 212-523-3456
NY	Millbrook, Villarreal Elctrns.	914-677-3447
NY	Mt. Vernon, QAR Indl. Elctrn. Sls.	914-699-2224
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rome, Rome Elctrns.	315-337-5400
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Hickory, Dixie Elctrns.	704-328-2646
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
OH	Columbus, Elctrns. Mktg. Corp. (EMC)	614-299-4161
OH	Highland Heights, Elctrns. Mktg. Corp. (EMC)	216-442-3441
OH	Kettering, Elctrns. Mktg. Corp. (EMC)	513-439-4711
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Portland, P&R Inds.	503-641-9525
PA	Harrisburg, Advacom	717-545-5674
PA	Horsham, Pioneer/Delaware Valley	215-674-4000
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elctrns.	215-293-9000
RI	Pawtucket, Major/Edwards	401-725-7400
SC	Charleston, Dixie Elctrns.	803-554-7515
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Dixie Elctrns.	803-297-1430
TN	Gray, Dixie Elctrns.	615-477-3838
TN	Knoxville, Dixie Elctrns.	615-938-4131
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Dallas, Computer Comps. Corp.	214-239-0271
TX	El Paso, ERA Elctrns., Inc.	915-592-4126
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Stafford, Southwest Elctrns.	713-491-4900
VA	Roanoke, Mexitronics Corp.	703-342-4444
WA	Bellevue, Bell Inds.	206-747-1515
WA	Seattle, Pacific Elctrns.	206-575-1050
WI	Mequon, Taylor Electric	414-241-4321

ARRA INC., 15 Harold Ct., Bay Shore, NY 11706, Tel: 516-231-8400, TWX: 510-227-6231; Empl.: 50; *Sls. Mgr.:* M. V. Geraci .... **1A**•1689

Local Sales Offices & Reps

AL	Huntsville, Redstone Military Svc.	205-837-6136
AZ	Chandler, Blackhart Assoc.	602-831-2566
CA	Los Angeles, McDougall/McLaughlin	213-477-8556
CA	Mountain View, Mark V Assocs.	415-964-6275
FL	Winter Park, Microwave Mktg.	305-678-2141
IL	Mt. Prospect, Cain & Co.	312-253-3578
IA	Cedar Rapids, Palatine Sls.	319-365-8071
KS	Mission, Palatine Sls.	913-831-0555
KS	Wichita, Palatine Sls.	316-776-0065
MD	Ellicott City, Doss Elctrns.	301-465-1336
MA	Chelmsford, BBC	617-256-6593
MO	Hazelwood, Palatine Sls.	314-839-0800
NY	Great Neck, EAC	516-466-9798
NY	Utica, B D Hummel Co.	315-736-7821
NC	Raleigh, Barker Assoc.	919-851-7841
OH	Dayton, Haacke Co.	513-254-1951
OH	Lancaster, Cain & Co.	614-654-4800
PA	Newtown, SWR Assocs. Corp.	215-356-8550
TX	Garland, TESCO	214-681-1376
WA	Seattle, Datacom Assocs.	206-285-2525

ARRAY TECHNOLOGY, 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129, Tel: 408-252-9900; *Sls. Mgr.:* Jim Schenck

ARROW FASTENER, 271 Mayhill St., Saddlebrook, NJ 07662, Tel: 201-843-6900; Empl.: 600

COOPER INDUSTRIES

ARROW HART

ARROW HART DIV., Cooper Inds., 103 Hawthorn St., Hartford, CT 06101, Tel: 203-249-8471, Telex: 99328 .... **1B**•1568-1573

Local Sales Offices & Reps

AL	Huntsville, Hollingsworth & Still	800-241-5712
AZ	Phoenix, Elec-Com	602-967-8643
CA	Los Angeles, Arrow Hart Div.	213-588-5251
CO	Denver, West, Inc.	303-692-0131
CT	Hartford, Arrow Hart	203-249-8471
FL	Ft. Lauderdale, Hollingsworth & Still	800-241-5712
FL	Miami, Hollingsworth & Still	800-241-5712
FL	Orlando, Hollingsworth & Still	800-241-5712
GA	Norcross, Hollingsworth & Still	800-241-5712
IL	Wood Dale, Arrow Hart Div.	312-766-9570
MO	St. Louis, Arrow Hart	314-569-0626
NJ	Berlin, Arrow Hart	609-768-9520
NM	Albuquerque, Elec-Com Assoc.	505-898-6101
NC	Greensboro, Hollingsworth & Still	800-241-5712
NC	Kernersville, Hollingsworth & Still	800-241-5712
OH	Mason, Arrow Hart	513-398-0156
OR	Portland, Micro Sales, Inc.	503-297-4726
PA	Willow Grove, Arrow Hart	215-659-3728
TX	Richardson, Arrow Hart Div.	214-644-6210
UT	Salt Lake City, Meridian West	801-466-2888
WA	Belleview, Micro Sales, Inc.	206-451-0569
WI	Pewaukee, Arrow Hart Div.	414-367-0081

Local Distributors

AL	Muscle Shoals, Jones Elctrns.	205-383-1241
AZ	Phoenix, Be Switched	602-275-4805
AZ	Tempe, Fisher/Brownell	602-967-1464
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Alhambra, Fisher/Brownell	213-289-0255
CA	Commerce, Electro Comps.	213-727-0200
CA	Covina, Selecta Switch	213-967-4123
CA	Gardena, California Switch & Signal	213-770-2330
CA	Los Angeles, Master Distributor	213-452-1229
CA	Los Angeles, Electric Switches	213-660-1310
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, Fisher/Brownell	714-560-8545
CA	San Francisco, Zack Elctrns.	408-626-1444
CA	San Jose, Consolidated Parts	408-263-9521
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	San Leandro, Electro Components	415-352-5210
CA	Santa Clara, Fisher/Brownell	408-988-6041
CA	Santa Fe Springs, Eurton Elec.	213-946-4477
CA	Tustin, Western Switches & Control	714-731-4333
CO	Denver, Elctrn. Parts	303-744-1992
CO	Denver, Integrated Elctrns.	303-534-6121
CO	Denver, Denver Wintronics	303-934-2406
CO	Denver, Consolidated Parts	303-623-5313
CO	Denver, Star for Parts	303-623-4224
CO	Denver, Fistells Elctrn. Supp.	303-244-4691
CT	Shelton, Century Elec. Sy	203-736-2684
CT	West Hartford, Gal Elec.	203-232-9880
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
FL	Jacksonville, Ace Elec. Supp.	904-398-9857
FL	Miami, Electrn. Equip.	305-871-3500
FL	Miami, Alpeco Intl.	305-592-2985
FL	Sarasota, Workman Elctrn.	813-371-4242
FL	Sarasota, Dow Elctrns.	813-365-3393
GA	Atlanta, Ack Radio Supply	404-351-6340
GA	Atlanta, A-C Equip.	404-451-2747
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Addison, LComp Chicago	312-628-1400
IL	Chicago, Revere Elec. Supp.	312-738-3636
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Rockford, G. C. Elctrns.	815-968-9661
IL	Wood Dale, Electro Kinetics	312-595-6700
IN	East Chicago, Acro Elctrns.	219-397-8681
IN	Evansville, Hutch & Son	812-425-7201
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Marion, Brenneman & Assoc.	319-377-6394
LA	Lafayette, Ralph's Elctrns.	318-233-0105
LA	New Orleans, William B. Allen	504-525-8222
LA	Shreveport, Ind. Elctrns.	318-222-9459
MD	Bethesda, Empire Elec. Sy	301-656-3300
MD	Rockville, Capital Radio Whlsrs.	301-881-2270
MA	Allston, Hilco Elec. Supp.	617-783-2600
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Hingham, Sager Elctrl.	617-749-6700
MI	Grand Rapids, S-F Elctrn. Sy.	616-459-0216
MI	Livonia, Pioneer Michigan	313-525-1800
MI	Livonia, RS Elctrns.	313-525-1155
MI	St. Clair Shores, SPEMCO	313-771-2700

MN	Minneapolis, Sterling Elec.	612-332-4571
MN	St. Paul, Gopher Elctrns. Co.	612-483-4450
MS	Jackson, Ellington Elctrns.	601-355-0561
MO	Kansas City, LComp Kansas City	816-221-2400
MO	Maryland Heights, LComp St. Louis	314-291-6200
NE	Lincoln, Scott Elctrns.	402-466-8221
NJ	Camden, General Radio Sy. Co.	609-964-8560
NJ	East Hanover, State Elctrn. Parts	201-887-2550
NJ	Manasquan, Heiman H. Smith	201-223-9400
NJ	Prospect Park, Kappe	201-790-1999
NM	Albuquerque, Walker Radio	505-247-2288
NY	Binghamton, Florance Elec Sy	607-724-2455
NY	Buffalo, Genesee Radio & Parts	716-873-9661
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, S.A.I.	516-293-2710
NY	Hempstead, Electronic Equip.	516-538-5510
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	New York City, Browneli Electro	212-691-1171
NY	Rochester, Rochester Radio Sy.	716-454-7800
NY	Woodside, Switches Unltd.	212-478-5000
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Cleveland, Midland Elec.	216-248-3800
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Esco	513-226-1133
OH	Dayton, Pioneer/Dayton	513-236-9900
OR	Portland, Johnstone Corp.	503-231-4833
PA	Philadelphia, Philadelphia Elctrns.	215-568-7444
RI	Providence, W. M. Dandreta	401-861-2800
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Carlton-Bates	615-244-3562
TN	Nashville, Randolph & Rice	615-255-5602
TX	Austin, Harrison Equip.	512-458-3555
TX	Dallas, Associated Aircraft	214-331-4381
TX	Dallas, Wilkinson Brothers	214-941-9963
TX	Dallas, Harrison Equip.	214-239-2750
TX	El Paso, Midland Specialty	915-533-9555
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Harrison Equip.	713-879-2600
TX	Lubbock, Texas Elctrn. Sy. Corp.	806-765-8456
TX	Richardson, Fisher/Brownell	214-235-3177
TX	San Antonio, Sherman Elctrns.	512-224-1004
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Charlottesville, Virginia Radio Sy	804-296-4184
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Bell Ind.	206-747-1515
WA	Bellevue, Integrated/Jaco	206-455-2727
WA	Seattle, Zepher Elctrn. Sls.	206-241-1980
WA	Seattle, Radar Elec.	206-282-2511
WI	Mequon, Taylor Elec. Co.	414-241-4321

arstan

ARSTAN PRODUCTS INTL. LTD., 99 Jericho Tpke., Jericho, NY 11753, Tel: 516-333-8100, Telex: 221519 ARSTN; Empl.: 8; *Sls. Mgr.:* Stan Shapiro .... **1A**•2132-2134

Local Sales Offices & Reps

CA	San Diego, S & A Technical Sales	619-295-8330
FL	North Miami, Ben Goldner	305-932-2782
GA	Atlanta, Electro Sls.	404-394-1122
IL	Chicago, Berndt Assoc.	312-283-0713
KY	Louisville, KW Electronic Sales, Inc.	502-451-1860
MA	Southboro, K.S.A. of New England	617-485-9432
MI	Novi, Lektronics Sales	313-349-3304
MN	Minneapolis, Berndt Assoc.	612-546-2021
NY	Bayside, John Kavanagh	212-229-2731
NC	Greensboro, KZJ Component Sales	919-852-5990
OH	Dayton, KW Electronic Sales, Inc.	513-890-2150
OH	Shaker Heights, KW Electronic Sales, Inc.	216-491-9177
OH	Worthington, KW Electronic Sales, Inc.	614-888-0483
PA	Philadelphia, Check Associates	215-487-3007
TN	Chattanooga, Electro Sales	615-267-4260

ARTECH CORP., 2901 Telestar Ct., Falls Church, VA 22042, Tel: 703-560-3292; Empl.: 40; *Sls. Mgr.:* S. Martin

ARTEL COMMUNICATIONS CORP., 93 Grand St., Worcester, MA 01602, Tel: 617-752-5690

ARTISAN ELCTRNS., 5 Eastmans Rd., Parsippany, NJ 07054, Tel: 201-887-7100; Empl.: 200; *Sls. Mgr.:* Gail Norton; *Dist. Mgr.:* Gail Norton

Local Distributors

CA	Haywards, Allied Elctrns. Inc.	415-487-5250
IL	Elgin, Allied Elctrns. Inc.	312-697-8200
NJ	Fair Lawn, Relay Specialties	800-526-5376
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
PA	Washington Crossing, Riverside Comp. Supp. Co.	215-493-5228
TX	Fort Worth, Allied Elctrns.	817-336-5401

ARTRONIC INSTR. CO., INC., 9 Division St., Sidney, NY 13838, Tel: 607-563-8444; FSC No.: 09446

ART WIRE/DODUCO, 9 Wing Dr., Cedar Knolls, NJ 07927, Tel: 201-267-2000, Telex: 13-6455; Empl.: 100

ASACA SHIBASKU CORP. OF AMER., 12509 Beatrice St., Los Angeles, CA 90066, Tel: 827-7144, Telex: 182089; *Sls. Mgr.:* Alan R. Davis; *Dist. Mgr.:* Susan Grossinger

ASCO WIRE & CABLE CO., 412 Housatonic Ave., Bridgeport, CT 06608, Tel: 203-366-5294; Empl.: 30; *Sls. Mgr.:* M. Madow

Local Sales Offices & Reps

FL	Melbourne Beach, James Indus.	305-725-9807
IL	Inverness, James Indus.	312-358-8000
VA	Portsmouth, FBD Sales	804-484-3162

Local Distributors

NY	Corona, Magnet Wire	212-651-0900

ASHLAND CHEMICAL, Ashland Oil, Inc., Box 2219, Columbus, OH 43216, Tel: 614-889-3333

ASHLAND ELEC. PRODS., 32-02 Queens Blvd., Long Island City, NY 11101, Tel: 212-392-4010; Empl.: 115; *Sls. Mgr.:* Harland W. Cashman

ASHMAN INDUSTRIES (1966) LTD., 66 Brock Rd., Greensville Dundas, ON , Canada, Tel: 416-628-6371; Empl.: 56

ASM, 525 Truck La., Smithfield, NC 27577, Tel: 919-934-3104; FSC No.: 31336; Empl.: 12; *Sls. Mgr.:* L. L. Armstrong

ASMANN COMPONENTS, Div. of ebm Industries, Inc., 525 New Britain Ave., Unionville, CT 06085, Tel: 203-674-1515, TWX: 710-423-8723; *Sls. Mgr.:* Edward A. Cyr .... **2**•1255

ASPECT ELCTRNS., 725 San Aleso, Sunnyvale, CA 94086, Tel: 408-737-2290; *Sls. Mgr.:* Doug Coke

A. S. R. SERVOTRON, INC., (Sub. Baldor Elec. Co.), 7945 Deering Ave., Canoga Park, CA 91304, Tel: 818-999-6193, Telex: 181213 ASR USA CNPK; Empl.: 2400; *Sls. Mgr.:* Robert W. Ferran

ASSEM-PRO INSTRS., Div. of Overnight Engineering Inc., 1859 Andrews Ave., San Jose, CA 95124, Tel: 408-267-1168; *Sls. Mgr.:* Lynn Riordan; *Dist. Mgr.:* Lynn Riordan

ASSEMBLY SPECIALISTS, 914 Main St., Box 965, Acton, MA 01720, Tel: 617-263-9100; *Sls. Mgr.:* George L. Boyden

ASSOCIATED CIRCUITS INC., 621 Old County Rd., San Carlos, CA 94070, Tel: 415-592-7528; *Sls. Mgr.:* Betty Smeland

ASSOCIATED ENGRG. MFG., 546 Valley Rd., Upper Montclair, NJ 07043, Tel: 201-783-7800, Telex: 138866; Empl.: 69

ASSOCIATED ENVIRONMENTAL SYSTEMS, 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 617-388-5662, TWX: 710-347-0590; Empl.: 300; *Sls. Mgr.:* A. P. Campagna

ASSOCIATED RESEARCH, INC., 8221 N. Kimball Ave., Skokie, IL 60076, Tel: 312-647-7850, Telex: 28-3511; FSC No.: 04237; Empl.: 80; *Sls. Mgr.:* Larry Gulik

ASSOCIATED SPECIALTIES, 1751 Main St., Orefield, PA 18069, Tel: 215-395-9172; *Sls. Mgr.:* V. Laudenslager; *Dist. Mgr.:* V. Laudenslager

ASSOCIATED SPRING, BARNES GRP., 18 Main St., Bristol, CT 06010, Tel: 203-583-1331, Telex: 962449, TWX: 710-454-0592; Empl.: 1850; *Sls. Mgr.:* R. Hufsmith

Local Sales Offices & Reps

CA	Gardena	213-323-4833
CT	Bristol	203-582-9581
GA	Atlanta	404-955-1123
IL	Lombard	312-495-4760
IL	Mattoon	217-235-5601
MI	Ann Arbor	313-665-8686
MI	Livonia	313-478-5300
NY	Syracuse	315-457-9200
NC	Arden	704-684-7836
OH	Dayton	513-253-4131
PA	Corry	814-664-9646
TN	Memphis	901-362-9544
TX	Dallas	214-330-8661
WI	Milwaukee	414-482-1600

ASSOCIATED TESTING LABS., Div. of Kidde, Inc., 53 Second Ave., Burlington, MA 01803, Tel: 617-272-9050; Empl.: 80; *Sls. Mgr.:* Robert H. Croft

ASTEC USA, LTD., A BSR Intl. Co., 2880 San Tomas Expwy., #200, Santa Clara, CA 95051, Tel: 408-748-1200, Telex: 4745018 ASTEC UI, TWX: 310-474-5018; *Sls. Mgr.:* Russ Sinagra .... **3**•1500

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Tempe, Cantec Sls.	602-829-0191
CA	San Diego, SR Elctrns.	619-560-8330
CA	Santa Clara, I Squared	408-988-3400
CA	Santa Clara, Astec (USA) Ltd.	408-748-1200
CA	Thousand Oaks, SC Cubed	805-496-7307
CA	Tustin, SC Cubed	714-731-9206
CO	Wittleton, Lange Sales Inc.	303-795-3300
DC	Fairfax, Scientific Assocs.	703-385-0600
GA	Stone Mtn., 20th Century Mktg.	404-292-7088
IL	Rolling Meadows, Sumer	312-991-8500
MA	Burlington, Mill-Bern Assocs.	617-273-1313
MN	Bloomington, Elctrn. Sls. Agency	612-884-8291
NJ	Pennsauken, Representatives Inc.	609-662-5222
NY	Jamaica, SJ Assocs.	212-291-3232
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OK	Tulsa, West Assocs.	918-492-0390
TN	Knottsville, 20th Century Mktg.	615-690-1618
TX	Austin, West Assocs.	512-454-3681
TX	Dallas, West Assocs.	214-248-7060
TX	Houston, West Assocs.	713-777-4108
WA	Bellevue, SDR Squared	206-747-9424

Local Distributors

CA	El Segundo, Wyle Labs.	213-322-8100
CA	Irvine, Wyle Labs.	714-863-9953
CA	Rancho Cordova, Wyle Labs.	916-638-5282
CA	San Diego, Wyle Labs.	619-565-9171
CA	Santa Clara, Wyle Labs.	408-727-2500
CO	Phoenix, Wyle Labs.	602-249-2232
CO	Thornton, Wyle Labs.	303-457-9953
OK	Tulsa, Quality Comps.	918-634-8812
OR	Hillsboro, Wyle Labs.	503-640-6000
TX	Austin, Quality Comps.	512-835-0220
TX	Dallas, Quality Comps.	214-387-4949
TX	Sugarland, Quality Comps.	713-491-8812
UT	Salt Lake City, Wyle Labs.	801-974-9953
WA	Bellevue, Wyle Labs.	206-453-8300

ASTRO CIRCUIT, 100 Hale St., Lowell, MA. 01851, Tel: 617-458-3240, TWX: 710-343-0754; Empl.: 220

ASTROCOM ELECTRONICS, INC., Box 370, Oneonta, NY 13820, Tel: 607-432-1930

ASTRO DYNAMICS, INC., 2 Gill St., Woburn, MA 01801, Tel: 617-935-4944; Empl.: 50

ASTRODYNE, 35 Executive Dr., Hudson, NH 03051, Tel: 603-880-8600; FSC No.: 28023; Empl.: 60; *Sls. Mgr.:* Warren Heinzelmann; *Dist. Mgr.:* Warren Heinzelmann

ASTRO-GEO-MARINE, INC., 202 E. Cota St., Santa Barbara, CA 93101, Tel: 805-965-7005; FSC No.: 51473; Empl.: 15

ASTRO INSTRUMENT CORP., 2501 NW 17th Ln., Pompano Beach, FL 33064, Tel: 305-748-5527, TWX: 510-956-9601; FSC No.: 51761; *Sls. Mgr.:* William E. Watson

ASTROLAB, 345 Dalziel Rd., Linden, NJ 07036, Tel: 201-862-0022, TWX: 710-996-5930; FSC No.: 16301; Empl.: 36; *Sls. Mgr.:* J. R. Toma

ASTRO-MED, INC., Atlan-Tol Indl. Pk., W. Warwick, RI 02893, Tel: 401-828-4000, TWX: 710-382-6409; Empl.: 120; *Sls. Mgr.:* Everett V. Pizzuti; *Dist. Mgr.:* Everett V. Pizzuti .... **3**•1382

ASTRONAUTICS CORP. OF AMERICA, P.O. Box 523, Milwaukee, WI 53201, Tel: 414-447-8200, TWX: 910-262-3153; FSC No.: 10138

ASTRON CORP., 2852 Walnut #E, Tustin, CA 92680, Tel: 714-832-7770; *Sls. Mgr.:* William Pochirowski; *Dist. Mgr.:* William Pochirowski .... **3**•1501

Local Distributors

CA	Los Angeles, Henry Radio	213-820-1234
CA	Northridge, Ora Elctrns.	213-701-5848
CA	Sun Valley, Cartwright Comms.	213-768-7744
CO	Aurora, Electro Tech Sls.	303-343-8937
GA	Marrietta, NBC Mktg.	404-424-9097
IL	Joliet, Primus Elctrns.	815-436-8945
IL	Joliet, Communications Assoc.	815-744-6444
MD	Cockleysville, Tessco.	301-252-0860
NJ	Clifton, Meridian Comms.	201-473-1623
OH	Cincinnati, Cartwright Comms.	513-489-1755
TX	Dallas, M. Hutton Co.	214-484-0580

ASTROSYN AMERICA, 14349 Victory Blvd., Ste. 304, Van Nuys, CA 91401, Tel: 213-785-2197, Telex: 651446; *Sls. Mgr.:* D. F. Dowis; *Dist. Mgr.:* D. F. Dowis

asi

ASTROSYSTEMS, 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600, TWX: 510-223-0411; Empl.: 150; *Sls. Mgr.:* James R. Boyer ....**3**•1189, 1504, 1817

Local Sales Offices & Reps

AL	Huntsville, Kemp Engrg.	205-837-4304
AR	El Dorado, Indust. Controls Assoc.	501-862-2051
CA	Cerritos, Foxco Equip.	213-921-3421
CO	Englewood, Dynatech	303-773-2830
CO	Englewood, Dynatech	303-773-2830
FL	Sanibel, Motion Products	813-472-0066
GA	Atlanta, Kemp Instrs.	404-452-8050
GA	Doraville, Kemp Inst.	404-938-5973
IL	Elgin, JHS Assocs.	312-741-9070
IN	Mishawaka, Engineered Sls.	219-255-5111
MD	Bethesda, Multi-Measurements, Inc.	301-889-0471
MI	Detroit, Static Controls Corp.	313-537-2975
MI	Walled Lake, Static Controls Corp.	313-363-4500
MS	Industrial, Controls Assoc.	501-862-2051
NC	Charlotte, Jake Rudisill Assoc. Inc.	704-377-6901
OH	Cleveland, Instr. Sys.	216-845-8800
OH	Dayton, Instr. Sys.	513-294-2838
OK	Tulsa, Industrial Controls Assoc.	501-862-2051
PA	Pittsburgh, Instrumentation Sys.	412-243-1111
PA	Warminster, Multi-Measurements	215-675-3082
TX	Fort Worth, Indust. Controls Assoc.	501-862-2051
TX	Houston, Indust. Controls Assoc.	501-862-2051
WA	Bothell, Pacific N.W. Controls Inc.	206-821-0448

ASTRO TOOL CO., INC., 21615 Southwest Tualatin Valley Hwy., Beaverton, OR 97006, Tel: 503-642-9853

AT&T, 475 South St., Morristown, NJ 07960, Tel: 201-631-6790; *Sls. Mgr.:* D. J. Liedberg

Local Sales Offices & Reps

CA	Sunnyvale	408-746-2332
CO	Denver	303-538-2406
GA	Atlanta	404-257-6495
MA	Burlington	617-229-5672
MN	Minneapolis	612-724-2019
NJ	Morristown	201-631-6790
OH	Columbus	614-860-5155
PA	King of Prussia	215-768-2626

ATEC, Box 19426, 8219 Kempwood Dr., Houston, TX 77055, Tel: 713-468-7971, Telex: 77-4132 FLEKS HOU; FSC No.: 09552; Empl.: 80; *Sls. Mgr.:* F. Sawberger

A-SYSTEMS INC., Box 13, Ivy, VA 22945, Tel: 804-295-7200; *Sls. Mgr.:* F. M. Artrip

ATEC SYS., 107 N. Washington St., E. Rochester, NY 14445, Tel: 716-381-4740; Empl.: 6; *Sls. Mgr.:* Harry Turner

ATHENA CONTROLS, INC., 5145 Campus Dr., Whitemarsh Ind. Campus, Plymouth Meeting, PA 19462, Tel: 215-828-2490; Empl.: 85; *Sls. Mgr.:* David A. Tryon; *Dist. Mgr.:* Allen Breckenridge

ATKINS TECH., 3321 S.W. 40th Blvd., Gainesville, FL 32608, Tel: 904-378-5555, Telex: 51-4736-HALA; Empl.: 30; *Sls. Mgr.:* Walter Fitz-William; *Dist. Mgr.:* Walter Fitz-William

ATLANTIC MAGNETICS, INC., P.O. Box 4127, Margate, FL 33063, Tel: 305-492-5196; *Sls. Mgr.:* Edward Cammarata; *Dist. Mgr.:* Rolando Marrero

ATLANTIC OPTICAL MOULDING, Ellis St., P.O. Box 309, Dudley, MA 01570, Tel: 617-943-1746; Empl.: 6

ATLANTIC RESEARCH, 5390 Cherokee Ave., Alexandria, VA 22312, Tel: 703-642-4000, Telex: 248893; FSC No.: 95335; Empl.: 2000

ATLANTIC
SCIENTIFIC CORPORATION

ATLANTIC SCIENTIFIC CORP., 2711 S. Harbour City Blvd., Melbourne, FL 32901, Tel: 305-725-8000, Telex: 755959; *Sls. Mgr.:* Murray W. Boggs .... **1B**•1257

Local Sales Offices & Reps

AZ	Phoenix, R. A. Mayes Co.	602-279-5243
CO	Englewood, R. A. Mayes Co.	303-761-9447
CT	Mt. Carmel, Scientific Dvcs.	203-248-9361
MA	Waltham, Scientific Dvcs.	617-890-2252
NM	Albuquerque, R. A. Mayes Co.	505-292-2330
NY	Albany, H. C. Johnson Agencies Inc.	518-459-1239
NY	Buffalo, H. C. Johnson Agencies Inc.	716-632-7880
NY	Rochester, H. C. Johnson Agencies Inc.	716-586-0777

Distributor

ATLANTIC SWITCH CONTROLS, INC., 194 Elliott St., Hartford, CT 06114, Tel: 203-527-7705 .... **1B**•1742

ATLANTIC SWITCH CONTROLS, INC., 5 Coliseum Ave., Nashua, NH 03063, Tel: 603-880-1971 .... **1B**•1742

ATLAS
ENERGY SYSTEMS

ATLAS ENERGY SYS., 9457 Rush St., S. El Monte, CA 91733, Tel: 213-575-0755, TWX: 910-587-3531; Empl.: 35; *Sls. Mgr.:* J. Thompson .... **3**•1826

Local Sales Offices & Reps

CA	Santa Ana	714-953-9645
CA	Santa Clara	408-988-5386
IL	Chicago	312-372-2237
MA	Boston	617-492-2525

ATLAS ENGRG. CORP., 10 Cheney St., Dorchester, MA 02121, Tel: 617-445-7100; FSC No.: 07001; Empl.: 75; *Sls. Mgr.:* Norman Scotch

ATLAS EYELETS, Pinkham St., Fairhaven, MA 02719, Tel: 617-997-9491; *Sls. Mgr.:* Arthur S. Tisch

ATLAS SOUND DIV., 10 Pomeroy Rd., Parsippany, NJ 07054, Tel: 201-887-7800, Telex: 13-6119; Empl.: 350; *Sls. Mgr.:* H. M. Jaffe; *Dist. Mgr.:* David A. Chambers

ATLEE

ATLEE INC., One Gill St., Woburn, MA 01801, Tel: 617-933-3510, Telex: 949407; FSC No.: 99378; Empl.: 40; *Sls. Mgr.:* Leon Kadis ......**1B**•1259; **2**•1009, 1859, 1875, 1904

Local Sales Offices & Reps

CA	Agoura, Cal Rep	213-991-1940
CA	Corte Madera, Paul Oneal Assoc.	415-924-1691
CO	Arvada, Challange Sls.	303-427-3149
FL	Melbourne, R-Rep	305-725-6993
MD	Baltimore, Stitzer Assocs.	301-823-7688
MN	St. Paul, Countryman Assoc	612-645-9151
NY	Huntington, C. R. Mayer Co.	516-921-7876
NY	Rochester, Net Sls.	716-467-4538
NC	Raleigh, B. T. Funderburk	919-782-3493
OH	Cleveland, Techn. Sls. Assocs.	216-461-0826
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Dallas, Rem-Air Comp. Corp.	214-234-1069

Local Distributors

AZ	Phoenix, EGR	602-840-0320
CA	Northridge, Acort Inds.	213-993-6444
CA	San Jose, Afcom	408-263-0660
CA	San Jose, Bisco Inds.	408-946-8980
IN	Ft. Wayne, Graham Elec. Supp.	219-423-3422
IA	Cedar Rapids, Deeco	319-365-7551
MA	Winchester, Rush Inds.	617-729-5800
MN	Minneapolis, Aerospace Computer	612-884-4725
NJ	Nutley, Essex Electric	201-661-2600
NJ	Paramus, N.Y. Fastener	201-265-8770
NY	Bayshore, Merrit Fastener	516-242-1800
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Dist.	716-887-2800
NY	Long Island City, Hardware Specialty	212-361-9393
NY	Plainview, G & B Fastener	516-694-0990
NY	Plainview, G & B Fasteners	516-694-0990
TX	Dallas, National Precision	214-357-3921
TX	Richardson, Altair Co.	214-231-5166
VA	Charlottesville, Virginia Radio Supp. Co.	804-296-4184

ATMOSPHERE CONTROLS PRODS., 295 Polaris, Mountain View, CA 94043, Tel: 415-969-2640; Empl.: 14; *Sls. Mgr.:* Walter Quave Jr.; *Dist. Mgr.:* W. H. Ellis

ATR ELCTRNS., INC., 280 E. Lafayette Frontage Rd., St. Paul, MN 55107, Tel: 612-222-3791; *Dist. Mgr.:* R. D. Van Valin .... **3**•1827

ATV RESEARCH, INC., 1301 Broadway, Dakota City, NE 68731, Tel: 402-987-3771; *Sls. Mgr.:* Mel Shadbolt

AUBURN MFG., Pease Ave. & Stack St., Middletown, CT 06457, Tel: 203-346-6677; Empl.: 45; *Sls. Mgr.:* Richard Agria

AUDIO EQUIP., Div. W. Kidde & Co., Inc., 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 510-587-5461; Empl.: 50

AUDIOSEARS, South St., Stamford, NY 12167, Tel: 607-652-7305; FSC No.: 97101; Empl.: 140; *Sls. Mgr.:* D. Hartwell

AUDIOSONE, INC., 617 Fan Hill Rd., Monroe, CT 06468, Tel: 203-268-4372, 800-243-8160; *Sls. Mgr.:* Rudolph Duris

AUDIOTRONICS CORP., 7428 Bellaire Ave., N. Hollywood, CA 91605, Tel: 818-765-2645, Telex: 69-1241; Empl.: 300; *Sls. Mgr.:* Roy Schaub

AUDIOVOX CORP., 150 Marcus Blvd., Hauppage, NY 11787

AUGAT INC., 33 Perry Ave., Box 779, Attleboro, MA 02703, Tel: 617-222-2202, TWX: 710-391-0644; FSC No.: 91506; Empl.: 3,200; *Sls. Mgr.:* Jim Fuchs; *Dist. Mgr.:* William Hall ....**2**•1162, 1163, 1876-1879

Local Sales Offices & Reps

AL	Huntsville, Glen White Assocs.	205-883-7938
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CA	Santa Clara, Augat Sls.	408-980-0955
CO	Littleton, Simpson Assocs.	303-794-8381
FL	Castleberry, Augat Sls.	305-339-3724
FL	Safety Harbor, Augat Sls.	813-725-1037
FL	Tamarac, Augat Sls.	305-721-6021
GA	Norcross, Glen White Assocs.	404-441-1447
HI	Honolulu, Hawaii Elctrns. Sls. & Svc.	808-845-8207
IL	Rolling Meadows, Sumer	312-991-8500
IA	Davenport, Ensco-Rep. Inc.	319-386-6600
KS	Overland Park, Ensco-Rep, Inc.	913-381-7557
KS	Wichita, Ensco-Rep. Inc.	316-683-1070
MD	Silver Spring, NKA Inc. (Govt.)	301-585-6141
MA	Norwood, Augat Sls.	617-762-3164
MI	Detroit, Rathsburg Assocs.	313-882-1717
MN	Edina, Augat Sls.	612-925-0255
MO	Maryland Hts., Ensco-Rep. Inc.	314-423-3935
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Maple Shade, NKA Inc. (Govt.)	609-234-4008
NM	Albuquerque, C. T. Carlberg Assoc.	505-888-3883
NY	Mt. Vernon, D. Sonkin Assocs.	914-668-9809
NY	N. Syracuse, L. D. Allen, Inc.	315-437-8387
NC	Raleigh, Glen White Assocs.	919-787-7016
OH	Dayton, NKA, Inc.	513-268-8771
OH	Englewood, A. Nace Co.	513-836-0931
OH	Richfield, A. Nace Co.	216-659-7178
TN	Gray, Glen White Assocs.	615-447-8850
TX	Houston, Augat Sls.	713-495-3100
TX	Richardson, Augat Sls.	214-235-7166
UT	Midvale, Simpson Assocs.	801-566-3691
VA	Lynchburg, Glen White Assocs.	804-237-6291
WA	Bellevue, Augat Sls.	206-455-2846
WI	Brookfield, Sumer Inc.	414-784-6641

AUGAT/ALCOSWITCH, See Alco Elctrn. Prods., Inc.

AUGAT/ES•P, INC., 12832 Chadron Ave., Hawthorne, CA 90250, Tel: 213-973-0262, Telex: 66-4467; Empl.: 85

AUGAT FIBEROPTICS, 40 Perry Ave., Attleboro, MA 02703, Tel: 617-222-2202, TWX: 710-391-0644; *Sls. Mgr.:* Bob Goecheler; *Dist. Mgr.:* Bill Hall

AULT, INC.

AULT, INCORPORATED, 1600 Freeway Blvd., Minneapolis, MN 55430, Tel: 612-560-9300, TWX: 910-756-3435; Empl.: 450; *Sls. Mgr.:* Dennis Getter ....3•1502, 1503

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
AZ	Scottsdale, DAR-C, Inc.	602-948-2240
CA	Los Angeles, West Elctrn. Sls.	714-898-0120
CA	San Diego, Dick West & Assocs.	619-233-0236
CA	Santa Clara, Magna Sls.	408-727-8753
CO	Denver, William J. Purdy	303-777-1411
CT	Manchester, G/M Assocs.	203-646-4443
FL	Ft. Lauderdale, QXI, Inc.	305-485-6030
FL	St. Petersburg, QXI, Inc.	813-821-2281
GA	Atlanta, L & D, Inc.	404-455-3483
IL	Arlington Hgts., MSI	312-956-1000
IN	Indianapolis, McFadden Sls.	614-459-1280
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Framingham, G/M Assocs.	617-872-4871
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MO	St. Louis, Beams Co.	314-569-1060
NV	Carson City, Magna Sls.	702-883-1471
NH	Exeter, G/M Assocs.	603-778-7472
NJ	Ocean, P. Saftler Assoc.	201-922-3014
NY	Lynbrook, P. Saftler Assoc.	516-593-7880
NC	Greensboro, L & D, Inc.	919-292-3201
OH	Cleveland, Lyons Corp.	216-659-9224
OH	Dayton, E. Lyons Co.	513-278-0714
OR	Portland, Jas. J. Bacher Co.	503-297-8744
PA	Philadelphia, Samuel K. MacDonald, Inc.	215-545-1205
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-840-0590
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

CA	Cincinnati, Hughes Peters	513-351-2000
CA	Mountain View, USI Elctrn. Comps.	415-969-5420
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Santa Monica, Distr. Specialists	213-393-9666
CA	Van Nuys, Natl. Electro Sls. Corp.	213-781-0505
IL	Downers Grove, JaBro Batteries	312-964-9358
MA	Sharon, Adcour	617-784-8123
MO	St. Charles, Finnigan Elctrns.	314-946-6201
Can	St. Laurent, Quebec, Tech-Rep Elctrns. Ltd.	514-337-6046

AURA MFG., 50 McDermott Rd., New Haven, CT 06473, Tel: 203-777-2541; Empl.: 150; *Sls. Mgr.:* Joe Abbatiello

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100; Empl.: 35

AUSTRON, INC., P.O. Box 14766, Exit 248 N. IH 35, Austin, TX 78761, Tel: 512-251-2313, TWX: 910-874-1356; FSC No.: 24672; Empl.: 153; *Sls. Mgr.:* R. Ellis ....1A•1314, 1315

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices - SE	205-536-1969
AZ	Scottsdale, Territorial Mktg.	602-994-8665
CA	Goleta, Thorson Co.	805-964-8751
CA	Pleasant Hill, Austron	415-930-7268
CA	San Carlos, Westronics Assocs.	415-592-1417
CA	San Diego, Thorson Co.	619-292-8525
CA	Signal Hill, Thorson Co.	213-595-0361
CT	Southington, Scheinfein Assocs.	203-621-3492
FL	Orlando, Sci. Devices - SE	305-841-8180
FL	Shalimar, Sci. Devices - SE	904-651-4407
GA	Atlanta, Sci. Devices-SE	404-452-8709
IL	Elk Grove, Loren Green Assoc.	312-593-0282
IN	Indianapolis, Loren Green Assoc.	317-293-9827
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Union Lake, Ashby Assocs.	313-363-1100
MN	Minneapolis, Loren Green Assoc.	612-571-6666
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NY	Huntington, CDB Entprs.	516-692-5200
NC	Winston Salem, Sci. Devices-SE	919-765-5766
OH	Dayton, Ashby Assocs.	513-252-5627
OH	Lyndhurst, Ashby Assocs.	216-461-0826
OR	Portland, Cascade Data Mktg.	503-641-9266
PA	Plymouth Meeting, Sci. Devices - Phila.	215-825-9515
TX	Houston, Sci. Devices - Gulfcoast	713-864-1711
TX	Richardson, Sci. Devices - SW	214-231-8106
VA	McLean, Austron	703-734-1990
WA	Woodinville, Cascade Data Mktg.	206-788-3421

AUTOMATED PROD. EQUIP. CORP., 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120; FSC No.: 57216; *Sls. Mgr.:* Edward F. Farnham; *Dist. Mgr.:* Edward F. Farnham

AUTOMATIC COIL CORP., Sub. Designatronics, Inc., 455 E. 10th Ave., Hialeah, FL 33010, Tel: 305-883-5311, TWX: 810-848-8097; Empl.: 125 ....1A•1221-1223, 1451-1453

Local Sales Offices & Reps

AL	Huntsville, CRS Elctrns.	205-533-2444
CA	Huntington Beach, Mil-Com Sls.	714-840-2424
GA	Atlanta, CRS Elctrns., Inc.	404-396-3720
IL	Palatine, T-Squared Assocs.	312-999-2144
MA	Manchester, Allard, Galagan & Assoc.	617-526-7733
NY	Brooklyn, Irv Morse Sls.	212-444-4974
OH	Dayton, Rockford Controls Ohio, Inc.	513-898-5452
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
OK	Broken Arrow, Genzel Sls. & Assoc., Inc.	918-258-8656

AUTOMATIC Connector, Inc.

AUTOMATIC CONNECTOR, INC., 400 Moreland Rd., Commack, NY 11725, Tel: 516-543-5000, TWX: 510-226-3744; FSC No.: 94375; Empl.: 250; *Sls. Mgr.:* William Pitcher

Local Sales Offices & Reps

AZ	Tucson, WJM Sls.	602-888-4847
CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
CA	Garden Grove, Elsco Elctrns.	714-891-4621
CA	San Diego, Elsco Elctrns.	714-292-1771
CO	Boulder, Comp. Prods. Sls.	303-530-2800
CT	Bridgeport, Millennium Elctrn. Sls.	203-372-2037
FL	Clearwater, Brennan Assoc.	813-446-5006
FL	Melbourne, Brennan Assoc.	305-724-0854
GA	Atlanta, Brennan Assoc.	404-996-6623
IL	Westchester, WG Controls	312-344-0690
IN	Ft. Wayne, Given Corp.	219-432-5585
MD	Union, Jedco Elctrn. Sls.	201-355-0474
MA	Woburn, Component Technology	617-933-5390
MO	St. Louis, R. F. Carlson Co.	314-961-4485
NJ	Haddonfield, Sunday - O'Brien	609-429-4013
NJ	Ho-Ho-Kus, J&B Assocs.	201-447-0126
NJ	Union, Jedco Elctrn. Sls.	201-355-0474
NM	Albuquerque, WJM Sls.	505-898-5917
NY	Buffalo, Quality Comp.	716-837-5430
NY	Manlius, Quality Comp.	315-682-8885
NY	Mt. Vernon, Sonkin Assoc.	914-668-9809
NC	Raleigh, B. T. Funderburk	919-782-3493
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Kettering, Government Bidders Svc.	513-296-5991
OH	Vandalia, Stegman Blaine Mktg.	513-890-7975
TX	El Paso, WJM Sls.	915-566-4628
TX	Houston, Aid Elctrns.	713-777-3882
TX	Irving, Aid Elctrns.	214-259-4761
UT	Salt Lake City, Comp. Prods. Sls.	801-262-0000
WA	Bellevue, Venture Elctrn.	206-454-4594

AUTOMATIC TEST SYSTEMS, 23 Poplar St., Malden, MA 02148, Tel: 617-322-1107

AUTOMATIC TIMING & CONTROLS CO., 201 So. Gulph Rd., King of Prussia, PA 19406, Tel: 215-337-5500, 800-441-8245, Telex: 84-6437; Empl.: 300; *Sls. Mgr.:* V. C. McMahon ....3•1123

Local Sales Offices & Reps

AZ	Phoenix, Portis & Assocs.	602-947-4379
CA	Gardena, Instrument Lab.	213-327-3282
CA	San Francisco, Automated Process Controls	415-467-6162
CO	Englewood, E & M Sls.	303-761-6202
FL	Lakeland, A.A. Elec. Div.	813-665-6941
GA	Norcross, A.A.Electric Div. of AEC	404-449-8670
IL	Glen Ellyn, Rockford Controls	312-469-6016
IN	Indianapolis, Rockford Controls	317-248-2518
KY	Louisville, Air-Hydro Power	502-451-1000
LA	New Orleans, Mid South Sls.	504-641-7480
MD	Baltimore, Jobe & Co.	301-327-0220
MA	Hingham, Hingham Bay Corp.	617-749-8700
MI	Brighton, H. H. Barnum Co.	313-229-2961
MN	Minneapolis, Automated Controls	612-941-4092
MO	Kansas City, Duncan Sls. & Engrg.	816-356-1888
MO	St. Louis, E. Mooney Co.	314-878-9910
NE	Omaha, Lakeland Engrg. Equipt.	402-734-2600
NJ	Newark, Norman Bragar Co.	201-344-1100
NM	Albuquerque, E & M Sls.	505-883-8955
NY	Buffalo, Niagara Electric Sls.	716-886-4000
NY	Rochester, Niagara Electric Sls.	716-271-1223
NY	Syracuse, Niagara Elec. Sls.	315-437-1656
NC	Charlotte, Brown & Morrison	704-554-8570
OH	Cincinnati, Anderson-Bolds	513-528-5680
OH	Cleveland, Anderson-Bolds	216-229-4700
OH	Worthington, Anderson-Bolds	614-885-3933
OK	Tulsa, Driscoll Automatic Control	918-747-6625
OR	Portland, Coons Western	503-295-0411
PA	King of Prussia, Applied Controls	215-265-3832
PA	Pittsburgh, Gilson Engrg. Sls.	412-931-6114
TX	Houston, Gettys-Eads-Adair	713-781-3005
UT	Salt Lake City, Control Equip.	801-487-7741
VA	Richmond, Jobe & Co.	804-282-6508
WA	Seattle, J. A. Tudor & Assoc.	206-682-7444
WA	Spokane, J. A. Tudor & Assoc.	509-327-3328
WI	Cedarburg, Automation Engrg.	414-377-7500

AUTOMATION ASSOCS., 1212 Westheimer #120, Austin, TX 78752, Tel: 512-458-4412

AUTOMATION DISPLAYS INC., 3833 N. White Ave., Eau Claire, WI 54701, Tel: 715-834-9595; Empl.: 38

Local Sales Offices & Reps

AZ	Scottsdale, Al Meurer Co.	602-941-4848
GA	Atlanta, Secom Sys.	404-434-8101
IN	Indianapolis, GEB Controls Group Inc.	317-271-9008
MA	Norwell, Besco	617-659-4915
MN	Minneapolis, Countryman Assocs.	612-645-9151
NY	New York, Friedman-Smith Elctrn. Sls.	914-664-4866
TX	Dallas, Jacobson Co.	214-363-7584
WA	Bellevue, Hudson Co.	206-455-0773

AUTOMATION DYNAMICS, 77 Brookside Pl., Hillsdale, NJ 07642, Tel: 201-666-2458; FSC No.: 53089; Empl.: 40

AUTOMATION COMPONENTS, INC., One Short Ave., Peckville, PA 18452, Tel: 717-489-7508

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, Telex: 775-959

AUTOMATION UNLTD., 10H Roessler Rd., Woburn, MA 01801, Tel: 617-933-7288, Telex: 949329; *Sls. Mgr.:* Stephen A. Gould

AUTOSPLICE, INC., 59-12, 37th Ave, Woodside, NY 11377, Tel: 212-429-0500, Telex: 420902, TWX: 968171; Empl.: 86; *Sls. Mgr.:* O. Nedelkovich

Local Sales Offices & Reps

CA	Glendale, Tooltronics	213-240-4000
CA	San Diego, Autosplice West	619-560-0571
CA	Santa Clara, Tooltronics	408-496-6000
IL	Chicago, Schiffer Assoc.	312-847-2400
IN	Fort Wayne, Menze Sls.	219-747-5616
MA	Cambridge, Autosplice Northeast	617-576-3838

AUTO-SWAGE PRODS., 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, Telex: 963-542; Empl.: 170; *Sls. Mgr.:* R. Mikulsky ....2•1860

Local Sales Offices & Reps

CA	Glendale, Haldeman & Frazier	213-247-3330
CO	Denver, Regional Sls. Co.	303-433-7397
CT	Newtown, Yankee Engrg.	203-426-5679
FL	Boca Raton, F/G Assocs.	305-395-3907
IL	Barrington, Perhats Assocs.	312-381-6360
IN	Greensburg, H. K. Feaster Assocs.	812-663-5689
MN	Minneapolis, W. R. Maleckar Co.	612-926-7601
MO	St. Louis, Meiners Sls.	314-383-4833
NY	Rochester, Antil-Thrasher Assoc.	315-468-2370
OH	Chagrin Falls, Bray Assocs.	216-247-4474
PA	Broomall, AM Tech. Sls. Co.	215-356-0574
SC	Fort Mills, Eagle Sales, Inc.	803-548-2222
EXP	NY, New York, Lang & Zysk	212-227-1743

AUTOTROL, P.O. Box 557, Crystal Lake, IL 60014, Tel: 815-459-3080, Telex: 72-2417; Empl.: 140; *Sls. Mgr.:* Gerald L. Adair

AUTO-TROL TECH., 12500 N. Washington St., Denver, CO 80233, Tel: 303-452-4919, TWX: 910-320-0772; Empl.: 600; *Sls. Mgr.:* Jim Norrod

AUTRONICS, 314 E. Live Oak, Ste. A, Arcadia, CA 91006, Tel: 818-445-5470, TWX: 910-582-3216; FSC No.: 03972; Empl.: 65

Local Sales Offices & Reps

CA	Fullerton, Hawk Assocs.	714-773-4152
CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Westlake Village, Jayess Co.	213-991-0632
TX	Richardson, Scientific Sls. & Svcs.	214-231-6541
WA	Bellevue, Thorson Northwest	206-455-9180

AVA INSTRMN., INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, Telex: 357403 AVA; FSC No.: 61933; Empl.: 6; *Sls. Mgr.:* Allan Hughes

Local Sales Offices & Reps

CA	Encino, King Eng.	213-995-7271
CA	San Jose, Data Rep.	408-279-1212
MA	Andover, PC Associates	617-475-3298
NY	NY, Hartford, PDQ Assocs.	315-768-8167
PA	Huntingdon Valley, Lynbar Group	215-947-3554

AVANTEK, INC., 3175 Bowers Ave., Santa Clara, CA 95051, Tel: 408-496-6710, Telex: 34-6337, TWX: 910-339-9274; Empl.: 2268

Local Distributors

AL	Huntsville, CDI Branch Off.	205-883-7501
AZ	Scottsdale, Spirit Elctrns.	602-998-1533
CA	Los Altos, Pen Stock Co.	415-948-6552
CA	Los Angeles, Sertek, Inc.	213-477-9051
CA	Orange, Sertek, Inc.	714-997-7311
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
IL	Arlington Heights, Peak Distrs.	312-255-0707
IN	Indianapolis, Peak Distrs.	317-247-1316
MD	Beltsville, Applied Specialties	301-595-5393
NC	Raleigh, CDI Branch Off.	919-781-0262

AVCO-ELCTRNS. DIV., 4807 Bradford Dr., Huntsville, AL 35805, Tel: 205-837-6500, TWX: 810-726-2240; Empl.: 700; *Sls. Mgr.:* Jim Pool and David Helms

AVEL-LINDBERG INC., Peacock Alley 116, 1 Padanaram Rd., Danbury, CT 06810, Tel: 203-797-8698, TWX: 710-456-9984; Empl.: 4; *Sls. Mgr.:* Harvey R. Snider

Advertisement

Off-the-shelf and custom designed transformers for low radiated noise, high efficiency and smaller size and weight. Toroidal transformers in ratings from 15 VA to 1900 VA are offered in the "Budget", open style or encapsulated in a polycarbonate case. The "On-Board" range, PCB styled miniatures, bobbin wound for close card spacing in ratings from 2 VA to 30 VA.

Local Distributors

CT	Wallingford, Sager Elctrl. Supp. Co.	203-265-4600
MA	Hingham, Sager Electrical Supp. Co.	617-749-6700
NY	New York, Martin Audio/Video Corp.	212-541-5900

AVEX ELCTRNS., 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-3300; FSC No.: 58414; *Sls. Mgr.:* Mike Battery Batley; *Dist. Mgr.:* Mike Batley .... **3**•1403

AVIBANK MFG., 210 S. Victory Blvd., Burbank, CA 91503, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 330; *Sls. Mgr.:* D. Ladin

AVIONIC INSTRS., 943 E. Hazelwood Ave., Rahway, NJ 07065, Tel: 201-388-3500, Telex: 844413; Empl.: 42; *Sls. Mgr.:* Wallace J. Izzo; *Dist. Mgr.:* Wallace J. Izzo .... **3**•1828, 1829

Local Sales Offices & Reps

EXP	NJ, Rahway, REA Intl. Ltd.	201-382-7100

AVIONICS, Box 200, Niagara-On-Lake, ON , Canada, Tel: 416-468-3632; Empl.: 25

AVTEL DIV., UNITRON INC., 2826 W. Kingsley Rd., Dept. G, Garland, TX 75041, Tel: 214-271-4531, Telex: 73-0644; FSC No.: 6130; Empl.: 95; *Sls. Mgr.:* R. L. Beutel .... **3**•1831, 1832

Local Sales Offices & Reps

CA	Sunland, Unitron (Jim Crevier)	818-352-7348
GA	Byron, Unitron (Joe Joiner)	912-956-2866
PA	Lansdowne, Unitron (Douglas S. Feisler)	215-622-4811

AVX CORPORATION, Box 867, Myrtle Bch., SC 29577, Tel: 803-448-9411, TWX: 810-661-2252; FSC No.: 9K916; *Sls. Mgr.:* John Winn; *Dist. Mgr.:* George Lees .... **1A**•1002, 1010-1014; **1B**•1002, 1008, 1009

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Interstate Mktg.	602-244-9050
AR	Little Rock, Beacon Elctrns.	501-224-5449
CA	San Diego, Interstate Mktg.	619-292-8117
CA	San Jose, Quadrep Inc.	408-946-4000
CA	Woodland Hills, Interstate Mktg. Assocs.	213-883-7606
CO	Denver, Elcom	303-337-2300
FL	Clearwater, Dyne-a-Mark	813-441-4702
FL	Fort Lauderdale, Dyne-a-Mark	305-771-6501
FL	Maitland, Dyne-a-Mark	305-831-2097
FL	Palm Bay, Dyne-a-Mark	305-727-0192
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Highland Park, T.B. Hunter Assocs.	312-433-7000
IN	Ft. Wayne, F.J. Campisano Co.	219-747-2633
IN	Indianapolis, Frank J. Campisano	317-253-7651
IA	Cedar Rapids, Comstrand	319-377-1575
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Lexington, J.E. Boeing Co.	617-862-2500
MI	Grand Rapids, J.L. Montgomery	616-774-9308
MI	Southfield, J.L. Montgomery	313-358-2616
MN	Minneapolis, Comstrand Inc.	612-788-9234
MO	Grandview, Beneke & McCaul	816-765-2998
NJ	Bellmawr, Thomas Assoc.	609-933-2600
NM	Albuquerque, Thorson Co.	505-293-8555
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NC	Raleigh, Tingen Technical Sales	919-781-1100
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OH	Cleveland, Frank J. Campisano	216-749-5550
OH	Dayton, Schmidt & Assoc.	513-293-6652
OK	Oklahoma City, Ammon & Rizos	405-942-2552
OR	Hillsboro, Western Tech. Sls.	503-640-4621
PA	Coraopolis, F.J. Campisano Co.	412-264-5151
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Dallas, Ammon & Rizos Co.	214-644-5591
TX	Houston, Ammon & Rizos Co.	713-781-6240
UT	Salt Lake City, Elcom, Inc.	801-532-7940
VA	Lynchburg, Burgin-Kreh Assoc.	804-239-2626
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Techn. Sls.	509-922-7600

Local Distributors

AL	Huntsville, R. M. Elctrns.	205-852-1550
AZ	Phoenix, TTI	602-966-1616
AZ	Phoenix, Kierulff Elctrns.	602-243-4101
AZ	Phoenix, Wyle Distr.	602-249-2232
AZ	Tempe, Arrow Elctrns.	910-950-2019
CA	Chatsworth, IEC	213-998-2200
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Chatsworth, IEC Elctrns.	213-998-2200
CA	El Monte, Marshall Elctrns	818-442-7204
CA	El Segundo, Wyle Distribution Grp.	213-322-8100
CA	Hayward, Arrow Dist. Center	415-487-4300
CA	Irvine, Wyle Dist. Gp.	714-863-9953
CA	Irvine, IEC	714-660-1055
CA	Irvine, Marshall Elctrns	714-556-6400
CA	Irvine, Wyle Distr. Grp.	714-863-9953
CA	Los Angeles, Kierulff Elctrns.	213-725-0325
CA	N. Hollywood, T.T.I.	818-982-0201
CA	Rancho Cordous, Wyle Dist. Gp.	916-638-5252
CA	Sacramento, IEC	916-424-5297
CA	San Diego, Kieruff Elctrns.	714-278-2112
CA	San Diego, Wyle Distr.	619-565-9171
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Jose, Cetec Elctrns.	408-263-7373
CA	San Jose, Eric Elctrns.	408-262-1111
CA	San Jose, IEC	408-263-1100
CA	Santa Clara, Wyle Distr.	408-727-2500
CA	Southgate, Cetec Elctrns.	213-773-6521
CA	Sun Valley, Q.C. Components	213-768-6111
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Tustin, Arrow Elctrns.	714-838-5422
CA	Tustin, Kierulff Elctrns.	714-731-5711
CO	Denver, IEC	303-292-6121
CO	Denver, Arrow Elctrns.	303-758-2100
CO	Denver, Kierulff Elctrns.	303-371-6500
CO	Thornton, Wyle Dist. Gp.	303-457-9953
CT	E. Haven, J. V. Elctrns.	203-469-2321
CT	Wallingford, Marshall Elctrns.	203-265-3822
CT	Wallingford, Kierulff Elctrns.	203-265-1115
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Orlando, Marshall Elctrns.	305-841-1878
FL	Orlando, T.T.I.	305-859-1000
FL	Palm Bay, Arrow Elctrns.	305-725-1480
FL	St. Petersburg, Kierulff Elctrns.	813-576-1966
GA	Norcross, Kierulff Elctrns.	800-241-0560
GA	Norcross, Marshall Elctrns.	404-923-5750
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Elk Grove, Kierulff Elctrns.	312-640-0200
IL	Lombard, RM Elctrns.	312-932-5150
IL	Schaumburg, Marshall Elctrns.	314-490-0155
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, RM Elctrns.	317-247-9701
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Gaithersburg, Marshall Elctrns.	301-840-9450
MD	Rockville, M.S. Elctrns.	301-340-6400
MA	Wakefield, MCI	617-245-5967
MA	Westboro, Future Elctrns.	617-366-2400
MA	Wilmington, RC Components	617-273-1860
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Grand Rapids, Arrow Elctrns.	616-243-0912
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, Marshall Elctrns.	313-525-5850
MN	Edina, Kierulff Elctrns.	612-941-7500
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Plymouth, Marshall Elctrns.	612-559-2211
MO	Maryland Hgts., Kierulff Elctrns.	314-739-0855
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Fairfield, Marshall Elctrns.	201-882-0320
NJ	Fairfield, Arrow Elctrns.	201-797-5800
NJ	Marlton, Arrow Elctrns.	609-596-8000
NJ	Mt. Laurel, Marshall Elctrns.	609-234-9100
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Bohemia, TTI	516-567-1500
NY	E. Farmingdale, Tri-Start	516-293-0400
NY	Endwell, Marshall Industries	607-754-1570
NY	Hauppague, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Marshall Industries	516-273-2424
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Liverpool, Arrow Elctrns	315-652-1000
NY	Lynbrook, Patriot	516-599-8881
NY	Melville, Arrow Elctrns.	516-391-1484
NY	Rochester, Marshall Industries	716-235-7620
NY	Rochester, Arrow Elctrns.	716-275-0300
NC	Greensboro, Kierulff Elctrns.	919-852-9440
NC	Raleigh, Kierulff Elctrns.	919-872-8410
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston Salem, Arrow Elctrns.	919-725-8711
OH	Akron, Akron	216-762-8818
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cleveland, Kierulff Elctrns.	216-587-6558
OH	Dayton, Marshall Elctrns.	513-236-8088
OH	Solon, Arrow Elctrns.	216-248-3990
OK	Tulsa, Kierulff Elctrns.	918-252-7537
OK	Tulsa, Arrow Elctrns.	918-665-7700
OR	Tigard, Arrow Elctrns.	503-684-1690
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Philadelphia, Almo Elctrns.	215-698-4000
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Austin, Kierulff Elctrns.	512-835-2090
TX	Dallas, Kierulff Elctrns.	214-343-2400
TX	Dallas, R.M. Elctrns.	214-235-3100
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Ft. Worth, T.T.I.	817-429-1440
TX	Houston, Kierulff Elctrns.	713-530-7030
TX	Richardson, Jaco	214-235-9575
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	N. Salt Lake City, IEC	801-298-1868
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
UT	Salt Lake City, Kierulff Elctrns.	801-973-6913
WA	Bellevue, Arrow Elctrns.	206-643-4800
WA	Bellevue, Wyle Elctrns.	206-453-8300
WA	Bellevue, IEC	206-455-2727
WI	New Berlin, R.M. Elctrns.	414-784-4420
WI	Oak Creek, Arrow Elctrns.	414-764-6600

AXEL ELCTRNS., 134-20 Jamaica Ave., Jamaica, NY 11418, Tel: 212-291-3900, TWX: 710-582-2618; FSC No.: 13058; Empl.: 210; *Sls. Mgr.:* J. Alaimo

AXIAL MAGNETICS, 6600 Whitaker Ave., Van Nuys, CA 91406, Tel: 818-994-3346

AXIOM CORP., 1014 Griswold Ave., San Fernando, CA 91340, Tel: 213-365-9521

AXIS, INC.

AXIS, INC., 7825 Engineer Rd., Ste. 208, San Diego, CA 92111, Tel: 619-560-7737; FSC No.: 9S849; Empl.: 12; *Sls. Mgr.:* Mark J. Prager ....2•1010

Local Sales Offices & Reps

FL	St. Petersburg, Southern Engrg. Assoc.	813-577-7700
IL	Chicago, Fairlines Co.	312-735-2606
MD	Catonsville, Robert Elctrn. Sls.	301-788-2380
MI	Southfield, Infinity	313-557-7230
MN	Eden Prairie, First Rep Co. of Minn.	612-944-2097
MO	St. Louis, Design Solutions	314-961-7170
WA	Bellevue, Olson Ferree & Assocs.	206-883-7792

AYDIN CORP., 700 Dresher Rd., Horsham, PA 19044, Tel: 215-657-7510, Telex: 685 1211, TWX: 510-661-0518; Empl.: 2,000; *Sls. Mgr.:* B. Jack Miller

AYDIN CONTROLS, 414 Commerce Dr., Ft. Washington, PA 19034, Tel: 215-542-7800, Telex: 6851057, TWX: 510-661-0518; Empl.: 533; *Sls. Mgr.:* Joseph J. Taylor

AYDIN MICROWAVE, 75 East Trimble Rd., San Jose, CA 95131, Tel: 408-946-5600, Telex: 4990756, TWX: 910-338-0216; Empl.: 200; *Sls. Mgr.:* Bruce M. Jennings

Local Sales Offices & Reps

VA	Alexandria, Aydin Corp.	703-823-9735

AYDIN MONITOR SYS., 502 Office Center Dr., Ft. Washington, PA 19034, Tel: 215-646-8100, TWX: 510-661-1520; Empl.: 241

AYDIN VECTOR DIV., Box 328, Newtown, PA 18940, Tel: 215-968-4271, TWX: 510-667-2320; FSC No.: 13923; Empl.: 280

BABCOCK ELECTRO-MECHANICAL, INC., Sub. of Electro-Module, Inc., 3535 Harbor Blvd., Costa Mesa, CA 92626, Tel: 714-540-1234, TWX: 910-595-1517; FSC No.: 56623; Empl.: 245; *Sls. Mgr.:* Albin Gudis; *Dist. Mgr.:* Albin Gudis

Local Sales Offices & Reps

CA	Palo Alto, Horne Electro Sales	415-494-6777
TX	Houston, Barry Sls.	713-784-5860

BACH-SIMPSON LTD., 1255 Brydges St., London, ON N5W-2C2, Canada, Tel: 519-452-3200

BACON INDS., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518; FSC No.: 99098; Empl.: 23; *Sls. Mgr.:* R. S. Cass

BAILEY CONTROLS CO., 29801 Euclid Ave., Wickliffe, OH 44092, Tel: 216-585-5800, Telex: 980621, TWX: 216-944-4160; Empl.: 2300; *Sls. Mgr.:* R. A. Purmal; *Dist. Mgr.:* R. C. Wright

BAKER, J. T., CHEMICAL CO., 222 Red School La., Phillipsburg, NJ 08865, Tel: 201-859-2151, TWX: 510-235-2924; Empl.: 1,200; *Sls. Mgr.:* D. J. Calder

BAKER CO., INC., Drawer E - Sanford Airport, Sanford, ME 04073, Tel: 207-324-8773; Empl.: 105

BALLANTINE LABS., 90 Fanny Rd., Boonton, NJ 07005, Tel: 201-335-0900, TWX: 710-987-8380; FSC No.: 50423; Empl.: 90; *Sls. Mgr.:* Joe Deery; *Dist. Mgr.:* Joe Deery ....3•1191

Local Sales Offices & Reps

AZ	Phoenix, Zeus Elctrns.	602-263-6022
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	San Jose, MCH Assocs.	408-246-7330
CA	Van Nuys, FLW Inc.	213-989-5237
CO	Denver, Zeus Elctrns.	303-321-6818
FL	Orlando, Micro Spec, Inc,	305-299-6508
GA	Lawrenceville, Micro Spec, Inc.	404-979-3444
IL	Arlington Hgts., Dytec/Central	312-394-3380
IN	Indianapolis, Dytec/Central	317-247-1316
MA	Reading, Scheinfein Assoc.	617-944-2304
MI	Madison Hgts., WKM Assoc.	313-588-2300
NJ	Elmwood Park, L & M Assocs.	201-797-0441
NM	Albuquerque, Zeus Elctrns.	505-842-6633
OH	Cleveland, WKM Assoc.	216-267-0445
OH	Dayton, WKM Assoc.	513-434-7500
OR	Portland, Westcon	503-283-0132
PA	Andalusia, L & M Assocs.	215-245-6658
PA	Pittsburgh, WKM Assoc.	412-292-2953
SC	Rock Hill, Micro Spec, Inc.	803-366-3015
UT	Salt Lake City, Zeus Elctrns.	801-534-0500
VA	Alexandria, Dyna Rep Co.	703-354-1222

BALL ELECTRONIC DISPLAY DIV, Box 43376, St Paul, MN 55164, Tel: 612-786-8900, TWX: 910-563-3552; Empl.: 500; *Sls. Mgr.:* L. R. Lemke

BALL ELCTRN., Systems Div., 1950 33rd St., Boulder, CO 80302, Tel: 303-441-5400, Telex: 45776; Empl.: 500

BALSTON, 703 Massachusetts Ave., Lexington, MA 02173, Tel: 617-861-7240, Telex: 92-3481; Empl.: 50; *Sls. Mgr.:* J. Alpert

BALZERS OPTICAL GRP., 170 Locke Dr., Marlboro, MA 01752, Tel: 617-481-9860, Telex: 951-562; Empl.: 136; *Dist. Mgr.:* Michael G. Allen

B & B MOTOR & CONTROL CORP., Apple Hill Commons, Burlington, CT 06013, Tel: 203-673-7151, Telex: 14-1484; Empl.: 90; *Sls. Mgr.:* Sam Mandel

Local Sales Offices & Reps

CT	Berlin	203-828-8550
FL	Clearwater	800-845-1020
IL	Chicago	312-681-0089
IN	Indianapolis	317-248-0396
KY	Louisville	502-589-7753
MA	Boston	617-890-4944
NH	Nashua	603-883-1062
NJ	Piscataway	201-572-0500
NY	Baldwin	212-784-1313
NY	Elmira	607-732-6599
NY	Long Island City	212-784-1313
NY	Rochester	716-424-7040
NC	Charlotte	704-375-0577
OH	Cincinnati	513-381-1885
SC	Greenville	803-268-5702
TX	Dallas	214-641-0857
TX	Houston	713-820-7931

B & G PRECISION ELCTRNS., 538 Maple Ave., Doylestown, PA 18901, Tel: 215-348-4413; *Sls. Mgr.:* Eugene R. Bigay; *Dist. Mgr.:* Xavier Garcia

B & K PRECISION PROD. GRP., DYNASCAN, 6460 W. Cortland, Chicago, IL 60635, Tel: 312-889-9087, Telex: 253475; FSC No.: 08098, 18110, 48560, 30678; Empl.: 250; *Sls. Mgr.:* Dennis Hoy ....3•1182, 1198-1202, 1362-1364, 1509

Local Sales Offices & Reps

CA	Irvine, Mike Roth Sls.	714-250-0722
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CO	Louisville, Stan Sliz & Assocs.	303-666-4760
FL	Maitland, Hutto, Hawkins, Peregoy	305-831-2474
GA	Tucker, Maitland K. Smith	404-939-3322
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Carmel, Brainard-Wilson Mktg.	317-844-2800
KS	Shawnee Mission, Lowell-Kangas & Assocs.	913-631-3515
LA	Chalmette, Erickson Sls.	504-271-1976
MD	Perry Hall, Electra-Tech	301-256-2723
MA	Woburn, W & D Marketing	617-935-5610
MI	Southfield, Robert Milsk Co., Inc.	313-354-3310
MN	Minneapolis, HMR, Inc.	612-888-2100
MO	St. Louis, Lowell-Kangas Assoc.	314-821-4050
NY	Bellmore, Selectra Sls.	516-221-7865
NY	Rochester, Warren Kaufman & Assoc.	716-266-2728
OH	Conneaut, Thomas P. Clements	412-261-0950
OK	Oklahoma City, Erickson Sls.	405-682-2947
OR	Portland, Fleehart & Sullivan	503-641-8540
PA	Norristown, Precision Meas. Co.	215-279-4242
TX	Dallas, Erickson Sls.	214-739-5833
VA	Dumfries, Electra-Tech	703-670-6962
WA	Seattle, Fleehart & Sullivan	206-527-5454
WI	Waukesha, Brainard-Wilson Mktg.	414-547-2285
EXP	NY, Plainview, Empire Exporters	516-293-5582

BANNER ENGRG. CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, Telex: 29-1011; *Sls. Mgr.:* Floyd Schneider

BARBER-COLMAN CO., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132, Tel: 815-877-0241, Telex: 257327; Empl.: 5000; *Sls. Mgr.:* John Parry

BARBER-COLMAN CO., Motor Div., 14116 Rock St., Rockford, IL 61101, Tel: 815-877-0241, Telex: 25-7419, TWX: 910-631-3425; Empl.: 3500; *Sls. Mgr.:* R. B. Nelson

BARCEL WIRE & CABLE CORP., Electronics Div., 2851 Aton Ave., Irvine, CA 92714

BARKSDALE CONTROLS DIV., Transamenca DeLaval, 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058, Tel: 213-589-6181, Telex: 67-4113; Empl.: 325; *Sls. Mgr.:* R. C. Wolf

BARNES & REINECKE, INC., 2375 Estes Ave., Elk Grove Village, IL 60007, Tel: 312-640-7200; Empl.: 290

B E

BARNES ENGRG., 1645 So. Claudina Way, Anaheim, CA 92805, Tel: 714-533-7530; FSC No.: FSCM 53823 S.I.C. 3469; Empl.: 38; *Sls. Mgr.:* Gorgdon Mackenzie ....2•1011-1013

BARNES ENGRG., 44 Commerce Rd., P.O. Box 53, Stamford, CT 06904, Tel: 203-348-5381, Telex: 965921, TWX: 710-474-3367; Empl.: 300; *Sls. Mgr.:* H. R. Hofmann, Jr.

BARON-BLAKESLEE, INC., Sub. Purex Inds., Inc., 2001 N. Janice Ave., Melrose Pk., IL 60160, Tel: 312-450-3900, Telex: 25-4701; *Sls. Mgr.:* B. Uffer

BARON WIRE & CABLE, 1811 W. Bryn Mawr Ave., Chicago, IL 60660, Tel: 312-728-7480, Telex: 72-4322; Empl.: 50; *Sls. Mgr.:* Al Desaluo

B+K PRECISION

AUTHORIZED DISTRIBUTORS

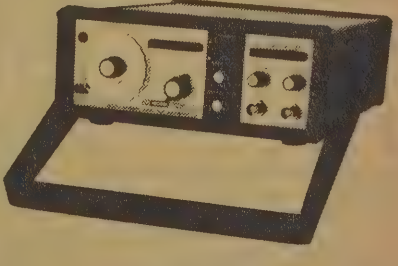
RAG ELECTRONICS, INC.

WEST 21418 Parthenia Street
Canoga Park, CA 91304
Tel. (818) 998-6500

EAST 1 Pollack Avenue
Ocean, N.J. 07712
Tel. (201) 544-0666

NEW & RECONDITIONED TEST EQUIPMENT

• SALES • RENTALS • PURCHASE OPTIONS
• REPAIR & CALIBRATION



Call Toll-Free

West
(Outside CA)
1-800-732-3457

East
(Outside NJ)
1-800-922-0945

BARRY CONTROLS, Barry Wright Corp., 700 Pleasant St., Watertown, MA 02172, Tel: 617-923-1150, TWX: 710-327-1290; FSC No.: 81860; *Sls. Mgr.:* Philip R. Littlewood

BARSOM INC., See IR Scientific

BARTLETT-EMERY INSTR., 14th & Ave. 'M', P.O. Box 445, Ft. Madison, IA 52627, Tel: 319-372-8366; Empl.: 25; *Sls. Mgr.:* P. R. Bartlett

BASCOM-TURNER INSTRS., 111 Downey St., Norwood, MA 02062, Tel: 617-769-9660, Telex: 92-2413; Empl.: 35; *Sls. Mgr.:* D. Weise; *Dist. Mgr.:* S. Holly

Local Sales Offices & Reps

IL	Union	815-923-4494
MA	Norwood	617-769-9660
PA	Pittsburgh	412-279-5544

BASE TEN SYS., One Electronics Dr., Box 3151, Trenton, NJ 08619, Tel: 609-586-7010, Telex: 4754158, TWX: 510-685-5692; FSC No.: 30377; Empl.: 255; *Sls. Mgr.:* Oleh Pavlovsky

BASF SYS., Crosby Dr., Bedford, MA 01730, Tel: 617-271-4000, 800-343-4600, Telex: 92-3423; Empl.: 1,100; *Sls. Mgr.:* David F. Pippin

BASIC MEASURING INSTRS., 402 Lincoln Centre Dr., Foster City, CA 94404, Tel: 415-570-5355; *Sls. Mgr.:* Joseph K. Kirkup .... 3•1830

BASLER ELEC., Rte. 143, Highland, IL 62249, Tel: 618-654-2341, TWX: 910-996-2522; Empl.: 940

BASLER ELEC. CIRCUITS, INC., 204 Highland Dr., P.O. Box 1165, Taylor, TX 76574, Tel: 512-352-7683; Empl.: 110; *Sls. Mgr.:* Sam Jones

Local Sales Offices & Reps

CO	Lakewood, Mike Ikeda	303-987-0900
TX	Dallas, Barry Black	214-321-4359

BAUSCH & LOMB, 820 Linden Ave., Rochester, NY 14625, Tel: 716-338-6000, Telex: 97-2286; *Sls. Mgr.:* Martin Green

BAUSCH & LOMB, 820 Linden Ave., Rochester, NY 14625, Tel: 716-338-6314, Telex: 98-8286; Empl.: 500

BAUSCH & LOMB, S.O.P.D. DIV, 1400 N. Goodman St., Rochester, NY 14602, Tel: 716-338-6000, Telex: 97-8231, TWX: 510-253-6189; Empl.: 5000; *Sls. Mgr.:* D. Curtiss

BAYLEY INSTR. CO., Box 357, Kenwood, CA 95452, Tel: 707-833-6014

BBC
BROWN BOVERI
GOERZ
METRAWATT

BBC-METRAWATT/GOERZ, 6901 W. 117th Ave., Broomfield, CO 80020, Tel: 303-469-5231, 800-821-6327, Telex: 45-4540; Empl.: 12; *Sls. Mgr.:* Andy Zeidler .... 3•1192, 1193

Multimeter Rep List

AL	Trussville, Adams & Assocs.	205-681-5162
CA	Campbell, Olsheski & Assoc.	408-378-6003
CA	Sun Valley, Tequni-Rep. Assoc.	213-768-4223
FL	Lake Worth, Adams & Assocs.	305-588-7630
GA	Marietta, Adams & Assocs.	404-973-0853
KS	Wichita, Maury Bettis	316-265-8250
KS	Olathe, Maury Bettis	913-764-0621
IN	Indianapolis, DeVoe Co.	317-842-3246
IL	Chicago, Industrial Reps.	312-647-7755
LA	Kenner, Gunn & Assocs.	504-443-5072
MA	Norwood, MacInnis Corp.	617-762-8090
MI	Livonia, Harvey Sls.	313-476-1974
MN	Bloomington, Northport Engineer	612-854-5556
MO	St. Louis, Maury Bettis	314-429-2099
NY	Whitestone, Jack Brown Elect.	212-767-1977
NY	Kew Gardens, Jack Brown Elect.	212-846-5130
NC	Greensboro, Adams & Assocs.	919-272-6838
OH	Cleveland, Kirik Sls.	216-581-7722
OK	Oklahoma City, Gunn & Assocs.	405-721-9400
PA	Wynnewood, Stinson Assocs.	215-896-7278
TN	Memphis, Hicks Sls.	901-386-5725
TX	Carrollton, Gunn & Assocs.	214-733-1222
TX	Houston, Gunn & Assocs.	713-466-8673
TX	San Antonio, Gunn & Assocs.	512-655-1041
WA	Seattle, Pacific Mktg. Grp.	206-485-1888

Recorder Rep List

AL	Huntsville, Newcombe Assocs.	201-837-3233
CA	Martinez, Rotech	415-372-6007
CA	Woodland Hills, Friedman & Assoc.	213-702-0665
CO	Arvada, Air-Row Entprs.	303-421-4204
IL	Rolling Meadows, Commodore 1	312-394-5441
IL	Fairview Heights, Delta Inst.	618-939-7755
IA	Coralville, Delta Inst.	319-626-6794
KS	Wellington, Delta Inst.	316-326-6398
MA	West Roxbury, Reptek	617-469-3311
MD	Wheaton, Brimberg Sls.	301-946-2670
MI	Hazel Park, TIBY Company	313-547-3550
NC	R.T.P., Newcomb Assocs.	919-549-0486
NY	Rochester, L-Tron	716-436-4410
NY	Albany, L-Tron	518-482-1987
NY	Roslyn Heights, Penzias Assocs.	516-621-8522
OH	Cleveland, TIBY Co.	216-371-5335
OR	Portland, Westcon	503-283-0132
PA	Philadelphia, DANA Scientific	215-969-8550
TX	Austin, Acudata	512-346-4033
TX	Houston, Acudata	713-580-2451
TX	Plano, Acudata	214-424-3567

Multimeter Distributors

AL	Dothan, Carmichael Elect.	205-793-7066
AL	Mobile, Arnolds Inst.	205-478-3230
AL	Mobile, Brownell-Electro	205-479-8581
AL	Mobile, Breard-Gardner	205-476-6174
AK	Anchorage, Alaska Electr. Sup.	907-563-3774
AK	Juneau, Juneau Elctrns.	907-586-2260
AZ	Phoenix, Arizona Whls. Supp.	602-258-7901
AZ	Phoenix, Parts Elect. of Arizona	602-968-6231
AZ	Phoenix, Tri-Tek	602-995-9352
AZ	Scottsdale, Beta Distrs.	602-947-7841
CA	Alameda, Alameda Elctrn. Dist.	415-523-6933
CA	Berkley, Al Lasher's Elctrns.	415-843-5915
CA	Burbank, Elctrn. City	213-842-5275
CA	Chatsworth, Intl. TV Cor	213-700-0900
CA	Costa Mesa, Marvac Elctrns.	714-540-3280
CA	Costa Mesa, Wesco Elect. Supp.	714-556-8788
CA	El Segundo, WASSCO	213-772-8171
CA	Fullerton, Specialized Prods.	714-773-9555
CA	Hawaiian Gardens, Carson Elctrns.	213-421-3786
CA	Hayward, Alameda Elect. Dist.	415-786-1400
CA	Hollywood, Yale Elctrns.	213-465-4169
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Los Angeles, Radio Equip. Dist.	213-664-1948
CA	Los Angeles, Intl. TV Corp.	213-776-8830
CA	Los Angeles, Intl. TV Corp.	213-388-0621
CA	Los Angeles, Rexanne Prods.	213-663-3261
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Panorama City, Panorama Elect.	213-894-2248
CA	Pasadena, Dow Radio	818-793-1195
CA	Sacramento, H.S.C. Elect. Supp.	916-338-2545
CA	Sacramento, Sacramento Elect. Supp.	916-441-4821
CA	San Diego, Southland Elect. Supp.	619-283-3941
CA	San Diego, Western Radio Elect.	619-239-0361
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Mateo, San Mateo Elect. Supp.	415-341-8731
CA	Santa Ana, Advanced Computor Prod.	714-558-8813
CA	Santa Clara, Anchor Elctrns.	408-727-3693
CA	Sunnyvale, Com-Kyl	800-547-9768
CA	Sunnyvale, Tool Kit Spec.	408-745-6020
CA	Sunnyvale, Sunnyvale Elctrns.	408-745-6020
CA	Sunnyvale, Halted Specialties	408-732-1573
CA	Torrance, Torrance Elctrns.	213-328-2501
CA	Van Nuys, Hurley Elctrns.	213-781-8410
CO	Arvada, Air-Row Instrs.	303-421-4204
CO	Aurora, Anixter	303-371-6992
CO	Aurora, R&R Instrument	303-340-8728
CO	Englewood, Beta Distrs.	303-779-4494
CT	Norwalk, Park Distrib.	800-243-5006
FL	Hialeah, Kimball Elect Lab	305-822-5792
FL	Miami, Brownell Electro	305-591-3215
FL	Orlando, Brownell Electro	305-843-6770
GA	Atlanta, Brownell Electro	404-762-5181
GA	Atlanta, Wholesale Ind. Elect.	404-447-8431
HI	Honolulu, Integrated Cir.	808-841-4175
IN	East Chicago, Acro Elect.	219-397-8681
IN	Evansville, Electro-Lab	812-423-5211
IN	Indianapolis, Graybar	317-631-1411
IN	Indianapolis, MAR Elctrns.	317-875-4510
IN	Indianapolis, Graham Elctrns.	317-634-8202
LA	Baton Rouge, Breard-Gardner	504-272-4420
LA	Baton Rouge, Barnhill Assoc.	504-924-6826
LA	New Orleans, WB Allen Sup.	504-525-8222
MD	Rockville, Capitol Radio Whsle.	301-881-2270
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Boston, Hub Matl.	617-542-7531
MA	Cambridge, Kaufman Co.	617-491-5500
MA	N. Billerica, AST Servo Sys.	617-667-8541
MA	Newtonville, Security Sup. Serv.	617-965-3400
MA	Waltham, Calibron Instr.	617-894-6440
MA	Woburn, Brownell Electro	617-935-7820
MI	Detroit, Elctrn. Parts Co.	313-891-7400
MI	East Detroit, Elctrn. Parts Co.	313-773-0030
MN	Barnville, Atrix Tool	612-894-6154
MS	Jackson, Ellington Electr.	601-355-0561
MS	Meridian, Hooper Electr. Sup.	601-693-2668
MO	Rolla, Show-Me Elctrns.	314-364-1515
MO	St. Louis, Van Sickle Radio Elect.	314-621-5000
MT	Helena, D. N. Latus & Co.	406-442-3940
NV	Las Vegas, Hurley Elctrns.	702-384-5666
NJ	Bergenfield, Schirmer Nat'l.	201-385-1200
NJ	North Caldwell, Hosica Labs	201-256-7724
NJ	Raritan, Masters Elect. Supp.	201-725-3533
NJ	S. Plainfield, Brownell Electro	201-753-4600
NJ	Trenton, Jackson Distrs.	609-392-4141
NM	Albuquerque, Barnhill Assoc.	505-299-7658
NY	New York, Taft Elctrns.	212-575-5194
NY	New York, Brownell Electro	212-691-1171
NC	Charlotte, Brownell Electro	704-597-1270
NC	Fayette, Eastern Radio Supp.	919-485-2161
NC	Raleigh, Brownell Electro	919-876-6524
NC	Raleigh, Meter Metrics	800-446-7230
OH	Cleveland, Christie Labs	216-651-4100
OK	Enid, Enid Walker Elect.	405-234-2218
OK	Tulsa, Inotek Corp.	918-627-1500
OK	Tulsa, Tri-State Instr. Lab	918-836-0286
OR	Beaverton, Eicher-Richards Co.	503-221-1123
OR	Lake Oswego, Com-Kyl	800-538-1578
OR	Medford, United Radio Supp.	503-779-7933
OR	Portland, United Radio Supp.	503-223-5341
PA	Plymouth Meeting, Techni-Tool	215-825-4990
RI	Pawtucket, Jabbour Elect. Supp.	401-728-4600
SC	Charlestown, Whsle. Ind. Elect.	803-577-6388
SC	Greenville, Whsle. Ind. Elect.	803-235-8334
TN	Chattanooga, Curle Elctrns.	615-266-4727
TN	Knoxville, Brownell Electro	615-966-3441
TN	Memphis, Bluff City Electr.	901-345-9500
TN	Memphis, Brownell Electro	901-795-8487
TN	Nashville, Bluff City Elect.	615-242-8000
TN	Nashville, Brownell Electro	615-889-8230
TX	Austin, Beta Distrs.	512-452-0199
TX	Brownsville, Rio Radio Supp.	512-546-2492
TX	Corpus Christie, Leader Elctrns.	512-884-5527
TX	Dallas, Inotek Corp.	214-243-7000
TX	Dallas, Specialized Prods.	214-358-4663
TX	Ft. Worth, Inotek Corp.	817-877-5100
TX	Harlingen, Rio Radio Supp.	512-423-1959
TX	Houston, Specialized Prods.	713-789-6610
TX	Houston, Gilbert Elctrns.	713-225-0107
TX	Houston, Beta Distrs.	713-688-9971
TX	Houston, Angie Elctrns.	713-659-8386
TX	Houston, Brownell Electro	713-699-1981
TX	Houston, Inotek Corp.	713-688-7000
TX	McAllen, Rio Radio Supp.	512-682-5524
TX	Richardson, Beta Distrs.	214-783-1065
TX	San Antonio, Sherman Elect. Supp.	512-224-1001
UT	Salt Lake City, Beta Distrs.	801-973-4455
UT	Salt Lake City, Standard Sup.	800-662-7537
VT	Roanoke, Peoples Elect. Supp.	703-342-8933
VA	Richmond, Meter Metrics	800-552-7952
WA	Bellevue, United Radio Supp.	206-451-9396
WA	Seattle, Eicher-Richards Co.	206-523-7888

BBK, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-772-8119; *Sls. Mgr.:* Jerome Kunze

B-D CRYSTAL ENTPRS., INC., 1727 W. Galbraith Rd., Cincinnati, OH 45239, Tel: 513-522-3300, Telex: 21-4545; *Sls. Mgr.:* Janet Wood, Charles Fithen

BDS COMPUTER CORP., 800 Maude Ave., Mountain View, CA 94043, Tel: 415-964-2115, TWX: 910-373-2005; *Sls. Mgr.:* Dave Lester

BEAD ELCTRNS., Div. Bead Chain Mfg. Co., 110 Mountain Grove St., Bridgeport, CT 06605, Tel: 203-334-4124; Empl.: 175

BEA ELECTRO-OPTICS, INC., 690 First Ave., Des Plaines, IL 60016, Tel: 312-298-1420; *Sls. Mgr.:* George E. Magerl; *Dist. Mgr.:* Vic Halkyn

BEAM TUBE CORP., 11 Beach St., Milford, MA 01757, Tel: 617-473-0660

BEAN RUBBER MFG. CO., 1623 S. 10th St., San Jose, CA 95112, Tel: 408-293-2790; FSC No.: 18545; *Sls. Mgr.:* Kris Mosher

BEARING INSPECTION, 10041 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 213-944-6251; Empl.: 31

BEAU PRODUCTS DIV., Box 10, Laconia, NH 03247, Tel: 603-524-5101, TWX: 710-364-1843; Empl.: 230; *Sls. Mgr.:* John Jansen; *Dist. Mgr.:* Larry Murphy .... **2**•1164-1166

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, The Knight Co.	602-582-8506
CA	Los Angeles, The Knight Co.	213-670-2833
CA	Santa Clara, Nova-Tronix Elec. Sls.	408-727-9530
CO	Denver, W.J. Purdy Co.	303-777-1411
FL	Orlando, Cartwright & Bean	305-422-4531
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Lisle, W-G Controls	312-963-5954
LA	Kenner, Cartwright & Bean	504-466-0020
MA	Needham, R. Perron & Co.	617-449-6162
MI	Lathrup Village, R.C. Nordstrom Co.	313-559-7373
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Kansas City, Forristal-Young Sls. Co.	816-358-6771
NH	Dover, R. Perron & Co.	603-742-2321
NJ	West Caldwell, Grimm, Siegel Assoc.	201-575-9300
NM	Albuquerque, C.T. Carlberg & Assoc.	505-883-3883
NY	Buffalo, Rudell-Merrifield Assoc	716-634-4300
NC	Charlotte, Cartwright & Bean	704-377-5673
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
OK	Oklahoma City, Erickson Sls.	405-682-2947
PA	Broomall, L.D. Lowery	215-356-5300
PA	Pittsburgh, Jim Finnegan	412-561-4687
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Dallas, Erickson Sls.	214-739-5833
WA	Medina, Henry Paulman Sls. Co.	206-455-3311

BEAU TECH, P.O. Box 523, Portland, ME 04122, Tel: 207-775-6139; Empl.: 9

BEAVER LABS, P.O. 1290, Framingham, MA 01701, Tel: 617-653-2025; Empl.: 5

BEC INC., 2709 N. Broad St., Philadelphia, PA 19132, Tel: 215-229-9800; *Sls. Mgr.:* Bob Kandel

BECKMAN INSTRS., 2500 Harbor Blvd., Fullerton, CA 92634, Tel: 714-871-4848, Telex: 06-7413; Empl.: 12000

BECKMAN INSTRS., Cedar Grove Opers., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-6200, TWX: 710-994-5781

BECKMAN INSTRS., Electro-Prods. Grp., 2500 Harbor Blvd., Fullerton, CA 92634, Tel: 714-871-4848, Telex: 06-78413, TWX: 910-592-1260; FSC No.: 73138; Empl.: 3700; *Sls. Mgr.:* M. P. Crugnale

BECKMAN INSTRS., HELIPOT DIV., See Beckman Instrs., Electro-Prods. Grp.

BEECHWOOD MFG., 310 S. Ohmer, Indianapolis, IN 46219, Tel: 317-356-2493; *Sls. Mgr.:* Robt. Cox

BEEDE ELECTRICAL INSTR. CO., S. Main St., Penacook, NH 03303, Tel: 603-753-6362, TWX: 710-364-6977; Empl.: 500; *Sls. Mgr.:* Mike Harbour

BEHLMAN DIV., CALIFORNIA INSTRS., Div. of Norlin Inds., 5150 Convoy St., San Diego, CA 92111, Tel: 619-279-8620, Telex: 695-047; FSC No.: 16067; Empl.: 90

BEHLMAN ENGINEERING CORPORATION, 1142 Mark Ave., Carpinteria, CA 93013, Tel: 805-684-8311; FSC No.: 53636; *Sls. Mgr.:* Edward C. Bertolet .... **3**•1834-1839

Local Sales Offices & Reps

AZ	Phoenix, R. L. Davis	602-955-2266
CA	Cupertino, T. Louis Snitzer	408-257-8333
CA	Del Mar, T. Louis Snitzer	714-226-0305
CA	Los Angeles, T. Louis Snitzer	213-836-6170
FL	Satellite, Reynolds & Assocs.	305-773-4700
GA	Atlanta, Reynolds & Assocs.	404-252-5360
MD	Rockville, Farrell Assocs.	301-424-9460
MA	Needham, Addelco	617-444-4754
MN	St. Paul, Dytec No.	612-645-5816
EXP	CA, Los Angeles, Hanex	213-556-3807

BEI MOTION SYSTEMS CO., Corporate Off., 681 Market St., Ste. 741, San Francisco, CA 94105. Tel: 415-974-1275 .... **1B**•1832

Local Sales Offices & Reps

CA	Santa Ana, BEI Motion Sys. Co.	714-973-8510
CA	Santa Clara, BEI Motion Sys. Co.	408-986-9006
CO	Boulder, BEI Motion Sys. Co.	303-440-7240
GA	Lawrenceville, BEI Motion Sys. Co.	404-963-0673
IL	Rockford, BEI Motion Sys. Co.	815-968-9528
MA	Wakefield, BEI Motion Sys. Co.	617-245-3851
MI	Plymouth, BEI Motion Sys. Co.	313-451-0359
OH	Cincinnati, BEI Motion Sys. Co.	513-321-1121
PA	King of Prussia, BEI Motion Sys. Co.	215-337-9228
TX	Euless, BEI Motion Sys. Co.	817-267-9351
WA	Bellevue, Thorson Co. Northwest	206-455-2300

BEI MOTION SYS. CO., Computer Prod. Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600; *Sls. Mgr.:* Everett McElroy .... **1B**•1832

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BEI MOTION SYS. CO., Digital Prods. Div., P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, TWX: 910-722-7384; Empl.: 506; *Sls. Mgr.:* H. O. Tyler .... **1B**•1832

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BEI MOTION SYS. CO., General Control Systems Div., 564 Alpha Dr., Pittsburgh, PA 15238, Tel: 412-963-0515; *Sls. Mgr.:* Chic Sweeney .... **1B**•1832

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BEI MOTION SYS. CO., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782; *Sls. Mgr.:* Glenn Avolio .... **1B**•1832

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BEI MOTION SYS. CO., Position Controls Div., 819 Reddick Ave., Santa Barbara, CA 93103, Tel: 805-966-1538, TWX: 910-334-4903; *Sls. Mgr.:* K. Capps .... **1B**•1832

Refer to BEI Motion Sys. Co., Corporate Off., San Francisco, CA for sales office information.

BELDEN, Electronic Wire & Cable, P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, TWX: 810-345-1393; Empl.: 2180; *Sls. Mgr.:* Bill Donahoe .... **2**•1934, 1946-1985

Regional Sales Offices

CA	Irvine	714-474-1200
IN	Richmond	317-983-5200
MA	Framingham	617-872-7846
TX	Dallas	214-788-4300

Local Sales Reps.

AZ	Scottsdale, W. Atkins	602-998-7355
CA	Huntington Beach, E. Kerezsi	714-848-2157
CA	Newark, R. Tribendis	415-490-0838
CA	Northridge, J. Duffin	213-993-8919
CA	Orange, K. Wales	714-750-9066
CA	San Jose, S. Landis	408-723-7117
CA	Tustin, W. Caughlin	714-832-5278
CO	Aurora, S. Groves	303-695-8466
CT	South Bury, L. Kerchief	212-264-8012
FL	Boca Raton, G. Pedigo	305-482-1279
FL	Longwood, J. Vandemark	305-774-0959
GA	Marietta, J. Fienning	404-973-6212
IL	Schaumburg, M. Peterschmidt	312-490-9244
IL	Wheaton, M. Davis	312-653-0695
IN	Indianapolis, L. Brown	317-849-1945
IN	Richmond, J. Daggy	317-962-6103
LA	Kenner, K. Ingram	504-469-9154
MD	Columbia, E. Wunder	301-997-4480
MA	Framingham, A. Harris	617-872-2066
MA	Franklin, S. LaRocco	617-528-1896
MI	Southfield, W. Bryant	313-559-1944
MN	Mound, J. Hughes	612-472-7545
MN	Robbinsdale, J. Stanley	612-522-9183
MO	Clayton, F. Lane	314-725-1488
NY	Northport, LI, L. Thompson	516-754-9038
NY	Rochester, T. Centofonti	716-461-0818
NY	Sunnyside, E. Mammone	212-361-0993
NC	Raleigh, A. Hatcher	919-848-3342
OH	Medina, H. Flanders	216-725-4285
OR	Lake Oswego, D. Clicquennoi	503-638-0271
PA	Norristown, B. Easley	215-272-8044
SC	Columbia, G. Owen	803-781-9739
TX	Austin, M. Mullery	512-345-5204
TX	Dallas, M. McQuistion	214-341-3424
TX	Houston, M. Masucci	713-721-6023
TX	Houston, E. Cheney	713-729-1259
TX	Houston, C. Amonett	713-350-2271
TX	Richardson, D. Berg	214-349-7712
WA	Bellevue, S. Abernethy	206-885-5808
WI	Milwaukee, M. Lucky	414-355-4986

BELDEN, Fiber Optics, 2000 S. Batavia Ave., Geneva, IL 60134, Tel: 312-232-8900, TWX: 910-237-1681

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463, TWX: 710-730-5301; Empl.: 225; *Sls. Mgr.:* A. Sutta .... **1A**•1454-1465; **1B**•1260-1262

Local Sales Offices & Reps

Delay Lines

AL	Huntsville, EMA Inc.	205-830-4030
AZ	Scottsdale, SMS & Assocs.	602-998-0831
CA	Cupertino, Thresum Assocs.	408-996-9889
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Los Angeles, Corcoran	213-823-4589
CO	Boulder, Front Range Mktg.	303-443-4780
CT	Branford, L.J.M. Assocs.	203-488-4244
FL	Altamonte Springs, Semtronics Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Fort Lauderdale, Semtronics Assoc.	305-731-2484
IL	Chicago, MGA	312-775-1151
IN	Indianapolis, Insul-Reps	317-842-5203
MA	Wellesley Hills, Sturdy Co.	617-235-2330
MI	Bloomfield Hills, Enco Mktg.	313-642-0203
NJ	East Brunswick, Winch Sls. Assocs.	201-828-4615
NY	East Syracuse, Nycom	315-437-8343
NC	Apex, FBD Sls.	919-362-4091
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
PA	Bala Cynwyd, Friedman & Assocs.	215-667-1838
SC	Mauldin, FBD Sales	803-288-2323
TN	Knoxville, Insul-Reps	615-691-7586
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
TX	Houston, Oeler & Menelaides	713-772-0730
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Chesapeake, FBD Sls.	804-484-3162
WA	Kent, R & R Assocs.	206-251-5396
PR	Hato Rey, M. Anderson Co.	809-751-2026

Fuses

AL	Huntsville, EMA Inc.	205-830-4030
CA	Los Altos, Landia	415-490-5651
CA	Los Angeles, Corcoran Assoc.	213-823-4589
CA	Huntington Beach, Corcoran Assoc.	714-841-4759
CO	Boulder, Front Range Mkt.	303-443-4780
CT	North Haven, Coakley, Boyd & Abbett	203-239-6217
IL	Chicago, MGA Assoc.	312-775-1151
IN	Indianapolis, Insul-Reps	317-842-5203
MA	Needham Heights, Coakley, Boyd & Abbett	617-444-5470
MI	Bloomfield Hills, ENCO Mktg.	313-642-0203
MN	Minnetonka, Beta Engrg.	612-544-1800
NH	Plaistow, Coakley, Boyd & Abbett	603-382-9234
NM	Albuquerque, Syntech	505-266-7951
NY	Hempstead, Kahgan Sls.	516-538-2300
NC	Cary, FBD Sls.	919-467-7595
PA	Narbeth, Samuel Jeffries Inc.	215-664-8500
SC	Mauldin, FBD Sls.	802-288-2323
TN	Knoxville, Insul-Reps	615-691-7586
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Chesapeake, FBD Sls.	804-484-3162
WA	Kent, R & R Assoc.	206-251-5396

Local Distributors

Delay Lines

CA	Inglewood, Force Elctrns.	213-776-1324; 800-421-5880
CA	San Jose, Force Elctrns.	408-943-1324
NH	Hudson, C & H Elctrns.	603-882-1133

Fuses

AZ	Phoenix, Lion Elctrns.	602-869-9611
CA	City of Industry, Ital Elctrns.	213-968-8515
CA	Costa Mesa, Deco Elctrns.	714-754-1322
CA	Hayward, KEA Elctrns.	415-887-2900
CA	San Diego, Sigma Elctrns.	619-763-0545
CO	Aurora, Jet Elctrn. Supp. Co.	303-364-1000
CT	Norwalk, Cobra Comps.	203-847-6442
FL	Boca Raton, D & R Assocs.	305-395-2341
MA	Woburn, Elctrn. Packaging Comps.	617-935-0400
NH	Hudson, C & H Elctrns.	603-882-1133
NY	Bohemia, Key Comps.	516-567-7500
OH	Columbus, Seneca Fuse	614-895-2631
PA	Cornwells Heights, Reliance Merchandising	215-638-8200
TX	Dallas, Fuses Inc.	214-341-6407
WA	Kent, Shannon Ltd.	206-763-0545

BELL, FLOYD, ASSOCS., INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-488-3193, TWX: 810-482-1763; FSC No.: 56493; *Sls. Mgr.:* Tom Shain .... **3**•1026-1028

Local Sales Offices & Reps

CA	Pasadena, Paul Nurches Co.	213-681-8957
CA	Redwood City, Hickey Indl. Sls. Corp.	415-368-3849
CO	Denver, Moss Mktg.	303-455-7205
FL	Casselberry, Barrett & Assocs.	305-699-0311
FL	Melbourne, Barrett Assocs.	305-727-2491
FL	Miami, Barrett Assocs.	305-681-4957
FL	Palm Harbor, Barrett Assocs.	813-785-1954
GA	Marietta, Dahlcom Sls.	404-424-8909
IL	Mt. Prospect, Robert Adams Sls. Co.	312-297-8733
KY	Edgewood, ELECCO	606-341-0330
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Scituate, New England Area Reps.	617-545-6327
MI	Jenison, R.C. Nordstrom	616-457-5762
MI	Lathrup Village, R.C. Nordstrom	313-559-7373
MN	Minneapolis, A.J. Warner Co.	612-729-7371
NJ	Ocean, P. Saftler Assocs.	516-593-7880
NM	Albuquerque, Moss Mktg.	505-298-4275
NY	Fulton, P. Saftler Assocs.	315-592-7184
NY	Lynbrook, P. Saftler Assocs.	516-593-7880
OH	Cleveland, ROC Assocs.	
OH	Worthington, ROC Assocs.	614-885-1057
OR	Aloha, Elctrn. Comp. Sls.	503-245-2342
PA	Paoli, Tyler Griffin Co.	215-647-1550
TX	Dallas, Jim D. Gray & Assocs.	214-341-7190
UT	Bountiful, Moss Mktg.	801-292-8660
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 305-678-6900, TWX: 810-853-3115; FSC No.: 18479; *Dist. Mgr.:* Edward S. Wilush .... **3**•1194-1197

Local Sales Offices & Reps

CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	Pasadena, Jim Robins Assoc.	818-795-9118
CO	Denver, Moss Mktg.	303-455-7205
FL	Indian Rock Beach, Par Assoc.	813-596-8841
GA	Atlanta, Par Assoc.	404-448-4181
IL	Downers Grove, Splon Assoc.	312-963-7011
KS	Overland Park, Ramsey Assocs.	913-649-6996
MA	Needham Hgts., Shain Assoc.	617-449-4380
MI	Royal Oak, Dave Ray & Assocs.	313-280-0000
MO	Maryland Hgts., Ramsey Assocs.	314-878-5042
NM	Albuquerque, Moss Mktg.	505-298-4275
NY	White Plains, Cane Tech. Sls.	914-694-9240
OH	Chagrin Falls, RPM Indl. Sls.	216-247-3295
PA	Paoli, T. Griffin Co.	215-644-7710
TX	Carrollton, Seaton Corp.	214-380-0414

Local Distributors

AZ	Phoenix, Jensen Tools & Alloys	602-968-6231
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	Pasadena, Jim Robins Assoc.	818-795-9118
CA	Pasadena, Pasadena Elctrns.	213-796-5844
CO	Denver, Moss Mktg.	303-455-7205
FL	Palm Bay, EIL Instrs.	305-725-8300
GA	Atlanta, Process Meas. Co.	404-696-7481
IL	Downers Grove, Splon Assocs.	312-963-7011
IL	Rolling Meadows, Commodore-1	312-394-5441
MA	Needham Hgts., Shain Assocs.	617-449-4380
MO	Maryland Hgts., Ramsey Assocs.	314-878-5042
NY	White Plains, Cane Tech. Sls.	914-694-9240
OH	Chagrin Falls, RPM Indl. Sls.	216-247-3295
OH	Dayton, National Instr. Distrs.	513-435-4503
PA	Paoli, Tyler Griffin Co.	215-644-7710
TN	Chattanooga, Edwin Bohr Elctrns.	615-877-8207
TX	Houston, Quality Instr. Lab.	713-524-0528

BELL & HOWELL/CEC DIV., 360 Sierra Madre Villa, Pasadena, CA 91109, Tel: 213-796-9381, Telex: 67-5415, TWX: 910-582-3205; Empl.: 500

BELL AUDIO SYS., 994 Freeway Drive North, Columbus, OH 43229, Tel: 614-846-2766; Empl.: 20; *Sls. Mgr.:* Thomas A. Curran

BELL CO., INC., 106 Morrow Ave., Box 92E, Trussville, AL 35173, Tel: 205-655-2135; Empl.: 19; *Sls. Mgr.:* R. Bell; *Dist. Mgr.:* Neil H. Bell

J. W. Miller Division
BELL INDUSTRIES

BELL INDS., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224, Tel: 213-537-5200, TWX: 910-346-6740; FSC No.: 76493; Empl.: 55 .... **1A**•1224-1229

Local Sales Offices & Reps

AZ	Phoenix, Moore Sls.	602-274-4558
AR	El Dorado, D. Bellew Sls.	501-863-8325
CA	Santa Clara, Logan Sls. Co.	408-496-0660
CO	Denver, Wm. J. Purdy Co.	303-777-1411
FL	Ft. Lauderdale, Hutto-Hawkins-Peregoy	305-971-5750
FL	Maitland, Hutto-Hawkins-Peregoy	305-831-2474
GA	Atlanta, Millar Elctrns.	404-261-6160
HI	Gardena, CA, Bidwell Sls. Assoc.	213-770-0300
IL	Chicago, Ken Levy & Assocs.	312-763-5000
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IN	South Bend, Elctrn. Reps.	219-277-4565
MD	Columbia, Par-Nell Sls. Co.	301-992-5454
MA	N. Scituate, W. A. Hendrickson Co.	617-545-0652
MI	Detroit, Burcaw Co. & Assoc. Inc.	313-533-7700
MI	Wyoming, Burcaw Co. & Assoc. Inc.	616-532-2756
MN	Minneapolis, Electro Mark, Inc.	612-881-3306
MO	Raytown, Marty Taraski Sls. Co.	816-358-1442
NJ	Englewood, Baum & Epstein Assoc.	201-569-7600
NM	Albuquerque, Wm. J. Purdy Co.	505-266-7959
NY	Syracuse, Pl'Tronics, Inc.	315-455-7346
NC	Raleigh, Millar Elctrns.	919-787-9564
OH	St. Marys, T. Shelby & Co.	419-394-3377
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Langhorne, Par-Nell Sls. Co.	215-750-0380
TN	Memphis, D. Bellew Sls.	901-452-1468
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
UT	Salt Lake City, Wm. J. Purdy Co.	801-486-8557
WA	Seattle, Earl & Brown Co.	206-284-1121
EXP	NY, New York, Roburn Agencies	212-989-5939

Local Distributors

AZ	Tempe, Circuit Specialists	602-966-0764
AZ	Tempe, Bell Industries/EDD	602-966-7800
CA	Buena Park, RPS Elctrns.	714-521-5230
CA	Garden Grove, Bell Industries/EDD	714-220-0681
CA	Gardena, Bell Industries/EDD	213-515-1800
CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	San Diego, Bell Industries/EDD	619-268-1277
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Sunnyvale, Bell Industries/EDD	408-734-8570
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Denver, Bell Industries/EDD	303-424-1985
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	New Haven, Greene-Shaw Co.	203-397-0710
CT	Wallingford, Sager Elctrcl. Supp.	203-265-4600
FL	West Palm Beach, Nurmi Elctrns.	305-684-0320
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Bell Industries/EDD	312-982-9210
IL	Palatine, Ohm/Elctrns, Inc.	312-359-5500
IN	Fort Wayne, Graham Elect./Div. Bell Ind.	219-423-3422
IN	Indianapolis, Graham Elect./Div. Bell Ind.	317-634-8202
IA	Cedar Rapids, Bell Industries/EDD	319-395-0730
LA	New Orleans, Wm. B. Allen Supp.	504-525-8222
MD	Rockville, MS Elctrns.	301-340-6400
MA	Hingham, Sager Elctrcl. Supp.	617-749-6700
MA	Newton, Greene-Shaw Co.	617-969-8900
MN	Minneapolis, Ind. Comps., Inc.	612-831-2666
MO	Saint Louis, Olive Elctrns.	314-426-4500
NJ	Camden, General Radio	609-964-8560
NJ	East Hanover, State Elctrn. Parts	201-887-2550
NM	Albuquerque, Bell Industries/EDD	505-292-2700
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Bell Industries/Micro-Mil Div.	513-434-8231
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Bell Industries/EDD	503-241-4115
PA	Allentown, P. A. Peters, Inc.	215-434-5237
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Willow Grove, Resco Elctrns.	215-659-4575
TN	Chattanooga, Techni-Tronics, Inc.	615-875-5449
TX	Dallas, Wholesale Elctrns./Ind. Div.	214-824-3001
TX	Fort Worth, TTI, Inc.	817-831-0441
TX	Houston, Lenert Co.	713-225-1465
UT	Salt Lake City, Bell Industries/EDD	801-972-6969
VA	Charlottesville, Virginia Radio	804-296-4184
WA	Bellevue, Bell Industries/EDD	206-747-1515
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Bell Industries/EDD	414-547-8879

BELLOFRAM CORP., A Rexnord Co., 30 Blanchard Rd., Burlington, MA 01803, Tel: 617-272-2100, 800-225-1031, Telex: 94-9457; Empl.: 350; *Sls. Mgr.:* James L. Diegnan; *Dist. Mgr.:* James L. Diegnan

BELL PA PRODS., See Bell Audio Sys.

BELTING INDS. CO. INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 201-272-8591, Telex: 138045; Empl.: 125; *Sls. Mgr.:* Harry K. Denaker

Local Sales Offices & Reps

CO	Boulder	303-443-8512
FL	Jacksonville, Quinn Indl. Inc.	904-268-3062
GA	Norcross	404-449-5616
IL	Addison, Eng. Sls. Co.	312-832-8425
MN	St. Paul, Vikeland Sls. Inc.	612-645-4647
NJ	Kenilworth, Belting Inds. Co. Inc.	201-272-8591
NY	Sodus, Warner Woven Belting	315-483-9490

Local Distributors

MI	Detroit, Michiean Indl. Belting Co.	313-584-1652

BEMAN MFG., P.O. Box 370, New Cumberland, PA 17070, Tel: 717-938-1451, TWX: 510-650-3539; Empl.: 300; *Sls. Mgr.:* D. Fortenbaugh

BEMCO, 9908 San Fernando Rd., Pacoima, CA 91331, Tel: 818-899-5296, TWX: 910-496-1520; Empl.: 45; *Sls. Mgr.:* John Riddle; *Dist. Mgr.:* Brian Duggan

BENDIX CORP., Electrical Comps. Div., Sidney, NY 13838, Tel: 607-563-5324, Telex: 932 456, TWX: 510-261-7550; FSC No.: 77820; Empl.: 3000; *Dist. Mgr.:* G. Anderson

BENDIX CORP., Electric Power Div., Hwy. 35, Eatontown, NJ 07724, Tel: 201-542-2000, Telex: 132-444 , TWX: 710-722-6686; FSC No.: 83298; Empl.: 875; *Sls. Mgr.:* H. I. Nadler; *Dist. Mgr.:* Cal Schrum

BENDIX CORP., Electrodynamics Div., 11600 Sherman Way, N. Hollywood, CA 91605, Tel: 818-765-1010, TWX: 910-499-2151; Empl.: 1200

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENDIX CORP., Test Systems Div., Teterboro, NJ 07608, Tel: 201-288-2000, TWX: 710-990-6136; Empl.: 1,077

BENJAMIN ELECTROPRODUCTS, INC., Robins Div., 80 Smith St., Farmingdale, NY 11735, Tel: 516-293-7744, Telex: 12-7908; Empl.: 100

BENSON, INC., 2690 Orchard Parkway, P.O. Box 32059, San Jose, CA 95152-2059, Tel: 408-945-1000, Telex: 176887 BENSON SNJ, TWX: 9103382069 BENSON SNJ; Empl.: 400; *Sls. Mgr.:* Larry Maguire

BENTHOS, INC., Edgerton Dr., N. Falmouth, MA 02556, Tel: 617-563-5917, Telex: 94-0884; Empl.: 110; *Sls. Mgr.:* R. D. Jones

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 702-782-3611, Telex: 354437

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010; Empl.: 150; *Sls. Mgr.:* C. Keenan

BERG ELCTRNS., Du Pont Co., 30 Hunter La., Camp Hill, PA 17011, Tel: 800-237-BERG, TWX: 510-650-3538; *Sls. Mgr.:* J. McAluney; *Dist. Mgr.:* P. Raudensky

BERGER-LAHR CORP., Fitzgerald Dr., Jaffrey, NH 03452, Tel: 603-532-7701, Telex: 92-8445; Empl.: 50; *Sls. Mgr.:* Wolfgang Hartert

BERGQUIST, 5300 Edina Ind'l., Minneapolis, MN 55435, Tel: 612-835-2322, TWX: 910-576-2423; FSC No.: 55285; Empl.: 45; *Sls. Mgr.:* Bob Savage

BERGQUIST SWITCH, INC., Bergquist Co., 5300 Edina Indl. Blvd., Edina, MN 55435, Tel: 612-835-2322, TWX: 910-576-2423; *Sls. Mgr.:* Lamar Popp

BNC

DIGITAL DELAY
AND
LIGHT PULSE
GENERATORS

BERKELEY NUCLEONICS CORP., 1198 Tenth St., Berkeley, CA 94710, Tel: 415-527-1121, Telex: 677-1167; Empl.: 30; *Sls. Mgr.:* E. J. Buchs ....3•1203

All sales engineering services in the U.S. and Canada are provided by our factory-direct sales staff. For immediate assistance please contact: Sales Department (415) 527-1121.

BERKSHIRE TRANSFORMER CORP., Route 341, Kent, CT 06757, Tel: 203-927-3541

BERK TEK, INC., Box 60, RD 1, Reading, PA 19607, Tel: 215-376-8071, TWX: 510-651-0511; Empl.: 185; *Sls. Mgr.:* P. J. Parrelli; *Dist. Mgr.:* P. J. Parrelli

BERMAR CORP., 6300 Westgate Rd., Raleigh, NC 27612, Tel: 919-821-5993; *Sls. Mgr.:* M. Conland

BA
BERTAN ASSOCIATES, INC.

BERTAN ASSOCS., 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110, TWX: 510-221-2144; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Howard Bertan ....3•1506, 1507

Local Sales Offices & Reps

AZ	Phoenix, Sigma Engrg. Sls. Co.	602-241-1334
CA	Encino, King-Way Assoc.	213-788-4124
CA	Los Altos, Cain-White & Co.	415-948-6533
CO	Boulder, H. Bass Assocs.	303-530-7509
CT	Madison, Dave Minshall	203-421-4561
FL	DeBary, DJE Assocs.	305-668-6827
GA	Lawrenceville, Electramark	404-963-4793
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
IN	Fort Wayne, Coombs Assocs.	219-747-4017
IA	Cedar Rapids, Coombs Assocs.	319-362-4116
MD	Randallstown, Beacon North	703-591-1300
MI	Farmington, Carter, McCormic & Peirce	313-477-7700
MN	St. Paul, John J. Exon Co.	612-636-5533
MO	Bridgeton, Electro Mechanical Assoc.	314-291-8661
NM	Albuquerque, Thorson Co.	505-293-8555
NY	Fairport, NACO Elctrns. Corp.	716-223-4490
NY	Syracuse, NACO Elctrns. Corp.	315-699-2651
NY	Utica, NACO Elctrns. Corp.	315-732-1801
NC	Raleigh, Barker Assocs.	919-876-0282
OH	Cleveland, Geotronix	216-526-2535
OR	Portland, Showalter Instrs.	503-224-8487
PA	Audubon, Holmes Assocs.	215-666-0636
TX	Dallas, Automated Motion Control	214-340-4192
TX	Denton, Automated Motion Control	817-382-4159
UT	Bountiful, H. Bass Assoc.	801-295-7100
VA	Fairfax, Beacon North	703-591-1300
WA	Bellevue, Showalter Instrs.	206-746-6032
WI	Milwaukee, Coombs Assocs.	414-351-6123

BERTSCH U.S.

BERTSCH U.S., Sycamore Resch. Ctr., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7420; Empl.: 20; *Sls. Mgr.:* S. W. Linko ....1B•1132-1134

BEST ELECTRICS DIV., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300, TWX: 910-444-2154; Empl.: 8 ....1B•1794

Local Sales Offices & Reps

CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890

BETA TRANSFORMER TECHNOLOGY CORP., One Comac Loop, Ronkonkoma, NY 11779, Tel: 516-588-2505

BG ELCTRNS., 30 South St., Mt. Vernon, NY 10551, Tel: 914-664-5591, Telex: 6818048; FSC No.: 33791; Empl.: 36

B-G INSTRUMENTS, P.O. Box 67, Alta Loma, CA 91701, Tel: 714-989-4802, 980-2826, Telex: 910-581-2792; *Sls. Mgr.:* John Baum ....3•1071

Local Sales Offices & Reps

WA	Spokane	509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghampton, NY 13904, Tel: 607-722-2376

B. H. ELCTRNS., 331 Bremer Bldg., St. Paul, MN 55101, Tel: 612-228-6463, Telex: 297080; FSC No.: 3677; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ....1A•2136, 2137

Local Sales Offices & Reps

CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Dunellen, J. A. Maguire	201-752-8480
NY	Syracuse, C & L Sales	315-451-7810
WA	Redmond, Halbar Assocs.	206-882-0990
WI	Theinsville, TFL Assoc.	414-242-6800

B.H. INDS., INC., 5784 Venice Blvd., Los Angeles, CA 90019, Tel: 213-937-4763; Empl.: 6

BICC-VERO ELCTRNS., INC., 171 Bridge Rd., Hauppauge, NY 11788, Tel: 516-234-0400, TWX: 510-227-8890; Empl.: 25; *Sls. Mgr.:* Joseph Lago; *Dist. Mgr.:* Larry Spenceley

Local Sales Offices & Reps

AL	Huntsville, Raycom	205-859-2017
CA	Anaheim, Bicc-Vero Elctrns.	714-630-2030
CT	Milford, Todino Engrg.	203-874-6643
FL	Melbourne, Star-Tec	305-727-2247
GA	Duluth, Raycom	404-446-9015
IL	Ithasca, L-Tec	312-773-2900
IN	Indianapolis, Harrison Blind & Assocs.	317-291-0860
KS	Overland Park, Barnes-Midwest Sls.	913-341-9317
MD	Lutherville, J. A. Dougherty Sls.	301-321-7890
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Jackson, Norwood Scroggs	517-750-1170
MN	St. Paul, Proud Inds.	612-646-9428
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NY	Kingston, P.R.M. Elctrns.	914-331-0872
NC	Raleigh, Raycom	919-847-8276
OH	Chesterland, K-T Mktg.	216-729-3588
PA	Hatboro, Rep Force	215-441-4178
TX	Garland, Texport	214-681-1376
TX	Houston, Texport Elctrn. Sls. Co.	713-777-1443
UT	Salt Lake City, Chuck Fields & Assocs.	801-277-4859

Local Distributors

CA	Los Angeles, Dyna Svc.	213-268-8531
CT	Wallingford, Mid-State Elect.	203-265-9900
FL	Dania, Summit Distr.	305-920-6253
IL	Arlington Hgts., Redel Labs	312-253-5000
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
MD	Baltimore, Resco	301-823-0070
MA	Framingham, NOW Elctrns.	617-872-5876
MI	Lansing, Demco Controls	517-321-1700
MI	Madison Heights, McNaughton-McKay Electric Co.	313-399-7500
NJ	Springfield, Route Elctrns.	201-467-0166
NY	Buffalo, Summit Distr.	716-884-3450
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Rochester, Summit Distr.	716-442-3494
NC	Raleigh, Resco	919-781-5700
OH	Cleveland, Roberts Elctrns.	216-238-1711
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Braddock, Leff Elctrs.	412-351-5000
TX	Houston, City Elctrns.	713-621-1060
WI	Mequon, Taylor Elctrns.	414-241-4321

BICRON ELCTRNS., Box 807, Barlow St., Canaan, CT 06018, Tel: 203-824-5125; Empl.: 100; *Sls. Mgr.:* Peter B. Kent

BIDDLE INSTRUMENTS, A Thorn EMI Co., 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, Telex: 83-4423 BIDDLE PMTG

BIKOR
CORPORATION

BIKOR, 1504 W. 228th St., Torrance, CA 90501, Tel: 213-539-6320, TWX: 910-349-6667; Empl.: 50; *Sls. Mgr.:* Dave Jenest ....3•1508

Local Sales Offices & Reps

CA	Santa Clara, Electro Venture North	408-727-1553
FL	Orlando, Gra-Mar	305-894-3351
MN	Minnetonka, Chris-Tek	612-934-1334
MO	St. Louis, B & H Assocs.	314-434-4425
NH	Nashua, Bell Controls	603-882-6984
NJ	Haddonfield, Tritek Sls.	609-429-1551
NJ	Hasbrouck Hgts., Comp. Tech. Sls.	201-288-7400
NY	Rochester, Tae-Rep	716-586-8710
OH	Mentor, Depco	216-951-3998
TX	Garland, Tesco	214-681-1376
WA	Kirkland, Electro Venture N.W.	206-823-1708
WI	Brookfield, Sumer	414-784-6641

Local Distributors

CA	Buena Park, RPS Elctrns.	714-521-5230
CA	Burlingame, Rose Elctrn. Distbg. Co.	415-348-2740
NJ	Hasbrouck Hgts., Tory Sls.	201-288-7400

BINDICATOR, P.O. Box 9, 1915 Dove St., Port Huron, MI 48060, Tel: 313-987-2700; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

BIO-IMAGING RESEARCH, #1 Bio-Imaging Plaza, 425 Barclay Blvd., Lincolnshire, IL 60069, Tel: 312-564-3190; *Sls. Mgr.:* J. G. Close

BIOSPHERICAL INSTRS., INC., 4901 Morena Blvd. #1003, San Diego, CA 92117, Tel: 619-270-1315; *Sls. Mgr.:* Dennis Bryan

BIRD, RICHARD H., & CO., INC., 1 Spruce St., Waltham, MA 02154, Tel: 617-894-0160, Telex: 923-441; FSC No.: 17706; Empl.: 50; *Sls. Mgr.:* R.J. Cameron

BIRD ELCTRN., 30303 Aurora Rd., Cleveland, OH 44139, Tel: 216-248-1200, Telex: 706898 Bird Elec. UD; FSC No.: 70998; Empl.: 250; *Sls. Mgr.:* W. L. Yochum; *Dist. Mgr.:* Greg Johns

Local Sales Offices & Reps

CA	Ojai	805-646-7255

BIRTCHER

BIRTCHER CORP., 4501 N. Arden Dr., El Monte, CA 91731, Tel: 818-575-8144, Telex: 4720899 BIRTCHER ELM; Empl.: 200; *Sls. Mgr.:* H. Robert Sproul ....2•1015-1017

Local Sales Offices & Reps

AL	Huntsville, Mar-Tec.	205-883-5910
AZ	Scottsdale, Mercury Eng. Sls.	602-949-5054
CA	Brea, M. A. Stolaroff Co.	714-529-0866
CA	Los Angeles, M. A. Stolaroff Co.	213-295-7781
CA	Santa Clara, Nova Tronix	408-243-9530
CO	Broomfield, Connors, Inc.	303-466-9628
FL	Ft. Lauderdale, Hutto-Hawkins-Peregoy	305-971-5750
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
KS	Mission, Midland Eng. Sls.	913-262-6565
MD	Baltimore, Burgin Kreh Assoc.	301-265-8500
MA	Burlington, Conti-Younger Assoc.	617-273-1582
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NJ	Haddonfield, Tritek Sls.	609-429-1551
NY	Great Neck, Tylinski Assoc.	516-466-9070
NY	Syracuse, I. A. Hotze Assoc.	315-479-6641
NC	Raleigh, Burgin Kreh Assoc.	919-781-1100
OH	Cincinnati, Jim Finnegan Co.	513-321-6370
OH	Cleveland, Jim Finnegan Co.	216-238-5905
OR	Beaverton, Barrett-Squibb Assoc.	503-644-2550
TX	Dallas, Forner Sales	214-241-2166
VA	Lynchburg, Burgin Kreh Assoc.	804-239-2626
WA	Redmond, Barrett-Squibb Assoc.	206-885-6991

Local Distributors

CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	San Jose, Bisco Industries	408-946-8980

CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Aurora. Jet Elctrns. Supp.	303-364-1000
FL	Dania, Summit Distrs.	305-920-6253
IL	Elk Grove, Dot-Tronics	312-593-0282
MA	Winchester, Rush Inds.	617-729-5800
MN	Minneapolis, Stark Elctrns.	612-322-1325
NY	Bohemia, Car Lac Indl. Sls.	516-567-4200
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Rochester, Summit Elctrns.	716-334-8110
OH	Englewood, Argent Industries	513-836-8633
TX	Ft. Worth, Industrial Elctrns.	817-731-7321
TX	Houston, Solid State Electronics	713-772-8483
WA	Redmond, Murphy Elctrns.	206-881-1234
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280

BISHOP GRAPHICS, INC., 5388 Sterling Center, Westlake Village, CA 91359, Tel: 818-991-2600, Telex: 66-2400 BISHOP WKVG; Empl.: 160; *Sls. Mgr.:* Fred Kern

BIVAR, INC., 4 Thomas, Irvine, CA 92714, Tel: 714-951-8808; FSC No.: 32559; Empl.: 22; *Sls. Mgr.:* E. M. Muldoon .... **2**•1018

Local Sales Offices & Reps

AZ	Mesa, Tempe Assocs.	602-829-1901
CA	San Diego, Qualtronics Co.	619-560-8955
CO	Westminster, D. Barth	303-427-8679
FL	Plymouth, Duay Entprs.	305-889-2249
GA	Peachtree City, Spyraflo	404-487-7600
IL	Chicago, Berndt Assocs. Inc.	312-283-0713
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
KS	De Soto, Midtec Assocs.	913-441-6565
MA	Newtonville, C. Segel	617-969-6900
MI	Milford, Dodsworth	313-875-5755
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Florissant, Midtec Assocs.	314-837-5200
NJ	Berkeley Heights, Cambridge-Allen	201-464-0203
NY	Syracuse, T-Squared Elctrns.	315-463-8592
NC	Bethania, Lee, Ltd.	919-924-8245
OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
OR	Portland, Eclipse Mktg. Grp.	503-644-2550
PA	Elkins Park, K. B. Erdman Co.	215-224-1833
TX	Richardson, Draper Co.	214-680-1650
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

AZ	Phoenix, Kachina Elctrn. Distr.	602-269-6201
AZ	Phoenix, EKO Sales	602-275-7501
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Mountain View, Vic/Tal Sls.	415-964-6254
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Santa Fe Springs, F T R Fasteners	714-957-0202; 213-946-6464
CA	Temple City, Fastening Sys.	213-579-4600
CA	Westlake Village, R. C. Dudek	213-707-1310
CO	Englewood, Indus. Elctrns.	303-694-9444
CT	Milford, Plastic & Metal Comps. Co.	203-877-2723
GA	Peachtree City, Spyraflo Inc.	404-487-7600
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Chicago, EMF	800-621-0080
IL	Hillside, Miltex Sls.	312-449-0420
IL	Lisle, Components, Inc.	312-852-7707
MD	Gaithersburg, Capitol Fasteners	301-948-9310
MA	Burlington, Contact East	617-272-5051
MA	Marlboro, Hardware Specialty Co.	617-481-8622
MA	Waltham, Electronic Fasteners	617-890-7780
MA	Winchester, RUSH	617-729-5800
MI	Southfield, LSI Marketing	313-356-7002
MI	Zeeland, Tubergen & Assoc.	616-772-1548
MN	Eden Prairie, S. W. Anderson Co.	612-941-4108
NH	Goffstown, New Hampshire Fasteners	603-497-4151
NH	Londonderry, E.P.E. Corp.	603-669-9181
NJ	Kenilworth, Federated Purchaser	201-376-8900
NY	Central Islip, Domino Components	516-582-3050
NY	Johnson City, Gold Crest Elctrns.	607-797-2380
NY	Long Island City, Empire Fasteners	212-728-3900
NY	Long Island City, Hardware Specialty Co.	212-361-9393
NY	Mt. Vernon, QAR Elctrns.	914-699-2224
NY	Plainview, Tower Fastener Co.	516-349-7670
NC	Raleigh, Century Elctrn. Comps.	919-755-0537
NC	Raleigh, Century Fasteners	919-787-1800
OH	Englewood, Argent Inds.	513-836-8633
OH	Solon, REH/Electra	216-248-1636
OR	Beaverton, Murphy Elctrns.	503-642-2001
OR	Beaverton, Component Resources	503-641-8488
PA	Norristown, Century Elctrns.	215-631-5400
PA	Pittsburgh, Alder-Tronics	412-821-5565
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Seattle, Pacific Elctrns.	206-575-1050

BIW CABLE SYS., INC., 65 Bay St., Dorchester, MA 02125, Tel: 617-265-2102, Telex: 94-0604; FSC No.: 71102; Empl.: 600; *Sls. Mgr.:* E. McCormick

BLACK & WEBSTER, 281 Winter St., Waltham, MA 02154, Tel: 617-890-9100, Telex: 951102; Empl.: 80

BLACK BOX CORP., Micom Sys., P.O. Box 12800, Pittsburgh, PA 15241, Tel: 412-746-5500, Telex: 510-697-3125; *Sls. Mgr.:* Peter Highberg

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701; FSC No.: 12724; Empl.: 10

BLANCK, A. R., CO., Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 6; *Sls. Mgr.:* Dr. A. R. Blanck; *Dist. Mgr.:* Dr. A. R. Blanck

BLATEK INDS., Box 574, Bellefonte, PA 16823, Tel: 814-355-4910; Empl.: 20; *Sls. Mgr.:* Linda C. Feltman .... **1B**•1835

Local Sales Offices & Reps

CA	Burbank, Mo'Dco	213-848-2215
CO	Littleton, McCarthy Co.	303-773-0643
CT	Woodbridge, Elctrn. Mktg.	203-397-1461
IL	Elk Grove Village, Loren Green Assocs.	312-593-0282
MI	Benton Harbor, McNabb & Assocs.	616-925-2166

BLH ELCTRNS., 42 Fourth Ave., Waltham, MA 02254, Tel: 617-890-6700, Telex: 92-3413, TWX: 710-324-0683; FSC No.: 03089; Empl.: 350; *Sls. Mgr.:* D. Erikson

BLILEY ELEC. CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, TWX: 510-696-6886; FSC No.: 71034; Empl.: 170; *Sls. Mgr.:* H. A. Yocum .... **1A**•1316-1323

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-882-6050
CA	Los Angeles, Elsner-Rambo Co.	213-664-2928
CA	Mountain View, Gene C. Woempner Co.	415-964-5454
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Altamonte Springs, R. W. Mitscher Co.	305-788-6844
FL	Boca Raton, R. W. Mitscher Co.	305-482-5649
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
MD	Laurel, R. W. Mitscher Co.	301-498-6090
MA	Needham, Sturgeon Co.	617-444-6603
NY	Bainbridge, R. W. Mitscher Co.	607-967-7192
NY	Buffalo, R. W. Mitscher Co.	716-633-7970
NY	N. Syracuse, R. W. Mitscher Co.	315-458-1321
NY	Pittsford, R. W. Mitscher Co.	716-586-4012
NY	Red Hook, R. W. Mitscher Co.	914-758-8375
NY	Rochester, R. W. Mitscher Co.	716-227-0839
NY	West Hempstead, Schmitt Indl. Mktg. Corp.	516-486-3510
NC	Charlotte, R. W. Mitscher Co.	704-598-8644
NC	Raleigh, R. W. Mitscher Co.	919-848-0941
OR	Portland, Dussault & Assocs. Inc.	503-641-8780
TN	Johnson City, R. W. Mitscher Co.	615-929-7258
TX	Richardson, Vector Sls. Co.	214-234-4291
VA	Midlothian, R. W. Mitscher Co.	804-744-4676
WA	Seattle, Dussault & Assocs., Inc.	206-527-5454
EXP	CT, Stamford, Dage Corp.	203-324-3123

® BLUE M

BLUE M, A UNIT OF GENERAL SIGNAL, 138th & Chatham Sts., Blue Island, IL 60406, Tel: 312-385-9000, TWX: 910-689-3398; Empl.: 300; *Sls. Mgr.:* H. G. Mathews .... **3**•1173

Local Sales Offices & Reps

AZ	Tempe	602-894-2305
CA	El Monte	818-442-6672
CA	Sunnyvale	408-734-8734
DE	Wilmington	302-478-6983
FL	Winter Park	305-671-6655
GA	Atlanta	404-455-3452
MA	Natick,	617-651-1616
MI	Taylor	313-281-2107
NY	Nanuet	914-623-0900
NY	Syracuse	315-437-0192
NC	Charlotte	704-527-2492
OH	Cincinnati	513-821-6278
OH	Hudson	216-656-1177
TX	Garland	214-272-2509
TX	Houston,	713-778-1146
WA	Seattle	206-763-1030

BLUM, JULIUS & CO., INC., Box 292, Carlstadt, NJ 07072, Tel: 201-438-4600, Telex: 13-3491; Empl.: 40

BMS DATA HANDLING, INC., 12155 Magnolia, Riverside, CA 92503, Tel: 714-359-8820; Empl.: 16; *Sls. Mgr.:* Richard Mestler

BODINE ELEC. CO., 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, Telex: 25-3646; *Sls. Mgr.:* R. E. Ford .... **1B**•1135

Local Sales Offices & Reps

CA	Los Angeles, C. E. Mello	213-626-9159
CA	San Jose, E. W. Duemmlein	408-243-4800
KS	Shawnee Mission, J. S. Gleeson & Assocs.	913-362-4422
MA	Andover, L. R. Cascino	617-470-0050
MI	Grosse Ile, Steve Cavender	313-676-2724
NY	Massapequa, D. V. Mayorga	516-541-1611
NY	Rochester, Application Specialists	716-586-6226
NY	Syracuse, Application Specialists	315-437-2813
OH	Hudson, J. H. Basten	216-656-4226
OR	Portland, D. E. Johnson	503-246-3131
TX	Richardson, General Power Equip.	214-783-8371
VA	McLean, J. S. Hsia	703-734-1739
EXP	IL., Chicago, Export Dept., Bodine Elec.	312-478-3515

Local Distributors

AL	Mobile, Brownell Electro	205-479-5405
AK	Anchorage, Airport Machinery Co	907-272-0544
AZ	Phoenix, Minarik Elec. Co.	602-233-3000
AR	Fort Smith, Dagwell-Dixie Arkansas	501-646-8028
CA	Carson, Power Trans. Specialties	213-631-7502
CA	Los Angeles, Minarik Elec. Co.	213-624-3161
CA	Mountain View, King Bearing Inc.	415-968-8316
CA	San Diego, Minarik Elec. Co.	619-560-6632
CA	San Jose, Republic Supp. Co.	408-279-2202
CA	San Jose, King Bearing Inc.	408-998-5464
CA	San Leandro, Republic Supp. Co.	415-357-2211
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
CO	Denver, Wazee Elec. Co.	303-892-7004
CT	Berlin, B & B Motor & Control	203-828-8550
CT	Hartford, Machine Drives & Controls	203-728-0403
CT	Norwalk, Machine Drives & Controls	203-846-2007
FL	Miami, Brownell Electro	305-591-3215
FL	Orlando, Brownell Electro	305-843-6770
GA	Hapeville, Brownell Electro	404-762-5181
IL	Chicago, Excel Elec. Svc. Co.	312-421-7220
IL	Chicago, Harris & Lee	312-372-7272
IL	Rockford, Harris & Lee	815-398-0606
IL	St. Charles, Harris & Lee	312-584-5000
IL	Waukegan, Harris & Lee	312-662-0372
IN	Indianapolis, B & B Motor & Control	317-248-0396
IA	Cedar Rapids, Precision Bearing Co.	319-365-5276
IA	Des Moines, Precision Bearing Co.	515-265-9811
KS	Kansas City, Kornfeld Thorp Elec.	913-321-7070
MA	Medford, Empire Elctrl. Co.	617-395-5000
MA	Somerville, Electro Sls. Co., Inc.	617-666-0500
MI	Detroit, Howard Elec. Co.	313-923-0430
MN	Minneapolis, Boustead Elec. & Mfg.	612-544-9131
MO	St. Louis, Zeller Elec. Inc.	314-638-9641
NE	Omaha, Precision Bearing Co.	402-444-3939
NV	Reno, Republic Supp. Co.	702-677-1761
NJ	Cherry Hill, Jos. T. Fewkes & Co.	609-424-5810
NJ	Piscataway, B & B Motor & Control	201-572-0500
NY	Binghamton, K. J. Elec. Corp.	607-772-1760
NY	East Syracuse, K. J. Elec. Corp.	315-437-2826
NY	Long Island City, B & B Motor & Control	212-784-1313
NY	Rochester, B & B Motor & Control	716-424-7040
NC	Charlotte, Mize Co., Inc.	704-375-5761
NC	Charlotte, Brownell Electro	704-597-1270
OH	Cleveland, Reserve Elec. Co.	216-771-5764
OH	Dayton, Thal Mor Assoc., Inc.	513-298-9939
OK	Oklahoma City, Dagwell Dixie Co.	405-232-7671
OK	Tulsa, Southwest Drives, Inc.	918-834-4231
OR	Portland, Campbell Ind. Supp.	503-231-4820
PA	Pittsburgh, Braunlich-Roessie	412-471-6995
SC	Taylors, B & B Motor & Control	803-268-5702
TN	Memphis, Brownell Electro	901-795-8487
TN	Nashville, Tennessee Machinery Co.	615-244-8150
TX	Dallas, Motion Industries	214-351-2211
TX	Fort Worth, Motion Industries	817-335-8131
TX	Houston, Research Designs, Inc.	713-995-8591
TX	Houston, B & B Motor & Control	713-820-7931
TX	Houston, B & B Motor & Control	713-820-7931
VA	Richmond, Ind. Supp.	804-355-8041
WA	Seattle, Industrial Elec.	206-329-3900
WA	Seattle, Campbell Ind. Supp.	206-447-7100
WA	Spokane, Campbell Ind. Supp. Co.	509-828-8288
WA	Tacoma, Campbell Ind. Supp. Co.	206-383-2431
WI	Milwaukee, Trester Svc. Elec.	414-264-8170
WI	New Berlin, Elec. Sls. & Engrg.	414-782-2400

BOEING MICROELECTRONICS, PCB OPNS., M/S: 88-34, Box 24666, Seattle, WA 98124, Tel: 206-773-1083, Telex: 32-9430, TWX: 910-423-1563; Empl.: 120; *Sls. Mgr.:* M.A. Schalk

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406, Tel: 612-729-9365

BOMAR CRYSTAL, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 201-356-7787, 800-526-3935, TWX: 710-480-4560; Empl.: 75; *Sls. Mgr.:* Phil Casciano

BOMCO, See MuShield Co.

BONUS-BILT, INC., Hofmann Inds., 1096 Air Way, Glendale, CA 91201, Tel: 818-245-9177, 800-692-8888; Empl.: 100; *Sls. Mgr.:* Robert J. Grimm

BOONTON

BOONTON ELCTRNS. CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, TWX: 710-986-8215 BOONTRONICS; FSC No.: 04901; Empl.: 180; *Sls. Mgr.:* J. Garthwaite ....3•1204

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices	205-536-1969
AZ	Phoenix, Aztec Entprs.	602-943-8178
CA	North Hollywood, O'Halloran Assocs.	213-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-326-1493
CO	Littleton, Aztec Entprs.	303-795-0250
CT	Mt. Carmel, Sci. Devices	203-248-9361
FL	Orlando, Sci. Devices	305-841-8180
FL	Shalimer, Sci. Devices	904-651-4407
GA	Marietta, Sci. Devices SE	404-427-8660
IL	Schaumburg, K. W. Meyers	312-882-4808
IN	Indianapolis, K. W. Meyers	317-243-6681
IA	Cedar Rapids, K. W. Meyers	319-363-8987
KS	Overland Park, Ramsey Assoc.	913-649-6996
MD	Silver Spring, Sel-Tronics	301-589-3391
MA	Lexington, R. J. Sickles	617-862-5100
MN	Minneapolis, K. W. Meyers	612-920-7080
MO	Maryland Hgts., Ramsey Assoc.	314-878-5042
NJ	Englewood Cliffs, Sci. Devices	201-871-3916
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Rochester, Sci. Devices	716-334-2445
NC	Winston-Salem, Sci. Devices	919-765-5776
OH	Centerville, Micro Sls.	513-433-8171
OH	N. Olmsted, Micro Sls.	216-734-3080
OR	Portland, Sci. Devices	503-292-6934
PA	Melrose Park, R. Meyers	215-224-1663
TX	Austin, Testech	512-327-7033
TX	Houston, Testech	713-956-0837
TX	Richardson, Testech	214-644-5010
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Bellevue, Sci. Devices	206-747-5169
WI	Brookfield, K. W. Meyers	414-784-3790

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BOSCH, ROBERT, CORP., 2800 S. 25th Ave., Broadview, IL 60153, Tel: 312-865-5200, Telex: 23-5563; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson ....1B•1310, 1311

10TH Anniversary 1974–1984

BOSCHERT INC., 384 Santa Trinita Ave., Sunnyvale, CA 94086, Tel: 408-732-2440, TWX: 910-339-9241; Empl.: 600; *Sls. Mgr.:* Ed Bennett; *Dist. Mgr.:* Bill Sabetti ....3•1510, 1511

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Los Alamitos, Santana Sls.	714-827-9100
CA	San Diego, Harvey King	619-566-5252
CA	Santa Clara, Criterion	408-988-6300
CA	Sunnyvale, Boschert	408-732-2440
CO	Aurora, Electrodyne	303-695-8903
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
FL	Maitland, Dyne-A-Mark	305-831-2097
FL	Palm Bay, Dyne-A-Mark	305-727-0192
GA	Atlanta, Elctrn. Mktg.	404-448-1215
GA	Huntsville, Elctrn. Mktg.	205-837-7363
IL	Arlington Hgts., Micro Sls.	312-956-1000
IN	Indianapolis, SAI Mktg.	317-241-9276
IA	Cedar Rapids, Stan Clothier	319-395-0245
MA	Framingham, Eastern Micro	617-620-1616
MI	Brighton, SAI Mktg.	313-227-1786
MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	St. Louis, Design Solutions	314-961-7170
NJ	Cherry Hill, Datronix	609-424-6622
NJ	Clifton, Boschert	201-478-4659
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NY	Huntington, Morgan Elctrns.	516-549-5180
NC	Raleigh, Elctrn. Mktg.	919-847-8800
OH	Centerville, SAI Mktg.	513-435-3181
OH	Shaker Hgts., SAI Mktg.	216-751-3633
OR	Hillsboro, Olson, Ferree & Assoc.	503-640-9660
SC	Greenville, Elctrn. Mktg.	803-233-4637
TX	Austin, O. M. Sales	512-452-1838
TX	Dallas, O. M. Sales	214-241-3876
TX	Houston, O. M. Sales	713-789-4426
UT	Salt Lake City, Electrodyne	801-486-3801
WA	Bellevue, Olson, Ferree & Assoc.	206-883-7792
WI	Brookfield, Micro Sls.	414-782-1171

Local Distributors

AL	Huntsville, Marshall	205-881-9236
AL	Huntsville, Pioneer/Wash	205-837-9300
AZ	Tempe, Anthem	602-244-0900
AZ	Tempe, Marshall Inds.	602-968-6181
CA	Canoga Park, Marshall Inds.	213-999-5001
CA	Chatsworth, Anthem	213-700-1000
CA	El Monte, Marshall Inds.	213-442-7204
CA	Irvine, Marshall Inds.	714-556-6400
CA	San Diego, Anthem	619-453-9005
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, Anthem	408-946-8000
CA	Sunnyvale, Marshall Inds.	408-732-1100
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Tustin, Anthem	714-730-8000
CO	Denver, Marshall Inds.	303-427-1818
CO	Englewood, Anthem	303-790-4500
CT	Norwalk, Pioneer-Harvey Elctrns.	203-853-1515
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Pioneer/Wash	305-834-9090
FL	Ft. Lauderdale, Pioneer/Wash	305-771-7520
FL	Orlando, Marshall Inds.	305-841-1878
GA	Norcross, Pioneer/Wash	404-448-1711
GA	Norcross, Marshall Inds.	404-923-5750
IL	Elk Grove Vlg., Pioneer-Standard	312-437-9680
IL	Schaumberg, Marshall	312-490-0155
IN	Indianapolis, Pioneer-Standard	317-849-7300
MD	Gaithersburg, Pioneer/Wash	301-948-0710
MD	Gaithersburg, Marshall Inds.	301-840-9450
MA	Burlington, Marshall Inds.	617-272-8200
MA	Lexington, Pioneer-Harvey Elctrns.	617-861-9200
MI	Livonia, Marshall	313-525-5850
MI	Livonia, Pioneer-Standard	313-525-1800
MN	Minnetonka, Pioneer-Standard	612-935-5444
MN	Plymouth, Marshall	612-559-2211
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Pine Brook, Pioneer-Harvey Elctrns.	201-227-1262
NY	Endwell, Marshall	607-754-1570
NY	Fairport, Pioneer-Harvey Elctrns.	716-381-7070
NY	Hauppauge, Marshall Inds.	516-273-1515
NY	Rochester, Marshall	716-235-7640
NY	Vestal, Pioneer-Harvey Elctrns.	607-748-8211
NY	Woodbury, Pioneer-Harvey Elctrns.	516-921-8700
NC	Charlotte, Pioneer/Wash	704-572-8188
OH	Cleveland, Pioneer-Standard	216-587-3600
OH	Dayton, Marshall	513-236-8088
OH	Dayton, Pioneer-Standard	513-236-9900
OR	Beaverton, Marshall	503-644-5050
PA	Horsham, Pioneer/Wash	215-665-6778
PA	Pittsburgh, Pioneer-Standard	412-782-2300
TX	Austin, Marshall	512-458-5654
TX	Austin, Pioneer-Standard	512-835-4000
TX	Dallas, Pioneer-Standard	214-386-7300
TX	Dallas, Marshall Inds.	214-233-5200
TX	Houston, Pioneer-Standard	713-988-5555
TX	Houston, Marshall Inds.	713-789-6600
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Marshall Inds.	206-747-9100
WA	Redmond, Anthem	206-881-0850

BOSTON SYSTEMS OFFICE, 469 Moody St., Waltham, MA 02154, Tel: 617-894-7800, TWX: 710-324-0760; Empl.: 60; *Sls. Mgr.:* Francis X. O'Brien; *Dist. Mgr.:* Debra DellaCamera (International)

BOURNS, INC., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, Tel: 714-781-5050, TWX: 910-332-1252; Empl.: 4000; *Sls. Mgr.:* R. A. Sickler; *Dist. Mgr.:* Dennis Lause ....1A•1804-1807, 2022-2035

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Encino, Great American Rep Co.	213-990-4870
CA	San Diego, SR Elctrns.	619-560-8330
CA	San Jose, QuadRep Inc.	408-946-4000
CA	Tustin, Great American Rep Co.	714-832-8113
CO	Parker, Parker Webster	303-841-4888
FL	Altamonte Springs, Dyne-A-Mark	305-831-2097
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
FL	Palm Bay, Dyne-A-Mark	305-727-0192
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Boise, Intermountain Technlg.	208-322-5022
IL	Elk Grove Village, John G. Twist Co.	312-593-0200
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, REP Assocs. Corp.	319-373-0152
KY	Louisville, Technlg. Mktg. Corp.	502-499-7808
MD	Baltimore, Micro-Comp.	301-247-0400
MA	Lexington, John E. Boeing Co.	617-862-2500
MI	Detroit, Rathsburg Assoc.	313-882-1717
MN	Edina, Mel Foster	612-941-9790
MO	Bridgeton, Centech	314-291-4230
MO	Raytown, Centech	816-358-8100
NJ	Bellmawr, Thomas Assoc.	609-933-2600
NM	Albuquerque, Shefler-Kahn Co.	505-296-0749
NY	Ithaca, B. Dean	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Wappingers Falls, Bourns	914-297-1180
NC	Raleigh, CSR Electronics	919-878-9200
OH	Richfield, Bear Mktg.	216-659-3131
OK	Oklahoma City, Ammon & Rizos	405-942-2552
OR	Portland, J. J. Backer	503-297-8744
OR	Salem, J. J. Backer	503-362-0717
TX	Austin, Ammon & Rizos	512-454-5131
TX	Dallas, Ammon & Rizos	214-233-5591
TX	Houston, Ammon & Rizos	713-781-6240
UT	Salt Lake City, Parker Webster	801-487-5911
VA	Huddleston, Micro-Comp	301-247-0400
WA	Seattle, J. J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Pioneer/Washington	205-837-9300
AL	Huntsville, Schweber	205-882-2200
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Phoenix, Cetec Elctrns.	602-272-7951
AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Phoenix, Elctrn. Parts Co.	602-277-7281
AZ	Tempe, Elctrn. Supp.	602-258-4769
AZ	Tempe, Acacia Sls.	602-894-2874
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Acacia Sales	303-232-2882
AZ	Tempe, Hamilton/Avnet	602-231-5100
CA	Canoga Park, Schweber Elctrns.	213-999-4702
CA	Chatsworth, Avnet Elctrns.	213-700-2600
CA	Citrus Hts, Hall-Mark Elctrns.	916-443-7282
CA	Compton, Harper S.I.D.	213-979-5090
CA	Costa Mesa, Hamilton Elctrns.	714-641-4100
CA	Costa Mesa, Avnet Elctrns.	213-558-2313
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Culver City, Hamilton Electro Sls.	213-558-2883/84
CA	Culver City, Hamilton Electro Sls.	213-558-2121
CA	El Segundo, Hall-Mark Elctrns.	213-643-9101
CA	Garden Grove, Bell Inds.	213-444-0301
CA	Gardena, Bell Inds.	213-515-1800
CA	Irvine, Schweber Elctrns.	714-863-0261
CA	Irvine, Cetec Elctrns.	714-250-4141
CA	Irvine, Acacia Sls.	714-549-0954
CA	Irvine, Schweber Elctrns.	714-556-3880
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Riverside, Elctrn. Supp. Corp.	714-787-9220
CA	Roseville, Bell Inds.	916-969-3100
CA	Sacramento, Schweber Elctrns.	916-929-9732
CA	Sacramento, Hamilton/Avnet	916-920-3150
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Acacia Sls.	619-565-4365
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Cetec Elctrns.	619-278-5020
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Elctrn. Supp.	619-278-5020
CA	San Diego, Hamilton/Avnet	619-571-7500
CA	San Jose, Cetec Elctrns.	408-263-7373
CA	Santa Ana, Teknopak	714-558-8840
CA	Santa Clara, Schweber Elctrns.	408-748-4700
CA	Santa Clara, Schweber Elctrns.	408-496-0200
CA	Southgate, Cetec Elctrns.	213-773-6521

CA	Sunnyvale, Acacia Sales	408-745-7200
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CA	Tustin, Hall-Mark Elctrns.	714-669-0681
CA	Woodland Hills, Avnet Elctrns.	213-884-3322
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Hall-Mark Elctrns.	303-694-1662
CO	Englewood, Hamilton/Avnet	303-779-9998
CO	Lakewood, Acacia Sales	303-232-2882
CO	Wheat Ridge, Bell Inds.	303-424-1985
CT	Danbury, Hamilton/Avnet	203-797-2856
CT	Danbury, Schweber Elctrns.	203-792-3500
CT	Hamden, Almo Elctrns. Corp.	203-288-6556
CT	Norwalk, Pioneer Standard	203-853-1515
CT	Wallingford, Midan Elctrns.	203-265-2077
FL	Altamonte Springs, Pioneer Standard	305-834-9090
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Dania, Summit Distrs.	305-920-6253
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Ft. Lauderdale, Pioneer/Washington	305-771-7520
FL	Ft. Lauderdale, Hamilton/Avnet	305-971-2900
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Hollywood, Schweber Elctrns.	305-927-0511
FL	Largo, Graham Elctrns.	813-541-4434
FL	Orlando, Hall-Mark	305-855-4020
FL	Orlando, Pioneer/Orlando	305-834-9090
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	St. Petersburg, Hamilton/Avnet	813-576-3930
FL	St. Petersburg, Hall-Mark Elctrns.	813-576-8691
FL	Winter Park, Hamilton/Avnet	305-628-3888
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Pioneer/Washington	404-448-1711
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Schweber Elctrns.	404-449-9170
GA	Norcross, Hamilton/Avnet	404-447-7500
IL	Bensenville, Hamilton/Avnet	312-860-8523
IL	Bensenville, Hall-Mark Elctrns.	312-860-3800
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elk Grove Village, Schweber Elctrns.	312-364-3750
IL	Elk Grove Village, Pioneer Standard	312-437-9680
IL	Palatine, Ohm Electronics	312-359-5500
IL	Peoria, Klaus Radio	309-691-4840
IN	Carmel, Hamilton/Avnet	317-844-9333
IN	Fort Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Pioneer Standard Elctrns.	317-849-7300
IN	Lafayette, Graham Elctrns.	317-423-5564
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
IA	Cedar Rapids, Bell Inds.	319-395-0730
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
KS	Overland Park, Schweber Elctrns.	913-492-2921
KS	Overland Pk., Hamilton/Avnet Elctrns.	913-888-8900
LA	New Orleans, Wm B Allen Supp.	504-525-8222
MD	Baltimore, Radio Elec. Svc. Co.	301-823-0070
MD	Beltsville, Radio Elec. Svc. Co.	202-937-9100
MD	Columbia, Hamilton/Avnet	301-995-3500
MD	Columbia, Hall-Mark Elctrns.	301-796-9300
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MD	Rockville, Almo Elctrns. Corp.	301-251-1161
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Burlington, Lionex Corp.	617-272-9400
MA	Canton, Almo Elctrns. Corp.	617-821-1450
MA	Lexington, Pioneer Standard	617-863-1200
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wilmington, RC Comps.	617-273-1860
MA	Woburn, Hall-Mark Elctrns.	617-935-9777
MA	Woburn, Hamilton/Avnet	617-273-7500
MI	Flint, RS Elctrns.	313-762-5800
MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Kalamazoo, RS Elctrns.	616-381-5470
MI	Livonia, Schweber Elctrns.	313-525-8100
MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Hamilton/Avnet	313-522-4700
MI	Livonia, Pioneer Standard Elctrns.	313-525-1800
MI	Roseville, RS Elctrns.	313-779-2450
MI	Wyandotte, RS Elctrns.	313-AV2-5880
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
MN	Eden Prairie, Schweber Elctrns.	612-941-5280
MN	Edina, Schweber Elctrns.	612-941-5280
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minnetonka, Hamilton/Avnet	612-932-0600
MN	Minnetonka, Pioneer Standard Elctrns.	612-935-5444
MO	Earth City, Schweber Elctrns.	314-739-0526
MO	Earth City, Hamilton/Avnet	314-344-1200
MO	Maryland Hts, Hall-Mark Elctrns.	314-291-5350
NH	Hudson, C&H Elctrns.	603-882-1133
NH	Manchester, Schweber Elctrns.	603-625-2250
NJ	Camden, General Radio	609-964-8560
NJ	Cherry Hill, Hamilton/Avnet	609-424-0110
NJ	Cherry Hill, Hall-Mark Elctrns.	609-424-7300
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Fairfield, Hall-Mark Elctrns.	201-575-4415
NJ	Fairfield, Hamilton/Avnet	201-575-3390
NJ	Fairfield, Schweber Elctrns.	201-227-7880
NJ	Fairfield, Lionex	201-227-7960
NJ	Pine Brook, Pioneer Std.	201-227-1262
NM	Albuquerque, Elctrn. Parts	505-293-6161
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Elctrn. Parts Co.	505-293-6161
NM	Albuquerque, Hamilton/Avnet Elctrns.	505-765-1500
NM	Las Cruces, Elctrn. Parts Co.	505-523-4578
NY	Buffalo, Summit Distrs.	716-884-3450
NY	E. Syracuse, Hamilton/Avnet	315-437-2647
NY	Fairport, Pioneer-Harvey	716-381-7070
NY	Hauppauge, Pioneer-Harvey	516-231-9200
NY	Hauppauge, Mast Distrs.	516-273-4422
NY	Hauppauge, Lionex	516-273-1660
NY	Melville, Hamilton/Avnet	516-231-9800
NY	Melville, Hamilton/Avnet	516-454-6000
NY	Rochester, Summit Distrs.	716-334-8110
NY	Rochester, CAM/RPC	716-865-2080
NY	Rochester, Schweber Elctrns.	716-424-2222
NY	Rochester, Hamilton/Avnet Elctrns.	716-475-9130
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600
NY	Vestal, Pioneer Std.	607-748-8211
NY	Westbury, Schweber Elctrns.	516-334-7474
NY	Woodbury, Pioneer-Harvey	516-921-8700
NC	Charlotte, Pioneer/Washington	704-527-8188
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Greensboro, Pioneer/Washington	919-273-4441
NC	Raleigh, Hall-Mark Elctrns.	919-873-0712
NC	Raleigh, Schweber Elctrns.	919-876-0000
NC	Raleigh, Hamilton/Avnet	919-878-0819
NC	Raleigh, Hall-Mark Elctrns.	919-872-6286
NC	Raleigh, Hamilton/Avnet Elctrns.	919-829-8030
OH	Beachwood, Schweber Elctrns.	216-464-2970
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, Hall-Mark Elctrns.	513-563-5980
OH	Cleveland, Hamilton/Avnet	216-831-3500
OH	Cleveland, Pioneer Std.	216-587-3600
OH	Cleveland, CAM/Ohio	216-461-4700
OH	Columbus, Graham Elctrns.	614-895-1590
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Bell Inds.	513-434-8213
OH	Dayton, Schweber Elctrns.	513-439-1800
OH	Dayton, Pioneer Std.	513-236-9900
OH	Dayton, Hamilton/Avnet	513-433-0610
OH	Maumee, RS Elctrns.	419-893-0721
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OH	Westerville, Hall-Mark Elctrns.	614-891-4555
OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
OK	Tulsa, Schweber Elctrns.	918-622-8000
OR	Beaverton, Almac Elctrns.	503-641-9070
OR	Beaverton, Acacia Sls.	503-646-3377
OR	Lake Oswego, Bell Inds.	503-241-4115
OR	Lake Oswego, Hamilton/Avnet Elctrns.	503-635-8831
PA	Horsham, Schweber Elctrns.	215-441-0600
PA	Horsham, Pioneer/Washington	215-674-4000
PA	Horsham, Lionex Corp.	215-443-5150
PA	Lancaster, CAM/RPC	717-392-8141
PA	McKean, Advacom Inc.	814-476-7774
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Pittsburgh, Schweber Elctrns.	412-782-1600
PA	Pittsburgh, CAM/RCP	412-782-3770
PA	Pittsburgh, Almo Elctrns. Corp.	412-931-5990
PA	Pittsburgh, Pioneer Standard Elctrns.	412-782-2300
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Nashville, Graham Elctrns.	615-242-2682
TX	Austin, Harrison Equip. Co.	512-458-3555
TX	Austin, Hall-Mark Elctrns.	512-258-8848
TX	Austin, Schweber Elctrns.	512-458-8253
TX	Austin, Hamilton/Avnet	512-837-8911
TX	Austin, Pioneer Standard Elctrns.	512-835-4000
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Dallas, Hall-Mark Elctrns.	214-341-1147
TX	Dallas, Pioneer Standard Elctrns.	214-386-7300
TX	Dallas, Schweber Elctrns.	214-661-5010
TX	El Paso, Ideal Indl. Elctrn. Supp.	915-779-6647
TX	Houston, Schweber Elctrns.	713-784-3600
TX	Houston, Pioneer Std.	713-988-5555
TX	Houston, Hall-Mark Elctrns.	713-781-6100
TX	Houston, Harrison Equip. Co.	713-879-2600
TX	Houston, Hamilton/Avnet	713-975-3501
TX	Houston, Pioneer Standard Elctrns.	214-386-7300
TX	Irving, Hamilton/Avnet	214-659-4100
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Hamilton/Avnet	801-972-2800
WA	Bellevue, Bell Inds.	206-747-1515
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Hamilton/Avnet	206-643-3950
WI	Brookfield, Schweber Elctrns.	414-784-9020
WI	Mequon, Taylor Elec.	414-241-4321
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Electronic Expeditors	414-228-8100
WI	New Berlin, Hamilton/Avnet	414-784-4510
WI	Oak Creek, Hall-Mark Elctrns.	414-761-3000
WI	Waukesha, Bell Inds.	414-547-8879

BOURNS INSTRS., INC., Technical Prods. Grp., 6135 Magnolia Ave., Riverside, CA 92506, Tel: 714-781-5433; *Sls. Mgr.:* Ken Pinkham; *Dist. Mgr.:* Ken Pinkham

BOURNS INSTRS., INC., Industrial Div., 1960 Chicago Ave., Unit F, Riverside, CA 92503, Tel: 714-781-5147, Telex: 676401, TWX: 910-332-1281; *Sls. Mgr.:* Tom McCarthy

BOURNS MAGNETIC DIV., Technical Products Group, Box 1398, Romoland, CA 92380, Tel: 714-657-5195, TWX: 910-332-1304; Empl.: 120; *Sls. Mgr.:* Dennis Dalbeck

BOWMAN INDUSTRIES, 9300 Hall Rd., Downey, CA 90241

BOWMAR/ALI, Bowmar Instr. Corp., 531 Main St., Acton, MA 01720, Tel: 617-263-8365, TWX: 710-347-1441; Empl.: 170; *Sls. Mgr.:* Cliff Lewis

Bowmar

BOWMAR INSTRUMENT CORP., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809, Tel: 219-747-3121, TWX: 810-332-1510; FSC No.: 99479; Empl.: 215; *Sls. Mgr.:* Herb Black .....1B•1762, 1763; 3•1124

Advertisement

Bowmar/Aerospace Division manufactures state-of-the-art tactile feel short stroke keyboards for industrial and military applications. Also manufactured are "CHOICE", Computer Hosted Operator Interactive Controls Execution panels. Additionally, the Aerospace Division designs and manufactures electromechanical components; counters, gearheads, actuators, control sticks, and other custom designed components and systems.

Local Sales Offices & Reps

AZ	Scottsdale, TC Elctrns.	602-994-5153
CA	Los Angeles, Westaironics	213-641-4122
CA	San Francisco, Quigley Entprs.	415-591-6319
CT	Windsor Locks, Bowmar Instr. Corp.	203-627-9940
FL	Bradenton, Saber Assocs.	813-441-1301
FL	Longwood, Saber Assocs.	305-422-3686
FL	Melbourne, Saber Assocs.	305-724-0920
FL	Pompano Beach, Saber Assocs.	305-943-3076
IL	Rolling Mewdows, KMA Sls. Co.	312-398-5300
IA	Cedar Rapids, Ard Sls. Inc.	319-393-6392
MN	Bloomington, Electronic Sls. Agy.	612-884-8291
MO	St. Louis, Abrams Assocs.	314-569-0447
NJ	Matawan, Bowmar Instr. Corp.	201-526-0400
OH	Dayton, Raystan Controls	513-278-3559
PA	West Chester, Bowmar Instr. Corp.	215-692-2700
TX	Arlington, Bowmar Instr. Corp.	817-429-4164

BOWMAR INSTRUMENT CORP., Commercial Products Div., 4640 126th Ave. N., Clearwater, FL 33520, Tel: 813-576-2525, TWX: 810-863-0375; Empl.: 127; *Sls. Mgr.:* M. Kaylor; *Dist. Mgr.:* M. Kaylor

BOWMAR/TIC, INC., 850 Lawrence Dr., Newbury Park, CA 91320, Tel: 805-498-2161, TWX: 910-336-1265; FSC No.: 99957; Empl.: 100; *Sls. Mgr.:* Reece Kendall

BOW SOLDER PRODS., 900 Hobson St., Union, NJ 07083, Tel: 201-686-6040, 800-526-4496; Empl.: 38; *Sls. Mgr.:* Karl Lazar

BRADY CO., 574A Somerset St., N. Plainfield, NJ 07060, Tel: 201-753-7988; *Sls. Mgr.:* Ed Brady; *Dist. Mgr.:* John Blaze

BRADY, W.H., CO., Elctrn. Prods. Div., 6150 N. Flint Rd., Milwaukee, WI. 53201, Tel: 414-332-8100, Telex: 26-677; *Sls. Mgr.:* David D. Tatham

BRADY, W. H., CO., Indl. Prods. Div., 2221 W. Camden Rd., Milwaukee, WI 53201, Tel: 414-351-6630, Telex: 26-677, TWX: 910-262-3151; *Sls. Mgr.:* K. O. Barr; *Dist. Mgr.:* J. C. Barbieri

BRADY, W.H., CO. NAMEPLATE DIV., See Brady, W.H., Co., Elctrn. Prods. Div

BRADY, W. H., CO., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201, Tel: 414-355-8300, Telex: 26-677, TWX: 910-262-3151; FSC No.: 85480; *Sls. Mgr.:* G. R. Manich; *Dist. Mgr.:* G. R. Manich

BRAEMAR COMPUTER CORP., 11950 Twelfth Ave. S., Burnsville, MN 55337, Tel: 612-890-5135; Empl.: 130; *Sls. Mgr.:* Tom Foster

BRAILSFORD & CO., 670 Milton Rd., Rye, NY 10580, Tel: 914-967-1820; Empl.: 25

BRAND DIELECTRICS, INC., Route 203, N. Windham, CT 06256, Tel: 203-423-6321; Empl.: 5; *Sls. Mgr.:* Philip Harvey

BRANDEN, T. G., CORP., 5565 S.E. Intl. Way, Portland, OR 97222, Tel: 503-659-9366; Empl.: 8; *Sls. Mgr.:* Ted Brandt

BRAND-REX, Electronic & Indl. Cable Div., Box 498, Willimantic, CT 06226, Tel: 203-423-7771, TWX: 710-440-2247; FSC No.: 71124; Empl.: 1000; *Sls. Mgr.:* J. F. Cichy

Local Sales Offices & Reps

AZ	Phoenix, M/R Engrg. Sls. Inc.	602-956-4670
CA	San Jose, Brand-Rex	408-247-9811
CA	Santa Ana, Brand-Rex	714-835-0802
CO	Westminster, Western Region Mktg., Inc.	303-430-8883
CT	Manchester, Brand-Rex	203-423-7771
FL	Fern Park, E.I.R., Inc.	305-830-9600
IL	Rolling Meadows, Brand-Rex	312-392-7362
IN	Indianapolis, Insulation Reps.	317-842-5203
MD	Hanover, J. A. Maguire & Co.	301-796-0970
MI	Farmington Hills, Joseph H. Clark Sales Co.	313-553-0610
MN	Edina, Grayden & Flemmer	612-941-1120
MO	Chesterfield, Durnin & Assocs.	314-532-9774
NJ	Dunellen, J. A. Maguire & Co.	201-752-8480
NJ	Pennsauken, J. A. Maguire & Co.	609-665-5136
NY	Great Neck, Cooper-Simon & Co.	516-487-1142
NY	Pittsford, Kirby Mktg.	716-248-8750
OH	Chagrin Falls, Joseph H. Clark Sls.	216-247-7848
OR	Portland, Barrett, Squibb & Assocs.	503-644-2550
SC	Greenwood, Bamco	803-229-6801
TN	Knoxville, Insul-Reps	615-691-7586
TX	Richardson, C. J. Tellier Co.	214-231-6348
VA	Portsmouth, J. A. Maguire & Co.	804-398-0202

Local Distributors

AZ	Phoenix, Storm Prods.	602-269-3485
CA	Inglewood, Storm Prods.	213-649-6141
CA	Santa Clara, Storm Prods.	408-749-9400
CO	Broomfield, Storm Prods.	303-466-1991
FL	Ft. Lauderdale, K.S.M. Elctrns.	305-971-5900
IL	Hinsdale, Storm Prods.	312-323-9121
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Minneapolis, Bergquist Co.	612-835-2322
NY	Fairport, Pacer Elctrns.	716-377-0462
NY	Farmingdale, Vertx Elctrns.	516-293-9800
NY	Farmingdale, Weico Elctrns.	516-293-0050
PA	Folcroft, Delphi Elctrns.	215-534-3900
TX	Dallas, Storm Prods.	214-330-1381
WA	Redmond, Storm Prods.	206-883-4666

BRANDT ELCTRNS., INC., 1220 Alderwood Ave., Sunnyvale, CA 94086, Tel: 408-734-8310, TWX: 910-339-9560; FSC No.: 57837; *Sls. Mgr.:* Frank D. Brandt

BRANSON CORP., Box 147, Newton, NJ 07860, Tel: 201-383-3132, TWX: 710-988-2298; FSC No.: 99928; Empl.: 40; *Sls. Mgr.:* James A. Witzler

BRAXTON MFG., Echo Lake Rd. N., Watertown, CT 06795, Tel: 203-274-6781, TWX: 710-477-0621; Empl.: 100; *Sls. Mgr.:* Mark W. Ritucci

BREEZE-ILLINOIS, TransTechnology Corp., Main & Agard Sts., P.O. Box 368, Wyoming, IL 61491, Tel: 309-695-2511, TWX: 510-390-3691; Empl.: 180; *Sls. Mgr.:* Patrick Banakis **2**•1986, 1987

Local Sales Offices & Reps

CA	Redwood City, Ault Assocs.	415-367-1710
CA	Woodland Hills, Cal Ward Sls.	213-883-2202
CO	Longmont, Todd & Fry Assocs.	303-776-7331
FL	St. Petersburg, Tech. Reps. Assocs.	813-577-2779
IL	Berkeley, Balhorn & Roeser	312-449-3900
KS	Desoto, Midtec Assocs., Inc.	913-441-6565
MD	Ellicott City, Tech. Sls., Inc.	301-461-2400
MA	Milton, Naton Assocs.	617-698-0670
MI	Madison Heights, Pine Sls., Inc.	313-589-0350
MN	Bloomington, Merrill Franklin	612-854-9446
MO	Florissant, Technical Sls., Inc.	314-837-5200
NY	Great Neck, Trionic Assocs.	516-466-2300
OH	Chagrin Falls, Pine Sls., Inc.	216-247-6198
PA	Pittsburgh, Pine Sls., Inc.	412-456-7471
TX	Bedford, DeArmond Enterprises	817-267-2048
WA	Bellevue, Lehr Assocs.	206-453-9993

BRELONIX, 106 No. 36th St., Seattle, WA 98103, Tel: 206-633-1964; Empl.: 10; *Sls. Mgr.:* A. L. DeVore

BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, Telex: 220883 TAUR; FSC No.: 51828; Empl.: 90; *Sls. Mgr.:* R. Mainzer; *Dist. Mgr.:* R. Mainzer **3**•1404-1406

Local Sales Offices & Reps

AZ	Phoenix, Fetty/Schoenduve	602-241-9009
CA	El Segundo, Fetty/Schoenduve	213-322-4991
CA	San Diego, Fetty/Schoenduve	619-292-5136
CA	San Francisco, Fetty/Schoenduve	415-962-8330

BREVEL MOTORS, INC., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, Tel: 201-933-0220; *Sls. Mgr.:* Jack Dominice **1B**•1136

Local Sales Offices & Reps

AZ	Scottsdale, Mercury Engr.	602-954-6964
AR	El Dorado, Industrial Control Assoc.	501-862-2051
CA	Los Angeles, Electric Motor Engr.	213-469-7393
CO	Denver, West Inc.	303-773-8180
CT	Old Saybrook, M. L. Assoc.	203-388-9718
FL	Altamonte Springs, Machine Controls	305-788-6607
IL	Chicago, Jerry Gooten Co.	312-792-1991
KS	Prairie Village, Darco Sls.	913-381-7913
MA	Ashland, M. L. Assoc.	617-485-6190
MI	Livonia, Electrolines	313-591-2428
MN	St. Paul, Vikeland Sls.	612-645-4647
NJ	Teaneck, Herbert Rude & Assoc.	201-836-6778
NY	Penfield, Upstate Comps.	716-381-6070
NC	Raleigh, Leigh Sls.	919-872-1484
OH	Bucyrus, Sissler & Assoc.	419-562-9311
OH	Columbus, Sissler & Assoc.	614-488-4455
PA	Exton, Kiley Elec. Co.	215-363-8550
TN	Cleveland, Hicks Sls.	615-472-7398

Local Distributors

AZ	Phoenix, Johnstone	602-269-9354
CA	Baldwin Park, Johnstone	213-962-7138
CA	Los Angeles, Minarik	213-624-3161
CO	Denver, Johnstone	303-573-5626
CT	New Haven, Star Supply Co.	203-772-2240
FL	Ft. Lauderdale, Johnstone	305-971-9350
GA	Norcross, Johnstone	404-446-0400
ID	Boise, Johnstone	208-377-1600
IL	Chicago, Harry Alter	312-376-3505
KS	Wichita, Johnstone	316-267-3629
LA	New Orleans, Harry Alter Co.	504-488-4435
MD	Rockville, Johnstone	301-251-0281
MA	Medford, Empire	617-395-5000
MI	Farmington Hills, Universal Elec. Prod.	313-476-9500
MO	Kansas City, Johnstone Corp.	816-842-3250
MT	Billings, Johnstone Corp.	406-252-1207
NE	Omaha, Johnstone Corp.	402-339-2342
NV	Sparks, Johnstone Corp.	702-356-6668
NJ	Cherry Hill, Motor and Control Syst.	609-424-5810
NJ	Gafield, The Harry Alter Co.	201-478-0455
NM	Albuquerque, Johnstone Corp.	505-884-0824
NY	Manhattan, The Harry Alter Co.	212-255-5300
OH	Cleveland, Reserve Elec	216-771-5764
OK	Oklahoma City, Johnstone Corp.	405-232-8576
OR	Portland, Johnstone Corp.	503-233-1151

BREW, RICHARD D., & CO., INC., 90 Airport Rd., Concord, NH 03301, Tel: 603-225-6605, Telex: 943-483; FSC No.: 98913; Empl.: 43

BRIDGE COMPUTER CO., Sea Data Corp., 1 Bridge St., Newton, MA 02158, Tel: 617-244-8190, Telex: 951107; *Sls. Mgr.:* Elaine Doll

BRIGGS, C. A., CO., P.O. Box 151, Glenside, PA 19038, Tel: 215-885-2244, Telex: 83-4753; Empl.: 10; *Sls. Mgr.:* C. A. Briggs, Jr.

BRIM ELCTRNS., 120E Home Pl., Lodi, NJ 07644, Tel: 201-796-2886; FSC No.: 57834 **2**•1988-1995

Local Sales Offices & Reps

FL	De Bary, DJE Assocs.	305-668-6827
MA	Millis, R G Assocs.	617-376-2044
MA	Stow, R G Assocs.	617-897-7146
EXP	NY, N.Y.C., Roburn Agencies	212-989-5939

Local Distributors

AL	Dothan, Carmichael Whls. Supp.	205-793-7066
CA	Canoga Park, Tim-Co. Sls.	213-992-5040
CA	San Diego, Shanks & Wright	619-239-0176
CT	Manchester, IMS	203-649-4415
CT	Waterbury, Suburban Supp.	203-757-1251
GA	Marietta, Atlanta Elec. Wire & Cable	404-955-6800
LA	New Orleans, Radio Parts	504-581-5959
MA	Billerica, Eastern Video Sys.	617-667-0009
MA	Lexington, Wholesale Elect. Supp.	617-862-3590
MA	Springfield, Electro-Term	413-734-6469
MA	Waltham, Linear Elect.	617-894-7300
MI	Troy, Northern Wire & Cable	313-589-0510
NH	Dover, American Radio Corp.	603-742-6800
NJ	Hackensack, Milcor	201-489-1313
NY	LIC, H.L. Dalis	212-361-1100
NY	N.Y.C., Center Indl.	212-YU9-6363
OK	Tulsa, Radio	918-587-9123
PA	Philadelphia, Spectrum Elec.	215-748-3010
RI	Newport, J & S Elctrn. Distb.	401-847-2977
TN	Knoxville, Bondurant Bros. Co.	615-573-9151
TX	Grand Prairie, Southwest Hardware & Fastever	214-264-4711
TX	Texarkana, Lavender Elec.	501-773-4631
TX	Texarkana, McCulloch Elctrns.	214-792-6923
VA	Norfolk, Todd Elec.	804-855-3111
WA	Seattle, Amateur Radio Supp.	206-767-3222

BRISTOL BABCOCK INC., 40 Bristol St., Waterbury, CT 06708, Tel: 203-575-3000, Telex: 962417, TWX: 203-754-1477; Empl.: 600; *Sls. Mgr.:* Don Grice

BRISTOL SAYBROOK, 97 Coulter St., Old Saybrook, CT 06475, Tel: 203-388-3414, Telex: 966-435; Empl.: 125; *Sls. Mgr.:* George S. Willis

Local Sales Offices & Reps

CA	Los Angeles, C.E. Mello Co.	213-626-9159
CT	Old Saybrook, M-L Assoc.	203-388-9718
FL	Largo, Kirk Sls, Inc.	813-595-7353

Local Distributors

CA	Los Angeles, Minarik Electic Co.	213-624-3161
MA	Somerville, Electro Sls. Co.	617-666-0500
NY	Sodus, AED Distributors	315-483-6561

BROOKS INSTR. DIV., Emerson Elec. Co., 407 W. Vine St., Hatfield, PA 19440, Tel: 215-362-3500, Telex: 846-181; Empl.: 1500; *Sls. Mgr.:* William Weierbach

BROOKS MFG. CO., 2016/24 Amber St., Philadelphia, PA 19125, Tel: 215-425-3395, 800-523-0130; Empl.: 35; *Sls. Mgr.:* G. Brooks; *Dist. Mgr.:* G. Brooks

BROWN BOVERI ELEC., Norristown Rd., Spring House, PA 19477, Tel: 215-628-7400, TWX: 510-661-0168; Empl.: 3,500

BROWN BOVERI ELECTRIC, INC., 167 Overland Drive, P.O. Box 648, West Columbia, SC 29171, Tel: 803-796-9502

BRUEL & KJAER INSTRS. INC., 185 Forest St., Marlboro, MA 01752, Tel: 617-481-7000, TWX: 710-347-1187 **1B**•1836, 1837; **3**•1205

Local Sales Offices & Reps

AL	Huntsville, Bruel & Kjaer Instrs.	404-951-0115
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Anaheim, Bruel & Kjaer Instrs.	714-978-8066
CA	Foster City, Bruel & Kjaer Instrs.	415-574-8155
CO	Wheat Ridge, Emcar Mktg., Inc.	303-424-0108
CT	Groton, Bruel & Kjaer Instrs.	617-481-7000
FL	Maitland, Bruel & Kjaer Instrs.	404-951-0115
GA	Atlanta, Bruel & Kjaer Instrs.	404-951-0115
HI	Honolulu, J. C. Elctrns.	808-841-5526
IL	Hoffman Estates, Bruel & Kjaer Instrs.	312-358-7582
IN	Indianapolis, Bruel & Kjaer Instrs.	313-522-8600
IA	Bettendorf, Bruel & Kjaer Instrs.	312-358-7582
KY	Louisville, Bruel & Kjaer Instrs.	313-522-8600
MD	Gaithersburg, Bruel & Kjaer Instrs.	301-948-0494
MA	Marlborough, Bruel & Kjaer Instrs.	617-481-7000
MI	Livonia, Bruel & Kjaer Instrs.	313-522-8600
MN	Minneapolis, Bruel & Kjaer Instrs.	312-358-7582
MO	St. Charles, Bruel & Kjaer Instrs.	312-358-7582
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	West Caldwell, Bruel & Kjaer Instrs.	201-526-2284
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Albany, Bruel & Kjaer Instrs.	617-481-7000
NY	Rochester, Bruel & Kjaer Instrs.	617-481-7000
NC	Raleigh, Bruel & Kjaer Instrs.	404-951-0115
OH	Cleveland, Bruel & Kjaer Instrs.	313-522-8600
OH	Dayton, Bruel & Kjaer Instrs.	313-522-8600
OH	Lexington, Bruel & Kjaer Instrs.	313-522-8600
PA	Philadelphia, Bruel & Kjaer Instrs.	201-526-2284
PA	Pittsburgh, Bruel & Kjaer Instrs.	313-622-8600
SC	Rock Hill, Bruel & Kjaer Instrs.	404-951-0115

TX	Dallas, Bruel & Kjaer Instrs.	713-645-0167
TX	Houston, Bruel & Kjaer Instrs.	713-645-0167
WA	Seattle, Bruel & Kjaer Instrs.	206-625-1112

BRUSH MAGNETIC HEADS, Forgflo Corp., 3rd & Reagan Sts., P.O. Box 638, Sunbury, PA 17801, Tel: 717-286-5611, 800-233-0362, TWX: 510-655-0222; FSC No.: 19418; Empl.: 80; *Sls. Mgr.:* D. Stephen Morrison

BRYANT CIRCUIT DEVICES DIV., Westinghouse Elec. Corp., 500 Sylvan Ave., Bridgeport, CT 06606, Tel: 203-334-5561, Telex: 643-817, TWX: 710-453-8709; Empl.: 1000; *Sls. Mgr.:* G. V. Curtin

BSR (USA) LTD, Route 303, Blauvelt, NY 10913

BTU ENGRG. CORP., Bruce Sys., Esquire Rd., N. Billerica, MA 01862, Tel: 617-667-4111, Telex: 94-7489; Empl.: 600; *Sls. Mgr.:* D. Barry

BUBBL-TEC, 6800 Sierra Ct., Dublin, CA 94566, Tel: 415-829-8705, TWX: 910-389-6890; Empl.: 19; *Sls. Mgr.:* T. J. Netoff

BUCHANAN, See Control Prods. Div., Amerace Corp.

BUCKBEE-MEARS CO., Nashua Div., 100 Northeastern Blvd., P.O. Box 888, Nashua, NH 03062, Tel: 603-883-5541, Telex: 94-0340; *Sls. Mgr.:* Randolph Roody

BUCKEYE STAMPING CO., 555 Marion Rd., Columbus, OH 43207, Tel: 614-445-8433; Empl.: 85; *Sls. Mgr.:* R. E. Osborne VP Mktg. ....**2•**1019

Local Sales Offices & Reps

CA	Pasadena, P. Nurches Co.	213-MU1-8957
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Denver, G. Moss Elctrns.	303-455-7205
GA	Atlanta, Par Assoc.	404-391-9117
KS	De Soto, Midtec Assoc.	913-441-6565
MA	Belmont, Elctrn. Comps. & Svc.	617-484-8680
MN	Minneapolis, A. J. Warner Co.	612-729-7371
NY	Lynbrook, P. Saftler Assoc.	516-593-7880
OH	Columbus, McFadden Sls.	614-459-1280
PA	Paoli, T. Griffin Co.	215-647-1550

B the Buckeye
stamping co.

AUTHORIZED & STOCKING
DISTRIBUTOR

ESI

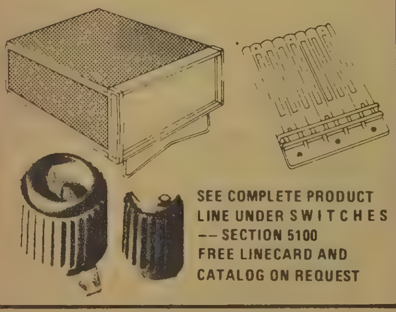
ELECTRIC SWITCHES
INCORPORATED

2478 Fletcher Drive, Los Angeles, Calif. 90039

(213) 660-1310

TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640

TWX 910-321-2971



SEE COMPLETE PRODUCT
LINE UNDER SWITCHES
-- SECTION 5100
FREE LINECARD AND
CATALOG ON REQUEST

TX	Dallas, Advance Tech. Sls.	214-340-1300
WA	Mercer Island, Elctrns. Comp. Sls.	206-232-9301

Local Distributors

CA	Los Angeles, Elect. Switches	213-664-1141
CA	Santa Clara, Aquari Comps.	408-496-0880
GA	Atlanta, Lakeland Engrg. Equip.	404-696-7334
MI	Ann Arbor, Wedemeyer Elctrns.	313-665-8611
NY	Hauppauge, Broadline Elctrn. Dist.	516-231-4100
WA	Seattle, Radar Electric	206-282-2511

BUD INDS., INC., 4605 E. 355th St., Willoughby, OH 44094, Tel: 216-946-3200, Telex: 810-427-2604; FSC No.: 71218; Empl.: 200; *Sls. Mgr.:* A. N. Haas; *Dist. Mgr.:* B. K. Haas

BUD RADIO, 4605 E. 355th St., Willoughby, OH 44094, Tel: 216-946-3200, TWX: 810-427-2604; Empl.: 200; *Sls. Mgr.:* A.N. Haas; *Dist. Mgr.:* Blair Haas

BUDWIG MFG., P.O. Box 829, Ramona, CA 92065, Tel: 619-789-0900

BUEHLER PRODS., P.O. Box A, Hwy. 70 E., Kinston, NC 28501, Tel: 919-522-3101, TWX: 510-924-2474; Empl.: 400; *Sls. Mgr.:* R. B. Davis ....**1B•**1137

BUGGIE H. H./CATON CONNECTOR CORP., 20 Wapping Rd., Kingston, MA 02364, Tel: 617-585-4315, TWX: 710-391-7546; FSC No.: 52196; *Sls. Mgr.:* Daniel J. Galambos ....**2•**1167

Local Sales Offices & Reps

CA	Fullerton, ISI/Mktg.	714-773-0411
TX	Dallas, CCI	214-484-9691

BULOVA SYS. & INSTR., Green Acres Rd., W., Valley Stream, NY 11582, Tel: 516-561-2600, TWX: 510-225-8709; Empl.: 850

BULOVA WATCH CO., See Frequency Control Prods., Inc., American Time Prods. Div.

BUMPER PRODUCTS CORP., 14 King St., P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, Telex: 244437 ACTP-UR; *Sls. Mgr.:* Ed Rosenthal ....**2•**1866

Local Distributors

CA	Covina, Arow Fasteners	818-967-6335
CA	Hayward, Arow Fasteners	800-227-2901
CA	San Leandro, Boyd Corp.	415-278-8000
CA	Santa Clara, San Jose Screw Prods.	408-988-3771
CA	Temple City, Fastening Systems	818-579-4600
FL	Tampa, Spencer Prods.	813-877-8276
GA	Atlanta, Georgia Rubber & Supply	404-355-0830
IL	Schaumburg, Engineered Fastener Co.	312-980-4082
IN	Ft. Wayne, Spencer Prods.	219-482-4882
IN	St. John, A.M. Associates	219-365-2100
MA	South Boston, Accurate Fasteners	617-268-8300
MI	Detroit, Tri-West Prods.	313-273-0400
MO	St. Louis, Engineered Fastener Co.	314-434-2888
NY	Buffalo, J.M. Cranz	716-832-3300
NY	Mt. Vernon, S.D. Christie Co.	914-699-7223
OH	Bedford, Spencer Prods.	216-475-8700
OH	Cincinnati, Spencer Prods.	513-771-6821
PA	Southampton, M & C Specialties	215-322-1600
TX	Dallas, Wilshire Foam Prods.	214-869-1727
TX	Ft. Worth, Cut-Craft	817-737-8207
WA	Spokane, Boyd Corp.	509-928-7200
WI	Brookfield, Cable Comps.	414-785-1060
Can	Quebec, Simfer Indl. Prod.	515-354-0886

BUNKER RAMO, see Amphenol, An Allied Co.

BUNTING MAGNETICS, 500 So. Spencer Rd., Newton, KS 67114, Tel: 316-284-2020; Empl.: 100; *Sls. Mgr.:* Robert J. Bunting

BUREAU OF ENGRAVING, INC., Ind'l. Div., 3311 Broadway N.E., Minneapolis, MN 55413, Tel: 612-623-0900, TWX: 910-576-2733; Empl.: 750

BURGESS SWITCH CO., INC., 638 Anthony Trail, North Brook, IL 60062, Tel: 312-291-1760, Telex: 206774; FSC No.: 6U850; *Sls. Mgr.:* Robin Dick; *Dist. Mgr.:* Robin Dick ....**1B•**1544-1546

Local Sales Offices & Reps

CA	Mountain View, Westech Sls.	415-961-1422
CA	Tustin, Sierra Pacific Engrg.	714-731-3411
FL	Casselberry, SEMI	305-695-3334
FL	Ft. Lauderdale, SEMI	305-475-3686
GA	Atlanta, Murphy and Cota	404-875-2525
IL	Des Plaines, Lincoln, Hodges and Assocs.	312-297-3810
IA	Cedar Rapids, Kencotronics	319-364-5288
KS	Mission, Mertens Co.	913-432-9323
MA	Cambridge, R.J.C. Assocs.	617-492-5858
MI	Ferndale, Hilltronics	313-398-5556
MN	St. Paul, Kencotronics	612-645-7717
MO	St. Louis, Mertens Co.	314-993-6600
NJ	Palisades Park, A. P. Technical Sls.	201-461-8875
NY	Albany, Niagara Elec. Sls.	518-869-0130
NY	Buffalo, Niagara Elec. Sls.	716-886-4000
NY	East Syracuse, Niagara Elec. Sls.	315-437-1656
NY	Rochester, Niagara Elec. Sls.	716-271-1223
NC	Burlington, Murphy & Cota	919-584-6450
OH	Cincinnati, Anderson-Bolds, Inc.	513-528-5680
OH	Cleveland, Anderson-Bolds, Inc.	216-229-4700
OH	Worthington, Anderson-Bolds Inc.	614-885-3933
PA	Philadelphia, Kenneth B. Erdman, Co.	215-224-1833
TX	Dallas, William Reese Assocs.	214-638-6575
TX	Houston, William Reese Assocs.	713-682-8149
WA	Seattle, Anthem Corp.	206-824-3399
WI	Janesville, Antek/Lincoln, Hodges & Assoc.	608-754-4214
WI	Waukesha, Lincoln, Hodges and Assocs.	414-542-3087

Local Distributors

AL	Muscle Shoals, Jones Elctrns., Inc.	205-383-1241
CA	Burlingame, Elec. Control Devices	415-348-0791
CA	Redondo Beach, Elctrl. Power & Controls	213-772-8890
FL	Miami, B & R Elctrns. Supp. Inc.	305-255-4510
FL	Miami, Electro-Standards Labs	305-633-6975
IL	Chicago Heights, Helsel-Jepperson	312-756-5600
MA	Fall River, Broadway Elec. Sls.	617-673-3339
MA	Holyoke, Falcetti & Clark Elec.	413-532-9402
MA	Springfield, Yankee Elec.	413-739-2101
MI	Grand Rapids, S & F Elctrns. Supp.	616-459-0216
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Elctrn. Center Inc.	612-371-5200
NH	Manchester, Cohen Machinery Co. Inc.	603-624-4324
NJ	Fairlawn, Relay Specialties	201-797-3313
NY	Commack, L.I., Schuyler Elec. Ind'l Co.	516-354-5711
NY	Gloversville, Montano Elctrl. Supp.	518-725-3139
NY	Woodside, Switches Unlimited	212-478-5000
NC	Durham, Triangle Elec. Motor	919-596-1333
NC	Gastonia, MJT Elctrns. & Control	704-867-4401
OH	Cincinnati, Richards Elec. Supp.	513-242-8800
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, Esco Elctrl. Supp.	215-923-6050
RI	Providence, J & H Elec. Co., Inc.	401-421-7840
TX	San Antonio, Sherman Elec. Supp. Inc.	512-224-1001
VA	Roanoke, Peoples Elctrn. Supp.	703-342-8933

BURLEIGH INSTRS., Burleigh Pk., Fishers, NY 14453, Tel: 716-924-9355, Telex: 978379; Empl.: 50; *Sls. Mgr.:* Dr. Gary Forrest; *Dist. Mgr.:* Dr. Gary Forrest

BURLING INSTR., P.O. Box 298, Chatham, NJ 07928, Tel: 201-635-9481; Empl.: 29; *Sls. Mgr.:* Roger Nation

BURNDY/BERCO, 226 Brookside Road, Waterbury, CT , Tel: 203-574-4766

BURNDY CORPORATION, Richards Ave., Norwalk,, CT 06852, Tel: 203-838-4444, TWX: 710-468-2546; Empl.: 3500; *Sls. Mgr.:* J. Bradley

BURR-BROWN, P.O. Box 11400, Tucson, AZ 85734, Tel: 602-746-1111, Telex: 66-6491, TWX: 910-952-1111; Empl.: 1500; *Sls. Mgr.:* T.W. Fern

Local Sales Offices & Reps

AL	Huntsville, Conley & Assocs.	205-882-0316
CA	San Jose, Burr-Brown Corp.	408-559-8600
CA	Santa Ana, Burr-Brown Corp.	714-835-0712
CA	Westlake Village, Burr-Brown Corp.	818-991-8544
CO	Loveland, Burr-Brown Corp.	303-663-4440
FL	Oviedo, Conley & Assocs.	305-365-3283
IL	Addison, Burr-Brown Corp.	312-832-6520
MA	Needham, Burr-Brown Corp.	617-444-9020
MI	Farmington, Burr-Brown Corp.	313-474-6533
MN	Bloomington, Electronic Sls. Agency	612-884-8291
NY	Clinton, Advanced Comps. Corp.	315-853-6438
NY	Endicott, Advanced Comps. Corp.	607-785-3191
NY	Scottsville, Advanced Comps. Corp.	716-889-1429
NY	Syracuse, Advanced Comps. Corp.	315-699-2671
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Chesterfield, K-T Mktg.	216-729-3588
OH	Dublin, Burr-Brown Corp.	614-764-9764
PA	Pittsburgh, K-T Mktg.	412-487-8777
PA	Willow Grove, QED Elctrns.	215-657-5600
TX	Dallas, Burr-Brown Corp.	214-681-5781
TX	Houston, Burr-Brown Corp.	713-988-6546
WA	Bellevue, Burr-Brown Corp.	206-455-2611

BURTON ELECTRICAL ENGINEERING, 111 Maryland Street, El Segundo, CA 90245, Tel: 213-772-1406

BUSSCO ENGRG., 119 Standard St., El Segundo, CA 90245, Tel: 213-322-6580, TWX: 910-348-6295; FSC No.: 29593; Empl.: 87

Local Sales Offices & Reps

AZ	Tempe, Jarko	602-243-4387
CA	Los Angeles, Electrn. Tech. Assoc.	714-998-9241
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Casselberry, Electrn. Mrktg. Corp.	305-339-7070
MA	Brockton, Forsberg Sls.	617-522-6300
MI	Jackson, Norwood Scroggs Co.	517-750-1170
MN	Bloomington, D.A. Case	612-888-8666
NY	Great Neck, Trionics	516-466-2300
NY	Rochester, B. H. Tollefson Assoc.	716-271-4141
PA	Hatboro, Jacobsen Assoc.	215-674-2937
TX	Dallas, P.J. Scanlon	214-231-4661

BUSSMANN DIV., P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, Telex: 44 841; Empl.: 3000; *Sls. Mgr.:* George Ockuly; *Dist. Mgr.:* George Ockuly

Local Sales Offices & Reps

AZ	Phoenix, More Sls.	602-274-4558
CA	N. Hollywood, Bassett Sls. Corp.	213-877-7129
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CO	Denver, Lindberg Co.	303-758-9033
FL	Orlando, Cartwright & Bean	305-422-4531
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Rolling Meadows, Sumer	312-991-8500
IN	Carmel, Mktg. Engrs.	317-872-5665
MA	Braintree, Anderson Sls. Assocs.	617-848-9194
MI	Ferndale, Shalco	313-547-4771
MN	Minnetonka, Gibb Elctrn. Sls.	612-935-4600
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Englewood, ABS Assocs.	201-871-0020
NY	Syracuse, Paston-Hunter	315-437-2992
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
WA	Bellevue, Vantage Corp.	206-455-3460

BYTEX CORP., 2 California Ave., Framingham, MA 01701, Tel: 617-879-5050, Telex: 951151; Empl.: 80; *Sls. Mgr.:* Ralph W. Lowry

CABLE SYS & ASSEMBLY, 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, TWX: 710-348-1760; FSC No.: 33426; Empl.: 125; *Sls. Mgr.:* A. Armelin Jr.

CABLEWAVE SYSTEMS, INC., 718 North Colony Road, Wallingford, CT 06492, Tel: 203-265-6560

CABLEWAVE SYS., 60 Dodge Ave., North Haven, CT 06473, Tel: 203-239-3311, TWX: 710-465-0244; Empl.: 250

CABOT BERYLCO, Div. Cabot Corp., PO Box 1296, Reading, PA 19603, Tel: 215-921-5000, TWX: 510-651-0677; Empl.: 600; *Sls. Mgr.:* Thomas N. Marks

CABTRON SYS., INC., 200 N. Anets Dr., Northbrook, IL 60062, Tel: 312-498-6090; Empl.: 30; *Sls. Mgr.:* Mike Gober .... **2**•1020

Local Sales Offices & Reps

AZ	Tempe, Sierra Tech. Grp.	602-894-2335
CA	San Jose, Warren Assoc.	408-988-7762
CO	Englewood, Sierra Tech. Grp.	303-741-0227
CT	Reading, Meco, Inc.	617-944-6660
MD	Silver Spring, Ansell Engrg.	301-949-1655
MA	Reading, Meco, Inc.	617-944-6660
MI	Livonia, H. Lowell Co.	313-464-2722
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	Kansas City, Prod. Automation	816-737-3030
MO	St. Charles, Prod. Automation	314-441-6600
NJ	Mt. Lakes, N.J. Comps. for Elctrns.	201-334-2921
NM	Albuquerque, Sierra Tech. Grp.	505-294-8408
NY	Syracuse, Ossmann Instrs.	315-437-7052
OH	Cleveland, Geotronix	216-526-2535
OH	Columbus, Geotronix	614-457-8472
PA	Albrightville, Centurion Linear	717-722-0166
TX	Addison, Dunbar Assocs.	214-239-7151

CADDELL-BURNS MFG., 40 E. 2nd St., Mineola, NY 11501, Tel: 516-746-2310; Empl.: 30 .... **1A**•1233

CADDELL COIL CORP., 35M Main St., Poultney, VT 05764, Tel: 802-287-4055, Telex: 752092; Empl.: 6; *Sls. Mgr.:* James Caddell

Advertisement

10TH ANNIVERSARY (1974-1984)
COIL WINDING JOB SHOP—RF coils, chokes, transformers. Coils to Print or Specification—toroids, printed circuit, pot core inductors, high current chokes, coils with ferrite or powdered iron, slug tuned, pi wound, single layer, random wound, encapsulation. RF coils for communication, experimentation, avionics, radar, CATV, RF power, tests & measurement.
Send for catalog of stock coils.

Local Sales Offices & Reps

FL	Sebastian, R.B. Caddell	305-589-4977

CADDOCK
ELECTRONICS, INCORPORATED

CADDOCK ELECTRONICS, INC., 1717 Chicago Ave., Riverside, CA 92507, Tel: 714-788-1700, TWX: 910-332-6108; FSC No.: 19647; Empl.: 240 .... **1A**•1808-1827

Local Sales Offices & Reps

OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OR	Portland, Elctrn. Sources	503-684-0040
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

TX	Houston, Lenert Co.	713-225-1465

CADILLAC PLASTIC & CHEM., 1221 Bowers St., P.O. Box P-2020, Birmingham, MI 48012, Tel: 313-646-5100, TWX: 810-232-1886; Empl.: 1000

CAELUS MEMORIES, P.O. Box 6297, San Jose, CA 95150

CAI, 550 W. Northwest Hwy., Barrington, IL 60010, Tel: 312-381-2400, Telex: 25-4268, TWX: 910-651-1904; Empl.: 650

CAIG LABS., 1175-0 Industrial Ave., Escondido, CA 92025, Tel: 619-743-7143; Empl.: 10

CALABRO INDS., INC., See UNITRACK Div., Calabro Inds., Inc.

CALCOMP, 2411 W. La Palma Ave., Anaheim, CA 92801, Tel: 714-821-2011, TWX: 910-591-1154; Empl.: 2100; *Sls. Mgr.:* James F. Waltz

CAL CONTROLS INC., 1155 Waukegan Rd., Glenview, IL 60025, Tel: 312-998-5720, Telex: 256293; *Sls. Mgr.:* Alan Bates

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-854-XTAL, TWX: 910-591-1892; *Sls. Mgr.:* Herb Plumhoff

Advertisement

Cal Crystal manufactures crystals for communications, computers, test equipment and other applications where precise frequency control is required. Emergency service is available and a large inventory is on hand on standard frequencies. Our manufacturing capabilities range from one to 100,000 crystals. Call us for information or brochure.

CALEX MFG. CO., INC., 3355 Vincent Rd., Pleasant Hill, CA 94523, Tel: 415-932-3911, Telex: 338 506; FSC No.: 29988; Empl.: 50; *Sls. Mgr.:* Steven M. Mathias .... **3**•1006, 1512, 1513

Local Sales Offices & Reps

AZ	Glendale, Adtek Inc.	602-931-9289
CA	Inglewood, Basic Sys.	213-673-4300
CA	San Diego, Basic Sys.	619-279-9641
CA	Santa Clara, Basic Sys.	408-727-1800
CT	Washington, Tri-Com	203-868-7748
FL	Melbourne, Raycom Inc.	305-259-7988
GA	Duluth, Raycom Inc.	404-446-9015
IL	Skokie, Mar-Con Assocs.	312-675-6450
KS	Shawnee Mission, Midtec Assocs.	913-441-6565
MA	Burlington, Tri-com	617-272-8163
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Eden Prairie, EIC Inc.	612-937-9701
MO	Florissant, Midtec Assocs.	314-837-5200
NY	Clarence, Trott Elctrns.	716-634-8500
NY	White Plains, Cane Techn. Sls.	914-694-9240
NC	Raleigh, Lee Assoc.	919-787-5818
OH	Chesterland, EQS	313-961-3042
PA	Media, W. Reeves Assoc.	215-566-6709
TX	Garland, Carey, McMahill & Zerbe Co.	214-681-1414
TX	Houston, Carey, McMahill & Zerbe Co.	713-771-1500
WA	Bellevue, Topp Engrg. Sls. Co.	206-747-5401

Local Distributors

CA	Inglewood, Basic Sys.	213-673-4300
CA	Pleasant Hill, Calex Mfg. Co.	415-932-3911

CALIBRON INSTRS., 220 Grove St., Waltham, MA 02154, Tel: 617-894-6440; Empl.: 14; *Dist. Mgr.:* W. Burton

CALIFORNIA AVIONICS LABS., Box 701, Palo Alto, CA 94302, Tel: 415-328-7999; Empl.: 5 .... **3**•1206

CALIFORNIA DC, 2150 Anchor Ct., Newbury Park, CA 91320, Tel: 805-499-3621, 213-706-8221; Empl.: 100; *Sls. Mgr.:* Peter Gajewski .... **3**•1514

Local Sales Offices & Reps

CA	Los Angeles, Porter Company	213-700-0808
CA	San Diego, Power Assocs.	619-275-0641
CA	San Jose, Quad Rep	408-946-4000
MA	Westboro, RJC Associates	617-366-0399
OR	Beaverton, Meritech Sls. Corp.	503-644-0304
PA	King of Prussia, Rivco-January	215-265-5211
TX	Dallas, Technology Sls.	214-380-0200
WA	Spokane, Meritech Sls. Corp.	509-255-9122

CALIFORNIA EASTERN LABS. INC., 3005 Democracy Way, Santa Clara, CA 95050, Tel: 408-988-3500, Telex: 346393, TWX: 171197; Empl.: 85; *Sls. Mgr.:* Jim McAuley; *Dist. Mgr.:* Jim McAuley

California
INSTRUMENTS
Invertron® AC Power Equipment

CALIFORNIA INSTRUMENTS, A Div. of Amstar Tech. Prods. Co., Inc., 5150-Convoy St., San Diego, CA 92111, Tel: 619-279-8620, 800-356-2244, 800-821-1634, Telex: 695047 CALICO SDG; FSC No.: 16067; Empl.: 100; *Sls. Mgr.:* Don Chilcoat, Lee Campbell .... **3**•1840, 1841

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, Aztec Ent., Inc.	602-944-9185
CA	Los Alamitos, Sci. Dvcs. West	213-598-7678
CA	Los Altos, Jay Stone Assocs.	415-948-4563
CA	San Diego, Sci. Dvcs. West	619-573-0157
CO	Denver, Aztec Entprs.	303-779-5285
FL	Bradenton, Saber Assocs.	800-432-6288
FL	Melbourne, Saber Assocs.	800-432-6288
GA	Griffin, Saber Assocs.	800-327-0853
IL	Chicago, EIA, Inc.	312-298-2290
IN	Indianapolis, EIA, Inc.	317-257-7231
KS	DeSoto, Midtec Assocs.	913-441-6565
LA	Baton Rouge, SESCO	504-928-4951
MD	Cockeysville, SCI-REP	301-321-1411
MA	Waltham, McBar Assocs.	617-890-0233
MN	Minneapolis, Prairie Assocs.	612-559-7550
MO	Florissant, Midtec Assocs.	314-837-5200
NJ	Englewood Cliffs, Sci. Dvcs. East, Inc.	201-871-3916
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Fayetteville, Andrews Co.	315-637-3144
NC	Clayton, Saber Assocs.	800-327-0853
OH	Dayton, Hocker Assocs.	513-298-8638
OK	Tulsa, SESCO	918-622-3868
PA	Springhouse, Sci. Dvcs. East.	215-643-3335
SC	Columbia, Saber Assocs.	800-327-0853
TX	Austin, SESCO	512-892-2490
TX	Dallas, SESCO	214-231-9364
TX	Houston, SESCO	713-999-3510
UT	Ogden, Aztec Ent., Inc.	801-621-1655
VA	McLean, Creative Mktg. Assoc. Ltd.	703-442-9100
WA	Seattle, Datacom Assocs.	206-285-2525

CALIFORNIA MICRO DEVICES, INC., 215 Topaz Street, Milpitas, CA 95035, Tel: 408-263-3214

CALIFORNIA MICROWAVE, 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-732-4000, Telex: 35-2016, TWX: 910-339-9231; Empl.: 1200

CALIFORNIA MINICOMPUTER SYS., 5534 Westlawn Ave., Los Angeles, CA 90066, Tel: 213-640-2930, TWX: 910-343-6489; Empl.: 50; *Dist. Mgr.:* R. D. Mowry

CALLYER INSULATED WIRE CO., 100 Higginson Ave., Lincoln, RI 02865, Tel: 401-723-7800

CALMARK
CORPORATION

CALMARK CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 213-287-0451, TWX: 910-589-1540; FSC No.: 52094; Empl.: 70; *Sls. Mgr.:* R. L. Rosenthal; *Dist. Mgr.:* R. L. Rosenthal ....2•1021

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Tempe, Delta Elctrn. Sls.	602-224-1601
CA	San Diego, Noo Rep. Tech. Sls.	619-483-4861
CA	Santa Clara, Calmark Corp.	408-984-2618
CO	Littleton, West Mark	303-979-3720
FL	Clearwater, WMM Assoc.	813-461-7074
GA	Atlanta, Remco	404-447-6937
ID	Boise, Quest Mktg.	208-343-9969
IL	Elk Grove, Martec	312-956-8090
KS	DeSoto, Midtec Assoc.	913-441-6565
MA	Westboro, Tech. Mktg. Svcs. Co.	617-366-6655
MN	Minneapolis, Comps. Grp.	612-374-1250
MO	Florissant, Midtec Assoc.	314-837-5200
NH	Windham, Tech. Mktg. Svcs.	603-434-2716
NJ	Madison, Livera-Polk Assoc.	201-377-3220
NY	Cooperstown, Fitzelle Assocs.	607-547-9333
NY	Glen Head, Livera-Polk Assoc.	516-759-9300
NC	Raleigh, Remco	919-847-5079
OH	Cleveland, Comps., Inc.	216-243-9200
OH	Miamisburg, Comps., Inc.	513-866-0661
OR	Beaverton, Quest Mktg.	503-644-8077
PA	Horsham, Dalbrook Corp.	215-441-8380
PA	Pittsburgh, Comps., Inc.	412-824-1600
TX	Richardson, Zonk Assoc.	214-238-7651
WA	Renton, Quest Mktg.	206-223-1541
EXP	San Gabriel, CA, Calmark Corp.	213-287-0451

Local Distributors

AZ	Phoenix, Aero-Space Computer Supps.	602-861-1785
AZ	Phoenix, Scottsdale Tool & Supp.	602-273-7376
CA	Anaheim, Henry Mann West	213-995-3900
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Torrance, Cypress Elctrns.	213-533-6005
CO	Denver, Solder Tec.	303-922-6214
FL	Longwood, Intertec Comps.	305-834-7777
IL	Elk Grove, Martec Assoc.	312-956-8090
MA	Waltham, Etchomatic	617-893-2020
MA	Westboro, TMSC Elctrn. Supp.	617-366-8462
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
NJ	Collingswood, Index	609-429-4055
NJ	Nutley, Nationwide Circuit Prods.	201-667-1333
NY	Elmsford, Multimetrics Co.	914-347-3667
PA	Huntingdon Valley, Henry Mann, Inc.	215-355-7200
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Richardson, Zec Sls.	214-238-7651
UT	Salt Lake City, Solder Tec	801-974-0444
EXP	CA, San Gabriel, Calmark Corp.	213-287-0451
EXP	Cappoquin, Ireland, Calmark-Killeen Ltd.	058-54205
EXP	Osaka, Japan, Settsu Metal Indust.	06-992-2331
EXP	Ramat-Gan, Israel, Shaham Electronics	03-700303
EXP	Singapore, Singapore, Mazda Electronics	2987851
Intl	Eng., Stoke-on-Trent, Tekdata Elctrns.	0782 813631

C&K

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

CAL-METEX CORP., See Shielding Techn.

CAL-POWER CORP., 140 Kansas St., El Segundo, CA 90245, Tel: 213-772-2171, TWX: 910-348-6678; Empl.: 30

CAL-R®, INC.

CAL-R, INC., P.O. Box 1397, Santa Monica, CA 90406, Tel: 213-450-1761, TWX: 910-343-6966; FSC No.: 14193; Empl.: 130; *Sls. Mgr.:* J. F. Catrambone ....1A•1829-1831; 1B•1795-1797

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assoc.	602-277-1453
CA	Cupertino, F & F Assocs.	408-446-2349
CT	Woodbridge, Electronic Mktg. Co.	203-397-1461
IN	South Bend, Schillinger & Assoc.	219-291-6258
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
PA	Rydal, Espy Sls.	215-576-0780
TX	Dallas, Delta Comps.	817-572-1195
TX	Houston, Delta Comps.	713-785-3238
EXP	CA, Santa Monica, Trans-World Trade	213-472-0444

CAL-TEK ENGRG., 29 Pemberton Rd., Wayland, MA 01778, Tel: 617-653-0355; Empl.: 5

CAMBION DIV., See Midland-Ross, Cambion Div.

CAMBRIDGE DIGITAL SYS., Compumart, P.O. Box 568, 65 Bent St., Cambridge, MA 02139, Tel: 617-491-2700, Telex: 92-1401 COMPUMART/CAM; *Sls. Mgr.:* James O. Tropp

CAMBRIDGE FILTER CORP., P.O. Box 4906, Syracuse, NY 13221, Tel: 315-457-1000, Telex: 937311; *Sls. Mgr.:* Sam Stenger

CAMBRIDGE PRODS., Hi-G, Inc., 244 Woodland Ave., Bloomfield, CT 06002, Tel: 203-243-1761; Empl.: 32; *Sls. Mgr.:* A. Horowitz

CAMBRIDGE TECHNOLOGY, INC., 2464 Massachusetts Ave., Cambridge, MA 02140, Tel: 617-876-0891; *Sls. Mgr.:* Bruce Rohr ....3•1207

CAMBRIDGE THERMIONIC CORP., 445 Concord Ave., Cambridge, MA 02138, Tel: 617-491-5400

C.A.M. GRAPHICS CO., INC., 145 Toledo St., Farmingdale, NY 11735, Tel: 516-694-1315, TWX: 510-224-6181; FSC No.: 63203; *Sls. Mgr.:* Manny Cardinale

CANBERRA IND., One State St., Meriden, CT 06450, Tel: 203-238-2351, Telex: 643251, TWX: 710-461-0192; Empl.: 600; *Sls. Mgr.:* Peter Devecchis; *Dist. Mgr.:* Peter Devecchis

C&K
The Primary Source Worldwide...

C & K COMPONENTS, INC., 15 Riverdale Ave., Newton, MA 02158, Tel: 617-964-6400, Telex: 92-2544, TWX: 710-335-1163; FSC No.: 09353; Empl.: 600; *Sls. Mgr.:* P. Kincaid; *Dist. Mgr.:* R. Benshimol ....1B•1565

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Scottsdale, Sls. Engrg.	602-994-3230
AR	Little Rock, Beacon Elctrns.	501-224-5449
CA	Los Altos, Ewing-Foley	415-941-4525
CA	Los Angeles, Universal Comps.	213-641-4255
CO	Boulder, Front Range Mktg.	303-443-4780
CT	Glastonbury, Barton Assoc.	203-633-9417
FL	Boca Raton, Beacon Elctrns.	305-392-3500
FL	Clearwater, Beacon Elctrns.	813-796-2378
FL	Maitland, Beacon Elctrns.	305-647-3498
FL	Melbourne, Beacon Elctrns.	305-724-8010
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Elk Grove Vlg., Control Sls.	312-595-2110
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
KY	Louisville, Technlg. Mktg. Corp.	502-499-7808
MD	Randallstown, Beacon North	703-591-1300
MA	Ludlow, Gerber Sls. Corp.	413-589-9817
MA	Newton Upper Falls, Gerber Sls. Corp.	617-969-2620
MI	Brighton, AP Assocs.	313-229-6550
MN	Minnetonka, Gibb Elctrns.	612-935-4600
MO	Bridgeton, Dy-Tronix	314-731-5799
MO	Independence, Dy-Tronix	816-373-6600
NJ	W. Berlin, Quality Comps.	609-428-6266
NM	Albuquerque, Reptronix	505-292-1718
NY	Babylon, Astrorep	516-422-2500
NY	Latham, L-Tron Corp.	518-785-5032
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Beachwood, Thompson & Assocs.	216-831-6277
OH	Dayton, Thompson & Assocs.	513-435-7733
OR	Beaverton, LD Elctrns.	503-649-6177
TX	Houston, R. F. Kimball Co.	713-840-0590
TX	Richardson, R. F. Kimball Co.	214-231-3447
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Fairfax, Beacon North	703-591-1300
VA	Forest, Beacon North	804-239-8486
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Thiensville, Control Sls.	414-242-4580

CANOGA DATA SYS., 6740 Eton Ave., Canoga Park, CA 91303, Tel: 213-888-2003, Telex: 182341

CANON U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, Tel: 516-488-6700, Telex: 96-1333; Empl.: 500; *Sls. Mgr.:* P. Specter ....1B•1138

Local Sales Offices & Reps

AL	Birmingham, Motion Technlg.	404-972-4040
AZ	Phoenix, Thor Engrg.	602-437-1463
AR	El Dorado, Industrial Control Assocs.	501-863-2051
CA	Los Angeles, Motion Dynamics	818-345-2127
CA	San Jose, J.T. McFarland Assoc.	408-286-9333
CO	Denver, Qudrum 3 Sls. Grp.	303-696-8480
CT	Wolcott, Vanguard Elctrns.	203-879-9310
FL	Orlando, Motion Technology	404-972-5050
GA	Lilburn, Motion Techn.	404-972-5050
IL	Elgin, JHS & Assocs.	312-741-9070
IL	Glenview, JHS Assocs.	312-998-1960
IN	Ft. Wayne, J&B Engrg.	219-483-2813
IN	Indianapolis, J & B Engrg.	317-842-2681
MA	Needham Hgts., Vanguard Elctrns.	617-449-5578
MI	Farmington Hills, W. R. Hummon & Associates	313-474-0661
MN	Minneapolis, Components Grp.	612-374-1250
NJ	Wayne, SHL Assocs.	201-790-1714
NY	E. Rochester, A & D Devices	716-385-2778
NY	Sidney, A & D Devices	607-563-8488
NC	Charlotte, Motion Technology	704-525-9855
OH	Galion, Retronics	419-468-3253
OR	Portland, Controltek	503-641-0877
PA	Wayne, Technical Indl. Sls.	215-688-0220
TX	Dallas, Blackburn Assocs.	214-692-8885
TX	Houston, Blackburn Assocs.	713-463-1356
WA	Spokane, Controltek	509-922-2971
WI	Milwaukee, EMCO	414-242-0800

CANRAD-HANOVIA, 100 Chestnut St., Newark, NJ 07105, Tel: 201-589-4300, Telex: 13-8531; Empl.: 250; *Sls. Mgr.:* George Bachar

CANYON electronics

CANYON ELCTRNS., 2001 W. North Lane, Phoenix, AZ 85021, Tel: 602-944-4421; *Sls. Mgr.:* George J. Mitlak ... **1B**•1030

CAPACITOR SPECIALIST, See CSI Capacitors

CAPACITOR TECHNOLOGY, INC., 5015 Speedway Dr., Ft. Wayne, IN 46825, Tel: 219-484-9054 ... **1A**•1015

CAPAR COMPONENTS CORP., Div. of Diplomat Electronics, 25 Dubon Ct., Farmingdale, NY 11735, Tel: 516-454-6390, Telex: 221794; *Sls. Mgr.:* Abe Kosakowsky ... **1A**•1016-1019, 1828, 2092

Local Sales Offices & Reps

AL	Huntsville, South Eastern Mktg.	205-882-1633
AZ	Phoenix, Howe & Howe Sls. Inc.	602-264-7971
AR	Hot Springs, Automation Supplies	501-525-4588
CA	Carlsbad, Addem	619-729-9216
CA	Los Alamitos, Santana Sales	714-827-9100
CA	Redwood City, Hickey Industrial Sls.	415-368-3849
CA	Santa Ana, Caper West	714-547-7034
CT	Woodbury, Lindco Assoc. Inc.	203-263-0629
FL	Carl Springs, H A I Electronics	305-752-7520
IL	Downers Grove, Momak Sales	312-963-6400
IN	indianapolis, Willson Technical Sls.	317-298-3345
MA	Tyngsboro, Comptech, Inc.	617-649-3030
NJ	Perth Amboy, Astrorep Corp.	201-826-8050
NY	Babylon, Astrorep Corp.	516-422-2500
NC	Raliegh, Hi-Tech Assocs.	919-781-4139
OH	Akron, B. J. Davis Corp.	216-645-0517
TX	Plano, B & R Electrnc. Sls. Corp.	214-985-0028
UT	Salt Lake City, Aspen Sales	801-467-2401
WA	Redmond, Doran Sls. Assocs.	206-885-1885

Western states call Capar West at 714-547-7034 for distributor information.

All other states call Capar West at 516-454-6390 for distributor information.

CAPCO, Box 1028, Grand Junction, CO 81502, Tel: 303-243-8751, TWX: 910-929-6989; Empl.: 200

CAPINTEC INSTRS., 6 Arrow Rd., Ramsey, NJ 07446, Tel: 201-825-9500, Telex: 642375; FSC No.: 6666; Empl.: 150; *Sls. Mgr.:* R. J. Kanzler

CAPITOL MACHINE & SWITCH CO., Box 890, Danbury, CT 06810, Tel: 203-744-3300; FSC No.: 01548; Empl.: 90; *Sls. Mgr.:* E. P. DiMarco

CAPITOL MAGNETIC PRODS., 6902 Sunset Blvd., Hollywood, CA 90028, Tel: 213-461-2701, Telex: 67-3271, TWX: 910-321-3500; Empl.: 700

CAPITOL TEMPTROL, 5 Coulton Rd., Old Lyme, CT 06371, Tel: 203-739-4421; FSC No.: 4100; *Sls. Mgr.:* James M. Kronick

CAPTOR CORP., 5040 S. County Rd. (25A), Tipp City, OH 45371, Tel: 513-667-8484; FSC No.: 23939; Empl.: 80; *Sls. Mgr.:* Omer B. Bruns

CARBONE-FERRAZ, INC., Eastmans Rd., Parsippany, NJ 07054, Tel: 201-428-8400, 800-526-9067, Telex: 136045; *Sls. Mgr.:* John Harper

CARBONE LORRAINE INDS., 400 Myrtle Ave., Boonton, NJ 07005, Tel: 201-DE4-0700, Telex: 136407; Empl.: 450

CARBONE USA CORP., Carbone Lorraine Inds. Corp., 402 Myrtle Ave., Boonton, NJ 07005, Tel: 201-334-0700, Telex: 136407; *Sls. Mgr.:* Norman Carver; *Dist. Mgr.:* Norman Carver

CARBORUNDUM

CARBORUNDUM CO., Electric Prods. Div., Box 339, Niagara Falls, NY 14302, Tel: 716-278-2383, Telex: 91 555; Empl.: 250; *Sls. Mgr.:* Joe Cox ... **1A**•1832-1835; **1B**•1798, 1799

Local Sales Offices & Reps

CA	El Segundo, Varigon Assocs.	213-322-1120
CA	San Diego, Varigon Assocs.	619-576-0100
CT	Greenwich, Crane & Egert Corp.	203-964-0111
FL	Cocoa Beach, Reynolds & Assocs.	305-784-4700
IL	Highland Pk., Thomas B. Hunter Assocs.	312-433-7000
NY	Elmont, Crane & Egert Corp.	516-872-0800
OH	Dayton, R.R.M. Assocs.	513-433-7761
TX	Arlington, EPR	817-467-0377

CARBORUNDUM CO., Semiconductor Prods. Div., 3425 Hyde Park Blvd., Niagara Falls, NY 14302, Tel: 716-276-2731 ... **1A**•1020

CARDINAL CONTROL CO., 110 Kensington Rd., Kensington, CT 06037, Tel: 203-828-6379; *Sls. Mgr.:* L.E.P. Beatman; *Dist. Mgr.:* L.E.P. Beatman

CARDION ELCTRNS., Div. of Gen. Sig. Conts., Inc. Unit of Gen. Sig. Corp., Long Island Expwy., Woodbury, NY 11797, Tel: 516-921-7300, Telex: 221683 CARD, TWX: 510-221-2179; FSC No.: 12909; Empl.: 680; *Sls. Mgr.:* J. J. Murphy

CARDON CORP., P.O. Box 2371, Boston, MA 02107, Tel: 617-357-5898

CAREY ELCTRN. ENGRG. CO., 1880 Clifton Ave., Springfield, OH 45505, Tel: 513-323-6300; Empl.: 10-25

CARLINGSWITCH, INC., 505 New Park Ave., W. Hartford, CT 06110-0641, Tel: 203-233-5551, TWX: 710-425-0034; Empl.: 1200; *Sls. Mgr.:* Mark Facey ... **1B**•1548, 1549

Local Sales Offices & Reps

Call toll free 1-800-243-8556 for locations of Representatives and Distributors

AL	Huntsville, CSR Elctrn.	205-533-2444
AR	Hot Springs, Automation Supplies	501-525-4588
AZ	Phoenix, Robert Anderson Co.	602-266-2070
CA	Fullerton, Dave Berryman	213-791-4404
CA	San Rafael, Wright & Assoc.	415-457-9940
CA	Westlake Village, Scott Johnson	818-708-0478
CO	Denver, Quorum 3	303-696-8480
CT	Clinton, Berkshire Elect.	203-669-0752
FL	Orlando, OEM Mktg.	305-299-1000
GA	Atlanta, CSR Elect.	404-396-3720
IL	Schiller Park, Jim Hannan	312-678-1997
IN	Indianapolis, D-M Assoc.	317-842-4424
KS	Mission, Merdens Co.	913-432-9323
LA	Metairie, Automation Supplies	504-831-2183
MD	Woodbine, Naudain Assoc.	301-442-2270
MA	Hopkinton, Berkshire Elctrns.	617-435-6025
MI	Smithfield, R. C. Nordstrom	313-559-7373
MN	Edina, Monroe-Hanna Assoc.	612-925-5700
MO	Clayton, Mertens Co.	314-993-6600
NJ	Burlington, VDE Elctrns.	609-387-9331
NJ	Union, Pacent Engrg.	201-687-7197
NY	Great Neck, Pacent Engrg.	516-482-4678
NY	Rochester, VDE Elctrns.	716-473-5015
NC	Raleigh, Crossroads Elctrns.	919-362-4009
OH	Miamisburg, Gerry Bryant	614-294-7103
OR	Aloha, Elctrn. Comp. Sls.	503-245-2342
PA	Carnegie, Brown-Yates	412-279-1101
SC	W. Columbia, Crossroads Elctrns.	919-362-4099
TX	Dallas, Control Comps.	214-458-8877
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WI	Mequon, Wm. Bolles Assoc.	414-241-3320

Local Distributors

CA	Anaheim, Electro Comps.	213-628-2844
CA	Los Angeles, Electric Switches	213-660-1310
CA	San Leandro, Electro Comps.	415-352-5210
CA	Van Nuys, Pacific Switch Controls	213-873-4802
CT	Hartford, Atlantic Switch Controls	203-527-7705
FL	Lakeland, Switch Controls	813-644-7564
IL	Carol Stream, Conectrix	312-653-1460
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Carl Bergquist Co.	612-835-2322
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Mt. Laurel, Jerseyswitch	609-778-8190
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Woodside, Switches Unltd.	212-478-5000
OH	Columbus, Ohioswitch	614-885-0319
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Texaswitch	214-357-1768

CAROL CABLE CO. WEST, 2665 E. Del Amo Blvd., Rando Dominquez, CA 90221, Tel: 213-537-8050

CAROL®

CAROL CABLE CO., INC., Columbia Elctrn. Cables Div., 249 Roosevelt Ave., Pawtucket, RI 02862, Tel: 401-724-9605, Telex: 927-750; FSC No.: 53909; Empl.: 1,000; *Dist. Mgr.:* Patrick E. Rush ... **2**•1997-2019

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, J. R. Morgan	602-268-3464
CA	Aptos, West Cal Sls./Ind.	408-688-6568
CA	Costa Mesa, Berman-Gravley	714-549-2122
CA	San Francisco, Technical Sls.	415-467-1434
CO	Denver, William J. Purdy Co.	303-777-1411
FL	Maitland, Hutto, Hawkins, Peregoy	305-831-2474
GA	Atlanta, Cartwright & Bean	404-233-2939
HI	Honolulu, Snider, Campbell & Sutton	808-845-9937
IL	Chicago, IRI, Inc.	312-647-7755
IN	Indianapolis, Mktg. Engrs.	317-872-5665
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
LA	Kenner, Cartwright & Bean	504-466-0020
MD	Mt. Airy, Lowery & Assoc.	301-831-5827
MA	Seekonk, Rudolph Mktg.	617-399-6270
MI	E. Detroit, J. M. Thorpe	313-779-6363
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Cedar Grove, Legtronics	201-239-4098
NY	Rochester, Apex Assocs.	716-254-6050
NY	Tuckahoe, L-C-A Sales	914-961-4700
NC	Raleigh, Cartwright & Bean	919-781-6560
OH	Cleveland, Marlow Assoc.	216-991-6500
OK	Oklahoma City, J. Y. Schoonmaker Co.	405-685-4477
OR	Beaverton, Wm. J. Purdy Co.	503-641-9373
PA	Broomall, L. D. Lowery	215-356-5300
TN	Knoxville, Cartwright & Bean	615-693-7450
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
TX	Houston, J. Y. Schoonmaker Co.	713-686-0371
UT	Salt Lake City, W. J. Purdy Co.	801-531-0182
VA	Charlottesville, Lowery & Assoc.	804-973-6672
WA	Redmond, William J. Purdy Co.	206-882-3144
WI	Milwaukee, IRI, Inc.	414-259-0966

CAROLINA STEEL & WIRE, I-20 & S.C. 6, Lexington, SC 29072, Tel: 803-359-5501, Telex: 573355; FSC No.: 72954; Empl.: 125

CARPENTER MFG. CO., INC., Fairgrounds Dr., P.O. Box 188, Manlius, NY 13104-0188, Tel: 315-682-9176; *Sls. Mgr.:* Jack Henderson

CARPENTER TECHN., Box 662, Reading, PA 19603, Tel: 215-371-2000; Empl.: 4500; *Sls. Mgr.:* W.M. Detterer

CARROLL TOUCH TECHNOLOGY, P.O. Box 1309, Round Rock, TX 78680, Tel: 512-244-3500; *Sls. Mgr.:* Alan Hochman ... **3**•1072, 1073

CARSON MFG. CO., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220, Tel: 317-257-3191; Empl.: 75

CARTER MFG., Sugar Rd., Bolton, MA 01740, Tel: 617-779-5501; FSC No.: 03929; Empl.: 30; *Sls. Mgr.:* L. W. Tedstone

CARTER MOTOR, 2707 W. George St., Chicago, IL 60618-7898, Tel: 312-588-7700

CASSO-SOLAR, 3 Pearl Ct., Allendale, NJ 07401, Tel: 201-825-4600, Telex: 475-4099; Empl.: 50; *Sls. Mgr.:* Rolf Kates

CASTALL, INC., Weymouth Indl. Park, E. Weymouth, MA 02188, Tel: 617-337-6075; Empl.: 30

CATALYST RESEARCH, 1421 Clarkview Rd., Baltimore, MD 21209, Tel: 301-296-7000, Telex: 87-768; Empl.: 400; *Sls. Mgr.:* J. Wesley Kulp; *Dist. Mgr.:* Edward Hatch ... **3**•1407

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
CA	Mountain View, M.T.S.R. & Co.	415-966-6446
FL	Lighthouse Point, R. C. Simon & Co.	305-941-2757
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Hinsdale, Willtech Corp.	312-655-4850
MD	Annapolis, Vince Iorio Assocs.	301-261-1716
MI	Detroit, W. R. Hummon & Assoc. Inc.	313-474-0661
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NY	Jamaica, S-J Assocs.	212-291-3232
NC	Cary, Montgomery Mktg.	919-467-6319

OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Pittsburgh, J. C. Hofstetter Co.	412-327-1410
TX	Austin, Kruvand Assocs.	512-458-9204
TX	Dallas, Kruvand Assocs.	214-691-4592
TX	Houston, Kruvand Assocs.	713-780-9710

CATEL TELECOMMUNICATIONS, United Scientific Corp., 4800 Patrick Henry Dr., Santa Clara, CA 95054, Tel: 408-988-7722, TWX: 910-338-2263; *Sls. Mgr.:* Dick Old; *Dist. Mgr.:* Dick Old

CATON

CATON CONNECTOR CORP., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, Tel: 617-585-4315, TWX: 710-391-7546; FSC No.: 52196; Empl.: 25; *Sls. Mgr.:* D. Galambos ....2•1167

Local Sales Offices & Reps

CA	Van Nuys, ISI	714-773-0411
MD	Baltimore, Jack Onore	301-355-0474
OH	Dayton, Delta Sales	513-271-5444

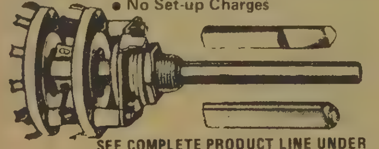
CATRONIX CORP., 120 Ralph McGill Blvd. N.E., Ste. 800, Atlanta, GA 30308, Tel: 404-872-2300; *Sls. Mgr.:* Terence R. Binion

CATV DIV., GTE Communications Prods. Corp., 1790 Lee Trevino Dr., El Paso, TX 79936, Tel: 915-594-3555, 800-351-2345, Telex: 74 9337

C-COR ELCTRNS., 60 Decibel Rd., State College, PA 16801, Tel: 814-238-2461, TWX: 510-670-3513; FSC No.: 12775; Empl.: 600; *Sls. Mgr.:* S. Dance

CDS - COLORADO DATA SYS., 3301 W. Hampden, Unit C, Englewood, CO 80110, Tel: 303-762-1640, TWX: 910-933-0193; Empl.: 35; *Sls. Mgr.:* Louis Klahn

Centralab
ELECTRONIC DIVISION
AUTHORIZED DISTRIBUTOR
E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971
WE ASSEMBLE CENTRALAB
SELECTASHAFT ROTARY SWITCHES
TO FIT YOUR DESIGN REQUIREMENTS
• Immediate Delivery • No Factory Delay
• No Set-up Charges



SEE COMPLETE PRODUCT LINE UNDER
SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

Local Sales Offices & Reps

CA	Anaheim, Moxon Elctrns.	714-635-7600
FL	Pompano Beach, Saber Assocs.	305-973-3804
IL	Arlington Heights, Dytec/Central	312-394-3380
MA	Boston, Scientific Devices, N.E.	617-890-2252
MN	Eden Prairie, Scientific Devices, Minneapolis	612-944-3515
MO	St. Louis, Dytec South	314-569-2990
NJ	Englewood Cliffs, Scientific Devices, East	201-871-3916
NM	Albuquerque, Odyssey 1	505-883-4019
NY	Rochester, Scientific Devices, New York	716-334-2445
OH	Dayton, WKM Associates	513-434-7500
TX	Dallas, Data Mktg.	214-661-0300
VA	McLean, Creative Mktg. Assoc.	703-442-9100
WA	Bellevue, Showalter Instrs.	206-455-4922

CEA DIVISION OF BERKLEONICS, INC., 1 Aerovista Pk., San Luis Obispo, CA 93401, Tel: 805-544-5454, TWX: 910-351-6705; FSC No.: 04932; Empl.: 120; *Sls. Mgr.:* Jerry Satuloff ....3•1515

Local Sales Offices & Reps

CA	Inglewood, Basic Sys. Corp.	213-673-4300
CA	San Diego, Basic Sys. Corp.	619-268-8000
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
FL	Melbourne, Jack McGirr	305-773-4313
IL	Rolling Meadows, Sieger Assocs.	312-991-6161
KS	Wichita, Electro-Mechanical Assocs.	316-682-9433
MD	Wheaton, Brimberg Sls., Inc.	301-792-8661
MA	Dover, George Urban Assocs.	617-329-4068
MI	Farmington Hills, KRW Sls.	614-464-1861
MO	Independence, Electro-Mechanical Assocs.	816-373-8539
NY	Congers, LRC Assocs.	914-268-4435
NY	Liverpool, Precision Sls.	315-451-3480
NY	Pittsford, Precision Sls.	716-381-2821
OH	Columbus, KRW Sls.	614-464-1861
PA	Broomall, Sapinosa Assocs.	215-353-7267
PA	Oakmont, KRW Sls.	614-464-1861
TN	Greenville, Lamons Sls. Co.	615-638-4320
TX	Grapevine, Elctrns. Mktg. Assocs.	817-481-7502
TX	Houston, Elctrns. Mktg. Assocs.	713-498-8120
WA	Lynnwood, IEI Inc.	206-775-3516

CEAG ELEC. CORP., Power Supply Div., 1324 Motor Pkwy., Hauppauge, NY 11788, Tel: 516-582-4422, TWX: 510-227-4904; FSC No.: 57973; *Dist. Mgr.:* G. Roger Preisick

C-E ELGIN ELCTRNS., 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, TWX: 510-699-6870; Empl.: 500; *Sls. Mgr.:* J. D. Neff; *Dist. Mgr.:* J. M. Tenglund

CELANESE PLASTICS, 26 Main St., Chatham, NJ 07928, Tel: 201-635-2600; *Sls. Mgr.:* L. F. Bond

CELCO, 70 Constantine Dr., Mahwah, NJ 07430, Tel: 201-327-1123, TWX: 710-988-1018; Empl.: 35; *Sls. Mgr.:* P. S. Christaldi

celesco

CELESCO TRANSDUCER PRODS., INC., 7800 Deering Ave., Canoga Park, CA 91304, Tel: 818-884-6860, Telex: 67 3382, TWX: 910-494-1951; *Sls. Mgr.:* James P. Callahan; *Dist. Mgr.:* James P. Callahan ....1B•1838, 1839

Local Sales Offices & Reps

AK	Soldotna, C. Hillhouse Inc.	907-262-7340
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Palo Alto, Gado Instr. Sls.	415-961-2222
CA	Westminster, Transducer Sys.	714-840-5357
CO	Denver, Innovative Prods.	303-740-9492
FL	Indian Rocks Beach, PAR Assocs.	813-596-8841
GA	Atlanta, PAR Assocs.	404-391-9117
IL	Hindsdale, I & C Sls.	312-323-8205
LA	Baton Rouge, Charles Instrs.	504-273-3233
MA	Chestnut Hill, Reptek	617-469-3311
MI	Trenton, I & C Sales	313-671-1320
MN	Minneapolis, CMI Corp.	612-566-6930
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	Hillsdale, C.B. Assocs.	201-664-6230
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Rochester, Trott Elctrns.	716-586-8251
NC	Charlotte, Par Assocs., Inc.	704-375-9403
OH	Cincinnati, I & C Sales	513-772-3101
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	Portland, Pacific N.W. Controls	503-244-3141
PA	Bridgeville, Instrument Svcs.	412-221-3601
PA	Cheltenham, Test Equip. Sls.	215-379-5431
PA	Erie, Instrument Svcs.	814-455-1969
TX	Austin, Advance Tech. Sls.	512-459-1351
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
UT	Salt Lake City, Trembly Assocs.	801-486-5292
WV	Charleston, Instrument Svcs.	304-345-0348

Local Distributors

CA	Ventura, Vacumed	805-644-7461

CELESTION INDS., INC., Kuniholm Dr., Box 521, Holliston, MA 01746, Tel: 617-429-6706, Telex: 948417

CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 12; *Sls. Mgr.:* A. Freimanis

CENTERFLEX TECHN. CORP., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507, Tel: 201-423-0505, TWX: 710-988-4147; Empl.: 50; *Sls. Mgr.:* S. C. Kellner

CENTIGRAM CORP., 155A Moffett Park Dr., Sunnyvale, CA 94086, Tel: 408-734-3222, Telex: 171-994; *Sls. Mgr.:* Leonard H. Magnuson; *Dist. Mgr.:* Paul W. Masters

CENTRALAB, INC., A North American Philips Co., 4561 Colorado Blvd., Los Angeles, CA 90039, Tel: 818-240-4880, TWX: 910-497-2282

CENTRALAB, INC., A North American Philips Co., 2566 Northwestern Ave., McClure Pk., West Lafayette, IN 47906, Tel: 317-463-2536, TWX: 810-342-1889

CENTRALAB, INC., A North American Philips Co., Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, Tel: 515-573-1300, TWX: 910-520-2493

CENTRALAB, INC., A North American Philips Co., 7158 Merchant Ave., El Paso, TX 79915, Tel: 915-779-3961, TWX: 910-964-1311

CENTRALAB, INC., A North American Philips Co., 5855 N. Glen Park Rd., Milwaukee, WI 53209, Tel: 414-228-7380, TWX: 910-262-3083; Empl.: 5000; *Sls. Mgr.:* F. Funk; *Dist. Mgr.:* R. Booker

CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61820, Tel: 217-359-8010, Telex: 910-245-0787; *Sls. Mgr.:* N. E. Mac Gregor

CENTRAL MICROWAVE CO., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-393-1236; FSC No.: 17540; *Sls. Mgr.:* Jim Caldwell

CENTRE ENGRG., 2820 E. College Ave., State College, PA 16801, Tel: 814-237-0321, TWX: 510-670-3517; Empl.: 425; *Sls. Mgr.:* H.D. Shirey

CENTRONIC INC., 5 Eastmans Rd., Parsippany, NJ 07054, Tel: 201-233-7200, Telex: 138275; FSC No.: 7P396; Empl.: 300; *Sls. Mgr.:* Tony Green ....1B•1212, 1213

Local Sales Offices & Reps

AZ	Tempe, Griot Assocs.	602-968-4428
CA	Corona del Mar, Griot Assocs.	714-675-5090
CA	El Segundo, Griot Assocs.	213-322-8383
CA	Los Altos, Griot Assocs.	415-941-2533
CA	Santa Clara, Griot Assocs.	408-727-2880
FL	Melbourne Bch., Millett Assocs.	305-725-5055
GA	Roswell, Electro Comp Sls.	404-993-4253
IL	Chicago, Coomb Assocs.	312-298-4830
MA	Concord, Nortech. Engrg. Sls.	617-259-0032
MI	Jackson, Norwood Scroggs Co.	517-750-1170
MN	Minneapolis, Intl. Sls.	612-831-8423
NY	Commack, RC Engrg.	516-543-3325
OR	Beaverton, Griot Assocs.	503-646-5627
PA	Glenside, Koebert & Assocs.	215-887-2310

CENTURY DATA SYS., Xerox Corp., 1270 N. Kraemer Blvd., Anaheim, CA 92806, Tel: 714-632-7500, Telex: 655437; Empl.: 901; *Sls. Mgr.:* Richard Brechtlein; *Dist. Mgr.:* Don Wilder

Local Distributors

NY	Westbury, Schweber Elctrns.	516-334-7474

Ceramaseal

CERAMASEAL, Box 25, New Lebanon Center, NY 12126, Tel: 518-794-7800, Telex: 14-5442; FSC No.: 07601; Empl.: 80; *Sls. Mgr.:* Gene D. Sawin ....2•1168

Local Sales Offices & Reps

AZ	Phoenix, Wadsworth/Bryant	602-275-7366
CA	Atherton, Wadsworth/Bryant	415-321-3619
CA	Hacienda Hgts., Wadsworth/Bryant	213-330-5592
CO	Golden, J. F. Hurlbut Co.	303-279-7796
IL	Mt. Prospect, Automation Equip. Co.	312-398-7550
KS	De Soto, Midtec Assocs.	913-441-6565
MD	Baltimore, R. A. Wafer Assoc.	301-744-1133
MA	Boston, P-J Engrg. Sls.	617-783-0510
MO	Florissant, Midtec Assocs.	314-837-5200
NY	Rochester, Canavan-Scanlon Assoc.	716-424-1830
NY	Syracuse, Canavan-Scanlon Assoc.	315-437-1271
NC	Charlotte, JWL Assoc.	704-523-3001
PA	Feasterville, Knowles Assocs.	215-322-7100
PA	Pittsburgh, Kurt J. Lesker Co.	412-892-2996
TN	Knoxville, C. E. Fox	615-522-4404
TX	Richardson, Spectra Sls.	214-234-3600
WA	Seattle, J. B. Jolly, Inc.	206-938-4166

CERAMIC MAGNETICS, INC., 87 Fairfield Rd., Fairfield, NJ 07006, Tel: 201-227-4222, Telex: 138 730; Empl.: 50

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500

CERMETEK MICROELECTRONICS INC., 1308 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-734-8150, TWX: 910-379-6931; Empl.: 130; *Sls. Mgr.:* Ken Archbold

Local Sales Offices & Reps

AZ	Scottsdale, Dar-C, Inc.	602-948-2240
CA	Garden Grove, Elsco Elctrns.	714-891-4621
CA	San Diego, Earle Assoc.	619-278-5441
CA	San Jose, H.T.S.	408-279-2443
CO	Denver, D/Z Assocs.	303-429-9369
FL	Boca Raton, Lawrence Assocs.	305-368-7373
GA	Doraville, K & E Assocs.	404-448-7025
IL	Barrington, OMNI Elctrn. Mktg.	312-381-9087
IN	Indianapolis, SAI Mktg.	317-241-9276
IA	Des Moines, Beams Co.	515-255-1148
MI	Ann Arbor, R. L. Rowe & Assocs.	313-995-8711
MN	Bloomington, Smiley Scott Assoc.	612-888-5551
NM	Albuquerque, Syntech	505-266-7951
NY	Great Neck, MOS Assoc.	516-487-3966
OK	Tulsa, Cunningham Comps. Corp.	918-492-0390
OR	Beaverton, E.S. Chase	503-641-4111
PA	L.J. Kairys, Coraopolis	412-331-6100
TX	Houston, Cunningham Co.	713-461-4197
UT	Salt Lake City, D/Z Assocs.	801-268-2876
WA	Bellevue, E.S. Chase	206-453-0765

Local Distributors

AL	Huntsville, RM Elctrns.	205-852-1550
AZ	Phoenix, R.V. Weatherford	602-272-7144
CA	Glendale, R.V. Weatherford	213-849-3451
CA	Sunnyvale, R.V. Weatherford	408-738-8694
CO	Denver, R.V. Weatherford	303-428-6900
CT	Orange, Milgray	203-795-0711
FL	Winter Park, Milgray	305-647-5747
GA	Atlanta, Milgray	404-393-9666
IL	Lombard, RM Elctrns.	312-932-5150
IN	Indianapolis, RM Elctrns.	317-247-9701
KS	Overland Park, Milgray	913-236-8800
MD	Rockville, Milgray	301-468-6400
MA	Burlington, Milgray	617-272-6800
MI	Wyoming, RM Elctrns.	616-531-9300
NJ	Marlton, Milgray	609-983-5010
NY	Farmingdale, Milgray	516-391-3000
OH	Cleveland, Milgray	216-447-1520
TX	Dallas, R.V. Weatherford	214-931-7333
WA	Seattle, R.V. Weatherford	206-575-1340
WI	New Berlin, RM Elctrns.	414-784-4420

CES ELCTRNS., 2968 Avenue Z, Brooklyn, NY 11235; Empl.: 20

CETA CORP., 160 S. Whisman Rd., Bldg. F, Mountain View, CA 94041, Tel: 415-969-5927, TWX: 910-379-5065; Empl.: 25; *Sls. Mgr.:* Tom Levenhagen ....3•1516

CETEC RAYMER, 7315 Fulton Ave., No. Hollywood, CA 91605, Tel: 213-875-0423; Empl.: 50; *Sls. Mgr.:* Jean Hurst

CGIS, A COMSAT CO., 7701 N. Lamar Blvd., Austin, TX 78752, Tel: 512-451-7938; Empl.: 150; *Sls. Mgr.:* Jack Johannsen

CGTI, 2 Windward Ave., White Plains, NY 10605, Tel: 914-949-3719, TWX: 710-568-1305; Empl.: 270; *Sls. Mgr.:* G. N. Snider

CHABIN CORP., 890 Fortress St., Chico, CA 95926, Tel: 916-891-6410, TWX: 910-536-1001; *Sls. Mgr.:* Peter Tunis

CHADWICK-HELMUTH, 4601 N. Arden Dr., El Monte, CA 91731, Tel: 213-575-6161, Telex: 194-271; Empl.: 75; *Sls. Mgr.:* John Beach

CHA INDUSTRIES, 3565 Haven Avenue, Menlo Park, CA 94025, Tel: 415-363-8011, Telex: 334426; *Sls. Mgr.:* Jack Patten

CHALCO ENGRG., 15126 S. Broadway, Gardena, CA 90248, Tel: 213-FA1-0121, TWX: 910-346-7026; Empl.: 95

CHAMPLAIN CABLE, PO Box 7, Winooski, VT 05404, Tel: 802-655-2121, TWX: 510-299-0018; FSC No.: 05973; Empl.: 425; *Sls. Mgr.:* J. Brooks

CHANNEL INDS., 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, Telex: 658416; Empl.: 75

CHAPMAN CORP., P.O. Box 10700, Portland, ME 04104, Tel: 207-773-4726; Empl.: 60; *Dist. Mgr.:* Elizabeth Angell

Local Sales Offices & Reps

AZ	Phoenix, Pamela Hopkins Assocs.	602-252-7119
AR	El Dorado, Indl. Controls Assocs.	501-862-2051
CA	Pico Rivera, Application Reps.	213-692-7761
CA	San Jose, Domar Group	408-268-6804
IL	Elgin, J.H.S. & Assocs.	312-741-9070
MD	Baltimore, Advanced Packaging	301-358-9444
MA	Brookline, Harman Assocs.	617-232-6687
NY	Pittsford, Noeth-Honsinger	716-585-9002
NY	Smithtown, T & K Sls.	516-724-3456
NC	Charlotte, Motion Techn.	704-525-9855
OH	Reynoldsburg, Goodwin Entprs.	614-866-0168
OR	Portland, Fry Controls	503-226-2620
PA	Downingtown, Web Access.	215-269-6511
WI	Cedarburg, R. E. Norene & Assocs.	414-377-5440

CHARTPAK, 1 River Rd., Leeds, MA 01053, Tel: 413-584-5446; Empl.: 195

CHASSIS-TRAK, P.O. Box 39100, Indianapolis, IN 46239, Tel: 317-897-7000, Telex: 27-2169; FSC No.: 06666; Empl.: 190; *Sls. Mgr.:* H. L. Crouch ....2•1032, 1033

Local Sales Offices & Reps

AL	Huntsville, Hughes Assoc.	205-533-9108
AZ	Phoenix, Snyder Engr.	602-279-2010
CA	Fullerton, Groh Assocs.	714-738-7105
CA	Mountain View, G. Woempner	415-964-5454
CO	Boulder, R. F. Mayo Assoc.	303-499-2155
CT	Waterbury, Coakley, Boyd & Abbett	617-444-5470
FL	Lighthouse Point, J. Krutek & Assoc.	305-941-6544
GA	Atlanta, Hughes Assoc.	404-252-7486
IL	Glencoe, Howard Benjamin Assoc.	312-835-0150
IN	Noblesville, Century Elctrns.	317-849-2026
KS	Shawnee Mission, Lowell, Kangas & Assoc.	913-631-3515
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MI	Plymouth, J. Plass Assocs.	313-455-8262
MN	Bloomington, Northport Engrg.	612-854-5556
MS	Corinth, Hughes Assoc.	601-287-2915
MO	St. Louis, Lowell, Kangas & Assocs.	314-821-4050
NH	Plaistow, Coakley, Boyd & Abbett	617-444-5470
NJ	Mountainside, Henry G. Richter	201-233-4615
NY	Fayetteville, H. G. Richter	315-637-6713
NC	Raleigh, Hughes Assoc.	919-782-2065
OH	Cleveland, Components	216-243-9200
OH	Miamisburg, Components	513-866-0661
OK	Tulsa, Advance Tech. Sls.	918-664-0482
PA	Doylestown, Monterio Assoc.	215-345-5855
TN	Morristown, Hughes Assoc.	615-587-2433
TX	Austin, Advance Tech. Sls.	512-459-1351
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford Assoc.	206-866-2001
EXP	IN, Indianapolis, General Devices	317-897-7000

CHATHAM CONTROLS, 33 River Rd., Chatham, NJ 07928, Tel: 201-635-8892; FSC No.: 04814; Empl.: 11

CHATSWORTH DATA CORP, Cablemaster Div., 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 65; *Sls. Mgr.:* Hank Boehm ....3•1208

Local Sales Offices & Reps

MD	Silver Spring, A.R.A. Elctrns.	301-565-2585
MA	Waltham, W. M. Hague	617-899-5600
OH	Cleveland, Triad Assoc	216-248-3350
PA	Glenside, A.R.A. Elctrns.	215-887-5250
VA	Richmond, A.R.A. Elctrns.	804-285-9309
WA	Lynnwood, Sys. Specialists	206-775-6603

CHATSWORTH DATA CORP, Impact-o-Graph Div., 20710 Lassen St., Chatsworth, CA 91311, Tel: 213-341-3000; Empl.: 50 ....3•1208

CHEM-MIXX CORP., 55 North St., Medford, MA 02155, Tel: 617-395-7270; Empl.: 9; *Sls. Mgr.:* Allen Swartz

Local Sales Offices & Reps

CA	South Gate, A. G. Barstow Co.	213-569-8125
GA	Lilburn, Georgia Airtech	404-925-3084
IN	Lawrence, American Indl.	317-897-9900
MN	Edina, Adhesive Sys. Technig.	612-944-7999
MO	Maryland Hgts., T. B. Moore Co.	314-434-6844
PA	Pittsburgh, Kurt J. Lesker Co.	412-892-2996

CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, Telex: 968567; FSC No.: 21267; Empl.: 40; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

CHERRY ELECTRICAL PRODS. CORP., 3623 Sunset Ave., Waukegan, IL 60087, Tel: 312-578-3500, TWX: 910-235-1572; Empl.: 2000; *Sls. Mgr.:* Robert Terwall; *Dist. Mgr.:* George Seyk ....1B•1551-1563, 1758, 1764-1769

Local Sales Offices & Reps

AL	Huntsville, CSR Elec.	205-533-2444
AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
CA	Palo Alto, Abbott Engrg. Co.	415-968-2265
CA	San Diego, O'Donnell Assocs.	619-578-1645
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Boulder, Front Range Mktg.	303-443-4780
CT	North Haven, Coakley, Boyd & Abbett	203-239-6217
FL	Coral Springs, CBC Elctrns.	305-755-1111
FL	Longwood, CBC Elctrns.	305-831-5380
GA	Atlanta, CSR Elctrns.	404-396-3720
IL	Waukegan, Cherry Elec. Prod. Corp.	312-578-3500
IN	Ft. Wayne, Menze Sls.	219-747-5616
IA	Cedar Rapids, Dy-Tronix	319-377-8275
MA	Needham Hgts., Coakley, Boyd & Abbett	617-444-5470
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MI	Southfield, Cherry Elec. Prod.	313-358-5588
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Bridgeton, Dy-Tronix	314-731-5799
MO	Independence, Dy-Tronix	816-373-6600
NH	Plaistow, Coakley, Boyd & Abbett	617-444-5470
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Rochester, Elcom Sls.	716-385-1400
NY	Syracuse, Elcom Sls.	315-685-8245
NY	W. Hempstead, Schmitt Indl. Mktg. Corp.	516-486-3510
NC	Mathews, CSR Elctrns.	704-847-1927
NC	Raleigh, CSR Elctrns.	919-878-9200
OK	Broken Arrow, Genzel Sales & Assoc.	918-258-8656
OR	Portland, Jas. J. Bacher Co.	503-297-8744
OR	Salem, Jas. J. Bacher Co.	503-362-0717
TX	Austin, Bonser-Philhower Sales	512-346-9186
TX	Houston, Bonser-Philhower Sales	713-531-4144
TX	Richardson, Bonser-Philhower Sales	214-234-8438
UT	Salt Lake City, Front Range Mktg.	801-364-6481
WA	Seattle, Jas. J. Bacher Co.	206-285-1300
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, Cetec Elctrns.	602-277-7951
AZ	Phoenix, Elctrn. Parts	602-277-7281
AZ	Temple, Fisher-Brownell	602-967-1464
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Alhambra, Fisher-Brownell	213-289-0255
CA	Chatsworth, Diplomat Westates Elctrns.	213-341-4411
CA	Costa Mesa, Diplomat Westates Elctrns.	714-549-8401
CA	Oakland, Brill Elctrns.	415-834-5888

CA	San Diego, Fisher-Brownell	619-560-8545
CA	San Diego, Diplomat Westates Elctrns.	619-292-5693
CA	San Jose, Cetec Elctrns.	408-263-7373
CA	Santa Clara, Fisher-Brownell	408-988-6041
CA	Southgate, Cetec Elctrns.	213-773-6521
CA	Sunnyvale, Diplomat Westates Elctrns.	408-744-1555
CO	Denver, Denver Wintronics	303-431-7161
CO	Denver, Integrated Elect.	303-292-6121
CT	Wallingford, Midan Elect.	203-265-2077
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Miami, ESL Elctrn. Distrs.	305-633-6973
GA	Atlanta, KSM Elctrns.	404-458-2013
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
IL	Bensenville, Diplomat Elctrns.	312-595-1000
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Indianapolis, Graham Elec.	317-634-8202
IN	Indianapolis, Genesis Elctrn.	317-637-5571
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Advent Elctrn.	319-363-0221
KS	Edwardsville, C. Tennant Sons & Co.	913-441-1801
KY	Louisville, P. I. Burks Co.	502-589-3960
MD	Savage, Pyttronic Ind.	301-792-0780
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Needham, Cronin Elect.	617-449-5000
MI	Clawson, Empire Elctrns.	313-435-0460
MI	Farmington Hills, Star-Tronic Distr.	313-477-7586
MI	Livonia, Rep-Tron Elctrns.	313-525-2700
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	Kansas City, Walters Radio Supp.	316-531-7015
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Bellmawr, Mid-Atlantic Elec.	609-931-5303
NJ	Clifton, J-Mar Elec., Inc.	201-772-6400
NM	Albuquerque, Elctrn. Parts	505-293-6161
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Mt. Vernon, QAR Ind'l. Elctrn. Sls.	914-699-2224
NY	Rochester, Rochester Radio & Supp. Co.	716-454-7800
NY	Woodbury, C. Tennant Sons & Co.	516-364-9070
NC	Cary, Powell Elctrns.	919-467-1212
NC	Winston-Salem, Kirkman Elctrn.	919-722-9131
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Selectronics	216-621-5080
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Esco Elect.	513-226-1133
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elctrns.	503-232-3404
OR	Portland, Tekelectric Control	503-246-5451
PA	Montgomeryville, Pyttronic Ind.	215-643-2850
TX	Dallas, Wallace Elec. Co.	214-340-0400
TX	Houston, Solid State Elctrns. Co.	713-772-8483
TX	Irving, Solid State Elctrns. Co.	214-438-5700
TX	San Antonio, Sherman Elctrns. Supp.	512-224-1004
TX	Stafford, Southwest Elect.	713-491-4900
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
UT	Salt Lake City, Diplomat Elctrns.	801-486-4134
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, R. M. Wisconsin	414-784-4420

CHERRY SEMICONDUCTOR CORP, 2000 S. County Trail, East Greenwich, RI 02818, Tel: 401-885-3600; Empl.: 200

CHESSELL CORP., Penns Trail, Newtown, PA 18940, Tel: 215-968-0660, Telex: 83-1701; Empl.: 50; *Sls. Mgr.:* D. Neal .... **3**•1383

Local Sales Offices & Reps

AZ	Phoenix, Southwest Controls, Inc.	602-267-1171
CA	Fountain Valley, Yardley Instrs.	714-963-1000
CO	Lakewood, Loritz Controls	303-232-7803
FL	Orlando, Datarep, Inc.	305-843-5224
GA	Roswell, Cascade Controls	404-998-1027
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Des Plaines, Chessell Corp.	312-699-0529
IN	Ft. Wayne, Domino Unltd.	219-747-5621
KY	Louisville, Control Prods. Co.	502-452-2611
LA	Baton Rouge, Rise Inc.	504-766-4645
MA	Waltham, Techn. Entprs.	617-890-5300
MI	Royal Oak, Satullo Co.	313-549-3910
MN	Minneapolis, The Mark Co.	612-920-6280
MO	St. Louis, Adelphi, Inc.	314-821-1232
NV	Reno, Applied Indl. Controls Corp.	702-356-7401
NM	Albuquerque, Southwest Controls, Inc.	505-884-6202
NY	Rochester, Cascade Control Corp.	716-385-1410
NY	White Plains, MIT Sls.	914-946-5077
NC	Matthews, Johnston, Inc.	704-847-3107
OH	Dayton, P. J. Navin Co.	513-434-8940
OH	Willoughby, P. J. Navin Co.	216-255-1411
OK	Tulsa, Dave Allert Co.	918-743-7705
PA	Murrysville, Data Acquisition	412-327-8979
TN	Knoxville, George C. Paris	615-966-2141
TX	Arlington, Pan-Tech Controls Co.	817-640-3232
TX	Burleson, Chessell Corp.	817-572-4392
TX	Houston, Process Instruments, Inc.	713-893-3310
UT	Midvale, Bee and Tee Controls	801-566-7722
VA	Richmond, Advance Control Equip. Co.	804-270-7182
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400
WI	Brookfield, BII, Inc.	414-786-1980

Local Distributors

CA	Pasadena, J. Arthur Moore CA, Inc.	213-793-1145
DE	Newark, G. W. Smith Assocs.	302-738-7308
IL	Hinsdale, Envirocom Controls	312-920-8610
TX	Houston, Total Instrs.	713-488-2333

CHESTER CABLE, Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, TWX: 510-249-4813; *Sls. Mgr.:* William R. Dungan

CHESTERFIELD PRODS., 37 Midland Ave., Elmwood Park, NJ 07407, Tel: 201-797-9655; Empl.: 35; *Sls. Mgr.:* M. Perry .... **1A**•1586

Local Sales Offices & Reps

CA	Palo Alto, J M Assocs.	415-857-1260
FL	Winter Haven, Heimendinger	813-294-5815
MD	Towson, Holden Engrg.	301-823-3763
MA	Framingham, Bengal Assocs.	617-877-2639
MA	Randolph, Bengal Assocs.	617-961-4120
NJ	Elmwood Park, L & M Assocs.	201-797-0441
NY	New York, L & M Assocs.	212-243-6155
PA	Andalusia, L & M Assocs.	215-245-6658
TX	Richardson, Carl Tinch Sls. Co.	214-231-1322

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070

CHICAGO LASER SYSTEMS, INC., 4034 N. Nashville Ave., Chicago, IL 60634, Tel: 312-282-2710, Telex: 206-647; *Sls. Mgr.:* Bernard Alpiner, V.P.

CHICAGO LOCK CO., 4311 W. Belmont Ave., Chicago, IL 60641, Tel: 312-282-7177, Telex: ITT 4994023; Empl.: 426; *Sls. Mgr.:* Don Meisinger; *Dist. Mgr.:* Dale N. Padjen .... **1B**•1564

Local Sales Offices & Reps

CA	Oceanside, Sales Engineer	619-726-9499

CHICAGO SWITCH, INC., 1714 N. Damen, Chicago, IL 60647, Tel: 312-489-5500, TWX: 910-221-5252; Empl.: 250; *Sls. Mgr.:* R. Schmidt; *Dist. Mgr.:* R. Scrivner

CHLORIDE ELECTRO NETWORKS, Maple St., Caledonia, NY 14423, Tel: 716-538-4421, TWX: 510-254-0422; FSC No.: 08715; Empl.: 625; *Sls. Mgr.:* J. Joseph Cowan

Local Sales Offices & Reps

CA	San Jose, Power Supply Specialists	408-980-1677
CA	Santa Clara, Electroventure	408-727-1553
CO	Black Forest, Alan Lupton Assocs.	303-495-4707
CT	Canton, Bell Controls	203-693-8926
FL	Orlando, Perrott Assoc.	305-275-1132
IL	Downers Grove, Richmar Elctrns.	312-968-0118
NH	Nashua, Bell Controls	603-882-6984
NY	Rochester, Alan Lupton Assocs.	716-482-7700
TX	Dallas, Advance Techn. Sls.	214-340-1300

CHOMERICS, INC., 77 Dragon Ct., Woburn, MA 01888, Tel: 617-935-4850, TWX: 710-393-0173; Empl.: 500; *Sls. Mgr.:* Kevin A. Dunne

CHORUS DATA SYSTEMS, P.O. Box 810, 27 Proctor Hill Rd., Hollis, NH 03049, Tel: 603-465-7100; *Sls. Mgr.:* Bruce Monk

CHR INDS., 407 East St., P.O. Box 1911, New Haven, CT 06509, Tel: 203-777-3631, TWX: 710-465-0264; Empl.: 116

CHRISLIN INDS., 31352 Via Colinas, Westlake Village, CA 91361, Tel: 213-991-2254, TWX: 910-494-1253; Empl.: 38; *Sls. Mgr.:* John Ross; *Dist. Mgr.:* John Ross

CHRISTIANSEN RADIO INC., 1950 San Remo, Laguna Beach, CA 92651, Tel: 714-497-1506; Empl.: 9

CHRISTIE, S. D., ASSOCS. INC., 693 Locust St., Mt. Vernon, NY 10552, Tel: 212-597-1773, 914-699-7223; Empl.: 8; *Sls. Mgr.:* Sam D. Christie

CHRISTIE
ELECTRIC CORP.

CHRISTIE ELEC. CORP., 20665 Manhattan Pl., Torrance, CA 90501, Tel: 213-320-0808, TWX: 910-349-6260; FSC No.: 02294; Empl.: 200 .... **3**•1517

Local Sales Offices & Reps

AZ	Phoenix, PLS Assocs.	602-246-6614
CA	Tustin, John Franek Co.	714-832-0290
CO	Englewood, PLS Assocs.	303-773-1218
FL	Orlando, Newco & Assocs.	305-422-7700
GA	Lithia Springs, Newco, Inc.	404-941-6077
MD	Laurel, CSDS	301-490-3800
MA	Needham, Shain Assocs.	617-449-4380
MO	St. Louis & Grandview, Harris-Hanson	816-763-6200; 314-432-3611
NJ	Hohokus, Hansen & Hughes	201-652-7055
NM	Albuquerque, Fry Gates Inc.	505-262-1525
NC	Charlotte, Newco, Inc.	704-527-7070
OH	Chesterland, EQS Systems	216-729-2222
PA	Philadelphia, Technical Instr. Sls. Co.	215-836-2222
SC	Florence, Newco, Inc.	803-662-4878
TX	Richardson, Carl Tinch Sls. Co.	214-231-1322
TX	Richardson, C. Tinch	214-231-1322
UT	Midvale, PLS Assocs.	801-566-0671

CHROMALOX INSTRS. & CONTROLS, 100 Heil-Quaker Blvd., Lavergne, TN 37086, Tel: 615-793-7561, Telex: 55-5129; Empl.: 110; *Sls. Mgr.:* John Cox

CHROMATICS, 2558 Mountain Indl. Bldg., Tucker, GA 30084, Tel: 404-493-7000, TWX: 810-766-8099; *Sls. Mgr.:* Donald K. McKinney

CHRONO-LOG CORP., 2 W. Park Rd., Havertown, PA 19083, Tel: 215-853-1130, Telex: 831579; Empl.: 20; *Sls. Mgr.:* David Biberman .... **3**•1074

Local Sales Offices & Reps

CA	Los Angeles, Western Sci. Mktg.	213-628-8023
CA	San Diego, Western Sci. Mktg.	619-565-6699
CT	Southboro, J. J. Wild	203-264-9494
IL	Deerfield, Deerfield Sys., Inc.	312-948-8494
MA	Needham, J. J. Wild, Inc.	617-449-5600
MI	Detroit, Comtel Instrs.	313-358-2505
MO	St. Louis, Engrg. Services	314-997-1515
NH	Merrimack, J. J. Wild	603-424-4717
NJ	Union, Friedman Assocs., Inc.	201-964-6200
NY	Albany, Ossmann Instrs.	518-374-8560
NY	Rochester, Ossmann Instrs.	716-442-6990
NY	Syracuse, Ossmann Instrs.	315-437-7052
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Columbus, Comtel Instrs.	614-876-8305
PA	Pittsburgh, Comtel Instrs.	412-922-5720
VA	Arlington, H. J. Heffernan Co.	703-522-6666
WA	Seattle, Hood Engrg. Sls.	206-453-9375

CHRONOMITE LABS, 21011 S. Figueroa St., Carson, CA 90745, Tel: 213-320-9452; Empl.: 15

CHURCHILL CORP., 344 Franklin St., Melrose, MA 02176, Tel: 617-665-4700; FSC No.: 94867; Empl.: 30; *Sls. Mgr.:* W. Schermerhorn

CIMCO WIRE & CABLE, INC., See Pirelli Cimco

CINCH, See TRW Connector Div.

CINCINNATI ELCTRNS., 2630 Glendale Milford Rd., Cincinnati, OH 45241, Tel: 513-563-6000, Telex: 21-4452, TWX: 810-464-8151; FSC No.: 80045; Empl.: 1300; *Sls. Mgr.:* W. E. Wood

CINCINNATI ELECTROSYS., 469 Wards Corner Rd., Loveland, OH 45140, Tel: 513-831-4347; *Sls. Mgr.:* J. C. Privett

CINCINNATI SUB-ZERO PRODS., 2612 Gilbert Ave., Cincinnati, OH 45206, Tel: 513-751-8810, Telex: 214390 SUBZERO CIN; Empl.: 69; *Sls. Mgr.:* George Molenaar .... **3**•1175

CIPHER DATA PRODS., INC., P.O. Box 85170, San Diego, CA 92138, Tel: 619-578-9108, TWX: 910-335-1251; Empl.: 1100; *Dist. Mgr.:* Ruth Lewellyn

CIPRICO INC., 2405 Annapolis La., Plymouth, MN 55441, Tel: 612-559-2034; *Sls. Mgr.:* Stu Reile .... 3•1075

Local Sales Offices & Reps

AL	Birmingham, Southeastern First Rep.	205-967-7082
AZ	Scottsdale, Frontier Technlg.	602-998-4438
CA	Los Alamitos, Gemini Assocs.	213-594-9618
CA	North Hollywood	213-846-2633
CA	San Diego	619-268-1181
CA	San Jose, Data Rep	408-279-1212
CA	Sepulveda	213-891-1000
CA	Sunnyvale, Diamond Point Intl.	408-730-1187
CO	Aurora, Electrodyne	303-695-8903
FL	Kissimmee, Southeastern First Rep.	305-846-1306
FL	Melbourne, Southeastern First Rep	305-259-6373
FL	N. Palm Beach, Southeastern First Rep.	305-844-3658
HI	Honolulu, Sam O. Hirota	808-535-9971
IL	Elmhurst, First Rep	312-530-2450
IN	Indianapolis	317-844-4175
KS	Prairie Village, Panatek	913-362-3349
MD	Silver Spring, L. G. White	301-434-1555
MA	Norwood, Northeast Peripherals	617-769-9110
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Edina, Micro Resources	612-830-1454
NH	Londonderry, Ciprico	603-434-8909
NJ	Springfield, Gebhardt Marketing	201-376-4415
NY	New Hartford, PDQ Assocs.	315-768-8167
NY	W. Seneca, PDQ Assocs.	716-674-7816
NC	Southport, Southeastern First Rep.	919-457-4526
OH	Cleveland, Diamond Point Intl.	216-238-0200
OH	Cleveland, Pete Kovachy	216-779-5100
OH	Englewood	513-836-0951
OR	Portland, Northwest Mktg. Assoc.	503-297-2581
PA	Jenkintown, Monument Technical Assocs.	215-884-3737
PA	Pittsburgh	412-372-4415
TX	Austin, Microlog.	512-327-7033
TX	Houston, Microlog.	713-956-0837
TX	Richardson, Microlog.	214-644-5010
UT	Salt Lake City, Electrodyne.	801-486-3801
WA	Bellevue, Northwest Mktg. Assoc.	206-455-5846

CIRCLE ELECTRONICS, A Division of F-Dyne Elctrns., 3501 Electronics Way, W. Palm Beach, FL 33407, Tel: 305-844-1310; *Sls. Mgr.:* John Strickland

CIRCUIT ASSEMBLY CORP., 18 Thomas St., Irvine, CA 92714, Tel: 714-540-5490, TWX: 910-595-1971; FSC No.: 52072; Empl.: 275; *Sls. Mgr.:* William E. Corr

CIRCUITS, INC., 59 Deming Rd., Berlin, CT 06037, Tel: 203-828-3526; Empl.: 90

CIRCUIT STRUCTURES LAB., Div. D-Cemco Inc., 3200 N. San Fernando Blvd., Burbank, CA 91504, Tel: 818-849-6341, TWX: 970-498-2228; Empl.: 4

CIRCUIT TECHN., 160 Smith St., Farmingdale, NY 11735, Tel: 516-293-8686, TWX: 510-224-6555; Empl.: 400

CIRTECH, 15237 Cherry St., Stanley, KS 66223, Tel: 913-681-2801, TWX: 910-749-6806; FSC No.: 5915; Empl.: 75; *Sls. Mgr.:* John P. Parr

CITEL, INC., 3060 Raymond St., Santa Clara, CA 95050, Tel: 408-727-6562, TWX: 910-338-0540; *Sls. Mgr.:* Paul Macdonald

CLAIREX ELCTRNS., 560 S. 3rd Ave., Mt. Vernon, NY 10550, Tel: 914-664-6602, Telex: 137308; Empl.: 230 .... 1B•1214-1217

Local Sales Offices & Reps

AL	Huntsville, K & E Assocs.	205-883-9720
CA	El Toro, Clairex Elctrns.	714-768-4561
CA	Sunnyvale, Schwerin & Merrill Inc.	408-735-7900
GA	Doraville, K & E Assocs.	404-448-7025
IL	Chicago, Berndt Assoc.	312-283-0713
IN	Carmel, Berndt Assoc.	317-884-0114
KS	Overland Park, Advanced Techn. Sls.	913-492-4333
MD	Silver Springs, Youth Assoc. Inc.	301-598-5740
MA	Bolton, Clairex	617-779-2780
MI	Ferndale, Hilltronics	313-398-5556
MN	Minneapolis, H.M.R.	612-920-8200
MO	St. Louis, A.T.S. Inc.	314-227-4448
NJ	Ridgefield, Rical	201-945-5250
NY	Seaford, Abbott Assoc.	516-781-5256
NC	Raleigh, Crossroads Elect. Assoc.	919-362-4099
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix Inc.	513-854-5939
PA	Media, W. Reeves	215-566-6709
TX	Austin, J. B. Guenther	512-258-0004
TX	Dallas, J. B. Guenther	214-691-8500
WA	Seattle, H. Levinson	206-323-5100
WI	Milwaukee, Berndt Assoc.	414-545-8400
EXP	NJ, Oradell, Sylvan Ginsbury	201-261-3200

Local Distributors

CA	Culver City, EV Roberts	213-870-9561
CA	Industry City, Ital Elctrn. Sls.	714-990-0922
CA	Santa Clara, Western Electromotive	408-985-0908
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Miami, Elctrn. Equip.	305-871-3500
IL	Chicago, Bell Indus.	312-982-9210
IN	Indianapolis, Graham Elctrns.	317-634-8486
MD	Rockville, All American Transistor	301-251-1205
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwell, Bordewieck Eng. Sls.	617-659-4915
MI	Ann Arbor, Wedemeyer Elctrn.	313-665-8611
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	St. Louis, Van Sickle Radio Elect.	314-621-5000
NJ	Mt. Laurel, D.F. Assocs.	609-234-5324
NY	Buffalo, Summit Distr.	716-884-3450
NC	Charlotte, Dixie Elctrns.	704-377-4348
OH	Columbus, Hughes Peters	614-294-5351
OK	Tulsa, Altair	918-665-0523
SC	Columbia, Dixie Radio	803-779-5332
TN	Knoxville, Dixie Elctrns.	615-938-4131
TX	Houston, Altair	713-462-2410
TX	Richardson, Altair	214-231-5166
WA	Seattle, Radar Elec.	206-282-2511
Can	Willowdale, Ont., Electro Sonic	416-494-1666

CLARE RELAYS

CLARE DIVISION, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, Tel: 312-262-7700, Telex: 25-3775; Empl.: 2400; *Sls. Mgr.:* S. N. Horowitz; *Dist. Mgr.:* S. N. Horowitz .... 1B•1288, 1312-1316

Local Sales Offices & Reps

AL	Huntsville, Clare Div., Genl. Instr. Corp.	205-883-9130
AZ	Phoenix, Clare Div., Genl. Instr. Corp.	602-997-7448
AZ	Scottsdale, Summit Sls.	602-998-4850
AR	Ft. Smith, Electro-Related Prods.	501-452-4030
CA	Irvine, J. V. Earley & Assocs.	714-833-1806
CA	San Diego, SR Electronics	619-560-8330
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CT	Yalesville, Kanan Assocs.	203-265-2404
CT	Yalesville, Kanan Assocs.	203-265-2404
FL	Chuluota, R. I. Smith Assocs.	305-365-8077
FL	Chuluota, R. I. Smith Assocs.	305-365-8077
FL	Ft. Lauderdale, R. I. Smith Assocs.	305-772-5100
FL	Largo, R.I. Smith Assocs.	813-581-1492
IL	Des Plaines, Clare Div., Genl. Instr. Corp.	312-981-0630
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
KS	Overland Park, Thomas L. Dowell & Assocs.	913-648-7373
MD	Ellicott City, Doss Elctrns.	301-465-1336
MA	Reading, Kanan Assocs.	617-944-8484
MA	Woburn, Clare Div. Genl. Instr. Corp.	617-938-0666
MN	Eden Prairie, Aldridge Assocs. Inc.	612-944-8433
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NJ	Palisades Park, Janco Technlg. Inc.	201-941-4008
NC	Raleigh, Zucker Assocs. Inc.	919-782-8433
OH	Columbus, Baehr, Greenleaf & Assoc.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assoc.	513-439-0724
OH	Lakewood, Baehr, Greenleaf & Assoc.	216-221-9030
OR	Hillsboro, Western Tech. Sls.	503-640-4621
PA	Erdenheim, Omni Sls.	215-233-4600
TX	Dallas, Electra Reps	214-387-3594
TX	Houston, Electra Reps	713-530-2208
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Brookfield, Sumer Inc.	414-784-6641

CLARKE-HESS COMM. RESCH. CORP., 17 West 17th St., New York, NY 10011, Tel: 212-255-2940, Telex: 971308 RAPID NYK ATT: CH, TWX: 710-582-2292 RAPID NYK ATT: CH; FSC No.: 34423; Empl.: 14

CLAROSTAT MFG., Washington St., Dover, NH 03820, Tel: 603-742-1120, TWX: 510-297-4455; FSC No.: 12697; Empl.: 600; *Sls. Mgr.:* H. E. Taylor

CLARY CORP., Precision Instrs. Div., 320 W. Clary Ave., San Gabriel, CA 91776, Tel: 818-287-6111, TWX: 910-589-3369; Empl.: 50; *Sls. Mgr.:* Steven M. Spilker .... 3•1842

CLAUSS CUTLERY CO., Box 667, Fremont, OH 43420, Tel: 419-332-7344; Empl.: 175

CLEAN ROOM PRODS., 56 W. Penataquit Ave., Bay Shore, NY 11706, Tel: 516-968-8282, Telex: 645151; Empl.: 52; *Sls. Mgr.:* Florence Gaconnier

CLEMENS MFG., 630 So. Berry Rd., St. Louis, MO 63122, Tel: 314-961-7228; Empl.: 3

CLEVELAND CRYSTALS, Box 17157, Euclid, OH 44117, Tel: 216-486-6100, TWX: 810-421-8031; FSC No.: 8K400; Empl.: 40; *Sls. Mgr.:* L. R. Shiozawa

CLEVELAND MICA CO., 1360 Hird Ave., Lakewood, OH 44107, Tel: 216-226-1360; Empl.: 50

CLIFTON PRECISION, Marple at Broadway, Clifton Hgts., PA 19018, Tel: 215-622-1000, TWX: 510-669-9782; FSC No.: 86197; Empl.: 1000; *Sls. Mgr.:* J. Gum .... 1B•1139

Local Sales Offices & Reps

AZ	Phoenix, Clifton Precision	602-242-0910
CA	Cupertino, Clifton Precision	408-996-7507
CA	San Clemente, Clifton Precision	714-492-6904
CA	Woodland Hills, Clifton Precision	818-347-0603
CO	Aurora, Midwest Meridian	303-341-7550
FL	Longwood, Boetto Corp.	305-331-1771
IL	Elk Grove Village, Midwest Meridian	312-640-9540
IA	Cedar Rapids, Midwest Meridian	319-365-6561
MA	W. Newton, Larcom Inc.	617-244-2053
MN	Prior Lake, Midwest Meridian	612-447-8222
MO	Maryland Hgts., Midwest Meridian	314-878-4441
NY	Greenlawn, Reflex Elctrn.	516-549-1888
OH	Fairborn, Midwest Meridian	513-879-7100
OR	Beaverton, Ravencraft	503-646-9261
PA	Clifton Heights, Eastern Sls.	215-622-1000
TX	Ft. Worth, Midwest Meridian	817-654-2132

CLIMATRONICS, 140 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-7300, Telex: 971329; Empl.: 46

CLINTON ELCTRNS., 6701 Clinton Rd., Rockford, IL 61111, Tel: 815-633-1444, Telex: 257-484; *Sls. Mgr.:* Jerry C. Garrett

CLIPLITE, See Visual Communications

CMC INSTR. DIV., Connecticut microComputer Inc., 36 Del Mar Dr., Brookfield, CT 06804, Tel: 203-775-4595, TWX: 710-456-0052; *Sls. Mgr.:* Shirley Fletcher

CML MACARR DIV., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, Tel: 212-857-2400, Telex: 12-5327; FSC No.: 00062; Empl.: 100; *Sls. Mgr.:* Gary Mandell .... 3•1843-1845

Local Sales Offices & Reps

MI	Detroit, Bill Teplitz Associates	216-439-3265
NJ	Parlin, Fred Romer Assocs.	201-721-4137
OH	Cincinnati, Bill Teplitz Associates	513-481-1648
OH	Cleveland, Bill Teplitz Associates	216-439-3265

COAST COIL CO., 5333 W. Washington Blvd., Los Angeles, CA 90016, Tel: 213-936-6188; Empl.: 50

COASTCOM, 2312 Stanwell Dr., Concord, CA 94520, Tel: 415-825-7500, TWX: 910-481-5781; Empl.: 110

Local Sales Offices & Reps

CA	Anaheim, Moxon Elctrns.	714-635-7600
CT	Easton, Massini Assocs.	203-261-0320
FL	Orlando, Col-ins-co	800-432-4480
FL	Riverview, George A. Racine	813-677-7953
HI	Honolulu, Advanced Data Corp.	808-537-9758
PA	Mechanicsburg, Stan Hurst	717-697-8201
TX	Richardson, Barnhill Assoc.	214-231-2573

COAX DEVICES INC., Box 234-EEM, Chelsea, MA 02150, Tel: 617-884-6983; Empl.: 20; *Sls. Mgr.:* Sam Rosen

COAXIAL DYNAMICS, 13110 Enterprise, Cleveland, OH 44135, Tel: 216-267-2233, Telex: 980630; Empl.: 31; *Sls. Mgr.:* R. J. Scott

COBEHN, INC., 226 Passaic Ave., Fairfield, NJ 07006, Tel: 201-227-6675; Empl.: 5

COBER ELCTRNS., 102 Hamilton Ave., Stamford, CT 06902, Tel: 203-327-0003, TWX: 710-474-3371; FSC No.: 28909; Empl.: 100; *Sls. Mgr.:* Saul Haffner

CODENOLL TECHNOLOGY CORP., 1086 N. Bwy., Yonkers, NY 10701, Tel: 914-965-6300, Telex: 646159; *Sls. Mgr.:* Lori Principe

Advertisement

CODENOLL TECHNOLOGY CORPORATION is a leading manufacturer of fiber optic products for use in various military and commercial applications. Products include optical data links, manchester encoders/decoders, fiber optic modems, fiber optic Ethernet, modular turn key communications systems, free space line of sight links, high radiance edge emitting LEDs. For further information or applications assistance contact a Codenoll Applications Engineer.

CODI SEMICONDUCTOR, INC., 350 Hurst Ave., Linden, NJ 07036, Tel: 201-862-8484, Telex: 844-796; FSC No.: 16352; Empl.: 48; *Sls. Mgr.:* Joe LaBruna; *Dist. Mgr.:* Joe LaBruna

COGENEL/ENTRELEC DIV., 2 Ram Ridge Rd., Spring Valley, NY 10977, Tel: 914-425-7460, Telex: 0996619; Empl.: 50; *Sls. Mgr.:* F. D. Leynaert

COGNITRONICS, 25 Crescent St., Stamford, CT 06906, Tel: 203-327-5307, TWX: 710-474-3523; Empl.: 200; *Sls. Mgr.:* Vincent Harrison

COHERENT COMMUNICATIONS SYS. CORP., 60 Commerce Dr., Hauppauge, NY 11788, Tel: 516-231-1550, Telex: 94-1439; *Sls. Mgr.:* Bertram J. Ralph

COHERENT, INC., 3210 Porter Dr., Palo Alto, CA 94304, Tel: 415-493-2111, Telex: 34-8304; Empl.: 1000; *Sls. Mgr.:* John Ferro;Len Goldfine

COHU, Box 85623, San Diego, CA 92138, Tel: 619-277-6700, TWX: 910-335-1244; Empl.: 178; *Sls. Mgr.:* H. Winter

COILCRAFT, 1102 Silver Lake Rd., Cary, IL 60013, Tel: 312-639-6400, TWX: 910-651-2251 .... **1A**•1230-1232

entrelec

AUTHORIZED DISTRIBUTOR

E S I

ELECTRIC SWITCHES
INCORPORATED

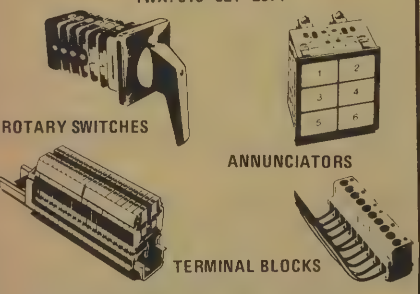
2478 FLETCHER DR., LOS ANGELES, CA. 90039

(213) 660-1310

CALL TOLL FREE
NATIONAL:
800-421-8855

CALIFORNIA (except 213):
800-252-4640

TWX: 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER
SWITCHES—SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

COIL-Q CORP., 340 Bronxville Rd., Bronxville, NY 10708, Tel: 914-337-4775; Empl.: 12

Advertisement

Our line of turnable RF coils affords highest Q and stability in filter applications from audio thru VHF. Values of .027 to 100,000 uH spaced in a 10% series have overlapping turning ranges. We also make wideband matching transformers, power splitter combiners, Directional couplers, audio transformers, fixed and tunable filters. We will also design and fabricate any of the above items to your specific requirements.

COLBER CORP., 26A Buffington St., Irvington, NJ 07111, Tel: 201-371-9500, TWX: 710-995-4416; Empl.: 50; *Sls. Mgr.:* Roberta Bryner .... **1A**•1845

Local Sales Offices & Reps

CT	Vernon, G.M. Assocs.	203-646-4443
IN	Fort Wayne, Walter W. Bieberich	219-432-2537
MI	Grosse Pointe Farms, Ed Walter	313-882-3746
PA	Oreland, CMS Mktg.	215-887-1325
TN	Fairview, Walter W. Bieberich	615-799-0120

COLE HERSEE, 20 Old Colony Ave., Boston, MA 02127-2467, Tel: 617-268-2100, Telex: 94-0901; *Sls. Mgr.:* Wesley L. Peterson

COLE
INSTRUMENT CORP.

COLE INSTR., 2650 S. Croddy Way, Santa Ana, CA 92704, Tel: 714-556-3100; Empl.: 50; *Sls. Mgr.:* P. Hanson .... **1B**•1567

Local Sales Offices & Reps

AL	Huntsville, Rakes Engrg. & Mktg.	205-533-3763
AR	Dallas, Control Comps., Inc.	214-458-8877
CA	Costa Mesa, Gabriel & Assocs.	714-957-1981
CT	Glastonbury, Barton Assocs.	203-633-9417
GA	Atlanta, Rakes Engrg. & Mktg.	404-447-6937
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Wheaton, Chadra Schilke & Assocs.	312-653-8126
IN	Fort Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
KS	Merriam, Midwest Techn. Sls.	913-236-8557
KY	Buckner, Needler Sls. Co.	502-241-4046
LA	Dallas, Control Components, Inc.	214-458-8877
MD	Silver Spring, Carwithen Assocs.	301-589-9040
MA	Waban, Barton Assocs.	617-965-8590
MI	Birmingham, Forand Sls. Co.	313-644-0087
MN	Minneapolis, Voltage Control Sls.	612-553-1051
NY	Fayetteville, R. D. Sherman Co.	315-637-9861
NC	Raleigh, Rakes Engrg. & Mktg.	919-847-5079
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
PA	Broomall, TCA	215-353-2022

COLLINS AVIONICS DIVISIONS, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498, Tel: 319-395-1000, Telex: 464-421, TWX: 910-525-1321; Empl.: 9,000; *Sls. Mgr.:* R. D. Thorpe

COLLINS RADIO GROUP COMPS. MKTG., See Rockwell Filter Prods.

COLLINS TRANSMISSION SYS. DIV., See Rockwell Intl., Commercial Elctrns. Opers.

COLLMER SEMICONDUCTOR, INC., 14368 Proton Rd., Dallas, TX 75234-3335, Tel: 214-233-1589, TWX: 910-860-5462; Empl.: 20; *Sls. Mgr.:* Gene Uecker

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
AZ	Tempe, J. F. Hurlbut Co.	602-968-5962
CA	Carlsbad, Ed Landa Co.	619-942-1086
CA	Mission Viejo, Collmer Semiconductor	714-643-2588
CA	Mountain View, Taarcom, Inc.	415-960-1550
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Madeira Beach, MacKay, Smith & Assocs.	813-393-7144
FL	Orlando, MacKay, Smith & Assocs.	305-277-1513
GA	Norcross, MacKay, Smith & Assocs.	404-449-7444
IL	Des Plaines, Electron Mktg. Corp.	312-298-2330
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
MA	Tyngsboro, Comptech Inc.	617-649-3030
MI	Livonia, Electronic Salesmasters Inc.	800-321-1848
MN	Minneapolis, Loren Green Assocs.	612-571-6666
NJ	Nutley, Falk-Baker Assocs.	201-661-2430
NY	Buffalo, Rudell-Merrifield Assoc.	716-634-4300
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
NC	Raleigh, MacKay, Smith & Assocs.	919-851-5000
OH	Beachwood, Electronic Salesmasters, Inc.	216-831-9555
OR	Portland, Fleehart & Sullivan	503-641-8540
PA	Harrison City, Rudell-Merrifield Assoc.	412-327-0858
PA	Hatboro, Electro Rep	215-674-4421
TX	Dallas, Blackburn Assocs.	214-692-8885
TX	Houston, Blackburn Assocs.	713-463-1354
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
WA	Seattle, Fleehart & Sullivan	206-527-5454

Local Distributors

CA	Industry, Ital Elctrn. Sls., Inc.	213-968-8515
CA	Tustin, Added Value Elctrns. Distribution, Inc.	714-730-5848
IL	Chicago, NEP Elctrns., Inc.	414-785-9100

COLORADO CRYSTAL CORP., 2303 W. 8th St., Loveland, CO 80537, Tel: 303-667-9248; Empl.: 110; *Sls. Mgr.:* David Lind .... **1A**•1324

Local Sales Offices & Reps

CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CO	Loveland, Morbak Mktg.	303-669-8900
IL	Wauconda, Cudahy Sls.	312-526-2484
KS	Mission, Robinson & Assocs.	913-262-1374
MA	Randolph, Bengal	617-961-4120
OR	Beaverton, L. D. Elctrns.	503-649-6177
PA	Glenside, Koebert	215-887-2310
WA	Spokane, L. D. Elctrns.	509-922-4883

COLORADO VIDEO, INC., Box 928, Boulder, CO 80306, Tel: 303-444-3972, TWX: 910-940-3248; Empl.: 47; *Sls. Mgr.:* Jim Dole

Local Sales Offices & Reps

MA	Chelmsford, Northeast Sls. Office	617-256-3381
VA	Arlington, Colorado Video	703-525-1447
WA	Edmonds, Colorado Video	206-774-6869

COLUMBIA CHASE CORP., HUMISEAL DIV., See HumiSeal Div.

COLUMBIA COMPS., 9 Division St., Sidney, NY 13838, Tel: 607-563-3520; FSC No.: 59178; Empl.: 10; *Sls. Mgr.:* Helen Montren

Local Sales Offices & Reps

CA	Sherman Oaks, RT Assocs.	213-788-7588
IL	Chicago, Electro-Tech Mktg. Assoc.	312-588-4535
MA	Malden, J-K Assocs.	617-321-2922
NJ	Cherry Hill, Jay Assocs.	609-662-0399
NY	Bohemia, Norelcom Electrns. Corp.	516-567-8866

Local Distributors

NY	Bohemia, Norelcom Elctrns. Corp.	516-567-8866

COLUMBIA ELEC. MFG., 4519 Hamilton Ave. N.W., Cleveland, OH 44114, Tel: 216-361-8060; Empl.: 60; *Sls. Mgr.:* H. W. Sussman

COLUMBIA ELCTRN. CABLES DIV., See Carol Cable Co., Inc., Columbia Elctrn. Cables Div.

COLUMBIA RESCH. LABS., Macdade Blvd. & Bullens La., Woodlyn, PA 19094, Tel: 215-532-9464, TWX: 510-669-3625; FSC No.: 07571; Empl.: 81; *Sls. Mgr.:* Jack Sarty

COLUMBUS ELEC. MFG., Box 289A Rt #2, Piney Flats, TN 37686, Tel: 615-538-8191; Empl.: 160

COLUMBUS INSTRUMENTS, 950 N. Hague Ave., Columbus, OH 43204, Tel: 614-488-6176; *Sls. Mgr.:* Jan Czekajewski

COMCLOCK INC., 1142 N. Gilbert St., Anaheim, CA 92801, Tel: 714-991-1580, 800-854-XTAL, TWX: 910-591-1892; *Sls. Mgr.:* Herb Plumhoff .... **1A**•1328

Local Sales Offices & Reps

MA	Malden, J-K Assocs.	617-321-2922
TX	Houston, TCI Elctrns.	713-774-5019

COMDESIGN, 751 S. Kellogg Ave., Goleta, CA 93117, Tel: 805-964-9852, TWX: 910-334-1189; Empl.: 125; *Sls. Mgr.:* Ralph M. Armstrong; *Dist. Mgr.:* Donald Sullivan

COMLINEAR CORP., 2468 E. 9th St., Loveland, CO 80537, Tel: 303-669-9433, Telex: 45-0881; FSC No.: 62839; Empl.: 17; *Sls. Mgr.:* Wayne Lonowski

COMMERCIAL ELEC. HEATING DEVICES & MFG., INC., 1008 E. Garvey Blvd., Monterey Park, CA 91754, Tel: 213-288-9445; Empl.: 12

COMMERCIAL SYS. LABS., Commercial Sys. Grp., P.O. Box 2710, Auburn, AL 36831, Tel: 205-821-1133; *Sls. Mgr.:* Buzz Mershon; *Dist. Mgr.:* Buzz Mershon

COMMUNICATION ASSOCS., 200 McKay Rd., Huntington Sta., NY 11746, Tel: 516-271-0800, Telex: 510-226-6998; Empl.: 150; *Sls. Mgr.:* Alfred Carlson

COMMUNICATION CABLE, 5 Glen Rd., Manchester, CT 06040, Tel: 203-647-1468; Empl.: 40; *Sls. Mgr.:* E. V. Marozzi

COMMUNICATIONS INSTRS., INC., Box 520, Fairview, NC 28730, Tel: 704-628-1711, Telex: 577436; FSC No.: 58614; Empl.: 450; *Sls. Mgr.:* R. McClinton .... **1B**•1318-1321

Local Sales Offices & Reps

AL	Huntsville, Conley Assocs.	205-882-0316
AZ	Phoenix, PLS Assoc. Inc.	602-246-6477
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CA	Santa Clare, Ross Mktg.	408-988-8111
CO	Englewood, PLS Assocs.	303-773-1218
CT	Guilford, A & M Elctrns.	203-453-1612
FL	Boca Raton, Conley Assocs.	305-395-3108
FL	Ovieda, Conley Assocs.	305-365-3283
FL	Tampa, Conley Assocs.	813-885-7658
GA	Atlanta, Conley Assocs.	404-447-6992
IL	Glenview, CII	312-792-2508
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	Desoto, Midtec Assocs.	913-441-6565
MD	Ellicott City, Doss Elctrns.	301-465-1336
MA	Needham, A & M Elctrns.	617-444-8170
MO	St. Louis, John G. Macke Co.	314-432-2830
NM	Albuquerque, PLS Assocs.	505-255-2330
NY	Lynbrook, HLJ Comp. Tech.	516-599-2999
NY	Macedon, M. M. Hare Co.	315-986-3742
NC	Raleigh, Conley Assocs.	919-876-9862
OH	Cleveland, Baehr-Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr-Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr-Greenleaf & Assocs.	513-439-0724
OR	Portland, Syscom Sls. Co.	503-644-2505
UT	Salt Lake City, PLS Assocs.	801-466-8729
WA	Bellevue, Syscom Sls. Co.	206-641-5080

COMMUNICATIONS TECHNOLOGY CORP., 2237 Colby Ave., Los Angeles, CA 90064, Tel: 213-478-5061, TWX: 910-342-6983; Empl.: 250

COMMUNICATION TECHNIQUES INC., 36 Route 10, East Hanover, NJ 07936, Tel: 201-884-2580, TWX: 710-986-8265; FSC No.: 53213; *Sls. Mgr.:* Louis R. Trummel

COMPAC, 279 Skidmore Rd., Deer Park, NY 11729, Tel: 516-667-3933, TWX: 510-227-1064; FSC No.: 62099; Empl.: 50; *Sls. Mgr.:* Peter C. Rao;Charles F. Groves .... **1A**•1587, 1690, 1691; **2**•1023-1027

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Assoc.	205-881-5031
AZ	Scottsdale, Territorial Mktg.	602-994-8665
AR	Little Rock, Beacon Elctrn. Assoc.	501-224-7310
CA	Agoura, Cal-Rep	213-991-1940
CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
FL	Clearwater, Beacon Elctrn. Assoc.	813-796-2378
FL	Ft. Lauderdale, Beacon Elctrn. Assoc.	305-491-1054
FL	Maitland, Beacon Elctrn. Assoc.	305-647-3498
FL	Melbourne, Beacon Elctrn. Assoc.	305-724-8010
GA	Atlanta, Beacon Elctrn. Assoc.	404-256-9640
IL	Prospect Heights, R-Tek, Inc.	312-459-6170
IN	Ft. Wayne, R-Tek, Inc.	219-432-8783
MA	Haverill, L-K Assoc.	617-373-1313
NJ	Haddonfield, Mills-Brown Assoc.	609-429-1005
NY	Deer Park, Compac	516-667-3933
NY	Stoney Brook, Gama Metro	516-751-2072
NY	Utica, B. D. Hummel Co.	315-736-7821
NC	Greensboro, Beacon Elctrn. Assoc.	919-275-9997
NC	Raleigh, Beacon Elctrn. Assoc.	919-787-0330
TN	Johnson City, Beacon Elctrn. Assoc.	615-282-2421
TX	Garland, Carey, McMahill & Zerbe	214-681-1414
TX	Houston, Carey, McMahill & Zerbe	713-771-1500
VA	Fairfax, Schibley Assocs.	703-591-3008

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
AR	Little Rock, Component Distrs.	501-227-6278
CA	Cupertino, Elctrn. Resources	408-996-8858
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
LA	New Orleans, Component Distrs.	504-525-9668
NY	Deer Park, R. F. Comp. Sources	516-242-6748
NY	Utica, B. D. Hummel Co.	315-736-7821
NC	Raleigh, Component Distrs.	919-781-0262
VA	Falls Church, Component Distrs.	703-241-8227

COMPACT SOFTWARE, INC., Comsat Corp., 1131 San Antonia Rd., Palo Alto, CA 94303, Tel: 415-966-8440; *Sls. Mgr.:* Henry Wong

COMPEX CORP., 35A East Main St., Marlton, NJ 08053, Tel: 609-596-9388; Empl.: 13

COMPLIANCE DESIGN INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 617-264-4668; *Sls. Mgr.:* Ira Barry

COMPONENT GENERAL, INC., 13620 Wright Cir., Tampa, FL 33625, Tel: 813-855-6655; Empl.: 30; *Sls. Mgr.:* James A. Cook

Local Sales Offices & Reps

CA	Costa Mesa, EBA	714-857-6079
CA	Los Angeles, EBA	213-822-7510
CA	Santa Clara, Mollard Mktg.	408-727-2050
DC	Washington, M. Lader Co.	202-296-2497
IN	Columbus, Chambers Mktg.	812-372-0272
MA	Andover, Bee Assoc.	617-475-2124
MN	Minneapolis, Comstrand	612-788-9234
MO	Grandview, R. R. Burton	816-763-5385
MO	Maryland Hgts., R. R. Burton	314-576-4209
NY	Bayside, Robert Diamond Inc.	212-423-7330
NY	N. Tonawanda, Ed Westgren Assoc.	716-691-6143
PA	Lafayette Hill, M. Lader Co.	215-825-3177
PA	Murrysville, Pittsburgh Sls. Assoc.	412-327-3268
EXP	CT, Stamford, Control Devices	203-322-7300

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 617-580-0111, TWX: 710-390-1081; *Sls. Mgr.:* R. E. Owens; *Dist. Mgr.:* R. E. Owens

COMPONENT MARKING SYS., 90 Morse St., Norwood, MA 02062, Tel: 617-762-6908

CRC
COMPONENT RESEARCH CO.

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 213-829-3615, TWX: 910-343-6864; FSC No.: 12517; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman .... **1A**•1022-1063

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290; Empl.: 11; *Sls. Mgr.:* W. H. Gordon

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPUTER PRODUCTS™
POWER CONVERSION

COMPOWER DIV., Div. of Computer Prods., Inc., 2220 Lundy Ave., San Jose, CA 95131, Tel: 408-942-1600, Telex: PE 172760 CMPL; Empl.: 200; *Sls. Mgr.:* Lyle D. Bennett, Jr.; *Dist. Mgr.:* Tazz A. Pettebone .... **3**•1701-1704

Refer to Computer Prods., Inc., Pompano Beach, FL for sales offices and representatives and for distributor listings.

COMPUCORP, 2211 Michigan Ave., Santa Monica, CA 90404, Tel: 213-829-7453, Telex: 4720106, TWX: 910-342-6510; Empl.: 450; *Sls. Mgr.:* Joe Thorpe; *Dist. Mgr.:* Richard Venn

COMPU-LITE CORP., 711 W. 17th St. #F12, Costa Mesa, CA 92627, FSC No.: 51420; Empl.: 50; *Sls. Mgr.:* W.D. Cobben

COMPUNETICS, INC., 2000 Eldo Rd., Monroeville, PA 15146, Tel: 412-373-8110; *Sls. Mgr.:* Jerry Schmitt

Local Sales Offices & Reps

NJ	Wayne, SHL Assoc.	201-790-1714
NC	Smithfield, ADI	919-934-8136
TN	Knoxville, Data World, Inc.	615-690-6966

COMPUPRO, 3506 Breakwater Ct., Hayward, CA 94545, Tel: 415-786-0909; *Sls. Mgr.:* Jim Lanphear; *Dist. Mgr.:* Kevin Coonan

COMP-U-STAFF, 1 Investment Pl., Towson, MD 21204, Tel: 301-828-0788; Empl.: 180; *Sls. Mgr.:* Catherine Harper

COMPUTER AVIONICS, 740 Market, Mt. Carmel, IL 62863, Tel: 618-263-4343; Empl.: 24; *Sls. Mgr.:* Lee Grismore

COMPUTER CABLE & PRODS. INC., Affil. Vertex Elctrns., 147 Gazza Blvd., Farmingdale, NY 11735, Tel: 516-293-1610, Telex: 14-3155, TWX: VERTEX FDLE; FSC No.: 6T500; Empl.: 100; *Sls. Mgr.:* Don McPhee; *Dist. Mgr.:* Penny Shaw

COMPUTER COMPONENTS, INC., 629 Fifth Ave., Pelham, NY 10803, Tel: 914-738-1611; FSC No.: 12965; Empl.: 25; *Sls. Mgr.:* G. Tsokris .... **1B**•1323

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, TWX: 510-226-0448; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard .... **3**•1144, 1145

Local Sales Offices & Reps

CA	Buena Park, Motion Control Eng.	714-994-6952
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	N. Hollywood, Crown Elctrns.	213-877-3550
CO	Denver, WH Howard Assoc.	303-426-3499
FL	Melbourne, R-Rep Co.	305-725-6993
IL	Downers Grove, GnH Sales	312-985-3764
MA	Brookline, Technology Prods. Grp.	617-731-0858
MI	Newport, Industrial Sensors, Inc.	313-289-3374
NM	Albuquerque, Fry-Gates Co.	505-262-1525
NY	Liverpool, R & D Assocs.	315-457-0100
OH	Mentor, CADS & Assoc.	216-946-9635
OR	Portland, Tek Elec. Controls	503-246-5451
TX	Dallas, Jacobson Co.	214-363-7584

COMPUTER CORP. OF AMERICA, 675 Massachusetts Ave., Cambridge, MA 02139, Tel: 617-492-8860, Telex: II 710-320-6479, TWX: 710-320-6479; *Sls. Mgr.:* Mr. Robert Roda

COMPUTER DESIGN & APPLICATIONS INC., 411 Waverly Oaks Rd., Waltham, MA 02154, Tel: 617-647-1900, Telex: 232-2240; *Sls. Mgr.:* Thomas Goliash

COMPUTER DEVICES, 25 North Ave., Burlington, MA 01803, Tel: 617-273-1550, Telex: 949398; Empl.: 314; *Sls. Mgr.:* William S. Stanger; *Dist. Mgr.:* Dick Leeman

COMPUTER DEVICES CORP., 63 Austin Blvd., Commack, NY 11725, Tel: 516-543-4220; Empl.: 50 .... **1A**•1466

Local Sales Offices & Reps

MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
EXP	NY, New Rochelle, Montclair Elctrns.	914-576-1400

COMPUTER DYNAMICS, 105 S. Main St., Greer, SC 29651, Tel: 803-877-7471; *Sls. Mgr.:* Kurt Priester

COMPUTER INSTRS., 100 Madison Ave., Hempstead, NY 11550, Tel: 516-483-8200, TWX: 510-222-4189; Empl.: 50; *Sls. Mgr.:* F. Cooper; *Dist. Mgr.:* F. Mitchell

COMPUTER MAINTENANCE CORP., 111-117 Enterprise Ave. S., Secaucus, NJ 07094, Tel: 201-866-6400; Empl.: 52; *Sls. Mgr.:* William Putnam

COMPUTER OPTICAL PRODS., INC., Sub. of Hathaway Corp., 9316 Deering Ave., Chatsworth, CA 91311, Tel: 818-882-0424; *Sls. Mgr.:* Brian Gillespie

COMPUTER POWER INC.

COMPUTER POWER, 124E W. Main St., High Bridge, NJ 08829, Tel: 201-735-8000, Telex: 847481; FSC No.: 3643; Empl.: 145; *Sls. Mgr.:* George A. Ardolino; *Dist. Mgr.:* Stanley A. Smith, Jr. .... **3**•1847

Local Sales Offices & Reps

AL	Huntsville, Col-Ins-Co	305-423-7615, 800-327-6600
AZ	Scottsdale, Williams-Assocs.	602-947-4297

CA	Inglewood, Basic Sys. Corp.	213-673-4300
CA	San Diego, Basic Sys. Corp.	619-279-9641
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
CO	Commerce City, Williams-Assocs.	303-289-5647
CT	New Milford, Power Assocs.	800-421-0011
FL	Coral Springs, Col-Ins-Co	800-432-4480, 305-423-7615
FL	Largo, Col-Ins-Co.	305-423-7615, 800-432-4480
FL	Orlando, Col-Ins-Co	305-423-7615, 800-432-4480
GA	Atlanta, Col-Ins-Co	800-327-6600, 404-491-9395
IL	Chicago, SEA, Inc.	312-255-4820
IN	Indianapolis, SEA, Inc.	317-846-2591
KY	Louisville, SEA, Inc.	502-228-5401
LA	Baton Rouge, Col-Ins-Co	800-327-6600, 305-423-7615
MD	Linthicum, K-D Assoc.	301-859-5151
MA	N. Chelmsford, Power Assocs.	617-251-7756
MI	Farmington Hills, CMP Inc.	313-477-7700
MN	Minneapolis, SEA, Inc.	612-425-4455
NJ	Marlton, Linden C.E. Kite	201-925-1899
NM	Albuquerque, Williams-Assocs.	505-255-1638
NY	Binghamton, Tae Rep., Inc.	607-772-6952
NY	Buffalo, A. Cosentino Entprs.	716-876-4172
NY	Huntington, C. E. Kite	516-266-2808
NY	Rochester, TAE-REP, Inc.	716-586-8710
NC	Raleigh, Col-Ins-Co	800-327-6600, 305-423-7615
OH	Cleveland, CMP Inc.	216-779-5100
OH	Englewood, CMP Inc.	513-836-0951
PA	Conshohocken, TEDCO	215-825-6450
PA	Monroeville, CMP Inc.	412-372-4415
SC	Greenville, Col-Ins-Co	800-327-6600, 305-423-7615
TN	Knoxville, Col-Ins-Co	800-327-6600, 305-423-7615
TX	Garland, TESCO	214-681-1376
TX	Houston, TESCO	713-777-1443
UT	Salt Lake City, Williams-Assocs.	801-485-6511
WA	Edmonds, Power Sources Unltd.	206-784-3336
WI	Milwaukee, SEA, Inc.	414-784-9379

Local Distributors

AZ	Phoenix, Keystone Electro Sls.	602-995-3005
CA	Hayward, Elsar	415-887-8550
FL	Homossassa, Bunts Auto Elec.	904-795-0069
FL	Orlando, Veytec	305-859-7340
GA	Atlanta, Encore Lodging	404-953-1724
GA	Atlanta, Corporate Data Sys.	404-952-3376
IL	Deerfield, Electrocon	312-948-0320
MA	Cohasset, Emergency Ltg. & Sys.	617-383-6500
MA	Framingham, Total Power Corp.	617-237-2024, 2025
MA	Sharon, Adcour Assocs.	617-784-8123
NJ	Bridgeton, Penn M & G Elec. Supp.	609-451-2291
NJ	Cherry Hill, UHR Electric Supply Co.	609-795-4504
NJ	Linden, Registration Electric	516-266-2808
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Orchard Park, Park Electric Supply, Inc.	716-662-7070
OK	Oklahoma City, Smith Ltg. Sls., Inc.	405-521-0093
OK	Tulsa, Computer Power of OK	918-252-5406
PA	Coatesville, Penn Elec. Supp. Co.	215-647-5552
PA	Doylestown, Penn Electric Supply Co.	215-673-4450
PA	Philadelphia, Penn Electric Supply Co.	215-471-1111
TX	Austin, Computerfixx	512-282-3472
WA	Seattle, Miller Elec.	206-248-1102
EXP	Santurce, Electronic Power Systems	809-727-7960, 1062

COMPUTER PRODUCTS™
POWER CONVERSION

COMPUTER PRODS. INC., Power Conversion Grp., 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-5500, TWX: 510-956-3098; FSC No.: 62125; Empl.: 700; *Sls. Mgr.:* Martin L. Gross; *Dist. Mgr.:* Dale T. Raveny .... **3**•1438, 1518

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg.	205-533-2100
AZ	Tempe, Elec-Com Assocs.	602-967-8644
CA	Danville, Power Conversion Grp.	415-837-8593
CA	Folsom, Manco	916-985-0370
CA	Santa Clara, Manco	408-496-6611
CO	Parker, Parker Webster Co.	303-841-4888
FL	Coral Springs, EPM Corp.	305-755-5387
GA	Atlanta, Electro-Mech Sls. Engrg.	404-447-6478
ID	Boise, Intermountain Technlg.	208-322-5022
IL	Des Plaines, Janus, Inc.	312-298-9330
IL	Glenview, Power Conversion Grp.	312-998-6715
IN	Indianapolis, Fred A. Dorsey & Assocs.	317-842-0060
KS	Overland Park, J. F. Guernsey Co.	913-381-2225
KY	Louisville, Fred A. Dorsey & Assocs.	502-426-3540
MD	Baltimore, Professional Reps.	301-653-3600
MA	Woburn, Power Conversion Grp.	617-933-0237
MI	Livonia, Lowell Wendt Mktg.	313-464-2722
MN	Bloomington, Smiley Scott Assocs.	612-888-5551
MO	Florissant, J. F. Guernsey Co.	314-921-5720
NJ	Englewood, Tecnimat	201-569-4200
NM	Albuquerque, Elec-Com Assocs.	505-898-6101
NY	Fayetteville, Power Unltd.	315-637-5291
NY	Lewiston, Power Unltd.	716-285-3295
NC	Raleigh, Electro-Mech Sls. Engrg.	919-851-8165
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-854-5939
OK	Bixby, MGR Elctrns.	918-369-5186
OR	Portland, Power Sources Unltd.	503-292-0820
PA	Ambler, Denco	215-542-9876
TN	Nashville, Electro-Mech Sls. Engrg.	615-885-0073
TX	Austin, MGR Elctrns.	512-250-0926
TX	Dallas, MGR Elctrns.	214-238-5246
UT	Salt Lake City, Parker Webster	801-266-9939
VA	Charlottesville, Professional Reps.	804-971-9650
WA	Lynnwood, Power Sources Unltd.	206-743-6641

Local Distributors

CA	Milpitas, Power Systems Distrs.	408-946-8300
CA	N. Hollywood, B. J. Wolfe Entprs.	213-877-5518
MD	Columbia, Aztech Elctrs.	301-995-1760
MA	Wilmington, RC Comps.	617-273-1860
MI	Livonia, LWC Distrs.	313-464-7700
OK	Tulsa, Norvell Elctrns.	918-663-1247
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
Can	Concord, Ontario, Kaytronics	416-669-2262
Can	Kanata, Ontario, Kaytronics	613-592-6606
Can	Surrey, British Columbia, Kaytronics	604-581-7611
Can	Ville St. Pierre, Quebec, Kaytronics	514-367-0101

COMPUTER SYSTEM ASSOCS., 7562 Trade St., San Diego, CA 92121, Tel: 619-566-3911; Empl.: 8; *Sls. Mgr.:* Chuck Bennett

COMPUTER TALK, INC., Box 148, Morrison, CO 80465, Tel: 303-697-5485; Empl.: 20

Local Sales Offices & Reps

MN	St. Paul, Imtech, Inc.	612-646-7340

COMPUTER TERMINAL SYS., 89 Arkay Drive, Hauppauge, NY 11788, Tel: 516-435-2916, Telex: 291411, 291413, TWX: 510-224-6050; FSC No.: 33948; Empl.: 120; *Sls. Mgr.:* K. Oliver

COMPUTERVISION CORP., 201 Burlington Rd., Bedford, MA 01730, Tel: 617-275-1800

COMPUTERWISE, 4006 E 137th Terr., Grandview, MO 64030, Tel: 816-765-3330; Empl.: 20; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTROL DIV. KIDDE AUTOMATED SYS., INC., 15 Ethan Allen Hwy., Ridgefield, CT 06877, Tel: 203-544-9371, Telex: 643358; Empl.: 85; *Sls. Mgr.:* Chuck Brewer

COMPUTYPE, INC., 2285 W. County Road "C", St. Paul, MN 55113, Tel: 612-633-0633, 800-328-0852, TWX: 910-563-3699

comstron

COMSTRON CORP., 200 E. Sunrise Hwy., Freeport, NY 11520, Tel: 516-546-9700, TWX: 510-225-3699; Empl.: 97; *Sls. Mgr.:* Stephen B. Rosenfield .... **1A**•1325-1327, 1588; **3**•1210, 1211

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
CA	Anaheim, Blair Assocs.	714-635-1350
CA	San Diego, Interstate Mktg. Assocs.	714-292-8117
CA	Sunnyvale, Applied Sys.	408-773-0616
CA	Woodland Hills, Interstate Mktg. Assocs.	213-883-7606
CO	Castle Rock, Odyssey I	303-688-3555
FL	Altamonte Springs, Dyne-A-Marr Corp.	305-831-2097
FL	Clearwater, Dyne-A-Marr Corp.	813-441-4702
FL	Fort Lauderdale, Dyne-A-Mark Corp.	305-944-5031
FL	Ft. Lauderdale, Reynolds & Assocs.	305-581-6611
FL	Melbourne, Reynolds Assocs.	305-259-7000
FL	Palm Bay, Dyne-A-Marr Corp.	305-727-0192
FL	St. Petersburg, Reynolds & Assocs.	813-360-1484
GA	Acworth, Reynolds & Assocs.	404-451-9558
GA	Marietta, Comstron/Southeast	404-973-3325
IL	Arlington Heights, Dytec Cen.	312-394-3380
IN	Indianapolis, Dytec Cen.	317-247-1316
KS	Lenexa, Dytec South	913-888-0215
MA	Lexington, Lancer Assocs.	617-861-1720
MI	Madison Hts., WKM Assocs.	313-588-2300
MN	St. Paul, Dytec North	612-645-5816
MO	Maryland Hts., Dytec South	314-569-2990
NJ	Englewood Cliffs, Sci. Devices East	201-871-3916
NM	Albequerque, Odyssey 1	505-265-6645
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Spring Hope, Reynolds & Assocs.	305-259-7000
OH	Dayton, WKM Assocs., Inc.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
PA	Pittsburgh, WKM Assocs., Inc.	412-892-2953
PA	Spring House, Sci. Devices East	215-643-3335
TX	Dallas, Marcom	214-351-4532
TX	Richardson, Sci. Devices, S.W.	214-231-8106
VA	McLean, Creative Mktg. Assocs.	703-442-9100
WA	Vancouver, Ray Over Sls.	206-695-6179

COMTECH MICROWAVE CORP., Comtech Corp., 63 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-4646, Telex: 971403 COMMIC HAUP; FSC No.: 61381; *Sls. Mgr.:* M. Javits

COM/TECH SYSTEMS, 505 Eighth Ave., New York, NY 10018, Tel: 212-594-5377; Empl.: 9

COMTEC INFOR. SYS., INC., 53 John St., Cumberland, RI 02864, Tel: 401-724-8500, TWX: 710-387-1171; Empl.: 75; *Sls. Mgr.:* R. A. Hamilton

CONCORD DATA SYSTEMS, 303 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-1394, Telex: 95-1793; Empl.: 90

Local Sales Offices & Reps

CA	Santa Ana, Concord Data Sys.	714-541-4974
IL	Wilmette, Concord Data Sys.	312-251-8336

CONCORD ELCTRNS., 30 Great Jones St., Dept. JE, New York, NY 10012, Tel: 212-777-6571, TWX: 710-581-4930; Empl.: 225; *Sls. Mgr.:* Josie Wheaton .... **2**•1170-1243

CONDENSER PRODS., P.O. Box 997, Brooksville, FL 33512, Tel: 904-796-3561; Empl.: 26; *Sls. Mgr.:* Pat K. Johnson

CONDITIONING SEMICONDUCTOR DEVICES, Box 2116, Wayne, NJ 07470, Tel: 201-335-6723, Telex: 219023; FSC No.: 60644; Empl.: 20; *Sls. Mgr.:* A. G. Zimmerly; *Dist. Mgr.:* Jill Mullen

CONDOR INC.
D.C. POWER SUPPLIES

CONDOR, 201 Flynn Rd., Camarillo, CA 93010, Tel: 805-484-2851, 800-235-5929; Empl.: 220; *Sls. Mgr.:* Fred Adams .... **3**•1519-1534

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech	205-881-9298
AZ	Phoenix, O'Donnell Assoc.	602-944-9542
CA	Inglewood, Basic Systems Corp.	213-673-4300
CA	Irvine, Basic Systems Corp.	714-999-0300
CA	San Diego, Basic Systems Corp.	619-268-8000
CA	Santa Clara, Basic Systems Corp.	408-727-1800
CO	Denver, R. Marketing	303-455-5360
FL	Casselberry, Pen-Tech	305-645-3444
FL	Deerfield Beach, Pen-Tech	305-421-4989
GA	Marietta, Pen-Tech	404-424-1931
IL	Schaumberg, Engrg. Prods.	312-882-7640
IN	Greenfield, Engrg. Prods.	317-894-7156
IA	Coralville, Engrg. Prods.	319-354-5344
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Wayland, Daner Hayes Inc.	617-655-0888
MN	Edina, Engrg. Prods.	612-835-9022
NJ	Bellmawr, TAI	609-933-2600; 215-627-6615
NY	Yonkers, Sonkin Assoc.	914-968-7736
NC	Greensboro, Pen-Tech	919-852-6000
OH	Dayton, Thompson Assoc.	513-435-7733
PA	Mars, Thompson Assoc.	412-776-6495
TX	Dallas, Seaton Corp.	214-380-0414
UT	N. Salt Lake City, R. Marketing	801-298-2631
WA	Bellevue, Al Smith Co.	206-746-6770

Local Distributors

CA	Inglewood, Basic Systems Corp.	213-673-4300
CA	Irvine, Basic Systems Corp.	714-999-0300

CA	San Diego, Basic Systems Corp.	619-268-8000
CA	Santa Clara, Basic Systems Corp.	408-727-1800
IL	Schaumberg, Engrg. Prods.	312-882-7640
MD	Wheaton, Brimberg Sls.	301-946-2760
MI	Madison Heights, McNaughton-McKay	313-399-7500
MN	Edina, Engrg. Prods.	612-835-9022
NY	Yonkers, Kintronics	914-968-8282
Intl	Belgium, Mulder-Hardenburg	031-680032
Intl	Denmark, Danika Supply	09-432122
Intl	England, Gresham/Powerdyne	(025-672)4246
Intl	Finland, Oy Ferrado AB	0-550002
Intl	France, AK Electronique	01-5755353
Intl	Holland, Mulder-Hardenburg BV	023-319184
Intl	Norway, Powerbox AS	02-535-837
Intl	Sweden, Power Box AB	0518-11920
Can	Canada, Duncan Inst. Ltd.	416-742-4448

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, Telex: 65-1442; Empl.: 40

CONDOR SYSTEMS, INC., 2605 S. Winchester Blvd., Campbell, CA 95008, Tel: 408-866-5900, Telex: 184819 Systems SANTA; FSC No.: 62065; *Sls. Mgr.:* Dick Keenly; *Dist. Mgr.:* Ed Brown

CONDUCTIVE RUBBER TECHNLG., 1235 Coast Village Rd., Santa Barbara, CA 93108, Tel: 805-969-5805, Telex: 658-305; *Sls. Mgr.:* Robert Webb

---

Distributor

CONECTRIX, INC., 376 E. Gunderson St., Carol Stream, IL 60188, Tel: 312-653-1460 .... **1B**•1742

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777; Empl.: 35

CONKLIN INSTR. CORP., West Rd., Pleasant Valley, NY 12569, Tel: 914-635-2136; Empl.: 65

Local Sales Offices & Reps

CA	Santa Ana, Craig Martin & Assoc.	714-556-1106
CT	Bethel, Gemini Elctrn. Sls.	203-748-5506
GA	Newnan, Dolan Assocs.	404-251-1102
NJ	Kinnelon, R.J. Alvarez, Inc.	201-838-5641
OH	Howard, Denman Assocs.	614-397-6240
WA	Redmond, Control Q	206-881-7440

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 106 Powder Mill Rd., Box 389, Canton, CT 06019, Tel: 203-693-4247; FSC No.: 50974; Empl.: 16; *Sls. Mgr.:* S. T. Urbank

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059 .... **2**•1244, 1245

CONNECTOR INDS. OF AMER., 639 N. Wayne, Cincinnati, OH 45215, Tel: 513-733-3680; FSC No.: 32076; Empl.: 35

Local Sales Offices & Reps

AZ	Phoenix, Southwest e/m Engrg.	602-944-1521
CA	Anaheim, Libratronix	714-534-7073
CT	Branford, W. McCoy Co.	203-488-2012
IL	Chicago, D. Dolin Sls. Co.	312-286-6200
IN	Greenwood, Valentine & Assocs.	317-888-2260
MI	Birmingham, Forand Sls. Co.	313-644-0087
MN	Bloomington, J. G. Twist	612-835-2120
NY	N. York, ABS Assoc.	201-871-0020
PA	Hatboro, Jacobsen Assocs.	215-674-2937
TX	Dallas, Kruvand Assocs.	214-691-4592

CONNOR-WINFIELD CORP., 109 Turner Ct., POB L, W. Chicago, IL 60185, Tel: 312-231-5270, TWX: 910-230-3231; FSC No.: 21022; Empl.: 35; *Sls. Mgr.:* John Hoag .... **1A**•1329-1332

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Westlake Village, C.D.H. Assocs.	213-707-1970

CONOLOG CORP., 5 Columbia Rd., Somerville, NJ 08876, Tel: 201-722-8081

CONRAC CORP., System Comps. Div., 1700 S. Mountain Ave., Duarte, CA 91010, Tel: 213-359-9141, Telex: 96-5978; Empl.: 200; *Sls. Mgr.:* Albert N. Caputo

CONRAC DIV., Conrac Corp., 600 N. Rimsdale Ave., Covina, CA 91722, Tel: 213-966-3511, Telex: 67-0437; Empl.: 450

CONSELL, 463 Payne Dr., Cheshire, CT 06410, Tel: 203-272-6837; Empl.: 3; *Sls. Mgr.:* A. R. Aikman

CONSOLIDATED CONTROLS, 15 Durant Ave., Bethel, CT 06801, Tel: 203-743-6721, Telex: 969615, TWX: 710-456-0446; FSC No.: 02750; Empl.: 650; *Sls. Mgr.:* A.F. Jakubauskas

Consolidated
electronic wire & cable

CONSOLIDATED ELECTRONIC WIRE & CABLE CORP., 11044 King St., Franklin Park, IL 60131, Tel: 312-455-8830, TWX: 910-227-1705; FSC No.: 73612; Empl.: 57; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton .... **2**•2021-2075

Local Sales Offices & Reps

AL	Birmingham, Hollingsworth & Still	205-822-2846
AR	Little Rock, Erickson Sls., Inc.	501-225-7379
CA	San Jose, O'Donnell & Assoc.	408-263-6500
CO	Parker, Parker-Webster Co.	303-841-4888
FL	Orlando, Hollingsworth & Still	305-859-9423
GA	Norcross, Hollingsworth & Still	404-447-1700
IL	Highland Park, Bramsky Sls. Co.	312-433-2375
IN	Indianapolis, Green Sls. Co.	317-291-2232
KS	Prairie Village, R. W. Kunz & Assocs.	913-648-3535
KY	Louisville, K W Elctrn. Sls.	502-451-1860
KY	Louisville, Green Sls. Co.	502-241-1212
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MD	Kensington, Forti Assocs.	301-949-1706
MA	Southboro, KSA of New England	617-485-9432
MI	Detroit, Burcaw Co. & Assoc.	313-533-7700
MI	Wyoming, Burcaw Co. & Assoc.	616-532-2756
MN	Edina, Monroe-Hanna	612-925-5700
MO	St. Louis, R. W. Kunz & Assocs.	314-966-4977
NJ	East Orange, Willgold Sls. Corp.	201-678-7700
NM	Albuquerque, Trembly & Assoc.	505-266-8616
NY	Rochester, Warren Kaufman & Assoc.	716-266-2728
NY	Schenectady, Warren Kaufman & Assocs.	518-374-0749
NC	Kernersville, Hollingsworth & Still	919-996-4622
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Shaker Heights, KW Elctrn. Sls.	216-491-9177
OH	Worthington, K W Elctrn. Sls.	614-888-0483
OK	Oklahoma City, Erickson Sls. Inc.	405-682-2947
OR	Troutdale, Comtec Int'l.	503-661-4308
PA	Allison Park, K W Elctrn. Sls.	412-487-4300
PA	Philadelphia, Samuel K. MacDonald, Inc.	215-545-1205
TX	Dallas, Erickson Sls. Inc.	214-739-5833
UT	Salt Lake City, Parker-Webster Co.	801-266-9939
UT	Salt Lake City, Cleveland Entprs. of Colorado	801-355-8424
VA	Vinton, Forti Assocs.	703-345-2505
WA	Bellevue, Comtec, Intl.	206-453-1189
WI	Cedarburg, Branksy Sls. Co.	414-377-6837
EXP	NY, Plainview, Morhan Exporting	516-293-5582

Local Distributors

AL	Huntsville, Pioneer/Huntsville	205-837-9300
AZ	Tucson, Elctrn. City	602-622-1173
CA	Concord, Pacific Radio Supp.	415-682-4700
CA	Costa Mesa, Marvac Elctrns.	714-540-3280
CA	Fullerton, Garden Elctrns.	714-526-7882
CA	Redwood City, HDB Elctrns.	415-368-1388
CT	Wallingford, Midan Elctrns.	203-265-2077
FL	Ft. Lauderdale, Pioneer/Florida	305-771-7520
GA	Atlanta, Wholesale Ind'l. Elctrns.	404-447-8431
HI	Honolulu, Electrical Equip.	808-533-3884
IL	Peoria, Klaus Radio, Inc.	309-691-4840
IL	Wheeling, Hawk Elctrns.	312-459-4030
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KY	Florence, URI Elctrns.	606-371-4423
LA	New Orleans, L. F. Gaubert	504-822-7272
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MA	Norwook, Emtel	617-769-9500
MI	Grand Rapids, SF Elctrns.	616-459-0216
MO	Maryland Heights, L-Comp	314-291-6206
NH	Manchester, Yankee Elctrn. Supp.	603-625-9746
NJ	East Hanover, State Elctrns. Parts	201-887-2550
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Genesee Radio Parts	716-873-9661
NY	Rochester, Goldcrest Elctrns.	716-266-2728
NC	Greenville, Pair Elctrns.	919-756-2292
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Dayton, Pioneer/Dayton	513-236-9900
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Allentown, Lehigh Elctrn. Comps.	215-433-3045
SC	Charleston, Wholesale Ind'l. Elctrns.	803-722-2634
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Appleton, Appleton Radio Supp.	414-734-5767
EXP	Plainview, Morhan Exporting	516-293-5582

CONSOLIDATED PRODUCTS CORP., P.O. Box 67, Idyllwild, CA 92349, Tel: 714-659-2183

CONSOLIDATED RESISTANCE CO. AMERICA, 222 Lake Ave., Yonkers, NY 10701, Tel: 914-YO3-5900; Empl.: 20

CONSOLINK CORP., Lestronics, Inc., 1840 Industrial Cir., Longmont, CO 80501, Tel: 303-651-2014; TWX: 910-320-0786; *Sls. Mgr.:* Lisa Estabrooks; *Dist. Mgr.:* Lisa Estabrooks

CONSUMERTRONICS, 2011 Crescent Dr., Alamogordo, NM 88310, Tel: 505-434-0234; Empl.: 5; *Sls. Mgr.:* Laurie Laurencia

CONTACT, INC., 5 Elm Ave., Hudson, NH 03051, Tel: 603-883-7708; FSC No.: M07015; Empl.: 11; *Sls. Mgr.:* T. Foresta; *Dist. Mgr.:* R. Reid

CONTACT EAST, 7 Cypress Dr., Burlington, MA 01803, Tel: 617-272-5051; *Sls. Mgr.:* Kai Juel

contact **Contact Electronics Inc.**

CONTACT ELECTRONICS INC., 30 Plymouth St., Fairfield, NJ 07006, Tel: 201-575-7660, 800-221-1451, Telex: 130-216; Empl.: 50; *Sls. Mgr.:* Thomas E. Bodnar; *Dist. Mgr.:* Thomas E. Bodnar .... **2**•1169

Local Sales Offices & Reps

CA	Santa Clara, Contact Elctrns. Inc.	408-988-5400
CA	Simi Valley, Tri Electro Sls.	805-583-5124
CT	Mystic, JMG	203-572-9448
FL	Orlando, Over & Over	305-857-4057
GA	Norcross, Over & Over	404-449-6205
IL	Chicago, KGA Engrg.	312-477-8181
IN	Indianapolis, J & W Sales	317-842-3740
MD	Glendale, Electromate, Inc.	301-262-2702
MA	Norwood, JMG	617-762-5333
MI	Farmington Hills, Willis Trombley & Son	313-553-2200
MN	Fridley, Teskey & Assocs.	612-571-0876
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NJ	Mountainside, Henry G. Richter	201-233-4615
NY	Fayetteville, Henry G. Richter	315-637-6713
NC	Charlotte, Over & Over	704-527-3070
OH	Cleveland, Pressler-Weissinger Co.	216-333-7977
OR	Tigard, Electronic Sources	503-684-0040
TN	Antioch, Over & Over	615-834-0140
TX	Dallas, Blackburn Assocs.	214-692-8885
TX	Houston, Blackburn Assocs.	713-463-1354
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

CA	Irvine, Ratel Elctrns.	213-637-0839
CA	Mountain View, Cornett Elctrns.	415-969-5420
CA	Mountainview, Target Elctrns.	415-961-1170
CA	S. San Francisco, Peters de Laet	408-727-9440
CA	San Jose, Ratel Elctrns.	408-946-4300
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
MD	Beltsville, Applied Specialties Inc.	301-792-2211
MD	Frederick, Digital Sys. Inc.	301-694-9355
MA	Burlington, JV Elctrns. of Boston	617-273-4300
MA	Middleboro, Glynn Elctrns.	617-947-4262

NJ	Berlin, GCI	609-768-6767
NJ	Frenchtown, Sintec Co.	201-996-4093
NJ	Hanover, State Elctrns.	201-887-2550
NY	Hauppauge, LI, Broadline Elctrns.	516-231-4100
NY	New York, Knickerbocker Annunciator	212-964-6258
OR	Lake Oswego, Moore Elctrns.	503-684-3100
OR	Wilsonville, Zepher Indus.	503-682-2929
TX	Stafford, Southwest Elctrns., Inc.	713-491-4900
WA	Seattle, Zepher Indus.	206-241-1980

CONTEL INFO. SYS., INC., Continental Tel. Corp., 130 Steamboat Rd., Great Neck, NY 11024, Tel: 516-829-5900; Empl.: 450

CONTINENTAL DATA SYS., 131 N. Ludlow St., Dayton, OH 45402, Tel: 513-222-8626; Empl.: 4

CONTINENTAL ELECTRONICS MFG. CO., P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, Telex: 73-398; FSC No.: 52151; *Sls. Mgr.:* R. L. Floyd, Domestic Broadcast

CONTINENTAL RESOURCES, INC., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, TWX: 710-326-0833; Empl.: 275; *Sls. Mgr.:* Michael Mattleman .... **3•1212**

Local Sales Offices & Reps

CA	Carson	213-638-0454
CA	Santa Clara	408-727-9870
FL	Orlando	305-855-9544
IL	Bensenville	312-860-5991
MD	Gaithersburg	301-948-4310
NJ	Scotch Plains	201-654-6900
TX	Dallas	214-458-7616

CONTINENTAL SPECIALTIES CORP., See Global Specialties Corp.

CONTOURS, INC., P.O. Box 1041, Middletown, CT 06457, Tel: 203-347-5694; FSC No.: 033501; *Sls. Mgr.:* Richard M. Nokes

CONTRAVES GOERZ CORP., 610 Epsilon Dr., Pittsburgh, PA 15238, Tel: 412-967-7700, Telex: 86-6237, TWX: 710-664-2082; FSC No.: 51261; *Sls. Mgr.:* Henry M. Voss; *Dist. Mgr.:* Ronald L. Ekas

PoCo

We Stock

BUCHANAN®

SINGLE SCREW BARRIER BLOCKS

SCREWDRIVER DEDICATED

EDGEBOARD CONNECTORS

POCO SALES
8925 Fullbright Street
Chatsworth, California 91311
(818) 700-8727
Serving Western Region

CONTROL CONCEPTS CORP., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484; Empl.: 41; *Sls. Mgr.:* Vieda I. Lawton .... **1B•1263**

Local Sales Offices & Reps

AZ	Phoenix, Power Specialists	602-996-4100
CA	Los Alamitos, Power Specs.	213-594-9418
CA	Redwood City, Ault Assocs.	415-367-1710
MD	Baltimore, Scientific Assocs.	301-321-1411
MA	Needham, Shain Assoc.	617-449-4380
MI	Southfield, Comtel Instrs.	313-358-2505
NJ	Cherry Hill, Scientific Reps.	609-482-0059
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573
PA	Chalfont, Eastern Scientific Marketing	215-822-6503
PA	Pittsburgh, Comtel Instrs.	412-922-5720
VA	Fairfax, Scientific Assocs.	703-385-0600

CONTROL DATA CORP., P.O. Box O, Minneapolis, MN 55440, Tel: 1-800-828-8001 Operator 82, In Minnesota 612-921-4400; Empl.: 56,000

CONTROL ELCTRNS. CO., INC., 107-B Allen Blvd., Farmingdale, NY 11735, Tel: 516-694-0125; FSC No.: 95924; Empl.: 60; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Jack Leonard ....**1A•1467-1469**

Local Sales Offices & Reps

CA	Sherman Oaks, R.T. Assocs.	213-788-7588
FL	Melbourne, VPI	305-727-3305
FL	Tampa, VPI	813-832-2041
IL	Chicago, Electro-Tech Mktg. Assoc.	312-588-4535
MD	Ellicott City, VPI	301-461-2525
MA	W. Medway, J. Gallagher	617-533-7292
MN	Fridley, Teskey & Assocs.	612-571-0876
PA	Montgomery, VPI	215-474-3200
TX	Dallas, Texas Avionics Co.	214-363-6324
EXP	FL, Hallandale, Emec	305-925-6366

CONTROL ENGRG., INC., 1686 Riverdale St., West Springfield, MA 01089, Tel: 413-781-1330; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROL EQUIP. CORP., 171 Lincoln St., Lowell MA 01851, Tel: 617-459-0573; Empl.: 10

CONTROLEX/EANCO, See Fincor

CONTROL INDS. INC., 530 Burnside Ave., Inwood, NY 11696, Tel: 212-471-9800; Empl.: 40

CONTROLLED ENVIR. EQUIP. CORP., 3 Delta Drive, Westbrook, ME 04092, Tel: 207-854-9126; Empl.: 5; *Sls. Mgr.:* R. D. Peck

CONTROLLED POWER COMPANY

CONTROLLED POWER CO., 1955 Stephenson Hwy., Troy, MI 48084, Tel: 313-528-3700, TWX: 810-232-3401 .... **3•1814, 1848-1853**

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, Telex: 643167; Empl.: 160; *Sls. Mgr.:* Peter C. DiMaria

CONTROL-O-MATION, INC, 7300 W. Huron River Dr., Dexter, MI 48130, Tel: 313-426-3935; Empl.: 72; *Sls. Mgr.:* Richard Lundy

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* J. R. Nile

CONTROL PRODS., Devar Inc., P.O. Box 589, Bridgeport, CT 06601, Tel: 203-368-6751, Telex: 96-4234; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

CONTROL PRODS. DIV., Amerace Corp., 2330 Vauxhall Rd., Union, NJ 07083, Tel: 201-964-4400, Telex: 13-8978, TWX: 710-985-4687; FSC No.: 3L154; Empl.: 275; *Sls. Mgr.:* J. Cooper .... **3•1125**

Local Sales Offices & Reps

AL	Hoover, Control Prods. Agency	205-320-6197
AZ	Phoenix, Mercury Engrg. Sls.	602-244-0123
CA	Los Altos, J. Wilhoit Co.	415-961-3660
CA	San Diego, J. C. Henberger Co.	619-292-5772
CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
CO	Denver, C. Beabout Co.	303-244-3151
CT	Glastonbury, Tulimieri Assocs.	203-659-3531
FL	Deerfield Pk., Brandel-Stephens	305-427-8558
FL	Orlando, B. Stephens Co.	305-425-3202
GA	Atlanta, Control Prods. Div.	404-296-3115
HI	Miliani Town, H. C. Burgess	808-623-3118
IL	Algonquin, Control Prods. Div.	312-358-2840
IL	Woodridge, Control Prods. Div.	312-358-2840
IA	Des Moines, Jerry L. Shumway & Assocs.	515-285-0704
KS	Overland Park, Arehart-Barnds-Rains Sls. Co. (Buchanan Prods. Only)	913-649-9270
MD	Mount Airy, Strayton Assocs.	301-831-7007
MA	Norwell, Control Prods. Div.	617-659-4474
MI	Troy, George R. Peters Assoc.	313-362-1220
MN	Minneapolis, Harold Mercer Co.	612-933-7111
MS	Jackson, Welch & Doby, Inc.	601-932-5534
MO	Bridgeton, Dy-Tronix, Inc.	314-731-5799
MO	Independence, Dy-Tronix, Inc.	816-373-6600
NJ	Dunellen, Control Prods. Div.	201-964-4400
NM	Sandia Park, Sun Sls.	505-281-3373
NY	Camillus, Ontec	315-672-5626
NY	Manhasset, Control Prods. Div.	516-627-8809
NY	Rochester, Ontec	716-464-8636
NY	Wappinger Falls, Ontec	914-462-7188
NC	Greensboro, Hile Assocs.	919-288-1500
OH	Mentor, Control Prods. Div.	216-543-4233
OH	West Chester, Control Prods. Div.	513-777-2472
OR	Portland, Syscom	503-644-2505
PA	Pittsburgh, Control Prods. Div.	412-761-0581
PA	Willow Grove, Cusick Elec. Sls.	215-659-6666
TX	Bedford, Reynolds Assoc., Inc.	817-267-5635
TX	Houston, Control Prods. Div.	713-984-8128
WA	Bellevue, Syscom Sls.	206-641-5080
WV	Huntington, Lilly Electrical Sls.	304-523-3441
WI	Wauwatosa, Control Prods.	414-377-0800

CSI CONTROL SCIENCES INCORPORATED

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510, Telex: 36-44-12 INTR; FSC No.: 53317; Empl.: 14; *Sls. Mgr.:* Rhod Zimmerman .... **3•1146-1148**

Local Sales Offices & Reps

CA	Sunnyvale, Koosen Tech. Sls.	408-249-5858
CO	Boulder, Herb Bass Assocs.	303-499-7509
FL	Orlando, Gra-Mar Inc.	305-894-3351
IL	Rolling Meadows, KMA Sales	312-398-5300
IN	Ft. Wayne, J & B Engrg.	219-483-2813
MN	St. Paul, Northstar Motion & Control	612-770-5311
MO	Peculiar, PEM Sales	816-884-4784
MO	St. Louis, PEM Sales	314-427-7200
NY	Victor, A & D Devices	716-924-9171
OH	Cleveland, Geotronix	216-526-2535
OH	Columbus, Geotronix	614-457-8472
PA	Media, Homer Smith Sls.	215-543-2434
PA	Pittsburgh, Raystan/Symcon	412-734-1185
TX	Ft. Worth, Rick McDonald Assoc.	817-429-4272
TX	Richardson, McDonald Assocs.	214-238-1858
WA	Bellevue, Poggi Assocs.	206-454-2026
WI	Milwaukee, KMA	414-259-1771

CONTROLS PROTOELECTRIC, 1 Memorial Dr., Cambridge, MA 02142, Tel: 617-864-8000; *Sls. Mgr.:* S. L. Davis

CONTROLS UNLIMITED, INC., 1895 Blase-Nemeth Rd., Painesville, OH 44077, Tel: 216-354-4111; Empl.: 35

CONTROL TECHNOLOGY CO., 41-16 29th St., Long Island City, NY 11101, Tel: 212-361-2133; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper .... **3•1930, 1931**

Local Sales Offices & Reps

CA	Claremont, W. Roth & Assocs.	714-621-1019

CONVER CORP., 10629 Bandley Dr., Cupertino, CA 95014, Tel: 408-255-0151, TWX: 910-338-2036; *Sls. Mgr.:* Matthew Winston

CONVERSION EQUIP. CORP., 1620 So. Sunkist, Anaheim, CA 92806, Tel: 714-634-9698; *Sls. Mgr.:* Mark Kato; *Dist. Mgr.:* Mark Kato

CONVERTER CONCEPTS INC

CONVERTER CONCEPTS, INC., Industrial Pkwy., Pardeeville, WI 53954, Tel: 608-429-2144, TWX: 910-280-2630; Empl.: 75; *Sls. Mgr.:* Michael J. Schoenwald; *Dist. Mgr.:* Michael J. Schoenwald .... 3•1536-1539

Local Sales Offices & Reps

AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Goleta, The Thorson Co.	805-964-8751
CA	Hayward, Pacific Mktg.	415-887-1620
CA	Signal Hill, The Thorson Co.	213-595-0361
FL	Clearwater, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assoc.	305-298-7748
FL	Sunrise, Perrott Assocs.	305-792-2211
IL	Rolling Meadows, KMA Sales	312-398-5300
MA	Natick, Wayland Engrg. Sls.	617-655-6080
MN	Minneapolis, Jos-co/Melius	612-861-3343
NY	Syracuse, Pi-Tronics	315-455-7346
OH	Dayton, Bradcor	513-294-5477
OH	Euclid, Bradcor Elctrns.	216-261-0888
PA	Glenside, Koebert Assoc.	215-887-2310
TX	Garland, Tesco	214-681-1376
TX	Houston, Tesco	713-777-1443
WA	Linnwood, Power Sources Unltd.	206-784-3336
WI	Milwaukee, KMA Sales	414-259-1771

CONVEX CORP., P.O. Box 17225, Dulles Intl. Airport, Washington, DC 20041, Tel: 703-661-8900; Empl.: 24

COOL-AMP CONDUCTO-LUBE CO., 8621 S.W. 17th Ave., Portland, OR 97219, Tel: 503-244-2230; Empl.: 5; *Sls. Mgr.:* Audrea Dick

COONER WIRE CO., 9186 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8311; *Sls. Mgr.:* Steven W. Smith .... 2•2076-2081

COOPER GROUP, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, Telex: 579497; *Sls. Mgr.:* J.J. Barrese

CO-ORD SWITCH DIV., LVC Inds., Inc., 23 Hanse Ave., Freeport, NY 11520, Tel: 516-868-1900; *Sls. Mgr.:* P. Parnicas

COORS PORCELAIN, 600 Ninth St., Golden, CO 80401, Tel: 303-278-4000, Telex: 45593; Empl.: 1700

COOSOL, 3013 Harbor Blvd., Costa Mesa, CA 92626, Tel: 714-545-2216; Empl.: 20; *Sls. Mgr.:* Aram Solomonian; *Dist. Mgr.:* Aram Solomonian

CORBY INDS. INC., P. O. Box 2838, Allentown, PA 18001, Tel: 215-433-1412, Telex: 847318 CORBYUHL; Empl.: 22; *Sls. Mgr.:* Glenn M. Matz; *Dist. Mgr.:* Lewis S. Walters

CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 312-680-7400, TWX: 910-684-3269; FSC No.: 05245; Empl.: 1000 .... 1A•1589

Local Sales Offices & Reps

AL	Huntsville, Robert O. Whitesell	205-883-5110
AZ	Phoenix, I.S.D.S.	602-971-6250
CA	Los Angeles, I.S.D.S.	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, I.S.D.S.	619-571-1544
CA	Santa Ana, I.S.D.S.	714-973-2162
CA	Woodland Hills, I.S.D.S.	213-883-7130
CO	Arvada, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
FL	Clearwater, E.I.R. Inc.	813-531-5990
FL	Fern Park, E.I.R. Inc.	305-830-9600
FL	Plantation, E.I.R. Inc.	305-581-6905
FL	Plantation, E.I.R. Inc.	305-791-8243
ID	Boise, Cascade Comps.	208-343-9886
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-359-9283
IN	Kokomo, Robert O. Whitesell	317-457-9127
KS	Overland Park, K & H Sls.	913-642-9564
KY	Louisville, Robert O. Whitesell	502-426-7696
MD	Ellicott City, Marketing Technlg.	301-465-5944
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-559-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
NM	Albuquerque, Straube Assocs.	505-292-0428
NY	Endicott, Noeth-Honsinger Assocs.	607-754-3214
NY	Manhasset, Win-Cor Elctrn. Sls.	516-627-9474
NY	Pittsford, Noeth-Honsinger Assocs.	716-586-9002
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OK	Hillsboro, Cascade Comps.	503-640-4714
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Greenville, Robert O. Whitesell	615-639-6154
TX	Austin, K & H Sls.	512-258-8841
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Lynchburg, Marketing Technlg.	804-384-6459
WA	Seattle, Cascade Comps.	206-433-1113
WI	Brookfield, Sumer, Inc.	414-784-6641

Local Distributors

AL	Huntsville, Pioneer	205-837-9300
AZ	Phoenix, Cetec Elctrns.	602-272-7951
CA	Canoga Park, Marshall Ind.	213-999-5001
CA	Chatsworth, Diplomat Elctrns.	213-341-4411
CA	Costa Mesa, Diplomat Elctrns.	714-549-8401
CA	Irvine, Marshall Ind.	213-443-3724
CA	San Diego, Marshall Ind.	619-578-9600
CA	San Diego, Cetec Elctrns.	619-278-5020
CA	San Diego, Diplomat Elctrns.	619-292-5693
CA	San Jose, Cetec Elctrns.	408-263-7373
CA	South Gate, Cetec Elctrns.	213-773-6521
CA	Sunnyvale, Marshall Ind.	408-732-1100
CA	Sunnyvale, Diplomat/Westland	408-734-1900
CO	Denver, Marshall Ind.	303-427-1818
CO	Englewood, Diplomat Elctrns.	303-740-8300
CT	Danbury, Diplomat Elctrns.	203-797-9674
CT	E. Haven, J.V. Elctrns.	203-469-2321
FL	Clearwater, Diplomat Elctrns.	813-443-4515
FL	Ft. Lauderdale, Pioneer	305-771-7520
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Pioneer	305-834-9090
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Atlanta, Marshall Ind.	404-923-5750
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Pioneer	317-849-7300
MD	Baltimore, Resco	301-823-0070
MD	Beltsville, Resco/Washington	301-937-9100
MD	Gaithersburg, Pioneer	301-921-0660
MD	Savage, Pyttronic Inds.	301-792-0780
MA	Burlington, Marshall Ind.	617-272-8200
MA	Newton, Greene Shaw	617-969-8900
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Livonia, Pioneer	313-525-1800
MI	Livonia, R.S. Elctrns.	313-525-1155
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minnetonka, Pioneer/Twin Cities	612-935-5444
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	St. Louis, Olive Elctrns.	314-426-4500
NJ	Bellmawr, Mid Atlantic Elctrns. Corp.	609-931-5303
NJ	Totowa, Diplomat Elctrns.	201-785-1830
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Melville, Diplomat Elctrns.	516-454-6334
NY	Mt. Vernon, QAR Indl. Elctrn. Sls.	914-699-2224
NY	Rochester, Summit Distrs.	716-334-8110
NY	Rochester, Rochester Radio Supp.	716-454-7800
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer	216-587-3600
OH	Dayton, Pioneer	513-236-9900
OR	Beaverton, Almac Elctrns.	503-641-9070
PA	Montgomeryville, Pyttronic Inds.	215-242-6700
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Pittsburgh, Pioneer	412-782-2300
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Allen, Prime Distrbg. Co.	214-231-0170
TX	Austin, Pioneer	512-835-4000
TX	Dallas, Pioneer	214-386-7300
TX	Ft. Worth, TTI	817-831-0441
TX	Houston, Pioneer	713-988-5555
UT	Salt Lake City, Diplomat/Alta Land	801-486-4134
WA	Bellevue, Almac Stroum Elctrns.	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL-DUBILIER ELECTRONICS, 150 Avenue "L", Newark, NJ 07105, Tel: 201-589-7500, Telex: 03-8366; FSC No.: 14655; Empl.: 3000; *Sls. Mgr.:* A. Cavuto

CORNELL-DUBILIER ELECTRONICS, Div. of Federal Pacific Electric Co., 1605 East Rodney French Blvd., New Bedford, MA 02744, Tel: 617-996-8561

CORNELL-DUBILIER ELCTRNS., Wayne Interchange, Plaza 1, Wayne, NJ 07470, Tel: 201-256-2000; *Sls. Mgr.:* A. Cavuto

CORNING GLASS WORKS, Main Plant, MS 2136, Corning, NY 14831, Tel: 607-974-4102, Telex: 932-499; Empl.: 30000; *Sls. Mgr.:* B. J. Lanahan

CORNING GLASS WORKS, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, Tel: 607-974-9000, Telex: 932481; Empl.: 8000; *Sls. Mgr.:* Ben S. Williams; *Dist. Mgr.:* Lyle E. Pirnie

CORNING GLASS WORKS, Memory Prods. Dept., 3900 Electronic Dr., Raleigh, NC 27604, Tel: 919-876-1100, TWX: 510-928-1840; Empl.: 17; *Sls. Mgr.:* A. Greenlaw

CORNING GLASS WORKS, Telecomm Prods. Dept., BH-5, Corning, NY 14830, Tel: 607-974-9000, Telex: 932498; Empl.: 28,000

CORNING MEDICAL & SCIENTIFIC, See Corning Glass Works, Corning Elctrns.

CORTEC, INC., 15811 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529; Empl.: 35

CORTRON DIV., 400 W. Grand Ave., Elmhurst, IL 60126, Tel: 312-279-9110, TWX: 910-254-0154; Empl.: 300; *Sls. Mgr.:* Jim Powers

COSAR, 3121 Benton St., Garland, TX 75042, Tel: 214-276-9487, 800-527-1207, Telex: 730-764; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Jerry Jarka

COSMO PLASTICS CO., 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594, TWX: 810-421-8444; Empl.: 500; *Sls. Mgr.:* B. Gordon

COTO CORPORATION, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686, TWX: 710-381-8016; Empl.: 200; *Sls. Mgr.:* W. Poisson .... 1B•1324-1330

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
CA	Lomita, Component Mktg. Assoc.	213-326-1460
CA	San Diego, D Squared Sls.	619-560-6266
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Sls.	303-696-1601
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	W. Lafayette, Richmar Elctrns.	317-846-6383
NY	Melville, Jarms Assoc.	516-752-0404
NC	Cary, Montgomery Mktg.	919-467-6319
OR	Portland, Ecco Mktg.	503-254-5588
PA	Ardmore, Manreps	215-649-6300
TX	Plano, Richmar Elctrns.	214-867-8224
WA	Seattle, Ecco Mktg.	206-364-0200
WA	Spokane, Ecco Mktg.	509-926-9950
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

Intl	England, Surrey, Rhopoint	08833-OX-7988

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 212-646-7996; Empl.: 15; *Sls. Mgr.:* Alan Marks

COUNTIS INDS., 2670 Lockheed Way, Carson City, NV 89701, Tel: 702-882-6123; Empl.: 12; *Sls. Mgr.:* T. J. Countis; *Dist. Mgr.:* T. J. Countis

CPS INC., 110 Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-738-0530, Telex: 35-7450; FSC No.: 31640; Empl.: 80; *Sls. Mgr.:* Rick Ross .... 3•1540

Local Sales Offices & Reps

MA	Burlington, Intersell	617-273-3844
NY	Great Neck, Industron Assocs.	516-487-2620

CRAIG SYS., 360 Merrimack St., Lawrence, MA 01842, Tel: 617-688-6961, TWX: 710-342-0765; FSC No.: 81902; Empl.: 300; *Sls. Mgr.:* Edwin C. Simas; *Dist. Mgr.:* Edwin C. Simas

CRAMER INC., 625 Adams St., Kansas City, KS 66105, Tel: 913-621-6700, TWX: 910-743-6856; Empl.: 200; *Sls. Mgr.:* Thomas R. Hyland

CRAMER COIL & TRANSFORMER CO., INC., 1121 15th Ave., Grafton, WI 53024, Tel: 414-377-7040; Empl.: 65; *Sls. Mgr.:* Philia G. Hayes

CRAMER DIVISION, Conrac Corporation, Mill Rock Rd., Old Saybrook, CT 06475, Tel: 203-388-3574, Telex: 966-453; Empl.: 250; *Sls. Mgr.:* Mktg. Mgr. J. H. Moor; *Dist. Mgr.:* E. Latourette

Local Sales Offices & Reps

CA	Anaheim, Spectrum Assocs.	714-630-6977
CA	Palo Alto, Mollard Mktg.	415-961-0456
CA	Placentia, Spectrum Assocs.	714-996-9400
CA	San Carlos, Electronic Engrg. Assoc., Inc.	415-593-2189
CA	Santa Clara, Held & Mollard	408-727-2050
IL	Elk Grove, Martec Assocs.	312-956-8090
IL	Glen Ellyn, Cramer Sls. Office	312-858-5166
IN	Indianapolis, Tech Sls. & Mktg., Inc.	317-849-6612
MI	Detroit, J.C. Hofstetter Co.	313-533-7788
MI	Farmington Hills, Anderson Elctrns., Inc.	313-553-7600
MN	St. Paul, Skor Inc.	612-426-1160
NM	Albuquerque, Vic Myers Assocs., Inc.	505-884-6878
NY	East Syracuse, Application Specialists Inc.	315-437-2813
NY	Rochester, Application Specialists Inc.	716-586-6226
OH	Dayton, RDP Corp.	513-253-6175
OH	Medina, J. C. Hofstetter	216-241-4880
PA	Bromall, White/Whiddett	215-353-6343
PA	Pittsburgh, Wainwright Tech. Sls.	412-487-5055
PA	Willow Grove, Jacabson-Rodger Assoc. Inc.	215-657-4300
TX	Austin, Sesco Inc.	512-892-2490
WA	Mercer Island, Andersen Assocs.	206-232-0484

CREATIVE PACKAGING CO., 1202 Kentucky Ave., Indianapolis, IN 46285

CRESTRON ELEC., 101 Broadway, Cresskill, NJ 07626, Tel: 201-894-0660

CRESTRONICS DIV., Applied Electro Technlg., Int., 2220 S. Anne St., Santa Ana, CA 92704, Tel: 714-556-6570, TWX: 910-595-1797; FSC No.: 52797; Empl.: 25; *Dist. Mgr.:* D. Dore

CROMEMCO, 280 Bernardo Ave., Mountain View, CA 94043, Tel: 415-964-7400, TWX: 910-379-6988; Empl.: 500; *Sls. Mgr.:* Tom Keating; *Dist. Mgr.:* Tom Keating

CROMPTON INSTRS., 1562 Parkway Loop, Units A & B, Tustin, CA 92680, Tel: 714-731-2333, Telex: 69-2309; FSC No.: 53498; *Sls. Mgr.:* J. Berger

CROMPTON INSTRS., 2763 Higgins Rd., Elk Grove Village, IL 60007, Tel: 312-593-1107, Telex: 28-0540; *Sls. Mgr.:* Tony A. Pitt

CROSS ELCTRNS., 100 Commonwealth Dr., Warrendale, PA 15086, Tel: 412-776-1591; Empl.: 35

CROSSPOINT
THE LIGHTED DISPLAY DIVISION
INFO-LITE CORPORATION

CROSSPOINT, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455; FSC No.: FSCM 52116; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli; *Dist. Mgr.:* Joseph M. Cartelli .... **1B**•1574

Local Sales Offices & Reps

CA	No. Hollywood, Crown Elctrns.	213-877-3550
CA	Redwood City, Caltronic Assocs.	415-365-2545
CT	Weston, CJA Assoc.	203-226-4317
FL	St. Petersburg, R. L. Matus & Assocs.	813-896-4133
GA	Buford, R. L. Matus & Assocs.	404-945-2946
IL	Lake Zurich, L & B Assocs.	312-438-7917
MI	Brighton, Michigan Mktg. & Sls.	313-229-6218
NJ	Wayne, GT Assocs.	201-694-6040
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, A.S.A.	216-662-6080
OH	Dayton, Mohawk Intronics	513-434-8873
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415

CROUSE HINDS/SEPCO CORP., 1200 Kennedy Rd., Windsor, CT 0695, Tel: 203-683-4300

CROUZET CONTROLS, INC., 1083 State Pkwy., Schaumburg, IL 60195, Tel: 312-843-2200, Telex: 206 297; Empl.: 14; *Sls. Mgr.:* Ben Delcourt .... **1B**•1140, 1332, 1333, 1575

Local Sales Offices & Reps

AZ	Phoenix, Motion Technology.	602-991-1782
CA	Anaheim, Motion Technology	714-777-4259
CA	Chatsworth, Motion Technology.	818-993-3762
CA	San Jose, Motion Technology	408-932-0990
CA	San Rafael, Motion Technology	415-459-2171
CO	Denver, Control Agency	303-936-6641
FL	Tamarac, Davmik Sls.	305-920-2222
GA	Stone Mountain, DTM, Inc.	404-962-2530
IL	Roselle, Michael J. Koepke Assoc.	312-980-1575
IA	Des Moines, Jack Davidson Co.	515-263-8478
MA	Wellesley, Electro Kinetics	617-235-9415
MI	Royal Oak, Dave Ray & Assocs.	313-280-0000
MN	Minneapolis, Jos-Co/Melius.	612-861-3343
MO	St. Charles, C-F Electronics, Sales	314-946-8500
NY	Fairport, Tac Sls.	716-425-1070
NY	Syosset, Motion Control Sls.	516-921-5656
NC	Tryon, Halliday & Assoc.	704-894-8205
OH	Cincinnati, Tom Mulligan & Assocs.	513-574-1932
OH	Columbus, Tom Mulligan Co.	614-457-2242
PA	Bensalem, William D. Staats Co.	215-639-5231
TX	Dallas, Automated Motion Control	214-340-4192
UT	Salt Lake City, Control Agency	801-328-4305
WA	Bellevue, Sea Inc.	206-883-4999
WA	Vancouver, Sea Inc.	206-573-5161

Local Distributors

CA	Burlingame, Elec. Control Devices	415-348-0791
CA	Los Angeles, Master Distr.	213-452-1229
FL	Pembroke Pines, Donza Intl.	305-987-1122
IL	Chicago, Excel Elec.	312-421-7220
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Vonnegut Indl. Prods.	317-899-8800/8877
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Bettendorf, Custom Controls Ltd.	319-335-4787
MA	Wellesley, Electro-Mechanical Distr.	617-235-1565
MI	Comstock Park, Mor Elec.	616-784-1121
MI	Grand Rapids, S-F Electronics	616-459-0216
MI	Royal Oak, George Instr. Co.	313-280-1111
MN	St. Paul, Powermation	612-645-0781
NE	Omaha, Lakeland Engrg.	402-734-2600
NJ	Edison, Howman Applied Control Prods.	201-797-3313
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	W. Trenton, Electronic Serv. Div. (Roller Bearing Co. of America)	609-882-7400
NY	Commack, Monarch Comps.	516-499-1770
NC	Asheville, Electric Supply Co.	704-255-8899
NC	Gastonia, J.M.T. Elctrn. Supp.	704-867-4401
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
ND	Bismarck, Border States Elec.	701-258-6060
OH	Cincinatti, Hughes-Peters.	513-351-2000
OH	Cleveland, Reserve Elec. Co.	216-771-5764
OH	Columbus, Hughes-Peters.	614-294-5351
OH	Dayton, Duellman Elctrns.	513-461-5010
OK	Tulsa, Radio.	918-587-9123
OR	Portland, Mill & Power Specialties	503-228-7621
PA	Allentown, P. A. Peters.	215-434-5237
PA	Philadelphia, Herbach & Rademan	215-426-1700
SC	Greenville, Holder Elec. Supp.	803-271-7111
TN	Chattanooga, Curle Elctrns.	615-266-4728
TX	Ft. Worth, Swieco.	817-335-6521
WA	Kent, Motors & Controls Corp.	206-872-8010
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Waukesha, Powermation	414-542-2868

CROVEN CRYSTALS, 500 Beech St., Whitby, ON L1N 5S5, Canada, Tel: 416-668-3324, TWX: 610-384-2750; FSC No.: 00809; Empl.: 250; *Sls. Mgr.:* R. McCormick .... **1A**•1346

Local Sales Offices & Reps

AZ	Mesa, Sedco Sls.	602-835-6281
CA	San Mateo, Melvin Sls.	415-349-7444
CA	Van Nuys, R.L. Assocs.	213-782-7826
FL	Palm Bay, Spartech Assocs.	305-727-8045
GA	Smyrna, Spartech Assocs.	404-432-3644
MA	Milton, Naton Assoc.	617-698-0670
MO	Blue Springs, Chesco	816-229-1404
MO	St. Charles, Chesco	314-946-6677
NJ	Cherry Hill, Harry J. White	609-428-4544
NY	Melville, Carnes Assocs.	516-694-1600
OH	Englewood, Clayton-Ellier Co.	513-836-3556
TX	Arlington, W. Pat Fralia	817-640-9101
VA	Springfield, Tech Reps Inc.	703-569-6868
WI	Mequon, Artmor Ltd.	414-241-4040

CRYDOM DIVISION, Int'l. Rectifier, 1521 Grand Ave., El Segundo, CA 90245, Tel: 213-322-4987, Telex: 67-4660, TWX: 910-348-6283; Empl.: 100; *Sls. Mgr.:* John Deith; *Dist. Mgr.:* Bob Arnstein

CRYOMAGNETICS, INC., 795 Oak Ridge Tpk., Oak Ridge, TN 37830, Tel: 615-482-9551; *Sls. Mgr.:* R. M. Ennis, Jr.

CRYSTALOID ELCTRNS., Box 628, Hudson, OH 44236, Tel: 216-655-2429, Telex: 241-244; Empl.: 130; *Sls. Mgr.:* Sharon Werstler .... **1B**•1031

CRYSTEK CORP, P.O. Box 06135, Ft. Myers, FL 33906, Tel: 813-936-2109, TWX: 510-951-7448; FSC No.: 13454; Empl.: 2500

CSI Capacitors

CSI CAPACITORS, CSI Technlgs., 810 Rancheros Dr., San Marcos, CA 92069, Tel: 619-747-4000, Telex: 697832; FSC No.: 10026; Empl.: 50; *Sls. Mgr.:* H. R. Smith .... **1A**•1021

Local Sales Offices & Reps

AZ	Tempe, Cleveland Entprs. of AZ	602-820-1127
CA	San Jose, Silicon Valley Sls.	408-286-7510
CA	Tarzana, High Voltage Sls.	213-881-9194
FL	Orlando, Glenn Tech. Sls. Co.	305-299-8700
IL	Chicago, Esco Assocs.	312-763-0800
KY	Louisville, K. W. Electronic Sls.	512-451-1860
MA	Framingham, Sullivan Tech. Sls.	617-620-0195
NJ	Leonia, Peter E. Schmitt Co.	201-944-2806
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Cazenovia, S. T. Woolard	315-655-8145
OH	Dayton, K. W. Electronic Sls.	513-890-2150
PA	Washington Crossing, DVS Company	215-493-4642
TX	Dallas, Cunningham Comps. Corp.	214-233-4303
TX	Houston, Cunningham Comps. Corp.	713-461-4197

C-TEK
INCORPORATED

C-TEK INC., 4 Railroad Ave., Wakefield, MA 01880, Tel: 617-246-1720, Telex: 882485; Empl.: 15; *Sls. Mgr.:* John Vanaman .... **3**•1126, 1127

Local Sales Offices & Reps

CO	Boulder, Measurement Consits. of CO	303-499-7506
CT	Ansonia, R. H. Sturdy Co.	203-734-2186
MA	Waltham, Calibron Instrs.	617-894-6440
MA	Wellesley Hills, R. H. Sturdy Co.	617-235-2330
MI	Southfield, Fred H. Gehrke & Assocs.	313-559-5363
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Pittsford, Trott Elctrns.	716-586-8251
NY	Syosset, Motion Control Sls.	516-921-5656
NC	Charlotte, Jake Rudisill Assocs.	704-377-6901
NC	Charlotte, Trott Elctrns.	704-376-2237
PA	Carnegie, N. H. Andrews Co.	412-279-5335
VA	Richmond, Jake Rudisill Assocs.	804-320-0201
WA	Seattle, Eicher-Richards Co.	206-523-7888

CTI-CRYOGENICS, 266 Second Ave, Waltham, MA 02254, Tel: 617-890-9400, Telex: 92-3442; Empl.: 350; *Sls. Mgr.:* R. A. Bryce

CTS® CORPORATION*

CTS CORP., 905 North West Blvd., Elkart, IN 46514, Tel: 219-293-7511, TWX: 810-294-2167; Empl.: 6,800; *Dist. Mgr.:* J. C. Wells

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400

CA	Pleasanton, CTS Corp.	415-462-6635
CA	South Pasadena, CTS Corp.	213-682-1137
CO	Denver, ELCOM	303-337-2300
CT	North Haven, CompRep Assocs.	203-239-9762
FL	Altamonte Springs, Electrocomp Assocs.	305-331-0173
FL	Deerfield Beach, Electrocomp Assocs.	305-429-0802
FL	Melbourne, Electrocomp Assocs.	305-242-0621
FL	St. Petersburg, Electrocomp Assocs.	813-327-9677
GA	Norcross, Interep Assocs.	404-449-8680
IL	Addison, CTS Corp.	312-543-5021
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IA	Cedar Rapids, Seltec Sls. Corp.	319-393-1114
KS	Overland Park, Advanced Tech. Sls.	913-642-6675
MD	Baltimore, Professional Reps.	301-653-3600
MA	Westwood, CompRep Assocs.	617-329-3454
MI	Grand Rapids, J. L. Montgomery Assocs.	616-774-9308
MI	Southfield, J. L. Montgomery Assocs.	313-358-2616
MN	Minneapolis, Robert W. Marshall Co.	612-929-0457
MO	St. Louis, Advanced Tech. Sls.	314-227-4448
NM	Albuquerque, Compass Mktg. & Sls.	505-292-7377
NY	E. Syracuse, Nycom	315-437-8343
NY	Jamaica, S-J Sales Assocs.	212-291-3232
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OK	Tulsa, Southern States Mktg.	918-665-8338
PA	Mars, Baehr, Greenleaf & Assocs.	412-776-2151
PA	Trevose, P.S.A. Inc.	215-245-0513
TN	Greeneville, Interep Assocs.	615-639-3491
TX	Austin, Southern States Mktg.	512-452-9459
TX	Houston, Southern States Mktg.	713-558-4900
TX	Richardson, Southern States Mktg.	214-238-7500
UT	Salt Lake City, ELCOM	801-532-7940
WA	Bellevue, SD-R^2 Prods. & Sls.	206-747-9424
EXP	Elkhart, Indiana, CTS Corp.	219-293-7511
PR	Mayaguez, CompRep de Puerto Rico	809-832-9529

CTS CORPORATION, Asheville Division, P.O. Box 100, Skyland, NC 28776, Tel: 704-684-6451, TWX: 510-935-0059; *Sls. Mgr.:* T. B. Haney

CTS CORPORATION*
BERNE DIVISION

CTS OF BERNE, 406 Parr Rd., Berne, IN 46711, Tel: 219-589-3111, TWX: 810-323-1580; Empl.: 975; *Sls. Mgr.:* James A. Long ....**1A**•1836-1844, 2036

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400
CA	Pleasanton, CTS Corp.	415-462-6635
CA	South Pasadena, CTS Corp.	213-682-1137
CO	Denver, ELCOM	303-337-2300
CT	N. Haven, CompRep Assocs.	203-239-9762
FL	Ft. Lauderdale, Electrocomp Assocs.	305-491-4141
FL	Melbourne, Electrocomp Assocs.	305-242-0621
FL	St. Petersburg, Electrocomp Assocs.	813-327-9677
GA	Norcross, Interep Assocs.	404-449-8680
IL	Addison, CTS Corp.	312-543-5021
IN	Elkhart, CTS Corp.	219-293-7511
IA	Cedar Rapids, Seltec Sls. Corp.	319-393-1114
KS	Overland Park, Advanced Tech. Sls.	913-492-4333
MD	Baltimore, Professional Reps.	301-653-3600
MA	Westwood, CompRep Assocs.	617-329-3454
MI	Grand Rapids, J. L. Montgomery Assocs.	616-774-9308
MI	Southfield, J. L. Montgomery Assocs.	313-358-2616
MN	Minneapolis, Robert W. Marshall Co.	612-929-0457
MO	St. Louis, Advanced Tech. Sls.	314-227-4448
NJ	Haddonfield, Tritek Sls.	609-429-1551
NM	Albuquerque, Compass Mktg. & Sls.	505-292-7377
NY	E. Syracuse, Nycom	315-437-8343
NY	Jamaica, S-J Sales Assocs.	212-291-3232
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Cincinnati, Baehr, Greenleaf & Assocs.	513-891-3827
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OR	Beaverton, SD-R^2 Prods. & Sls.	503-641-7377
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
TN	Knoxville, Interep Assocs.	615-584-0191
TX	Addison, Southern States Mktg.	214-248-8600
TX	Austin, Southern States Mktg.	512-452-9459
TX	Houston, Southern States Mktg.	713-988-0991
UT	Salt Lake City, ELCOM	801-532-7940
VA	Charlottesville, Professional Reps.	804-977-0031
WA	Bellevue, SD-R^2 Prods. & Sls.	206-747-9424
PR	Mayaguez, CompRep de Puerto Rico	809-832-9529

Local Distributors

AL	Huntsville, Hall-Mark/Huntsville	205-837-8700
AL	Huntsville, RM Electronics Co.	205-852-1550
AZ	Phoenix, R. V. Weatherford Co.	602-272-7144
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Marshall Inds.	602-968-6181
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	Canoga Park, Marshall Inds.	213-999-5001
CA	Chatsworth, Arrow/Los Angeles	213-701-7500
CA	El Monte, Marshall Inds.	213-442-7204
CA	Gardena, Bell Inds.	213-515-1800
CA	Glendale, R. V. Weatherford Co.	213-849-3451
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Hayward, Arrow/Primary West	415-487-4300
CA	Irvine, Marshall Inds.	714-556-6400
CA	Irvine, Ratel/Irvine	714-549-8611
CA	Los Angeles, Western Electromotive	213-820-3777
CA	Newport Beach, Arrow/Newport Beach	714-851-8961
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Diego, Western Electromotive/Intercon	619-271-4511
CA	San Diego, R. V. Weatherford Co.	619-695-1700
CA	San Diego, Arrow/San Diego	619-565-4800
CA	San Jose, Ratel/San Jose	408-946-4300
CA	Santa Clara, Western Electromotive	408-985-7411
CA	Sunnyvale, Arrow/Sunnyvale	408-745-6600
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Integrated Elctrns. Co.	303-534-6121
CO	Denver, Arrow/Denver	303-758-2100
CO	Englewood, R. V. Weatherford Co.	303-428-6900
CO	Englewood, Industrial Elctrns.	303-694-9444
CO	Lakewood, Ratel/Denver	303-232-8830
CT	Wallingford, Arrow/Wallingford	203-265-7741
CT	Wallingford, Midan Elctrns.	203-265-2077
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Dania, Summit Distrs.	305-920-6253
FL	Ft. Lauderdale, Arrow/Ft. Lauderdale	305-971-7160
FL	Ft. Lauderdale, Hall-Mark/Ft. Lauderdale	305-971-9280
FL	Longwood, MRP Micro Elctrns.	305-331-8787
FL	Orlando, Hall-Mark/Orlando	305-855-4020
FL	Orlando, Marshall Inds.	305-841-1878
FL	Palm Bay, Arrow/Palm Bay	305-725-1480
GA	Norcross, Arrow/Norcross	404-449-8252
GA	Norcross, Hall-Mark/Norcross	404-447-8000
IL	Bensenville, Hall-Mark/Elk Grove Vlg.	312-860-3800
IL	Chicago, Bell Inds.	312-982-9210
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Lombard, RM Electronics Co.	312-932-5150
IL	Schaumburg, Arrow/Schaumburg	312-893-9420
IN	Indianapolis, RM Electronics Co.	317-247-9701
IN	Indianapolis, Arrow/Indianapolis	317-243-9353
KS	Lenexa, Hall-Mark/Kansas City	913-888-4747
MD	Baltimore, Hall-Mark/Baltimore	301-796-9300
MD	Baltimore, RESCO/Baltimore	301-823-0070
MD	Baltimore, Arrow/Baltimore	301-247-5200
MD	Beltsville, RESCO/Washington	301-937-9100
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Woburn, Time Elctrns.	617-935-8080
MA	Woburn, Arrow/Boston	617-933-8130
MI	Ann Arbor, Arrow/Ann Arbor	313-971-8220
MI	Grand Rapids, Arrow/Grand Rapids	616-233-0912
MI	Grand Rapids, RM Electronics Co.	616-531-9300
MI	Kalamazoo, RS Electronics	616-381-5470
MI	Livonia, RS Electronics	313-525-1155
MN	Bloomington, Hall-Mark/Minneapolis	612-854-3223
MN	Edina, Arrow/Edina	612-830-1800
MN	Minneapolis, Industrial Comps.	612-831-2666
MN	Plymouth, Marshall Inds.	612-559-2255
MO	Maryland Heights, Hall-Mark/St. Louis	314-291-5350
MO	St. Louis, Arrow/St. Louis	314-567-6888
MO	St. Louis, Olive Elctrns.	314-426-4500
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NE	Omaha, Scott Elctrn. Supp.	402-734-6750
NJ	Cherry Hill, Hall-Mark/New Jersey	215-355-7300
NJ	Fairfield, Arrow/New Jersey	201-575-5300
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Moorestown, Arrow/Moorestown	215-928-1800
NJ	Nutley, Vantage Comps.	201-667-1840
NM	Albuquerque, Arrow/Albuquerque	505-243-4566
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distrs.	716-884-3450
NY	East Syracuse, Marshall Inds.	315-432-0644
NY	Endwell, Marshall Inds.	607-754-1570
NY	Farmingdale, Arrow Elctrns.	516-694-6800
NY	Farmingdale, Arrow Intl.	516-694-6800
NY	Hauppauge, Fairmont Elctrn. Sls.	516-231-3313
NY	Hauppauge, Arrow/Long Island	516-694-6800
NY	Jamaica, Archer Indl. Dist.	212-291-3232
NY	Liverpool, Arrow/Syracuse	315-652-1000
NY	Mount Vernon, QAR Electronics	914-699-2224
NY	Rochester, Arrow/Rochester	716-275-0300
NY	Rochester, Marshall Inds.	716-235-7620
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Rochester, Summit of Rochester	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Hall-Mark/Raleigh	919-832-4465
NC	Raleigh, Arrow/Raleigh	919-876-3132
NC	Raleigh, RESCO/Raleigh	919-781-5700
NC	Winston-Salem, Arrow/Winston-Salem	919-725-8711
OH	Centerville, Arrow/Dayton	513-435-5563
OH	Cincinnati, Arrow/Cincinnati	513-761-5432
OH	Dayton, Marshall Inds.	513-236-8088
OH	Highland Heights, Hall-Mark/Cleveland	216-473-2907
OH	Solon, Arrow/Solon	216-248-3990
OH	Westerville, Hall-Mark/Columbus	614-891-4555
OK	Tulsa, Hall-Mark/Tulsa	918-665-3200
OR	Lake Oswego, Moore Elctrns.	503-635-8823
PA	McKean, Advacom	814-476-7774
PA	Monroeville, Arrow/Pittsburgh	412-351-4000
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Philadelphia, TRW Elctrns. Supp.	215-922-8900
TX	Addison, Captronics/Dallas	214-980-0123
TX	Austin, Arrow/Austin	512-835-4180
TX	Austin, Captronics/Austin	512-459-4328
TX	Dallas, Arrow/Dallas	214-386-7500
TX	Dallas, R. V. Weatherford Co.	214-980-1110
TX	Dallas, Hall-Mark/Dallas	214-341-1147
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Houston, R. V. Weatherford Co.	713-688-7406
TX	Stafford, Southwest Elctrns.	713-491-4900
TX	Stafford, Arrow/Houston	713-491-4100
UT	Salt Lake City, Standard Supply Co.	801-486-3371
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Arrow/Seattle	206-643-4800
WA	Seattle, Zepher Elctrn. Sls. Corp.	206-241-1980
WA	Seattle, R. V. Weatherford Co.	206-575-1340
WA	Seattle, Western Electromotive	206-575-1910
WI	Oak Creek, Arrow/Wisconsin	414-764-6600
WI	Oak Creek, Hall-Mark/Oak Creek	414-761-3000

CTS ELECTRONICS CORP., PASO ROBLES DIV., Electromechanical Gp., 500 Linne Rd., Paso Robles, CA 93446, Tel: 805-238-0350, TWX: 910-351-6796; *Sls. Mgr.:* Jack Bell; *Dist. Mgr.:* Bob Tarkenton ....**1B**•1576-1580

CTS FABRI-TEK, INC., Connector Div., 9210 Science Center Dr., Minneapolis, MN 55428, Tel: 612-533-3533, TWX: 910-576-2717; Empl.: 300; *Sls. Mgr.:* John B. McKee ....**2**•1246-1248

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AZ	Phoenix, Compass Mktg.	602-266-5400
CA	South Pasedena, CTS Corp.	213-682-1137
CO	Denver, ELCOM, Inc.	303-337-2300
CT	Danbury, CTS Corp.	203-743-3681
FL	Ft. Lauderdale, Electrocomp Assocs.	305-491-4141
GA	Norcross, Interep	404-449-8680
IL	Addison, CTS Corp.	312-543-5021
IN	Indianapolis, Elctrn. Rep.	317-894-1414
IA	Cedar Rapids, Seltec	319-393-1114
MD	Baltimore, Pro Representatives	301-653-3600
MI	Southfield, J. L. Montgomery	313-358-2616
MN	Minneapolis, S & R Sls.	612-559-3090
NY	Jamaica, S. J. Assocs.	212-291-3232
NY	Pittsford, Kirby Mktg.	716-248-8750
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OK	Tulsa, Southern States Mktg.	918-665-8338
OR	Portland, SD-R⅜¢2 Prods.	503-297-8677
PA	Trevose, PSA, Inc.	215-245-0513
TN	Knoxville, Interep Assocs.	615-584-0191
TX	Dallas, Southern States Mktg.	214-238-7500
TX	Houston, Southern States Mktg.	713-558-4900
UT	Salt Lake City, ELCOM, Inc.	801-532-7940
VA	Charlottesville, Pro Representatives	804-977-0031
WA	Bellevue, SD-R^2 Prods. & Sls.	206-747-9424

CTS FABRI-TEK, INC., 6900 Shady Oak Rd., Eden Prairie, MN 55344, Tel: 612-941-9100, TWX: 910-576-2913; FSC No.: 21542; Empl.: 1400; *Sls. Mgr.:* Bruce Richardson

CTS KNIGHTS, 400 Reimann Ave., Sandwich, IL 60548, Tel: 815-786-8411, TWX: 910-642-0860; Empl.: 500; *Sls. Mgr.:* Larry Barbary; *Dist. Mgr.:* Larry Barbary ....**1A**•1333-1345

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400
CA	Pleasanton, CTS Corp.	415-462-6635
CA	S. Pasadena, CTS Corp.	213-682-1137
CO	Denver, Elcom	303-337-2300
CT	North Haven, CompRep Assocs.	203-239-9762

FL	Deerfield Beach, Electrocomp Assocs.	305-429-0802
FL	Melbourne, Electrocomp Assocs.	305-242-0621
FL	St. Petersburg, Electrocomp Assocs.	813-327-9677
GA	Norcross, Interep Assocs.	404-449-8680
IL	Addison, CTS Corp.	312-543-5021
IN	Indianapolis, E.R.I.	317-894-1414
IA	Cedar Rapids, Seltec Sls. Corp.	319-393-1114
KS	Overland Park, Advanced Tech. Sls.	913-642-6674
MD	Baltimore, Pro Rep	301-653-3600
MA	Westwood, CompRep Assocs.	617-329-3454
MI	Grand Rapids, J. L. Montgomery Assocs.	616-774-9308
MI	Southfield, J. L. Montgomery Assocs.	313-358-2616
MN	Minneapolis, Robert W. Marshall Co.	612-929-0457
MO	St. Louis, Advanced Tech. Sls.	314-227-4448
NM	Albuquerque, Compass Mktg. & Sls.	505-292-7377
NY	E. Syracuse, Nycom	315-437-8343
NY	Jamaica, S-J Sales Assocs.	212-291-3232
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
TN	Greeneville, Interep Assocs.	615-639-3491
TX	Austin, Southern States Mktg.	512-452-9459
TX	Houston, Southern States Mktg.	713-558-4900
TX	Richardson, Southern States Mktg.	214-238-7500
UT	Salt Lake City, Elcom	801-532-7940
WA	Bellevue, SD-R² Prods. & Sls.	206-747-9424

CTS MICROELECTRONICS, INC., 1201 Cumberland Ave., W. Lafayette, IN 47906, Tel: 317-463-2565, TWX: 810-342-1882; Empl.: 505; *Sls. Mgr.:* David C. Anderson ....**1A**•1646-1651

Refer to CTS Corp. for distributor & sales office information

CTS HALEX, 1202 McGaw Ave., Irvine, CA 92714, Tel: 714-556-2850, TWX: 910-595-2648; Empl.: 70; *Sls. Mgr.:* Gene P. Markley

Refer to CTS Corp for distributor & sales office information.

CTS METAL PRODS., Jose Division, 660 Lenfest Rd., San Jose, CA 95113, Tel: 408-251-1600, Telex: 910-997-8006; Empl.: 500; *Sls. Mgr.:* Ed King; *Dist. Mgr.:* Charles Nadler

CUESTA SYSTEMS, INC., 3440 Roberta Ct., San Luis Obispo, CA 93401, Tel: 805-541-4160; *Sls. Mgr.:* David V. Dickey

CUPLEX, INC., 1500 E. Hwy. 66, Garland, TX 75040, Tel: 214-276-0333, TWX: 910-860-5098; *Sls. Mgr.:* Grady C. Young

CURRENTECHNOLOGY CORP., 135 Prestige Pk. Circle, E. Hartford, CT 06108, Tel: 203-289-6831, TWX: 710-425-6063; *Sls. Mgr.:* Bob Ramage

CURTIS ELECTRO DEVICES, INC., Box 4090, Mountain View, CA 94040, Tel: 415-964-3846; Empl.: 12; *Sls. Mgr.:* J. Curtis

CURTIS INDS., 8000 West Tower Ave., Milwaukee, WI 53223, Tel: 414-354-1500, TWX: 910-262-3035; Empl.: 160

CURTIS

CURTIS INSTRS., INC., 200 Kisco Ave., Mt. Kisco, NY 10549, Tel: 914-666-2971, TWX: 710-571-2163; FSC No.: 18530; Empl.: 95; *Sls. Mgr.:* Rhoda McDonald ....**3**•1128

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assoc.	602-944-9542
CA	Burlingame, Polach & Bensinger	415-697-2525
CA	Seal Beach, Texel Engrg.	213-596-9411
CO	Littleton, Grifco	303-795-1989
FL	Longwood, NSL Assocs.	305-629-5226
IL	La Grange Park, Bierhaus Sls.	312-354-5100
IN	Ft. Wayne, Aktron Sls.	219-747-3650
MA	Brookline, Harman Assocs.	617-232-6687
MN	Minnetonka, S. J. Collins	612-933-7661
NY	Manhasset, WinCor Elctrn. Sls. Corp.	516-627-9474
NY	Syracuse, C & L Sales	315-451-7810
OH	Chagrin Falls, K. F. Naverz	216-338-8450
PA	Media, W. Reeves Assocs.	215-566-6709
TX	Dallas, Etron Corp.	817-430-8422
WA	Lynnwood, Blum & Assocs.	206-775-6656
WI	Milwaukee, Bierhaus Sls.	414-963-0318

CUSHMAN ELCTRNS., 2450 N. 1st St., San Jose, CA 95131, Tel: 408-263-8100, TWX: 810-338-0556; Empl.: 400; *Sls. Mgr.:* Harris Fuller

CUSTOM CABLE, 242 Butler, Westbury, NY 11590, Tel: 516-334-3600; Empl.: 13; *Sls. Mgr.:* J. Michelman; *Dist. Mgr.:* D. Pollack

CUSTOM COIL & TRANSFORMER CO., Box 2369, Zanesville, OH 43701, Tel: 614-452-6973, TWX: 810-238-2629; Empl.: 80

CUSTOM CONNECTOR, 1738 E. 30th St., Cleveland, OH 44114, Tel: 216-241-1679; Empl.: 36; *Sls. Mgr.:* Larry Weider ....**2**•1249

Local Sales Offices & Reps

CA	Mountain View, Westech Sls.	415-961-1422
CT	Glastonbury, Barton Assoc.	203-633-9417
FL	Longwood, Vic Murray & Assoc.	305-831-0877
IL	Arlington Hgts., Langdon Engrg.	312-364-0830
MD	Baltimore, Haacke Assoc.	301-889-7875
MA	Waban, Barton Assoc.	617-965-8590
NC	Charlotte, J.W.L. Assoc.	704-523-3001
WI	Shorewood, Werking Ind. Sls.	414-964-2225

CUSTOM CONTROL SYS., 21 E. Canon Perdido St., Santa Barbara, CA 93101, Tel: 805-965-7577; Empl.: 2; *Sls. Mgr.:* Fred Winter

CUSTOM ELCTRNS., Browne St., Oneonta, NY 13820, Tel: 607-432-3880, TWX: 510-241-8292; FSC No.: 23280; Empl.: 100; *Sls. Mgr.:* D. Hathaway

CUSTOM PRODS. GRP., Sys. Dev. Corp.-A Burroughs Co., P.O. Box 517, Paoli, PA 19301, Tel: 215-648-2241, Telex: 215-647-9961, TWX: 510-668-7243; *Sls. Mgr.:* Spiro Greenwood; *Dist. Mgr.:* Joseph Benn

CUSTOM SCI. INSTRS., 13 Wing Dr., Cedar Knolls, NJ 07927, Tel: 201-538-8500, Telex: 25-4328; Empl.: 20; *Sls. Mgr.:* Henry J. Bultman, Jr.

CUTLER HAMMER GRP., EATON CORP., Aerospace Controls/Systems Div., 2074 Whitfield Ave. East, Sarasota, FL 33578, Tel: 813-758-7726

CUTLER-HAMMER, INC., SHALLCROSS RESISTOR PRODS., See Shallcross, Inc.

CUTLER-HAMMER PRODS., See Eaton Corp./Cutler-Hammer Prods.

CVC PRODS., 525 Lee Rd., Rochester, NY 14603, Tel: 716-458-2550, Telex: 97-8269; Empl.: 160; *Sls. Mgr.:* Steven Rothstein

CYBERNETIC MICRO SYS., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074, Tel: 415-726-3000, Telex: 171-135 Attn: CYBERNETICS; *Sls. Mgr.:* K. Moty

Advertisement

CYBERNETIC MICRO SYSTEMS packs onto a single chip the intelligence and power of a board-level peripheral controller. These user-programmable chips control such devices as LCDs, motors, printers, waveforms, process monitors, parallel/serial interface, networks, etc, and include general purpose programmable controllers. Volume custom versions considered.

CYBERSONIC CORP., Box 38, Glenside, PA 19038, Tel: 215-885-1734, Telex: 83-4753; Empl.: 11; *Sls. Mgr.:* Norman Rivers

Local Distributors

CA	Los Angeles, Automation Sys. & Svcs.	213-776-2424
MA	Wellesley Hills, Electro-Mechanical Distr.	617-235-1565
MI	Royal Oak, D. T. Randall Assocs.	313-546-5707
MN	St. Paul, Power/Mation Div.	612-645-0781
OH	Cincinnati, A.T.R. Distrbg.	513-574-8500
OH	Cleveland, Adcor Engrg.	216-238-3915
WI	Waukesha, Power/Mation	414-542-2868

CYBERSYSTEMS, INC., 7540 South Memorial Pkwy., Huntsville, AL 35802, Tel: 205-883-4410; FSC No.: 66; Empl.: 25; *Sls. Mgr.:* Mike Long

CYBER SYS., INC., 2031 E. Cerritos Ave., Anaheim, CA 92806, Tel: 714-722-2051, Telex: 692-375; *Sls. Mgr.:* Charles Muhle

CYCLO-TRONICS, INC., 1345 N. Old Rand Rd., Wauconda, IL 60084, Tel: 312-526-0800; Empl.: 10

CYTEC CORP., 107 N. Washington St., E. Rochester, NY 14445, Tel: 716-381-4740; *Sls. Mgr.:* Harry Turner ....**3**•1213

Local Sales Offices & Reps

FL	Osprey, Dick Ridgewell Co.	813-966-4401
MA	Burlington, Tritek	617-272-4550
NY	Frankfort, Kapital Sls.	315-896-4225

DABURN ELCTRNS. & CABLE, 70 Oak St., Norwood, NJ 07648, Tel: 201-768-5400, TWX: 710-991-9856; FSC No.: 25706; *Sls. Mgr.:* Randy Hibshman ....**2**•2083-2093

Local Sales Offices & Reps

AR	Little Rock, Leo Barker	501-835-0978
CA	Anaheim, Galaxie Sales	714-752-1580
CA	Redwood City, Hickey Ind'l. Sls.	415-368-3840
FL	Casselberry, HA Inc.	305-695-8592
FL	Coral Springs, H A Inc.	305-752-7520
IL	Elgin, Marican Sls.	312-888-2207
IN	Indianapolis, Sukup & Cox	317-253-5501
MA	No. Scituate, W. A. Hendrickson	617-545-0652
MN	Minneapolis, RIL Sls.	612-786-5713
NY	Fairport, Paul Arness Assoc.	716-223-4923
NY	N.Y.C., Robt. Smith Assoc.	212-541-4885
NY	Plainview, R. Smith Assoc.	516-681-3155
OH	Cinn, John Olsen Co.	513-574-7711
OH	Goshen, John Olsen Co.	513-722-1497
OR	Beaverton, R & R Assocs.	503-644-8077
PA	King of Prussia, Freedman-Malta	215-337-9211
PA	Pittsburgh, John Olsen Co.	412-279-2550
TX	Richardson, Eagle Marketing	214-238-5383
VA	Arlington, Howard Golonpaul & Assoc.	703-525-5898
WA	Kent, R & R Assocs.	206-251-5396

DADEN ASSOCS., 23011 Moulton Pkwy., Ste. A12, Laguna Hills, CA 92653, Tel: 714-770-1522, TWX: 910-596-1324; FSC No.: 57032; Empl.: 21; *Sls. Mgr.:* Dennis Hook

DAICO INDUSTRIES, INC.

DAICO INDS., INC., Box 5225, Compton, CA 90224, Tel: 213-631-1143, TWX: 910-346-6741; FSC No.: 28983; Empl.: 115; *Sls. Mgr.:* James Adamson ....**1A**•1692-1703

Local Sales Offices & Reps

AZ	Phoenix, Faser Tech. Sls.	602-948-4404
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Los Angeles, Midwin & Olifson	213-838-3455
CA	San Diego, Midwin & Olifson, Inc.	619-571-0177
FL	Palm Bay, Spartech Assocs.	305-727-8045
GA	Smyrna, Spartech Assocs.	404-432-3644
IL	Mt. Prospect, Cain-Forlaw Co.	312-253-3578
ME	Ogunquit, Micronic Assocs.	617-933-2121
MD	Burtonsville, Eastern Instrmn.	301-384-8500
NY	Hartsdale, Spectrum Sls.	914-472-8600
OH	Lancaster, Cain-Forlaw Co.	614-654-4800
PA	Newtown Square, SWR Assocs.	215-353-6711
TX	Dallas, McDonald Assocs.	214-238-1858
TX	Ft. Worth, McDonald Assocs.	817-429-4272

DAI-ICHI SHOJI OF AMER., INC., 150 Fifth Ave., New York, NY 10011, Tel: 212-691-9050, Telex: 429120 DSANY; Empl.: 3; *Sls. Mgr.:* A. Takayama ....**1A**•1064; **1B**•1583; **2**•1254

DALE®

DALE ELECTRONICS, INC., Columbus Div., Box 609, 2064 12th Ave., Columbus, NE 68601, Tel: 402-564-3131, TWX: 910-626-8314; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Darrel Smejkal; *Dist. Mgr.:* Jerry Jilek ....**1B**•1032-1034

Local Sales Offices & Reps

AL	Huntsville, JWL Assoc.	205-536-8410
AZ	Tempe, Dale Elctrns. Sls.	602-966-0291
CA	Los Alamitos, Reed Elctrn. Mktg.	213-598-6676
CA	Redwood City, J. S. Heaton Co.	415-367-9000
CA	San Diego, Reed Elctrn. Mktg.	619-452-1456
CO	Loveland, Dale Elctrns. Sls.	303-667-7500

CT	West Hartford, Kaelber & Mack, Inc.	203-667-4514
FL	Lake Park, Graham Assocs.	305-622-4049
FL	Melbourne, Graham Assocs.	305-773-6631
FL	Winter Garden, Graham Assocs.	305-656-9369
GA	Marietta, JWL Assoc.	404-429-8010
IL	Chicago, Indl. Reps.	312-647-7755
IN	Fort Wayne, Scott Elctrns.	219-484-7865
IN	Indianapolis, Scott Elctrns.	317-897-9976
KS	Shawnee Mission, Dale Sls.	913-432-9140
MD	Millersville, Tri-Mark	301-987-9103
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MI	Plymouth, Jay Mktg. Assoc.	313-459-1200
MN	Bloomington, Merrill Franklin Co.	612-854-9446
NJ	Fairlawn, Kaelber & Mack	201-797-7782
NJ	Oakland, Kaelber & Mack, Inc.	201-337-4520
NY	Commack, Kaelber & Mack	516-499-2924
NY	Ithaca, Dale Elctrns. Sls.	607-272-6212
NC	Charlotte, JWL Assoc.	704-523-3001
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns. Inc.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
OR	Beaverton, LD Elctrns.	503-649-6177
PA	Horsham, TMI	215-441-4300
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Dallas, E. F. Aymond Co.	214-826-7620
TX	Houston, E. F. Aymond Co.	713-880-8229
TX	San Antonio, E. F. Aymond Co.	512-366-1526
VA	Lynchburg, Tri-Mark	804-528-0681
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Milwaukee, Indl. Reps.	414-259-0965

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
AZ	Tempe, Acacia Sls. Inc.	602-894-2874
AZ	Tempe, T.T.I., Inc.	602-966-1616
AZ	Tempe, Hamilton/Avnet	602-231-5100
AZ	Tempe, Shelley Elctrns.	602-894-2058
CA	Chatsworth, Avnet Elctrns.	818-700-2600
CA	Chatsworth, Shelly Elctrns.	818-998-3333
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4100
CA	Culver City, Hamilton Electro Sls.	213-558-2121
CA	Huntington beach, Inductor Supp. Inc.	714-891-4524
CA	Irvine, Acacia Sls.	213-971-2428
CA	N. Hollywood, T.T.I., West	213-982-0201
CA	Sacramento, Hamilton/Avnet	916-925-2216
CA	San Diego, Acacia Sls. Inc.	619-565-4365
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Diego, Hamilton/Avnet	619-571-7510
CA	San Jose, T.T.I., Inc.	408-943-9155
CA	San Jose, Shelley Elctrns.	408-942-9111
CA	Sunnyvale, Acacia Sls.	408-745-7200
CA	Sunnyvale, Hamilton/Avnet	408-734-3355
CO	Boulder, Shelley Elctrns.	303-442-2718
CO	Commerce City, Waco Elctrns.	303-289-4743
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Hamilton/Avnet	303-779-9998
CO	Lakewood, Acacia Sls. Inc.	303-232-2882
CT	Danbury, Hamilton/Avnet	203-797-2800
CT	Stratford, Electro/Comp.	203-375-5811
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
FL	Ft. Lauderdale, Hamilton/Avnet	305-971-2900
FL	Largo, Lodan Elctrns.	813-586-2851
FL	Orlando, T.T.I., II	305-859-1000
FL	Palm Beach Gardens, Legri S. Resistor	305-845-7101
FL	St. Petersburg, Hamilton/Avnet	813-576-3930
FL	Winter Park, Hamilton/Avnet	305-628-3888
GA	Norcross, Hamilton/Avnet	404-447-7507
IL	Bensenville, Hamilton/Avnet	312-860-7700
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Bell Ind.	312-982-9210
IL	Crystal Lake, Sub-Sem	815-459-4139
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Carmel, Hamilton/Avnet	317-844-9333
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Graham Elec.	317-634-8202
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KS	Overland Park, Hamilton/Avnet	913-888-8900
KS	Wichita, RSC Elec.	316-267-5213
MD	Baltimore, RESCO	301-823-0070
MD	Columbia, Hamilton/Avnet	301-995-3500
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Waltham, Sterling Elctrns.	617-894-6200
MA	Woburn, T.T.I.	617-938-8800
MA	Woburn, Hamilton/Avnet	617-273-7500
MI	Grand Rapids, S-F Elctrn. Supp.	616-459-0216
MI	Grand Rapids, Newark Elec.	616-241-6681
MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Livonia, R-S Elctrns.	313-525-1155
MI	Livonia, Hamilton/Avnet	313-522-4700
MI	Livonia, Reptron Elctrns.	313-525-2700
MI	Oak Park, Newark Elec.	313-967-0600
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minnetonka, Hamilton/Avnet	612-932-0600
MO	Earth City, Hamilton/Avnet	314-344-1200
NJ	Cherry Hill, Hamilton/Avnet	609-424-0100
NJ	Cranford, G.S.I. Elec.	201-272-6400
NJ	Fairfield, Hamilton/Avnet	201-575-3390
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Springfield, Newark Elctrns.	201-376-9500
NM	Albuquerque, Hamilton/Avnet	505-765-1500
NY	Bohemia, L.I., T.T.I., New York	516-567-1500
NY	Buffalo, Summit Dist.	716-884-3450
NY	E. Syracuse, Hamilton/Avnet	315-437-2641
NY	Endwell, A.S.I. Elctrns.	607-754-3823
NY	Farmingdale, Command Elctrns.	516-293-1212
NY	Hauppauge, Fairmont	516-231-3313
NY	Melville, Hamilton/Avnet	516-454-6060
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Hamilton/Avnet	716-475-9130
NY	Rockville Centre, Midway Indl.	516-293-6800
NY	Rome, Rome Elctrns.	315-337-5400
NY	Valley Stream, L&S Elctrns.	516-561-2474
NY	W. Hempstead, March Elctrns.	516-486-6511
NC	Raleigh, Hamilton/Avnet	919-878-0810
NC	Raleigh, RESCO	919-781-5700
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Pioneer Standard	216-587-3600
OH	Cleveland, Hamilton/Avnet	216-831-3500
OH	Cleveland, W. M. Pattison Supp.	216-441-3000
OH	Columbus, Camelot/Ohio	614-294-7169
OH	Dayton, Hamilton/Avnet	513-433-0610
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Dayton, Pioneer Standard	513-236-9900
OH	Lima, LRP Elctrns.	419-228-1220
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Acacia Sls.	503-646-3377
OR	Lake Oswego, Hamilton/Avnet	503-635-8831
OR	Portland, Radar Elec.	503-232-3404
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Pittsburgh, CAM/RPC	412-782-3770
PA	Reading, Barbery Elctrns.	215-376-7451
PA	York, E.C.I., Inc.	717-843-8971
TX	Austin, Hamilton/Avnet	512-837-8911
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Ft. Worth, T.T.I., Inc.	817-831-0441
TX	Houston, Hamilton/Avnet	713-780-1771
TX	Houston, Lenert Co.	713-225-1465
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Irving, Hamilton/Avnet	214-659-4111
UT	Salt Lake City, Hamilton/Avnet	801-972-2800
WA	Bellevue, Hamilton/Avnet	206-453-5844
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Hamilton/Avnet	414-784-4510

DALE®

DALE ELECTRONICS, INC., El Paso Div., P.O. Box 26950, El Paso, TX 79926, Tel: 915-592-3253; FSC No.: 91637; Empl.: 272; *Sls. Mgr.:* Douglas Wagenknecht; *Dist. Mgr.:* Jerry Jilek ...**1A•**1846-1868

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE®

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, Tel: 402-371-0080, TWX: 910-623-0163; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Jim Filips; *Dist. Mgr.:* Jerry Jilek ....**1B•**1800, 1801

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE®

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, Tel: 602-967-7874, TWX: 910-950-1943; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jerry Jilek ....**1A•**1348, 1349

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE®

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, Tel: 605-665-9301, TWX: 910-668-3605; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* Irvin Sterner; *Dist. Mgr.:* Jerry Jilek ....**1A•**1234-1242, 2139-2150; **2•**1250-1253

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DAMON/ELCTRNS. DIV., 80 Wilson Way, Westwood, MA 02090, Tel: 617-449-0800, TWX: 710-348-6722; Empl.: 90; *Sls. Mgr.:* Edward J. Doherty ....**1A•**1347

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	N. Hollywood, Jewett Co.	213-789-8103
CA	Palo Alto, Waldman Assocs.	415-961-4100
DC	Washington, Stemler Assocs.	301-944-8262
FL	Melbourne, Repcom	305-254-1877
MD	Baltimore, Stemler Assocs.	301-944-8262
MA	Waltham, Del Tech Sls.	617-890-1020
NJ	Cherry Hill, Stemler Assocs.	609-966-4070
NJ	Hackensack, T.M.A. Assoc.	201-342-4008
NY	Cazenovia, S. T. Wollard Co.	315-655-8145
TX	Ft. Worth, El-Tec Sls.	817-268-2896

D & B POWER, INC.

D & B POWER, INC., 204 N. Fehr Way, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Peggy Brock ....**3•**1542, 1543

Local Sales Offices & Reps

CA	Los Altos, Schwerin Merrill	415-961-0913
CA	Pasadena, Electro Mecha. Instrs.	213-795-7193
NY	East Setauket, Edgerton Elctrn.	516-751-7089

D & L SALES CO. INC., 296 Preakness Ave., Paterson, NJ 07502, Tel: 201-684-8223/8224; Empl.: 10

DANIELS MFG. CORP., 6103 Anno Ave., Orlando, FL 32809, Tel: 305-855-6161, Telex: 564321; FSC No.: 5120, 5180; Empl.: 150

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 9705 Lurline Ave., Chatsworth, CA 91311, Tel: 818-882-7979/5280; FSC No.: 31690; Empl.: 6; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, Telex: 35-5457; FSC No.: 56960; Empl.: 110; *Sls. Mgr.:* Peter Normandin

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55112, Tel: 612-484-2108; Empl.: 22

DASH, STRAUS & GOODHUE, INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 617-263-2662; Empl.: 7; *Sls. Mgr.:* Ira Barry

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

D.A.T.A., INC., Cordura Co., P.O. Box 26875, San Diego, CA 92126, Tel: 619-578-7600, TWX: 910-322-1340; Empl.: 39

DATA CAPTURE TECHNOLOGY, 5436-F South Mingo Rd., Tulsa, OK 74146, Tel: 918-627-7521, Telex: 796355; *Sls. Mgr.:* Gary DeShazer

DATA CHECK CORP., 10070 Willow Creek Rd., San Diego, CA 92131, Tel: 619-578-0101, TWX: 910-335-1596; FSC No.: 55792; *Sls. Mgr.:* Al Agent

DATACHRON INC., 3186 J Airway Ave., Costa Mesa, CA 92626, Tel: 714-751-2211, Telex: 678401; FSC No.: 56259; Empl.: 16; *Sls. Mgr.:* Clyde Davis

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32548, Tel: 904-244-6121, TWX: 510-730-7693; Empl.: 50

dataCon

DATACON, INC., 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, Telex: 951651; Empl.: 400; *Sls. Mgr.:* John A. Marshall ....**3•1923**

Local Sales Offices & Reps

CA	Chatsworth, DataCon	818-700-0600
CA	Mountain View, DataCon	415-967-5700
CA	Santa Clara, DC Electronics	408-980-1199
CO	Lakewood, Christee - Meade Co.	303-232-0287
FL	Orlando, Mackay Smith & Assoc.	305-277-1513
GA	Decatur, DataCon	404-373-1212
GA	Norcross, Mackay Smith	404-449-7444
IL	Lisle, W. G. Controls	312-963-5954
IL	Schaumburg, DataCon	312-529-7690
IN	Fort Wayne, Hoyle Assocs.	219-485-6433
MA	Burlington, DataCon	617-273-5800
MA	Newton Upper Falls, Anchor Engrg.	617-964-6205
MN	St. Paul, Countryman Assoc.	612-645-9151
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NY	Bohemia, DataCon	516-589-1100
NC	Cary, Mackay Smith	919-467-5400
OH	Centerville, Micro Sls. Corp.	513-433-8171
PA	Newtown Square, Hagy Assocs.	215-459-0504
TN	Chattanooga, Mackay Smith	615-899-6951
TX	Bedford, DataCon	817-540-1479
TX	Richardson, Lear Assoc.	214-231-5388

DATA-CONTROL SYS., Commerce Dr., Box 860, Danbury, CT 06810, Tel: 203-743-9241, TWX: 710-456-0376; FSC No.: 08539; Empl.: 87

DATA CONVERSION, See Analogic Corp., Data Conversion Prods. Grp.

DATACOPY CORP., 1215 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-965-7900, Telex: 701994 DATACOPY UO; *Sls. Mgr.:* Charles Joseph

data delay devices, inc. ®

DATA DELAY DEVICES, 385 Lakeview Ave., Clifton, NJ 07011, Tel: 201-772-1106, TWX: 710-989-7008; Empl.: 38 ....**1A•1471-1482, 1592**

Local Sales Offices & Reps

CA	El Toro, Martronix	714-855-6397
CA	Mountain View, Weseloh/Swanson	415-961-0565
TX	Dallas, West & Assocs.	214-661-9400

Local Distributors

CA	Mountain View, Target Elctrns.	415-961-1170

DATA-DESIGN LABS., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730, Tel: 714-987-2511; Empl.: 1300; *Sls. Mgr.:* J. F. Nicholson, Exec. Vice Pres. (Operations)

DATA DEVICE CORP., See ILC Data Device Corp.

DATA DISPLAY PRODUCTS, Box 91072, Los Angeles, CA 90009, Tel: 213-674-5940, Telex: 664690; FSC No.: 15513; Empl.: 20; *Sls. Mgr.:* William F. Million

DATADYNE, Box 247, King of Prussia, PA 19406, Tel: 215-666-5751; FSC No.: 53032; Empl.: 23; *Sls. Mgr.:* James Riggs

DATA GENERAL, 4400 Computer Dr., Westboro, MA 01581, Tel: 617-366-8911, Telex: 920-329, TWX: 710-390-1217; Empl.: 14,750; *Sls. Mgr.:* Frank Keaney

DATA INSTRUMENTS INC., 4 Hartwell Pl., Lexington, MA 02173, Tel: 617-861-7450, TWX: 200081; Empl.: 250; *Sls. Mgr.:* Ernest C. Lutfy ....**1B•1840**

Local Sales Offices & Reps

AZ	Mesa, RLS	602-892-9329
CA	Riverside, Jim Mitchell	714-684-6404
CA	San Carlos, Elctrn. Engrg. Assocs.	415-593-2189
CO	Boulder, Herb Bass Assocs.	303-530-7509
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Addison, John O'Keefe	312-628-6041
MA	Swampscott, John Snow	617-592-0511
MO	Kansas City, Delltron Co.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NJ	Stockholm, Jim Musumeci	201-492-9097
NM	Las Cruces, SOTA-COM	505-523-4480
NC	Charlotte, B. A. Robinson Co.	704-527-4537
OH	Olmstead Falls, Ken Schleger	216-871-9047
TX	Dallas, Griffin Sls.	214-234-5013
UT	Bountiful, Herb Bass Assocs.	801-295-7100
WA	Bellevue, S.E.A. Sls.	206-883-4999
WA	Vancouver, S.E.A. Sls.	206-573-5161

DATA I/O CORP., 10525 Willows Rd. N.E., C-46, Redmond, WA 98052, Tel: 206-881-6444, Telex: 15-2167; Empl.: 400

DATAK CORP., 65 Seventy-First St., Guttenberg, NJ 07093, Tel: 201-869-2200; *Sls. Mgr.:* Theresa Pflueger ....**2•1090, 1759, 2095**

Local Sales Offices & Reps

CA	Burlingame, Polach & Bensinger	415-697-2525
CA	West Covina, Don Forth Assocs.	213-919-2322
CO	Broomfield, Conners Co.	303-466-9628
FL	Bradenton, T. G. & Assocs.	813-753-5632
FL	Pompano, T.G. and Assocs.	305-781-8328
GA	Roswell, Henry W. Phillips Co.	404-992-3070
IL	Wheaton, Archie Joyner Assocs.	312-665-6662
IN	Indianapolis, Sukup & Cox	317-253-5501
MD	Annapolis, Pecore Assocs.	301-267-0328
MI	East Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Minneapolis, Kodo Assoc.	612-881-1255
MO	Raytown, Marty Taraski Sls.	816-358-1442
NJ	Teaneck, Steve Fisher Sls.	201-837-1200
NY	Rochester, Warren Kaufman & Assoc.	716-266-2728
NC	Matthews, Henry W. Phillips Co.	704-882-2878
OH	Jamestown, Landro Edwards Sls.	513-675-2059
PA	Library, Landro Edwards Sls.	412-854-5727
RI	Coventry, Adams-McGregor	401-821-1320
RI	Lincoln, Adams-McGregor	401-726-1300
TX	Dallas, J & J Sls. Co.	214-328-9739
WA	Edmonds, McLaughlin Mktg.	206-743-1161

Local Distributors

AL	Birmingham, Forbes Distrbg.	205-251-4104
AK	Anchorage, Alaska Elecs. Sply.	907-563-3774
AZ	Phoenix, Tri-Tek	602-995-9352
AZ	Tempe, Circuit Specialists	602-966-0764
CA	Berkeley, Al Lasher's Elect.	415-843-5915
CA	Canoga Park, Sandy's Elect.	213-346-8353
CA	El Cerrito, Trumbull Co.	415-525-7242
CA	Fullerton, Orvac Elect.	714-871-1020
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CO	Lakewood, D.H. Crump & Co.	303-936-4407
CT	Greenwich, Wise Comps.	203-531-4880
CT	Hartford, Hatry Elect.	203-527-1881
CT	Wallingford, Tron Town U.S.A.	203-237-5598
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Orlando, Orlando Frame & Art	305-896-7191
FL	St. Petersburg, Knapp of Florida	813-392-0406
GA	Atlanta, Ack Elctrn. Supp.	404-351-6340
HI	Honolulu, Honolulu Elect.	808-949-5564
IL	Berwyn, B-B & W Inc.	312-749-1710
IL	Mt. Prospect, Tri-State Elect.	312-255-0600
IL	Niles, Joseph Elect.	312-297-4200
IL	Northbrook, Reproduction Specialists	312-564-0404
IN	Ft. Wayne, Graham Elect.	219-423-3422
IN	Indianapolis, Graham Elect.	317-634-8202
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KS	Wichita, RSC	316-267-5213
KY	Louisville, Peerless Elect.	502-637-7674
LA	Lafayette, Ralph's	318-233-0105
LA	New Orleans, Radio Parts Inc.	504-581-5959
MD	Baltimore, A S I Elect.	301-265-5100
MD	Baltimore, RESCO Elctrns.	301-823-0070
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Hingham, Sager Electrical Sply.	617-749-6700
MA	Lynn, Land Elctrns. Supp.	617-592-2220
MA	Norwood, Gerber Elect.	617-769-6000
MI	Flint, Shand Elctrns.	313-743-8940
MI	Livonia, Norwest Elect.	313-261-4551
MN	Minneapolis, Acme Elctrns.	612-338-4754
MO	Kansas City, Elctrn. Sply.	816-931-0250
MO	St. Louis, Olive Elctrn.	314-426-4500
MO	St. Louis, Van Sickle	314-621-5000
MO	St. Louis, Gateway Elect.	314-427-6116
NE	Lincoln, Scott Elect. Sply.	402-466-8221
NV	Las Vegas, Hurley Elect.	702-384-5666
NV	Reno, Elect. Distr. Co.	702-323-2766
NH	Dover, American Radio	603-742-6800
NH	Hudson, C & H Elect.	603-882-1133
NJ	Edison, William Elctrns. Supp.	201-985-3700
NY	Buffalo, Summit Distributor	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Long Island City, H. L. Dalis, Inc.	212-361-1100
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cincinnati, URI Elect.	513-761-4030
OH	Columbus, Hughes-Peters	614-294-5351
OK	Oklahoma City, Trice Wholesale	405-524-4411
OR	Beaverton, Norvac Elect.	503-644-1025
OR	Portland, Portland Radio Sply.	503-228-8647
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Philadelphia, A.C. Radio	215-462-9379
PA	Reading, Barbey Elctrns.	215-376-6116
PA	Willow Grove, Resco	215-659-4575
RI	Providence, W. Dandreta & Co.	401-861-2800
SC	Charleston, Wholesale Industrial Elecs.	803-722-2634
TN	Memphis, Bluff City Distr.	901-345-9500
TX	Dallas, Electrotex Elect. Corp. of TX	214-234-0433
TX	El Paso, Ideal Indl. Elec. Sply.	915-779-6647
TX	Houston, Gateway Elctrns.	713-978-6575
UT	Salt Lake City, Kimball Elect.	801-328-2075
VA	Arlington, Arlington Elect. Whlse.	703-524-2412
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Seattle, Radar Elect. Co.	206-282-2511
WV	Charleston, Elctrn. Materials Corp.	304-344-3577
WI	Milwaukee, Indl. Elctrns.	414-276-1212

DATA-MATCH CORP., 3810 Oakcliff Ind. Ct., Doraville, GA 30340, Tel: 404-441-0408; *Sls. Mgr.:* Charles L. Frazier III

DATAMETRICS CORP., Defense Products Div., 7630 Gloria Ave., Van Nuys, CA 91406, Tel: 818-989-3840, TWX: 910-495-2009; FSC No.: 19059; Empl.: 150; *Sls. Mgr.:* Jim Foti

datametrics DRESSER

DATAMETRICS • DRESSER INDS., INC., 340 Fordham Road, Wilmington, MA 01887, Tel: 617-658-5410, TWX: 710-347-7672; Empl.: 175; *Sls. Mgr.:* A. W. Siff ....**1B•1841**

Local Sales Offices & Reps

AZ	Phoenix, Motion Technology	602-991-1782
CA	Anaheim, Motion Technology	714-777-4259
CA	Chatsworth, Motion Technology	818-993-3762
CA	San Jose, Motion Technology	408-923-0990
CA	San Raphael, Motion Technlg.	415-459-2171
CO	Englewood, Integrated Motion Sys.	303-762-1817
CT	Guilford, Gem Sls.	203-453-5424
IL	Rolling Meadows, KMA Sls.	312-398-5300
MI	Lamont, Xanthus	616-677-3103
MI	Troy, Xanthus	313-528-2000
MN	Minneapolis, Trask Engrg.	612-537-2434
NH	Salem, Gem Sls.	603-893-0009
NJ	Williamstown, Precision Motion Sls.	609-629-4757
NY	Clark Mills, KLM-Garner	315-853-6126
NY	Glen Cove, Precision Motion Sls.	516-676-1645
NY	N. Syracuse, KLM-Garner	315-458-6214
NY	Pittsford, KLM-Garner	716-381-8350
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
OH	Chagrin Falls, K. F. Nauerz	216-338-8450
OH	West Chester, Fehrco	513-777-4248
TX	Dallas, Automated Motion Control	214-340-4192
TX	Denton, Automated Motion Control	817-382-4159
WA	Bellevue, Al Smith Co.	206-746-6770
WA	Vancouver, Al Smith Co.	206-892-9912
WI	Milwaukee, KMA Sls.	414-259-1771

DATA PLUS, INC., 7205E Lockport Pl., Lorton, VA 22079, Tel: 800-368-3747, Telex: 901878; Empl.: 20; *Sls. Mgr.:* George E. Pritz

DATAPOINT CORP., Peripheral Operations Division, 686 West Maude Avenue, Sunnyvale, CA 94086, Tel: 408-732-7330, TWX: 910-339-9244; Empl.: 500

DATAPOWER, INC., 3328 West First St., Santa Ana, CA 92703, Tel: 714-775-2000, Telex: 683323, TWX: 910-595-1560; *Sls. Mgr.:* William O. Fordiani

Local Sales Offices & Reps

CA	Santa Clara	408-986-8322
MA	Chelmsford	617-256-2287

DATA POWER, See Beaver Labs

DATA PRECISION CORPORATION, Electronics Ave., Danvers, MA 01923, Tel: 617-246-1600, Telex: 921819; FSC No.: 51692; Empl.: 260; *Sls. Mgr.:* John P. Kelly, William Sapankevych; *Dist. Mgr.:* John Kelly ....3•1214, 1215

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	305-724-0920; 800-327-0853
AZ	Phoenix, Odyssey I	602-246-8846
CA	Carson, Amasco	213-516-8561
CA	Sunnyvale, Amasco	408-733-8690
CO	Castle Rock, Odyssey I	303-688-3555
FL	Melbourne, Saber Assocs.	305-724-0920; 800-327-0853
GA	Griffin, Saber Assocs.	305-724-0920; 800-327-0853
MD	Rockville, Elctrn. Mktg. Assn.	301-881-5300
MA	Danvers, John D. Seney	617-246-1600; 603-668-1096
MI	Northville, Donald C. Pickren	313-349-0233; 312-685-4544
MN	Chanhassen, Elctrn. Instr. Consit.	612-445-7056
MO	Kansas City, E.I.R. Co.	816-452-7030
MO	Leasburg, E.I.R. Co	314-895-4100
NJ	Cedar Grove, KLS Assocs.	201-785-4450
NM	Albuquerque, Odyssey I	505-265-6645
NY	Frankfort, Kapital Instr. Sls.	207-774-6266; 800-492-8011
NC	Clayton, Saber Assocs.	305-724-0920; 800-327-0853
PA	Pittsburgh, Staples Assn.	412-881-5990
PA	Plymouth Meeting, Elctrn. Mktg. Assn.	215-248-5050; 215-828-7400
SC	Columbia, Saber Assocs.	305-724-0920; 800-327-0853
TX	Georgetown, Richard Morgenstern	512-869-1507
WA	Bellevue, Sls. & Engrg. Assn.	206-883-4999
WA	Vancouver, Sls. & Engrg. Assn.	206-573-5161

Local Distributors

AL	Huntsville, Pioneer Instrs.	205-837-9300
AL	Mobile, Brownell-Instr. & Cntrl.	205-479-5404
AZ	Phoenix, Metermaster	602-437-1425
AR	Morrilton, Tri-State Instr. Lab.	501-354-1849
CA	Arcadia, Shafer Engrg. Svc.	213-445-4127
CA	Canoga Park, G.A.G. Entprs.	213-998-6500
CA	Long Beach, Meas. Assoc.	213-433-0977
CA	Los Angeles, Metermaster	213-685-4340
CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CA	Palo Alto, Metermaster	415-968-0313
CA	San Diego, Instr. Engrs.	619-268-8344
CA	San Diego, Metermaster	619-560-4841
CA	Santa Clara, RGB Electro. Indl.	408-980-1300
CO	Denver, E.I.L. Instrs.	303-534-4160
CO	Englewood, BETA	303-779-4494
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Hialeah, Kimball Elec. Labs.	305-822-5792
FL	Orlando, Brownell-Instr. & Cntrl.	305-843-6770
FL	Palm Bay, E.I.L. Instrs.	305-725-8300
GA	Atlanta, Brownell Electro	404-762-5181
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, Dot-Tronics, Div. of Loren Green Assoc.	312-593-0282
IL	Elk Grove Village, Pioneer Standard	312-437-9680
IL	Elk Grove Village, Metermaster	312-593-8650
IL	Niles, Joseph Elctrns.	312-297-4200
IL	Oak Park, Pacific Indicator	312-383-0220
IN	East Chicago, Acro Elec.	219-397-8681
IN	Indianapolis, Pioneer Standard	317-849-7300
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
IN	Indianapolis, Loren Green Assocs.	317-293-9827
KY	Louisville, Peerless Elec. Equip.	502-637-7674
LA	Baton Rouge, Ind. Elec. Supply	504-357-4249
LA	Kenner N.O., Breard Gardner	504-466-3401
LA	New Orleans, Ind. Instr. Works	504-733-8355
MD	Gaithersburg, Pioneer Instrs.	301-921-0660
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, Contact East	617-272-5051
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Woburn, Brownell Electro	617-935-7820
MI	Ferndale, Ram Meter	313-398-6767
MI	Flint, R.S. Elctrns.	313-762-5800
MI	Grand Rapids, R.S. Elctrns.	616-241-3483
MI	Kalamazoo, R.S. Elctrns.	616-381-5470
MI	Livonia, Pioneer Standard	313-525-1800
MI	Livonia, R.S. Elctrns.	313-525-1155
MI	Roseville, R.S. Elctrns.	313-779-2450
MI	Wyandotte, R.S. Elctrns.	313-282-5880
MN	Minneapolis, Loren Green Assocs.	612-571-6666
MO	St. Louis, Instr. & Control Sls.	314-535-5760
NJ	Edison, Brownell Electro	201-287-2030
NJ	Ocean, Rag Elctrns.-East	201-544-0666
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Hauppauge, E.I.L. Instrs.	516-231-6333
NY	New York, Brownell Electro	212-691-1171
NY	New York, Advanced Elctrns.	212-730-7030
NY	Pittsford, Trott Elctrns.	716-586-8251
NY	Rochester, R. Baker Elctrns.	716-586-9164
NY	Rochester, E.I.L. Instrs.	716-424-5750
NC	Charlotte, Brownell Electro	704-597-1270
NC	Charlotte, Trott Elctrns.	704-376-2237
NC	Greensboro, Pioneer Instr.	919-273-4441
NC	Raleigh, Lee Assoc. of the Carolinas	800-822-8888
OH	Cleveland, Pioneer Instr.	216-587-3600
OH	Dayton, E.I.L. Instrs.	513-435-2134
OH	Dayton, Pioneer Instr.	513-236-9900
OH	Dayton, Natl. Instr.	513-435-4503
OH	Maumee, R.S. Elctrns.	419-893-0721
OK	Oklahoma City, Huston-De Pue Labs	405-235-5469
OR	Beaverton, Eicher Richards	503-221-1123
OR	Medford, Branom Instrs.	503-772-3187
OR	Portland, Branom Instrs.	503-283-2555
PA	Horsham, Pioneer Instr.	215-674-4000
PA	Philadelphia, Sunshine Sci.	215-673-5600
PA	Pittsburgh, E.I.L. Instrs.	412-731-5230
PA	Pittsburgh, Pioneer Instr.	412-782-2300
TN	Knoxville, Brownell-Electro	615-966-3441
TN	Memphis, Brownell-Electro	901-795-8483
TN	Nashville, Brownell-Electro	615-889-8230
TX	Dallas, E.I.L. Instrs.	214-931-1236
TX	Dallas, R.E. Davis Co.	214-653-1041
TX	Dallas, Pioneer Instr.	214-386-7300
TX	Garland, Metermaster	214-271-5671
TX	Houston, Quality Instrs.	713-524-0528
TX	Houston, E.I.L. Instrs.	713-271-3100
VA	Alexandria, E.I.L. Instrs.	703-354-4330
VA	Richmond, Metermetrics	804-275-1431
VA	Vienna, Elctrn. Equip. Bank	703-938-3350
VA	Virginia Beach, E.I.L. Instrs.	804-499-3746
WA	Seattle, Eicher Richards	206-523-7888
WA	Seattle, E.I.L. Instrs.	206-762-0880
WA	Seattle, Branom Instrs.	206-762-6050

DATAPROBE, 110 Palisades Blvd., Palisades Park, NJ 07650, Tel: 201-947-9500, Telex: 642-165; Empl.: 12

Local Sales Offices & Reps

AZ	Scottsdale, Western Sade	602-998-9585
CA	Los Angeles, Mark Assocs.	216-641-1840
NH	Concord, Concord Communications Inc.	603-228-8627
TX	Seabrook, Q Max Inc.	713-474-2233
VA	Falls Church, Data Comm. Sys.	703-241-7803

DATAPRODUCTS, 6200 Canoga Ave., Woodland Hills, CA 91365, Tel: 213-887-8000, Telex: 67-4734; Empl.: 4300; *Sls. Mgr.:* James B. Towell; *Dist. Mgr.:* L. Bowne

DATA PRODS. NEW ENGLAND, Barnes Park N. Caller Box 30, Wallingford, CT 06492, Tel: 203-265-7151, TWX: 710-476-3427

DATAPROFITS CORP., 2260 Distributors Dr., Indianapolis, IN 46241; Empl.: 5

DATARAM CORP., Princeton-Highstown Rd., Cranbury, NJ 08512, Tel: 609-799-0071, TWX: 510-685-2542; Empl.: 225; *Sls. Mgr.:* John F. Gilligan

Local Sales Offices & Reps

AL	Huntsville, Col-Ins Co.	800-327-6600
AZ	Phoenix, Cherry Assocs.	602-242-1922
CA	Irvine, Dataram Corp.	714-261-1622
CA	Mountain View, Thorson West	415-964-9300
CO	Denver, Westek Data Prods.	303-232-2250
FL	Orlando, Col-Ins-Co.	800-432-4480
GA	Atlanta, Col-Ins-Co.	800-327-6600
IL	Oak Brook, Dataram Corp.	312-789-3710
LA	Baton Rouge, Col-Ins-Co.	800-327-6600
MD	Rockville, Technical Sls. Assocs.	301-340-0600
MA	Waltham, Dataram Corp.	617-891-7090
MN	Eden Prairie, First Rep Co. of Minnesota	612-944-2097
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NM	Sante Fe, Unique Sys. Electronics Inc.	505-984-0262
NY	Rochester, RG Engrg.	716-742-1623
NC	Raleigh, Col-Ins-Co.	800-327-6600
OH	Columbus, SelTech Mktg.	614-451-3865
SC	Greenville, Col-Ins-Co.	800-327-6600
TN	Knoxville, Col-Ins-Co Inc.	800-327-6600
TX	Austin, Thorson Southwest	512-451-7527
TX	Dallas, Thorson Southwest	214-233-5744
TX	Houston, Thorson Southwest	713-771-3504

DATA RAY CORP., 8401 Baseline Rd., Boulder, CO 80303, Tel: 303-494-4444; FSC No.: 303-494-8107; *Sls. Mgr.:* Jerry Garrett

DATA RENTALS/SLS., INC, P. O. Box 3257, Culver City, CA 90230, Tel: 213-559-3822; Empl.: 51; *Sls. Mgr.:* Steven Beaver

DATAROYAL, 235 Main Dunstable Rd., Nashua, NH 03061, Tel: 603-883-4157, TWX: 710-228-1077; *Sls. Mgr.:* George Bouchard

DATA SIGNAL CORP., 149 California St., Newton, MA 02158, Tel: 617-926-5080

DATASPAN SYSTEMS INC., 120 W. Palisades Blvd., Palisades Park, NJ 07650, Tel: 201-461-3337; *Sls. Mgr.:* Sy Weiss

DATA SPECIALTIES, INC., 3455 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-1800, Telex: 206230; Empl.: 110; *Sls. Mgr.:* John H. Kindsvater, Jr.

DATA TECH, DIV. OF PENRIL CORP., 3110 W. Segerstrom, Santa Ana, CA 92704, Tel: 714-546-7160, TWX: 910-595-1570; Empl.: 125; *Sls. Mgr.:* James K. Way; *Dist. Mgr.:* James K. Way

DATATEX CORP., 10935 S. Wilcrest Dr., Houston, TX 77099, Tel: 713-495-3100; Empl.: 100; *Sls. Mgr.:* Glenn Messerschmitt; *Dist. Mgr.:* K. Pelletier

DATATRAN LABS, P.O. Box 384, Sussex, NJ 07461, Tel: 914-856-4313; Empl.: 18; *Sls. Mgr.:* Richard E. Johnson

DATA TRANSLATION, 100 Locke Dr., Marlboro, MA 01752, Tel: 617-481-3700, Telex: 4430109; Empl.: 110; *Sls. Mgr.:* Andrew Davis

DATATRON, INC., 2942 Dow Ave., Tustin, CA 92680, Tel: 714-544-9970, TWX: 910-595-1589; Empl.: 125

"Refer to Shelly Assocs. Datatron Inc. for Sales Office and distributor information"

DATATRONIC SYSTEMS CORP., Computer Sciences Div., P.O. Box 44128, Panorama City, CA 91402, Tel: 818-988-5290; Empl.: 150

DATAWARE SYS. LEASE, INC., 30 Bay St., Staten Island, NY 10301, Tel: 212-447-4911, Telex: 421394, TWX: 710-588-6738; *Sls. Mgr.:* Ben Welwart

DATAWEST, 7333 E. Helm Dr., Scottsdale, AZ 85260, Tel: 602-948-3280, TWX: 910-950-1289; Empl.: 25; *Sls. Mgr.:* Jim Buckley

DATEC, INC., 200 Eastowne Dr., Ste. 116, Chapel Hill, NC 27514, Tel: 919-929-2135; Empl.: 75; *Sls. Mgr.:* Albert J. Jenks, Jr.

DA-TECH CORP., 92 Steamwhistle Dr., Ivyland, PA 18974, Tel: 215-322-9410; *Sls. Mgr.:* Bradford W. Bentz

DATEL

DATEL, 11 Cabot Blvd., Mansfield, MA 02048, Tel: 617-339-9341, Telex: 95-1340, TWX: 710-346-1953; Empl.: 650; *Sls. Mgr.:* H. Batchelder ...3•1076, 1105, 1150-1152, 1323, 1545

Local Sales Offices & Reps

AZ	Phoenix, Tech. Sales	602-246-1614
CA	Santa Ana, Datel	714-835-2751
CA	Sunnyvale, Datel	408-733-2424
CO	Denver, Cleveland Entprs. of Colo.	303-751-3252
CT	Hamden, JBL Assocs.	203-281-3161
FL	Coral Springs, H. A. Inc.	305-752-7520
HI	Honolulu, Adtech.	808-941-0708
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
IA	Davenport, Ensco-Rep, Inc.	319-386-6600
KS	Overland Park, Ensco-Rep, Inc.	913-381-7557
MA	Mansfield, Datel	617-339-9341
MI	Livonia, Electro Sls. Assoc.	313-474-7320
MN	Minneapolis, J.R. Assoc.	612-559-5673
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NJ	Perth Amboy, Astrorep, Inc.	201-826-8050
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Babylon, Astrorep	516-422-2500
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Winston-Salem, Comp. Concepts	919-765-3484
OH	Cleveland, Instrmn. Sys.	216-845-8800
OH	Dayton, Instrmn. Sys.	513-294-2838

OR	Aloha, Hood Engrg.	503-642-3591
PA	Pittsburgh, Instrmn. Sys.	412-243-1111
TX	Carrollton, Tech. Mktg.	214-387-3601
TX	Houston, Tech. Mktg.	713-777-9228
UT	Salt Lake City, Cleveland Entprs. of Colo.	801-355-8424
VA	Arlington, H. J. Heffernan	703-522-6666
WA	Bellevue, Hood Engrg. Co.	206-453-9375
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280

DATOTEK, INC., 13740 Midway Rd., Dallas, TX 75234, Tel: 214-233-1030, Telex: 73-0558; Empl.: 130; *Sls. Mgr.:* T. Peddicord

DATRON INSTRS., INC., 3401 SW 42nd Ave., Stuart, FL 33497, Tel: 305-283-0935, Telex: 525724; Empl.: 120

Local Sales Offices & Reps

AL	Huntsville, Scientific Dvcs.	205-536-1969
AZ	Phoenix, Zeus Elctrns.	602-263-6022
CA	Redondo Beach, Ward Davis Assoc.	213-973-7772
CA	San Diego, Ward Davis Assoc.	714-292-1000
CA	Santa Clara, Ward Davis Assoc.	408-245-3700
CO	Denver, Zeus Elctrns.	303-321-4246
CT	North Haven, Pat Jenks Assoc.	203-239-6201
FL	Orlando, Sci. Devices	305-841-8180
IL	Rolling Meadows, Commodore-I	312-394-5441
MA	Woburn, Pat Jenks Assoc.	617-938-0488
MN	St. Paul, Dytec/North, Inc.	612-645-5816
NJ	Pennsauken, Sci. Reps.	609-662-5222
NY	Fayetteville, D B Assocs.	315-446-0220
NY	Great Neck, R T I	516-829-3770
NC	Winston-Salem, Sci. Dvcs.	919-765-5776
OH	Chesterland, EQS Sys.	216-729-2222
OR	Beaverton, Northwest Test & Meas.	503-646-9966
TX	Richardson, Spectra Sls.	214-234-3600
UT	Salt Lake City, Zeus Elctrns.	801-534-0500
VA	McLean, Creative Mktg. Assocs.	703-442-9100
WA	Redmond, Northwest Test & Meas.	206-881-8857

DATRON

DATRON SYS., 20700 Plummer St., Chatsworth, CA 91311, Tel: 818-882-9616, TWX: 910-494-2787; FSC No.: 32255; Empl.: 150

Local Sales Offices & Reps

AZ	Scottsdale, Territorial Mktg.	602-994-8665
CA	Santa Barbara, Kannard Engrg., Inc.	805-492-5678
CO	Colorado Springs, Don Rondeau	303-599-3698
MD	Beltsville, Applied Engrg. Conslts.	301-953-2808
MA	Lexington, Eugene Delfino Co.	617-862-1118
NJ	Holmdel, Douglas Conslts.	201-741-5666
NY	Manlius, Quality Comps.	315-682-8885
TX	Garland, Carey, McMahill & Zerbe	214-681-1414

DATTILO ELECTRONICS, 11621 Electron Dr., Louisville, KY 40299, Tel: 502-267-4446; Empl.: 32

DATUM, STORAGE PRODS. DIV., 1363 State College Blvd., Anaheim, CA 92806, Tel: 714-533-6333, TWX: 910-592-1289; FSC No.: 31160; Empl.: 350; *Sls. Mgr.:* Roger Evans

datum inc

DATUM INC., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806, Tel: 714-533-6333, Telex: 4722045 (Intl.), TWX: 910-592-1289; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann .... 3•1154, 1155

Local Sales Offices & Reps

AL	Huntsville, Lee Assocs.	205-533-5896
AZ	Scottsdale, BFA Corp.	602-994-5400
CA	Anaheim, Datum	714-533-6333
CA	San Diego, M. Ficken	619-292-9392
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Denver, BFA Corp.	303-777-8070
CT	Mt. Carmel, Scientific Devices-New England	203-248-9361
FL	Fort Walton Beach, RAM-Z	904-862-2700
FL	Sarasota, RAM-Z	813-957-4900
FL	Sebastion, RAM-Z	305-388-0784
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
MA	Waltham, Daner-Hayes	617-894-7290, 800-225-8760
MA	Waltham, Scientific Devices-New England	617-890-2252
MI	New Berlin, Marsland	414-786-6611
MI	Plymouth, Daner-Hayes	313-464-4520
MI	Plymouth, Micro Sls. Corp.	313-459-1670
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NM	Albuquerque, BFA Corp.	505-292-1212
NM	Las Cruces, BFA Corp.	505-524-9693
OH	Centerville, Micro Sls. Corp.	513-433-8171
OH	No. Olmsted, Micro Sls. Corp.	216-734-3080
OK	Tulsa, Data Mktg. Assocs.	918-496-1457
PA	Pittsburg, Microsales	412-471-0105
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	El Paso, BFA Corp.	915-542-1762
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
UT	Salt Lake City, BFA Corp.	801-466-6522
VA	McLean, Creative Mktg. Assocs.	703-442-9100
WA	Seattle, Comptronics	206-284-4842

DAVEN COMPONENTS GRP., See Armtec Inds., Inc., Daven Comps. Grp.

DAVIDSON ELCTRN. DEV. CO., 113 E. 13th St., Erie, PA 16512, Tel: 814-453-7547, Telex: 914-529; Empl.: 27

DAVIES, HARRY, MOLDING CO., 4920 Bloomingdale Ave., Chicago, IL 60639, Tel: 312-622-8966; FSC No.: 72512; Empl.: 140; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

Local Sales Offices & Reps

AZ	Mesa, Littrell Western Sls.	602-838-7300
AR	Little Rock, L. E. Offutt Co.	501-225-8192
CA	Belmont, Littrell Western Sls. Inc.	415-592-3346
CA	Monterey Park, Littrell Western Sls.	213-261-0164
CO	Wheat Ridge, Christensen Sls.	303-423-8833
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Pinellas Park, Carpenter Assoc.	813-546-8296
IL	Chicago, Druse Corp.	312-745-9073
IN	Noblesville, McCaw Sls.	317-877-5300
IA	Cedar Rapids, Clancey Co.	319-365-7141
IA	Des Moines, Clancey Co.	515-278-1331
KS	Shawnee Mission, Clancey Co.	913-432-4550
MA	Needham Heights, P. R. Sturgeon Co.	617-444-6603
MI	Detroit, Bishop-Strek & Co.	313-538-0595
MN	Bloomington, Clague Sls. Corp.	612-944-7982
MO	St. Louis, Clancey Co.	314-225-0800
NY	Wading River, Rywel Sls.	516-929-4884
NC	Matthews, Anthom, Inc.	704-847-7363
OH	Westlake, Foley Co.	216-871-8830
OR	Lake Oswego, Tri-Rep	503-635-4760
PA	Erie, H. De Paulis	814-838-7874
PA	Paoli, W. G. Walker	215-627-8146
TN	Brentwood, L. E. Offutt Co. Inc.	615-373-2951
TN	Memphis, L. E. Offutt Co.	901-396-3320
TX	Dallas, L. T. Greenwood	214-522-8718
WI	Milwaukee, Clague Sls.	414-272-1951

DAVIS, J. W., & CO., P.O. Box 26177, Dallas, TX 75226, Tel: 214-651-7341; Empl.: 42

DAVIS ELEC. CO., Box 38, Cape Girardeau, MO 63701, Tel: 314-335-5547; Empl.: 40

DAVONG SYSTEMS, INC., 217 Humboldt Ct., Sunnyvale, CA 94089, Tel: 408-734-4900, Telex: 176386; *Sls. Mgr.:* Donna Barry; *Dist. Mgr.:* Frank Jordan

DAYCO CORP., 333 W. First St., Dayton, OH 45402, Tel: 513-226-5927, Telex: 288219, TWX: 810-459-1822; Empl.: 10000

DAY-LIGHT DISPLAY CORP., 4 Barnet Rd., P.O. Box 694, Pine Brook, NJ 07058, Tel: 201-575-1045; FSC No.: 57736; Empl.: 14; *Sls. Mgr.:* P. Schneider

DAYTRONIC CORP., 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, TWX: 810-473-2978; Empl.: 109; *Sls. Mgr.:* John A. Perkins

D-B-DEVELOPMENTS, 7709 Kilbourne Rd., Rome, NY 13440, Tel: 315-339-1265; Empl.: 3

D-CEMCO, INC., 3200 N. San Fernando Blvd., Burbank, CA 91504, Tel: 213-849-6341, TWX: 910-498-2228; Empl.: 30

Local Sales Offices & Reps

AL	Decatur, Tenn Tech Inc.	205-350-0630
AZ	Scottsdale, Gleason Sls. Co.	602-946-3992
CA	Los Altos, Frauman Assoc.	415-941-0660
CA	San Diego, Hill & Assoc.	619-560-6368
CO	Longmont, Piper Sls. Co.	303-651-2378
FL	Maitland, Delmac Sls.	305-423-7562
IN	Fort Wayne, Jim Finnegan & Co.	219-747-9525
MA	Marlboro, O.K. Engrg. Co.	617-481-6400
MN	Minneapolis, Bitronics Sls.	612-835-7744
NJ	Fort Lee, Necco	201-461-2789
NJ	Jenkintown, Arnold Assoc.	215-742-0600
OH	Cincinnati, Jim Finnegan & Co.	513-931-1686
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
OR	Portland, Jud LeBrun Co., Inc.	503-244-6805
PA	Jenkintown, Arnold Assoc.	215-742-0600
TX	Austin, Stevens Sls. Co.	512-250-5104
TX	Dallas, Stevens Sls.	214-350-2476
UT	Salt Lake City, Piper Sls. Co.	801-268-8707
VA	Reston, Boyle Assocs.	703-620-9558

DCI, INC., 720 E. Dennis, Olathe, KS 66061, Tel: 913-782-5672; FSC No.: 58677; Empl.: 9; *Sls. Mgr.:* William D. Cook .... 3•1324

Local Sales Offices & Reps

AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	San Diego, Windsor Dynamics	714-452-1891
CA	Sherman Oaks, Windsor Dynamics	213-990-4173
CA	Woodside, N-S Assoc.	415-854-4870
CO	Colorado Springs, J. Smith & Assoc.	303-597-5343
CT	Tolland, R. G. Assoc.	203-875-4201
FL	Melbourne, EME³	305-259-2711
GA	Stone Mountain, Zelco	404-498-2181
IL	Chicago, Commodore I	312-394-5441
IN	Indianapolis, Commodore I	317-636-3318
KS	Shawnee Mission, Vertec	913-677-3200
MA	Danvers, R. G. Assocs.	617-777-3199
MI	Detroit, Michigan Valve & Fitting	313-884-9415
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	St. Louis, Vertec	314-394-6242
NJ	Wayne, Ramapo	201-839-6767
NM	Albuquerque, J. Smith & Assoc.	505-265-3406
NY	Latham, L-Tron	518-785-5032
NC	Charlotte, Zelco	704-523-2961
OH	Columbus, R. D. Cloon Assoc.	614-459-2890
PA	Radnor, Roberts Engrg. Sls.	215-688-6525
TX	Richardson, Meas. Sys. & Sls.	214-644-4954

DEAK TECHNOLOGY, INC., Sainte Claire Plaza, 1121 Boyle Rd., Pittsburgh, PA 15241, Tel: 412-341-2245; *Sls. Mgr.:* David Thornburg .... 3•1216

YOUR FULL SERVICE SOURCE
DEARBORN
FOR WIRE CABLE INSULATION

DEARBORN WIRE & CABLE CO., 9299 Evenhouse Ave., Rosemont, IL 60018, Tel: 312-696-1000, TWX: 910-253-0343; Empl.: 80 .... 2•2096-2101

Local Sales Offices & Reps

CA	Chino, Dearborn West	714-591-9393
CA	San Diego, OHM Spun Elctrns.	619-695-8102
CO	Littleton, Advanced Technlg. Mktg.	303-979-8420
FL	Orlando, Admiral Sls.	305-352-0046
GA	Atlanta, Beacon Assocs.	404-256-9640
IL	Chicago, LGS Sls.	312-456-9616
IL	Wilmette, Joel Wasserman Assocs.	312-256-3566
IN	Indianapolis, Elctrn. Reps.	317-894-1414
MA	Clinton, F. J. Coleman & Co.	617-368-0116
MI	Southfield, R. C. Merchant & Co.	313-354-4300
MI	St. Joseph, R. C. Merchant & Co.	616-983-7378
MN	Golden Valley, Ambassador Indl. Mktg.	612-542-8437
MO	St. Charles, Buckman & Assocs.	314-946-6201
NJ	Livingston, Accurate Wire & Cable	201-533-0103
NJ	Medford, Jack McCoy, Inc.	609-953-0770
NY	Fairport, Net Sls.	716-467-4538
OH	Richfield, Bear Mktg.	216-659-3131
PA	Downington, Jack McCoy, Inc.	215-363-0350
TN	Memphis, Electronic Sls. Co.	901-682-2281
VA	Lynchburg, Mechanical Assocs.	804-237-6286
WA	Everett, Huntley Assocs.	206-353-1833

Local Distributors

AL	Huntsville, Chase Elctrns.	205-536-0738
AL	Madison, S.E.A. Wire and Cable	205-772-9616
CA	Chatsworth, Sonic Wire	213-701-0565
CA	Inglewood, Newark Elctrns.	213-678-0441
CO	Denver, Newark Elctrns.	303-757-3351
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
FL	Ft. Lauderdale, Simcona Elctrns.	305-485-4455
IL	Bloomington, K. L. Tannehill	612-881-6700
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elk Grove Village, GBL/Goold Elctrns.	312-593-3220
IL	Northbrook, Classic Comps.	312-272-9650
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Carmel, Altex	317-848-1323
IN	Evansville, Hutch & Sons	812-425-7201
IN	Indianapolis, Genesis Elctrns.	317-637-5571
IA	Cedar Rapids, Deeco	319-365-7551
LA	New Orleans, Radio Parts	504-581-5959
MI	Grand Rapids, R. M. Electrns.	616-531-9300
MI	Grand Rapids, SF Elctrns.	616-459-0216
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Bloomington, K. L. Tannehill	612-881-6700
MN	Bloomington, Berquist Corp.	612-835-2322
MN	Bloomington, NWR Elctrns.	612-854-7329
MN	Hibbing, NWR Elctrns.	218-262-5228
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Dover, Electro Spec	201-361-6300
NJ	E. Brunswick, Brothers Elec.	201-238-2200
NJ	W. Collingswood Hgts., The Edge Supp.	609-456-3955
NM	Albuquerque, Walker Elctrn. Supp.	505-247-2288
NY	Binghamton, Help Elctrns.	607-729-3528
NY	Elmira, CAC Elec. Supp.	607-734-1696
NY	Fairport, Pacer Elctrns.	716-377-0462
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Troy, Trojan Elctrn. Supp.	518-274-4481
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Valley View, Newark Elctrns.	216-447-8860
PA	Harrisburg, Pyttronics	717-236-8001
PA	McKean, Advacom	814-476-7774
TX	Austin, R.S.I.	512-834-2015
TX	Dallas, Shearson Elec.	214-340-3094
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elctrns.	713-782-4800
UT	Salt Lake City, RA-ELCO	801-487-0571
VA	Charlottesville, Virginia Radio Supp.	804-296-4184
VA	Lynchburg, Components Unltd.	804-237-6286
WA	Seattle, Carlyle Tech. Sls.	206-575-6750
WI	Milwaukee, Marsh Elctrns.	414-475-6000

DECC DIV., See Helionetics, Inc., DECC Div.

DECISION DATA COMPUTER CORP., 100 Witmar Rd., Horsham, PA 19044

DECOM SYS., 340 Rancheros Dr., San Marcos, CA 92069, Tel: 619-744-1002, TWX: 910-322-1758; FSC No.: 55744; Empl.: 44; *Sls. Mgr.:* G. F. Tremain

Local Sales Offices & Reps

AL	Lake Guntersville, Kelley Sys. Corp.	205-582-8677
CA	Los Angeles, L. L. Stoakes, Inc.	213-640-2178
CA	Palo Alto, Egbert Engrg.	415-326-1387
CA	San Diego, L. L. Stoakes, Inc.	619-452-1600
CO	Boulder, Grady Moore Assocs.	303-494-3351
FL	Sarasota, S. Bass Assocs.	813-922-9538
IN	Indianapolis, Loren Green Associates	317-293-9827
KS	Shawnee Mission, Techn. Sls. Assocs.	913-888-3330
MD	Severna Park, Delmarva, Ltd.	301-647-8007
MA	Bedford, Claflin Assocs.	617-275-7428
MO	St. Louis, Techn. Sls. Assocs.	314-725-5361
NM	Albuquerque, Grady Moore Assocs.	505-262-1416
PA	Huntingdon, Rabal Assocs.	215-947-4825
EXP	CA, San Marcos, Decom Sys.	619-744-1002

DE COURSEY ENGRG. LAB., 11828 W. Jefferson, Culver City, CA 90230, Tel: 213-EX7-9668; Empl.: 7

DEGUSSA, Rte. 46 & Hollister, Teterboro, NJ 07608, Tel: 201-288-6500, Telex: 134610, TWX: 710-990-6143; FSC No.: 630673043; *Sls. Mgr.:* Paul M. Silberman

DEK, INC., 3480 Swenson Ave., St. Charles, IL 60174, Tel: 312-377-2575, Telex: 297284 DEK UR; Empl.: 115; *Sls. Mgr.:* L. R. Pappone

Local Distributors

AZ	Tempe, Waltronics Sls.	602-967-1020
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Santa Clara, Waltronic Sls.	408-727-1200
IL	Addison, L-Comp	312-628-1400
MD	Hanover, Vertex-Mid Atlantic	301-796-5000
MA	No. Wilbraham, Indl. Comps. Corp.	413-596-3854
MI	Lavonia, Camelot Elctrns.	313-427-8660
MN	St. Paul, Arden Indl. Prods.	612-483-6681
MO	Maryland Heights, L-Comp	314-291-6200
NJ	East Orange, Willgold Sls. Corp.	201-678-7700
NJ	Kenilworth, Federated	201-272-0505
NY	Farmingdale, Vertex Elctrns.	516-293-9880
OH	Columbus, Elctrn. Mktg.	614-299-4161
PA	Philadelphia, Phila. Elctrns.	215-568-7400
TN	Paris, Southern States Indl. Sls.	901-642-0885
TX	Crowley, Service Assocs.	817-297-4604
TX	Dallas, Wholesale Elctrn.	214-824-3001
TX	Ft. Worth, Ft. Worth Wire & Cable	817-332-8252
UT	Ogden, Grimes Mktg.	801-546-4029
WI	Waukeshaw, Cable Comps.	414-785-1060

DELBERT BLINN CO., Box 2007, Pomona, CA 91766, Tel: 714-629-3900; Empl.: 10 .... **1A**•2093

Local Sales Offices & Reps

CA	San Carlos, Baytronic's	415-588-0958
MD	Baltimore, Callas Elctrns.	301-744-7711
NY	Commack, Kaelber & Mack	516-499-2924
WA	Woodinville, W. J. Stulgis Co.	206-486-8539

Local Distributors

MN	Minneapolis, Stark Elctrns.	612-332-1325

DELCO WIRE & CABLE, INC., 257 Rittenhouse Cir., Bristol, PA 19007, Tel: 215-785-0511, Telex: 06-964523, TWX: 510-667-0968; *Sls. Mgr.:* T. Blick

DEL ELCTRNS. CORP., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000, TWX: 710-562-0130; FSC No.: 01378; Empl.: 180 .... **1A**•2151; **3**•1546, 1547

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Pasadena, A-F Sales Engrg.	213-681-5631
CA	San Carlos, Winco Sls.	415-592-0357
CO	Lakewood, Trembly Assocs.	303-233-9544
IL	Elmhurst, Scott Assocs.	312-279-5681
MA	Burlington, TriTek	617-272-4550
MI	Dearborn, Pitcher-Poulin	313-582-5450
NV	Las Vegas, Trembly Assocs.	702-739-9770
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Smithtown, T & K Sales	516-724-3456
OK	Tulsa, Barry Sales	918-749-7775
OR	Portland, Syscom Sls., Inc.	503-644-2505
PA	Ardmore, Martin Assoc.	215-649-6332
TX	Houston, Barry Sales	713-784-5860
TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Trembly Assocs.	801-486-5292
WA	Bellevue, Syscom Sls., Inc.	206-641-5080

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, Tel: 716-652-3600, Telex: 91-293; FSC No.: 99800; Empl.: 400; *Sls. Mgr.:* R. Nareau .... **1A**•1243

Local Sales Offices & Reps

AL	Huntsville, Conley & Assocs.	205-882-0316
AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Culver City, Bestronics	213-870-9191
CA	El Toro, Delevan	714-768-5522
CA	Freemont, Advanced Technlg. Sls.	415-651-0123
CA	Irvine, Bestronics	714-261-7233
CA	San Diego, Bestronics	619-452-5500
CA	Woodland Hills, Bestronics	213-704-5616
CO	Aurora, High Tech Assocs.	303-695-1990
FL	Boca Raton, Conley & Assocs.	305-395-6108
FL	Oviedo, Conley & Assocs.	305-365-3283
FL	Tampa, Conley & Assocs.	813-885-7658
GA	Doraville, Conley & Assocs.	404-447-6992
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Fort Wayne, Walter W. Bieberich	219-432-2537
IN	New Albany, Walter W. Bieberich	812-945-3187
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Parker, S. W. Wollard	913-898-6552
MD	Lutherville, D. A. Dougherty Sls. Co.	301-321-7890
MA	Boston, P. J. Engrg. Sls. Co.	617-924-5950
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Bellmawr, TAI	609-933-2600
NJ	Parlin, Martech Assocs.	201-721-2200
NY	Endicott, Tech-Mark	607-748-7473
NY	Manhassett, Martech Assocs.	516-627-1151
NY	Mendon, Tech-Mark	716-624-3840
NY	Whitesboro, Tech-Mark	716-624-3840
NC	Raleigh, Conley & Assoc.	919-876-9862
OH	Beachwood, Electronic Salesmasters	216-831-9555
TX	Irving, Kite Elctrn. Sls. Co.	214-438-9336
WI	Milwaukee, Momak Sls.	414-963-1590

Local Distributors

CA	Chatsworth, IEC	213-998-2200
CA	Glendale, R. V. Weatherford	213-849-3451
CA	Santa Clara, WDG/Santa Clara	408-727-2500
FL	West Palm Beach, Nurmi Elctrn. Supp. Co.	305-686-8553
IN	South Bend, Genesis Elctrns.	219-287-2911
MD	Sauage, Pyttronics Inds. Inc.	301-792-0780
MA	Boston, P. J. Engrg. Supp.	617-783-0510
NJ	New Brunswick, Brothers Elctrns.	201-238-2200
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray/New York	516-420-9800
PA	Norristown, Century Elctrn. Comp.	215-631-5400
TX	Dallas, R. V. Weatherford Co.	214-931-7333
TX	Fort Worth, Patco Supply	817-429-8596
Can	Burnaby B.C., R-A-E Indl. Elctrns. Ltd.	604-291-8866
Can	Don Mills, Ontario, Saynor Elctrns. Ltd.	416-445-2347
Can	Montreal, Quebec, Prelco Elctrns. Ltd.	514-389-8051
Can	Pointe-Claire Quebec, Future Elctrn.	514-694-7710

DELTA DESIGN, 5775 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-292-5000, TWX: 910-335-1215; Empl.: 150; *Sls. Mgr.:* Bob Williams

DELTA ELECTRONIC CONTROLS CORP. (DECC), See Helionetics, Inc., DECC Div.

DELTA ELECTRONIC IND. USA, Delta Elctrn. Ind. Co. Ltd., 3401 Investment Blvd., Ste. 5, Hayward, CA 94545, Tel: 415-785-5231, 415-785-5235, Telex: 4992342 DELTAITTHY; Empl.: 1000; *Sls. Mgr.:* Bruce Cheng; *Dist. Mgr.:* Bruce Cheng .... **1A**•1590, 1591

Local Sales Offices & Reps

AL	Huntsville, Technlg. Mktg. Assocs. Inc.	205-883-7893
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Mountain View, Taarcom Inc.	415-960-1550
CA	National City, Tri-Electro Sls.	619-470-1564
CA	Simi Valley, Tri-Electro Sls.	805-583-5124
CO	Aurora, Mountain View Mktg. Ltd.	303-360-9641
CT	Waterbury, Compak	203-755-5629
CT	Wethersfield, Compak	203-563-4784
FL	Atlanta, Technlg. Mktg. Assocs., Inc.	404-257-0374
FL	Melbourne, Technlg. Mktg. Assocs., Inc.	305-254-2554
FL	Orlando, Technlg. Mktg. Assocs., Inc.	305-857-3760
FL	Pompano Beach, Technlg. Mktg. Assocs., Inc.	305-942-0774
IL	Chicago, United Prods. Co.	312-631-1122
IN	Indianapolis, Electronic Sls. & Engrg., Inc.	317-849-4260
IA	Cedar Rapids, Palatine Engrg. & Sls. Inc.	319-365-8071
KS	Mission, Palatine Engrg. & Sls. Inc.	913-831-0555
KS	Wichita, Palatine Engrg. & Sls. Inc.	316-262-1020
MD	Baltimore, Burgin-Kreh Assocs. Inc.	301-265-8500
MA	Woburn, Compak	617-938-8580
MA	Woburn, Mascon Inc.	617-938-8950
MN	Edina, Monroe Hanna	612-925-5700
MO	Hazelwood, Palatine Engrg & Sls.	314-839-0800
NJ	Kenilworth, Ventronics	201-272-9262
NC	Charlotte, Robert W. Chapman & Co.	704-525-2421
NC	Greensboro, Robert W. Chapman & Co.	919-282-0740
NC	Raleigh, Robert W. Chapman & Co.	919-782-2624
OK	Tulsa, Advance Tech. Sls., Inc.	918-664-0482
OR	Portland, Jas. J. Backer & Co.	503-297-8744
OR	Salem, Jas. J. Backer & Co.	503-362-0717
SC	Greenville, Robert W. Chapman & Co.	803-288-8821
SC	W. Columbia, Robert W. Chapman & Co.	803-256-0072
TX	Austin, Advance Tech. Sls., Inc.	512-459-1351
TX	Dallas, Advance Tech. Sls., Inc.	214-340-1300
TX	Houston, Advance Tech. Sls., Inc.	713-440-3888
UT	Murray, Mountain View Mktg.	801-261-4867
VA	Lynchburg, Burgin-Kreh Assocs., Inc.	804-239-2626
WA	Seattle, Jas. J. Backer Co.	206-285-1300
PR	San Juan, Electronic Tech. Sls.	809-790-1300

Local Distributors

CA	Mountain View, Cornett Elctrns.	415-969-5420
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Torrance, Cypress Elctrns.	213-533-6005
IL	Chicago, UPCO Distrs., Ltd.	312-631-1122
IA	Cedar Rapids, Bergquist Co.	319-366-8733
MA	Wellesley Hills, Target Elctrn. Supp., Inc.	616-235-2545
MN	Minneapolis, Bergquist Co.	612-835-2322

DELTA ELCTRNS., 145 Fayette St., Winston-Salem, NC 27101, Tel: 919-725-4122; Empl.: 45; *Sls. Mgr.:* L. E. Hancock

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 617-927-1060

DELTA PRODS., Box 1147, Grand Junction, CO 81501, Tel: 303-242-9000; Empl.: 35; *Sls. Mgr.:* K. D. Braa

DELTA WIRE & CABLE CO., P.O. Box 833, 1900 Marquette, North Chicago, IL 60064, Tel: 312-473-4990; Empl.: 12; *Sls. Mgr.:* Mike Golden; *Dist. Mgr.:* Matt Coleman

DELTROL CONTROLS, 2745 S. 19th St., Milwaukee, WI 53215, Tel: 414-671-6800; Empl.: 300 ....**1B**•1334, 1335, 1482, 1483

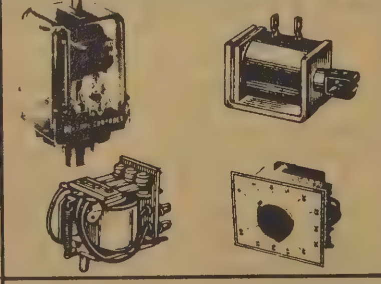
Local Sales Offices & Reps

CA	Canoga Park, Cummings & Assocs.	213-340-6035
CA	Santa Clara, Cummings & Assocs.	408-247-8656
CO	Denver, Cummings & Assocs.	303-455-6860
CT	Marion, Sands Co.	203-628-4363
FL	Lighthouse Point, J. Krutek & Assocs.	305-941-6544
HI	Honolulu, Aloha Assocs.	808-941-1574
IN	Indianapolis, Nationwide Comps.	317-872-7207
MD	Woodbine, Naudain Assocs.	301-252-5378
MI	Farmington Hills, W. R. Hummon & Assocs.	313-474-0661
MN	St. Paul, Kencotronics	612-645-7717
MO	Ellisville, Weisler & Assocs.	314-394-4543
MO	Kansas City, Weisler & Assocs.	816-421-1679
NJ	Marlton, Naudain Assocs.	609-235-1801
NY	Babylon, Astrorep.	516-422-2500
NY	Rochester, Omni Sls.	716-473-3340
NC	Charlotte, JWL Assocs.	704-364-3177
OH	Willoughby, Nationwide Comp. Reps.	216-946-3226
OR	Portland, Cummings & Assocs.	503-761-4411
PA	Philadelphia, Naudain & Assoc.	609-235-1801
TX	Garland, R. May Assocs.	214-276-5214

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
AZ	Phoenix, Elctrns. Parts Co.	602-277-7281
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Anaheim, Electro Comps. Distrs.	714-634-0222
CA	Buena Park, Control Design	714-521-5040
CA	Canoga Park, C & A Elctrns.	213-340-6022
CA	Los Angeles, Electric Switches	213-664-2125
CA	Los Angeles, Electro Comps. Distrs.	213-264-7100
CA	Mt. View, Corrnett Elctrns.	415-969-5420
CA	Pasadena, Dow Radio Co.	213-793-1195
CA	San Jose, Consolidated Parts	408-263-9521
CA	Tustin, Western Switches	714-731-4333
CO	Colorado Springs, Centennial Elctrns.	303-633-4666
CO	Denver, Integrated Elctrns.	303-534-6121
CO	Denver, Fistell's Elctrn. Supp.	303-629-1312
CO	Englewood, Industrial Elctrns.	303-771-2632
CO	Grand Junction, Radio & Elctrns. Supp.	303-243-3346
CT	Danbury, Pilgrim Elctrns.	203-792-7274
FL	Altamore Springs, Control Des.	305-788-3220
FL	Ft. Lauderdale, Peerless Radio Corp.	305-566-5966
FL	Ft. Lauderdale, SE Elctrns.	305-563-4131
FL	Jacksonville, Mitchell Elctrns.	904-356-8427
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Tampa, Leader Elctrns. Distrs.	813-870-3315
GA	Atlanta, Georgia Control Ctr.	404-876-8833
GA	Atlanta, A-C Equip.	404-451-2747
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Pocatello, Kimball Elctrns.	208-232-2201
IL	Chicago, Otto Frankenbush	312-647-0755
IL	Elk Grove Village, GBL	312-593-3222
IL	Genoa, Control Design	815-784-6515
IL	Rosemont, Advent Elctrns.	312-295-4210
IN	Indianapolis, Advent Elctrns.	317-297-4910
IN	Indianapolis, Warren Radio Co.	317-634-5566
IN	Indianapolis, Control Design	317-788-4559
IN	Lafayette, CWY Elctrns.	317-447-4617
IA	Cedar Rapids, Iowa Radio Supp.	319-364-6154
IA	Davenport, Warren Radio	319-322-5301
IA	West Des Moines, Ramco Co.	515-225-6933
KS	Kansas City, Kornfield Thorp Elec.	913-321-7070
KS	Topeka, Carroll Radio	913-234-6677
KY	Ashland, Ashland Elec. Co.	606-324-4107
KY	Bowling Green, Randolph, Hale & Meredith	502-781-1460
KY	Louisville, Peerless Elctrn. Equip.	502-637-7677
KY	Paducah, Warren Radio Co.	502-442-4367
LA	Shreveport, Indl. Elec. Supp.	318-222-9459
MA	Brighton, Interstate Elctrns. Equip.	617-782-9000
MA	Newton Upper, Instock Prods.	617-964-6200
MA	Wakefield, Lorcor Elec.	617-246-1903
MI	Augusta, Great Lakes Elec.	616-731-4156
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Flint, Michigan Elctrns.	313-232-6550
MI	Flint, Roth Elec. Supp.	313-234-8661
MI	Kalamazoo, Warren Radio	616-381-4203
MN	Minneapolis, Control Design	612-721-6555
MO	Kansas City, Western Extralite	816-421-8404
MO	St. Louis, Van Sickle Radio Elctrns.	314-621-5000
MO	St. Louis, Control Design	314-426-3150
NJ	Edison, William Elctrns. Supp.	201-985-3700
NJ	Fairlawn, Relay Specialties	201-797-3313
NY	Farmingdale, Ramtronix	516-752-1272
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Hempstead, Elctrn. Equip. Co.	516-895-5757
NY	Jamestown, Warren Radio	716-484-1141
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, SE Elec.	919-828-2311
ND	Grand Forks, Border States	701-772-3477
OH	Cincinnati, United Radio	513-761-4030
OH	Columbus, McJunkin Corp.	614-294-3711
OH	Toledo, Warren Radio Supp.	419-248-3364
OH	Wickliffe, Gateway Elctrns.	216-944-8565
OK	Ardmore, Ardmore Elec. Supp.	405-223-3571
OR	Eugene, Portland Elec. & Plumbing	503-243-6885
OR	Eugene, North Coast Elec. Co.	503-343-7701
OR	Portland, Portland Elec. & Plumbing Co.	503-243-6832
OR	Portland, Dunn Elec.	503-285-0214
PA	Erie, REM Elctrns.	814-453-5626
PA	Malvern, Control Design	215-296-0150
PA	Philadelphia, Anco Elec.	215-468-5544
PA	Philadelphia, Lindley Elec.	215-329-7005
SC	Greenville, Hammond Elec.	803-233-4421
TN	Chattanooga, Curle Elctrns.	615-266-4728
TN	Memphis, Warren Radio	901-274-2460
TX	Dallas, Dallas Instrs.	214-394-1180
TX	Dallas, Watson Elec. Supp.	214-742-8441
TX	Dallas, Control Design	214-358-1441
TX	Dallas, J & S Elec.	214-681-1394
TX	El Paso, Midland Specialty	915-533-9555
TX	Lubbock, R & R Elec. Co.	806-765-7727
TX	San Antonio, Blackburn Drives Controls	512-349-2621
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VA	Ashland, Hermitage Distrs.	801-328-2075
VA	Staunton, Southern Elec.	703-886-6218
WI	Manitowac, Englewood Elec.	414-684-6653
WI	Mequon, Taylor Elec.	414-241-4321
WI	New Berlin, Control Design	414-784-1015

DELTROL
controls
AUTHORIZED DISTRIBUTOR
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971



RELAYS – SOLENOIDS – TIMERS
See complete product line under
SWITCHES ––section 5100
FREE linecard and catalog on request

DELTRON, INC., P.O. Box 1369, Wissahickon Ave., N. Wales, PA 19454-9990, Tel: 215-699-9261, TWX: 510-661-8061; Empl.: 150; *Sls. Mgr.:* Jack Phillips

DELTRONIC CRYSTAL INDS., 215 Rt. 10, Bldg. 3, Sec. 5, Randolph, NJ 07869, Tel: 201-361-2222, Telex: 13-6170; Empl.: 8

DENNIS CHEMICAL, 2701 Papin St., St. Louis, MO 63103, Tel: 314-771-1800; Empl.: 70; *Sls. Mgr.:* Dan J. Edwards; *Dist. Mgr.:* Dan J. Edwards

DENNISON KUBE, Div. Dennison Computer Supplies Inc., 132 Calvary St., Waltham, MA 02254-0472, Tel: 617-899-0012, Telex: 94-0179; FSC No.: 17691; Empl.: 450; *Sls. Mgr.:* Alfred J. Black

DENNISON MFG. CO., 300 Howard St., Framingham, MA 01701, Tel: 617-879-0511, Telex: 948-478; FSC No.: 5975; Empl.: 8000; *Sls. Mgr.:* J. Campion; *Dist. Mgr.:* Lorn Clancey

Local Sales Offices & Reps

CA	City of Industry	213-333-5291
CA	Redwood City	415-365-6736
FL	Altamonte Springs	305-830-1549
IL	Des Plaines	312-298-8870
MI	Southfield	313-354-7440
MO	St. Louis	314-569-3050
NY	Armonk	914-273-6550
NC	Gastonia	704-867-8315
OH	Cincinnati	513-621-0865
PA	Wayne	215-687-9806
TX	Dallas	214-680-9846

DENSITRON
CORPORATION

DENSITRON CORP., 20775 Western Ave., Torrance, CA 90501, Tel: 213-618-9647, TWX: 910-349-6200; FSC No.: 62483; *Sls. Mgr.:* Keith Luskin ....**1B**•1036, 1037, 1485

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, Telex: 951833 SBSB WOR; Empl.: 5

DESIGN TECHNOLOGY, 7760 Vickers St., San Diego, CA 92111-1871, Tel: 619-268-8194; *Sls. Mgr.:* Pam Hamilton; *Dist. Mgr.:* Sherry Kuzara

DESPATCH INDS., P.O. Box 1320, Minneapolis, MN 55440, Tel: 612-331-1873, Telex: 29-0704; Empl.: 475; *Sls. Mgr.:* T. Oelfke;R. Pieper;J. Paulson

DEST CORP., 2380 Bering Dr., San Jose, CA 95131, Tel: 408-946-7100; Empl.: 50; *Sls. Mgr.:* Richard Dixon

DEUTSCH CO., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045, Tel: 213-649-1400; *Sls. Mgr.:* Ken Ahmad

DEUTSCH FASTENER, 1315 East Grand Ave., El Segundo, CA 90245, Tel: 213-322-8840, Telex: 66-4453, TWX: 910-348-6676; Empl.: 300; *Sls. Mgr.:* Ian J. Skone-Rees

DEUTSCH RELAYS, INC., 65 Daly Road, East Northport, NY 11731, Tel: 516-499-6000

DEVCO ENGRG., Control Sys. Div., 36 Pier Lane West, Fairfield, NJ 07006, Tel: 201-CA8-0321, Telex: 139-340; Empl.: 36

DEVELCO, INC., 404 Tasman Dr., Sunnyvale, CA 94089-1797, Tel: 408-734-5700, TWX: 910-339-9295; Empl.: 50; *Sls. Mgr.:* W. J. Baker

Local Sales Offices & Reps

TX	Houston, DEVELCO, Inc., Mr. Larry Wysong	713-436-9600
VA	Reston, Sphere Assocs.	703-471-7887

DEXCEL, Div. of Gould, 2285C Martin Ave., Santa Clara, CA 95050, Tel: 408-727-9833, TWX: 910-338-0180; Empl.: 210; *Sls. Mgr.:* Art Kawai

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, Telex: 757075 DEXTER RES UD; Empl.: 22; *Sls. Mgr.:* D. M. Szeles

DGS ASSOCS., 1353 Sarita Way, Santa Clara, CA 95051, Tel: 408-554-1469

DIALIGHT CORP., 203 Harrison Pl., Brooklyn, NY 11237-1587, Tel: 212-497-7600, TWX: 710-584-5487; Empl.: 400; *Sls. Mgr.:* J. McNamara ...**1B**•1038, 1039

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Ralph Stitzer Co.	602-997-7415
CA	Anaheim, Westrep	213-404-3881
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	San Diego, Westrep	619-276-0751
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Ft. Lauderdale, Cartwright & Bean	305-735-4900
FL	Orlando, Cartwright & Bean	305-422-4531
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Indianapolis, Elctrn. Reps.	317-894-1414
KS	Shawnee Mission, K & M Sls.	913-262-1444
LA	Kenner, Cartwright & Bean	504-466-0020
MA	Needham, Mullin Tech. Sls.	617-444-4780
MI	Ferndale, Hilltronics	313-398-5556
MN	Minneapolis, Professional Sales For Ind.	612-944-8545
MS	Jackson, Cartwright & Bean	601-981-1170
NY	Liverpool, Precision Sls.	315-451-3480
NC	Charlotte, Cartwright & Bean	704-377-5673
NC	Raleigh, Cartwright & Bean	919-781-6560
OH	Dayton, K.W. Elctrn. Sls.	513-890-2150
OH	Shaker Hgts., K.W. Elctrn. Sls.	216-491-9177
OH	Worthington, K.W. Elctrn. Sls.	614-888-0483
OR	Tigard, Elctrn. Sources	503-684-0040
PA	Allison Park, K.W. Elctrn. Sls.	412-487-4300
PA	Broomall, L.D. Lowery	215-528-5170
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Garland, Tesco	214-681-1376
TX	Houston, Tesco	713-777-1443
UT	Salt Lake City, Comp. Prods. Sls.	801-262-0000
WA	Bellevue, Elctrn. Sources	206-451-3500
WI	Milwaukee, D. Dolin Sls.	414-482-1111

Local Distributors

AZ	Tempe, Richey Western Elctrns.	602-894-9251
CA	Alhambra, Fisher/Brownell	213-289-0255
CA	Chatsworth, Diplomat Westates Elctrns.	213-341-4411
CA	Costa Mesa, Diplomat Westates	714-549-8401
CA	Gardena, Bell Indus.	213-515-1800
CA	Inglewood, Newark Elctrns.	213-671-7387
CA	Los Angeles, Richey Western Elctrns.	213-820-3777
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	San Diego, Richey Western Elctrns.	714-565-4444
CA	San Diego, Fisher/Brownell	714-560-8545
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Santa Clara, Fisher/Brownell	408-988-6041
CA	Sun Valley, Richey Western Elctrns.	213-768-3800
CA	Sunnyvale, Bell Indus.	408-734-8570
CA	Sunnyvale, Time Elect.	408-734-9888
CO	Denver, Newark Denver Elctrns.	303-757-3351
CO	Denver, CSID Inc.	303-292-9594
CT	Wallingford, Sager Elctrl. Supply	203-265-4600
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Atlanta, Specialty Dist.	404-873-2521
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio & Elect.	309-691-4840
IN	Ft. Wayne, Graham Elctrn.	219-423-3422
IN	Indianapolis, Graham Elctrn.	317-634-8202
IN	South Bend, Genesis Elctrn.	219-287-2911
KY	Louisville, P.I. Burks	502-589-3960
LA	Lafayette, Ralph's of Lafayette	318-234-4507
LA	New Orleans, Southern Radio Supp.	504-524-2343
MD	Baltimore, Resco/Baltimore	301-937-9100
MD	Gaithersburg, Pioneer Wash. Elect.	301-948-0710
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Springfield, T.F. Cushing	413-788-7341
MA	Wilbraham, Ind'l. Comps.	413-596-3854
MI	Ann Arbor, Wedemeyer Elctrn. Supp.	313-665-8611
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrn.	313-967-0600
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	Kansas City, LCOMP	816-221-2400
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	Maryland Hgts., LCOMP	314-291-6200
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Kenilworth, Federated Electronics	201-272-0505
NJ	Oakland, Gordon/Horne	201-337-5200
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Buffalo, Summit Dists.	716-884-3450
NY	Elmsford, Ancar Elctrns. Supp.	914-592-7100
NY	Endwell, ASI Elect.	607-754-3823
NY	Farmingdale, Arrow Elctrns.	516-694-6800
NY	Farmingdale, Harrison Radio	516-293-7990
NY	Long Island City, Dalis Indl. Elect.	212-361-1100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NY	Woodbury, Pioneer/Harvey	516-921-8700
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Akron, Sun Radio	216-434-2171
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Solon, REPCO Elctrn.	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Almac Elctrns.	503-641-9070
PA	McKean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic Indus.	215-643-2850
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Pittsburgh, Cam RPC Elect.	412-782-3770
PA	Reading, Barbey Elctrns.	215-376-6116
RI	Providence, Wm. Dandreta	401-861-2800
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Kingsport, Radio Elec. Supp.	615-247-8111
TN	Nashville, Carlton-Bates Co.	615-244-3562
TX	Austin, Norvell Austin	512-458-8106
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Newark Elctrns.	713-782-4800
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Norfolk, Priest Elctrns.	804-855-0105
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Seattle, Zepher Elctrns.	206-241-1980
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	Milwaukee, Indl. Elect.	414-276-1212

DIAL PRODS. CO., 19-21 Cottage St., Bayonne, NJ 07002, Tel: 201-HE7-0720; Empl.: 100; *Sls. Mgr.:* Beverly Malen

DIAMOND MAGNETICS, P.O. Box 4736, San Luis Obispo, CA 93403, Tel: 805-544-4019; Empl.: 20; *Sls. Mgr.:* Lyle Nighswonger

DIAMOND SHAMROCK CORP, 1100 Superior Ave, Cleveland, OH 44114, Tel: 216-694-5000

DIANACHART INC., 129 Hibernia Ave., Rockaway, NJ 07866, Tel: 201-625-2299; *Sls. Mgr.:* L. Koepplinger

DI/AN CONTROLS, INC., 944 Dorchester Ave., Boston, MA 02125, Tel: 617-288-7700, TWX: 710-333-1732; FSC No.: 06900; Empl.: 135; *Sls. Mgr.:* C. S. Aspinwah Jr.; *Dist. Mgr.:* C. S. Aspinwah Jr.

DIA-NETICS INC., 18823 Napa St., Northridge, CA 91324, Tel: 213-886-2616; Empl.: 35

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678; FSC No.: 08441; Empl.: 250; *Sls. Mgr.:* Paul C. Colombo; *Dist. Mgr.:* Paul C. Colombo

DIELECTRIC INSTR. CORP., 761 Franklin Ave., Pittsburgh, PA 15221, Tel: 412-731-6566; Empl.: 7

DIELECTRIC LABS., 69 Albany St., Cazenovia, NY 13035, Tel: 315-655-8710, TWX: 710-541-1530; FSC No.: 55153; Empl.: 65; *Sls. Mgr.:* David Carter

Local Sales Offices & Reps

CA	Los Angeles, McDougal/McLaughlin	213-477-8556
CA	Menlo Park, Kipp Assoc.	415-854-2856
CO	Aurora, Sage Sls.	303-750-3501
FL	Palm Bay, Spar Tech.	305-727-8045
GA	Smyrna, Spar Tech.	404-432-3644
IL	Northfield, Feller Assoc.	312-446-8065
IN	Fort Wayne, J&B Engr. Sls.	219-483-2813
IA	Cedar Rapids, Feller Assoc.	319-364-0566
KS	Overland Park, Deltron	913-649-2078
MD	Owings Mills, Neal Deoul Assoc.	301-363-4311
MA	Burlington, Microwave Mkt. Spec.	617-272-7530
MO	St. Louis, Deltron	314-869-4779
NY	Bayside, Robert Diamond, Inc.	212-423-7330
PA	Ambler, WM Assoc.	215-643-4119
TX	Dallas, Tritex Tech. Sls.	214-247-3041
UT	Salt Lake City, Sages Sls.	801-485-5111
WA	Kirkland, Manon Engr.	206-827-7449

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911; Empl.: 26

DIETZGEN CORP., 250 Wille Rd., Des Plaines, IL 60018, Tel: 312-635-5200; Empl.: 200

DIGELEC, INC., Affil. Wavetek Corp., 586 Weddell Drive, Suite 1, Sunnyvale, CA 94089, Tel: 408-745-0722, Telex: 821877; *Sls. Mgr.:* Dick Woods

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs., Inc.	205-883-8660
AZ	Scottsdale, Barnhill Assocs., Inc.	602-947-7841
CA	Redondo Beach, Ward/Davis Assocs.	213-643-6977
CA	San Diego, Ward/Davis Assocs.	619-292-1000
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Englewood, Barnhill Assocs., Inc.	303-779-3600
CT	North Haven, Pat Jenks Assocs.	203-239-6201
FL	Orlando, W. A. Brown Instrs., Inc.	305-425-5505
GA	Norcross, W. A. Brown Instrs., Inc.	404-441-2980
HI	Honolulu, EMC Corp.	808-836-1138
IL	Arlington Heights, Dytec/Central Inc.	312-394-3380
IN	Indianapolis, Dytec/Central Inc.	317-247-1316
LA	Mandeville, W. A. Brown Instrs., Inc.	504-626-9701
MA	Woburn, Pat Jenks Assocs.	617-938-0488
MI	Madison Heights, WKM Assocs., Inc.	313-588-2300
MN	St. Paul, Dytec/North, Inc.	612-645-5816
NM	Albuquerque, Barnhill Assocs., Inc.	505-299-7658
NY	Fairport, Naco Elctrns. Corp.	716-223-4838
NY	N. Syracuse, Naco Elctrns. Corp.	315-699-2651
NY	Utica, Naco Elctrns. Corp.	315-732-1801
NC	Durham, W. A. Brown Instrs., Inc.	919-683-1580
OH	Dayton, WKM Assocs., Inc.	513-434-7500
OH	Independence, WKM Assocs., Inc.	216-524-5930
OK	Tulsa, Data Mktg. Assocs.	918-496-1457
PA	Bensalem, Eastern Instrmn. of Philadelphia	215-245-6660
PA	Pittsburgh, WKM Assocs., Inc.	412-892-2953
SC	Columbia, W. A. Brown Instrs., Inc.	803-798-8070
TN	Oak Ridge, W. A. Brown Instrs., Inc.	615-482-5761
TX	Austin, Data Marketing Assocs.	512-451-5174
TX	Dallas, Data Marketing Assocs.	214-661-0300
TX	Houston, Data Marketing Assocs.	713-780-2511
TX	San Antonio, Data Marketing Assocs.	512-342-3031
UT	Murray, Barnhill Assocs., Inc.	801-262-3000
VA	McLean, Creative Mktg. Assocs.	703-442-9100
WA	Redmond, Axiom Data Sys.	206-881-8447
WV	Pittsburgh, WKM Assocs., Inc.	412-892-2953
WI	Elm Grove, Dytec/Central, Inc.	414-784-9686

DIGIAC CORP., 175 Engineers Rd., Hauppauge, NY 11788, Tel: 516-273-8600, TWX: 510-227-9879; Empl.: 25; *Sls. Mgr.:* L. Keckeisen; *Dist. Mgr.:* S. Opperer

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, TWX: 710-867-9254; Empl.: 80; *Sls. Mgr.:* Allen Grams

DIGIMAX

DIGIMAX INSTRS. CORP., 5625 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-569-6582, Telex: 697120-DATAMAX; FSC No.: 5T492; *Sls. Mgr.:* Dan Burton; *Dist. Mgr.:* Dan Burton ....3•1217

DIGITAL COMMUNICATIONS ASSOCS., INC., 303 Technology Pk., Norcross, GA 30092, Tel: 404-448-1400, Telex: 261333 DCAATL

DIGITAL DATA SYS., 1551 N.W. 65 Ave., Plantation, FL 33313, Tel: 305-792-3290, Telex: 232 005 ATT DIGITAL; Empl.: 20; *Sls. Mgr.:* Floyd Simon; *Dist. Mgr.:* A. Gomez

DIGITAL DEV. CORP., 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-278-9920, Telex: 69-54-30; Empl.: 430; *Sls. Mgr.:* Charles Theodore

DIGITAL DYNAMICS, INC., 123 Water St., Watertown, MA 02172, Tel: 617-923-4315, Telex: 9580076; Empl.: 21; *Sls. Mgr.:* Eric Kapust

DIGITAL ELCTRNS., 26142 Eden Landing Rd., Ste. 2, Hayward, CA 94545, Tel: 415-786-0520, Telex: 334422; *Sls. Mgr.:* Bob Christensen

DIGITAL EQUIP., One Iron Way, Marlborough, MA 01752

DIGITAL GRAPHIC SYS., 935 Industrial Ave., Palo Alto, CA 94303, Tel: 415-856-2500; *Sls. Mgr.:* Robert Pickthorn

DIGITAL LABS. INC., 600 Pleasant St., Watertown, MA 02172, Tel: 617-924-1680; Empl.: 15; *Sls. Mgr.:* William M. Kahn

DIGITAL MICROSYSTEMS, 1840 Embarcadera, Oakland, CA 94606, Tel: 415-261-1034, TWX: 910-366-7310; Empl.: 200; *Sls. Mgr.:* Jim Massey; *Dist. Mgr.:* Dennis Haynes

DIGITAL MEDIA, 3178 Gibraltar Ave., Costa Mesa, CA 92626, Tel: 714-751-1373; *Sls. Mgr.:* David Scott

DIGITAL PATHWAYS, INC., 1060 E. Meadow Cir., Palo Alto, CA 94303, Tel: 415-493-5544, TWX: 910-379-5034; *Sls. Mgr.:* Jan Legassick

DIGITAL POWER CORP., 686 East Gish Rd., San Jose, CA 95112, Tel: 408-288-5600, TWX: 910-338-0579; *Sls. Mgr.:* Claude Adkins ....3•1549

Local Sales Offices & Reps

CA	Palo Alto, Qualtech	415-494-9060
PA	Montgomeryville, Eastern Scientific Mktg.	215-822-6503
TX	Garland, Tesco	214-681-1376
WA	Edmonds, Power Sources	206-784-3336

DIGITAL RADIO CORP., 8901 La Cienega Blvd., Inglewood, CA 90301, Tel: 213-670-8611; *Sls. Mgr.:* Arvin L. Perry

DIGITAL TRANSMISSION TECHNIQUES, INC., P.O. Box 1847, Wayne, NJ 07470, Tel: 201-831-1615; Empl.: 3; *Sls. Mgr.:* Charles Herbst

DIGITEC CORP., 918 Woodley Rd., P.O. Box 458, Dayton, OH 45401, Tel: 513-254-6251, Telex: 6874219 W.U.I.; FSC No.: 16152; Empl.: 135 ....3•1077, 1156, 1157, 1326, 1327

Local Sales Offices & Reps

CA	Carlsbad, Elotek Sys.	714-438-4856
CA	Mountain View, IFM, Inc.	415-961-2828
CT	New Canaan, R. J. Sickles Assoc.	203-966-4630
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-924-3568
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
KS	Shawnee, Marsland Assocs.	913-631-5400
MI	Southfield, Comtel-Instr.	313-358-2505
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-878-2402
NJ	Cherry Hill, Sci. Reps.	609-482-0059
NM	Albuquerque, Fry-Gates	505-262-1525
NY	Fayetteville, M. P. Andrews, Inc.	315-637-3144
OH	Cleveland, Comtel-Instr.	216-442-8080
OH	Dayton, Comtel-Instr.	513-298-7573
PA	Pittsburgh, Comtel-Instr.	412-922-5720
TX	Houston, Adaptive Controls	713-995-9791
UT	Salt Lake City, Meas. Consits.	801-364-3174
VA	Fairfax, Scientific Reps.	703-385-0600

DIGITECH INDS., INC., 66 Grove St., Ridgefield, CT 06877, Tel: 203-438-3731, Telex: 969-623; Empl.: 80

DIGITEK INC., P.O. Box 468, Kenmore, WA 98028, Tel: 206-485-6571; *Sls. Mgr.:* Paul J. McManus; *Dist. Mgr.:* Paul J. McManus

DIGITRAN®

BECTON DICKINSON

DIGITRAN CO., 3100 New York Dr., Pasadena, CA 91107, Tel: 818-791-5600, Telex: 67-5485, TWX: 910-588-3794; Empl.: 520; *Sls. Mgr.:* M. H. Hankinson (Digital Switch Prods.)

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns. Assoc.	205-881-5031
AZ	Scottsdale, Arcom Sls.	602-947-5745
AR	Little Rock, Beacon Elctrn. Assoc.	501-224-5449
CA	Anaheim, Westrep	213-404-3881, 714-527-2822
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Westrep	408-988-8833
CO	Littleton, Omega, Ltd.	303-798-7040
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Clearwater, Beacon Elec. Assoc.	813-796-2378
FL	Ft. Lauderdale, Beacon Elec. Assocs.	305-491-1054
FL	Maitland, Beacon Elec. Assocs.	305-647-3498
FL	Melbourne, Beacon Elec. Assoc.	305-724-8010
GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Ft. Wayne, R. O. Whitesell & Assoc.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assoc.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assoc.	317-457-9127
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
KY	Louisville, R. O. Whitesell & Assoc.	502-426-7696
MD	Silver Spring, Marktron	301-460-6100
MD	Timonium, Marktron	301-252-7111
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Grand Rapids, R. O. Whitesell & Assoc.	616-942-5420
MI	Southfield, R. O. Whitesell & Assoc.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assoc.	616-983-7337
MO	St. Louis, The Beams Co.	314-569-1060
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	New York, Comp-Tech Sls.	516-593-2628
NY	Rochester, Ossmann Comp. Sls.	716-424-4460
NY	Syracuse, Ossmann Comp. Sls.	315-455-6611
NC	Greensboro, Beacon Elctrns. Assoc.	919-275-9997
NC	Raleigh, Beacon Elec. Assoc.	919-787-0330
OH	Cincinnati, R. O. Whitesell & Assoc.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assoc.	216-447-9020
OH	Columbus, R. O. Whitesell & Assoc.	614-888-9396
OH	Dayton, R. O. Whitesell & Assoc.	513-298-9546
OR	Beaverton, Barrett-Squibb & Assoc.	503-642-1661
PA	Pittsburgh, R. O. Whitesell & Assoc.	412-963-6161
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-988-1600
TX	Hurst, Allied Comps.	817-589-0456
TX	Round Rock, Allied Comps.	512-244-1166
UT	Riverton, Omega, Ltd.	801-254-6723
VA	Charlottesville, Marktron	301-460-6100
WA	Redmond, Barrett-Squibb & Assoc.	206-885-6991
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
AL	Huntsville, Comp. Distrs.	205-883-7501
AZ	Phoenix, BeSwitched	602-275-4805
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	San Diego, El-Com	619-578-0900
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CO	Denver, CSID, Inc.	303-292-9594
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Electr./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IN	Indianapolis, Graham Elec.	317-634-8202
IN	Indianapolis, Pioneer/Indiana	317-849-7300
IN	Indianapolis, Magnuson Elctrns.	317-247-5108
MD	Columbia, Powell Electr.	301-621-4070
MD	Timonium, Zebra Elec.	301-252-6576
MA	Canton, Impact Sls. Co.	617-821-1500
MA	West Borough, Powell Electrns.	617-336-6100
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
MN	St. Paul, Magnuson Elec.	612-227-8495
NJ	Hasbrouck Hgts., Tory Sls.	201-288-5656
NJ	Pompton Plains, Zebra Elec.	201-839-9040
NY	Rochester, Modutex Corp.	716-647-9700
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Beaverton, Shannon, Ltd.	503-644-8077, 800-426-4615
OR	Wilsonville, Zepher Elec. Sls. Corp.	503-682-2929; 800-547-1853
PA	Philadelphia, Powell Electr.	215-365-1900
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Houston, Pioneer/Houston	713-988-5555
TX	Irving, Powell Elctrns.	214-258-6841
WA	Kent, Shannon, Ltd.	206-763-0545
WA	Seattle, Zepher Elec. Sls. Corp.	206-241-1980; 800-562-5057
WI	Mequon, Taylor Electrns.	414-241-4321

DILLON, W. C., & CO., 2320 Airport Blvd., Santa Rosa, CA 95401, Tel: 707-527-5555; Empl.: 99

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45459, Tel: 513-433-7600, Telex: 288-367; Empl.: 150; *Sls. Mgr.:* R. Cramer

DIONICS, 65 Rushmore St., Westbury, NY 11590, Tel: 516-997-7474, TWX: 510-222-0974; Empl.: 85; *Sls. Mgr.:* Mel Geffner

DIO-REY

THE LIGHTED DISPLAY DIVISION
INFO-LITE CORPORATION

DIO-REY, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455; FSC No.: FSCM 52116; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli; *Dist. Mgr.:* Joseph M. Cartelli ....1B•1040-1047; 3•1159

Local Sales Offices & Reps

CA	No. Hollywood, Crown Elctrns.	213-877-3550
CA	Redwood City, Caltronic Assocs.	415-365-2545
CT	Weston, CJA Assoc.	203-226-4317
FL	St. Petersburg, R. L. Matus & Assocs.	813-896-4133
GA	Buford, R. L. Matus & Assocs.	404-945-2946
IL	Lake Zurich, L & B Assocs.	312-438-7917
MI	Brighton, Michigan Mktg. & Sls.	313-229-6218
NJ	Wayne, GT Assocs.	201-694-6040
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, A.S.A.	216-662-6080
OH	Dayton, Mohawk Intronics	513-434-8873
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415

DISC INSTRS., 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-979-5300, TWX: 910-595-1987; Empl.: 175; *Sls. Mgr.:* D. Jolliff

Local Sales Offices & Reps

AZ	Phoenix, R.A. Mayes Co.	602-279-5243
CA	Costa Mesa, Disc Instrs.	714-979-5300
CA	Costa Mesa, Disc Instrs.	714-979-5300
CA	San Jose, Disc Instrs.	408-977-3019
CO	Denver, R.A. Mayes Co.	303-893-2264
FL	Casselberry, Hilco, Inc.	305-695-6208
GA	Dunwoody, Hilco, Inc.	404-393-1771
KS	De Soto, Midtec Assocs.	913-441-6565
MI	Troy, Disc Instr.	313-649-1340
MI	Troy, Disc Instrs.	313-649-1340
MN	Edina, J. H. Hanson Co.	612-893-9960
MO	Florissant, Midtec Assoc.	314-837-5200
NM	Albuquerque, R.A. Mayes Co.	505-292-2330
NC	Charlotte, Hilco, Inc.	813-422-3908
OR	Portland, Controltek Sls. Ltd.	503-641-0877
RI	Providence, Disc Instr.	401-438-6000
SC	Mount Pleasant, Hilco, Inc.	803-883-9633
TX	Richardson, Meas. Sys. & Sls. Inc.	214-644-4954

DISPLAY DEVICES, Box 667, Encinitas, CA 92024, Tel: 619-753-0113; FSC No.: 26107

DISPLAY INTERFACE CORP., 525 Boston Post Rd., P.O. Box 250, Milford, CT 06460, Tel: 203-877-7661; *Sls. Mgr.:* Leigh H. Hickcox

DISPLAYS, INC., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044, Tel: 717-242-2541, Telex: 842540; Empl.: 50

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co.	602-954-0301
CA	San Diego, Power Assoc.	619-275-0641
CA	Torrance, Cutlass Elctrns.	213-324-7360
MA	Weston, Bay Colony Reps.	617-899-8800

DISPLEX, INC., Alexander Place, Glen Cove, NY 11542, Tel: 516-671-4400, Telex: 640 476, TWX: (Northills Gove); Empl.: 12; *Sls. Mgr.:* Bill Adikes; *Dist. Mgr.:* Peter Reuter ....3•1860

Local Sales Offices & Reps

CA	Gardena, Bidwell Sls.	213-532-7305
CA	Westlake Village, WEW Entprs.	213-707-1551
IL	Elmhurst, First Rep Co.	312-530-2450
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Needham, Addelco Corp.	617-444-4754
NY	Great Neck, F & F Metro	516-482-4080
OH	Cleveland Heights, Seltech	614-451-3868
OH	Columbus, Seltech	614-451-3865
OR	Portland, Belusko & Co.	503-222-4279
TN	Nashville, Computer Power Corp.	615-366-1703
PR	Casuas, Micro-Tech Sys & Controls.	809-783-0100

DISTRIBUTED COMPUTER SYS., 223 Crescent St., Waltham, MA 02154, Tel: 617-899-6619, TWX: 710-324-6476; Empl.: 32; *Sls. Mgr.:* Garry Stephens

DISTRIBUTED LOGIC CORP. (DILOG), 12800-G Garden Grove Blvd., Garden Grove, CA 92643, Tel: 714-534-8950, Telex: 681399; FSC No.: 95-3205555; Empl.: 105; *Sls. Mgr.:* Dennis Edwards; *Dist. Mgr.:* Dennis Edwards

Local Sales Offices & Reps

CA	Garden Grove	714-534-8950
NJ	Red Bank	201-530-0044

Distributor

DISTRIBUTOR SPECIALISTS, 632 Santa Monica Blvd., Santa Monica, CA 90401, Tel: 213-393-9666 .... p.700

DIVERSIFIED CASE CO., Ellis Ave., Off. 2, Whitesboro, NY 13492, Tel: 315-736-3028; *Sls. Mgr.:* John Fitzsimmons

DIVERSIFIED ELECTRONICS, INC.

DIVERSIFIED ELCTRNS., INC., Indl. Controls Div., 119 N. Morton Ave., Evansville, IN 47711, Tel: 812-426-2806; Empl.: 55; *Sls. Mgr.:* James M. Kellum .... 1B•1336

Local Sales Offices & Reps

CA	Danville, Stuart Assocs.	415-837-8197
CA	Signal Hill, California Electro Sls. Co.	213-595-7427
CO	Denver, Empire Elctrl. Sls.	303-744-1776
FL	Leesburg, Diversified Elctrns.	800-874-0619
GA	Atlanta, Grady Duckett	404-451-3529
ID	Boise, Doran Sales Assocs., Inc.	208-343-9969
IL	Des Plaines, Antek/Lincoln, Hodges & Assocs.	312-297-0885
IN	Seymour, Diversified Elctrns. Inc.	812-522-1481
IA	Bettendorf, Weisler & Assocs.	319-344-0566
MD	Fulton, S. Jefferies	301-792-7452
MA	Wayland, Gilman Assocs.	617-358-7571
MO	Ellisville, Weisler & Assocs.	314-394-4543
MO	Kansas City, Weisler & Assocs.	816-421-1679
NY	Great Neck, Frank Tylinski Co.	516-466-9070
NC	Charlotte, Sentry Power	704-535-1774
OH	Cleveland, Syntron, Inc.	216-572-2848
OH	Cleveland, Arthur Baier	216-461-6161
OH	Dayton, Arthur Baier	513-276-4128
OR	Forest Grove, Doran Sls. Assoc.	503-357-3333
PA	Narberth, S. A. Jefferies	215-664-8500
TX	Houston, Weisler & Assocs.	713-467-1847
UT	Salt Lake City, Conely Engrg. Co.	801-972-5923
WA	Green Acres, Doran Sls. Assocs., Inc.	509-922-2317
WA	Redmond, Doran Sls.	206-855-1885
WI	Janesville, Antek Mktg. Assocs.	608-754-4214

Local Distributors

AL	Birmingham, MG Elctrns. & Equip., Co., Inc.	205-328-4525
AL	Mobile, Specialty Distrg. Co.	205-344-0450
AR	Rogers, Evans Elec. Motor Centers	501-636-0721
CA	Cathedral City, Consolidated Elec.	714-328-1131
CA	Danville, Cal-West Supp.	415-837-8245
CA	Fresno, Electric Motor & Supp.	209-233-1155
CA	Long Beach, Mag-Trol/Long Beach, Inc.	213-435-3451
CA	N. Hollywood, Associated Terminals & Cont.	213-875-0344
CA	Palm Springs, Lake Service	619-328-1163
CA	Palo Alto, Elctrl. Matls., Inc.	415-494-0400
CA	Redondo Beach, Elctrl. Power & Controls, Inc.	213-772-8890
CA	South El Monte, Walton Electrical Controls, Inc.	213-442-4610
CO	Denver, Control Comps, Inc.	303-371-2727
CO	Golden, Utility Control & Equip. Co.	303-425-1990
DC	Washington, Wesco	202-833-5250
FL	Ft. Lauderdale, Graybar Elec.	305-523-1453
FL	Ft. Myers, Con. Elec. Supp. Co.	813-332-1515
FL	Jacksonville, Graybar Elec.	904-356-7611
FL	Lakeland, A-A Elec.	813-665-6941
FL	Largo, Graybar Elec.	813-535-6460
FL	New Port Richey, Pasco Elec. Sup.	813-842-8405
FL	Orlando, Consolidated Elec.	305-849-6532
FL	St. Petersburg, Graybar Elec.	813-822-3851
FL	Tallahassee, Graybar Elec.	904-222-5332
FL	W. Palm Beach, Nurmi Elctrn. Supp., Inc.	305-686-8553
GA	Albany, Specialty Distrbg. Co., Inc.	912-435-1711
GA	Athens, Specialty Distrbg. Co., Inc.	404-548-1334
GA	Atlanta, Dapco, Inc.	404-458-6341
GA	Atlanta, Specialty Distrbg. Co., Inc.	404-873-2521
GA	Augusta, Specialty Distrbg. Co., Inc.	404-722-1526
GA	Brunswick, Specialty Distrbg. Co., Inc.	912-265-1927
GA	College Park, Specialty Distrbg. Co., Inc.	404-763-3828
GA	Columbus, Specialty Distrbg. Co., Inc.	404-327-7414
GA	Macon, Specialty Distrbg. Co., Inc.	912-743-5421
GA	Marietta, Specialty Distrbg. Co., Inc.	404-422-4333
GA	Norcross, A-A Electric	404-449-8670
GA	Savannah, Specialty Distrbg. Co., Inc.	912-234-1684
GA	Savannah, Graybar Elec.	912-232-1121
GA	Valdosta, Specialty Distrbg. Co., Inc.	912-242-4910
ID	Coeur d'Alene, R. C. Worst & Co., Inc.	208-664-2133
ID	Idaho Falls, Electrical Supp.	208-523-2800
ID	Pocatello, Electrical Supp.	208-233-1362
ID	Rexburg, Electrical Supp.	208-356-7282
IL	Bloomingdale, Seversen Engrg.	312-529-0501
IL	Fairfield, Precision Elec. Co.	618-842-7000
IL	Mt. Prospect, Legend Elctrl. Sls.	312-952-0090
IN	Evansville, Hutch & Son, Inc.	812-425-7201
IN	Indianapolis, Genesis Elec.	317-637-5571
IN	Vincennes, Valley Elec.	812-882-7860
KS	Salina, American Elec.	913-823-2248
KY	Louisville, Peterson Elec. Supp. Co., Inc.	502-491-5010
KY	Louisville, Peerless Elec.	502-637-7677
KY	Louisville, E & H Elec.	502-587-0991
MD	Baltimore, Infinity Sys., Inc.	301-358-8500
MD	Baltimore, Wesco	301-327-4300
MD	Salisbury, Wesco	301-742-2193
MN	Minneapolis, Texa Minn Prods.	612-861-2900
MO	St. Louis, United Elec. Supp.	314-771-5555
NE	McCook, American Elec.	308-345-3414
NE	Omaha, West Dodge Elec.	402-393-8071
NH	Manchester, Graybar Elec.	603-624-4341
NJ	Audubon, Universal Elctrns. Supp. Co.	609-547-3430
NJ	Collingswood, Universal Supp.	609-854-2220
NJ	E. Rutherford, A-A Elec.	201-777-5477
NJ	Fairlawn, Relay Specialties	201-797-3313
NY	Long Island, Graybar Elec.	212-392-2000
NY	Maybrook, Air Power House	914-457-3113
NY	Whitestone, Power Electro Supp. Co., Inc.	212-767-1447
NC	Charlotte, Southern Elec. Svc. Co.	704-372-4832
NC	Charlotte, Wesco	704-377-3471
NC	Gastonia, J. M. T. Elec.	704-867-4401
NC	Huntersville, Scott Equip. Co.	704-875-1611
NC	Jacksonville, Rapp Prods.	919-374-1754
OH	Cincinnati, Wesco	513-542-4300
OH	Cleveland, Milner Elec.	216-361-0300
OK	Oklahoma City, Evans Elec. Motor Centers	405-631-1344
OK	Tulsa, Evans Elec. Motor Centers	918-587-1566
OK	Tulsa, Cooper Supp. Co.	918-628-1500
OR	Albany, Pepco	503-926-7755
OR	Bend, North Coast Elec. Co., Inc.	503-382-6211
OR	Coos Bay, North Coast Elec. Co., Inc.	503-267-2145
OR	Coos Bay, Pepco	503-269-5011
OR	Eugene, North Coast Elec. Co., Inc.	503-343-7701
OR	Eugene, Pepco	503-484-7309
OR	Klamath Falls, North Coast Elec. Co., Inc.	503-884-4171
OR	Medford, North Coast Elec. Co., Inc.	503-772-7131
OR	Medford, Pepco	503-779-6311
OR	Portland, North Coast Elec. Co., Inc.	503-228-5111
OR	Portland, Pepco	503-243-7820
OR	Tualatin, North Coast Elec. Co., Inc.	503-620-3910
PA	Bala-Cyn-Wyd, Wesco	215-581-9314
PA	Erie, Wesco	814-454-8191
PA	Johnstown, Wesco	814-536-8761
PA	Monroeville, Wesco	412-325-1300
PA	Philadelphia, Mechanical Specialties, Inc.	215-331-5555
PA	Philadelphia, Wesco	215-238-4500
PA	Pittsburgh, Wesco	412-255-4290
PA	York, Wesco	717-843-0891
SC	Columbia, J. W. Vaughn Co.	803-779-2690
SC	Greenville, Shealy Elctrl. Whlsrs.	803-242-6880
TN	Chattanooga, Specialty Distrbg. Co., Inc.	615-267-9531
TX	Ft. Worth, Swieco, Inc.	817-335-6521
TX	Houston, Commercial Equip.	713-237-8682
TX	Huntsville, Hedco	713-224-4771
TX	Midland, Energy Sys., Inc.	915-694-9657
TX	Waco, Smith Pump Co.	817-776-0377
TX	Wichita Falls, Evans Elec. Motor Centers	817-723-7466
UT	S. Salt Lake, Engineered Control Sys., Inc.	801-487-6226
VT	White River Jct., Arrow Elctrns., Inc.	802-295-3193
VA	Alexandria, Calvert-Jones Co., Inc.	703-370-5850
VA	Chantilly, Engineered Svcs., Inc.	703-471-6310
VA	Danville, Wesco	804-826-6730
VA	Hampton, Wesco	804-826-6730
VA	Lynchburg, Wesco	804-845-0948
VA	Norfolk, Wesco	804-625-7451
VA	Petersburg, Wesco	804-732-1222
VA	Richmond, Wesco	804-353-7353
VA	Roanoke, Wesco	703-344-3271
WA	Kennewick, Pepco	509-586-3168
WA	Longview, North Coast Elec. Co., Inc.	206-423-1550
WA	Moses Lake, Inland Elctrl. Supp. Co.	509-765-1251
WA	Renton, Pepco	206-251-5055
WA	Richland, Wesco	509-783-1397
WA	Spokane, North Coast Elec. Co., Inc.	509-922-1317
WA	Spokane, Power Pump & Elec. Supp.	509-534-5616
WV	Beckley, Wesco	304-252-8633
WV	Bluefield, Wesco	304-325-6151
WV	Bridgeport, Wesco	304-624-6311
WV	Charleston, Wesco	304-768-1293
WV	Parkersburg, Wesco	304-485-6541
WI	Cedarburg, A-A Elec.	414-377-7500
WI	Green Bay, Climatic Control Co., Inc.	414-336-4060
WI	Madison, Climatic Control Co., Inc.	608-273-1717
WI	Milwaukee, Climatic Control Co., Inc.	414-259-9070
WI	Monroe, Precision Drive & Control, Inc.	608-328-5600
WY	Casper, Wesco	307-266-3740
WY	Gillette, Wesco	307-687-0014
Intl	St. Thomas, Power Sys., Inc.	809-776-0217
PR	Bayamon, Jenson Protective Devices	809-798-3264

DIVERSIFIED TECHNLG., P.O. Box 748, Ridgeland, MS 39157, Tel: 601-856-4121, Telex: 585326, TWX: 810-966-2626; Empl.: 65; *Sls. Mgr.:* Bill Long; *Dist. Mgr.:* Bill Long

DIXON INDS., 386 Metacom Ave., Bristol, RI 02809, Tel: 401-253-2000, Telex: 927706

DIXSON INSTRUMENTS

DIXSON, INC., INSTRUMENT DIV., Box 1449, Grand Junction, CO 81502, Tel: 303-242-8863, TWX: 910-929-6991; Empl.: 250; *Sls. Mgr.:* Ray Carlson .... 3•1325

Local Sales Offices & Reps

AL	Birmingham, Sesco-Birmingham	205-988-8304
AZ	Phoenix, Finn-Pat Co. Inc.	602-954-0301
CA	El Segundo, Varigon Assocs.	213-322-1120
CA	Santa Clara, Ross Mktg.	408-988-811
CO	Grand Junction, Dixson Instrs.	303-242-8863
CT	Hamden, Pond Technical Sales	203-281-0005
FL	North Palm Beach, Sesco-Miami	305-832-0770
GA	Atlanta, Sesco-Atlanta	404-458-6423
IL	Bartlett, JJS Mktg. Svcs.	312-830-1670
LA	Baton Rouge, Sesco-Baton Rouge	504-928-4951
ME	W. Buxton, Pond Tech. Sls.	207-637-2200
MA	Waltham, Pond Tech. Sls.	617-890-5535
MI	Swartz Creek, JJS Mktg. Svcs.	313-635-7305
MN	Chanhassen, Elctrn. Instr. Cnslts.	612-445-7056
NY	Mt. Vernon, Sonkin Assocs.	914-668-9809
NY	North Syracuse, Naco Electronics	315-699-2651
NC	Cary, Sesco-Raleigh	918-467-7482
NC	Charlotte, Sesco-Charlotte	704-535-4920
OH	Dayton, Instrmn. Sys. Inc.	513-294-2838
OK	Tulsa, Sesco-Tulsa	918-622-3868
OR	Portland, Instr. Representatives Assoc.	503-245-6103
PA	King of Prusia, FLW of PA, Inc.	215-337-4343
PA	Pittsburgh, Instrmn. Sys. Inc.	412-243-1111
TX	Austin, Sesco-Austin	512-892-2490
TX	Dallas, Sesco-Dallas	214-231-9364
TX	Houston, Sesco-Houston	713-999-3510
WA	Seattle, Instr. Representatives Assoc.	206-762-0707

DMA SYS., 601 Pine St., Goleta, CA 93117, Tel: 805-683-3811; *Sls. Mgr.:* Don M. Minami

DOCUMATION, Box 1240, Melbourne, FL 32901, Tel: 305-725-5500, TWX: 510-959-6286; Empl.: 2800; *Sls. Mgr.:* K. Nelson; *Dist. Mgr.:* D. Carson

D. O. INDUSTRIES, 317 E. Chestnut St., E. Rochester, NY 14445, Tel: 716-385-4920, Telex: 200802; FSC No.: 716-381-7032; *Sls. Mgr.:* Gerard Morio

DOLAN-JENNER INDS., Box 1020, Woburn, MA 01801, Tel: 617-935-7444, Telex: 95-5439, TWX: 710-350-7544; Empl.: 120; *Sls. Mgr.:* S. Futran; *Dist. Mgr.:* S. Futran

DOLCH LOGIC INSTRS., 3052 Orchard Dr., San Jose, CA 95134, Tel: 408-998-5730, TWX: 910-338-2023; *Sls. Mgr.:* Ken Pine

DOLPH, JOHN C., CO., New Rd., Monmouth Junction, NJ 08852, Tel: 201-329-2333; *Sls. Mgr.:* J. E. Rooze

DONGAN ELECTRIC MFG. CO., 2987 Franklin St., Detroit, MI 48207, Tel: 313-964-3500

DONTECH INC., 601-606 Airport Indl. Blvd., Doylestown, PA 18901, Tel: 215-348-5010, Telex: 685 1155 DONTK; *Sls. Mgr.:* John Kinard

DORAN MFG. CO., 2851 Massachusetts Ave., Cincinnati, OH 45225, Tel: 513-681-5424; Empl.: 40; *Sls. Mgr.:* Russ DeMar

DORMAN BOGDONOFF CORP., Corp. Center, Willow Pond, Andover, MA 01810, Tel: 617-470-0001, Telex: 710-347-0333; *Sls. Mgr.:* Charles P. Centore

DORMEYER INDS., 3418 N. Milwaukee, Chicago, IL 60641, Tel: 312-283-4000, TWX: 910-221-3831; Empl.: 900; *Sls. Mgr.:* Larry D. Harney; *Dist. Mgr.:* Lynn Masukevich

DOTRONIX, 160 First St. SE, New Brighton, MN 55112, Tel: 612-633-1742, TWX: 910-563-3541; Empl.: 80; *Sls. Mgr.:* L. R. Lemke

Local Sales Offices & Reps

CA	Gilroy, Dotronix	408-848-2499
CA	Upland, Vidtek	714-985-6030
IL	Arlington Hts., Dotronix	312-577-6105
MA	Burlington, Conti-Younger Assoc.	617-273-1582
MN	New Brighton, Dotronix	612-633-1742
TX	Dallas, MGR	214-238-5246

DOUGLAS ELCTRNS., 718 Marina Blvd., San Leandro, CA 94577, Tel: 415-483-8770

DOUGLAS RANDALL, 6 Pawcatuck Ave., Pawcatuck, CT 02891, Tel: 203-599-2075, Telex: 6814060; Empl.: 125; *Sls. Mgr.:* N. Paulson .... **1B**•1337-1345

Local Sales Offices & Reps

AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Anaheim, Galaxie Sls. Int'l.	714-752-1580
CA	Oakland, Powermatic Assoc.	415-635-6825
CA	San Diego, Qualtronics	619-560-8955
CO	Lakewood, Trembly Assoc.	303-233-9544
CT	Mystic, JMG Inc.	203-572-9448
FL	Maitland, Ellis & Assoc.	305-645-1101
GA	Lilburn, W. A. Stancil	404-923-2416
IL	Chicago, Ropek-Cahill-Vogt	312-631-0070
MD	Oxon Hill, Schoeplein & Co.	301-292-1701
MA	Norwood, JMG, Inc.	617-762-5333
MI	Southfield, Fred H. Gehrke & Assoc.	313-559-5363
MN	Osseo, Gaffney Sls. Co.	612-425-5484
MO	Kansas City, Delltron Co. Inc.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NV	Las Vegas, Trembly Assoc.	702-739-9770
NJ	Morristown, Andrews & Andrews	201-569-8800
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Huntington, Andrews & Andrews	516-692-8686
NY	Rochester, J. G. Welch Assoc.	716-244-1100
NY	Syracuse, C. W. Floring & Assoc.	315-478-2149
NC	Raleigh, Leigh Sls.	919-872-1484
OH	Cleveland, Geotronix Mktg. Assoc.	216-526-2535
OH	Columbus, Geotronix Mktg. Assoc.	614-457-8472
OH	Trotwood, Geotronix, Inc.	513-854-5939
OR	Beaverton, Caruso & Northcutt	503-646-4973
PA	Glenside, Elcom	215-885-1715
TX	Dallas, Paramount Controls	214-341-4561
UT	Salt Lake City, Trembly Assoc.	801-486-5292
WA	Bellevue, Caruso & Northcutt	206-454-9699

Local Distributors

CA	Chatsworth, Mil-Comm Dist.	213-998-3111
CA	S. San Francisco, Steven Engrg.	415-588-9200
MA	Middleboro, Glynn Elect.	617-947-4262
OH	Cleveland, Alpha Corp.	216-526-3716
TX	Houston, Butler & Land	713-464-4662
EXP	Jerusalem, Efraim Ben Yakir	
Intl	London, England, Kynmore Eng.	01-839-2371

DOW CHEMICAL CO., 2020 Dow Center, Midland, MI 48640, Tel: 517-636-1000, Telex: 227455, TWX: 810-266-9490; Empl.: 53,300

DOW CORNING

DOW CORNING CORP., Box 1767, Midland, MI 48640-0994, Tel: 517-496-4000, Telex: 227450, TWX: 810-266-9006; Empl.: 5800 .... **2**•1080, 1081

Local Sales Offices & Reps

CA	Irvine	714-261-0800
CA	Santa Clara	408-988-1177
GA	Atlanta	404-256-2626
IL	Chicago	312-671-3100
MA	Boston	617-965-1010
MI	Detroit	313-553-0400
NJ	Parsippany	201-267-0440
NC	Greensboro	919-275-9708
OH	Beachwood	216-464-2330
TX	Dallas	214-661-0702

Local Distributors

AL	Birmingham, Brownell Electro	205-322-3374
AL	Mobile, Brownell Electro	205-479-5405
AZ	Tempe, K. R. Anderson	602-829-1898; 800-538-8712
CA	Santa Ana, K. R. Anderson Co.	714-549-1343; 800-672-1858
CA	Sunnyvale, K. R. Anderson Co.	408-736-6730; 800-538-8712
CO	Commerce City, Waco Elctrns.	303-289-4743; 800-525-0811
CT	Hartford, Brownell Electro	203-278-9000
FL	Miami, Brownell Electro	305-592-2636
FL	Orlando, Brownell Electro	305-843-6776
GA	Atlanta, Prehler Inc.	404-447-5540
IL	Chicago, Prehler Inc.	312-384-6100; 800-621-4177
MD	Linthicum, Brownell Electro	301-636-3626; 800-492-1734
MA	Woburn, Brownell Electro	617-935-7820
MN	Bloomington, Prehler Inc.	800-621-4177
MO	Bridgeton, Crown Distrbg.	314-731-3001; 816-373-6604
MO	Independence, Crown Distrbg.	816-373-6604; 314-731-3001
NJ	Livingston, Robert McKeown Co.	201-992-0700; 800-631-1125
NM	Albuquerque, Waco Elctrns.	505-268-2409; 800-525-0811
NY	New York, Brownell Electro	212-924-6000
NY	Rochester, Wolcott-Park	716-342-3120
NC	Charlotte, Brownell Electro	704-597-1270
NC	Raleigh, Brownell Electro	919-876-6524
OH	Middleburg Hgts., Prehler Electrical Insul. Co.	216-243-5510
PA	Bridgeville, Brownell Electro	412-221-0074
PA	Trevose, Brownell Electro	215-364-1400
TN	Knoxville, Brownell Electro	615-966-3441
TN	Memphis, Brownell Electro	901-795-8483
TN	Nashville, Brownell Electro	615-885-1302
TX	Dallas, Specialized Prods. Co.	214-358-4663
TX	Houston, Specialized Prod. Co.	713-789-6610
UT	Salt Lake City, Waco Elctrns.	801-485-6511; 800-525-0811
VA	Norfolk, Brownell Electro	804-582-8121
WV	Princeton, Brownell Electro	304-487-1477
WI	Milwaukee, Ellsworth Corp.	414-352-1230

DowKey®
Division of Kilovac Corporation

DOW KEY DIV., KILOVAC CORP., Box 4422-EM, Santa Barbara, CA 93103, Tel: 805-684-4560, TWX: 910-336-1141; FSC No.: 00471; Empl.: 130; *Dist. Mgr.:* Jack Dysart .... **1B**•1346, 1347

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark	602-968-9037
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CA	West Lake Village, Hy-Tech Sls.	213-991-7491
FL	Melbourne, Saber Assocs., Inc.	305-724-0920
IL	Schaumburg, Gassner & Clark	312-882-8608
IA	Cedar Rapids, H. R. Brown Sls. Co.	319-366-0635
MD	Beltsville, Applied Engrg. Consits.	301-792-2211
MA	Lowell, Matrix Sls., Inc.	617-458-2096
MN	St. Paul, De Beck	612-635-4649
MO	Kansas City, EIR Co.	816-452-7030
MO	Kansas City, EIR Co.	816-452-7030
MO	Leasburg, EIR Co.	314-895-4100
NM	Albuquerque, Data Handling	505-884-0284
NY	Cazenovia, S. T. Woolard Co.	315-655-8145
NY	Melville, Metro-Mics	516-433-3333
NY	Rochester, Lamb	716-323-1250
NC	Clayton, Saber Assocs.	305-724-0920
OH	Cincinnati, Delta Sls.	513-271-5444
OK	Tulsa, Norcom, Inc.	918-832-7747
OR	Portland, Components West	503-643-5588
PA	Paoli, Tyler Griffin	215-647-1550
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
WA	Redmond, Components West	206-885-5880

Local Distributors

CA	Los Angeles, Henry Radio	213-820-1234
CA	Sacramento, Zackit	916-446-3131
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement	408-998-5900
CA	Santa Monica, Distr. Specialists	213-393-9666
IN	Indianapolis, Graham Elctrns.	317-634-8202
LA	New Orleans, Southern Radio Supp.	504-524-2343
MD	Rockville, Capitol Radio Wholesalers	301-792-2827; 301-881-2270
MA	Plainville, Teknis, Inc.	617-695-3591
NM	Albuquerque, Walker Radio	505-247-2288
TX	Ft. Worth, Allied Elctrns.	817-336-5401
WI	Milwaukee, Amateur Elctrn. Radio Supp.	414-442-4200

DRACON DIV., See Harris Corp., Dracon Div.

DRAKE, R. L., CO., 540 Richard St., Miamisburg, OH 45342, Tel: 513-866-2421, Telex: 28-8017; *Sls. Mgr.:* M. Brubaker

DRANETZ TECHNOLOGIES, INC., 1000 New Durham Rd., CN-91, Edison, NJ 08818, Tel: 201-287-3680, Telex: 499-7808, TWX: 710-997-9553; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* A. Orlacchio .... **3**•1218

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Scottsdale, Barnhill Assoc.	602-947-7841
CA	Pasadena, Jim Robins & Associates	213-795-9118
CA	Redondo Beach, Ward/Davis Assocs.	213-643-6977
CA	San Diego, Wheelock Associates	619-454-3473
CA	San Diego, Ward/Davis Assocs.	619-292-1000
CA	Santa Clara, Ward/Davis Associates, Inc.	408-245-3700
CO	Englewood, Barnhill Assoc.	303-779-3600
CT	Mount Carmel, Sci. Devices	203-248-9361
FL	Orlando, Datarep	305-843-5224
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Chicago, Memeco Sls. & Svc. Corp.	312-228-9555
IL	Elk Grove Village, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Memeco Sls. & Svc. Corp.	317-356-8098
IN	Indianapolis, Loren Green Assocs.	317-293-9827
KS	Shawnee, Atech	913-268-9644
LA	Baton Rouge, Barnhill Assoc.	504-924-6826
LA	Lafayette, Kemp Instrs.	318-269-9452
MD	Rockville, Elctrn. Mktg. Assocs.	301-881-5300
MA	Waltham, Sci. Devices	617-890-2252
MI	Brighton, Stress Analysis Svcs.	313-632-6110
MI	Farmington, Carter, McCormic & Peirce	313-477-7700
MN	Edina, Carvel Engrg. & Sls. Co.	612-835-7929
MN	Minneapolis, Loren Green Assoc.	612-571-6666
MN	Minneapolis, Arjay Sls.	612-854-4972
MO	Raytown, Power Specialties	816-353-6550
MO	St. Louis, Atech	314-576-2884
NE	Lincoln, Harry Ferris Co.	402-464-6148
NJ	Lodi, SDM Rep.	201-368-0123
NM	Albuquerque, Barnhill Assoc.	505-299-7658
NY	Rochester, SDM Rep.	716-247-8770
NC	Charlotte, Baesel & Assocs.	704-375-1044
OH	Cleveland, Carter, McCormic & Peirce	216-779-5100
OH	Dayton, Stress Analysis Svcs.	513-263-8036
OH	Englewood, Carter, McCormic & Peirce	513-836-0951
OH	Medina, Stress Analysis Svcs.	216-725-7733
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Monroeville, Carter, McCormic & Peirce	412-372-4415
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
PA	Plymouth Meeting, Elctrn. Mktg. Assoc.	215-828-7400
TX	Austin, Barnhill Assoc.	512-451-0217
TX	Houston, Barnhill Assoc.	713-688-9971
TX	Richardson, Barnhill Assoc.	214-231-2573
UT	Murray, Barnhill Assoc.	801-262-3000
WA	Bellevue, Topp Engrg. Sls.	206-747-5400

DRAWN METAL PRODUCTS, 6143 W. Howard St., Niles, IL 60648, Tel: 312-647-8941; Empl.: 60; *Sls. Mgr.:* Tom Amundson

DREEFS SWITCH INC., 3782 Hawthorn Ct., Waukegan, IL 60085, Tel: 312-662-7667, 800-323-9605, Telex: 703784; Empl.: 45; *Sls. Mgr.:* E. L. Magiera; *Dist. Mgr.:* E. L. Magiera .... **1B**•1585-1587

Local Sales Offices & Reps

CA	Costa Mesa, Electro Mech Sls.	714-642-2390
CA	San Diego, Electro Mech Sls.	714-642-2390
CA	Sunnyvale, Schwerin Merrill	408-735-7900
IL	Oak Brook, MSL & Assocs.	312-655-8977
IL	Waukegan, Dreefs Switch Inc.	800-323-9605
MN	Minneapolis, Robert W. Marshall Co.	612-929-0457
MO	Bridgeton, Centech Inc.	314-291-4230
MO	Raytown, Centech Inc.	816-358-8100
NY	Fulton, P. Saftler Assocs.	315-592-7184
NY	Lynbrook, P. Saftler Assocs.	516-593-7880
OH	Cincinnati, Jim Finnegan Co.	513-931-1686
OH	Cleveland, Jim Finnegan Co.	216-238-5905
OH	Toledo, Jim Finnegan Co.	419-865-5306
OR	Portland, Controltek, Sls.	503-641-0877

TX	Austin, Precision Technlg.	512-250-0201
TX	Richardson, Precision Technlg.	214-234-8071
WI	Milwaukee, Badgerep Inc.	414-258-6630

Local Distributors

CA	San Jose, Cypress Elctrns.	408-945-8400; 800-538-5112
CA	Torrance, Cypress Elctrns.	213-530-1900
IL	Wheeling, Hawk Elctrns.	312-459-4030
TX	McKinney, Sun Belt Elctrns.	214-542-1432
Can	Concord, Ontario, Astec Comp.	416-669-4022

DRESSEN-BARNES ELCTRNS., 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 220; *Sls. Mgr.:* B. Guy

DRESSER INDS., 1505 Elm St., Dallas, TX 75201, Tel: 214-746-6000, Telex: 73-2489, TWX: 910-861-4136; Empl.: 55,000

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174, Tel: 312-584-2300, Telex: 720426; Empl.: 700; *Sls. Mgr.:* Jack Hollis; *Dist. Mgr.:* Jack Hollis

DUMONT ELCTRNS., See Thomson-CSF Comps. Corp., DuMont Div.

DUMONT INSTRUMENTATION, INC., 75 Mall Dr., Commack, NY 11725, Tel: 516-864-8500, TWX: 510-226-3739; Empl.: 15,000; *Sls. Mgr.:* H. Poschmann

DUMONT OSCILLOSCOPE LABS., 40 Fairfield Pl., W. Caldwell, NJ 07006, Tel: 201-575-8666, Telex: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* John Carter, Jr.

DUNCAN ELECTRONICS, INC., 2865 Fairview Rd., Costa Mesa, CA 92626, Tel: 714-545-8261, TWX: 910-595-1128; FSC No.: 5905; Empl.: 160; *Sls. Mgr.:* J. Colligan; *Dist. Mgr.:* J. Colligan

DUNEGAN/ENDEVCO, Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-831-9131, Telex: 68-3430; Empl.: 80; *Sls. Mgr.:* B. Toffelmier

DUOTONE, 6875 S.W. 81st St., S. Miami, FL 33143, Tel: 305-665-1121; Empl.: 20; *Sls. Mgr.:* S. Nester; *Dist. Mgr.:* S. G. Nester

DUPONT DE NEMOURS, E. I., & CO., 1007 Market St., Wilmington, DE 19898, Tel: 302-773-3218; Empl.: 130,000

DUPREE, INC., 9835 Dupree St., So. El Monte, CA 91733, Tel: 818-442-4700; Empl.: 60; *Sls. Mgr.:* Beverly Bowdry

DURACELL INTL., S. Broadway, Tarrytown, NY 10591, Tel: 914-591-7000, Telex: 131548, TWX: 710-564-0810; Empl.: 4000

DURAKOOL, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, Telex: 25-8482; Empl.: 200; *Sls. Mgr.:* Darrell Wilk; *Dist. Mgr.:* F. Aitchison

DURALITH, 525 Orange St., Millville, NJ 08332, Tel: 609-825-6900, TWX: 510-687-7520; Empl.: 370

DURGIN & BROWNE, 80 Allen Rd., So. Burlington, VT 05401, Tel: 802-863-6873; Empl.: 35; *Sls. Mgr.:* Chris Riggs

DY-4 SYSTEMS INC., 888 Lady Ellen Pl., Ottawa, ON K1Z 5M1, Canada, Tel: 613-728-3711, Telex: 053-4969; *Sls. Mgr.:* Terry Black

DYLON DATA CORP., 9561 Ridgehaven Ct., San Diego, CA 92123, Tel: 619-292-5584, TWX: 910-335-1524; Empl.: 20; *Sls. Mgr.:* R. A. Comstock; *Dist. Mgr.:* Steve Komarek

DYMA ENGRG., Box 1535, Los Lunas, NM 87031, Tel: 505-865-6700; Empl.: 14

DYNACIRCUITS INC., 11230 W. Addison, Franklin Park, IL 60131, Tel: 312-451-1700; *Sls. Mgr.:* Fred Stein

DYNAGE, INC., CONTROL PRODS GRP., 135 Prestige Park Circle, E. Hartford, CT 06108, Tel: 203-289-6831, TWX: 710-425-6063; Empl.: 40; *Sls. Mgr.:* Sidney C. Oakleaf

DYNAGE, POWER SUPP. GRP., 135 Prestige Park Circle, E. Hartford, CT 06108, Tel: 203-289-6831, TWX: 710-425-6063; Empl.: 40; *Sls. Mgr.:* Sidney C. Oakleaf

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, Telex: 642-033; FSC No.: 27908; Empl.: 19

Local Sales Offices & Reps

CA	Westminster, Contronic Devices	714-897-2266
FL	Ft. Lauderdale, Etchomatic	305-563-5060
MA	Manchester, Lee Thomas Assoc.	617-525-3028
MA	Waltham, Etchomatic	617-893-2020
MN	Minneapolis, International Sls.	612-831-8423

DYNAMIC MEASUREMENTS, 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870, TWX: 710-348-6596; Empl.: 61; *Sls. Mgr.:* Bill Schromm

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, Telex: 69-6171; Empl.: 100; *Sls. Mgr.:* Jim Moore

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 130

DYNAPLEX INC., Interplex, 120-12 28th Ave., Flushing, NY 11354, Tel: 212-961-6750, TWX: 710-582-3048; *Sls. Mgr.:* Lester Zimmerman; *Dist. Mgr.:* Lester Zimmerman

DYNATECH CORP., 1225 E. Wakeham Ave., P.O. Box 1019, Dept. E, Santa Ana, CA 92702, Tel: 714-558-8755, TWX: 910-595-1951; Empl.: 340; *Sls. Mgr.:* Rick Burbank

DYNATEC INTERNATIONAL, 3594 West 1820 South, Salt Lake City, UT 84104, Tel: 801-973-9500, 800-722-7425; *Sls. Mgr.:* Robert Checketts; *Dist. Mgr.:* Robert Checketts

DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, TWX: 297861 DYTX UR; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

DYNISCO, 10 Oceana Way, Norwood, MA 02062, Tel: 617-769-6600, Telex: 092-4347; Empl.: 108

DYSAN CORP., 5201 Patrick Henry Dr., Santa Clara, CA 95050, Tel: 408-988-3472, Telex: 171551 DYSAN SNTA, TWX: 910-338-2144

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, Telex: 96-1454; FSC No.: 72794; Empl.: 100; *Sls. Mgr.:* George R. Davis

EAGLE ELECTRIC MFG. CO., INC., 45-31 Court Sq., L.I.C., NY 11101, Tel: 212-937-8000, Telex: ITTEAGLE 426774; *Sls. Mgr.:* Joseph Mannarino; *Dist. Mgr.:* John Chambers

EAGLE MAGNETIC COMPANY, INC., 7417 Crawfordsville Rd., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, TWX: 810-341-3386; Empl.: 37; *Sls. Mgr.:* Dane Love ....**2**•1905

EAGLE-PICHER INDS., INC., Elctrns. Div., Box 47, Joplin, MO 64801, Tel: 417-623-8000, TWX: 910-774-4508; Empl.: 700

EAGLE SIGNAL CONTROLS, Mfg. Div. Gulf & Western Inds., Box 16100, Austin, TX 78761, Tel: 512-837-8401; Empl.: 600; *Sls. Mgr.:* Don Benice

Local Sales Offices & Reps

CA	La Fayette	415-283-0380
CA	Studio City	213-572-8000
GA	Atlanta	404-996-4511
IL	Downers Grove	312-969-9000
NJ	Saddle Brook	201-368-2270
TX	Arlington	817-265-7790

EALING OPTICS CO., Ealing Corp., 22 Pleasant St., S. Natick, MA 01760, Tel: 617-655-7000, Telex: 948339; *Sls. Mgr.:* Peter Andreas

E & L INSTRUMENTS, INC., 61 First St., Derby, CT 06418, Tel: 203-735-8774, Telex: 963536; Empl.: 46

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, Telex: 96-4347; Empl.: 19; *Sls. Mgr.:* George T. Bracci ....**1B**•1589

Local Sales Offices & Reps

AL	Huntsville, Conley and Assocs.	205-882-0316
AZ	Scottsdale, Luscombe Engrg.	602-949-9333
AR	Little Rock, Beacon Elctrn. Assocs.	501-224-5449
CA	Campbell, Luscombe Engrg.	408-370-2020
CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Luscombe Engrg.	619-295-4300
CO	Denver, Cleveland Entprs. of Colo.	303-751-3252
CT	Farmington, Ray Perron & Co.	203-673-4825
CT	New Milford, Ray Perron and Co.	203-354-2569
FL	Boca Raton, Conley and Assocs.	305-395-6108
FL	Oviedo, Conley and Assocs.	305-365-3283
GA	Atlanta, Conley and Assocs.	404-447-6992
GA	Tampa, Conley and Assocs.	813-885-7658
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Carmel, Brainard-Wilson Mktg.	317-844-2800
KS	Mission, Mertens Co.	918-432-9323
MD	Columbia, Delta 111 Assocs.	301-730-4700
MA	Needham, Ray Perron & Co.	800-225-4280; 617-449-6162
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, OEM Elctrical Sls. Co.	612-559-2448
MO	Clayton, Mertens Co.	314-993-6600
NH	Dover, Ray Perron & Co	603-742-2321
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Rochester, Apex Assocs., Inc.	716-254-6050
NC	Raleigh, Conley and Assocs.	919-876-9862
OH	Mentor, Jay Mktg. Assocs.	216-257-5244
PA	Hatboro, Jacobsen Assoc.	215-674-2937
PA	Pittsburgh, R. W. Kneip	412-823-0169
TN	Johnson City, Beacon Elctrn. Assocs.	615-282-2421
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415
UT	Salt Lake City, Cleveland Entprs. of Colo.	801-355-8424
WA	Lynnwood, Blum & Assocs.	206-775-6656
WI	Milwaukee, Badgerep	414-258-6630

Local Distributors

AL	Huntsville, R.M. Alabama	205-852-1550
AZ	Phoenix, Minarik Electric	602-233-3000
AZ	Tempe, Fisher Brownell	602-967-1464
CA	Alhambra, Fisher Brownell	714-739-2201
CA	Burlingame, Electronic Control Devices	415-348-0791
CA	Gardena, California Switch and Signal	213-770-2330
CA	Los Angeles, Minarik Elec. Co.	213-624-3161
CA	San Diego, Minarik Elec. Co.	619-560-8545
CA	San Diego, Fisher Brownell	619-560-6632
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
CA	Santa Clara, Fisher Brownell	408-988-6041
CA	Van Nuys, Patane Avionics	213-988-4455
CO	Denver, CSID	800-525-3532
CT	Hamden, Impact Sls.	203-281-1331
CT	Shelton, Century Elec. Supp.	203-736-2684
FL	Oviedo, Dixie Sales	305-365-5211
GA	Norcross, Wilshire Elctrns.	404-923-5750
IL	Arlington Hgts., Martec Assoc.	312-956-8090
IL	Lombard, R.M. Illinois	312-932-5150
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, R.M. Indiana	317-247-9701
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	Baton Rouge, Menard Elctrns.	504-355-0323
LA	Jefferson, Gulfside Company	504-733-4481
MA	Canton, Impact Sls. Co.	617-821-1500
MI	Grand Rapids, R.M. Elctrns.	616-531-9300
MI	St. Claire Shores, SPEMCO Switches	313-771-2700
MN	Minneapolis, Electronic Ctr.	612-371-5200
NJ	Cranford, Garden State Elctrns.	201-272-6400
NJ	Roseland, Walker Engrg.	201-226-0855
NY	Buffalo, Summit Distrs.	716-887-2800
NY	New York, Martin Audio/Video	212-541-5900
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rochester, Modutex Corp.	716-424-1620
NY	Woodside, Switches Unlimited	212-478-5000
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Columbus, Electronics Mktg.	614-299-4161
OH	Highland Hgts., Electronic Mktg. Corp.	216-442-3441
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Minarik Elc. Co.	503-253-3402
PA	Harrisburg, Advacom	717-545-5674
PA	McKean, Advacom	814-476-7774
PA	Norristown, Kimberly-James Co.	215-666-7286
PA	Pittsburgh, Grant Industrial Controls	412-787-9770
TX	Dallas, R.M. Dallas	214-235-3100
TX	Garland, Indl. Equip. Co. of Dallas	214-271-5494
TX	Richardson, Fisher Brownell	214-235-3177
TX	San Antonio, Minarik Elec. Co.	512-822-7097
WA	Bellevue, Integrated Elctrns.	206-455-2727
WI	Milwaukee, Marsh Elctrns.	414-475-6000

E-A-R DIV., Cabot Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-872-1111, TWX: 810-341-3412; *Sls. Mgr.:* Richard W. Holub ....**2**•1867

EASCO/K-D TOOLS, 3575 Hempland Rd., Lancaster, PA 17604, Tel: 717-665-4557, Telex: 848429; *Sls. Mgr.:* Mark Lax

EASTERN AIR DEVICES MOTOR DIV., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, TWX: 510-297-4454; Empl.: 200; *Sls. Mgr.:* D. Cooper ....**1B**•1141

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
CA	Buena Park, Sales Engrs. Ltd.	213-921-0681

CA	Los Altos, Servo Data	415-964-1325
CO	Boulder, R. G. Entprs.	303-447-9211
FL	Orlando, Perrott Assoc.	305-275-1132
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
MA	Framingham, Gerald Rosen Co.	617-879-5505
MN	St. Paul, REPCO	612-488-0201
NJ	Ridgefield, Rical Assocs.	201-945-5250
NY	Rochester, Elcom Sls.	716-385-1400
NY	Syracuse, ELCOM Sls.	315-685-8245
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
PA	Paoli, ETC Sales	215-296-3527
TX	Austin, Mech-Tron Mktg.	512-835-0980
TX	Dallas, MECH-TRON Mktg.	214-343-3786
WA	Seattle, Eltech	206-767-4330
WI	Milwaukee, Berndt Assocs.	414-545-8400

EASTERN DELTA CORP., 29-09 S. Broadway, Fair Lawn, NJ 07410, Tel: 201-797-4200; FSC No.: 18105; Empl.: 35

EASTERN ELECTRONICS MFG. CORP., 180 Roberts St., East Hartford, CT 06108, Tel: 203-528-9821; Empl.: 100; *Sls. Mgr.:* T. P. Dunn

EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 516-483-7070, Telex: 968095; Empl.: 8; *Sls. Mgr.:* P. Coburn; *Dist. Mgr.:* L. Sherman

EASTERN MICROWAVE, 4 Gill St., Woburn, MA 01801, Tel: 617-935-8600; FSC No.: 30616; Empl.: 45; *Sls. Mgr.:* S. C. Lowe

EASTERN SMELTING & REFINING CORP., 37-39 Bubier St., Lynn, MA 01901, Tel: 617-599-9000, Telex: 940108; *Sls. Mgr.:* Donald Decareau

EASY HEAT-WIREKRAFT, 555 North Michigan St., Lakeville, IN 46536, Tel: 219-784-3011, Telex: 233159; *Sls. Mgr.:* Russell W. Riddle

Cutler Hammer

AUTHORIZED DISTRIBUTOR

E S I

ELECTRIC SWITCHES

INCORPORATED

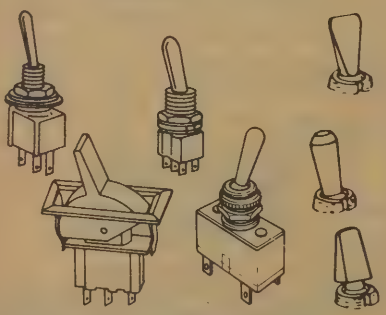
2478 FLETCHER DRIVE

LOS ANGELES, CALIFORNIA 90039

(213) 660-1310

TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640

TWX 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER
SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

EATON CORP., Aerospace Controls/Systems Div., 2074 Whitfield Ave., East, Sarasota, FL 33578, Tel: 813-758-7726

EATON CORP., Microwave Components Div., 680 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-733-3883, TWX: 910-339-9252; FSC No.: 54987; Empl.: 30

Local Sales Offices & Reps

AZ	Tempe, Sierra Technl. Grp.	602-894-2335
CA	Costa Mesa, EBA Microwave	714-857-6079
CA	Sunnyvale, Loeswicks	408-745-6751
FL	Winter Park, Microwave Mktg.	305-678-2141
IA	Cedar Rapids, S & O Sls.	319-393-1845
KS	Merriam, Midwest Tech. Sls.	913-236-8555
ME	Ogunquit, Micronic Assocs.	617-933-2121
MD	Silver Spring, Youth-Nelson Assocs.	301-598-5740
NY	Fayetteville, R. D. Sherman & Co.	315-637-9861
PA	Huntingdon Valley, Rabal Assoc., Inc.	215-947-4825
TX	Dallas, Stevens Sls. Co.	214-350-2476
WA	Seattle, Ecco Mktg.	206-364-0200

EATON CORP., A.I.L. Div., Comac Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 2250; *Sls. Mgr.:* H. N. Kreisberg

EATON CORP., Microwave Comps. Div., 783 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-245-6810, TWX: 910-339-9230; Empl.: 120; *Sls. Mgr.:* J. R. Campbell

Local Sales Offices & Reps

AZ	Tempe, Sierra Tech. Grp.	602-894-2335
CA	Sherman Oaks, Midwin & Olifson	213-996-9093
CA	Sunnyvale, Loeswick	408-745-6751
FL	Winter Park, Microwave Mktg.	305-678-2141
KS	Merriam, Midwest Tech. Sls.	913-236-8557
MD	Silver Spring, Youth-Nelson Assocs.	301-598-5740
MA	Needham Heights, O'Sullivan & Murphy	617-449-4141
NY	Fayetteville, R. D. Sherman & Co.	315-637-9861
NY	Melville, Metro Mics	516-271-6677
OH	Dayton, Ashby Assocs.	513-252-5627
PA	Huntingdon Valley, Rabal Assoc.	215-947-4825
TX	Dallas, Stevens Sls. Co.	214-350-2476

EATON CORP., Durant Digital Instrs., 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, TWX: 910-260-3713; Empl.: 400; *Sls. Mgr.:* H. L. Sisson; *Dist. Mgr.:* Dennis G. Walz

EATON CORP., Elctrn. Instrmn. Div., 2070 Fifth Ave., Ronkonkoma, NY 11779, Tel: 516-588-3600, TWX: 510-228-6507; Empl.: 400

EATON CORP., Printer Prods Oper., Techn. Resch. Pk., Riverton, WY 82501, Tel: 307-856-4821, Telex: 910 949 4864; Empl.: 185; *Sls. Mgr.:* Roger Rayburn

EATON CORP., TEST SYS. DIV., Discrete Test, Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, TWX: 710-456-5030; *Sls. Mgr.:* Chuck Winick

EATON CORP., TEST SYS. DIV., Memory Test Sys., 21135 Erwin St., Woodland Hills, CA 91365, Tel: 213-887-5550, Telex: 69-8489; Empl.: 200; *Sls. Mgr.:* Chuck Winick

EATON CORP, Yig-Tek Prods., 785 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-737-7300, TWX: 910-339-9395; Empl.: 100

EATON

Cutler-Hammer Products

EATON CORP./CUTLER-HAMMER PRODS., Aerospace/Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216, Tel: 414-449-7487, Telex: 26-716; FSC No.: 81640; *Sls. Mgr.:* W. L. Reinke; *Dist. Mgr.:* J. R. McDonough ..1B•1590-1611

Local Sales Offices & Reps

CA	Los Angeles	714-776-1910
CA	San Francisco	415-967-0606
FL	Tampa	813-985-5777
GA	Atlanta	404-939-3023
IL	Chicago	312-530-7980
KS	Kansas City	913-384-0080
MD	Baltimore	301-296-9640
MA	Boston	617-863-5427
MI	Detroit	313-354-7513
MN	Minneapolis	612-831-8668
NY	Melville	516-595-4424
OH	Cleveland	216-835-4554
OH	Dayton	513-294-1877
PA	Philadelphia	215-692-9126
PA	Pittsburgh	412-221-4420
TX	Dallas	214-386-4121
WA	Seattle	206-643-2717
WI	Milwaukee	414-327-7300

Local Distributors

AL	Huntsville, Hamilton-Avnet Elctrns.	800-633-2992
AZ	Phoenix, Dalis Elctrn. Supp.	602-254-8471
AZ	Tempe, Fisher/Brownell	206-967-1464
AZ	Tempe, Hamilton/Avnet	602-894-9600
CA	Campbell, Centrex Elctrns.	408-379-0800
CA	Costa Mesa, Avnet Elctrns.	213-558-2345
CA	Covina, Selecta Switch	213-967-4123
CA	Fountain Valley, Comp. Center	714-979-0433
CA	Glendale, Western Elctrn. Supp.	213-246-4861
CA	Los Angeles, Electric Switch	213-660-1310
CA	Los Angeles, California Switch & Signal	213-770-2330
CA	Los Angeles, Fisher/Brownell	213-289-0255
CA	Los Angeles, Western Electromotive/Shephard	213-820-3777
CA	San Diego, Fisher/Brownell	619-560-8545
CA	San Diego, Hamilton/Avnet	619-571-7500
CA	San Jose, Consolidated Parts	408-263-9521
CA	Santa Ana, Norstan Elctrns. Inc.	714-540-4165
CA	Santa Clara, Western Electromotive	408-727-7411
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Santa Clara, Fisher/Brownell	408-988-6041
CA	Santa Fe Springs, Eurton Elec. Co.	213-946-4477
CA	Sunnyvale, Hamilton-Avnet Elctrns.	408-743-3355
CO	Denver, C.S.I.D. Inc.	303-893-9594
CO	Denver, Con. Parts	303-623-5313
CO	Denver, Newark Elctrns. Corp.	303-757-3351
CO	Englewood, Hamilton/Avnet	303-740-1000
CT	Danbury, Hamilton-Avnet Elctrns.	203-762-0361
CT	New Haven, Hatry Elec.	203-787-5921
CT	Wallingford, Sager Elctrl. Supp. Co.	203-265-4600
CT	West Hartford, Gal Elec. Co.	203-232-9880
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Hamilton-Avnet Elctrns.	305-971-2900
FL	Ft. Lauderdale, Peerless	303-973-4141
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Orlando, Hammond	305-849-6060
FL	St. Petersburg, Hamilton-Avnet Elctrns.	813-576-3930
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Atlanta, Brownell Electro	404-762-5181
GA	Norcross, Hamilton-Avnet Elctrns.	404-447-7500
IL	Addison, LCOMP Chicago	312-628-1400
IL	Chicago, Revere Elec. Supp. Co.	312-738-3636
IL	Chicago, Advent Elctrns.	312-297-6200
IL	Chicago, Steiner	312-685-7000
IL	Chicago, Complete-Reading	312-547-5400
IL	Chicago, Hamilton/Avnet	312-678-6310
IL	Chicago, Ohm	312-359-5500
IL	Chicago, Newark	312-638-4411
IN	Ft. Wayne, Graham Elctrn. Supp.	219-423-3422
IN	Indianapolis, Graham Elctrn. Supp.	317-634-8202
IA	Davenport, Crescent Elec. Supp. Co.	319-323-1811
IA	West Des Moines, Ramco Co.	515-225-6933
KS	Kansas City, Hamilton/Avnet	913-888-8900
KS	Wichita, LCOMP	316-265-8501
KS	Wichita, Airtechnics	316-267-2849
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
LA	Lafayette, Ralph's of Lafayette	318-233-0105
LA	New Orleans, Long Elctrl. Supp. Co.	504-524-8383
MD	Beltsville, Treeko Sls.	301-792-0112
MD	Gaithersburg, Pioneer-Wash	301-948-0710
MD	Kensington, Marine Air	301-949-9560
MA	Boston, Hamilton-Avnet Elctrns.	617-273-7500
MA	Boston, Controller Svc.	617-269-1300
MA	Boston, Sager	617-749-6700
MA	Canton, Impact Sls. Co.	617-821-1500
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Waltham, Sterling Elctrns.	617-894-6200
MI	Detroit, Hamilton-Avnet Elctrns.	313-522-4700
MI	Detroit, R S Elctrns.	313-525-1155
MI	Detroit, Don Blackburn & Co.	313-261-9100
MI	Detroit, Spemco Switches	313-771-2700
MI	Grand Rapids, S-F Elctrns. Supp.	616-459-0216
MN	Minneapolis, H. A. Holden	612-333-5353
MN	Minneapolis, Hamilton/Avnet	612-932-0600
MN	Minneapolis, Boustead	612-544-9131
MN	Minneapolis, Newark	612-331-6350
MN	St. Paul, Ragon Elctrns.	612-642-2852
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
MO	Kansas City, LCOMP	816-221-2400
MO	St. Louis, Hamilton-Avnet Elctrns.	314-340-1200
MO	St. Louis, LCOMP	314-291-6200
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Hackensack, Nassor Elctrl. Supp. Co.	201-641-3737
NJ	Jersey City, Cuny & Guerber	201-653-0222
NJ	Manasquan, Kulka Smith	201-223-9400
NJ	Paterson, Hamilton-Avnet Elctrns.	201-575-3390
NM	Albuquerque, Walker Elctrns. Supp. Co.	505-247-2288

NM	Albuquerque, Hamilton/Avnet	505-765-1500
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit	716-884-3450
NY	Hauppauge, Hamilton-Avnet Elctrns.	516-231-9800
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Lynnbrook, Peerless	516-593-2121
NY	New York, Brownell Electro	212-924-6000
NY	Rochester, Modutex	716-647-9700
NY	Rochester, Hamilton-Avnet Elctrns.	716-475-9130
NY	Rochester, Simcona	716-328-3230
NY	Syracuse, Hamilton-Avnet Elctrns.	206-437-2641
NY	Woodside, Switches Unltd.	212-478-5000
NC	Charlotte, Brownell Electro	704-597-1270
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Hamilton/Avnet	919-829-8030
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, Schuster	513-489-1400
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Cleveland, Hamilton-Avnet Elctrns.	216-831-3500
OH	Cleveland, Complete-Reading	216-267-1000
OH	Cleveland, Roland	216-351-2050
OH	Dayton, Pioneer Standard Elctrns.	513-236-9900
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Dayton, Related Comps.	513-253-6116
OH	Dayton, Hamilton/Avnet	513-433-0610
OH	Warren, REM Elctrns. Supp. Co.	216-373-1300
OK	Oklahoma City, Electro Entprs.	405-427-6591
OK	Oklahoma City, John H. Cole Co.	405-235-1761
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Almac/Stroum	503-641-9070
PA	Altoona, Allegheny Elctrns.	814-946-0871
PA	Braddock, M. Leff Radio Parts Co.	412-351-5000
PA	Erie, Erie Indl.	814-455-8051
PA	Harrisburg, Dauphin Elec.	717-232-4201
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Philadelphia, Peak	215-293-9000
PA	Pittsburgh, Cam/R.P.C.	412-782-3770
PA	Reading, Barbey	215-376-7451
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Chattanooga, Techni-Tronics	615-875-5449
TN	Memphis, Brownell Electro	901-795-8487
TN	Nashville, Electra Distrbg. Co.	615-329-3971
TX	Addison, Computer Comps. Corp.	214-239-0271
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Austin, Hamilton-Avnet Elctrns.	512-837-8911
TX	Dallas, Fisher/Brownell	214-235-3177
TX	Dallas, Associated Aircraft	214-331-4381
TX	Dallas, Southwest Elctrns.	713-234-3050
TX	Dallas, Complete-Reading	214-827-8891
TX	El Paso, Ideal Indl. Elctrns. Sys.	915-779-6647
TX	Ft. Worth, Swieco	817-429-1107
TX	Ft. Worth, Allied	817-336-5401
TX	Houston, Southwest	713-491-4900
TX	Houston, Hamilton/Avnet	713-780-1771
TX	Irving, Hamilton-Avnet Elctrns.	214-659-4100
UT	Salt Lake City, Stuart	801-466-8605
UT	Salt Lake City, Hamilton/Avnet	801-972-2800
VA	Charlottesville, Virginia Radio Supp.	804-296-4184
VA	Richmond, Sterling Elctrns.	804-266-2190
WA	Seattle, Hamilton-Avnet Elctrns.	206-453-5844
WA	Seattle, Almac Elctrns. Corp.	206-643-9992
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	Milwaukee, Standard Elec.	414-272-8100

EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, Telex: 98-5301; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

EBM INDS., INC., 525 New Britain Ave., Unionville, CT 06085, Tel: 203-674-1515, TWX: 710-423-8723; FSC No.: 62292; *Sls. Mgr.:* Edward A. Cyr
....**2**•1255, 1806, 1807

Local Sales Offices & Reps

AL	Huntsville, Raycom	205-859-2017
AZ	Tempe, Argus Sls.	602-968-7791
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CA	Santa Clara, Ross Mktg. Assocs.	408-988-8111
CO	Littleton, Simpson Assocs.	303-794-8381
CT	Cheshire, Selmark Assocs.	203-573-9088
FL	Orlando, Trimark Assocs.	305-859-5504
GA	Fayetteville, Raycom	404-461-4026
IL	Elk Grove, Carlson Elctrn. Sls.	312-956-8240
IN	Indianapolis, J & W Sales	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
KS	Overland Park, Web Elctrns.	913-381-2225
MD	Millersville, Tri-Mark	301-987-9103
MA	Millis, Selmark Assocs.	617-376-2914
MI	Detroit, Burcaw Co.	313-533-7700
MN	St. Paul, Arkco Sls.	612-777-7454
MO	Florissant, Web Elctrns.	314-921-5720
NH	Hopkinton, Selmark Assocs.	603-746-3299
NJ	Marlton, b.g.r. Assocs.	609-983-1020
NJ	Oakland, Robert Horne Assocs.	201-337-5200
NY	Buffalo, Rudell-Merrifield Assocs.	716-634-4300
NC	Raleigh, Raycom	919-847-8276
OH	Chesterland, Depco	216-729-3588
OK	Tulsa, Bonser-Philhower Sls.	918-496-3236
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Harrison City, Rudell-Merrifield Assocs.	412-327-0858
TX	Austin, Bonser-Philhower Sls.	512-346-9186
TX	Dallas, Bonser-Philhower Sls.	214-234-8438
TX	Houston, Bonser-Philhower Sls.	713-531-4144
UT	Midvale, Simpson Assocs.	801-566-3691
WA	Seattle, Earl & Brown Co.	206-284-1121
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790

Local Distributors

AZ	Tempe, GRQ Ltd.	602-968-5932
CA	Fullerton, Pyramid/Fullerton	714-773-0781
CA	Fullerton, Young Sls. Co.	714-871-5355
CA	Hollywood, Yale Elctrns.	213-465-3186
CA	San Diego, Deco Elctrns.	619-693-1595
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Indl. Elctrns.	303-694-9444
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	Hamden, Impact Sls. Co.	203-281-1331
FL	Melbourne, Frankland	305-259-7988
GA	Fayetteville, Frankland	404-461-4026
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MD	Baltimore, Resco/Baltimore	301-823-0070
MD	Beltsville, Resco/D.C.	301-937-9100
MA	Canton, Impact Sls. Co.	617-821-1500
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, S.F. Elctrns.	616-459-0216
MN	Minneapolis, Bergquist	612-835-2322
NJ	Berlin, General Comps.	609-768-6767
NJ	Oakland, Gordon/Horne	201-337-5200
NY	Rochester, Simcona	716-328-3230
NY	Suffern, Nobel Elctrns.	914-357-4500
OH	Akron, Akron Elctrns.	216-762-8818
OH	Dayton, Related Comps.	513-253-6116
PA	Norristown, Century Elctrn. Comp. Co.	215-631-5400
TN	Chattanooga, Techni-Tronics	615-875-5449
TX	Addison, ACT Corp.	214-980-1888
UT	North Salt Lake, Integrated Elctrns.	801-298-1868
WA	Bellevue, Integrated Elctrns./Jaco	206-455-2727
WI	Mequon, Taylor Elec. Co.	414-241-4321

EBY CO., 2751 Southampton Rd., Philadelphia, PA 19154, Tel: 215-969-4200, TWX: 710-670-0452; FSC No.: 72825; Empl.: 150; *Sls. Mgr.:* C. R. Dedera
....**2**•1256, 1257

Local Sales Offices & Reps

AL	Huntsville, Hollingsworth & Still	800-241-5712
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Anaheim, Galaxie Sls. Intl.	714-752-1580
CA	Los Altos, J. W. Wilhoit Co.	415-961-3660
CO	Boulder, R. F. Mayo Assocs.	303-499-2155
GA	Norcross, Hollingsworth & Still	404-447-1700
IL	Chicago, Rendell Sls. Co.	312-528-9025
IN	Ft. Wayne, Given Corp.	219-432-5585
IA	Cedar Rapids, Gassner & Clark	319-393-5763
MD	Glen Burnie, Macrotech Assocs.	301-437-5588
MA	Newton Upper Falls, Anchor Engrg.	617-964-6205
MI	Brighton, Electronic Sources, Inc.	313-227-3598
MN	Edina, Grayden & Flemmer	612-941-1120
MO	Ellisville, Larco Sls., Inc.	314-394-7141
NY	Fairport, Bastian Sls. Agency, Inc.	716-223-0237
NY	Melville, Comtronic Assoc.	516-249-0505
NY	Syracuse, Bastian Sls. Agency, Inc.	325-437-1482
NC	Kernersville, Hollingsworth & Still	800-241-5712
OH	Dayton, J. N. Bailey & Assoc.	513-226-0512
OR	Beaverton, Caruso & Northcutt, Inc.	503-646-4973
PA	Philadelphia, Omni Sls.	215-233-4600
SC	Columbia, Hollingsworth & Still	800-241-5712
TX	Austin, Stevens Sls. Co.	512-250-5104
TX	Dallas, Stevens Sls. Co.	214-350-2476
VA	Gladys, Ralley Entprs., Inc.	804-283-5656
WA	Bellevue, Caruso & Northcutt, Inc.	206-454-9699

Local Distributors

AL	Birmingham, American Elec. Supp. Co.	205-254-3280
AL	Huntsville, Contact Elctrns.	205-881-9321
AL	Mobile, Electronic Supp. Co.	205-478-0455
AZ	Phoenix, Lion Elctrn. Distrs.	602-869-9611
AZ	Tucson, Kachina Elec. Dist. Inc.	602-792-2223
CA	Canoga Park, Afcom	213-703-6161
CA	City of Industry, Ital Elctrn. Sls.	213-968-8515
CA	Irvine, AMC Milliken	714-549-9811
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	San Jose, Afcom	408-263-0660
CA	Santa Ana, Amcotec Elec. Comp. Sales	714-957-3003
DE	Wilmington, A.M. Elctrns.	302-654-9233
FL	Casselberry, Afcom	305-831-6630
FL	W. Palm Beach, Nurmi Elctrn. Supp.	305-686-8553
GA	Atlanta, Specialty Dist. Co. Inc.	404-873-2521
GA	Atlanta, ACK Radio Supp.	404-351-6340
IL	Elk Grove, Afcom	312-228-0760
KY	Bowling Green, Randolph, Hale & Meredith	502-781-1460
KY	Hopkinsville, Randolph & Hale	502-885-5357
KY	Louisville, P.I. Burkes Co.	502-589-3960
MD	Columbia, Aztech Elctrns. Inc.	301-995-1760
MA	Woburn, Afcom	617-935-3200
MI	Grand Rapids, S-F Elctrn. Supp. Co.	616-459-0216
NJ	Clifton, Afcom	201-365-2700
NY	Albany, E.E. Taylor	518-438-7811
NY	Buffalo, Summit Elctrns.	716-887-2833
NY	Jamaica, Eby Sls. Co. of NY	212-291-3232
NY	Long Island City, Hardware Specialty Co.	212-361-9393
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Dayton, Televox, Inc.	513-294-4499
PA	Philadelphia, Spectrum Elctrns. Inc.	215-748-3010
PA	York, Electronic Comps. for Ind.	717-843-8971
SC	Columbia, Dixie Elec.	803-779-5332
TN	Chattanooga, Indl. Elec. Dist. Inc.	615-698-3413
TN	Clarksville, Randolph, Hale & Matthews	615-647-2325
TN	Cookville, Randolph & Parks	615-526-6184
TN	Memphis, Bluff City Distrs.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5602
TN	Tullahoma, Randolph, Rice & Williams	615-455-4531
TX	Dallas, Afcom	214-238-7845
TX	El Paso, Midland Specialty Co.	915-533-9555
VA	Roanoke, Peoples Elctrn. Supp.	703-342-8933

ECD CORP., 196 Broadway, Cambridge, MA 02139, Tel: 617-661-4400, TWX: 710-320-6965; Empl.: 40

ECI COMPANY, Box 1565, Terra Haute, IN 47808, Tel: 812-232-4442; Empl.: 3

ECO INSTRS. DIV., Sea Data Corp., 1 Bridge St., Newton, MA 02158, Tel: 617-964-8360, Telex: 951107; Empl.: 40; *Sls. Mgr.:* Jill Shipman

Local Sales Offices & Reps

CA	Burlingame, BHL Assocs.	415-342-7850
CA	Yorba Linda, Western Analytical Prods.	714-558-7300
CO	Littleton, Hiltech	303-741-2536
GA	Lilburn/Atlanta, Spectrum Sci.	404-921-5235
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Des Plaines, Byron Ellis Assocs.	312-298-7626
MD	Gaithersburg, Renwar Tech.	301-949-9808
MI	W. Bloomfield, Scientific, Pittsburgh	313-851-2390
MS	Vicksburg, Sea Data Corp.	601-634-1110
NM	Albuquerque, Hiltech	505-268-1733
NY	Westbury, Kramer Assocs.	516-334-7181
OH	Cincinnati, Scientific, Pittsburgh	513-825-6994
PA	Paoli, Engleman Engrg.	215-644-8181
PA	Pittsburgh, Scientific, Pittsburgh	412-921-7700
TX	Houston, Sales Tech. Assocs.	713-723-3228
WA	Kirkland, Pelco Sci.	206-823-2290

ECONOMY FUSE, Reliance Electric, 2070 Maple St., Des Plaines, IL 60016, Tel: 312-299-2211, Telex: 726-453; FSC No.: 72076; Empl.: 200

Refer to Federal Pacific Electric Co. for sales office information.

ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford
....**3**•1007

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, Aztec Entprs.	602-944-9185

CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Hayward, FLW Inc.	415-487-2222
CA	San Diego, FLW Inc.	619-277-0993
CA	Van Nuys, FLW Inc.	818-989-5238
CO	Littleton, Aztec Entprs.	303-795-0250
FL	Melbourne, Saber Assocs.	305-724-0920
GA	Griffin, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Baton Rouge, Sesco	504-928-4951
MD	Rockville, Elctrn. Mktg. Assoc.	301-744-7700
MA	Needham, Addelco Corp.	617-444-4754
MI	Royal Oak, Satullo	313-549-3910
MN	Bloomington, Sector Eng. Sls. Inc.	612-888-6920
MO	Maryland Hgts., Ramsey Assocs.	314-878-5042
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	East Syracuse, Ossmann Instrs.	315-437-7052
NY	Plainview, Eastern-Metro Assoc.	516-931-1414
NY	Rochester, Ossmann Instrs.	716-442-6990
NY	Saratoga Springs, Ossmann Instrs.	518-377-8604
NC	Clayton, Saber Assocs.	800-327-0853
OH	Cleveland, Instrmn. Sys.	216-845-8800
OH	Dayton, Instrmn. Sys.	513-294-2838
OK	Tulsa, Sesco	918-622-3868
PA	Pittsburgh, Instrmn. Sys.	412-243-1111
PA	Plymouth Meeting, Elctrn. Mktg. Assoc.	215-828-7400
SC	Columbia, Saber Assoc. Inc.	800-327-0853
TX	Houston, Sesco	713-999-3510
TX	Richardson, Sesco	214-231-9364
UT	Ogden, Aztec Entprs.	801-621-1655
VA	Chesapeake, Elctrn. Mktg. Assoc.	804-482-3318
WA	Seattle, Datacom Assoc. Inc.	206-285-2525
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280

EDAC INC., 20 Railside Rd., Toronto, ON M3A 1A4, Canada, Tel: 416-445-2292, TWX: 610-492-1398; FSC No.: 31781; Empl.: 120; *Sls. Mgr.:* Alan Little; *Dist. Mgr.:* Alan Little ....2•1258-1263

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assocs.	205-837-7363
AZ	Tempe, Cleveland Entprs. of Ariz.	602-802-1127
AR	Dallas, Allied Comps.	214-238-0408
CA	Los Angeles, Universal Comps. Co.	213-641-4255
CA	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
CO	Aurora, Sage Sls.	303-750-3501
CT	Bloomfield, S.I.R. Assocs.	203-243-9343
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, Elctrn. Mktg. Assocs.	404-448-1215
HI	Honolulu, Aloha Assocs.	
ID	Portland, Earl & Brown Co.	503-245-2283
IL	Elk Grove Village, Control Sls.	312-595-2110
IA	West Des Moines, Nevco	515-225-9866
KS	North Kansas City, Nevco	816-421-1751
ME	Bedford, S.I.R. Assocs.	617-275-5550
MD	Woodbine, Naudain Assocs. Southern	301-442-2270
MA	Bedford, S.I.R. Assocs.	617-275-5550
MI	Birmingham, Favco	313-644-0173
MN	Spring Lake Park, Holmgren Assocs.	612-786-7641
MO	North Kansas City, Nevco	816-421-1751
MO	St. Louis, Nevco	314-843-7406
NV	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Manhasset, Win-Cor Elctrn. Sls. Corp.	516-627-9474
NC	Raleigh, Elctrn. Mktg. Assocs.	919-847-8800
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Parkland, Rayco Sls.	215-757-1899
SC	Greenville, Elctrn. Mktg. Assocs.	803-233-4637
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-988-1600
TX	Hurst, Allied Comps.	817-589-0456
TX	Round Rock, Allied Comps.	512-244-1166
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Seattle, Earl & Brown Co.	206-284-1121
WI	Thiensville, Control Sls.	414-242-4580
PR	Puerto Rico, Distributronics	809-843-3321

Local Distributors

AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Heilind Elctrns.	602-243-7171
AZ	Phoenix, Second Source	602-861-1141
AZ	Tempe, Fisher-Brownell	602-967-1464
CA	Alhambra, Fisher-Brownell	213-289-0255
CA	Cerritos, El-Com	213-404-2961
CA	Sacramento, Dunlap Elctrns.	916-444-8070
CA	San Diego, Fisher-Brownell	619-560-8545
CA	San Diego, El-Com	619-578-0900
CA	Santa Clara, Fisher-Brownell	408-988-6041
CA	Santa Clara, El-Com	408-496-0880
CA	Sunnyvale, Time Elctrns.	408-734-9888
CO	Arvada, Denver Wintronics	303-431-7161
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Hamden, Connector Co.	203-288-0044
CT	Wallingford, Midan Elctrns.	203-265-2077
FL	Altamonte Springs, Pioneer Orlando	305-834-9090
FL	Ft. Lauderdale, Pioneer	305-771-7520
GA	Atlanta, Prehler	404-447-5540
IL	Addison, Lectro Comps.	312-543-1680
IL	Chicago, Prehler	312-384-6100
IL	Northbrook, Classic Comps. Supp.	312-272-9650
MD	Beltsville, Treeko Sls.	301-937-8260
MD	Gaithersburg, Pioneer Elctrns.	301-921-0660
MD	Savage, Pyttronic Inds.	301-792-0780
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Waltham, Sterling Elctrns.	617-894-6200
MI	Farmington Hills, Prehler Elctrns.	313-473-7200
MI	Roseville, Madison Elctrns.	313-778-7640
MN	Edina, Inds. Comps.	612-831-2666
MO	Kansas City, L Comp	816-221-2400
MO	Maryland Heights, L Comp	314-291-6200
MO	St. Louis, Time Elctrns./Mid-west	314-391-6444
NH	Hudson, Heilind Elctrns.	603-883-9536
NJ	Dover, Electrospec	201-361-6300
NJ	Old Bridge, BTC Elctrn. Comps.	201-536-8000
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NY	Mount Vernon, Q.A.R. Inds. Elctrn. Sls.	914-699-2224
NY	New York, Peerless Radio Corp.	516-593-2121
NC	Charlotte, Pioneer/Carolina Elctrns.	704-527-8188
OH	Cincinnati, Schuster Elec. Co.	513-984-1600
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Beaverton, Almac Elctrns. Corp.	503-641-9070
OR	Salem, Zepher Elctrn. Sls.	503-399-8503
PA	Allentown, P. A. Peters	215-434-5237
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Harrisburg, Pyttronic Inds.	717-236-8001
PA	Horsham, Pioneer Elctrns.	215-674-4000
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Willow Grove, Resco Elctrns.	215-659-4440
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Dallas, Heilind Elctrns.	214-351-2050
TX	El Paso, International Elctrns.	915-598-3406
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Elctrn. Packaging Comps.	713-447-5800
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Richardson, Fisher-Brownell	214-235-3177
TX	Stafford, Southwest Elctrns.	713-491-4900
UT	Salt Lake City, Diplomat Elctrns.	801-486-7227
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Almac Elctrns. Corp.	206-643-9992
WA	Seattle, Zepher Elctrn. Sls.	206-241-1980
WI	New Berlin, R. M. Wisconsin	414-784-4420
WI	New Berlin, Classic Comps. Supp.	414-786-5300

EDL INC., 385 Oser Ave., Hauppauge, NY 11787, Tel: 516-435-2808, 800-DIAL EDL, 800 342-5335; Empl.: 50; *Sls. Mgr.:* Don Polsky

EDMAC CORP., 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750, Tel: 716-924-4000, TWX: 510-254-2896; Empl.: 170; *Sls. Mgr.:* Shera Banbury

EDO CORP./ELINCO DIV., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861, Telex: 96-5945; FSC No.: 73693; Empl.: 87

Local Sales Offices & Reps

CA	Buena Park, Rock Assocs.	714-521-6980
CA	Campbell, R & D Assocs.	408-866-6358
CO	Denver, High Plains Mktg.	303-751-7150
FL	Sarasota, H.G.L. Assocs.	813-923-2484
MA	Lexington, John E. Boeing Co.	617-862-2500
MO	St. Louis, Schutz Assocs.	314-962-2622
NY	Liverpool, Jones/Sudders	315-598-3838
NC	Charlotte, Robert W. Chapman & Co.	704-525-2421
OH	Chagrin Falls, K. F. Nauerz Co.	216-338-8450
PA	Birchrunville, Jadelectronic Assocs.	215-296-3800
TX	Lewisville, Jim Hughes Co.	214-221-1536
TX	Stafford, Jim Hughes Co.	713-343-0673

EDO WESTERN CORP., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115, Tel: 801-486-7481/7481/3846, Telex: 388-315; Empl.: 360; *Sls. Mgr.:* Doug Moore

EDWARDS CO., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06032, Tel: 203-678-0410; *Sls. Mgr.:* Al Canevari; *Dist. Mgr.:* Al Canevari

EECO INCORPORATED, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, Tel: 714-835-6000, Telex: 67-8420, TWX: 910-595-1550; Empl.: 625; *Sls. Mgr.:* Frank Bruder; *Dist. Mgr.:* Ken Plount ....**1B**•1612-1615

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Thom Luke Sls.	602-941-1901
AR	Fort Smith, Electra Reps.	501-452-4030
CA	Fountain Valley, Bager Elctrns.	714-957-3367
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, Harvey King Inc.	619-566-5252
CO	Denver, Delltron Co.	303-373-0300
CT	Farmington, Ray Perron & Co.	203-673-4825
CT	New Milford, Ray Perron & Co.	203-354-2569
FL	Pompano Beach, Ema, Inc.	305-943-3732
FL	Winter Park, EMA, Inc.	305-671-6800
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Elk Grove Village, John G. Twist Co.	312-593-0200
IN	Fort Wayne, M/S Sls. & Assoc.	219-484-1904
IA	Cedar Rapids, Palatine Sls.	319-365-8071
KS	Mission, Palatine Sls.	913-831-0555
MD	Rockville, EMA (Elctrn. Mktg. Assts.)	301-881-5300
MA	Needham, Ray Perron & Co.	617-449-6162
MI	Livonia, Lowell Wendt Mktg.	313-464-2722
MN	Bloomington, Elctrn. Sls. Agecy.	612-884-8291
MO	Hazelwood, Palatine Sls.	314-839-0800
NH	Dover, Ray Perron & Co.	603-742-2321
NJ	Englewood, Tecnimat	201-569-4200
NY	Endicott, Tech-Mark, Inc.	607-748-7473
NY	Mendon, Techmark, Inc.	716-624-3840
NY	Utica, Techmark, Inc.	315-733-0575
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc. (Engr. Mktg. Assts.)	513-433-2800
OR	Beaverton, Blair Hirsh Co.	503-641-1875
PA	Plymouth Meeting, EMA (Elctrn. Mktg. Assts.)	215-248-5050
TX	Dallas, Electra Reps. Inc.	214-387-3594
TX	Houston, Electra Reps. Inc.	713-530-2208
UT	Salt Lake City, Delltron Co.	801-268-4574
WA	Lynnwood, Blair Hirsh Co.	206-774-8151
WI	Brookfield, John G. Twist Co.	414-782-2670

Local Distributors

AL	Huntsville, Hallmark Elctrn.	205-837-8700
AZ	Tempe, Fisher-Brownell	602-967-1464
AZ	Tempe, Marshall Ind.	602-968-6181
AZ	Tucson, Marshall Inds.	602-790-5687
CA	Alhambra, Fisher Brownell	213-289-0255
CA	Canoga Park, Marshall Ind.	213-999-5001
CA	El Monte, Marshall Ind.	213-442-7204
CA	Irvine, Marshall Ind.	714-556-6400
CA	San Diego, Fisher Brownell	714-560-8545
CA	San Diego, Marshall Ind.	619-578-9600
CA	Santa Clara, Fisher Brownell	408-988-6041
CA	Sunnyvale, Time Electronics	408-734-9888
CA	Sunnyvale, Marshall Ind.	408-732-1100
CO	Denver, Marshall Ind.	303-427-1818
CO	Englewood, Hallmark Electronics	303-694-1662
CT	Wallingford, Sager Electrical Supply Co.	203-265-4600
CT	Wallingford, Marshall Ind.	203-265-3822
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
FL	Orlando, Marshall Ind.	305-841-1878
FL	Orlando, Hall-Mark	305-855-4020
GA	Atlanta, Marshall Inds.	404-923-5750
GA	Norcross, Hallmark Electronics	404-447-8000
IL	Bensenville, Hall-Mark	312-860-3800
IL	Schaumburg, Marshall Ind.	312-490-0155
KS	Lenexa, Hall-Mark	913-888-4747
MD	Baltimore, Hall-Mark	301-796-9300
MD	Gaithersburg, G.S. Marshall	301-840-9450
MA	Burlington, Marshall Ind.	617-272-8200
MA	Hingham, Sager Supply	617-749-6700
MI	Livonia, LWC Distributors	313-464-7700
MN	Bloomington, Hall-Mark Elctrn.	612-854-3223
MN	Plymouth, Marshall Ind.	612-559-2211
MO	Maryland Heights, Hall-Mark Elctrn.	314-291-5350
NJ	Cherry Hill, Hall-Mark Elctrn.	609-424-7300
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Mount Laurel, Marshall Inds.	215-627-1920
NM	Albuquerque, Int'l Elctrns.	505-345-8127
NY	Buffalo, Summit Distributors, Inc.	716-887-2800
NY	Endwell, Marshall Ind.	607-754-1570
NY	Hauppauge, Marshall Ind.	516-273-2424
NY	Lynbrook, L.I., Peerless Radio Corp.	516-593-2121
NY	Rochester, Marshall Ind.	716-235-7620
NC	Raleigh, Hall-Mark Elctrn.	919-872-0712
OH	Dayton, Marshall Ind.	513-236-8088
OH	Solon, Hall-Mark Elctrns.	216-473-2907
OH	Westerville, Hallmark Electronics	614-891-4555

OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
OR	Beaverton, Almac/Electronics Corp.	503-641-9070
TX	Austin, Hall-Mark Ind.	512-258-8848
TX	Dallas, Hall-Mark Ind.	214-341-1147
TX	Dallas, Marshall Ind.	214-233-5200
TX	El Paso, Int'l Elctrns.	915-598-3406
TX	Houston, Hall-Mark Ind.	713-781-6100
TX	Houston, Marshall Ind.	713-789-6600
TX	Richardson, Fisher Brownell	214-235-3177
WA	Bellevue, Almac/Stroum	206-643-9992
WA	Bellevue, Marshall Ind.	206-747-9100
WA	Spokane, Almac/Stroum	509-838-5714
WI	Oak Creek, Hall-Mark Ind.	414-761-3000

EEMCO DIV., 4585 Electronics Pl., Los Angeles, CA 90039, Tel: 213-247-7060, TWX: 910-497-2269; FSC No.: 72121; Empl.: 350; *Sls. Mgr.:* D. Haymond; *Dist. Mgr.:* D. Haymond

EEV INC., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-6050, Telex: 6818096; Empl.: 36; *Sls. Mgr.:* Tom Soldano

EFRATOM, a division of Ball Corp., 18851 Bardeen Ave, Irvine, CA 92715, Tel: 714-752-2891, Telex: 68-5635; Empl.: 105 .... **1A**•1350

Local Sales Offices & Reps

CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CA	Los Angeles, Cain Technlg.	213-477-9054
FL	Sarasota, Bass Assocs.	813-922-9538
MA	Natick, Wayland Engrg. Sls.	617-655-6080
NJ	Pennsauken, Sci. Reps.	609-662-5222
NY	Huntington, CDB Entprs.	516-692-5200
TX	Houston, Sci. Devices	713-864-1711
TX	Richardson, Sci. Devices	214-231-8106
VA	Fairfax, Sci. Assoc.	703-385-0600

EG&G, INC., Electro-Optics Div., 35 Congress St., Salem, MA 01970, Tel: 617-745-3200, TWX: 710-347-6741; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG & G ALMOND INSTRUMENTS, 1330 E. Cypress St., Covina, CA 91724, Tel: 818-967-9521, TWX: 910-584-1320; Empl.: 200; *Sls. Mgr.:* J. D. Cardall .... **3**•1550, 1551

Local Sales Offices & Reps

FL	Orlando, Truex Assocs.	305-859-2160
TX	Garland, Tesco	214-681-1376

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, Telex: 697938; *Sls. Mgr.:* George Unangst

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94086, Tel: 408-734-4616, Telex: 357435; FSC No.: 34314; *Sls. Mgr.:* Ross Johnson; *Dist. Mgr.:* Fritz Faber

EG&G RETICON, Div. of EG&G, 345 Potrero Ave., Sunnyvale, CA 94086-9930, Tel: 408-738-4266, Telex: 910-339-9343; *Sls. Mgr.:* Alex Findlay

EG&G ROTRON

EG & G ROTRON, Commercial Div., Shokan, NY 12481, Tel: 914-657-6661, TWX: 510-247-9033; *Sls. Mgr.:* Michael Keating; *Dist. Mgr.:* Ralph Stevens .... **2**•1800, 1808-1813

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
CA	Anaheim, Westrep	213-404-3881
CA	Chatsworth, Rotron Sls.	213-709-2133
CA	San Diego, Hadden Assoc.	619-565-9444
CA	Santa Clara, Westrep	408-988-8833
CO	Littleton, Lange Sls.	303-795-3600
FL	Apopka, G. Bohman	305-886-1882
HI	Honolulu, R. Clark	808-531-5897
IL	Elk Grove Village, EG&G Rotron	312-364-7050
IL	Rolling Meadows, Sumer	312-991-8500
IA	Cedar Rapids, S & O Sls.	319-393-1845
KS	Raytown, CenTech	816-358-8100
MD	Columbia, L. D. Lowery	215-356-5300
MA	Lexington, Circuit Sls.	617-861-0567
MI	Farmington, W. R. Hummon & Assoc.	313-474-0661
MN	Mendota Heights, G-11 Sales	612-454-3086
MO	Earth City, CenTech	314-291-4230
MO	Raytown, CenTech	816-358-8100
NJ	Springfield, F. Sylvester	201-376-3324
NY	Woodstock, Rotron (Commercial Div.)	914-679-2401
NC	Charlotte, Over & Over	704-527-3070
OH	Cincinnati, F. J. Campisano	513-574-7111
OH	Cleveland, Comp., Inc.	216-243-9200
OK	Oklahoma City, Ammon & Rizos	405-942-2552
PA	Columbia, L. D. Lowery	215-356-5300
TX	Dallas, Ammon & Rizos	214-233-5591
TX	Houston, Ammon & Rizos	713-781-6240
UT	Salt Lake City, Lange Sls.	801-487-0843
WA	Lynnwood, Blum & Assocs.	206-775-6656
EXP	NY, Great Neck, A. Auriema	516-487-0700

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Cetec Elctrns.	602-272-7951
AZ	Phoenix, R. V. Weatherford	602-272-7144
CA	Anaheim, R. V. Weatherford	714-547-0891
CA	El Segundo, Hall Mark Elctrns.	213-643-9101
CA	Glendale, R. V. Weatherford	213-849-3451
CA	Pomona, R. V. Weatherford	714-623-1261
CA	San Diego, Cetec Elctrns.	714-278-5020
CA	San Diego, R. V. Weatherford	714-695-1700
CA	San Jose, Cetec Elctrns.	408-263-7373
CA	Southgate, Cetec Elctrns.	213-773-6521
CA	Sunnyvale, R. V. Weatherford	408-738-8694
CA	Tustin, Hall Mark Elctrns.	714-669-0681
CO	Denver, Arrow Elctrns.	303-758-2100
CO	Denver, R. V. Weatherford	303-428-6900
CT	Norwalk, Pioneer	203-853-1515
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
FL	Palm Bay, Arrow Elctrns.	305-725-1480
GA	Norcross, Arrow Elctrns.	404-449-8252
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
IL	Bensenville, Hall-Mark Elctrns.	312-860-3800
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, Pioneer/Indiana	317-849-7300
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MA	Lexington, Pioneer	617-861-9200
MA	Woburn, Hall Mark Elctrns.	617-935-9777
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	Livonia, RS Elctrns.	313-525-1155
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, I.C.I.	612-831-2666
MO	Maryland Hts., Hall-Mark Elctrns.	314-291-5350
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Marlton, Arrow Elctrns.	609-596-8000
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NJ	Pinebrook, Pioneer	201-227-1267
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Buffalo, Summit Elctrns.	716-884-3450
NY	Fairport, Pioneer	716-381-7070
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Ronkonkoma, Hall Mark Elctrns.	516-737-0600
NY	Vestal, Pioneer	607-748-8211
NY	Woodbury, Pioneer	516-921-8700
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Solon, Arrow Elctrns.	216-248-3990
OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
PA	Marlton, Arrow Elctrns.	609-596-8000
PA	Pennsauken, Resco Elctrns.	609-662-4000
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Houston, Pioneer/Houston	713-988-5555
TX	Houston, Hall-Mark Elctrns.	713-781-6100
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Arrow Elctrns.	206-643-4800
WA	Seattle, R. V. Weatherford	206-575-1340
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Oak Creek, Hall-Mark Elctrns.	414-761-3000
WI	Oak Creek, Arrow Elctrns.	414-764-6600

EG & G ROTRON, Custom Div., Hasbrouck La., Woodstock, NY 12498, Tel: 914-679-5201, TWX: 510-247-9033; FSC No.: 82877; *Sls. Mgr.:* Mike Lyon; *Dist. Mgr.:* Andy Kozak .... **2**•1814, 1815

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Tucson, Morrow & Assocs.	602-296-4719
CA	Garden Grove, Custom Div. Dist. Sls. Off.	714-898-5649
CA	San Diego, Hadden Assocs.	619-565-9444
CO	Littleton, Lange Sls., Inc.	303-795-3600
DE	Ft. Lauderdale, G. F. Bohman & Assocs.	305-979-0008
FL	Apopka, G. F. Bohman & Assocs.	305-886-1882
FL	St. Petersburg, G. F. Bohman & Assocs.	813-522-6120
GA	Norcross, Over & Over, Inc.	404-449-6205
HI	Honolulu, Roger Clark Co.	808-531-5897
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Ft. Wayne, Frank J. Campisano Co.	219-747-2633
IN	Indianapolis, Frank J. Campisano Co.	317-253-7651
IA	Cedar Rapids, S & O Sales Co.	319-393-1845
MD	Towson, Custom Div. Dist. Sls. Off.	301-377-5195
MA	Lexington, Circuit Sls. Co.	617-861-0567
MI	Farmington Hills, W. R. Hummon & Assocs., Inc.	313-474-0661
MN	Mendota Heights, G-II Sales, Inc.	612-454-3086
MO	Bridgeton, Centech, Inc.	314-291-4230
MO	Raytown, Centech, Inc.	816-358-8100
NJ	Neshanic Stat, Dustom Div. Dist. Sls. Off.	201-369-5354
NY	Corona, Dustom Div. Dist. Sls. Off.	212-271-5287
NC	Charlotte, Over & Over, Inc.	704-527-3070
NC	Raleigh, Over & Over, Inc.	919-872-2262
OH	Cincinnati, Frank J. Campisano Co.	513-574-7111
OH	Cleveland, Components, Inc.	216-243-9200
OH	Cleveland, Frank J. Campisano Co.	216-749-5550
OH	Columbus, Frank J. Campisano Co.	614-876-5405
OK	Oklahoma City, Ammon & Rizos Co.	405-942-2552
PA	Coraopolis, Frank J. Campisano Co.	412-264-5151
PA	Pittsburgh, Comps., Inc.	412-824-1600
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Dallas, Ammon & Rizos Co.	214-233-5591
TX	Houston, Ammon & Rizos Co.	713-781-6240
UT	Salt Lake City, Lange Sls., Inc.	801-487-0843
WA	Lynnwood, Blum & Assocs.	206-775-6656
WI	Brookfield, Sumer, Inc.	414-784-6641

EG & G TORQUE SYSTEMS, 36 Arlington St., Watertown, MA 02172, Tel: 617-924-6000, Telex: 95-1736; Empl.: 200; *Sls. Mgr.:* W. F. O'Leary; *Dist. Mgr.:* H. D. Waddell

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley .... **1B**•1253

EG&G WAKEFIELD ENGRG., 60 Audubon Rd., Wakefield, MA 01880, Tel: 617-245-5900, TWX: 710-348-6713; Empl.: 240; *Sls. Mgr.:* Ray A. Radford; *Dist. Mgr.:* Carl Swanson

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-882-9182
AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Anaheim, West Rep	213-404-3881
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, Mesa Elctrns.	714-278-8021
CO	Longmont, Piper Sls. Co.	303-443-5337
CT	Stamford, Circuit Sls.	203-322-0240
FL	Orlando, Over & Over Inc.	305-857-4057
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IA	Cedar Rapids, S & O Sls. Co.	319-393-1845
MD	Columbia, Bresson Assocs.	215-664-6460
MA	Lexington, Circuit Sls.	617-861-0567
MI	Livonia, Luebbe Sls.	313-477-3130
MN	Mendota Heights, G-II Sls.	612-454-3086
MO	Raytown, Cen Tech, Inc.	816-358-8100
NY	Commack, ERA, Inc.	516-543-0510
NY	E. Rochester, Tri Tech Elctrns.	716-385-6500
NY	Fayetteville, Tri Tech Elctrns.	315-446-2881
NC	Charlotte, Over & Over, Inc.	704-527-3070
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	215-333-0426
OK	Oklahoma City, Ammon & Rizos Co.	405-942-2552
OR	Portland, SDR^2 Prods. & Sls.	503-641-7377
PA	Narbeth, Bresson Assocs.	215-664-6460
TN	Johnson City, Over & Over, Inc.	615-477-7700
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
UT	Salt Lake City, Piper Sls. Co.	801-268-8707
VA	Lynchburg, Bresson, Assocs.	215-664-6460
WA	Bellevue, SDR^2 Prods. & Sls.	206-624-2621
WI	Brookfield, Sumer, Inc.	414-784-6641

E-H ELECTRONICS, Sub. E-H Intl., Inc., 7303 Edgewater Dr., Oakland, CA 94621, Tel: 415-638-5656, TWX: 910-366-7258; FSC No.: 13488; Empl.: 99; *Sls. Mgr.:* Nicholai T. Zavadsky

EHRHORN TECHNOLOGICAL OPERS., INC., P.O. Box 888, Canon City, CO 81212, Tel: 303-275-1613; *Sls. Mgr.:* Ray Heaton

EIGEN VIDEO, P.O. Box 848, Nevada City, CA 95959, Tel: 916-272-3461, Telex: 298788 EIG UR; FSC No.: 59535; Empl.: 50

EIKONIX CORP., 23 Crosby Dr., Bedford, MA 01730, Tel: 617-275-5070

Local Sales Offices & Reps

CA	Sunnyvale, Hap Baldwin	408-737-9172
FL	Singer Island, Robert Hanright	305-845-7252
NJ	Trenton, Lester Stine	609-883-4860
NY	Brooklyn, John Milby	212-284-8588
PA	Morristown, George Striker	215-539-5411
TX	Richardson, George Tallman	214-680-2728

EIP MICROWAVE INC., 2731 North First St., San Jose, CA 95134, Tel: 408-946-5700, TWX: 910-338-0155; FSC No.: 34257; Empl.: 250; *Sls. Mgr.:* Robert Loft, West Reg. Mgr.;Bill Dentinger, East Reg. Mgr.

EITEL MFG., 2835 Laguna Canyon Rd., Laguna Beach, CA 92652, Tel: 714-494-2012; Empl.: 6; *Sls. Mgr.:* H. Mengel

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, TWX: 910-997-0649; *Sls. Mgr.:* Jerry Zis .... **1A**•1653

Local Sales Offices & Reps

AZ	Scottsdale, Tusar	602-998-3688
CA	Los Altos, Elrepco, Inc.	415-962-0660
CA	Woodland Hills, Interstate Mktg.	213-883-7606
CO	Englewood, Thorson Rocky Mountain	303-779-0666
CT	Wallingford, Com-Sale	203-269-7964
IL	Arlington Heights, Micro Sales, Inc.	312-956-1000
IN	Fort Wayne, Giesting & Assoc.	219-486-1912
IN	Indianapolis, Giesting & Assoc.	317-271-5183
IA	Hiawatha, Gassner & Clark	319-393-5763
MD	Baltimore, Stemler Assocs.	301-944-8262
MA	Needham, Com-Sale	617-444-8071
MI	Coloma, Giesting & Assocs.	616-468-4200
MI	Novi, Giesting & Assocs.	313-348-3811
MN	Bloomington, High Tech Sls.	612-888-8088
MO	Grandview, R. R. Burton & Assoc.	816-763-5385
MO	Maryland Heights, R. R. Burton & Assoc.	314-434-1678
NH	Exeter, Com-Sale	603-772-3300
NJ	Cherry Hill, Stemler Assocs.	609-966-4070
NJ	Parsippany, HLM Assocs.	201-263-1535
NM	Albuquerque, Tusar	505-293-1399
NY	Northport, HLM Assocs.	516-757-1606
OH	Cincinnati, Giesting & Assocs.	513-521-8800
OH	Dayton, Giesting & Assocs.	513-293-4044
OH	Mentor, Giesting & Assocs.	216-942-3407
OR	Oloha, Micro Sales, Inc.	503-642-1818
PA	Bensalem, Stemler Assocs.	215-638-4850
PA	Pittsburgh, Giesting & Assocs.	412-963-0727
TX	Austin, Sundance Sls.	512-250-0320
TX	Houston, Sundance Sls.	713-772-4988
TX	Plano, Sundance Sls.	214-867-0592
UT	West Valley City, Thorson Rocky Mountain	801-973-7969
WA	Bellevue, Micro Sales, Inc.	206-451-0568
WI	Brookfield, Micro Sales, Inc.	414-782-1171

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, TWX: 510-691-3117; Empl.: 500; *Sls. Mgr.:* J. J. Smith; *Dist. Mgr.:* John J. Galiney, Jr.

ELCO CORP., Interconnect Systems Div., 2250 Park Pl., El Segundo, CA 90245, Tel: 213-675-3311; *Sls. Mgr.:* T. Tuttle

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100

Local Sales Offices & Reps

CA	Anaheim, Magna-Code, Inc.	714-821-7500
MA	Newton Highlands, Butler Assocs., Inc.	617-965-1080

ELCOM SYSTEMS, INC., 4032 Clint Moore Rd., Boca Raton, FL 33431, Tel: 305-994-1774; FSC No.: 32424; Empl.: 5; *Sls. Mgr.:* D. Pollachek

ELDEC CORP., Monitor & Control Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98036, Tel: 206-743-1313, Telex: 32-8959, TWX: 910-449-2855

ELDEC CORP., Power Conversion Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98036, Tel: 206-743-1313, Telex: 32-8959, TWX: 910-449-2855

ELDEC CORP., Sensing Systems Div., 18009 Hwy. 99, P.O. Box 5110, Lynnwood, WA 98036, Tel: 206-771-7350, Telex: 32-8959, TWX: 910-449-0873

ELDORADO INSTRS., 7303 Edgewater Dr., Oakland, CA 94621, Tel: 415-638-5656, TWX: 910-366-7258; FSC No.: 54495; *Sls. Mgr.:* Paul Magnusson

ELDRE COMPS., 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-244-2570, TWX: 510-253-4347; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* Harvey Erdle

ELECTRAC, INC., 1614 Orangethrope Way, Anaheim, CA 92801, Tel: 714-879-6021, Telex: 692433; FSC No.: 016154; Empl.: 21

ELECTRICAL INDS., 691 Central Ave., Murray Hill, NJ 07974, Tel: 201-464-3200, TWX: 701-984-7979; FSC No.: 20093; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTR. SVC., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590; Empl.: 35 .... **3**•1296-1298

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CO	Commerce City, Williams Assocs.	303-289-5647
DC	Washington, Whitcomb Assocs.	202-737-0763
IL	Lincolnwood, Saffro & Assocs.	312-677-9720
KS	Shawnee Mission, Comtel - Midwest	913-722-1030
MD	Baltimore, Whitcomb Assocs.	301-889-1245
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Comtel - Midwest	314-991-5363
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Dayton, Comtel Instrs. Co.	513-298-7573
OH	Hilliard, Comtel Instrs. Co.	614-876-8305
OK	Tulsa, Data Mktg. Assocs.	918-496-1457
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
UT	Salt Lake City, Williams-Assocs.	801-532-7701
WI	Lake Mills, Saffro & Assocs.	414-648-2605

ELECTRICAL PLASTICS CORP., 500 Long Branch Ave., Long Branch, NJ 07740, Tel: 201-870-9500; Empl.: 50

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224; Empl.: 6

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-3060

ELECTRIC FIELD MEASUREMENTS, Box 326, W. Stockbridge, MA 01266, Tel: 413-637-1929; Empl.: 3; *Sls. Mgr.:* L. Hegi

Distributor

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim .... **1B**•1616, 1617; pgs. 605, 616, 630, 634, 638, 652, 658, 667, 679, 681, 683, 703, 716, 717, 727, 734, 741, 756, 773, 778

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-SA6-7723, Telex: 83-1475; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTROCHEM INDS., Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-6901, Telex: 91-386; FSC No.: 6U589; *Sls. Mgr.:* R. Carey; *Dist. Mgr.:* L. Hanitz, M. Brookman

ELECTROCOM INDS., 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

EC
ELECTRO-CRAFT CORPORATION

ELECTRO-CRAFT, 1600 2nd St. So., Hopkins, MN 55343, Tel: 612-931-2700, TWX: 910-576-3132; Empl.: 500; *Sls. Mgr.:* Don Larson ...... **1B**•1143-1145

Local Sales Offices & Reps

CA	Long Beach, Matzinger-Keegan	213-434-5794
CA	Westlake Village, Electro-Craft	213-889-3631
CO	Boulder, Electro-Craft	303-447-2754
FL	Altamonte Springs, WMM Assocs.	305-831-4530
FL	Clearwater, WMM Assocs.	813-442-3913
FL	Ft. Lauderdale, WMM Assocs.	305-772-9850
GA	Atlanta, Electro-Craft	404-452-7253
IL	Chicago, Electro-Craft Corp.	312-298-0687
IN	Indianapolis, Electro-Craft	317-872-0013
MA	Salem, Electro-Craft	603-893-5552
MN	Minneapolis, Electro-Craft	612-931-2700
NJ	Cherry Hill, Electro-Craft	609-662-0555
NJ	Monmouth Junction, Electro-Craft	201-329-6233
NY	Rochester, Ross Equip.	716-271-5660
OH	Cleveland, Electro-Craft	216-526-3995
TX	Dallas, Electro-Craft	214-980-1948
WA	Bellevue, Sweo Engrg.	206-451-0558

Local Distributors

CA	San Jose, Republic Supp.	408-279-2202
CA	San Leandro, Republic Supply, Power Transmission Div.	415-357-2211
IN	Indianapolis, B&B Motor & Control	317-248-0396
MA	Medford, Empire Electrical Co.	617-395-5000
NY	New York, B & B Motor & Control	212-966-5777
NY	Rochester, B&B Motor & Control	716-473-6640
Can	Ottawa, Ont., Electrodesign Ltd.	613-745-0541
Can	Toronto, Ont., Electrodesign Ltd.	416-787-0991
Can	LaSalle, Electrodesign Ltd.	514-636-4838
Intl.	England, Cricklewood, London, Unimatic Engineers Ltd.	01-455-0012
Intl.	Finland, Helsinki, Stig Wahlstrom OY	90-5577 x51
Intl.	France, E.R.N.	956.00.11
Intl.	Holland, Rotterdam, Van Gelder Compagnie B.V.	010-156622
Intl.	India, Hyderabad, Kashinath & Co.	36942
Intl.	Israel, Yizreel, Elex Control Sys.	065-94036
Intl.	Italy, Milano, Pamoco S.r.l.	02-800982-804615
Intl.	Japan, Tokyo 104, Midoriya Electric Co.	03-561-8851
Intl.	Spain, Barcelona, Robbins & Myers Espana S.A.	34-38934200
Intl.	Sweden, Johanneshov, L. Ostergren El.	08-815013
Intl.	W. Germany, Darmstadt, Eduard Bautz G.m.b.H.	06151/82973

ELECTROCUBE, 1710 So. Del Mar Ave., San Gabriel, CA 91776, Tel: 818-573-3300, TWX: 910-589-1609; FSC No.: 14752; Empl.: 175; *Sls. Mgr.:* E. F. Bryant; *Dist. Mgr.:* E. F. Bryant

Local Distributors

CA	Chatsworth, Mil-Comm Distrs.	213-998-3111
CA	San Diego, Mock III Sls.	619-560-0515
CA	Sunnyvale, Acacia Sls.	408-745-7200
CO	Lakewood, Acacia Sls.	303-232-2882
IL	Elk Grove Village, Nu-Way Elctrns.	312-437-7120
OH	Englewood, Argent Inds.	513-836-8633
OH	Solon, Repco, Inc.	216-248-8900
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166

ELECTRO DESIGN SYS., 100 W. 35th St., Ste. S, National City, CA 92050, Tel: 619-420-2351, Telex: 182827; Empl.: 35

ELECTRODYNAMICS

ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 312-259-0740, Telex: 28-1070; FSC No.: 10236; Empl.: 250; *Sls. Mgr.:* Frank Rafferty .... **3**•1129

Local Sales Offices & Reps

CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Hayward, Avionics Liaison	415-783-1131

CO	Denver, West, Inc.	303-692-0131
FL	Clearwater, Delmac Sls.	813-447-5192
FL	Orlando, Delmac Sls.	305-898-4688
FL	Tamarac, Delmac Sls.	305-726-1330
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
MD	Severna, Delmarva Engrg. Assocs., Ltd.	301-647-8007
MA	Winchester, FJS Assocs.	617-729-3135
MN	New Brighton, TWC Sls.	612-636-1770
MO	Maryland Hgts., Midwest Meridian Corp.	314-878-4441
NY	Binghamton, Noeth Honsinger Assocs.	607-724-4865
NY	Pittsford, Noeth Honsinger Assocs.	716-586-9002
OR	Portland, Caruso & Northcutt	503-646-4973
PA	King of Prussia, Rivco January Inc.	215-265-5211
TX	Hurst, Midwest Meridian	817-654-2132
UT	Salt Lake City, Meridian West	801-968-4177
WA	Bothwell, Caruso & Northcutt	206-454-9699

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027, Tel: 206-392-2493; *Sls. Mgr.:* W. A. Pommer

ELECTROFILM, 27727 Avenue Scott, Valencia, CA 91355, Tel: 805-257-2240, Telex: 65-1438; FSC No.: 85932; Empl.: 250; *Sls. Mgr.:* George Hulett

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150, TWX: 710-382-0405; Empl.: 72; *Sls. Mgr.:* Frank Urrico .... **1A**•1870, 1871

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
FL	W. Melbourne, Great Southern Rep. Co.	305-724-4510
GA	Doraville, BCI, Inc.	404-455-0405
IL	Hinsdale, Willtech Corp.	312-655-4850
IN	Indianapolis, CC Electronics	317-255-1508
MA	Allston, Vector Sls.	617-787-2790
MI	Livonia, Electro Sls. Assocs.	313-474-7320
MN	Minneapolis, Comprehensive Tech. Sls.	612-888-7011
NM	Albuquerque, Grady Moore Assocs.	505-262-1416
NY	Kew Gardens, Robert Smith Assocs.	212-780-0097
NY	New York, Robert Smith Assocs.	212-541-4885
NY	Plainview, Robert Smith Assocs.	516-681-3155
NY	Syracuse, Labtronics	315-455-7314
NC	Charlotte, BCI, Inc.	704-567-0473
NC	Raleigh, BCI, Inc.	919-781-9426
OH	Cleveland, Electro Sls. Assocs.	216-261-5440
OH	Dayton, Electro Sls. Assocs.	513-426-5551
PA	Allison Park, Electro Sls. Assocs.	412-487-3801
PA	Oreland, EFW Tech. Sls.	215-887-5300
TX	Austin, J. Clay Co.	512-346-7340
TX	Dallas, J. Clay Co.	214-350-1281
TX	Houston, Elctrn. Mktg. Assocs.	713-498-8120
WA	Seattle, MARS	206-747-3292
EXP	MA, Plainville, Teknis, Inc.	617-695-3591

ELECTRO IMPULSE, Box 870, Red Bank, NJ 07701-0870, Tel: 201-741-0404, TWX: 710-722-5717; FSC No.: 91161; Empl.: 99; *Sls. Mgr.:* Mark Rubin .... **2**•1817; **3**•1220

Local Sales Offices & Reps

CA	Los Angeles, RDH Assocs.	213-396-4100
MA	Reading, Geder Assocs.	617-944-3105
NY	Greenvale, B. D. Aaron & Co.	516-621-0630
TX	Richardson, Spectra Sls. Corp.	214-234-3600
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200

Local Distributors

CA	Los Angeles, RDH Assocs.	213-396-4100
MA	Reading, Geder Assocs.	617-944-3105
NJ	Oradell, Sylvan Ginsbury	201-261-3200
NY	Greenvale, Bertram D. Aaron & Co.	516-621-0630
TX	Richardson, Spectra Sls.	214-234-3600

ELECTRO INDUSTRIES, Div. E.I. Elctrns. Inc., 316 Westbury Ave., Carle Place, NY 11514, Tel: 516-334-0870; Empl.: 20; *Sls. Mgr.:* S. Kagan .... **3**•1328, 1329

For further information call toll free: 800-645-6342

ELECTRO KINETICS CO., Sub. HTL Inds., Inc., 402 E. Gutierrez St., Santa Barbara, CA 93102, Tel: 805-963-2055, TWX: 910-334-1177; FSC No.: 02101; Empl.: 260; *Sls. Mgr.:* N.G. Otis

ELECTROL

ELEC-TROL, INC., 26477 N. Golden Valley Rd., Saugus, CA 91350, Tel: 805-252-8330, Telex: 18-1151; FSC No.: 15636; Empl.: 650; *Sls. Mgr.:* Frank Cooper; *Dist. Mgr.:* Barbara J. Owens .... **1B**•1352-1362

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Assocs.	205-881-5031
AZ	Scottsdale, TC Electronics	602-944-5153
AR	Little Rock, Beacon Elctrn. Assocs.	501-224-5449
CA	Garden Grove, Elsco	714-891-4621
CA	San Jose, Jeff Mallman	408-972-9072
CO	Denver, Elcom	303-337-2300
FL	Clearwater, Beacon Elctrn. Assocs.	813-796-2378
FL	Ft. Lauderdale, Beacon Elctrn. Assocs.	305-491-1054
FL	Maitland, Beacon Elctrn. Assocs.	305-647-3498
FL	Melbourne, Beacon Elctrn. Assocs.	305-724-8010
GA	Atlanta, Beacon Elctrn. Assocs.	404-256-9640
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
IN	Granger, Gregory Sls.	219-272-9626
MA	Framingham, Stone Comps.	617-875-3266
MN	Minneapolis, Westlund & Assoc.	612-866-5002
NY	Clark Mills, KLM-Garner Co.	315-853-6126
NY	Mt. Vernon, Sonkin Assocs.	914-668-9809
NY	North Syracuse, KLM-Garner Co.	315-458-6214
NY	Pittsford, KLM-Garner Co.	716-381-8350
NC	Greensboro, Beacon Elctrn. Assocs.	919-275-9997
OH	Columbus, Mulligan & Assoc.	614-457-2242
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Birchrunville, Jadelectronics	215-296-3800
TN	Johnson City, Beacon Elctrn. Assocs.	615-282-2421
TX	Houston, Aid Elctrns.	713-955-6204
TX	Irving, Aid Elctrns.	214-259-4761
UT	Salt Lake City, Elcom	801-532-7940
WA	Seattle, Earl & Brown Co.	206-284-1121
WI	Waukesha, Lincoln, Hodges & Assocs.	414-542-3087

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
AZ	Tempe, Acacia Sls.	602-894-2874
CA	Anaheim, Arrow Elctrns.	714-774-5290
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Irvine, Acacia Sls.	714-549-0954
CA	San Carlos, Control Design	415-592-4806
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Diego, Acacia Sls.	619-565-4365
CA	Santa Clara, Patane/Selectronics	408-496-6151
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Sunnyvale, Acacia Sls.	408-745-7200
CA	Van Nuys, Patane Avionics	213-988-4455
CO	Denver, Arrow Elctrns.	303-758-2100
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Clearwater, Diplomat Elctrns.	813-443-4514
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
FL	Palm Bay, Arrow Elctrns.	305-725-1480
IL	Bensenville, Diplomat Elctrns.	312-595-1000
IL	Itasca, Voyager Elctrns.	312-773-4900
IN	Indianapolis, Arrow Elctrns.	317-243-9353
MA	Framingham, Jaks Elctrns.	617-875-3266
MA	Holliston, Diplomat Elctrns.	617-429-4121
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	East Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fairlawn, Relay Specialties	201-797-3313
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NJ	Saddle Brook, Arrow Elctrns.	201-797-5800
NY	Farmingdale, Arrow Elctrns.	516-293-6363
NY	Farmingdale, Arrow Elctrns.	516-694-6800
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Mount Vernon, Kin-Tronics	914-668-9885
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Solon, Repco	216-248-8900
OR	Beaverton, Acacia Sls.	503-646-3377
OR	Portland, Radar Elec. Co.	503-232-3404
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Philadelphia, Shap Elctrns.	215-969-3300
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Houston, Solid State Elctrns. Co. of Tex.	713-772-8510
TX	Irving, Solid State Elctrns. Co. of Tex.	214-438-5700
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Diplomat Elctrns.	801-486-4134
WA	Bellevue, Arrow Elctrns.	206-643-4800
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Oak Creek, Arrow Elctrns.	414-764-6600

ELECTROL CO., 321 Dewey St., P.O. Box 29, York, PA 17405, Tel: 717-848-1722; Empl.: 38; *Sls. Mgr.:* Debra Dudley; *Dist. Mgr.:* Debra Dudley

ELECTROMAGNETIC INDUSTRIES, INC., Box 6440, Clearwater, FL 33518, Tel: 813-447-2511

ELECTRO-MAGNETIC PROCESSES, INC., 9616 Owensmouth Ave., Chatsworth, CA 91311, Tel: 818-882-6333, Telex: 499 2240 EMP UI; FSC No.: 51290; Empl.: 35; *Sls. Mgr.:* Arthur Sullivan

ELECTRO MATERIALS CORP. AMER., See EMCA, Sub. Rohm & Haas Advanced Matls. Co.

ELECTROMATIC COMPS. LTD., 1531 Burgundy Pkwy., Streamwood, IL 60103, Tel: 312-837-4600, TWX: 910-222-3452; FSC No.: 75203; Empl.: 280; *Sls. Mgr.:* Robert Martin

ELECTROMECH, INC., 528 Elm Street, Kearney, NJ 07032, Tel: 201-997-0950; Empl.: 40; *Sls. Mgr.:* Solomon Ezraseneh

ELECTRO MECHANICAL DESIGN SERVICES, INC., 16698 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710; *Sls. Mgr.:* Patrick E. Roney .... **3**•1221

ELECTRO-MECHANICS CO., Box 1546, Austin, TX 78767, Tel: 512-835-4684, Telex: 767178; Empl.: 15

WE BUILD THEM ALL

From micro-miniature audio inputs to 5KVA control units

From power to audio to high frequency inverter units

From ferros to mag-amps to AC and DC current transformers

Because at Electromech we believe...

It takes all kinds

Electromech inc.

528 ELM STREET
KEARNY, NEW JERSEY 07032
(201) 997-0950

ELECTRO-MECHANISMS, 2745 E. Huntington Dr., Duarte, CA 91010, Tel: 818-359-2535; FSC No.: 52592; Empl.: 27 .... **1B**•1486, 1487

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assoc.	818-445-9729
CA	Redwood City, Hickey Indl. Sls.	415-368-3849
CA	San Diego, Van Gott & Assocs.	619-286-3633
CO	Lakewood, Cristee-Meade Co.	303-232-0287
FL	Ft. Meyers, Rainbow Sls., Inc.	813-332-2210
IL	Addison, Engrd. Sls. Co.	312-832-8425
MD	Baltimore, R. P. Luce	301-752-8200
MN	St. Paul, Vikeland Sls., Inc.	612-645-4647
NJ	Piscataway, R. P. Luce	201-752-8750
NY	Buffalo, Good Comps.	716-634-4400
NY	New Hyde Park, R. P. Luce	516-437-4550
NC	Raleigh, G. P. O'Malley & Assoc., Ltd.	919-848-9865
OH	Dayton, Harvey Teplitz	513-898-4330
PA	Philadelphia, R. P. Luce & Co.	215-233-0999
TX	Dallas, Marcom	214-351-4532
WA	Vancouver, Ray Over Sls.	206-695-6179

ELECTRO-MECH COMPS., 1826 N. Floradale Ave., So. El Monte, CA 91733, Tel: 818-442-7180; FSC No.: 07150; Empl.: 75; *Sls. Mgr.:* Walter H. Trumbull; *Dist. Mgr.:* Margaret W. Ambrose .... **1B**•1618, 1619

Local Sales Offices & Reps

CA	Los Angeles, Universal Comps. Co.	213-641-4255
CA	San Diego, Qualtronics	619-560-8955
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Englewood, Franklin Sls.	303-789-2526
CT	Milford, Todino Engrg.	203-874-6643
FL	Orlando, Publicover	305-898-9361
ID	Boise, Doran Sls. Assocs.	208-343-9969
IL	Chicago, Indl. Rep.	312-647-7755
IN	Fort Wayne, Scott Elctrns.	219-484-7865
IN	Indianapolis, Scott Elctrns.	317-897-9976
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Southfield, Component Assocs.	313-557-3232
MN	Bloomington, D. A. Case Associates	612-888-8666
NJ	Medford, Comp. Conslts.	609-654-5300
NY	Mamaroneck, Bassin Tech.	914-698-9332
NY	Vestal, SHR	717-967-2607
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
OR	Forest Grove, Doran Sls.	503-357-3333
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Richardson, McCoy Assocs.	214-238-1017
WA	Redmond, Doran Sls.	206-885-1885
WI	Milwaukee, Indl. Rep.	414-259-0965

electro-mech
LIGHTED PUSH BUTTON
SWITCH PRODUCTS

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

Ask about electro-mech's
CLARE-PENDAR
EQUIVALENTS

TOLL FREE
(Outside N.Y.)
800/431-2625

Local Distributors

AZ	Phoenix, Parts Elctrn.	602-258-6476
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Los Angeles, Elec. Distr.	213-660-1310
CA	Pomona, Western Intl.	714-629-3315
CA	Tustin, Western Stitches & Controls	714-731-4333
FL	Ft. Lauderdale, Powell Elctrns.	305-972-4300
FL	Pompano Beach, Components South	305-971-0350
NY	Buffalo, Genesee Radio & Parts	716-873-9661
NY	Mamaroneck, Logi Comp Elctrns.	914-698-9332
Intl	England, Kensington, London, G.E. Elctrns.	01-727 0711/3
Intl	Israel, Holon, M.S.R. Engrg. & Dev.	847686
Intl	Switzerland, Oberengstringen, G & P Elctrns.	(01)643231/644555

ELECTRO-METRICS, 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798; FSC No.: 18581; Empl.: 105; *Sls. Mgr.:* David Cook

ELECTRO NATL., Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, TWX: 810-990-0938; FSC No.: M-54208; Empl.: 40

ELECTRON, INC., P.O. Box 28640, San Diego, CA 92128, Tel: 216-681-4700, Telex: 98-0240; Empl.: 85

ELECTRONIC ARRAYS, 550 E. Middlefield Rd., Mtn. View, CA 94043, Tel: 415-964-4321, TWX: 910-379-6985; Empl.: 450; *Sls. Mgr.:* Ed Neubauer

ELECTRONIC COIL CORP., 347 New Britain Ave., Plainville, CT 06062, Tel: 203-747-1213; Empl.: 85

ELECTRONIC COMPONENTS GROUPE, 26 N. 5th St., Minneapolis, MN 55403, Tel: 612-375-0011, TWX: 910-576-1725; *Sls. Mgr.:* Herman Sinn; *Dist. Mgr.:* Bill Magnuson .... **1B**•1621

Local Sales Offices & Reps

AZ	Phoenix, Eltron	602-266-2164
CA	Brea, Masco	714-529-0867
CA	Cupertino, F & F Assoc.	408-446-2349
CA	Los Angeles, Masco	213-295-7781
CO	Aurora, Mountain View Mktg.	303-699-1665
FL	Ft. Lauderdale, Beacon Elec.	305-491-1054
IL	Downers Grove, Richmar Elec.	312-968-0118
IN	Indianapolis, Insul-Reps	317-842-5203
MA	Newton Upper Falls, A & M Elect.	617-444-8170
MI	Brighton, A. P. Assoc.	313-229-6550
MN	Minneapolis, Comps. Representative Groupe	612-894-8055
MO	Kansas City, Delltron Co.	816-436-6445
MO	St. Louis, Delltron Co. Inc.	314-869-4779
NY	Great Neck, MOS	516-487-3966
OH	Dublin, AP Assoc.	614-766-1855
OH	Fairview Park, A. P. Assoc.	216-356-2424
OK	Tulsa, Southern States Mktg.	918-665-8338
OR	Aloha, Electronic Comp. Sls.	503-245-2342
PA	Ambler, Dalbrook Corp.	215-441-8380
TX	Austin, Southern States Mktg.	512-473-2741
TX	Houston, Southern States Mktg.	713-558-4900
TX	Richardsón, Southern States Mktg.	214-238-7500
UT	Salt Lake City, Mountain View Mktg.	801-264-8488
VA	Falls Church, Beacon Elec.	703-534-7200
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301
WI	Milwaukee, Richmar Elec.	312-968-0118

Local Distributors

CA	Hollywood, Yale Radio	213-465-3186
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	Riverside, Electronic Supp.	714-683-7300
CA	San Carlos, Logan Elect.	415-594-0700
FL	Ft. Laud., KSM Elect.	305-971-5900
IL	Chicago, UPCO Dist.	312-631-1122,
MD	Beltsville, PSI	301-937-4960
MD	Columbia, D. K. Electronics	301-995-1950
MN	Mpls., Glenmark, Inc.	612-941-4825
WA	Seattle, Radar Elect.	509-747-3053

ELECTRONIC CONCEPTS, INC., Box 627 E, Eatontown, NJ 07724, Tel: 201-542-7880, Telex: 7107226661; Empl.: 215; *Sls. Mgr.:* Philip N. Lepore .... **1A**•1065-1068

Local Sales Offices & Reps

CA	Colton, Elctrn. Concepts, Inc.	714-824-2525
CA	La Mirada, Select Elctrns.	714-739-8891
CA	Los Gatos, Elctrn. Concepts, Inc.	408-395-4224
CO	Aurora, Sage Sls.	303-750-3501
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MA	Methuen, Elctrn. Concepts, Inc.	617-689-8318
MN	Minneapolis, Components Grp.	612-374-1250
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200, 212-586-8440
OR	Portland, Components West	503-643-5588
OR	St. Louis, Harris-Hanson Co.	816-763-6200
TX	Austin, Milred Assocs., Inc.	512-258-2828
TX	Houston, Milred Assocs., Inc.	713-937-0127
TX	Richardson, Milred Assocs., Inc.	214-644-6731
VT	Salt Lake City, Sage Sls.	801-467-5451
WA	Seattle, Components West	206-885-5880

Local Distributors

IL	Chicago, Nep Elctrns.	312-625-8400
NJ	Teterboro, Elcon Sls.	201-288-8170
TX	Dallas, R. V. Weatherford	214-931-7333
TX	Houston, R. V. Weatherford	713-688-7406
WI	New Berlin, Nep Elctrns.	414-785-9100

ELECTRONIC CONTROLS, INC., 561 Tamarack Ave., Brea, CA 92621, Tel: 714-990-0850; Empl.: 9

ELECTRONIC CONTROLS DESIGN, 13626 S. Freeman Rd., Mulino, OR 97042, Tel: 503-829-9108. Telex: 70-3874 ECDINC; *Sls. Mgr.:* Rex Breunsbach

ELECTRONIC CONVENTIONS, INC., P.O. Box 92275, Worldway Postal Ctr., Los Angeles, CA 90009. Tel: 213-772-2965; *Sls. Mgr.:* William C. Weber, Gen. Mgr.

ELECTRONIC DEV. CORP., 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, Telex: 951596 (ELECDEVCO BSN); FSC No.: 12619; *Sls. Mgr.:* Robert B. Ross .... **3**•1223-1225

Local Sales Offices & Reps

AL	Huntsville, MOCO	205-881-5968
AZ	Phoenix, R. A. Mayes Co.	602-279-5243
CA	Costa Mesa, Feeger, Lucas, Wolf	714-751-7512
CA	Hayward, Feeger, Lucas, Wolf	415-487-2222
CA	San Diego, Feeger, Lucas, Wolf	619-277-0993
CA	Van Nuys, Feeger, Lucas, Wolf	213-989-5237
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Winter Haven, Lee Assocs.	813-294-5815
IL	Hoffman Estates, Carvel Engrg.	312-885-8800
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assts.	913-649-6996
MD	Bethesda, Powell-Pendergraph	301-656-4535
MA	Hudson, Datarep	617-481-0333
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Edina, Carvel Engrg. & Sls.	612-835-7929
MO	St. Louis, Ramsey Assocs.	314-878-5042
NM	Albuquerque, R. A. Mayes Co.	505-292-2330
NY	E. Syracuse, Ossmann Instrs.	315-437-7052
NY	Rochester, Ossmann Instrs.	716-442-6990
NY	Saratoga Springs, Ossmann Instrs.	518-377-8604
NY	White Plains, Cane Techn. Sls.	914-694-9240
NC	Raleigh, Lee Assocs.	919-848-8818
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Willow Grove, Powell-Pendergraph	215-657-0330
TX	Dallas, Tech Rep Mktg.	214-241-2434
TX	El Paso, R. A. Mayes Co.	Enterprise 750
TX	Kemah, Hi Tech Systems	713-783-3856
UT	West Jordan, R. A. Mayes Co.	801-292-6781
VT	Burlington, Data Reps.	802-864-0933
VA	Richmond, Powell-Pendergraph	804-270-1400
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	New Berlin, Carvel Engrg.	414-784-7007

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELCTRN. DEVICES, 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TWX: 710-560-0021; Empl.: 200; *Sls. Mgr.:* Dennis Dean; *Dist. Mgr.:* Dennis Dean

ELECTRONIC ENCLOSURES, Div. Wyle Labs, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 213-643-8181, TWX: 910-348-6699; FSC No.: 09097; Empl.: 400; *Sls. Mgr.:* Richard W. Bow

ELECTRONIC ENGRG. CO. OF CAL., See EECO

ELECTRONIC HARDWARE, 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950; Empl.: 100

EI&S

ELECTRONIC INSTR. & SPECIALTY CORP., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-5300, Telex: 948-025; FSC No.: 14908; Empl.: 180 ......1B•1364, 1365

Local Sales Offices & Reps

AL	Huntsville, REMCO (Raken Engr. of Mktg. Corp.)	205-533-3763
AL	Huntsville, JWL Assocs.	205-881-0413
AZ	Phoenix, Anderson Co.	602-266-2070
CA	Escondido, Cirolia Elctrn. Sls. Inc.	619-489-2452
CA	Granada Hills, C & W Comps.	213-368-4032
CA	San Diego, Cirolia Elctrn. Sls.	619-743-3015
CA	San Jose, G. R. McKnight Co.	408-942-0880
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Lighthouse Point, Jack Krutek & Assocs.	305-941-6544
GA	Atlanta, REMCO (Raker Engr. of Mktg. Corp.)	404-447-6937
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Carmel, Brainard-Wilson Mktg.	317-844-2800
MD	Woodbine, Naudain Assocs.-Southern	301-442-2270
MA	Stoneham, E I & S	617-438-5300
MI	Oak Park, A. Blumenberg Assocs., Inc.	313-968-3230
MN	Minneapolis, Peterson Sls. & Assocs.	612-944-0030
NJ	Perth Amboy, Astrorep	201-826-8050/51
NY	Babylon, Astrorep	516-422-2500
NY	Fairport, NET Sales	716-467-4538
NC	Charlotte, JWL Assocs.	704-523-3001
OH	Rocky River, Norm Case Assocs.	216-333-0400
OR	Portland, SPS Elctrns.	503-297-6919
PA	King of Prussia, R J I, Inc.	215-265-5211
PA	Norristown, Rivco-January Inc.	215-631-1414
TX	Dallas, P. J. Scanlon Co. Inc.	214-231-4661
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
WA	Redmond, SPS Elctrns.	206-323-4140
WA	Seattle, SPS Elctrns.	206-323-4140
WI	Waukesha, Brainard-Wilson Mktg.	414-547-2285

Local Distributors

CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Clara, Cypress Elctrns.	408-727-7080
CA	Torrance, Cypress Elctrns.	215-530-1900
CT	New Haven, The Greene-Shaw Co.	203-397-0710
MD	Columbia, DK Elctrns.	301-995-1950
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Newton, The Greene-Shaw Co.	617-969-8900
MN	Minneapolis, The Joel Co.	612-545-5669
NJ	Fairlawn, Relay Specialties	201-797-3313
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Troy, Trojan Elctrn. Supp. Co.	518-274-4481
OK	Tulsa, Radio, Inc.	918-587-9123
TX	Houston, Gaumer Co.	713-460-5200

ELCTRN. INSTR. & SPEC. CORP., MC DIV., See Millen Comps.

ELECTRONIC KITS INTL., INC., 791 Redrock Rd., St. George, UT 84770, Tel: 801-628-3627; *Sls. Mgr.:* Gary Gibson; *Dist. Mgr.:* Charles Meinkey

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 201-922-9300, Telex: 132-424; Empl.: 250; *Sls. Mgr.:* C. Roney ...3•1552, 1553

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices	205-536-1969
AZ	Phoenix, Sci. Devices	602-957-0401
CA	Los Alamitos, Sci. Devices	213-598-7678
CA	San Diego, Sci. Devices	619-279-6642
CA	San Jose, Sci. Devices	408-554-0455
CO	Boulder, Sci. Devices	303-449-9466
FL	Orlando, Sci. Devices	305-841-8180
GA	Marietta, Sci. Devices	404-427-8660
IL	Chicago, Comtel	312-539-4838
IN	Indianapolis, Comtel	317-253-1681
IA	Cedar Rapids, Comtel	319-377-9434
KS	Mission, Palatine Engrg. & Sls.	913-831-0555
MD	Pikesville, Imagitron Sls. Co.	301-521-2020
MA	Winchester, FJS Assoc.	617-729-3135
MI	Southfield, Comtel	313-358-2510
MN	Wayzata, Comtel	612-476-1551
MO	Hazelwood, Palatine Engrg. & Sls.	314-839-0800
NJ	Englewood Cliffs, Scientific Dvcs.	201-871-3916
NM	Albuquerque, Sci. Devices	505-883-3668
NY	East Syracuse, Ossmann Insts.	315-437-7052
NY	Englewood Cliffs N.J., Scientific Dvcs.	201-871-3916
NC	Winston-Salem, Sci. Devices	919-765-5776
OH	Dayton, WKM Assoc.	513-434-7500
PA	Pittsburgh, WKM Assoc.	412-892-2953
TX	Austin, Alphatech	512-458-9179
WA	Bellevue, Al Smith Co.	206-746-6770
WA	Vancouver, Al Smith Co.	206-892-9912
WI	New Berlin, Comtel	414-544-6042

ELCTRN. MOLDING CORP., 96 Mill St., Woonsocket, RI 02895, Tel: 401-769-3800, TWX: 710-387-1350; FSC No.: 17117; Empl.: 300; *Sls. Mgr.:* Murry Roth; *Dist. Mgr.:* Robert Dactrechy ......2•1268-1270, 1872, 1880-1886

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean of GA	205-830-1540
AZ	Phoenix, Mercury Engrg. Sales	602-244-0123
CA	Cupertino, Thresum Assocs.	408-996-9889
CA	Mountain View, West Mark Assocs.	415-969-1700
CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Luscombe Engrg.	619-295-4300
CO	Lakewood, Christee-Meade Co.	303-232-0287
CO	Wheat Ridge, Cristee-Meade Co.	303-232-0287
FL	Ft. Lauderdale, Cartwright & Bean of FL	305-735-4900
FL	Orlando, Cartwright & Bean of FL	305-422-4531
GA	Atlanta, Cartwright & Bean of GA	404-233-2939
IL	Lisle, W.G. Controls	312-963-5954
IL	Oak Brook, Winner Co.	312-655-3545
IN	Ft. Wayne, Denton Mktg.	219-627-5525
KS	De Soto, Midtec Assocs.	913-441-6565
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
LA	Kenner, Cartwright & Bean of TN	504-466-0020
MD	Glen Burnie, Macrotech Assocs.	301-437-5588
MD	Pasadena, Macrotech Assocs.	301-437-5588
MI	Bloomfield Hills, Enco Marketing, Inc.	313-642-0203
MI	Farmington, Amtech	313-474-8300
MN	Hopkins, Kits Co.	612-933-1888
MS	Jackson, Cartwright & Bean of TN	601-981-1170
MO	Florissant, Midtec Assocs.	314-837-5200
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Haddonfield, Mills-Brown Assocs.	609-429-1005
NJ	Wayne, G.T. Assocs.	201-694-6040
NY	Binghamton, Empire Tech. Assoc.	607-772-0651
NC	Charlotte, Cartwright & Bean of GA	704-377-5673
NC	Greensboro, Blair Engrg.	919-292-8200
NC	Raleigh, Cartwright & Bean of GA	919-781-6560
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-725-4477
OK	Tulsa, Blair Engrg.	918-747-3100
OR	Portland, Jas. J. Backer Co.	503-297-8744
OR	Salem, Jas. J. Backer Co.	503-362-0717
PA	Hickory, J.C. Hofstetter Co.	412-356-2305
PA	Pittsburgh, J. C. Hofstetter Co.	412-327-1410
TN	Knoxville, Cartwright & Bean of TN	615-693-7450
TN	Memphis, Cartwright & Bean of TN	901-276-4442
TX	Austin, Blair Engrg.	512-458-3107
TX	Dallas, Blair Engrg.	214-241-5655
TX	Houston, Blair Engrg.	713-776-0011
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AZ	Phoenix, Kachina Elctrn.	602-269-6201
AZ	Phoenix, Heilind Elctrns.	602-243-7171
CA	Inglewood, Force Elctrn.	213-776-1324
CA	San Jose, Force Elctrn.	408-943-1324
CO	Denver, C.S.I.D.	303-292-9594
CO	Wheat Ridge, ACT	303-422-9229
CT	Bethel, Heilind Elctrns.	203-797-8600
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Largo, Graham Elctrn.	813-541-4434
FL	Orlando, Aztech Elctrn.	305-291-1681
FL	Palm Bay, Action Elctrns.	305-725-4920
IL	Elk Grove Village, Nu Way Elctrns.	312-437-7120
IN	Ft. Wayne, Graham Electrn.	219-423-3422
IN	Indianapolis, Graham Electrn.	317-634-8202
IN	Lafayette, Graham Electrn.	317-423-5564
IA	Cedar Rapids, Bergquist	
MD	Columbia, Aztech Elctrn.	301-995-1760
MA	Burlington, Heilind Elctrn.	617-272-5610
MI	Grand Rapids, Calder Elctrn.	616-949-2900
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Bergquist Co.	612-835-2322
NH	Hudson, Heilind Elctrn.	603-883-9536
NJ	Pennsauken, Resco Elctrn.	609-662-4000
NM	Albuquerque, Intl. Elctrn.	505-345-8127
NY	Bohemia, Car-Lac Elctrn.	516-567-4200
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Millbrook, Villarreal Elctrn.	914-677-3447
NY	Rochester, Masline Elctrn.	716-546-5373
NY	Suffern, Nobel Elctrn.	914-357-4500
OH	Cincinnati, Graham Elctrn.	513-772-1661
OH	Cincinnati, Schuster Elctrn.	513-489-1400
OH	Columbus, Graham Elctrn.	614-895-1590
OH	Twinsburg, Schuster Elctrn.	216-425-8134
OK	Tulsa, Altair Co.	918-252-5781
TN	Nashville, Graham Elctrn.	615-242-2682
TX	Austin, Altair Co.	512-837-4970
TX	Dallas, Heilind Elctrn.	214-351-2050
TX	Houston, Heilind Elctrn.	713-988-2711
TX	Houston, Altair Co.	713-462-3029
TX	Houston, Lenert Co.	713-225-1465
TX	Richardson, Altair Co.	214-231-5166

ENI The advanced design line of power amplifiers

ELECTRONIC NAVIGATION INDS., 3000 Winton Rd. S., Rochester, NY 14623, Tel: 716-473-6900, Telex: 97-8283; FSC No.: 10226; Empl.: 200; *Sls. Mgr.:* L. A. Benedict ......3•1008, 1009

Local Sales Offices & Reps

AL	Huntsville, Brown Instrs.	205-883-8660
AZ	Phoenix, Sci. Devices West	602-957-0401
CA	Los Angeles, McDougall/McLaughlin Co.	213-477-8556
CA	Menlo Park, Kipp Assocs.	415-854-2855
CO	Boulder, Sci. Devices West	303-449-9466
FL	Ft. Lauderdale, Brown Instrs.	305-776-4800
FL	Melbourne, Brown Instrs.	305-723-0766
FL	Orlando, Brown Instrs.	305-425-5505
GA	Atlanta, Brown Instrs.	404-455-1035
IL	Elmhurst, Sector	312-530-7850
IN	Indianapolis, Sector	317-842-1120
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Mandeville, Brown Instrs.	504-626-9701
MD	Silver Spring, Gawler Knoop Co.	301-589-4406
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Bloomington, Sector	612-888-6920
MO	Maryland Hgts., Ramsey Assocs.	314-878-5042
NH	Nashua, JPR Elctrn. Sls.	603-889-8285
NM	Albuquerque, Sci. Devices West	505-293-3494
NY	Great Neck, RTI, Inc.	516-829-3770
NC	Durham, Brown Instrs.	919-683-1580
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Portland, Sci. Devices Northwest	503-292-6934
PA	Mechanicsville, John Bell Assoc.	215-794-7075
PA	Pittsburgh, WKM Assocs.	412-892-2953
SC	Columbia, Brown Instrs.	803-798-8070
TX	Houston, Sci. Devices-Texas	713-864-1711
TX	Richardson, Sci. Devices-Texas	214-231-8106
TX	San Antonio, Sci. Devices-Texas	512-736-3164
WA	Bellevue, Sci. Devices Northwest	206-454-0900
WI	Milwaukee, Sector	414-352-8280

epc CORPORATION

ELCTRN. PRECISION COMPS., 11 W. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-664-2333; FSC No.: 75898; Empl.: 8 ....1A•1593, 1869; 3•1226, 1227

Local Sales Offices & Reps

CA	Granada Hills, W.H. Industries Inc.	213-363-3910
CO	Denver, Midwest Meridian Corp.	303-341-7550

IL	Elk Grove Village, Midwest Meridian Corp.	312-640-9540
IA	Cedar Rapids, Midwest Meridian Corp.	319-365-6561
MA	Andover, William Crawford Assocs.	617-470-2122
MN	Prior Lake, Midwest Meridian Corp.	612-447-8222
MO	Marylan Heights, Midwest Meridian Corp.	314-878-4441
OH	Fairborn, Midwest Meridian Corp.	513-879-7100
TX	Fort Worth, Midwest Meridian Corp.	817-654-2132
WA	Kirkland, W.H. Industries	206-827-1024

ELECTRONIC PRODS. CORP., Interstate Indl. Plaza, R. D. #5, York, PA 17402, Tel: 717-767-6517; Empl.: 16; *Sls. Mgr.:* M. E. Lehman; *Dist. Mgr.:* M. E. Lehman

Local Sales Offices & Reps

IL	Downers Grove, T. E. Moore Co.	312-969-7792
MD	Greenbelt, Potomac Triad Corp.	301-441-2275
NY	Pittsford, Mill Valley	716-248-2653
PA	York, Tillotson & Tillotson	717-767-6517

ELECTRONIC RELAYS, 30 Plaza Dr., Westmont, IL 60559, Tel: 312-789-8166, TWX: 910-991-3903; FSC No.: 53087; Empl.: 29; *Sls. Mgr.:* Barbara Breibach; *Dist. Mgr.:* Barbara Breibach

erc

ELECTRONIC RESEARCH CO., 7618 Wedd St., Overland Park, KS 66204, Tel: 913-631-6700, TWX: 910-749-6477; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler .... **1A**•1351

Local Sales Offices & Reps

Frequency Product

NJ	Riverdale, Comp-Tech Sls.	201-935-5454
NJ	Union, Comp-Tech Sls.	201-687-2484
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628

Electronic Solutions

ELECTRONIC SOLUTIONS, 9255 Chesapeake Drive, San Diego, CA 92123, Tel: 619-292-0242, TWX: 910-335-1169; Empl.: 50; *Sls. Mgr.:* Charles H. Henry .... **3**•1106-1109

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Tempe, Mar Tech	602-968-4944
CA	Anaheim, Qualtech South	714-639-9820
CA	Brentwood, Qualtech South	415-634-9060
CA	Los Angeles, Qualtech South	213-765-1419
CA	San Diego, Mesa Engrg.	619-278-8021
CA	Sunnyvale, Qualtech	408-732-4800
CO	Littleton, Radco	303-794-4279
CT	Canton, Bell Controls	203-693-8926
FL	Melbourne, Southeastern First Rep	305-259-6373
GA	Atlanta, Remco	404-447-6937
IL	Chicago, Marcon	312-675-6450
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MD	Rockville, Spectro	301-279-2010
MA	Nashua, Bell Controls	603-882-6984
MI	Livonia, Lowell Wendt	313-464-2722
MN	Minneapolis, Micro Resources	612-830-1454
MO	St. Louis, The Beams Co.	314-434-8448
NH	Nashua, Bell Controls	603-882-6984
NJ	Springfield, Gebhardt Mktg.	201-376-4415
NM	Albuquerque, Mar Tech	505-821-2775
NY	New Hartford, PDQ	315-768-8167
NC	Raleigh, Remco	919-847-5079
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-854-5939
OR	Portland, NW Mkt	503-297-2581
PA	Jenkintown, Monument Tech. Assocs.	215-884-3737
TX	Austin, Acudatix	512-346-4033
TX	Dallas, Acudata	214-424-3567
TX	Houston, Acudata	713-580-2451
WA	Bellevue, NW Mkt	206-455-5846
WI	Waukesha, Computer & System Sales	414-544-1141

Local Distributors

CT	Danbury, Pilgrim Elctrns.	203-792-7274

ELECTRONIC SPACE SYS. CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 617-369-7200, Telex: 923480 ESSCO WCRD; FSC No.: 15175; Empl.: 82; *Sls. Mgr.:* Susan M. Cuevas

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 617-655-1532, 800-225-4876, Telex: 955-329 ATTN: ESP; Empl.: 35; *Sls. Mgr.:* David Monahan

ES

ELECTRONIC SPECIALTY DIV., ElecSpec Corp., 18900 N.E. Sandy Blvd., Portland, OR 97230, Tel: 503-665-0121, Telex: 360-453, TWX: 910-469-8782; FSC No.: 98927; Empl.: 250; *Sls. Mgr.:* R. Lisdero .... **1B**•1348-1350

Local Sales Offices & Reps

CA	Costa Mesa, Gabriel & Assoc.	714-957-1981
FL	Ft. Meyers, Rainbow Sls.	813-939-9150
FL	Melbourne, Rainbow Sls.	305-727-3305
KS	Wichita, Baka Corp.	316-262-0179
MI	Brighton, A.P. Assoc.	313-229-6550
NY	Glen Head, Livera-Polk Assoc.	516-759-9300
TX	Dallas, Blackburn Assoc.	214-692-8885

ELECTRONICS STAMPING CORP., Sub. of Buckbee-Mears Co., 19920 S. Alameda St., Rancho Dominguez, CA 90220, Tel: 213-639-2120, Telex: 678401; FSC No.: 57297; Empl.: 70; *Sls. Mgr.:* Robert J. Ferm

ELECTRONIC SYS. & PROGRAMMING, See Augat/ES•P, Inc.

ELECTRONIC TRANSFORMER CORP., P.O. Box 188, Totowa, NJ 07511, Tel: 201-942-2222; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRONIC TRANSISTORS, 112-15 Northern Blvd., Flushing, NY 11368, Tel: 212-651-7200, Telex: 96-0173; FSC No.: 12045; Empl.: 45; *Sls. Mgr.:* Mike Byrnes; *Dist. Mgr.:* Mike Byrnes

ELECTRONIC TREND PRODS., 10080 N. Wolfe Rd., Ste. 372, Cupertino, CA 95014, Tel: 408-996-7401, Telex: 345516; Empl.: 3; *Dist. Mgr.:* Gene Selven

ELECTRONIC WATTMETER CO., 2275 Sixth St., Sarasota, FL 33577, Tel: 813-953-5355; Empl.: 6

ELECTRONIZED CHEMICALS CO., Div. of High Voltage Engrg., 23 Industrial Way, Wilmington, MA 01887, Tel: 617-657-8030, Telex: 68-17284

ELECTRON-MACHINE CORP., Box M, Umatilla, FL 32784, Tel: 904-669-3101, Telex: 56-4300; Empl.: 55; *Sls. Mgr.:* S. K. Kemp V.P. Mktg

ELECTRON PRODUCTS, 2084 Central Ave., Duarte, CA 91010, Tel: 818-359-8281; FSC No.: 99515; *Sls. Mgr.:* Ann Meunier; *Dist. Mgr.:* Ann Meunier

ELECTRO-NUMERICS, 1811 Reynolds, Irvine, CA 92714, Tel: 714-549-8821, Telex: 68-5612; FSC No.: 51666; Empl.: 24

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
AR	El Dorado, Kemp Engrg.	501-862-5869
CA	Fremont, William Parks Assocs.	415-490-2011
CA	Santa Ana, Brooks-Moore & Assocs.	714-544-8900
CO	Boulder, Herb Bass Assocs.	303-530-7509
FL	Melbourne, Beacon Elctrn. Assocs.	305-724-8010
GA	Atlanta, Beacon Elctrn. Assocs.	404-256-9640
IL	La Grange, PVA Co.	312-579-9300
LA	Lafayette, Kemp Engrg.	318-269-9452
MD	Randallstown, Beacon North	703-591-1300
MA	West Newbury, Di-Ana Sales	617-363-5420
MI	Royal Oak, Satullo Co.	313-549-3910
MN	Hopkins, Kits Co.	612-933-1888
MO	Bridgeton, Electro-Mechanical Assoc.	314-291-8661
NM	Albuquerque, Shefler-Kahn Co.	505-296-0749
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NC	Raleigh, Beacon Electrn. Assocs.	919-787-0330
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
OK	Tulsa, Kemp Engrg.	918-663-4501
TX	Addison, Kemp Engrg.	214-931-7100
TX	Houston, Kemp Engrg.	713-466-1465
VA	Fairfax, Beacon North	703-591-1300
WA	Redmond, Westenn Sales	206-885-2054
WI	Glendale, Stapleman Corp.	414-352-5777

ELECTRO-OPTICAL INDS., Box 3770, Santa Barbara, CA 93105, Tel: 805-964-6701, Telex: 65-8427; Empl.: 100

ELECTRO-PACIFIC, 5782 Thornwood Dr., Goleta, CA 93017, Tel: 805-964-0751; FSC No.: 29853; Empl.: 60; *Sls. Mgr.:* Kay Mahone

Local Sales Offices & Reps

CA	Del Mar, Electro-Pacific Inc.	619-481-5201

ELECTRO PHYSICS, 1910 West Birchwood Ave., Chicago, IL 60626, Tel: 312-274-9669; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 48 Spruce St., Nutley, NJ 07110, Tel: 201-667-2262, Telex: 642277

ELECTRO-PREP, 30 Cayuga Ave., E. Falmouth, MA 02536, Tel: 617-477-1791; *Sls. Mgr.:* J. Anderson

ELECTRO-RACK PRODUCTS CO., 1742 S. Clementine St., Anaheim, CA 92802, Tel: 714-776-5420; FSC No.: 26073; Empl.: 25; *Sls. Mgr.:* Allen Benson

ELECTRO-RENT CORP., 4131 Van Owen Place, Burbank, CA 91505, Tel: 213-843-3131, TWX: 910-498-2238; Empl.: 100; *Sls. Mgr.:* R. Tarullo

ELECTRO SCIENTIFIC INDS., 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, Telex: 15-1246; FSC No.: 11837; Empl.: 750; *Sls. Mgr.:* Dick Donaca;Don Hofmann

ESF
Electro-Space
Fabricators, Inc.

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* T. Roth .... **2**•1028, 1029

Local Sales Offices & Reps

AL	Huntsville, Mackan, Smith & Assocs.	205-539-8000
CA	Irvine, Vale Assocs.	714-551-4004, 4821
CA	San Jose, Silicon Valley Sls.	408-286-7510
CT	Bridgeport, Betronic Assocs.	203-374-6404
FL	Lighthouse Point, Jack Krutek & Assocs.	305-941-6544
FL	Madeira Beach, MacKay, Smith & Assocs.	813-393-7144
FL	Orlando, MacKay, Smith & Assocs.	305-277-1513
GA	Norcross, MacKay, Smith & Assocs.	404-449-7444
IL	Northbrook, Raines & Assocs.	312-498-0890
MD	Pikesville, Imagitron Sls. Co.	800-638-3592
MD	Pikesville, Imagitron Sls.	301-521-2020
MA	Waltham, Betronic Assocs.	617-894-8400
MN	Minneapolis, Electro-Tech Assocs.	612-927-5878
NJ	Boonton, Winter Assocs.	201-334-3434
NY	Binghamton, Miles & Burke Assoc.	607-723-8397
NY	Kirkwood, Miles M. Burke & Assocs.	315-822-5916
NY	Morrisville, Promark-Electrns.	315-662-3310
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
OH	Galion, James R. Bright	419-468-3787
OK	Tulsa, Advance Techn. Sls.	918-664-0482
PA	Doylestown, Monteiro Assocs.	215-345-5855
PA	McKean, ECCO	814-476-1376
TN	Chattanooga, MacKay, Smith & Assocs.	615-899-6951
TX	Austin, Advance Techn. Sls.	512-459-1351
TX	Dallas, Advance Techn. Sls.	214-340-1300
TX	Houston, Advance Techn. Sls.	713-440-3888
WA	Auburn, Elctrn. Sls. Northwest	206-839-5808
WA	Maple Valley, Electrn. Sls. Northwest	206-432-1002

ELECTROSPACE SYS., INC., Box 1359, Richardson, TX 75080, Tel: 214-783-2004, TWX: 910-867-4768; FSC No.: 33875; Empl.: 902

ELECTRO STANDARDS LAB., INC., P.O. Box 9144, Providence, RI 02940, Tel: 401-943-1164, Telex: 697-2057 ESLAB; Empl.: 20; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATIC CONSLTG. ASSOCS., 556 Lowell Rd., Groton, MA 01450, Tel: 617-448-5485; Empl.: 5; *Sls. Mgr.:* Paul Malinaric

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414; FSC No.: 34538; Empl.: 17

ELECTRO STYLUS, 31 Cheyenne Blvd., Colorado Springs, CO 80906, Tel: 303-633-5969; Empl.: 10; *Sls. Mgr.:* L. F. Murray; *Dist. Mgr.:* M. L. Murray

ELECTRO SWITCH, King Ave., Weymouth, MA 02188, Tel: 617-335-5200, TWX: 710-388-0377; FSC No.: 82121; Empl.: 260; *Sls. Mgr.:* H. F. Peters .... **1B**•1010, 1622, 1623

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Los Angeles, Wiley	213-666-1611

CA	Moraga, W. Nott & Co.	415-376-1922
CA	San Diego, Wiley Co.	619-571-2881
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Winter Park, Floritronics	305-886-4818
GA	Atlanta, Holman-Lobsinger	404-256-9120
IL	Elk Grove Village, Electro Switch	312-593-2225
IA	Bettendorf, H.J. Weisler & Assoc.	319-344-0566
MD	Woodbine, Naudain Assocs.	301-442-2270
MI	Ferndale, Hilltronics	313-398-5556
MN	St. Paul, Kencotronics	612-645-7717
MO	Ellisville, H.J. Weisler & Assoc.	314-394-4543
MO	No. Kansas City, H.J. Weisler & Assocs.	816-421-1679
NJ	Fairfield, Electro Switch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Rochester, Sweetco Assoc.	716-225-2383
NY	Utica, Sweetco Assoc.	315-797-6721
NC	Winston-Salem, L.G. White Southern	919-725-3612
OH	Columbus, Rockford Controls	614-868-5577
OH	Dayton, Rockford Controls	513-898-5452
OH	Euclid, Rockford Controls	216-731-5250
PA	Pittsburgh, R. F. Clark	412-242-9500
SC	Greenville, L.G. White Southern	803-271-0630
TX	Bellaire, Brice Co.	713-666-1788
TX	Dallas, Brice Co.	214-233-9808
UT	Salt Lake City, Comp. Prods. Sls.	801-262-0000
VA	Richmond, L.G. White Southern	804-740-7093
WA	Seattle, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assoc.	414-258-0529

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
CA	Moraga, Willard Nott & Co.	415-376-1922
FL	Ft. Lauderdale, Peerless Radio Corp. of Florida	305-973-4141
GA	Atlanta, Georgia Control Ctr.	404-876-8833
IL	Bridgeview, Midco Comp. Sls.	312-599-7777
MD	Baltimore, Automation Indl. Control	301-747-0044
MD	Kensington, Marine Air Supply	301-949-9560
MA	Sharon, Adcour	617-784-8123
MI	Grand Rapids, S-F Electronic Supply	616-459-0216
MN	St. Paul, K. D. I.	612-645-7717
NE	Omaha, West Dodge Elec. Supp.	800-228-2314
NY	Hempstead, Electronic Equip. Co.	516-538-5510
NC	Winston-Salem, General Prods. Co.	919-725-3612
OH	Euclid, Rockford Controls Ohio	216-731-5250
PA	Conshohocken, I/O Elec. Supp. Corp.	215-825-4610
PA	Pittsburgh, Clayton Engrg. Co.	412-288-0643
TX	Bellaire, Barclay Wholesale	713-666-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373
WI	Milwaukee, I/O Elec. Supp. Corp.	414-963-9050

ELECTRO-TECH SYS., INC., 35 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196; *Sls. Mgr.:* Sharon Sandy; *Dist. Mgr.:* Stanley Weitz

ELECTRO VECTOR, INC., 6555 Covey Rd., Forestville, CA 95436, Tel: 707-887-2292, TWX: 510-746-6024; *Sls. Mgr.:* Wayne Brigden

ELECTROVERT INC., 399 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-7322, Telex: 646186; *Sls. Mgr.:* Steve Vineis .... 2•1266, 1267

Local Sales Offices & Reps

CA	Santa Ana	714-835-2033
GA	Norcross	404-441-3644
IL	Rosemont	312-678-5557
TX	Dallas	214-353-9950

ELECTROVERT USA CORP., 10969 Shady Trail, #101, Dallas, TX 75220, Tel: 214-353-9950, Telex: 4630186; Empl.: 150; *Sls. Mgr.:* Tom Gill

Local Sales Offices & Reps

CA	Santa Ana	714-835-2033
CA	Santa Clara	408-739-6015
CO	Denver	303-423-5598
GA	Norcross	404-441-3644
IL	Rosemont	312-678-5557
NH	Manchester	603-625-5877
NY	Elmsford	914-592-7322
TX	Dallas	214-353-9950

ELECTRO WEAVE, 38 Harlow St., Worcester, MA 01605, Tel: 617-752-8932, TWX: 710-340-0635; FSC No.: 54207; Empl.: 18; *Sls. Mgr.:* C. J. Nowasacki

ELFAB CORP., P.O. Box 810555, Dallas, TX 75381-0555, Tel: 214-233-3033, 800-527-0753, TWX: 910-860-5460; Empl.: 299; *Sls. Mgr.:* Kermit Dye .... 2•1271-1274

Local Sales Offices & Reps

AL	Huntsville, Raycom	205-859-2017
AZ	Tempe, Delta Elect.	602-966-9903
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Santa Clara, Elfab Corp.	408-988-1716
CA	Tustin, Elfab Corp.	714-731-2515
CO	Littleton, Lange Sls., Inc.	303-795-3600
FL	Orlando, Tri Mark Assocs.	305-859-5504
GA	Fayettsville, Raycom, Inc.	404-461-4026
IL	Crystal Lake, E. S. Healy & Assocs.	815-459-4386
MD	Pikesville, Imagitron Sls.	301-521-2020
MA	Hopkinton, Marathon Sls., Ltd.	617-435-6984
MI	Grand Rapids, R. P. Urban Assoc.	616-245-0511
MN	Stillwater, Tech Mktg.	612-330-3699
MO	St. Charles, C.F. Elctrns.	314-946-8500
NJ	Cherry Hill, Elfab Corp.	609-795-6262
NJ	Springfield, F. F. Sylvester Assoc.	201-376-3324
NY	N. Syracuse, Advanced Comps.	315-699-2671
NC	Raleigh, Rick Burns Assoc., Inc.	919-876-2224
OH	Beachwood, Duane Thompson & Assoc.	216-831-6277
OH	Dayton, Duane Thompson & Assocs.	513-237-9422
OK	Oklahoma City, Ammon & Rizos Co.	405-942-2552
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Dallas, Ammon & Rizos Co.	214-233-5591
TX	Houston, Ammon & Rizos Co.	713-781-6240
UT	Salt Lake City, Lange Sls., Inc.	910-925-4006
WA	Seattle, Blum & Assocs.	206-285-2590

ELGAR

An Onan/McGraw-Edison Company

ELGAR CORP., 8225 Mercury Ct., San Diego, CA 92111, Tel: 619-565-1155, TWX: 910-335-1246; FSC No.: 25965; Empl.: 375 .... 3•1854-1859

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech Assocs.	205-881-9298
AZ	Tempe, Trembly Assoc.	602-967-2058
CA	Redondo Beach, Ward/Davis Assocs.	213-973-7772
CA	San Diego, Ward/Davis Assocs.	619-292-1000
CA	San Jose, D.P. Assocs.	408-296-1492
CO	Lakewood, Trembly Assocs.	303-233-9544
CT	North Haven, P. Jenks Assocs.	203-239-6201
FL	Casselberry, Pen-Tech Assocs.	305-645-3444
FL	Deerfield Beach, Pen-Tech Assocs.	305-421-4989
GA	Marietta, Pen-Tech Assocs.	404-424-1931
HI	Honolulu, Elctrn. Sls. Procurement	808-847-4300
IL	Arlington Heights, Dytec/Central	312-394-3380
IN	Indianapolis, Dytec/Central	317-247-1316
KS	Lenexa, Dytec/South	913-888-0215
MD	Rockville, Elctrn. Mktg. Assocs.	301-881-5300
MA	Woburn, P. Jenks Assocs.	617-938-0488
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Maryland Hgts., Dytec/South	314-569-2990
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	Hackensack, TMA	201-646-9222
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Fairport, NACO Elctrns. Corp.	716-223-4490
NY	Great Neck, RTI	516-829-3770
NY	North Syracuse, NACO Elctrns. Corp.	315-699-2651
NY	Utica, NACO Elctrns. Corp.	315-732-1801
NC	High Point, Pen-Tech Assocs.	919-883-9125
OH	Cleveland, WKM Assocs.	216-267-0445
OH	Dayton, WKM Assocs.	513-434-7500
OR	Beaverton, Northwest Test & Meas.	503-646-9966
OR	Portland, Topp Engrg.	503-244-7265
PA	Pittsburgh, WKM Assocs.	412-892-2953
PA	Plymouth Meeting, Elctrn. Mktg. Assocs.	215-828-7400
TX	Austin, Data Aids Assocs.	512-327-8600
TX	Dallas, Data Aids Assocs.	214-620-1551
TX	Spring, Data Aids Assocs.	713-353-7728
UT	Salt Lake City, Trembly Assocs.	801-486-5292
WA	Bellevue, Topp Engrg.	206-747-5400
WA	Redmond, Northwest Test & Meas.	206-881-8857
WI	Elm Grove, Dytec Central Inc.	414-784-9686
EXP	CA, San Diego, Elgar Intl. Corp.	619-565-1155

Local Distributors

CA	Berkeley, Northern Lights	415-540-6162
CA	Inglewood, Cal. Micro	213-671-6075
IL	Arlington Heights, Peak Distrs., Inc.	312-394-3380
MN	St. Paul, Dytec North, Inc.	612-645-5816
MO	Maryland Heights, Dytec Distrs.	314-569-2990
NJ	Hackensack, Logon, Inc.	201-646-9222
NY	North Syracuse, Naco Elctrns. Corp.	315-699-2651
NC	Greensboro, Pen-Tech Sls.	919-852-6000
OH	Centerville, National Instrs. Distrs., Inc.	513-434-7500
PA	Penllyn, Promark Distrs., Inc.	215-643-3400
TX	Springs, Data Aids Assocs.	713-353-7728
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954; FSC No.: 15455; *Sls. Mgr.:* Duane Beecher .... 3•1228-1233

Local Sales Offices & Reps

CA	Sherman Oaks, Windsor Dynamics	213-990-4173
CA	Woodside, N-S Assocs.	415-854-4870
CT	Hamden, Polytek Assoc.	203-288-5246
MA	Waban, Polytek Assoc.	617-881-4741
NJ	Marmore, Holdsworth & Co.	609-398-4340
NM	Albuquerque, Technology Mktg. Assoc.	505-345-8921
PA	Newtown Square, Holdsworth & Co.	215-356-8550

ELIN DIV., California Instrs. Co., Div. of Norlin Ind., 5150 Convoy St., San Diego, CA 92111, Tel: 619-279-8620, Telex: 695-047; FSC No.: 16067; Empl.: 90; *Sls. Mgr.:* W.W. Hanford

ELMA ENGRG., 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, Telex: 345-560; Empl.: 50; *Sls. Mgr.:* Karl W. Widl

ELMAG, 54 Clark St., Newark, NJ 07104, Tel: 201-481-1600; FSC No.: 23160; Empl.: 25

Local Sales Offices & Reps

OH	Dayton, Irving Atkind Assoc.	513-278-4160

ELM SYSTEMS, 1101 Brown St., Wauconda, IL 60084, Tel: 312-526-5003; *Sls. Mgr.:* T. A. McCollum

Elmwood Sensors Inc.

Subsidiary of FASCO®

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, Telex: 6814066 ELMWOOD, TWX: 710-381-6413; Empl.: 700; *Sls. Mgr.:* Gary Polkow .... 1B•1802

Local Sales Offices & Reps

AL	Decatur, Tenn. Tech. Sls.	205-350-0630
AZ	Phoenix, O'Donnell SW	602-944-9542

ELECTROSWITCH
ELECTRO SWITCH CORP.

AUTHORIZED DISTRIBUTOR

E S I

ELECTRIC SWITCHES
INCORPORATED

2478 Fletcher Dr., Los Angeles, Calif. 90039

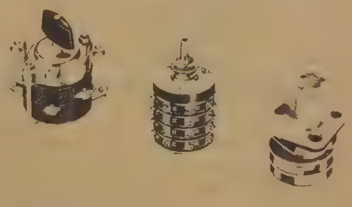
(213) 660-1310

TOLL FREE WATS
NATIONAL: 800–421–8855
CALIFORNIA: 800–252–4640

TWX 910–321–2971

IMMEDIATE DELIVERY FROM STOCK

ROTARY SWITCHES for INDUSTRIAL CONTROL APPLICATIONS



SEE COMPLETE PRODUCT LINE UNDER SWITCHES — SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

CA	San Diego, O'Donnell Assocs.	619-578-1645
CA	San Jose, O'Donnell Assocs.	408-263-6500
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Coral Springs, CBC Electronics	305-755-1111
GA	Atlanta, Tenn. Tech. Sls.	404-622-5784
IL	Arlington Heights, Thermek	312-577-6900
IN	Fort Wayne, O. Bromberg	219-456-6010
KY	Louisville, O. Bromberg	502-245-8916
MA	Danvers, C. H. Burnham Assoc.	617-774-0111
MI	Brooklyn, Engineered Comps.	517-592-3236
MN	Minneapolis, C. Listug Sls.	612-537-6740
MO	Creve Coeur, Hill & Co.	314-432-1136
NH	Durham, C. H. Burnham Assoc.	603-868-2282
NY	Fairport, Bastian Sls.	716-223-0237
NY	Larchmont, G. M. Moch Co.	914-834-3530
NY	Latham, L-Tron Corp.	518-785-5032
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Charlotte, Tenn-Tech Sls.	704-525-6295
OH	Cincinnati, O. Bromberg	513-771-9333
OH	Cleveland, Allied Entprs.	216-779-0080
OK	Tulsa, Ion Assoc.	918-664-0186
PA	Murrysville, Allied Entprs.	412-325-3200
RI	Johnston, C. H. Burnham Assoc.	401-231-7475
TX	Austin, Ion Assocs.	512-346-7160
TX	Grand Prairie, Ion Assocs.	214-647-8225
TX	Houston, Ion Assocs.	713-977-4354
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Midlothian, Daniel E. Boehling Assocs.	804-794-5879
WA	Bellevue, Lehr Assoc.	206-453-9993
WA	Bothell, Temco Northwest	206-488-1254
WI	Milwaukee, R. Zingler	414-351-5005

ELNA AMERICA, INC., 153 E. Savarona Way, Carson, CA 90746, Tel: 213-327-6090, Telex: 68-6427, TWX: 910-346-6730; *Sls. Mgr.:* Don L. Bilsing; *Dist. Mgr.:* Isao Kikuchi

ELNETIC ELCTRNS., 1730 21st St., Santa Monica, CA 90404, Tel: 213-828-9541; FSC No.: 98460; Empl.: 25; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELNIK INSTRS., 410 Garibaldi Ave., Lodi, NJ 07644, Tel: 201-779-7388, Telex: 133429; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

ELPAC COMPS., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513; Empl.: 130; *Sls. Mgr.:* Rod Bolton ......**1A**•1070, 1071

Local Sales Offices & Reps

AZ	Tempe, Sunwest Mktg. Assocs.	602-838-7586
CA	Loomis, Sacremento Office	916-652-9702
CA	San Diego, Wes-K Assocs.	619-578-2040
CA	Santa Clara, I Squared.	408-988-3400
CA	Van Nuys, Wes-K Assocs.	213-989-3070
CO	Arvada, Wescom Mktg.	303-422-7619
CT	Milford, Todino Engr. Sls.	203-874-6643
FL	Orlando, OEM Mktg. Corp.	305-299-1000
IL	Highland Park, Bransky Sls.	312-433-2375
IA	Cedar Rapids, Palatine Engr. & Sls.	319-365-8071
KS	Mission, Palatine Engr. & Sls.	913-831-0555
KS	Rose Hill, Palatine Engr. & Sls.	316-776-0065
MD	Timonium, Wakefield Grp.	301-561-3221
MA	Needham Heights, Todino Engr. Sls.	617-444-7925
MI	Farmington Hills, W. R. Hummon & Assocs.	313-474-0661
MN	Bloomington, Smiley-Scott Assocs.	612-888-5551
MO	Hazelwood, Palatine Engr. & Sls.	314-839-0800
NJ	Englewood, Harold Gray Assocs.	201-894-0894
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Beaverton, Caruso & Northcutt.	503-646-4973
PA	Hickord, J. C. Hofstetter Co.	412-356-2305
TX	Dallas, Reese & Assocs.	214-638-6575
UT	Salt Lake City, Wescom Mktg.	801-466-9594
WA	Bellevue, Caruso & Northcutt.	206-454-9699
WI	Cedarburg, Bransky Sls.	414-377-6837

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, T.T.I.	602-861-0222
AZ	Tempe, Powell Elctrns.	602-438-1505
CA	Chatsworth, Mil-Comm	213-998-3111
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	Garden Grove, Megacap	714-891-5176
CA	Irvine, Kelex	714-863-1230
CA	San Jose, T.T.I.	408-943-9155
CA	San Jose, Powell Elctrns.	408-943-9020
CA	San Jose, Capacitors Unltd.	408-946-7676
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
FL	Orlando, T.T.I. Florida	305-979-5000
IL	Northbrook, Classic Components	312-272-9650
IL	Skokie, Kellner Elctrns.	312-677-1120
MD	Columbia, Powell Elctrns.	301-995-0410
MA	Westborough, Powell Elctrns.	617-366-6100
MA	Wilmington, Aved Elctrns.	617-657-8311
MA	Woburn, T.T.I., Inc. NE	617-938-8800
MN	Minneapolis, C. Tennant & Sons	612-475-7300
MO	Maryland Heights, Ensco Distribg., Inc.	314-423-3935
NJ	Englewood, Powell Elctrns.	201-894-0800
NY	Bohemia, T.T.I.	516-567-1500
NC	Cary, Powell Elctrns.	919-467-1212
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Austin, Captronics	512-459-4328
TX	Dallas, Captronics	214-340-3592
TX	Ft. Worth, T.T.I.	817-429-1440
TX	Houston, Altair Co.	713-462-3029
TX	Irving, Powell Elctrns.	214-258-6841
WA	Bellevue, Powell Elctrns.	206-641-4446
WI	Mequon, Taylor Elec. Dists.	800-558-8921
WI	New Berlin, Classic Comps.	414-786-5300
WI	Racine, Badger Elctrns.	414-637-1256; 414-933-6685

ELPAC POWER SYS., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513; Empl.: 270; *Sls. Mgr.:* Patrick D'Acre; *Dist. Mgr.:* Randy Bilsley .... **3**•1554-1559

Local Sales Offices & Reps

AL	Huntsville, K&E Assoc.	205-883-9720
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Westrep	408-988-8833
CO	Parker, A-5 Co.	303-841-3651
CT	Yalesville, The Newscott Co.	203-269-2654
FL	Clearwater, Gallagher & Assoc.	813-726-3187
FL	Plantation, Gallagher & Assoc.	305-473-2101
GA	Doraville, K&E Assoc.	404-448-7025
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Ft. Wayne, F. J. Campisano	219-747-2633
IN	Indianapolis, F. J. Campisano	317-253-7651
IA	Cedar Rapids, Electromec	319-362-6413
MD	Pikesville, Imagitron Sls.	301-521-2020
MA	Needham Hgts., Newscott Co.	617-444-1923
MN	Burnsville, Electromec Sls.	612-894-8200
NJ	Fairfield, TAM	201-575-4390
NY	S. Hauppauge, TAM	516-348-0800
OH	Cincinnati, F. J. Campisano	513-574-7111
OH	Cleveland, F. J. Campisano	216-749-5550
OK	Tulsa, ION Assoc	918-664-0186
OR	Beaverton, Caruso & Northcutt	503-646-4973
PA	Coraopolis, F. J. Campisano	412-264-5151
TX	Austin, Ion Assoc.	512-346-7160
TX	Grand Prairie, ION Assoc	214-647-8225
TX	Houston, Ion Assoc.	713-977-4354
WA	Bellevue, Caruso & Northcutt	206-454-9699
WI	Cedarburg, Bransky Sls.	414-377-6837

Local Distributors

BS	Huntsville, Marshall Industries	205-881-9235
AL	Birmingham, ACK Radio Supp.	205-322-0588
AL	Huntsville, RM Elctrns.	205-852-1550
AZ	Tempe, Marshall Inds.	602-968-6181
CA	Canoga Park, Marshall Inds.	213-999-5001
CA	El Monte, Marshall Industries	213-442-7204
CA	Inglewood, Newark Elctrns.	213-678-0441
CA	Irvine, Marshall Inds.	714-556-6400
CA	San Diego, Marshall Inds.	619-578-9600
CA	Sunnyvale, Marshall Inds.	408-732-1100
CO	Denver, Marshall Inds.	303-427-1818
CT	Wallingford, Sager Elctrns.	203-265-4600
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Orlando, Marshall Inds.	305-841-1878
GA	Atlanta, ACK Radio Supply	404-351-6340
GA	Norcross, Marshall Inds.	404-923-5750
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Northbrook, Classic Components	312-272-9650
IL	Schaumburg, Marshall Inds.	312-490-0155
IN	Indianapolis, RM Elctrns.	317-247-9701
MD	Gaithersburg, Marshall Inds.	301-840-9450
MA	Burlington, Marshall Inds.	617-272-8200
MA	Burlington, QPL Elctrns.	617-229-2424
MA	Hingham, Sager Elctrns.	617-749-6700
MI	Grand Rapids, RM Elect.	616-531-9300
MI	Livonia, Marshall Industries	313-525-5850
MN	Plymouth, Marshall Inds.	612-559-2211
MO	St. Charles, Finnigan Elect.	314-946-6201
NJ	Cranford, Garden State Indl.	201-272-6400
NJ	Fairfield, Marshall Industries	201-882-0320
NJ	Mt. Laurel, Marshall Inds.	215-627-1920
NJ	Nutley, Vantage Comps.	201-667-1840
NY	Commack, Vantage Comps.	516-543-2000
NY	Endwell, Marshall Industries	607-754-1570
NY	Hauppauge, Marshall Inds.	516-273-2424
NY	Hauppauge, Broadline Elctrns.	212-895-6232
NY	Melville, Diplomat	516-454-6400
NY	Rochester, Marshall Inds.	716-235-7620
NC	Greensboro, Hammond	919-275-6391
OH	Dayton, Marshall Industries	513-236-8088
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Austin, Marshall Industries	512-458-5654
TX	Dallas, RM Elctrns.	214-235-3100
TX	Dallas, Marshall Inds.	214-233-5200
TX	Houston, Marshall Inds.	713-789-6600
TX	Houston, Newark Elctrns.	713-782-4800
WA	Bellevue, Marshall Inds.	206-747-9100
WI	New Berlin, RM Elctrns.	414-784-4420
WI	New Berlin, Classic Comps.	414-786-5300

ELPA MARKETING IND., Thorens & Atlantic Ave., Garden City Park, NY 11040, Tel: 516-746-3002

Technacell™
by Elpower®

ELPOWER, 2117 S. Anne St., Santa Ana, CA 92704, Tel: 714-540-6155, Telex: 678354 ELPOWER SNA; Empl.: 200; *Sls. Mgr.:* D. Keil; *Dist. Mgr.:* Ronnie LeFevre .... **3**•1408-1410

Local Sales Offices & Reps

AZ	Phoenix, Shefter-Kahn	602-257-9015
CA	Mountain View, Gene C. Woempner Co.	715-964-5454
CO	Denver, Moss Mktg.	303-455-7205
CT	Milford, Todino Engrg. Sls. Co.	203-874-6643
GA	Norcross, Hollingsworth & Still	404-447-1700
IL	Chicago, G. McI. Cole Co.	312-774-3535
IN	Indianapolis, Elctrn. Mktg. Conslts.	317-253-1668
KS	Overland Park, Thomas L. Dowell & Assoc.	913-648-7373
MD	Baltimore, Component Sales	301-484-3647
MA	Needham Heights, Todino Engrg.	617-444-7925
MI	Coopersville, Electronic Salesmasters	800-321-1848
MN	Edina, Restronics	612-941-9135
MO	St. Louis, Thomas L. Dowell & Assoc.	314-849-4234
NJ	Englewood Cliffs, Masin Esco	201-569-8868
NJ	Marlton, Twin Sales	609-966-4070
NY	Chappaqua, Masin Esco	914-238-8337
NY	Syosset, Masin Esco	516-364-0310
OH	Beachwood, Electronic Salesmasters	216-831-9555
PA	Bensalem, Twin Sales	215-638-4850
TX	Dallas, R. E. Nesbitt Co.	214-357-4601
WA	Seattle, Northmar	206-524-5170

Local Distributors

AL	Huntsville, Components Distrs.	205-883-7501
CA	Cerritos, El Com	213-404-2961
CA	Fremont, Terminal Sls.	415-656-7722
CA	Gardena, Culver Elctrn. Sls.	213-538-2811
CA	Mountain View, Energy Sales	415-969-0800
CO	Denver, Hensley Battery	303-455-3643
FL	Del Rey Beach, Chapman Security Sys.	305-737-6776
GA	Atlanta, Custom Alarm Prods.	404-458-0990
IL	Downers Grove, Telecommunication Dvcs.	312-971-3460
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Indianapolis, Graham Elctrns.	317-634-8202
LA	Shreveport, Industrial Elctrn. Supp.	318-222-9459
MD	Savage, Pyttronic	301-792-0780
MA	Newtonville, Security Supp. Svc.	617-965-3400
MI	Livonia, Alarm Supp. Co.	313-591-9100
MN	Burnsville, Power Trust Grp.	612-890-1360
MO	St. Louis, Van Sickle Radio	314-621-5000
NE	Lincoln, Scott Elctrns.	402-466-8221
NY	Centereach, Air Ways Distrs.	516-698-7447
NY	Jackson Hgts., A-1 Alarmatic	212-639-8300
OR	Portland, Radar Elec.	503-232-3404
PA	Allentown, A. A. Peters	215-434-5237

UT	Salt Lake City, Standard Supply	801-486-3371
VA	Richmond, AVCC Elctrns.	804-359-6071
WA	Seattle, Radar Elec.	206-282-2511

EL-RAD MFG., 4300 N. California, Chicago, IL 60618, Tel: 312-478-7300, TWX: 910-221-0104; FSC No.: 11253; Empl.: 225; *Sls. Mgr.:* Marvin S. Christ

Local Sales Offices & Reps

AZ	Scottsdale, Memco Sales	602-241-2254
AR	Little Rock, Jard Electro Sales	214-231-6654
CA	Huntington Beach, J. J. Riley Assoc.	714-841-1411
CA	Mountain View, Westech Sls.	415-961-1422
FL	Pompano Beach, Cole-Tek	305-781-8110
IL	Elk Grove Village, I R O Co.	312-593-0644
MD	Glen Burnie, Faion Lott & Co.	301-744-4611
MD	St. Louis, Abrams & Assoc.	314-569-0447
MI	Benton Harbor, Mc Nabb & Assocs.	616-925-2166
NJ	Baltimore, Faion Lott & Co.	301-744-4611
NM	Phoenix, Memco Sls.	602-952-2254
TX	Richardson, Jaro Electro Sls.	214-231-6654

ELTEC INSTRS., P.O. Box 9610, Daytona Bch., FL 32020, Tel: 904-252-0411, TWX: 810-832-6294; Empl.: 120; *Sls. Mgr.:* Douglas S. Armstrong

EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543, Tel: 914-698-8434, TWX: 710-566-1128; Empl.: 70; *Sls. Mgr.:* Dennis Hanley

Local Sales Offices & Reps

CA	Pleasant Hill, EMCA	408-998-1540
CA	Santa Clara, Mead Assocs.	408-748-1991
CA	Tustin, EMCA	714-731-4373
FL	Largo, Michael Nadreau	813-581-9113
NY	Chappaqua, Micrel Assocs.	914-238-4961
TX	Dallas, EMCA	214-321-5498

EMCO HIGH VOLTAGE CO., 556 Weddell Dr., Sunnyvale, CA 94089, Tel: 408-734-9123; Empl.: 38 .... **3**•1560

EMCON INC., Sub. of Kyocera Intl., 11620 Sorrento Valley Rd., San Diego, CA 92138, Tel: 619-459-4355, TWX: 910-322-1130; Empl.: 500; *Sls. Mgr.:* Bob Goodman; *Dist. Mgr.:* George Maines

Emcor Products

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, TWX: 910-565-2374; *Sls. Mgr.:* John Horton .... **2**•1030

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-883-8660
AZ	Phoenix, Aztec Enterprises	602-944-9185
CA	Cupertino, T. Louis Snitzer Co.	408-257-8333
CA	Del Mar, T. Louis Snitzer Co.	714-226-0305
CA	Los Angeles, T. Louis Snitzer Co.	213-836-6170
CO	Denver, Delltron Co.	303-373-0300
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Ft. Lauderdale, W. A. Brown Instrs.	305-776-4800
FL	Melbourne, W. A. Brown Instrs.	305-723-0766
FL	Orlando, W. A. Brown Instrs.	305-425-5505
GA	Norcross, W. A. Brown Instrs.	404-441-2980
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Des Plaines, Marsland Assocs.	312-694-2262
IN	Indianapolis, Marsland Assocs.	317-293-5437
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
LA	Mandeville, W. A. Brown Instrs.	504-626-9701
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Southfield, Comtel Instrs.	313-358-2505
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Cedar Grove, KLS Associates	201-785-4450
NM	Albuquerque, Aztec Entps.	505-262-1688
NY	Albany, Reagan/Compar Albany	518-489-4777
NY	Endwell, Reagan/Compar Albany	607-723-8743
NY	Fairport, Reagan/Compar Albany	716-271-2230
NY	New Hartford, Reagan/Compar Albany	315-732-3775
NY	New York, KLS Assocs.	201-785-4450
NC	Durham, W. A. Brown Instrs.	919-683-1580
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573
OH	Hilliard (Columbus), Comtel Instrs.	614-876-8305
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Hatboro, Jacobsen Assocs.	215-674-2937
PA	Huntingdon Valley, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, Comtel Instrs.	412-922-5720
SC	Columbia, W. A. Brown Instrs.	803-798-8070
TN	Oak Ridge, W. A. Brown Instrs.	615-482-5761
TX	Dallas, J. A. Green Co.	214-631-7450
TX	Houston, J. A. Green Co.	713-526-2959
UT	Salt Lake City, Delltron Co.	800-692-2069
VA	Alexandria, Dyna Rep Co.	703-354-1222
WA	Bellevue, N. R. Schultz Co.	206-454-0300

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, Telex: 710 896 0193; FSC No.: 24602; Empl.: 75; *Sls. Mgr.:* Peter Semitschew

EMERGENCY BEACON CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-235-9400; Empl.: 25; *Sls. Mgr.:* T. E. Ziegler

EMERSON, INDL. CONTROLS DIV., 3300 Standard St., Santa Ana, CA 92702, Tel: 714-545-5581, Telex: 67-8460; Empl.: 800; *Sls. Mgr.:* R. L. Calvin

EMERSON & CUMING, W. R. Grace & Co., 59 Walpole St., Canton, MA 02021, Tel: 617-828-3300, TWX: 710-348-1324; Empl.: 500

Local Distributors

CA	Culver City, E. V. Roberts & Assoc.	213-870-9561
FL	Stuart, Southeast Resin	305-286-8955
IL	Chicago, Prehler, Inc.	312-384-6100
MD	Baltimore, Sosco Corp.	301-574-7555
MA	Burlington, Schaal Associates, Inc.	617-272-7940
MA	Peabody, Adhesive Packaging Specialists	617-531-3300
MN	Bloomington, T.C. Services, Inc.	612-881-4536
MO	Maryland Heights, Thomas B. Moore, Inc.	314-434-6844
NJ	Plainfield, Pro-Pac	201-755-4940
NY	Ronkonkoma, Plastic Products & Tooling	516-467-0960
NC	Greensboro, Whitaker Metals, Inc.	919-294-3825
OH	Westerville, John W. Blair Co.	614-882-6431
TN	Memphis, Accrabond, Inc.	601-895-4480
TX	Dallas, Roy E. Davis & Co.	214-688-0652
TX	Garland, Ipscot, Inc.	214-272-5952

EMICO INC., Box 368, Dublin, PA 18917, Tel: 215-249-9330, TWX: 510-665-9583; FSC No.: 85925; Empl.: 170; *Sls. Mgr.:* R. Jones .... **3**•1330, 1331

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe	602-949-9333
CA	Campbell, Luscombe Engrg.	408-370-2020
CA	Pasadena, Luscombe	213-684-2000
CO	Arvada, Arrowhead Sls. Co.	303-423-5556
FL	Pinellas Park, Chaco Sls.	813-546-6658
IL	Chicago, Ropek & Cahill	312-631-0070
IN	Carmel, S T B & Assocs.	317-844-9227
KS	Shawnee Mission, Robinson & Assocs.	913-262-1374
MD	Silver Spring, H.R. Sieber Co.	301-589-9110
MA	Braintree, Anderson Sls. Co.	617-848-9194
MN	Minneapolis, H.M.R., Inc.	612-831-7400
NJ	Marlton, B.G.R. Assocs.	609-428-2440
NY	Mt. Vernon, Sonkin Assoc.	914-MO8-9809
NY	Syracuse, Nycom, Inc.	315-437-8343
NC	Charlotte, Electro-Rep. Assocs.	704-527-2530
OH	Rocky River, Loesch Assocs.	216-333-0077
TX	Richardson, Campion Sls.	214-238-8145
WA	Redmond, Barrett-Squibb	206-885-6991
WI	Colgate, Rep I and Assocs.	414-628-4016

EMI GENCOM INC., See THORN EMI Gencom Inc.

EMI TECHNOLOGY INC., See THORN EMI Technology Inc.

E/M LUBRICANTS, INC., Div. of Great Lakes Chemical Corp., Highway 52 NW, W. Lafayette, IN 47906, Tel: 317-463-2511, Telex: 27-9428; FSC No.: 11770

Local Sales Offices & Reps

CA	Mountain View	415-961-5865
CA	North Hollywood	213-875-0101
CO	Denver	303-371-6771
CT	New Britain	203-224-9148
GA	Atlanta	404-361-2550
IL	Lombard	312-620-6808
MA	Auburn	617-792-6919
MI	Roseville	313-779-6460
MN	New Brighton	612-780-3202
OH	Dayton	513-254-8481
PA	Sharon Hill	215-461-1015
TX	Ft. Worth	817-834-8817

EMM SEMI, SUB OF EM & M, See GTE Microcircuits

EMM/SESCO, 20630 Plummer St., Chatsworth, CA 91311, Tel: 213-998-9090, Telex: 691404, TWX: 910-494-4990; *Sls. Mgr.:* Russ Summers

Empro
SHUNTS ®

EMPRO MFG. CO., INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 .... **3**•1234

Local Sales Offices & Reps

CA	La Canada, Lew Brooks Co.	213-790-8358
CA	Santa Ana, Lew Brooks Co.	714-544-8900
GA	Atlanta, Brownell Electro Inc.	404-762-5181
MA	Burlington, E.I.L. Instr.-Mancib Div.	617-272-9450
NJ	Belleville, D. F. Tobias & Co.	201-751-8680
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
PA	Philadelphia, Sunshine Sci. Instr. Inc.	215-673-5600
TX	Houston, Ev Smith Sls.	713-649-5756

EMR DATA SYSTEMS, DIV. SANGAMO-WESTON, Box 3041, Sarasota, FL 33578, Tel: 813-371-0811, Telex: 052-890, TWX: 810-864-0406; Empl.: 1100; *Sls. Mgr.:* F. V. Hinkel

E M S DEVELOPMENT CORP., 200 Allen Blvd., Farmingdale, NY 11735, Tel: 516-694-2886, TWX: 510-224-6480; FSC No.: 51435; Empl.: 95; *Sls. Mgr.:* Ed Simkovich

EMULOGIC, 3 Technology Way, Norwood, MA 02062, Tel: 617-329-1031; *Sls. Mgr.:* Robert Smith

ENCLOSURE CORP., 4529 Adams Circle, Cornwells Hts., PA 19020, Tel: 215-638-9550; FSC No.: 32360; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODS., 1601B Dover Rd., Sandpoint, ID 83864, Tel: 208-263-8541, TWX: 510-776-1595; Empl.: 70; *Sls. Mgr.:* Vance Conner

ENDEVCO, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, Telex: 68-5608, TWX: 910-596-1415; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* B. Toffelmier

Local Sales Offices & Reps

AL	Huntsville	205-536-4454
CA	Anaheim	714-831-9200
CA	Mountain View	415-969-3212
CA	San Francisco	415-552-1763
CT	West Mystic	203-572-0571
DC	Washington	391-261-1760
FL	Orlando	305-855-4535
IL	Chicago	312-754-3888
MD	Annapolis	301-269-8800
MA	Boston	617-969-8063
MI	Charlotte	313-471-0685
NJ	Lambertville	609-397-0883
OH	Cleveland	216-659-3138
OH	Dayton	513-253-6175
TX	Houston	713-462-1971

ENDICOTT COIL, 22 E. Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, Telex: 932411; Empl.: 180; *Sls. Mgr.:* Raymond Taylor .... **1A**•1244, 2152

ERG™
Endicott Research Group.Inc.

ENDICOTT RESCH. GRP., INC., 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187, TWX: 510-252-0155; FSC No.: 63312; Empl.: 100; *Sls. Mgr.:* Robert S. Rakowski .... **1B**•1049-1051; **3**•1561

Local Sales Offices & Reps

CA	Lomita, Component Mktg. Assoc.	213-326-1460
CA	Saratoga, Testco	408-253-1900

CO Denver, West Incorporated 303-692-0131
CT Bloomfield, SIR Assocs. 203-243-9343
FL Pompano Beach, Cole-Tek Assocs. 305-781-8110
GA Atlanta, Wallace Electronics 404-752-6611
IL Elk Grove Village, Carlson Elctrn. Sls. 312-956-8240
IN Indianapolis, Carlson Elctrn. Sls. 317-842-3740
IA Cedar Rapids, Carlson Elctrn. Sls. 319-377-6341
KS Wichita, PMR, Inc. 316-684-4141
MA Bedford, SIR Assocs. 617-275-5550
MN Minneapolis, Jos-Col Melius 612-861-3343
MO Maryland Hts., PMR, Inc. 314-569-1220
NE Overland Park, PMR, Inc. 913-381-0004
NJ Livingston, Eagle Sls. Co. 201-992-2030
NY Albany, H. C. Johnson Agencies 518-459-1239
NY Buffalo, H. C. Johnson Agencies 716-632-7880
NY Rochester, H. C. Johnson Agencies 716-482-3000
NY Wadin & River, Rywel Sales Inc. 516-929-4884
NC Kernersville, Wallace Electronics 919-996-2742
OH Dayton, Dynel Co. 513-434-6467
PA Glenshaw, H. C. Johnson Agencies 412-961-0414
PA King of Prussia, Freedman-Malta Assocs. 215-279-5767
TX Austin, Mil-Rep Associates 512-258-2828
TX Houston, Mil-Rep Associates 713-937-0127
TX Richardson, Mil-Rep Associates 214-644-6731
UT Salt Lake City, West Inc. 801-466-5739
WA Bellevue, Testco 206-454-7422
WI Milwaukee, Carlson Elctrn. Sls. 414-476-2790

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGY CONCEPTS, PO Box 128, Carlsbad, CA 92008, Tel: 619-942-3144; FSC No.: 01830; Empl.: 6; *Sls. Mgr.:* Marilyn Decarlo

Local Sales Offices & Reps

CA Mill Valley, Roy Colen Sls. 415-383-8700
CA Sante Fe Springs, Wallace & Wallace 213-945-2908
CO Denver, KC Marketers 303-733-5561
GA Atlanta, Harvey Minsk and Assoc. 404-934-3272
IL Schaumburg, Resha/Assoc. 312-397-9010
KS Wichita, Maury Bettis Co. 316-265-8250
MA N. Scituate, Montague & Murray 617-545-5505
OH Aurora, GTEC 216-562-9872
TX Dallas, The Assoc. 214-241-7190
WA Everett, Fordco 206-258-1515

ENGELHARD CORP., 70 Wood Ave. S., Iselin, NJ 08830, Tel: 201-321-5900, Telex: 83-3147; Empl.: 8500

ENGELMANN MICROWAVE CO., KDI Pyrofilm, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700, TWX: 710-986-8220; *Sls. Mgr.:* Carl Schraufnagl

EC^2 engineered components company

ENGINEERED COMPS. CO., P.O. Box Y, San Luis Obispo, CA 93406, Tel: 805-544-3800; FSC No.: 32440; Empl.:160 .... **1A**•1444, 1484-1508; **2**•1870, 1887

ENGD. PROD., Div. of Acme Elec. Corp., 40 Water St., Cuba, NY 14727, Tel: 716-968-2400, Telex: 91-6451, TWX: 510-245-2700; Empl.: 850; *Sls. Mgr.:* Dick Milne

ENGINEERING & ELCTRN. DEVICES, 1024 N. McCadden Pl., Los Angeles, CA 90038, Tel: 213-463-4175; Empl.: 4; *Sls. Mgr.:* John H. Aulbach, Jr.; *Dist. Mgr.:* Henry C. Lerner

ENGINEERING DESIGN & SLS., Rt. 2, Box 305, Danville, VA 24540, Tel: 804-685-7073; Empl.: 50; *Sls. Mgr.:* Mark Gignac

ENGLER INSTRS., Sangamo Weston, Inc., 250 Culver Ave., Jersey City, NJ 07305, Tel: 201-332-5353, TWX: 710-730-5236; FSC No.: 07446; *Sls. Mgr.:* Vic Stuart; *Dist. Mgr.:* Al Brunelli

ENI, INC., See Electronic Navigation Inds., Inc.

ENI POWER SYS., 3000 Winton Rd. S., Rochester, NY 14623, Tel: 716-473-7330, Telex: 97-8283; FSC No.: 10226; Empl.: 200; *Sls. Mgr.:* L. A. Benedict

Local Sales Offices & Reps

CA Santa Ana, Micro-Tec West 714-547-5941
MA Needham, NGS Associates 617-449-6777

ENTECH SYSTEMS, INC., 15 Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557; *Sls. Mgr.:* A. D. Jorczak

ENTERPRISE SYS. CORP., P.O. Box 698, Dover, NH 03820, Tel: 603-742-7363; Empl.: 20; *Sls. Mgr.:* G. E. Perrine

Entran

ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07006, Tel: 201-227-1002, Telex: 130-361; *Sls. Mgr.:* John W. G. Budd .... **1B**•1842, 1843

Advertisement

Manufacturer of Miniature Accelerometers, Pressure Transducers/Meters/Transmitters, Load Cells and Semiconductor Strain Gages for measuring static and dynamic pressures and accelerations. Full scale ranges from 5g to 10,000g, 2 psi to 30,000 psi, and 1 lb to 2500 lb. Direct output in mV/g, mV/psi, mV/lb, and 4 or 4 1/2 digit LED display. Available in sizes as small as .050″ dia. weighing as little as 1/4 gram 0.7 cr damping available. Up to .05% accuracy. Entran means Miniature.

Local Sales Offices & Reps

AZ Phoenix, J. Smith & Assocs. 602-267-0981
CA Long Beach, Saber Entprs. 213-595-5646
CA San Diego, Saber Entprs. 619-271-1523
CA Walnut Creek, Secco 415-937-1094
CO Colorado Springs, J. Smith & Assoc. 303-597-5343
GA Atlanta, Quantum Meas. 404-351-3531
IL Lombard, The G.B. Hall Co. 312-858-1700
IN Plainfield, Stress Analysis Svcs. 317-839-8235
MI Brighton, Stress Analysis Svcs. 313-632-6110
NJ Hopatcong, Measurements, Inc. 201-770-1281
NM Albuquerque, J. Smith & Assocs. 505-265-3406
NC Chapel Hill, Quantum Meas. 919-933-7408
OH Dayton, Stress Analysis Svcs. 513-263-8036
OH Medina, Stress Analysis Svc. 216-725-7733
OR Portland, Topp Engrg. Sls. 503-244-7265
PA Frazer, Measurements, Inc. 215-644-7142
TX Dallas, Technical Prods. 214-357-9603
TX Houston, Technical Prods. 713-493-6520
VA Fredericksburg, Measurements, Inc. 703-373-5520

ENTRELEC DIV., See Cogenel, Inc./Entrelec Div.

ENVIRONMENTAL COMM., 3150 Pullman St., Costa Mesa, CA 92627, Tel: 714-557-7800, TWX: 910-595-1781; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Glen Underwood

ENVIRONMENTAL CONTAINER SYS., INC., 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, Tel: 503-476-8871, TWX: 510-755-0777; FSC No.: 24995; Empl.: 135

EOTEC CORP., 200 Frontage Rd., W. Haven, CT 06516, Tel: 203-934-7961; Empl.: 24; *Sls. Mgr.:* James W. Campbell

E.P.E. CORP., P.O. Box 5238, Manchester, NH 03108, Tel: 603-669-9181, Telex: 943536; Empl.: 65; *Sls. Mgr.:* James D. Bell; *Dist. Mgr.:* Thomas S. Bell

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, Telex: 12-6531; Empl.: 8; *Sls. Mgr.:* Peter Letica

ERIE TECHNOLOGICAL PRODUCTS, 645 West 11th St., Erie, PA 16512, Tel: 814-453-5611

EPOCH ENTPR., 3541 N. Olive Rd., Tucson, AZ 85719, Tel: 602-887-1970

EPOXYLITE CORP., 1265 N. Kraemer Blvd., Anaheim, CA 92806, Tel: 714-630-7910; Empl.: 60

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., P.O. Box 567, Billerica, MA 01821, Tel: 617-667-3805, Telex: 94-7140; FSC No.: 33246

Local Sales Offices & Reps

AZ Phoenix, Wadsworth/Bryant 602-275-7366
CA Atherton, Wadsworth/Bryant 415-321-3619
CA Hacienda Heights, Wadsworth/Bryant 213-330-5592
CO Boulder, Specialty Sales Co. 303-444-0954
CT Colchester, Normell Assoc. 203-537-5555
FL Fort Pierce, Hyber-Sem 305-464-0461
IL Chicago, E. Przechera Sls. Co. 312-725-1933
MA Newton, Normell Assoc. 617-969-5478
MI Royal Oak, Murray A. Perciuau Co. 313-548-1971
NJ Clinton, Price-Tech Inc. 201-735-9797
NY Fair Haven, Feikert Assoc. 315-652-5577
OH Dayton, Berberich Assoc. 513-433-0342
OR Beaverton, Demarest Assoc. 503-643-0141
UT West Jordan, Specialty Sales Co. 801-561-0222
WA Seattle, Demarest Assoc. 206-523-3210

EPSCO, 920 Westwood Ave., Addison, IL 60101, Tel: 312-543-0410; FSC No.: 53003; Empl.: 8 .... **3**•1563

Local Distributors

AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Garden Grove, Allied Elctrns. 714-554-0731
CA San Francisco, VWR Scientific Inc. 415-469-0100
CO Denver, Newark Elctrns. 303-757-3351
FL Marathon, Marathon Wholesale Electric Supply 305-743-2262
GA Atlanta, Spec. Distr. Co. 404-873-2521
HI Honolulu, Honolulu Elctrn. 808-949-5564
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
IL Elmhurst, McMaster-Carr Supp. 312-834-9600
IL Skokie, Sargent-Welch Sci. 312-677-0600
IN Indianapolis, Graham Elctrns. 317-634-8202
LA New Orleans, Radio Parts 504-581-5959
MA Lynn, Land Elctrns. 617-592-2220
MI Flint, Shand Elctrns. 313-743-8940
MI Lansing, Fulton Radio 517-394-5020
MO Kansas City, Walters Radio Supp. 816-531-7015
MO St. Louis, Olive Elctrn. 314-426-4500
NJ Bridgeport, VWR Scientific Corp. 609-467-2600
NM Albuquerque, Walker Radio 505-247-2288
NY Buffalo, Summit Distr. 716-884-3450
OH Dayton, Stotts-Friedman 513-298-5555
OK Oklahoma City, Trice Whlsr. 405-524-4411
PA Pittsburgh, Fischer Scientific Co. 412-562-8300
SC Columbia, Dixie Radio Supp. 803-253-5333
TN Nashville, Electra Distr. Co. 615-329-3971
TX Dallas, Wholesale Elctrns. 214-824-3001
TX Ft. Worth, Allied Elctrns. 817-336-5401
UT Salt Lake City, Newark Elctrns. 801-486-1048
VA Norfolk, Avec Elctrns. 804-627-3502
WI Milwaukee, Industrial Elctrns. Supp. 414-276-1212

EPSCO MICROWAVE, 411 Providence Hwy., Westwood, MA 02090, Tel: 617-329-1500, TWX: 710-348-0484; FSC No.: 15894; Empl.: 185; *Sls. Mgr.:* John M. Shalhoub

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 312-232-9611, TWX: 910-237-1684; Empl.: 30; *Sls. Mgr.:* Robert Knox

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60507, Tel: 312-859-1000; Empl.: 300; *Sls. Mgr.:* Ralph Zettinger

EQUIPTO ELCTRNS. CORP., 351 Woodlawn Ave., Aurora, IL 60507, Tel: 312-897-4691; FSC No.: 14002; *Sls. Mgr.:* Larry Suggett .... **2**•1031

Local Sales Offices & Reps

AL Huntsville, Hollingsworth & Still 800-241-5712
AZ Tempe, Burland Assoc. 602-894-5564
CA Anaheim, Spectrum Assocs. 714-630-6977
CA Sunnyvale, Ward Elctrn. Packaging Sls. 408-730-4494
CO Littleton, Grifco 303-795-1989
CT Stratford, Technical Instrs. 203-368-4582
FL Orlando, Hollingsworth & Still 800-241-5712
GA Norcross, Hollingsworth & Still 404-447-1700
IL Palatine, Joseph Clark Co. 312-358-5095
IN Ft. Wayne, Scott Elctrns. 219-484-7865
MD Silver Spring, Sel-Tronics 301-589-3391
MA Wilmington, Technical Instrs. 617-944-3930
MI Troy, Scott Elctrns. 313-585-7690
MO Blue Springs, Cairns & Hayes Elctrn. Sls. 816-229-1404
MO St. Charles, Cairns & Hayes Elctrn. Sls. 314-946-6677
NJ Englewood, Tecnimat 201-569-4200
NM Albuquerque, R.L.S. Instr. 505-265-4187
NY Syracuse, Labtronics 315-455-7314
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns. 513-294-0539
PA Valley Forge, J. E. Cuesta & Co. 215-265-5800

SC	Columbia, Hollingsworth & Still	800-241-5712
TX	Dallas, Kruvand Assocs.	214-691-4592
TX	Houston, Kruvand Assocs.	713-780-9710
WA	Seattle, S.J.I. Corp.	206-763-8981

ERA POLY-PLANAR DIV., 311 E. Park St., Moonachie, NJ 07074, Tel: 201-641-3650, TWX: 710-990-5064; Empl.: 100; *Sls. Mgr.:* John Apelian

ERA TRANSPAC DIV., Sub. Elctrn. Research Assocs., 311 B East Park St., Dept. 1202, Moonachie, NJ 07074, Tel: 201-641-3650, TWX: 710-990-5064; FSC No.: 96762; Empl.: 100; *Sls. Mgr.:* John Apelian

ERC, See Electronic Research Co.

ERICSON MFG. CO., 4215 Hamann Pkwy., Willoughby, OH 44094, Tel: 216-951-8000, Telex: 98-5390; *Sls. Mgr.:* J. E. (Jay) Ericson, Jr.

ERIE TECHN. PRODS., See Murata Erie No. Amer., Inc.

ERM, 27 Water St., Wakefield, MA 01880, Tel: 617-246-3550

ERNI COMPS. CORP., Erni Elektroapparate GMBH, 1235 E. Davis St., Arlington Heights, IL 60005, Tel: 312-577-8620, TWX: 910-687-0260; *Sls. Mgr.:* J. Garratt; *Dist. Mgr.:* G. F. Zib

Local Sales Offices & Reps

CA	Burbank, Mod-Co.	213-848-2215
CO	Littleton, Protronics Group	303-973-3096
FL	Melbourne Beach, Jack McGirr Assoc.	305-723-6678
GA	Jonesboro, Wallace Elctrn. Sls.	404-471-6297
IL	Mt. Prospect, Dombrow Co.	312-253-3326
IN	Indianapolis, Sukup & Cox	317-253-5501
MA	Dover, George Urban Assoc.	617-329-4068
MN	Bloomington, D. A. Case Assoc.	612-888-8666
MO	Lees Summit, MYA Midwest	816-865-3370
NC	Kernersville, Wallace Elctrn. Sls.	800-672-4290
PA	Southampton, Campbell Assoc.	215-322-6630
TN	Hixson, Wallace Elctrn. Sls.	615-870-2080
TX	Dallas, D & K Sales	214-247-0138
WA	Auburn, Elctrn. Sls. Northwest	206-432-1002

Local Distributors

CA	Inglewood, Force Elctrns.	213-776-1324
CA	Santa Clara, Force Elctrns.	408-739-1324
CT	Hamden, Impact Sls.	203-281-1331
GA	Atlanta, Prehler, Inc.	404-447-5540
IL	Chicago, Prehler, Inc.	312-384-6100
MA	Canton, Impact Sls.	617-821-1500
MN	Bloomington, Prehler, Inc.	612-854-6670
MN	St. Paul, Northern Automatic Assembly	612-481-0022
NH	Salem, Astrum Elctrns.	603-329-5656
NJ	Englewood Cliffs, M.G. Assoc., Co.	201-567-4900
NY	Port Washington, Connector Concepts Corp.	513-883-3800
OH	Middleburgh Heights, Prehler, Inc.	216-826-0110

ESC

ESC ELCTRNS. CORP., 534 Bergen Blvd., Palisades Pk., NJ 07650, Tel: 201-947-0400, TWX: 710-991-9780; Empl.: 120 .... **1A**•1510-1520, 1594

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AZ	Mesa, Sedco Sales	602-835-6281
CA	Culver City, Westaironics	213-641-4122
CA	Santa Clara, Rodgers Assoc.	408-984-8110
CO	Westminster, D/Z Assocs.	303-429-9369
CT	Bridgeport, Betronic Assocs.	203-374-6404
FL	St. Petersburg, QXI, Inc.	813-821-2281
FL	Tamarac, QXI, Inc.	305-485-6030
IL	Elk Grove, Carlson Elctrn. Sls. Co.	312-956-8240
IN	Indianapolis, J & W Sales	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls. Co.	319-377-6341
KS	Merriam, Midwest Tech. Sls.	913-236-8555
MA	Waltham, Betronic Assocs.	617-894-8400
MN	Minneapolis, R-J, Inc.	612-866-3661
NY	New York City, Robert Smith Assocs.	212-541-4885
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Raleigh, Interep Assoc.	919-872-1401
NC	Raleigh, Interep Assocs.	919-872-1401
OH	Cincinnati, Makin Assocs.	513-871-2424
OR	Beaverton, Ravencraft	503-646-9261
PA	Marlton, BGR Assocs.	609-983-1020
TX	Plano, Zeus Engrg.	214-423-2027
UT	Salt Lake City, D/Z Assocs.	801-268-2876
VA	Reston, Tytronics Tech. Sls.	703-471-0440
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790
EXP	NJ, Palisades Pk., ESC Elctrns. Corp.	201-947-0400

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 213-322-2136; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* R. Mayers; *Dist. Mgr.:* R. Mayers

ESNA DIV., 2330 Vauxhall Rd., Union, NJ 07083, Tel: 201-686-6000, Telex: 1-38243, TWX: 710-985-4677; Empl.: 700

ESNA DIV., Amerace Corp., 2330 Vauxhall Rd., Union, NJ 07083, Tel: 201-686-6000, Telex: 1-38243, TWX: 710-985-4677; Empl.: 600; *Sls. Mgr.:* W. H. Riley; *Dist. Mgr.:* A. H. Wighton

ESPEY MFG. & ELECTRONICS CORP., 223-239 Ballston Ave., Saratoga Springs, NY 12866, Tel: 518-584-4100

E² TECHNOLOGY CORP., 1545 Morse Ave., Ventura, CA 93003, Tel: 805-644-9544, Telex: 658-480

ESSCO INDS., P.O. Box 515, Sierra Madre, CA 91024-0515, Tel: 818-355-8315; Empl.: 33

ESSEX CONTROLS, See Stancor Products

ESSEX CONTROLS DIV., ESSEX GRP., See Essex Controls, United Technologies

ESSEX GROUP, 9933 13th St., Ft. Wayne, IN. 46809, Tel: 219-478-1521; Empl.: 300-500; *Sls. Mgr.:* J. Scott

ESSEX GRP., ESSEX TERMINALS/ TERMINALS/CONNECTORS, See United Technologies, Comps. Div. Terminals

ESSEX GRP., Power Conductor Div., 2601 S. Adams, Marion, IN 46953, Tel: 317-664-6211, TWX: 317-667-6972; Empl.: 700; *Sls. Mgr.:* J. Burdick

ESTES ENGRG. CO., 930 Marine Dr., Port Angeles, WA 98362, Tel: 206-457-0904; FSC No.: 22590; Empl.: 28

E-SYSTEMS, Garland Div., Box 226118, Dallas, TX 75266, Tel: 214-272-0515, TWX: 910-860-5187; Empl.: 1927

E-SYSTEMS, Greenville Div., P.O. Box 1056, Greenville, TX 75401, Tel: 214-457-4694, Telex: 73-2392; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046

E-SYSTEMS, Memcor Div., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300, TWX: 810-333-1530; Empl.: 1100; *Sls. Mgr.:* Ray Vanderspool .... **1A**•1872, 2037

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
CA	Santa Ana, Cal-Tronic Sls.	714-979-4863
CA	Santa Clara, D.H. Ross	408-988-8111
CO	Denver, West, Inc.	303-692-0131
FL	Indialantic, Raycom	305-727-8860
GA	Atlanta, Murcota	404-875-2525
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Ft. Wayne, Menze Sls.	219-747-5616
MI	St. Clair Shores, J.M. Thorpe	313-779-6363
MN	Eden Praise, Bohlig & Associates	612-698-6921
MO	Blue Springs, Chesco	816-229-1404
MO	St. Charles, Chesco	314-946-6677
NH	Atkinson, Mark Rep Assoc.	603-362-4526
NJ	Englewood Cliffs, Masin Esco	201-569-8868
NY	Hauppauge, Masin Esco	516-273-3500
NY	Pittsford, Noeth-Honsinger	315-586-9002
NC	Burlington, Murcota	919-585-1577
NC	Winston-Salem, Murcota	919-723-1001
OH	Cleveland, Glover Sls.	216-842-4520
PA	Newtown Square, G.M. Conneen	215-353-2241
TX	Dallas, SW Elctrn. Ind.	214-233-9816
TX	Houston, SW Elctrn. Ind.	713-729-1670
UT	Salt Lake City, West, Inc.	801-966-0171
WA	Redmond, Barrett-Squibb	206-885-6991

E-T-A setting the pace for circuit protection

E-T-A CIRCUIT BREAKERS, 7400 N. Croname Rd., Chicago, IL 60648, Tel: 312-647-8303, Telex: 253780; Empl.: 20

Local Sales Offices & Reps

CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	Tustin, Sierra-Pacific Eng.	714-731-3411
CO	Denver, Challenge Sls.	303-450-2402
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Orlando, EAB Inc.	305-898-7444
IL	Arlington Heights, Thermek	312-577-6900
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
KY	Louisville, Needler Sls. Co.	502-241-4046
MA	Boston, Eagle Assocs.	617-444-3446
MI	Detroit, Hilltronics	313-398-5556
MN	Minneapolis, Chris & Assocs.	612-432-1823
MO	Kansas City, Delltron Co.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NY	New York, Schmitt Indl. Mktg. Corp.	516-486-3510
NY	Rochester, Robert F. Lamb Co.	716-323-1250
NY	Syracuse, Robert F. Lamb Co.	315-455-2469
OH	Cincinnati, J. O. Olsen Co.	513-574-7711
OH	Cleveland, J. O. Olsen Co.	216-662-3454
OR	Portland, Temco Northwest	503-648-8171
PA	Philadelphia, Techparts	215-628-3200
PA	Pittsburgh, J. O. Olsen Co.	412-279-2550
TN	Hendersonville, Stark & Assoc.	615-822-1667
TX	Austin, Delta Comps.	512-458-4288
TX	Dallas, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
WA	Seattle, Temco Northwest	206-488-1254
WI	Milwaukee, Star Engineering	414-645-3680

ETI ELECTRONICS, 5751 Miami Lakes Dr., Miami Lakes, FL 33014, Tel: 305-556-4000, Telex: 80-3347; *Sls. Mgr.:* R. Grossman; *Dist. Mgr.:* S. Zucker

ETI SYSTEMS

ETI SYSTEMS, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, Tel: 619-757-7770, TWX: 910-322-1396; FSC No.: 952 762672; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Bill Tice .... **1A**•2038; **1B**•1146-1149

ETM ELECTROMATIC, 470 San Antonio Ave., Palo Alto, CA 94306, Tel: 415-494-1505; *Sls. Mgr.:* Kenneth F. Lillis

ETRI

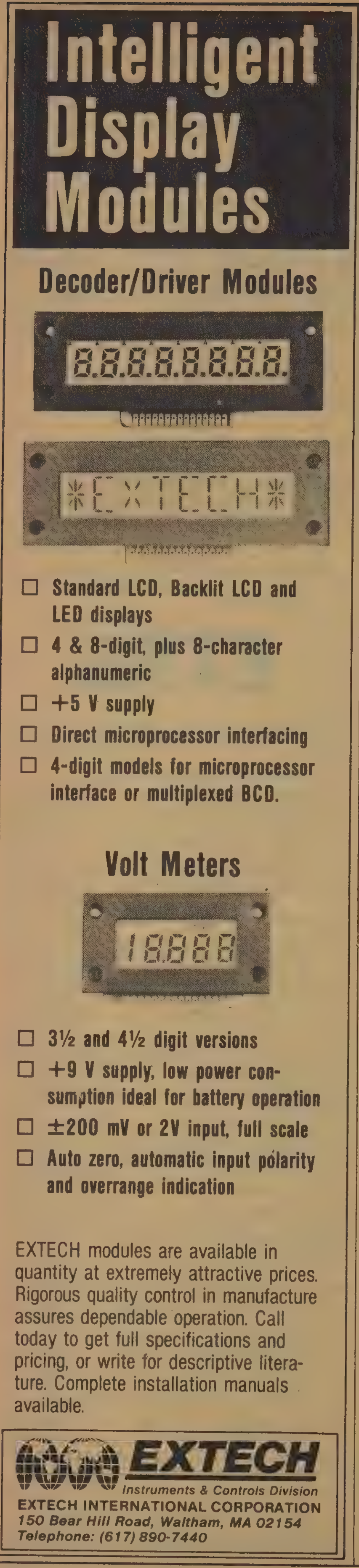
ETRI, 608 Broome St., P.O. Box 568, Monroe, NC 28110, Tel: 704-289-5423, TWX: 810-649-1352; *Sls. Mgr.:* G. Wolf .... **2**•1818-1820

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Los Gatos, Nor-West	408-395-1190
CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Bestronics	619-452-5500
CO	Boulder, Comp. Prods. Sls.	303-530-2800
CT	N. Haven, John E. Boeing Co.	203-239-5369; 800-343-4331
FL	Altamonte Springs, Semtronics Assoc.	305-831-8233
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
IN	Ft. Wayne, Advanced Comp. Sls.	219-484-0722
IN	Indianapolis, Advanced Comp. Sls.	317-545-6441
IA	Cedar Rapids, PMR, Inc.	319-362-9177
KS	Overland Park, PMR, Inc.	913-381-0004
KS	Wichita, PMR, Inc.	316-684-4141
MA	Lexington, J. E. Boeing	617-862-2500
MI	Birmingham, Favco Techn. Reps.	313-644-0173
MN	Minneapolis, Milt Westlund	612-866-5002
MO	Maryland Heights, PMR, Inc.	314-569-1220
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NY	Manhasset, Win-Cor Elctrns.	516-627-9474
NY	Syracuse, C. W. Floring Assocs.	315-478-2149
NC	Cary, Mohtgomery Mktg.	919-467-6319
OH	Akron, Imtech, Inc.	216-666-1185
OH	Dayton, Imtech, Inc.	513-278-6507
OK	OK, Tulsa, Nova Mktg.	918-743-6202
OR	Wilsonville, RTS, Inc.	503-638-5670
TX	Dallas, Nova Mktg.	214-750-6082
TX	Houston, Nova Mktg.	713-988-6082
UT	Salt Lake City, Comp. Prods. Sls.	801-262-0000
WA	Vancouver, RTS, Inc.	206-892-0141
WA	Vashon, RTS, Inc.	206-285-1363
WI	Waukesha, Lincoln, Hodges & Assocs.	414-542-3087

Local Distributors

AZ	Tempe, Fisher-Brownell	602-967-1464
AZ	Tempe, Acacia Sls.	602-894-2874
CA	Alhambra, Fisher-Brownell	213-289-0255
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Irvine, Acacia Sls.	714-549-0954
CA	San Diego, Fisher-Brownell	619-560-8545
CA	San Diego, Acacia Sls.	619-565-4365
CA	Santa Clara, Fisher-Brownell	408-988-6041
CA	Sunnyvale, Acacia Sls.	408-745-7200
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Altamonte Springs, Pioneer	305-834-9090
FL	Ft. Lauderdale, Pioneer	305-771-7520



Intelligent Display Modules

Decoder/Driver Modules

- ☐ Standard LCD, Backlit LCD and LED displays
- ☐ 4 & 8-digit, plus 8-character alphanumeric
- ☐ +5 V supply
- ☐ Direct microprocessor interfacing
- ☐ 4-digit models for microprocessor interface or multiplexed BCD.

Volt Meters

- ☐ 3½ and 4½ digit versions
- ☐ +9 V supply, low power consumption ideal for battery operation
- ☐ ±200 mV or 2V input, full scale
- ☐ Auto zero, automatic input polarity and overrange indication

EXTECH modules are available in quantity at extremely attractive prices. Rigorous quality control in manufacture assures dependable operation. Call today to get full specifications and pricing, or write for descriptive literature. Complete installation manuals available.

EXTECH
Instruments & Controls Division
EXTECH INTERNATIONAL CORPORATION
150 Bear Hill Road, Waltham, MA 02154
Telephone: (617) 890-7440

FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
IL	Addison, L-Comp	312-628-1400
IN	Indianapolis, RM Elctrns.	317-247-9701
IN	Indianapolis, Advent Elctrns.	317-872-4910
KS	Overland Park, Milgray Elctrns.	913-236-8800
KS	Wichita, L-Comp	316-265-5100
MD	Rockville, MS Elctrns.	301-340-6400
MD	Rockville, Milgray Elctrns.	301-468-6400
MA	Burlington, Milgray Elctrns.	617-272-6800
MA	Wilmington, R C Comps. Inc.	617-273-1860
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	Kansas City, L-Comp	816-221-2400
MO	Maryland Heights, L-Comp	314-291-6200
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Bohemia, Key Comps.	516-567-7500
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Pittsford, Milgray Elctrns.	716-385-9330
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Milgray Elctrns.	216-447-1520
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Richardson, Fisher-Brownell	214-235-3177
UT	Salt Lake City, Bell Indus.	801-972-6969
VA	Charlottesville, Virginia Radio Supp.	804-296-4184
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	New Berlin, RM Elctrns.	414-784-4420

EUBANKS ENGRG., 1307 So. Myrtle Ave., Monrovia, CA 91016, Tel: 213-357-7011, Telex: 675403; Empl.: 90; *Sls. Mgr.:* J. Reed

EVANS ASSOCS., Box 5055, Berkeley, CA 94705, Tel: 415-653-3083

EVAPORATED COATINGS, 798 Welsh Rd., Huntingdon Valley, PA 19006, Tel: 215-947-1465; Empl.: 24; *Sls. Mgr.:* Stephen L. Schaffer

EVEREADY-ENERGIZER, See Union Carbide Battery Prods. Div.

EVEREST INTERSCIENCE, P.O. Box 345, Tustin, CA 92680, Tel: 714-992-4461, 714-730-0747; Empl.: 11; *Sls. Mgr.:* Marilyn M. Everest

Local Sales Offices & Reps

CA	Woodland Hills, R. Friedman Assocs.	213-702-0665
CO	Littleton, Radco Elctrns.	303-794-4279
IL	Decatur, Mueller Sls.	217-442-6379
IA	Cedar Rapids, Mueller Sls.	319-365-1196
LA	Baton Rouge, Allesco	504-928-1571
MA	Peabody, J S R Assocs.	617-532-0348
MN	Golden Valley, Mueller Sls.	612-544-8888
NE	Omaha, Mueller Sls.	402-571-3033
NM	Albuquerque, R L S Instrs. Co.	505-293-7931
NY	Buffalo, Seelbach & Schmitt Inc.	716-839-2300
NY	Plainview, Eastern Metro Assocs. Inc.	516-931-1414
OH	Cincinnati, Pro-Con Analytical	513-272-3300
OR	Portland, Fairman B. Lee Co.	503-283-9442
PA	Havertown, Shelby Jones	215-446-6600
TX	Dallas, Allesco	817-261-3966
TX	Houston, Allesco	713-771-0115
WA	Seattle, Fairman B. Lee Co.	
WI	Brookfield, Mueller Sls.	414-781-5310

EVERETT/CHARLES CONTACT PRODS. INC., 700 E. Harrison Ave., Pomona, CA 91767, Tel: 714-625-5551, Telex: 67-55-78, TWX: 910-581-1210; *Sls. Mgr.:* Bud Fabian

EVERETT/CHARLES TEST EQUIP. INC., 2887 N. Towne Ave., Pomona, CA 91767, Tel: 714-621-9511, TWX: 910-581-3838; Empl.: 200; *Sls. Mgr.:* Jim Malloy

EVERSHED & VIGNOLES LTD., Acton Lane, Chiswick, London, W4 5HJ, England, Tel: 01-994-3670, Telex: 22583; Empl.: 300; *Sls. Mgr.:* J. Gilpin

Local Sales Offices & Reps

NY	Copiague, Intl. Precision Mech., Inc.	516-842-6332

EV-GAME INC., See EVG, Inc.

EWALD INSTRS., Rte. 7R, Kent, CT 06757, Tel: 203-927-3278

EWC INC.

EWC, INC., 725 Federal Ave., Kenilworth, NJ 07033, Tel: 201-245-3200, 800-526-4048, TWX: 710-996-5993; FSC No.: 15387; Empl.: 185; *Sls. Mgr.:* C. G. Hiotis; *Dist. Mgr.:* C. G. Hiotis ....**1A**•2154-2163

Local Sales Offices & Reps

AZ	Mesa, Cummings & Assoc.	602-994-9027
CA	Canoga Park, Cummings & Assocs.	213-340-6035
CA	San Diego, Cummings & Assoc.	714-297-6035
CA	Santa Clara, Cummings & Assocs.	408-247-8656
CO	Denver, Cummings & Assocs.	303-455-6860
CT	Ridgefield, Phoenix Sales	203-438-9644
FL	Greenacres City, Tech-Rep. Assoc.	305-968-7792
FL	Melbourne Beach, Tech. Rep. Assoc.	305-725-4655
FL	St. Petersberg, Tech-Rep. Assoc.	813-577-2779
IL	Chicago, Electro-Tech Mktg.	312-588-4535
ME	Chelmsford, Dynamic Engrg. Corp.	617-250-0200
MD	Glen Burnie, Stinson Assoc.	301-760-8878
MA	Chelmsford, Dynamic Engrg. Corp.	617-250-0200
MN	St. Paul, Proud Inds.	612-646-9428
NJ	E. Brunswick, Winch Assoc.	201-828-4615
NY	De Ruyter, Net Sls. Co.	315-662-7996
NY	Pittsford, Net Sls. Co.	716-467-4538
NY	Roslyn Heights, Winch Assoc.	516-621-6378
NY	Troy, Net Sls. Co.	518-274-4758
OR	Portland, Cummings & Assoc.	503-761-4411
PA	Bensalem, Stemler Assoc.	215-639-9298
PA	Greensberg, Pro-Mark	412-832-3800
RI	Greensberg, Pro-Mark	412-832-3800
TX	Dallas, Associated Entprs.	214-630-7623
TX	Houston, Associated Entprs.	713-495-9767
UT	Salt Lake City, Cummings & Assoc.	801-263-8131
VT	Chelmsford, Dynamic Engrg. Corp.	617-250-0200
VA	Reston, Stinson Assoc.	703-471-0723
WI	Brookfield, Electro-Tech Mktg.	414-785-9554

Local Distributors

CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	San Diego, Park-West Inc.	619-277-8433
CA	Woodland Hills, C & A Elctrns.	213-340-6036
CT	Norwalk, Park Dist.	203-853-2010
FL	West Palm Beach, Nurmi Elctrn. Supp.	305-686-8553
IL	Arlington Heights, Reptron Elctrns.	312-593-7070
MD	Baltimore, Whitney Dist.	301-944-8080
OR	Portland, Dunn Elctrns.	503-285-0214
OR	Portland, Radar Elec.	503-233-3691
PA	McKean, Advocom Elctrns.	814-476-7774
WA	Seattle, Radar Elec.	206-282-2511

EXACT ELECTRONICS, Div. of Dynatech Nevada Inc., Box 1925, 2000 Arrowhead Dr., Carson City, NV 89701, Tel: 702-883-3400, 800-648-7952, Telex: 170054; FSC No.: 34511; Empl.: 60; *Sls. Mgr.:* Joe Foster

EXAR INTEGRATED SYS., P.O.B. 62229, Sunnyvale, CA 94088, Tel: 408-732-7970, TWX: 910-339-9233; Empl.: 450; *Dist. Mgr.:* Jack Hanoka

Local Distributors

AL	Huntsville, Pioneer Elctrns.	205-837-9300
AL	Huntsville, Resisticap.	205-883-4270
AZ	Phoenix, Sterling Electronics	602-258-4531
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Chatsworth, Jaco	213-998-2200
CA	Sunnyvale, Bell Indus.	408-734-8570
CA	Tustin, A.V.E.D.	213-770-0871
CO	Denver, Diplomat Elctrns.	303-740-8300
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Danbury, Diplomat Elctrns.	203-797-9674
CT	East Haven, J.V. Elctrns.	203-469-2321
GA	Comming, Pan American	404-889-0066
IL	Bensenville, Diplomat Elctrns.	312-595-1000
IL	Lombard, R.M. Elctrns.	312-932-5150
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, R.M. Elctrns.	317-247-9701
IA	Cedar Rapids, Deeco	319-377-5795
MD	Columbia, Diplomat Elctrns.	301-995-1226
MD	Gaithersburg, Pioneer Elctrns.	301-948-0710
MA	Canton, Almo Elctrns.	617-329-8810
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Wilmington, RC Comps.	617-657-4310
MA	Woburn, Diplomat Elctrns.	617-935-6611
MI	Farmington, Diplomat Elctrns.	313-477-3200
MI	Grand Rapids, R.M. Elctrns.	616-531-9300
MN	Minneapolis, Merit Elctrns.	612-546-5583
MO	St. Louis, Olive Industrial Elctrns.	314-426-4500
NJ	Totowa, Diplomat Elctrns.	201-785-1830
NJ	Totowa, Diplomat Elctrns.	201-785-1830

NM	Albuquerque, Betatron	505-344-2381
NM	Albuquerque, Bell Indus.	505-292-2700
NY	E. Syracuse, Diplomat Elctrns.	315-437-9900
NY	Farmingdale, S.A.I.	516-293-2710
NY	Hauppauge, JACO	516-273-5500
NY	Melville, Diplomat Elctrns.	516-454-6400
NY	Port Chester, Zeus Comps.	914-937-7400
OH	Cincinnati, Graham Elctrns.	513-772-1661
OK	Tulsa, Radio.	918-587-9123
OR	Portland, Radar Elec.	503-233-3691
PA	Horsham, Pioneer Elctrns.	215-674-4000
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Almo Elctrns.	215-698-4000
TX	Austin, Quality Comps.	512-838-0551
TX	Dallas, Quality Comps.	214-387-4949
TX	Houston, Quality Comp.	713-772-7100
UT	Salt Lake City, Diplomat Indus.	801-486-4134
UT	Salt Lake City, Bell Elctrns.	801-972-6969
WA	Redmond, Western Microtechnology	206-881-6737
WI	Mequon, Taylor Elec.	414-241-4321

exatron
automatic test equipment

EXATRON AUTOMATIC TEST EQUIP., 3513 Ryder St., Santa Clara, CA 95051, Tel: 408-737-7111 800-EXA-TRON, Telex: 172-090; Empl.: 9; *Sls. Mgr.:* Kathryn Henderson

Local Sales Offices & Reps

AZ	Mesa, RLS Instrs.	602-892-9329
CA	Covina, Romar Intl.	213-332-8548
CA	Sunnyvale, C.C.L.M.	408-578-6119
CO	Westminster, Alphatek	303-428-5348
FL	Melbourne, E.M.S.	305-724-1027
IL	Chicago, Solid State Elctrns. of Illinois	312-889-8033
MA	Woburn, Programmable Devices	617-935-9530
MN	Edina, P.E.C./Levi	612-944-8540
NJ	Vincentown, JRM Elctrns.	609-859-2106
NM	Albuquerque, RLS Instrs.	505-293-7931
OH	Hudson, Technical Sales	216-656-3978
OR	Beaverton, Northwest Test & Meas.	503-646-9966
TX	Dallas, Elctrn. Production Spec.	214-985-1932
WA	Redmond, Northwest Test & Meas.	206-881-8857

EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781; Empl.: 50

EXCEL TECHNOLOGY INTL. CORP., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, Tel: 201-874-4747, TWX: 710-480-5401; *Sls. Mgr.:* K. Thomas Shih .... **1B**•1053-1055

Local Sales Offices & Reps

AR	N. Little Rock, Leo Barker Co.	501-834-2537
CA	San Diego, Uni-Rep	619-746-5131
CA	San Jose, Cerco	401-298-1918
CT	Washington, Tri-Com Assocs.	203-563-2241
FL	Coral Springs, HAI Elctrns.	305-752-7520
GA	Stone Mountain, Dixie Tech. Mktg.	404-962-2530
IL	Chicago, ESCO Assocs.	312-763-0800
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	E. Brunswick, Kong Sys.	201-828-8514
NC	Charlotte, Mackay, Smith and Assoc.	704-372-1188
OR	Portland, Frank Jackson, Assoc.	503-292-2638
TX	Dallas, Southwest Elctrn. Inds.	214-690-9881

EXIDE ELCTRNS., P.O. Box 58189, Raleigh, NC 27658, Tel: 919-872-3020, TWX: 510-928-0598; FSC No.: 31795; Empl.: 900; *Sls. Mgr.:* Richard King

EXTECH INTERNATIONAL CORP., 150 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-7440, Telex: 940913; *Sls. Mgr.:* Neal DeWitt

E-Z-HOOK, Div. Tektest Inc., Box 450 - 225 N. Second Ave., Arcadia, CA 91006, Tel: 818-446-6175, TWX: 910-582-1614; FSC No.: 08505; Empl.: 23; *Sls. Mgr.:* C. Haskin; *Dist. Mgr.:* P. Wood

Fabricast, Inc.

FABRICAST, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, Tel: 818-443-3247; FSC No.: 13345; Empl.: 8 .... **1B**•1150-1155

FAB-TEK INC., 68 Morgan Ave., Danbury, CT 06810, Tel: 203-743-3312; Empl.: 5

FACET ENTERPRISES, INC., Elmira, NY 14903, Tel: 607-737-8011, Telex: 93-2490, TWX: 510-252-1594; Empl.: 400; *Sls. Mgr.:* Gary Packard

Local Sales Offices & Reps

AL	Birmingham, Wilcox & Allen	205-254-8051
CA	Millbrae, Schriver Indl. Sls.	415-692-6836
CA	Tustin, Morgan Johnson	714-832-7282
CO	Englewood, Techna-Quip	303-779-5399
CT	Hamden, Aid Engrg. Sls.	203-434-1673
FL	Cocoa, Reynolds & Assocs.	305-784-4700
FL	Ft. Lauderdale, Reynolds & Assocs.	305-581-6611
FL	St. Petersburg, Reynolds & Assocs.	813-360-1484
GA	Atlanta, Reynolds & Assocs.	404-451-9558
IL	Northfield, Lenhart Assoc.	312-446-9320
MA	Bedford, Aid Engrg. Sls.	617-663-2225
MA	Westboro, Aid Engrg. Sls.	617-890-8181
MI	Madison Hgts., Pine Sls.	313-589-0350
MO	Kansas City, Terry & Hodges	913-722-1024
MO	St. Louis, Terry & Hodges	314-965-0746
NY	Alexander, B. H. Tollefson Assoc.	716-591-1219
NY	Auburn, B. H. Tollefson Assoc.	315-253-4109
NY	Rochester, B. H. Tollefson Assoc.	716-271-4141
NC	Charlotte, M. R. Snyder	704-527-6752
OH	Chagrin Falls, Pine Sls.	216-247-6198
OH	Cincinnati, Fremont & Lewis	513-851-1500
OR	Portland, N. Rupp	503-231-7701
PA	Bridgeville, Foster-McClinton	412-941-4800
PA	Devon, Goodall Industrial Equpt. Co.	215-964-1070
TN	Chattanooga, Willcox & Allen	615-698-7125
TX	Richardson, D. E. Harman	214-234-2021
TX	Woodlands, MJM Intl. Sls.	713-273-3126
WA	Bellevue, N. Rupp	206-455-2130
WV	Hurricane, Foster-McClinton	304-757-6645
WI	Wauwatosa, Gille Engrg. Sls.	414-258-4100

FAIRCHILD CAMERA & INSTR. CORP., 464 Ellis St., MS15-1035, Mountain View, CA 94042, Tel: 415-962-5011, TWX: 910-379-6435; Empl.: 17 405; *Sls. Mgr.:* Hal Mumma

FAIRCHILD MICROPROCESSOR DIV., Fairchild Camera & Instr. Corp., 450 National Ave., Mountain View, CA 94042, Tel: 415-962-3838, TWX: 910-379-5091

FAIRCHILD TEST SYS. GRP., Testline Instrs., 1400 White Dr., Titusville, FL 32780, Tel: 305-267-7212, TWX: 510-950-3043; Empl.: 103; *Sls. Mgr.:* Bill Wirth

FAIRCHILD WESTON, DATA RECORDERS, P.O. Box 3041, Sarasota, FL 33578, Tel: 813-371-0811, Telex: 4991610, TWX: 810-864-0406; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Steve Hoff .... **3**•1235

Local Sales Offices & Reps

AZ	Mesa, Vic Myers Assocs.	602-897-7378
CA	Cupertino, Fairchild Weston	408-257-1813
CA	Laguna Hills, Elotek Sys.	714-830-4856
CA	Westlake, Fairchild Weston	213-889-1057
CO	Fort Collins, Vic Myers Assocs.	303-223-8907
CT	Higganum, Intersell	203-528-5357
FL	Fort Walton Beach, RAM-Z Assocs.	904-862-2700
FL	Maitland, Wade H. Boggs	305-647-2226
ID	Rathdrum, Hood Engrg. Sls., Inc.	208-772-7235
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
MD	Silver Spring, Sel-Tronics	301-589-3391
MA	Burlington, Intersell	617-273-3844
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Lovis, Marsland Assocs.	314-991-1399
NJ	Cedar Grove, KLS Assocs.	201-785-4450
NM	Albuquerque, Vic Myers Assocs.	505-884-6878
NY	Rochester, Scientific Dvcs. NY	716-334-2445
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
PA	Devon, Fairchild Weston	215-687-3220
TX	Conroe, Fairchild Weston	713-539-1315
WA	Bellevue, Hood Engrg. Sls., Inc.	206-453-9375
WI	New Berlin, Marsland Assocs.	414-786-6611

FAIRCHILD WESTON, See Weston Controls, Div. Fairchild

FAIR-RITE PRODS., PO Box J, Wallkill, NY 12589, Tel: 914-895-2055, TWX: 510-249-4819; FSC No.: 34899; Empl.: 170; *Sls. Mgr.:* B. G. Tolen .... **2**•1907

Local Sales Offices & Reps

AL	Huntsville, Macro-Mktg. Assocs.	205-883-9630
CA	Anaheim, Micrometals	714-630-7420
CA	Sunnyvale, Schwerin & Merrill Assocs.	408-735-7900
CO	Englewood, A-G Elctrns.	303-850-0657
CT	W. Hartford, R. S. Pettigrew & Assoc.	203-233-8533
FL	New Smyrna Beach, J. Wetzel	904-423-5707
IL	Marshall, Fair-Rite Prod.	618-584-2944
IN	Indianapolis, Frank J. Campisano Co.	317-253-7651
MI	Southfield, J. L. Montgomery Assoc.	313-358-2616
MN	Bloomington, Holmes & Ladky Assocs. of Minn.	612-884-2125
NY	Hempstead, Kahgan Sales	516-538-2300
OH	Cincinnati, F. J. Campisano & Assoc.	513-574-7111
OR	Portland, Freed Assocs.	503-289-5320
PA	Easton, Kendon Co.	215-253-3100
TX	Dallas, S.E.I. Inc.	214-690-9881
VA	Roanoke, A. B. Kreger & Co.	703-989-4738
WI	Milwaukee, Frank W. Ladky Assocs.	414-351-2112

F & M SYSTEMS CO., See Texas Controls

FAN-S CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, Telex: 985319; Empl.: 75; *Sls. Mgr.:* John Hallums; *Dist. Mgr.:* William Forkins

FARIA, THOMAS G., CORP., 19 Faria Lane, Uncasville, CT 06382, Tel: 203-848-9271; Empl.: 225; *Sls. Mgr.:* A. Knupp

FARINON DIV., Harris Corp., 1691 Bayport, San Carlos, CA 94070, Tel: 415-594-3000, Telex: 34-8491; *Sls. Mgr.:* John Stockford

FASCO INDUSTRIES, INC., Div. of Hawker Siddeley Group, 601 North Federal Highway, Boca Raton, FL 33432, Tel: 305-368-0600, Telex: 51-5612; *Sls. Mgr.:* Clarence A. Button; *Dist. Mgr.:* Paul R. Reid

FCM PLASTICS, Plastics Technologies Inc., 2555 Oak Industrial Dr. NE, Grand Rapids, MI 49505, Tel: 616-451-4502, TWX: 810-273-6038; *Sls. Mgr.:* Patrick K. Parsons

FEMA ELCTRNS. CORP., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816, Tel: 201-238-1223, Telex: 299425 FEMA UR; Empl.: 10 to 20; *Sls. Mgr.:* Bob Cheng

EXTECH
Digital Panel Meters
Measure, Monitor, Control

-000
3000
EXTECH

- Indicate, Monitor, Control Temperature
- Measure, Monitor RH, Temperature
- DCV, DCA, ACV, ACA, Hz
- Measure, Monitor, Control pH, ORP
- Versatile Pressure Indicator
- Tachometers, Timers
- LED or LCD — ¼, ⅛ DIN, Miniature Cases

EXTECH
Instruments & Controls Division
EXTECH INTERNATIONAL CORPORATION
150 Bear Hill Road, Waltham, MA 02154
Telephone: (617) 890-7440

FEMCO, INC., P.O. Box 26710 Parkmoor Sta., San Jose, CA 95159, Tel: 408-946-1188, Telex: 17-1618, TWX: 910-338-2290

FENWAL, INC., 400 Main St., Ashland, MA 01721; Empl.: 1000; *Sls. Mgr.:* John W. Rice

FENWAL ELCTRNS., 63 Fountain St., Framingham, MA 01701, Tel: 617-872-8841, TWX: 710-346-0678; Empl.: 500; *Sls. Mgr.:* W. M. Minnucci; *Dist. Mgr.:* Tom Colacchio 1B•1803

Local Sales Offices & Reps

AL	Huntsville, Conley & Assocs.	205-882-0316
AZ	Phoenix, Dorton Entprs.	602-944-2957
CA	Cupertino, Codella Mktg. Grp.	408-257-2561
CA	Los Angeles, Landa/Minyard, Inc.	213-879-0770
CO	Denver, Elcom	303-337-2300
CT	Southington, Andrews Airtronics	203-621-6158
FL	Boca Raton, Conley & Assocs.	305-395-6108
FL	Oviedo, Conley & Assocs.	305-365-3283
FL	Tampa, Conley & Assocs.	813-885-7658
GA	Doraville, Conley & Assocs.	404-447-6992
IL	Chicago, Century Elctrns. Corp.	312-777-9700
IN	Noblesville, Century Elctrns. Corp.	317-849-2026
IA	Cedar Rapids, Palatine Engrg. & Sls.	319-365-8071
KS	Mission, Palatine Engrg. & Sls.	913-831-0555
MD	Woodbine, Naudain Assoc. So.	301-442-2270
MA	Danvers, Andrews Airtronics	617-246-2450
MI	Ferndale, Hilltronics	313-398-5556
MN	Bloomington, Northport Engrg.	612-854-5556
MO	Hazelwood, Palatine Engrg. & Sls.	314-839-0800
NY	Huntington, CDB Entprs.	516-692-5200
NY	Kingston, R. P. Kennedy Co.	914-876-2700
NY	Rochester, R. P. Kennedy Co.	716-271-6326
NY	Rochester, R. P. Kennedy Co.	716-271-6322
NC	Raleigh, Conley & Assocs.	919-876-9862
OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OR	Portland, Jas. J. Backer Co.	503-297-8744
OR	Salem, Jas. J. Backer Co.	503-362-0717
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Arlington, W. Pat Fralia Co.	817-640-9101
TX	Austin, W. Pat Fralia Co.	512-835-7911
TX	Houston, W. Pat Fralia Co.	713-772-1572
UT	Salt Lake City, Elcom	801-532-7940
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Century Elctrns. Corp.	414-645-3680
EXP	MA, Framingham, Fenwal Elctrns.	617-872-8841

Local Distributors

CA	Burlingame, Rose Elctrn. Distr.	415-348-2740
CA	Chatsworth, Mil-Comm Distr.	213-998-3111
CO	Denver, Newark-Denver Elctrn. Supp.	303-757-3351
CO	Englewood, Indl. Elctrns. Corp.	303-694-9444
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
GA	Norcross, Newark Elctrns.	404-321-0413
IL	Chicago, Newark Elctrns. Corp.	312-638-4411
IL	Elgin, Allied Elctrns.	312-697-8200
IN	Indianapolis, Graham Elctrns. Supp.	317-634-8202
MD	Beltsville, Newark Elctrns.	301-937-5085
MA	Woburn, Newark Elctrns.	617-935-8350
MI	Grand Rapids, Newark Elctrns.	616-241-6681
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Minneapolis, Stark Elec.	612-332-1325
MO	St. Louis, Olive Indl. Elec.	314-426-4500
NJ	Springfield, Newark Elctrns.	201-376-9500
NY	Buffalo, Summit Dists.	716-887-2800
NY	Huntington, CDB Dev.	516-692-5200
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Warrensville Heights, Newark Elctrns.	216-587-1700
OK	Tulsa, Radio, Inc.	918-587-9123
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Fort Worth, Allied Elec.	817-336-5401
TX	Fort Worth, Patco Supply	817-429-8596
UT	Salt Lake City, Standard Supp.	801-486-3371

FERRANTI ELEC., 87 Modula Ave., Commack, NY 11725, Tel: 516-543-0200, TWX: 510-226-1490; *Sls. Mgr.:* Mike Kennett

FERRETEC INC., 1701A Fortune Dr., San Jose, CA 95131, Tel: 408-263-1216, TWX: 910-338-2353; *Sls. Mgr.:* Allen E. Rosenzweig

Local Sales Offices & Reps

CA	Los Altos, Jay Stone & Assocs.	415-948-4563
CA	Torrance, DeTomasi & Grupp Inc.	213-327-1775
FL	Mebourne Beach, Millett Assocs.	305-725-5055
IL	Wauconda, Cudahy Sls. Co.	312-526-2484
MD	Severna Park, Delmarva Engrg. Assocs.	301-647-8007
MA	Chelmsford, BBC	617-452-7211
MO	Leasburg, EIR Co.	314-245-6860
NY	Great Neck, Phase Four Inc.	516-482-1790
NY	Utica, B. D. Hummel Co.	315-736-7821
PA	Elkins Park, Snow Assocs.	215-379-4700
TX	Dallas, Tritex Technical Sls., Inc.	214-247-3041

FERRO CORP., Composites Div., 34 Smith St., Norwalk, CT 06852, Tel: 203-853-2123

FERRO CORP., Ottawa Chem. Div., 700 N. Wheeling St., Toledo, OH 43605, Tel: 419-691-3507

FERRO, Thick Film Sys. Div., 25 Castilian Dr., Santa Barbara, CA 93117, Tel: 805-968-5000, Telex: 98-0165; Empl.: 26; *Sls. Mgr.:* William Faix, Jr.

FERRO CERAMIC GRINDING, INC., 247 Water St., Wakefield, MA 01880, Tel: 617-245-1833; Empl.: 14; *Sls. Mgr.:* Philip Strasnick

FERRONICS, 66 N. Main St., Fairport, NY 14450, Tel: 716-223-1010, TWX: 510-254-2893; Empl.: 90; *Sls. Mgr.:* M. Northrup

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Seal Beach, Texel	213-596-9411
FL	Ft. Lauderdale, Electrocomp	305-491-4141
GA	Atlanta, L & D	404-455-3473
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Columbus, Chambers Mktg.	812-362-0272
MD	Baltimore, Bernard White	301-484-5400
MA	Canton, New England Elctrn. Sls.	617-828-4835
MI	Birmingham, Forand Sls.	313-644-0087
MN	St. Paul, Countryman Assoc.	612-645-9151
MO	Blue Springs, Cairns & Hayes Co.	816-229-1404
NJ	Upper Saddle River, B. Cameron	201-825-1304
NY	Syracuse, J Rudy Co.	315-487-6951
NC	Raleigh, L & D	919-876-5301
PA	Hatboro, Joe Oberlies Co.	215-675-4226
TX	El Paso, Alexander Entprs.	915-591-3142
TX	Richardson, Jaro Elec. Sls.	214-231-6654
WA	Seattle, General Elctrns.	206-575-4030

FERROTRAN ELCTRNS. CO., INC., 11 W. 25th St., New York, NY 10010, Tel: 212-691-3610; *Sls. Mgr.:* H. King 3•1564, 1565

FERROXCUBE CORP., See Amperex Elctrns., Ferroxcube Div.

FG ENGRG., Box 476, Fredonia, AZ 86022, Tel: 602-643-7375; Empl.: 6; *Sls. Mgr.:* F. Griswold

FIBERGUIDE INDUSTRIES INC., 33 Poplar Dr., Stirling, NJ 07980, Tel: 201-647-6601

FIBEROPTIC FABRICATIONS, INC., 70 Pullman St., Worcester, MA 01606, Tel: 617-853-6449, Telex: 951838; *Sls. Mgr.:* A. John Cunningham

FIBEROPTICS TECHNLG., INC., Quassett Rd., Pomfret, CT 06258, Tel: 203-928-0443; *Sls. Mgr.:* J. H. Castonguay

FIBRONICS INTL. INC., 325 Stevens St., Hyannis, MA 02601, Tel: 617-778-0700, Telex: 951297; *Sls. Mgr.:* Kenneth Bowes

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye; *Dist. Mgr.:* Robert E. Frye 1B•1265

FIDELITY CHEM. PRODS. CORP., 472 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4110; Empl.: 35

FIELD ELECTRONICS, 1416 Commerce St., Chatham, NJ 07928, Tel: 201-635-6566

FIELD-FAB, 43 School St., N. Springfield, VT 05150, Tel: 802-886-8278; *Sls. Mgr.:* Harold Lombard

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350, TWX: 510-681-8412; Empl.: 50; *Sls. Mgr.:* William D. Kinney 1B•1366, 1624

Local Sales Offices & Reps

NJ	West Long Branch, Eastern Elctrn. Sls. Co.	201-544-0600

FIL-COIL CO., INC., 800 Axinn Ave., Garden City, NY 11530, Tel: 516-294-5445, Telex: 965-957; FSC No.: 56528; Empl.: 70; *Sls. Mgr.:* William Goldman

FIL-COIL ECONOMY INTL., INC., 800 Axinn Ave., Garden City, NY 11530, Tel: 516-294-5445, Telex: 965-957; FSC No.: 56528; Empl.: 85; *Sls. Mgr.:* William Goldman 1A•1595

Local Sales Offices & Reps

AZ	Phoenix, Thor Engrg.	602-867-1843
CA	Goleta, Thorson Co.	805-964-8751
CA	Los Angeles, High Voltage Sales	213-881-9194
CA	Walnut Creek, W. A. Borden Co.	415-937-5196
FL	Clearwater, Brennan Assoc.	813-446-5006
GA	Atlanta, Remco	404-447-6937
IL	Skokie, Esco Assocs.	312-674-2376
MD	Beltsville, Applied Engrg.	301-953-2808
MA	Wakefield, Nerem Co.	617-245-5767
MN	Chanhassen, Barnes Sls. Assoc.	612-474-2907
NJ	Fairfield, Addem Sls. Co.	201-882-0993
NM	Albuquerque, IMEC	505-883-9010
OH	Avon, J. D. Babb Assoc.	216-934-6113
OH	Dayton, O. Penrod	513-228-4555
OR	Forest Grove, Doran Sls. Assoc.	503-357-3333
PA	Bridgeport, R. D. Freedman/Malta	215-279-5767
PA	Southampton, Campbell Assocs.	215-322-6630
PA	Thomasville, Lou Weaver	717-792-1305
TX	Richardson, Eagle Mktg.	214-238-5383

FILM CAPACITORS, 100 8th St., Passaic, NJ 07055, Tel: 201-779-2240; Empl.: 55

FILM MICROELECTRONICS, 17 A St., Burlington, MA 01803, Tel: 617-272-5650, TWX: 710-332-1124; Empl.: 130; *Sls. Mgr.:* Denise Laplante

FILTER CONCEPTS INC., 2624 S. Rousselle, Santa Ana, CA 92707, Tel: 714-545-7003; *Sls. Mgr.:* Stan Jones 1A•1596, 1597

FILTRON CO., INC., Div. of Aeroflex Labs., Inc., 148 Sweet Hollow Rd., Old Bethpage, NY 11804, Tel: 516-752-1144; *Sls. Mgr.:* Harold Samkoff

Local Sales Offices & Reps

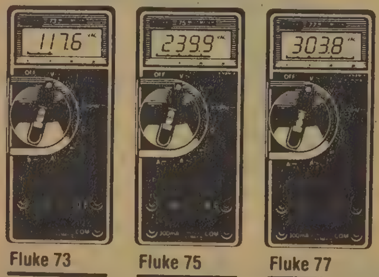
AZ	Tucson, WJM Sls.	602-887-4847
CA	Granada Hills, C & W Comp. Sls.	213-368-4032
CA	Sunnyvale, Esco Assoc.	408-745-1410
CO	Boulder, A. Bissell Co.	303-444-1173
FL	New Port Richey, Lobo Mktg. Assoc.	813-848-8578
MD	Baltimore, Bernard White & Co.	301-484-5400
MA	Westwood, O. E. M. New England	617-769-4976
MN	Bloomington, Merrill Franklin Co.	612-854-9446
NY	Melville, Carnes Assoc.	516-694-1600
OH	Kettering, J. May Assoc.	513-299-8424
TX	Bedford, De Armond Ent.	817-267-2048
WA	Vancouver, Ray Over Sls.	206-695-6179

FLUKE®
DIGITAL MULTIMETERS & COUNTERS
AUTHORIZED DISTRIBUTORS
RAG ELECTRONICS, INC.

WEST
21418 Parthenia Street
Canoga Park, CA 91304
Tel. (818) 998-6500

EAST
1 Pollack Avenue
Ocean, N.J. 07712
Tel. (201) 544-0666

NEW & RECONDITIONED TEST EQUIPMENT
• SALES • RENTALS • PURCHASE OPTIONS
• REPAIR & CALIBRATION



Call Toll-Free
West (Outside CA) 1-800-732-3457
East (Outside NJ) 1-800-922-0945

FINCOR, 3750 E. Market St., York, PA 17402, Tel: 717-757-4641, Telex: 840-432; FSC No.: 061790; Empl.: 500 .... 3•1566-1569

Local Sales Offices & Reps

AL	Pinson, JM Simpson & Assocs.	205-854-2546
CA	Los Angeles, Dyna Sls.	213-268-1175
FL	Altamonte Springs, WMM Assocs.	305-831-4530
FL	Clearwater, WMM Assocs.	813-442-3913
FL	Ft. Lauderdale, WMM Assocs.	305-772-9850
MI	Centerline, Dietrich & Assoc.	313-754-6450
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
NJ	Cinnaminson, Scott Sls. Co.	609-829-2991
NY	Huntington, C. R. Mayer Co.	516-WA 1-7876
OH	Cleveland, Dietrich & Assoc.	216-781-1855
OH	Dayton, Dietrich & Assoc.	513-223-6042
PA	Pittsburgh, Dietrich & Assoc.	412-892-2992
TX	Garland, Tesco	214-681-1376
WA	Seattle, Eicher-Richards Co.	206-LA 3-7888

FIRST COMPUTER CORP., 645 Blackhawk Dr., Westmont, IL 60559, Tel: 312-920-1050, TWX: 910-651-1916; Empl.: 25; *Sls. Mgr.:* Allan L. Parker

FISCHER AMERICA, INC.

FISCHER-AMERICA INC., 13756 Glenoaks Blvd., Sylmar, CA 91342, Tel: 818-362-9393, Telex: 499-4182; *Sls. Mgr.:* Ron Fuller .... 2•1275

FITCHBURG COATED PRODS., P.O. Box 1106, Scranton, PA 18501, Tel: 717-347-2035; Empl.: 300

FKC ENGINEERING CO., 161 Rand Street, Central Falls, RI 02863, Tel: 401-724-1760

FLEXCO MICROWAVE, INC., P.O. Box 174, Karrville Rd., Port Murray, NJ 07865, Tel: 201-689-3020, Telex: 467439; FSC No.: 52214; *Sls. Mgr.:* Robert C. Tappen; *Dist. Mgr.:* Robert C. Tappen

FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43085, Tel: 614-889-6152; *Sls. Mgr.:* D. Morlan .... 1A•2165

FLEX-KEY CORP., 18 Sargent St., Gloucester, MA 01930, Tel: 617-281-2040, Telex: 94-0333; FSC No.: 51163; Empl.: 50; *Sls. Mgr.:* Philip P. Bodoni .... 1B•1770, 1771

FLEXPRINT DIV, Sanders Assocs., Inc., Grenier Field, Manchester, NH 03103, Tel: 603-669-4615, TWX: 710-220-1845; Empl.: 700

FLIGHT CONNECTOR CORP., Dubilier America, 233 E. Manville St., Rancho Dominguez, CA 90220, Tel: 213-631-1133, Telex: 664734; FSC No.: 28680; *Sls. Mgr.:* Ken Tillery; *Dist. Mgr.:* Ken Tillery

FLIGHT SYSTEMS, INC., Tracor, Inc., 1091 Dove St., Newport Beach, CA 92660, Tel: 714-833-9661, Telex: 183542 FSI NPBH; *Sls. Mgr.:* William J. Weiss

FLITE-TRONICS COMPANY, INC., See Marathon Flite-Tronics Company

FLOATING POINT SYSTEMS, INC., P.O. Box 23489, Portland, OR 97223, Tel: 503-641-3151, Telex: 4742018 FLPT UI; *Sls. Mgr.:* Paul Shapiro

FLORIDA DATA, 600D John Rodes Blvd., Melbourne, FL 32935, Tel: 305-259-4700, Telex: 56-210 FDC MELB; Empl.: 200; *Sls. Mgr.:* B. Winkelspecht

FLOW TECHN., Box 21346, Phoenix, AZ 85036, Tel: 602-437-1315, Telex: 668-344; Empl.: 85; *Sls. Mgr.:* Art Marshall

FLUKE, JOHN, MFG. CO., Box C9090, MS 250C, Everett, WA 98206, Tel: 206-356-5400, Telex: 152662, TWX: 910-445-2943; Empl.: 2645; *Sls. Mgr.:* W. Hoffman; *Dist. Mgr.:* T. Rockney

FMC CORP., Ind'l. Chemical Grp., 2000 Market St., Philadelphia, PA 19103, Tel: 215-299-6000; Empl.: 800

Local Sales Offices & Reps

CA	City of Industry	213-330-0680
CA	San Jose	408-289-3853
IL	Downers Grove	312-971-8600
NC	Charlotte	704-554-1551
OH	Cincinnati	513-563-2100
PA	King of Prussia	215-337-9475
TX	Dallas	214-783-0877

FOGG SYS., 15592 E. Batavia Dr., Aurora, CO 80011, Tel: 303-344-1883; Empl.: 7

FOREDOM ELEC. CO., Blackstone Inds., Route 6, Bethel, CT 06470, Tel: 203-792-8622, Telex: 643438; Empl.: 100; *Sls. Mgr.:* Kent Kristensen; *Dist. Mgr.:* Kent Kristensen

FORK STANDARDS, INC., 666 Western Ave., Lombard, IL 60148, Tel: 312-932-9380; Empl.: 14

FORMA SCIENTIFIC, Div. of Mallinckrodt Inc., Box 649, Marietta, OH 45750, Tel: 614-373-4763, Telex: 29-8205; Empl.: 290; *Sls. Mgr.:* Ned Urschel

FORMULATED RESINS INC., Box 508, Greenville, RI 02828, Tel: 401-949-2060; Empl.: 15; *Sls. Mgr.:* H. R. Oldham

FOUNDATION INSTRUMENTS INC., 24 Colonnade Rd., Nepean, ON K2E 7J6, Canada, Tel: 613-226-4000, Telex: 053-4153; *Sls. Mgr.:* Jean Paul Clermont

FOURJAY INDUSTRIES, Box 1465 Northridge Br., Dayton, OH 45414, Tel: 513-278-9416; Empl.: 20; *Sls. Mgr.:* M. W. Frawley

FOXBORO CO., 28020 Stanford Ave., Valencia, CA 91355, Tel: 805-257-4200, Telex: 67-4389

FOX ELCTRNS., P.O. Box 1078, Cape Coral, FL 33910, Tel: 813-482-7212, TWX: 510-951-7386; FSC No.: 61429; *Sls. Mgr.:* Mark Stearns (East Reg.), Lynn Stacey (West Reg.), Vivian Lee (Exp.) .1A•1352-1355

Local Sales Offices & Reps

AL	Huntsville, Beacon	205-881-5031
AZ	Glendale, Adtek	602-931-9289
CA	Aqoura, Cal Rep	213-991-1940
CA	Mountain View, Brooks Tech. Grp.	415-960-3880
CA	Riverside, Cal Rep Branch	714-682-6762
CA	San Diego, DePierre & Assocs.	619-578-2555
CA	Tarzana, Cal Rep Branch	213-996-6745
CO	Parker, Technology Mktg. Assoc. of CO	303-841-3435
CT	Waterbury, HLM CT	203-753-9894
FL	Clearwater, Beacon	813-796-2378
FL	Ft. Lauderdale, Beacon	305-491-1054
FL	Maitland, Beacon	305-647-3498
FL	Melbourne, Beacon	305-724-8010
GA	Atlanta, Beacon	404-256-9640
IL	Rolling Meadows, Sumer	312-991-8500
LA	Mandeville, Design Mktg.	713-273-2319
MD	Woodbine, Naudain Assocs. Southern	301-442-2270
MI	Fenton Lake, McNab & Assoc.	616-925-2166
MN	Bloomington, 2 M Sales	612-890-7774
NH	Nashua, Comptech	617-649-3030
NJ	Parsippany, HLM NJ	201-263-1535
NY	Northport, HLM NY	516-757-1606
NY	Syracuse, Pitronics	315-455-7346
NC	Raleigh, Beacon	919-787-0330
OH	Akron, B.J. Davis	216-645-0517
OK	Tulsa, Design Mktg.	918-622-7387
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Southampton, Vista Sls. Assoc.	215-322-7420
TX	Dallas, Design Mktg.	214-680-9767
TX	Hurst, Design Mktg.	817-268-2004
TX	Round Rock, Design Mktg.	512-255-9896
UT	Salt Lake City, Technology Mktg. Assoc.	801-364-3296
WA	Seattle, Earl & Brown	206-284-1121
WI	Brookfield, Sumer	414-784-6641

Local Distributors

AL	Huntsville, Contact Elctrns.	205-881-9321
AZ	Phoenix, Kachina Elctrn. Dist.	602-269-6201
CA	Belmont, Arndt	415-592-8097
CA	Chatsworth, Integrated Elctrns.	213-998-2200
CA	Irvine, Integrated Elctrns.	714-660-1055
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Jose, Integrated Elctrns.	408-287-6488
CA	Santa Clara, Cypress	408-727-7080
CA	Santa Clara, California Capacitor	408-980-8495
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Orlando, Hammond Elec.	305-849-6060
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IL	Palatine, Technology Sls.	312-991-6600
IN	Carmel, Altex	317-848-1323
LA	Harvey, AFG Elctrn. Supp.	504-368-9696
MA	Needham, Cronin Elctrns. Inc.	617-449-5000
MA	Wilmington, R C Components	617-273-1860
MI	Walled Lake, Ambur Elctrns.	313-659-3710
MN	Edina, Northern Elctrns. Supp.	612-944-1167
NJ	Bellmawr, Mid Atlantic Elect. Corp.	609-931-5303
NY	Rochester, Cam/RPC Ind. Elec.	716-865-2080
NY	Syracuse, Add	315-437-0300
OH	Cleveland, CAM/Ohio Ind. Elec.	216-461-4700
OR	Beaverton, Almac Elctrns.	503-641-9070
PA	Lancaster, Cam/RPC Ind. Elec.	717-392-8141
PA	Pittsburgh, Cam/RPC Ind. Elec.	412-782-3770
TX	Austin, Tinkertronics	512-926-4420
TX	Channel View, Henry Radio	713-452-4451
TX	Dallas, Heilind Elctrns.	713-988-2711
TX	Houston, Essential Elctrns.	713-493-5028
TX	McKinney, Sunbelt Elect.	214-235-0587
UT	North Salt Lake, Integrated Elctrns.	801-298-1868
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bellevue, Almac Elctrns.	206-643-9992
WV	Charleston, Cam/WVA Ind. Elec.	304-344-8029

FRAMAR METAL PRODS., 124 W. Main St., Dept. 1201, High Bridge, NJ 08829, Tel: 201-638-6688; Empl.: 6; *Sls. Mgr.:* J. W. Moore

JOHN FRANEK

FRANEK, JOHN, CO., INC., P.O. Box 11752, Santa Ana, CA 92711-1752, Tel: 714-832-0290, 800-854-9420; Empl.: 7; *Sls. Mgr.:* John D. Franek; *Dist. Mgr.:* Tom A. Goreth .... 3•1394, 1395, 1570, 1571, 1862-1877

FRANK, B.H., CO., 3733 W. 139th St., Hawthorne, CA 90250, Tel: 213-675-9182, Telex: 674432; *Sls. Mgr.:* Andrew Hilbert

FRAZIER, 1930 Valley View La., Dallas, TX 75234, Tel: 214-241-3441; Empl.: 20; *Sls. Mgr.:* W. A. Wadkins

FREDERICK CABLE PRODS., Digital Systems Corp., 406 Sagner Ave., Frederick, MD 21701, Tel: 301-694-9355; *Sls. Mgr.:* Robert Pennington; *Dist. Mgr.:* Robert Pennington

Local Sales Offices & Reps

MD	Annapolis, Electromate	301-262-2702
PA	Collegeville, Linton Assoc.	215-489-2447

FLUKE®

DIGITAL MULTIMETERS & COUNTERS

AUTHORIZED DISTRIBUTORS

METERMASTER

FOR

Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration

METERMASTER LOCATIONS:

ARIZONA
Phoenix .... (602) 437-1425
Tucson .... (602) 792-3411
CALIFORNIA
Los Angeles .... (213) 685-4340
Palo Alto .... (415) 968-0313
San Diego .... (619) 560-4841
GEORGIA
Atlanta .... (404) 446-0166
ILLINOIS
Chicago .... (312) 593-8650
MASSACHUSETTS
Boston .... (617) 523-2580
MINNESOTA
Minneapolis .... (612) 332-6117
MISSOURI
St. Louis .... (314) 454-0241
NEW MEXICO
Albuquerque .... (505) 292-3330
OHIO
Cleveland .... (216) 651-4100
OKLAHOMA
Tulsa .... (918) 582-1444
PENNSYLVANIA
Pittsburgh .... (412) 261-4548
TEXAS
Austin .... (512) 473-8876
Dallas .... (214) 271-5671
Houston .... (713) 733-9814
WISCONSIN
Milwaukee .... (414) 643-0554
ALL OTHER STATES .... (800) 962-8128

FREDERICK COMPONENTS INTL., 20806 Plummer St., Chatsworth, CA 91311, Tel: 818-882-0868, 800-354-0660 .... 2•1821; 3•1572, 1573

FREDERICK ELCTRNS. CORP., 7630 Hayward Rd., P.O. Box 502, Frederick, MD 21701-0502, Tel: 301-662-5901, Telex: 893438; FSC No.: 15230; Empl.: 350; *Sls. Mgr.:* Marty Bandler

FREDERICKS CO., Philmont & Anne Sts., Huntingdon Valley, PA 19006, Tel: 215-947-2500; Empl.: 150

FREED TRANSFORMER, 1718 Weirfield St., Ridgewood, NY 11385, Tel: 212-386-1300; FSC No.: 73386; Empl.: 200; *Sls. Mgr.:* M. Salzberg .... 1A•2166-2169; 3•1236

Local Sales Offices & Reps

CA	San Gabriel, R. G. Moye Co.	213-283-1669
CO	Denver, Nelson Co.	303-573-1516
CT	Marlborough, Precision Sls.	203-295-0580
GA	Smyrna, B-C. Elctrn. Sls.	404-436-5169
MD	Baltimore, B. White & Co.	301-484-5400
NY	Pittsford, Noeth-Honsinger Assoc.	716-586-9002
NY	White Plains, QED Elctrns.	914-946-3424
OH	Cleveland, Scott Elctrns.	216-291-2600
OH	Trotwood, I. Atkind & Assoc.	513-837-4750
PA	King of Prussia, Freedman-Malta Assoc.	215-279-5767
EXP	NY, Plainview, Morhan Exp.	516-293-5582

FREQUENCY AND TIME SYSTEMS, INC., 34 Tozer Rd., Beverly, MA 01915, Tel: 617-927-8220, Telex: 94-0518 FTS BVLY; FSC No.: 56219; Empl.: 126 .... 3•1154

Local Sales Offices & Reps

CA	Anaheim, Datum Timing	714-533-6333
CA	Santa Clara, Ward-Davis Assocs.	408-245-3700
FL	Sarasota, Ram-Z Assocs.	813-921-5561
MD	Ashton, Blackwood Assocs., Inc.	301-924-2858
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
TX	Richardson, Lear Assocs., Inc.	910-867-4718

FREQUENCY CONTROL PRODS., INC., American Time Prods. Div., 61-20 Woodside Ave., Woodside, NY 11377, Tel: 212-458-5811, TWX: 710-582-2637; FSC No.: 59559; *Sls. Mgr.:* Sanford Cohen - Crystals, Ed Cohen - Oscillators Servo, John Murray - Electro Optic .... 1A•1356, 1357; 3•1010

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Tempe, Foley, Tallent & Lee	602-894-2345
CA	Auburn, Straube Assocs.	916-885-0632
CA	Mountain View, Straube Assocs.	415-969-6060
CA	Palo Alto, Alfred Barauck	415-327-7711
CA	San Luis Obispo, Johnson Assocs.	805-544-7770
CO	Westminster, Straube Assocs.	303-426-0890
FL	Melbourne, Raycom	305-259-7988
IL	Chicago, Probe Elctrns.	312-698-2044
IN	Ft. Wayne, J & B Sls. Co.	219-483-2813
IN	Ossian, Science Sls.	219-622-7383
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MI	Grand Rapids, A. Blumenberg	616-456-7320
MI	Oak Park, A. Blumenberg	313-968-3230
MN	Minneapolis, Bohlig & Assocs.	612-922-7011
NJ	Carlstadt, Com-Tech Sls.	201-935-5454
NM	Albuquerque, Straube Assocs.	505-292-0428
NY	Albany, H. C. Johnson Agencies	518-459-1239
NY	Buffalo, H. C. Johnson Agencies	716-632-7880
NY	Centerport, Carnes Diamond Assoc.	516-261-8100
NY	Rochester, H. C. Johnson Agencies	716-586-0777
NY	White Plains, Cane Technical Sls.	914-694-9240
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Broomall, Sapinosa Assoc.	215-353-7267
PA	Glenshaw, H. C. Johnson Agencies	412-961-0414
TX	Richardson, Carl Tinch Sls.	214-231-1322
UT	Salt Lake City, Straube Assocs.	801-263-2640

FREQUENCY DEVICES, INC., 25 Locust St., Haverhill, MA 01830, Tel: 617-374-0761, TWX: 710-347-0314; Empl.: 60 .... 1A•1624; 3•1237

FREQUENCY ELCTRNS., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, Tel: 516-794-4500, TWX: 510-223-0418; Empl.: 350; *Sls. Mgr.:* A. Lazar .... 1A•1358, 1359

Local Sales Offices & Reps

CA	Mountainview, Pacific Techn. Mktg.	415-969-3010
FL	Orlando, Truex Assoc.	305-859-2160
MD	Silver Spring, Marktron	301-460-6100
MD	Timonium, Marktron	301-252-7111
MA	Wayland, High-Tech Sls.	617-653-3838
NJ	East Windsor, Micro Lambda	609-443-3113
NJ	W. Orange, E-F Techn. Sls.	201-731-7203
NY	Huntington Sta., E-F Techn. Sls.	516-549-1818
OH	Cleveland, Tiby Co.	216-371-5335
TX	Houston, Spectra Sls. Corp.	713-783-8333
TX	Richardson, Spectra Sls. Corp.	214-234-3600
VA	Charlottesville, Marktron	804-973-5874
EXP	NY, New York, Henley Elctrns.	212-986-5544

FSN

FREQUENCY SELECTIVE NETWORKS, INC., 69-20 Garfield Ave., Woodside, NY 11377, Tel: 212-424-7500; FSC No.: 56662; Empl.: 30; *Sls. Mgr.:* Michael L. Izzolo .... 1A•1361

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States	602-998-2444
CA	Santa Clara, F.M. Assocs.	408-733-9143
FL	Ft. Lauderdale, Donato Assoc.	305-733-3450
KS	Shawnee Mission, Elctrn. Comp. Sls.	913-764-2611
MA	Andover, B. E. E. Assocs	617-475-2124
MN	Bloomington, 2M Sls.	612-888-7414
NJ	Paramus, Carnes Diamond Assocs	201-967-1309
NY	Centerport, Carnes Diamond Assocs	516-261-8100
NY	Rochester, H.C. Johnson Agencies	716-482-3000
NC	Winston-Salem, Murcoto	919-722-9445
OH	Akron, Augnat Assocs	216-725-6087
PA	Glenshaw, H. C. Johnson Assocs	412-961-0444
PA	Glenside, Koebert Assoc.	215-887-2310

FREQUENCY SOURCES, KSW Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 617-256-8101, TWX: 710-343-0404; FSC No.: 50101; Empl.: 80

FREQUENCY WEST, INC., 3140 Alfred St., Santa Clara, CA 95050, Tel: 408-727-8500, TWX: 910-338-0163; FSC No.: 8F150; Empl.: 158; *Sls. Mgr.:* James K. McGuinness

FRESNEL OPTICS, Div. of Alliance Tool Corp., 1300 Mt. Read Blvd., Rochester, NY 14606, Tel: 716-647-1140, Telex: 97-8322; *Sls. Mgr.:* Helmut Walter;Adolph Gulde

FRONT PANEL DEVICES, INC., 530 Burnside Ave., Inwood, NY 11696, Tel: 212-471-9800, Telex: 645-580; Empl.: 20; *Sls. Mgr.:* Michael Geller

FSI/FORK STANDARDS INC., 666 Western Ave., Lombard, IL 60148, Tel: 312-231-3511, 312-932-9380; FSC No.: 14986; Empl.: 20; *Sls. Mgr.:* A. E. Toht; *Dist. Mgr.:* A. E. Toht

FTS SYS., POB 158, Stone Ridge, NY 12484, Tel: 914-687-7664, TWX: 510-247-0547; Empl.: 45; *Sls. Mgr.:* T. N. Thompson, Jr.

FUJI-SVEA, P. O. Box 3375, Torrance, CA 90510, Tel: 213-533-1221, Telex: 182-392; *Sls. Mgr.:* Chris Moore

FUJITSU

FUJITSU AMERICA, INC., 918 Sherwood Dr., Lake Bluff, IL 60044, Tel: 312-295-2610, Telex: 206196, TWX: 910-651-2259; Empl.: 30 .... 1B•1367-1385; 2•1276-1292

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg.	205-536-5938
AZ	Phoenix, Sanford Sls.	602-957-3570
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	San Jose, Applied Elctrn. Mktg.	408-225-6144
CA	Thousand Oaks, SC Cubed	805-496-7307
CA	Tustin, SC Cubed	714-731-9206
CO	Denver, Donohue Sls.	303-455-1719
FL	Altamonte Springs, 'C' Assocs.	305-831-1717
FL	Pompano Beach, 'C' Assocs.	305-972-9200
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
GA	Stone Mtn., Dixie Tech. Mktg.	404-962-2530
IL	Elk Grove Vl., John G. Twist	312-593-0200
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Noblesville, McFadden Sls.	317-877-5070
KS	Prairie Village, R. W. Kunz & Assocs., Inc.	913-648-3535
ME	E. Sabago, Electrical Comps. Inc.	207-787-3145
MD	Baltimore, Component Sls.	301-484-3647
MA	Fall River, Elec. Comps.	617-674-0064
MA	Longmeadow, Elec. Comps.	413-567-0153
MA	Natick, Elec. Comps.	617-655-2225
MI	Brighton, A. P. Assocs.	313-229-6550
MI	Warren, DEM Elctrn. Sls.	313-575-9444
MN	Bloomington, John G. Twist	612-835-2120
MN	Minneapolis, Milt Westlund & Assoc.	612-866-5002
MO	St. Louis, R. W. Kunz & Assocs., Inc.	314-966-4977
NJ	Bellmawr, TAI Corp.	609-933-2600
NJ	Parlin, JMR Sls.	201-727-5335
NY	E. Setauket, JMR Sls.	516-689-8871
NY	Rochester, Lake Bluff Sls. Div., Elec. Comps.	716-385-9303
NC	Charlotte, Robert W. Chapman Co.	704-525-2421
NC	Greensboro, Robert W. Chapman	919-282-0740
NC	Raleigh, Robert W. Chapman	919-782-2624
OH	Columbus, McFadden Sls.	614-459-1280
PA	Greensburg, Pro-Mark	412-832-3800
TX	Dallas, United Comps.	214-475-0051
UT	Bountiful, Anderson Assocs.	801-292-8991
VA	Charlottesville, Component Sls., Inc.	804-979-1681
WA	Bellevue, Whisler Sls. Co.	206-643-1463
WI	Brookfield, John G. Twist	414-782-2670
WI	Cedarburg, Bransky Sls.	414-377-6837

Local Distributors

CA	Brisbane, Automated Process Controls	415-467-6162
CA	Buena Park, Control Design Supp.	213-802-2429
CA	San Carlos, Control Design Supp.	415-592-4808
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Ana, Pacesetter Elctrns.	714-557-7131; 213-233-5800
CA	Santa Monica, Distr. Specialists	213-393-9666
CA	Torrance, Cypress Elctrns.	213-533-6005; 714-761-3366
CO	Denver, CSID	303-292-9594
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Altamonte Springs, Control Design Supp.	305-788-3220
FL	Lakeland, A-A Elec.	813-665-6941
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Prehler Elctrns., Inc.	404-447-5540
GA	Atlanta, Milgray Elctrns.	404-393-9666
GA	Atlanta, Electrical Control Prods.	404-455-1216
GA	Norcross, A-A Elec.	404-449-8670
GA	Stone Mountain, Control Design Supp.	404-979-3500
IL	Addison, Lectro Comps.	312-543-1680
IL	Chicago, Prehler Elctrns., Inc.	312-384-6100
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Genoa, Control Design Supp.	815-784-6519
IL	Joliet, Mainline Supp. Co.	815-436-3900
IL	Northbrook, Classic Comp. Supp.	312-272-9650
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Indianapolis, Control Design Supp.	317-788-0551
IA	Marian, Control Design Supply, Inc.	319-373-2923
KS	Overland Park, Milgray Elctrns.	913-236-8800
ME	Portland, Rockingham Elec. Supp.	207-772-4614
MD	Rockville, Milgray Elctrns.	301-468-6400
MA	Burlington, Milgray Elctrns.	617-272-6800
MA	Middleboro, Glynn Electronics	617-947-4262
MA	Natick, Tec-Con Elctrns.	617-655-9333
MA	Somerville, Electro Sls.	617-666-0500
MI	Farmington Hills, Prehler Elctrns., Inc.	313-473-7200
MN	Burnsville, Custom Connections	612-894-4090
MN	Minneapolis, Control Design Supp.	612-721-1628
MN	Minneapolis, Bergquist	612-835-2322
MO	St. Louis, Control Design Supp.	314-426-3160
MO	St. Louis, Interstate Industrial Elctrns.	314-423-4322
NE	Omaha, Radio Equip.	402-341-7700
NJ	Berlin, General Comps. Inc.	609-768-6767
NJ	Fairlawn, Relay Specialties	201-797-3313
NJ	Marlton, Milgray Elctrns.	609-983-5010
NJ	Nutley, Vantage Comps.	201-667-1840
NJ	Whippany, Tonar Inds.	201-884-1400
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	N. Babylon, E.I.M. Intl. Mktg.	516-643-5700
NY	Pittsford, Milgray Elctrns.	716-385-9330
NC	Charlotte, Control Design Supp.	704-588-4410
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Middleburg Heights, Prehler Elctrns., Inc.	216-243-5510
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom, Inc.	814-476-7774
TX	Austin, Altair Co.	512-837-4490
TX	Dallas, Control Design Supp.	214-358-1441
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
UT	Salt Lake City, Active Comp Technlg.	801-487-8131
WA	Bellevue, Integrated Elctrns./Jaco	206-455-2727
WI	Cedarburg, A-A Elec.	414-377-7500
WI	Mequon, Taylor Elec.	414-241-4321
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	New Berlin, Control Design Supp.	414-784-1016
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	New Berlin, Classic Comp. Supp.	414-786-5300
WI	Racine, Badger Elctrn. Parts Co.	414-637-1256

FURMAN SOUND, INC., 30 Rich St., Greenbrae, CA 94904, Tel: 415-927-1225, Telex: 172029 SPXSRFL; *Sls. Mgr.:* Diane Poole; *Dist. Mgr.:* Diane Poole

FURNAS ELEC., 1197 McKee St., Batavia, IL 60510, Tel: 312-879-6000, Telex: 72-0458; Empl.: 1360; *Sls. Mgr.:* T. W. Thornton; *Dist. Mgr.:* R. Lanser

FUSECOM, 14864 NE 95th St., Redmond, WA 98052, Tel: 206-881-2442; *Sls. Mgr.:* Bruce Barndt

GABRIEL ELCTRNS., Box 70, Scarborough Indl. Pk., Scarborough, ME 04074, Tel: 207-883-5161, Telex: 95-0113; Empl.: 135; *Sls. Mgr.:* D. B. Crisman

Local Sales Offices & Reps

MO	St. Louis, Gabriel Elctrns.	314-878-2982

GALITE, 2 Tower Dr., Wallingford, CT 06492, Tel: 203-265-7126, TWX: 710-476-0764; FSC No.: 56447; *Sls. Mgr.:* James W. Campbell, Jr.

GAMBLE, CHARLES T., INDS., 605 Perkins La., Delanco, NJ 08075, Tel: 609-461-1900; Empl.: 150; *Sls. Mgr.:* W. Snyder

GAMMA HIGH VOLTAGE RESCH. INC., 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-5050 .... 3•1574, 1575

Local Sales Offices & Reps

IL	Chicago, Ropek, Cahill & Vogt	312-631-0070
NM	Albuquerque, Cleveland Entprs.	505-265-7893

GAMMA SCIENTIFIC INC., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, Telex: 69-7938; Empl.: 65; *Sls. Mgr.:* G.C. Unangst

GANDALF DATA, INC., 1019 S. Noel Ave., Wheeling, IL 60090, Tel: 312-541-6060, TWX: 910-651-4951; Empl.: 350; *Sls. Mgr.:* Ken Charbauski

Local Sales Offices & Reps

CA	El Monte	213-571-6644
CA	San Francisco	415-363-0848
CO	Denver	303-321-4246
GA	Atlanta	404-451-2293
MD	Silver Spring	301-622-5400
MA	Dedham	617-329-7630
TX	Bellaire	713-665-6546
TX	Richardson	214-669-3643

GAP INSTR., 110 Marcus Blvd., Hauppauge, NY 11787, Tel: 516-273-0909, TWX: 510-227-6237; FSC No.: 00607; Empl.: 50

GARDINER ELCTRNS., 4729 North 7th Ave., Phoenix, AZ 85013, Tel: 602-274-9681

GARDINER SOLDER CO., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632, Tel: 312-847-0100, TWX: 910-221-2510; Empl.: 100; *Sls. Mgr.:* M. Boyle .... 2•1927

Local Sales Offices & Reps

AZ	Phoenix, Astro Prods.	602-268-2948
CA	La Mirada, Gardiner Solder	714-994-6350
FL	Merritt Island, James A. Kennedy	305-452-9821
GA	Tucker, Elctrl. Concepts, Inc.	404-491-3154
IA	Princeton, Johnson Mfg.	319-289-5123
MA	Woburn, Yankee Tech Sls.	617-935-6278
MO	St. Charles, Phillips & Assocs.	314-441-0148
NJ	Englewood, Wilson Industries	201-871-4658
NJ	Scotch Plains, Gardiner Solder Co.	201-232-1965
NY	Sidney, Wingate & Assocs.	607-563-2113
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
TX	Dallas, The Mello Co.	214-241-9196
TX	Dallas, Elctrn. Production Specialists	214-422-5476
VA	Falls Church, Hyka, Inc.	703-560-6115
WA	Bellevue, Doland	206-454-4952

Local Distributors

AL	Birmingham, E.I.S., Inc.	205-252-9046
AZ	Phoenix, Lion Elctrns. Distrs.	602-869-9611
AZ	Phoenix, Elctrl. Specialty Co.	602-275-5736
CA	Anaheim, Elctrl. Specialty Co.	714-630-7050
CA	Anaheim, Advance Electrical Sls., Inc.	714-870-0300
CA	Belmont, Advance Elctrl. Sls.	415-592-4550
CA	Chino, Tracy Elctrn. Sls.	714-591-4736
CA	Glendale, Mac Donald & Co.	800-423-2453
CA	Los Angeles, Elctrl. Specialty Co.	213-724-9600
CA	Los Angeles, John Cameron Supply Co.	213-870-7403
CA	San Diego, Hi-Tech Metals Co.	619-270-8081
CA	San Diego, Elctrl. Specialty Co.	619-560-1800
CA	San Diego, Casco	619-560-9319
CA	San Francisco, Elctrl. Specialty Co.	415-589-9611
CA	Santa Clara, RGB Electro Ind. Tool	408-980-1300
CA	Simi Valley, Cal-Pacific Suppliers	213-998-4982
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Denver, Elctrl. Specialty Co.	303-321-0226
CT	Wallingford, Tech. Assocs.	203-265-4241
FL	Boca Raton, Kimco	305-994-0590
FL	Clearwater, Your Production Cupboard	813-447-2581
FL	Orlando, E.I.S., Inc.	305-855-7100
FL	Orlando, Mavidon Entprs.	305-298-7324
GA	Atlanta, E.I.S., Inc.	404-355-1651
IL	Addison, International Soldering Supplies	312-628-8083
IL	Hillside, Complete-Reading Electric Co.	312-547-5400
IN	Indianapolis, Complete-Reading Electric Co.	317-872-3710
KY	Louisville, E.I.S., Inc.	502-636-0384
LA	New Orleans, Complete-Reading Elec. Co.	504-944-5561
MD	Baltimore, Complete-Reading Elec. Co.	301-646-1330
MA	Woburn, Pacer Electronics	617-935-8330
MI	Warren, Complete-Reading Elec. Co.	313-755-6020
MN	Eden Prairie, Cassidy Elctrns.	612-944-0100
MN	Edina, Complete-Reading Elec. Co.	612-831-8145
MN	Minneapolis, W. D. Forbes Co., Inc.	612-378-1917
MO	Kansas City, Complete-Reading Elec. Co.	816-471-5966
MO	Maryland Heights, Complete-Reading Elec. Co.	314-569-1611
MO	St. Charles, Finnigan Wire & Cable	314-946-6201
NV	Carson City, Gibson Tool Co.	702-883-3566
NJ	Stirling, Janel	201-647-5600
NY	Fairport, Pacer Elctrns. of NY	716-377-0462
NY	Farmingdale, S.A.I.	516-293-2710
NY	Liverpool, Complete-Reading Elec. Co.	315-457-1350
NY	Sidney, Wingate & Assoc.	607-563-2113
NC	Charlotte, E.I.S., Inc.	704-392-7366
NC	Raleigh, E.I.S., Inc.	919-781-4750
OH	Cincinnati, E.I.S., Inc.	513-771-4073
OH	Cleveland, Complete-Reading Elec. Co.	216-267-1000
OH	Mentor, Kimco	216-255-1992
OK	Tulsa, Complete-Reading Elec. Co.	918-664-4000
OR	Portland, Elctrl. Specialty Co.	503-227-3601
PA	Pittsburgh, Complete-Reading Elec. Co.	412-788-1580
TN	Memphis, E.I.S., Inc.	901-947-4176
TN	Nashville, E.I.S., Inc.	612-883-0862
TX	Beaumont, Complete-Reading Elec. Co.	713-842-2117
TX	Dallas, Complete-Reading Elec. Co.	214-827-8891
TX	El Paso, Elctrl. Specialty Co.	915-594-8251
TX	Houston, Complete-Reading Elec. Co.	713-691-0080
UT	Salt Lake City, Electrical Specialty Co.	801-972-4184
VA	Bluefield, Complete-Reading Elec. Co.	703-322-5424
VA	Richmond, E.I.S., Inc.	804-649-9221
WA	Tukwila, Electrical Specialty Co.	206-241-1010
WI	Mequon, Complete-Reading Elec. Co.	414-241-3880
PR	San Juan, Distributronics, Inc.	809-781-0631

GAR ENTERPRISES, 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0785; Empl.: 25

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 714-624-5071; Empl.: 50; *Sls. Mgr.:* Joseph C. Hyatt

GARRY MFG. CO., DIV. OF BRAND-REX CO., 9 Queen Anne Ct., Laghorne, PA 19047, Tel: 215-949-2300; Empl.: 250; *Sls. Mgr.:* Tom Malek; *Dist. Mgr.:* Bob D'Autrachy

GASKET INTL. INC., 49 Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6814; Empl.: 5; *Sls. Mgr.:* Russell L. Steinman

GATES, GEO. W., & CO., INC., Hempstead Tpke. & Lucille Ave., Franklin Sq., NY 11010, Tel: 212-347-0787; Empl.: 10; *Sls. Mgr.:* T. E. Schulz, Jr

GATES ENERGY PRODS., 1050 S. Broadway, Denver, CO 80217, Tel: 303-744-4806, Telex: 045-511, TWX: 910-931-2658; Empl.: 500; *Sls. Mgr.:* R. O. Hammel; *Dist. Mgr.:* M. R. Harrison

GAVITT WIRE & CABLE, Brookfield, MA 01506, Tel: 617-867-6476; Empl.: 75

GAYNOR ELEC. CO., 172 E. Aurora St., Waterbury, CT 06720, Tel: 203-755-1175; Empl.: 50; *Sls. Mgr.:* John Swanson; *Dist. Mgr.:* John Swanson

Local Sales Offices & Reps

CA	Chatsworth, Porter Co.	818-700-0808
CT	Madison, United Comps.	203-562-4002
IL	Elk Grove Village, Control Sls.	312-595-2110
MA	Norwood, United Comps.	617-226-0556
MN	St. Louis, Lestronix	612-926-8466
NJ	Mountain Lakes, Browning-Naughton Co., Inc.	201-335-2029
OH	Cleveland, Jubell Assoc.	216-662-2884
OH	Mentor, Appliance Elctrns.	216-257-6019
WI	Thiensville, Control Sls.	414-242-4580

G B INSTRUMENTS INC., 2030 Coolidge St., Hollywood, FL 33020, Tel: 305-920-0225, TWX: 510-954-9813; FSC No.: 31601; Empl.: 30; *Sls. Mgr.:* B. J. Weiss

GC ELCTRNS., 400 S. Wyman St., Rockford, IL 61101, Tel: 815-968-9661, Telex: 237-318, TWX: 257318 GC Elect; Empl.: 360; *Sls. Mgr.:* Owen Jackson

GCI, INC., 14520 Lima Rd., Fort Wayne, IN 46808, Tel: 219-637-5520; Empl.: 108; *Sls. Mgr.:* C. Ward

Local Sales Offices & Reps

CA	Canoga Park, Ward Elctr. Packaging Sls.	213-998-5844
CA	Granada Hills, C&W Component Sls.	213-368-4032
FL	Orlando, B&M Sales	305-855-2455
IL	Chicago, L-Tec, Inc.	312-593-7200
IN	Columbus, J. Weaver Co.	812-372-3625
IA	Cedar Rapids, J. R. Sales Engrg., Inc.	319-393-2232
KY	Ft. Wayne, Kylar, Inc.	219-432-7716
MA	Norwood, JMG, Inc.	617-762-5333
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	Minneapolis, Electro-Mark	612-881-3306
MO	St. Louis, Buckman & Assocs.	314-946-6201
NJ	Sewell, Parker Assocs.	609-589-5503
NC	Kannapolis, Bass Assocs.	704-433-1672
OH	Galion, Retronics	419-468-3253
TX	Dallas, Dynamark Tech. Sls.	214-340-1800

GEC TECHNOLOGY CORP., 4430 Forest Lane, Garland, TX 75042, Tel: 214-276-1164

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5555; Empl.: 11

GEMCOR, See General-Electro-Mechanical Corp.

GEMINI, 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957; *Sls. Mgr.:* Gary Pearson .... 2•1897-1899

Just how long should standby power stand by?

- Gates Energy cells retain 80%+ of rated capacity for 8-10 years at 23°C in float applications.
- Excellent low temperature performance: 50% of C/10 room temp. capacity at −40°C.
- Sealed construction — no maintenance.
- Rated at 2V in 2.5Ah, 5Ah, 12.5Ah and 25Ah. Endless battery configurations.

Gates Energy Products, Inc., 1050 S. Broadway, Denver, CO 80217. 303/744-4806.

Gates
Energy Products
CYCLON
SEALED
RECHARGEABLE
BATTERY

GATES ENERGY

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-836-1469
AZ	Phoenix, M/R Engrg. Sls.	602-956-4670
AR	North Little Rock, Leo Barker Co.	501-834-2537
CA	San Diego, Qualtronics	619-560-8955
CA	Santa Ana, Spaulding Sls.	714-542-3991
CO	Arvada, Delconec, Inc.	303-422-7023
FL	Key Largo, Jerrold Helbein & Assocs.	305-367-3025
GA	Atlanta, L & D Inc.	404-455-3483
IL	Palatine, JRS Assocs.	312-991-6626
IN	Noblesville, Century Elctrns. Corp.	317-849-2026
IA	Cedar Rapids, Dick Taylor	319-364-2282
LA	Vidalia, Leo Barker Co.	318-336-9565
MA	Brookline, Harman Assocs.	617-232-6687
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MO	St. Louis, Harris Hanson Co.	816-763-6200
NY	New York, Reuse Packaging	212-939-6080
NY	Rochester, Leonard D. Allen, Inc.	716-377-3530
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Thomasville, Jerrold Helbein & Assocs.	919-476-2365
OH	Akron, B. J. Davis Sls. Corp.	216-753-8555
OR	Beaverton, Underwood-Hanify	503-641-4463
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
TX	Austin, J. Clay Co.	512-346-7340
TX	Dallas, J. Clay Co.	214-350-1281
UT	Salt Lake City, Medax	801-266-4545
WA	Bellevue, Underwood-Hanify	206-451-8223
WI	Wauwatosa, Larsen Assocs.	414-258-0529

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENERAL ATRONICS CORP., 1200 E. Mermaid Lane, Philadelphia, PA 19118, Tel: 215-233-4100

GENERAL AUTOMATIC CORP., 70 Liberty St., Metuchen, NJ 08840, Tel: 201-494-9300; Empl.: 59; *Sls. Mgr.:* M. Barron

GENERAL CABLE CO., Cornish Products Div., 160 Water Street, Williamstown, MA 01267, Tel: 413-458-8171

GENERAL CABLE CO., Fiber Optics Div., 160 Fieldcrest Ave., Raritan Ctr., Edison, NJ 08817, Tel: 201-225-4780, Telex: 642892; *Sls. Mgr.:* Allen B. Kasiewicz

SWITCHBOARD METERS & PANEL METERS
AUTHORIZED DISTRIBUTORS

METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration

METERMASTER LOCATIONS:

ARIZONA	
Phoenix	(602) 437-1425
Tucson	(602) 792-3411
CALIFORNIA	
Los Angeles	(213) 685-4340
Palo Alto	(415) 968-0313
San Diego	(619) 560-4841
GEORGIA	
Atlanta	(404) 446-0166
ILLINOIS	
Chicago	(312) 593-8650
MASSACHUSETTS	
Boston	(617) 523-2580
MINNESOTA	
Minneapolis	(612) 332-6117
MISSOURI	
St. Louis	(314) 454-0241
NEW MEXICO	
Albuquerque	(505) 292-3330
OHIO	
Cleveland	(216) 651-4100
OKLAHOMA	
Tulsa	(918) 582-1444
PENNSYLVANIA	
Pittsburgh	(412) 261-4548
TEXAS	
Austin	(512) 473-8876
Dallas	(214) 271-5671
Houston	(713) 733-9814
WISCONSIN	
Milwaukee	(414) 643-0554
ALL OTHER STATES	**(800) 962-8128**

GENERAL COMPUTERS, 1624 Veteran Ave., Los Angeles, CA 90024; Empl.: 10

GENERAL CONNECTOR CORP., 80 Bridge St., Newton, MA 02158, Tel: 617-244-5706

GENERAL CONTROL CO., 1200 Soldiers Field Rd., Boston, MA 02134, Tel: 617-782-7440; Empl.: 25

GENERAL DEVICES, Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000, Telex: 27-2169; Empl.: 250 .... **2**•1032-1035

Local Sales Offices & Reps

AZ	Phoenix, Snyder Engrg.	602-279-2010
CA	Fullerton, Groh Assoc.	714-738-7105
CA	Mountain View, G. Woempner Co.	415-964-5454
CO	Boulder, R. F. Mayo Assoc.	303-499-2155
CT	North Haven, Coakley, Boyd & Abbett	203-481-2828
FL	Maitland, J. Krutek	305-628-4837
FL	North Miami, J. Krutek & Assoc.	305-941-6544
IL	Glencoe, Howard Benjamin	312-835-0150
IN	Noblesville, Century Elctrns.	317-849-2026
KS	Shawnee Mission, Lowell & Kangas	913-631-3515
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MI	Plymouth, J. Plass Assoc.	313-455-8262
MN	Bloomington, Northport Engrg.	612-854-5556
MO	St. Louis, Lowell & Kangas	314-821-4050
NH	Plaistow, Coakley, Boyd & Abbett	617-444-5470
NJ	Mountainside, Henry G. Richter	201-233-4615
NY	Fayetteville, H.G. Richter	315-637-6713
OH	Cincinnati, Components	513-866-0661
OH	Cleveland, Components	216-243-9200
OK	Tulsa, Advance Tech. Sls.	918-664-0482
PA	Doylestown, Monteiro Assoc.	215-345-5855
TX	Austin, Advance Tech. Sls.	512-459-1351
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford & Assocs.	206-866-2001

GENERAL DIGITAL, 700 Burnside Ave., E. Hartford, CT 06108, Tel: 203-528-9041; Empl.: 32; *Sls. Mgr.:* Stuart H. Hoffer; *Dist. Mgr.:* Stuart H. Hoffer

GENERAL ELECTRIC CO., 333 W. Seymour Ave., Cincinnati, OH 45216, Tel: 513-948-5000

GENERAL ELECTRIC CO., Battery Business Dept., P.O. Box 992, Gainesville, FL 32602, Tel: 904-462-4480, TWX: 810-836-8500; *Sls. Mgr.:* K. Edwards

GENERAL ELEC. CO., Carboloy Systems Dept., Box 237, Detroit, MI 48232, Tel: 313-536-9100, TWX: 810-226-9617; Empl.: 1800; *Sls. Mgr.:* R. A. Alukonis

GENERAL ELEC. CO., Electromaterials Bus. Dep., Coshocton, OH 43812, Tel: 614-622-5310, Telex: 810-255-2921; Empl.: 1100; *Sls. Mgr.:* R.L. Morris; *Dist. Mgr.:* J. L. Schreiber

GENERAL ELECTRIC CO., Instrument Prods. Section, 40 Federal St., Lynn, MA 01910, Tel: 617-594-7011, Telex: 6817036; Empl.: 200; *Sls. Mgr.:* J. D. Rhea; *Dist. Mgr.:* S. M. Brandijen

GENERAL ELECTRIC CO., Lamp Comps. & Technical Prods. Div. Sls. Oper., 21800 Tungsten Rd., Cleveland, OH 44117, Tel: 216-266-2451, Telex: 985569; *Sls. Mgr.:* P. A. Wrobleski

GENERAL ELECTRIC CO., Liquid Xtal Displays Oper., 24000 Mercantile Rd.; Beachwood, OH 44122, Tel: 216-831-8100, Telex: 98-5442; *Sls. Mgr.:* John B. Burnette

GENERAL ELECTRIC CO., Microwave Tube Operation, 1 River Road, Schenectady, NY 12345, Tel: 518-385-2211 (main NBR)

GENERAL ELECTRIC CO., OEM Marketing Dept., Nela Park, Clevland, OH 44112, Tel: 216-266-2121; *Sls. Mgr.:* W. D. Wells

GENERAL ELECTRIC CO., Power Elctrns. Semiconductor Dept., W. Genesee St., Auburn, NY 13021, Tel: 315-253-7321; Empl.: 4000; *Sls. Mgr.:* George H. Oliver; *Dist. Mgr.:* Richard Levitre .... **1A**•2094, 2095

Local Sales Offices & Reps

AL	Huntsville	205-837-0411
AZ	Phoenix	602-241-7224
CA	Palo Alto	415-493-2600
CA	San Diego	714-565-4114
CA	Santa Monica	213-450-0353
CO	Denver	303-320-3031
CT	Meriden	203-238-6895
FL	Pålm Beach Gardens	404-458-8401
FL	Winter Park	404-458-8401
GA	Atlanta	404-458-8401
IL	Des Plaines	312-827-9100
IN	Ft. Wayne	219-422-8551
IN	Indianapolis	317-298-5317
IA	Bettendorf	319-359-1661
KS	Overland Park	913-967-6254
MD	Columbia	301-992-1299
MA	West Lynn	617-594-7270
MI	Southfield	313-355-3554
MN	Minneapolis	612-835-2550
MO	St. Louis	314-997-8437
NJ	Fairfield	201-227-6050
NY	Albany	518-454-2576
NY	Jericho	516-681-0900
NY	Rochester	716-422-3230
NY	Syracuse	315-456-3421
NC	Charlotte	704-376-2136
NC	Greensboro	919-379-8474
OH	Cleveland	216-266-2900
OH	Dayton	513-297-3287
OK	Oklahoma City	405-943-9015
PA	Erie	814-875-3891
PA	Philadelphia	215-964-2991
PA	Pittsburgh	412-921-4134
TN	Nashville	615-254-0342
TX	Dallas	214-661-8582
TX	Houston	713-978-4347
VA	Waynesboro	703-943-1151
WA	Seattle	206-575-2865
WI	Milwaukee	414-226-1625
PR	Catano	809-788-1515

Local Distributors

AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Mobile, Forbes Distg. Co.	205-479-4535
AZ	Tempe, Hamilton/Avnet Elctrns.	602-275-7851
CA	Canoga Park, Marshall Inds.	213-999-5001
CA	Canoga Park, Schweber Elctrns.	213-999-4702
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4108
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	El Monte, Marshall Inds.	213-686-0141
CA	Irvine, Marshall Inds.	714-556-6400
CA	Irvine, Schweber Elctrns.	714-556-3880
CA	Los Angeles, Kierulff Elctrns.	213-725-0325
CA	Sacramento, Hamilton Electro Corp.	916-920-3150
CA	San Diego, Hamilton/Avnet Elctrns.	714-571-7527
CA	San Diego, Kierulff Elctrns.	714-278-2112
CA	Santa Clara, Schweber Elctrns.	408-496-0200
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3300
CA	Tustin, Kierulff Elctrns.	714-731-5711
CA	Woodland Hills, Avnet Elctrns.	213-999-4702
CO	Denver, Kierulff Elctrns. Inc.	309-371-6500
CO	Denver, Arrow Elctrns.	303-758-2100
CT	Danbury, Hamilton/Avnet Elctrns.	203-797-2854
CT	Wallingford, Arrow Elctrns.	203-265-7741
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Ft. Lauderdale, Hamilton/Avnet Elctrns.	305-971-3491
FL	Ft. Lauderdale, Arrow Elctrn.	305-776-7790
FL	Hollywood, Schweber Elctrns.	305-927-0511
FL	St. Petersburg, Hamilton/Avnet Elctrns.	813-576-3930
GA	Norcross, Arrow Elctrns.	404-449-8252
GA	Norcross, Hamilton/Avnet Elctrns.	404-447-7504
IL	Bensenville, Hamilton/Avnet Elctrns.	312-860-7700
IL	Elk Grove Village, Schweber Elctrns.	312-364-3770
IL	Schaumburg, Arrow Elctrns.	312-893-9400
IN	Evansville, Hutch and Son, Inc.	812-425-7201
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Pioneer-Standard	317-849-7300
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KS	Overland Park, Hamilton/Avnet Elctrns.	913-888-8900
LA	Metairie, Sterling Elctrns.	504-887-7610
MD	Columbia, Hamilton/Avnet	301-995-3500
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Norwood, Gerber Radwo	617-329-2400
MA	Woburn, Arrow Elctrns.	617-933-8130
MA	Woburn, Hamilton/Avnet	617-935-9700
MI	Grand Rapids, Hamilton/Avnet Elctrns.	616-243-8805
MI	Livonia, Hamilton/Avnet Elctrns.	313-522-4700
MI	Livonia, R.S. Elctrns.	313-525-1155
MI	Livonia, Pioneer-Standard	313-525-1800
MI	Madison Heights, Galco Indl. Elctrns.	313-542-9090
MN	Eden Prairie, Schweber	612-941-5280
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minnetonka, Hamilton/Avnet Elctrns.	612-932-0600
MN	St. Paul, Gopher Elctrns.	612-483-3322

MO	Earth City, Hamilton/Avnet Elctrns.	314-344-1200
MO	Kansas City, LCOMP	816-221-2400
MO	Lincoln, Scott Elctrns.	402-466-8221
MO	St. Louis, Arrow	314-567-6888
MO	St. Louis, Olive Industrial Elctrns.	314-426-4500
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Camden, General Radio Supp.	609-964-8560
NJ	Cherry Hill, Hamilton/Avnet Elctrns.	609-424-0100
NJ	Fairfield, Hamilton/Avnet Elctrns.	201-575-5390
NJ	Fairfield, Lionex	201-227-7960
NJ	Fairfield, Arrow Elctrns.	201-797-5800
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NM	Albuquerque, Hamilton/Avnet Elctrns.	505-765-1500
NY	Buffalo, Summit	716-887-2825
NY	Farmingdale, Arrow Intl.	516-293-6363
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Lionex Corp.	516-273-1660
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Melville, Hamilton/Avnet Elctrns.	516-454-6010
NY	Rochester, Hamilton/Avnet Elctrns.	716-442-7820
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Rochester, Schweber Elctrns.	716-424-2222
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Rome, Rome Elctrns.	315-476-2033
NY	Syracuse, Hamilton/Avnet Elctrns.	315-437-2641
NY	Westbury, Schweber Elctrns.	516-334-7474
NC	Charlotte, Dixie Elctrns.	704-337-5413
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Raleigh, Hamilton/Avnet Elctrns.	919-829-8030
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Raleigh, Southeast Radio Supp.	919-828-2311
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Beachwood, Schweber Elctrns.	216-464-2970
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cincinnati, Graham Elctrns.	513-772-1661
OH	Cleveland, Pioneer-Standard	216-587-3600
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Schweber Elctrns.	513-439-1800
OH	Dayton, Hamilton/Avnet Elctrns.	513-433-0610
OH	Dayton, Pioneer-Standard	513-236-9900
OH	Warren, REM Elctrns.	216-373-1300
OH	Warrensville Hts., Hamilton/Avnet Elctrns.	216-831-3500
OK	Tulsa, Sterling Elctrns.	918-663-2410
OK	Tulsa, Oil Capitol Elctrns.	918-622-8520
OK	Tulsa, Schweber Elctrns.	918-622-8000
OK	Tulsa, Norvell Elctrns.	918-663-1247
OK	Tulsa, Arrow Elctrns.	918-665-7700
OR	Beaverton, Almac Elctrns. Corp.	503-641-9070
OR	Lake Oswego, Hamilton/Avnet Elctrns.	503-635-8157
PA	Horsham, Schweber Elctrns.	215-441-0600
PA	Philadelphia, Almo Elctrns.	215-689-4021
PA	Pittsburgh, Schweber Elctrns.	412-782-1600
PA	Pittsburgh, Pioneer-Standard	412-782-2300
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Knoxville, Industrial Elctrns.	615-573-7135
TX	Austin, Hamilton Electro Corp.	512-837-8911
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Austin, Schweber Elctrns.	512-458-8253
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Dallas, Schweber Elctrns.	214-661-5010
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Schweber Elctrns.	713-784-3600
TX	Houston, Hamilton/Avnet Elctrns.	713-780-1771
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Irving, Hamilton/Avnet Elctrns.	214-659-4111
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Kierulff Elctrns. Inc.	801-973-6913
UT	Salt Lake City, Hamilton/Avnet Elctrns.	801-972-2800
VA	Charlottesville, Virginia Radio Supp.	804-296-4184
WA	Bellevue, Almac Elctrns. Corp.	206-643-9992
WV	Charleston, McJunkin Corp.	304-348-5268
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Hamilton/Avnet Elctrns.	414-784-4510

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL ELECTRIC CO., Wire & Cable, 1285 Boston Ave., Bridgeport, CT 06602, Tel: 203-382-2000, Telex: 96-4209; Empl.: 2000; *Sls. Mgr.:* D. A. Pritchard; *Dist. Mgr.:* M. Peterson

GENERAL ELECTRO-MECHANICAL CORP., 785 Hertel Ave., Buffalo, NY 14207, Tel: 716-876-9685, Telex: 91-222; Empl.: 100; *Sls. Mgr.:* Tom Speller, Jr.

GENERAL FIBER OPTICS, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4400, Telex: 130-224; *Sls. Mgr.:* Herb Berkowitz

GENERAL HARDWARE MFG., 80 White St., New York, NY 10013, Tel: 212-431-6100, Telex: 126394 Aegis; *Sls. Mgr.:* Tom McGannon

GENERAL INDS., Taylor & Olive St., Elyria, OH 44035, Tel: 216-323-3136, TWX: 810-424-2109; Empl.: 1100

GENERAL INSTR., Discrete Semiconductor Div., 600 West John St., Hicksville, NY 11802, Tel: 516-733-3333, TWX: 510-221-1865; *Sls. Mgr.:* Tom Hurley; *Dist. Mgr.:* R. Graziano

GENERAL INSTR., Govt. Sys., 600 W. John St., Hicksville, NY 11802, Tel: 516-733-3000, Telex: 510221-1865; Empl.: 500

GENERAL INSTR., Lamp Div., 4433 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-784-1020, TWX: 910-221-5445; FSC No.: 71744; Empl.: 390; *Sls. Mgr.:* Jim Flanagan .... **1B**•1056

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech.	205-533-2100
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
AR	Fort Smith, Electra Reps.	501-452-4030
CA	Fremont, General Instr. Lamp Div.	415-796-8210
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Denver, Moss Mktg.	303-455-7205
CT	Middletown, Gerber Sls.	203-347-3000
FL	Altamonte Springs, "C" Assocs.	305-831-1717
FL	Pompano Beach, "C" Assocs.	305-972-9200
GA	Norcross, Electro-Mech Sls. Engrg. Co.	404-447-6478
IL	Des Plaines, Elctrn. Mktg.	312-298-2330
IN	Indianapolis, M. Gottlieb Assocs.	317-846-5788
IN	Kokomo, M. Gottlieb Assocs.	317-455-0444
IA	Cedar Rapids, Dy-Tronix	319-377-8275
MA	Ludlow, Gerber Sls. Corp.	413-589-9837
MA	Newton Upper Falls, Gerber Sls. Corp.	617-969-2620
MI	Detroit, Rathsburg Assoc.	313-882-1717
MN	Bloomington, Northport Engrg.	612-854-5556
MO	Bridgeton, Dy-Tronix	314-731-5799
MO	Independence, Dy-Tronix	816-373-6600
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Manasquan, General Instr. Lamp Div.	201-528-5495
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Buffalo, L. D. Allen	716-837-1955
NY	Commack, Kaelber & Mack	516-499-2924
NY	Fairport, L. D. Allen	716-377-3530
NY	Syracuse, L. D. Allen	315-437-8387
NC	Raleigh, Electro-Mech	919-851-8165
OH	St. Marys, T. Shelby & Co.	419-394-3377
OR	Portland, J. J. Backer Co.	503-297-8744
OR	Salem, J. J. Backer Co.	503-362-0717
TN	Nashville, Electro-Mech. Sls. Engrg. Co.	615-883-0073
TX	Dallas, Electra Reps.	214-387-3594
TX	Houston, Electra Reps.	713-530-2208
UT	Bountiful, Moss Mktg.	801-292-8660
WA	Seattle, J. J. Backer Co.	206-285-1300
EXP	Rio Piedras, Elctrn. Sls. Assocs.	809-769-2911

Local Distributors

AZ	Phoenix, Dalis Radio	602-254-8471
AZ	Tucson, Inland Elctrn. Supp.	602-294-2628
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Buena Park, RPS Elect.	714-521-5230
CA	Gardena, Bell Ind.	213-515-1800
CA	Mountain View, Abacus Elctrn.	408-961-1500
CA	Sun Valley, Richey Elctrn.	213-875-2862
CA	Sunnyvale, Bell Ind.	408-734-8570
CO	Denver, Electronic Parts	303-744-1992
CT	Middletown, Mid-State	203-347-5638
FL	Orlando, Hammond Elctrn.	305-849-6060
GA	Atlanta, E. Sam Jones	404-351-3250
IL	Chicago, Steiner Elec.	312-685-7000
IL	Chicago, Newark Elect.	312-638-4411
IL	Palatine, Ohm Elctrn.	312-359-5500
IL	Peoria, Klaus Radio	309-691-4840
IN	Indianapolis, Genesis (Radisco)	317-637-5571
IA	Cedar Rapids, Deeco	319-365-7551
KY	Louisville, Peerless Elctrn.	502-636-3336
LA	Lafayette, Ralph's Elctrn.	318-234-4507
MD	Rockville, Capitol Radio	301-881-2270
MA	Hingham, Sager Elec.	617-749-6700
MI	Flint, Michigan Elctrn.	313-232-6550
MN	St. Paul, Gopher Elctrn.	612-483-3322
MO	Kansas City, Walters Radio	816-531-7015
MO	St. Louis, Olive Indl.	314-426-4500
NJ	Camden, General Radio	609-964-8560
NJ	Cranford, Garden State	201-272-6400
NY	Buffalo, Summitt Dist.	716-884-3450
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Rochester Radio	716-454-7800
NY	Rochester, Masline Elect.	716-546-5373
NC	Raleigh, Southeastern Elctrn.	919-828-2311
OH	Akron, Akron Elect.	216-762-8818
OH	Cincinnati, Hughes-Peters	513-591-2000
OH	Columbus, Hughes-Peters	614-294-5351
OK	Oklahoma City, Trice Elctrn.	405-524-4411
OK	Tulsa, Oil Capitol Elctrn.	918-622-8520
OR	Portland, United Radio	503-233-5346
SC	Columbia, Dixie Elctrn.	803-779-5332
TN	Memphis, Bluff City	901-345-9500
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Fort Worth, Allied Elctrn.	817-336-5401
TX	Fort Worth, Swieco	817-335-6521
TX	Houston, Harrison Equip.	713-652-4700
UT	Salt Lake City, Standard Supp.	801-486-3371
WA	Seattle, Robert E. Priebe Co.	206-682-8242
WI	Milwaukee, Marsh Elctrn.	414-475-6000

GENERAL INSTRUMENT CORP., Microelectronics Div., 600 W. John St., Hicksville, NY 11802, Tel: 516-733-3107, TWX: 510-221-1866; *Sls. Mgr.:* A. Lindgren; *Dist. Mgr.:* J. Johnson

GENERAL INSTR., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-0400, Telex: 348430, TWX: 910-373-1767; FSC No.: 58361; Empl.: 500; *Sls. Mgr.:* J. Beach; *Dist. Mgr.:* W. Clark

GENERAL MAGNETICS, 211 Grove St., Bloomfield, NJ 07003, Tel: 201-743-2700; FSC No.: 99165; Empl.: 60

GENERAL MFG., 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MICROWAVE CORP., 155 Marine St., Farmingdale, NY 11735, Tel: 516-694-3600, TWX: 510-224-6406; FSC No.: 11332; Empl.: 185; *Sls. Mgr.:* M. Wind .... **1A**•1704; **3**•1238

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, Odyssey One	602-246-8846
CA	Los Angeles, RF Assocs.	213-478-1586
CA	Palo Alto, RF Assocs.	415-494-3331
CO	Castle Park, Odyssey One	303-688-3555
FL	Apopka, Saber Assocs.	800-432-6288

CHICAGO MINIATURE
AUTHORIZED DISTRIBUTOR
ELECTRIC SWITCHES INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971
LAMPS & LEDS
INDICATOR LIGHTS
CLIPLITE
Snap-in mount
Send for Catalog
Available in amber, red green & yellow
SEE COMPLETE PRODUCT LINE UNDER SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

FL	Bradenton, Saber Assocs.	800-432-6288
FL	Coral Springs, Saber Assocs.	800-432-6288
FL	Ft. Lauderdale, Saber Assocs.	800-432-6288
FL	Melbourne, Saber Assocs.	305-724-0920
GA	Griffin, Saber Assocs.	800-327-0853
IL	Mt. Prospect, Cain Forlaw	312-253-3578
MA	Burlington, Microwave Mktg. Specialists	617-272-7530
NJ	West Orange, EF Tech. Sls.	201-731-7203
NM	Albuquerque, Odyssey One	505-265-6645
NY	Huntington Sta., EF Tech. Sls.	516-549-1818
NC	Clayton, Saber Assocs.	800-327-0853
OH	Lancaster, Cain Forlaw	614-654-4800
PA	Andalusia, Les Associates	215-245-5250
SC	Columbia, Saber Assocs.	800-327-0853
TX	Dallas, Cain & Co.	214-233-6809
VA	McLean, Creative Mktg. Assoc., Ltd.	703-442-9100

GENERAL OPTRONICS, 3005 Hadley Rd., So. Plainfield, NJ 07080, Tel: 201-549-9000, TWX: 710-997-9556; Empl.: 65; *Sls. Mgr.:* Mas Oishi

GENERAL POWER SYS., 1400 N. Baxter St., Anaheim, CA 92806, Tel: 714-956-9321, Telex: 182283; FSC No.: 04801; Empl.: 340; *Sls. Mgr.:* M. E. Heyman; *Dist. Mgr.:* M. E. Heyman

GENERAL PRODUCTS CORP., 9030 Carroll Way, San Diego, CA 92121, Tel: 619-578-9690

GENERAL RESISTANCE

GENERAL RESISTANCE, INC., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; FSC No.: 05591; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson .... **1A**•1873; **3**•1239

Local Sales Offices & Reps

Instruments

AL	Birmingham, SESCO	205-988-8304
AZ	Phoenix, Qualtech	602-967-4655
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Palo Alto, Gado Instr. Sls.	415-961-2222
CA	San Diego, Saber Entrps.	619-271-1523
CO	Littleton, Radco	303-794-4279
CT	Cheshire, MECO, Inc.	203-271-0026
FL	St. Petersburg, SESCO	813-576-6991
GA	Altanta, SESCO	404-458-6423
IL	Des Plaines, Marsland Assocs.	312-694-2262
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
LA	Baton Rouge, SESCO	504-928-4951
MA	Reading, MECO, Inc.	617-944-6660
MI	Mt. Clemens, R. J. O'Hara Assocs.	313-791-7140
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Hillsdale, CB Associates	201-664-6230
NJ	Pennsauken, Scientific Reps	609-662-5222
NM	Albuquerque, Qualtech	505-243-5605
NY	Binghamton, TAE-REP	607-772-6952
NY	Fishkill, TAE-REP	914-896-6966
NY	Rochester, TAE-REP	716-586-8710
NC	Charlotte, SESCO	704-535-4920
OH	Dayton, RIXAN Assocs.	513-278-4216
OK	Tulsa, SESCO	918-622-3868
TX	Austin, SESCO	512-892-2490
TX	Dallas, SESCO	214-231-9364
TX	El Paso, Waltech Inc.	915-592-2415
TX	Houston, SESCO	713-999-3510
VA	Fairfax, Scientific Assocs.	703-385-0600
WA	Seattle, Datacom Assocs.	206-283-2525

Components

CA	Saratoga, TESTCO	408-253-1900
CO	Golden, J. F. Hurlbut Co.	303-279-7796
MI	Farmington, W. R. Hummon & Assoc.	313-474-0661
OH	Dayton, RIXAN Assocs.	513-278-4216
PA	Havertown, Quarracino	215-449-7500
TX	Dallas, Blackburn Assocs.	214-692-8885
TX	Houston, Blackburn Assocs.	713-463-1354
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
VA	Fairfax, Beacon North Inc.	703-591-1300
VA	Forest, Beacon North Inc.	804-239-8486

Local Distributors

CA	Saratoga, TESTCO	408-253-1900
OH	Dayton, RIXAN Assocs.	513-278-4216

PoCo
We Stock
TOSHIBA
TOSHIBA CORPORATION
CRT
DISPLAYS & MONITORS
MONOCHROME
COLOR
POCO SALES
8925 Fullbright Street
Chatsworth, California 91311
(818) 700-8727
Serving Western Region

GENERAL ROBOTICS CORP., 57 N. Main St., Hartford, WI 53027, Tel: 414-673-6800, Telex: 269686; *Sls. Mgr.:* Lou Bruner; *Dist. Mgr.:* Lou Bruner

GENERAL SCANNING, 500 Arsenal St., Watertown, MA 02172, Tel: 617-924-1010, Telex: 443-0105; Empl.: 195

GENERAL SEMICONDUCTOR INDS., INC., 2001 W. 10 Pl., Tempe, AZ 85281, Tel: 602-968-3101, TWX: 910-950-1942; FSC No.: 24444; Empl.: 425; *Sls. Mgr.:* Jim Williams; *Dist. Mgr.:* Howard Israel

GENERAL TRANSISTOR CORP., 216 W. Florence Av., Inglewood, CA 90301, Tel: 213-673-8422, Telex: 653474; FSC No.: 1P738; Empl.: 39; *Sls. Mgr.:* Al Barrios

GENICOM CORP., General Electric Dr., Waynesboro, VA 22980, Tel: 703-949-1000; FSC No.: 01526; Empl.: 2300; *Sls. Mgr.:* W. J. Vanco .... **1B**•1386, 1387

Local Sales Offices & Reps

CA	Los Angeles	213-701-0353
CA	San Francisco	408-925-6648
CT	Meriden	203-238-6800
DC	Washington	301-770-4434
GA	Atlanta	404-256-1966
IL	Chicago	312-577-1100
MA	Boston	617-657-4800

Local Distributors

AL	Huntsville, Arrow Elctrns.	205-882-2730
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Newport Beach, Arrow Elctrns.	714 851-8961
CA	San Diego, Arrow Elctrns	619-565-4800
CA	Santa Ana, Norstan	714-540-4165
CA	Sunnyvale, Arrow	408-745-6600
CO	Thornton, Arrow	303 451-5934
CT	Wallingford, Arrow	203-265-7741
FL	Fort Lauderdale, Arrow	305-776-7790
FL	Palm Bay, Arrow	305-725-1480
GA	Norcross, Schweber	404-449-9170
IL	Schaumburg, Arrow	312-397-3440
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IA	Cedar Rapids, Arrow Electrns.	319-395-7230
MD	Baltimore, Arrow	301-247-5200
MD	Towson, Electronic Comp. Sls.	301-296-6282
MA	Woburn, Arrow	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Grand Rapids, Arrow Elctrns.	612-830-1800
MN	Edina, Arrow	612-830-1800
MO	St. Louis, Arrow	314-567-6888
NH	Manchester, Arrow	603-668-6968
NJ	Fairfield, Arrow	201-575-5300
NJ	Moorestown, Arrow	609-235-1900
NM	Albuquerque, Arrow	505-243-4566
NY	Hauppauge, Arrow	516-231-1000
NY	Liverpool, Arrow	315-652-1000
NY	Rochester, Arrow	716-275-0300
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Raleigh, Arrow Elctrns.	919 876-3132
NC	Winston-Salem, Arrow	919-725-8711
OH	Centerville, Arrow Electrns.	513-435-5563
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Elctrns Mktg. Corp.	513-278-5745
PA	Monroeville, Arrow Elctrns.	412-856-7000
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Dallas, Arrow	214-386-7500
TX	Stafford, Arrow	713-491-4100
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
WA	Bellevue, Arrow Elctrns.	206-643-4800
WI	Madison, Arrow Elctrns.	414-764-6600
WI	Oak Creek, Arrow Elctrns.	414-764-6600

GENISCO MEMORY PRODS. CORP., 10874 Hope St., Cypress, CA 90630, Tel: 213-537-4750, 714-220-0720, TWX: 910-347-6773; FSC No.: 96682; Empl.: 175; *Sls. Mgr.:* Harry Watt

GENISCO TECHNOLOGY CORP., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 03797; Empl.: 450; *Sls. Mgr.:* W. R. Esser

GENISCO TECHNLG. CORP., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 07294; Empl.: 450; *Sls. Mgr.:* B. Hanna

GENISCO TECHNLG. CORP., Rotating Test Div., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 13946; Empl.: 450; *Sls. Mgr.:* F. Schodlbauer

GENISCO TECHNLG. CORP., Transducers Prods. Div., 650 Easy St., Simi Valley, CA 93065, Tel: 805-581-3985, TWX: 910-346-6773; FSC No.: 13946; Empl.: 450; *Sls. Mgr.:* J. Becker

GENRAD, INC., 300 Baker Ave., Concord, MA 01742, Tel: 617-369-4400

GENSTAR RENTAL ELCTRNS., 2445 Faber Pl., Palo Alto, CA 94303, Tel: 415-856-7600, Telex: 348368

GENTEX, Box 315, Carbondale, PA 18407, Tel: 603-434-0311, Telex: 831-883; FSC No.: 97427; *Sls. Mgr.:* Ture Heline

GENTRON CORP., 6667 N. Sydney Pl., Milwaukee, WI 53209, Tel: 414-351-1660, Telex: 26881; Empl.: 90; *Sls. Mgr.:* Ron Ragland

Local Sales Offices & Reps

CA	Arcadia, Van Gott Assocs.	213-445-9728
CA	Mountain View, Energy Comp.	415-969-0330
FL	Sunrise, Arnold Milrot & Assocs.	305-748-6446
IN	Greenwood, Valentine & Assoc.	317-888-2260
KS	Overland Park, WEB Elctrns.	913-381-2225
MA	Millis, Selmark Assocs.	617-376-2914
MI	Brighton, SAI Mktg. Corp.	313-227-1786
MN	Minneapolis, Furber Sls.	612-881-3620
MO	Florissant, WEB Elctrns.	314-921-5794
NH	Hopkinton, Selmark Assocs.	603-623-5774
NJ	Teaneck, R. T. Reid Assocs.	201-692-0200
NY	Rochester, Ossmann Comp. Sls.	716-424-4460
NY	Syracuse, Ossmann Comp. Sls.	315-455-6611
OR	Portland, SPS Elctrns.	503-285-0214
PA	Philadelphia, Fite Eltech	215-248-3171
TX	Lewisville, Jim Hughes Co.	214-434-2566
TX	Stafford, Jim Hughes Co.	713-343-0673
WA	Seattle, SPS Elctrns.	206-323-4140
WI	Mequon, Stumm Sls.	414-241-8414
WI	Milwaukee, Speaker Electronics	414-878-3727

Local Distributors

CA	Santa Ana, AMCOTEC	714-957-3003
NY	Ronkonkoma, Trace Elctrns.	516-645-6111
NC	Gastonia, JMT Elctrn. Supply Co.	704-867-4401
TX	Fort Worth, Allied Elctrns.	817-336-5401

GEORATOR

GEORATOR CORP., Box 70, Manassas, VA 22110, Tel: 703-368-2101, Telex: 892-431; Empl.: 49; *Sls. Mgr.:* Charles E. Trefzger .... 3•1878-1880

GERBER SYS. TECHNLGY., INC., 40 Gerber Rd. E., South Windsor, CT 06074, Tel: 203-644-2581, Telex: 6819200 GSTH UW, TWX: 710-447-5300 GST HFD; *Sls. Mgr.:* A. John Klein

GERMANIUM POWER DEVICES, Box 3065, Shawsheen Village Sta., Andover, MA 01810, Tel: 617-475-5982, Telex: 94-7150; Empl.: 100; *Sls. Mgr.:* R. W. Kassiotis

GEYER SYSTEMS, See GSI Corp.

GFC/HAMMOND ELCTRNS., INC., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710, Telex: 91-6452; *Sls. Mgr.:* Ray Shatzel .... 3•1583

Local Sales Offices & Reps

CA	N. Hollywood, Bert Moore & Assocs.	213-877-5955
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CT	Guilford, Elctrn. Mktg. Assoc.	203-453-5424
FL	Clearwater, Brennan Assocs.	813-446-5006
GA	Atlanta, Millar Elctrns.	919-787-9564
MA	Marblehead, Elctrn. Mktg. Assoc.	617-536-8206
MI	Southfield, Component Assocs.	313-557-3232
MS	Jackson, Welch & Doby Mktg.	601-932-5534
NH	Salem, Elctrn. Mktg. Assoc.	603-893-5378
NJ	Middlesex, Comtec Cornell Assocs.	201-469-1303
TX	Dallas, S. W. Marketing	214-341-8631
UT	Salt Lake City, Control Agencies	801-328-4305
WA	Seattle, Fleehart & Sullivan	206-522-1533

GGB INDUSTRIES, INC., Picoprobe Division, P.O. Box 125, Gillette, NJ 07933, Tel: 201-464-1749; *Sls. Mgr.:* Greg Boll

GIANNINI PETRO MARINE, 9474 Chesapeake Dr., San Diego, CA 92123, Tel: 619-569-1668, Telex: 181754; FSC No.: 24727; Empl.: 12

GIBSON/EGAN, 2666 East Huntington Dr., Duarte, CA 91010, Tel: 818-358-0191; Empl.: 40

GIC SYSTEMS, 2324 A Ridgepoint Dr., Austin, TX 78754, Tel: 512-926-8840; *Sls. Mgr.:* Ed Barry; *Dist. Mgr.:* Bob Lynch .... 3•1078-1081

Refer to Gordos Corporation, Bloomfield, New Jersey for Representatives and Authorized Distributor information.

GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, Telex: 23-5714; Empl.: 7

GIDDINGS & LEWIS ELCTRNS., A Unit of AMCA Intl., 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935, Tel: 414-921-7100, Telex: 26-2722, TWX: 910-275-1100; Empl.: 200; *Sls. Mgr.:* Tom Bullock

GILTRONIX, 3780 Fabian Way, Palo Alto, CA 94303, Tel: 415-493-1300, Telex: 345542; *Sls. Mgr.:* Eddie Poplawski

GILWAY TECHNICAL LAMP, 165M New Boston St., Woburn, MA 01801, Tel: 617-935-4442, Telex: 949-329; Empl.: 11; *Sls. Mgr.:* Clark Benjamin III; *Dist. Mgr.:* Cathy A. DiCroce .... 1B•1057

GIMIX, INC., 1337 W. 37th Place, Chicago, IL 60609, Tel: 312-927-5510, TWX: 910-221-4055; Empl.: 14; *Sls. Mgr.:* Richard Don

GLAR-BAN DIV. OF MARK IV INDS., INC., 2937 Alt Blvd., Grand Island, NY 14072, Tel: 716-773-2871, Telex: 91578; Empl.: 85; *Sls. Mgr.:* Scott Simons

GLASGAL COMMUNICATIONS, INC., 207 Washington St., Northvale, NJ 07647, Tel: 201-768-8082, TWX: 710-991-8585; *Sls. Mgr.:* Ralph Glasgal; *Dist. Mgr.:* Al Harnisch

GLASSMAN
HIGH VOLTAGE INC.

GLASSMAN HIGH VOLTAGE INC., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889, Tel: 201-534-9007, TWX: 710-480-2839; Empl.: 45; *Sls. Mgr.:* John R. Belden .... 3•1578-1581

Local Sales Offices & Reps

AZ	Scottsdale, Power Specialists	602-996-4100
CA	Los Alamitos, Power Specialists	213-594-9418
CA	Los Altos, Jay Stone & Assocs.	415-948-4563
CA	San Diego, Power Specialists	619-560-4061

GLATZER INDUSTRY CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-576-2700; Empl.: 15

GLENAIR, 1211 Air Way, Glendale, CA 91201, Tel: 213-247-6000, Telex: 67-3485, TWX: 910-497-2066; FSC No.: 06324; Empl.: 485; *Sls. Mgr.:* Fred J. Hans

GLENMARC MFG., 330 Melvin Dr., Northbrook, IL 60062, Tel: 312-272-9030, Telex: 28-3499; Empl.: 13; *Sls. Mgr.:* Kevin L. Bagaline, David Greenwood

GLOBAL SPECIALTIES CORP., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, TWX: 710-465-1227; Empl.: 107

GLOBE BATTERY DIV., See Johnson Controls, Globe Battery Div.

GLOBE PLASTICS, 1342 S. Signal Dr., Pomona, CA 91766, Tel: 714-623-2747; Empl.: 15

GLOBE UNION, See Johnson Controls, Globe Battery Div.

GM NAMEPLATE, INC., 2040 15th Ave. West, Seattle, WA 98119, Tel: 206-284-2200, TWX: 910-444-2053; *Sls. Mgr.:* Ed Westfall

GMR INC., Computer Elctrns., 1048 E. Burgrove St., Carson, CA 90746, Tel: 213-639-4663; *Sls. Mgr.:* Harvey Mushman

GNB BATTERIES INC., Ind'l. Battery Div., 2010 Cabot Blvd. W., Langhorne, PA 19047, Tel: 215-752-0555, TWX: 510-667-2056

GNT AUTOMATIC, 1560 Trapelo Rd., Waltham, MA 02154, Tel: 617-890-3305; Empl.: 14; *Sls. Mgr.:* K. P. Olson

GOLDEN PACIFIC ELCTRNS., INC., 1020 N. Batavia St., Ste. Q, Orange, CA 92667, Tel: 714-538-9752/9753, TWX: 910-593-1620 ....1B•1058; 3•1029, 1582

GOLDWELL COMPS., 1815 W. 205th St. Ste. 201, Torrance, CA 90501, Tel: 213-533-1228, Telex: 182-392; *Sls. Mgr.:* S. Komori

GORDON, CLAUD S., CO., 5710 Kenosha St., Richmond, IL 60071, Tel: 815-678-2211, Telex: 72-2427; Empl.: 260

GORDON, L., PACKAGING, 1050 S. Paca St., Baltimore, MD 21230, Tel: 301-539-6537

GORDON PRODS., 67 Del Mar Dr., Brookfield, CT 06804, Tel: 203-775-4501; Empl.: 20; *Sls. Mgr.:* Leon Najman; *Dist. Mgr.:* Leon Najman

GORDOS
CORPORATION

GORDOS CORP., 250 Glenwood Ave., Bloomfield, NJ 07003, Tel: 201-743-6800, TWX: 710-994-4787; Empl.: 800; *Sls. Mgr.:* Bill McDermott; *Dist. Mgr.:* Bob Lynch ....1B•1396-1399, 1401-1403, 1625-1627; 2•1888, 1889

Local Sales Offices & Reps

AZ	Phoenix, Cleveland Entprs.	602-944-4679
CA	Santa Clara, Maxim Elctrn. Sls.	408-727-0694
CO	Wheatridge, Waugaman Assocs.	303-423-1020
CT	Orange, R. F. Duffy Assocs.	203-795-3678
MA	Braintree, R. F. Duffy Assocs.	617-848-3550
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Pittsford, Noeth-Honsinger Assoc.	716-586-9002
OR	Portland, Micro Sls.	503-297-4726
UT	S. Jordan, Waugaman Assocs.	801-254-0570
WA	Bellevue, Micro Sls.	206-451-0568

Local Distributors

AL	Birmingham, Regal Controls	205-991-6340
AL	Huntsville, RM	205-852-1550
AL	Huntsville, Pioneer	205-837-9300
AZ	Phoenix, Newark	602-957-0085
AZ	Phoenix, Arizona Comps.	602-279-9446
AZ	Phoenix, Be Switched	602-275-4805
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Time	602-967-2000
AR	Little Rock, Newark	501-225-8130
CA	Buena Park, Control Design	714-521-5040
CA	Chatsworth, IEC	213-998-2200
CA	Foster City, Newark	415-572-8300
CA	Inglewood, Newark	213-671-7066
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	San Carlos, Control Design	415-592-4808
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	Sunnyvale, Time	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Denver, Integrated Elctrns.	303-534-6121
CO	Denver, Newark	303-757-3351
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Cheshire, Future Elctrns.	203-272-1852
CT	Danbury, Future	203-743-9594
FL	Ft. Lauderdale, Power Comps.	305-565-1614
FL	Ft. Lauderdale, Pioneer	305-771-7520
FL	Ft. Lauderdale, Newark	305-587-2372
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, Pioneer	305-834-9090
GA	Atlanta, Control Design	404-979-3500
GA	Norcross, Newark	404-448-1300
GA	Norcross, Pioneer	404-448-1711
GA	Stone Mountain, Control Design	404-979-3500
HI	Pearl City, Newark	808-456-5933
ID	Boise, Newark	208-342-4311
IL	Addison, L Comp	312-628-1400
IL	Chicago, Newark	312-638-4411
IL	Elk Grove Village, Pioneer	312-437-9680
IL	Genoa, Control Design	815-784-6515
IL	Lombard, RM	312-932-5150
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, Control Design	317-788-4559
IN	Indianapolis, RM	317-247-9701
IN	Indianapolis, Pioneer	317-849-7300
IA	West Des Moines, Ramco	515-225-6933
KS	Wichita, L Comp	316-265-8501
LA	New Orleans, Currier P Roser	504-734-1147
MD	Beltsville, Newark	301-937-5085
MD	Columbia, Time	301-964-3090
MD	Gaithersburg, Pioneer	301-921-0600
MA	Westboro, Future Elctrns.	617-366-2400
MA	Woburn, Newark	617-935-8350

GORDOS
AUTHORIZED DISTRIBUTOR
E
S
I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800–421–8855
CALIFORNIA: 800–252–4640
TWX 910–321–2971
REED
RELAYS
Reeds & Solid State
GRIGSBY BARTON
REEDAC RELAYS
MERCURY
See complete product line under
SWITCHES ––section 5100
FREE linecard and catalog on request

MA	Woburn, Time	617-935-8080
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, Pioneer	313-525-1800
MI	Oak Park, Newark	313-967-0600
MN	Minneapolis, Newark	612-331-6350
MN	Minneapolis, Control Design	612-721-1628
MN	Minnetonka, Pioneer	612-935-5444
MO	Kansas City, L Comp	816-221-2400
MO	St. Louis, L Comp	314-291-6200
MO	St. Louis, Control Design	314-426-3150
NE	Omaha, L Comp	402-895-5517
NE	Omaha, Newark	402-392-1221
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Pennsauken, Resco	609-662-4000
NJ	Springfield, Newark	201-376-9500; 212-349-7087
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Elctrn. Dvcs.	505-884-2950
NY	Buffalo, Summit	716-884-3450
NY	Hauppauge, JACO	516-273-5500
NY	New York, Time	516-273-0100
NY	Rochester, Summit	716-334-8110
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
NC	Charlotte, Pioneer/Carolina	704-527-8188
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Pineville, Control Design	704-588-4410
NC	Shelby, Dixie Indl. Supply	704-482-5641
OH	Cleveland, Pioneer	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Pioneer	513-236-9900
OH	Kettering, Elctrns. Mktg. Corp.	513-439-4711
OH	Solon, REH Elctrns.	216-248-1636
OH	Valley View, Newark	216-447-1050
OK	Tulsa, Newark	918-832-7004
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Broomall, Time Elctrns.	215-359-1200
PA	Horsham, Pioneer	215-674-4000
PA	Malvern, Control Design	215-296-0150
PA	Pittsburgh, Pioneer	412-782-2300
PA	Willow Grove, Resco Elctrns.	215-659-4575
SC	Greenville, Hammond	803-233-4121
TX	Austin, Pioneer	512-835-4000
TX	Dallas, Control Design	214-358-1441
TX	Dallas, Pioneer	214-386-7300
TX	Dallas, RM Elctrns.	214-263-8361
TX	Houston, Newark	713-782-4800
TX	Houston, Pioneer	713-988-5555
TX	Richardson, JACO	214-235-9575
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Ballard Supp. Corp.	801-972-2435
VA	Chester, Virginia Control Equip. Co.	804-796-3001
WA	Bellevue, Newark	206-641-9800
WA	Bellevue, IEC	206-455-2727
WA	Bellevue, Bell Inds.	206-747-1515
WI	Milwaukee, Indl. Elctrns.	414-276-1212
WI	New Berlin, RM Elctrns.	414-784-4420
WI	New Berlin, Control Design	414-784-1015
PR	Carolina, Newark	809-762-4490

GORDOS ARKANSAS, INC., 1000 N. Second St., Rogers, AR 72756, Tel: 501-636-5000, TWX: 910-720-7998; *Sls. Mgr.:* Paul Bachman; *Dist. Mgr.:* Bob Lynch .... **1A**•1654-1657; **1B**•1388-1395, 1400

Local Sales Offices & Reps

AZ	Phoenix, Cleveland Entprs.	602-944-4679
CA	Santa Clara, Maxim Elctrn. Sls.	408-727-0694
CO	Wheatridge, Waugaman Assocs.	303-423-1020
CT	Orange, R. F. Duffy Assocs.	203-795-3678
MA	Braintree, R. F. Duffy Assocs.	617-848-3550
NM	Albuquerque, Cleveland Entprs.	505-256-7893
NY	Pittsford, Noeth-Honsinger Assoc.	716-586-9002
OR	Portland, Micro Sls.	503-297-4726
UT	S. Jordan, Waugaman Assocs.	801-254-0570
WA	Bellevue, Micro Sls.	206-451-0568

Refer to Gordos Corporation, Bloomfield, New Jersey for Authorized Distributor information.

GORE, W. L., & ASSOCS., INC., 1505 N. Fourth St., P.O. Box 1389, Flagstaff, AZ 86002, Tel: 602-526-1290, TWX: 910-972-0969; FSC No.: 60622; *Sls. Mgr.:* Burt Chase (Intl.)

GORE, W. L., & ASSOCS., 555 Paper Mill Rd., Newark, DE 19714, Tel: 302-738-4880, TWX: 510-666-0825; Empl.: 2000; *Sls. Mgr.:* A. B. Chase

GORMAN MACHINE CORP., 7 Burke Dr., Brockton, MA 02401, Tel: 617-588-2900, TWX: 710-345-0679; *Sls. Mgr.:* Kenneth P. Gorman

GORMAN-REDLICH MFG. CO., 6 Curtis St., Athens, OH 45701, Tel: 614-593-3150; Empl.: 4; *Sls. Mgr.:* Jim Gorman

GOULD
Electronics

GOULD INC., Corporate Headquarters, 10 Gould Center, Rolling Meadows, IL 60008; Empl.: 20,650 .... **1B**•1404-1413; **3**•1380, 1384

GOULD-AMI, Sub. Gould Inc., 3800 Homestead Rd., Santa Clara, CA 95051, Tel: 408-554-2150, TWX: 910-338-0018; *Dist. Mgr.:* Judi MacGregor

Local Sales Offices & Reps

CA	Newport Beach, AMI	714-851-5931
CA	Santa Clara, AMI	408-738-4151
FL	Altamonte Springs, AMI	305-830-8889
IL	Elk Grove Village, AMI	312-437-6496
NY	Monsey, AMI	914-352-5333
PA	Ambler, AMI	215-643-0217

GOULD INC., Circuit Protection Div., 374 Merrimac St., Newburyport, MA 01950, Tel: 617-462-6662/3131, Telex: 94-7427, TWX: 710-347-0264; *Sls. Mgr.:* Richard Gray

Local Sales Offices & Reps

AK	Palmer, North Star Agencies	907-745-5436/5446
AZ	Scottsdale, Mahaffey & Assocs.	602-991-9790
CA	Concord, G & R Sales	415-827-1727
CA	Costa Mesa, Dennis Don & Assocs.	213-638-0427
CO	Evergreen, Jim Hammond & Assocs.	303-674-6906
FL	Miami, Glenn Assoc. of Florida	305-592-7335
FL	Orlando, Glenn Assoc. of Florida	305-293-7482
GA	Atlanta, Berry-Elsberry Co.	404-355-9296
HI	Honolulu, Pacific Factors	808-533-7135
ID	Boise, C & J Enterprises	208-375-3116
IL	Addison, McBud, Inc.	312-628-8570
IN	Indianapolis, ESI, Inc.	317-638-4439
IA	Des Moines, Jerry L. Shumway & Assoc.	515-285-0704
KS	Prairie Village, George H. Pearson Co.	913-341-6210
KY	Louisville, Henry Thompson Sls. Co.	502-583-3636
LA	Mandeville, Service Electrical Sls.	504-467-0775
MD	Owings Mills, Specialty Electrical Sls. Co.	301-356-7700, 800-638-6146
MI	Highland, Holley & Upleger	313-887-0064
MN	Minneapolis, LESCO, Inc.	612-542-8242
MS	Brandon, Service Electrical Sls.	601-992-9122
MO	St. Louis, George H. Pearson Co.	314-822-4080
MT	Big Fork, B. L. Peck & Assoc.	406-837-5092
NH	Meredith, Raymon Gerard Assocs.	603-524-6005, 800-343-0574
NJ	Kenilworth, Tri-Tech Assoc.	201-851-0370/0371, 212-567-2610
NY	No. Syracuse, Lachut Electrical Sls.	315-422-2575
NC	Greensboro, Electra-Tek Carolinas	919-272-8254
OH	Cleveland, Electro-Specialities	216-447-3048
OH	Milford, Alexander Equip. Co.	513-248-0901
OK	Oklahoma City, P. & C. Sales Co.	405-745-3431
OR	Portland, Robert A. Amey Co.	503-646-7196
PA	Pittsburgh, Robert W. Colley & Assoc.	412-331-3121
TN	Germantown, Talley & Talley Assocs.	901-755-3130
TX	Houston, Hodges, Kinney & Clark	713-748-8235
TX	Plano, Tubbesing Sls. Corp.	214-985-1079
UT	Salt Lake City, Electrical Systems	801-487-8811
WA	Seattle, Shaffer & Nelson	206-453-5575
WI	Milwaukee, D. S. Berry Co.	414-224-0680
PR	Carolina, Glenn Intl.	809-769-1851

GOULD COMPION, 1101 E. University, Urbana, IL 61081, Tel: 217-384-8500

GOULD INC., Computer Sys. Div., 6901 W. Sunrise Blvd., Ft. Lauderdale, FL 33313, Tel: 305-587-2900, TWX: 510-955-9843; FSC No.: 59-0913135; Empl.: 2376; *Sls. Mgr.:* Howard Kossak; *Dist. Mgr.:* Lionel Agar (Intl.)

GOULD INC., Design & Test Sys. Div., 4600 Old Ironsides Dr., Santa Clara, CA 95050, Tel: 408-988-6800, TWX: 910-338-0509; *Sls. Mgr.:* Dan Cockcroft

GOULD INC., Foil Div., 35129 Curtis Blvd., Eastlake, OH 44094, Tel: 216-953-5000, TWX: 810-427-2506; *Sls. Mgr.:* Tim Quigley

GOULD INC., Imaging & Graphics Div., 1870 Lundy Ave., San Jose, CA 95131, Tel: 408-263-7155, TWX: 910-338-7656; Empl.: 200; *Sls. Mgr.:* Mike Battaglia; *Dist. Mgr.:* Ernie Ohrenstein

GOULD INC., Industrial Controls Div., 901 Baltimore Blvd., Westminster, MD 21157, Tel: 301-876-2214, TWX: 710-862-0846; Empl.: 325; *Sls. Mgr.:* M. Freyermuth .... **1B**•1404-1413

Local Sales Offices & Reps

AZ	Tempe, Delta Elctrn. Sls.	602-966-9903
CA	Cerritos, El-Com	213-404-2961
CA	Fremont, Wm. Parks Assocs.	415-490-2011
CO	Denver, Electronic Sls.	303-771-6300
CT	Cheshire, Selmark Assocs.	203-573-9088
FL	Melbourne, Raycom	305-259-7988
GA	Atlanta, Electro-Rep. Assocs.	404-320-1134
ID	Boise, Huntley Assocs.	208-343-3753
IL	Chicago, Industrial Reps.	312-647-7755
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Marion, Design Solutions	319-377-1129
KS	Wichita, Design Solutions	316-529-0114
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Millis, Selmark Assocs.	617-376-2914
MI	Livonia, Elctrn. Salesmasters	800-321-1848
MN	Minneapolis, Giefer Sls.	612-884-2395
MO	Brentwood, Design Solutions	314-961-7170
NH	Hopkinton, Selmark Assocs.	603-623-5774
NJ	Medford, Component Conslts.	609-654-5300
NJ	Oakland, Peter C. Gordon Assoc.	201-337-5200
NY	Endicott, Noeth Honsinger Assoc.	607-724-4865
NY	Pittsford, Noeth Honsinger Assoc.	716-586-9002
NC	Charlotte, Electro-Rep Assocs.	704-527-2530
OH	Beachwood, Elctrns. Salesmasters	216-831-9555
OR	Beaverton, Huntley Assocs.	503-649-5388
PA	Pittsburgh, Process Engrg. Co.	412-561-5050
TX	El Paso, Alexander Entprs.	915-591-3142
TX	Seagoville, Delta Comps.	214-287-6333
WA	Everett, Huntley Assocs.	206-353-1833
WI	Milwaukee, Industrial Reps.	414-259-0965

Local Distributors

CA	Cerritos, El-Com	213-404-2961
CA	Hayward, KEA Distr.	415-887-2900
CA	Los Angeles, Master Distrs.	213-452-1229
CO	Englewood, Elctrn. Sls.	303-771-6300
CT	East Haven, JV Elctrns.	203-469-2321
CT	Stamford, Bond Elctrns.	203-348-2663
FL	Altamonte Springs, Control Design	305-788-3220
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
ID	Spirit Lake, A-I Elctrns.	208-623-3111
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Genoa, Control Design	815-784-6515
IN	Fort Wayne, Graham Elctrns.	219-423-3422
KS	Wichita, R.S.C., Inc.	316-267-5213
MA	Newton, Greene-Shaw	617-969-8900
MN	Minneapolis, Control Design	612-721-1628
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Oakland, Gordon/Horne	201-337-5200
NM	Albuquerque, Intl. Elctrns.	505-262-2011
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Buffalo, Summit Distributing	716-884-3450
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Rome, Rome Elctrns.	315-337-5400
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Akron, Akron Elctrns.	216-762-8818
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Wickliffe, Gateway-Megatech	216-944-8565
OK	Oklahoma City, Electro Entprs.	405-427-6591
PA	Philadelphia, Shap Elctrns.	215-969-3300
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TN	Nashville, Electra Distrs.	615-329-3971
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Geophysical Supp.	713-666-4100
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WA	Seattle, Carlyle Tech. Sls.	206-575-6750

GOULD INC., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030, Tel: 805-487-8511, Telex: 65-9223; Empl.: 500

GOULD INC., Medical Prods. Div., 1900 Williams Dr., Oxnard, CA 93030, Tel: 805-983-1300, Telex: 182-204

GOULD INC., Micro Power Prods. Div., 2777 Eagandale Blvd., Eagan, MN 55121, Tel: 612-681-4200, Telex: 297-486; Empl.: 100; *Sls. Mgr.:* H. T. Ross; *Dist. Mgr.:* Mary Weber

GOULD INC., Motion Control Div., 2701 N. Green Bay Rd., Racine, WI 53404, Tel: 414-637-6591, Telex: 201-309

GOULD INC., POWER CONVERSION DIV., See RTE DELTEC CORPORATION

GOULD INC., Programmable Control Div., Box 83, S.V.S., Andover, MA 01810, Tel: 617-475-4700, Telex: 947-402, TWX: 710-347-6610; *Sls. Mgr.:* George Dannecker; *Dist. Mgr.:* Richard Bell

GOULD INC., Recording Systems Div., 3631 Perkins Ave., Cleveland, OH 44114, Tel: 216-361-3315; FSC No.: 96795; Empl.: 550; *Sls. Mgr.:* George Trudeau .... 3•1380, 1384

Local Sales Offices & Reps

AZ	Mesa, Gould Inc., Recording Sys. Div.	602-833-1602
CA	Cerritos, Gould Inc., Recording Sys. Div.	213-404-1919
CA	Hayward, Gould Inc., Recording Sys. Div.	415-782-0852
CO	Englewood, Gould Inc., Recording Sys. Div.	303-781-4473
FL	Altamonte Springs, Gould Inc., Recording Sys. Div.	305-830-0695
GA	Atlanta, Gould Inc., Recording Sys. Div.	404-441-5556
HI	Honolulu, EMC Corp.	808-836-1138
IL	Elk Grove Village, Gould Inc., Recording Sys. Div.	312-640-4135
IN	Indianapolis, Gould Inc., Recording Sys. Div.	317-842-4484
MD	Greenbelt, Gould Inc., Recording Sys. Div.	301-345-0050
MA	Burlington, Gould Inc., Recording Sys. Div.	617-272-0750
MI	Madison Heights, Gould Inc., Recording Sys. Div.	313-588-4020
MN	Minneapolis, Gould Inc., Recording Sys. Div.	612-544-5253
MO	Florissant, Gould Inc., Recording Sys. Div.	314-921-3444
NJ	Saddle Brook, Gould Inc., Recording Sys. Div.	201-845-0220
NM	Albuquerque, Gould Inc., Recording Sys. Div.	505-292-4063
NY	Albany, Gould Inc., Recording Sys. Div.	518-584-7999
NY	Rochester, Gould Inc., Recording Sys. Div.	716-235-4980
NC	Greensboro, Gould Inc., Recording Sys. Div.	919-275-1978
OH	Centerville, Gould Inc., Recording Sys. Div.	513-433-9586
OH	Cleveland, Gould Inc., Recording Sys. Div.	216-361-3315
PA	Malvern, Gould Inc., Recording Sys. Div.	215-647-2214
PA	Pittsburgh, Gould Inc., Recording Sys. Div.	412-923-2970
TN	Hermitage, Gould Inc., Recording Sys. Div.	615-754-7100
TX	Dallas, Gould Inc., Recording Sys. Div.	214-634-2131
TX	Houston, Gould Inc., Recording Sys. Div.	713-680-1121
VA	Richmond, Gould Inc., Recording Sys. Div.	804-282-5533
WA	Bellevue, Gould Inc., Recording Sys. Div.	206-453-2461

GOULD DATAMETRICS, See Datametrics Inc.

GOWANDA ELCTRNS., 1 Industrial Pl., Gowanda, NY 14070, Tel: 716-532-2234, TWX: 710-529-1211; FSC No.: 24226; Empl.: 200; *Sls. Mgr.:* K. Strohmeyer

GOW-MAC INSTR. CO., P.O. Box 32, Bound Brook, NJ 08805, Tel: 201-560-0600, Telex: 833-174; Empl.: 40; *Sls. Mgr.:* R. J. Mathieu

Local Sales Offices & Reps

CA	Anaheim, Applied Instr. Corp.	714-535-6551
CA	Danville, Western Scientific Assoc.	415-837-4622
MD	Edgewater, Gow-Mac Instr. Co.	301-956-5641
MO	St. Louis, P.J. Cobert Assocs.	314-423-8388
NM	Albuquerque, Hiltech	505-268-1733
NC	Pinehurst, Tri Sci. Co.	919-295-6112
OR	Portland, Extech Ltd.	503-292-9219
TX	Houston, Indl. Sci. Corp.	713-528-1258
UT	Salt Lake City, Instrmn. Sls.	801-277-2044

GRADO LABS., 4614 Seventh Ave., Brooklyn, NY 11220, Tel: 212-435-5340

GRALEX INDS., 155 Marine St., Farmingdale, NY 11735, Tel: 516-694-3600, TWX: 510-224-6406; FSC No.: 11332; Empl.: 25; *Sls. Mgr.:* Moe Wind

GRA-MAR INC., 3165 McCrory Pl., Ste. 265, Orlando, FL 32803, Tel: 305-894-3351, TWX: 810-850-0125; FSC No.: 58-12-31006-40

GRAND TRANSFORMERS, Box 188, Grand Haven, MI 49417, Tel: 616-842-5430; Empl.: 125; *Sls. Mgr.:* G. V. Retzlaff

GRANGER ASSOCS., 3101 Scott Blvd., Santa Clara, CA 95051, Tel: 408-727-3101, Telex: 34-8380; Empl.: 750; *Sls. Mgr.:* Rick Green

GRANITE STATE CIRCUITS, Power Elctrns. Corp., P.O. Box 2208, 96 Milton Rd., Rochester, NH 03867, Tel: 603-332-3334, TWX: 510-297-4462; *Sls. Mgr.:* Robert S. Karstedt

GRANT HARDWARE CO., Div. of Grant Inds. Inc., 7 Hoover Ave, Haverstraw, NY 10927-1092, Tel: 914-EL8-4400, TWX: 914-358-3541; FSC No.: 83508; Empl.: 490; *Sls. Mgr.:* F. Centrillo

Local Sales Offices & Reps

CA	Canoga Park, Catlin Inds.	213-347-0444
CA	City of Industry, Grant Hardware Co.	213-686-2110
CA	Santa Clara, Nova-Tronix	408-243-9530
CO	Arvada, Challege Sls.	303-427-3149
FL	Ft. Lauderdale, Electro-Comp Assocs.	305-491-4141
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
KS	Overland Park, J. Singer Indl. Sls. Corp.	913-381-3684
MA	Lexington, E.F. Del Fino Co.	617-938-1217
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	St. Paul, Repco	612-642-2828
NJ	Fort Lee, Necco	201-461-2789
NJ	Ridgefield, M - D Inds.	201-941-3113
NY	Binghamton, Precision Sls.	607-648-3686
NY	Liverpool, Precision Sls.	315-451-3480
NC	Charlotte, J. Corn Assocs.	704-552-0991
OH	Cincinnati, Tri State Mktg.	513-761-7993
OH	Cleveland, Carter McCormic & Peirce	216-779-5100
OH	Englewood, Carter McCormic & Peirce	513-836-0951
TX	Dallas, Blackburn Assocs.	214-692-8885
WA	Seattle, Norwest Co.	206-282-3707
WI	Waukesha, Lincoln, Hodges & Assoc.	414-542-3087

GRANT TECHNOLOGY SYS. CORP., 11 Summer St., Chelmsford, MA 01824, Tel: 617-256-8881; Empl.: 15; *Sls. Mgr.:* V.P.T. McLeod

GRAPHITE METALLIZING CORP., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702, Tel: 914-968-8400, Telex: 13-1571; Empl.: 178; *Sls. Mgr.:* W. W. Walker .... 1B•1156

GRAPHTEC SERVICES, INC., 1600 N.W. Madrid Way, Boca Raton, FL 33432, Tel: 305-392-3373; Empl.: 12; *Sls. Mgr.:* Ralph D. Pistor

GRASSLIN CONTROLS CORP., Dieter Grasslin Feinwerktechnik, 45 Spear Rd., Ramsey, NJ 07446, Tel: 201-825-9696, Telex: 135038; Empl.: 5

GRAYHILL INC., 569 Hillgrove Ave., La Grange, IL 60525, Tel: 312-354-1040, Telex: 6871375 GHLG UW, TWX: 910-683-1850; FSC No.: 5930; Empl.: 1000; *Sls. Mgr.:* John A. Udisches; *Dist. Mgr.:* Robert J. Ferrel .... 1B•1414, 1415, 1629-1645, 1772-1779; 2•1294

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Phoenix, Mercury Engrg. Sls.	602-244-0123
CA	Anaheim, Impact Elctrns.	714-533-1351
CA	Los Altos, Nickerson-Gray Assoc.	415-941-5777
CA	San Diego, Earle Assocs.	619-278-5441
CO	Denver, Lindberg Co.	303-758-9033
FL	Ft. Lauderdale, Newell-Hynes	305-761-1113
GA	Tucker, Rep, Inc.	404-938-4358
IL	La Grange, Grayhill Inc.	312-354-1040
IN	Ft. Wayne, Menze Sls.	219-747-5616
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, PMR Inc.	913-381-0004
KS	Wichita, PMR Inc.	316-684-4141
MD	Woodbine, Naudain Assocs. Southern	301-442-2270
MA	Wellesley Hills, Newscott Co.	617-444-1923
MI	Troy, C. B. Jensen & Assoc.	313-643-0506
MN	Bloomington, Northport Engrg.	612-854-5556
MO	Maryland Hgts., PMR Corp.	314-569-1220
NJ	Marlton, Naudain Assoc.	609-983-5300
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Great Neck, Tylinski Assocs.	516-466-9070
NY	Ithaca, B. Dean Inc.	607-257-1111
NC	Charlotte, R. W. Chapman & Co.	704-525-2421
NC	Greensboro, R. W. Chapman	919-282-0740
NC	Raleigh, R. W. Chapman	919-782-2624
OH	Cleveland, A. H. Baier Co. & Assoc.	216-461-6161
OH	Dayton, A. H. Baier Co. & Assoc.	513-276-4128
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
TN	Jefferson City, Rep, Inc.	615-475-4105
TX	Arlington, W. Pat Fralia Co.	817-640-9101
TX	Austin, W. Pat Fralia Co.	512-835-7911
TX	Houston, W. Pat Fralia Co.	713-772-1572
UT	Salt Lake City, Lindberg Co.	801-467-1794
WA	Bellevue, Eltech, Inc.	206-643-4330
WI	Milwaukee, Badgerep	414-258-6630

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, Fisher/Brownell	602-967-1464
AZ	Phoenix, Kachina Elctrns.	602-269-6201
AZ	Tempe, Richey/Western Electrns.	602-894-9251
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Alhambra, Fisher/Brownell	213-289-0255
CA	Anaheim, R. V. Weatherford Co.	714-634-9600
CA	Glendale, R. V. Weatherford Co.	213-849-3451
CA	Los Angeles, Electric Switches	213-660-1310
CA	Riverside, Electronic Supp.	714-683-7300
CA	San Diego, Fisher/Brownell	619-560-8545
CA	San Diego, Richey/Western Electrns.	619-271-4511
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Fisher/Brownell	408-988-6041
CA	Sun Valley, Richey/Western Electrns.	213-875-2862
CA	Sunnyvale, R. V. Weatherford Co.	408-738-8694
CO	Denver, Ragon Elctrns.	303-777-9430
CO	Denver, Newark Elctrns.	303-757-3351
CO	Denver, CSID Inc.	303-292-9594
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Wallingford, Midan Elctrns.	203-265-2077
FL	Ft. Lauderdale, Powell Elctrns.	305-972-4300
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Norcross, A-A Elec.	404-449-8670
HI	Honolulu, Precision Radio	808-537-5291
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Northbrook, Classic Comp. Supp.	312-272-9650
IL	Palatine, Ohm Elctrn.	312-359-5500
IL	Peoria, Klaus Radio	309-691-4840
IN	Evansville, Hutch & Son	812-425-7201
IN	Fort Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Genesis Elctrns.	317-637-5571
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco Inc.	319-365-7551
KS	Wichita, LComp, Inc.	316-265-5100
MD	Baltimore, Resco	301-823-0070
MD	Columbia, Powell Elctrns.	301-621-4070
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Hingham, Sager Elctrns.	617-749-6700
MA	North Adams, Elctrn. Supp. Ctr.	413-663-6828
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Worcester, R M Elctrns.	617-791-7861
MI	Livonia, R.S. Elctrns.	313-525-1155

Grayhill
AUTHORIZED DISTRIBUTOR
E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971
SEE COMPLETE PRODUCT LINE UNDER SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

MI	Livonia, Pioneer Mich	313-525-1800
MI	Oak Park, Newark Detroit Elctrns.	313-967-0600
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Newark Elec.	612-331-6350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	St. Paul, Gopher Elctrns.	612-483-3322
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
MO	Kansas City, LComp, Inc.	816-221-2400
MO	Maryland Hgts., LComp, Inc.	314-291-6200
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Hudson, Heilind Elctrns.	603-883-9536
NJ	East Hanover, State Elec.	201-887-2550
NJ	Mt. Laurel, Jerseyswitch, Inc.	609-778-8190
NM	Albuquerque, Walker Elctrn. Supp.	505-247-2288
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NY	Bohemia, Car-Lac Elctrns.	516-567-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Endwell, A.S.I. Elctrns.	607-754-3823
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NC	Charlotte, Pioneer/Carolina	704-527-8188
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Dayton, Stotts-Friedman	513-298-5555
OK	Oklahoma City, Electro Entprs.	405-427-6591
OK	Tulsa, Oil Capitol Elctrns.	918-622-8520
OR	Beaverton, Component Resources	503-641-8488
OR	Portland, United Radio	503-233-5346
PA	Erie, REM Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
PA	Pittsburgh, CAM/RPC	412-782-3770
PA	Reading, George D. Barbey Co.	215-376-7451
RI	Pawtucket, Major Edwards Elctrns.	401-781-8000
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	El Paso, Intl. Elctrns.	915-598-3406
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Kent Elctrns.	713-780-7770
TX	Stafford, Harrison Equip.	713-879-2600
TX	Stafford, Southwest Elctrns.	713-491-4900
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Seattle, R. V. Weatherford Co.	206-575-1340
WI	Milwaukee, Marsh Elctrns.	414-475-6000

GREENLEE TOOL CO., 2330 23rd Ave., Rockford, IL 61108, Tel: 815-399-3903

GREENRAY INDS., INC., 840 W. Church Rd., Mechanicsburg, PA 17055, Tel: 717-766-0223, TWX: 510-650-4939; FSC No.: 16681; Empl.: 65; *Sls. Mgr.:* D. R. Widener

Local Sales Offices & Reps

AZ	Scottsdale, Faser Technical Sls.	602-948-4404
CA	Inglewood, L&M Engrg. So.	213-674-6850
CA	Los Altos Hills, HB Mktg.	415-941-4080
FL	Clearwater, Electrocraft Inc.	813-576-5404
IL	Wauconda, Cudahy Sls.	312-526-2484
MD	Wheaton, Brimberg Sls. Inc.	301-946-2670
MA	Reading, Geder Assoc.	617-944-3105
NY	Huntington, Andrews & Andrews, Inc.	516-692-8686
NY	Skaneateles, Robtron Inc.	315-685-5731
NC	Burlington, P. J. Nahser Co. Inc.	919-226-8053
OH	Columbus, Tom Mulligan & Assoc.	614-457-2242
PA	Glenside, Arby Elctrns.	215-887-2317
TX	Richardson, Southwest Microwave Elect.	214-669-1195

GREGG ELEC., 608 W. Emporia, Ontario, CA 91761, Tel: 714-983-1794; FSC No.: 53014; Empl.: 8

GREIBACH INSTRS. DIV., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590; Empl.: 35

G. R. ELECTRONICS, 1640 5th St., Suite 224, Santa Monica, CA 90401, Tel: 213-395-4774, Telex: 65-2337 (BT Smedley SNM); *Sls. Mgr.:* Jillian I. Girard; *Dist. Mgr.:* Christopher E. Thomson

GRIES/DYNACAST, Div. Coats & Clark Inc., 162 Beechwood Ave., New Rochelle, NY 10801, Tel: 914-633-8600, TWX: 914-235-2188; Empl.: 600

GRIM CORPORATION, Box 67, Medford, NJ 08055, Tel: 609-267-7950, TWX: 510-683-9392; FSC No.: 21870; Empl.: 125; *Sls. Mgr.:* T. A. McGarrity .... **3**•1064

GRM CORP., See Grim Corp.

GROVER PATENT PRODUCTS, 339 W. Arden Ave., Glendale, CA 91203, Tel: 213-245-4400; Empl.: 4

GRUENBERG OVEN CO., INC., P.O. Box 3246, 2121 Reach Rd., Williamsport, PA 17701, Tel: 717-326-1755; Empl.: 75; *Sls. Mgr.:* James Polk

GSE, 23640 Research Dr., Farmington Hills, MI 48024, Tel: 313-476-7875, Telex: 23-0738; Empl.: 105; *Sls. Mgr.:* Harold G. Munn

GSI

GSI CORP., 1917 Greenspring Dr., Timonium, MD 21093, Tel: 301-252-1768; FSC No.: 60990; Empl.: 28; *Sls. Mgr.:* L. B. Morgan .... **2**•2102

Local Sales Offices & Reps

MD	Timonium, Roy N. Cook, Jr. & Assocs.	301-252-1161
NC	Raleigh, Barker Assocs.	919-876-0282

GTE AUTOMATIC ELEC., 400 N. Wolf Rd., Northlake, IL 60164, Tel: 312-681-7071, Telex: 72-8477, TWX: 910-226-1975; Empl.: 8,000; *Sls. Mgr.:* J. E. Murphy

GTE CORP., Sylvania Emissive Prods./Process Heat, Portsmouth Ave., Exeter, NH 03833, Tel: 603-772-4331, TWX: 510-294-4471; Empl.: 200000

GTE METAL LAMINATES, 1704 Barnes St., Reidsville, NC 27320, Tel: 918-342-2381; Empl.: 260; *Sls. Mgr.:* J. W. Leone

GTE MICROCIRCUITS, 2000 West 14th St., Tempe, AZ 85281, Tel: 602-968-4431, TWX: 910-951-1383; FSC No.: 16766; Empl.: 432; *Sls. Mgr.:* David Thompson

GTE PRODUCTS GRP. (SYLVANIA), See Sylvania Miniature Lighting

GTE SWITCHING & TELEPHONE PRODUCTS, 400 N. Wolf Rd., Northlake, IL 60164, Tel: 312-681-7100

GTE SYLVANIA, INC., CHEM. & METAL. DIV., See Sylvania Chemicals/Metals

GTE SYLVANIA LIGHTING PRODS., Sylvania Lighting Ctr., 100 Endicott St., Danvers, MA 01923, Tel: 617-777-1900

GTE SYLVANIA, INC., CIRCUIT MOD. OPER., See Sylvania Electronics

GTE SYLVANIA, INC., CONNECTOR PRODS. OPER., See Sylvania Connector Prods. Oper.

GTE SYLVANIA, INC., DETROIT, MI, See GTE Metal Laminates

GTE SYLVANIA, INC., ELCTRN. SYS. GRP., See Sylvania Elctrn. Sys. Grp.

GTE SYLVANIA, INC., STANDISH, ME, See Sylvania Control Devices

GTE SYLVANIA, INC., TECH PRODS. DIV., See Sylvania Parts

GTE SYS.-SYLVANIA SYS. GRP., Western Div., P.O. Box 7188, Mountain View, CA 94039, Tel: 415-966-2000, Telex: 415-966-3401, TWX: 910-379-6948; Empl.: 2500; *Sls. Mgr.:* Evan S. Baker; *Dist. Mgr.:* Evan S. Baker

GTE WESGO TECHNICAL CERAMICS & METALS, 477 Harbor Blvd., Belmont, CA 94002, Tel: 415-592-9440; Empl.: 500; *Sls. Mgr.:* W. S. Smith

GTI/CIRCUITS DIV., Box 217, Leesburg, IN 46538, Tel: 219-453-3261, Telex: 023-2653; Empl.: 150; *Sls. Mgr.:* Hugh M. Walker

GTI/ELCTRNS. DIV., P.O. Box 96, Hadley, PA 16130, Tel: 412-253-3161, Telex: 914-545; Empl.: 250; *Sls. Mgr.:* Richard C. Kaufman; *Dist. Mgr.:* Richard C. Kaufman

GUARDIAN CALIFORNIA, 16100 S. Figueroa St., Gardena, CA 90240, Tel: 213-532-3092, TWX: 910-344-7381; Empl.: 48; *Sls. Mgr.:* J. Antrim; *Dist. Mgr.:* K. Ross

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engr. Co.	205-883-9624
AZ	Phoenix, O'Donnell Assocs. SO W	602-274-6072
CA	San Jose, O'Donnell Assocs.	408-263-6500
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Denver, Comp. Technlgy.	303-758-5750
FL	Coral Springs, CBC Elctrns.	305-755-1111
GA	Atlanta, Electro-Mech Sls. Engr. Co.	404-447-6478
IL	Chicago, Frank Nitti Sls.	312-243-1100
IN	Fort Wayne, Needler Sls.	219-447-2123
MD	Glen Burnie, Faion Lott & Co.	301-744-4611
MI	Farmington, Miltimore Sls.	313-476-2446
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Louis, KKB & Co.	314-647-2400
NH	Salem, Sls. Engrg.	603-893-5521
NJ	Manville, DynoRep	201-685-0135
NY	Rochester, Elcom Sales	716-385-1400
OH	Mentor, K-T/Depco	216-729-3588
PA	Doylestown, T.O.E. Sls.	215-348-5333
TX	Dallas, Ion Assocs.	817-640-8282
WA	Bothell, Temco Northwest	206-488-1254

GUARDIAN ELEC. MFG. CO., 1550 W. Carroll Ave., Chicago, IL 60607, Tel: 312-243-1100, TWX: 910-221-5073 .... **1B**•1417-1431

GUILDLINE INSTRS., 2 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-9101, Telex: 145-487; Empl.: 85; *Sls. Mgr.:* W. Dietz

GULTON INDS., INC., ELCTRN. COMPS. DIV., See Gulton Inds., Inc., Piezo Products Div.

GULTON INDS., INC., Graphic Instruments Div., Gulton Ind'l. Pk., E. Greenwich, RI 02818, Tel: 401-884-6800, TWX: 710-387-1500; Empl.: 400; *Sls. Mgr.:* Dave Snyder; *Dist. Mgr.:* Ed Cunnie

GULTON INDS., INC., Piezo Prods. Div., Box 4300, Fullerton, CA 92634, Tel: 714-871-2150, TWX: 910-592-1247; Empl.: 120; *Sls. Mgr.:* J. Sloane

GULTON INDS., INC., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627, Tel: 714-642-2400, 800-854-4066, Telex: 183-532, TWX: 910-596-1352; FSC No.: 99564; Empl.: 320; *Sls. Mgr.:* Tom Perrin, Jr.

GUNTHER, W., GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911/65521, TWX: 622351 Wigu d; Empl.: 260; *Sls. Mgr.:* Albert Gunther; *Dist. Mgr.:* Bob Lynch

Refer to Gordos Corporation, Bloomfield, New Jersey for Representatives and Authorized Distributor information.

HACKER INSTRS., Box 657, Fairfield, NJ 07007, Tel: 201-226-8450, Telex: 642769; Empl.: 12

HADCO PRINTED CIRCUITS, Manchester Rd. Rte. 28, Derry, NH 03038, Tel: 603-432-9541, TWX: 710-366-0788; *Sls. Mgr.:* Ronald Boutin

HADES MFG. CORP., 151-A Verdi St., Farmingdale, NY 11735, Tel: 516-249-4244; FSC No.: 51578; Empl.: 18; *Sls. Mgr.:* K. Norris

HADLEY, ROBERT M. CO., INC., 750 West 51st St., Los Angeles, CA 90037, Tel: 213-234-9091

HALLMARK METALS INC., 610 W. Foothill Blvd., Glendora, CA 91740, Tel: 213-335-1263; Empl.: 20; *Sls. Mgr.:* Robert Schoenick

HALMAR ELECTRONICS, INC., 900 N. Hague Ave., Columbus, OH 43204, Tel: 614-276-0131, TWX: 810-482-1654; Empl.: 80

HALLMARK NAMEPLATE, INC./ELECTROPANEL CO., 1855 New Highway, Farmingdale, NY 11735, Tel: 516-454-0700, Telex: 510-222-0884; *Sls. Mgr.:* Florence Finkle

HAMAMATSU PHOTONICS K.K., 1126 Ichino-Cho, Hamamatsu City, Shizuoka Pref, Japan, Tel: 0534-34-3311, Telex: 4225-185; Empl.: 890; *Sls. Mgr.:* M. Ito

HAMEG, INC., 88-90 Harbor Rd., Port Washington, NY 11050, Tel: 516-883-3837, TWX: 510-223-0889; *Sls. Mgr.:* John F. King

HAMILTON METALCRAFT, 848 N. Fair Oaks Ave., Pasadena, CA 91103, Tel: 818-795-4811; *Sls. Mgr.:* Mel Stahler

HAMILTON STANDARD CONTROLS/STANCOR, See Stancor/Hamilton Standard Controls

HAMILTON STD. CONTROLS, United Technologies, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859, Tel: 219-747-6142, TWX: 810-295-0699; Empl.: 3,700; *Sls. Mgr.:* C. Michalski .... **1B•1474**

Local Sales Offices & Reps

CA	Santa Fe Springs	213-946-4807
FL	Orlando, A.P. Assocs.	305-298-2816
IN	Logansport	219-753-7521
NY	New York, Roburn Agencies	212-989-5939
PA	E. Stroudsburg	717-421-1025

HAMILTON STANDARD DIV., United Technologies Corp., Windsor Locks, CT 06096, Tel: 203-623-1621

HAMLIN INC

HAMLIN, Lake & Grove Sts., Lake Mills, WI 53551, Tel: 414-648-2361, TWX: 910-260-3740; Empl.: 1800; *Sls. Mgr.:* Ken Deans .... **1B•**1063, 1433, 1646, 1844

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Westrep	408-988-8833
CO	Boulder, R-G Entprs.	303-447-9211
CT	North Haven, Coakley, Boyd & Abbett, Inc.	203-239-6217
FL	Casselberry, Southern Elctrn. Mktg.	305-695-3334
FL	Ft. Lauderdale, Southern Electrn. Mktg.	305-475-3686
GA	Jonesboro, Wallace Elctrn. Sls.	404-471-6297
IL	Chicago, Indl. Rep.	312-647-7755
IN	Carmel, Rich Elctrn. Mktg.	317-844-8462
IN	Fort Wayne, Rich Elctrn. Mktg.	219-432-5553
IA	Cedar Rapids, Palatine Sls.	319-365-8071
KS	Mission, Palatine Sls.	913-831-0555
KY	Louisville, Rich Elctrn. Mktg.	502-499-7808
MD	Churchville, Atlantic Technical Sls.	301-879-2236
MA	Needham Heights, Coakley, Boyd & Abbett, Inc.	617-444-5470
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	Hazelwood, Palatine Sls.	314-839-0800
NH	Plaistow, Coakley, Boyd & Abbett, Inc.	617-444-5470
NJ	Marlton, Naudain Assoc.	609-983-5300
NJ	West Caldwell, Grimm Siegel	201-575-9300
NM	Albuquerque, Shefler-Kahn	505-296-0749
NY	Great Neck, Tylinski Assocs.	516-466-9070
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Richfield, Bear Mktg.	216-659-3131
OR	Portland, Syscom	503-644-2505
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-988-1600
TX	Hurst, Allied Comps.	817-589-0456
TX	Round Rock, Allied Comps.	512-244-1166
WA	Bellevue, Testco, Inc.	206-454-7422
WI	Milwaukee, Indl. Rep.	414-259-0965

Local Distributors

AL	Huntsville, Mock Elctrns.	205-539-2401
AZ	Tempe, Circuit Specialties	602-966-0764
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	San Jose, Cypress Elctrns. Inc.	408-945-8400
CA	Santa Clara, Pyramid Elctrns.	408-727-9018
CA	Torrence, Cypress Elctrns. Inc.	213-533-6005
CA	Van Nuys, Patane Avionics	213-988-4455
CO	Englewood, Ind. Elctrns.	303-694-9444
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Hartford, Hatry Elctrns.	203-527-1881
CT	New Haven, Hatry Elctrns.	203-787-5921
CT	Stratford, Hatry Elctrns.	203-375-5866
CT	Wallingford, Sager Elect. Supp.	203-265-4600
CT	Waterbury, Hatry Elctrns.	203-755-1181
FL	Lakeland, AA Elec.	813-665-6941
FL	Longwood, Intertec Inc.	305-834-7777
FL	Miami, Elctrn. Equip. Co.	305-871-3500
FL	Orlando, Hammond Elctrn.	305-849-6060
FL	Tampa, Leader Elctrns.	813-870-3315
GA	Norcross, AA Elec.	404-449-8670
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Lombard, RM Illinois	312-932-5150
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Ft. Wayne, Graham Elctrns.	219-424-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, RM Elctrns. Co.	317-247-9701
IA	Cedar Rapids, Iowa Radio Supp. Co.	319-393-4510
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Wyoming, R-M Elctrn. Co.	616-531-9300
MN	Fridley, Voyager Electronics	612-571-7766
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
NH	Hudson, Heilind Elctrns.	603-883-9536
NJ	Fairlawn, Relay Spec.	201-797-3313
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distr.	716-884-3450
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rome, Rome Elctrns.	315-337-5400
NC	Charlotte, United Elctrn. Supp.	704-372-2650
NC	Gastonia, JMT Elctrns.	704-867-4401
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Greenville, Pair Elctrns.	919-756-2291
NC	Greenville, Hammond Elctrns.	803-232-5357
NC	Shelby, Dixie Indl. Supp.	704-482-5641
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Graham Elctrns.	513-772-1661
OH	Solon, Repco	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elec.	503-233-3691
PA	McKeesport, Barno Radio	412-751-5966
RI	Providence, Wm. Dandreta & Co.	401-861-2800
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Gray, Dixie Elctrns.	615-477-3838
TN	Nashville, Eddie Warner Inc.	615-254-1224
TX	Austin, Harrison Equip. Co.	512-458-3555
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Fort Worth, Allied Elctrns.	214-265-9341
TX	Houston, Harrison Equip.	713-879-2771
WA	Kent, Interface Elctrns.	206-872-5800
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Cedarburg, AA Elec.	414-377-7500
WI	Mequon, Taylor Elec.	414-241-4321

HAMMOND MANUFACTURING.

HAMMOND MFG. CO., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710, Telex: 91-6452; Empl.: 850; *Sls. Mgr.:* Ray Shatzel ... **1A•**2171; **2•**1036, 1037

Local Sales Offices & Reps

AZ	Scottsdale, Mahaffey & Assoc.	602-991-9790
CA	N. Hollywood, Burt Moore & Assocs.	213-877-5955
CA	Redwood City, Hickey Indl. Sls.	415-368-3849
GA	Atlanta, Millar Elctrns.	404-261-6160
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
MD	Silver Spring, Mid Atlantic Sls.	301-593-7749
MA	N. Scituate, W. A. Hendrickson Co.	617-545-0652
MI	Hazel Park, Component Assocs.	313-557-3232
MO	St. Louis, Kathrinus, Kelly & Baumhauer (K.K.B.)	314-647-2400
NY	Bellmore, Selectra Sls.	516-221-7865
NY	Syracuse, Paston-Hunter Co. Inc.	315-437-2992
NC	Raleigh, Millar Elctrns.	919-787-9564
OH	Dayton, Shamrock Elctrn. Sls.	513-258-1227
OR	Portland, Dussault & Assoc. Inc.	503-641-8780
PA	Springfield, George M. Conneen	215-544-5884
TX	Dallas, J. Y. Schoonmaker Co. Inc.	214-349-1650
WA	Seattle, Dussault & Assoc. Inc.	206-527-5454

Local Distributors

AL	Birmingham, Ack Radio	205-322-0588
AL	Montgomery, Handey's Elec. Ctr.	205-262-4885
AL	Muscle Shoals, Jones Elctrns.	205-383-1241
AZ	Phoenix, Tri Tek	602-995-9352
AZ	Phoenix, Electronic Parts Co.	602-277-7281
AZ	Tempe, Circuit Specialists	602-966-2878
AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
CA	Burbank, Electronic City	213-842-5275
CA	Burlingame, Logan Elctrns.	415-697-6481
CA	Canoga Park, Sandy's Elec.	213-346-8353
CA	Chatsworth, Poco Sls.	213-700-8727
CA	Costa Mesa, Marvac Elec.	714-540-3280
CA	El Toro, R-Vac Elec.	714-586-1210
CA	Glendale, Eagle Elctrns.	213-245-2338
CA	Hollywood, Yale Radio Elec.	213-465-3186
CA	Hollywood, Pacific Radio	213-462-1392
CA	Irvine, Graymark Intl.	714-540-5480
CA	Los Angeles, I. T. C.	213-388-0621
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Pasadena, Dow Radio	213-681-3416
CA	Redwood City, H.D.B.	415-368-1388
CA	San Diego, Western Radio Elec.	714-239-0361
CA	San Jose, Con. Parts Inc.	408-263-9521
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Santee, Mouser Elec.	619-449-2300
CO	Denver, Fistell Elctrns.	303-629-1312
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Denver, Con. Parts Inc.	303-458-0978
CT	Danbury, Pilgrim Elec.	203-792-7274
CT	Hartford, Hatry Elec.	203-527-1881
CT	Hartford, Signal Elec. Center	203-233-8551
CT	Middletown, Midstate Elec.	203-347-5638
CT	New London, Aikins Elec. Supp.	203-442-4406
CT	Norwalk, Park Distrbg.	203-853-2011
CT	Norwalk, Cobra	203-853-8228
CT	Stratford, Hatry Elec.	203-375-5866
FL	Dania, Summit Elec.	305-920-6253
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Longwood, Intertec	305-834-7777
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Atlanta, Ack Radio	404-351-6340
GA	Atlanta, Wholesale Dist.	404-447-8431
HI	Honolulu, Elctrn. Equip. Co.	808-533-3884
HI	Honolulu, Honolulu Elec.	808-949-5564
IL	Chicago, Newark Elec.	312-638-4911
IL	Joliet, Mainline Elec.	815-436-3900
IL	Niles, Joseph Elec.	312-459-4030
IL	Northbrook, Classic Comps.	312-272-9650
IL	Wheeling, Hawk Elec.	312-459-4030
IN	Indianapolis, Advent Elec.	317-872-4910
IN	Indianapolis, Mar Elec.	317-875-4510
IN	Lafayette, C.W.Y. Elec.	317-448-1611
KY	Louisville, Peerless Elctrns.	502-637-7677
LA	Harvey, A.F.G. Elec.	504-368-9696
LA	New Orleans, Wm. B. Allen Supp.	504-525-8222
LA	Shreveport, Industrial Elec. Supp.	318-222-9459
MD	Beltsville, Mark Elctrns.	301-595-5040

PoCo

We Stock

HAMMOND MANUFACTURING.

PLASTIC BOXES

DIE CAST BOXES

INSTRUMENT CASES

DESK TOP CONSOLES

RACK & PANEL

CABINETS

POCO SALES

8925 Fullbright Street
Chatsworth, California 91311
(818) 700-8727
Serving Western Region

MD	Bethesda, Empire Elec.	301-656-3300
MD	College Park, Electronics Plus	301-441-9009
MD	Rockville, M. S. Elec.	301-340-6400
MA	Lynn, Land Elec. Supp.	617-592-2220
MA	Needham, Y.D.I. Elec.	617-449-1005
MA	Woburn, Abbott Elec.	617-935-2040
MA	Woburn, Brownell Electro.	617-935-7820
MI	Farmington Hills, Advent Elec.	313-477-1650
MI	Grand Rapids, S. F. Electrns.	616-459-0216
MI	Lansing, Demco	517-321-1700
MN	Edina, Northern Elec.	612-944-1167
MN	Minneapolis, Acme Elec.	612-338-4754
MO	Kansas City, Electronic Supp.	816-931-0250
MT	Billings, Electronic Supp. Co.	406-252-2197
NH	Dover, American Radio Corp.	603-742-6800
NH	Mason, Radio Kit	603-878-1033
NJ	Fairlawn, Relay Specialties	201-797-3313
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Dist.	716-884-3450
NY	Buffalo, Goldcrest Elec.	716-885-5878
NY	Buffalo, Genesee Radio	716-873-9661
NY	Commack, Spartan Elec.	516-499-9500
NY	Cortland, Central Elec.	607-756-2523
NY	Deer Park, BVG Elec.	516-586-8668
NY	Glenn Falls, Ray Supp.	518-792-5848
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Johnson City, Goldcrest Elec.	607-797-2389
NY	Johnson City, Unicorn	607-798-0260
NY	Kingston, Greylock Elec.	914-338-5300
NY	Levittown, Edlie Elec.	516-735-3330
NY	Middletown, Greylock Elec.	914-343-7900
NY	N.Y.C., Martin Audio Video	212-541-5900
NY	N.Y.C., Advance Elec.	212-730-7030
NY	Port Washington, Corrector Concepts	516-883-3800
NY	Poughkeepsie, Greylock Elec.	914-452-0550
NY	Rochester, Rochester Radio	716-454-7800
NY	Rochester, Goldcrest Elec.	716-546-8464
NY	Rochester, Masline Elec.	716-546-5373
NY	Rome, Rome Elec.	315-337-5400
NY	Schenectady, Grimmers Elec.	518-374-8480
NY	Schenectady, Goldcrest Elec.	518-377-6424
NY	Syracuse, Goldcrest Elec.	315-471-7115
NY	Syracuse, Saling Elec.	315-422-2336
NY	Troy, Trojan Elec.	518-272-4481
NY	Utica, Central Elec.	315-735-6474
NY	Woodside, Switches Unltd.	212-478-5000
NC	Greensboro, Hammond Elec.	919-275-6391
OH	Cleveland, Roberts Elec.	216-238-1711
OH	Cleveland, Winteradio	216-621-9383
OH	Columbus, Thompson Elec. Supp.	614-228-6191
OH	Dayton, Stott Friedman	513-251-3633
OH	Parma Heights, Phil Reddish Supp.	216-885-1222
OH	Toledo, Warren Radio	419-248-3364
OH	Wintersville, D & R Elec.	614-264-1611
OK	Oklahoma City, Radio Inc.	405-528-2391
OK	Tulsa, Radio Inc.	918-587-9123
OK	Tulsa, Combined Tech.	918-582-8242
OK	Tulsa, Genesis Elec.	918-622-8520
PA	Drexel Hill, Kass Elec.	215-449-2300
PA	Erie, Warren Radio	814-454-5285
PA	Erie, J. V. Duncombe Elec.	814-454-5278
PA	McKean, Advacom	814-476-7774
PA	McKeesport, Barno Radio	412-751-5966
PA	Wayne, Peak Elec.	215-293-9000
RI	Cranston, OEM Supp.	401-781-3904
RI	Newport, J & S Elec. Supp.	401-847-2977
RI	Pawtucket, Major Elec. Supp.	401-725-7400
RI	Providence, Hope Elctrns.	401-521-5600
SC	Greensville, Hammond Elec.	803-242-6880
TN	Memphis, Bluff City Elec.	901-345-9500
TX	Austin, Austin Elec.	512-836-9677
TX	Corpus Christi, Douglas Elec.	512-883-5103
TX	Dallas, Wholesale Elec.	214-824-3001
TX	Dallas, Electrotex	214-234-0433
TX	El Paso, Midland Specialties	915-533-9555
TX	Ft. Worth, Wholesale Elec.	817-336-0461
TX	Ft. Worth, Allied Elec.	817-336-5401
TX	Houston, City Elec. Supp.	713-621-1060
TX	Houston, Ace Elec.	713-688-8114
TX	Houston, Electrotex	713-526-3456
TX	Long View, Vidco	214-757-4911
TX	San Antonio, Electrotex	512-735-9271
TX	San Antonio, Sherman Elec.	512-224-1001
TX	San Antonio, Altex	512-828-0503
UT	Salt Lake City, Standard Elec. Supp.	801-486-3371
UT	Salt Lake City, Western Cont.	801-328-4302
VT	Burlington, Greylock Elec.	802-658-5700
VA	Alexandria, Certified Elec.	703-548-5115
WA	Bellevue, Integrated Elec.	206-455-2727
WA	Bellevue, Nidi Northwest	206-746-7970
WI	Mequon, Lakeview Elec.	414-377-8250
WI	Mequon, Taylor Elec.	414-241-4321
WI	New Berlin, R. M. Wisconsin	414-784-4420

HAMPTON PRODS., 2995 Eastrock Dr., Rockford, IL 61109, Tel: 815-398-2770, TWX: 910-631-3432; *Sls. Mgr.:* Gary Gohlinghorst; *Dist. Mgr.:* Steve Schweitzer

H&T COMPONENTS INC., H&T Components Ltd., 87 Sand Pit Rd., Danbury, CT 06810, Tel: 203-794-1798, Telex: 643011; *Sls. Mgr.:* K. Pulasky; *Dist. Mgr.:* Janet Rapoza .... **2**•1318-1328

Local Sales Offices & Reps

AL	Huntsville, D.H.R. Mktg.	205-533-5165
AZ	Phoenix, Adtek Inc.	602-931-9289
CA	Sunnyvale, Schwerin Merrill Inc.	408-735-7900
CO	Littleton, Elctrn. Comp. Sys.	303-797-2772
CT	Milford, Todino Engineering Sales	203-874-6643
FL	Casselberry, Sls. Engrg. Concepts	305-678-1035
GA	Atlanta, D.H.R. Mktg.	404-451-9848
IL	Chicago, Esco Assocs.	312-763-0800
KS	DeSoto, Midtec Assocs.	913-441-6565
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Needham Heights, Todino Engrg. Sls.	617-444-7925
MI	Birmingham, Favco	313-644-0173
MN	Bloomington, D. A. Case Assocs.	612-888-8666
MO	Florissant, Midtec Assocs.	314-837-5200
NJ	Haddonfield, Mills Brown Assocs.	609-429-1005
NY	Endicott, Noeth-Honsinger Assocs.	607-754-3214
NY	Hackensack, Meg Elctrns.	201-489-7700
NY	Pittsford, Noeth-Honsinger Assocs.	716-586-9002
NC	Raleigh, McGee Assocs.	919-781-9579
OH	Akron, Augnat Assocs.	216-273-1211
OR	Portland, Barrett Squibb & Assocs.	503-644-2550
TX	Plano, Richmar Elctrns.	214-867-8224
UT	Salt Lake City, Charles Fields & Assocs.	801-277-4859
VA	Richmond, Delta III Assocs.	804-771-9204
WA	Redmond, Barrett Squibb & Assocs.	206-885-6991

Local Distributors

AZ	Phoenix, Dalis Elctrns.	602-275-2626
AZ	Tucson, Inland Elctrn. Supp.	602-294-2628
CA	Mountain View, Bell Inds.	415-960-1440
CA	S. San Francisco, Peters deLaet	415-873-9595
CA	Santa Ana, C. R. Electronics	714-556-2040
CT	Bridgeport, Accurate Elctrns.	203-366-0214
FL	Ft. Lauderdale, Simcona	305-485-4455
GA	Norcross, Whitehead Elctrns.	404-923-6667
IL	Lisle, Components Inc.	312-852-7707
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
LA	Lafayette, Ralphs Indl. Elctrn. Supp.	318-234-4507
MD	Baltimore, Pyttronic Inds.	301-792-0780
MA	Hopkinton, Interface Elctrns.	617-435-6858
MA	Lowell, Colonial Wire & Cable	617-459-6400
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	North Chatsworth, Northern Automatic	612-481-0022
NJ	Oakland, Gordon/Horne	201-337-5200
NY	Buffalo, Summit Distrs.	800-462-1880
NY	Hauppauge, Broadline Elctrns.	516-231-4100
OH	Cleveland, Roberts Elctrns.	216-238-1711
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Dayton, Televok Inc.	513-294-4499
PA	Montgomeryville, Pyttronic Inds.	215-242-6700
TX	Dallas, Computer Components	214-239-0271
TX	Houston, Ralphs Indl. Elctrn. Supp.	713-748-4902
UT	Salt Lake City, Pen-Tec Entprs.	801-972-4817
WA	Redmond, Murphy Elctrns.	206-881-1234

HANDY & HARMAN, 850 Third Ave., New York, NY 10022, Tel: 212-752-3400; Empl.: 800; *Sls. Mgr.:* C. P. Zitzmann

HANDY & HARMAN ELCTRN. MATLS. CORP., 72 Elm St. N., Atteboro, MA 02760, Tel: 617-695-1401; Empl.: 450

HANKSCRAFT MOTORS, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959, Tel: 608-524-4341; Empl.: 550

HANSCOM, H. F., CO., INC., 225 Chapman St., Providence, RI 02905, Tel: 401-941-1455, Telex: 952107; Empl.: 50; *Sls. Mgr.:* William E. Taplin

HAPCO, Box 1205, Boulder, CO 80302, Tel: 303-447-0441; Empl.: 10; *Sls. Mgr.:* B. Ewing

HARBISON INDL. PRODS., Sub. of Polymer Corp., 7205 Hibbs La., Levittown, PA 19057, Tel: 215-943-9000, TWX: 510-667-0167; Empl.: 50; *Sls. Mgr.:* R. S. Spangler

HARDIGG INDS., INC., North Main St., South Deerfield, MA 01373, Tel: 413-665-2163, Telex: 955431; FSC No.: 11214; *Dist. Mgr.:* Warren H. Bickford

HARDMAN INC., 600 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-3000, TWX: 710-995-4940; Empl.: 95; *Sls. Mgr.:* Carl T. Sanford

HAROWE SERVO CONTROLS, Westtown Rd. at West Chester Pike, W. Chester, PA 19380, Tel: 215-692-2700, Telex: 83-5486, TWX: 510-663-0335; FSC No.: 06989; Empl.: 450; *Sls. Mgr.:* Dennis B. Daisy

HARREL, INC., 16 Fitch St., E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* W. Becker .... **3**•1131

Local Sales Offices & Reps

CA	Sherman Oaks, Windsor Dynamics	213-989-3631
CA	Walnut Creek, Viking Instr.	415-933-1221
NY	Cazenovia, P. M. Decew, Inc.	315-065-8602
NC	Charlotte, Beck Sls.	704-366-5366
OH	North Olmstead, Odessa Instr. Co.	216-734-6777
PA	Elkins Park, Edwin F. Gregg	215 CA4-0248
TN	Knoxville, Robert Olsen Co.	615-688-4038

HARRIS CIRCUITS MFG., 2706 Colley Ave., Norfolk, VA. 23517, Tel: 804-467-1116; Empl.: 15

HARRIS CORP., Computer Systems Div., 2101 W. Cypress Creek Rd., Ft. Lauderdale, FL 33309, Tel: 305-974-1700, TWX: 510-956-3096; FSC No.: 29436; Empl.: 1000; *Sls. Mgr.:* Jeff Oromaner

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93010, Tel: 805-987-9511, Telex: 182327; Empl.: 360; *Sls. Mgr.:* Tom Sadowski; *Dist. Mgr.:* Keith Boutillier

HARRIS CORP., PRD Elctrns. Div., 6801 Jericho Tpke., Syosset, NY 11791, Tel: 516-364-0400, TWX: 510-222-4494; FSC No.: 77327; Empl.: 1,850; *Sls. Mgr.:* R. A. Lebowitz

HARRIS MICROWAVE SEMICONDUCTOR, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-262-2222, TWX: 910-338-2247

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32901, Tel: 305-724-7400, TWX: 510-959-6259; FSC No.: 34371; Empl.: 2300; *Sls. Mgr.:* Dan McCranie; *Dist. Mgr.:* Charles H. Beaty

HARSHAW FILTROL PARTNERSHIP, 1945 E. 97th St., Cleveland, OH 44106, Tel: 216-721-8300; *Sls. Mgr.:* Robert Anfang

HARTLEY PRODS., 620 Island Rd., Ramsey, NJ 07446, Tel: 201-327-4443; *Sls. Mgr.:* R. Schmetterer

HARTMAN SYSTEMS, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746, Tel: 516-427-7500, TWX: 510-226-6982; FSC No.: 92220; Empl.: 310; *Sls. Mgr.:* Robert Griffith

HARTWELL CORP., 900 S. Richfield Rd., Placentia, CA 92670, Tel: 714-993-4200, Telex: 683-485, TWX: 910-596-1294; FSC No.: 83014; Empl.: 425

HARWIL, 1548 17th St., Santa Monica, CA 90404, Tel: 213-829-2310; Empl.: 7

HASCO COMPS., INC., 214-22 Waters Edge Dr., Bayside, NY 11360, Tel: 212-428-5155, TWX: 710-582-5750; Empl.: 6; *Sls. Mgr.:* Tab Hauser .... **1B**•1436-1442, 1647

HAYDON SWITCH & INSTR., 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, Telex: 643852 - HSIINTLWBY; FSC No.: 02005; Empl.: 291; *Sls. Mgr.:* Scott Moulton

HAZELTINE CORP., 500 Commack Rd., Commack, NY 11725, Tel: 516-462-5100, Telex: 64-0525, TWX: 510-226-0239; Empl.: 2,500

H-A-Z LABORATORIES, Brass Castle Rd., P.O. Box 67-M, Washington, NJ 07882, Tel: 201-689-0110; *Sls. Mgr.:* Henry Zajac

HBS EQUIPMENT DIV., 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, TWX: 910-580-3179; Empl.: 40; *Sls. Mgr.:* K. Lowery

HDR POWER SYS., INC., 600 Oakland Park Ave., Columbus, OH 43214, Tel: 614-262-6832, Telex: 246524; Empl.: 41; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, Telex: 64585; Empl.: 54

HEADWAY RESCH., INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, Telex: 73-0257; Empl.: 50; *Sls. Mgr.:* Mina Kelly

Local Sales Offices & Reps

CA	Santa Clara, California Tech. Svcs.	408-496-1156/57
CA	Tarzana, California Tech. Svcs.	213-343-3131
NY	New Rochelle, East Coast Sls. Co.	914-636-4325

HEATH CO., Benton Harbor, MI 49022, Tel: 616-982-3886, Telex: 72-9421

HEAT SYSTEMS-ULTRASONICS, INC., 1938 New Highway, Farmingdale, NY 11735, Tel: 516-694-9555, Telex: 14-3101; *Sls. Mgr.:* Lyle E. Cady

HECON CORP., 31 Park Rd., Tinton Falls, NJ 07724, Tel: 201-542-9200, Telex: 13-2457; Empl.: 200; *Sls. Mgr.:* P. Shine; *Dist. Mgr.:* R. Drum

HEI, INC., 1495 Steiger Lake La., Victoria, MN 55386, Tel: 612-443-2500, TWX: 910-578-3961; Empl.: 175; *Sls. Mgr.:* R. D. Young .... **1B**•1219

Local Sales Offices & Reps

AL	Huntsville, REP, Inc.	205-881-9270
AZ	Phoneix, Toward Engrg.	602-955-3193
AR	Little Rock, Quad State	501-680-9588
CA	Los Angeles, MASCO	714-525-0866
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Aurora, Ausco Sls.	303-750-3846
FL	Coral Springs, CBC Elctrns.	305-755-1111
FL	Longwood, CBC Elctrns.	305-831-5380
GA	Tucker, REP, Inc.	404-938-4358
IL	Schaumburg, Micro-Tex	312-885-1131
KS	De Soto, Midtec Assocs.	913-441-6565
MI	Novi, Miltimore Sls.	313-349-0260
NH	Salem, Sls. Engrg.	603-893-5521
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Massapequa, Coughlin Assoc.	516-799-7743
NY	Rochester, D. L. Eiss Assocs.	716-328-3000
NC	Raleigh, REP, Inc.	919-851-3007
OH	Rocky River, Norm Case Assocs.	216-333-0400
TN	Jefferson City, REP, Inc.	615-475-9012
TX	Dallas, Quad State Mktg.	214-680-9588
WA	Bellevue, Comtec	206-453-1188

HEINEMANN ELEC. CO., Brunswick Pike, Alt. Rte. 1, P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-882-4800, Telex: 843431; FSC No.: 74193; Empl.: 625; *Sls. Mgr.:* R. E. Delaney .... **1B**•1266, 1267

Local Sales Offices & Reps

AL	Birmingham, Austin Brown Assocs. Inc.	205-822-6198
AZ	Phoenix, O'Donnell Assocs. SW	602-944-9542
CA	Chatsworth, Porter Co.	818-700-0808
CA	San Diego, Porter Co.	619-275-0641
CA	San Jose, O'Donnell Assocs. No.	408-263-6500
CO	Englewood, Computech Mktg.	303-773-3981
FL	Boca Raton, Conley & Assoc.	305-395-6108
FL	Oviedo, Conley & Assocs.	305-365-3283
FL	Tampa, Conley & Assocs.	813-885-7658
GA	Atlanta, Austin Brown Assocs. Inc.	404-457-6381
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Ft. Wayne, O.H. Bromberg & Assocs.	219-456-6010
KY	Louisville, O.H. Bromberg & Assocs.	502-245-8916
MD	Pikesville, Imagitron Sls. Co.	301-521-2020
MA	Framingham, Sullivan Tech. Sls.	617-620-0195
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, Furber/Smith Assoc.	612-881-3620
MO	Creve Coeur, Hill & Co.	314-432-1136
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NY	Rochester, Canavan-Scanlon	716-424-1830
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cincinnati, O.H. Bromberg & Assocs.	513-771-9333
OH	Cleveland, Brown Elect. Prod.	216-331-2072
OH	Dayton, KW Elctrn. Sls.	513-890-2150
PA	Allison Park, KW Electrn. Sls.	412-487-4300
PA	Washington Crossing, DVS Co.	215-493-4642
TN	Brentwood, Austin Brown Assocs. Inc.	615-373-2068
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415
WA	Mercer Island, Andersen Assocs.	206-232-0484
WI	Elm Grove, Key Entpr.	414-784-3390

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Burlingame, Campbell & George	415-697-2965
CA	Chatsworth, POCO Sls.	818-700-8727
CA	San Jose, Cazco Sls.	408-263-6503
CO	Denver, CSID Inc.	303-292-9594
CT	Hartford, L. E. Whelan Co.	203-246-5694
CT	New Haven, Green Shaw Co.	203-397-0710
FL	Oviedo, Dixie Sls.	305-365-5211
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Nedco Elctrns.	312-286-5565
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IN	Indianapolis, Graham Elctrns.	317-634-8202
KS	Edwardville, C. Tennant & Sons	913-441-1801
MD	Baltimore, Automation Indl. Control	301-747-0044
MA	Boston, Apparatus Svc.	617-787-1300
MA	Framingham, Cavalier Comps.	617-875-2000
MA	Newton, Green Shaw Co.	617-969-8900
MI	Southfield, Michigan Lectrols Corp.	313-353-1350
MN	Minneapolis, Northland Elec. Supp.	612-341-6100
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Trenton, Automation Controls & Equip.	609-882-6330
NJ	West Caldwell, L. E. Whelan Co.	201-575-5880
NY	Binghamton, Pioneer/Harvey Elctrns.	607-748-8211
NY	Syracuse, Baldwin Hall	315-463-9251
NY	Whitestone, Power Electro Supp. Co.	212-767-1447
NC	Charlotte, Joyce Sls. Co.	704-377-1555
OH	Cincinnati, Cartessa Corp.	513-385-7700
OH	Dayton, Duellman Elec.	513-461-5010
OH	Solon, REPCO Elctrns.	216-248-8900
OH	Valley View, Newark Elctrns.	216-447-8860
OR	Portland, Platt Elec. Supp.	503-228-6121
OR	Tualatin, North Coast Elec. Co.	503-684-2570
PA	Washington Crossing, Riverside Comps.	215-493-4642
PA	West Chester, West Chester Elec. & Electrn.	215-696-7500
TN	Chattanooga, Techni-Tronics	615-875-5449
TX	Dallas, Geeco Sls. Co.	214-341-2626
VA	Charlottesville, Va. Radio Supp. Co. Inc.	804-296-4184
WI	Milwaukee, Hunt Co.	414-383-1781

HEINEMANN ELECTRIC CO., P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-882-4800

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 212-565-0004; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456, Tel: 805-928-3851, TWX: 910-351-5856; FSC No.: 13201; Empl.: 41

HELIONETICS, INC., DECC Div., 17312 Eastman St., Irvine, CA 92714, Tel: 714-546-4731, 800-421-7915, TWX: 910-595-2829; *Sls. Mgr.:* R. S. Tullock

HELLESENS BATTERY ENGRG., INC., A/S Hellesens, 1636 Hyde Park Ave., Hyde Park, MA 02136, Tel: 617-361-7555, Telex: 940536 BOSTELEX; FSC No.: 60289; *Sls. Mgr.:* James Epstein

Advertisement

Hellesens Battery Engineering, Inc. designs, develops, and manufactures lithium/thionyl chloride batteries in cylindrical sizes from 10mm to 67mm diameter and rectangular configurations to your specifications. Contract research, design, development on both primary and secondary lithium batteries with liquid and solid depolarizers. Send us your specifications or call for data sheets and technical information.

HELM INSTR. CO., INC., 1387 Dussel Drive, Maumee, OH 43537, Tel: 419-531-0146, Telex: 28-6078; Empl.: 35; *Sls. Mgr.:* Mike Wilhelm

HENES PRODS., 4301 E. Madison St., Phoenix, AZ 85034, Tel: 602-275-4126; Empl.: 25

HENSCHEL, 14 Cedar St., Amesbury, MA 01913, Tel: 617-388-1103, Telex: 94-7444; FSC No.: 28199; Empl.: 180

HERAEUS-VOLKERT INC., 222-34 96th Ave., Queens Village, NY 11429, Tel: 212-464-8400, Telex: 142338; Empl.: 250; *Sls. Mgr.:* Len Lattanzi

HERBERT PRODS. INC., 180 Linden Ave., Westbury, NY 11590-0384, Tel: 516-334-6500, TWX: 510-222-5963; Empl.: 98; *Sls. Mgr.:* L. C. Peshkin

HERMETIC SEAL, 4232 Temple City Blvd., Rosemead, CA 91770, Tel: 818-283-0411, TWX: 910-587-3352; FSC No.: 04820; Empl.: 220

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, Telex: 796125 Hermetic CKSA; Empl.: 150; *Sls. Mgr.:* E. R. Andrus .... **1B**•1648

Local Sales Offices & Reps

CA	Arcadia, V. Gott & Assocs.	818-445-9728
CA	San Diego, V. Gott & Assocs.	612-272-8452

890 HECON

COUNTERS
PRINTERS

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

PoCo

We Stock

HEINEMANN
Circuit Breakers

SERIES
JA, AM, CF & KD
ONE, TWO & THREE POLES
MULTIPLES OF 5 AMPERES
60 Hz AND DC
SLOW AND FAST DELAY

POCO SALES
8925 Fullbright Street
Chatsworth, California 91311
(818) 700-8727
Serving Western Region

GA	Atlanta, Electro Technlg. Prods.	404-458-4427
MD	Timonium, Heller Sls.	301-252-4780
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	Minneapolis, Peterson Sls. & Assocs.	612-944-0030
NY	Oceanside, Current Inds.	516-678-3895
OR	Beaverton, LD Elctrns.	503-649-8556
PA	Furlong, Avenir	215-348-8290
TX	Austin, R. F. Kimball Co.	800-442-4506
TX	Houston, R. F. Kimball Co.	713-840-0590
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns. (Boise, ID #)	208-343-2741

HERTNER DIV., 12690 Elmwood Ave., Cleveland, OH 44111, Tel: 216-252-4242, Telex: 98-5552; Empl.: 125; *Sls. Mgr.:* S. Steven

HERTZ FILTER, 3 Aerial Way, Syosset, NY 11791, Tel: 516-822-4770; Empl.: 22 .... **1A**•1598

HEURIKON CORP., 3001 Latham Dr., Madison, WI 53713, Tel: 608-271-8700; Empl.: 55; *Sls. Mgr.:* C. M. Priebe .... **3**•1082-1084

Local Sales Offices & Reps

CA	N. Hollywood, Qualtech	213-765-1419
CA	Orange, Qualtech	714-639-9820
CA	Palo Alto, Qualtech	415-494-9060
CA	San Diego, Mesa Engrg.	619-278-8021
CO	Denver, PAR Assocs.	303-371-4140
GA	Atlanta, Magaro & Assocs.	404-451-8862
KS	Prairie Village, Panatek	913-362-3349
MD	Rockville, Spectro Assocs.	301-279-2010
MA	Waltham, Daner-Hayes	617-894-7290
MN	Minneapolis, Micro Resources	612-830-1454
NY	Brewster, Daner-Hayes	800-225-8760
OH	Cincinnati, Applied Data Management	513-579-8108
TX	Houston, Acudata	713-488-8195
TX	Plano, Acudata	214-424-3567
UT	Centerville, PAR Assocs.	801-292-8145

HEWLETT-PACKARD CO., P.O. Box 301, 815 Southwest 14th St., Loveland, CO 80537, Tel: 303-667-5000

HEWLETT
PACKARD

HEWLETT-PACKARD CO., 1820 Embarcadero Rd., Palo Alto, CA 94303, Tel: Call Local Sls. Off.; Empl.: 68,000 .... **3**•1585-1588

Local Sales Offices & Reps

AL	Huntsville	205-881-4591
AZ	Phoenix	602-273-8000
AZ	Tucson	602-889-4631
CA	Fresno	209-221-6821
CA	Fullerton	714-870-1000
CA	Lawndale	213-970-7500
CA	North Hollywood	213-877-1282
CA	Palo Alto	415-857-8000
CA	Sacramento	916-929-7222
CA	San Diego	714-279-3200
CA	Santa Ana	714-641-0977
CA	Santa Clara	408-988-7000
CO	Englewood	303-771-3455
CT	Wallingford	203-265-7801
FL	Ft. Lauderdale	305-973-2600
FL	Orlando	305-859-2900
GA	Atlanta	404-955-1500
HI	Honolulu	808-526-1555
IL	Bloomington	309-663-0383
IL	Downers Grove	312-960-5760
IL	Rolling Meadows	312-255-9800
IN	Indianapolis	317-842-1000
IA	Iowa City	319-351-1020
LA	Kenner	504-463-6201
MD	Hanover	301-796-7700
MD	Rockville	301-948-6370
MA	Lexington	617-861-8960
MI	Farmington Hills	313-476-6400
MN	St. Paul	612-644-1100
MO	Kansas City	816-763-8000
MO	St. Louis	314-878-0200
NV	Las Vegas	702-736-6610
NJ	Eatontown	201-542-1384
NJ	Paramus	201-265-5000
NJ	Piscataway	201-981-1199
NM	Albuquerque	505-292-1330
NM	Las Cruces	505-526-2484
NY	Albany	518-458-1550
NY	Clarence	716-759-8621
NY	Fairport	716-223-9950
NY	Poughkeepsie	914-462-7683
NY	Syracuse	315-455-2486
NY	Woodbury	516-921-0300
NC	Greensboro	919-852-1800
OH	Cleveland	216-243-7300
OH	Columbus	614-436-1041
OH	Dayton	513-859-8202
OK	Oklahoma City	405-721-0200
OR	Wilsonville	503-682-8000
PA	King of Prussia	215-265-7000
PA	Pittsburgh	412-782-0400
TX	El Paso	915-533-3555
TX	Houston	713-776-6400
TX	Richardson	214-231-6101
TX	San Antonio	512-434-8241
UT	Salt Lake City	801-974-1700
VA	Richmond	804-285-3431
WA	Bellevue	206-643-4000
WA	Spokane	509-922-7000
WI	Brookfield	414-784-8800
PR	Carolina	809-762-7255

SERVING INDUSTRY
HEXACON
50 YEARS

HEXACON ELEC., 161 W. Clay Ave., Roselle Park, NJ 07204, Tel: 201-245-6200, Telex: 13-8812; Empl.: 150 .... **2**•1928

Local Sales Offices & Reps

AL	Huntsville, BJR Mfrs. Reps.	205-881-3569
AZ	Tucson, Ross IV Associates	602-299-1425
CA	Newport Beach, Ross IV Asso.	714-650-5542
CA	Sunnyvale, J. F. Peil Co.	408-730-5869
CO	Littleton, Production Equip. Sls.	303-795-5022
CT	E. Woodstock, H & M Assocs.	203-928-9442
FL	Merritt Island, J. A. Kennedy Co.	305-452-9821
IL	Elk Grove Village, Bradley Reps.	312-228-8450
IN	Indianapolis, Harvey Guenther	317-251-8143
KS	Kansas City, L. E. Bruns	913-287-5242
MD	Phoenix, B&W Mktg.	301-592-8907
MN	Fridley, Teskey & Assocs.	612-571-0876
NJ	Jersey City, Dunn & Bryan	201-963-4478
NY	New Hartford, V. Clair	315-735-8122
OH	Solon, KDF Co.	216-248-8010
OR	Gladstone, Northcoast Mfrs. Agency II	503-657-9427
PA	West Chester, B&W Mktg.	215-692-7155
TX	Dallas, P. J. Scanlon	214-231-4661
WA	Seattle, Northcoast Mfrs. Agency	206-284-5024
EXP	NY, New York, W. D. Blood & Co.	212-344-0210

HEYCO

HEYCO MOLDED PRODUCTS, Box 160, Kenilworth, NJ 07033, Tel: 201-245-0033, 800-526-4182, Telex: 844771; FSC No.: 28520; Empl.: 96 .... **2**•1861

Local Distributors

Intl	Australia, Kilkenny, Werner Elctrn. Inds.	268-2766
Intl	Austria, Braunau/Inn, Albert Berner	07722-2211
Intl	Belgium, Bruxelles, N.V. Beluma S.A.	02-427-42-15
Intl	Denmark, Herlev, Harttung Fasteners A/S	02-84-11-00
Intl	England, Wimborne, Heyco Mfg.	0202-87-14-11
Intl	Finland, Tampere, United Shoe Mach.	28-180
Intl	France, Paris, M.F.O.M.	205-67-39
Intl	Germany, Giessen, Heyman Mfg.	0641-76250
Intl	Hong Kong, North Point, S & T Entprs.	5-784-0921
Intl	Israel, Tel Aviv, Helet Trading Ltd.	216-157
Intl	Italy, Milan, Elektrozubehor	02-74-90-541
Intl	Japan, Tokyo, Hakuto Co. Ltd.	03-341-2611
Intl	Mexico, Mexico City, Retenes y Refacciones Ind.	5-754-0503
Intl	Netherlands, Diemen, Onkenhout & Onkenhout B.V.	020-90-40-40
Intl	Norway, Oslo, United Shoe Mach.	02-21-86-50
Intl	Singapore, 0923, S & T Entprs.	747-9235
Intl	South Africa, Durban, Three-D Agencies	39-23-51
Intl	South Africa, Johannesburg, Three-D Agencies	825-5065
Intl	South America - Colombia - Cordoba, Ira Export	40-4648
Intl	Sweden, Orebro, United Shoe Mach.	019-12-42-30
Intl	Switzerland, Hunzenschwil, Agro AG	064-472-61
Intl	Taiwan, Taipei, Shigma Inc.	771-3403
Can	Toronto, Cords Canada	416-787-1114

HGA ELCTRNS., 519 S. Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-5393; Empl.: 2

HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626; Empl.: 13

HICKOK ELEC. INSTR., 10514 DuPont Ave., Cleveland, OH 44108, Tel: 216-541-8060, TWX: 810-421-8286; Empl.: 450; *Dist. Mgr.:* T. Hayden

HICO HORIZONS INTL. CO., See Maxon Precision Motors

HI G, CO., INC., 580 Spring St., Windsor Locks, CT 06096, Tel: 203-623-2481

Hi-G COMPANY
A Subsidiary of Nytronics, Inc.

HI-G COMPANY, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, Tel: 203-522-8600, Telex: 643394, TWX: 710-425-1379; FSC No.: 02289; Empl.: 550; *Sls. Mgr.:* J. Parsons

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Westrep	408-988-8833
CO	Littleton, Omega	303-798-7040
FL	Clearwater, Hallmark Elctrns.	305-530-4543
FL	Melbourne, Beacon	305-724-8010
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Fort Wayne, Given Corp.	219-432-5585
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, Advanced Tech. Sls.	913-642-6675
MD	Pikesville, Imagitron Sls. Co.	301-521-2020
MA	Bloomfield, Astrorep New England	203-967-4848
MI	Ann Arbor, Elliott Sls. Co.	313-662-4087
MN	St. Paul, Repco	612-642-2828
MO	St. Louis, Advanced Tech. Sls.	314-227-4448
NE	Lincoln, Lorenz Sls.	402-475-4660
NJ	Perth Amboy, Astrorep	201-826-8050
NY	Babylon, Astrorep	516-422-2500
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Ronkonkoma, Hallmark Elctrns.	516-737-0600
NC	Greensboro, L & D Inc.	919-292-3201
OH	Cleveland, Comps.	216-243-9200
OH	Miamisburg, Comps.	513-866-0661
OK	Tulsa, Bonser-Philhower Sls.	918-496-3236
OR	Wilsonville, RTS	503-638-5670
PA	Pittsburgh, Comps.	412-824-1600
TX	Richardson, Bonser - Philhower Sls.	214-234-8438
WA	Vashon, RTS	206-285-1363
WI	Cedarburg, Bransky Sls.	414-377-6837

Local Distributors

AL	Huntsville, Hallmark Elctrns.	205-837-8700
AZ	Phoenix, Hallmark Elctrns.	602-243-6601
AR	Little Rock, Electro Entprs.	501-664-9207
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Chatsworth, IEC/Jaco	213-998-2200
CA	Newport Beach, Arrow Elctrns.	714-851-8961
CA	San Diego, Hallmark Elctrns.	714-268-1201
CA	San Diego, Arrow Elctrns.	714-565-4800
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Ana, Norstan Elctrns.	714-540-4165
CA	Sunnyvale, Hallmark Elctrns.	408-773-9990
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Torrance, Cypress Elctrns.	213-533-6005
CO	Denver, Arrow Elctrns.	303-758-2100
CO	Englewood, Hallmark Elctrns.	303-790-1662
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Clearwater, Hallmark Elctrns.	305-530-4543
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Ft. Lauderdale, Hallmark Elctrns.	305-971-9280
FL	Orlando, Hallmark Elctrns.	305-855-4020
FL	Palm Bay, Arrow Elctrns.	305-725-1480

GA	Norcross, Hallmark Elctrns.	404-447-8000
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Bensenville, Hallmark Elctrns.	312-860-3800
IL	Northbrook, Classic Comps.	312-272-9650
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Arrow Elctrns.	317-243-9353
KS	Lenexa, Hallmark Elctrns.	913-888-4747
KS	Wichita, Lee Prods.	316-264-2172
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Columbia, Hallmark Elctrns.	301-988-9800
MA	Waltham, QPL Elctrn. Distrs.	617-229-2424
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MN	Bloomington, Hallmark Elctrns.	612-884-9056
MN	Edina, Arrow Elctrns.	612-830-1800
MN	St. Paul, Ragon Elctrns.	612-642-2828
MO	Maryland Heights, Hallmark Elctrns.	314-291-5350
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Cherry Hill, Hallmark Elctrns.	609-424-7300
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Fairfield, Hallmark Elctrns.	201-575-4415
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Binghampton, Pioneer/Harvey Elect.	607-748-8211
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Melville, Arrow Elctrns.	516-391-1505
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Ron Kon Koma, Hallmark Elctrns.	516-737-0600
NC	Raleigh, Hallmark Elctrns.	919-832-4465
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Solon, Arrow Elctrns.	216-248-3990
OH	Solon, Hallmark Elctrns.	216-349-4632
OH	Wosterville, Hallmark Elctrns.	614-891-4555
OK	Oklahoma City, Electro Entprs.	405-478-1752
OK	Tulsa, Hallmark Elctrns.	918-835-8458
PA	Monroeville, Arrow Elctrns.	412-856-7000
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Austin, Hallmark Elctrns.	512-837-2814
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Dallas, Hallmark Elctrns.	214-341-1147
TX	Houston, Hallmark Elctrns.	713-781-6100
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Arrow Elctrns.	206-643-4800
WI	New Berlin, Classic Comps.	414-786-5300
WI	Oak Creek, Arrow Elctrns.	414-764-6600
WI	Oak Creek, Hallmark Elctrns.	414-761-3000

HIGH ENERGY, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, Telex: 510-0663-0332; Empl.: 100

HIGH REL BURN-IN, Riverside Assoc. Inc., 2326 Kruse Dr., San Jose, CA 95131, Tel: 408-946-1300; Empl.: 18

HIGHTEMP RESINS, INC., 225 Greenwich Ave., Stamford, CT 06902, Tel: 203-357-7401; Empl.: 5

HIGH VOLTAGE ENGRG. CORP., S. Bedford St., Burlington, MA 01803, Tel: 617-272-1313, TWX: 710-332-0245; Empl.: 750

HILEVEL TECH., INC., 18902 Bardeen Way, Irvine, CA 92715, Tel: 714-752-5215, Telex: 655316; *Sls. Mgr.:* Norbert Laengrich

HILTON INDUSTRIES, INC., Div. of Core Industries, 1177 Cattlemen Road, Sarasota, FL 33582, Tel: 813-371-2600, TWX: 810-864-4363; *Sls. Mgr.:* F. Moloney

Local Sales Offices & Reps

CA	Los Altos, Landia Sls. Grp.	415-490-5651
CA	Los Angeles, Corcoran Assocs.	213-823-2425
CO	Parker, Parker-Webster	303-841-4888
FL	Orlando, EAB, Inc.	305-898-7444
IL	Steamwood, Al Holte & Assocs.	312-837-4066
KS	Shawnee Mission, Florence & Meyer, Inc.	913-722-5210
MA	Topsfield, RFC Assocs.	617-887-8545
MN	Minneapolis, Wendell E. Lee & Assocs.	612-831-5056
NY	Great Neck, Cooper & Simon & Co., Inc.	516-487-1142
NY	Rochester, BKT Assocs., Inc.	716-586-5814
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
PA	W. Conshohocken, Eastern Comps. Sls. Corp.	215-825-8610
TX	Plano, B & R Elctrn Sls. Corp.	214-985-0028

Local Distributors

CA	Santa Ana, Projections Unltd.	714-641-4172
FL	Longwood, Intertec Comps., Inc.	305-834-7777

IL	Des Plaines, Edmar Elctrn. Co.	312-298-8580
IL	Elmhurst, Schuten Elctrns.	312-941-9033
IL	Melrose Park, Belford Elctrns.	312-965-2400
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NY	Plainview, A.C.I. Elctrns.	516-293-6630
PA	McKean, ADVACOM	814-476-7774
PA	York, E.C.I., Inc.	717-843-8971
WA	Kent, Shannon Ltd.	206-763-0545

HILTRONICS CORP., 111 S. Liberty Dr., Stony Pt., NY 10980, Tel: 914-942-1222

Hipotronics

HIPOTRONICS, P.O. Drawer A, Brewster, NY 10509, Tel: 914-279-8091, Telex: 425476 (Ams. Back:Hipo Ul), TWX: 710-574-2420 (Ams. Back:Hipo Brws NY); Empl.: 200; *Sls. Mgr.:* Steve Peschel .... **1A**•2172-2174; **3**•1240-1242, 1590, 1591, 1882, 1883

Local Sales Offices & Reps

AL	Birmingham, E. J. Ruth Assocs.	205-979-0880
CA	Pasadena, RDX Corp.	213-681-3451
CA	San Diego, RDX Corp.	619-278-6863
CA	Sunnyvale, RDX Corp.	408-734-4500
CO	Denver, E. C. Rudy Co.	303-433-1066
CT	Meriden, Abbott Allison Co.	203-481-0405
FL	Ft. Lauderdale, Powercom Engrg. Corp.	305-463-6059
HI	Honolulu, Aloha Assocs.	808-879-5296
IL	Hawthorne Woods, Ryan & Assocs.	312-438-2905
IN	Ossian, Science Sales	219-622-7383
KS	St. Louis, Fitzgerald Sales Co.	314-862-1660
MN	Edina, Ainslie Co.	612-920-2996
NJ	East Orange, Friedman Assocs.	201-694-6200
NM	Albuquerque, Hewitt & Assocs.	505-229-7746
NY	Cazenovia, Peter De Cew Agency	315-655-8602
PA	Downingtown, Kenn Ebert-Hipotronics	215-269-5898
TX	Richardson, Hipotronics-Dusty Arnold	214-644-7607
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

HJ
HIRAM JONES

HIRAM JONES ELCTRNS., 11607 Vanowen St., No. Hollywood, CA 91605, Tel: 818-875-0213; FSC No.: 04867; Empl.: 8 .... **2**•1314-1317

Local Sales Offices & Reps

TX	Paris, Packard Assocs.	214-785-4544
EXP	MN, Minneapolis, C. Tennant, Sons & Co. of New York	612-475-7321

Local Distributors

TX	Houston, Lenert Co.	713-225-1465
TX	Paris, Electro Hardware Co.	214-785-4544

HISONIC, INC., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061-1130, Tel: 913-782-0012, Telex: 4-2562; FSC No.:. 11402; Empl.: 98; *Sls. Mgr.:* W. S. Bonebright .... **1A**•1599, 2175

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
FL	Ft. Lauderdale, MacKay, Smith & Assocs.	305-467-3888
FL	Madeira Beach, MacKay, Smith & Assocs.	813-393-7144
FL	Orlando, MacKay, Smith & Assocs.	305-277-1513
FL	St. Petersburg, MacKay, Smith & Assocs.	813-393-7144
GA	Atlanta, MacKay, Smith & Assocs.	404-449-7444
KS	Shawnee Mission, Florence & Meyer	913-722-5210
MO	St. Louis, Florence & Meyer	314-965-5117
NC	Cary, MacKay, Smith & Assocs.	919-467-5400
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
NC	Raleigh, MacKay, Smith & Assocs.	919-851-5000
TX	Houston, AID Elctrns.	713-777-3882
TX	Irving, AID Elctrns.	214-259-4761

HITACHI AMERICA, 1800 Bering Dr., San Jose, CA 95112, Tel: 408-292-6404, Telex: 17-1581, TWX: 910-338-2103; *Sls. Mgr.:* Jack Ordway; *Dist. Mgr.:* Michael Barthman

HITACHI AMERICA, LTD., 59 Route 17 South, Allendale, NJ 07401, Tel: 201-825-8000, Telex: (WU) 642734; *Sls. Mgr.:* William J. Pearson

HITACHI DENSHI AMERICA LTD., Test & Meas. Div., 175 Crossways Pkwy. W., Woodbury, NY 11797, Tel: 516-921-7200, TWX: 510-221-1899; Empl.: 110

Local Sales Offices & Reps

CA	Carson, Hitachi Denshi Amer. Ltd.	213-538-4880
CO	Broomfield, Connors Inc.	303-466-9628
GA	Doraville, Hitachi Denshi Amer. Ltd.	404-451-9453
GA	Smyrna, BC Elctrns.	404-436-5169
IL	Itasca, L-Tec	312-775-2900
IL	Melrose Park, Hitachi Denshi Amer. Ltd.	312-344-4020
IN	Indianapolis, Loren Green Assocs.	317-293-9827
MA	Burton, Forrester	617-848-7234
MI	Lathrup Village, R. C. Nordstrom & Co.	313-559-7373
MN	Eden Prairie, Electronics Instr. Conslts.	612-937-9701
NY	Auburn, ADN Enterprises	315-255-2701
OH	Westlake, KRW Sls.	216-871-7521
TX	Dallas, Hitachi Denshi Amer. Ltd.	214-233-7623
TX	Dallas, SW Mktg. Assocs.	214-341-8631
WA	Tumwater, Weeks & Assocs.	206-943-1079

Local Distributors

CA	Canoga Park, RAG Entprs.	213-998-6500
CA	Chatsworth, Priority I Elctrns.	213-709-5464
CA	Palo Alto, Metermaster	415-968-0313
CA	Sacramento, Zackit Corp.	916-446-3131
CA	San Diego, Instrument Engrs.	619-278-8037
CA	Van Nuys, Testek Corp.	213-786-6890
CO	Boulder, Instr. Repair Labs	303-449-2721
CO	Denver, CW Elctrns. Sls.	303-832-1111
CT	Norwalk, Park Distrs.	203-853-2011
CT	West Hartford, Signal Elctrn. Center	203-233-8551
FL	Ft. Lauderdale, Southeastern	305-563-4131
FL	Miami, Walder Elctrns.	305-379-4794
FL	Tampa, Hammond Elctrns.	813-253-0104
GA	Decatur, EME II	404-325-0165
HI	Honolulu, R. W. Tully Co.	808-836-0838
IL	Niles, Joseph Elctrns.	313-297-4200
IL	S. Holland, Union Elctrns.	312-333-4100
IA	Davenport, Waren Radio Co.	319-322-5301
KS	Wichita, Radio Supp.	316-267-5213
LA	Metairie, Pelican Elctrn. Supp.	504-888-4720
LA	Shreveport, Whls. Elctrn. Supp.	318-222-2063
MD	Savage, Pyttronic Inds.	301-792-0780
MA	N. Billerica, AST/Servo System	617-667-8541
MA	N. Wilbraham, Industrial Comps.	413-596-3854
MA	Waltham, Calibron Instrs.	617-894-6440
MI	Clawson, Radio Supp. & Engrg.	313-435-5660

HITACHI

AUTHORIZED DISTRIBUTORS

RAG ELECTRONICS, INC.

WEST
21418 Parthenia Street
Canoga Park, CA 91304
Tel. (818) 998-6500

EAST
1 Pollack Avenue
Ocean, N.J. 07712
Tel. (201) 544-0666

NEW & RECONDITIONED TEST EQUIPMENT

• SALES • RENTALS • PURCHASE OPTIONS
• REPAIR & CALIBRATION

Call Toll-Free
West (Outside CA) 1-800-732-3457
East (Outside NJ) 1-800-922-0945

MN	Minneapolis, Stark Elctrn.	612-333-3361
MO	St. Louis, Olive Elctrns.	314-426-4500
NJ	N. Caldwell, Hosica Labs.	201-256-7724
NJ	Ocean, RAG Entprs.	201-544-0666
NJ	Pinebrook, Parts Masters Inc.	201-227-7797
NM	Santa Fe, A-1 Comms. Supp.	505-982-4488
NY	Great Neck, Instr. Mart	516-487-7430
NY	New York, Advance Elctrns.	212-730-7030
NY	Rochester, R. Baker Elctrns.	716-586-9164
NY	Rochester, Goldcrest Elctrns.	716-546-8464
NY	Rockville Center, Midway Indl. Elctrns.	516-764-2400
NY	Schenectady, Adirondack Elctrns.	518-346-4717
NC	Greenville, Pair Elctrns.	919-756-2291
OK	Oklahoma City, Whls. Elctrns. Supp.	405-528-2391
OK	Tulsa, Whls. Elctrn. Supp.	918-587-5516
PA	Allentown, A. A. Peters	215-434-5237
PA	Melrose Park, Robert Meyers Assoc.	215-224-1663
PA	Philadelphia, Sunshine Sci. Inst.	215-673-5600
RI	Providence, Hope Elctrns. Supp.	401-521-5600
TN	Nashville, Eddie Warners	615-254-1224
TX	Austin, Whls. Elctrn. Supp.	512-478-9568
TX	Austin, Electrotex	512-476-7644
TX	Beaumont, Electrotex	713-838-6421
TX	Corpus Christi, Electrotex	512-854-5306
TX	Dallas, Electrotex	214-234-0433
TX	Dallas, SJB Distrs.	214-343-1328
TX	Dallas, Whls. Elctrn. Supp.	214-824-3001
TX	Dallas, M. Hutton & Co.	214-661-9800
TX	Ft. Worth, Whls. Elctrns. Supp.	718-429-3956
TX	Houston, Electrotex	713-941-7016
TX	Houston, Electrotex	713-526-3456
TX	Houston, Electrotex	713-695-6851
TX	Longview, Whls. Elctrn. Supp.	214-757-3961
TX	Lufkin, Electrotex	713-632-4409
TX	Phoenix, Meter Master	602-243-4111
TX	Phoenix, Dalis Elctrn. Supp.	602-258-8151
TX	San Antonio, Electrotex	512-735-9271
TX	Waco, Whls. Elctrns. Supp.	817-752-9252
TX	Wichita Falls, Whls. Elctrn. Supp.	817-723-8106
UT	Provo, Central Utah Elctrns.	801-373-7522
VA	Richmond, I.T.R.	804-275-1431
VA	Vienna, Elctrn. Equip. Bank	703-938-3350
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Tumwater, JW Elctrns.	206-943-1079
WI	Madison, Schrenk Sls.	608-255-7400
WI	Mequon, Taylor Elec.	414-241-4321
WY	Casper, Hathaway Elctrns.	307-234-1821

HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 312-746-2447; Empl.: 35 .... **2**•1822

Local Sales Offices & Reps

AR	Fort Smith, Electro-Related Prods.	501-452-4030
CA	Woodland Hills, Glenn M. Stevenson Co.	213-348-5506
CT	South Windsor, Maher Assocs.	203-644-2481
FL	Orlando, Alcott Prods. Co.	305-295-5457
IL	Wood Dale, Power Prods.	312-595-1142
MA	Lynn, Maher Assocs.	617-581-3244
MI	Sheridan, MacDougall and Assocs.	517-291-3334
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
NJ	River Edge, Maher Assocs.	201-261-2225
OH	Seven Hills, Nenaoal Entprs.	216-524-4293
OR	Lake Oswego, Baxter Air Engrg.	503-635-3915
TN	Chattanooga, Wade Prods. Co.	615-266-2262
TX	Fort Worth, Terrell J. Small Co.	817-332-6352
WA	Bellevue, Baxter Air Engrg.	206-641-6118

HITRAN

Division of AGEX

HITRAN CORP., Agex, Rte. 31, RD 5-65, Flemington, NJ 08822, Tel: 201-782-5525, Telex: 833701/AGEX/FLEM; FSC No.: 27672; Empl.: 110; *Sls. Mgr.:* Chris Hughes .... **1A**•2176; **3**•1592, 1884, 1885

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assoc.	205-539-8000
CA	Los Angeles, RF Assocs.	213-478-1586
CA	Palo Alto, RF Assocs.	415-494-3331
CT	Ridgefield, Manning & Assoc. Inc.	203-438-5027
CT	West Haven, Northeast Power Sys.	203-933-8222
FL	Ft. Lauderdale, MacKay, Smith & Assocs.	305-467-3888
FL	Orlando, MacKay, Smith & Assocs.	305-277-1513
FL	St. Petersburg, MacKay, Smith & Assocs.	813-393-7144
GA	Atlanta, MacKay, Smith & Assocs.	404-449-7444
HI	Honolulu, Aloha Assocs.	808-941-1574
ID	Boise, Calvert Controls	208-343-3964
MD	Elkton, Electro-Mek Sls.	301-398-8148
MT	Billings, Calvert Controls	406-252-0064
NJ	Wayne, G & A Sales	201-256-8500
NJ	Woodbury, Electro-Mek Sls.	609-423-5611
NY	Manlius, Electrotech Sys.	315-682-5346
NY	Moravia, Electrotech Sys.	315-497-1598
NY	Roslyn Hgts., G & A Sales	516-621-3223
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
NC	Raleigh, MacKay, Smith & Assocs.	919-851-5000
OH	Dayton, Mohawk Intronics	513-434-8873
OR	Eugene, Calvert Controls	503-683-2018
OR	Portland, Calvert Controls	503-222-6473
PA	Harrisburg, Electro-Mek Sls.	717-589-7222
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
UT	Salt Lake City, Calvert Controls	801-531-8129
VA	Charlottesville, Marktron	804-973-5874
WA	Seattle, Calvert Controls	206-447-9375
WA	Spokane, Calvert Controls	509-244-3601
WA	Tri-Cities, Calvert Controls	509-545-4506

Local Distributors

FL	Winter Park, Elctrn. Technlg.	305-678-5876

HM ELCTRNS., 6151 Fairmount Ave., San Diego, CA 92120, Tel: 619-280-6050, Telex: 697-122; Empl.: 55; *Sls. Mgr.:* John Kenyon

HMW ENTERPRISES INC., 604 Salem Road, Etters, PA 17319, Tel: 717-938-4691, TWX: 510-650-3536; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* Gerhard Schmutz

HOBART ENGRG., 4143 Cheshire Dr., Cypress, CA 90630, Tel: 714-827-2135; *Sls. Mgr.:* D. C. Hobart

HOBBS, Div. of Steward Warner, Ash at Yale Blvd., Springfield, IL 62705, Tel: 217-753-7600

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600; Empl.: 75; *Sls. Mgr.:* H. L. Behm

Local Sales Offices & Reps

CA	Fremont, Spence Assocs.	415-656-9506
CA	Los Angeles, Corcoran Assocs.	213-823-4589
IN	Indianapolis, Specialty Mfrs.	317-635-2723
NY	Buffalo, R. W. Mitscher Co.	716-633-7970
NC	Raleigh, R. W. Mitscher Co.	919-848-0941
WA	Bothell, Temco Northwest	206-488-1254

HOFFMAN, P.R., CO., DIV. AIKEN INDS., See Hoffman, P.R., Co.

HOFFMAN, P. R., CO., MATERIALS PROCESSING DIV., Amstar Tech. Prods. Co., Inc., 321 Cherry St., Carlisle, PA 17013, Tel: 717-243-2011, TWX: 510-650-2285; Empl.: 150

HOFFMAN ENGRG., Federal Cartridge, 9th & Tyler Sts., Anoka, MN 55303, Tel: 612-421-2240, Telex: 29-0499, TWX: 910-578-2211; *Sls. Mgr.:* Larry Muehlbauer

HOFFMAN ENGRG. CORP., 183 Sound Beach Ave., Old Greenwich, CT 06870, Tel: 203-637-1719; FSC No.: 06097; *Sls. Mgr.:* Richard H. Hulit

HOFFMAN INDUSTRIAL PRODS., 170 Allen Blvd., Farmingdale, NY 11735, Tel: 516-293-5244, Telex: 14-4578; Empl.: 30; *Sls. Mgr.:* Sy Friedman; *Dist. Mgr.:* J. Dunnells

HOKE, 1 Tenakill Pk., Cresskill, NJ 07626, Tel: 201-568-9100, Telex: 135428; *Sls. Mgr.:* David Grim; *Dist. Mgr.:* Len Bruscia

HOLADAY INDUSTRIES, INC., 14825 Martin Drive, Eden Prairie, MN 55344, Tel: 612-934-4920, Telex: 290922; *Sls. Mgr.:* Burton Gran

HOLLEX, INC., 81 W. Wyoming Ave., Melrose, MA 02176, Tel: 617-665-2413; Empl.: 28; *Sls. Mgr.:* H. E. Holley; *Dist. Mgr.:* H. E. Holley

HOLLINGSWORTH SOLDERLESS TERMINAL CO., 700 N.W. 57th Pl., Ft. Lauderdale, FL 33309, Tel: 305-772-7660, Telex: 846143; Empl.: 750; *Sls. Mgr.:* Terry Rodenhaver

HOLLIS ENGRG., INC., Charron Ave., Box 1189, Nashua, NH 03061, Tel: 603-889-1121, TWX: 710-228-1881; Empl.: 121; *Sls. Mgr.:* R. Abercrombie

HOLLIS ENGRG./WIRE-WRAP, 15 Charron Ave., Nashua, NH 03061, Tel: 603-889-1121, Telex: 710-2281881; Empl.: 250; *Sls. Mgr.:* Gary Barrett

HOLMBERG ELECTRONICS

HOLMBERG ELCTRNS., Asheville Hwy., Inman, SC 29349, Tel: 803-472-4141, TWX: 810-690-2302; *Sls. Mgr.:* John Galli; *Dist. Mgr.:* Frank Pellatt .... **2**•1295-1310

Local Sales Offices & Reps

AZ	Phoenix, M. R. Engrg.	602-956-4670
AZ	Scottsdale, Fred Board & Assoc.	602-994-9388
CA	San Diego, Hadden Assoc., Inc.	619-565-9444
CO	Aurora, Electrodyne	303-695-8903
FL	Boca Raton, Lawrence Assoc.	305-368-7373
FL	Clearwater, Lawrence Assoc.	813-443-2698
GA	Lawrenceville, B.T.F. Inc.	404-963-9495
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Indianapolis, Elctrn. Mktg. Consul. (EMCI)	317-253-1668
MA	Lexington, Circuit Sls.	617-861-0567
MN	Edina, Monroe Hanna	612-925-5700
NJ	Livingston, Varrellman-Gorman Co.	201-992-2505
NM	Alburquerque, Fred Board & Assoc.	505-293-1399
NY	Binghamton, Empire Technical Assoc.	607-772-0651
NC	Henderson, B.T.F., Inc.	919-438-7570
NC	Raleigh, B.T.F. Inc.	919-782-3493
OH	Dayton, Del Steffen & Assoc.	513-293-3145
OR	Portland, Barrett-Squibb	503-644-2550
TX	Dallas, Erickson Sls.	214-739-5833
UT	Salt Lake City, Electrodyne	801-486-3801
WA	Redmond, Barrett- Squibb	206-885-6991
WI	Milwaukee, Momak Sls.	414-962-9576
EXP	SC, Inman, Holmberg Elctrns.	803-472-2821
PR	Hato Rey, Karden Corp.	809-765-7355

Local Distributors

AZ	Mesa, Bergquist Co.	602-986-4271
AZ	Phoenix, Arizona Comps.	602-279-9446
AZ	Tempe, Bell Inds., Elctrn.	602-966-7800
CA	Belmont, Lodan, Inc.	415-592-4600
CA	Cerritos, El-Com Sls.	714-739-5656
CA	Fountain Valley, Component Center	714-979-0433
CA	Irvine, Product Supply	714-641-8736
CA	Riverside, Electronic Supply	714-683-7300
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, El-Com Sls.	619-578-0900
CA	San Francisco, Peters-De Laet	415-873-9595
CA	San Jose, Cypress Elctrns.	408-945-8400
CO	Denver, CSID Elctrns.	303-893-9594
CT	Yalesville, Schaal Assoc.	203-269-3779
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Longwood, Intertec Comps.	305-834-7777
FL	Orlando, Deanco	305-671-5100
GA	Atlanta, K.S.M.	404-458-2013
GA	Cumming, Pan American	800-554-9796
GA	Marietta, Deanco	404-429-0126
IL	Addison, K.S.M.	312-953-9473
IL	Arlington Hgts., Lodan Elctrns.	312-398-5311
IL	Lisle, Comps., Inc.	312-852-7707
IN	Indianapolis, RM Indiana	800-792-3445
IA	Cedar Rapids, Bergquist Co.	319-366-8733
MD	Baltimore, Whitney Distr.	301-944-8080
MD	Baltimore, Resco-Baltimore	301-823-0070
MD	Beltsville, Resco/Washington	301-937-9100
MD	Gaithersburg, Deanco	301-948-5444
MA	Burlington, Deanco	617-272-1506
MA	Burlington, Schaal Assocs.	617-272-7940
MA	Natick, Tec-Con	617-655-9333
MI	Grand Rapids, S&F Elec.	616-459-0216
MN	Minneapolis, Cassidy Elctrns.	612-835-7746
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Kansas City, Finnigan Elctrns.	816-421-4277
NJ	Fairfield, Deanco	201-575-7960
NJ	Whippany, Tonar Inds.	201-884-1400
NY	Hauppauge, Schaal Assocs.	516-234-4600
NY	Ithaca, Deanco	607-257-4444
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rome, Rome Elctrns.	315-476-2033
NC	Raleigh, Century	919-872-2203
NC	Raleigh, Deanco	919-851-2065
OH	Dayton, Televox, Inc.	513-294-4499
OR	Lake Oswego, Bell Inds.	503-241-4115
OR	Lake Oswego, Rose Elctrn. Distr. Co.	503-635-8823
PA	Montgomeryville, Pytronic Ind., Inc.	215-643-2850
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TN	Memphis, Nealco Dist.	901-353-1241
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Ft. Worth, Texas Connector	817-246-0109
UT	Salt Lake City, Diplomat	800-453-5503
VA	Virginia Beach, Deanco	804-460-3558
WA	Bellevue, Bell Inds.	206-747-1515
WA	Redmond, Murphy Elctrns.	206-881-1234

HOLT INC., 8 Chrysler Ave., Irvine, CA 92714, Tel: 714-859-8800, Telex: 753307; Empl.: 102; *Sls. Mgr.:* Mark Ellsberry

HOLT LLOYD CORP., LPS Chem. Prods., 4647 Hugh Howell Rd., Tucker, GA 30084, Tel: 404-934-7800, TWX: 810-766-4920; *Sls. Mgr.:* Les Gable

HOLUB INDUSTRIES, 1701 W. Bethany Rd., Sycamore, IL 60178, Tel: 815-895-6501, Telex: 25-7359; Empl.: 90; *Sls. Mgr.:* R. J. Morrison

HONEYWELL INC., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5186, TWX: 910-576-2692; Empl.: 15,000

HONEYWELL INC., Commercial Div., MN 27-7246, Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5346

HONEYWELL INFO. SYS., 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICRO SWITCH DIV., See Micro Switch, a Honeywell Division

Honeywell

HONEYWELL OPTOELECTRONICS, 830 E. Arapaho Dr., Richardson, TX 75080, Tel: 214-234-4271, Telex: 73-0890; Empl.: 300; *Sls. Mgr.:* Joe Tucker; *Dist. Mgr.:* Joe Tucker ....**1B**•1112, 1113, 1220-1230

Local Sales Offices & Reps

AL	Huntsville, RM Alabama	205-852-1550
AZ	Phoenix, Cetec Elctrns.	602-272-7951
CA	Anaheim, Honeywell Optoelectronics	714-956-4410
CA	Cupertino, Western Micro	408-725-1660
CA	Glendale, Orion Sales, Inc.	213-240-3151
CA	Inglewood, Force Elctrns.	213-776-1324
CA	Irving, Cetec Elctrns.	714-250-4141
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Cetec Elctrns.	619-278-5020
CA	San Jose, Cetec Elctrns.	408-263-7373
CA	Santa Clara, Force Elctrns.	408-739-1324
CA	Santa Clara, I⅜¢2 Inc.	408-988-3400
CA	South Gate, Cetec Elctrns.	213-773-6521
CO	Denver, Integrated Elctrns.	303-534-6121
CO	Englewood, Delta Sls. Assocs.	303-741-0646
CO	Englewood, Honeywell Optoelctrns.	303-779-6541
CT	Glastonbury, Honeywell Optoelctrns.	203-659-4011
CT	Stanford, Bond	203-348-2663
DE	Huntington Valey, Knowles Assocs.	215-947-5641
FL	Coral Springs, E.P.M.	305-752-0054
FL	Ft. Lauderdale, Hammond	305-973-7103
FL	Orlando, Hammond	305-849-6060
GA	Atlanta, E.M.A. Inc.	404-448-1215
IL	Bensenville, Honeywell Optoelctrns.	312-860-3984
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Elk Grove Village, Oasis Sales	312-640-1850
IL	Lombard, RM Illinois	312-932-5150
IL	Rosemont, Advent	312-297-6200
IN	Indianapolis, Advent	317-872-4910
IN	Indianapolis, Elctrn. Sls. and Engrg.	317-849-4260
IN	Indianapolis, Advent	317-247-9701
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
IA	Cedar Rapids, Advent	319-363-0221
KS	Wichita, LCOMP, Inc.	316-265-8501
KS	Wichita, LComp	316-265-8501
MD	Baltimore, Whitney	301-944-8080
MD	Baltimore, Whitney	301-944-8080
MD	Glen Burnie, Stinson Assocs.	301-760-8878
MA	Burlington, Lionex	617-272-9400
MA	Newton, Gerber Sls.	617-969-2620
MA	Newton Lower Falls, Honeywell Optoelctrns.	617-923-7675
MA	W. Newton, A. W. Mayer	617-965-1111
MI	Grand Rapids, RM Michigan	616-531-9300
MI	Novi, Action Comps.	313-349-3940
MN	Bloomington, Com-Tek Sls.	612-888-7011
MN	Minneapolis, Industrial Comp.	612-831-2666
MO	Bridgeton, Dy-Tronix, Inc.	314-731-5799
MO	Independence, Dy-Tronix, Inc.	816-373-6600
MO	Kansas City, LComp	816-221-2400
MO	Maryland Heights, LComp	314-291-6200
NH	Hudson, C&H Elctrns.	603-882-1133
NJ	Bellmawr, Mid Atlantic	609-931-5303
NJ	Fairfield, Lionex Corp.	201-227-7960
NJ	Fairfield, Lionex	201-227-7960
NM	Albuquerque, B.F.A. Corp.	505-292-1212
NM	Albuquerque, Elctrn. Devices	505-884-2950
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Endwell, Noeth Honsinger Assocs.	607-754-3214
NY	Hauppauge, Lionex	516-273-1660
NY	Ilion, Noeth Honsinger Assocs.	315-894-9943
NY	Pittsford, Noeth Honsinger Assocs.	716-586-9002
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rochester, Honeywell Optoelctrns.	716-424-2700
NC	Greensboro, Hammond	919-275-6391
NC	Raleigh, E.M.A. Inc.	919-847-8800
OH	Akron, B.J. David Corp.	216-645-0517
OH	Cincinnati, Schuster Elec.	513-489-1400
OH	Columbus, Hughes-Peters	614-294-5351
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Portland, Jas. J. Backer Co.	503-297-8744
PA	Feasterville, Knowles Assocs.	215-322-7100
PA	Horsham, Lionex	215-443-5150
SC	Greenville, E.M.A. Inc.	803-233-4637
SC	Greenville, Hammond	803-233-4121
TX	Austin, Harrison Equip. Co. Inc.	512-458-3555
TX	Dallas, Harrison Equip. Co. Inc.	214-239-2750
TX	Houston, Harrison Equip. Co. Inc.	713-879-2727
TX	Houston, Force Elctrns.	713-772-8483
TX	Irving, Force Elctrns.	214-438-5700
TX	Richardson, Honeywell Optoelctrns.	214-234-4271
UT	Salt Lake City, Integrated Elctrns.	801-298-1869
VA	Charlottesville, Stinson Assocs.	804-973-2678
VA	Cloverdale, Stinson Assocs.	703-992-5459
VA	Rustin, Stinson Assocs.	703-471-0723
WA	Kent, Shannon Ltd.	206-763-0540
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Brookfield, Oasis Sales	414-782-6660
WI	Mequon, Taylor Elec. Co.	414-241-4321

HONEYWELL, Process Control Div., 1100 Virginia Dr., Ft. Washington, PA 19034, Tel: 800-321-5111, Ext. 596, TWX: 510-661-0328; Empl.: 2500

Local Sales Offices & Reps

AL	Birmingham	205-945-3500
AZ	Phoenix	602-861-4402
AR	Little Rock	501-664-0070
CA	Los Angeles	213-726-6000
CA	San Francisco	415-957-2500
CO	Englewood	303-779-6200
CT	Hartford	203-549-3800
FL	Orlando	305-894-3131
GA	Atlanta	404-982-2000
IL	Lansing	312-474-9300
IL	Park Ridge	312-296-0710
IN	Indianapolis	317-243-0831
IA	Davenport	319-359-3441
KS	Wichita	316-522-3431
KY	Louisville	502-459-5970
LA	Baton Rouge	504-924-8601
ME	Portland	207-775-3501
MD	Baltimore	301-667-4020
MA	Newton	617-969-0250
MI	Farmington Hills	313-478-1600
MI	Grand Rapids	616-247-4811
MN	Minneapolis	612-830-3500
MS	Jackson	601-957-1025
MO	St. Louis	314-576-2500
NE	Omaha	402-331-3200
NJ	Westfield	201-233-9200
NM	Albuquerque	505-884-1070
NY	Albany	518-456-7000
NY	Syracuse	315-451-4000
NC	Charlotte	704-364-4770
OH	Cleveland	216-459-6000
OK	Oklahoma City	405-848-2811
OR	Portland	503-245-0721
PA	Philadelphia	215-666-8200
SC	Columbia	803-779-3280
TN	Memphis	901-345-6222
TX	Houston	713-780-6500
UT	Salt Lake City	801-487-0681
VA	Richmond	804-285-8211
WA	Seattle	206-233-2000
WV	Charleston	304-766-8000
WI	Milwaukee	414-784-6260

HONEYWELL, Test Instrs. Div., P.O. Box 5227, Denver, CO 80217, Tel: 303-773-4700, Telex: 45793 DVR; Empl.: 850; *Sls. Mgr.:* Frank Doherty

HOPKINS ENGRG., 12900 Foothill Blvd., San Fernando, CA 91342, Tel: 213-361-8691, TWX: 910-496-1531; FSC No.: 02777; Empl.: 100; *Sls. Mgr.:* Gary M. Smith; *Dist. Mgr.:* Clyde M. Salisbury

HOPT, KARL, CO., 118 First Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-0633, Telex: 132496; Empl.: 400; *Sls. Mgr.:* G.C. Ellis

HOTPACK CORP., Heinicke Instrs., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694; FSC No.: 66; Empl.: 100; *Sls. Mgr.:* Ed Hammer

Hotpack is a manufacturer and is sold direct. To contact the salesman in your area call 800-523-3608 or 215-824-1700.

HOTTINGER BALDWIN MEASUREMENTS, 139 Newberry St., Framingham, MA 01701, Tel: 617-875-8282, Telex: 94-8499; Empl.: 179; *Sls. Mgr.:* Robert Haggerson

HOUSE OF METAL ENCLOSURES, Box 225, Hermann, MO 65041, Tel: 314-486-3111; Empl.: 55; *Sls. Mgr.:* Richard L. Kastel

HOUSTON INSTRUMENT, Div. Bausch & Lomb, P.O. Box 15720, Austin, TX 78761, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDS., Box 287, Milford, IL 60953, Tel: 815-889-4105, TWX: 910-642-2950; FSC No.: 815-889-4105; Empl.: 500; *Sls. Mgr.:* Ralph Young; *Dist. Mgr.:* Al Mancuso

HOWELL INSTRS., 3479 W. Vickery Blvd., Ft. Worth, TX 76107, Tel: 817-336-7411, Telex: 75-8233; FSC No.: 98869; Empl.: 180; *Sls. Mgr.:* Bruce Pike

HTL ELECTRO KINETICS, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 180; *Sls. Mgr.:* Robert E. Lynch

HUDSON TOOL & DIE CO., INC., 18 Malvern St., Newark, NJ 07105, Tel: 201-589-1800, TWX: 710-995-4445; FSC No.: 02875; Empl.: 300; *Sls. Mgr.:* William Miller

HUGHES AIRCRAFT CO., 6155 El Camino Real, Carlsbad, CA 92008, Tel: 619-438-9191, TWX: 910-322-1393; Empl.: 1000

HUGHES AIRCRAFT CO, Aerospace Grps./Support Sys., P.O. Box 90515, Los Angeles, CA 90009, Tel: 213-670-1515, Telex: 67222, TWX: 213-871-5210; *Sls. Mgr.:* W. L. Pemberton

HUGHES AIRCRAFT CO., Connecting Devices Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5701, TWX: 910-595-2523; FSC No.: 53669; Empl.: 700; *Sls. Mgr.:* Phil Larson

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509, Tel: 213-517-6000, Telex: 67-7064, TWX: 910-347-7321; Empl.: 2,748; *Sls. Mgr.:* Robert L. Woods

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
CA	Anaheim, Blair Assocs.	714-635-1350
CA	San Jose, MCH Assocs.	408-246-7330
CO	Littleton, FG Mktg.	303-795-9176
FL	Orlando, E. G. Holmes & Assocs.	305-894-8901
GA	Chamblee, E. G. Holmes & Assocs.	404-451-6161
IL	Mt. Prospect, Cain-Forlaw Co.	312-253-3578
MD	Columbia, M. Lader Co.	202-296-2497
MO	Kansas City, EIR Co.	816-452-7030
MO	Leasburg, EIR Co.	314-895-4100
NH	Nashua, JPR Electronic Sls.	603-889-8285
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Fayetteville, R.D. Sherman	315-637-9861
NY	New Rochelle, Ascor Elctrns.	914-235-8838
OH	Lancaster, Cain-Forlaw	614-654-4800
PA	Lafayette Hill, M. Lader Co.	215-825-3177
WA	Bellevue, Arva-Hudson, Inc.	206-455-0773

HUGHES AIRCRAFT CO., Indl. Prods. Div. FACT Sys., 6155 El Camino Real, Carlsbad, CA 92008, Tel: 619-438-9191, Telex: 672222, TWX: 910-322-1393; *Sls. Mgr.:* R. L. Giusti

HUGHES AIRCRAFT CO., Microelctrn. Sys. Div., 2601 Campus Dr., Irvine, CA 92715, Tel: 714-752-3800, TWX: 910-595-2435; *Sls. Mgr.:* J. L. Waters

HUGHES

HUGHES AIRCRAFT COMPANY

HUGHES SOLID STATE PRODUCTS, 500 Superior Ave., Dept. E8, Newport Bch., CA 92663, Tel: 714-759-2171, TWX: 910-596-1374 ....**1A**•1362-1365

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193

CA	Mountain View, Weseloh/Swanson	415-961-0565
CA	San Diego, Wes-K Assocs.	619-295-3501
CA	Van Nuys, Wes-K Assocs.	213-989-3070
CT	Ansonia, R. H. Sturdy Co.	203-734-2186
CT	Rocky Hill, R. H. Sturdy Co.	203-563-8455
FL	Clearwater, Delmac Sls.	813-447-5192
FL	Orlando, Delmac Sls.	305-898-4688
FL	Tamarac, Delmac Sls.	305-726-1330
GA	Atlanta, L & D Inc.	404-455-3483
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Indianapolis, J & W Sales	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
KS	Shawnee Mission, Technical Sls. Assocs.	913-888-3330
MD	Glen Burnie, Faion Lott & Co.	301-744-4611
MA	Salisbury, R. H. Sturdy Co.	617-465-1505
MA	Wellesley Hills, R. H. Sturdy Co.	617-235-2330
MI	Livonia, Luebbe Sls.	313-477-3131
MN	Minneapolis, Deming (Bill) & Assocs.	612-888-5000
MO	Ferguson, Technical Sls. Assocs.	314-725-5361
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fairport, Tri-Tech Elctrns.	716-223-5720
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Great Neck, Cooper-Simon & Co.	516-487-1142
NY	Poughkeepsie, Tri-Tech Elctrns.	914-473-3880
NC	Greensboro, L & D Inc.	919-292-3201
NC	Raleigh, L & D Inc.	919-876-5301
OH	Cincinnati, Luebbe Sls.	513-891-5770
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
PA	Bala Cynwyd, Electro-Comp Sls.	215-667-9360
PA	Pittsburgh, Luebbe Sls.	412-931-0414
TX	Dallas, Southern States Mktg.	214-248-8600
TX	Houston, Southern States Mktg.	713-988-0991
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

HUGHEY & PHILLIPS, INC., 3050 N. California St., Burbank, CA 91504, Tel: 818-849-1104, TWX: 910-498-2252; FSC No.: 94295; Empl.: 38; *Sls. Mgr.:* C.L. Phillis; *Dist. Mgr.:* C.L. Phillis

HUGIN INDS. INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, Telex: 348 399; Empl.: 4; *Sls. Mgr.:* Peter Hugin

Local Sales Offices & Reps

IL	Chicago, Patton Sls.	312-325-2170
NJ	Tenafly, D&D Engrg.	201-568-5032
NY	Rochester, Irondequoit Inds.	716-544-6257
NC	Fayetteville, Zim-Tek	919-485-2222
OH	Dover, AJ Assocs.	216-343-2224

HULL CORP., Davisville Rd., Hatboro, PA 19040, Tel: 215-672-7800, TWX: 510-665-6822; Empl.: 200; *Sls. Mgr.:* Ken Haywood

HumiSeal®

Coatings for Electronics

HUMISEAL DIV., 26-60 Bklyn. - Queens Expwy., Woodside, NY 11377, Tel: 212-932-0800, TWX: 710-582-2141; FSC No.: 99109; Empl.: 150 **2**•1083

Local Sales Offices & Reps

AL	Huntsville, BJR Mfg. Reps.	205-881-3569
AZ	Phoenix, Coker & Assocs.	602-277-7148
CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Mountain View, Target Elctrns.	415-961-1170
CO	Arvada, Arrowhead Sls.	303-423-5556
CT	Bridgeport, Betronic Assocs.	203-374-6404
FL	Casselberry, Barrett Assocs.	305-699-0311
IL	Hillside, Miltex Sales Corp.	312-449-0420
KS	Kansas City, L. E. Bruns Co.	913-287-5242
MD	Baltimore, Advanced Tech. Sls.	301-583-8252
MA	Waltham, Betronic Assocs.	617-894-8400
MI	Birmingham, W. R. Cline	313-642-2526
MN	Bloomington, Smiley-Scott Assoc.	612-888-5551
NJ	Florham Park, H. Thaw Sls.	201-992-2711
NY	Rochester, Gislason Sls.	716-454-4741
NC	Charlotte, Reynolds Cowardin Assocs.	704-596-6898
OH	Cleveland, Marlow Assocs.	216-991-6500
PA	Pittsburgh, Marlow Assocs.	412-367-8886
TX	Dallas, R. D. Spooner Co.	214-357-6636
VA	Richmond, Reynolds Cowardin Assocs.	804-266-3457
WA	Kirkland, R. R. Chase & Assocs.	206-823-6500

Local Distributors

CA	Alhambra, ULTEX	213-283-7694
CA	Mountain View, Target Elctrns.	415-961-1170
TX	Dallas, R. D. Spooner Co.	214-357-6636
WA	Kirkland, R. R. Chase & Assocs.	206-823-6500
WI	Milwaukee, Ellsworth Sys.	414-352-1230
Intl	England, Surrey, Woking, Concoat Ltd.	(04862) 6944/14
Intl	France, Paris, Spetelec	686-56-65, 25801
Intl	Japan, Tokyo, Bokusui Brown	572-8851, J22491
Can	Scarborough, Ont., Paisley Prods.	416-755-2216

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631, TWX: 910-335-2001; Empl.: 220

Local Sales Offices & Reps

CA	Los Angeles, L.L. Stoakes Inc.	213-640-2178
CA	Palo Alto, Harris Assocs.	415-328-3370
CA	San Diego, L.L. Stoakes Inc.	714-452-1600
FL	Orlando, Gra-Mar, Inc.	305-894-3351
IN	Carmel, Carter, McCormic & Peirce	317-844-4175
KS	Wichita, Humphrey, Inc.	316-685-7563
MA	Cochituate, High Tech Sls. Inc.	617-653-3838
MI	Farmington, Carter, McCormick & Peirce	313-477-7700
NY	Plainview, Eastern Metro Assocs.	516-931-1414
OH	Cleveland, Carter, McCormick & Peirce	216-779-5100
OH	Englewood, Carter, McCormick & Peirce	513-836-0951
PA	Philadelphia, Humphrey, Inc., Eastern Div.	215-632-6040
PA	Pittsburgh, Carter, McCormick & Peirce	412-824-3760
TX	Dallas, W.N. Rider Co.	214-357-2246
TX	El Paso, Nokomis of El Paso	915-778-2801
TX	Houston, Humphrey, Inc.	713-774-2004
WA	Nine Mile Falls, H. R. Davis Tech. Sls.	509-466-1532

HUNTER STANLEY ELEC., 208 Russell St., Nashville, TN 37213, Tel: 615-254-6532; FSC No.: 21675; Empl.: 10; *Sls. Mgr.:* W. D. Stanley

HUNTER TOOLS, 6721 Baymeadow Dr., Glen Burnie, MD 21061, Tel: 301-760-2200; Empl.: 450

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 80-81, Huntington, IN 46750, Tel: 219-356-0778; *Sls. Mgr.:* Robert Smith

HUNTRON INSTRS., INC., 15123 Highway 99, Lynnwood, WA 98036, Tel: 206-743-3171, 800-426-9265, Telex: 152951 Hunt Inst, TWX: Lywd; FSC No.: 57705; *Sls. Mgr.:* Jim Crosson; *Dist. Mgr.:* Jim Crosson

HURST MFG. CORP., Box 326, Princeton, IN 47670, Tel: 812-385-2564; Empl.: 200; *Sls. Mgr.:* W. W. Taylor

Local Sales Offices & Reps

AZ	Phoenix, Sierra Ind. Eng.	602-272-0084
CA	Los Angeles, Sierra Ind'l. Engrg. Co.	213-624-3123
CA	San Jose, Sierra Ind'l. Engr. Co.	408-274-7041
CO	Denver, Comp. Sls.	303-759-1666
FL	St. Petersburg, Tech-Rep Assoc.	813-577-2779
IL	Chicago, Jerry Golten Co.	312-792-1991
IN	Indianapolis, Pacer Sls. & Engrg. Co.	317-849-1481
MD	Glen Arm, Hodgins Assoc.	301-592-7047
MA	Lexington, Hathaway Elctrns.	617-861-7010
MI	Grand Rapids, R. Van Riper Sls.	616-452-0464
MN	Minneapolis, Giefer Sls. Co.	612-884-2395
MO	Ferguson, Kinrick Co.	314-521-4877
NJ	Little Falls, D. Carbone	201-256-9191
NM	Phoenix, Sierra Ind. Eng.	602-272-0084
NY	Rochester, W.H. Zimmerman Co.	716-586-4450
NY	Syracuse, W.H. Zimmerman Co.	315-474-4889
NC	Garner, Candor Co.	919-876-4999
OH	Chagrin Falls, Kilroy Sls. Co.	216-247-8997
SC	Myrtle Beach, Candor Co.	803-448-8361
TX	Houston, C.R. Colvin Assoc.	713-961-1262
TX	Richardson, Campion Sales Co.	214-238-8145
UT	Salt Lake City, Comp. Sls.	801-466-8623
WA	Seattle, Rep-West	206-283-8351
WI	Milwaukee, Badgerep Inc.	414-258-6630
EXP	NY, Freeport, Minthorne Int'l.	516-546-4700

HUTSON INDS., 1000 Hutson Cir., Frisco, TX 75034, Tel: 214-377-3557; TWX: 910-860-5051; *Sls. Mgr.:* Bill Giles

HYBRICON CORP., 410 Great Rd., Littleton, MA 01460, Tel: 617-486-3174, TWX: 710-347-0654; Empl.: 62; *Sls. Mgr.:* Richard W. Palmer

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Cristee-Meade Co.	602-267-7197
AR	Little Rock, Beacon Elctrns.	501-224-5449
CA	Inglewood, Basic Sys. Corp.	213-673-4300
CA	San Diego, Basic Sys. Corp.	619-268-8000
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
CO	Lakewood, Cristee-Meade Co.	303-232-0287
FL	Ft. Lauderdale, Beacon Elctrns.	305-491-1054
GA	Atlanta, Beacon Elctrns.	404-256-9640
KS	Wichita, DLE Elctrns.	316-744-2126
MD	Churchville, Atlantic Tech. Sls.	301-879-2236
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Jericho, J-Square Mktg.	516-935-3200
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Cincinnati, Applied Data Mgmt.	513-579-8108
OR	Beaverton, Elctrns. Tech. Sls. Assoc.	503-641-5780
PA	Huntingdon Valley, Lynbar Grp. Inc.	215-947-3554
TX	Dallas, Jim D. Gray & Assocs.	214-341-7190
WA	Kirkland, Elctrns. Tech. Sls. Assoc.	206-827-8086

HYBRID ELCTRNS., 142 Adams St., Newton, MA 02158, Tel: 617-527-2711; Empl.: 28; *Sls. Mgr.:* D. Kates

HYBRID SVCS. INC., 38 Main St., North Reading, MA 01864, Tel: 617-664-5500; Empl.: 45; *Sls. Mgr.:* Richard A. Vogel

HYBRID SYSTEMS CORP., 22 Linnell Circle, Billerica, MA 01821, Tel: 617-667-8700, TWX: 710-347-1575; Empl.: 250; *Sls. Mgr.:* H. Diamond

HY-CAL ENGRG., 9650 Telstar Ave., El Monte, CA 91731, Tel: 213-444-4000, Telex: 67-5548; FSC No.: 12199; Empl.: 120

HyComp,Inc.

HYCOMP INC., 75 Union Ave., Box 377, Sudbury, MA 01776, Tel: 617-443-4631, TWX: 710-347-0385; FSC No.: 34707; Empl.: 30; *Sls. Mgr.:* James Chacharone **1A**•1658, 1874, 1875

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Mesa, SEDCO Sls.	602-835-6281
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Santa Ana, Calif. Elctrn. Mktg.	714-835-2701
CT	Collinsville, Dynamic Sls. of New Eng.	203-693-6567
FL	Clearwater, Cherith Sls.	813-797-3004
GA	Atlanta, Magaro & Assocs.	404-451-8862
IL	Palatine, T-Squared Assocs.	312-991-2144
IN	Ft. Wayne, Scott Elctrns.	219-484-7865
IN	Indianapolis, Scott Elctrns.	317-897-9976
KS	Kansas City, BC Elctrns.	913-342-1211
KS	Wichita, BC Elctrns.	316-942-9840
KY	Louisville, Scott Elctrns.	502-964-0640
MD	Lutherville, Walker-Houck Assocs.	301-296-6021
MA	Burlington, Dynamic Sls. of New Eng.	617-272-5676
MI	Brighton, Michigan Marketing & Sales	313-229-6218
MN	Minnetonka, S.A.I. Mktg. Corp.	612-935-0777
MO	Bridgeton, BC Elctrns.	314-291-1101
NY	Lynbrook, HLJ Comp-Tech	516-599-2999
NY	Rochester, Murcan Sls. Corp.	716-586-4450
NY	Syracuse, Murcan Sls. Corp.	315-437-0734
NC	Greensboro, Magaro & Assocs.	919-294-4783
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Kettering, Scott Elctrns.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
PA	Norristown, Rivco January	215-631-1414
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Austin, Dyna Mktg.	512-454-3114
TX	Dallas, Dyna Mktg.	214-438-6528
TX	Houston, Dyna Mktg.	713-460-0314
VT	S. Burlington, Dynamic Sls. of New Eng.	802-863-6665
VA	Moneta, Walker-Houck Assocs.	703-297-4496
WI	Racine, T-Squared Assocs.	414-633-9456

HYDRA-ELECTRIC CO., 3151 Kenwood St., Burbank, CA 91503, Tel: 213-843-6211

HYDROCAP CORP., 975 N.W. 95 St., Miami, FL 33150, Tel: 305-696-2504; Empl.: 5

HYLETRONICS, Newtown Rd., Littleton, MA 01460, Tel: 617-486-8911, TWX: 710-347-0656; FSC No.: 22534; Empl.: 82; *Sls. Mgr.:* Norman Hill

HYPERTRONICS CORP., 16 Brent Dr., Hudson, MA 01749, Tel: 617-568-0451, 800-225-9228, Telex: 95-1152; FSC No.: 50541; Empl.: 100; *Sls. Mgr.:* E. Dalrymple **2**•1311-1313

Local Sales Offices & Reps

AL	Brownsboro, JHU Assoc.	205-536-7455
AZ	Scottsdale, Western Tech. Sls.	602-991-7306
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	N. Hollywood, Jewett Co.	213-789-8103
CO	Commerce City, Williams Assocs.	303-289-5647

CT	Bethany, Reps. Corp.	203-393-0024
DC	Washington, Tyler Griffin Co.	
FL	Orlando, Design Mktg.	305-291-8208
GA	Atlanta, Design Mktg.	404-457-5621
IN	Indianapolis, CC Elctrns.	317-255-1508
KS	Merriam, Midwest Tech. Sls.	913-236-8557
MD	Baltimore, Tyler Griffin Co.	
MA	Wellesley, Reps. Corp.	617-237-6476
MN	St. Paul, Murnco, Inc.	612-484-8200
NJ	Wayne, G.T. Assocs.	201-694-6040
NM	Albuquerque, Williams Assocs.	505-255-0622
NY	Fayetteville, R. D. Sherman	315-637-9861
NC	Greensboro, JHU Assoc.	919-852-9097
OH	Centerville, Dolfuss-Root & Co.	513-433-6776
OK	Tulsa, Cunningham Comps.	918-492-0390
PA	Paoli, Tyler Griffin Co.	215-647-1550
TN	Talbot, JHU Assoc.	615-581-4141
TX	Dallas, Cunningham Comps.	214-233-4303
UT	Salt Lake City, Williams Assocs.	801-532-7701
WA	Bellevue, A.I.E. Inc.	206-455-4697

HYSOL, 15051 E. Don Julian, City of Industry, CA 91749, Tel: 818-968-6511, TWX: 910-584-1342; *Sls. Mgr.:* Mike Johnson

HY-TEC INDUSTRIES, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786, Tel: 516-744-5062; *Sls. Mgr.:* Tom Poole

hytek

HYTEK MICROSYSTEMS, 980 University Ave., Los Gatos, CA 95030, Tel: 408-395-2300, TWX: 910-597-5393; FSC No.: 57474; Empl.: 220; *Sls. Mgr.:* Richard Fryhoff; *Dist. Mgr.:* Richard Fryhoff ....**1A**•1522-1527, 1659

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400
AZ	Tempe, Cantec Sls.	602-829-0191
CA	Del Mar, Chapman & Chapman	619-453-0771
CA	Los Angeles, Astralonics	213-991-3602
CA	Los Gatos, Pro Assocs.	408-358-3861
CA	Tarzana, Power Comps. Sls.	213-881-9111
CO	Englewood, Dynatech, Inc.	303-773-2830
FL	Melbourne, Reynolds & Assocs.	305-259-7000
IL	Des Plaines, Electron Mktg. Corp.	312-298-2330
IL	Elk Grove Village, Micro Sls.	312-956-1000
MD	Glen Burnie, New Era Sls.	301-768-6666
MD	Towson, DGR	301-583-1360
MA	Randolph, Bengal Assocs.	617-961-4120
MA	Tyngsboro, Comptech, Inc.	617-649-3030
MN	Minneapolis, Comps. Grp.	612-374-1250
MN	Roseville, Components Grp.	612-636-5060
NV	Carson City, Hytek Microsystems	702-883-0820
NM	Albuquerque, Power Entprs.	505-298-1918
NM	Albuquerque, Reptronix	505-881-8001
NY	Cazenovia, Naylor Elctrns.	315-655-8174
NY	Rochester, L-Mar Assocs., Inc.	716-323-1000
NY	Wantagh, Tri-Tek	516-221-7600
NC	Kernersville, Naylor Assocs.	919-996-4641
OH	Bricksville, W.R.R. Assocs.	216-526-2023
TX	Austin, Sundance Sls.	512-250-0320
TX	Dallas, Sundance Sls.	214-699-0451
TX	El Paso, Power Entprs.	915-533-9902
TX	Grapevine, Elctrns. Mktg. Assoc.	817-481-7502
TX	Houston, Electronics Mktg.	713-498-8120
WA	Bellevue, Olson, Ferre & Assocs.	206-454-2110
WI	Elm Grove, Key Entprs.	414-784-3390

HY-TEMP TRANSDUCERS, Box 1084, Cranford, NJ 07016, Tel: 201-276-1170; *Sls. Mgr.:* Joe Savare

ICCI, 196 Broadway, Cambridge, MA 02139, Tel: 617-864-3270, Telex: 95-1106; *Sls. Mgr.:* Jeremiah Snow

I.C. INDS., Box 104, Altamonte Springs, FL 32701, Tel: 305-339-8298, Telex: 56-4303; *Sls. Mgr.:* William S. Hodges

ICON, 156 Sixth St., Cambridge, MA 02142, Tel: 617-868-5400, TWX: 710-321-1883; Empl.: 81; *Sls. Mgr.:* Irvin L, McKittrick

ICO-RALLY, 2575 E. Bayshore Rd., Palo Alto, CA 94303, Tel: 415-856-9900, Telex: 34-8335; FSC No.: 51705; Empl.: 45; *Dist. Mgr.:* Don Steiner

ICS ELECTRONICS CORP., 2185 Old Oakland Rd., San Jose, CA 95131, Tel: 408-263-4844, TWX: 910-338-7810; *Sls. Mgr.:* Robert H. Prosin; *Dist. Mgr.:* Robert H. Prosin

Advertisement

ICS designs/manufactures IEEE 488 interfaces—the "building blocks" needed to build 488-based systems: RS232-, BCD-, relay-, and analog-to-488 couplers; bus controller, analyzer, isolators, expanders, extenders; bus-compatible DPM and speech synthesizer; equipment for remote diagnostics. Write or call for data sheets/brochures.

ICS, INC., 520 Interstate Rd., Addison, IL 60101, Tel: 312-543-6200, TWX: 910-991-5945; *Sls. Mgr.:* Andrew Hart; *Dist. Mgr.:* Andrew Hart

IDEAL INDUSTRIES, 4450 Becker Pl., Sycamore, IL 60178, Tel: 815-895-5181, TWX: 910-639-0613; Empl.: 700; *Dist. Mgr.:* Roger Hamilton

IDEAL PRECISION METER, 214 Franklin St., Brooklyn, NY 11222, Tel: 212-383-6904, TWX: 710-584-2160; FSC No.: 11707; Empl.: 150; *Sls. Mgr.:* T. Bell

IDEC SYSTEMS & CONTROLS CORP., 3050 Tasman Dr., Santa Clara, CA 95050, Tel: 408-988-7500, Telex: 34-0601, TWX: 910-339-9383; Empl.: 60; *Sls. Mgr.:* D.J. Synnott; *Dist. Mgr.:* James Young

IEC CORPORATION, 3100 Longhorn Blvd., Austin, TX 78759, Tel: 512-836-0547, Telex: 757025; FSC No.: 16071; Empl.: 23; *Sls. Mgr.:* Florencio Canizales, Jr.

IEC ELCTRNS., 105 Norton St., Newark, NY 14513, Tel: 315-331-7742, TWX: 510-250-2515; Empl.: 550; *Sls. Mgr.:* Russ Stingel; *Dist. Mgr.:* Steve Hotchkiss

Advertisement

IEC is a full service electronic manufacturer specializing in PC and wire harness assembly. Fully automatic testing, materials management quality and manufacturing engineering are a part of the full service available. For 17 years IEC has produced assemblies that give our customer significant advantages of lower price, better product, dependable delivery and better asset management. Measure your in-house efficiency; get a quote on your assembly from IEC.

IEE, See Industrial Elctrn. Engrs., Inc.

IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 818-849-2481, TWX: 910-498-2206; *Sls. Mgr.:* Richard Schuckman

IET LABS, INC.

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959 ....**3**•1244, 1245

DDC

ILC DATA DEVICE CORPORATION

ILC DATA DEVICE CORP., 105 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-5600, TWX: 510-228-7324; FSC No.: 19645; Empl.: 720; *Sls. Mgr.:* J.P. Sheahan ....**3**•1160, 1161

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	North Hollywood, ILC Data Device Corp.	818-982-6454
CO	Englewood, WesTenn Sls.	303-798-0945
CT	Canton Center, Dynamic Sls. of New Eng.	203-693-6567
FL	Clearwater Beach, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
FL	Sunrise, Perrott Assocs.	305-792-2211
GA	Norcross, Montgomery Mktg. Inc.	404-447-6124
IL	Des Plaines, Elctrn. Mktg.	312-298-2330
IN	Fort Wayne, Giesting & Assocs.	219-486-1912
IN	Indianapolis, Giesting & Assocs.	317-271-5183
KS	Lenexa, Dytec/South	913-888-0215
MA	Burlington, Dynamic Sls. of New Eng.	617-272-5676
MI	Coloma, Giesting & Assocs.	616-468-4200
MI	Novi, Giesting & Assocs.	313-348-3811
MN	Minneapolis, Comprehensive Techn.	612-888-7011
MO	Maryland Hgts., Dytec/South	314-569-2990
NJ	Haddonfield, G.L. Williams Assocs.	609-428-6060
NM	Albuquerque, Vermillion Co.	505-883-3668
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	E. Rochester, Tri Tech Elcttrns.	716-385-6500
NY	Endwell, Tri Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri Tech Elctrns.	315-446-2881
NY	Fishkill, Tri Tech Elctrns.	914-897-5611
NC	Cary, Montgomery Mktg. Inc.	919-467-6319
OH	Cincinnati, Giesting & Assocs.	513-521-8800
OH	Dayton, Giesting & Assocs.	513-293-4044
OH	Montor, Giesting & Assocs.	216-942-3407
OK	Tulsa, Bonser-Philhower Sls.	918-496-3236
OR	Aloha, Venture Elect.	503-642-9090
PA	Pittsburgh, Giesting & Assocs.	412-963-0727
TX	Austin, Bonser-Philhower Sls.	512-346-9186
TX	Houston, Bonser-Philhower Sls.	713-531-4144
TX	Richardson, Bonser-Philhower Sls.	214-234-8438
UT	Salt Lake City, Trembly Assocs.	801-486-5292
VT	Burlington, Dynamic Sls. of New Eng.	802-863-6665
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Milwaukee, JM Sls.	414-546-0040

ICL TECHNOLOGY, 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, TWX: 910-339-9389; *Sls. Mgr.:* Robert Turner;Lynn Reiter

IC ILLINOIS CAPACITOR, INC.

ILLINOIS CAPACITOR, INC., 3757 W. Touhy Ave., Lincolnwood, IL 60645, Tel: 312-675-1760, Telex: 72-4361; Empl.: 44; *Sls. Mgr.:* C. Kurland ....**1A**•1072, 1073

Local Sales Offices & Reps

AZ	Tempe, Jarko Assocs.	602-243-4387
CA	El Cajon, KCE Corp.	619-588-1198
CA	Palo Alto, Mollard Mktg.	415-961-0456
CA	Woodland Hills, Illinois Capacitor, Inc.	800-323-3652
CO	Denver, Elcom	303-337-2300
CT	Bristol, Technology Prods. Grp.	617-731-0858
FL	N. Miami Beach, Ben Goldner	305-932-2782
IN	Indianapolis, Fred Dorsey Assoc.	317-842-0060
KY	Louisville, Fred Dorsey Assoc.	502-426-3540
MA	Brookline, Technology Prods. Grp.	617-731-0858
MI	Warren, Dem Elctrns. Sls.	313-575-9444
MN	Golden Valley, Highland Elctrn. Sls. Co.	612-545-4028
MS	Jackson, Welch & Doby, Inc.	601-932-5534
MO	Blue Springs, Kathrinus-Kelly & Co.	816-229-0001
MO	St. Louis, Kathrinus-Kelly	314-647-2400
NJ	Wayne, Richman Sls. Co.	201-694-1115
NY	Commack, Richman Sls. Co.	516-543-5532
NY	De Ruyter, Net Sales, Inc.	315-662-7996
NY	Fairport, Net Sls.	716-467-4538
NY	Troy, Net Sales, Inc.	518-274-4758
NY	Webster, Net Sales, Inc.	716-671-0022
NC	Raleigh, J & B Sls.	919-878-8600
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
PA	Narberth, J. Bresson Assocs.	215-664-6460
TN	Tullahoma, J & B Sls., Inc.	615-455-7487
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Elcom	801-532-7940
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WI	Milwaukee, Erdman Sls. Co.	414-281-1330

Local Distributors

CA	Anaheim, A to Z Elctrns.	714-634-3620
CA	Canoga Pk., Myco/Vickers Elctrn. Supp.	213-340-2025
CA	Santa Ana, Projections Unltd.	714-641-1472
CO	Englewood, Industrial Elctrns.	303-694-9444
IN	Carmel, Altex Elctrns.	317-848-1323
IA	Cedar Rapids, Bergquist Co.	319-366-8733

LA	Harvey, AFG Electrn. Supp.	504-368-9696
MA	Wakefield, Lorcor	617-246-1903
MA	Woburn, Semtex	617-935-2150
MI	Grand Rapids, R M Elctrns.	616-531-9300
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Camden, General Radio Supp. Co.	609-964-8560
NJ	Roselle, Lectron Ind.	201-245-5859
NY	Buffalo, Genesee Radio & Parts Co.	716-873-9661
NY	Freeport, Semtex Ind. Corp.	800-645-3960
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Troy, Trojan Elctrn. Supp.	518-274-4481
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Dayton, Semtex Ind. Corp.	513-435-6600
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Channelview, Henry Elctrns.	713-452-4451
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Milwaukee, Badger Capacitor Sls.	414-281-1330
EXP	Rexdale, ON, Electrn. Supp., Inc.	416-741-4000
Can	Rexdale, Ont., Frank Eakin Ltd.	416-245-3600

ILLINOIS LOCK CO., The Eastern Co., 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 312-537-1800; *Sls. Mgr.:* Kim Palmer ....**1B**•1655; **2**•1331 -1333

Local Sales Offices & Reps

AZ	Tempe, Desert-West Technical Sls.	602-244-0735
CA	Los Angeles, Universal Comps.	213-641-4255
CA	San Rafael, Wright Assoc.	415-457-9940
IN	Carmel, TMC	317-844-8462
IN	Fort Wayne, TMC	219-432-5553
KY	Louisville, TMC	502-499-7808
MA	Woborn, Boston Electronics Assocs.	617-938-3727
MN	Minneapolis, Jos. Co/Melius	612-861-3343

Local Distributors

CA	Gardena, California Switch & Signal	213-770-2330
CA	San Leandro, Electro-Components	415-352-5210
NJ	N. Arlington, Northeast Lock Co.	201-998-6767

IMAGE GRAPHICS, INC., 107 Ardmore Street, Fairfield, CT 06430, Tel: 203-259-1394; FSC No.: 5M867; Empl.: 35; *Sls. Mgr.:* J. P. Whitley

IMAGE MAKERS OF PITTSFORD, 6 Wood Gate, Pittsford, NY 14534, Tel: 716-385-4567; *Sls. Mgr.:* Richard H. Roberts; *Dist. Mgr.:* Richard H. Roberts

IMAGE TECHNOLOGY METHODS CORP., 103 Moody St., Waltham, MA 02154, Tel: 617-894-1720

imc

IMC MAGNETICS CORP., Exec. Off., 100 Jericho Quadrangle, Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, TWX: 510-221-2126; *Dist. Mgr.:* E. Egan ....**1B**•1157; **2**•1823

IMC MAGNETICS CORP., Arizona Div., 1900 East Fifth St., Tempe, AZ 85281, Tel: 602-968-4441, Telex: 667451 IMC MAG TMPE; *Sls. Mgr.:* Alex Lazutin

IMC MAGNETICS CORP., Eastern Div., 570 Main St., Westbury, NY 11590, Tel: 516-334-7070, TWX: 510-222-4469; *Sls. Mgr.:* K. Barthal ....**1B**•1157; **2**•1823

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cerritos, El Com Inc.	213-404-2961
CA	Los Altos, Recht Assocs.	415-964-6321
CO	Englewood, Thorson Rocky Mountain	303-779-0666
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Coral Springs, Heller Assocs.	305-752-7520
GA	Atlanta, Beacon Elctrns.	404-256-3640
IL	Chicago, D. Dolin Sls. Co.	312-286-6200
MA	Newton Upper Falls, Gerber Sls. Corp.	617-969-2620
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Haddonfield, Mesa Tech. Assoc.	609-429-9531
NY	Fairport, Net Sales Co.	716-467-4538
NY	Great Neck, Trionics Assocs.	516-466-2300
NC	Greensboro, Beacon Elctrns.	919-275-9997
OH	Dayton, Electrical Systems Co.	513-434-9822
OR	Lake Oswego, Huntley Assocs.	503-636-7558
TN	Oak Ridge, Beacon Elctrns.	615-482-2409
TX	Dallas, Kruvand Assocs.	214-691-4592
VA	Falls Church, Beacon North	703-534-7200
WA	Everett, Huntley Assocs.	206-353-1833

IMC/HANSEN, Box 23, Princeton, IN 47670, Tel: 812-385-3415, Telex: 27-8458; *Sls. Mgr.:* George A. Gilbert

Local Sales Offices & Reps

CA	Los Altos, Recht Assoc.	415-964-6321
CA	Van Nuys, Viking Sls.	818-997-3933
CO	Englewood, Thorson Rocky Mountain	303-779-0666
CT	Essex, Winslow Elec.	203-767-8229
FL	Coral Springs, Heller Assoc.	305-752-7520
IL	Oakbrook Terrace, Fromm	312-627-9595
MA	Newton, Gerber Sls.	617-969-2620
NJ	Haddonfield, Mesa Tech.	609-429-9531
NY	Great Neck, Trionic Assoc.	516-466-2300
NY	Rochester, H. C. Johnson Agcy.	716-586-0777
NY	Williamsville, H. C. Johnson Agcy.	716-632-7880
PA	Exton, Kiley Elec.	215-363-8550
PA	Glenshaw, H. C. Johnson Agcy.	412-961-0414
TX	Dallas, Mark Kruvano Assoc.	214-691-4592
VA	Falls Church, Beacon North	703-534-7200
WA	Everett, Huntley Assoc.	206-353-1833
EXP	Ottawa, ON, Graham Dewar & Assoc.	613-235-0970

IMC MAGNETICS CORP., New Hampshire Div., Rte. 16B, Rochester, NH 03867, Tel: 603-332-5300, TWX: 510-297-4466; *Sls. Mgr.:* Robert Kintner; *Dist. Mgr.:* William L. Beaulieu

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cerritos, El Com Inc.	213-404-2961
CA	Los Altos, Recht Assocs.	415-964-6321
CO	Englewood, Thorson Rocky Mountain	303-779-0666
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Coral Springs, Heller Assocs.	305-752-7520
GA	Atlanta, Beacon Elctrns.	404-256-3640
IL	Chicago, D. Dolin Sls. Co.	312-286-6200
MA	Newton Upper Falls, Gerber Sls. Corp.	617-969-2620
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Haddonfield, Mesa Tech. Assoc.	609-429-9531
NY	Fairport, Net Sales Co.	716-467-4538
NY	Great Neck, Trionics Assocs.	516-466-2300
NC	Greensboro, Beacon Elctrns.	919-275-9997
OH	Dayton, Electrical Systems Co.	513-434-9822
OR	Lake Oswego, Huntley Assocs.	503-636-7558
TN	Oak Ridge, Beacon Elctrns.	615-482-2409
TX	Dallas, Kruvand Assocs.	214-691-4592
VA	Falls Church, Beacon North	703-534-7200
WA	Everett, Huntley Assocs.	206-353-1833

Local Distributors

AL	Huntsville, C.D.I.	205-883-7501
AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, Bell Industries	602-966-7800
AZ	Tucson, Southwest Sales	602-325-4087
AR	Little Rock, Comp. Distr., Inc.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Garden Grove, Bell Industries	714-220-0681
CA	Gardena, Bell Industries	213-515-1800
CA	Inglewood, Newark Elctrns.	213-671-7387
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, El-Com	619-578-0900
CA	Santa Clara, El-Com, Santa Clara Div.	408-496-0880
CA	Sunnyvale, Bell Industries	408-734-8570
CA	Thousand Oaks, Bell Industries	805-499-6821
CO	Denver, Newark Denver Elctrns.	303-757-3351
CO	Ravada, Denver Wintronics	303-431-7161
CO	Wheatridge, Bell Inds.	303-424-1985
CT	East Haven, J. V. Elctrns.	203-469-2321
CT	Wallingford, Sterling Electronics	203-265-9535
CT	Wallingford, Sager Elctrl. Supp. Co.	203-265-4600
FL	Ft. Lauderdale, C.D.I.	305-971-4950
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Norcross, C.D.I.	404-441-3320
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Bell Industries	312-982-9210
IL	Northbrook, Classic Comps.	312-272-9650
IN	Carmel, Altex Elctrns. Inc.	317-848-1323
KS	Wichita, RSC Elctrns.	316-267-5213
LA	Metairie, Sterling Electronics	504-887-7610
MD	Savage, Pyttronic Industries	301-792-0780
MA	Burlington, Lionex Corporation	617-272-9400
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Somerville, Electro Sales	617-666-0500
MA	Waltham, Sterling Elctrns.	617-894-6200
MI	Adrian, Wedemeyer Elctrn. Supp. Co.	517-263-2925
MI	Ann Arbor, Wedemeyer Elctrn. Supp. Co.	313-665-8611
MI	Lansing, Wedemeyer Elctrn. Supp. Co.	517-484-9009
MN	Minneapolis, Aero-Space Computer Supplies Inc.	612-884-4725
MO	St. Louis, Olive Elctrns. Inc.	314-426-4500
NJ	Bellmawr, Mid-Atlantic Interstate Industrial Park	609-931-5303
NJ	Fairfield, Lionex Corp.	201-227-7960
NJ	Perth Amboy, Sterling Elctrns.	201-442-8000
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NM	Albuquerque, Bell Industries	505-292-2700
NY	Buffalo, Summit	716-884-3450
NY	Endwell, A.S.I. Elctrns.	607-754-3823
NY	Hauppauge, Lionex Corp.	516-273-1660
NY	Mt. Vernon, Q.A.R. Indl. Sls.	914-699-2224
NY	Plainview, Progress Elctrns.	516-433-1700
NY	Rochester, Summit	716-334-8110
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, C.D.I.	919-834-9465
OH	Columbus, Wedemeyer Elctrn. Supp. Co.	614-436-9600
OH	Dayton, Bell Industries Micro-Mil Div.	513-434-8231
OH	Dayton, Esco Elctrns.	513-226-1133
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Youngstown, Newark Elctrns.	216-793-6134
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Lake Oswego, Bell Industries	503-241-4115
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Horsham, Lionex Corp.	215-443-5150
PA	McKean, Advacom Inc.	814-476-7774
PA	Montgomeryville, Pyttronic Industries	215-643-2850
PA	Reading, Barbey Elctrns.	215-376-6116
RI	Providence, Wm. Dandreta & Co.	401-861-2800
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Nashville, Electra Distrbg. Co.	615-329-3971
TX	Austin, Sterling Elctrns.	512-863-1341
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Dallas, Heilind Elctrns.	214-351-2050
TX	El Paso, Intl. Elctrns.	915-598-3406
TX	Houston, Sterling Elctrns.	713-623-6600
UT	Salt Lake City, Standard Supp.	801-486-3371
UT	Salt Lake City, Bell Industries	801-972-6969
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Bell Industries	206-747-1515
WI	New Berlin, Classic Comps.	414-786-5300
WI	Waukesha, Bell Industries	414-547-8879

IMC MAGNETICS CORP., Thermal Prods. Grp., 100 Jericho Quad., Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, TWX: 510-221-2126

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cerritos, El Com Inc.	213-404-2961
CO	Englewood, Thorson Rocky Mountain	303-779-0666
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Coral Springs, Heller Assocs.	305-752-7520
GA	Atlanta, Beacon Elctrns.	404-256-3640
IL	Chicago, D. Dolin Sls. Co.	312-286-6200
MA	Newton Upper Falls, Gerber Sls. Corp.	617-969-2620
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Haddonfield, Mesa Tech Assoc.	609-429-9531
NY	Fairport, Net Sales Co.	716-467-4538
NY	Great Neck, Trionics Assocs.	516-466-2300
NC	Greensboro, Beacon Elctrns.	919-275-9997
OH	Dayton, Electrical Systems Co.	513-434-9822
OR	Lake Oswego, Huntley Assocs.	503-636-7558
TN	Oak Ridge, Beacon Elctrns.	615-482-2409
TX	Dallas, Kruvand	214-691-4592
VA	Falls Church, Beacon North	703-534-7200
WA	Everett, Huntley Assocs.	206-353-1833

IMC MAGNETICS CORP., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90701, Tel: 213-926-0927, TWX: 910-583-1355; FSC No.: 99743; *Sls. Mgr.:* Joe Gute

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Cerritos, El Com Inc.	213-404-2961
CA	Los Altos, Recht Assocs.	415-964-6321
CO	Englewood, Thorson Rocky Mountain	303-779-0666
CT	Middletown, Gerber Sls. Corp.	203-347-3000
FL	Coral Springs, Heller Assocs.	305-752-7520
GA	Atlanta, Beacon Elctrns.	404-256-3640
IL	Chicago, D. Dolin Sls. Co.	312-286-6200
MA	Newton Upper Falls, Gerber Sls. Corp.	617-969-2620
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Haddonfield, Mesa Tech. Assoc.	609-429-9531
NY	Fairport, Net Sales Co.	716-467-4538
NY	Great Neck, Trionics Assocs.	516-466-2300
NC	Greensboro, Beacon Elctrns.	919-275-9997
OH	Dayton, Electrical Systems Co.	513-434-9822
OR	Lake Oswego, Huntley Assocs.	503-636-7558
TN	Oak Ridge, Beacon Elctrns.	615-482-2409
TX	Dallas, Kruvand Assocs.	214-691-4592
VA	Falls Church, Beacon North	703-534-7200
WA	Everett, Huntley Assocs.	206-353-1833

IMEC CORP., 2434 Southport Way, National City, CA 92050, Tel: 619-474-8991

IMPANDEX, INC., 203 Brookdale St., Maywood, NJ 07607, Tel: 201-845-4664, Telex: 134 656; Empl.: 11; *Sls. Mgr.:* Stanley I. Goldberg; *Dist. Mgr.:* Rober F. Carlson

I.M.S. EQUIPMENT, INC., P.O. Box 16909, Irvine, CA 92713, Tel: 714-559-6901, Telex: 678317; *Sls. Mgr.:* W. Charles Davison

IMTRONICS INDS., 11930 31st Ct., Clearwater, FL 33520, Tel: 813-577-9010, Telex: 566027 IMTRON CWTR UD; Empl.: 10; *Sls. Mgr.:* Steven B. Cohen

INCOM, INC., 205 Chapin St., P.O. Drawer G, Southbridge, MA 01550, Tel: 617-765-9151, TWX: 710-347-1604; *Sls. Mgr.:* David MacGrath

INCONIX CORP., 10 Tech Circle, Natick, MA 01760, Tel: 617-655-1170, TWX: 710-386-1997; Empl.: 60; *Sls. Mgr.:* Al Vitale

INDEPENDENT CABLE, INC., 43 Broad St., Hudson, MA 01749, Tel: 617-562-9913

INDIANA GENERAL/DIV. EMM CORP., Magnet Prods., 405 Elm St., Valparaiso, IN 46383, Tel: 219-462-3131, Telex: 25-8489, TWX: 910-690-4891; Empl.: 1200; *Sls. Mgr.:* Royce D. Wright

INDUCTIVE PRODS. INC., 11733 Markon Dr., Garden Grove, CA 92641, Tel: 714-891-2572; Empl.: 10; *Sls. Mgr.:* Cary Rosen

Industrial Computer Designs

INDUSTRIAL COMPUTER DESIGNS, INC., 31121 Via Colinas 1005, Westlake Village, CA 91362, Tel: 818-889-3179; *Sls. Mgr.:* David J. Knight .... 3•1110, 1111

Local Distributors

CA	Chatsworth, Priority One Elctrns.	818-709-5111
CA	Irvine, Priority One Elctrns.	714-660-1411; 800-423-5922 (outside CA)

INDUSTRIAL CONDENSER CORP., See Industrial Midwec Capacitors

INDUSTRIAL CONTROL CO., 3100 Pineda Ave., Rockledge, FL 32955, Tel: 305-259-7105; Empl.: 15; *Sls. Mgr.:* I. Nobilio .... 3•1932

INDUSTRIAL DEVICES, INC., Edgewater, NJ 07020, Tel: 201-224-4700, Telex: 12-7459; FSC No.: 91802; Empl.: 200; *Sls. Mgr.:* Michael Diceglie .... 1B•1020, 1064-1083

Local Sales Offices & Reps

AL	Huntsville, E.M.A., Inc.	205-837-7363
AZ	Phoenix, Bill Earl Assoc.	602-994-3813
CA	Los Angeles, Universal Comps.	213-641-4255
CA	Mountain View, Westech Sls.	415-961-1422
CO	Aurora, Sage Sls.	303-750-3501
FL	Casselberry, Southern Elctrn. Mktg.	305-695-3334
FL	Clearwater, Southern Elctrn. Mktg.	813-441-3902
FL	Ft. Lauderdale, Southern Elctrn. Mktg.	305-475-3686
GA	Atlanta, E.M.A., Inc.	404-448-1215
IL	Chicago, K. D. Engle	312-539-1820
IN	Indianapolis, Elctrn. Mktg. Conslts.	317-253-1668
MD	Towson, Ernie Stefkovic Assocs.	301-321-6008
MA	Newton Upper Falls, Anchor Engrg.	617-964-6205
MI	Oak Pk., W. Spenser	313-967-0808
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
NJ	Cherry Hill, Ernie Stefkovic Assocs.	609-667-4066
NJ	Manville, Dyno Rep	201-685-0135
NY	New York, Drake America Corp.	212-758-5400
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, E.M.A., Inc.	919-847-8800
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	800-362-2265
OR	Portland, Earl & Brown	503-245-2283
PA	Pittsburgh, Marlow Assocs.	412-367-8886
SC	Greenville, E.M.A., Inc.	803-233-4637
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-840-0590
TX	Richardson, R. F. Kimball Co.	214-231-3447
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Seattle, Earl & Brown	206-284-1121

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
CA	Gardena, Calif. Switch & Signal	213-770-2330
CA	Los Angeles, Elec. Switches	213-664-1141
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Pasadena, Empire Elctrn. Distr.	213-681-2711
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	San Diego, Sigma Elctrns.	714-565-2000
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Cypress Elctrns.	408-727-7080
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Santa Rosa, Steven Engrg.	707-578-0666
CO	Arvada, Denver Wintronics	303-431-7161
CT	Norwalk, Park Distrs.	800-243-5006
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Longwood, Inter Tec	800-432-1654
FL	Miami, Electro Standard Lab (ESL)	305-633-6973
FL	Tampa, Leader Elctrns.	813-870-3315
GA	Atlanta, Wholesale Indl. Elec.	800-282-1857
HI	Honolulu, Precision Radio	808-537-5291
IL	Bridgeview, Midco Comps.	312-599-7777
IL	Villa Park, Melvin Elctrns.	312-279-5015
IL	Wood Dale, Electro-Kinetics	312-595-6700
IN	East Chicago, ACRO Elctrns.	312-375-1269
IN	Evansville, Hutch & Son	812-425-7201
IN	Fort Wayne, Graham Elctrs.	219-423-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Bergquist Co.	319-366-8733
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
KY	Bowling Green, Crescent Elctrns.	502-842-2444
LA	Lafayette, Ralph's	318-234-4507
LA	New Orleans, Wm. B. Allen Supp. Co.	800-462-9520
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	N. Wilbraham, Indl. Comps.	413-596-3854
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Worcester, RM Elctrns.	617-756-8311
MI	Flint, Shand Elctrns.	313-743-8940
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Elctrn. Center	612-371-5200
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	Kansas City, Olive Indl. Elect.	816-842-8556
MO	St. Louis, Van Sickle Radio-Elec.	314-621-5000
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NE	Omaha, Scott Elctrn. Supp.	402-734-6750
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Fair Lawn, Relay Spec.	201-797-3313
NJ	Hanover, State Elctrns. Parts	201-887-2550
NJ	Springfield, Route Elctrns.	201-379-7710
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hempstead, Elctrn. Equip.	800-645-1605
NY	Mt. Vernon, Q.A.R. Indl. Elctrn. Sls.	914-699-2224
NY	New York, Drake America Corp.	212-758-5400
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Raleigh, Southeastern Radio Supp.	919-828-2311
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, United Radio	513-761-4030
OH	Cleveland, REPCO Inc.	216-248-8900
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Toledo, Warren Radio	419-248-3364
OK	Oklahoma City, Trice Whls. Elctrns.	405-524-4411
OK	Tulsa, Oil Capitol Elctrns.	918-622-8520
OR	Portland, United Radio Supp.	503-233-7151
PA	Erie, Rem/Mace Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
SC	Columbia, Dixie Radio Supp.	803-779-5332
TN	Knoxville, Roden Elctrl. Supp.	615-546-8755
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5601
TX	Fort Worth, Swieco	817-335-6521
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	San Antonio, Sherman Elctrns. Supp.	512-224-1004
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Arlington, Arlington Elctrn. Whlsrs.	703-524-6256
VA	Glenn Allen, Hermitage Distrs.	804-798-3830
WA	Seattle, United Radio Supp.	206-284-0200
WI	Milwaukee, Marsh Elctrns.	414-475-6000

IEE THE DISPLAY MAKERS
INDUSTRIAL ELECTRONIC ENGINEERS

INDUSTRIAL ELCTRN. ENGRS., INC., 7740 Lemona Ave., Van Nuys, CA 91405, Tel: 818-787-0311, TWX: 910-495-1707; Empl.: 400; *Sls. Mgr.:* C. Doria, J. Hart, I. Minarik; *Dist. Mgr.:* J. Hart .... 1B•1084, 1085, 1781

Local Sales Offices & Reps

AL	Huntsville, TMA Technology Mktg. Assoc.	205-883-7893
AZ	Phoenix, Gramer & Co.	602-995-9455; 602-942-1415
CA	Brea, Masco Elctrns., Inc.	714-529-0866
CA	Campbell, LCO Tech. Sls.	408-378-9900
CA	Los Angeles, Masco Elctrns. Inc.	714-529-0866
CA	Vista, Masco Elctrns., Inc.	619-758-5562
CO	Denver, Lindberg Co.	303-758-9033,34,35,36
CT	North Haven, Kitchen & Kutchin, Inc.	203-239-0212
FL	Melbourne, TMA Technlg. Mktg. Assoc.	305-676-3776
FL	Orlando, TMA Technlg. Mktg. Assoc.	305-857-3760
FL	Pompano Beach, TMA Technlg. Mktg. Assoc.	305-942-0774
GA	Atlanta, TMA Technlg. Mktg. Assoc.	404-257-0374
ID	Boise, Huntley Assocs.	208-343-7588
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Carmel, TMC Techng. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, TMC Techng. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, PMR Penzner/Mankus Reps., Inc.	319-362-9177
KS	Overland Park, PMR Penzner/Mankus Reps., Inc.	913-381-0004
KS	Wichita, PMR Penzner/Mankus Reps., Inc.	316-684-4141
KY	Louisville, TMC Technlg. Mktg. Corp.	502-499-7808
MD	Hunt Valley, Marktron, Inc.	301-628-1111
MD	Rockville, Marktron, Inc.	301-251-8990

IEE
INDUSTRIAL ELECTRONIC ENGINEERS, INC.
LAMPS • LED's • LCD's

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

MA	Burlington, Kitchen & Kutchin, Inc.	617-229-2660
MI	Southfield, L. H. Dickelman Co.	313-353-8210
NY	Fairport, Reagan/Compar Albany, Inc.	716-271-2230
NY	New Hartford, Reagan/Compar Albany, Inc.	315-732-3775
OH	Cleveland, Geotronix, Inc.	216-526-2535
OH	Trotwood, Geotronix, Inc.	513-854-5939
OR	Beaverton, Huntley Assocs.	503-649-5388
PA	Norristown, RJI	215-631-1414
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TX	Dallas, MGR Electronics, Inc.	214-238-5246; 713-759-0187;817-338-1493
UT	Salt Lake City, Lindberg Co.	801-467-1794,95
VA	Charlottesville, Marktron, Inc.	804-973-5874
WA	Everett, Huntley Assocs.	206-353-1833
WI	Cedarburg, Bransky Sls.	414-377-6837

Local Distributors

AL	Huntsville, C.D.I.	205-883-7501
AZ	Phoenix, Tri-Tek, Inc.	602-995-9352
AZ	Tempe, Circuit Specialists Co.	602-966-0764
AR	Little Rock, C.D.I.	501-227-6278
CA	Cerritos, El-Com, Inc.	213-404-2961
CA	Gardena, California Switch & Signal Co.	213-538-9830
CA	Industry, Ital Elctrn. Sls. Inc.	818-968-8515; 714-990-0922
CA	Lakeside, Mouser Elctrn. Corp.	619-449-2229
CA	San Diego, Richey/Western Elctrns.	619-565-4444
CA	San Diego, El-Com, Inc.	619-578-0900
CA	San Jose, Richey/Western Elctrns.	408-946-6611
CA	Santa Clara, Waltronic Sls.	408-727-1200
CA	Sun Valley, Richey/Western Elctrns.	818-768-3800
CO	Denver, Integrated Elctrns.	303-292-6121
CT	East Haven, U.V. Elctrns.	203-469-2321
FL	Alamonte Springs, Pioneer/Orlando	305-834-9090; 800-432-6094
FL	Ft. Lauderdale, C.D.I.	305-971-4950
FL	Miami, Elctrn. Equip. Co. Inc.	305-871-3500
GA	Norcross, C.D.I.	404-441-3320
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Bell Inds.	312-982-9210
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Elmhurst, Semiconductor Specialists, Inc.	312-279-1005
IL	Northbrook, Classic Comps.	312-272-9650
IN	Carmel, Altex Elctrns., Inc.	317-848-1323; 800-692-6039
KS	Wichita, R.S.C.	316-267-5213
MD	Beltsville, Treeko Sls.	301-937-8260
MD	Gaithersburg, Pioneer/Washington	301-948-0710
MA	Billerica, A. W. Mayer Co., Inc.	617-667-6900
MA	Danvers, Criterion Elctrns.	617-777-4725
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MI	Grand Rapids, S-F Elctrn. Supp. Inc.	616-459-0216
MI	Southfield, Michigan Lectrols Corp.	313-353-1350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	Kansas City, Semiconductor Specialists, Inc.	816-452-3900
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
NM	Albuquerque, Beatron Elctrns.	505-344-2381
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Farmingdale, S.A.I.	516-293-2710
NY	Mamaroneck, Logicomp Elctrns.	914-698-9332
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Modutex Corp.	716-424-1620
NC	Greensboro, Hammond Elec.	919-275-6391
NC	Raleigh, So. Eastern. Elctrns.	919-828-2311
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Alpha Distr. Corp.	216-526-3716
OH	Dayton, The Stotts-Friedman Co.	513-298-5555
OK	Oklahoma City, Electro Entrs., Inc.	405-427-6591
PA	Philadelphia, Philadelphia Elctrns. Inc.	215-568-7400
PA	Philadelphia, Herbach & Rademan, Inc.	215-426-1700
SC	Taylors, Cantrell Wholesalers	803-268-1194
TX	Austin, The Altair Co.	512-837-4490
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Houston, Solid State Elctrns.	713-772-8483
TX	Houston, The Altair Co.	713-462-3029
TX	Irving, Solid State Elctrns.	214-438-5700
TX	Richardson, The Altair Co.	214-231-5166
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Richardson, The Altair Co.	214-231-5166
TX	Stafford, Southwest Elctrns.	713-491-4900
WA	Kent, Shannon Ltd.	206-763-0545
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	Milwaukee, Marsh Elctrns.	414-475-6000

INDUSTRIAL ELCTRN. HARDWARE CORP., 109 Prince St., New York, NY 10012, Tel: 212-677-1881, TWX: 710-581-4338; FSC No.: 97913; Empl.: 430; *Sls. Mgr.:* Louis Roberts; *Dist. Mgr.:* Louis Roberts .... **2**•1329

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Knight Co.	602-582-8506
CA	Los Angeles, Knight Co	213-670-2833
CA	San Diego, Knight Co.	619-693-1806
CA	Sunnyvale, M2 Mktg. Grp.	408-733-1361
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
FL	St. Petersburg, Tech. Rep. Assoc.	813-577-2779
GA	Atlanta, Beacon Elctrns.	404-256-9640
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MD	Ellicot City, Techn. Sls.	301-461-2400
MA	Lowell, Underwood Sls.	617-256-8191
MN	St. Paul, Countryman	612-645-9151
MO	St. Louis, Thunderbird Tech. Sls.	314-567-6488
NJ	Fort Lee, FJK Assocs. Inc.	201-592-1002
NJ	Haddonfield, Mills-Brown Assoc	609-429-1005
NY	Buffalo, Franklin Sls.	716-248-8251
NY	Pittsford, Franklin Sls.	716-248-8251
NY	Ronkonkoma, PMR	516-467-8200
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555
OR	Beaverton, Barrett-Squibb	503-642-1661
RI	Warwick, Monette Eng. & Assoc.	401-885-2205
TX	Dallas, Pro-Mark	214-644-0497
VA	Portsmouth, F.B.D. Sls.	804-484-3162
WA	Redmond, Barrett-Squibb	206-885-6991

INDUSTRIAL FABRICATING CO., 820 Woodend Ave., Stratford, CT 06497, Tel: 203-375-5853; Empl.: 30; *Sls. Mgr.:* Ray Peterson

INDUSTRIAL MIDWEC CAPACITORS, 4902 Tollview Dr., Rolling Meadows, IL 60008, Tel: 312-577-0120, TWX: 910-687-3375; Empl.: 800; *Sls. Mgr.:* Andy Kaluski

Powertron

INDUSTRIAL TEST EQUIP., 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Robert Loiacono .... **3**•1886-1888

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, Telex: 83-1633; Empl.: 49; *Sls. Mgr.:* Lori Clarkin

INFICON LEYBOLD-HERAEUS, INC., 6500 Fly Rd, E. Syracuse, NY 13057, Tel: 315-437-0377, TWX: 710-541-0594; Empl.: 150; *Sls. Mgr.:* D. A. Di Renzo

InfoCap

INFOCAP, INC., 31119 Via Colinas 502, Westlake Village, CA 91362, Tel: 818-991-1410; *Sls. Mgr.:* David Knight .... **3**•1085

INFODEX, INC., 395 W. Main St., Waterbury, CT 06702, Tel: 203-757-9291, Telex: 178702 IFDX; FSC No.: 09087; Empl.: 42; *Sls. Mgr.:* E. H. Ulm .... **1B**•1086, 1087

Local Sales Offices & Reps

CA	Pasadena, A-F Sales Engrg.	818-681-5631
MA	Boston, Nortech Engrg. Sls.	617-359-6063
MA	Concord, Nortech Engrg. Sls.	617-259-0032

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFORMATION CONTROL, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 55; *Sls. Mgr.:* Carol J. Smith

INFORMATION CONTROL CORP., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 50

INFORMATION CONTROL CORP., Light Pen Div., Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 50

INFORMATION TERMINALS, See Verbatim Corp.

iti THE SWITCHING COMPANY

INFORMATION TRANSFER INDL., Box 357, Holcomb, NY 14469, Tel: 716-657-7074; FSC No.: 55137; Empl.: 40; *Sls. Mgr.:* J. E. Wiseman .... **3**•1162, 1163, 1246

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Campbell, Luscombe Engrg.	408-370-2020
CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Luscombe Engrg.	714-295-4300
CT	Hamden, Polytek Assocs.	203-288-5246
IL	Schaumburg, Kenneth W. Meyers Co.	312-882-4808
IN	Indianapolis, Kenneth W. Meyers Co.	317-243-6681
IA	Cedar Rapids, Kenneth W. Meyers Co.	319-363-8987
MD	Greenbelt, Riffe Assocs.	301-474-8600
MA	Ashland, Polytek Assocs.	617-881-4741
MN	Minneapolis, Kenneth W. Meyers Co.	612-920-7080
NJ	Oxford, Malin Assocs.	201-689-7398
NY	Albany, R. F. Lamb Co.	518-869-3355
NY	Buffalo, R. F. Lamb Co.	716-874-4900
NY	Rochester, R. F. Lamb Co.	716-323-1250
NY	Syracuse, R. F. Lamb Co.	315-454-2469
OR	Portland, Tasco	503-245-8168
PA	Melrose Park, Robert Meyers Assocs.	215-224-1663
TX	Houston, Sci. Sls. Co.	713-460-9170
TX	Richardson, Sci. Sls. Co.	214-231-6541
WA	Bellevue, Tasco	206-453-1414
WI	Brookfield, Kenneth W. Meyers Co.	414-784-3790

INFOSPHERE, INC., 4730 S.W. Macadam Ave., Portland, OR 97201, Tel: 503-226-3515, Telex: 360312; *Sls. Mgr.:* Wm. David Sharon; *Dist. Mgr.:* Wm. David Sharon

Local Sales Offices & Reps

AZ	Scottsdale, A.S.R.	602-949-8293
CA	Sacramento, Manco	916-985-0370
CA	Santa Clara, Manco	408-496-6611
NM	Albuquerque, A.S.R.	505-243-8454
OH	Cleveland, Dolfuss-Root and Co.	216-238-0300
OH	Columbus, Dolfuss-Root and Co.	513-433-6776
OR	Portland, Cascade Data Mktg.	503-641-9266
PA	Pittsburgh, Dolfuss-Root and Co.	412-221-4420
TX	Houston, Abcor, Inc.	713-486-9251
WA	Seattle, Cascade Data Mktg.	206-747-6190

INFRARED INDS., INC., P.O. Box 14200, Orlando, FL 32857, Tel: 305-282-7700, Telex: 568908; Empl.: 80; *Sls. Mgr.:* Thomas Chisholm

INJECTORALL ELCTRNS., 98-100 Glen St., Glen Cove, NY 11542, Tel: 516-671-6010 .... **2**•1091

Local Sales Offices & Reps

AL	Birmingham, John F. Russell Co.	205-822-2196
CA	Burlingame, Carelli-Ema	415-342-4514
CA	Long Beach, Ross Sls.	213-424-9818
FL	Miami Beach, Everett Wollman Sls.	305-932-1790
MA	Northboro, W. B. Pray Co.	617-393-3434
MI	Livonia, Harvey Sales Co.	313-476-1974
NY	Brooklyn, Moet Maltz & Co.	212-252-1139
OH	Jamestown, Landro-Edwards Sls.	513-675-2059
PA	Library, Landro & Edwards Sls. Co.	412-854-5727
WA	Edmonds, McLaughlin Mktg. Inc.	206-743-1161

Local Distributors

AL	Huntsville, Mock	205-539-2401
AZ	Tucson, Electronic City	
CA	Los Angeles, ITC	213-388-0621
CA	San Jose, Quement	408-998-5900
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
FL	Pensacola, Pensacola Elctrns.	904-478-3771
GA	Atlanta, Delta	404-458-4690
IL	Chicago, Tron	
IN	East Chicago, Acro	219-397-8681
KY	Louisville, P.I. Burkes	
MA	Needham, Y.D.I.	617-449-1005
MI	Bay City, KDC	517-892-1594
MI	Port Huron, Main	313-985-5103
NJ	Vineland, Laraco	609-691-2900
NY	Elmsford, Ancar	914-592-7100
NY	Levittown, Edlies Elctrns.	516-735-3330
NY	New York City, Taft	212-575-5194
NY	Richmond Hill, Anchor	212-846-2420
OR	Beaverton, Norvac	503-644-1025
PA	Norristown, Philadelphia Elctrns.	215-275-5550
TX	Dallas, Nanney	

TX	Fort Worth, Sweico	817-335-6521
WA	Seattle, Elctrn. Supermart	206-575-1093
WA	Seattle, Radar	206-282-2511

INLAND MOTOR DIV. KOLLMORGEN, INDL. DRIVES GRP., See Kollmorgen Corp.

INLAND MOTOR, SPECIALTY PRODS. DIV., Kollmorgen Corp., 4020 E. Inland Rd., Sierra Vista, AZ 85635, Tel: 602-459-1150, Telex: 62858, TWX: 910-973-9869; *Sls. Mgr.:* Ken Irvin

INLAND MOTOR SPECIALTY PRODS. DIV., Kollmorgen Corp., 501 First St., Radford, VA 24141, Tel: 703-639-9045, TWX: 710-875-3740; FSC No.: 11384; Empl.: 450

Local Sales Offices & Reps

Specialty/Instrument/Industrial Drive Group

AL	Huntsville, Technology Mktg. Assoc.	205-883-7893
AZ	Phoenix, Thor Engrg. Mfg.	602-437-1463
AZ	Sierra Vista, Inland Motor - SPD	602-459-1150
CA	Alhambra, Thorson Co.	213-281-2280
CA	Goleta, Thorson Co.	805-964-8751
CA	Mountain View, Thorson Co.	415-964-9300
CA	San Diego, Thorson Co.	619-292-8525
CA	Signal Hill, Thorson Co.	213-595-0361
CO	Englewood, Thorson Co.	303-779-0666
CT	Wolcott, Vanguard Elctrns.	203-879-9310
FL	Melbourne, Technology Mktg. Assoc.	305-676-3776
FL	Orlando, Technology Mktg. Assoc.	305-857-3760
FL	Pompano Beach, Technology Mktg. Assoc.	305-942-0774
FL	Winter Park, Magna Engrg. Sls.	305-671-8716
GA	Atlanta, Technology Mktg. Assoc.	404-257-0374
IL	Collinsville, Magna Engrg. Sls.	618-345-5583
IL	Elk Grove, Carlson Elctrn. Sls.	312-956-8240
IN	Indianapolis, Carlson Elctrn. Sls.	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
KS	Wichita, Magna Engrg. Sls.	316-744-0851
MD	Baltimore, Rep-Tron	301-621-1313
MA	Needham Heights, Vanguard Elctrns.	617-449-5578
MI	Detroit, R. P. Urban Assoc.	313-535-2355
MI	Grand Rapids, R. P. Urban Assoc.	616-245-0511
MN	St. Paul, J. J. Exon co.	612-636-5533
NJ	Wayne, S. Howard Lagerveld & Assoc.	201-790-1714
NY	E. Rochester, A & D Devices	716-385-2778
OH	Chagrin Falls, Jerry Kilroy Corp.	216-543-3370
OR	Beaverton, Thorson Co.	503-644-5900
PA	Media, Homer Smith Co.	215-543-2434
TX	Dallas, Magna Engrg. Sls.	214-349-6171
UT	West Valley City, Thorson Co	801-973-7969
WA	Bellevue, Thorson Co.	206-455-9180
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

INMAC, 2465 Augustine Dr., Santa Clara, CA 95051, Tel: 408-727-1970, TWX: 910-338-2091; Empl.: 500

INMARK CORP., 147 West Cedar St., Norwalk, CT 06854, Tel: 203-866-8474, Telex: 99-6419; *Sls. Mgr.:* Lars Giers

INMOS CORP., P.O. Box 16000, Colorado Springs, CO 80935, Tel: 303-630-4000 Ext. 4454, TWX: 910-920-4904; Empl.: 1500; *Sls. Mgr.:* Peter Fowler; *Dist. Mgr.:* Jim O'Sullivan

INNOTRONICS, Brooks Rd., Lincoln, MA 01773, Tel: 617-678-8720; *Sls. Mgr.:* Julio DeCastro; *Dist. Mgr.:* Stephen Scheuer

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., Millerton, NY 12546, Tel: 914-373-9003, Telex: 750120; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., 4714 N.W. 165th St., Miami, FL 33014, Tel: 305-624-1644, Telex: 80-7121; Empl.: 28; *Sls. Mgr.:* Diane Ruggiero; *Dist. Mgr.:* Diane Ruggiero

INRECO, See Ransco Industries

INRESCO/INSTR. RESISTOR, 2106 Bridge Ave., Pt. Pleasant, NJ 08742, Tel: 201-892-5881; Empl.: 16; *Sls. Mgr.:* G. L. Martin

INSERVCO, INC., Box 106, La Grange, OH 44050

INSTRON CORP., 100 Royall St., Canton, MA 02021, Tel: 617-828-2500, Telex: 924434; Empl.: 1000; *Sls. Mgr.:* S. J. Vinciguerra; *Dist. Mgr.:* Lawrence Frost

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Philip C. Alderton

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	303-289-5647
CA	Los Angeles, Crown Elctrns.	213-877-3550
CA	San Francisco, Paul Rosen Co.	415-526-8286
CO	Denver, Williams Assoc.	303-289-5647
GA	Atlanta, E. G. Holmes & Assoc.	404-451-6161
IL	Chicago, Data Elctrn.	312-283-0300
IN	Indianapolis, Data Elctrns.	317-359-5368
KS	Overland Park, Ramsey Assocs.	913-649-6996
MD	Baltimore, Easter Instr.	301-384-8500
MA	Boston, Addelco Corp.	617-444-4754
MI	Detroit, E.Q.S. Sys.	313-961-3042
MN	Minneapolis, Loren Green Assoc.	612-571-6666
MO	St. Louis, Ramsey Assoc.	314-878-5042
NJ	Cresskill, Eastern Inst. of N Y	201-567-9505
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Syracuse, DB Assocs.	315-446-0220
NC	Raleigh, E. G. Holmes	919-469-8850
OH	Chesterland, E. Q. S. Sys.	216-729-2222
OH	Dayton, E.Q.S. Systems	513-294-2476
PA	Philadelphia, Sci. Devices	215-825-9515
TX	Lewisville, Milstek Inc.	214-436-1597
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Seattle, Hood Engrg.	206-453-9375

INSTRU-LEC, 520 Homestead Ave., Mt. Vernon, NY 10550, Tel: 914-668-3754; FSC No.: 13782; Empl.: 10

INSTRUMENTATION & CONTROL SYS., 520 Interstate Rd, Addison, IL 60101, Tel: 312-543-6200, TWX: 910-991-5945; Empl.: 50; *Sls. Mgr.:* Andrew Hart;Ken Horning

INSTRUMENTATION MEASUREMENTS LAB., Div. of Lockheed Electronics Co. Inc., 1501 Rt. 22, Plainfield, NJ 07061, Tel: 201-757-3730; *Sls. Mgr.:* P. Murray Grinnell

INSTRUMENTATION PRODS., 3M Co., 300 S. Lewis Rd., Camarillo, CA 93010, Tel: 805-482-1911, TWX: 910-336-1676; Empl.: 500

INSTRUMENT ENCLOSURES, 9767 Glenoaks Blvd., Sun Valley, CA 91352, Tel: 213-768-4622, Telex: 66-2442; FSC No.: 62012; Empl.: 20; *Sls. Mgr.:* William B. Taylor

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESISTOR CO., See INRESCO/INRESCO/Instr. Resistor

INSTRUMENTS, INC., 7263 Engineer Rd., San Diego, CA 92111, Tel: 619-571-1111, Telex: 695073, TWX: 910-335-1607; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

INSTRUMENTS AND CONTROLS DIV., Technology Inc., P.O. Box 3036, Overlook Branch, Dayton, OH 45431, Tel: 513-426-2405, TWX: 810-450-2620; FSC No.: 23978; Empl.: 100

INSTRUMENTS FOR INDUSTRY

INSTRUMENTS FOR INDUSTRY, INC., 151 Toledo St., Farmingdale, NY 11735, Tel: 516-694-1414, TWX: 510-222-0876; Empl.: 25; *Sls. Mgr.:* Ron Richards .... **3**•1011

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, R. A. Mayes Co.	602-279-5243
CA	Los Altos, DJM Elctrns.	415-966-1680
CA	Valencia, DJM Elctrns.	213-367-9482
CO	Lakewood, Westek Data Prods.	303-989-1900
FL	Clearwater, Beacon Elctrns.	813-796-2378
GA	Atlanta, Beacon Elctrns.	404-256-9640.
MD	Laurel, CSDS, Inc.	301-490-3800
MN	Minneapolis, Deerland Distrs.	612-331-6433
MO	Kansas City, EIR Co.	816-452-7030
MO	Leasburg, EIR Co.	314-895-4100
NJ	N. Plainfield, Brady Co.	201-753-7988
NM	Albuquerque, R. A. Mayes Co.	505-292-2330
NY	Guilderland, Electro Modular Sys.	518-456-2665
NC	Greensboro, Beacon Elctrns.	919-275-9997
OH	Bedford Hgts., Bill Teplitz Assocs.	216-439-3265
OH	Dayton, Bill Teplitz Assocs.	513-277-6531
TN	Johnson City, Beacon Elctrns.	615-282-2421
UT	Salt Lake City, Westek Data Prods.	801-582-1200
WI	Milwaukee, Deerland Distrs.	414-784-1414

INSTRUMENT SPECIALTIES CO., P.O. Box A, Delaware Water Gap, PA 18327, Tel: 717-424-8510, TWX: 510-671-4526; Empl.: 350; *Sls. Mgr.:* James P. May .... **2**•1908, 1909

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs.	602-274-6072
CA	San Diego, O'Donnell Assocs.	619-578-1645
CA	Sunnyvale, O'Donnell Assocs.	408-745-7043
CA	Torrance, O'Donnell Assocs.	213-328-9710
SC	Greenville, B & B Sls.	803-297-1200
TX	Dallas, J. M. Spell	214-620-0040
WA	Bothell, Temco Northwest	206-488-1254

INTECH, Instruments Div., 282 Brokaw Rd., Santa Clara, CA 95050, Tel: 408-727-0500, TWX: 910-338-0254; Empl.: 120; *Sls. Mgr.:* Howard Randall; *Dist. Mgr.:* Howard Randall

INTECH, Microcircuits Div., 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-4930, TWX: 910-338-2213; FSC No.: 33967; Empl.: 150; *Sls. Mgr.:* D. Arnold

INTEGRA, INC., 2368 Walsh Ave., Santa Clara, CA 95051, Tel: 408-727-9601, TWX: 910-338-0585; FSC No.: 51162

INTEGRAL DATA SYS., INC., Rte. 13 S, Milford, NH 03055, Tel: 603-673-9100, Telex: 95-3032; *Dist. Mgr.:* M. Dude

INTEGRATED CIRCUIT ENGRG. CORP. (ICE), 15022 N. 75th St., Scottsdale, AZ 85260, Tel: 602-998-9780, Telex: 165-755; Empl.: 45; *Sls. Mgr.:* Daniel J. Shelton

INTEGRATED CIRCUITS, INC., 10301 Willows Road, Redmond, WA 98052, Tel: 206-882-3100, TWX: 910-443-2302; FSC No.: 50821; Empl.: 160; *Sls. Mgr.:* B. W. Brugman .... **1A**•1660; **3**•1593-1597

Local Sales Offices & Reps

CA	El Toro, Martronix	714-855-6397
CA	Mountain View, Weseloh-Swanson Sls.	415-961-0565
CO	Parker, Tech. Mktg. Assoc.	303-841-3435
FL	Melbourne, EMS Inc.	305-724-1027
IL	Schaumburg, Gassner & Clark Co.	312-882-8608
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MN	Minneapolis, Electromark	612-881-3306
MO	St. Louis, Beams Co.	314-569-1060
NJ	Flanders, K & R Engrg. Sls.	201-584-5235
OH	Cleveland, Arthur H. Baier Co.	216-461-6161
PA	Newtown, Yax Assocs.	215-860-2540
TX	Irving, Kite Elctrn. Sls.	214-438-9336

INTEGRATED COMPUTER SYSTEMS, 6305 Arizona Pl., P.O. Box 45405, Los Angeles, CA 90045, Tel: 213-417-8888, Telex: 4995168 ICS LA; Empl.: 80; *Sls. Mgr.:* Ruth Dordick

INTEGRATED DEVICE TECHNLG., INC., 3236 Scott Blvd., Santa Clara, CA 95051, Tel: 408-727-6116, TWX: 910-338-2070; FSC No.: 61772; Empl.: 240; *Sls. Mgr.:* Lanny Flessas

INTEGRATED MICROWAVE, 11526 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-457-0277, TWX: 910-335-2037; FSC No.: 60656; *Sls. Mgr.:* Art Brand

INTEL MEMORY SYSTEMS, 1302 N. Mathilda, Sunnyvale, CA 94086, Tel: 408-734-8102, TWX: 910-339-9361; FSC No.: 34649; Empl.: 600; *Sls. Mgr.:* G. Andersen, Mktg. Mgr.

INTERACTIVE
Computer Products, Inc.

INTERACTIVE COMPUTER PRODUCTS, INC., 23591 El Toro Rd., Ste. 180, El Toro, CA 92630, Tel: 714-770-5332, Telex: 469459; *Sls. Mgr.:* Jim Bearden

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
CA	Sunnyvale, Industrial Modules	408-737-7727
CA	Van Nuys, Momjian & Associates	213-764-4891
CO	Aurora, Garrett Sls. Co.	303-695-3720
GA	Stone Mountain, 20th Century Mktg.	404-292-7088
MA	Waltham, Benchmark Associates	617-899-3390
NY	Staten Island, Budd-Tronics Sales	212-494-7894
TN	Knoxville, 20th Century Mktg.	615-690-1618
UT	Salt Lake City, Garrett Sls. Co.	801-350-7406

INTERACTIVE MICRO SYS., INC., 644 Davisville Rd., Willow Grove, PA 19090

INTERCONICS, BMC Industries, Inc., 610 Bremer Tower, St. Paul, MN 55101, Tel: 612-228-6512, Telex: 297022; *Sls. Mgr.:* Lee Jamison

INTERCONNECT DEVICES, INC., 5101 Richland Ave., Kansas City, KS 66106, Tel: 913-342-5544, Telex: 437-262; *Sls. Mgr.:* Edward J. Schifman

Local Sales Offices & Reps

AZ	Phoenix, Piper Sls. Co.	602-949-0048
CA	Los Angeles, M.A. Stolaroff Co.	213-295-7781
CA	Santa Clara, Electro Venture	408-727-1553
CO	Denver, Piper Sls. Co.	303-443-5337
CT	Canton, Bell Controls	203-693-8926
FL	Orlando/Ft. Lauderdale, Equipment Sales	305-339-2972
GA	Atlanta, Equipment Sales	404-992-7180
MN	Minneapolis, Mil-Com Marketing	612-944-8030
NH	Nashua, Bell Controls	603-882-6984
NY	New York, Sprung-Nussbaum	201-569-5666
TX	Dallas, R. F. Kimball	214-231-3447

INTERCONNECTION TECHNOLOGY, INC., 5542 Buckingham Drive, Huntington Beach, CA 92649, Tel: 714-891-5305, TWX: 910-596-1879; *Sls. Mgr.:* Ken Rhines .... **2**•1890

Local Sales Offices & Reps

AZ	Scottsdale, Semi-sys. Arizona, Inc.	602-991-1151
CA	El Segundo, Varigon Assocs.	213-322-1120
CA	El Toro, Varigon Assocs.	714-855-0233
CA	San Diego, Varigon Assocs.	619-576-0100
CA	Santa Clara, DC Elctrns.	408-980-1199
IL	Park Ridge, Probe Elctrns.	312-696-2828
MD	Pasadena, Macrotech Assocs.	301-437-5588
NM	Albuquerque, Syntech	505-266-7951
OH	Mansfield, Ralph Meckling Assocs.	419-756-4433
WA	Edmonds, Cunningham Sales, Inc.	206-771-4848

INTERDESIGN, INC., 1500 Green Hills Rd., Scotts Valley, CA 95066, Tel: 408-438-2900, TWX: 910-339-9374; Empl.: 230

Local Sales Offices & Reps

IL	Schaumburg, Interdesign	312-397-1990
MA	Burlington, Interdesign	617-229-5811

INTERDYNE CO., 157 Topaz St., Milpitas, CA 95035, Tel: 408-943-9133; FSC No.: 31598; Empl.: 30

INTERELECTRONICS CORP., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920, Tel: 914-EL8-8000; Empl.: 82; *Sls. Mgr.:* M. H. Pintell; *Dist. Mgr.:* G. Sherwood .... **3**•1598

INTERFACE, 7401 Butherus Dr., Scottsdale, AZ 85260, Tel: 602-948-5555, Telex: 668-394; FSC No.: 32311

INTERFACE ENGRG., 386 Lindelof Ave., Stoughton, MA 02072, Tel: 617-344-7383, Telex: 940-848; FSC No.: 14352; Empl.: 25; *Sls. Mgr.:* Thomas Scanlon .... **3**•1164, 1165

Local Sales Offices & Reps

NY	Great Neck, Industron Assoc.	516-487-2620
VA	Arlington, Gans & Pugh	703-527-3262

INTERFACE TECH. DYNATECH, 150 East Arrow Hill Way,, San Dimas, CA 91773, Tel: 714-592-2971

INTERGALACTIC CORP., Box 7025, Salt Lake City, UT 84107, Tel: 801-262-0094

INTERLOK
ONE OF THE **PURDY** GROUP OF COMPANIES

INTERLOK, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-348-5625, TWX: 910-374-2353; FSC No.: 55951; Empl.: 30; *Sls. Mgr.:* Ray Vorce .... **2**•1038, 1039, 1334-1337, 1761

Local Sales Offices & Reps

AZ	Tempe, Foley, Tallent & Lee	602-894-2345
AR	Little Rock, J. Y. Schoonmaker	501-375-2168
CA	Anaheim, Impact Elctrns., Inc.	714-553-1351
CA	Burlingame, W. J. Purdy	415-347-7701
CO	Denver, W. J. Purdy	303-777-1411
CT	Hartford, Sturgeon	203-249-7800
IL	Elmhurst, Hill-Gray Assoc.	312-832-4101
IN	Indianapolis, Sukup & Cox	317-253-5501
IA	Marion, MSB Assocs.	319-377-6261
KS	Shawnee Mission, MSB Assocs.	913-432-2131
MD	Lisbon, S. K. MacDonald	301-442-1590
MA	Needham Hgts., P. R. Sturgeon	617-444-6603
MI	Ferndale, Hilltronics	313-398-5556
MO	Hazelwood, MSB Assocs.	314-895-4700
NJ	Englewood, Harold Gray	201-894-0894
NM	Albuquerque, W. J. Purdy	505-266-7959
NY	Syracuse, Paston-Hunter	315-437-2843
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OK	Tulsa, J. Y. Schoonmaker	918-444-0373
OR	Beaverton, William J. Purdy	503-641-9373
PA	Philadelphia, S. K. MacDonald	215-545-1205
TX	Dallas, J. Y. Schoonmaker	214-349-1650
TX	Houston, J. Y. Schoonmaker	713-738-2427
WA	Redmond, William J. Purdy	206-882-3144

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
AZ	Tempe, Waltronic Sls.	602-967-1020
CA	Chatsworth, Panel Parts Co.	213-998-5991
CA	Santa Clara, Dynametron	408-727-6531
CA	Santa Clara, Waltronic Sls.	408-727-1200
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Wallingford, Sager Electrical Supp. Co.	203-265-4600
IL	Villa Park, Melvin Elctrns.	312-279-5010
MA	Hingham, Sager Electrical Supp. Co.	617-749-6700
MA	Lynn, Land Elctrn. Supp. Co.	617-592-2220
MA	Waltham, Vantage Elctrns. Corp.	617-894-8690
NJ	Cranford, Garden State Elctrns., Inc.	201-272-6400
NY	Buffalo, Summit Distrs.	716-884-3450
OK	Tulsa, Radio, Inc.	918-587-9123
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TX	Houston, Lenert Co.	713-225-1465
VA	Richmond, Instrument Tech. Rep.	804-275-1431

INTER-MARKET, 1946 Lehigh Ave., Glenview, IL 60025, Tel: 312-729-5330, TWX: 910-651-1997; FSC No.: 34165; Empl.: 10; *Sls. Mgr.:* Phil Gardanier .... **1B**•1088, 1649

Local Sales Offices & Reps

MA	Braintree, Nova Assoc.	617-848-9330
MN	St. Paul, Kenco Tronics	612-645-7717
PA	Rydal, Espy Sls.	215-576-0780
TX	Irving, Kite Elctrn. Sls.	214-438-9336
WA	Redmond, Elctrn. Mktg.	206-882-0962

Local Distributors

CA	Chatsworth, Mil-Comm Distr.	213-998-3111
CO	Denver, Integrated Elctrns.	303-292-6121
ID	Spirit Lake, A-1 Electronics	800-635-1545
IL	Chicago, Newark Elctrns.	312-638-4411
MI	Grand Rapids, S-F Electronics	616-459-0216
MN	St. Paul, K.D.I. Inc.	612-645-5090
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Fairlawn, Relay Specialties	201-797-3313
OH	Dayton, Stotts-Friedman	513-298-5555
PA	Willow Grove, Resco Electric	215-659-4575
TX	Austin, Galtronics	512-837-7470
WI	Mequon, Lake-View Elctrn.	414-377-8250
WI	Oshkosh, Electronic Inds.	414-235-8930
Can	Montreal, Que., Braydon Electro	514-332-5650

INTERMATIC, Intermatic Plaza, Spring Grove, IL 60081, Tel: 815-675-2321, Telex: 25-265; Empl.: 1000

INTERNATIONAL COMPS. CORP., 105 Maxess Rd., Melville, NY 11747, Tel: 516-293-1500, TWX: 510-224-6409; Empl.: 100; *Sls. Mgr.:* Irwin Okin .... **1A**•1074, 1876, 2096; **2**•1338; **3**•1030

Local Sales Offices & Reps

AL	Huntsville, EMA	205-533-6640
AZ	Tempe, Electronic Dev. & Sls.	602-829-9699
CA	Anaheim, Impact Elctrns.	714-533-1351
CA	Anaheim, Impact Elctrns.	714-533-1351
CA	Redwood City, Hickey Inds.	
CT	Bethel, GM Branch	203-744-1426
CT	Vernon, G-M Assoc.	203-646-4443
FL	Casselberry, HAI	305-752-7520
FL	Coral Springs, HAI	305-752-7550
GA	Atlanta, EMA	404-329-0530
IL	Arlington Heights, MJ Petersen & Assoc.	312-577-8200
IN	Fort Wayne, Jim Finnegan & Co.	219-747-7650
IA	Cedar Rapids, IOWA Tech. Sls.	319-377-5795
MD	Baltimore, Espy Sls. Co.	301-444-6982
MA	Framingham, G-M Assoc.	617-872-4871
MA	Stroughton, GM Assocs.	617-344-0116
MN	Minneapolis, PSI	612-944-8545
NH	Exeter, GM Branch	603-778-7472
NJ	East Brunswick, Winch Sls. Assocs.	201-828-4615
NY	Jericho, Metro Tech. Sls.	516-935-3330
NY	Syracuse, Nycom	315-437-8343
NC	Pineville, EMA	704-541-2628
NC	Winston-Salem, EMA	919-784-7304
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
PA	Camp Hill, ESPY Branch	717-763-9577
PA	Rydal, Espy Sls. Co.	215-576-0780
TN	Donnelson, EMA	615-883-1414
TN	Jonesboro, EMA Branch	615-753-8861
TX	Austin, Mech-tron Mktg.	512-835-0980
TX	Dallas, Mech-tron Mktg.	214-343-3786
TX	Houston, Mech-tron Mktg.	713-462-1432
WA	Edmonds, McLaughlin Mktg. Inc.	206-743-1161

Local Distributors

AZ	Phoenix, ACC	602-269-5655
CA	Canoga Park, Myco Vickers	213-340-2025
CA	Redwood City, Hi-Cor	415-365-5087
CO	Denver, Integrated Elect.	303-623-8713
CT	Danbury, Pilgrim Elect.	203-792-7274
CT	East Haven, JV Elctrns.	203-469-2321
CT	Wallingford, Midstate Elctrns. Co.	203-265-9900
FL	Ft. Lauderdale, National Resistor Co.	305-772-4500
MD	Baltimore, Lorac Elctrns. Co.	301-247-1682
MN	Eden Prarie, Cassidy Elec. Co.	612-944-0100
MN	Minneapolis, Cassidy Elctrns.	612-835-7746
PA	Philadelphia, Mur'Tronics	215-632-4330
PA	Philadelphia, Jan Indl. Elec.	215-WA 2-1321
TX	Ft. Worth, C & W Supp. Co.	817-831-0395

INTERNATIONAL CRYSTAL MFG., 10 N. Lee, P.O. Box 26330, Oklahoma City, OK 73126, Tel: 405-236-3741, Telex: 747-147, TWX: 910-831-3177; Empl.: 165; *Sls. Mgr.:* Paul E. Denwalt .... **1A**•1367

INTERNATIONAL DATA SCIENCES, 7 Wellington Rd., Lincoln, RI 02865, Tel: 401-333-6200, TWX: 710-384-1911; Empl.: 125

INTERNATIONAL DEVICES INC., 3200 Pendleton, Santa Ana, CA 92704, Tel: 714-557-9394, 800-854-7651, Telex: 681387; FSC No.: 53763; *Sls. Mgr.:* Alan J. Vanek; *Dist. Mgr.:* Alan J. Vanek

INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 312-358-4622; Empl.: 30; *Sls. Mgr.:* T. Pretto .... **3**•1031

Local Sales Offices & Reps

NY	New York, United Research Labs.	212-751-4660

INTL. ELCTRN. RESCH., 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 213-849-2481, TWX: 910-498-2206; FSC No.: 98978; Empl.: 116; *Sls. Mgr.:* J.S. Smith

INTERNATIONAL HIGH VOLTAGE ELCTRNS., INC., 98 Mill Plain Rd., Danbury, CT 06810, Tel: 203-792-7820; *Sls. Mgr.:* A. Pellegrino .. **3**•1599-1601

Local Sales Offices & Reps

CT	Waterbury, HLM Assocs.	203-753-9894
NJ	Parsippany, HLM Assocs.	201-263-1535
NY	Northport, HLM Assocs.	516-757-1606

INTERNATIONAL INSTRUMENTATION, 31131-602 Via Colinas, Westlake Vlg., CA 91362, Tel: 213-991-9614; *Sls. Mgr.:* C. D. Morrison; *Dist. Mgr.:* D. Casey

INTERNATIONAL INSTRUMENTS, 88 Marsh Hill Rd., Orange, CT 06477, Tel: 203-795-4711, TWX: 710-465-2897; Empl.: 150; *Dist. Mgr.:* J. Connolly

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Burlingame, Engrg. Rep.	415-348-5042
CA	Los Angeles, Barnard & Assocs.	213-515-2978
CA	San Diego, Engrg. Rep.	714-565-2131
CO	Denver, Nelson	303-573-1516
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Chicago, Memeco Sls. & Svc.	312-774-0919
KS	Shawnee Mission, Tech. Sls. Assoc.	913-888-3330
MD	Perry Hall, Electra-Tech	301-256-2723
MA	Hingham, Northeast Reps.	617-749-8700
MN	Eden Prairie, Yukon Sls. Assocs.	612-941-8155
MO	Ferguson, Tech. Sls. Assocs.	314-725-5361
NJ	Berkley Heights, NBS Assocs.	201-464-8500
NY	Rochester, H.C. Johnson Agencies	716-586-0777
NY	Williamsville, H.C. Johnson Agencies	716-632-7880

NC	Charlotte, D.G.W.	704-334-7090
NC	Winston Salem, D.G.W.	919-768-7166
OH	Westlake, Advanced Tech. Assocs.	216-835-5050
OK	Tulsa, Telstar Instr.	918-628-1011
OR	Portland, Garland Affolter Engrg.	503-223-7349
PA	Glenshaw, H.C. Johnson Agencies	412-487-1246
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Houston, Wilson-Markham Assoc.	713-445-5780
VA	Dumfries, Electra-Tech	703-670-6962
WA	Kirkland, Garland Affolter Engrg.	206-822-2275

INTERNATIONAL LASER SYS., 3404 N. Orange Blossom Trail, Orlando, FL 32804, Tel: 305-295-4010, TWX: 810-850-0195; Empl.: 408; *Sls. Mgr.:* W. C. Hudson

INTERNATIONAL MFG. SVCS., 50 Schoolhouse La., Portsmouth, RI 02871, Tel: 401-683-9700; Empl.: 25; *Sls. Mgr.:* Jay Benson

INTERNATIONAL MICROELECTRONIC PRODS., 2830 North First Street, San Jose, CA 95134, Tel: 408-262-9100, Telex: 499-1041, TWX: 910-338-2274; *Sls. Mgr.:* Robert Kromer

INTERNATIONAL MICROSYSTEMS, 11554 C Ave., Auburn, CA 95603, Tel: 916-885-7262, TWX: 910-367-3706; Empl.: 12; *Sls. Mgr.:* Gail Jones

INTERNATIONAL MICROTRONICS CORP., 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900, TWX: 910-952-1170; Empl.: 25; *Sls. Mgr.:* Otto Fest; *Dist. Mgr.:* Janice Dougall

INTERNATIONAL POWER MACHINES, 11534 Pagemill Rd., Dallas, TX 75243, Tel: 214-343-6076; *Sls. Mgr.:* Jack Conn

INTERNATIONAL RECTIFIER CORP., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, Tel: 213-772-2000, Telex: 472-0403, TWX: 910-348-6291; Empl.: 1200; *Sls. Mgr.:* W. Lewis; *Dist. Mgr.:* D. Coppinger

Local Sales Offices & Reps

IL	Palatine	312-991-5520
MN	Edina	612-831-6400
NJ	Pallisades Park	201-943-4554
OH	Independence	216-447-9717
VA	Charlottesville	804-973-1316
WI	Elm Grove	414-784-2480

INTERNATIONAL RESOURCE SVCS., 7343 N.W. 79th Terr., Miami, FL 33166, Tel: 305-884-2924, Telex: 522261 MIA DEPT 262; Empl.: 5; *Sls. Mgr.:* Richard L. Winn

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111; Empl.: 45 .... **1A•1661**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assoc. SW	602-966-1788
CA	Claremont, Gandalf Elctrns.	714-626-5481
CA	Palo Alto, Tri-Rep	415-965-1822
CT	Branford, LJM Assocs.	203-488-4244
FL	Plantation, Electro-Mechanical Standards	305-587-7146
IL	Chicago, Esco Assocs.	312-763-0800
MA	Westboro, RJC Assocs.	617-366-0399
MN	Minneapolis, R-J Inc.	612-866-3661
NY	Syracuse, Labtronics	315-455-7314
NY	Wantagh, Bytec Reps.	516-781-7400
OR	Beaverton, Ravencraft	503-646-9261
PA	Southampton, Campbell Assocs.	215-322-6630
TX	El Paso, Nokomis Consumer Prods.	915-778-2801
TX	Euless, Andy Byles Intl.	817-267-4099
VA	Fairfax, Schibley Assoc.	703-591-3008

INTERNATIONAL TRANSDUCER, 93 Castilian Dr., Goleta, CA 93117, Tel: 805-685-1441, Telex: 658 495; FSC No.: ID 532; Empl.: 75; *Sls. Mgr.:* Glen E. Liddiard

INTERNATIONAL WIRE PRODUCTS CO., 500 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-5800, Telex: 642580; Empl.: 700; *Sls. Mgr.:* C. D. Abbott

INTEROPTICS
ONE OF THE PURDY GROUP OF COMPANIES

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727 .... **1B•1114, 1115**

INTERSIL, 10710 N. Tantau Ave., Cupertino, CA 95014, Tel: 408-996-5000, TWX: 910-338-0583; FSC No.: 32293; Empl.: 4102; *Dist. Mgr.:* Bruce Mattern

INTERSTATE ELECTRONICS CORP., Box 3117, 1001 E. Ball Rd., Anaheim, CA 92803, Tel: 714-635-7210, Telex: 655443, TWX: 910-591-1197; FSC No.: 6625, 5985; Empl.: 1500; *Sls. Mgr.:* Darryl Watanabe; *Dist. Mgr.:* R. Sorenson

INTERSWITCH

INTERSWITCH, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TWX: 910-374-2353; Empl.: 30; *Sls. Mgr.:* Ray G. Vorce .... **1B•1650**

Local Sales Offices & Reps

AZ	Tempe, Foley, Tallent & Lee	602-894-2345
AR	Little Rock, J. Y. Schoonmaker	501-375-2168
CA	Burlingame, W. J. Purdy	415-347-7701
CA	Costa Mesa, Berman-Gravely Co.	714-549-2122
CO	Denver, W. J. Purdy	303-777-1411
CT	Hartford, Sturgeon	203-249-7800
IL	Elmhurst, Hill-Gray	312-832-4101
IN	Indianapolis, Sukup & Cox	317-253-5501
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs.	913-432-2131
MD	Baltimore, S. K. MacDonald	301-254-3380
MA	Needham Hgts., P. Sturgeon	617-444-6603
MI	Ferndale, Hilltronics	313-398-5556
MO	Hazelwood, M-S-B Assocs.	314-895-4700
NJ	Englewood, H. Gray	201-894-0894
NM	Albuquerque, W. J. Purdy	505-266-7959
NY	Syracuse, Paston-Hunter	315-437-2843
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OK	Tulsa, J. Y. Schoonmaker	918-583-0912
OR	Beaverton, William J. Purdy	503-641-9373
PA	Philadelphia, S. K. MacDonald	215-545-1205
TX	Dallas, J. Y. Schoonmaker	214-349-1650
TX	Houston, J. Y. Schoonmaker	713-738-2427
UT	Salt Lake City, William J. Purdy	801-486-8557
WA	Redmond, William J. Purdy	206-882-3144

Local Distributors

AZ	Tempe, Waltronic Sls.	602-967-1020
AZ	Tempe, Anjon Entprs.	602-894-1332
CA	Chatsworth, Panel Parts Co.	213-998-5991
CA	N. Hollywood, Merit Comp. Supp.	213-842-8162
CA	Santa Clara, Waltronic Sls.	408-727-1200
CO	Denver, Ragon	303-744-3601
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
IL	Addison, L Comp-Chicago	312-628-1400
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
MA	Lynn, Land Elctrn. Supp. Co.	617-592-2220
MN	Minneapolis, Bergquist	612-835-2322
NJ	Englewood, Tech. Elctrn./Powell	201-894-0800
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Rochester, Summit Distrs.	716-334-8110
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
PA	Willow Grove, Resco Elctrns.	215-659-4575
TX	Houston, Harrison Equip. Co.	713-879-2600
WI	Mequon, Taylor Elec. Co.	414-241-4321

The Inter-Technical Group Inc.
WIMA Division

INTER-TECHNICAL GRP., Box 23, Irvington, NY 10533, Tel: 914-591-8822, TWX: 710-564-0802; Empl.: 13; *Sls. Mgr.:* T. A. Galgano .... **1A•1075-1079**

Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
AZ	Scottsdale, Semper Fi Sls. Inc.	602-991-4606
CO	Lakewood, Palmer Assocs.	303-233-9423
CT	Colchester, Normell Assocs.	203-537-5555/3758
FL	Altamonte Springs, "C" Assocs.	305-831-1717
GA	Dunwoody, J. R. Assocs.	404-399-1831
IL	Westchester, W. G. Brouilette & Assocs.	312-345-6500
MA	Newton, Normell Assocs.	617-969-5478
MN	Minneapolis, Intl. Sls.	612-831-8423
NJ	Colonia, H. B. Heft Assocs.	201-381-5193
NY	Lynbrook, H. B. Heft Assocs.	516-LY 9-3351
NY	Rochester, BKT Assocs.	716-586-5814
NC	Kennersville, Naylor Assocs.	919-996-4162
OR	Portland, Harry Levinson Co.	503-245-1902
PA	King of Prussia, R. D. Freedman Assocs.	215-279-5767
PA	W. Conshohocken, Eastern Comps. Sls. Corp.	215-825-8610
TX	Carrollton, Paulsen Elctrn. Sls.	214-386-4785
UT	Salt Lake City, Alpine Entprs.	801-278-6920
VA	Manassas, Eastern Comps. Sls.	800-223-3850
WA	Seattle, H. Levinson Co.	206-323-5100

INTEX MICRO SYSTEMS CORP., 725 S. Adams Rd., Suite L-8, Birmingham, MI 48011, Tel: 313-540-7601, Telex: 230254 WUPUBTLX; *Sls. Mgr.:* R. Thielman

INTRA-COMPUTER, 101 W. 31st St., New York, NY 10001, Tel: 212-947-5533, Telex: 64-5067; Empl.: 9; *Sls. Mgr.:* Art Yaglian

intronics

INTRONICS, INC., 57 Chapel St., Newton, MA 02158, Tel: 617-964-4000, Telex: 200095, TWX: 710-335-6835; Empl.: 130; *Sls. Mgr.:* J. Swartz .... **3•1602, 1603**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mfrs. Agts.	205-830-4030
AZ	Tempe, Delta Elctrns.	602-966-9903
CA	Los Altos Hills, HB Marketing	415-941-4080
CA	Temple City, HMC Inc.	213-285-0485
CO	Denver, Anderson Assoc.	303-295-3342
CT	Guilford, Elctrn. Mktg. Assoc.	203-543-5424
FL	Melbourne, Reynolds & Assoc.	305-259-7000
GA	Atlanta, Elctrn. Mfrs. Agts.	404-329-0530
IL	Palatine, Kingston Comps.	312-359-7990
IN	Fort Wayne, Domino Unlimited	219-747-5621
IA	Cedar Rapids, Technical Electronics	319-362-4116
KS	De Soto, Midtec Assoc.	913-441-6565
MD	Severna Park, DelMarva Engr.	301-647-8007
MI	Southfield, Infinity Inc.	313-557-7230
MN	Minneapolis, Dan'l Engr.	612-854-7550
MO	Florissant, Midtec Assoc.	314-837-5200
NH	Salem, Elctrn. Mktg. Assoc.	603-893-5378
NJ	Vincentown, Eastern Sci. Mktg.	609-268-0250
NY	Canandaigua, Bensman/Upstate	716-396-2498
NY	Jericho, J-Square Mktg.	516-935-3200
NC	Pineville, Elctrn. Mfrs. Agts.	919-781-4139
OH	Dayton, Del Steffen & Assoc.	513-293-3145
PA	Chalfont, Eastern Sci. Mktg.	215-822-6503
TN	Jonesboro, Elctrn. Mfrs. Agts.	615-753-5844
TX	Richardson, Scientific Sls.	214-231-6541
WA	Seattle, Data Com. Assoc.	206-285-2525

ION PHYSICS CO., Div. High Voltage Engrg. Corp., P.O. Box 416, So. Bedford St., Burlington, MA 01803, Tel: 617-272-2800, Telex: 951733

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935; Empl.: 50; *Sls. Mgr.:* D. T. Cusack

IQ SYSTEMS, Applied Circuit Tech., 2931 La Jolla St., Anaheim, CA 92806, Tel: 714-630-6834; *Sls. Mgr.:* Jim Stedt

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 617-369-7118; Empl.: 10; *Sls. Mgr.:* S. J. Sommer

ISC MAGNETICS DIV., See Aeroflex Labs., Inc., Magnetic Prods. Div.

ISKRA ELECTRONICS, INC., 8 Greenfield Rd., Syosset, NY 11791, Tel: 516-364-2616 ....**1A**•1080, 1081, 1877, 2039, 2097; **1B**•1443

ISL PRODUCTS INTL. LTD., 235 P Robbins Lane, Syosset, NY 11791-6093, Tel: 516-822-9601, TWX: 510-221-2109; Empl.: 25,000; *Sls. Mgr.:* Ken Kawaller ....**1A**•1082, 1083, 2098

Local Sales Offices & Reps

IL	Lake Bluff, R & R Marketing	312-295-6660
IN	Noblesville, Newton & Assoc.	317-845-8157
MD	Pikesville, Muncy Sls.	301-484-6376
MA	Topsfield, RFC Assocs.	617-887-8545
TX	Dallas, Dick Bellew Sls.	214-373-4590
VA	Charlottesville, Electronic Sources	804-953-6315

ISOCHEM PRODS. CO., A Sub. of Rohm and Haas Adv. Matls. Co., 99 Cook St., Lincoln, RI 02865, Tel: 401-723-2100; Empl.: 26; *Sls. Mgr.:* Arthur M. Goldfarb

ISOLATION PRODUCTS, INC., 1245 Birchwood Dr., Sunnyvale, CA 94086, Tel: 408-734-4068; *Sls. Mgr.:* Joseph D. Bianco

ISOREG CORP., 410 Great Rd., P.O. Box 486, Littleton, MA 01460, Tel: 617-486-9483, TWX: 710-347-6974 ISOREG LTTN; Empl.: 65; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

the connection for...
ITT Components
"The relay for you"
distributor specialists
632 Santa Monica Blvd.
Santa Monica,
California 90401
(213) 393-9666
A regional distributor of quality electronic components

ISOTEMP RESEARCH, INC, Box 3389, Charlottesville, VA 22901, Tel: 804-295-3101; FSC No.: 031785; Empl.: 30 ....**1A**•1368, 1369

Local Sales Offices & Reps

AZ	Scottsdale, Faser Technical Sls.	602-948-4404
CA	Costa Mesa, EBA Microwave	714-857-6079
CA	Fremont, Wm. Parks & Assocs.	415-490-2011
CA	San Diego, Qualtronics	619-560-8955
CO	Denver, W. H. Howard Assoc.	303-353-7281
IL	Woodridge, Trend-Tronics	312-985-0626
IN	Fort Wayne, Given Corp.	219-432-5585
MD	Columbia, M. Lader Co.	301-730-1550
MD	Conowingo, M. Leader Co.	301-272-3449
NY	Melville, Carnes Assoc.	516-694-1600
PA	Lafayette Hill, M. Lader Co.	215-825-3177

ISOTRONICS, Industrial Park, New Bedford, MA 02745, Tel: 617-998-2000, TWX: 710-344-1961; *Sls. Mgr.:* Mike LoFrumento

ITEK MEASUREMENT SYS., Div. Litton Inds., 27 Christina St., Newton, MA 02161, Tel: 617-969-7300, TWX: 710-335-6783; Empl.: 100 ....**1B**•1845

Local Sales Offices & Reps

CA	Los Angeles, Measurement Sys. Div.	213-641-0476
FL	Orlando, K. S. Chaney	305-293-5656
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
MN	Minneapolis, Marsland Assocs.	612-545-4481
NJ	Metuchen, Measurement Sys. Div.	201-548-1500
NM	Las Cruces, BFA Corp.	505-524-9693

Local Distributors

FL	Orlando, Kenneth S. Chaney	305-423-9465
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MN	Minneapolis, Marsland Assocs.	612-545-4481
NM	Las Cruces, BFA Corp.	505-524-9693
Intl	England, Tadley, Hampshire, Hightech Comps., Ltd.	07356-3922
Intl	France, Paris, Sedeme	580.72.000
Intl	Germany, Munich, Weltronic GmbH	089-49 20 66
Intl	Holland, Rotterdam, Anru	010-137395
Intl	India, Bombay, Echbee Corp.	253489
Intl	Israel, Tel-Aviv, Airtronic Engrg. Ltd.	45 48 71
Intl	Italy, La Spezia, Motordiesel Elec. Instr. & Comp.	36.232
Intl	Japan, Tokyo, Nippon Engrg. Sys.	494-4045
Intl	Norway, Oslo, Ole A. Nordby A/S	02 55 07 50
Intl	Sweden, Bromma, Magnetic AB	08-2904-60

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, TWX: 510-255-9307; Empl.: 120; *Sls. Mgr.:* Allen Roth

ITOH ELECTRONICS, INC., 5301 Beethoven St., Los Angeles, CA 90066, Tel: 212-682-0420, Telex: 12-5059; Empl.: 100; *Sls. Mgr.:* F.I. Makstein, VP Mktg.

ITT CANNON, 10550 Talbert Avenue, P.O. Box 8040, Fountain Valley, CA 92708, Tel: 714-964-7400, Telex: 65-5358, TWX: 910-596-2620; FSC No.: 71468; Empl.: 2500; *Sls. Mgr.:* Bruce Simpson; *Dist. Mgr.:* Frank Cosentino ....**2**•1339-1354

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens & Co.	205-833-0445
AZ	Phoenix, ITT Cannon	602-275-4792
CA	Campbell (San Jose), ITT Cannon	408-559-1777
CA	Fountain Valley, ITT Cannon	714-964-7400
CA	San Diego, ITT Cannon	619-560-0917
CA	Santa Ana, ITT Cannon	714-557-4700
CO	Denver, ITT Cannon	303-778-1855
CO	Littleton, ITT Cannon	303-973-8766
CT	Danbury, ITT Cannon	203-748-5801
CT	Enfield, ITT Cannon	203-749-7246
FL	Deerfield Beach, Brandel-Stephens & Co.	305-427-8558
FL	Orlando, Brandel-Stephens & Co.	305-425-3202
GA	Atlanta, Brandel-Stephens & Co.	404-261-7579
IL	Des Plaines, ITT Cannon	312-297-3150
IN	Fort Wayne, ITT Cannon	219-484-6447
IA	Swisher, ITT Cannon	319-369-9107
KS	Haysville, ITT Cannon	316-529-0127
MD	Baltimore, ITT Cannon	301-254-3707
MD	Baltimore, ITT Cannon	301-882-4760
MA	Wakefield, ITT Cannon	617-246-2510
MI	Sterling Heights, ITT Cannon	313-643-4620
MN	Minneapolis, ITT Cannon	612-854-1973
MO	Bridgeton, ITT Cannon	314-739-6040
NM	Albuquerque, ITT Cannon	505-293-0457
NY	Buffalo, L-Mar Assoc.	716-675-1277
NY	East Syracuse, L-Mar Assoc.	315-437-7779
NY	Henniker, ITT Cannon	603-428-3883
NY	Holbrook, ITT Cannon	215-646-2801
NY	Ithaca, L-Mar Assoc.	607-257-5712
NY	Poughkeepsie, ITT Cannon	914-473-3314
NY	Rochester, L-Mar Assoc.	716-323-1000
NC	Greensboro, Brandel-Stephens & Co.	919-274-6952
OH	Kettering, ITT Cannon	513-434-8181
OH	Uniontown, ITT Cannon	216-494-6749
PA	Blue Bell, ITT Cannon	215-646-2801
PA	Trevose, P.S.A., Inc.	215-245-0513
TX	Dallas, ITT Cannon	214-661-0302
TX	Houston, ITT Cannon	713-777-1177
WA	Bellevue, ITT Cannon	206-454-3903
WI	Waukesha, ITT Cannon	414-544-1018

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	San Diego, Richey/Western	619-271-4511
CA	Sun Valley, Richey Elctrns.	213-875-2862
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Denver, Arrow Elctrns.	303-758-4585
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
GA	Atlanta, Electro Air	404-351-3545
IL	Bensenville, Hall-Mark Elctrns.	312-860-3814
IN	South Bend, Genesis Elctrns.	219-287-2911
MA	Woburn, Time Elctrns.	617-935-8080
MO	St. Louis, Time Elctrns.	314-391-6444
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Time Elctrn. Sls.	516-273-0100
NY	Plainview, A.S.I./Progress	516-433-1700
PA	Broomall, Time Elctrns.	215-359-1200
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Warminster, Henwarr	215-675-4104
TX	Dallas, Hall-Mark	214-343-5000
TX	Stafford, Harrison Equip.	713-879-2600
WA	Bellevue, Almac Elctrns.	206-643-9992

ITT CANNON ELECTRIC, 666 East Dyer Rd., Santa Ana, CA 92702, Tel: 714-557-4700

ITT COMPS. ELECTROMECHANICAL GRP., 3201 So. Standard St., Santa Ana, CA 92705, Tel: 714-751-3900, Telex: 681-389, TWX: 910-595-1744; FSC No.: 61725; Empl.: 35; *Sls. Mgr.:* J Biggs; *Dist. Mgr.:* C. McElroy ....**1B**•1444- 1450, 1489

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens & Co.	205-883-0445
AZ	Scottsdale, Semi-Systems	602-991-1151
CA	Anaheim, Spectrum	714-630-6977
CA	Mountain View, Caltron Comps.	415-964-3244
CA	San Diego, C.K. Assocs.	619-279-0420
CO	Denver, I W Strong & Assoc	303-292-6900
CT	Guilford, Data Mark	203-453-0575
FL	Deerfield Beach, Brandel-Stephens & Co.	305-427-8558
FL	Orlando, Brandel-Stephens & Co.	305-425-3202
GA	Atlanta, Brandel-Stephens & Co.	404-261-7579
IL	Rolling Meadows, Sieger Assoc.	312-991-6161
IN	Fort Wayne, M/S Sls.	219-484-1904
KS	Leawood, Thunderbird Tech. Sls.	913-642-722
MD	Millersville, Trimark	301-987-910
MA	Southboro, KSA of New England	617-485-943
MI	Brighton, SAI Mktg.	313-227-178
MN	Minneapolis, SAI Mktg.	612-935-077
MO	Maryland Heights, Thunderbird Tech. Sls.	314-567-648
NM	Albuquerque, Syn Tech	505-266-795
NY	Manhasset, Wincor Elctrns.	516-627-947
NY	Rochester, D. L. Eiss Assoc.	716-328-300
NC	Greensboro, Brandel-Stephens & Co.	919-274-695
OH	Beachwood, Thompson & Assoc.	216-831-627
OH	Dayton, Thompson & Assoc.	513-435-773
OR	Portland, Jas. J. Backer Co.	503-297-847
PA	Prospect Park, Elf Sls.	215-534-334
TX	Austin, Norcom	512-451-275
TX	Dallas, Norcom	214-386-488
UT	Salt Lake City, I W Strong	810-942-699
VA	Lynchburg, Trimark	804-528-068
WA	Seattle, Jas. J. Backer Co.	206-285-130

Local Distributors

AL	Huntsville, RM Elctrns.	205-852-155
AZ	Phoenix, Kachina Elctrn. Distr.	602-269-620
AZ	Tempe, Richey Western Elctrns.	602-894-925
AZ	Tempe, TIME Elctrns.	602-967-200
CA	Anaheim, TIME Elctrns.	714-937-091
CA	Chatsworth, Integrated Elctrns.	213-998-220

CA	Irvine, Integrated Elctrns.	714-660-1055
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Los Angeles, Richey Western Elctrns.	213-820-3777
CA	San Diego, Richey Western Elctrns.	619-271-4511
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Santa Monica, Distr. Specialists	213-393-9666
CA	Sun Valley, Q.C. Comps.	213-768-6111
CA	Sunnyvale, TIME Elctrns.	408-734-9888
CA	Torrance, TIME Elctrns.	213-320-0880
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, TIME Elctrns.	303-850-7701
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	New Haven, Greene Shaw Co.	203-397-0710
CT	Norwalk, Pioneer Elctrns.	203-853-1515
CT	Stamford, Bond Elctrns.	203-348-2663
FL	Davie, ARCO Distrs.	305-772-4500
FL	Fort Lauderdale, NRC	305-772-4500
FL	Ft. Lauderdale, TIME Elctrns.	305-974-4800
GA	Atlanta, Prehler Elctrns.	404-447-5540
IL	Chicago, NEP Elctrns.	312-625-8400
IN	Indianapolis, RM Elctrns.	317-247-9701
IA	Cedar Rapids, DEECO	319-365-7551
MD	Baltimore, Resco	301-823-0070
MD	Beltsville, TREEKO Sales	301-792-0112
MD	Beltsville, RESCO-Washington	301-937-9100
MD	Columbia, TIME Elctrns.	301-964-3090
MA	Lexington, Pioneer Elctrns.	617-861-9200
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Wilmington, R.C. Components	617-273-1860
MA	Woburn, TIME Elctrns.	617-935-8080
MI	Farmington Hills, Prehler Elctrns.	313-473-7200
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Eden Prairie, Cassidy Elctrns.	612-944-0100
MN	Minneapolis, Industrial Comps.	612-831-2666
MO	St. Louis, TIME Elctrns.	314-391-6444
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Pine Brook, Pioneer Elctrns.	201-227-1262
NJ	Rahway, RSR	201-381-8777
NJ	Whippany, Tonar Inds.	201-884-1400
NM	Albuquerque, Betatron Elctrns.	505-344-2381
NM	Albuquerque, International Elctrns.	505-345-8127
NY	Fairport, Pioneer Elctrns.	716-381-7070
NY	Hauppauge, TIME Elctrns.	516-273-0100
NY	Hauppauge, JACO	516-273-5500
NY	Vestal, Pioneer Elctrns.	607-748-8211
NY	Woodbury, Pioneer Elctrns.	516-921-8700
OH	Columbus, Reptron	614-436-6675
OH	Middleburg Hts., Prehler Elctrns.	216-243-5510
OR	Wilsonville, Zepher Elctrns.	503-582-2929
PA	Broomall, TIME Elctrns.	215-359-1200
PA	Essington, Tri-Com	215-521-3080
PA	Horsham, RM Elctrns.	215-674-1181
TX	Addison, Quality Comps.	214-387-4949
TX	Austin, Quality Comps.	512-835-0220
TX	Dallas, RM Elctrns.	214-263-8361
TX	El Paso, International Elctrns.	915-598-3406
TX	El Paso, ERA Elctrns.	915-592-4126
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Seattle, Richey Western Elctrns.	206-575-1910
WA	Seattle, Zepher Elctrns.	206-241-1980
WI	New Berlin, RM Elctrns.	414-784-4420
WI	New Berlin, NEP Elctrns.	414-785-9100

ITT COMPS. PASSIVE GRP., 3201 S. Standard St., Santa Ana, CA 92705, Tel: 714-751-3900, Telex: 68-1389, TWX: 910-595-1744; FSC No.: 61725; Empl.: 35; *Sls. Mgr.:* Jim Biggs; *Dist. Mgr.:* C. McElroy .... **1A**•1084-1089, 1371

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens & Co.	205-833-0445
AZ	Scottsdale, Semi-Systems Arizona	602-991-1151
CA	Anaheim, Spectrum Assocs.	714-630-6977
CA	Mountain View, Caltron Comp. Corp.	415-964-3244
CA	San Diego, C. K. Assocs.	619-279-0420
CO	Denver, T. W. Strong & Assoc.	303-292-6900
CT	Guilford, Data Mark	203-453-0575
FL	Deerfield Beach, Brandel-Stephens & Co.	305-427-8558
GA	Atlanta, Brandel-Stephens & Co.	404-261-7579
IL	Rolling Meadows, Sieger Assoc.	312-991-6161
IL	Waukegan, Sieger Assoc.	312-991-6161
IN	Fort Wayne, M/S Sls. & Assoc.	219-483-4520
KS	Leawood, Thunderbird Tech. Sls.	913-642-7220
MD	Millerville, Tri-Mark	301-987-9103
MA	Southboro, KSA of New England	617-485-9432
MI	Brighton, SAI Mktg.	313-227-1786
MN	Minneapolis, SAT Mktg.	612-935-0777
MO	Maryland Hts., Thunderbird Tech. Sls.	314-567-6488
NM	Albuquerque, Syntech	505-266-7951
NY	Manhasset, Win-Cor Elctrns. Sls.	516-627-9474
NY	Rochester, D. L. Eiss Assoc.	716-328-3000
NY	Syracuse, D. L. Eiss Assoc.	315-457-0492
NC	Greensboro, Brandel-Stephens & Co.	919-274-6952
OH	Beachwood, Thompson Assoc.	216-831-6277
OH	Dayton, Thompson Assoc.	513-435-7733
OR	Portland, Jas J. Backer Co.	503-297-3777
OR	Salem, Jas J. Backer Co.	503-362-0717
PA	Prospect Park, Elf Sls.	215-534-3340
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
UT	Salt Lake City, I. W. Strong	810-942-6998
VA	Lynchburg, Tri-Mark	804-528-0681
VA	Lynchburg, Tri-Mark	804-528-0681
WA	Seattle, Jas J. Backer Co.	206-285-1300

Local Distributors

AL	Huntsville, RM Elctrns.	205-852-1550
AZ	Phoenix, Kachina Elctrn. Distrs.	602-269-6201
AZ	Tempe, Richey Western Elctrns.	602-894-9251
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Shelley Elctrns.	213-998-3333
CA	Chatsworth, Shelley Elctrns.	619-453-7133
CA	Chatsworth, Integrated Elctrns.	213-998-2200
CA	Irvine, Integrated Elctrns.	714-660-1055
CA	Los Angeles, Richey Western Elctrns.	213-820-3777
CA	San Diego, Richey Western Elctrns.	619-271-4511
CA	San Diego, Shelly Elctrns.	619-453-7133
CA	San Jose, Shelley Elctrns.	408-942-9111
CA	San Jose, Integrated	408-263-1100
CA	Santa Ana, Nesco	714-541-6181
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Sun Valley, G. C. Comps.	213-768-6111
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Torrance, Time Elctrns.	213-320-0880
CA	Van Nuys, Nesco	213-781-0505
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Time Elctrns.	303-850-7701
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	New Haven, Greene Shaw Co.	203-397-0710
CT	Norwalk, Pioneer Elctrns.	203-853-1515
CT	Stamford, Bond Elctrns.	203-348-2663
FL	Dania, Arco Distrs.	305-462-3370
FL	Fort Lauderdale, Time Elctrns.	305-974-4800
FL	Fort Lauderdale, NRC	305-772-4500
GA	Atlanta, Prehler Elctrns.	404-447-5540
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Elmhurst, Semiconductor Specialists	312-279-1000
IN	Indianapolis, RM Elctrns.	317-247-9701
IA	Cedar Rapids, DEECO	319-365-7551
MD	Baltimore, Resco-Baltimore	301-823-0070
MD	Beltsville, Treeko Sls.	301-792-0112
MD	Beltsville, Resco, Washington	301-937-9100
MD	Columbia, Time Elctrns.	301-964-3090
MA	Burlington, TLC	617-273-0140
MA	Lexington, Pioneer Elctrns.	617-861-9200
MA	Needham, Impact Elctrns.	617-444-3977
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Wilmington, R.C. Comps.	617-273-1860
MA	Woburn, Time Elctrns.	617-935-8080
MI	Farmington Hills, Prehler elctrns.	313-473-7200
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Eden Prairie, Cassidy Elctrns.	612-944-0100
MN	Edina, Cassidy Elctrns.	612-835-7747
MN	Minneapolis, Industrial Comps.	612-831-2666
MO	St. Louis, Olive Elctrns.	314-426-4500
MO	St. Louis, Time Elctrns.	314-391-6444
NV	Las Vegas, Klesub Elctrns.	702-733-3888
NJ	Pinebrook, Pioneer Elctrns.	201-227-1262
NJ	Rahway, RSR Elctrns.	201-381-8777
NJ	Whippany, TONAR Inds.	201-884-1400
NM	Albuquerque, Betatron Elctrns.	505-344-2381
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NY	Central Islip, Semicap Elctrns.	516-582-4400
NY	Fairport, Pioneer Elctrns.	716-381-7070
NY	Hauppauge, Time Elctrns.	
NY	Hauppauge, Jaco	516-273-5500
NY	Vestal, Pioneer Elctrns.	607-748-8211
NY	Woodbury, Pioneer Elctrns.	516-921-8700
OH	Columbus, Reptron	614-436-6675
OH	Middleburg Hieghts, Prehler Elctrns.	216-243-5510
OK	Tulsa, The Altair Co.	918-252-5781
OR	Wilsonville, Zepher Elctrns.	503-582-2929
PA	Broomall, Time Elctrns.	215-359-1200
PA	Essington, Tri-Com	215-521-3080
PA	Horsham, RM Elctrns.	215-674-1181
TX	Addison, Quality Comps.	214-387-4949
TX	Austin, Quality Comps.	512-835-0220
TX	Dallas, RM Elctrns.	214-263-8361
TX	Dallas, Captronics	214-340-3592
TX	El Paso, International Elctrns.	915-598-3406
TX	El Paso, ERA Elctrns.	915-592-4126
TX	Ft. Worth, TTI, Inc.	817-831-0441
TX	Houston, The Altair Co.	713-462-3029
TX	Richardson, The Altair Co.	214-231-5166
WA	Bellevue, Integrated	206-455-2727
WA	Seattle, Richey Western Elctrns.	206-575-1910
WA	Seattle, Zepher Elctrns.	206-241-1980
WI	Maguon, Taylor Elec. Co.	414-241-4321
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	New Berlin, RM Elctrns.	414-784-4420

ITT ELECTRON TUBE, Box 100, Easton, PA 18042, Tel: 215-252-7331, Telex: 847494; FSC No.: 20948; Empl.: 550

ITT ELECTRO-OPTICAL PRODS., 7635 Plantation Rd., Roanoke, VA 24019, Tel: 703-563-0371, Telex: 829458; Empl.: 850; *Sls. Mgr.:* R. Moore; *Dist. Mgr.:* P. Williams

ITT GENERAL CONTROLS DIV., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201, Tel: 213-842-6131, Telex: 673147, TWX: 910-498-2225; Empl.: 1545; *Sls. Mgr.:* Phillip Vaughn

Local Distributors

AL	Birmingham, Control Specialists	205-991-7274
AZ	Phoenix, Wisco Equip. Co.	602-243-4361
CO	Englewood, Davis & Davis	303-935-4694
CT	Portland, Flocon, Inc.	203-342-4840
FL	Orlando, Diller-Brown Assocs.	305-851-7830
GA	Atlanta, Automatic Controls Co.	404-266-0130
HI	Honolulu, ARVAK Inc., Machinery Prods. Div.	808-845-9386
MN	Minneapolis, Tech Sls. Co.	612-823-8238
MO	Kansas City, Economy Power & Instr.	816-523-1010
MO	St. Louis, C. M. Tilley Co.	314-878-3353
NE	Omaha, Newton Valve Svc. Div.	402-339-2443
NY	Buffalo, KOM-Lamb	716-874-3530
NC	Charlotte, Genl. Control Equip. Co.	704-588-0484
OH	Cincinnati, M. L. Johnson Co.	513-874-8445
TN	Kingsport, Tenn. Instrmn. Co.	615-247-1148
TX	Corpus Christi, ITT Snyder co.	512-884-3822
TX	Odessa, ITT Snyder Co.	915-332-9408
UT	Salt Lake City, Peterson Co.	801-972-3328
WA	Kirkland, Unit Process Co.	206-827-0433

ITT GILFILLAN, 7821 Orion Ave., Van Nuys, CA 91409, Tel: 818-988-2600, Telex: 651421, TWX: 910-495-1787; FSC No.: 24930; Empl.: 1600; *Sls. Mgr.:* Ted Sprink

ITT-HIGBIE MFG., Wagner Rd., Rochester, MI 48063, Tel: 313-651-5300, TWX: 810-232-1592; Empl.: 1500; *Sls. Mgr.:* C. J. Clemens

ITT JENNINGS, Div. ITT Corp., 970 McLaughlin Ave., San Jose, CA 95122, Tel: 408-292-4025, Telex: 34-6311, TWX: 910-338-0159; FSC No.: 73905; Empl.: 370; *Sls. Mgr.:* E. V. Valehrach ....**1A**•1090-1092; **1B**•1452-1454, 1651; **3**•1247

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Crown Systems	602-274-3180
CA	Granada Hills, C & W Comps.	213-368-4032
CA	Santa Clara, Silicon Valley Sls.	408-371-8814
CO	Denver, Lindberg Co.	303-758-9033
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Silver Spring, Marktron	301-460-6100
MD	Timonium, Marktron	301-252-7111
MA	Haverhill, L. K. Harman, Inc.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Englewood, Cooper Assocs.	201-871-4985
NM	Albuquerque, Lindberg Co.	505-881-1006
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Westlake, Harry W. Applegate Co.	216-331-2960
PA	Huntingdon Valley, Omega Elctrns.	215-947-4135
PA	Pittsburgh, Covert & Newman & Co.	412-531-2022
TX	Houston, Barry Sales	713-784-5860
TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-969-2400
VA	Charlottesville, Marktron	804-973-5874
WI	Milwaukee, Berndt Assocs.	414-545-8400

ITT POMONA ELECTRONICS, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, Tel: 714-623-3463, TWX: 910-581-3822; FSC No.: 05276; Empl.: 150; *Sls. Mgr.:* Carl Wm. Musarra; *Dist. Mgr.:* Carl Wm. Musarra ....**2**•1355- 1470

Local Sales Offices & Reps

AL	Madison, South Eastern Assocs.	205-772-9616
AZ	Phoenix, More Sls.	602-274-4558; 602-265-9201

CA	Burlingame, Carelli/EMA	415-342-4514
CA	Culver City, DeAngelo, Rothman & Co.	213-827-2202
CA	Pasadena, Paul Nurches Co.	818-681-8957; 818-796-5844
CA	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
CO	Denver, A-E-S Inc.	303-777-8733
FL	Hialeah, L. Haas Co.	305-822-2300
IL	Northbrook, W. M. Linz	312-498-9600
IN	Indianapolis, Blind Elctrn. Sls. Co.	317-291-0860; 317-293-6205
IA	West Des Moines, Nevco	515-225-9866
MA	Sharon, A Appell Assoc.	617-784-3439
MI	Kentwood, C. Geer	616-534-9449; 616-243-2746
MN	Minneapolis, Hei-lite Sls.	612-861-6051
MO	Kansas City, Nevco	816-421-1751
MO	St. Louis, Nevco	314-843-7406
NJ	Belleville, D. F. Tobias & Co.	201-751-8680
OH	Dayton, Lessis Assocs.	513-294-1551
OH	Mentor, P. Lohse	216-255-1992
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
OR	Portland, Eclipse Mktg. Grp.	503-644-2550
PA	Philadelphia, David S. Linz	215-379-0734
SC	Greenville, H. C. Norman	803-244-6254
TX	Dallas, Techno Assocs.	214-357-9212
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991

ITT POWERSYSTEMS DIV., Box 688, Galion, OH 44833, Tel: 419-468-8100, Telex: 24-1401, TWX: 810-248-2907; Empl.: 800; *Dist. Mgr.:* W. E. Fox

ITT ITT Schadow inc

ITT SCHADOW, 8081 Wallace Rd., Eden Prairie, MN 55344, Tel: 612-934-4400, Telex: 29-0556, TWX: 910-576-2469; Empl.: 175; *Sls. Mgr.:* Darrell Wilk; *Dist. Mgr.:* Darrell Wilk .... **1B**•1652-1654

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
CA	Los Angeles, Ed Landa	213-879-0770
CA	Mountain View, Caltron Comps.	415-964-3244
CA	San Diego, Ed Landa	619-729-7267
CO	Boulder, Component Prod. Sls.	303-442-1100
CT	Farmington, R. Perron & Co.	203-673-4825
CT	Trumbull, R. Perron & Co.	203-268-9631
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Chicago, IRI	312-647-7755
KS	Wichita, PMR	316-684-4141
MA	Newton, R. Perron & Co.	617-969-8100
MI	Lathrup Village, R. C. Nordstrom Co.	313-559-7373
MN	Edina, Monroe Hanna	612-925-5700
MO	Maryland Heights, PMR	314-569-1220
NH	Bedford, Ray Perron & Co.	603-472-3030
NH	Dover, Ray Perron & Co.	603-742-2321
NM	Albuquerque, Thorson Desert States	505-265-5655
NY	Rochester, Ossmann Comps.	716-424-4460
NY	Syracuse, Ossmann Comps.	315-455-6611
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Columbus, K. W. Elctrns.	614-888-0483
OH	Dayton, K. W. Elctrns.	513-890-2150
PA	Philadelphia, P.S.A., Inc.	215-245-0513
RI	Mt. Penn, P.S.A., Inc.	215-245-0513
TX	Arlington, W. Pat Fralia Co.	817-640-9101
TX	Houston, W. Pat Fralia Co.	713-772-1572
UT	Salt Lake City, Comp. Prods.	801-262-0000
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Huntsville, Hallmark	205-837-8700
CA	Los Angeles, Richey Western	213-820-3777
CA	Mountain View, Time Elctrns. Nor/Cal	415-961-1170
CO	Denver, Integrated Elctrns.	303-534-6121
FL	Miami, Hallmark	305-971-9280
FL	Orlando, Hallmark	305-855-4020
IL	Chicago, Hallmark	312-437-8800
KS	Kansas City, Hallmark	913-888-4747
KS	Wichita, Radio Supp.	316-267-5216
MD	Baltimore, Hallmark	301-796-9300
MD	Beltsville, Treeko Sls.	301-937-8260
MA	Boston, Sager Elec.	617-749-6700
MA	Waltham, Impact Sls. Co.	617-964-7740
MI	Kentwood, R.M. Elctrns.	616-531-9300
MN	Bloomington, Hallmark	612-884-9056
MN	Minneapolis, Berquist Co.	612-835-2322
MO	St. Louis, Hallmark	314-291-5350
NY	Lynbrook, Peerless Radio	516-593-2121
NC	Raleigh, Hallmark	919-832-4465
OH	Cincinnati, Schuster Elec.	513-984-1600
OH	Columbus, Hallmark	614-846-1882
OH	Medina, Schuster Elec.	216-722-5531
OK	Tulsa, Hallmark	918-835-8458
PA	Philadelphia, Phila. Elctrns.	215-568-7400
PA	Philadelphia, Hallmark	215-355-7300
TX	Austin, Hallmark	512-837-2814
TX	Dallas, Hall-Mark	214-234-7300
TX	Houston, Hall-Mark	713-781-6100
TX	Stafford, SW Elctrns.	713-494-6021
WA	Seattle, Zepher Elctrn. Sls.	206-575-0922
WI	Milwaukee, Hallmark	414-476-1270

ITT SEMICONDUCTORS, 500 Broadway, Lawrence, MA 01841, Tel: 617-688-1881, Telex: 947413, TWX: 710-342-1357; *Sls. Mgr.:* Ed Burgess; *Dist. Mgr.:* John Flannery

ITT SEMICONDUCTORS, Intl. Telephone & Telegraph, 470 Broadway, Lawrence, MA 01841, Tel: 617-688-1881, Telex: 947413, TWX: 710-342-1357; Empl.: 1600; *Sls. Mgr.:* Del Brand; *Dist. Mgr.:* Del Brand

ITT SURPRENANT DIVISION, 172 Sterling St., Clinton, MA 01510, Tel: 617-365-6331

ITT TELECOMMUNICATIONS, Apparatus Dept., Fulton Dr., Corinth, MS 38834, Tel: 601-287-3771, TWX: 510-984-0211; Empl.: 2000; *Sls. Mgr.:* Charles Yancey

ITT THERMOTECH, Div. IT & T, 1203 S. 5th St., Hopkins, MN 55343, Tel: 612-933-9400, Telex: 29-0414; Empl.: 605

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assoc.	602-955-3193
AR	Little Rock, Schmidt & Assocs.	501-225-5613
CA	Glendale, Secana	818-240-7570
CA	Oakland, Richard B. Peters Co. (Brush Holder Prods.)	415-835-5135
CO	Denver, Manufacturers Mktg.	303-425-9569
CT	Newington, Interep (Brush Holder Prods.)	203-666-4233
FL	Orlando, Don Wegner (Brush Holder Prods.)	305-894-6206
FL	St. Petersburg, Florida Div.	813-347-2191
IL	Arlington Hgts., Diethert-Angel	312-593-7600
IL	Bannockburn, Heth (Brush Holder Prods.)	312-295-8440
IL	Buffalo Grove, B. Reynolds	312-775-2425
IN	Ft. Wayne, R. McCampbell	219-672-3012
IN	Indianapolis, R & D Sls.	317-842-4768
IA	Cedar Rapids, Seltec Sls.	319-393-1114
IA	Des Moines, I. L. Davidson Co. (Brush Holder Prods.)	515-265-0288
MA	Newton Upper Falls, Anchor Engrg.	617-964-6205
MI	Farmington, L. George	313-474-1505
MN	Minneapolis, W. J. Houlihan	612-544-3023
MO	Maryland Heights, Leander & Co.	314-569-3338
NJ	Union, Plastech	201-687-4810
NY	Penfield, Upstate Comp. Sls.	716-381-6070
OH	Cleveland, W. J. Williams	216-831-6220
PA	Erie, F. W. "Fritz" Schubert (Brush Holder Prods.)	814-899-3740
PA	Wayne, Midlantic Plastic Sls.	215-964-0510
SC	Fort Mill, Eagle Sls.	803-548-2222
TN	Memphis, D. Barry Temple (Brush Holder Prods.)	901-386-3651
TX	Houston, Texstar Sls., Inc.	713-367-0465
VA	Salem, George Headford (Brush Holder Prods.)	703-989-8127
WI	Milwaukee, Indl. Sls. Tech.	414-462-5024

ITW, Cortron Div., 400 W. Grand, Elmhurst, IL 60126, Tel: 312-279-9110

ITW SWITCHES, Tool Works Co., 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, Telex: 4330130, TWX: 910-221-0275; *Sls. Mgr.:* A. Steiner; *Dist. Mgr.:* A. Steiner .... **1B**•1656-1667

Local Sales Offices & Reps

AL	Huntsville, Electro Mech	205-533-2100
AZ	Tempe, Spectrum Assoc. Southwest	602-966-1788
AR	Fort Smith, Electra Reps	501-452-4030
CA	Anaheim, Spectrum Assoc.	714-630-6977
CA	San Jose, McKnight	408-942-0880
CO	Denver, High Plains Mktg.	303-751-7150
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, Semtronics	305-831-8233
GA	Atlanta, Electro Mech.	404-447-6478
IL	Elk Grove Village, Parcom	312-228-6360
IA	Cedar Rapids, Comstrand	319-377-1575
KS	Kansas City, BC Elctrns.	913-342-1211
MD	Baltimore, MicroComp	301-247-0400
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Grand Rapids, Urban & Assoc.	616-245-0511
MN	Minneapolis, Comstrand	612-788-9234
MO	Bridgeton, BC Elctrns.	314-291-1101
NJ	Livingston, Varrelman Gorman	201-992-2505
NY	Syracuse, Fountain, Young & Co.	315-437-7733
NC	Raleigh, Electro Mech	919-851-8165
OH	Dayton, Rockford Controls	513-898-5452
OH	Euclid, Rockford Controls	216-731-5250
OR	Beaverton, Barrett Squibb & Assoc.	503-642-1661
PA	Ardmore, Precision Mktg.	215-649-6301
TN	Nashville, Electro Mech	615-885-0073
TX	Dallas, Electra Reps.	214-387-3594
TX	Houston, Electra Reps.	713-530-2208
WA	Redmond, Barrett Squibb & Assoc.	206-885-6991

IVEK CORP., 43 School St., N. Springfield, VT 05150, Tel: 802-886-8278; Empl.: 4; *Sls. Mgr.:* Gene Williams

IVERON PACIFIC, 1152 Morena Blvd., San Diego, CA 92110-3899, Tel: 619-275-1500; Empl.: 16; *Sls. Mgr.:* Lee Kerl

IVO INDS., INC., P.O. Box 603, 201 Industrial Way W., Eatontown, NJ 07724, Tel: 201-542-5151, Telex: 132-414; Empl.: 20; *Sls. Mgr.:* Nat Garratano

IWATSU ®

IWATSU INSTRUMENTS, INC., 430 Commerce Blvd., Carlstadt, NJ 07072, Tel: 201-935-5220, TWX: 710-989-0255 .... **3**•1366-1368

Local Sales Offices & Reps

CA	Garden Grove, Advanced Digital Grp.	213-598-9645
CA	Sunnyvale, Koosen Tech. Sls. Corp.	408-249-5858
CT	Old Saybrook, MJT Assocs.	203-388-5890
FL	Sarasota, Ram-Z Assocs.	813-921-5561
IL	Rolling Meadows, Commodore 1	312-394-5441
MN	Minneapolis, Kodo Assocs.	612-881-1255
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NH	Nashua, MJT Assocs.	603-889-5373
NJ	Parsippancy, HLM Assocs.	201-263-1536
NJ	Pennsauken, Sci-Rep Corp.	609-662-5222
NY	Northport, HLM Assocs.	516-757-1606
NY	Rochester, Harmony Labs.	716-458-3376
OH	North Ridgeville, TMS	216-327-3527
OK	Tulsa, Spectra Sls. Corp.	918-663-7188
TX	Houston, Spectra Sls. Corp.	713-747-2798
VA	Fairfax, Sci-Rep Corp.	703-385-0600

Local Distributors

CA	Canoga Park, Rag Elctrns.	213-998-6500
CA	Freemont, Rep Inc.	415-651-4131
CA	Van Nuys, Testek Corp.	213-786-6890
CO	Boulder, Instr. Repair Labs	303-449-2721
CT	Monroe, Connecticut Calibration	203-261-9518
FL	South Daytona, Kapital Instr. Sls.	904-257-4334
IL	Downers Grove, Ames Supply Co.	800-942-1596
MA	Billerica, Hayes Instr. Svc.	617-663-4800
MO	St. Louis, Indl. Svc. Lab. Corp.	314-535-5760
NJ	North Caldwell, Hosica	201-256-7724
NJ	Ocean, Rag Elctrns.	201-544-0666
NJ	Wyckoff, Ames Supply Co.	201-891-9560
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NY	Great Neck, Instrument Mart	516-487-7430
NC	Pineville, Elctrn. Measuring Instr. Svc.	704-588-4624
OK	Oklahoma City, Houston De Pue Labs.	404-235-5469
TX	Austin, Tinkertronics	512-926-4420
TX	Dallas, Hutton Co.	214-484-0580
VA	Fairfax, Scientific Trading	703-385-0600
WA	Seattle, Vanguard Elctrn. Tool	206-284-6186
WI	Madison, Schrenk Sls.	603-255-7400

IXYS CORP., 3685 Enochs, Santa Clara, CA 95051, Tel: 408-733-4045; *Sls. Mgr.:* Samuel Kory Jr. .... **1A**•1663; **1B**•1231; **3**•1605

JACO MFG. CO., 468 Geiger St., Berea, OH 44017, Tel: 216-234-4000

JAIDINGER MFG., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090; Empl.: 35; *Sls. Mgr.:* John S. Jaidinger

JAMB INDS., Box 281, Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-263-9295; Empl.: 3

JAMESBURY, 640 Lincoln St., Worcester, MA 01605, Tel: 617-852-0200, Telex: 92-0448, TWX: 710-240-1268; Empl.: 1000; *Sls. Mgr.:* C. A. Richardson

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, TWX: 910-221-5034; *Sls. Mgr.*: J. R. Ther; *Dist. Mgr.*: J. R. Ther

janco
AN ESOP CORP.

JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91504, Tel: 818-846-1800, TWX: 910-498-2701; FSC No.: 91812; Empl.: 205; *Sls. Mgr.*: Sam Kay, Jr. ....**1B**•1668, 1669

Local Sales Offices & Reps

AZ	Tempe, Piper Sls.	602-949-0048
AR	Dallas, M. Kruvand	214-691-4592
CA	Cupertino, Codella	408-257-2561
CA	San Diego, Qualtronics	619-560-8955
CO	Longmont, Piper Sls.	303-651-2378
FL	Orlando, MacKay, Smith & Assocs.	305-277-1513
GA	Atlanta, MacKay, Smith & Assocs.	404-449-7444
IL	Addison, Engineered Sls.	312-832-8425
IN	Ft. Wayne, Aktron Corp.	219-747-3650
KS	Wichita, T-Bird Tech. Sls. & Svc.	316-684-3941
MD	Silver Spring, H.R. Sieber	301-589-9110
MA	Newton, Cornwall, Caron, Fahey	617-332-2042
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Maryland Heights, T-Bird Sls. & Svc.	314-567-6488
NJ	Cherry Hill, Quality Comps.	609-428-6266
NY	Albertson, C.F. Ward	516-742-5561
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
OH	Columbus, Tom Mulligan Company	614-457-2242
TX	Dallas, Mark Kruvand	214-691-4592
WA	Seattle, Norwest	206-827-9562

Local Distributors

CA	Burbank, Merit Comp. Supp.	818-842-8162
CA	Westlake Village, Tech-Cable Prods.	818-991-4697

J & S TOOL, 70 Okner Pkwy., Livingston, NJ 07039, Tel: 201-533-0700, Telex: 139229; Empl.: 50; *Sls. Mgr.*: K.F. Swenson

JAN HARDWARE MFG. CO., 47-27 36th St., Long Island City, NY 11101, Tel: 212-361-0800; FSC No.: 99813; Empl.: 60; *Sls. Mgr.*: Irwin E. Wasserman ....**2**•1756, 1762-1779

Local Sales Offices & Reps

AZ	Phoenix, Steve Fisher Assocs.	602-247-7865
CA	Menlo Park, Long Assocs.	415-327-1300
CA	San Diego, Robert Scott Co.	619-420-6446
CA	Thousand Oaks, S.A.R.G.E.	213-991-6706
FL	Seminole, Custom Assembly	813-397-8302
IL	Schaumburg, Croydon Elect.	312-980-6766
MD	Woodbine, Naudain Assocs. Southern	301-442-2270
MA	Brookline, Harman Assocs.	617-232-6687
MA	Lee, Harman Assocs. Inc.	413-243-1158
MN	Golden Valley, A.I.M.	612-542-8437
MO	Crestwood, Nevco	314-843-7406
MO	Kansas City, Nevco	816-421-1751
NJ	Englewood, H. Gray Assoc.	201-894-0894
NJ	Marlton, Naudain Assocs.	609-983-5808
OH	Dayton, F. L. Ohmer & Assocs.	513-434-1454
TX	Richardson, AGM Sls.	214-644-1475

JAPANESE PRODS. CORP., 31368 Via Colinas, Suite 103-104, West Lake Village, CA 91362, Tel: 818-991-6111, Telex: 13-1581; Empl.: 8; *Sls. Mgr.*: Don Cassalia ....**1B**•1158

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Englewood, Integrated Motion Sys. Inc.	303-762-1817
FL	Casselberry, Hilco, Inc.	305-695-6208
GA	Dunwoody, Hilco, Inc.	404-393-1771
IL	Rolling Meadows, Sumer Inc.	312-991-8500
MD	Columbia, Versatrol	301-730-5577
MA	Salem, Forbes Engrg	617-744-1693
MI	Brighton, A.P. Assoc.	313-229-6550
MN	Minnetonka, Gibb Electric Sls.	612-935-4600
NY	Syosset, Motion Control Sls	516-921-5656
NC	Charlotte, Hilco, Inc.	704-568-3938
PA	Exton, Kiley Elec.	215-363-8550
PA	Pittsburgh, Exonic Sys.	412-784-8400
SC	Mt. Pleasant, Hilco, Inc.	803-883-9633
TX	Dallas, Automated Motion Control	214-340-4192
WA	Redmond, Halbar Assocs.	206-882-0990
WA	Vancouver, Halbar Assocs.	206-696-0170
WI	Brookfield, Sumer, Inc.	414-784-6641

Local Distributors

CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	Santa Monica, Trojan Inds.	213-829-1735
NY	New York, B&B Motor & Control	212-966-5777
TX	Fort Worth, Allied Elctrns.	817-336-5401

JARO COMPONENTS, INC., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883, Tel: 305-771-7000, Telex: 522-334; Empl.: 30; *Sls. Mgr.*: Robert C. Flipse; *Dist. Mgr.*: Floyd Burwell

JAY CONTROL CO., 21 Sequin Dr., Glastonbury, CT 06033, Tel: 203-633-5294; Empl.: 40; *Sls. Mgr.*: Mike Colomonico

JAYCOR, P.O. Box 85154, San Diego, CA 92138, Tel: 619-453-6580, TWX: 910-322-1064; Empl.: 300; *Sls. Mgr.*: Steven Lutjens

JAY-EL PRODS., Sub. Ducommun Inc., 1859 W. 169th St., Gardena, CA 90247, Tel: 213-321-3260, TWX: 910-346-7633; FSC No.: 08719; Empl.: 270

JB ELCTRN. TRANSFORMERS, 2300 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, TWX: 910-221-1283; FSC No.: 11700; Empl.: 150; *Sls. Mgr.*: F. J. Bussa

JBM ELECTRONICS, INC., 531 Front St., Manchester, NH 03102, Tel: 603-623-0222, Telex: 953134, TWX: 710-220-8978; *Sls. Mgr.*: David Crowley ....**1A**•1529-1536

J-B-T INSTRS., Box 1818, New Haven, CT 06508, Tel: 203-776-1111; Empl.: 25; *Sls. Mgr.*: Virginia Devitt ....**3**•1332

Local Sales Offices & Reps

MN	Minneapolis, Hei-Lite Sls.	612-861-6051
TX	Dallas, Forner Sls.	214-241-2166

Local Distributors

AL	Montgomery, Southern Controls	800-633-8796
CA	Glendale, Western Elctrns.	213-246-4861
CA	Los Angeles, Metermaster	213-685-4340
CA	San Francisco, Pacific Elctrns.	415-543-3104
CA	Wilmington, Wilmington Instrs.	213-834-1133
CO	Denver, E.I.L. Instrs.	303-534-4160
CT	New Haven, Hatry Elctrns.	203-787-5921
FL	Miami, Florida Precision	305-324-1731
GA	Augusta, Speciality Distributing	404-873-2521
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, Metermaster	312-593-8650
LA	Lafayette, Ralph's Elctrns.	318-234-4507
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Hingham, Sager Elec.	617-749-6700
MN	Minneapolis, Instrument Controls	612-871-2514
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
NJ	Belleville, Miscorp	201-751-8680
NJ	North Caldwell, Hosica Labs	201-256-7724
NY	Long Island City, Metermod	212-726-4850
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Maspeth, Harry Alter	212-366-0123
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Bluffton, Bluffton Prods.	419-358-7891
OH	Cleveland, Weschler Elec.	216-238-2550
OK	Oklahoma City, Trice Wholesale	405-524-4411
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Providence, William Dandreta	401-861-2800
TN	Nashville, Electra Distributing	615-329-3971
TX	Ft. Worth, Swieco	817-335-6521
TX	Garland, Metermaster	214-271-5671
TX	Houston, Harrison Equip.	713-879-2600
TX	Houston, Quality Instrs.	713-524-0528
WA	Seattle, Eicher-Richards	206-523-7888
WV	St. Albans, Preiser Scientific	304-727-2902

J-B-T SWITCHES, CUTLER-HAMMER PRODS., EATON CORP., Box 1904, New Haven, CT 06509, Tel: 203-772-2220; FSC No.: 55459; Empl.: 160; *Sls. Mgr.*: C. A. Peffer

Refer to Eaton Corp./Cutler-Hammer Prods., Aerospace/Commercial Controls Div. for distributor information.

JDK CONTROLS, INC., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, Tel: 805-499-7779; *Sls. Mgr.*: Reece Kendall ....**1A**•2040

JEFFERS ELCTRNS., Grand Plaza, 945 Grand Ave., Nogales, AZ 85621, Tel: 602-287-5851, TWX: 910-973-9794; FSC No.: 59474; Empl.: 400; *Sls. Mgr.*: Ken Shobert; *Dist. Mgr.*: Steve Morris

Local Sales Offices & Reps

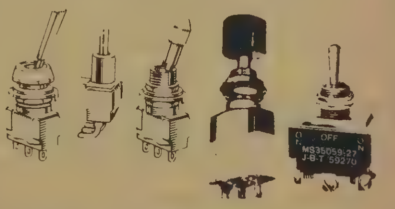
AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, O'Donnell Assoc.	602-944-9542
CA	Santa Clara, I Squared	408-988-3400
CO	Boulder, R.G. Entprs.	303-447-9211
CT	Middletown, Gerber Sls.	203-347-3000
FL	Tampa, APM Assoc.	813-886-2457
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Arlington Hgts., C.L. Greenslade Sls.	312-253-9620
IN	Ft. Wayne, J.F. Kilfoil	219-436-7233
KS	Overland Park, Advanced Techn. Sls.	913-642-6675
LA	Kenner, Cartwright & Bean	504-666-0020
MA	Newton Upper Falls, Gerber Sls.	617-969-2620
MI	Lathrup Village, R. C. Nordstrom	313-559-7373
MN	Edina, Grayden & Flemmer	612-941-1120
NM	Albuquerque, Power Entprs.	505-298-1918
NY	E. Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	E. Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Great Neck, MOS Assoc.	516-487-3966
NC	Raleigh, Cartwright & Bean	919-781-6560
OH	Cincinnati, J.F. Kilfoil Co.	513-791-6150
OR	Beaverton, Barrett & Squibb	503-642-1661
PA	Ardmore, Wm. K. Metz	215-896-7300
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Lewisville, Jim Hughes	214-221-1536
PR	Puerto Rico, Hato Rey, M. Anderson Co.	809-751-2026
WA	Redmond, Barrett & Squibb	206-885-6991

JEFFERSON ELEC., Litton Inds., 840 25th Ave., Bellwood, IL 60104, Tel: 312-626-7700, Telex: 72-8402; Empl.: 1200; *Sls. Mgr.*: Nick Shah; *Dist. Mgr.*: C. Travis

Local Sales Offices & Reps

AK	Anchorage, Alaska Elect. Agents	907-563-8699
AZ	Phoenix, Ross-Bloom & Assoc.	602-955-5024
AR	Little Rock, Southland Sls	501-753-4013
CA	Mountain View, TSR	415-961-5655
CA	Pasadena, A-F Sls. Eng'r.	213-681-5631
CO	Denver, E-O Sls.	303-778-1900
FL	Tampa, SRT Mktg.	813-884-4805
HI	Honolulu, Atlas Elec. Co.	808-524-5866
IL	Wood Dale, Power Prods. Co.	312-595-1142
IN	Indianapolis, Clyde Warble & Assoc.	317-632-1465
KY	Louisville, Bryan, Haley & Hackman	502-491-9984
LA	New Orleans, Corrigan Mktg.	504-626-5231
MA	Framingham, Gerald Rosen Co.	617-879-5505
MA	Stoughton, North Coast Sls.	617-344-1007

J-B-T
Division of CUTLER-HAMMER
AUTHORIZED DISTRIBUTOR
E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER
SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

MI	Detroit, Electrical Materials	313-541-1650
MI	Grand Rapids, Electrical Materials	313-942-0128
MN	Minneapolis, Boerger & Assoc.	612-560-3435
MS	Jackson, Welch & Doby	601-932-5534
MO	Kansas City, Forristal-Young	816-358-6771
MO	St. Louis, Schaeffer Sls.	314-647-1000
NE	Omaha, Boyle & Williamson	402-553-1666
NJ	Edison, Bizzarro Elect. Sls.	201-757-7010
NY	New Hartford, F. W. Laver & Son	315-724-2304
NC	Charlotte, W. H. Lassister Sls.	704-523-2736
NC	Raleigh, DHR Mktg.	919-876-5450
OH	Cincinnati, Bryan, Haley & Hackman	513-561-0500
OH	Cleveland, Marlow Assoc.	216-991-6500
PA	Philadelphia, Electrical Sls. Assn.	609-456-7110
PA	Pittsburgh, Robert Colley Assoc.	412-331-3121
TX	Dallas, SW Mktg.	214-341-8631
UT	Sandy, Pete Farley Agcy.	801-278-4082
WA	Seattle, Bangs Assoc.	206-262-0262
WI	Butler, J. F. Nolan & Assoc.	414-781-1140

JENSEN

JENSEN TOOLS, INC., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85040, Tel: 602-968-6241, TWX: 910-950-0115; Empl.: 100; *Sls. Mgr.:* Tom Fenzel .... **2**•1931

JEROME INDUSTRIES CORPORATION

JEROME INDUSTRIES CORP., Power Supply Div., B 730 Division St., Elizabeth, NJ 07201, Tel: 201-353-5700, Telex: 132001-JEROME, ELIZ; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo .... **3**•1606, 1607

Local Sales Offices & Reps

MN	St. Paul, Countrymen Assocs.	612-645-9151

JEROME INDUSTRIES CORP., Transformer Div., 730 Division St., Elizabeth, NJ 07201, Tel: 201-353-5700, Telex: 132001-JEROME, ELIZ; *Sls. Mgr.:* Anthony Di Girolamo .... **1A**•2177

JERSEY SPECIALTY CO., See JSC Wire & Cable

Distributor

JERSEYSWITCH, INC., 129A Gaither Dr., Mt. Laurel, NJ 08054, Tel: 609-778-8190 .... **1B**•1742

JETTRON PRODS., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* J. M. Schill .... **2**•1471

Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501
CA	Woodland Hills, A-Tronics	818-703-7212
NY	New York, Eltron Export Co.	212-944-7635

Local Distributors

Intl	England, Slough, Berks, LPPI	44-753-77788
Intl	France, Le Chesnay, LPPI	33 3 955 2104
Intl	Italy, Cinisello Balsamo (Milano), LPPI	2-6127821
Intl	Netherland, Krimpen a.d. Yssel, LPPI	31-1807-1 8555
Intl	Sweden, Stockholm, LPPI	46-8-132030
Intl	Switzerland, Zurich, Litton Precision Prods. Intl. Inc. (LPPI)	1 312 35 44

JEWELL ELECTRICAL INSTRS., Grenier Field, Manchester, NH 03108, Tel: 603-669-6400, Telex: 943435; Empl.: 400; *Sls. Mgr.:* W. P. Bolia .... **3**•1333

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
AZ	Phoenix, The Knight Co.	602-582-8506
AR	Little Rock, J. Y. Schoonmaker	501-375-2168
CA	Fremont, William Parks Assocs.	415-490-2011
CA	Los Angeles, Knight Co.	213-670-2833
CA	San Diego, Knight Co.	619-571-7903
CT	Middletown, Gerber Sls.	203-347-3000
FL	Orlando, Currie, Peak & Frazier	305-855-0843
GA	Duluth, Currie, Peak & Frazier	404-476-3107
GA	Norcross, Currie, Peak & Frazier Inc.	404-449-7662
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
IA	Cedar Rapids, Gassner & Clark Co.	319-393-5763
MA	Ludlow, Gerber Sls.	413-589-9837
MA	Newton Upper Falls, Gerber Sls.	617-969-2620
MI	Troy, C. B. Jensen	313-643-0506
MN	Edina, M. Foster Co.	612-941-9790
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NM	Albuquerque, C. T. Carlberg	505-888-3883
NY	Buffalo, Rudell-Merrifield Assocs.	716-634-4300
NY	Melville, Comtronics Assocs.	516-249-0505
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
NC	Raleigh, Currie, Peak & Frazier Inc.	919-787-0808
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	614-885-7643
OK	Oklahoma City, J. Y. Schoonmaker	405-685-4477
OR	Portland, Frank Jackson	503-292-2638
TX	Austin, J. V. Schoonmaker Co., Inc.	512-480-9257
TX	Dallas, J. Y. Schoonmaker	214-349-1650
TX	Houston, J. Y. Schoonmaker	713-738-2427
WA	Redmond, F. Jackson	206-881-7277
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

AL	Birmingham, Brownell Electro Inc.	205-322-3374
AL	Mobile, Brownell Electro Inc.	205-479-8581
AZ	Phoenix, Metermaster Inc.	602-243-4111
CA	Lamirada, Stevens Instr. Co.	714-994-5111
CA	Los Angeles, Metermaster, Inc.	213-685-4340
CA	Los Angeles, E.I.L. Instrs., Inc.	213-685-7020
CA	Palo Alto, Metermaster Inc.	415-968-0313
CA	San Diego, Metermaster, Inc.	619-560-4844
CA	Santa Clara, Dynametron Inc.	408-727-6531
CA	Santa Clara, E.I.L. Instrs. Inc.	408-727-0396
CA	Santa Clara, Fisher-Brownell	408-988-6041
CO	Denver, Metermaster Instr. Inc.	303-722-5766
CO	Denver, E.I.L. Instrs., Inc.	303-534-4160
CT	Middletown, E.I.L. Instrs. Inc.	203-346-6646
FL	Miami, Brownell Electro Inc.	305-591-3215
FL	Orlando, Brownell Electro Inc.	305-843-6770
FL	Palm Bay, E.I.L. Instrs., Inc.	305-725-8300
GA	Atlanta, Brownell Electro Inc.	404-762-5181
IL	Bridgeview, E.I.L. Instrs. Inc.	312-430-2292
IL	Elk Grove Village, Metermaster Inc.	312-593-8650
IL	Oak Park, Pacific Indicator Co.	312-383-0220
IN	Evansville, Electro-Lab Svcs., Inc.	812-423-5211
IN	Indianapolis, E.I.L. Instrs., Inc.	317-545-1373
KY	Louisville, E.I.L. Instrs., Inc.	502-454-3420
LA	Kenner, Breard-Gardner	504-466-3401
MD	Baltimore, Sunshine Sci. Instr., Inc.	301-661-5900
MD	Gaithersburg, Pioneer/Instrmn.	301-921-0660
MD	Sparks, E.I.L. Instrs., Inc.	301-771-4800
MA	Burlington, E.I.L. Instrs., Inc.	617-272-9450
MA	Waltham, Calibron Corp.	617-894-6440
MA	Woburn, Brownell Electro Inc.	617-935-7820
MN	Minneapolis, Process Measurement Co.	612-544-4035
NJ	Pennsauken, E.I.L. Instrs., Inc.	609-488-0474
NC	Charlotte, Trott Electronics, Inc.	704-376-2237
NC	Raleigh, Brownell Electro Inc.	919-876-6524
OH	Dayton, E.I.L. Instrs., Inc.	513-435-2134
OH	Dayton, Pioneer Std. Elctrn.	513-236-9900
OK	Tulsa, Combined Technlg. Co.	918-665-3002
PA	Pittsburgh, E.I.L. Instrs., Inc.	412-731-5230
PA	Pittsburgh, CAM/RPC Instrmn.	412-782-3770
TN	Knoxville, Brownell Electro Inc.	615-966-3441
TN	Nashville, Brownell Electro Inc.	615-889-8230
TX	Dallas, E.I.L. Instrs., Inc.	214-931-1236
TX	Dallas, Ultra Instr. Lab, Inc.	214-357-0297
TX	El Paso, McNicol Elctrns.	915-566-2936
TX	Houston, Quality Instr. Lab	713-524-0528
TX	Houston, E.I.L. Instrs., Inc.	713-271-3100
WA	Richland, Branom Instr. Co.	509-943-6664
WA	Seattle, E.I.L. Instrs., Inc.	206-762-0880
WV	Alexandria, E.I.L. Instrs., Inc.	703-354-4330
WV	Virginia Beach, E.I.L. Instrs., Inc.	804-499-3746

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JFW INDS., INC., 2719 E. Troy Ave., Indianapolis, IN 46203, Tel: 317-783-9875; Empl.: 30; *Sls. Mgr.:* Joetta Walker; *Dist. Mgr.:* Joetta Walker .... **1A**•1705-1707

Local Distributors

CA	Sunnyvale, Electronic Resources	408-745-1420

JKL COMPS., 13343 Paxton St., Pacoima, CA 91331, Tel: 818-896-0019, Telex: 910-496-1504; FSC No.: 55335; Empl.: 14; *Sls. Mgr.:* Bob Brandt

JMJ TECHNICAL PRODS., P.O. Box 26, Kendall Park, NJ 08824, Tel: 201-589-4257; Empl.: 8; *Sls. Mgr.:* John Stefiuk .... **2**•1780

JMK

JMK, INC., 15 Caldwell Dr., Amherst, NH 03060, Tel: 603-886-4100, Telex: 955329 TLY SRVC; Empl.: 200; *Sls. Mgr.:* J. Kennedy .... **1A**•1600

Local Sales Offices & Reps

AL	Huntsville, JWL Assoc.	205-881-0413
CA	Santa Clara, Cummings & Assoc.	408-247-8656
CA	Woodland Hills, Cummings & Assoc.	213-340-6035
CO	Denver, Arkco Sls.	303-758-1151
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Indianapolis, Gorny Sls.	317-271-7504
MA	Framingham, STS	617-620-0195
MI	Novi, Lektronics	313-349-3304
MN	St. Paul, Arkco Sls.	612-777-7454
NJ	Ridgewood, Ballou Assoc.	201-444-6990
NY	Rochester, Elcom Sls.	716-385-1400
NY	Syracuse, Elcom Sls.	315-685-8245
NC	Charlotte, JWL Assoc.	704-523-3001
OH	New Lebanon, J. N. Bailey	513-226-0512
OK	Tulsa, Barry Sls.	918-749-7775
OR	Portland, Cummings & Assoc.	503-761-4411
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Edmonds, Cummings & Assoc.	206-775-1421
WI	Muskego, Momak Sls.	414-363-7744

Local Distributors

CA	Woodland Hills, C & A Elctrns.	213-340-6022
IL	Chicago, Voyager Elctrns.	312-773-4900
MN	St. Paul, Voyager Elctrns.	612-571-7766
NH	Hudson, C & H Electronics	603-882-1133

JM TRANSFORMER CO., INC., 112 Florida St., Farmingdale, NY 11735, Tel: 516-293-0475; Empl.: 13; *Sls. Mgr.:* J. Millman .... **1A**•2178-2181

JOBMASTER CORP., 9008 Liberty Rd., Randallstown, MD 21133, Tel: 301-655-1400; Empl.: 12; *Sls. Mgr.:* Robert H. Goldman .... **2**•1792

JOHANSON DIELECTRICS

JOHANSON DIELECTRICS, 2220 Screenland Dr., Burbank, CA 91505, Tel: 213-848-4465, TWX: 910-498-2735; Empl.: 154 .... **1A**•1094

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400
CA	Anaheim, Westrep	213-404-3381
CA	Mountain View, Straube Assocs.	415-969-6060
FL	Orlando, Delmac Sls.	305-898-4688
IL	Park Ridge, Metcom Assocs.	312-696-1490
IN	South Bend, C-S Electronic Sls	219-291-6258
MA	Wethersfield, Compac Sls.	203-563-4784
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
NC	Greensboro, L & D Inc.	919-292-3201
PA	Trevose, PSA	215-245-0513
TX	Arlington, W. Pat Fralia Co.	817-640-9101
WA	Seattle, Northmar Inc.	206-524-5170

Local Distributors

CA	Los Alamitos, SEMI DICE	213-594-4631
CA	Santa Clara, SEMI DICE	408-980-9777
NJ	Fairfield, CHPS Inc.	201-882-0997

JOHANSON MFG. CORP., 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, TWX: 710-987-8367; FSC No.: 91293; Empl.: 200 .... **1A**•1095

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400
CA	Anaheim, Westrep	213-404-3881
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890
FL	Orlando, Perrott Assocs.	305-298-7748
IL	Northfield, Johanson Mfg.	312-446-4021
IN	South Bend, Schillinger Assocs.	219-282-4570
IA	Cedar Rapids, ARD Sales Co.	319-393-6392
MA	Seekonk, J. Murphy Assocs.	617-761-7153
MN	Bloomington, Bill Deming & Assoc.	612-888-5000

NJ	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Mount Vernon, Friedman-Smith Elctrn. Sls.	914-664-4866
NY	Pittsford, NHA, Inc.	716-586-9002
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Cleveland, Baehr, Greenleaf & Assoc.	216-221-9030
PA	Trevose, P.S.A.	215-245-0513
TX	Arlington, W. Pat Fralia Co.	817-640-9101
WA	Seattle, Northmar	206-524-5170

Local Distributors

AZ	Tempe, Shelley Elctrns.	602-894-2058
AZ	Tempe, Bell Inds.	602-267-7774
CA	Chatsworth, Shelley Elctrns.	213-998-3333
CA	Chatsworth, Integrated Electronics	213-998-2200
CA	Gardena, Bell Inds.	213-515-1800
CA	Irvine, Integrated Electronics	714-660-1055
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Jose, Shelley Elctrns.	408-942-9111
CA	San Jose, Integrated Electronics	408-263-1100
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Diplomat/Westland	408-734-1900
CA	Van Nuys, CW Swift & Assocs.	213-989-1133
CO	Boulder, Shelley Elctrns.	303-442-2718
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Orlando, Pelcor Co.	305-299-1541
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns.	312-638-4411
MD	Baltimore, Radio Elec. Svc.	301-823-0070
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Medford, Blake Assocs.	617-391-7890
MA	Woburn, Diplomat Elctrns.	617-935-6611
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
NY	Syracuse, Newark Elctrns.	315-437-6611
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TX	Ft. Worth, PATCO Supplies	817-429-8596
TX	Richardson, Jaco Elctrns.	214-235-9575
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515
WA	Bellevue, Integrated Electronics	206-455-2727

JOHNSON, E. F., CO., 299 Johnson Ave., Waseca, MN 56093, Tel: 507-835-6222, Telex: 290470, TWX: 910-565-2161; Empl.: 1400; *Sls. Mgr.:* G. Mena

JOHNSON CONTROLS, Globe Battery Div., 5757 N. Green Bay Ave., Milwaukee, WI 53201, Tel: 414-228-1200, TWX: 910-262-3084; Empl.: 20,000

JOLO INDS., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, TWX: 910-595-1138; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr.

JONARD INDS. CORP., 134 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-0700, Telex: 996570, TWX: 710-562-0107; Empl.: 65; *Sls. Mgr.:* R. Fersen

JONATHAN MFG., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, Telex: 910 592-1241; Empl.: 265

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORDAN ELEC., 2380 Camino Vida Roble, Carlsbad, CA 92008, Tel: 619-438-6876; FSC No.: 5905; Empl.: 75; *Sls. Mgr.:* B. M. Barton

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266; Empl.: 4

JOSLYN ELCTRN. SYS., 6868 Cortona Dr., Goleta, CA 93017, Tel: 805-968-3551, TWX: 910-334-3464; FSC No.: 23663; Empl.: 210; *Sls. Mgr.:* A. deSouza

JRW INDS., INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418; Empl.: 4; *Sls. Mgr.:* James Thorbahn

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07470, Tel: 201-694-6200; Empl.: 40; *Sls. Mgr.:* R. D. Foster; *Dist. Mgr.:* J. Freeman .... **2**•2103

Local Sales Offices & Reps

CA	Van Nuys, Art Szerlip Sls. Co.	213-782-1765
CO	Denver, Mountain Reps.	303-623-0972
DE	Newark, F. S. Carmine Co.	302-731-0697
FL	Crystal River, Foster Sls.	904-795-7831
IL	Chicago, Lassers & Co.	312-539-0170
IA	Burlington, J. S. Ridge Entprs.	319-754-8745
KY	Louisville, Mid Central Sls. Co.	502-239-5614
MA	Lynn, Keene Sls. Co.	617-595-2300
MI	Livonia, Harvey Sls.	313-476-1974
NJ	Teaneck, Fisher Elctrn. Assocs.	201-837-1200
NY	Rochester, Warren Kaufman	716-266-2728
NC	Charlotte, D. Austin Co.	704-334-0174
OH	Columbus, Benchmark	614-861-2070
OR	Portland, R. M. Minthorne	503-246-4556
TX	Dallas, Crockett Sls. Co.	214-748-8209
WI	Minneapolis, John E. M. Anderson	612-823-6459
EXP	NY, New York, Roburn Agencies	212-989-5939

JUDCO MFG. INC., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710, Tel: 213-534-0959 .... **1B**•1671

Judd Wire
DIVISION OF
HIGH VOLTAGE ENGINEERING

JUDD WIRE, High Voltage Engrg., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, TWX: 510-290-2147; FSC No.: 3357; Empl.: 148; *Sls. Mgr.:* Jack Allen .... **1B**•1011; **2**•2104, 2105

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
CA	Los Altos, Ewing Foley	415-941-4525
CO	Denver, Duffy Assocs.	303-595-4244
FL	Orlando, Donato & Assocs.	305-352-0727
GA	Norcross, Hughes Assocs.	404-449-1177
IL	Chicago, Rozner Sls. Co.	312-283-0022
MA	Marlborough, O.K. Engrg.	617-481-6400
MI	Southfield, C. H. Schmidt Co.	313-353-6000
MN	Brooklyn Center, Willman Assoc.	612-566-5010
MS	Corinth, Hughes Assocs.	601-287-2915
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NY	Attica, B. H. Tollefson Assoc.	716-591-1219
NY	Auburn, B. H. Tollefson Assoc.	315-253-4109
NY	Rochester, B. H. Tollefson Assoc.	716-271-4141
NC	Research Triangle Park, Naylor Assocs.	919-836-0478
OH	Worthington, Simcox Assocs.	614-885-8995
OR	Portland, Jas. J. Backer Co.	503-297-8744
SC	Greenville, Naylor Assocs.	803-297-9969
TN	Morristown, Hughes Assocs.	615-587-2433
TX	Dallas, Stevens Sls. Co.	214-350-2476
UT	Salt Lake City, Electrodyne	801-486-3801
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
AZ	Tempe, Pacer Elctrns.	602-267-0299
CA	Anaheim, Innovative Sys.	714-632-8800
CA	Concord, Control Master	415-939-3600
CA	Harbor City, Falmat	213-530-3333
CA	Mountain View, Sonic Wire	415-965-4646
CA	Torrance, Blake Wire & Cable	213-515-0561
CA	Valencia, Wirenetics Co.	805-257-2400
CT	East Hartford, E. J. Stephens Co.	203-568-1927
CT	Manchester, I.M.S.	203-649-4415
FL	Ft. Lauderdale, Simcona Elctrn.	305-485-4455
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
GA	Clarkston, Lance Engrg.	404-292-4404
MD	Hanover, Vertex Elctrns.	301-796-5000
MA	Burlington, QPL Elctrn. Dist.	617-229-2424
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Brooklyn Park, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NH	Manchester, Yankee Elctrn.	603-625-9746
NJ	Dover, Electro Spec.	201-361-5079
NJ	Fairfield, Olympic Wire & Cable	201-227-7996
NY	Fairport, Pacer Elctrns.	716-377-0462
NY	Farmingdale, Welco Elctrns.	516-293-0050
NY	Farmingdale, Vertex Elctrns.	516-293-9880
NY	Rochester, Simcona Elctrn.	716-328-3230
NY	Ronkonkoma, Zenith Wire	516-585-1444
OH	Dayton, Astro Inds.	513-429-5900
PA	Harleysville, Omega Wire & Cable	215-256-6577
PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Garland, Interstate Wire	214-271-0541
WA	Seattle, Anixter	206-251-5287
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2323

JUDD WIRE, High Voltage Engrg., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, TWX: 910-322-1149; FSC No.: 3357 .... **1B**•1011; **2**•2104, 2105

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JRL JULIE RESEARCH

JULIE RESCH. LABS., 211 West 61st St., New York, NY 10023, Tel: 212-245-2727, TWX: 710-581-5138; Empl.: 45; *Sls. Mgr.:* Pamela Spencer .... **1A**•1878; **3**•1248-1252

Local Sales Offices & Reps

Instruments

CO	Boulder, Instr. Repair Labs	303-449-2721

Resistors

CA	Northridge, Craig Assocs.	213-993-4060

JUNCTION DEVICES, INC., 2488-A Townsgate Rd., Westlake Village, CA 91361-2594, Tel: 213-889-4030, 805-497-4421, TWX: 910-336-1293; FSC No.: 60858; Empl.: 70; *Sls. Mgr.:* N. Pena

Local Sales Offices & Reps

CA	Burbank, MCA Repco	213-843-4096
CA	Cupertino, Allis Assoc.	408-252-2883
CA	Dana Point, MCA Repco	714-661-1300
CA	Westlake Village, MCA Repco	213-889-5553
FL	Palm Bay, Spartech Assoc.	305-727-8045
GA	Smyrna, Spartech Assoc.	404-432-3644
MA	Lowell, Matrix Sls.	617-458-2096
MO	Kansas City, E I R Company	816-452-7030
MO	Leasburg, E I R Company	314-245-6860
NY	Hartsdale, Spectrum Sls.	914-472-8600
TX	Richardson, Southwest Microwave Elctrns.	214-669-1195
VA	Fairfax, Schibley Assocs.	703-591-3008
EXP	NJ, Wayne, Expo Intl. Co.	201-956-7037

JUPITER SYSTEMS, 1100 Marina Village Parkway, Alameda, CA 94501, Tel: 415-523-9000; *Sls. Mgr.:* Richard MacElhiney

K KAHGAN Electronics Corp.

KAHGAN ELCTRNS. CORP., 556 Peninsula Blvd., Hempstead, NY 11550, Tel: 516-538-2300, TWX: 510-222-4347; Empl.: 39 .... **1A**•1119

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	Anaheim, Micrometals	714-630-7420
CA	Huntington Beach, Corcoran Assoc.	714-841-4759
CA	Los Angeles, Corcoran Assoc.	213-823-4589
CA	Santa Clara, Maxim Elctrn. Sls.	408-946-6001
CO	Aurora, High Tech Assocs.	303-695-1990
CO	Denver, Walter Engrg. Assocs.	303-777-5585
FL	Casselberry, Southern Elctrn. Mktg. (A/K/A Semi)	305-695-3334
FL	Ft. Lauderdale, Southern Elctrn. Mktg. (A/K/A Semi)	305-475-3686
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Palatine, Technology Sls.	312-991-6600
KS	Overland Park, J. F. Guernsey Co.	913-381-2225
MA	Lexington, Del-Con Sls.	617-938-1929
MN	Minneapolis, Smiley-Scott Assoc.	612-888-5551
NM	Albuquerque, Nelco Electronix	505-293-1399
NC	Raleigh, BCI, Inc.	919-781-9426
PA	King of Prussia, Emerald Elctrns.	215-265-1360
TX	Dallas, Marcom	214-351-4532
TX	Houston, Marcom	713-271-5635
VA	Reston, Tytronics Tech. Sls.	703-471-0440
WA	Vancouver, Ray Over Sls.	206-695-6179
WI	Wauseka, Techn. Sls.	414-787-5015

KAHLE ENGRG., Div. Joule Machinery Grp., 3344 Hudson Ave., P.O. Box 877, Union City, NJ 07087, Tel: 201-867-6500, Telex: 42-7757, TWX: 710-992-8835; Empl.: 50; *Sls. Mgr.:* Carl A. Napor

KAISER ELCTRNS., Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134, Tel: 408-946-3000, TWX: 910-338-0196

KAISER ELECTROPRECISION, Kaiser Aerospace & Elctrns., 1700 S. Redhill Ave., Irvine, CA 92714, Tel: 714-540-6810, Telex: 678467; FSC No.: 86831; *Sls. Mgr.:* Archie M. Cardwell

KAISER SYSTEMS, INC., 33 Cherry Hill Drive, Danvers, MA 01923, Tel: 617-777-5102 .... **3**•1608-1610

KALART VICTOR CORP., Hultenius St., Plainville, CT 06062, Tel: 203-747-1663; *Sls. Mgr.:* J. J. Costag

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017, Tel: 215-837-0700; *Sls. Mgr.:* Joe H. Ungerer

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Box 525, Broadview, IL 60153, Tel: 312-343-7004, TWX: 910-226-0713; Empl.: 290; *Sls. Mgr.:* D.R. Capparelli, Sr., V.P. Sls. & Mktg. .... **2**•1093

Local Sales Offices & Reps

AL	Huntsville, Alpha Mktg.	205-533-0766
CA	Pasadena, Black & White, Inc.	818-792-2133
CA	San Diego, Varigon Assocs.	619-576-0100
CA	Sunnyvale, M2 Mktg. Grp.	408-746-3630
CO	Boulder, Comp. Product Sls.	303-530-2800
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Tucker, Alpha Mktg.	404-491-9430
IL	Arlington Heights, M. J. Petersen & Assocs.	312-577-8200
IL	Chicago, W. F. Hamilton Co.	312-867-5030
IN	Ft. Wayne, F. J. Campisano Co.	219-747-2633
IN	Indianapolis, F. J. Campisano Co.	317-253-7651
MA	Braintree, Nova Assocs.	617-848-9330
MI	Jackson, Jim Jordan Assocs.	517-750-2677
MN	Minneapolis, Northstar Components	612-553-1888
MS	Meridian, Alpha Mktg.	601-483-9306
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	Mountainside, Henry G. Richter Co.	201-233-4615
NY	Fayetteville, Henry G. Richter Co.	315-637-6713
NY	Rochester, Henry G. Richter Co.	716-436-0300
NC	Charlotte, T. C. Sales, Inc.	704-364-8996
OH	Cincinnati, F. J. Campisano Co.	513-574-7111
OH	Cleveland, F. J. Campisano Co.	216-749-5550
PA	Corapolis, F. J. Campisano Co.	412-264-5151
TN	Austin, C. R. Colvin Assocs.	512-474-8698
TN	Houston, C. R. Colvin Assocs.	713-961-1262
TN	Oak Ridge, Alpha Marketing	615-482-4681
TX	Richardson, McCoy Assocs. Co.	214-238-1017
UT	Salt Lake City, Comp. Product Sls.	801-262-0000

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 301-749-2424, TWX: 710-864-9683; FSC No.: 50140; Empl.: 320; *Sls. Mgr.:* Charles J. Schaub

K & L QUARTZTEK, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043, Tel: 602-272-7944, TWX: 910-951-1305; FSC No.: 59492; *Sls. Mgr.:* Mark H. Story

K & M ELCTRNS., 123 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350, TWX: 710-350-6463; Empl.: 500; *Sls. Mgr.:* Allan Mallanik .... **1A**•1883

Local Distributors

MA	West Springfield, Moldcon	413-736-0371

KANTZ ELCTRN. IND., 1804 Wall Church Rd., Wall Township, NJ 07719, Tel: 201-974-0090; Empl.: 12; *Sls. Mgr.:* L. Herold

KAPPA NETWORKS, 165 Roosevelt Ave., Carteret, NJ 07008, Tel: 201-541-1600, Telex: 139408 KAPPA CRET; Empl.: 125; *Sls. Mgr.:* M. Pearl .**1A**•1538-1553

Local Sales Offices & Reps

CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Alhambra, Kappa Networks	213-283-2048
CA	Santa Clara, Emerging Technology Sls.	408-727-1771
CO	Englewood, White Sales Co.	303-694-9555
CT	Cheshire, Selmark Assocs.	203-573-9088
IA	Grandview, R.R. Burton & Assocs.	816-762-5285
MA	Millis, Selmark Assocs.	617-376-2914
MN	Osseo, Gaffney Sls. Co.	612-425-5484
MO	Grandview, R.R. Burton & Assocs.	816-765-5385
NH	Hopkinton, Selmark Associates	603-746-3299
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NC	Raleigh, Leigh Sls.	919-872-1484
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TX	Dallas, Technlg. Sls.	214-380-0200
TX	Houston, Technlg. Sls.	713-266-2473
EXP	Carteret NJ, Kappa Networks	800-223-0603

Local Distributors

CA	Alhambra, Delay Line Distrs. Co.	213-283-2058

KAPPA SCIENTIFIC CORP., Box 30585, Santa Barbara, CA 93105, Tel: 805-687-9648; Empl.: 4

KARKAR ELECTRONICS, INC., 245 Eleventh St., San Francisco, CA 94103, Tel: 415-552-1247, TWX: 910-372-7754; FSC No.: 017857; *Sls. Mgr.:* A. Slikkerveer

Local Sales Offices & Reps

NJ	Ocean Township, Karkar Elctrns., Inc.	201-493-3303
TX	Richardson, Karkar Elctrns., Inc.	214-680-9854

KARL HOPT CO, See Hopt, Karl, Co.

KATES SCI. INSTRS., 142 Adam St., Newton, MA 02158, Tel: 614-527-2711; Empl.: 28; *Sls. Mgr.:* D. Kates

KAUFMAN DATA COMMS., INC., Orange Nassau Elctrns. Co., 145 E. Dana St., Mountain View, CA 94041, Tel: 415-962-8811, TWX: 910-379-5021

KAVLICO CORP., 20869 Plummer St., Chatsworth, CA 91311-5096, Tel: 818-882-2400, FAX 818-998-2050, Telex: 65-1481; Empl.: 250; *Sls. Mgr.:* Vic Cetta; *Dist. Mgr.:* Rudi Kettler .... **1B**•1846

Local Sales Offices & Reps

CO	Lakewood, Loritz Controls	303-232-7803
FL	Winter Park, James T. Conklin, P.E.	305-629-1739
MN	Minneapolis, Industra Co.	612-835-5535
NM	Albuquerque, Indl. Prods. Corp. (IPC)	505-256-3561
NY	Thompson Ridge, Neville & Vespo Corp.	914-457-9209
PA	King of Prussia, FLW of PA	215-337-4343
SC	Greenville, E. C. Capell & Assocs.	803-297-6550
TX	Ft. Worth, UTM Engineering	817-429-2456
TX	Houston, Collinsystems Pro-Quip	713-464-9428

KAYE INSTRUMENTS, 15 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-0300, Telex: 6817183, TWX: 710-326-1598; Empl.: 170 .... **3**•1166

Local Sales Offices & Reps

AL	Birmingham, Hile Controls of Alabama	205-879-2990
AL	Mobile, Hile Controls of Alabama	205-476-7258
AZ	Phoenix, Southwest Controls Inc.	602-267-1171
AZ	Tucson, Southwest Controls Inc.	602-299-8981
AR	El Dorado, Kemp Engineering Co. Inc.	501-862-5869
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	Hayward, FLW, Inc.	415-487-2222
CA	San Diego, FLW, Inc.	619-277-0993
CA	Van Nuys, FLW, Inc.	213-989-5236
CO	Lakewood, Tech. Mktg. Mfg.	303-232-1516
CT	North Haven, Pat Jenks Assoc.	203-239-6201
FL	Tampa, Lewis & Assocs.	813-988-2104
GA	Marietta, Hile Controls of Georgia	404-424-8372
IL	Chicago, Comtel Midwest	312-539-4838
IN	Indianapolis, Comtel Midwest	317-253-1681
IA	Cedar Rapids, Comtel Midwest	319-377-9434
KS	Shawnee Mission, Comtel Midwest	913-722-1030
LA	Baton Rouge, Rise Inc.	504-776-4645
ME	Brewer, Leen Co.	207-989-7363
ME	Portland, Leen Co.	207-774-6266
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Woburn, Pat Jenks Assoc.	617-938-0488
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MI	Southfield, Comtel Midwest	313-358-2510
MN	Wayzata, Comtel Midwest	612-476-1551
MO	St. Louis, Comtel Midwest	314-991-5363
NJ	Emerson, Instrumentation Prods.	201-265-6330
NJ	Metuchen, FLW, Inc.	201-548-4343
NM	Albuquerque, Tech. Mktg. Mfg.	505-298-6893
NY	Syracuse, Labtronics	315-455-7314
NC	Matthews, W. K. Hile Co.	704-847-9125
OH	Cleveland, Fox & Dole	216-476-2625
OH	Englewood, Carter, McCormic & Peirce	513-836-0951
OK	Tulsa, Kemp Engrg. Co.	918-663-4501
PA	King of Prussia, FLW, Inc.	215-337-4343
PA	Murrysville, Data Acquisition Sys.	412-327-8979
TN	Knoxville, Hile Controls of TN	615-584-0208
TN	Memphis, Hile Controls of TN	901-372-0451
TX	Lubbock, Summit Controls	806-792-2072
TX	Plano, Summit Controls	214-867-6056
TX	Sugar Land, Pan/Tech Engrg. Corp.	713-240-1220
UT	Salt Lake City, Tech. Mktg. Mfg.	801-487-7676
WA	Issaquah, DCI/Alpha	206-392-7521
WA	Vancouver, DCI/Alpha	206-693-7447
WI	New Berlin, Comtel Midwest	414-544-6042

KAY ELEMETRICS CORP., 12 Maple Ave., Pine Brook, NJ 07058-9797, Tel: 201-227-2000, TWX: 710-734-4347; FSC No.: 80138; Empl.: 70; *Sls. Mgr.:* Stephen P. Crump .... **1A**•1708

KAY-TOWNES ANTENNA, P.O. Box 593, Rome, GA 30161, Tel: 404-291-9871, TWX: 810-764-4809; Empl.: 85; *Sls. Mgr.:* Charles S. Ford; *Dist. Mgr.:* James A. Sheffiled

KB ELCTRNS., 73 Wortman Ave., Brooklyn, NY 11207, Tel: 212-257-3300, TWX: 710 584 2308; Empl.: 125; *Sls. Mgr.:* A Bueller

KBI, A Div. of Cabot Corp., PO Box 1462, Reading, PA 19603, Tel: 215-371-3600, Telex: 902251, TWX: 510-651-0106; Empl.: 600; *Sls. Mgr.:* Robert J. Longenecker

KCK AMERICA INC., 1245 Forest Ave., Ste. 10, Des Plaines, IL 60018, Tel: 312-297-5435, Telex: 726481; *Sls. Mgr.:* Carl Bronder; *Dist. Mgr.:* Carl Bronder

KD COMPONENTS, INC., 3016 S. Orange Ave., Santa Ana, CA 92707, Tel: 714-545-7108, TWX: 910-595-2678; Empl.: 25

KDI ELECTRONICS, INC., 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-8100, TWX: 710-986-8220; Empl.: 250; *Sls. Mgr.:* William M. Dodge; *Dist. Mgr.:* William M. Dodge .... **1A**•1879

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Los Angeles, Elsco	714-891-4621
CA	Mountain View, Gene Woempner Co., Inc.	415-578-1581
CA	Mountain View, J.I. Tech. Sls.	415-969-5552
CA	Mountain View, Gene Woempner	415-578-1581
CO	Denver, High Plains Mktg.	303-751-7150
FL	PalmBay, Spartech Assocs., Inc.	305-727-8045
GA	Smyrna, Spartech Assocs., Inc.	404-432-3644
IL	Northfield, Imex Ltd.	312-446-8934
IL	Park Ridge, Probe Elctrns.	312-698-2044
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MA	Ashland, John O'Donnell	617-881-1380
MA	N. Andover, Torrey Assocs.	617-687-0099
MN	New Brighton, TWC Sls.	612-636-1770
MO	Grandview, Harris - Hanson	816-763-6200
MO	St. Louis, Harris - Hanson	314-432-3611
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Bridgeport, Lightstone Corp.	315-699-5747
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NY	Huntington, CDB Entrps., Inc.	516-692-5200
NY	Syracuse, T-Squared Elctrns.	315-463-8592
OH	Dayton, Frederick L. Ohmer & Assoc.	513-434-1454
PA	Doylestown, Lou Adezio	215-249-9729
TX	Dallas, Texas Avionics	214-386-3566
TX	Garland, Carey, McMahill & Zerbe Co., Inc.	214-681-1414
TX	Sherman, Repmasters	214-247-6236
WA	Vancouver, Ray Over Sls.	206-695-4697

Local Distributors

CA	Chatsworth, MIL-COMM Distrs.	213-998-3111
CA	Mountain View, Target Elctrns.	415-961-1170
FL	Tampa, Impala Elctrns.	813-885-4747
NJ	Englewood, Tech. Elctrn. Distrs.	201-894-0800
NY	Farmingdale, Command Elctrns.	516-293-1212
TX	Houston, Lenert Co.	713-225-1465

KEC ELECTRONICS, INC.

KEC ELCTRNS., INC., 20817 Western Ave., Torrance, CA 90501, Tel: 213-320-3902, TWX: 910-349-6962; Empl.: 8; *Sls. Mgr.:* Frank Chase .... 3•1613-1616

Local Sales Offices & Reps

AZ	Tempe, Quatra	602-894-2802
CA	Cupertino, Costar	408-446-9339
CA	Los Alamitos, Power Specialists	213-594-9418
CO	Fort Collins, Vic Myers Assoc.	303-223-8907
FL	Cocoa Beach, Teqspec	305-748-9292
FL	Hobe Sound, Teqspec	305-746-4987
FL	Palm Harbor, Teqspec	813-785-2276
GA	Atlanta, Teqspec	404-455-7222
IL	Elk Grove Village, Loren Green Assoc.	312-593-0282
IN	Indianapolis, Loren Green Assoc.	317-293-9827
MA	Danvers, C. H. Burnham Assocs.	617-774-0111
MI	Jenison, R. C. Nordstrom & Co.	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MN	Minnetonka, Chris-Tek	612-934-1334
NH	Durham, C. H. Burnham Assocs.	603-868-2282
NJ	Springlake, Neville & Vespo	201-974-1520
NM	Albuquerque, Vic Myers Assocs. Inc.	505-884-6878
NY	Binghamton, TAE-Rep.	607-772-6952
NY	Rochester, TAE-Rep.	716-586-8710
NY	Thompson Ridge, Neville & Vespo	914-457-9209
NC	Winston Salem, Teqspec	919-723-8102
OH	Chesterland, KT/DEPCO	216-729-3588
PA	Erdenheim, Omni Sls.	215-233-4600
PA	Pittsburg, KT/Depco	412-487-8777
RI	Johnston, C. H. Burnham Assocs.	401-231-7475
TN	Morristown, Teqspec	615-587-0980
VA	Fairfax, Nine Assocs.	703-273-1803
WA	Bellevue, Elctrn. Mktg. Grp.	206-746-5915

KEENE LAMINATES, Keene Corp., 199 Amaral St., E. Providence, RI 02914, Tel: 800-556-7683, Telex: 927524

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, TWX: 910-925-4116; Empl.: 100

KEENE RAY PROOF, Keene Corp., 50 Keeler Ave., Norwalk, CT 06878, Tel: 203-838-4555, Telex: 96-5812; *Sls. Mgr.:* Robert C. Barbour; *Dist. Mgr.:* Ken Makowski

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 216-248-0400, Telex: 98-5469; Empl.: 461; *Sls. Mgr.:* Ron Ruiz; *Dist. Mgr.:* T. A. Hayden

KEL-AM, 308 E. 5th, P.O. Box 313, Eldon, MO 65026, Tel: 314-392-7174, Telex: 42-301; FSC No.: 57856; Empl.: 67; *Sls. Mgr.:* Bob Riemer; *Dist. Mgr.:* Bob Riemer .... 2•1472-1483

Local Sales Offices & Reps

AZ	Scottsdale, BH&B Sls.	602-994-4455
CA	Placentia, Local Sls.	714-993-1800
CA	Santa Clara, Acclaim	408-745-7416
CO	Parker, Mikro Sls.	303-841-4131
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Sarasota, Phoenix Comps.	813-371-1163
GA	Atlanta, Electro Sls.	404-394-1122
IL	Arlington Heights, Diethert/Angel	312-593-7600
IN	Fort Wayne, Temple Engrg.	219-743-0362
IA	Davenport, Electro Tech.	319-386-1134
MD	Baltimore, Faion Lott, Inc.	301-744-4611
MA	Lexington, Kitchen & Kutchin	617-862-8230
MI	Ypsilanti, Tamco, Inc.	313-572-1950
MN	Minneapolis, Electro-Tech	612-927-5878
MO	N. Kansas City, Weisler & Assocs.	314-394-4543
MO	St. Louis, Weisler & Assocs.	
NJ	Clark, R. E. Breuer Co.	201-388-5045
NM	Albuquerque, Nelco Elctrns.	505-293-1399
NY	Port Washington, R. E. Breuer Co.	516-883-7810
NY	Rochester, Tech. Comps.	716-342-2406
OR	Portland, SPS Engrg.	503-297-6919
PA	Downingtown, MCCoy, Inc.	215-363-0350
PA	McKean, ECCO Sls.	814-476-1376
SC	Greer, Sunbelt Sls.	803-877-9088
TN	Chattonooga, Electro Sls.	615-267-4260
TX	Grapevine, Elctrn. Mktg. Assoc.	817-481-7502
TX	Houston, Elctrn. Mktg. Assoc.	713-498-8120
WA	Redmond, SPS Elctrns.	206-392-5264

Local Distributors

AZ	Tempe, Anjon	602-894-1332
CA	Belmont, LO-DAN Elctrns.	415-592-4600
CA	Corona, Konex Corp.	714-371-1200
CA	Glendale, Remco	714-558-3202
CA	Mountain View, Cornett Elctrns.	415-969-5420
CA	San Diego, Mann	619-578-1550
CA	San Fernando, REMCO	213-365-1176
CA	Santa Ana, Mann S.W.	714-558-3202
CA	Santa Clara, Mann Elctrns.	408-988-6061
CO	Denver, CSID Intergrated Elctrns.	303-893-9594
CT	Stratford, Utronics	203-378-4201
FL	Ft. Lauderdale, Intertec Comps.	305-975-8644
FL	Largo, Lo Dan Elctrns.	813-586-2851
FL	Longwood, Intertec Comps.	305-834-7777
IL	Arlington Hgts., Lo Dan Elctrns.	312-398-5311
IL	Hoffman Estates, Intercomp	312-843-2040
IN	Indianapolis, Graham Elctrns.	317-634-8202
KS	Shawnee, Besco Elctrns.	913-268-7633
KS	Wichita, Radio, Inc.	316-264-2798
MA	Lowell, Bay State Wire & Cable	617-454-2444
MA	Woburn, Elctrn. Packaging Comps.	617-935-0400
MI	Farmington Hills, Ambur Elctrns.	313-477-8670
MI	Southfield, LSI Mktg.	313-356-7002
MN	Farmington, Tel-Tek, Inc.	612-460-6299
MN	Minneapolis, Wilde, Inc.	612-941-4825
MO	Independence, H.F. Signalling	816-833-4448
NE	Lincoln, Scott Elctrns.	402-466-8221
NE	North Platte, Scott Elctrns.	308-532-9260
NE	Omaha, Scott Elctrns.	402-734-6750
NH	Hampstead, Astrum Elctrns.	603-329-5656
NJ	Roselle, Lectron Inds.	201-245-5858
NM	Albuquerque, Elctrn. Devices	505-293-1935
NY	Port Washington, Connector Concepts	516-883-3800
OK	Oklahoma City, Radio, Inc.	405-789-0741
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Zepher Elctrns.	503-643-1980
PA	McKean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronics	215-643-2850
TX	Addison, Connec/Tek	214-239-7552
WA	Redmond, Mann N.W.	206-881-0440
WA	Seattle, Zepher Elctrns.	206-241-1980

KELTEC FLORIDA, P.O. Box 2917, Ft. Walton Bch., FL 32549, Tel: 904-651-1210, TWX: 510-730-7654; FSC No.: 09062; Empl.: 400 .... 3•1617-1619

Local Sales Offices & Reps

AZ	Phoenix, J. Smith Assoc.	602-267-0981
CA	Los Angeles, Cain Technology	213-476-2251
CA	Orange, Cain Technology	714-997-7311
CA	Sunnyvale, Loeswick's	408-745-6751
CO	Colorado Springs, J. Smith Assoc.	303-597-5343
IN	Ossian, Science Sls.	219-622-7383
IA	Cedar Rapids, Palatine Sls.	319-365-8071
KS	Goddard, Palatine Engrg. & Sls.	316-788-5521
KS	Mission, Palatine Sls.	913-831-0555
MD	Ellicott City, VPI	301-461-2525
MA	Needham Hgts., O'Sullivan & Murphy	617-449-4141/4142/4144
MO	Hazelwood, Palatine Sls.	314-893-0800
NJ	Danville, Metro-MICS	201-625-5959
NJ	Westfield, Metro MICS	201-233-6116
NM	Albuquerque, J. Smith Assoc.	505-265-3406
NY	Melville, Metro MICS	516-433-3333
NY	N. Tonawanda, Labtronics	315-454-9314
NY	New York, Landseas Corp.	212-265-8323
NY	Syracuse, Labtronics	315-455-7314
OH	Brunswick, Science Sls.	216-273-4429
PA	Montgomerysville, VPI	215-474-3200
TX	Richardson, Lear Assocs.	214-231-5388
TX	Spring, Lear Assocs.	713-370-7449

KELTLON CORP., Viking Modules Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, Telex: 948197; Empl.: 75; *Sls. Mgr.:* T. Chadurjian

KELTRON CORP., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, Telex: 948197; Empl.: 270; *Sls. Mgr.:* E. Chown; *Dist. Mgr.:* E. Chown

KELTRON CORP., Walden Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, Telex: 948197; Empl.: 225; *Sls. Mgr.:* T. Chadurjian

KELVIN, 5919 Noble Ave., Van Nuys, CA 91411, Tel: 818-782-6662, Telex: 65-1417; FSC No.: 19587; Empl.: 250; *Sls. Mgr.:* R. A. Featherston .... 1A•1880-1882

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Scottsdale, D.H. Entprs.	602-990-0452
CA	Mountain View, G. C. Woempner Co.	415-964-5454
CA	Van Nuys, Wes-K Assoc.	213-989-3070
CO	Boulder, R-G Entprs.	303-447-9211
CT	Milford, Todino Engrg. Sls.	203-874-6643
FL	Ft. Lauderdale, Electro-Comp.	305-491-4141
IL	Deerfield, Walt Krueger	312-945-3720
MD	Reisterstown, Massey Assocs.	301-833-2039
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Birmingham, Forand Sls.	313-644-0087
MN	Minneapolis, Parker Shoap	612-755-6904
NJ	Medford, Jack McCoy Inc.	609-953-0770
NY	Fayetteville, Foster & Wager	315-637-5427
NY	Great Neck, Trionic	516-466-2300
NY	Webster, Foster & Wager	716-265-2072
OH	New Lebanon, J. N. Bailey & Assoc.	513-687-1325
OR	Beaverton, General Elctrns.	503-641-5288
TX	Austin, C. R. Colvin Assoc.	512-474-8698
TX	Dallas, Stasco	214-239-4517
TX	Houston, C. R. Colvin Assoc.	713-961-1262
WA	Seattle, General Elctrns.	206-241-7990

KEMET®

KEMET, UNION CARBIDE CORPORATION, ELCTRNS. DIV., Components Dept., Box 5928, Greenville, SC 29606, Tel: 803-963-6348, Telex: 57-0496, TWX: 810-287-2536; FSC No.: 31433; *Sls. Mgr.:* C. E. Volpe; *Dist. Mgr.:* J. A. Bruorton .... 1A•1096-1118

Local Sales Offices & Reps

AL	Huntsville, Union Carbide	205-830-1090
AZ	Tempe, Union Carbide	602-831-2151
CA	Marina del Rey, Union Carbide	213-821-8824
CA	Mountain View, Union Carbide	415-969-9390
CA	San Diego, Union Carbide	619-560-0768
CO	Englewood, Union Carbide	303-773-0494
FL	Ft. Lauderdale, Union Carbide	305-731-2187
FL	Orlando, Union Carbide	305-855-8886
FL	Pompano Beach, Union Carbide	305-785-1990
FL	Tampa, Union Carbide	813-872-1861
IL	Schaumburg, Union Carbide	312-843-1030
IN	Carmel, Union Carbide	317-844-7756
IA	Ceder Rapids, Seltec Sls.	319-393-1114
MD	Columbia, Union Carbide	301-992-5600
MA	Woburn, Union Carbide	617-938-5400
MI	Livonia, Union Carbide	313-591-0555
MN	Edina, Union Carbide	612-929-4642
NY	Liverpool, Union Carbide	315-451-0720

KEITHLEY

AUTHORIZED DISTRIBUTORS

RAG ELECTRONICS, INC.

WEST
21418 Parthenia Street
Canoga Park, CA 91304
Tel. (818) 998-6500

EAST
1 Pollack Avenue
Ocean, N.J. 07712
Tel. (201) 544-0666

NEW & RECONDITIONED TEST EQUIPMENT

• SALES • RENTALS • PURCHASE OPTIONS
• REPAIR & CALIBRATION

Call Toll-Free
West
(Outside CA)
1-800-732-3457
East
(Outside NJ)
1-800-922-0945

NY	Tarrytown, Union Carbide	914-332-4000
NC	Raleigh, Union Carbide	919-872-2877
OH	Worthington, Union Carbide	614-436-1510
OK	Tulsa, Union Carbide	918-664-8592
PA	Exton, Union Carbide	215-363-8310
SC	Greenville, Union Carbide	803-242-5789
TX	Austin, Union Carbide	512-458-3181
TX	Irving, Union Carbide	214-556-0009
WA	Kirkland, Union Carbide	206-828-4853
PR	Santurce, ISLA CARIBE Electro Sls.	809-722-5140

Local Distributors

AL	Huntsville, Schweber Elctrns.	205-882-2200
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Huntsville, Hall-Mark Elctrns. Corp.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns. Corp.	602-243-6601
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Fisher-Brownell	602-967-1464
AZ	Tempe, Hamilton/Avnet Elctrns.	602-231-5100
CA	Alhambra, Fisher-Brownell	714-739-2201
CA	Canoga Park, Schweber Elctrns.	213-999-4702
CA	Chatsworth, Integrated Elctrns.	213-998-2200
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Costa Mesa, Hamilton/Avnet Elctrns.	714-641-1850
CA	Culver City, Hamilton Electro Sls. (Corp. Off.)	213-558-2662
CA	Irvine, Schweber Elctrns.	714-556-3880
CA	Sacramento, Hamilton/Avnet Elctrns.	916-920-3150
CA	Sacramento, Schweber Elctrns.	916-929-9732
CA	San Diego, Fisher-Brownell	619-560-8545
CA	San Diego, Hall-Mark Elctrns. Corp.	619-268-1201
CA	San Diego, Hamilton/Avnet Elctrns.	619-571-7510
CA	Santa Clara, Fisher-Brownell	408-988-6041
CA	Santa Clara, Schweber Elctrns.	408-748-4700
CA	Sunnyvale, Hall-Mark Elctrns. Corp.	408-773-9990
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3355
CA	Sunnyvale, Bell Inds. (Corp. Off.)	408-734-8570
CA	Woodland Hills, Avnet Elctrns.	213-884-3333
CO	Englewood, Hall-Mark Elctrns. Corp.	303-694-1662
CO	Englewood, Hamilton/Avnet Elctrns.	303-740-1000
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Danbury, Schweber Elctrns.	203-792-3500
CT	Danbury, Hamilton/Avnet Elctrns.	203-797-2800
CT	Norwalk, Pioneer/Harvey Elctrns.	203-853-1515
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Ft. Lauderdale, Hall-Mark Elctrns. Corp.	305-971-9280
FL	Ft. Lauderdale, Hamilton/Avnet Elctrns.	305-971-2900
FL	Hollywood, Schweber Elctrns.	305-927-0511
FL	Orlando, Hall-Mark Elctrns. Corp.	305-855-4020
FL	St. Petersburg, Hamilton/Avnet Elctrns.	813-576-3930
GA	Norcross, Hall-Mark Elctrns. Corp.	404-447-8000
GA	Norcross, Schweber Elctrns.	404-449-9170
GA	Norcross, Hamilton/Avnet Elctrns.	404-447-7500
IL	Bensenville, Hamilton/Avnet Elctrns.	312-678-6310
IL	Bensenville, Hall-Mark Elctrns. Corp.	312-860-3800
IL	Elk Grove, Pioneer/Chicago Elctrns.	312-437-9680
IL	Elk Grove Village, Schweber Elctrns.	312-364-3750
IN	Carmel, Hamilton/Avnet Elctrns.	317-844-9333
IN	Indianapolis, Pioneer/Indianapolis	317-849-7300
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
KS	Lenexa, Hall-Mark Elctrns. Corp.	913-888-4747
KS	Overland Park, Hamilton/Avnet Elctrns.	913-888-8900
KS	Overland Pk., Schweber Elctrns.	913-492-2921
MD	Baltimore, Hall-Mark Elctrns. Corp.	301-796-9300
MD	Columbia, Hamilton/Avnet Elctrns.	301-995-3500
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Burlington, J. V. Elctrns. of Boston	617-273-4300
MA	Framingham, Cavalier Comps.	617-875-2000
MA	Lexington, Pioneer/Harvey Elctrns.	617-861-9200
MA	Woburn, Hamilton/Avnet Elctrns.	617-935-9700
MI	Grand Rapids, Hamilton/Avnet Elctrns.	616-243-8805
MI	Livonia, Pioneer/Michigan Elctrns.	313-525-1800
MI	Livonia, Hamilton/Avnet Elctrns.	313-522-4700
MI	Livonia, Schweber Elctrns.	313-525-8100
MN	Bloomington, Hall-Mark Elctrns. Corp.	612-884-9056
MN	Eden Prairie, Schweber Elctrns.	612-941-5280
MN	Minneapolis, Merit Elctrns. Corp.	612-546-5383
MN	Minnetonka, Pioneer/Twin Cities Elctrns.	612-935-5444
MN	Minnetonka, Hamilton/Avnet Elctrns.	612-932-0600
MO	Earth City, Schweber Elctrns.	314-739-0526
MO	Earth City, Hamilton/Avnet Elctrns.	314-344-1200
MO	Maryland Hgts., Hall-Mark Elctrns. Corp.	314-291-5350
NJ	Cherry Hill, Hall-Mark Elctrns. Corp.	609-424-7300 (NJ), 215-355-7300 (PA)
NJ	Cherry Hill, Hamilton/Avnet Elctrns.	609-424-0100
NJ	Fairfield, Hall-Mark Elctrns. Corp.	201-575-4415
NJ	Fairfield, Schweber Elctrns.	201-227-7880
NJ	Fairfield, Hamilton/Avnet Elctrns.	201-575-3390
NJ	Pine Brook, Pioneer/Harvey Elctrns.	201-227-1262
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Hamilton/Avnet Elctrns.	505-765-1500
NY	Buffalo, Summit Distrs.	716-884-3450
NY	E. Syracuse, Hamilton/Avnet Elctrns.	315-437-2642
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Melville, Hamilton/Avnet Elctrns.	516-454-6010
NY	Rochester, Summit Distrs.	716-334-8110
NY	Rochester, Schweber Elctrns.	716-424-2222
NY	Rochester, Hamilton/Avnet Elctrns.	716-475-9130
NY	Westbury, Schweber Elctrns. (Corp. Off.)	516-334-7474
NY	Woodbury, Pioneer/Harvey Elctrns.	516-921-8920
NC	Raleigh, Schweber Elctrns.	919-876-0000
NC	Raleigh, Hall-Mark Elctrns. Corp.	919-832-4465
NC	Raleigh, Hamilton/Avnet Elctrns	919-829-8030
OH	Beachwood, Schweber Elctrns.	216-464-2970
OH	Cleveland, Hamilton/Avnet Elctrns.	216-831-3500
OH	Cleveland, Pioneer/Cleveland Elctrns.	216-587-3600
OH	Cleveland, Hall-Mark Elctrns. Corp.	216-473-2907
OH	Dayton, Schweber Elctrns.	513-439-1800
OH	Dayton, Hamilton/Avnet Elctrns.	513-433-0610
OH	Dayton, Pioneer/Dayton Elctrns.	513-236-9900
OH	Westerville, Hall-Mark Elctrns. Corp.	614-891-4555
OK	Tulsa, Schweber Elctrns.	918-622-8000
OK	Tulsa, Hall-Mark Elctrns. Corp.	918-835-8458
OR	Lake Oswego, Bell Inds.	503-241-4115
OR	Lake Oswego, Hamilton/Avnet Elctrns.	503-635-7850
PA	Horsham, Schweber Elctrns.	215-441-0600
PA	Pittsburgh, Schweber Elctrns.	412-782-1600
PA	Pittsburgh, Pioneer/Pittsburgh Elctrns.	412-782-2300
TX	Austin, Pioneer/Austin	512-835-4000
TX	Austin, Schweber Elctrns.	512-458-8253
TX	Austin, Hall-Mark Elctrns. Corp.	512-837-2814
TX	Austin, Hamilton/Avnet Elctrns.	512-837-8911
TX	Dallas, Pioneer/Dallas Elctrns.	214-386-7300
TX	Dallas, Schweber Elctrns.	214-661-5010
TX	Dallas, Hall-Mark Elctrns. Corp. (Corp. Off.)	214-343-5000
TX	Houston, Pioneer/Houston Elctrns.	713-988-5555
TX	Houston, Hamilton/Avnet Elctrns.	713-780-1771
TX	Houston, Schweber Elctrns.	713-784-3600
TX	Houston, Hall-Mark Elctrns. Corp.	713-781-6100
TX	Irving, Hamilton/Avnet Elctrns.	214-659-4111
TX	Richardson, Fisher-Brownell	214-235-3177
TX	Richardson, Jaco Elctrns.	214-235-9575
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Hamilton/Avnet Elctrns.	801-972-2800
WA	Bellevue, Bell Inds.	206-747-1515
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bellevue, Hamilton/Avnet Elctrns.	206-453-5845
WI	Brookfield, Schweber Elctrns.	414-784-9020
WI	New Berlin, Hamilton/Avnet Elctrns.	414-784-4510
WI	Oak Creek, Hall-Mark Elctrns. Corp.	414-761-3000

KEMLITE LABS., INC., 1819 W. Grand Ave., Chicago, IL 60622, Tel: 312-829-6050; Empl.: 65; *Sls. Mgr.:* J.V. Daniels

KEMTRON CIRCUITS & ELCTRNS. CORP., 48 Merrick Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

KENCO INDUSTRIES, INC., Elctrn. Chemicals Div., P.O. Box 88500, Atlanta, GA 30338, Tel: 404-475-6100; Empl.: 25; *Sls. Mgr.:* J. Rothenbach

KENSOL WIRE MARKING, Kensol Olsenmark Inc., 40 Melville Park Road, Melville, NY 11747, Tel: 516-694-7773, Telex: 510-224-6418; *Sls. Mgr.:* Tony Fiorey

KEN-TRON MFG., INC., 1204 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, Telex: 20-4305; Empl.: 100; *Sls. Mgr.:* J. Douglas

KENYON MAGNETICS, 1040 Grand St, Hoboken, NJ 07030, Tel: 201-798-6511; FSC No.: 54194; Empl.: 47; *Sls. Mgr.:* J. R. Siegel

KEPCO, 131-38 Sanford Ave., Flushing, NY 11352, Tel: 212-461-7000, TWX: 710-582-2631; Empl.: 200; *Sls. Mgr.:* Paul Birman; *Dist. Mgr.:* Paul Birman .... 3•1621-1644

Local Sales Offices & Reps

AL	Huntsville, J. L. Highsmith Co.	205-536-6666
AZ	Tempe, J. F. Hurlbut Co.	602-968-5962
CA	Los Angeles, Windsor Dynamics	213-990-4173
CA	San Diego, Windsor Dynamics	714-452-1891
CA	San Francisco, N-S Assocs.	415-854-4870
CO	Denver, J. F. Hurlbut Co.	303-279-7796
CT	Farmington, R. Perron Co.	203-673-4825
FL	Boca Raton, J. L. Highsmith Co.	305-368-9194
FL	Orlando, J. L. Highsmith Co.	305-422-5794
GA	Tucker, J. L. Highsmith Co.	404-493-1055
IL	Chicago, Century Elctrns.	312-777-9700
IN	Noblesville, Century Elctrns.	317-849-2026
IA	Cedar Rapids, Century Elctrns.	319-362-4410
KS	Shawnee, ATECH	913-268-9644
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, R. Perron Co.	617-449-6162
MI	Detroit, Carter McCormic & Peirce	313-477-7700
MN	Minneapolis, E.C. Elctrn. Sls.	612-831-0229
MO	St. Louis, ATECH	314-576-2884
NH	Dover, R. Perron & Co.	603-742-2321
NJ	Cresskill, Eastern Instrmn.	201-567-9505
NM	Albuquerque, Techn. Mktg. Assoc.	505-345-8921
NY	Rochester, NACO Elctrns. Corp.	716-223-4490
NY	Syracuse, NACO Elctrns. Corp.	315-699-2651
NY	Utica, NACO Elctrns. Corp.	315-732-1801
NC	Charlotte, J. L. Highsmith Co.	704-333-7743
OH	Cleveland, Carter McCormic & Peirce	216-779-5100
OH	Dayton, Carter McCormic & Peirce	513-836-0951
OR	Portland, H. Levinson	503-245-1902
PA	Bensalem, Eastern Instrmn.	215-927-7778
PA	Pittsburgh, Carter McCormic & Peirce	412-372-4415
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-944-2055
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
VA	Richmond, J. L. Highsmith Co.	804-745-5555
WA	Seattle, H. Levinson Co.	206-382-1300
WI	Milwaukee, Century Elctrns. Sls.	414-645-3680

KEPRO CIRCUIT SYS., 630 Axminister Dr., Fenton, MO 63026, Tel: 314-343-1630; Empl.: 17; *Sls. Mgr.:* Jeff R. Keil; *Dist. Mgr.:* Jeff R. Keil

KESSLER-ELLIS PRODS., 120 1st Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-0500, 800-631-2165, Telex: 13-2496; FSC No.: 28222; Empl.: 85; *Sls. Mgr.:* Corson Ellis, III; *Dist. Mgr.:* Karen Henderson .... 3•1132, 1133

Call Our Applications Group Toll Free 800-631-2165

Local Distributors

AL	Dothan, All-Phase Elec. Supp.	205-793-2313
AK	Morrilton, Tri-State	501-354-1849
AZ	Phoenix, Metermaster	602-243-4111
AZ	Phoenix, Bob Anderson Co.	602-266-2070
AR	Little Rock, Drives and Elec.	501-568-8800
CA	Burbank, Coast Wholesale Elec.	213-843-4111
CA	Dublin, Standard Meter Lab	415-828-4837
CA	Fresno, Allied Elec. Motor Ser.	209-486-4222
CA	Irvine, Metercraft	714-979-1420
CA	Los Angeles, Metermaster	213-685-4340
CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CA	Oakland, Western Electro-Mechanical	415-452-1936
CA	Palo Alto, Metermaster	415-968-0313
CA	San Diego, Metermaster	619-560-4841
CA	Santa Clara, E.I.L. Instrs.	408-727-0396
CA	Santa Monica, Master Distr.	213-452-1229
CO	Aurora, Esco Svcs.	303-360-8008
CO	Denver, E.I.L. Instrs.	303-534-4160
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Cantonment, C.B. Metcalf	904-968-5500
FL	Clearwater, Esco Svc.	813-461-6454
FL	Ft. Lauderdale, Elctrn. Devices & Controls	305-974-2500
FL	Ft. Lauderdale, McDonald	305-563-6165
FL	Ft. Lauderdale, Power & Pumps	305-566-3261
FL	Jacksonville, Power & Pumps	904-356-5881
FL	Orlando, Power & Pumps	305-843-7400
FL	Palm Bay, E.I.L. Instrs.	305-725-8300
FL	Tampa, Power & Pumps	813-621-8071
GA	Norcross, Metermaster	404-446-0166
GA	Norcross, AA Elec.	404-449-8670
HI	Honolulu, Process Valve	808-848-0337
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Decatur, Englewood Elec.	217-875-7300
IL	Downers Grove, Neuco	312-960-3800
IL	Peoria, Tecco Inc.	309-692-2312
IL	Woodale, Electro-Kinetics	312-595-6700
IN	Columbus, Kirby Risk Supp.	812-372-8431
IN	Evansville, Hutch & Sons	812-425-7201
IN	Indianapolis, Bryat Controls	317-784-0261
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
KY	Edgewood, AC/DC	606-341-0330
KY	Louisville, E.I.L.	502-454-3432
LA	New Orleans, Indl. Instr. Works	504-733-8355
MD	Baltimore, B. R. Smith	301-945-1000
MD	Gaithersburg, Pioneer	301-921-0660
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	W. Springfield, Control Engrg.	413-781-1330
MI	Cadillac, Ackerman Elctrl. Supp.	616-775-9734
MI	Clio, Control Dvcs.	313-686-2410
MI	Grand Rapids, Ackerman Elctrl. Supp.	616-459-8327
MI	Marquette, NWR	906-228-9050
MI	Southfield, ESCO Svc.	313-354-3818

MN	Bloomington, NWR	612-854-7329
MN	Hibbing, NWR	218-262-5228
MN	Minneapolis, Dot Elctrns.	612-861-3343
MO	St. Louis, Indl. Svc. Labs	314-535-5760
NJ	Green Brook, Apparatus Elctrl. Supp.	201-752-8400
NJ	Paterson, Feldman Bros.	201-742-7329
NY	Hauppauge, E.I.L. Instrs.	516-231-6333
NY	Maspeth, Babco	212-446-5120
NY	Rochester, E.I.C.	716-424-5750
NY	Rochester, E.I.L. Instrs.	716-424-5750
NY	Rockaway Park, Metropolitan Sls.	212-634-3100
NC	Asheville, Elec. Supp. Co.	704-255-8899
NC	Charlotte, Carolina Elec. Supp. Co.	704-333-7526
NC	Charlotte, Count Inc.	704-392-7496
NC	Gastonia, J.M.T. Elctrn.	704-867-4401
OH	Chagrin Falls, RPM Sales	216-247-3295
OH	Cleveland, Metermaster	216-651-4100
OH	Cleveland, Pioneer Std.	216-587-3600
OH	Dayton, Pioneer	513-236-9900
OH	Dayton, E.I.L. Instrs.	513-435-2134
OH	Tipp City, Tech. Comp. Sls.	513-667-1216
OK	Tulsa, Tri-State	918-836-0286
OR	Portland, Westcon	503-283-0132
PA	Exton, Valey Assocs.	215-363-2650
PA	Havertown, Quarracino	215-449-7500
PA	Media, W. Reeves Assocs.	215-566-6709
PA	Pittsburgh, E.I.L. Instrs.	412-731-5230
PA	Pittsburgh, CAM RPC	412-782-3770
SC	Columbia, Control Specialists	803-254-8087
TX	Dallas, Solid State	214-438-5700
TX	Dallas, E.I.L. Instrs.	214-931-1236
TX	Fort Worth, Allied Electrns.	817-336-5401
TX	Ft. Worth, Swieco Inc.	817-335-6512
TX	Garland, Metermaster	214-271-5671
TX	Houston, Quality Inst. Labs	713-524-0528
TX	Houston, E.I.L. Instrs.	713-271-3100
UT	Fillmore, Stuart	801-743-5861
UT	Salt Lake City, Stuart	801-466-8603
VA	Alexandria, E.I.L. Instrs.	703-354-4330
VA	Virginia Beach, E.I.L. Instrs.	804-499-3746
WA	Seattle, E.I.L. Instrs.	206-762-0880
WA	Seattle, C. B. Parsons	206-762-7373
WI	Fond du Lac, Englewood Elctrl.	414-922-4240
WI	Green Bay, Englewood Elctrl.	414-432-2000
WI	Oconomowoc, Atlas Instrs.	414-367-8759
WI	Schoefield, Englewood Elctrl.	715-359-0454

KESTER SOLDER DIV., 4201 Wrightwood Ave., Chicago, IL 60639, Tel: 312-235-1600; Empl.: 350; *Sls. Mgr.:* Mack J. Haraburd .... 2•1084, 1929

Local Sales Offices & Reps

CA	Anaheim	714-871-0280
NJ	Newark	201-589-0246

KEUFFEL & ESSER/KRATOS, 20 Whippany Rd., Morristown, NJ 07960, Tel: 201-285-5181, Telex: 136425; Empl.: 1800

KEVLIN MICROWAVE CORP., 26 Conn St., Woburn, MA 01801, Tel: 617-935-4800, TWX: 710-393-1239; FSC No.: 25634; *Sls. Mgr.:* James E. Riley

KEYAN INDS., INC., P.O. Box 1228, Middleboro, MA 02346, Tel: 617-947-7719; Empl.: 11; *Sls. Mgr.:* Tris Klingenberg; *Dist. Mgr.:* Herb Holt

KEYEX, J. B. Man Corp., 838 S. Main St., Hampstead, MD 21074, Tel: 301-239-6777; *Sls. Mgr.:* Karl M. Yatovitz; *Dist. Mgr.:* Karl M. Yatovitz

KEYSTONE CARBON, Thermistor Div., St. Marys, PA 15857, Tel: 814-781-1591, Telex: 91-4517; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock .... 1B•1804-1807

Local Sales Offices & Reps

CA	San Carlos, Electro Pacific	415-592-3114
CA	Sierra Madre, McCornack & Assocs.	213-355-0466
CO	Littleton, Omega Ltd.	303-798-7040
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	West Dundee, W. S. Heffron	312-426-6472
IN	Fort Wayne, R.O. Whitesell & Assoc.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assoc.	317-359-9283
IN	Kokomo, R.O. Whitesell & Assoc.	317-457-9127
KS	Shawnee, Benson Engrg.	913-642-4442
KY	Louisville, R.O. Whitesell & Assoc.	502-426-7696
MI	Grand Rapids, J.L. Montogomery Co.	616-774-9308
MI	Southfield, J.L. Montgomery Assoc.	313-358-2616
MN	Minneapolis, Stoss Assocs.	612-925-2757
NY	Fayetteville, S.F. Foster Co.	315-637-5427
NY	Webster, S.F. Foster Co.	716-265-2072
NC	Greensboro, DHR Mktg.	919-273-2671
NC	Raleigh, DHR Mktg.	919-876-5450
OH	Cincinnati, R.O. Whitesell & Assoc.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assoc.	216-447-9020
OH	Columbus, R.O. Whitesell & Assoc.	614-888-9396
OH	Dayton, R.O. Whitesell & Assoc.	513-298-9546
PA	Pittsburgh, R.O. Whitesell & Assoc.	412-963-6161
PA	Plymouth Meeting, J. E. Shea	215-825-2046
SC	Greenville, DHR Mktg.	803-235-3594
TN	Greenville, R.O. Whitesell & Assocs.	615-639-6154
TX	Dallas, Benson Engrg.	214-352-7541
TX	Houston, Benson Engrg.	713-861-1551
WA	Seattle, Northmar Inc.	206-524-5170
WI	New Berlin, T. L. Labant	414-425-7157
EXP	NY, Freeport, Minthorne Int'l.	516-546-4700

Local Distributors

AZ	Scottsdale, Allied Elctrns.	602-990-9549
CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
FL	Ft. Lauderdale, Allied Elctrns.	305-486-0500
GA	Atlanta, Allied Elctrns.	404-237-3366
IL	Elgin, Allied Elctrns.	312-697-8200
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Westland, Allied Elctrns.	313-595-6565
MN	Minneapolis, Allied Elctrns.	612-559-9545
MO	Maryland Hgts., Newark Elctrns.	314-739-0133
MO	St. Louis, Allied Elctrns.	314-878-1229
NJ	Springfield, Newark Elctrns.	212-349-7087
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Cary, Allied Elctrns.	919-467-0720
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-667-6940
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-445-7123
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Brookfield, Newark Elctrns.	414-781-2450
WI	Milwaukee, Allied Elctrns.	414-463-2662

KEYSTONE ELCTRNS. CORP., 49 Bleecker St., New York, NY 10012, Tel: 212-475-4600, TWX: 710-581-2861; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* J. Magnuson; *Dist. Mgr.:* M. Barry .... 2•1484-1495

Local Sales Offices & Reps

CA	Mountain View, Del Bucchia & Assoc. (North)	415-965-8045
CA	N. Hollywood, Bassett Sls. Corp. (South)	213-877-7129; 714-539-4000
CO	Denver, William J. Purdy Co.	303-777-1411
FL	Lighthouse Point, Jack Krutek Assocs.	305-941-6544
GA	Atlanta, DHR Marketing	404-451-9848
IL	Wilmette, Joel Wasserman Assoc.	312-256-3566
IN	Carmel, Brainard-Wilson Mktg. Inc.	317-844-2800
MA	Needham Heights, The Newscott Co. Inc.	617-444-1923
MN	Minneapolis, Donald Luger & Assoc.	612-553-1122
MO	St. Louis, KKB & Co.	314-647-2400; 816-229-0001
NJ	South Orange, Sonny Simberkoff Assoc.	201-763-7900
NM	Albuquerque, William J. Purdy Co.	505-266-7959
NC	Raleigh, DHR Marketing	919-876-5450; 919-273-2671
OH	Beachwood, Elctrn. Salesmasters	216-831-9555; 800-321-1848
OR	Beaverton, William J. Purdy Co.	503-641-9373
UT	Salt Lake City, William J. Purdy Co.	801-486-8557
WA	Redmond, William J. Purdy Co.	206-882-3144

KEYTEK DIV., 6424 Warren Dr., Norcross, GA 30093, Tel: 404-449-6040, Telex: 810-766-4529; Empl.: 50; *Sls. Mgr.:* Ron Inneckin

KEYTEK INSTR. CORP., 12 Cambridge St., Burlington, MA 01803, Tel: 617-272-5170, Telex: 951389 KEYTEK BURL; *Sls. Mgr.:* Michael J. Hopkins

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Tempe, Cantec Sls., Inc.	601-829-0191
CA	Cupertino, Patterson Control Sys.	408-973-1050
CA	Long Beach, Measurement Assocs.	213-433-0977
CO	Englewood, F. G. Mktg. Co.	303-795-9176
CT	Mt. Carmel, Scientific Devices - CONN	203-248-9361
FL	Cocoa Beach, Teqspec, Inc.	305-783-3444
FL	Hobe Sound, Teqspec, Inc.	305-746-4987
FL	Palm Harbor, Teqspec, Inc.	813-785-2276
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	LaGrange, PVA Co.	312-579-9300
KS	De Soto, Midtec Assocs., Inc.	913-441-6565
MA	Waltham, Scientific Devices N.E.	617-890-2252
MN	Minneapolis, HEI-LITE Sls.	612-861-6051
NJ	Englewood Cliffs, Scientific Devices - East	201-871-3916
NC	Winston-Salem, Radco Co.	919-722-9671
OR	Beaverton, Eicher Richards Co.	503-641-3300
PA	Blairsville, Measurement Instrs. East, Inc.	412-459-8090
PA	Oreland, Technical Instr. Sls.	215-836-2222
TX	Dallas, True Tech. Co.	214-691-7870
VA	McLean, WWB Assocs.	703-893-6516
WA	Seattle, Eicher Richards Co.	206-523-7888
WI	Glendale, Stapelman Corp.	414-352-5777

KEY TRONIC, P.O. Box 14687, Spokane, WA 99214, Tel: 509-928-8000, TWX: 510-773-1885; FSC No.: 52833; Empl.: 1350

KGS ELECTRONICS, INC., GAR Entprs., 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0786; Empl.: 25 .... 3•1890, 1891

Local Sales Offices & Reps

TN	Memphis, Memphis Group	901-362-8600
TX	Dallas, Foxtronics	214-358-4425
TX	Dallas, Mark Hutton	214-484-0580
TX	Hurst, McGarrah & Assocs.	817-268-3557
EXP	NJ, Rahway, REA Intl.	201-382-7100

WALTER KIDDE, Div. of Kidde, Inc., P.O. Box 1147, Wake Forest, NC 27587, Tel: 919-556-6811, Telex: 802569 WALTKIDDE; Empl.: 250; *Sls. Mgr.:* Frank Lindsey

KIKUSUI INTL. CORP., 17819 S. Figueroa St., Gardena, CA 90248, Tel: 213-515-6432, 800-421-5334, TWX: 910-346-7648; *Sls. Mgr.:* Bill White .... 3•1370, 1371, 1645

Local Sales Offices & Reps

AL	Huntsville, Morard & Co.(MOCO)	205-881-5968
AZ	Phoenix, Cherry Assoc.(Scopes Only)	602-242-1922
AZ	Scottsdale, Power Specialist	602-996-4100
CA	Carson, Amasco South	213-516-8561
CA	Sunnyvale, Amasco North	408-733-8690
CO	Aurora, R & R Instrmn.	303-340-8728
FL	Melbourne, EMS, Inc.	305-724-1027
HI	Honolulu, EMC Corp.	808-836-1138
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
KS	Olathe, Rush & West Assoc. (Power Supp.)	913-764-2700
KS	Overland Park, Ramsey Assocs. (Scopes Only)	913-649-6996
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MD	Wheaton, Brimberg Sls. (Power Supp.)	301-946-2670
MA	Bedford, Eastronix	617-275-5775
MI	Warren, Dietrich & Assocs.	313-751-4990
MN	Minneapolis, Sector Engrg. Sls.	612-888-6920
MO	Ballwin, Rush & West Assoc. (Power Supp.)	314-394-7271
MO	Maryland Hgts., Ramsey Assocs. (Scopes Only)	314-878-5042
NJ	Englewood Cliffs, Sci. Devices East	201-871-3916
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Syracuse, Martindale - Paul	315-432-1141
OH	Cleveland, Dietrich & Assocs.	216-781-1855
OH	Dayton, Dietrich & Assocs.	513-223-6042
OR	Portland, Westcon	503-283-0132
PA	Pittsburgh, Dietrich & Assocs.	412-892-2992

PA	Springhouse, Sci. Devices East	215-643-3335
TX	Houston, Sci. Devices S.W.	713-864-1711
TX	Richardson, Sci. Devices S.W.	214-231-8106
VT	Shelburne, Eastronix	802-985-3743
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
PR	San Juan, David S. Ternent	809-762-2688

Kilovac®
Corporation

KILOVAC CORP., Box 4422-EM, Santa Barbara, CA 93103, Tel: 805-684-4560, TWX: 910-336-1141; FSC No.: 18741; Empl.: 130; *Sls. Mgr.:* Jerry L. Dysart; *Dist. Mgr.:* Jack Dysart .... **1B**•1456, 1457

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark	602-968-9037
CA	Campbell, Kottmeier Assocs.	408-866-5153
CT	Yalesville, Kanan Assocs.	203-265-2404
FL	St. Petersburg, David A. King	813-381-1893
IL	Schaumburg, Gassner & Clark	312-882-8608
IA	Cedar Rapids, H. R. Brown Sls. Co.	319-366-0635
KS	Olathe, M. E. Bettis Co.	913-649-7142
KS	Wichita, M. E. Bettis Co.	316-265-8250
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Reading, Kanan Assocs.	617-944-8484
MN	St. Paul, De Beck	612-835-4649
NJ	Colts Neck, Trionic Assoc.	201-431-0415
NM	Albuquerque, Data Handling	505-884-0284
NY	Cazenovia, S. T. Woolard Co.	315-655-8145
NY	Great Neck, Trionic Assoc.	516-466-2300
NY	Rochester, Lamb	716-323-1250
NC	Charlotte, DGW, Inc.	704-334-7090
NC	Winston-Salem, DGW, Inc.	919-768-7166
OH	Cleveland, Components, Inc.	216-243-9200
OH	Miamisburgh, Components, Inc.	513-866-0661
OK	Tulsa, Norcom, Inc.	918-832-7747
OR	Tigard, Components West	503-684-1671
PA	Paoli, Tyler Griffin	215-647-1550
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
WA	Renton, Components West	206-271-5252

KIMCO, 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, TWX: 910-322-1168; Empl.: 43; *Sls. Mgr.:* W. P. Byrnes

KINEMETRICS, INC., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, Telex: 67-5402; Empl.: 110; *Sls. Mgr.:* Steve Pauly

Local Sales Offices & Reps

CA	Santa Rosa, Kinemetrics/TrueTime	707-528-1230
OK	Tulsa, Kinemetrics/Monitron	918-836-6831

KINEMETRICS TRUETIME INSTR. CO., 3243 Santa Rose Ave, Santa Rosa, CA 95401, Tel: 707-528-1230, Telex: 176687 (TRUETIME SORO); Empl.: 30; *Sls. Mgr.:* Victor Kunkel

KINETIC SYS., 11 Maryknoll Dr., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831; Empl.: 160; *Sls. Mgr.:* Pat Kirby

KINEX CORP., Sub. of the Nokia Corp. - Helsinki, 6950 Bryan Dairy Rd., Largo, FL 33543, Tel: 813-541-6404, TWX: 810-863-0362; Empl.: 100; *Sls. Mgr.:* W. L. Huston (Vice President); *Dist. Mgr.:* Steve Ridge

KINGS ELCTRNS., 40 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-5000, Telex: 13-7449, TWX: 710-562-0110; FSC No.: 91836; Empl.: 465; *Sls. Mgr.:* F. Pack; *Dist. Mgr.:* Fred Della Iacono

KINGSLEY MACHINE CO., 850 Cahuenga Blvd., Hollywood, CA 90038, Tel: 213-469-7243, Telex: 910-3214581; *Sls. Mgr.:* John M. Butler

KING-WAY ASSOC., 16400 Ventura Blvd., Encino, CA 91316, Tel: 213-788-4124

KING WIRE & CABLE CORP., 179-45 110 Ave., Jamaica, NY 11433, Tel: 212-657-4422, 800-221-0144, Telex: 96-8858; FSC No.: 06145; *Sls. Mgr.:* Ira M. Lash; *Dist. Mgr.:* Ira M. Lash

KIPP & ZONEN, 390 Central Ave., Bohemia, NY 11716, Tel: 516-589-2885, Telex: 0960250; Empl.: 25; *Sls. Mgr.:* Wm. Novack; *Dist. Mgr.:* Wm. Novack

KISTLER-MORSE, 10201 Willows Road NE, Redmond, WA 98052, Tel: 206-881-8000, Telex: 15-2223; *Sls. Mgr.:* Jim Beaton

KLC CORP., 2234 East Colorado, Pasadena, CA 91107, Tel: 818-796-0525; Empl.: 6; *Sls. Mgr.:* Chris Connelly

KLC/KARL LAMBRECHT CORP., 4204 N. Lincoln Ave., Chicago, IL 60618, Tel: 312-472-5442, Telex: 759819

KLM ELECTRONICS, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037, Tel: 408-779-7363, TWX: 910-590-4468; Empl.: 250; *Sls. Mgr.:* Chuck McKinney

KLOCKNER MOELLER, 4 Strathmore Rd., Natick, MA 01760, Tel: 617-655-1910, Telex: 94-8434; Empl.: 250; *Sls. Mgr.:* George Tamer

Local Sales Offices & Reps

CA	Cerritos	213-926-2355
CA	Concord	415-676-5353
GA	Marietta	404-952-0258
IL	Elk Grove	312-593-0980
NJ	Fairfield	201-227-3140
NY	New York	212-697-1184
OK	Tulsa	918-627-0676
TX	Stafford	713-491-2687

KMC SYSTEMS INC., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432, Tel: 201-447-0007, Telex: 642-374; Empl.: 120; *Sls. Mgr.:* E. Verder

Local Sales Offices & Reps

NJ	Mt. Laurel, Control Equip.	215-676-1460
UT	Bountiful, Lectrol, Inc.	801-292-7674

KNOL ENTERPRISES, 3468 Sacramento Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881; Empl.: 6; *Sls. Mgr.:* Dave Bone

KNOWLES ELCTRNS., INC., 3100 N. Mannheim Rd., Franklin Park, IL 60131, Tel: 312-455-3600, Telex: 72-8397; *Sls. Mgr.:* Reginald G. Garratt, VP-Mktg.

KOA

KOA SPEER ELCTRNS., Bolivar Dr., P.O. Box 547, Bradford, PA 16701, Tel: 814-362-5536, Telex: 91-4404, TWX: 510-695-5921; Empl.: 50; *Sls. Mgr.:* L. G. Holzwarth; *Dist. Mgr.:* L. Rice .... **1A**•1885-1888

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, O'Donnell Assocs.	602-944-9542
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, I2 Inc.	408-988-3400
CO	Boulder, R. G. Entprs.	303-447-9211
CT	Middletown, Gerber Sls.	203-347-3000
FL	Ft. Lauderdale, APM Assocs.	305-565-0056
FL	Longwood, APM Assocs.	305-869-6831
FL	Tampa, APM Assocs.	813-886-2457
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Arlington Hgts., C. L. Greenslade Sls.	312-253-9620
IN	Fort Wayne, John F. Kilfoil	219-436-7233
KS	Overland Park, Advanced Techn. Sls.	913-642-6675
LA	Kenner, Cartwright & Bean	504-466-0020
MA	Ludlow, Gerber Sls.	413-589-9837
MA	Newton Upper Falls, Gerber Sls.	617-969-2620
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Edina, Grayden & Flemmer	612-941-1120
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Ellisville, Advanced Techn. Sls.	314-227-4448
NM	Albuquerque, Power Entprs.	505-298-1918
NY	East Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, MOS Assocs.	516-487-3966
NC	Charlotte, Cartwright & Bean	704-377-5673
NC	Raleigh, Cartwright & Bean	919-781-6560
OH	Cincinnati, John F. Kilfoil	513-791-6150
OR	Beaverton, Barrett-Squibb & Assoc.	503-642-1661
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Lewisville, Jim Hughes	214-221-1536
TX	Stafford, Jim Hughes	713-343-0673
WA	Redmond, Barrett-Squibb & Assoc.	206-885-6991
PR	Hato Rey, M. Anderson	809-751-2026

Local Distributors

AZ	Phoenix, Sterling Elctrns.	602-258-4531
AZ	Phoenix, Kachina	602-269-6201
AZ	Tucson, Kachina	602-792-2223
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Chatsworth, IEC/JACO	213-998-2200
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Irvine, KELEX	714-957-3247
CA	Irvine, Ryno Elctrns.	714-557-5021
CA	San Diego, Ryno Elctrns.	619-292-6022
CA	San Jose, Eric Elctrns.	408-262-1111
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Sun Valley, QC Comps.	213-768-6111
CO	Boulder, R. G. Entprs.	303-447-9211
CO	Denver, Integrated Elctrns.	303-534-6121
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Orlando, TTI	305-859-1000
FL	W. Palm Beach, Nurmi Elctrn. Supp.	305-684-0320
GA	Roswell, Quality Comps.	404-993-8146
IL	Elk Grove Village, GBL/Goold Elctrns.	312-593-3220
IL	Northbrook, Classic Comp. Supp.	312-272-9650
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
LA	Baton Rouge, Indl. Elctrn. Supp.	504-926-0513
LA	Shreveport, Indl. Elctrn. Supp.	318-222-9459
MD	Baltimore, Radio Elec. Svc. Co.	301-823-0070
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Billerica, Baldwin Comp. Ctr.	617-667-6710
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Waltham, Sterling Elctrns.	617-894-6200
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Prehler Elctrns.	313-476-7084
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, Reptron	313-525-2700
MN	St. Paul, Ragon Elctrns.	612-642-2828
NE	Lincoln, Scott Elctrns.	402-466-8221
NJ	Clifton, J Mar Elctrns.	201-772-6400
NJ	Mountainside, Enox Resistor Co.	201-654-7600
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Bohemia, Justin Elctrns.	516-589-4000
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, SAI	516-293-2710
NY	Hauppauge, Prime Comps.	516-582-6258
NY	Hauppauge, Fairmont Elctrn. Sls.	516-231-3313
NY	Hauppauge, Jaco	516-273-5500
NY	Huntington Station, Sherburn Elctrns.	516-421-1940
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Baldwin Comp. Ctr.	516-588-5700
NC	Raleigh, Resco Raleigh	919-781-5700
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Cleveland, Repco	216-248-8900
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
OH	Columbus, Reptron/Ohio	614-436-6675
OH	Dayton, Stotts-Friedman Elctrns.	513-298-5555
OH	Solon, Hart Elctrns.	216-248-8855
OK	Tulsa, Altair Co.	918-252-5781
PA	Braddock, Leff Elctrns.	412-271-2800
PA	Drexel Hill, Kass Elctrns. Dist.	215-449-2300
PA	Erie, Rem Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
RI	Providence, Wm. Dandreta Co.	401-861-2800
SC	Columbia, Dixie Radio Supp.	803-779-5332
TN	Kingsport, Radio Elctrn. Supp.	615-247-8111
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Bluff City Elctrns.	615-242-8000
TX	Ft. Worth, T.T.I. Inc.	817-429-1440
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
WA	Kent, Shannon Ltd.	206-763-0545
WA	Redmond, Murphy Elctrns.	206-881-1234
WI	Hartland, G W Elctrns.	414-367-6003
WI	New Berlin, RM-Wisconsin	414-784-4420

KODE, 2752 Walnut Ave., Tustin, CA 92680, Tel: 714-730-6901, TWX: 910-595-2680; FSC No.: 62767; Empl.: 65; *Sls. Mgr.:* Richard E. Miller

KOGYOSHA, 179 Riveredge Rd., Tenafly, NJ 07670, Tel: 201-569-8769; Empl.: 3; *Sls. Mgr.:* Mark Nakanishi; *Dist. Mgr.:* Mark Nakanishi

KOLE IND., 3553 N.W. 50th St., Miami, FL 33102-0152, Tel: 305-633-2556, 800-327-6085; Empl.: 45; *Sls. Mgr.:* B. J. Neelands

KOLIN INDS., Box 357, Pondfield Rd. W., Bronxville, NY 10708, Tel: 914-961-5065, Telex: 137453; Empl.: 40; *Sls. Mgr.:* J. Kolinsky

KOLLMORGEN CORP., Industrial Drives Div., 201 Rock Rd., Radford, VA 24141, Tel: 703-639-2495, TWX: 710-875-3743; FSC No.: 11384; Empl.: 250; *Sls. Mgr.:* Sandor L. Tako

KOLLSMAN INSTR., 220 Daniel Webster Hwy., Merrimack, NH 03054, Tel: 603-889-2500, Telex: 94-3537, TWX: 710-366-6883; Empl.: 2200

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 609-692-8500, TWX: 510-687-8967; *Sls. Mgr.:* Peter Davenport

KONTRON ELCTRNS., 630 Price Ave., Redwood City, CA 94062, Tel: 415-361-1012, TWX: 910-378-5207; Empl.: 200; *Sls. Mgr.:* Jeff Shahan

KOOLTRONIC, Hamilton Ave., Hopewell, NJ 08525, Tel: 609-466-3400, Telex: 84-3345; Empl.: 150; *Sls. Mgr.:* Gerald H. Freedman

KORRY ELECTRONICS, INC., 223 8th Ave. N., Seattle, WA 98109, Tel: 206-223-5400, TWX: 910-444-2295; Empl.: 410; *Sls. Mgr.:* Woody Hertzog

KRATOS DISPLAY SYSTEMS, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, Telex: 171946; *Sls. Mgr.:* Bill Bourke

KRECKMAN, HERB, CO., Cresco, PA 18326, Tel: 717-595-2212; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 201-636-1900; Empl.: 25 .... **1A•1601**

KRL ELCTRNS., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210, 800-257-3300, TWX: 710-220-1662; Empl.: 65

KROHN CERAMICS, INC, See Centerflex Techn.

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 617-580-1660, TWX: 710-345-0831; Empl.: 120; *Sls. Mgr.:* Craig S. Dunbar .... **3•1254, 1255**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-534-9771
AZ	Phoenix, Odyssey 1	602-246-8846
AR	Eldorado, Kemp Engrg.	501-826-5869
CA	Inglewood, L&M South	213-674-6850
CA	San Jose, L&M Engrg.	408-292-3220
CO	Castle Rock, Odyssey 1	303-688-3555
CT	New Haven, McBar Assocs.	203-865-4376
FL	Ft. Lauderdale, Gentry Assocs.	305-791-8405
FL	Orlando, Gentry Assocs.	305-859-7450
FL	Tampa, Gentry Assocs.	813-886-0720
GA	Atlanta, Gentry Assocs.	404-998-2828
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Gretna, Gentry Assocs.	504-367-3975
MD	Baltimore, Sci-Rep	703-385-0600
MA	Waltham, McBar	617-890-0233
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Englewood, Sci. Devices E.	201-871-3916
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Rochester, Ossmann Instrs.	716-442-6990
NY	Saratoga Springs, Ossmann Instrs.	518-584-6519
NY	Syracuse, Ossmann Instrs.	315-437-7052
NC	Burlington, Gentry Assocs.	919-227-3639
OH	Chesterland, EQS Sys.	216-729-2222
OH	Columbus, EQS Sys.	614-228-3453
OH	Dayton, EQS Sys.	513-294-2476
OK	Tulsa, Kemp Engrg.	918-663-4501
OR	Portland, McLaren	503-297-2248
PA	Pittsburgh, EQS Sys.	412-261-2604
PA	Spring House, Scientific Devices East	215-643-3335
SC	Columbia, Gentry Assocs.	803-772-6786
TN	Knoxville, Gentry Assocs.	615-584-0281
TX	Dallas, Kemp Engrg.	214-931-7100
TX	Houston, Kemp Engrg.	713-466-1465
VA	Fairfax, Sci-Rep	703-385-0600
WA	Bellevue, McLaren	206-454-3400
WI	Milwaukee, Berndt Assocs.	414-545-8400

KRYSTINEL CORP., 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, TWX: 710-988-5931; Empl.: 150 .... **2•1793**

Local Sales Offices & Reps

AZ	Phoenix, Charles T. Fink & Assoc.	602-992-9884
CA	Los Alamitos, Permag Pacific Corp.	213-594-6515
CA	Sunnyvale, Permag Sierra Corp.	408-738-1080
GA	Norcross, Permag Dixie Corp.	404-448-4998
IL	Elk Grove Vl., Permag Central Corp.	312-956-1140
MA	Billerica, Permag Northeast Corp.	617-273-2890
MN	Eden Prairie, Permag Minnesota Corp.	612-934-4635
NY	Hicksville, Permag Corp.	516-822-3311
OH	Toledo, Permag Magnetics Corp.	419-385-4621
TX	Richardson, Permag S.W.	214-699-1121

Local Distributors

CA	Los Alamitos, Permag Pacific Corp.	213-594-6515, 714-952-2091
CA	Sunnyvale, Permag Sierra Corp.	408-738-1080
GA	Norcross, Permag Dixie Corp.	404-448-4998
IL	Elk Grove Vl., Permag Central Corp.	312-956-1140
MA	Billerica, Permag Northeast Corp.	617-273-2890

KSI Kaiser Systems, Inc.
The High Voltage Power Supplies That Work

KSI, 33 Cherry Hill Dr., Danvers, MA 01923, Tel: 617-777-5102, Telex: 887159; FSC No.: 617-777-3340 .... **3•1646-1648**

KSW ELCTRNS. CORP., See Frequency Sources, KSW Semicond. Div.

K-SYSTEMS, INC., 3902 Lilac, Las Cruces, NM 88005, Tel: 505-526-3209; Empl.: 2; *Sls. Mgr.:* Alice Furphy

Local Sales Offices & Reps

MD	Bethesda, Fedmark, Inc.	301-986-9277
MA	Chelmsford, Bomara Assocs.	617-452-2299
PA	Pittsburgh, Dietrich & Assocs.	412-892-2929

KS kulite

KULITE SEMICONDUCTOR PRODS. INC., 1039 Hoyt Ave., Ridgefield, NJ 07657, Tel: 201-945-3000, Telex: 13-5458; Empl.: 250 .... **1B•1847**

Local Sales Offices & Reps

AL	Huntsville, Lee Associates	205-533-5896
AZ	Scottsdale, Dave Menegey Assocs.	602-994-9519
CA	Hollywood, B. J. Wolfe Entprs.	213-877-5518
CA	Walnut Creek, Dale-Dahl Assocs.	415-933-9595
CO	Boulder, Measurement Consultants	303-449-7506
DC	Baltimore, Reptron, Inc.	301-621-1313
FL	Osprey, Dick Ridgewell Co.	813-484-2020
IL	Park Ridge, E.I.A. Inc.	312-298-2290
IN	Indianapolis, EIA, Inc.	317-257-7231
MD	Baltimore, Reptron	301-799-7490
MA	Waltham, Daner-Hayes	617-894-7290
MI	Madison Heights, WKM Assoc.	313-588-2300
MN	New Hope, Trask Engrg.	612-537-2434
MO	St. Louis, Ozark Elctrn. Mktg.	314-423-7200
NH	Wilton, Daner-Hayes, Inc.	617-894-7290
NJ	Glen Gardner, Daner-Hayes, Inc.	617-894-7290
NM	Albuquerque, Amonette Entprs.	505-344-4143
NY	Brewster, Daner-Hayes, Inc.	617-894-7290
NY	Rochester, Daner-Hayes, Inc.	617-894-7290
OH	Cleveland, WKM Assocs.	216-267-0445
OH	Dayton, WKM Assocs	513-434-7500
OK	Edmond, Data Aids Assocs.	405-478-5000/01
PA	Doylestown, Daner-Hayes, Inc.	617-894-7290
PA	Pittsburgh, WKM Assocs.	412-892-2953
TX	Austin, Data Aids Assocs.	512-327-8600
TX	Dallas, Data Aids Assocs.	214-620-1551
UT	Salt Lake City, Measurement Conslts.	801-364-3174
VT	White River Junction, Daner-Hayes, Inc.	617-894-7290
WA	Seattle, Brett Assocs.	206-935-8054

KULKA SMITH, INC., 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400, TWX: 710-723-4410; Empl.: 500; *Sls. Mgr.:* John Chirico .... **2•1496-1501**

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
CA	Los Angeles, E E Strassner	818-242-8823
CA	Redwood City, Hickey Ind. Sls.	415-368-3849
CT	North Haven, Coakley, Boyd & Abbett	800-225-8402
IL	Northbrook, Dolin Sls.	312-498-6770
KS	Shawnee Mission, Lowell-Kangas & Assocs.	913-631-3515
MA	Needham Hgts., Coakley, Boyd & Abbett	617-444-5470
MO	St. Louis, Lowell-Kangas & Assocs.	314-821-4050
OH	Richfield, Bear Mktg.	216-659-3131
PA	Allison Park, K.W. Elctrns.	412-487-4300
PA	Trevose, P.S.A., Inc.	215-245-0513
WI	Milwaukee, D. Dolin Sls.	414-482-1111

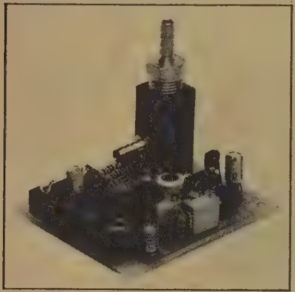
Local Distributors

AL	Birmingham, MG Elctrns.	205-328-4525
AZ	Phoenix, Parts Elctrns.	602-258-6476
AZ	Tempe, Fisher/Brownell	602-967-1464
CA	Alhambra, Fisher/Brownell	818-289-0255
CA	Buena Park, RPS Elctrns.	714-521-5230
CA	Buena Park, Control Design	213-802-1371
CA	Cerritos, El-Com	213-404-2961
CA	Mountain View, Cornett Elctrns.	415-969-5420
CA	San Carlo, Control Design	415-592-4808
CA	San Diego, Elcom	213-404-2961
CA	San Diego, Fisher/Brownell	619-560-8545
CA	Santa Clara, Fisher/Brownell	408-988-6041
CO	Denver, Denver Wintronics	303-934-2406
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Midan	203-265-2077
FL	Casselberry, Fla. AFCOM Inc.	305-831-6630
FL	Largo, Electronic Precepts	813-596-2742
FL	Miami, Electronic Equip. Co.	305-871-3500
FL	Winter Park, Electronic Equip. Co.	305-644-4833
IL	Addison, Lectro Comps.	312-543-1680
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Hoffman Estates, Control Design	312-882-7232
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio	309-691-4840
IL	Rockford, Mid West Associated	815-962-8036
IN	Indianapolis, Graham Elctrn. Supp.	317-634-8202
IN	Indianapolis, Control Design	317-788-4559
IA	Cedar Rapids, Vrbik-Berquist	319-366-8733
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
IA	Des Moines, Mid State Distrbg.	515-244-7231
IA	Marion, Control Design	313-373-2923
KS	Wichita, Radio Supp. Co.	316-267-5213
KY	Louisville, Peerless Elctrn. Equip.	502-637-7677
LA	New Orleans, W. B. Allen Supp.	504-525-8222
LA	New Orleans, Radio Parts	504-581-5959
MD	Baltimore, Resco/Baltimore	301-823-0070
MA	Newton, Greene Shaw Co.	617-969-8900
MA	Norwood, Gerber Elctrns.	617-329-2400
MI	Augusta, Great Lakes Elctrns.	616-731-4156
MI	Farmington Hills, Star-Tronic Distr.	313-477-7586
MI	Grand Rapids, Stotts Friedman	616-459-0216
MN	Minneapolis, Control Design	612-721-6555
MN	St. Paul, R. G. Ragon Elctrns.	612-488-0201
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	Maryland Hgts., L-Comp	314-291-6200
MO	St. Louis, Control Design	314-426-3150
NE	Omaha, Scott Elctrns. Supp.	402-466-8221
NJ	Prospect Park, Kappe Electrical Distrs.	201-790-1999
NM	Albuquerque, Walker Radio	505-247-2288
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Elmsford, Ancar Elctrns.	914-592-7100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Mt. Vernon, Qar Indl. Elctrns.	914-699-2224
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Distrs.	716-334-8110
NY	Rockville Center, Midway Indl.	516-764-2400
NC	Pineville, Control Design	704-588-4410
NC	Raleigh, Southeastern Radio Supp.	919-828-2311
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cleveland, W. M. Pattison Supp.	216-441-3000
OH	Columbus, Electronics Mktg.	614-299-4161
OH	Dayton, John A. Becker Co.	513-226-1341
OK	Oklahoma City, Electro Entprs.	405-478-1752
OK	Oklahoma City, Electronic Supp.	405-232-5215
OR	Beaverton, Almac/Stroum	503-641-9070
OR	Portland, Eoff Elec. Co.	503-222-9411
OR	Portland, Radar Elec.	503-232-3404
PA	Altoona, Allegheny Elctrns.	814-946-0871
PA	Duquesne, Advacom	412-469-2601
PA	Erie, Rem Elctrns.	814-453-5626
PA	Huntingdon Valley, Shap Elctrns.	215-322-7150
PA	Malverne, Control Design	215-296-0150
PA	Montgomeryville, Pyttronics	215-643-2850
PA	Philadelphia, CAM/RPC Co.	215-698-4000
PA	Pittsburgh, CAM/RPC Co.	412-782-3770
PA	Reading, Barbey Elctrns.	215-376-7451
TN	Knoxville, Industrial Elctrns.	615-573-7135
TX	Dallas, Solid State Elctrns.	214-438-5700
TX	Dallas, Control Design	214-358-1441
TX	Ft. Worth, Industrial Elctrns.	817-731-7321
TX	Houston, Solid State Elctrns.	713-772-8483
TX	Richardson, Fisher/Brownell	214-235-3177
TX	Stafford, Southwest Elctrns.	713-491-4900
UT	Salt Lake City, Ra-Elco	801-487-0571
VA	Charlottesville, Virginia Radio Supp.	804-296-4184

TRANSDUCERS • SENSORS • SYSTEMS

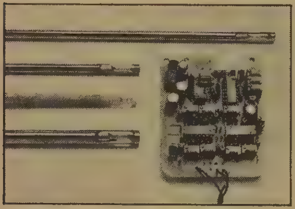
OEM PRODUCTS

Kurz manufactures a wide line of basic airflow and mass flow transducers and is always eager to work with you on your OEM product requirements.



SERIES 501
Micropower Mass Flow Meter
The 501, the worlds smallest commercial mass flow meter, measures flows up to 5 slpm. The 501 is perfect for biomedical toxicology and instrumentation applications.

SERIES 565
DC Powered Mass Flow Meters
The compact 565 Series include linear 0-5 VDC outputs and are most often specified for flows from 10 sccm to 10 scfm. Popular with OEM's, the economical 565 operates on 15VDC.



SERIES 435DC
Linear Air Velocity Transducers
Powered by 15VDC, and available in self contained, bare board with cable and rack mount configurations, the 435DC features a linear 0-5VDC output.

KURZ
INSTRUMENTS INC.

SERIES 430DC
Air Velocity Transducers
Powered by 15VDC, the self contained 430DC features a non-linear 0-5VDC output.

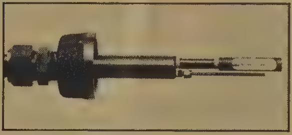
SERIES 430DC-VF
RS422 Frequency Output DC Powered Air Velocity Transducers
The 430DC-VF features a RS422 compatible output where 12KHz to 60KHz corresponds to zero to full scale. The high frequency output allows two-wire runs to lengths of several miles. The 430DC-VF operates on 15VDC, has 15 ft. of probe cable and a NEMA 1 electronics enclosure.

SERIES 280
Micropower Mass Flow Controlled Air Sampler
A miniature flow controller, the 280 combines the worlds smallest commercial mass flow meter, the 501, with the worlds smallest rotary carbon vane vacuum pump, the Series 290, to produce a compact, mass flow controlled, air sampler. The 280 can also function as a mass flow controlled gas supply, and can be computer controlled via an external setpoint feature.

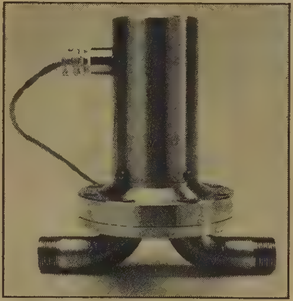
AIR VELOCITY

SERIES 415
2-Wire Linear Air Velocity Transducers
With linear 0-5 VDC outputs and 2-wire runs to over 1,000 ft., the popular 415 provides an industrial grade application solutions anywhere air flow is measured.

SERIES 400
Air Velocity Calibration Systems
Complete benchtop wind tunnel systems for calibrating a variety of air flow instrumentation and sensor.

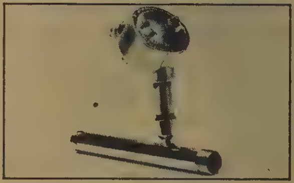


SERIES 455
Stack Velocity Transducer
The 455 is designed for operation in the harshest environments and features Kurzs new all metal sensor.

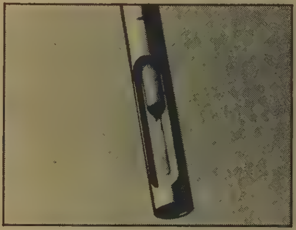


SERIES 730
Electric Rotary Ramp Metering Valve
A major breakthrough in valve technology invented by Dr. Kurz. This exclusive valve features single turn operation and a linear Cv from 0 to 100% of flow. The **730** Series valves alone allow new achievements in precise mass flow control.

MASS FLOW

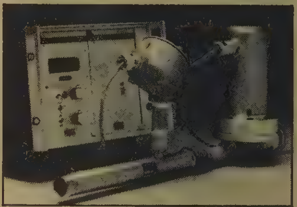


SERIES 505
In Line Mass Flow Meters
Previously complex measurements are now made simple with Kurz mass flow sensors. Linear outputs, 2-wire hookups, NBS calibrations, corrosive gases—the 505 Series does it all!



SERIES 515/555
Insertion Mass Flow Meters
For larger pipes, the economical 515 Series includes a ball valve/retractor assembly designed for hot tapping into existing lines. Weld on the fitting, drill a hole in the line, insert the probe and you're ready to go!

MASS FLOW CONTROL



Kurz **7500** Mass Flow Control system are composed of a Kurz **505** Series Mass Flow Meter, a Kurz **710** Series Electric Valve P.I.D. Controller and a Kurz **730** Series Electric Rotary Ramp Valve.

Many more state of the art Sensor and Transducer Systems are available from Kurz. Kurz Mass Flow Technology makes complex measurements simple. Call one of our Applications Engineers today.

1-800-4-AIRFLO

© KURZ INSTRUMENTS, INC. / 20 VILLAGE SQUARE / P.O. BOX 849 / CARMEL VALLEY, CA 93924 / TELEX 172275 / IN CA (408) 659-3421

WA	Seattle, Pacific Elctrns.	206-575-1050
WA	Seattle, Almac/Stroum	206-763-2300
WA	Seattle, Radar Elec.	206-282-2515
WI	Milwaukee, Electronic Expeditors	414-228-8100
WI	New Berlin, RM Wisconsin	414-784-4420
WI	New Berlin, Control Design	414-784-1015

KURZ INSTRS., 20 Village Sq., Carmel Valley, CA 93924, Tel: 408-659-3421, Telex: 172275; FSC No.: 94-24-11681; Empl.: 30; *Sls. Mgr.:* Phil Hickerson

KURZ-KASCH, Knob Div., 711 Hunter Dr., Wilmington, OH 45177, Tel: 513-382-0966; Empl.: 250; *Sls. Mgr.:* J. McGeady, M. Krystofik

KYOCERA INTL., INC., Elctrn. Comps. Grp., 11425 Sorrento Valley Rd., San Diego, CA 92138, Tel: 619-454-1800, TWX: 910-322-1130; *Sls. Mgr.:* Bob Goodman; *Dist. Mgr.:* Mike Drotar

LAAKMANN ELECTRO-OPTICS, INC., 33052 Calle Aviador, San Juan Capistrano, CA 92675, Tel: 714-493-6624, Telex: 681335; *Sls. Mgr.:* John Wheeler

LAB-LINE INSTRS., 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 312-450-2600, Telex: 270-312; Empl.: 225

LAFRANCE CORP., Entprs & Exec Aves, Philadelphia, PA 19153, Tel: 215-365-8000, Telex: 83-1732; *Sls. Mgr.:* James Craig

LAFRANCE CORP., PAC TEC DIV., See Pac Tec Div., LaFrance Corp.

LA MARCHE MFG., 106 Bradrock Dr., Des Plaines, IL 60018, Tel: 312-299-1188, Telex: 28-2526; Empl.: 225

LAMBDA ELECTRONICS, 515 Broad Hollow Rd., Melville, NY 11747, Tel: 516-694-4200, TWX: 510-224-6484; Empl.: 1200; *Sls. Mgr.:* R. Koslow

LAMBDA SEMICONDUCTORS, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, 800-255-9606, TWX: 910-876-1404; Empl.: 200; *Sls. Mgr.:* Dick Kief

LAMP TECHNOLOGY, INC., 141A Central Ave., Farmingdale, NY 11735, Tel: 516-454-6464, Telex: 645543; Empl.: 10; *Sls. Mgr.:* Edith Reuter

LAMPTRONIX CO., LTD., 85 N. Williams St., Crystal Lake, IL 60014, Tel: 815-455-0400, Telex: 280191; FSC No.: 61342; *Sls. Mgr.:* Nancy E. Towe

Local Sales Offices & Reps

CA	Lomita, Comp. Mktg. Assocs.	213-326-1460
CA	San Mateo, Comp. Mktg. Assocs.	415-345-7373
FL	Orlando, Over & Over Florida, Inc.	305-857-4057
GA	Norcross, Spada & Assocs.	404-448-4028
IL	Addison, Engineered Sls.	312-832-8425
IN	Noblesville, Newton & Assocs.	317-845-8157
NJ	Medford, McCoy, Inc.	609-953-0770
OH	Westlake, T. C. Sales & Mktg.	216-871-8832
TN	Antioch, Over & Over, Inc.	615-834-0140
TX	Austin, Rendell Elctrns.	512-835-5784
WA	Woodinville, Intl. Equip.	206-827-5402
EXP	Crystal Lake, Illinois, Lamptronix Co., Ltd.	815-455-0400

LANCE INDS., P.O. Box 4156, Sylmar, CA 91342-0156, Tel: 818-367-1811, Telex: 66-2443; *Sls. Mgr.:* Jerry Updyke; *Dist. Mgr.:* Joe Barris

Local Sales Offices & Reps

IL	Chicago	312-275-7000

LANDIS & GYR, INC., 4 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-4400, Telex: 137345; Empl.: 65; *Sls. Mgr.:* R. W. Strohm; *Dist. Mgr.:* R. W. Strohm

L & L SPECIAL FURNACE, 166 Kent Rd., Aston, PA 19014, Tel: 215-459-9216, Telex: 753264; Empl.: 20; *Sls. Mgr.:* Greg Lewicki; *Dist. Mgr.:* Stephen Lewicki

L & R MFG., 577 Elm St., Kearny, NJ 07032, Tel: 201-991-5330, Telex: 642078 Ellanar Krny.; Empl.: 220; *Sls. Mgr.:* Albert Stein

LANGLEY, P.O. Box 2911, San Diego, CA 92112, Tel: 619-264-3181; FSC No.: 83549; Empl.: 140; *Sls. Mgr.:* A. Kremm

LANSING

LANSING RESEARCH CORP., 705 Willow Ave., P.O. Box 730, Ithaca, NY 14850, Tel: 607-272-3265; *Sls. Mgr.:* Fred B. Widding .... **2**•1040

LA POINTE INDUSTRIES, INC., Electronics Products Div., 155 W. Main St., Rockville, CT 06066, Tel: 203-872-8581, TWX: 710-435-1663; FSC No.: 70117; Empl.: 650

LARK ELECTRONICS, INC., Box 390, New York, NY 10040, Tel: 212-569-0430; FSC No.: 52682

LARK ENGINEERING CO., 26401 Calle Rolando, San Juan Capistrano, CA 92675, Tel: 714-493-9501, TWX: 910-596-1411; FSC No.: 33175; Empl.: 40

LARSON INSTR., Greenbush Rd., Orangeburg, NY 10962, Tel: 914-359-3800; Empl.: 18; *Sls. Mgr.:* A. D. Stephens

Local Sales Offices & Reps

CA	Irvine, Metercraft Inc.	714-261-7135

LASER APPLICATIONS, 91 Carver Ave., Westwood, NJ 07675, Tel: 201-664-7636; Empl.: 5

LASER CONCEPTS, Omega Organization Intl., P.O. Box 687, Mercer Island, WA 98040, Tel: 206-232-6256; *Sls. Mgr.:* Sheila Chatelaine

LASER DIODE LABS, 1130 Somerset St., New Brunswick, NJ 08901, Tel: 201-249-7000, TWX: 710-998-0597; *Sls. Mgr.:* Richard Klein

LASER INC., Laser Lane, Box 537, Sturbridge, MA 01566, Tel: 617-347-7314, Telex: 95-1806; Empl.: 110; *Sls. Mgr.:* William H. Shiner

LASER PRECISION CORP., 1231 Hart St., Utica, NY 13502, Tel: 315-797-4449, Telex: 646803; Empl.: 110; *Sls. Mgr.:* Don Sypek

LASER TECHN., 10624 Ventura Blvd., N. Hollywood, CA 91604, Tel: 213-763-7091; Empl.: 18; *Sls. Mgr.:* H.B. McLaughlin

LATTIN RADIO LABS., 1431 Sweeney, P.O. Box 44, Owensboro, KY 42301, Tel: 502-683-2868; Empl.: 3; *Sls. Mgr.:* Wm J. Lattin

LAWRENCE-CROW ELCTRNS. INC., 2100 Stemmons, Dallas, TX 75207, Tel: 214-749-5440, Telex: 730213; *Sls. Mgr.:* Jesse Hall; *Dist. Mgr.:* Michael T. McAndrews

L-COM INC., 1755 Osgood St., Unit 11EM, N. Andover, MA 01845, Tel: 617-682-6936, Telex: 882157; Empl.: 14; *Sls. Mgr.:* Bruce Eldridge; *Dist. Mgr.:* Bruce Eldridge .... **2**•2106-2108; **3**•1649

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg. Inc.	205-533-5165
AZ	Scottsville, OEM Specialties	602-991-6967
CA	Anaheim, R. D. Brunnemer & Assoc.	714-525-1644
CA	Santa Clara, Acclaim	408-745-7416
CO	Denver, CEC	303-751-3252
FL	Apopka, G. F. Bohman Assoc., Inc.	305-886-1882
GA	Atlanta, DHR Mktg. Inc.	404-451-9848
IN	Fort Wayne, Denton Mktg. Inc.	219-627-5515
KS	Kansas City, BC Elctrns.	913-342-1211
MN	Minneapolis, Boerger & Assoc.	612-560-3435
MO	Bridgeton, BC Elctrns.	314-291-1101
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Rochester, R.F. Lamb Co., Inc.	716-323-1250
NC	Raleigh, DHR Mktg. Inc.	919-876-5450
OR	Portland, SPS	503-643-4705
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TX	Houston, Repmasters-Houston	713-692-8204
TX	Sherman, Repmasters-Dallas	214-247-6236
UT	Salt Lake City, CEC	801-355-8424
VA	Reston, Ty-Tronics	703-471-0440

LDJ INCORPORATED, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219, Tel: 313-528-2202, TWX: 810-232-1509 LDJ TRMI; Empl.: 63; *Sls. Mgr.:* Stephen Barry .... **3**•1256

LEACH® CONTROL PRODUCTS DIVISION

LEACH CORP., Control Prods. Div., 6900 Orangethorpe Ave., Buena Pk., CA 90620, Tel: 714-739-0770, TWX: 910-596-2867; Empl.: 220; *Sls. Mgr.:* Ron Zimmerman; *Dist. Mgr.:* F. Winer .... **1A**•1372, 1373, 1664, 1665; **1B**•1458, 1459

Local Sales Offices & Reps

AZ	Phoenix, Chopporal Elctrns.	602-252-0897
CA	Granada Hills, C & W Comps. Sls.	213-368-4032
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Englewood, Dynatech	303-773-2830
FL	Orlando, Donato & Assoc.	305-352-0727
KS	Wichita, BAKA Corp.	316-262-0179
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Woburn, Comp. Techn.	617-933-5390
MN	Minneapolis, Comprehensive Tech. Sls.	612-888-7011
NJ	Englewood Cliffs, Leach Corp.	201-567-6795
NY	Fayetteville, R. D. Sherman	315-637-9861
OH	Cincinnati, Giesting and Assocs.	513-521-8800
PA	Trevose, PSA, Inc.	215-245-0513
TX	Dallas, Caton Sls.	214-661-5792
VA	Charlottesville, Marktron	301-460-6100
WA	Bellevue, Leach Corp.	206-746-7263

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Sunnyvale, Time/Nor-Cal.	408-734-9888
CA	Torrance, Time Elctrns. West	213-320-0880
FL	Ft. Lauderdale, Time Elctrns.-Florida	305-974-4800
GA	Atlanta, Electro Air Corp.	404-351-3545
MD	Columbia, Time Elctrns.	301-964-3090
MA	Woburn, Time/New England	617-935-8080
MO	St. Louis, Time Midwest	314-391-6444
NY	Hauppauge, Time Elctrn. Sls.	516-273-0100
PA	Broomall, Time/Mid-Atlantic	215-359-1200
TX	Dallas, Electro Air Corp.	214-385-0566
WA	Bellevue, Electro-Air/Northwest	206-641-3640
WA	Redmond, Pan Pacific Elctrns.	206-881-7252

LEACH® RELAY DIVISION

LEACH CORP., Relay Div., 5915 Avalon Blvd., Los Angeles, CA 90003, Tel: 213-232-8221, TWX: 910-321-2303; FSC No.: 35344; Empl.: 575; *Sls. Mgr.:* F. Winer; *Dist. Mgr.:* F. Winer .... **1B**•1460-1465

Local Sales Offices & Reps

CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Englewood, Dynatech, Inc.	303-773-2830
FL	Orlando, Donato & Assoc.	305-352-0727
GA	Atlanta, Craft Assocs.	404-256-0420
KS	Wichita, BAKA Corp.	316-262-0179
MD	Silver Spring, Marktron	301-460-6100
MD	Timonium, Marktron	301-252-7111
MA	Woburn, Comp. Techn.	617-933-5390
MN	Minneapolis, Comprehensive Tech. Sls.	612-888-7011
MO	Ferguson, Leach Corp.	314-524-2880
NJ	Englewood Cliffs, Leach Corp.	201-567-6795
NY	Fayetteville, R. D. Sherman	315-637-9861
OH	Dayton, Leach Corp.	513-434-8151
PA	Trevose, PSA, Inc.	215-245-0513
TX	Dallas, Caton Sales	214-661-5792
VA	Charlottesville, Marktron	301-460-6100
WA	Bellevue, Leach Corp.	206-746-7263

Local Distributors

AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Sunnyvale, Time/Nor-Cal	408-734-9888
CA	Torrance, Time Elctrns. West	213-320-0880
FL	Ft. Lauderdale, Time Elctrns.-Florida	305-974-4800
GA	Atlanta, Electro Air Corp.	404-351-3545
MD	Columbia, Time Elctrns.	301-964-3090
MA	Woburn, Time/New England	617-935-8080
MO	St. Louis, Time/Midwest	314-391-6444
NY	Hauppauge, Time Elctrn. Sls.	516-273-0100
PA	Broomall, Time/Mid-Atlantic	215-359-1200
TX	Dallas, Electro Air	214-385-0566
WA	Bellevue, Electro-Air/Northwest	206-641-3640
WA	Redmond, Pan Pacific	206-881-7252

LEADER INSTRS. CORP., 380 Oser Ave., Hauppauge, NY 11788-3694, Tel: 516-231-6900, TWX: 510-227-9669; Empl.: 42; *Sls. Mgr.:* Bruce Storch

LEA, INC., A DYNATECH CO., 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990, Tel: 818-944-0916, TWX: 910-586-1381; FSC No.: 57499; Empl.: 35; *Sls. Mgr.:* David Sinn; *Dist. Mgr.:* E. Alvin Rich

Local Sales Offices & Reps

AL Huntsville, FM Assocs. Ltd. 205-882-0689
AZ Phoenix, Indl. Prods. Corp. 602-954-7300
CA Burbank, Biztek Co., Inc. 213-766-4890
CA Mountain View, Leddy Assocs. 415-969-6313
CO Boulder, Abco, Inc. 303-444-1173
CT Hamden, Applied Meas. 203-288-5288
DC Washington, Instrucom 202-223-1759
FL Jupiter, FM Assocs. Ltd. 305-746-2996
GA Atlanta, FM Assocs. Ltd. 404-451-2293
HI Honolulu, Nustate Aircon 808-839-1212
IL Chicago, Homad Engrg. 312-446-4875
IN Fort Wayne, Century Dynamics, Inc. 219-486-2681
KS Lenexa, C & C Sls. 913-888-6200
LA Baton Rouge, Fogarty Engrg. Co. 504-928-3372
ME Waterville, Kentrol 207-873-7741
MA Acton, Applied Meas. Inc. 617-263-2766
MI Birmingham, Thibodeau Engrg. 313-642-6620
MN St. Paul, Knox Assocs. 612-488-5402
MO Bridgeton, Electro Mechanical Assoc. 314-291-7661
NM Albuquerque, Industrial Prods. Corp. 505-256-3561
NY Lynbrook, Puleo Elctrns., Inc. 516-599-4875
NY Williamsville, Terryberry Sls. 716-632-7404
NC Ramseur, FM Assocs., Ltd. 919-824-2196
OH Wickliffe, Walter J. Brauer & Assoc. 216-943-0601
PA Warminster, Multi-Meas., Inc. 215-675-3082
TX Houston, Texas Tech. Prods. Co. 713-526-0656
TX Midland, Tex-Mex Inds. Inc. 915-684-5841
VT Bennington, Applied Meas., Inc. 802-422-2222
WA Seattle, R. W. Campbell, Inc. 206-622-3403
WY Casper, ABCO, Inc. 307-577-1851

LEAR SIEGLER, INC., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406, Tel: 213-452-6000, TWX: 910-343-6463; Empl.: 21,983

LEADER
Instruments Corporation

AUTHORIZED DISTRIBUTORS

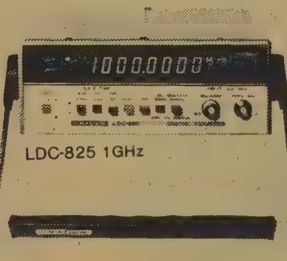
RAG ELECTRONICS, INC.

WEST 21418 Parthenia Street
Canoga Park, CA 91304
Tel. (818) 998-6500

EAST 1 Pollack Avenue
Ocean, N.J. 07712
Tel. (201) 544-0666

NEW & RECONDITIONED TEST EQUIPMENT

• SALES • RENTALS • PURCHASE OPTIONS
• REPAIR & CALIBRATION



Call Toll-Free
West (Outside CA) 1-800-732-3457
East (Outside NJ) 1-800-922-0945

LEAR SIEGLER, INC., Elctrn. Instr. Div., 714 N. Brookhurst St., Anaheim, CA 92803, Tel: 714-774-1010, TWX: 910-591-1157; Empl.: 250; *Sls. Mgr.:* J. Anderson ....**2**•1502

Local Sales Offices & Reps

CA Riverside, Rickenbob Assoc. 714-681-4922
CA San Diego, Qualtronics 619-560-8955
CO Denver, Moss Mktg. 303-455-7205
CO Greeley, Gordon Moss Elctrns. 303-455-7205
GA Atlanta, Grady Duckett 404-451-3529
IL Chicago, Mauer Co. 312-677-4771
IL Skokie, Mauer Co. 312-677-4771
IN Indianapolis, Elctrn. Sls. & Engr. 317-849-4260
MA Haverhill, L.K. Harmon 617-373-1313
MI Detroit, Hummon Assoc. 313-474-0661
MN Minneapolis, Paul Ericson & Assoc. Inc. 612-884-1969
NJ Bellmawr, Mid Atlantic Corp. 609-931-5303
NJ Tenafly, ABC Elec. 201-568-2354
NM Albuquerque, Moss Elec. 505-256-3622
NY Syracuse, C. W. Floring & Assoc. 315-478-2149
NY Williston Park, ABC Elec. 516-747-6610
OH Cleveland, Geotronix 216-526-2535
OH Columbus, Geotronix 614-457-8472
TX Houston, Alpha Tech 214-423-4570

Local Distributors

Intl Eng., Eastleigh Hants, Vero Elctrns. ....TWX 851-47-551
Intl Japan, Tokyo, Hakuto Co. ....TWX 78-12-2912
Can Ontario, Elctrn. Pkg. Sys. 613-549-5152

LEASAMETRIC, INC., 1164 Triton Dr., Foster City, CA 94404, Tel: 415-574-4441; *Sls. Mgr.:* David Sobo

LEBOW CO., 38 Gerald Cass Pl., Goleta, CA 93117, Tel: 805-964-7117; *Sls. Mgr.:* Sharon J. Neiman

LEBOW PRODUCTS, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48237, Tel: 313-643-0220; *Sls. Mgr.:* Richard C. Phillips

LECROY RESCH. SYS. CORP., 700 S. Main St., Spring Vly., NY 10977, Tel: 914-425-2000, TWX: 710-577-2832; Empl.: 300; *Sls. Mgr.:* Richard Eandi

LECROY RESCH. SYS. CORP. (CAL.), 1806 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-856-1800, TWX: 910-373-1791; *Sls. Mgr.:* Andy Keyser

LECTROHM DIV. OF CAPCO, INC., Box 1028, Grand Junction, CO 81502, Tel: 303-243-8480, TWX: 910-929-6989; Empl.: 200

LECTRO MAGNETICS, INC., 6056 W. Jefferson Blvd., Los Angeles, CA 90016, Tel: 213-870-9383, 800-325-9814; FSC No.: 29098; Empl.: 45; *Sls. Mgr.:* Terry Cantine

LECTROTECH, INC., 5810 N. Western Ave., Chicago, IL 60659, Tel: 312-769-6262; Empl.: 42

LEDCO DIV., 240 Plato Blvd., St. Paul, MN 55107, Tel: 612-222-2791, TWX: 910-563-3699; FSC No.: 55292; Empl.: 300; *Sls. Mgr.:* Greg Larson

LEDEX

LEDEX INC., P.O. Box 427, Vandalia, OH 45377, Tel: 513-898-3621, Telex: 28-8228, TWX: 810-450-2526; FSC No.: 81840; Empl.: 500; *Sls. Mgr.:* T. C. Ristoff ....**1B**•1480, 1490-1492, 1672-1674

Local Sales Offices & Reps

AL Huntsville, A. B. Andrews & Co. 205-539-6817
AZ Scottsdale, Arcom Sls. 602-947-5745
CA San Diego, Interstate Mktg. Assoc. 619-292-8117
CA Saratoga, Testco Co. 408-253-1900
CA Woodland Hills, Interstate Mktg. Assocs. 213-883-7606
CO Boulder, Front Range Mktg. 303-443-4780
CT Bloomfield, SIR Assoc. 203-243-9343
FL Melbourne, Techn. Mktg. Assocs. 305-676-3776
FL Orlando, Techn. Mktg. Assocs. 305-857-3760
FL Pompano Beach, Techn. Mktg. Assocs. 305-942-0774
IL Elk Grove Village, Control Sls. 312-595-2110
IN Greenwood, Valentine & Assoc. 317-888-2260
IN South Bend, Valentine & Assoc. 219-288-7070
KS Leawood, Thunderbird Tech. Sls. & Svcs. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. & Svcs. 316-684-3941
MA Bedford, SIR Assocs. 617-275-5550
MI Jenison, R. C. Nordstrom & Co. 616-457-5762
MI Lathrup Village, R. C. Nordstrom & Co. 313-559-7373
MN Bloomington, Merrill Franklin Co. 612-854-9446
MO Maryland Heights, Thunderbird Tech. Sls. & Svcs. 314-567-6488
NY Clark Mills, KLM-Garner Co. 315-853-6126
NY N. Syracuse, KLM-Garner Co. 315-458-6214
NY Oceanside, Bittan Assocs. 516-678-6222
NY Pittsford, KLM-Garner Co. 716-381-8350
NC Research Triangle Park, A. B. Andrews & Co. 919-544-1762
OH Cleveland, Del Steffen & Assoc. 216-461-8333
OH Dayton, Del Steffen & Assoc. 513-293-3145
OH Lexington, Del Steffen & Assoc. 419-884-2313
PA King of Prussia, Freedman-Malta Assoc. 215-337-9211
PA Pittsburgh, Del Steffen & Assoc. 412-276-7366
TX Richardson, Thunderbird Tech. Sls. & Svcs. 214-690-0763
UT Salt Lake City, Front Range Mktg. 801-364-6481
VA Vinton, A. B. Andrews & Co. 703-890-1128
WA Bellevue, Testco 206-454-7422
WI Thiensville, Control Sls. 414-242-4580

LEECRAFT MFG., 21-02 44th Rd., Long Island City, NY 11101, Tel: 212-392-8800, TWX: 710-582-2897; Empl.: 250; *Sls. Mgr.:* T. J. Marine ....**1B**•1089

Local Sales Offices & Reps

AL Huntsville, L & D, Inc. 205-837-1469
AZ Tempe, Tempe Assocs. 602-829-1901
CA Los Angeles, Hartfield-Kennan-Freytag 213-225-1318
CO Arvada, Arrowhead Sls. Co. 303-423-5556
CT Bloomfield, Zaslow Sls. 203-242-7781
FL Lighthouse Point, J. Krutek & Assoc. 305-941-6544
GA Atlanta, L & D, Inc. 404-455-3483
ID Boise, Doran Sls. Assoc. 208-343-9969
IL Elmhurst, Hill Gray 312-832-4101
IN Indianapolis, Needler Sls. Co. 317-255-8056
IA Cedar Rapids, PMR Corp. 319-362-9177
KS Overland Park, PMR Corp. 913-381-0004
KY Nicholasville, W. H. Mathews 606-885-4943
MD Woodbine, Naudain Assocs. Southern 301-442-2270
MA Northboro, Zaslow Sls. 617-393-8150
MI Livonia, Electronic Salesmasters 313-591-2433
MN Bloomington, Northport Engrg. 612-854-5556
MO Maryland Hgts., PMR Corp. 314-569-1220
NH Londonderry, Zaslow Sls. 603-432-8907
NJ Marlton, Naudain Assocs. 609-235-1801
NY Great Neck, Tylinski Assocs. 516-466-9070
NY Rochester, B. H. Tollefson Assoc. 716-271-4141
NC Greensboro, L & D, Inc. 919-292-3201
OH Beachwood, Elctrn. Sls. Masters 216-831-9555
OR Forest Grove, Doran Sls. Assocs. 503-357-3333
PA Philadelphia, Naudain Assocs. 609-235-1801
PA Pittsburgh, Covert & Newman 412-531-2002
RI Providence, Zaslow Sls. 401-351-0070
TN Franklin, Groover & Assocs. 615-794-6344
TX Arlington, Fralia & Assocs. 817-640-9101
TX Stafford, Fralia & Assocs. 713-772-1572
UT Salt Lake City, Arrowhead Sls. 801-261-1661
VA Richmond, L & D, Inc. 804-794-7915
WA Redmond, Doran Sls. Assocs. 206-885-1885
EXP NY, Long Island City, Leecraft Intl. Corp. 212-392-8800

Local Distributors

CA Alhambra, Fisher Brownell 213-289-0255
CA El Monte, Kimball & Stark 213-444-2594
CA Los Angeles, Western Electromotive 213-820-3777
CA Sacramento, Sacramento Elec. 916-441-4821
CA Santa Clara, Fisher Brownell 408-988-6041
CO Denver, Denver Wintronics 303-934-2406
CT Hartford, Allied Electric 203-527-6405
FL Casselberry, Afcom 305-831-6630
FL Miami, Electronic Equip. 305-871-3500
GA Atlanta, Specialty Dist. 404-873-2521
IL Champaign, Klaus Radio 217-356-1896
IL Chicago, Newark Elctrns. 312-638-4411
IL Niles, Industribution 312-966-5630
IL Northbrook, Classic Comps. 312-272-9650
IN Evansville, Hutch & Son 812-425-7201
IN Fort Wayne, Graham Elect. 219-423-3422
IN Indianapolis, Genesis Elect. 317-637-5571
IN Indianapolis, Graham Elctrns. 317-634-8202
KS Wichita, RSC Electronics 316-267-5213
KY Louisville, P. I. Burks 502-589-3960
LA New Orleans, Southern Radio 504-524-2343
MD Beltsville, Treeko Sls. 301-937-8260
MD Rockville, Capitol Radio 301-881-2270
MA Hingham, Sager Electrical Supp. 617-749-6700
MI Ann Arbor, Wedemeyer Elect. Supp. 313-665-8611
MI Grand Rapids, SF Elctrns. 616-459-0216
MI Livonia, LWC Distrs. 313-464-7700
MI Livonia, RS Elctrns. 313-525-1155
MN Minneapolis, Newark Elect. 612-331-6350
MO Kansas City, Electronics Supp. 816-931-0250
MO Kansas City, LCOMP 816-221-2400
MO Maryland Hgts., LCOMP 314-291-6200
NH Hudson, C & H Elect. 603-882-1133
NJ E. Hanover, State Elctrn. Parts 201-887-2550

NJ	Kenilworth, Federated Purchasers	201-272-0505
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Buffalo, Genesee Radio	716-873-9661
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Elmsford, Ancar Elctrns.	914-592-7100
NY	Endwell, ASI Electronics	607-754-3823
NY	Hempstead, Electronic Equip.	516-538-5510
NY	New York, City Elec.	212-564-5454
NY	Rochester, Summit Elec. of Roch.	716-334-8110
NY	Rockville Centre, Midway Ind. Elctrns.	516-764-2400
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Akron, Sun Radio	216-434-2171
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Cincinnati, United Radio	513-761-4030
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Warren, REM Elect.	216-373-1300
PA	McKeesport, Barno Radio	412-462-7574
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Philadelphia, Phila. Elect.	215-568-7400
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Providence, Wm. Dandreta	401-861-2800
TN	Kingsport, Radio Elec. Supp.	615-247-8111
TN	Nashville, Electra Distributing	615-329-3971
TX	McKinney, Prime Distributing	214-231-0170
TX	Richardson, Fisher Brownell	214-235-3177
VA	Richmond, Sterling Elect.	804-226-2190
WA	Seattle, Pacific Elctrns.	206-575-1050
WI	Milwaukee, Indl. Elctrns.	414-276-1212

LEEDS & NORTHRUP INSTRS., A Unit of General Signal Corp., Sumneytown Pike, North Wales, PA 19454, Tel: 215-643-2000; Empl.: 4800; *Sls. Mgr.:* R. A. Diamond

Local Sales Offices & Reps

CA	Orange	714-937-1647; 213-924-1647
GA	Atlanta	404-938-8946
IL	South Holland	312-596-8480
IA	Bettandorf	319-355-6481
MA	Dedham	617-326-8816
NJ	Union	201-686-5200
NC	Winston-Salem	919-765-6580
OH	Beachwood	216-292-0020
PA	Horsham	215-441-5600
PA	Pittsburgh	412-561-7808
TX	Richardson	214-234-3363
TX	Stafford	713-491-6000
WA	Seattle	206-451-9028
WV	Charleston	304-342-0385
WI	Milwaukee	414-774-6000

LEEPOXY PLASTICS, 3324 Ferguson Rd., Ft. Wayne, IN 46809, Tel: 219-747-7411; Empl.: 15

LEHIGHTON ELCTRNS., INC., Box 328, Dept M, Lehighton, PA 18235, Tel: 717-386-4156, 215-377-5990; Empl.: 55; *Sls. Mgr.:* George White; *Dist. Mgr.:* George White

LEIGH INSTRS. LTD., Frequency Control Div., C.R. Snelgrove Co., 141 Bond Ave., Don Mills, ON M3B 1M2, Canada, Tel: 416-447-8531, Telex: 06-966626, TWX: 610-492-1354; FSC No.: 02533; Empl.: 158; *Sls. Mgr.:* R. W. Parkins

LEKTRA LABS., 129-07 18th Ave., P.O. Box 222, College Point, NY 11356, Tel: 212-939-7171; Empl.: 45; *Sls. Mgr.:* Frank L. Chilton

LEL CO., 5 Burns Pl., Cresskill, NJ 07626, Tel: 201-569-8641; Empl.: 10

LEMO U.S.A. INC., P.O. Box 11006M, Santa Rosa, CA 95406, Tel: 707-578-8811, Telex: 340-933; FSC No.: 2P953; Empl.: 13; *Sls. Mgr.:* David A. Battaglia 2•1503-1512

Local Sales Offices & Reps

CA	Los Angeles, Ezra Mintz Assocs.	213-670-5410
CA	Moraga, Ruppert Sls. & Engrg.	415-376-8040
CA	San Diego, Ezra Mintz Assocs.	619-565-4921
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Littleton, Omega Ltd.	303-798-7040
FL	Indian Harbor Beach, Bill Toy Assocs.	305-773-5805
IL	Northbrook, Raines & Assocs.	312-498-0890
IA	Marion, M-S-B Assoc., Inc.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc., Inc.	913-432-2131
MA	Lexington, Zieco	617-861-8300
MI	Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Edina, Electro-Tech	612-927-5878
MO	St. Charles, M-S-B Assoc., Inc.	314-946-5577
NJ	Ho-Ho-Kus, Don J. Fisher Co.	201-652-0090
NY	Cooperstown, Lloyd Hart Assoc.	607-547-9333
NY	Rochester, Lloyd Hart Assocs.	716-244-3253
ND	Edina, Electro-Tech	612-927-5878
OH	Chesterland, K/T Depco	216-729-3588
OH	Troy, K/T Depco	513-335-3914
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Doylestown, T.O.E. Sls.	215-348-2212
PA	Pittsburgh, K/T Depco	412-487-8777
SD	Edina, Electro-Tech	612-927-5878
TX	Lewisville, Jim Hughes Co.	214-221-1536
TX	Stafford, Jesse B. Simms - Jim Hughes Co.	713-343-0673
WA	Seattle, Earl & Brown Co.	206-284-1121

LENCO ELCTRNS., INC., 1330 Belden St., McHenry, IL 60050, Tel: 815-344-2900; *Sls. Mgr.:* Lenard J. Duncan 1A•2182, 2183

Local Sales Offices & Reps

AZ	Phoenix, Vari Tron Sls. Co.	602-992-3438
CA	Northridge, Myco Sls.	818-886-7101
CA	Palo Alto, TriRep	415-965-1822
FL	Lighthouse Point, NPM Assocs.	305-941-4586
IL	McHenry, Mesa Inc.	815-344-2820
KS	Mission, McAllister Assocs.	913-262-5500
MA	Framingham, Stone Comps.	617-875-3266
MI	Farmington Hills, KRW Sls.	313-476-6090
MI	Grand Rapids, KRW Sls.	616-363-2925
NJ	Oak Ridge, P.G. Assocs.	201-697-0128
NC	Fripp Island, NPM Assocs.	803-838-4438
OH	Columbus, KRW Sls.	614-464-1861
OH	Westlake, KRW Sls.	216-871-7521
PA	Oakmont, KRW Sls.	412-261-1323
TX	Dallas, Seaton Corp.	214-380-0414

LENCO ELCTRNS., INC., 300 N. Maryland St., Jackson, MO 63755, Tel: 314-243-3147, TWX: 910-760-1382; Empl.: 70; *Sls. Mgr.:* Robert N. Henson; *Dist. Mgr.:* P. A. Leonard

Local Sales Offices & Reps

CA	San Jose, Lenco Elctrns. Div.	408-356-0221
GA	Albany, Lenco Elctrns. Div.	912-436-4927
IL	Mt. Prospect, Lenco, Inc., Elctrns. Div.	312-392-5297
MD	Middletown, Lenco Elctrns. Div.	301-371-5588
TX	Euless, Lenco, Inc., Elctrns. Div.	817-540-0130

LENOX-FUGLE ELCTRNS., 100 Sylvania Pl., S. Plainfield, NJ 07080, Tel: 201-756-1164; Empl.: 25; *Sls. Mgr.:* Henry J. Lenox

LENOX INSTR., 111 E. Luray St., Philadelphia, PA 19120, Tel: 215-DA4-4543, TWX: 710-670-1440; Empl.: 40; *Sls. Mgr.:* William Lang

LENOX LASER, 615 Pittsfield Rd., Lenox, MA 01240, Tel: 413-499-4477; *Sls. Mgr.:* Joe D'Entremont; *Dist. Mgr.:* Joe D'Entremont

LENZ ELECTRIC MFG. CO., 1751 N. Western Ave., Chicago, IL 60647, Tel: 312-276-4454

LEONARD ELEC. PRODS., 85 Industrial Dr., Brownsville, TX 78521, Tel: 512-546-1625; Empl.: 150; *Sls. Mgr.:* Andrew C. Smith

LEPCO, See Leonard Elec. Prods.

LEPEL, 59-21 Queens-Midtown Expwy., Maspeth, NY 11378, Tel: 212-426-4580, Telex: 12303; Empl.: 200; *Sls. Mgr.:* Richard Sutton

LESTRONICS, INC., 1840 Industrial Circle, Longmont, CO 80501, Tel: 303-443-6250, 800-525-6478, TWX: 910-320-0786; *Sls. Mgr.:* George Buys

LEXICON CORP. OF MIAMI, 1541 N. W. 65th Ave., Ft. Lauderdale, FL 33313, Tel: 305-792-4400, TWX: 510-955-4130; FSC No.: 7025-0011; Empl.: 40; *Sls. Mgr.:* Barry Sleight

LEXIDATA CORP., 755 Middlesex Tpke., Billerica, MA 01865, Tel: 617-663-8550, 800-472-4747, TWX: 710-347-1574; Empl.: 30; *Sls. Mgr.:* Lou Gennaro

LFE, Process Control Div., 55 Green St., Clinton, MA 01510, Tel: 617-835-1000, Telex: 92-3445, TWX: 710-347-1734; FSC No.: 20905; Empl.: 1500; *Sls. Mgr.:* Ray Grande; *Dist. Mgr.:* Bob Pugsley

LH RESEARCH, INC., 14402 Franklin Ave., Tustin, CA 92680, Tel: 714-730-0162, TWX: 910-595-2540; Empl.: 620; *Sls. Mgr.:* James Williams 3•1650-1653

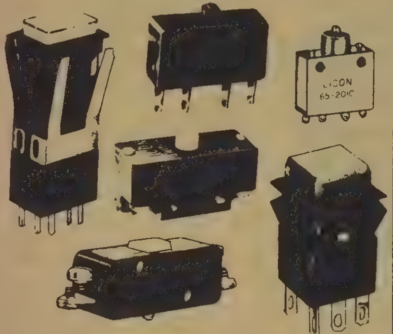
Local Sales Offices & Reps

CA	San Jose	408-943-9411
CO	Littleton	303-424-5119

LFE
PANEL METERS, CONTROLLERS & METER RELAYS
AUTHORIZED DISTRIBUTORS
METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration
METERMASTER LOCATIONS:
ARIZONA
Phoenix (602) 437-1425
Tucson (602) 792-3411
CALIFORNIA
Los Angeles (213) 685-4340
Palo Alto (415) 968-0313
San Diego (619) 560-4841
GEORGIA
Atlanta (404) 446-0166
ILLINOIS
Chicago (312) 593-8650
MASSACHUSETTS
Boston (617) 523-2580
MINNESOTA
Minneapolis (612) 332-6117
MISSOURI
St. Louis (314) 454-0241
NEW MEXICO
Albuquerque (505) 292-3330
OHIO
Cleveland (216) 651-4100
OKLAHOMA
Tulsa (918) 582-1444
PENNSYLVANIA
Pittsburgh (412) 261-4548
TEXAS
Austin (512) 473-8876
Dallas (214) 271-5671
Houston (713) 733-9814
WISCONSIN
Milwaukee (414) 643-0554
ALL OTHER STATES (800) 962-8128

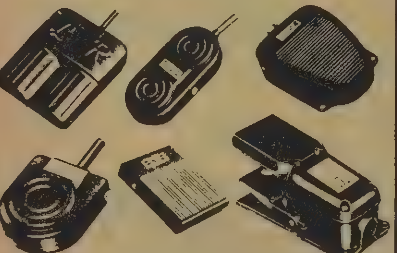
LITTELFUSE
AUTHORIZED DISTRIBUTOR
ESI
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971
FUSES AND FUSEHOLDERS
SEE COMPLETE PRODUCT LINE UNDER SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

itw LICON
Authorized Distributor
E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Dr., Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER
SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

LINEMASTER
Footswitch
AUTHORIZED DISTRIBUTOR
E S I
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER
SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

IL	Woodstock	815-337-0156
MA	Medway	617-533-4964/5/6/7
MN	Burnsville	612-890-1203
OH	Brunswick	216-225-8618
TX	Dallas	214-484-0754

LIBBY OWENS-FORD, 811 Madison Ave., Toledo, OH 43695, Tel: 419-247-4797; Empl.: 225

LIBERTY CONTROLS, 500 Brookforest Ave., Shorewood, IL 60435, Tel: 815-725-2241, TWX: 910-633-1557; Empl.: 60; *Sls. Mgr.:* Michael C. Maloney .... **1B**•1494, 1495

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-852-7676
CA	S. El Monte, H.M.C. Inc.	213-285-0485
CO	Englewood, Dynatech	303-773-2830
CT	Bloomfield, Wood Sls.	203-243-0457
FL	Ft. Lauderdale, Bolton Assocs.	305-491-6556
GA	Lawrence, R. W. Mitscher Co.	404-923-3239
IL	Downers Grove, Splon Assocs.	312-963-7011
IN	Ft. Wayne, Menze Sls.	219-747-5616
MD	Laurel, R. W. Mitscher Co.	301-498-6090
MA	Needham Hgts., Wood Sls. Corp.	617-444-1601
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	St. Paul, Countryman Assocs.	612-645-9151
NJ	Pennsauken, Vantage Sls.	609-663-6660
NY	Buffalo, R. W. Mitscher Co.	716-633-7970
NY	Lynbrook, H.L.J. Comptech	516-599-2999
SC	Columbia, R. W. Mitscher Co.	803-772-6240
TN	Johnson City, R. W. Mitscher Co.	615-282-6240
VA	Midlothian, R. W. Mitscher Co.	804-744-4676

LIBERTY INTL. CORP., First Resistor & Condenser Co., Ltd., 2539 237th St., Suite F, Torrance, CA 90505, Tel: 213-539-6452, Telex: 182421 LIBERTY TRNC; Empl.: 5; *Sls. Mgr.:* Gary Lee

Local Sales Offices & Reps

CA	San Diego, Sigma Elctrns.	714-565-2000
MA	Waltham, Del Tech Sls.	617-894-4550

LICON DIV., 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, Telex: 4330130, TWX: 910-221-0275; Empl.: 500; *Sls. Mgr.:* R. Schmidt; *Dist. Mgr.:* R. Scrivner

LIEBERT CORP., Programmed Power Div., 995 Benicia Ave., Sunnyvale, CA 94086, Tel: 408-245-8900, Telex: 499-1039; Empl.: 200; *Sls. Mgr.:* C. R. Harris

LIGHTNING PROTECTION CORP., Box 6086, Santa Barbara, CA 93160, Tel: 805-967-5089/4577; FSC No.: 56618; Empl.: 25; *Sls. Mgr.:* Chester J. Kawiecki

Advertisement

LIGHTNING PROTECTION CORP. designs and manufactures lightning and surge (including EMP) arresters, protectors, suppressors, and gas tube spark gaps for protection of electronic and electrical equipment against damaging voltage spikes and surge currents. AC and DC Power Arresters, Gas Tube Protectors, Co-Ax Arresters, special and unusual Hybrid Protectors.

LIGHTWAVE COMMUNICATIONS, INC., Sub. of Harbor Electrns., 650 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-3591, TWX: 710-467-0699; *Sls. Mgr.:* Timothy C. Gressett

LINCOLN INSTRS., 456 W. Montana St., Pasadena, CA 91103, Tel: 818-798-0733; Empl.: 8; *Sls. Mgr.:* Barbara J. Burchette .... **3**•1334

Local Sales Offices & Reps

CA	Westminster, Transducer Systems Co.	714-840-5357
MA	Burlington, Intersell	617-273-3844
OH	Cleveland, Tiby Co.	216-371-5335

LINCOLN LASER CO., 234 East Mohave, Phoenix, AZ 85004, Tel: 602-257-0407, Telex: 165-718; *Sls. Mgr.:* Robert S. Nehrbas, Jr.

LINDEN ULTRANSONICS, INC., 55 Harvey Rd., Londonderry, NH 03053, Tel: 603-434-4323; *Sls. Mgr.:* Forest Kimball

LINDGREN RF ENCLOSURES, INC., 1228 Capitol Drive, Addison, IL 60101, Tel: 312-628-9100, Telex: 254708 dfld; FSC No.: 18234; *Sls. Mgr.:* Matthew Resch .... **2**•1041

Local Sales Offices & Reps

CA	Santa Fe Springs, Wallace & Wallace	213-945-2908
CO	Denver, Westek Data Products, Inc.	303-232-2250
FL	Clearwater, Brennan Associates, Inc.	813-446-5006
FL	Melbourne Beach, Brennan Associates, Inc.	305-724-0854
IL	Addison, Lindgren R.F. Enclosures, Inc.	312-628-9100
MN	Stillwater, Ned Gordon & Associates	612-430-1572
NJ	Ocean, Gordon & Wallach	201-922-3014
NM	Albuquerque, Industrial Products Corp.	505-256-3561
NY	Ocean, Gordon & Wallach, Inc.	201-922-3014
OH	St. Marys, Thomas Shelby & Co., Inc.	419-394-3377
TX	Dallas, Tech Rep Marketing	214-241-2434
UT	Salt Lake City, Westek Data Products, Inc.	801-261-0999
VA	Springfield, Tech Reps, Inc.	703-569-6868
EXP	Durham, Sequence, (USA) Co., Ltd.	919-489-1146

LINEAR INSTRS., 500 Edison Way, Reno, NV 89502, Tel: 702-786-3636, Telex: 170044; Empl.: 90; *Sls. Mgr.:* David Powell

LINEAR MOTIONS CO., 17025 Dubesor St., Valinda, CA 91744, Tel: 818-918-7806; FSC No.: 5945; Empl.: 6; *Sls. Mgr.:* L. Wolby

LINEAR TECHNOLOGY CORP., 1630 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-942-0810, Telex: 499-3977; *Sls. Mgr.:* Mike Christoff; *Dist. Mgr.:* Tom Johnson

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Tusar	602-998-3688
CA	Culver City, Bestronics	213-870-9191
CA	Irvine, Bestronics	714-261-7233
CA	San Diego, Harvey King	619-566-5252
CA	Sunnyvale, Emerging Technlg. Sls.	408-720-0240
CA	Woodland Hills, Bestronics	213-704-5616
CO	Wheatridge, Waugaman Assoc.	303-423-1020
FL	Altamonte Springs, Semtronic Assoc.	305-831-8233
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Arlington Heights, Micro Sls.	312-956-1000
IN	Indianapolis, Leslie M. DeVoe Co.	317-842-3245
IA	Hiawatha, Gassner & Clark	319-393-5763
MD	Columbia, Delta III Assoc.	301-730-4700
MA	Burlington, New England Tech. Sls.	617-272-0434
MI	Birmingham, Favco	313-644-0173
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	Maryland Heights, R. R. Burton & Assoc.	314-434-1678
NJ	Haddonfield, Tritek Sls.	609-429-1551
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Hicksville, Lorac Sales	516-681-8746
NY	Syracuse, T-Squared Elctrns.	315-463-8592
NY	Victor, T-Squared Elctrns.	716-924-9101
NC	Gary, Montgomery Mktg.	919-467-6319
OH	Rocky River, Norm Case Assoc.	216-333-0400
OR	Portland, Micro Sls.	503-642-1818
TX	Austin, Technlg. Sls.	512-346-9940
TX	Dallas, Technlg. Sls.	214-380-0200
TX	Houston, Technlg. Sls.	713-266-2473
UT	Salt Lake City, Waugaman Assoc.	801-261-0802
WA	Bellevue, Micro Sls.	206-451-0568
WI	Brookfield, Micro Sls.	414-782-1171

LINEAR TECHNLG., P.O. Box 489, Sta. "A", Burlington, ON L7R 3Y3, Canada, Tel: 416-632-2996, Telex: 061-8525; Empl.: 105; *Sls. Mgr.:* D. F. Clifton

LINE ELEC. PRODS., G. General Electro-Components, Inc., 122 Naubuc Ave., Glastonbury, CT 06033, Tel: 203-659-3573, Telex: 643-067; FSC No.: 07065; *Sls. Mgr.:* Teo Babun; *Dist. Mgr.:* Roland Dombroski

LINEMASTER SWITCH, Box 52, Woodstock, CT 06281, Tel: 203-974-1000, TWX: 710-434-7412; FSC No.: 979180; Empl.: 190

LINSEIS
MEASUREMENT INSTRUMENTATION

LINSEIS, INC., P.O. Box 666, Princeton Junction, NJ 08550, Tel: 609-799-6282; *Sls. Mgr.:* C. Linseis .... **3**•1385

LION PRECISION, 60 Bridge St., Newton, MA 02195, Tel: 617-969-4710, TWX: 710-335-1280; FSC No.: 25404; Empl.: 30; *Sls. Mgr.:* R. A. Reichstein

LISK, G. W., CO., 2 South St., Clifton Springs, NY 14432, Tel: 315-462-2611, Telex: 685-4113; Empl.: 200; *Sls. Mgr.:* R. A. Nelson; *Dist. Mgr.:* R. A. Nelson

LITE-ON CORP., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248, Tel: 214-239-3565, TWX: 910-860-9316; Empl.: 1100; *Sls. Mgr.:* Jack P. Haesly; *Dist. Mgr.:* Jack P. Haesly

LITTELFUSE

LITTELFUSE, INC., 800 E. Northwest Hwy., Des Plaines, IL 60016, Tel: 312-824-1188, Telex: 910-233-4977, TWX: 310-433-0250; Empl.: 3000; *Sls. Mgr.:* Milan Bagel; *Dist. Mgr.:* Michael Budde ……**1B**•1062, 1254, 1268-1274

Local Sales Offices & Reps

AL	Huntsville, Hollingsworth & Still	205-772-0310
AZ	Tucson, Clemick & Assoc.	602-749-4003
AR	Little Rock, Erickson Sls.	501-225-7379
CA	Burlingame, Wm. J. Purdy	415-347-7701
CA	Carmichael, Wm. J. Purdy	916-484-1565
CA	Costa Mesa, Berman-Gravley	714-549-2122
CA	Tustin, Clemick & Assoc.	714-547-0966
CO	Denver, Wm. J. Purdy	303-777-1411
FL	Ft. Lauderdale, Hollingsworth & Still	305-748-8964
FL	Orlando, Hollingsworth & Still	305-859-9423
FL	Winter Park, Hollingsworth & Still	305-699-0505
GA	Norcross, Hollingsworth & Still	404-447-1700
IL	Mt. Prospect, C. P. Dombrow	312-253-3326
IN	Indianapolis, L. M. DeVoe	317-842-3245
KS	Overland Park, T. L. Dowell & Assocs.	913-648-7373
LA	Chalmette, Erickson Sls.	504-271-1976
MD	Laurel, R. W. Mitscher	301-498-6090
MD	Rockville, Mid-Atlantic Sls.	301-279-0684
MD	Silver Spring, Mid-Atlantic Sls.	301-593-7749
MA	Newtonville, C. Segel	617-969-6900
MI	Southfield, R. C. Merchant	313-354-4300
MI	St. Joseph, R. C. Merchant	616-933-7378
MN	Edina, M. Foster Tech. Sls.	612-941-9790
MO	St. Louis, T. L. Dowell & Assocs.	314-849-4234
NE	Panama, T. L. Dowell & Assocs.	402-788-2500
NJ	Englewood, Baum & Epstein	201-569-7600
NM	Albuquerque, Wm. J. Purdy	505-266-7959
NY	Buffalo, R. W. Mitscher	716-633-7970
NY	Manlius, R. W. Mitscher	315-637-9761
NY	N. Syracuse, R. W. Mitscher	315-458-1321
NY	Pittsford, R. W. Mitscher	716-586-4012
NY	Rochester, R. W. Mitscher	716-227-0839
NC	Kernersville, Hollingsworth & Still	919-996-4622
OH	Richfield, Bear Mktg.	216-659-3131
OR	Portland, J. V. Belusko	503-222-4279
PA	Greensburg, Bear Mktg.	412-836-1550
PA	Harrisburg, Beil & Whitaker	717-564-6900
PA	Narberth, Bresson Assocs.	215-664-6460
PA	Orefield, Beil & Whitaker	215-395-0150
PA	Reading, Beil & Whitaker	717-779-2610
TX	Dallas, Erickson Sls.	214-739-5833
TX	Dallas, Forner Sls.	214-241-2166
UT	Salt Lake City, Wm. J. Purdy	801-486-8557
VA	Midlothian, R. W. Mitscher	804-744-4676

LITTON APPLIED TECHNOLOGY, 645 Almanor Ave., P.O. Box 3478, Sunnyvale, CA 94088-3478, Tel: 408-773-0777, TWX: 910-339-9271; Empl.: 1700; *Sls. Mgr.:* J. Timm

Local Sales Offices & Reps

FL	Shalimar	904-651-3536
GA	Warner Robins	912-953-2002
OH	Dayton	513-253-3194
VA	Arlington	703-522-2050

LITTON ENCODER DIV., 20745 Nordhoff St., Chatsworth, CA 91311, Tel: 818-341-6161, TWX: 910-494-1229; FSC No.: 17080; Empl.: 350 ……**1B**•1848

Local Sales Offices & Reps

AZ	Phoenix, Clifton Precision Prod.	602-242-0910
CA	Cupertino, Clifton Precision	408-996-7507
CA	Los Angeles, Clifton Precision	818-347-0603
CO	Aurora, Midwest Meridian Corp.	303-341-7550
FL	Longwood, Boetto Corp.	305-331-1771
IL	Elk Grove Village, Midwest Meridian Corp.	312-640-9540
IA	Cedar Rapids, Midwest Meridian Corp.	319-365-6561
MN	Prior Lake, Midwest Meridian	612-447-8222
MO	Maryland Hgts., Midwest Meridian Corp.	314-878-4441
NY	Chappaqua, R. M. Glueck Assoc.	914-238-3233
OH	Fairborn, Midwest Meridian Corp.	513-879-7100
OR	Beaverton, Ravencraft	503-646-9261
TX	Fort Worth, Midwest Meridian Corp.	817-589-1711

LITTON INDS., Electron Tube Div., 960 Industrial Rd., San Carlos, CA 94070, Tel: 415-591-8411

LITTON INDUSTRIES, Electron Tube Div., 1035 Westminster Dr., Williamsport, PA 17701, Tel: 717-326-3561

LITTON POTENTIOMETER DIV., 750 So. Fulton Ave., Mt. Vernon, NY 10551, Tel: 914-664-7733, TWX: 710-562-0129; FSC No.: 04454; Empl.: 300; *Sls. Mgr.:* E. R. Cubbin

LITTON SYS. INC., Winchester Elecs/Use Co, 13536 G Saticoy St., Van Nuys, CA 91409, Tel: 213-786-9381, Telex: 67-4088, TWX: 910-495-1700; FSC No.: 88245; Empl.: 250; *Sls. Mgr.:* E. Wallen

LIXI, INC., 1438 Brook Dr., Downers Grove, IL 60515, Tel: 312-620-4646, Telex: 6871077, TWX: 910-991-3903; *Sls. Mgr.:* Joseph Plevak

LMB HEEGER, INC., 2946 E. 11th St., Los Angeles, CA 90023, Tel: 213-261-0382; *Sls. Mgr.:* Robert Heeger

LNR COMMUNICATIONS, INC., 180 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-7111, TWX: 510-227-9871; FSC No.: 51029; Empl.: 200

LOCKHEED ELECTRONICS, 1830 NASA - RD1, Houston, TX 77058, Tel: 713-483-3471

LOCUS, Box 740, State College, PA 16801, Tel: 814-466-6275; Empl.: 260; *Sls. Mgr.:* J. E. Hess

LODE SYSTEMS, 3501 Ryder St., Santa Clara, CA 95051, Tel: 408-732-5110; *Sls. Mgr.:* Douglas Cox

LOGE/INTERPRETATION SYS. INC., 420 S. Fairview Ave., Goleta, CA 93117, Tel: 805-967-2383, Telex: 658336; *Sls. Mgr.:* Stan Schlosser

LOGE/SPATIAL DATA SYS., 508 S. Fairview, Goleta, CA 93017, Tel: 805-967-2383, Telex: 658-336; Empl.: 30; *Sls. Mgr.:* S. Schlosser; *Dist. Mgr.:* S. Schlosser

LOGICAL TECHNICAL SVCS., Instr. Div., 675 Prospect St., Trenton, NJ 08618, Tel: 609-393-2222

Distributor

LOGICOMP ELECTRONICS, INC., 895 Mamaroneck Ave., Mamaroneck, NY 10543, Tel: 914-698-9332, 800-431-2625 ……pgs. 632, 664, 687, 695, 718, 726, 750, 778

LOGICOMP ELCTRNS., INC., Also see Pres-Air-Trol Corp.

LOGIC TECHNOLOGY, INC., 2452 Charleston Rd., Mtn. View, CA 94043, Tel: 415-967-1007; FSC No.: 51019

LOGIMETRICS, 121-03 Dupont St., Plainview, NY 11803, Tel: 516-349-1700, TWX: 510-221-1833; FSC No.: 33013; Empl.: 65; *Sls. Mgr.:* Eugene Blum

LOGITEK INC.

LOGITEK INC., 101 Christopher St., Ronkonkoma, NY 11779, Tel: 516-467-4200, TWX: 510-224-6253; FSC No.: 15420; Empl.: 55; *Sls. Mgr.:* Herbert Fischer ……**1B**•1466, 1467

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Scottsdale, Faser Technical Sls.	602-948-4404
CA	San Diego, Power Assocs.	619-275-0641
CT	Hartford, Dynamic Sls. of New England	203-693-6567
FL	Coral Springs, HAI Elctrns.	305-752-7520
GA	Atlanta, Remco	404-447-6937
KS	Wichita, D&O Engrg. Co.	316-686-2808
MA	Burlington, Dynamic Sls. of New England	617-272-5676
MI	Union Lake, G. L. Ashby Assoc. Inc.	313-363-1100
NC	Raleigh, Remco	919-847-5079
OH	Cleveland, G. L. Ashby Assoc. Inc.	216-461-0826
OH	Dayton, G. L. Ashby Assoc. Inc.	513-252-5627
PA	Churchville, Dynamic Elctrn. Sls.	215-322-2611
TX	Dallas, D&O Engrg. Co.	214-241-3099
VT	Burlington, Dynamic Sls. of New England	802-863-6665
WA	Seattle, Rep-West	206-283-8351

LONDON CO., See Radiometer Elctrns., U.S.

LORAIN PRODS., 1122 F St., Lorain, OH 44052, Tel: 216-288-1122, Telex: 98-0505, TWX: 810-246-2130; Empl.: 900; *Sls. Mgr.:* M. G. McGuire ……**3**•1654

Local Sales Offices & Reps

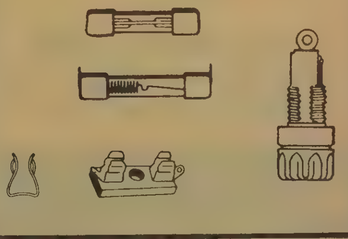
CA	Mountain View, Lorain Prods.	415-968-0542
IL	Genoa, Lorain Prods.	815-784-5535
NE	Omaha, Lorain Prods.	402-330-2754
NV	Las Vegas, Lorain Prods.	702-733-0936
NC	High Point, Lorain Prods.	919-869-3436
OH	Cincinnati, Luebbe Sls. Co.	513-871-4211
OH	Columbus, Luebbe Sls. Co.	614-431-0474
PA	Philadelphia, Lorain Prods.	215-276-8282
TN	Hendersonville, Lorain Prods.	615-244-2800
TX	Arlington, Lorain Prods.	817-640-1134
TX	Houston, Tesco	713-777-1443

LORAL TERRACOM, Div. of Loral Corp., 9020 Balboa Ave., San Diego, CA 92123, Tel: 619-278-4100, Telex: TERRACOM A SDG 18-2774, TWX: TERRACOM SDG 910-335-1202; *Sls. Mgr.:* Michael A. Lapadula

LORANGER MFG., Box 948, Warren, PA 16365, Tel: 814-723-2250, Telex: 914542; Empl.: 350; *Sls. Mgr.:* R. N. Ehrman

LORCH ELCTRNS., 105 Cedar La., Englewood, NJ 07631, Tel: 201-569-8282, TWX: 710-991-9718; FSC No.: 29971; Empl.: 50

LITTELFUSE
AUTHORIZED DISTRIBUTOR
ESI
ELECTRIC SWITCHES INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971



FUSES AND FUSEHOLDERS
SEE COMPLETE PRODUCT LINE UNDER SWITCHES — SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

LORTEC POWER SYS., INC., 5214 Mills Indl. Pkwy., N. Ridgeville, OH 44035, Tel: 216-327-5050, Telex: 98-0314; Empl.: 50; *Sls. Mgr.:* John R. Janner

LOVE CONTROLS, 1475 S. Wheeling Rd., Wheeling, IL 60090, Tel: 312-541-3232, Telex: 297115; Empl.: 120; *Sls. Mgr.:* Harold B. Koenen

LOYOLA CONTROLS INC., 1099 N. Batavia St., Orange, CA 92667, Tel: 714-639-0526; FSC No.: 15710; Empl.: 25; *Sls. Mgr.:* Benson Becker

Advertisement

Loyola Controls, Inc. is a leader in the field of Solid State Power Controllers. Units manufactured from 10 amps. to 2000 amps. at 120 to 600 VAC. On/off or time proportioning control, with zero crossover or phase angle firing is featured. Some devices have UL Listing or Recognition. Write/Call for complete catalog.

LPKF PACIFIC INC., LPKF Pacific Gesellschaft fuer internationalen Maschinenhandel m.b.h., 20C Pamaron Way, Novato, CA 94947, Tel: 415-883-1717, Telex: 470875; *Sls. Mgr.:* Juergen Seebach; *Dist. Mgr.:* Juergen Seebach

LPS RESCH. LABS, See Holt Lloyd

LSI COMPUTER SYS., 1235 Walt Whitman Rd., Melville, NY 11747, Tel: 516-271-0400, TWX: 510-226-7833; FSC No.: 55261; Empl.: 30; *Sls. Mgr.:* R. Colino

LTX, LTX Pk. @ University Ave., Westwood, MA 02090, Tel: 617-329-7550, TWX: 710-348-6621; *Sls. Mgr.:* Nick Stadtfeld

LUFF RESEARCH, Box 449, Jackson Hgts., NY 11372, Tel: 212-429-5900; Empl.: 4; *Sls. Mgr.:* A.M. Christopher

LUFT INSTRS., Hillside Rd, Lincoln, MA 01773, Tel: 617-259-9215; Empl.: 25

MAGNECRAFT
•
STANCOR/ESSEX

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

LUMITRON, P.O. Box 12, Summit, NJ 07901, Tel: 201-273-8998; FSC No.: 6240; Empl.: 20; *Sls. Mgr.:* Gil Chassie

LUNDY ELCTRNS. AND SYSTEMS, INC., 1 Robert La., Glen Head, NY 11545, Tel: 516-671-9000, Telex: 12-6929, TWX: 510-223-0605; FSC No.: 93712; Empl.: 700

LuTechnology, Inc.

LUTECHNOLOGY, INC., 3516 Breakwater Ct., Hayward, CA 94545, Tel: 415-887-1955; *Sls. Mgr.:* James Riggs ....3•1657

Local Sales Offices & Reps

AZ	Glendale, Adtek	602-931-9289
AZ	Phoenix, Sigma Engrg. Sls.	602-241-1334
CA	Fremont, George Matta	415-651-7395
CA	Garden Grove, Advanced Digital Grp.	213-598-9645
CO	Denver, Cleveland Entprs. of CO	303-751-3252
FL	Melbourne, Reynolds & Assocs.	305-259-7000
MA	Peabody, OEM Sls. of New England	617-535-2521
MN	Edina, Engrg. Prods. Assoc.	612-835-9022
NJ	Elmwood Park, L & M Assocs.	201-797-0441
NY	Fayetteville, Martin Andrews	315-637-5291
NC	Raleigh, Barker Assocs.	919-876-0282
PA	Chalfont, Eastern Scientific Mktg.	215-822-6503
TX	Dallas, Jim D. Gray & Assocs.	214-341-7190
WA	Bellevue, Al Smith Agency	206-746-6770

LUTRON ELCTRNS., Box 205, Suter Rd., Coopersburg, PA 18036, Tel: 215-282-3800, Telex: 847475, TWX: 510-651-3755; Empl.: 200; *Dist. Mgr.:* D. Savage

LUXO LAMP, P.O. Box 951, Port Chester, NY 10573, Tel: 914-937-4433, Telex: 137-336; Empl.: 150; *Sls. Mgr.:* Robert H. Newton

LVC INDS., INC., CO-ORD Switch Div., 23 Hanse Ave., Freeport, NY 11520, Tel: 516-868-1900; FSC No.: 32759; *Sls. Mgr.:* P. Parnicas

LYNN ELCTRNS., 915 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-677-6700, TWX: 510-667-1988; FSC No.: 19151; Empl.: 125; *Sls. Mgr.:* D.Giacomarra

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, Telex: 662729; FSC No.: 05791; *Sls. Mgr.:* Alfred C. Redlitz; *Dist. Mgr.:* Alfred C. Redlitz

LYON METAL PRODS., 47 Railroad Ave., Aurora, IL 60507, Tel: 312-892-8941, TWX: 910-232-3132; Empl.: 1200; *Sls. Mgr.:* T. L. Davis

MABUCHI MOTOR AMERICA CORP., 475 Park Ave. South, New York, NY 10016, Tel: 212-686-3622, Telex: 23-4374, TWX: 968209 MABU UR NYK; Empl.: 6000 ....**1B**•1159

PANAFAX: 212-532-4263

MACHINE COMPONENTS CORP., 70 Newtown Rd., Plainview, NY 11803, Tel: 516-694-7222; FSC No.: 15531; Empl.: 40; *Sls. Mgr.:* D. L. Dubov

MACHLETT LABS., INC., 1063 Hope St., Stamford, CT 06907, Tel: 203-348-7511

MACOM INDS., 8230 Haskell Ave., Van Nuys, CA 91406, Telex: 69-1192; Empl.: 31

M/A-COM. CABLE/HOME COMMUNICATIONS COMM/SCOPE COAXIAL CABLE, M/A-Com Inc., P.O. Box 1729, Hickory, NC 28603, Tel: 704-324-2200, 800-438-3331; *Sls. Mgr.:* Gene Swithenbank

M/A-COM CABLE/HOME COMMUNICATION PRODELIN SATELLITE ANTENNA SYSTEMS, M/A-Com, Inc., P.O. Box 468, Newton, NC 28658, Tel: 800-222-1195, 704-464-4141, Telex: 704-830; *Sls. Mgr.:* Dale Sherrill; *Dist. Mgr.:* Phil Cox

M/A-COM LASER DIODE, INC., M/A-COM, Inc., 1130 Somerset St., New Brunswick, NJ 08901, Tel: 201-249-7000, TWX: 710-998-0597; *Sls. Mgr.:* Stephen Klunk; *Dist. Mgr.:* Stephen Klunk

M/A-COM MICROWAVE CIRCUITS, INC., South Ave., Burlington, MA 01803, Tel: 617-272-3000, Telex: 94-9464, TWX: 710-332-6789; *Sls. Mgr.:* Norm Brown;Jim Fallon;Peter Gale;Gerry Porter

M/A-COM MICROWAVE POWER DVCS., 330 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1400, TWX: 510-227-6239; FSC No.: 34874; Empl.: 285

M/A-COM MILLIMETER PRODS., INC., South Ave., Burlington, MA 01803, Tel: 617-272-3000, Telex: 94-9464, TWX: 710-332-6789; *Sls. Mgr.:* William Ronis

M/A-COM OMNI SPECTRA, INC., 21 Continental Blvd., Merrimack, NH 03054, Tel: 603-424-4111, Telex: 6817280, TWX: 710-366-0674; FSC No.: 16179; Empl.: 750; *Sls. Mgr.:* Ernest DeVita; *Dist. Mgr.:* Terri Hastings

M/A-COM OSW, INC., 2626 S. Hardy Dr., Tempe, AZ 85282, Tel: 602-966-1471, Telex: 668-332, TWX: 910-950-1296; *Sls. Mgr.:* David Emerick

MAC PANEL

MAC PANEL CO., Box 5027, 216 Pine St., High Point, NC 27262, Tel: 919-884-8111; FSC No.: 16654; Empl.: 48; *Sls. Mgr.:* J. E. Craycroft ....**2**•1891

MACPOWER, 9115 26th Ave., Kenosha, WI 53140, Tel: 414-694-8866; *Sls. Mgr.:* Edward A. Joyner

MACRODYNE, 1004 Princetown Rd., Schenectady, NY 12301, Tel: 518-356-3500; Empl.: 22

MACRO ELECTRONICS CORP., 23 Royalston Lane, So. Setauket, NY 11720, Tel: 516-698-3357; *Sls. Mgr.:* N. Blumenthal; *Dist. Mgr.:* T. Shlisky

Local Sales Offices & Reps

NY	Kings Park, Pharmetics Inc.	516-360-0654

MACROLINK, 1150 E. Stanford Ct., Anaheim, CA 92805, Tel: 714-634-8080, TWX: 910-591-1671; Empl.: 25; *Sls. Mgr.:* Bill Goodale

MACRONETICS, See Veeco Instrs. Inc.

MAG-CON, 1626 Terrace Dr., St. Paul, MN 55113, Tel: 612-633-8820; Empl.: 30; *Sls. Mgr.:* M. Crellin

MAGNATROL VALVE CORP., 67 Fifth Ave., Hawthorne, NJ 07507, Tel: 201-427-4341, Telex: 130357; *Sls. Mgr.:* R. Kretschmer

MAGNAVOX ADVANCED PRODS. & SYS. CO., Magnavox Govt. Indl. Elctrns. Co., 2829 Maricopa St., Torrance, CA 90503, Tel: 213-618-1200, Telex: 674-373, TWX: 910-349-6657

MAGNECRAFT ELEC. CO., 5575 N. Lynch Ave., Chicago, IL 60630, Tel: 312-282-5500, TWX: 910-221-5221; FSC No.: 94696; Empl.: 700; *Sls. Mgr.:* M. S. Steinback; *Dist. Mgr.:* M. S. Steinback ....**1B**•1469

Local Sales Offices & Reps

AL	Huntsville, Electronic Mktg. Assoc.	205-837-7363
AZ	Tempe, Foley, Tallent & Lee	602-438-1564
CA	Campbell, Kottmeier Assoc.	408-866-5153
CA	Los Angeles, Universal Comp. Corp.	213-641-4255
CO	Parker, Technology Mktg. Assoc.	303-841-3435
CT	Farmington, R. Perron & Co.	203-673-4825
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
GA	Atlanta, Elctrn Mktg. Assoc.	404-448-1215
IN	Carmel, Mktg. Engrs.	317-872-5665
KS	Overland Park, Advanced Techn. Sls.	913-642-6675
LA	Folsom, McKinney Sls.	504-796-5861
MD	Lutherville, Walker-Houck Assocs.	301-296-6021
MA	Needham, R. Perron & Co.	617-449-6162
MI	Ferndale, Hilltronics	313-398-5556
MN	Minneapolis, Elec. Comps. Sls.	612-933-2594
MO	St. Louis, Advanced Techn. Sls.	314-227-4448
NH	Dover, R. Perron & Co.	603-742-2321
NJ	Marlton, B.G.R. Assoc.	609-940-1358
NY	Pittsford, W. A. Franklin Sls	716-248-8251
NY	West Hempstead, Schmitt Ind. Mkt.	516-486-3510
NC	Raleigh, Elctrn Mktg. Assoc.	919-847-8800

OH	Cleveland, Scott Elec. Inc.	216-473-5050
OH	Kettering, Scott Elec. Inc.	513-294-0539
PA	Pittsburg, Scott Elec. Inc.	412-963-6116
SC	Greenville, Elctrn. Mktg. Assoc.	803-233-4637
TX	Dallas, McKinney Sls.	214-631-9450
UT	Salt Lake City, Techn. Mktg. & Assoc.	801-364-3296
WA	Redmond, Quadra Sls.	206-883-3550

MAGNETEK, 7315 Red Deer Dr., Boulder, CO 80301-4696, Tel: 303-442-6700; FSC No.: 58439; Empl.: 25; *Sls. Mgr.:* Ruth E. Forsberg

Local Sales Offices & Reps

CA	San Diego, Mesa Engrg. & Sls. Assocs.	619-278-8021
KS	Shawnee Mission, Robinson & Assoc.	913-262-1374

3M

MAGNETIC AUDIO/VIDEO PRODUCTS DIV., 3M Co., 3M Center, Bldg. 223-5 South, St. Paul, MN 55101, Tel: 612-733-1110, TWX: 910-563-3712; Empl.: 38,351

Local Sales Offices & Reps

AK	Anchorage	907-279-6481
CA	Burbank	213-843-5935
CA	Los Angeles	213-726-6300
CA	San Francisco	415-761-1155
DC	Washington, D.C.	202-331-6963
GA	Atlanta	404-447-7000
HI	Honolulu	808-841-0147
IL	Argo	312-496-6500
IL	Hinsdale	312-920-7382
MA	Needham	617-449-0300
MI	Farmington	313-477-5000
MN	St. Paul	612-733-3300
MO	St. Louis	314-997-8500
NJ	Cherry Hill	609-667-7062
NJ	West Caldwell	201-575-2000
NC	High Point	919-886-7181
OH	Cincinnati	513-482-3100
OH	Cleveland	216-362-1700
PA	Philadelphia	215-728-5300
TX	Dallas	214-324-8100
WA	Seattle	206-244-7200

MAGNETIC CIRCUIT ELEMENTS, 1540 Moffett St., Salinas, CA 93905, Tel: 408-757-8752; FSC No.: 09349; Empl.: 24

Local Sales Offices & Reps

OR	Portland, RTS, Inc.	503-638-5670
WA	Vashon, RTS, Inc.	206-285-1363

MAGNETIC COILS INC., 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510; Empl.: 50; *Sls. Mgr.:* John O. Williams .... **1A**•2186-2191

MAGNETIC DEVICES INC., 5575 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-279-7054; FSC No.: 13786; *Sls. Mgr.:* Dave Loughlin

MAGNETIC INSTRUMENTATION, 8350 E. 48TH ST., Indianapolis, IN 46226, Tel: 317-545-2102, Telex: 27-2111; Empl.: 23 .... **3**•1261

Local Sales Offices & Reps

CA	Aptos, Wasson & Assocs.	408-496-6011
EXP	NY, Irvington, Inter Technical Export Corp.	914-591-8822

MAGNETIC METALS CO., Hayes Ave. at 21st St., Camden, NJ 08105, Tel: 609-964-7842, TWX: 710-891-7054; Empl.: 500; *Sls. Mgr.:* Brian J. Sully

MAGNETICO INC., 182 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1166; Empl.: 45 .... **1A**•2185

Local Sales Offices & Reps

CA	Woodland Hills, Interstate Mktg. Assoc.	213-883-7606

MAGNETICS, Box 391, Butler, PA 16003-0391, Tel: 412-282-8282, TWX: 710-373-3821; Empl.: 650; *Sls. Mgr.:* J. F. Huth

MAGNETIC SHIELD DIV., Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, Tel: 312-766-7800, TWX: 910-256-4815; Empl.: 43 .... **2**•1911-1913

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Redwood City, Ault Assoc.	415-367-1710
CA	Woodland Hills, Cal-Ward Sls. Co.	213-883-2202
CO	Denver, E. Johnson	303-985-4810
FL	Miami, Ludlum Assoc. Co.	305-592-6523
MD	Baltimore, Bernard White & Co.	301-484-5400
MA	Milton, Naton Assoc.	617-698-0670
MI	Farmington, Amtech Reps.	313-474-8300
MN	Minneapolis, Josco-Melius & Assoc.	612-861-3343
NM	Albuquerque, IMEC	505-883-9010
NY	Syracuse, Canavan-Scanlon Assoc.	315-437-1271
OH	Cleveland, Bill Teplitz & Co.	216-439-3265
PA	Media, W. Reeves Assoc.	215-566-6709
TX	Bedford, De Armond Ent.	817-268-6821

MAGNETIC SPECS., 10 Albemarle Ave., Trenton, NJ 08638; Empl.: 23

MAGNETIC SYSTEMS, 1021 Pecten Ct., Milpitas, CA 95035, Tel: 408-263-6680

MAGNETIC SYSTEMS INC., 95 Saginaw Dr., Rochester, NY 14623, Tel: 716-244-2940, Telex: 978324; Empl.: 50; *Sls. Mgr.:* G. H. McNeil

MAGNETIC TECHNOLOGY, 21001 Kittridge St., Canoga Pk., CA 91303, Tel: 213-887-7700, TWX: 910-494-1217; Empl.: 150; *Sls. Mgr.:* Jim Nelson .... **1B**•1160, 1161

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Los Altos, Servo Data	415-964-1325
CA	Los Angeles, Halbar Assocs.	213-246-8263
CT	Stratford, Gerald Rosen Co.	203-375-5456
FL	Orlando, MacKay, Smith & Assocs.	305-277-1513
GA	Atlanta, MacKay, Smith & Assocs.	404-449-7444
MA	Framingham, Gerald Rosen Co.	617-879-5505
MI	Detroit, A. Blumenberg Assoc.	313-968-3230
MI	Grand Rapids, A. Blumenberg Assoc.	616-456-7320
OK	Tulsa, Norcom	918-832-7747
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-933-6021
WA	Redmond, Halber Assocs.	206-882-0990

MAGNETIKA, INC., 4254 Glencoe Ave., Venice, CA 90292, Tel: 213-391-0391

MAGNETOELASTIC DEVICES, 326 Springside Ave., Box 625, Pittsfield, MA 01201, Tel: 413-445-5608

MAGNETRAN CORP., 5701 Savoy Lane, Houston, TX 77036, Tel: 713-785-4202; Empl.: 15

MAGNET SALES & MFG. CO. INC., 11250 Playa Court, Culver City, CA 90230-6127, Tel: 213-391-7213, 800-421-6692; FSC No.: 95-2916141; *Sls. Mgr.:* Anil Nanji; *Dist. Mgr.:* Anil Nanji .... **2**•1794

MAGNOS, Old School House Rd., Harvard, MA 01451, Tel: 617-456-8880; Empl.: 4

MAGNUM ELEC., 6385 Dixie Hwy., Erie, MI 48133, Tel: 313-848-2555, TWX: 810-231-7160; Empl.: 105; *Sls. Mgr.:* Ronald Pitchford; *Dist. Mgr.:* Ronald Pitchford .... **2**•1516-1518

Local Sales Offices & Reps

AZ	Tempe, Delta Elctrns.	602-224-1601
CA	Garden Grove, West Elctrn. Sls.	714-898-0120
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CO	Englewood, Grimes Mktg.	303-799-6063
CT	North Haven, Kitchen & Kutchin	203-239-0212
IL	Elk Grove Village, Control Sls.	312-595-2110
IN	Indianapolis, Marketing Engrs.	317-872-5665
KS	Overland Park, Thomas L. Dowell & Assocs.	913-648-7373
MD	Pikesville, Imagitron Sls. Co.	301-521-2020
MA	Burlington, Kitchen & Kutchin	617-862-8230
MN	Brooklyn Center, Willman Assocs.	612-566-5010
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NJ	Perth Amboy, Astrorep, Inc.	201-826-8050
NY	Babylon, Astrorep	516-422-2500
NY	Rochester, Marchese Marsey & Barden	716-544-4300
OH	Beachwood, ESI	216-831-9555
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OR	Portland, Jos. V. Belusko Co.	503-222-4279
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
TX	Dallas, J. Y. Schoonmaker	214-349-1650
TX	Houston, J. Y. Schoonmaker	713-738-2427
WI	Thiensville, Control Sls.	414-242-4580

MAGNUM MICROWAVE CORP., 365 Ravendale Dr., Mountain View, CA 94043, Tel: 415-968-9281, Telex: 171596; FSC No.: 59277; *Sls. Mgr.:* Gordon W. Graham

MAGNUM OPUS CUSTOM ELCTRN. ENGRG., 284 Kennedy St., Iselin, NJ 08830, Tel: 201-283-4925; *Sls. Mgr.:* R. Galanty .... **3**•1112

MAGNUSONIC DEVICES, 290 Duffy Ave., Hicksville, NY 11801, Tel: 516-938-4700, TWX: 510-221-1850; Empl.: 275; *Sls. Mgr.:* M. Stamouli

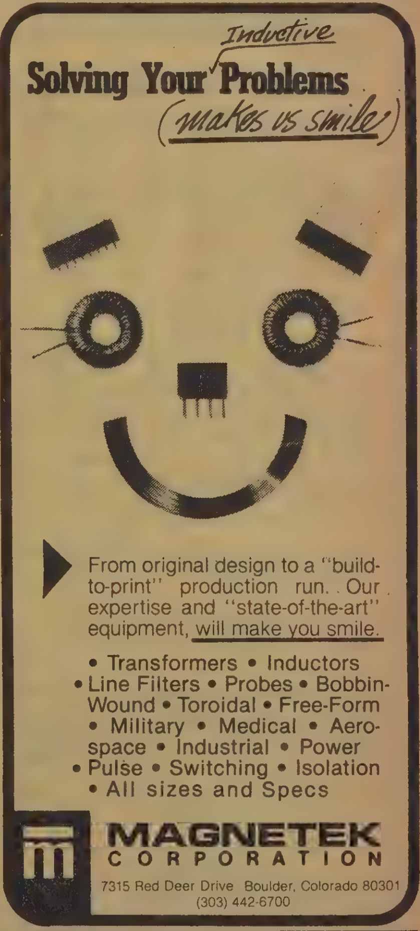
MAGTON INC., 1977 O'Toole Ave., San Jose, CA 95131, Tel: 408-943-9319; FSC No.: 52495; *Sls. Mgr.:* Robert C. Meyer

maida

MAIDA DEVELOPMENT CO., 20 Libby St., Hampton, VA 23663, Tel: 804-723-0785, Telex: 82-3443; Empl.: 299; *Sls. Mgr.:* Edward T. Maida, Frank Thompson .... **1A**•1121-1123

Local Sales Offices & Reps

CA	Los Angeles, High Voltage Sls.	213-881-9194
CA	Mountain View, West/Mark Assocs.	415-969-1700
FL	Vero Beach, John Hansen & Assocs.	305-562-2328
MA	Burlington, Conti-Younger	617-273-1582
MN	Fridley, Tesky & Assocs.	612-571-0876
NC	Cary, FBD Sls.	919-467-7595



From original design to a "build-to-print" production run. Our expertise and "state-of-the-art" equipment, will make you smile.

• Transformers • Inductors • Line Filters • Probes • Bobbin-Wound • Toroidal • Free-Form • Military • Medical • Aerospace • Industrial • Power • Pulse • Switching • Isolation • All sizes and Specs

MAGNETEK CORPORATION
7315 Red Deer Drive Boulder, Colorado 80301
(303) 442-6700

SC	Mauldin, FBD Sls.	803-828-2323
VA	Portsmouth, FBD Sls.	804-484-3162
WA	Seattle, ECCO Mktg.	206-364-0200

MALCO, DIV. MICRODOT CONNECTOR GRP., 12 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, TWX: 510-661-8206; Empl.: 400; *Sls. Mgr.:* C. H. Becker; *Dist. Mgr.:* M. Smith .... 2•1520-1522

MALLORY BATTERY, See Duracell Intl.

MALLORY

MALLORY CAPACITOR CO., Mallory Comps. Grp., 3029 E. Washington St., Indianapolis, IN 46201, Tel: 317-636-5353, Telex: 27-2155, TWX: 687-6015; FSC No.: 317-261-1581; Empl.: 1900; *Dist. Mgr.:* Frank Vendely ...... **1A**•1124-1133; **3**•1032-1035

Local Sales Offices & Reps

AZ	Scottsdale	602-949-7788
CA	Los Angeles	714-523-7992
CA	San Francisco	415-856-1136
CO	Denver	303-457-9373
FL	Orlando	305-855-6353
IL	Chicago	312-364-5750
IN	Indianapolis	317-636-5353
KS	Overland Park	913-362-7099
MA	Boston	617-965-5011
MI	Detroit	313-524-0015
MN	Minneapolis	612-884-2881
MO	St. Louis	314-291-8223
NJ	Hillsdale	201-666-3600
NY	Syracuse	315-437-9921
NC	Raleigh	919-836-0401
OH	Dayton	513-299-5505
OR	Portland	503-643-1203
PA	Carnegie	412-279-4248
PA	Willow Grove	215-657-4250
TN	Nashville	615-889-1174
TX	Dallas	214-324-2448

MALLORY TIMERS, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, Tel: 317-636-5353, TWX: 317-634-4214; Empl.: 2,000; *Sls. Mgr.:* Bill Miller

MANAGE, INC., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014, Tel: 413-598-8204, 592-3834; *Sls. Mgr.:* David Menard

Local Sales Offices & Reps

CA	San Francisco, Pacific Signal, Inc.	415-397-5995
CA	Woodlin Hills, Cal-Ward Sls. Co.	213-883-2202
IL	Downer Grove, Physic Equip.	312-960-4054
IN	Ossian, Science Sls.	219-622-7383
MA	Sudbury, Poulin Assoc, Inc.	617-443-7333
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NM	Albuquerque, Southwestern Eng. & Equip. Co.	505-881-3677
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NC	Fayetteville, ZIM-TEK	919-485-2222
TX	Dallas, Southwestern Eng. & Equip. Co.	214-340-1741
VA	Fairfax, Schibley Assocs., Inc.	703-591-3008
WA	Seattle, SJI Corp.	206-763-8981

M & T CHEMICALS INC., Woodbridge Rd. & Randolph Ave., Rahway, NJ 07065, Tel: 201-499-0200, Telex: 710-996-5841, TWX: 710-996-5842; Empl.: 1650

MANGER ELEC. CO., INC., W. Henry St., Stamford, CT 06902, Tel: 203-348-7761; Empl.: 100; *Sls. Mgr.:* J. V. Judge

MANHATTAN ELECTRIC CABLE, 225 Passaic St., Passaic, NJ 07055, Tel: 201-779-8900, Telex: 137-387; Empl.: 125; *Sls. Mgr.:* Ed Harvey; *Dist. Mgr.:* Allan Marconi

MANHATTAN ELEC. CABLE CORP., 1 Station Plaza, Rye, NY 10580, Tel: 914-967-8000, Telex: 137-387; Empl.: 125; *Sls. Mgr.:* Edward J. Harvey

MANN, HENRY, INC., 3983 Mann Road, Huntingdon Valley, PA 19006, Tel: 215-355-7200, Telex: 6851160; Empl.: 105; *Sls. Mgr.;* Jacques Werth; *Dist. Mgr.:* James P. Massi

MANNESMANN TALLY CORP., 8301 S. 180th St., Kent, WA 98032, Tel: 206-251-5500, Telex: 32-0200

MANTEX CORP., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051, Tel: 313-628-9711; Empl.: 100; *Sls. Mgr.:* Dennis J. Stepien .... **1B**•1783

Local Sales Offices & Reps

AZ	Phoenix, Cristee-Meade Co.	602-267-7197
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Diego, Mesa Engr. Sls. Assoc.	619-278-8021
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Lakewood, Christee-Meade Co.	303-232-0287
IL	Highland Park, Thomas B. Hunter Assoc.	312-433-7000
IN	Indianapolis, S.A.I. Mktg. Corp.	317-241-9276
KS	Leawood, Thunderbird	913-642-7220
KS	Wichita, Thunderbird	316-684-3941
MD	Baltimore, Muncy Sls. Assocs.	301-484-6376
MI	Brighton, S.A.I. Mktg. Corp.	313-227-1786
MN	St. Louis Park, Lestronix	612-926-8466
MO	Leawood, Thunderbird	913-642-7220
MO	Maryland Hgts., Thunderbird	314-567-6488
NH	Salem, Sales Engrg.	603-893-5521
OH	Columbus, S.A.I. Mktg. Corp.	614-454-8942
OH	Dayton, S.A.I. Mktg. Corp.	513-435-3181
OH	Shaker Hgts., S.A.I. Mktg. Corp.	216-751-3633
PA	Pittsburgh, S.A.I. Mktg. Corp.	412-261-0482
TX	Richardson, Thunderbird	214-690-0763
VA	Richmond, Muncy Sales Assoc.	804-288-5720

MANUFACTURING SYS., Div. LeDoux Inds., Inc., 2022-C S. Grand Ave., Santa Ana, CA 92705, Tel: 714-540-6630; Empl.: 6; *Sls. Mgr.:* Larry LeDoux

MARATHON BATTERY CO., 8301 Imperial Dr., Waco, TX 76714, Tel: 817-776-0650, TWX: 910-894-5203 MARATHON WAC; *Sls. Mgr.:* Walter H. Harder

MARATHON FLITE-TRONICS COMPANY, A Marathon Battery Co., 2525 N. Naomi St., Burbank, CA 91504, Tel: 213-841-3210, Telex: 69-1487; Empl.: 65

MARATHON SPECIAL PRODS., 13300 Van Camp Rd., Bowling Green, OH 43402, Tel: 419-352-8441, TWX: 810-499-2988; Empl.: 150; *Sls. Mgr.:* J. Campisi

MARCONI INSTRS., 100 Stonehurst Ct., Northvale, NJ 07647, Tel: 201-767-7250, TWX: 710-991-9752; *Sls. Mgr.:* A. Ramsden .... **3**•1258-1260

Local Sales Offices & Reps

AL	Huntsville, Beacon Electronics Assoc.	205-881-5031
CA	Los Alamitos, Scientific Devices—West	213-598-7678
CA	San Jose, Scientific Devices—West	408-554-0455
CA	Westminster, Marconi (Sls. Off.)	714-895-7182
FL	Ft. Lauderdale, Beacon Electrns. Assocs.	305-491-1054
GA	Atlanta, Beacon Electrns. Assocs.	404-256-9640
IL	Chicago, K.W. Meyers	312-882-4808
IN	Indianapolis, K. Meyers	317-243-6681
MD	Burtonsville, Bekr Inds.	301-421-1200
MA	Framingham, Marketing East	617-879-3355
MA	Stoneham, Ken Corp.	617-926-5525
MN	Minneapolis, K.W. Meyers	612-920-7080
MO	Grandview, P. A. C.	816-737-3030
NJ	Elmwood Park, L & M Assocs.	201-797-0441
NM	Albuquerque, Scientific Devices	505-883-3666
NY	Binghamton, Tae-Rep	607-772-6952
NY	New York City, L & M Assocs.	212-243-6155
NC	Raleigh, Beacon Electrns. Assoc.	919-787-0330
OH	Chesterland, EQS Systems	216-729-2222
OR	Portland, Marconi Sales Office	714-895-7182
PA	Andalusia, L & M	215-245-6658
TX	Dallas, Bradenco	214-243-7261

MAREL INSTR. CO., 907 South East 13th Pl., Cape Coral, FL 33904, Tel: 813-574-8788; Empl.: 14; *Sls. Mgr.:* T. Swift

MARINE ELECTRIC RPD, INC., See CML Macarr Div. Marine Electric RPD, Inc.

MARINE INDUSTRIAL CABLE CORP., P.O. Box 29207, New Orleans, LA 70189, Tel: 504-254-0754

WILD OATS

MARKAT DIV., Wild Oats Corp., 3 Country Dr., Plainview, NY 11803, Tel: 516-549-9272; Empl.: 228; *Sls. Mgr.:* K. L. Campbell; *Dist. Mgr.:* W. B. Heather

Advertisement

Specialists in the design and manufacturing of Industrial Control Systems of all types. Also manufacturers of the MARNAV marine navigation system which monitors Loran and satellite systems and all onboard operational instruments to provide instant updates on location and performance.

Local Sales Offices & Reps

AZ	Scottsdale, Southworth Sls.	602-945-3464
IN	Carmel, Hoosier Sls.	317-844-4535
NY	Massapequa Park, Systems Design & Engrg.	516-598-1270
OH	Centerville, Grimm & Co.	513-433-1717

MARKEL CORP., P.O. Box 752, Norristown, PA 19404, Tel: 215-272-8960, TWX: 510-660-0929; FSC No.: 03890; Empl.: 267

MARKEM CORP., 1000 Congress St., Keene, NH 03431, Tel: 603-352-1130, TWX: 710-366-1800; Empl.: 1200; *Sls. Mgr.:* Jack Lyman

MARKENRICH CORP., 14946-A Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 213-921-0250, Telex: 298727 MARK UR; Empl.: 6

Local Sales Offices & Reps

FL	Melbourne, Electro Mech. Standards	305-724-1027
IL	Palatine, Somers-Reagan	312-991-1108
MD	Timonium, Heller Sls. Co.	301-252-4780
MA	Reading, Lincoln Tech. Sls.	617-944-9594
MN	Edina, EPA, Inc.	612-835-9022
NY	Syracuse, I. A. Hotze Assocs.	315-479-6641
OR	Hillsboro, CompRepco	503-796-1350
PA	Chalfont, Eastern Sci. Mktg.	215-822-6503
TX	Richardson, Spectra Sls.	214-234-3600

MARKETING ENGINEERS, INC., 9860 Michigan Rd., Carmel, IN 46032

MARK EYELET & STAMPING, 202 Wakelee Rd., Wolcott, CT 06716, Tel: 203-756-8847, Telex: 69-6191; Empl.: 60

MARLEE SWITCH CO., 933-D N. Central Ave., Upland, CA 91786, Tel: 714-982-8988; *Sls. Mgr.:* LeRoy Tichy

MARLOW INDS., 10451 Vista Park Rd., Dallas, TX 75238, Tel: 214-340-4900, TWX: 910-860-5161; FSC No.: 55686; Empl.: 123; *Sls. Mgr.:* Richard J. Buist; *Dist. Mgr.:* Raymond Marlow

MARQUARDT SWITCHES INC., 67 Albany St., EEM, Cazenovia, NY 13035, Tel: 315-655-8050, Telex: 703-287-40; FSC No.: 315-655-8042; *Sls. Mgr.:* J. J. Kennedy; *Dist. Mgr.:* R. A. Philipchik .... **1B**•1675

MARTEL ELCTRNS. CORP., 13 Heritage Hill Rd., Windham, NH 03087, Tel: 603-893-0886, Telex: 95-1232; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286; Empl.: 2; *Sls. Mgr.:* DeWayne (Bud) Martin; *Dist. Mgr.:* DeWayne (Bud) Martin

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 60955; *Sls. Mgr.:* Wayne Whitney .... **3**•1892, 1893

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, Telex: 269-505; FSC No.: 83284; Empl.: 50; *Sls. Mgr.:* G. E. Mertins; *Dist. Mgr.:* G. E. Mertins

MASTER BOND, P.O. Box 522, Teaneck, NJ 07666, Tel: 201-343-8983; FSC No.: 59504; Empl.: 16; *Sls. Mgr.:* James Brenner

MASTER DYNAMICS CORP., 922 California Ave., Sunnyvale, CA 94086, Tel: 408-245-9040

MASTER ELCTRN. CONTROLS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 213-452-1336, Telex: 182041; Empl.: 64; *Sls. Mgr.:* I. Nizam; *Dist. Mgr.:* Bob Kent

MASTERITE CORPORATION, 2841 Lomita Blvd., Torrance, CA 90505, Tel: 213-775-3471, TWX: 910-347-6237; FSC No.: 05041; Empl.: 680; *Sls. Mgr.:* C.J. Huebert; *Dist. Mgr.:* G. Peterson

MASTER LOGIC, 761 E. Evelyn, Sunnyvale, CA 94086, Tel: 408-732-7777; *Sls. Mgr.:* Stephen Allen

MSC PRODS./EATON CORP., 1640 Monrovia St., Costa Mesa, CA 92627, Tel: 714-642-2427, Telex: 67-8433; Empl.: 350; *Sls. Mgr.:* J. McDorough

MATERIALS RESCH., Route 303, Orangeburg, NY 10962, Tel: 914-359-4200, Telex: 221862 MRC UR; Empl.: 700; *Sls. Mgr.:* Joseph Peoples

Local Sales Offices & Reps

AZ	Scottsdale	602-949-8311
CA	Carson	213-538-9032
CA	Santa Clara	408-748-0902
MO	Bridgeton	314-739-3326
NY	Pearl River	914-735-6100
TX	Dallas	214-235-9008

MATH ASSOCS., 2200 Shames Dr., Westbury, NY 11590, Tel: 516-334-6800; Empl.: 25; *Sls. Mgr.:* Robert DeLia

MATHEMATICAL SYSTEMS DESIGN, INC., 2850 Ocean Park Blvd., Ste. 300, Santa Monica, CA 90405, Tel: 213-450-9851; *Sls. Mgr.:* William E. Schaff

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036; Empl.: 10 .... **3**•1086

MATRIX CORP., 1639 Green St., Raleigh, NC 27603, Tel: 919-833-2837; *Sls. Mgr.:* Ron Zweben

MATRIX ENGINEERING CORP., 17000 S. Western Ave. 19, Gardena, CA 90247, Tel: 213-770-0521; Empl.: 7

MATRIX SCIENCE CORP., 435 Maple Ave., Torrance, CA 90503, Tel: 213-328-0271

MATRIX SYS. CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 213-992-6776, TWX: 910-494-4975; Empl.: 40; *Sls. Mgr.:* Jack Singleton .... **1A**•1709

Local Sales Offices & Reps

AZ	Scottsdale, Faser Techn. Sls.	602-948-4404
CA	Mountain View, IFM	415-961-2828
CA	N. Hollywood, Crown Elctrns.	213-877-3550
CO	Boulder, Sci. Dvcs.	303-449-9466
CT	Hamden, Poly Tek Assocs.	203-288-5246
FL	Melbourne, Reynolds & Assocs.	305-259-7000
GA	Acworth, RJC Assocs.	800-255-1965
IL	Chicago, Comtel Midwest	312-539-4838
IN	Indianapolis, Comtel Midwest	317-253-1681
IA	Cedar Rapids, Comtel Midwest	319-377-9434
KS	Shawnee Mission, Comtel Midwest	913-722-1030
MA	Ashland, Poly Tek Assocs.	617-881-4741
MI	Southfield, Comtel-Instr.	313-258-2505
MN	Wayzata, Comtel Midwest	612-476-1551
MO	St. Louis, Comtel Midwest	314-991-5363
NY	Mamaroneck, Bassin Tech. Sls. Co.	914-698-9332
NC	Winston Salem, Reynolds Assoc.	800-255-1965
OH	Cleveland, Comtel-Instr. Assocs.	216-442-8080
OH	Dayton, Comtel-Instr. Assocs.	513-298-7573
PA	Pittsburgh, Comtel-Instr. Assocs.	412-922-5720
TX	Carrollton, Seaton Corp.	214-380-0414
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	New Berlin, Comtel Midwest	414-544-6042

matrox

MATROX ELCTRN. SYS., 5800 Andover Ave., Montreal, QU H4T 1H4, Canada, Tel: 514-735-1182, Telex: 05-825651; Empl.: 185; *Sls. Mgr.:* Ed Dwyer

Local Sales Offices & Reps

AL	Huntsville, Pentech Assocs.	205-881-9298
AZ	Phoenix, P.A.R. Assocs.	602-243-4267
CA	Santa Clara, Indl. Modules	408-988-1911
CA	Torrance, High-Tech Digital	213-378-5131
CO	Denver, P.A.R. Assoc.	303-371-4140
FL	Deerfield Beach, Pentech Assocs.	305-421-4989
GA	Marietta, Pentech Assocs.	404-424-1931
IL	Schaumburg, Micro-Tex	312-885-1131
IL	Waukesha, Micro-Tex	414-542-5352
IN	Indianapolis, Giesting & Assocs.	317-271-5183
MD	Baltimore, Burgin-Kreh	301-265-8500
MA	Lexington, Nova Sls.	617-861-1820
MI	Novi, Giesting & Assocs.	313-348-3811
MN	Minneapolis, Jen-Ray Sys.	612-831-5060
NY	Clark Mills, KLM Garner	315-381-8350
NY	North Syracuse, KLM Garner	315-458-6214
NY	Pittsford, KLM Garner	716-381-8350
NY	Pleasantville, ABC Elctrn. Sls.	914-796-8088
NY	Williston Park, ABC Elctrn. Sls.	516-747-6610
NC	Greensboro, Pentech Assocs.	919-852-6000
OH	Cincinnati, Giesting & Assocs.	513-521-8800
OH	Mentor, Giesting & Assocs.	216-942-3407
OR	Portland, Westerberg & Assocs.	503-297-1710
PA	Pittsburgh, Giesting & Assocs.	412-963-0727
TX	Austin, Mycrosystems Mktg.	512-452-2842
TX	Houston, Mycrosystems Mktg.	713-270-7198
TX	Richardson, Mycrosystems Mktg.	214-669-2380
UT	Centerville, P.A.R. Assoc.	801-292-8145
VA	Lynchburg, Burgin-Kreh	804-239-2626
WA	Bellevue, Westerberg & Assoc.	206-453-8881

MATSUO ELCTRNS., 12831 Western Ave., Ste. A, Garden Grove, CA 92641, Tel: 714-898-0707, TWX: 910-596-1828; Empl.: 854; *Sls. Mgr.:* Ken Rhines; *Dist. Mgr.:* Ken Rhines

MAUREY INSTR. CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, TWX: 910-221-6025; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski ..**1A**•2041-2045; **1B**•1162

Local Sales Offices & Reps

FL	Orlando, ASI	305-851-7929
FL	Plantation, Innovative Mktg.	305-583-8895
WA	Vancouver, Sls. & Engrg. Assoc.	206-573-5161

Local Distributors

CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
CT	Ridgefield, PIC	203-451-1533
FL	Margate, Allied Elctrns.	305-973-3070
IL	Elgin, Allied Elctrns.	
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Westland, Allied Elctrns.	313-595-6565
MO	St. Louis, Allied Elctrns.	314-878-1229
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-821-0415
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-267-6940
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-932-7321
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Milwaukee, Allied Elctrns.	414-463-2662
Can	Lachine, Montreal, Electrodesign	514-636-4838

MAURY MICROWAVE, 8610 Helms Ave., Cucamonga, CA 91730, Tel: 714-987-4715, TWX: 910-581-3408; FSC No.: 13047; Empl.: 40; *Sls. Mgr.:* D. A. Smith

MAXI-SWITCH CO., 9697 East River Rd., Minneapolis, MN 55433, Tel: 612-755-7660, TWX: 910-576-2690; Empl.: 100; *Sls. Mgr.:* Craig Stout

maxon DC motor

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, TWX: 910-375-2049; Empl.: 270; *Sls. Mgr.:* Steven E. Buller .... **1B**•1163

MAXWELL LABS., 8835 Balboa Ave., San Diego, CA 92123, Tel: 619-279-5100, TWX: 910-335-2063; Empl.: 300; *Sls. Mgr.:* William Fox (Prods.);Mike Plum (Magneform)

MCCOY ELECTRONICS CO., Sub. Oak Technology Inc., 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548; Empl.: 600 .... **1A**•1374-1382

Local Sales Offices & Reps

AL	Huntsville, Oak Southeast	205-882-9296
CA	Huntington Bch., Oak Southwest	714-846-6691
CA	Los Altos, Oak Western	415-941-1237
CO	Colorado Springs, I. W. Strong & Assocs.	303-576-1962
CO	Denver, I. W. Strong & Assocs.	303-292-6900
CT	Meriden, JMG, Inc.	203-235-0819
FL	Altamonte Springs, Oak Southeast	305-831-5411
IL	Rolling Meadows, Oak Inds./Illinois	312-255-6150
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MA	Norwood, JMG, Inc.	617-762-5333
MN	St. Louis Pk., Wagner Conslts. Co.	612-922-6330
MO	N. Kansas City, Automatic Gen. Elctrn. Sls.	816-421-0426
NJ	Haddonfield, Gray Assocs.	609-429-5300
NY	Fayetteville, S. F. Foster Co.	315-637-5427
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Webster, S. F. Foster Co.	716-265-2072
NC	Raleigh, Oak Northeast	919-876-7591
OH	Cincinnati, Oak Inds./Ohio	513-851-4411
OR	Beaverton, Oak Northwest	503-643-0127
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-840-0590
TX	Richardson, R. F. Kimball Co.	214-231-3447
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200

MCE SEMICONDUCTOR, 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 305-845-2837, Telex: 513463; Empl.: 140

MCFADDEN SYS., INC., 8956 S. Atlantic Ave., South Gate, CA 90280-9990, Tel: 213-564-5958, Telex: 677161; FSC No.: 25750; Empl.: 28

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, Telex: 645518; FSC No.: 29779; Empl.: 30 .... **1B**•1277-1280

Local Sales Offices & Reps

CT	Norwalk, Gemini Grp.	203-852-8173
LA	Covington, Svc. Elctrl. Sls.	504-893-2830

For Thermoelectric Cooling:
LOOK TO THE LEADER!!

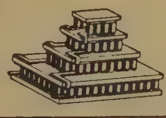
Through the years Marlow Industries' innovative approach to thermoelectric technology has established a reputation for excellence with the aerospace, military, telecommunications and other industries. Our experience covers a broad spectrum in the thermoelectric field, including:

- Infrared Detector Cooling
- Laser Diode Cooling
- Fast Transient Cooling
- CCD Cooling
- Medical and Laboratory Instrumentation Cooling
- Electronic Cabinet Cooling
- Consumer and Industrial Product Cooling
- Small Volume Refrigeration And Air Conditioning
- Power Supply/Temperature Controllers
- Accessories (Flux, Solder, Grease, Epoxy, Sensors, Headers, etc.)

Call or write Marlow Industries today and see how far thermoelectric technology has really come. Look to the leader!

mi marlow industries incorporated

10451 VISTA PARK ROAD • DALLAS, TEXAS 75238
(214) 340-4900 • TWX 910-860-5161



MS	Brandon, Svc. Elctrl. Sls.	601-992-9122
MO	St. Louis, Engrg. Svc. Co.	314-997-1515
NJ	Caldwell, Fred Urban	201-228-5249
NC	Greensboro, The Saylor Assocs.	919-292-0452

MCGILL MFG. CO., INC., Bearing Div., 909 N. Lafayette St., Valparaiso, IN 46383, Tel: 219-465-2200, Telex: 25-8446

MCGILL MFG. CO., INC., Electrical Div., 1002 N. Campbell St., Valparaiso, IN 46383, Tel: 219-465-2200, TWX: 910-690-4982; Empl.: 295; *Sls. Mgr.:* David Rickards (OEM Switch), Thomas Frary (Control Prods.); *Dist. Mgr.:* Thomas F. Morris .... 1B•1676

Local Sales Offices & Reps

AL	Decatur, Tenn Tech Sls.	205-350-0630
CA	S. El Monte, HMC Inc.	213-442-7970
CA	Santa Clara, Logan Sls.	408-496-0660
IN	Indianapolis, A. E. Fred Schaab	317-253-8689
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Needham, Hgts. Newscott Co.	617-444-1923
MI	W. Bloomfield, OBE, Inc.	313-332-4900
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Ellisville, Larco Sls.	314-394-7141
NJ	Cherry Hill, Danco Elctrn. Sls.	609-424-5590
NY	Baldwin, C. Glianna	516-378-2700
NY	N. Syracuse, Advanced Comp. Corp.	315-699-2671
OH	Cleveland, Allied Entprs.	216-779-0080
SC	Columbia, H. Heaton	803-256-9230
TX	Dallas, Erickson Sls.	214-739-5833
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Seattle, SPS Elctrns.	206-323-4140

MCGUIRK ELECTRONICS CO. INC., York St. P.O. Box 101 S.V., Andover, MA 01810, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* V. James Stabile

MCI TRANSFORMER DIV., See Magnetic Coils Inc.

MCKINSTRY METAL WORKS, INC., 285 McKinstry Ave., Chicopee, MA 01013; Empl.: 80

MCL, INC., 10 North Beach Ave., La Grange, IL 60525, Tel: 312-354-4350, TWX: 910-683-1899; FSC No.: 16469; Empl.: 60; *Sls. Mgr.:* Frank Morgan .... 3•1390, 1391

Local Sales Offices & Reps

CA	Los Angeles, RF Associates	213-478-1586
CA	Palo Alto, RF Associates	415-494-3331
GA	Riverdale, MCL, Inc./Bob Lundy	404-996-6632
MA	Reading, Geder Assocs.	617-944-3105

MCLEAN ENGRG., Div. of Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543; FSC No.: 03522; Empl.: 135; *Sls. Mgr.:* William L. Sly; *Dist. Mgr.:* Craig A. Reed .... 2•1824, 1825

Local Sales Offices & Reps

CA	Cupertino, T. Snitzer Co.	408-257-8333
CA	Del Mar, T. Snitzer Co.	714-226-0305
CA	L.A., T. Snitzer Co.	213-836-6170
CO	Boulder, Component Prod. Sls.	303-530-2800
CT	North Haven, John E. Boeing Co.	800-343-4331
FL	Clearwater, R.I. Smith Assocs.	813-581-1492
FL	Ft. Lauderdale, R.I. Smith Assocs.	305-772-5100
FL	Orlando, R.I. Smith Assocs.	305-365-8077
IL	Elmhurst, Scott Assocs.	312-279-5681
LA	Gretna, M. F. Sls.	504-361-4343
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Lexington, John E. Boeing Co.	617-862-2500
MI	East Detroit, J. Thorpe Co.	313-779-6363
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
MO	Grandview, Harris-Hanson	816-763-6200
MO	St. Louis, Harris-Hanson	314-432-3611
NJ	Ridgewood, Hansen & Hughes	201-652-7055
NM	Albuquerque, Fry-Gates	505-262-1525
NY	Albany, Reagan/Compar Albany	518-489-4777
NY	Binghamton, Reagan/Compar	607-754-8946
NY	Fairport, Reagan/Compar Albany	716-271-2230
NY	New Hartford, Reagan/Compar Albany	315-732-3775
NY	New York, Hansen & Hughes	800-526-5114
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	614-885-7643
OR	Wilsonville, R.T.S.	503-638-5670
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
PA	Pittsburgh, Marlow Assocs.	412-367-8886
SC	Greenville, Sunbelt Sls.	803-877-9088
TN	Taft, Sunbelt Sls.	615-425-6164
TX	Dallas, J.A. Green Co.	214-631-7450
TX	Houston, Milco Mktg.	713-946-2841
UT	Salt Lake City, Component Prod. Sls.	801-262-0000
VA	Charlottesville, Marktron	804-973-5874
WA	Vashon, R.T.S.	206-285-1363

Local Distributors

CA	Los Angeles, Snitzer Supply	213-836-6170
MI	Ann Arbor, Wedemeyer Elctrn. Supp. Co.	313-665-8611
TX	Houston, R. V. Weatherford	713-688-7406
Can	Guelph, Ontario, Hammond Mfg. Co.	519-822-2960

MCLEAN MIDWEST, 4000 83rd Ave. N., Brooklyn Pk., MN 55443, Tel: 612-561-9400, Telex: 29-0883, TWX: 910-576-2951; *Sls. Mgr.:* J. Buyse .... 2•1826, 1827

3M CO., Carbonless/Related Prods Div Ind'l Optics, 3M Center, Bldg. 225-3S, St. Paul, MN. 55144, Tel: 612-733-4403, Telex: 29-7023, TWX: 910-563-3712; *Sls. Mgr.:* A. Rivard

3M

3M-ELECTRONIC PRODUCTS DIVISION, 3M Center, Bldg. 225-1N-06, St. Paul, MN 55144, Tel: 612-733-7408 .... 2•1514, 1515

Local Sales Offices & Reps

AK	Anchorage	907-561-1030
CA	Los Angeles	213-726-6300
CA	So. San Francisco	415-761-1155
GA	Atlanta	404-447-7000
HI	Honolulu	808-422-2721
IL	Chicago	312-496-6500
MA	Boston	617-449-0300
MI	Detroit	313-477-5000
MN	St. Paul	612-733-3300
MO	St. Louis	314-997-8500
NJ	West Caldwell	201-575-2000
NC	High Point	919-889-7181
OH	Cincinnati	513-482-3100
OH	Cleveland	216-362-1700
PA	Philadelphia	215-728-5300
TX	Dallas	214-324-8100
WA	Seattle	206-244-7200

Local Distributors

AL	Huntsville, RM Alabama	205-852-1550
AL	Huntsville, Powell Electronics	205-539-2731
AZ	Tempe, Richey/Western Elctrns., Inc.	602-894-9251
AZ	Tempe, Acacia Sls.	602-894-2874
CA	Irvine, Ratel Elctrns.	714-549-8611
CA	Irvine, Acacia Sls.	714-549-0954
CA	Los Angeles, Richey/Western Elctrns., Inc.	213-820-3777
CA	San Diego, Acacia Sls.	619-565-4365
CA	San Diego, Richey/Western Elctrns., Inc.	619-271-4511
CA	San Jose, Ratel Elctrns.	408-946-4300
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Richey/Western Elctrns., Inc.	408-727-7411
CA	Sun Valley, Richey/Western Elctrns., Inc.	818-768-3800; 213-875-2862
CA	Sunnyvale, Acacia Sls.	408-745-7200
CO	Denver, Ragon Electronic Parts	303-744-3601
CO	East Haven, JV Elctrns.	203-469-2321
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Hamden, Impact Sls. Co.	203-281-1331
FL	Ft. Lauderdale, Power Elctrns.	305-979-5000
FL	Winter Park, Deanco	305-671-5100
GA	Atlanta, A.C. Equipment Co.	404-451-2747
GA	Marietta, Deanco	404-429-0126
IL	Chicago, Prehler	312-384-6100
IL	Lombard, RM Illinois	312-932-5150
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
MD	Columbia, Powell Elctrns.	301-995-0410; 301-621-4070 in D.C.
MD	Gaithersburg, Deanco	301-948-5444
MA	Burlington, Schaal Assoc./Deanco	617-272-1506
MA	Canton, Impact Sls.	617-821-1500
MA	Westboro, Powell Elctrns.	617-366-6100
MI	Grand Rapids, RM Michigan	616-531-9300
MN	St. Paul, Ragon Elctrns.	612-642-2828
MO	Independence, Ragon Elctrns.	816-254-3410
MO	St. Charles, Lectronix	314-946-6424
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Englewood, Powell Electronics	201-894-0800
NJ	Fairfield, Deanco	201-575-7960
NY	Farmingdale, Addem Distributors	516-752-9303
NY	Hauppauge, LI, Schaal Associates/Deanco	516-234-4600
NY	Ithaca, Deanco	607-257-4444
NY	Ronkonkoma, Zenith Wire & Cable	516-585-1444
NC	Cary, Powell Electronics	919-467-1212
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Highland Heights, Elctrns. Mktg. Corp.	2 6-422-3411
OH	Middleburg Heights, Prehler	216-826-0110
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Beaverton, Acacia Sls.	503-646-3377
OR	Lake Oswego, Moore Elctrns., Inc.	503-684-3100
OR	Wilsonville, Zepher Elctrns.	503-682-2929
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Norvell Elctrns.	512-458-8106
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Richardson, Kent Elctrns.	214-669-2600
UT	Midvale, Ratel Elctrns.	801-562-2600
WA	Seattle, Zepher Elctrns.	206-241-1980

3M

3M CO., STATIC CONTROL SYS. DIV., 3M Center, Bldg. 225-4S-04, St. Paul, MN 55144, Tel: 612-733-9420, TWX: 910-563-3712; Empl.: 300; *Sls. Mgr.:* Mike Martin .... 3•1924, 1925

Local Sales Offices & Reps

AZ	Phoenix	602-934-7413; 800-221-1046
CA	Los Angeles	800-221-1045
CA	San Francisco	415-761-1155
CO	Denver	303-321-3873
DC	Washington	800-241-3669
FL	Orlando	800-241-3669
GA	Atlanta	800-241-3670
IL	Chicago	312-496-6553
MA	Boston	617-449-0300
MI	Detroit	800-323-4087
MN	St. Paul	800-392-0312
MO	St. Louis	314-997-8500
NJ	Newark	800-221-1454
NJ	West Caldwell	800-221-1454
NY	Syracuse	800-221-1455
NC	High Point	919-889-7181
OH	Cincinnati	800-241-3669
OH	Cleveland	216-362-1700
PA	Philadelphia	215-728-5300
TX	Dallas	800-442-8046
TX	Houston	800-442-8046
WA	Seattle	206-244-7200; 206-241-2250

3M CO., TECH CERAMIC RESOURCES, 3M Center 225-4W, St. Paul, MN. 55101, Tel: 617-736-0601, Telex: 29-7023, TWX: 910-563-3712; Empl.: 83000

3M CO. VISUAL PRODS./INDUS. OPTICS., See 3M Co. Carbonless Related Prods. Div.

MDB SYS., 1995 N Batavia St., Orange, CA 92665, Tel: 714-998-6900, TWX: 910-593-1339; Empl.: 200; *Sls. Mgr.:* William Wollam

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06810, Tel: 203-743-3579, Telex: 499-8051; FSC No.: 60628; Empl.: 5 .... 3•1262

Advertisement

WHITE NOISE GENERATOR
DIODES AND MODULES

•Frequency Range: 10Hz to 1000MHz
•Temp. Range: Diodes −55°C to +125°C
Modules −35°C to +85°C
•RMS Noise Output: To Customer Spec.
•Flatness: To Customer Spec.
•ALL devices are Power-Aged.

PHONE (203) 743-3579 for catalog and pricing information or to submit your particular requirements.

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, Telex: 802-502, TWX: 510-920-0770; *Sls. Mgr.:* Stephen R. Katz

MS

MEASUREMENT SYS., INC., 121 Water St., Norwalk, CT 06854, Tel: 203-838-5561, TWX: 710-468-2185; Empl.: 75; *Sls. Mgr.:* John Cronan ....3•1134

Local Sales Offices & Reps

IA	Cedar Rapids, S & O Sls.	319-393-1845
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Hudson, Data Rep.	617-481-0333
PA	Melrose Park, R. Meyers Assocs.	215-224-1663
VA	Richmond, Robert Elctrn. Sls.	804-276-3979

MEC A/S, Industriparken 23, Ballerup, DK-2750, Denmark, Tel: 452-973366, Telex: 35323

Local Sales Offices & Reps

AZ	Phoenix, Eltron	602-266-2164
CA	Brea, Masco	714-529-0867
CA	Mountain View, Switches Inc.	415-962-8649
CA	Orange County, Pacific Switch Controls Inc	714-953-1254
CA	Van Nuys, Pacific Switch Controls Inc	213-873-4802
CO	Aurora, Mountain View Mktg.	303-360-9641
FL	Fort Lauderdale, KSM Elctrns. Inc	305-971-5900
GA	Atlanta, KSM Elctrns. Inc	404-458-2013
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Indianapolis, Insul Reps	317-842-5203
MA	Needham, A&M Elctrns.	617-444-8170
MI	Brighton, AP Assocs.	313-229-6550
MN	Minneapolis, Elctrn. Comps. Grp.	612-559-0720
NY	Great Neck, M.O.S. Assocs.	516-487-3966
PA	Glenside, Wyncote Instrmn.	215-572-6500
TX	Richardson, Southern States Mktg.	214-238-7500
VA	Fairfax	701-591-1300
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

MECHANICAL ENGRAVING, 4500 Bullard Ave, Bronx, NY 10470, Tel: 212-324-4455; FSC No.: 99040; Empl.: 35; *Sls. Mgr.:* Bernard W. Mandel

Local Sales Offices & Reps

CT	Huntington, Richard Jonassen & Assocs.	203-929-7987
IL	Chicago, Zinsmaster & Assocs.	312-870-7347
IL	Moline, Louis Turilli	309-797-2307
MO	Kansas City, Zinsmaster & Assocs.	816-333-6233
NH	Hillsboro, Richard Jonassen and Assocs.	603-464-3264

MECHANICAL ENTPRS., 461 Carlisle Dr., Herndon, VA 22070, Tel: 703-435-9496, TWX: 710-832-0942; Empl.: 25; *Sls. Mgr.:* R.H. Twyford ....**1B**•1677, 1784, 1785

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn.	714-551-4821; 619-693-0113;213-886-7101
CT	Bristol, Technlg. Prods.	203-583-0703
FL	Casselberry, Semi	305-695-3334
FL	Clearwater, SEMI	813-441-3902
FL	Ft. Lauderdale, SEMI	305-475-3686
IL	Arlington Heights, Coombs Assoc.	312-439-9810
IN	Ft. Wayne, Coombs Assoc.	219-747-7661
IA	Cedar Rapids, Coombs Assoc.	319-362-4116
MA	Brookline, Technlg. Prods.	617-731-0858
MI	Jackson, Norwood Scroggs Co.	517-750-1170
NJ	Parlin, JMR Sls., Inc.	201-727-5335
NY	Cooperstown, Fitzelle Assoc.	607-547-9333
NY	East Setauket, JMR Sls., Inc.	516-689-8871
NY	Rochester, Lloyd Hart Assoc.	716-225-4455
TX	Dallas, Stasco	214-239-4517
WI	Milwaukee, Coombs Assoc.	414-351-6123

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
IL	Wheeling, Hawk Elctrns.	312-459-4030
NY	Mt. Vernon, Kintronics	914-668-9885

MECHANICAL PRODUCTS, Amstar, 1824 Kiver St., P.O. Box 729, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Bob Vangermeersch

MECHANICAL TECHN., 968 Albany Shaker Rd., Latham, NY 12110, Tel: 518-785-2353, TWX: 710-443-8150; Empl.: 1000; *Sls. Mgr.:* David W. Bender; *Dist. Mgr.:* David W. Bender

MECHANIZED ELECTRONIC ASSEMBLY DIV., Universal Instrs. Corp., P.O. Box 825, Binghamton, NY 13902, Tel: 607-772-7522, TWX: 510-252-1990; *Sls. Mgr.:* Gene Exley ....**3**•1926

Local Sales Offices & Reps

MA	Marshfield, Universal Instrs. Corp.	617-834-6576
NY	Binghamton, Universal Instrs. Corp.	607-772-7472
PA	Hollidaysburg, Universal Instrs. Corp.	814-695-7324

MEDIA RECOVERY INC., Box 1407, Graham, TX 76046, Tel: 800-527-9497, 214-630-9625 (Texas), Telex: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

Local Sales Offices & Reps

CA	San Francisco, Media Recovery	415-572-0167
CA	Van Nuys, Media Recovery of Cal	213-782-8978
CT	Hartford, Media Recovery of N.J.	203-528-9776
GA	Atlanta, Media Recovery	404-441-1547
MA	Boston, Media Recovery Inc.	617-843-8400
MI	Livonia, Media Recovery	313-421-4244
TX	Dallas, Media Recovery of Tex	214-630-9625
TX	Houston, Media Recovery of Tex	713-681-5464
TX	San Antonio, Media Recovery of Texas	512-349-5854

MEGA LOGIC, 9659 Natl. Rd., Brookville, OH 45309, Tel: 513-833-5222

MEGATEK CORP., 9605 Scranton Rd., San Diego, CA 92121, Tel: 619-455-5590, TWX: 910-335-2056; Empl.: 500; *Sls. Mgr.:* Robert A. Becker, Dir., North Amer. Sls.; *Dist. Mgr.:* Michel Schwab, Dir., International Sls.

MEGATEST, 880 Fox La., San Jose, CA 95131, Tel: 408-998-7110, TWX: 910-338-0259; Empl.: 225; *Sls. Mgr.:* Rick Carmichael

MEGATRAN ELECTRONIC POWER, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300; TWX: 510-685-3645; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

MEISSNER INDS., 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10 ....**1A**•1889

melcor

MELCOR/MATERIALS ELCTRN. PRODS., 994 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178, Telex: 84-3314; FSC No.: 32333; Empl.: 100; *Sls. Mgr.:* M.A. Levine ....**2**•1828, 1829

MELCO SLS., See Mitsubishi Elctrns.

MELLES GRIOT, 1770 Kettering St., Irvine, CA 92714, Tel: 714-556-8200, Telex: 678-447; Empl.: 90; *Sls. Mgr.:* Richard P. Gluch

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEL TEC, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090, Tel: 617-329-1508, Telex: 95-1110, TWX: 710-348-0484; Empl.: 180

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
AZ	Scottsdale, Carl Carlburg Assocs.	
FL	Orlando, Currie, Peak & Frazier	305-855-0843
GA	Duluth, Currie, Peak & Frazier	404-476-3107
KS	Wichita, Kebco	316-733-1301
MD	Towson, Arbotek	301-825-0775
MI	Troy, C. B. Jensen	313-643-0506
MO	Maryland Heights, Kebco	314-576-4111
NM	Alburquerque, C. T. Carlburg & Assocs.	505-888-3883
NY	Melville, Long Island, Comtronic	516-249-0505
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
WI	Greenfield, Olympic	414-281-9294

MEMODYNE, 220 Reservoir St., Needham Hgts., MA 02194, Tel: 617-444-7000, Telex: 92-2537; Empl.: 40; *Sls. Mgr.:* N.H. Renaud ....**3**•1087

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assoc.	205-882-0827
AZ	Tempe, Mar Tech Assocs., Inc.	602-968-4944
CA	Fullerton, Elctrn. Comp. Mktg.	714-879-9460
CA	Santa Clara, Nelson Elctrns. Sls.	408-980-1950
CO	Englewood, F. G. Mktg. Co.	303-795-9176
CT	Hamden, Burton Forrester Associates	203-248-4380
GA	Atlanta, Magaro & Assoc.	404-451-8862
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Elmhurst, Scott Assocs.	312-279-5681
KS	DeSoto, Midtec Assocs.	910-743-6565
MA	Braintree, Burton Forrester Assocs.	617-848-7234
MI	Detroit, EQS Sys.	313-961-3042
MO	Florissant, Midtec Assocs.	313-837-5200
NM	Albuquerque, Mar Tech Assocs., Inc.	505-821-2775
NY	Clark Mills, KLM Assocs.	315-853-6126
NY	Elmont, Crane & Egert Corp.	516-872-0800
NY	North Syracuse, KLM Assocs.	315-458-6214
NY	Pittsford, KLM Assocs.	716-381-8350
NC	Greensboro, Magaro & Assocs.	919-294-4783
OH	Chesterland, EQS Sys.	216-729-2222
OH	Columbus, EQS Sys.	614-228-3453
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Ambler, Denco Data Equip. Corp.	215-542-9876
PA	Pittsburgh, EQS Sys.	412-261-2604
TX	Houston, Acudata	713-488-8195
TX	Plano, Acudata	214-424-3567
UT	Englewood, F. G. Mktg. Co.	303-795-9176
WA	Bellevue, Topp Engrg. Sls.	206-747-5400

MEMOREX CORP., San Thomas at Central Expwy., Santa Clara, CA 95052, Tel: 408-987-1000; Empl.: 12,284

Memory Protection Devices inc.

MEMORY PROTECTION DEVICES INC., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-454-0340; *Sls. Mgr.:* Lou Asighieri; *Dist. Mgr.:* Sandy Silvani ....**2**•1519

Local Sales Offices & Reps

AL	Huntsville, REP Inc.	205-881-9270
AZ	Phoenix, Stitzer & Dodd	602-944-2237
CA	Pleasonton, Moulthrop Sls.	415-846-0550
CA	San Diego, Tauber Assoc.	619-274-7242
CO	Denver, Comp. Sls. Inc.	303-759-1666
FL	Melbourne, Reynolds	305-259-7000
GA	Tucker, Rep Inc.	404-938-4358
IL	Chicago, Brock & Cushman	312-622-4110
IN	Indianapolis, Marketing Engr.	317-872-5665
KS	Olathe, Rush & West	913-764-2700
MA	Burlington, Conti Younger	617-273-1582
MI	Birmingham, Favco	313-644-0173
MN	Minneapolis, Electro Mark	612-881-3306
MO	Ballwin, Rush West	314-394-7271
NJ	Mt. Laurel, Comtek	609-235-8505
NY	Pittsford, Andres Comp.	716-381-3818
NY	Westchester Great Neck, Cooper Simon	516-487-1142
NC	Raleigh, Rep Inc.	919-851-3007
OH	Cleveland, Del Steffen	216-461-8333
OR	Tigard, Electronic Sources	503-684-0040
PA	Pittsburgh, Del Steffen	412-276-7366
TN	Jefferson City, Rep. Inc.	716-475-4105
TX	Dallas, Dunbar	214-239-7151
UT	Salt Lake City, Comp. Sls.	801-466-8623
WA	Bellevue, Elctrn. Sources	206-451-3500
WI	Menomonee Falls, Brock Cushman	414-255-2166

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-881-9270
CA	Burlingame, Rose Elect	415-348-0483
CA	San Diego, Fauber Elect	619-272-7242
CA	San Jose, Cypress Elect	408-945-8400
CA	Van Nuys, Nesco	213-781-0505
CO	Denver, Denver/Wentronics	303-934-2406
FL	Dania, Summit Distr	305-920-6253
FL	Longwood, Intertec	305-834-7777
IL	Chicago, Prehler Elec	312-384-6100
IN	Indianapolis, Graham Elec	317-634-8202
MA	Canton, Impact Sales	617-821-1500
MA	Sharon, Adcour	617-784-9123
MI	Brighton, A. P. Sales	313-229-6550
MI	Farmington Hills, Prehler Elec	313-476-7084
MN	Burnsville, Power Group	612-890-1360
MN	Thief River Falls, Digi Key	218-681-6674
NJ	Bellmawr, Mid-Atlantic	609-931-5303
NJ	Plainfield, Mars Elec	201-757-4332
NY	Buffalo, Summit Dist	716-887-2800
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Columbus, Hughes Peters	614-294-5351
OR	Beaverton, Almac	503-641-9070
PA	Allentown, Lehigh Elec	215-433-3045
TX	Dallas, Computer Comps.	214-239-0271
WA	Bellevue, Almac Elec	206-643-9997

Mepco//Electra
A NORTH AMERICAN PHILIPS COMPANY

MEPCO/ELECTRA, INC., North American Philips Corp., Corporate Headquarters, Columbia Rd., Morristown, NJ 07960, Tel: 201-539-2000, TWX: 710-986-7437; *Sls. Mgr.:* Michael F. Kirkowski; *Dist. Mgr.:* Robert G. Elko

MEPCO/ELECTRA, INC., North American Philips Corp., 11468 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-453-0332, TWX: 910-337-1120 .... **1A**•2046; **1B**•1012

Potentiometers (Cermet, Carbon) Industrial & Military

MEPCO/ELECTRA, INC., North American Philips Corp., 5900 Australian Ave., West Palm Beach, FL 33407, Tel: 305-842-3201, TWX: 510-952-7618 .... **1A**•1134; **1B**•1013

Tantalum Capacitors (Solid, Wet Slug, Chip) Military & Industrial

MEPCO/ELECTRA, INC., North American Philips Corp., Columbia Rd., Morristown, NJ 07960, Tel: 201-539-2000, TWX: 710-986-4737 .... **1A**•1136, 1890, 1891; **1B**•1012

Metal Film Resistors (Established Reliability-Hermetic) Thick Film Chips, Thick Film Networks, Non-Linear Resistors, Film Trimmer Capacitors

MEPCO/ELECTRA, INC., North American Philips Corp., 6071 St. Andrews Rd., Columbia, SC 29210, Tel: 803-772-2500, TWX: 810-666-2662 .... **1A**•1134-1136; **1B**•1013

DC Aluminum Electrolytic Capacitors (Computer Grade, Axial, Radial) Military, Industrial & Consumer, AC Motor Starts, Film Capacitors (Film/Foil, Metallized), Tantalum Capacitors (Foil)

MEPCO/ELECTRA, INC., North American Philips Corp., Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, TWX: 910-890-5855 .... **1A**•1891; **1B**•1012

Metal Film Resistors (General Purpose, Standard Precision, Ultra Precision, Standard Military, Established Reliability) Carbon Film Resistors, Precision Matched Sets

Local Sales Offices & Reps

AL	Huntsville, Macro-Mktg. Assoc.	205-883-9630
AZ	Tempe, Mepco/Electra	602-968-9573
CA	Harbor City, Refrigeration Comp.	213-325-3420
CA	Milpitas, Mepco/Electra	408-945-1020
CA	N. Hollywood, Mepco/Electra	818-982-7470
CA	San Diego, The Rep Co.	619-292-9001
CA	Santa Clara, I-Squared	408-988-3400
CO	Englewood, Thorson Rocky Mountain	303-779-0666
FL	Fern Park, Mepco/Electra	305-339-5073
FL	Ft. Lauderdale, Mepco/Electra	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Bannockburn, Heth	312-295-8440
IL	Elk Grove Village, Oasis Sls.	312-640-1850
IL	Itasca, Mepco/Electra	312-773-3399
IN	Fort Wayne, Corrao Marsh, Inc.	219-637-5548
IN	Greenfield, Corrao Marsh, Inc.	317-894-0377
IN	Indianapolis, Corrao Marsh, Inc.	317-872-7157
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Leawood, H. C. Heyde	913-649-8628
KS	Overland Park, PMR Corp.	913-381-0004
KS	Wichita, PMR Corp.	316-684-4141
MD	Columbia, Delta III Assoc.	301-730-4700
MA	Woburn, Mepco/Electra	617-935-6920
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MN	Burnsville, Heth, Inc.	612-435-7876
MN	Edina, Mepco/Electra	612-835-5935
MN	Minneapolis, Comprehensive Technical Sls.	612-888-7011
MO	Maryland Heights, PMR Corp.	314-569-1220
NE	Lincoln, Lorenz Sls.	402-475-4660
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200
NJ	Marlton, B.G.R. Assocs.	609-983-1020
NJ	Morristown, Mepco/Electra	201-539-2000
NJ	Springfield, Gebhardt Mktg.	201-376-4415
NY	Rochester, Electra Sls. Corp.	716-461-5252
NY	Syracuse, Electra Sls. Corp.	315-463-1248
NC	Charlotte, Over & Over, Inc.	704-527-3070
NC	Raleigh, Over & Over	919-872-2262
OH	Dayton, Mepco/Electra	513-278-5842
OR	Beaverton, Mepco/Electra	503-643-5516
PA	Greensburg, Pro Mark	412-832-3800
TX	Richardson, Mepco/Electra	214-231-8274
UT	West Valley City, Thorson Rocky Mountain	801-973-7969
VA	Richmond, Mepco/Electra	804-359-1416
WA	Bellevue, Mepco/Electra	206-643-4555
WI	Wauwatosa, Larsen Assoc.	414-258-0529

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
AZ	Tempe, Shelley Elctrns., Inc.	602-894-2058
AZ	Tempe, Hamilton/Avnet	602-231-5100
AZ	Tempe, T.T.I.-AZ	602-966-1616
CA	Chatsworth, Shelley Elctrns., Inc.	213-998-3333
CA	Compton, Harper, S.I.D.	213-979-5090
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4100
CA	Costa Mesa, Avnet Elctrns.	714-754-6077
CA	Culver City, Hamilton Electro Sls.	213-558-2131
CA	Culver City, Hamilton/Avnet	213-558-2020
CA	Garden Grove, Hi-Rel Distrs.	714-898-9858
CA	Los Angeles, Western Electromotive	213-820-3777
CA	Mountain View, Shelley Elctrns., Inc.	415-969-1820
CA	N. Hollywood, T.T.I. West	213-982-0201
CA	Sacramento, Hamilton/Avnet	916-920-3120
CA	San Diego, Hamilton/Avnet	619-571-7500
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Jose, TTI, Inc.	408-943-9155
CA	San Jose, Ratel Elctrns.	408-946-4300
CA	San Jose, Eric Elctrns.	408-262-1111
CA	Santa Clara, Western Electromotive	408-727-7411
CA	Sun Valley, Q.C. Comps.	213-768-6111
CA	Sunnyvale, Hamilton/Avnet	408-743-3355
CA	Woodland Hills, Avnet Elctrns.	818-700-8668
CO	Boulder, Shelley Elctrns., Inc.	303-442-2718
CO	Denver, Ragon Elctrns.	303-774-0527
CO	Englewood, Hamilton/Avnet	303-740-1000
CT	Danbury, Hamilton/Avnet	203-797-2800
CT	New Haven, Greene Shaw Co.	203-397-0710
FL	Ft. Lauderdale, Dielco	305-973-8700
FL	Ft. Lauderdale, Hamilton/Avnet	305-971-2900
FL	Orlando, T.T.I. II	305-859-1000
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	St. Petersburg, Hamilton/Avnet	813-576-3930
FL	Tampa, Impala Elctrns.	813-885-4747
GA	Norcross, Hamilton/Avnet	404-447-7507
IL	Bensenville, Hamilton/Avnet	312-860-7700
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Nep Elctrns.	312-625-8400
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Carmel, Altex Elctrns., Inc.	317-848-1323
IN	Carmel, Hamilton/Avnet	317-844-9603
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Overland Park, Hamilton/Avnet	913-888-8900
MD	Baltimore, Resco/Baltimore	301-823-0070
MD	Beltsville, Resco/Washington	301-937-9100
MD	Columbia, Hamilton/Avnet	301-995-3500
MD	Columbia, Aztech Elctrns.	301-995-1760
MA	Burlington, TLC Elctrns.	617-273-0140
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Woburn, Hamilton/Avnet	617-273-7500
MA	Woburn, T.T.I.	617-938-8800
MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Livonia, Hamilton/Avnet	313-522-4700
MI	Livonia, RepTron Elctrns.	313-525-2700
MN	Minneapolis, Merit Elctrns.	612-546-5383
MN	Minneapolis, Merit Elctrns.	612-546-5383
MN	Minnetonka, Hamilton/Avnet	612-932-0600
MN	St. Paul, Ragon Elctrns.	612-642-2828
MO	Earth City, Hamilton/Avnet	314-344-1200
MO	Independence, Ragon Elctrns.	816-254-3410
NJ	Cherry Hill, Hamilton/Avnet	609-424-0100
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Fairfield, Hamilton/Avnet	201-575-3390
NM	Albuquerque, Hamilton/Avnet	505-765-1500
NY	Bohemia, T.T.I. Inc.	516-567-1500
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Central Islip, Semi-Cap Elctrns.	516-582-4400
NY	East Syracuse, Hamilton/Avnet	315-347-2641
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Hempstead, Kahgan Comps.	516-538-2300
NY	Melville, Hamilton/Avnet	516-454-6060
NY	Rochester, Summit Distrs.	716-334-8110
NY	Rochester, Hamilton/Avnet	716-475-9130
NY	Rome, Rome Elctrns.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Hamilton/Avnet	919-829-8030
OH	Cleveland, Hamilton/Avnet	216-831-3500
OH	Columbus, RepTron Elctrns.	614-436-6675
OH	Dayton, Hamilton/Avnet	513-433-0610
OH	Englewood. Argent Electra	513-836-8633
OH	Fairborn, Aschbacher & Assocs.	513-252-7785
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Almac Elctrns.	503-641-9076
OR	Lake Oswego, Hamilton/Avnet	503-635-8157
PA	McKean, Advacom, Inc.	814-476-7774
PA	Norristown, Century Elctrn. Corp.	215-631-5400
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Austin, Altair Co.	512-837-4470
TX	Austin, Hamilton/Avnet	512-837-8911
TX	Dallas, Computer Comp.	214-239-0271
TX	El Paso, Era Elctrns.	915-592-4126
TX	Ft. Worth, T.T.I. Inc.	817-429-1440
TX	Houston, Altair Co.	713-462-3029
TX	Houston, Hamilton/Avnet	713-780-1771
TX	Irving, Hamilton/Avnet	214-659-4111
TX	Richardson, Jaco Elctrns.	214-235-9575
TX	Richardson, Altair Co.	214-231-5166
UT	Salt Lake City, Hamilton/Avnet	801-972-2800
VA	Arlington, Arlington Elctrns.	703-521-2412
VA	Charlottesville, Virginia Radio Supp. Co.	804-296-4184
WA	Bellevue, Almac Elctrns. Corp.	206-643-9992
WA	Bellevue, Hamilton/Avnet	206-643-3950
WA	Kent, Shannon Ltd.	206-763-0545
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, NEP Elctrns., Inc.	414-785-9100
WI	New Berlin, R.M. Elctrns.	414-784-4420
WI	New Berlin, Hamilton/Avnet	414-784-4510

MERCURY PLASTICS, A UNIT OF ZERO CORP., 672 Fuller Rd., Chicopee, MA 01020, Tel: 413-592-5118, 413-267-5561, TWX: 710-354-1450; Empl.: 100; *Sls. Mgr.:* Douglas W. Griffith; *Dist. Mgr.:* Douglas W. Griffith

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St., West Warwick, RI 02893, Tel: 401-828-4550; Empl.: 100; *Sls. Mgr.:* John E. Powell, Jr.

MERET, INC., 1815 24th St., Santa Monica, CA 90404-4998, Tel: 213-828-7496, Telex: 371-9305; Empl.: 23; *Sls. Mgr.:* David Medved .... **1B**•1116

Local Sales Offices & Reps

CA	Carmichael, Acquironics	916-487-9070
CA	West Covina, Eureka Tech. Sls.	213-331-8766
CO	Wheatridge, C-Tech	303-431-7025
FL	Melbourne, Star-Tec	305-727-2247
GA	Snellville, Oliver Engrg. Svcs.	404-972-2249
IL	Des Plaines, Synmark Sls. Co.	312-296-0180
MA	Brookline, Boston Elctrn. Corp.	617-566-3821
TX	Seabrook, Q-Max Mktg.	713-474-2233

MERIX CHEM. CO., 2234 East 75th St., Chicago, IL 60649, Tel: 312-221-8242; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437, Tel: 215-643-2116; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* Skip Hartman

MERRIMAC INDS., 41 Fairfield Pl., West Caldwell, NJ 07006, Tel: 201-575-1300, Telex: 6853128, TWX: 710-734-4314; FSC No.: 12457; Empl.: 225; *Sls. Mgr.:* Gary Tahlmore; *Dist. Mgr.:* T.V.R.O. Prods. Only - Laurie Festa

Local Distributors

AL	Birmingham, Long's Electrns.	205-956-9341
AR	Beebe, Odom Antenna	501-882-6485
AR	Littlerock, Intl. Video Comms.	501-771-2800
CO	Englewood, Echosphere Corp.	303-935-1909
KS	Oakley, Precision Satellite	913-672-3247
NC	Oxford, Channel Master	919-693-3141
OR	Bend, Wespercom Corp.	503-389-0996
PA	Bensalem, Eastern Instr.	215-245-6660

MERRIMACK MAGNETICS CORP., 121 Hale St., Lowell, MA 01851, Tel: 617-458-1487; Empl.: 450; *Sls. Mgr.:* L. J. Woods; *Dist. Mgr.:* R. O. Ross

MESUR-MATIC ELCTRNS., 50 Grove St., Salem, MA 01970-2294, Tel: 617-745-7000; Empl.: 29; *Sls. Mgr.:* Kosma L. Evangelidis

Local Sales Offices & Reps

AZ	Phoenix, Richard A. Mayes Co.	602-279-5243
CA	Claremont, Gandalf Elctrns.	714-626-5481
CO	Denver, Richard A. Mayes Co.	303-761-9447
IL	Maywood, KGA Engrg. Co.	312-343-6500
KS	Wichita, Electro Mechanical Assocs.	316-682-9433
MD	Glen Burnie, Macrotech Assocs.	301-437-5588
MO	Bridgeton, Electro Mechanical Assocs.	314-291-8661
NM	Albuquerque, Richard A. Mayes Co.	505-292-2330
NY	Latham, L-Tron Corp.	518-785-5032
PA	Glenside, Wyncote Instr.	215-572-6500

METAVAC, INC., 45-68 162nd St., Flushing, NY 11358, Tel: 212-HI5-0400; Empl.: 52; *Sls. Mgr.:* Clifford E. Sisler

METEREX CORP., 25 Industrial Park Rd., Hingham, MA 02043, Tel: 617-749-8100; Empl.: 5; *Sls. Mgr.:* K. Sharples

Distributor

METERMASTER, 5645 Jullson St., Los Angeles, CA 90040, Tel: 213-685-4340 ....pgs. 611, 675, 678, 715, 736, 769, 792

METHODE ELCTRNS., INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-9600, TWX: 910-221-2468; Empl.: 900; *Sls. Mgr.:* John Klimek; *Dist. Mgr.:* K. Lindsey

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 312-392-3500, TWX: 910-687-0760; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* L. W. Ekstrom; *Dist. Mgr.:* L. W. Ekstrom

METHODS RESEARCH, 54D Asbury Ave., Farmingdale, NJ 07727, Tel: 201-938-6000; *Sls. Mgr.:* J. James Mandy

METIER MANAGEMENT SYS., INC., 10175 Harwin Dr., Ste. 100, Houston, TX 77449, Tel: 713-988-9100, Telex: 774367 (Metier Hou); *Sls. Mgr.:* Don Gammon

METIS, P.O. Box 1499, Bowie, MD 20716, Tel: 301-249-1702; Empl.: 2; *Sls. Mgr.:* Eric K. Pritchard

METRA INSTRS., 2056 Bering Dr., San Jose, CA 95131, Tel: 408-297-8530; Empl.: 16; *Sls. Mgr.:* Gary Heil

Local Sales Offices & Reps

AL	Birmingham, Regal Controls	205-991-6340
CA	Anaheim, R. D. Brunnemer & Assocs., Inc.	714-525-1644
CO	Wheatridge, Emcar Mktg., Inc.	303-424-0108
FL	Jacksonville, W. K. Hile Co., Inc.	904-731-5595
GA	Marietta, W. K. Hile Co., Inc.	404-424-8372
IL	Chicago, Synergy Sys., Inc.	312-2021
MI	Detroit, Automatic Controls Co.	313-533-8890
MO	Penton, Hi-Tech Elec. Inc.	314-343-6060
NH	Portsmouth, The Valve Co.	603-431-5251
NY	Buffalo, Robert F. Lamb Co., Inc.	716-874-4900
NY	Rochester, Robert F. Lamb Co., Inc.	716-323-1250
NC	Matthews, W. K. Hile Co., Inc.	704-847-9125
OH	Cincinnati, Automatic Controls Co.	513-522-1118
OH	Cleveland, Automatic Controls Co.	216-631-0333
PA	Jenkintown, PCD Corp.	215-887-9610
TX	Houston, Abcor	713-486-9251

METRAPLEX CORP., Berkshire Indl. Park, Bethel, CT 06801, Tel: 203-748-0606, TWX: 710-456-3959; *Sls. Mgr.:* Charles B. Weaver

METRIC SYS., 645 Anchors St., Ft. Walton Beach, FL 32548, Tel: 904-244-9600, Telex: 70-2447; FSC No.: 12339; Empl.: 437

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, Telex: 77-5486; Empl.: 50; *Sls. Mgr.:* A. J. Bahry

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477; Empl.: 12; *Sls. Mgr.:* P. S. Kempf

METROPOLE PRODUCTS INC., P.O. Box 10275, Alexandria, VA 22310, Tel: 703-971-8606, 703-971-7082, Telex: 908041 BAL; FSC No.: 55908; *Sls. Mgr.:* John DePaola

METROSONICS, Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, Telex: 978330; Empl.: 80; *Sls. Mgr.:* W. Whitford; *Dist. Mgr.:* W. Whitford

METUCHEN CAPACITORS, INC., 420 Park Ave., Perth Amboy, NJ 08861, Tel: 201-442-0500, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ....**1A**•1138-1146, 1602, 1603; **2**•1524-1527

MEYERCORD, 365 E. North Ave., Carol Stream, IL 60187, Tel: 312-682-6200, Telex: 72-2449; Empl.: 500; *Sls. Mgr.:* J. O'Briskie

MFE CORP., Instr. Div., Keewaydin Dr., Bldg. #1, Salem, NH 03079, Tel: 603-893-1921, Telex: 94-7477, TWX: 710-366-1887; *Sls. Mgr.:* Peter Schwartz; *Dist. Mgr.:* Jim Muckenhoupt

MF ELCTRNS. CORP., 10 Renewal Pl., New Rochelle, NY 10801, Tel: 914-576-6570, TWX: 710-563-0643; FSC No.: 08111; Empl.: 65; *Sls. Mgr.:* Bill Braverman; *Dist. Mgr.:* Bill Braverman ....**1A**•1384-1386

Local Sales Offices & Reps

AL	Huntsville, E.M.A.	205-837-7363
CA	Irvine, J. V. Earley & Assocs.	714-833-1806
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Littleton, Quatra Inc.	303-795-3187
CT	Meriden, Orion Group	203-621-8371
FL	Hollywood, APM Assocs.	305-987-6720
FL	Longwood, APM Assocs.	305-869-6831
FL	Tampa, AMP Assocs.	813-886-2457
GA	Norcross, E.M.A.	404-448-1215
IL	Addison, Banner Tech. Sls.	312-279-6070
MI	Brighton, A.P.J. Assocs.	313-229-6550
MN	Minneapolis, Peterson Sls. & Assoc.	612-884-3483
NJ	Perth Amboy, Astro Rep.	201-826-8050
NY	Rochester, Sweetco Assocs.	716-225-2383
NY	Utica, Sweetco Assocs.	315-733-6721
NY	W. Babylon, Astro Rep.	516-422-2500
NC	Greenville, E.M.A.	803-233-4637
NC	Winston-Salem, E.M.A.	919-722-5151
OH	Dayton, APJ Assoc.	216-356-2424
OR	Portland, Controltek Sls.	503-641-0877
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Austin, Matthews & Assocs.	512-479-0028
TX	Dallas, Matthews & Assocs.	214-931-0167
WA	Bellevue, Controltek Sls.	206-451-8163
WI	Mukwonago, Banner Tech. Sls.	414-363-5086

Local Distributors

CA	Sunnyvale, Pacesetter	408-734-5470

MG ELECTRONICS

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400, Telex: 645113; Empl.: 14; *Sls. Mgr.:* Mel Karasik; *Dist. Mgr.:* Stan Grey ....**3**•1037

M.I.A.L., See TRW/Capacitor Div.

MICA CORPORATION, 8536 National Blvd., Culver City, CA 90230, Tel: 213-837-8100, Telex: WU 664336, ITT 4720769; FSC No.: 06216; Empl.: 300

Local Sales Offices & Reps

AZ	Glendale, Method Engrg.	602-846-7901
CA	Sunnyvale, The Mica Corp.	408-738-1020
FL	Sarasota, James N. Lordi	813-365-2992
MA	Pinehurst, Mica	617-272-1558
MN	Hopkins, Mica	612-933-3811
NC	Greensboro, DMI	919-885-4634
TX	Dallas, Stevens Sls.	214-350-2476

MICAP ELCTRNS., INC., 592 Oak St., Copiague, NY 11726, Tel: 516-842-8866; FSC No.: 61544; Empl.: 6; *Sls. Mgr.:* Bernard Lefenfeld

MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590; Empl.: 95; *Sls. Mgr.:* B. L. Killinger ....**3**•1038, 1039

Local Sales Offices & Reps

CT	Kensington, N. Stachelek Co.	203-828-4587
MN	Minneapolis, Countryman Assoc.	612-645-9151
WA	Bellevue, Panoco	206-454-2503

MICOM SYSTEMS, INC., 20151 Nordhoff Street, Chatsworth, CA 91311, Tel: 818-998-8844, Telex: 687-497, TWX: 910-494-4910; *Sls. Mgr.:* Mark Vonarx; *Dist. Mgr.:* Mark Vonarx

MICREL, INC., 1235 Midas Way, Sunnyvale, CA 94086, Tel: 408-245-2500, TWX: 910-379-0007; Empl.: 120

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904; Empl.: 15; *Sls. Mgr.:* B. H. Corzine ....**2**•1781

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co.	602-954-0301
TX	Houston, RCG Entprs.	713-955-7200

MICROBAR SYS., INC., 1121 San Antonio Rd., Palo Alto, CA 94303, Tel: 415-964-2862, TWX: 910-373-2047; *Sls. Mgr.:* Rich Boberg

MICROBOND DIV., PO Box 689, Altamonte Springs, FL 32701, Tel: 305-339-8298, Telex: 56-4303; *Sls. Mgr.:* William S. Hodges

MICROCAP, 11120 Roselle St., San Diego, CA 92121, Tel: 619-452-9812, Telex: 695073, TWX: 910-335-1607; *Sls. Mgr.:* Debbie Toscano ....**1A**•1186-1188

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-CIRCUITS CO., INC., Route 1 - Box 518, New Buffalo, MI 49117, Tel: 616-469-2727

MICRO COMPONENT TECHNLG., INC., P.O. Box 64013, St. Paul, MN 55164, Tel: 612-482-5100, Telex: 297422; Empl.: 500; *Sls. Mgr.:* James Gibson

MICROCOMPUTER POWER, 2272 Calle de Luna, Santa Clara, CA 95050, Tel: 408-988-0265, TWX: 910-338-7694; Empl.: 60; *Sls. Mgr.:* Jim Armstrong; *Dist. Mgr.:* Jim Armstrong

MICRO COMPUTER RENTALS, 742D Hampshire Rd., Westlake Village, CA 91361, Tel: 213-991-1704

MICRODATA CORP., 17481 Red Hill Ave., Irvine, CA 92705, Tel: 714-540-6730, TWX: 910-595-1764; Empl.: 375

MICRO DEVICES PRODUCT GROUP, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, Tel: 419-756-5005, Telex: 987455; *Sls. Mgr.:* J. A. Kight ....**1B**•1823

MICRO DIGITAL ASSOCS., INC., 12791 Western Ave., Unit C, Garden Grove, CA 92641, Tel: 714-891-2363; *Sls. Mgr.:* Ralph Moore; *Dist. Mgr.:* Ralph Moore

MICRODRY CORP., Golden Grain Macaroni Co., 3111 Fostoria Way, San Ramon, CA 94583, Tel: 415-837-9106, Telex: 33-5320; Empl.: 40; *Sls. Mgr.:* Al Katskee

MICRO ELECTRONIC SYS., INC., 87 Sand Pit Road, Danbury, CT 06810, Tel: 203-797-1441, 800-243-7254, Telex: 969659

MICROFLECT, 3575 25th S.E., Salem, OR 97302-0985, Tel: 503-363-9267, TWX: 510-599-0107; Empl.: 98; *Sls. Mgr.:* John J. Kranitz

MICRO INSTR., 2250 Micro Pl., Escondido, CA 92025, Tel: 619-746-2010, Telex: 882205 MICROINST ESCD; FSC No.: FSCM 24836; Empl.: 45; *Sls. Mgr.:* C. Marks

Local Sales Offices & Reps

CO	Conifer, Energy Equip. Sls.	303-674-8111
FL	Clearwater, Teqspec Inc.	813-725-2201
GA	Atlanta, Teqspec II	404-455-7222
MA	Natick, Wayland Engr. Sls.	617-655-6080
MO	Platte City, Stantec Sales	816-464-2211
NJ	Englewood Cliffs, Power Conversion & Conts.	201-569-0015
NC	Winston Salem, Teqspec III	919-723-8102
TX	Allen, Harris Tech. Sls.	214-727-2182

MICROLAB/FXR, 10 Microlab Rd., Livingston, NJ 07039, Tel: 201-992-7700, TWX: 710-994-4850; FSC No.: 00929; Empl.: 80

MICRO LAMPS, INC., 1N111 Linlar Rd., La Fox, IL 60147, Tel: 312-232-6001; *Sls. Mgr.:* R. Marimatsu

MICRO LOGIC CORP., P.O. Box 174, 100 2nd St., Hackensack, NJ 07602, Tel: 201-342-6518

MICROLOGIC, INC., 123 Water St., Watertown, MA 02172, Tel: 617-923-1700; *Sls. Mgr.:* Erick Kapust

MICROMETALS, 1190 N. Hawk, Anaheim, CA 92807, Tel: 714-630-7420, TWX: 910-591-1690; FSC No.: 12856; Empl.: 40; *Sls. Mgr.:* K. Baker, Jr.

Local Sales Offices & Reps

MA	Newton Upper Falls, Anchor Engrg.	617-964-6416
NY	Hempstead, Kahgan Sls.	516-538-2300
TX	Dallas, Southwest Elctrns.	214-690-9881

MICRO MODE PRODS., 1870 John Towers Ave., El Cajon, CA 92020, Tel: 619-449-3844, TWX: 910-331-1673; FSC No.: 15907; Empl.: 40; *Sls. Mgr.:* L. Moore; *Dist. Mgr.:* L. Moore

MICRO MO ELECTRONICS, INC., 742 2nd Ave. S., St. Petersburg, FL 33701, Tel: 813-822-2529, Telex: 807-982; Empl.: 25; *Sls. Mgr.:* Christine Contos .... **1B**•1164, 1165, 1849; **3**•1135

MICRO-MOUNTING DEVICES, 4092 Keith Dr., Campbell, CA 95008, Tel: 408-866-4626; FSC No.: 59058

micronel®

MICRONEL U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083, Tel: 619-727-7400; Empl.: 20; *Sls. Mgr.:* S. William Linko ... **2**•1830-1838

Local Sales Offices & Reps

MA	Lexington, Micronel U.S.-E.	617-862-1202

MICRONETICS, 36 Oak St., Norwood, NJ 07648, Tel: 201-767-1320, TWX: 710-991-9603; FSC No.: 54487; Empl.: 26; *Sls. Mgr.:* Gary Simonyan

MICRO NETWORKS, 324 Clark St., Worcester, MA 01606, Tel: 617-852-5400, Telex: 951808, TWX: 710-340-0067; Empl.: 300

MICRON INDS., 1830 N. 32nd Ave., Stone Park, IL 60165, Tel: 312-345-0788, Telex: 27-0248; FSC No.: 30882; Empl.: 100; *Sls. Mgr.:* Dave Hayes

MICRO-NOW INSTR. CO., INC., 8260 N. Elmwood St.; P.O. Box 856, Skokie, IL 60077, Tel: 312-677-4700, Telex: RCA 297214-MICRO-UR; FSC No.: 33288; Empl.: 25; *Sls. Mgr.:* C. Arnow

Local Sales Offices & Reps

CA	Los Angeles, Mc Dougall/Mc Laughlin	213-477-8556
CA	Mountain View, Mark V Assoc.	415-964-6275
CO	Boulder, H. Bass Assocs.	303-499-7509
CT	North Haven, Pat Jenks Assoc.	203-239-6201
MA	Woburn, Pat Jenks Assoc.	617-938-0488
NM	Albuquerque, IMEC	505-344-2212
NY	Huntington Station, Metro-Mic	516-GE3-3333
PA	Melrose Park, Robert Meyers Assoc.	215-224-1663
TX	Dallas, Texas Avionics	214-368-3566
WA	Seattle, Datacom	206-285-2525

MICRO SWITCH
a Honeywell Division

Franchised
Stocking
Distributor

FAST ENGRAVING SERVICE

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

MICRO-OHM
CORPORATION
Manufacturers of
QUALITY RESISTORS

MICRO-OHM CORP., 4900 Santa Anita Ave., El Monte, CA 91731, Tel: 818-442-3310, 213-686-0535, TWX: 910; FSC No.: 20940; Empl.: 109; *Sls. Mgr.:* Chas. Schwab; *Dist. Mgr.:* Don Ritchey .... **1A**•1892-1895

Local Sales Offices & Reps

AZ	Scottsdale, Burke Hill & Assoc.	602-945-9116
CA	Laguna Hills, Cravins Assoc.	714-855-4327
CA	Northridge, Myco Sls.	213-886-7101
CA	Rancho Cordova, Alpha Omega Grp.	916-638-0480
CA	San Diego, Cerco	619-450-1754
CA	San Marino, Walls Assoc.	213-287-7276
CO	Denver, William Purdy Co.	303-777-1411
FL	DeBary, DJE Assoc.	305-668-6827
IL	Woodridge, Trend-Tronics	312-985-0626
MA	Canton, N E E S Co.	617-828-4835
NM	Albuquerque, Wm. J. Purdy Co.	505-266-7959
OH	Cleveland, Jim Finnigan & Co.	216-238-5905
OR	Beaverton, Wm. J. Purdy Co.	503-641-9373
UT	Salt Lake City, Wm. J. Purdy Co.	801-486-8557

Local Distributors

CA	Anaheim, A to Z Elctrns.	714-634-3620
CA	Burbank, TAW Elctrns.	213-846-3911
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	Canoga Park, Myco-Vickers	213-340-2025
CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Industry, Ital Elctrn. Sls.	213-968-8515
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	Santa Ana, Compuserv	714-546-5140
IL	Des Plaines, Circuit Svc.	312-296-4412
MN	Minneapolis, Electronic Ctr.	612-371-5200
NE	Omaha, Radio Equip. Co.	402-341-7700
NH	Hampstead, Astrum Elctrns.	603-329-5656
NY	New Rochelle, Derf Elctrns.	914-235-4600
NY	Oceanside, Tritech	516-678-6222
OH	Toledo, J R Inds.	419-865-1408
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Industrial Elect.	817-731-7321
UT	Provo, Central Utah Elctrns. Supp.	801-373-7522
UT	Salt Lake City, Nytronics	800-242-7612
Intl	Japan, Tokyo, Yoshico Intl.	03-230-2641

MICROPAC INDS., 905 E. Walnut St., Garland, TX 75040, Tel: 214-272-3571, TWX: 910-860-5186; Empl.: 135; *Sls. Mgr.:* Dick Schlueter

MICROPAC INDS., INC., General Sensors Div., 905 E. Walnut St., Garland, TX 75040, Tel: 214-272-3571, TWX: 910-860-5186; Empl.: 120; *Sls. Mgr.:* Richard Schlueter

MICRO PERIPHERALS INC., 9754 Deering Ave., Chatsworth, CA 91311, Tel: 213-709-4202, TWX: 910-494-1213; Empl.: 400; *Sls. Mgr.:* Keith Murphy; *Dist. Mgr.:* Robert Lewis

MICROPHASE, 587 Connecticut Ave., Norwalk, CT 06856, Tel: 203-866-8000, TWX: 710-468-0003; Empl.: 180; *Sls. Mgr.:* F. S. Parin

MICRO PLASTICS INC., 20821 Dearborn St., Chatsworth, CA 91311

MICRO PLASTICS INC., Highway 178 N., Flippin, AR 72634, Tel: 501-453-2261, Telex: 783-036; FSC No.: 13764; *Sls. Mgr.:* James H. Beijen; *Dist. Mgr.:* James H. Beijen

MICROPLEX, inc.

MICROPLEX, INC., 1977 State College Blvd., Anaheim, CA 92806, Tel: 714-979-8833, 714-634-1535; Empl.: 30 .... **1A**•1897

MICRO POWER INTL., INC., 9420 Activity Rd., San Diego, CA 92126, Tel: 619-271-0831

MICRO POWER SYS. INC., 3100 Alfred St., Santa Clara, CA 95050, Tel: 408-727-5350, TWX: 910-338-0154; FSC No.: 54186; Empl.: 305; *Sls. Mgr.:* Don Cavallo; *Dist. Mgr.:* Reed Neddermeyer

MICRO-PRODUCTS ENGRG. CO., 230 Ridgewood Ave., Newark, NJ 07108, Tel: 201-824-8467; Empl.: 100; *Sls. Mgr.:* Gerald Muller

MICROSCIENCE, INC., 110A Jerusalem Rd., Cohasset, MA 02025, Tel: 617-383-1622, Telex: 750-480; *Sls. Mgr.:* Toni Z. Drybanski

MICRO SEMICONDUCTOR, 2830 S. Fairview St., Santa Ana, CA 92704, Tel: 714-979-8220, TWX: 910-595-1576; FSC No.: 14552; Empl.: 250; *Sls. Mgr.:* M. Gregson; *Dist. Mgr.:* M. Gregson

MICROSONICS INC., 60 Winter St., Weymouth, MA 02188, Tel: 617-337-4200, TWX: 710-388-6833; FSC No.: 11869; Empl.: 165; *Sls. Mgr.:* Frank Manning .... **1A**•1383

Local Sales Offices & Reps

CA	Los Altos, Kolm Mktg.	415-948-2635
CA	Los Angeles, D & G	213-641-7976
FL	Boca Raton, Lawrence Assocs.	305-368-7373
FL	Clearwater, Lawrence Assocs.	813-443-2698
FL	Melbourne, Lawrence Assocs.	305-724-8294
MD	Ellicott City, V.P.I.	301-461-2525
MA	Needham, O'Sullivan & Murphy	617-449-4141
MO	Kansas City, EIR	816-452-7030
MO	Leesburg, EIR	314-245-6860
NJ	Cherry Hill, Danco	609-424-5590
NY	Melville, Metro Mics	516-271-6677
TX	Houston, Lear Assocs.	713-777-5509
TX	Richardson, Lear Assocs.	214-231-5388
WA	Seattle, John Spaulding	206-282-9173

MICRO SWITCH
a Honeywell Division

MICRO SWITCH, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, Tel: 815-235-6600, Telex: 257499, TWX: 910-642-0922; Empl.: 3000; *Sls. Mgr.:* J. J. Tropsa; *Dist. Mgr.:* R. P. Genda .. **1B**•1679-1722, 1786, 1787, 1809, 1850-1852

Local Sales Offices & Reps

CA	Orange	714-558-7400
CA	San Jose	408-977-3008
CO	Englewood	303-779-6439
CT	Hartford	203-695-4011
GA	Atlanta	404-982-2565
IL	Bensenville	312-860-3968
IA	Bettendorf	319-359-3441
MA	Newton	617-969-0265
MI	Southfield	313-424-3569
MN	Minneapolis	612-830-3516
MO	St. Louis	314-576-2518
NJ	Westfield	201-233-9200
NY	Elmsford	914-592-3200
NY	Rochester	716-424-2700
NC	Charlotte	704-364-4770
OH	Brooklyn Heights	216-459-6075
OH	Dayton	513-237-4075
PA	Valley Forge	215-666-8340
TX	Dallas	214-688-7533
TX	Houston	713-780-6651
WA	Bellevue	206-453-7591
WI	Brookfield	414-784-6260

MICRO/SYS

MICRO/SYS, 1011 Grand Central Ave., Glendale, CA 91201-3010, Tel: 818-244-4600, TWX: 910-588-1988; *Sls. Mgr.:* Ian Evans

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg	205-536-5938
CA	Anaheim, M.S.C.	714-978-0721
CA	Santa Clara, Zytronix	408-730-1263
FL	Maitland, Lobo Mktg. Assocs.	395-628-8911
FL	New Port Richey, Lobo Mktg. Assocs.	813-848-8578
FL	Tamarac, Lobo Mktg. Assocs.	305-735-2210
GA	Stone Mountain, Dixie Tech. Mktg.	404-962-2530
IN	Ft. Wayne, Augnat	219-483-0259
MD	Baltimore, Rep-Tron	301-799-7490
MA	Chelmsford, Bomara Assocs.	617-452-2299

MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	Minneapolis, Prairie Assocs.	612-559-7550
NJ	Ho-Ho-Kus, Alto Assocs.	201-447-1770
NY	Fayetteville, Maty Andrews Mfrs. Rep.	315-637-5291
NY	Lindenhurst, Alto Assocs.	516-957-2772
NY	New Rochelle, Alto Assocs.	914-834-3771
NC	Winston Salem, Dixie Tech. Mktg.	919-833-4711
OH	Akron, Augnat	216-273-1211
PA	Glenside, Wyncote Instrmntn. Co.	215-572-6500
PA	Pittsburgh, Augnat	912-281-8983
TX	Dallas, Dyna Mktg.	214-243-7994
TX	Houston, Dyna Mktg.	713-460-0314
WI	Waukesha, Computer and Sys. Sls.	414-544-1141

MICROSYSTEMS DEV. CORP. INC., 1560 Teaneck Rd., Teaneck, NJ 07666, Tel: 201-837-0051, Telex: 13-6479 Att. 296; *Sls. Mgr.:* L. G. Mansoor

MICROTECH, 1420 Conchester Hwy., Boothwyn, PA 19061, Tel: 215-459-3566; Empl.: 22; *Sls. Mgr.:* H. Carter

MICROTECH EXPORTS, 467 Hamilton Ave., Ste. 2, Palo Alto, CA 94301, Tel: 415-324-9114, TWX: 910-370-7457 MUH-ALTOS; *Sls. Mgr.:* Patricia Martz

MTI MICRO-TECHNICAL INDUSTRIES

MICRO TECHNICAL INDS., Micro-Ohm Corp., 23666 Birtcher Dr., B, Lake Forest, CA 92630, Tel: 714-855-4326, TWX: 910-595-1745; *Sls. Mgr.:* Karen Hild .... **3**•1176, 1177

Advertisement

Micro Technical Industries manufactures affordable environmental testing instruments for the heat testing of any electronic component such as integrated circuits, diodes, transistors, etc. Write/call free brochures.

Local Sales Offices & Reps

AZ	Scottsdale, Burke Hill & Assocs.	602-945-9116
CA	San Marino, Walls & Assocs.	213-287-7276
MA	Cohasset, Resch. Ultd.	617-482-5959
OR	Portland, Controltek Sls. Ltd.	503-641-0877
PA	Jenkintown, Arnold Assocs.	215-887-7870
TX	Dallas, Dean Assocs.	214-458-1321
WA	Seattle, Controltek Sls. Ltd.	206-451-8163

MICRO TECHNOLOGY, INC., 1620 Miraloma Ave., Placentia, CA 92670, Tel: 714-632-7580; *Sls. Mgr.:* Mike Jacobs

MICROTEST SYSTEMS, INC., 1188 Bordeaux Dr., Sunnyvale, CA 94089-1281, Tel: 408-745-7000, TWX: 910-339-9325; *Sls. Mgr.:* Ian Z. Roberts; *Dist. Mgr.:* Tom J. Garza

MICROTRAN company, Inc.

MICROTRAN CO. INC., 145 E. Mineola Ave., Valley Stream, NY 11582, Tel: 516-561-6050, TWX: 510-225-8412; FSC No.: 00348; Empl.: 100; *Sls. Mgr.:* W. Benscher .... **1A**•1245, 2114, 2192-2205

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-533-6266
AZ	Scottsdale, F. Schoeffler	602-948-1004
CA	Campbell, Kottmeier Assocs.	408-866-5153
CA	El Monte, Cook Entprs.	213-686-2120
CO	Littleton, Omega, Ltd.	303-798-7040
FL	Orlando, Over & Over, Inc./Florida	305-857-4057
GA	Norcross, Over & Over	404-449-6205
IL	Wheaton, Chadra-Schilke Assoc.	312-653-8126
IN	Noblesville, R & D Elctrn. Sls.	317-849-2026
KS	Overland Pk., J.F. Guernsey Co.	913-381-2225
LA	New Orleans, Coastal Sls. Co.	504-737-8074
MA	Reading, Meco, Inc.	617-944-6660
MN	Minnneapolis, RK Sales	612-786-5713
MO	Florissant, John F. Guernsey Co.	314-921-5720
NJ	Englewood Cliffs, E. Glass Assocs.	212-586-8440
NM	Albuquerque, C. T. Carlberg & Assoc.	505-888-3883
NY	Rochester, J.G. Welch Assocs.	716-244-1100
NY	Utica, J.G. Welch Assocs.	315-736-7821
NC	Raleigh, Over & Over	919-872-2262
OH	Cincinnati, J.O. Olsen Co.	513-574-7711
OH	Cleveland, J.O. Olsen	216-662-3454
OR	Portland, SPS Elctrns.	503-297-6919
PA	Jenkintown, Arnold Assocs.	215-887-7870
PA	Pittsburgh, J.O. Olsen Co.	412-279-2550
TN	Antioch, Over & Over, Inc.	615-834-0140
TX	Grand Prairie, Howell Sls.	214-262-5153
WA	Seattle, SPS Elctrns.	206-323-4140

Local Distributors

AL	Birmingham, MG Elctrns. & Equip.	205-328-4525
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Santa Monica, Master Distrs.	213-452-1229
CO	Denver, Ragon Elctrns. Parts	303-744-3601
FL	Clearwater, Elctrn. Precepts of Florida	813-530-9781
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Fullerton, Pyramid/Fullerton	714-773-0781
IL	Northbrook, Classic Comp.	312-272-9650
IN	Indianapolis, Graham Elctrns.	317-634-3202
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
MA	Burlington, QPL Elctrn. Distr.	617-229-2424
MA	Hingham, Sager Elec. Supp.	617-749-6700
NJ	Kenilworth, Federated Elctrns.	201-272-0505
NM	Albuquerque, Walker Elctrn. Supp.	505-247-2288
NY	Binghamton, Help Elctrns.	607-729-3528
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Summit Distrs.	716-334-8110
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Cleveland, Pattison Supp.	216-441-3000
OH	Dayton, J.A. Becker Co.	513-226-1341
PA	McKeesport, Barno Radio Co.	412-751-5971
PA	Philadelphia, Shap Elctrns.	215-969-3300
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Houston, Lenert Co.	713-225-1465
UT	Salt Lake City, Newark Elctrns.	801-486-1048
WA	Seattle, Robert E. Priebe Co.	206-682-8242
WI	New Berlin, Classic Comp.	414-786-5300

MICROWAVE APPLICATIONS GROUP

MICROWAVE APPLICATIONS GRP., 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: (MAGSAMA) 910-351-5808; Empl.: 60; *Sls. Mgr.:* D. W. Prigge

Local Sales Offices & Reps

FL	Fort Lauderdale, Snow Co.	305-563-2448

MICROWAVE ASSOCS. LTD., Humphrey Rd., Dunstable, Bedfordshire, LU5 4SX, England, Tel: 44-(582) 60-14-41, Telex: 82295; *Sls. Mgr.:* K. Harris

MICROWAVE DEVELOPMENT LABS., 10 Michigan Dr., Natick, MA 01760, Tel: 617-655-0060, TWX: 710-386-6850; Empl.: 180; *Sls. Mgr.:* R. Tucker

Local Sales Offices & Reps

AZ	Chandler, Blackhart Associates	602-831-2566
CA	Orange, MDL West Coast	714-998-6020
CA	San Mateo, H. R. Grove	415-579-0555
CT	Conn., Stamford, Dage Corp.	203-324-3123
FL	Orlando, Hi Co.	305-897-2051
MA	Wayland, Hi-Tech Sls.	617-653-3838
NY	DeWitt, D.B. Assocs.	315-446-0220
NY	Great Neck, Trionic	516-466-2300
PA	Lafayette Hill, M. Lader	215-825-3177
TX	Dallas, Texas Microwave	214-351-4773
VA	Alexandria, Vanguard Engrg.	703-768-1660
WA	Seattle, Jon B. Jolly	206-938-4166

MICROWAVE DIODE CORP., Washington St-Box 250, W. Stewartstown, NH 03597, Tel: 603-246-3362/3362/3363, TWX: 710-321-8901; Empl.: 15

MICROWAVE FILTER INC., 6743 Kinne St., East Syracuse, NY 13057, Tel: 315-437-4529, 800-448-1666, TWX: 710-541-0493; FSC No.: 27834; Empl.: 125; *Sls. Mgr.:* E. Bostick, V.P. Mktg.

MICROWAVE SEMICONDUCTOR CORP., 100 School House Rd., Somerset, NJ 08873, Tel: 201-469-3311, Telex: 833473, TWX: 710-480-4730; Empl.: 430; *Sls. Mgr.:* Carl Lump

MICROWAVE/SYS., 1 Adler Dr., E. Syracuse, NY 13057, Tel: 315-437-9951, Telex: 710-541-0408; FSC No.: 26058; Empl.: 4; *Sls. Mgr.:* Michael P. Busse

MICTRON INC., 6050 Porter Way, Sarasota, FL 33582, Tel: 813-371-6659; *Sls. Mgr.:* M. Weinstein

MIDDLEBURG CORP., Middco Connectors, 220 Albany Turnpike, Canton, CT 06019, Tel: 203-693-8361; Empl.: 20; *Sls. Mgr.:* Betty-Lou Berube

Local Sales Offices & Reps

CA	Placentia, Local Sls.	714-993-1800
CO	Denver, Aspen Sales	801-467-2401
FL	Winter Park, E.M.A., Inc.	305-671-6800
LA	Mandeville, Design Mktg.	504-294-3076
NH	Nashua, Bell Controls	603-882-6984
NJ	Manville, DynoRep	201-685-0135
OH	Aurora, E.M.A.	216-562-6104
OH	Centerville, EMA	513-433-2800
OK	Broken Arrow, Design Mktg.	918-258-8656
PA	Horsham, Dalbrook	215-441-8380
TX	Dallas, Design Mktg.	214-680-9767
TX	Hurst, Design Mktg.	817-268-2004
TX	Round Rock, Design Mktg.	512-255-9896
UT	Salt Lake City, Aspen Sls.	801-467-2401

MIDGARD ELCTRNS., See Transkinetic Sys.

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06852, Tel: 203-866-2342; Empl.: 10; *Sls. Mgr.:* Frank J. Scallon; *Dist. Mgr.:* Frank J. Scallon

H HONEYWELL MICRO SWITCH

AUTHORIZED DISTRIBUTOR

E S I

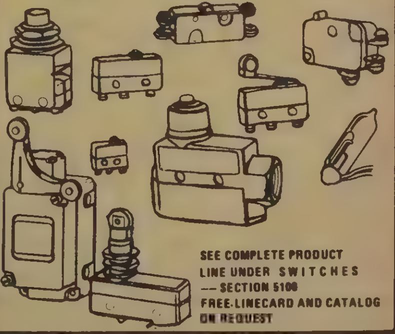
ELECTRIC SWITCHES INCORPORATED

2478 Fletcher Drive, Los Angeles, Calif. 90039

(213) 660-1310

TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640

TWX 910-321-2971



SEE COMPLETE PRODUCT LINE UNDER SWITCHES — SECTION 5100 FREE LINECARD AND CATALOG ON REQUEST

MIDLAND ROSS

MIDLAND-ROSS CORP., CAMBION DIV., One Airwife Place, Cambridge, MA 02140, Tel: 617-491-5400, Telex: 92-1480, TWX: 710-320-6399; FSC No.: 71279; Empl.: 900; *Sls. Mgr.:* Jim Gomes; *Dist. Mgr.:* Karen McMillian

Local Sales Offices & Reps

AZ	Tempe, Cambion Div.	602-966-4444
CA	Campbell, Cambion Div.	408-371-0585
CA	Torrance, Cambion Div.	213-326-7822
CO	Parker, A5 Co.	303-841-3651
FL	Orlando, Publicover Assocs.	305-898-9361
IL	Downers Grove, Richmar Elex.	312-968-0118
IN	W. Lafayette, Richmar Elex.	317-846-6383
KS	Shawnee Mission, B.C. Elctrn. Sls.	913-888-6680
KS	Wichita, BC Elctrn. Sls.	316-942-9840
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Edina, Peterson & Wolff Co.	612-933-3393
MO	Bridgeton, BC Elctrn. Sls.	314-291-1101
NC	Raleigh, J & B Sls.	919-772-3546
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
OR	Wilsonville, RTS Inc.	503-638-5670
PA	Philadelphia, K.B. Erdman Co.	215-224-1833
PA	Pittsburgh, Dolfuss-Root & Co.	412-221-4420
TX	Austin, R.F. Kimball	512-443-5284
TX	Houston, R.F. Kimball	713-840-0590
TX	Richardson, R.F. Kimball	214-231-3447
UT	Sandy, Aspen Sls.	801-943-1346
VA	Alexandria, Cambion Div.	703-941-5470
WA	Vashon, RTS Inc.	206-285-1363
WI	Butler, Richmar Elex.	414-781-1730
PR	San Juan, Elctrn. Techn. Sls.	809-781-8000

MIDLAND-ROSS CORP., Grimes Div., 515 N. Russell St., Urbana, OH 43078, Tel: 513-652-1431

MIDLAND-ROSS CORP., Midcom Unit, P.O. Box 3328, N. Mankato, MN 56001, Tel: 507-625-6521, TWX: 910-565-2244; Empl.: 200

MIDLAND-ROSS CORP., Midtex Div., P.O. Box 3328, No. Mankato, MN 56001, Tel: 507-625-6521, TWX: 910-565-2244; Empl.: 1008

MIDLAND-ROSS CORP., NEL Unit, 357 Beloit St., Burlington, WI 53105, Tel: 414-763-3591, TWX: 910-278-2450; FSC No.: 00815; Empl.: 300; *Sls. Mgr.:* Boyd Recknagel

Local Sales Offices & Reps

CA	Santa Clara, Midtex, NEL	408-727-2401
GA	Marietta, Midtex, NEL	404-971-6778
MD	Phoenix, Midtex, NEL	301-666-7150
WI	Brookfield, Midtex, NEL	414-785-9366

MIDLAND STANDARD, INC., 603 E. Chicago St., Box 38, Elgin, IL 60120, Tel: 312-741-6600; Empl.: 38

MIDWAY MFR. CO., 10750 W. Grand Ave., Franklin Park, IL 60131, Tel: 312-451-1360, Telex: 72-1596; Empl.: 2000; *Dist. Mgr.:* Allan Stearns

MIDWEC, See Industrial Midwec Capacitors

MCI

MIDWEST COMPS., 1981 Port City Blvd., Muskegon, MI 49443, Tel: 616-777-2602, TWX: 510-394-4130; FSC No.: 50157; Empl.: 125; *Sls. Mgr.:* J. E. Saling .... **1B**•1810-1817

Local Sales Offices & Reps

AL	Huntsville, Glen White Assoc.	205-883-7938
CA	Saratoga, Testco	408-253-1900
FL	Light House Pt., R. C. Simon	305-941-2757
GA	Norcross, Glen White Assoc.	404-441-1447
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Carmel, Rich Mktg.	317-844-8462
MD	Timonium, Glen White Assoc.	301-252-6360
MN	St. Paul, R. G. Ragon	612-488-0201
NJ	Burlington, Mallon Sls.	609-387-4044
NJ	Ft. Lee, Necco	201-461-2789
NY	Endicott, Tech-Mark	607-748-7473
NY	New York, Necco	201-461-2789
NC	Raleigh, Glen White Assoc.	919-787-7023
OH	Dayton, Jay Engrg.	513-253-2151
OH	N. Royalton, Jay Engrg.	216-237-4235
OK	Tulsa, Norcom	918-664-9526
TN	Gray, Glen White Assoc.	615-477-8850
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-988-0022
VA	Lynchburg, Glen White Assoc.	804-237-6291
WA	Bellevue, Testco	206-454-7422
WI	Milwaukee, D. Dolin Sls.	414-482-1111

MIKRON INSTR., Box 211, Ridgewood, NJ 07451, Tel: 201-891-7330, TWX: 710-988-5821; Empl.: 40; *Sls. Mgr.:* K. Irani

MIL ELECTRONICS, INC., 1 Mill St., Dracut, MA 01826, Tel: 617-453-8000; FSC No.: 07862; Empl.: 30; *Sls. Mgr.:* Mark Ryan

MILFORD RIVET & MACH., 857 Bridgeport Ave., Milford, CT 06460, Tel: 203-878-4631, Telex: 964363, TWX: 710-462-0538; Empl.: 400; *Sls. Mgr.:* Robert E. Kranz, Jr.

MILLEN COMPONENTS, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-6951, Telex: 948-025; FSC No.: 57285; Empl.: 50; *Sls. Mgr.:* R. A. Boisseau; *Dist. Mgr.:* Gardner Gray

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91734, Tel: 818-283-5111, TWX: 910-587-3438; *Sls. Mgr.:* Doug Hazelip

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611; Empl.: 42

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, Oquossoc, ME 04964, Tel: 207-864-3344; Empl.: 18; *Sls. Mgr.:* D. Hunger

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810, Tel: 203-743-4447, Telex: 643-711

MILLIFLECT, 7752 B Enterprise Dr., Newark, CA 94560, Tel: 415-791-5188; Empl.: 13; *Sls. Mgr.:* J. F. Rutschow

MILLI-SWITCH CORP., Box 67, Gladwyne, PA 19035, Tel: 215-MI2-9222; Empl.: 15

MILLIVAC INSTRS., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300; FSC No.: 85711; Empl.: 26; *Sls. Mgr.:* (Mrs.) Pola Metzger .... **3**•1263

Local Sales Offices & Reps

CA	Costa Mesa, Didion Entprs.	714-557-3063
MA	Needham, Addelco Corp.	617-444-4754
NY	Fayetteville, Martin P. Andrews	315-637-5191
NY	Melville, Paul W. Steen Assocs.	516-427-1114
PA	Media, S & S Div. of Klinetics	215-565-5388
TX	Houston, Scientific Sales	713-666-5318
TX	Richardson, Scientific Sales	214-231-6541

MILL-MAX MFG. CORP., P.O. Box 300, Oyster Bay, NY 11771, Tel: 516-922-6000, TWX: 510-221-1820; *Sls. Mgr.:* Therese Malhame .... **2**•1523

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 213-598-2454; FSC No.: 34238; Empl.: 50

MILTON ROSS CO., 511 Second St. Pike, Southampton, PA 18966, Tel: 215-355-0200, TWX: 510-667-1702; Empl.: 165; *Sls. Mgr.:* M. I. Ross

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; *Sls. Mgr.:* Robert Ceonzo; *Dist. Mgr.:* William Jennings

MRC

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807; Empl.: 100; *Sls. Mgr.:* W. R. Pollock; *Dist. Mgr.:* W. R. Pollock .... **1A**•1898-1901

Local Sales Offices & Reps

IL	La Grange, PVA Co.	312-579-9300
NY	Rochester, Gislason Sls.	716-454-4741

MILWAUKEE TRANSFORMER CO., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223; Tel: 414-438-5300; *Sls. Mgr.:* Richard T. Armantrout; *Dist. Mgr.:* Richard T. Armantrout

MIMIC, INC., P.O. Box 921, Acton, MA 01720, Tel: 617-263-2101; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINCO PRODS., 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, TWX: 910-576-2848; FSC No.: 09359; Empl.: 400; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 17815 F Sky Park Blvd., Irvine, CA 92714, Tel: 714-250-0474, TWX: 910-595-1144; *Sls. Mgr.:* Wendell Jacob

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-9985, Tel: 203-283-8261, TWX: 710-475-1091; FSC No.: 07479; Empl.: 61; *Sls. Mgr.:* John Pfingsten

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, Stitzer-Dodd	602-944-2237
CA	Alhambra, M.W. Riedel & Co.	213-283-7694
CA	Hayward, Avionics Liaison	415-783-1131
CO	Denver, West Inc.	303-692-0131
CT	Thomaston, Minelco	203-283-8261
FL	Orlando, Delmac	305-898-4688
GA	Atlanta, L & D, Inc.	404-455-3483
IL	Elk Grove Village, Midwest Meridian	312-640-9540
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Severna Park, DelMarva Eng. Assoc.	301-647-8007
MA	Winchester, F.J.S. Assocs.	617-729-3135
MN	New Brighton, TWC Sls.	612-636-1770
MO	Maryland Heights, Midwest Meridian	314-878-4441
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	Syracuse, J. R. Costello	315-472-0322
NC	Greensboro, L & D, Inc.	919-292-3201
OH	Fairborn, Midwest Meridian	513-879-7100
OR	Beaverton, Caruso-Northcutt	503-646-4973
PA	Downingtown, McCoy, Inc.	215-363-0350
TX	Fort Worth, Midwest Meridian	817-654-2132
UT	Salt Lake City, West, Inc.	801-466-2888
WA	Bellevue, Caruso-Northcutt	206-454-9699

MINI-CIRCUITS LAB., 2625 E. 14th St., Brooklyn, NY 11235, Tel: 212-769-0200, Telex: 125460, 620156 (Intl.); FSC No.: 15542 .... **1A**•1684, 1710-1773

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Crown Elctrns.	602-944-3721
AR	Little Rock, Beacon Elctrns.	501-224-5449
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	N. Hollywood, Crown Elctrns.	213-877-3550
FL	Clearwater, Beacon Elctrns.	813-796-2378
FL	Ft. Lauderdale, Beacon Elctrns.	305-491-1054
FL	Maitland, Beacon Elctrns.	305-647-3498
FL	Melbourne, Beacon Elctrns.	305-724-8010
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Mount Prospect, Cain Forlaw Co.	312-253-3578
MD	Columbia, M. Lader & Co.	301-730-1550
MD	Conowingo, M. Lader & Co.	301-378-3449
MA	Waltham, Scientific Devices	617-890-2252
NY	Hartsdale, Spectrum Sales	914-997-1166
NY	Skaneateles, Robtron	315-685-5731
NC	Greensboro, Beacon Elctrns.	919-275-9997
OH	Lancaster, Cain Forlaw Co.	614-654-4800
PA	Lafayette Hill, M. Lader & Co.	215-825-3177
TX	Dallas, Cain & Co.	214-233-6809

Local Distributors

AL	Huntsville, Components Distrs.	205-883-7501
AR	Little Rock, Components Distrs.	501-227-6278
CA	Los Altos, Pen Stock	415-948-6552
CA	N. Hollywood, Crown Elctrns.	213-877-3550
FL	Ft. Lauderdale, Components Distrs.	305-971-4950
IL	Mt. Prospect, CFC Distributors	312-253-3578
NC	Raleigh, Components Distrs.	919-781-0262
PA	Lafayette Hill, MLC Distrs.	215-825-3177

MINI COMPUTER TECHNLG., 696 E. Trimble Rd., San Jose, CA 95131, Tel: 408-942-1616, TWX: 910-338-2281; Empl.: 30; *Sls. Mgr.:* Doug Vincent; *Dist. Mgr.:* Ed Hagenbuch

MINI-SYSTEMS, INC., 20 David Rd., North Attleboro, MA 02761, Tel: 617-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 150 .... **1A**•1902

Local Sales Offices & Reps

FL	Coral Springs, Marks Tech. Sls. Assocs.	305-753-3830
MA	Newton, Normell Assocs.	617-969-5478
TX	Lewisville, C & J Assocs.	214-539-0140

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 617-695-2000, TWX: 710-348-0564 .... **1A•1666**

MITEC ELCTRNS., 15 Commerce St., Williston, VT 05495, Tel: 802-864-0064, TWX: 610-421-3572; *Sls. Mgr.:* Elayne Bernstein

MITEL SEMICONDUCTOR, P.O. Box 13089, Kanata, ON K2K 1X3, Canada, Tel: 613-592-5280, Telex: 053-3221, TWX: 610-562-8529; Empl.: 200

MITEQ INC., 100 Ricefield La., Hauppauge, NY 11788, Tel: 516-543-8873, TWX: 510-226-3781; Empl.: 140

MITRONICS, 18039 Crenshaw Blvd., Torrance, CA 90504, Tel: 213-323-7934

MITSUBISHI ELCTRNS. AMERICA, Computer Peripheral Div., 991 Knox St., Torrance, CA 90502, Tel: 213-515-3993; *Sls. Mgr.:* Mike Foster

MITSUBISHI ELCTRNS., Industrial Electronics Div., 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, Telex: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; *Sls. Mgr.:* Don Aarons

MITSUBISHI ELCTRNS. AMERICA, INC., Semiconductor Div., 777 N. Pastoria Ave., Sunnyvale, CA 94086, Tel: 408-730-5900; *Sls. Mgr.:* John Zucker

MITSUMI ELEC. CO., LTD., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan, Tel: 489-5333, Telex: J28846/J24935; Empl.: 1700; *Sls. Mgr.:* H. Sato; *Dist. Mgr.:* U. Nishimura

MIZAR INC.

MIZAR INC., 302 Chester St., St. Paul, MN 55107, Tel: 612-224-8941, Telex: 469542; Empl.: 11; *Sls. Mgr.:* Susan Roth .... **3•1113**

Local Sales Offices & Reps

AZ	Tempe, Foley, Tallent & Lee Inc.	602-894-2345
CA	Long Beach, B. K. & Associates	213-596-1233
CA	San Jose, Data-Rep Inc.	408-279-1212
FL	Melbourne, Star-Tec Co.	305-727-2247
MA	Waltham, Com-Sls. Inc.	617-890-0011
MN	Minneapolis, D. A. Case & Assoc.	612-888-8666
NJ	Springfield, Gebhardt Mktg. Inc.	201-376-4415
OH	Strongsville, Dolfuss Root & Co.	216-238-0300
PA	Hatboro, Electro-Rep Engrg.	215-674-4421
PA	Ivyland, Technico	215-322-5966
TX	Austin, Acudata, Inc.	512-346-4033
TX	Houston, Acudata, Inc.	713-580-2451

MKC ELCTRNS., 454 E. Donovan Rd., Kansas City, KS 66115, Tel: 913-371-1351; Empl.: 26

MKS INSTRS., INC., 22 Third Ave., Burlington, MA 01803, Tel: 617-272-9255, Telex: 94-9375; Empl.: 130

MOBILE-TRONICS CO., INC., Box 1022, Tustin, CA 92680, Tel: 714-768-4271; Empl.: 2

MODICON PROGRAMMABLE CONTROL DIV., Gould Inc., P.O. Box 83 S.V.S., Andover, MA 01810, Tel: 617-475-4700, Telex: 94-7402, TWX: 710-347-6610; *Sls. Mgr.:* Steven Mader (PC's); John Pemble (Motion Control); *Dist. Mgr.:* George Dannecker (Micro 84)

MODULAR COMPUTER SYSTEMS, P.O. Box 6099, Ft. Lauderdale, FL 33310, Tel: 305-974-1380, Telex: 52-2564, TWX: 510-956-9414; Empl.: 950

MODULAR AUDIO PRODS., Modular Devices Inc., 50 Orville Dr., Bohemia, NY 11716, Tel: 516-567-9620; *Sls. Mgr.:* S. Summer .... **3•1012**

Local Sales Offices & Reps

CA	San Diego, Total Elctrns. Intl., Inc.	619-224-3291

MODULAR DEVICES, 50 Orville Dr., Bohemia, NY 11716, Tel: 516-567-9620; FSC No.: 52202; Empl.: 40; *Sls. Mgr.:* Julius Brick .... **3•1012, 1933**

Local Sales Offices & Reps

NY	Rochester, T.T.A. North-Div. Tri-Tek Assoc.	716-271-6764
NY	Wantaugh, Tri-Tek Assocs.	516-221-7600
EXP	CA, San Diego, Total Elctrns. Int'l.	619-224-3291

MODULAR POWER SYS. INC., P.O. Box 180579, Austin, TX 78718-0579, Tel: 512-834-9262, Telex: 752-890; FSC No.: 58480; Empl.: 86; *Sls. Mgr.:* Manard Overall; *Dist. Mgr.:* Manard Overall

MODULAR SYSTEMS, 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 5; *Sls. Mgr.:* G. L. Blencowe

MODUTEC, 18 Marshall St., Norwalk, CT 06854, Tel: 203-853-3636, TWX: 710-468-2039; Empl.: 300; *Sls. Mgr.:* Lester A. Velez; *Dist. Mgr.:* William J. Betz .... **3•1335-1337**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns. Assocs.	205-881-5031
AK	Anchorage, Denali Indl. Sls.	907-243-6283
AZ	Scottsdale, Luscombe Engrg. Co.	602-949-9333
AR	Little Rock, Beacon Elec. Assoc.	501-224-5449
CA	Campbell, Luscombe Engrg. Co.	408-370-2020
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CO	Arvada, Arrowhead Sls. Co.	303-423-5556
FL	Clearwater, Beacon Elec. Assoc.	813-796-2378
FL	Ft. Lauderdale, Beacon Elctrn. Assoc.	305-491-1054
FL	Maitland, Beacon Elctrn. Assocs.	305-647-3498
FL	Melbourne, Beacon Elec. Assoc.	305-724-8010
GA	Atlanta, Beacon Elctrn. Assocs.	404-256-9640
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Carmel, Carter, McCormic & Peirce	317-844-4175
IN	Carmel, Brainard-Wilson Mktg.	317-844-2800
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs.	913-432-2131
MD	Randallstown, Beacon Elec.	703-534-7200
MA	Canton, New England Elctrn. Sls. Corp.	617-828-4835
MI	Farmington, Carter, McCormic & Peirce	313-477-7700
MN	Minneapolis, R.J. Inc.	612-866-3661
MO	St. Charles, M-S-B Assocs.	314-946-5577
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NJ	Marmora, Holdsworth & Co.	609-398-4340
NM	Albuquerque, Amonette Entprs.	505-344-4143
NY	Bainbridge, R. W. Mitscher	607-697-7192
NY	Buffalo, R. W. Mitscher	716-633-7970
NY	N. Syracuse, R. W. Mitscher	315-458-1321
NY	Pittsford, R. W. Mitscher	716-586-4012
NY	Red Hook, R. W. Mitscher	914-758-8375
NY	Rochester, R. W. Mitscher	716-227-0839
NC	Greensboro, Beacon Elctrn. Assoc.	919-275-9997
NC	Raleigh, Beacon Elctrn.	919-787-0330
OH	Cleveland, Carter, McCormic & Peirce	216-779-5100
OH	Englewood, Carter, McCormic & Peirce	513-836-0951
OR	Beaverton, Barrett-Squibb & Assoc.	503-644-2550
PA	Monroeville, Carter, McCormic & Peirce	412-372-4415
PA	Newtown Square, Holdsworth & Co.-SWR	215-356-8550
TX	Houston, Scientific Sls. Co.	713-460-9170
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, Arrowhead Sls.	801-261-1661
VA	Fairfax, Beacon Elctrns.	703-591-1300
VA	Forrest, Beacon North	804-239-8486
WA	Redmond, Barrett Squibb, Inc.	206-885-6991
WI	Colgate, Rep-1 Assoc.	414-628-4016
EXP	Freeport, Minthorne	516-546-4700

Local Distributors

AL	Birmingham, Brownell Electro	205-322-3374
AL	Huntsville, Component Distrs.	205-883-7501
AL	Mobile, Brownell Electro	205-479-8581
AR	Little Rock, Component Distrs.	501-227-6278
CA	Inglewood, Force Elctrns.	213-776-1324
CA	Los Angeles, Erlanger Sls.	213-731-2238
CA	Los Angeles, Erlanger Sls. Co.	213-731-2238
CA	Santa Clara, Fisher-Brownell	408-988-6041
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
FL	Miami, Brownell Electro	305-591-3215
FL	Orlando, Brownell Electro	305-843-6770
GA	Hapeville, Brownell Electro	404-762-5181
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elk Grove Village, Meter Master	312-593-8650
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
MD	Gaithersburg, Pioneer Instrumentation	301-921-0660
MA	Canton, E.D.S. Inc.	617-828-4835
MA	Woburn, Brownell Electro	617-935-7820
MA	Woburn, Abbott Elctrns.	617-935-2040
MI	Ferndale, RAM Meter	313-398-6767
MO	St. Louis, Olive Elctrns.	314-426-4500
NJ	Belleville, Miscorp	201-751-1190
NJ	Fairfield, Ampower Elctrn. Instr.	201-227-7720
NJ	S. Plainfield, Brownell Electro	201-753-4600
NY	Clarence, Trott Elctrns.	716-634-8500
NY	New York, Brownell Electro	212-691-1171
NY	Pittsford, Trott Elctrns.	716-586-8251
NC	Charlotte, Brownell Electro	704-597-1270
NC	Raleigh, Brownell Electro	919-876-6524
NC	Raleigh, Component Distrs.	919-781-0262
OH	Cleveland, Weschler Elec. Co.	216-238-2550
OH	Cleveland, Pioneer Instrumentation	216-587-3600
OH	Dayton, Pioneer Instrumentation	513-236-9900
PA	Norristown, Kimberly-James Co.	215-666-7286
SC	Columbia, Brownell Electro	803-772-6111
TN	Chattanooga, Techni-Tronics	615-875-5449
TN	Knoxville, Brownell Electro	615-966-3441
TN	Memphis, Brownell Electro	901-795-8483
TN	Nashville, Brownell Electro	615-889-8230
TX	Dallas, Inotek Corp.	214-243-7000
TX	Ft. Worth, Inotek Corp.	817-831-2126
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Brownell Electro	713-699-1981
TX	Houston, Inotek Corp.	713-688-4494
TX	Houston, American Analog	713-941-7265
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, E-M Instrs.	414-272-7799

MODU-TEL CORP., 1429 N. Halstead, Hutchinson, KS 67501, Tel: 316-662-3302, Telex: 469331 COMTRON CI; Empl.: 5; *Sls. Mgr.:* Paul Bascom

MOHAWK DATA SCIENCES, MDS Center, Herkimer, NY 13350, Tel: 315-866-5300, Telex: (71)662032; Empl.: 4500

MOHAWK WIRE & CABLE CORP., 9 Mohawk Drive, Leominister, MA 01453, Tel: 617-537-9961

MOLDCON CORP., 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, TWX: 710-350-6463; *Sls. Mgr.:* James Loeffler

MOLDING TECHNOLOGY INC., See MTI

MOLDTRONICS, INC., 707 Roger St., Downers Grove, IL 60515, Tel: 312-968-7000, TWX: 910-695-3537; Empl.: 140; *Sls. Mgr.:* Jim Arnold

Local Sales Offices & Reps

CA	Topauga, S-J-N Sales	213-455-1813
FL	Vero Beach, Peter Martinet	305-567-8413
IL	Downers Grove, Momak Sales	312-963-6400
IN	Indianapolis, Butler Sls. & Engrg.	317-253-5143
MN	St. Paul, PDO Comps.	612-690-5215
OH	Dayton, H. G. Lake Co.	513-277-8181
PA	Lancaster, Thomas G. Armstrong Assoc.	717-397-2942
RI	Wickford, R. P. Morrison Co.	401-295-5692

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 201-938-9473, TWX: 710-723-6943; Empl.: 175

Local Sales Offices & Reps

CA	Montrose, Roger D. Dahl	213-245-3817
CT	Orange, KLS Sls.	203-795-6210
IL	Northbrook, Jack Norlie Assocs.	312-498-3657
KS	Shawnee Mission, B.C. Elctrn. Sls.	913-342-1211
NC	Charlotte, QED	704-525-3053
PA	Ligonier, Patterson Elec.	412-238-6238
WA	Seattle, Comptronics	206-284-4842
WI	Mequon, Robco	414-241-3348

MOLEX, 2222 Wellington Ct., Lisle, IL 60532, Tel: 312-969-4550, TWX: 910-695-3227; Empl.: 2,200; *Sls. Mgr.:* Gregg Johnson; *Dist. Mgr.:* Pat Weber

Local Sales Offices & Reps

AL	Huntsville, Dennis Andrew	404-396-6120
AZ	Scottsdale, Luscombe Engrg. Co.	602-949-9333
AR	Little Rock, Glenn Montgomery	501-666-0260
CA	Costa Mesa, Molex (W Reg. Off.)	714-241-8588
CA	Encino, Dow Lebowski	714-241-8588
CA	Mission Viejo, Tony Scutetta	714-241-8588
CA	San Diego, Al Batza	619-241-8588
CA	Sunnyvale, Molex	408-773-0505
CO	Englewood, Thorson Rocky Mountain	303-779-0666
CT	West Hartford, Randy Stone	617-935-8983
FL	North Palm Beach, Chuck Vincent	404-396-6120
FL	St. Petersburg, Molex	404-396-6120
GA	Atlanta, Molex (SE Reg. Off.)	404-396-6120
IL	Crystal Lake, E.S. Healy & Assocs.	815-459-4386
IN	Connersville, George Allen	317-844-8986
IN	Indianapolis, Steve Byrne	317-844-8986
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
KY	Louisville, Glen Towater	404-396-6120
KY	Taylorsville, Jim Lieb	404-396-6120
MD	Bethesda, Molex	404-396-6120
MA	Mansfield, Paul Hansen	617-935-8983
MA	Marblehead, Pete Evans	617-935-8983
MA	Woburn, Molex (E Reg. Off.)	617-935-8983
MI	Grand Rapids, Mark Fluga	616-957-1205
MI	Royal Oak, Schwegman & Assocs.	313-542-6767
MN	Edina, Mark Boe	612-893-9029

MO	Gladstone, Mark Rider	214-247-7117
MO	Independence, Dy-Tronix Inc.	816-373-6600
NJ	Washington, Oscar Cobian	201-267-8014
NY	Webster, Joe Schmitt	716-223-6899
NC	Raleigh, Molex Inc.	404-396-6120
OH	Geneva, Bill Hyslop	216-466-9244
OR	Lake Oswego, Gary Rohde	503-636-7558
PA	Rosemont, Ed M. Sullivan	617-935-8983
TN	Knoxville, Insul Reps.	615-691-7586
TX	Austin, Daniel Daneff	512-453-1398
TX	Dallas, Dale Otten	214-247-7117
TX	Manchaca, Max Bassler	512-453-1398
UT	West Valley, Thorson Rocky Mountain	801-973-7969
WA	Redmond, Molex	206-881-2042
PR	Hato Rey, Max Anderson Co.	809-751-2202

MOLON MOTOR & COIL CORP., 3737 Industrial Ave., Rolling Meadows, IL 60008, Tel: 312-259-8700, TWX: 910-687-0428; Empl.: 350; *Sls. Mgr.:* J. Bailey

MONITOR LABS, INC., 10180 Scripps Ranch Blvd., San Diego, CA 92131, Tel: 619-578-5060, Telex: 182794

MONITOR
PC

MONITOR PRODS. CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510, TWX: 910-322-1381; FSC No.: 54331 .... **1A**•1387-1389

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Eltron	602-266-2164
CA	Encino, Great American Rep Co.	818-990-4870
CA	Mountain View, West Mark Assocs.	415-969-1700
CA	San Diego, Rep Co.	619-292-9001
CA	Tustin, Great American Rep. Co.	714-832-8113
CO	Aurora, Electrodyne	303-695-8903
CT	Woodbury, Lindco Assocs.	203-263-0629
FL	Lake Worth, Tech-Rep Assocs.	305-968-7792
FL	Melbourne Beach, Tech-Rep Assocs.	305-725-4655
FL	St. Petersburg, Tech-Rep Assocs.	813-577-2779
GA	Atlanta, CSR Elctrns.	404-396-3720
IL	Downers Grove, Momak Sls.	312-963-6400
IA	Davenport, Ensco Rep	319-386-6600
KS	Overland Park, Ensco Rep	913-381-7557
KS	Wichita, Ensco Rep	316-683-1070
MA	Stow, Today Comps. Sls.	617-897-7500
MN	Eden Prairie, Elctrn. Innovators	612-941-0830
MO	Maryland Heights, Ensco Rep	314-423-3935
NY	Nekvukke, Parallax	516-351-1000
NC	Matthews, CSR Elctrns.	704-847-1927
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Dayton, Berberich & Assocs.	513-433-0342
OR	Aloha, Micro Sales	503-642-1818
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
TX	Austin, Mil-Rep Assocs.	512-258-2828
TX	Houston, Mil-Rep Assocs.	713-937-0127
TX	Richardson, Mil-Rep Assocs.	214-644-6731
UT	Salt Lake City, Electrodyne	801-486-3801
VA	Fairfax, Beacon North	703-591-1300
WA	Bellevue, Micro Sales	206-451-0568
WI	Mukwonago, Momak Sls.	414-363-7744

MONOLITHIC COMPONENTS CORP., 6828 Nancy Ridge Drive, San Diego, CA 92121, Tel: 619-457-1727

MONOLITHIC SYS., 84 Inverness Circle E., Englewood, CO 80112, Tel: 303-790-7400, Telex: 45-4498; Empl.: 100; *Sls. Mgr.:* Mike Hart

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, Telex: 44-7282 .... **2**•1085-1087

MONSANTO-ELECTRONICS DIV., See General Instr., Optoelctrns. Div.

MOODY TOOLS, 43 Crompton Ave., E. Greenwich, RI 02818, Tel: 401-885-0911; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

Local Sales Offices & Reps

CA	San Carlos, W. M. S. Co.	415-591-7043
CO	Denver, A-E-S	303-777-8733
FL	Winter Park, Floritronics	305-886-4818
IL	Palatine, Witz-Knight, Inc.	312-358-5990
KS	Overland Park, Modern Mktg. Co.	913-341-2426
MD	Baltimore, Coastline Sls. Co.	301-828-8520
NY	New York, Lane-Mizner Assocs.	212-889-9711
NY	Orchard Park, S & B Indl. Sls.	716-662-5988
OH	St. Marys, Thomas Shelby & Co.	419-394-3377
OR	Portland, Joseph V. BeLusko Co.	503-222-4279
RI	Barrington, Kilburn Assocs.	401-437-1839
EXP	IL, Northbrook, Vaco/Intl.	312-564-3300

MORRIS, J. I., CO., 372 Elm St., Southbridge, MA 01550, Tel: 617-764-4394; Empl.: 45

MORRIS ENTPRS., 16799 Schoenborn St, Sepulveda, CA 91343, Tel: 213-894-9103, Telex: 6-74681, TWX: 910-496-1525; FSC No.: 54918; Empl.: 40; *Sls. Mgr.:* J. Dumpert

MOSS CO., See Electron General

MOTION CONTROL DEVICES, INC., 80 Steadman St., Lowell, MA 01851, Tel: 617-454-3704, Telex: 955318-INTL-DIV-ATTEN-MCD-I; Empl.: 25; *Sls. Mgr.:* Joe Laliberte

MOTOROLA INC., Auto. & Indl. Elctrns. Grp., 1299 E. Algonquin Rd., Schaumburg, IL 60196, Tel: 312-576-4850, Telex: 722443; *Sls. Mgr.:* Jay A. Bonk

MOTOROLA INC.
Component Products

MOTOROLA, INC., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 312-451-1000, TWX: 910-227-0799; Empl.: 1400; *Sls. Mgr.:* Barnie III; *Dist. Mgr.:* Ted Hoffman .... **1A**•1390, 1391; **3**•1413

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell	205-883-5110
AZ	Scottsdale, Thorson Desert States	602-998-2444
AR	Ft. Smith, Electra Reps.	501-452-4030
CA	Campbell, Kottmeier Assocs.	408-866-5153
CA	Fullerton, Groh Assoc.	714-738-7150
CO	Englewood, Thorsen Co.	303-779-0666
FL	Clearwater, Perrott Assocs.	813-443-5414
FL	Orlando, Perrott Assocs.	305-298-7748
FL	Sunrise, Perrott Assocs.	305-792-2211
GA	Norcross, Glen White Assoc.	404-441-1447
IL	Rolling Meadows, KMA Sls. Co.	312-398-5300
IN	Fort Wayne, R. O. Whitesell	219-432-5591
IN	Indianapolis, R. O. Whitesell	317-359-9283
IA	Cedar Rapids, Comstrand	319-377-1575
MD	Timonium, Glen White Assoc.	301-252-6360
MA	Natick, Wayland Engrg. Sls.	617-655-6080
MI	Southfield, R. O. Whitesell Assoc.	313-559-5454
MI	St. Joseph, R. O. Whitesell Assoc.	616-983-7337
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Louis, Abrams Assoc.	314-569-0447
NM	Albuquerque, Thorsen Desert States	505-293-8555
NY	Great Neck, Trionic Assoc.	516-466-2300
NY	Rochester, Ossmann Comp. Sls.	716-442-4460
NY	Syracuse, Ossmann Comp. Sls.	315-455-6611
NC	Raleigh, Glen White Assoc.	919-787-7016
OH	Cincinnati, R. O. Whitesell	513-521-2290
OH	Cleveland, R.O. Whitesell & Assoc.	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R. O. Whitesell	513-298-9546
OK	Tulsa, H. J. Daly Co.	918-494-7711
OR	Tigard, Elctrn. Sources	503-684-0040
PA	Glenside, Koebert Assoc.	215-887-2310
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Gray, Glen White Assoc.	615-477-8850
TX	Dallas, Electra Reps.	214-387-3594
TX	Houston, Electra Reps.	713-530-2208
UT	West Valley City, Thorsen Co.	801-973-7969
VA	Colonial Beach, Glen White Assoc.	804-224-7764
VA	Lynchburg, Glen White Assoc.	804-237-6291
WA	Bellevue, Electronic Sources	206-451-2530
WI	Milwaukee, KMA Sls. & Co.	414-259-1771
EXP	IL, Franklin Pk., Motorola	312-451-1000

MOTOROLA INC.

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, Adv. 72, Box 20912, Phoenix, AZ 85036, Tel: 602-244-6900, TWX: 910-951-1334; FSC No.: 04713; *Sls. Mgr.:* Brian Hilton; *Dist. Mgr.:* John Dunleavy **1A**•1667-1677, 2086, 2099-2105; **1B**•1117; **3**•1114-1116

Local Sales Offices & Reps

AL	Huntsville	205-830-1050
AZ	Phoenix, (General Motors Grp.)	602-244-7125
AZ	Phoenix	602-244-7100
CA	Encino/Sherman Oaks	213-986-6850, 213-872-1504
CA	Los Angeles	213-445-5585
CA	Orange	714-634-2844
CA	San Diego	619-560-4644
CA	San Jose	408-985-0510
CO	Colorado Springs	303-599-7404
CO	Denver	303-773-6800
CT	New Haven/Hamden	203-281-0771
DC	Washington	301-577-2600
FL	Casselberry/Maitland	305-831-3422
FL	Pompano Bch./Ft. Lauderdale	305-491-8141
FL	St. Petersburg	813-576-6030
GA	Atlanta	404-256-0222
IL	Chicago/Schaumburg	312-576-7800
IN	Ft. Wayne	219-484-0436
IN	Indianapolis	317-849-7060
IN	Kokomo	317-457-6634
IA	Cedar Rapids	319-373-1328
KS	Kansas City/Mission	913-384-3050
MD	Hyattsville	301-577-2600
MA	Berlin	617-562-3856
MA	Burlington	617-273-5020
MI	Detroit/Westland	313-261-6200
MN	Minneapolis	612-545-0251
MO	St. Louis	314-872-7681
NJ	River Edge	201-488-1200
NY	Hauppauge	516-231-9000
NY	Pittsford	716-248-5494
NY	Poughkeepsie/Fishkill	914-473-8102
NY	Syracuse	315-455-7373
NC	Raleigh	919-876-6025
OH	Cleveland	216-461-3160
OH	Columbus/Worthington	614-846-9460
OH	Dayton	513-294-2231
OK	Tulsa	918-664-5227
OR	Portland	503-641-3681
PA	Philadelphia/Horsham	215-443-9400
TN	Knoxville	615-690-5592
TX	Austin	512-452-7673
TX	Dallas	214-931-9222
TX	Houston	713-783-6400
UT	Salt Lake City	801-539-1190
VA	Charlottesville	804-977-3691
WA	Bellevue	206-454-4160
WA	Seattle Access	206-622-9960
WI	Milwaukee/Wauwatosa	414-476-5554

Motorola Systems Reps.

AL	Huntsville, EMA	205-830-4030
CA	Inglewood, Basic Sys. Corp.	213-673-4300
CA	San Diego, Basic Sys. Corp.	619-999-6566
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
CT	Goshen, Northern Computer Sls.	203-491-3585
GA	Norcross, EMA	404-329-0530
IL	Northbrook, Marketech Assoc.	312-291-0315
IN	Carmel, Carter, McCormic & Peirce	317-844-4175
MA	Westwood, Northern Computer Sls.	617-326-3454
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Minneapolis, P.S.I. Co.	612-944-8545
MO	Independence, Dy-Tronix	816-373-6600
NY	Elmont, Crane & Egert Corp.	516-872-0800
NC	Raleigh, EMA	919-781-9369
OH	Cleveland, Carter, McCormic & Peirce	216-779-5100
OH	Dayton, Carter, McCormic & Peirce	513-836-0951
OR	Beaverton, Thorson Co. Northwest	503-644-5900
PA	King of Prussia, K.S.I.	215-783-6440
PA	Monroeville, Carter, McCormic & Peirce	412-372-4415
TN	Jonesboro, EMA	615-753-5844
WA	Bellevue, Thorson Co. Northwest	206-455-9180

Local Distributors

AL	Huntsville, Schweber Elctrns.	205-882-2200
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Pioneer/Huntsville	205-837-9300
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Phoenix, Kierulff Elctrns.	602-243-4101

AZ	Tempe, Hamilton/Avnet Elctrns.	602-231-5100
AZ	Tucson, Kierulff Elctrns.	602-624-9986
CA	Anaheim, Zeus Comps. West	714-632-6880
CA	Canoga Park, Schweber Elctrns.	213-999-4702
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4111
CA	Costa Mesa, Avnet	714-754-6155, 213-558-2345
CA	Culver City, Hamilton Electro Sls./L.A.	213-558-2000
CA	Culver City, Hamilton/Avnet	213-558-2000
CA	Irvine, Schweber Elctrns.	213-537-4321
CA	Los Angeles, Kierulff Elctrns.	213-725-0325
CA	Palo Alto, Kierulff Elctrns.	415-968-6292
CA	Roseville, Bell Inds.	916-969-3100
CA	Sacramento, Hamilton/Avnet Elctrns.	916-925-2216
CA	Sacramento, Schweber Elctrns.	916-929-9732
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Hamilton/Avnet Elctrns.	619-571-7510
CA	San Diego, Kierulff Elctrns.	619-278-2118
CA	Santa Clara, Schweber Elctrns.	408-748-4700
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3360
CA	Tustin, Kierulff Elctrns.	714-731-5711
CA	Woodland Hills, Hamilton/Avnet Elctrns.	213-887-2353
CO	Denver, Hall-Mark Elctrns.	303-694-1662
CO	Denver, Kierulff Elctrns.	303-790-4444
CO	Denver, Hamilton/Avnet Elctrns.	303-740-1017
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Danbury, Hamilton/Avnet Elctrns.	203-797-2800
CT	Danbury, Schweber Elctrns.	203-792-3500
CT	Norwalk, Pioneer-Harvey/Norwalk	203-853-1515
FL	Altamonte Springs, Pioneer/Florida	305-834-9090
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Ft. Lauderdale, Pioneer/Ft. Lauderdale	305-771-7520
FL	Ft. Lauderdale, Kierulff Elctrns.	305-486-4004
FL	Ft. Lauderdale, Hamilton/Avnet Elctrns.	305-971-2900
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Hollywood, Schweber Elctrns.	305-927-0511
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
FL	St. Petersburg, Hamilton/Avnet Elctrns.	813-576-3930
FL	St. Petersburg, Kierulff Elctrns.	813-576-1966
GA	Atlanta, Schweber Elctrns.	404-449-9170
GA	Norcross, Kierulff Elctrns.	404-447-5252
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Hamilton/Avnet Elctrns.	404-447-7507
GA	Norcross, Pioneer/Atlanta	404-448-1711
IL	Bensenville, Hall-Mark Elctrns.	312-860-3800
IL	Bensenville, Hamilton/Avnet Elctrns.	312-860-7700
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns. Corp.	312-638-4411
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IL	Elk Grove Village, Kierulff Elctrns.	312-640-0200
IL	Elk Grove Village, Schweber Elctrns.	312-364-3750
IN	Indianapolis, Hamilton/Avnet Elctrns.	317-844-9333
IN	Indianapolis, Pioneer/Indiana	317-849-7300
IN	Indianapolis, Graham Elctrns. Supp.	317-634-8202
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
KS	Overland Pk., Hamilton/Avnet Elctrns.	913-888-8900
KS	Shawnee Mission, Hall-Mark Elctrns.	913-888-4747
MD	Baltimore, Kierulff Elctrns.	301-636-5800
MD	Baltimore, Hall-Mark Elctrns.	301-796-9300
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MD	Gaithersburg, Pioneer/Washington	301-948-0710
MD	Hanover, Hamilton/Avnet Elctrns.	301-621-5410
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Boston, Kierulff Elctrns.	617-667-8331
MA	Boston, Lionex Corp.	617-272-9400
MA	Burlington, Zeus Comps.	617-273-0750
MA	Needham, Impact Sls. Co.	617-821-1500
MA	Woburn, Hamilton/Avnet Elctrns.	617-935-9700
MI	Grand Rapids, Hamilton/Avnet Elctrns.	616-243-8805
MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Schweber Elctrns.	313-525-8100
MI	Livonia, Hamilton/Avnet Elctrns.	313-522-4700
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	Madison Hgts., McNaughton-McKay Elec. Co.	313-399-7500
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
MN	Eden Prairie, Schweber Elctrns.	612-941-5280
MN	Edina, Kierulff Elctrns.	612-941-7500
MN	Minnetonka, Pioneer/Twin Cities	612-935-5444
MN	Minnetonka, Hamilton/Avnet Elctrns.	612-932-0600
MO	Earth City, Hall-Mark Elctrns.	314-291-5350
MO	Earth City, Hamilton/Avnet Elctrns.	314-344-1200
MO	Maryland Hgts., Kierulff Elctrns.	314-739-0855
MO	St. Louis, Schweber Elctrns.	314-739-0526
NJ	Cherry Hill, Hall-Mark Elctrns.	609-424-7300
NJ	Cherry Hill, Hamilton/Avnet Elctrns.	609-424-0110
NJ	Fairfield, Hall-Mark Elctrns.	201-575-4415
NJ	Fairfield, Kierulff Elctrns.	201-575-6750
NJ	Fairfield, Schweber Elctrns.	201-227-7880
NJ	Fairfield, Hamilton/Avnet Elctrns.	201-575-3390
NJ	Pinebrook, Pioneer-Harvey/Pinebrook	201-227-1262
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NM	Albuquerque, Bells Inds.	505-292-2700
NM	Albuquerque, Hamilton/Avnet Elctrns.	505-765-1500
NY	Binghamton, Pioneer-Harvey/Binghamton	607-748-8211
NY	E. Syracuse, Hamilton/Avnet Elctrns.	315-437-2641
NY	Fairport, Pioneer-Harvey/Rochester	716-381-7070
NY	Hauppauge, Pioneer/Military	516-231-9200
NY	Hauppauge, Lionex Corp.	516-273-1660
NY	Melville, Hamilton/Avnet Elctrns.	516-454-6060
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rochester, Hamilton/Avnet Elctrns.	716-475-9130
NY	Rochester, Schweber Elctrns.	716-424-2222
NY	Westbury, Schweber Elctrns.	516-334-7474
NY	Woodbury, Pioneer-Harvey/Woodbury	516-921-8700
NC	Greensboro, Kierulff Elctrns.	919-872-8410
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
NC	Raleigh, Hamilton/Avnet Elctrns.	919-878-0810
OH	Beachwood, Schweber Elctrns.	216-464-2970
OH	Centerville, Hamilton/Avnet Elctrns.	513-433-0610
OH	Cincinnati, Graham Elctrns.	513-772-1661
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Cleveland, Hall-Mark Elctrns.	216-473-2907
OH	Cleveland, Hamilton/Avnet Elctrns.	216-831-3500
OH	Dayton, Schweber Elctrns.	513-439-1800
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Westerville, Hall-Mark Elctrns.	614-891-4555
OK	Tulsa, Schweber Elctrns.	918-622-8000
OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
OK	Tulsa, Kierulff Elctrns.	918-252-7537
OR	Beaverton, Almac Elctrns. Corp.	503-641-9070
OR	Lake Oswego, Hamilton/Avnet Elctrns.	503-635-8831
OR	Portland, Kierulff Elctrns.	503-641-9150
PA	Horsham, Pioneer/Delaware Valley	215-674-4000
PA	Horsham, Schweber Elctrns.	215-441-0600
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
PA	Pittsburgh, Schweber Elctrns.	412-782-1600
TX	Austin, Pioneer/Austin	512-835-4000
TX	Austin, Hall-Mark Elctrns.	512-258-8848
TX	Austin, Schweber Elctrns.	512-458-8253
TX	Austin, Kierulff Elctrns.	512-835-2090
TX	Austin, Hamilton/Avnet Elctrns.	512-837-8911
TX	Dallas, Hall-Mark Corp.	214-343-5000
TX	Dallas, Schweber Elctrns.	214-661-5010
TX	Dallas, Kierulff Elctrns.	214-343-2400
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Dallas, Hall-Mark Elctrns.	214-341-1147
TX	Houston, Pioneer/Houston	713-988-5555
TX	Houston, Hall-Mark Elctrns.	713-781-6100
TX	Houston, Schweber Elctrns.	713-784-3600
TX	Houston, Kierulff Elctrns.	713-530-7030
TX	Houston, Hamilton/Avnet Elctrns.	713-780-1771
TX	Irving, Hamilton/Avnet Elctrns.	214-659-4111
UT	Salt Lake City, Kierulff Elctrns.	801-973-6913
UT	Salt Lake City, Hamilton/Avnet Elctrns.	801-972-2800
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Hamilton/Avnet Elctrns.	206-643-3950
WA	Seattle, Almac Elctrns. Corp.	206-643-9992
WA	Tukwila, Kierulff Elctrns.	206-575-4420
WI	Brookfield, Schweber Elctrns.	414-784-9020
WI	New Berlin, Hamilton/Avnet Elctrns.	414-784-4510
WI	Oak Creek, Hall-Mark Elctrns.	414-761-3000
WI	Waukesha, Bell Inds.	414-784-0235
WI	Waukesha, Kierulff Elctrns.	414-784-8160

MOTOR-TRONICS, INC., 2142 Industrial Ct., Bldg. F2, Vista, CA 92083, Tel: 619-727-7430 ......1B•1166, 1167

MOTRONICS CORP., Riverside Indl. Pk., Little Falls, NY 13365, Tel: 315-823-4050; Empl.: 90; *Sls. Mgr.:* Thomas J. Breach ......1B•1169

Local Sales Offices & Reps

CA	San Jose, McFarland Assocs. Corp.	408-286-9333
CO	Englewood, Integrated Motion Sys.	303-762-1817
FL	Melbourne, R-Concept	305-725-6993
IN	Beech Grove, Control Sls.	317-353-6094
KS	Shawnee Mission, L.S.C. Inc.	913-362-2121
MA	Southborough, Motion Engrg.	617-485-2144
MI	Livonia, Electrolines	313-591-2428
MN	St. Paul, Northstar Motion & Control Co.	612-770-5311
NY	Clark Mills, KLM Garner	315-853-6126
OH	Chesterland, KT/Depco	216-729-3588
PA	Audubon, Holmes Assocs.	215-666-0636
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
VA	Roanoke, Engrg. & Mktg. Corp. of Virginia	703-986-1410
WI	Milwaukee, Schreiber-Arterburn	414-545-7800

Distributor

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 619-449-2222, TWX: 910-331-1175; Empl.: 200; *Sls. Mgr.:* Jerry Tallent p.731

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 817-483-4422......p.731

MOUSE SYS. CORP., 2336H Walsh Ave., Santa Clara, CA 95051, Tel: 408-988-0211, Telex: 467848; *Sls. Mgr.:* Evelyn Boyd; *Dist. Mgr.:* Barbara Marsh-Wetherell

MOXON INC., See Kode

MPB CORP., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; Empl.: 1600

MPC SYS., Div. of Consulting Systems, RFD Box 441, Fremont, NH 03044, Tel: 603-642-5913; *Sls. Mgr.:* W. Morse

MPH ELCTRNS., 2660 Loma Ave., S. El Monte, CA 91733, Tel: 213-442-7818; *Sls. Mgr.:* A. Pastecci

MPI, 4426 S. Century Dr., Salt Lake City, UT 84107, Tel: 800-821-8848; *Sls. Mgr.:* Jamie Johnston

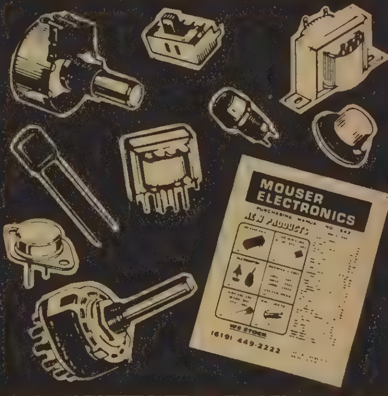
MSI DATA CORP., 340 Fischer Ave., Costa Mesa, CA 92626, Tel: 714-549-6000, TWX: 910-595-1719; Empl.: 750; *Sls. Mgr.:* J. Falvey; *Dist. Mgr.:* S. Altice

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 212-672-6500, Telex: 424431; FSC No.: 18518; Empl.: 25; *Sls. Mgr.:* A. Lederman

Local Sales Offices & Reps

AZ	San Diego, Fetty/Schoenduve	619-292-5136
CA	El Segundo, Fetty/Schoenduve	213-322-4991

ELECTRONIC COMPONENTS



MANUFACTURERS OF QUALITY ELECTRONIC COMPONENTS

•BATTERY HOLDERS & CLIPS • COILS
• CAPACITORS • CONNECTORS • FUSES
• JACKS • KNOBS • LAMPS • PLUGS
• MICROPHONES • POTENTIOMETERS
• RF COILS • RELAYS • RESISTORS
• SEMICONDUCTORS • SPEAKERS
• SWITCHES • TRANSFORMERS

OVER 15,000 DIFFERENT ITEMS IN STOCK!

• Send For New Catalog

MOUSER ELECTRONICS
11433 WOODSIDE AVE. SANTEE, CA 92071
PHONE (619) 449-2222 TWX 910-331-1175

CA	Palo Alto, Tri-Rep	415-965-1822
FL	Lighthouse Pt., R. C. Simon & Co.	305-941-2757
FL	Riverview, R. C. Simon & Co.	813-669-1947
GA	Keenesaw, BWS Mktg.	404-448-7759
IL	McHenry, Mesa, Inc.	815-344-2820
IN	Ft. Wayne, Menze Sls. Inc.	219-747-5616
MD	Laurel, CSDS Inc.	301-490-3800
MA	Framingham, Stone Comp. Sls.	617-875-3266
NY	Plainview, R. Smith Assocs.	516-681-3155
PA	Jenkintown, Arnold Assocs.	215-887-7870
TX	Richardson, Eagle Mktg. Inc.	214-238-5383
EXP	NY, Woodside, MSI Elctrns.	212-672-6500

MTE
CORPORATION

MTE CORP., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, Tel: 414-358-5300, 800-558-4332 **1A**•2208

M-TRON INDS., P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603; Empl.: 226; *Sls. Mgr.:* Mike Huennekens; *Dist. Mgr.:* Karen Hansen **1A**•1393

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Tempe, SSA Sales	602-829-9338
CA	San Diego, Bestronics	619-452-5500
CA	Santa Ana, SC Cubed	714-731-9206
CA	Santa Clara, Criterion Mfg.	408-988-6300
CA	Thousand Oaks, SC Cubed	805-496-7307
CO	Littleton, Simpson Assoc.	303-794-8381
CT	Ridgefield, Phoenix Sls.	203-438-9644
FL	Apopka, G.F. Bohman	305-886-1882
FL	Ft. Lauderdale, Bohman Assoc.	305-979-0008
GA	Stone Mountain, 20th Century	404-292-7088
IL	Arlington Hgts., Micro Sls.	312-956-1000
IN	Fort Wayne, Given Corp.	219-432-5585
IA	West Des Moines, SPS Assoc.	515-225-0607
KS	Olathe, SPS Assoc.	913-764-4460
MD	Ellicott City, Marketing Tech Inc.	301-862-1882
MA	Reading, Kanan	617-944-8484
MI	Detroit, Rathsburg Assoc.	313-882-1717
MN	Bloomington, Com-Tek Sls.	612-888-7011
NE	Panama, SPS Assoc.	800-228-3018
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NJ	Marlton, BGR	609-983-1020
NM	Albuquerque, SSA	505-881-8877
NC	Smithfield, ADI	919-934-8136
OH	Dayton, Lyons Corp.	513-278-0714
OH	Richfield, Lyons Corp.	216-659-9224
SC	Fort Mill, ADI	803-547-2115
TN	Knoxville, 20th Century	615-966-3608
TX	Austin, Mech-Tron Mktg.	512-835-0980
TX	Dallas, Mech-Tron Mktg.	214-343-3786
TX	Houston, Mech-Tron Mktg.	713-462-1432
UT	Midvale, Simpson Assoc.	801-566-3691
VA	Lynchburg, Marketing Tech Inc.	804-384-6459
WA	Redmond, Quadra Sls.	206-883-3550

Local Distributors

AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Wyle Distr. Grp.	602-249-2232
AZ	Phoenix, Sterling Elect.	602-258-4531
AZ	Tempe, CSC Distr.	602-966-0764
AZ	Tempe, Bell Inds.	602-966-7800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Irvine, Ryno Elctrns.	714-261-2500
CA	San Diego, Ryno Elctrns.	619-292-6022
CA	Santa Clara, Capacitors Unltd.	408-946-7676
CA	Santa Clara, Wyle Distr. Grp.	408-727-2500
CA	Tustin, Image Elctrns.	714-730-0303
CO	Thornton, Wyle Distr. Grp.	303-457-9953
CO	Wheatridge, Bell Inds.	303-424-1985
CT	E. Haven, J. V. Elctrns.	203-469-2321
CT	Norwalk, Pioneer Elctrns.	203-853-1515
CT	Orange, Milgray Elctrns.	203-795-0711
CT	Wallingford, Mid-State Elect.	203-265-9900
FL	Orlando, Pioneer Elctrns.	305-834-9090
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Norcross, Pioneer Elctrns.	404-448-1711
IL	Elk Grove, Pioneer Elctrns.	312-437-9680
IL	Hoffman Estates, Inter Comp	312-843-2040
IN	Indianapolis, Advent	317-872-4910
IN	Indianapolis, Pioneer/IN	317-849-7300
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Beltsville, Resco/Wash.	301-937-9100
MD	Gaithersburg, Pioneer	301-921-0660
MD	Rockville, Milgray Elctrns.	301-468-6400
MA	Burlington, Milgray Elctrns.	617-272-6800
MA	Burlington, J.V. Elctrns.	617-273-4300
MA	Lexington, Pioneer Elctrns.	617-861-9200
MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Pioneer Elctrns.	313-525-1800
MN	Bloomington, NWR	612-854-7329
MN	Minneapolis, Stark Elctrns.	612-832-1325
MN	Minnetonka, Pioneer Elctrns.	612-935-5444
MO	St. Louis, Olive Elctrns.	314-426-4500
NJ	Berlin, GCI	609-768-6767
NJ	Marlton, Milgray Elctrns.	609-983-5010
NJ	Mt. Laurel, P.A.C. Elctrns.	609-778-1526
NJ	Pinebrook, Pioneer Elctrns.	201-575-3510
NM	Albuquerque, Sterling Elect.	505-884-1900
NY	Binghamton, Pioneer Elctrns.	607-748-8211
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Woodbury, Pioneer Elctrns.	516-921-8700
NC	Charlotte, Pioneer Elctrns.	704-527-8188
NC	Raleigh, Century Elctrns.	918-872-2203
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Cleveland, Pioneer Elctrns.	216-587-3600
OH	Dayton, Pioneer Elctrns.	513-236-9900
OK	Tulsa, Radio Inc.	918-587-9123
OR	Hillsboro, Wyle Distr. Grp.	503-640-6000
OR	Portland, Radar Elctrns.	503-232-3404
PA	Horsham, Pioneer Elctrns.	215-674-4000
PA	Pittsburgh, Pioneer Elctrns.	412-782-2300
TX	Dallas, Pioneer Elctrns.	214-386-7300
TX	Dallas, Solid State Elctrns.	214-438-5700
TX	Houston, Powerline Elctrns.	713-578-3222
UT	Salt Lake City, Standard Supp.	801-486-3371
UT	West Valley City, Wyle Distr. Grp.	801-974-9953
VT	Richmond, Sterling Elect.	804-226-2190
WA	Bellevue, Wyle Distr. Grp.	206-453-8300
WI	Milwaukee, Marsh Elect.	414-475-6000

MTS SYS., Box 24012, Minneapolis, MN 55424, Tel: 612-937-4000, Telex: 29-0521; Empl.: 800; *Sls. Mgr.:* J. Beal

MUELLER ELEC. CO., 1583 E 31st St., Dept. 20, Cleveland, OH 44114, Tel: 216-771-5225; Empl.: 156; *Sls. Mgr.:* J. E. Wisneski **2**•1528, 1529; **3**•1264, 1265

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-533-3509
AZ	Glendale, Heath Group	602-938-8308
AZ	Phoenix, Heath Group	602-944-4340
CA	Downey, Ungar Sls. Assocs.	213-923-1467
CA	Gardena, Ungar Sales Co.	213-538-2811
CA	Reseda, Ungar Sls. Assocs.	213-342-2671
CA	San Francisco, Maddox Sls.	415-647-5560
CO	Colorado Springs, Norris & Warren Co.	303-576-8697
CO	Denver, Norris & Warren	303-759-1676
FL	Ft. Lauderdale, Cartwright & Bean	305-735-4900
FL	Orlando, Cartwright & Bean	305-422-4531
FL	Tampa, Cartwright & Bean Inc.	305-422-4531
GA	Atlanta, Cartwright & Bean	404-233-2939
IL	Libertyville, R. Klipp Assocs.	312-367-4676
IN	Indianapolis, Sukup & Cox	317-253-5501
KS	Shawnee Mission, K & M Sls.	913-262-1444
MA	Lynn, Keene Sls.	617-595-2300
MA	Springfield, Keene Sls. Co. Inc.	413-785-1158
MI	Ferndale, Hilltronics	313-398-5556
MN	Minneapolis, Boerger & Associates	612-560-3435
MS	Jackson, Cartwright & Bean	601-981-1368
NJ	Medford, Champion Elctrn. Sls.	609-654-0475
NY	Port Washington, Joseph Assocs.	516-883-1829
NY	Webster, Bieniek & Assocs.	716-872-0387
NC	Charlotte, Cartwright & Bean	704-377-5673
NC	Raleigh, Cartwright & Bean	919-781-6560
OH	Akron, Arrow Mktg.	216-733-8901
OH	Mogadore, Arrow Mktg. Co.	216-733-8901
OR	Portland, Jud LeBrun	503-244-6805
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Waco, Jabs Sls.	817-776-3236

M. U. INC., P.O. Box 1007, Oceanside, CA 92054, Tel: 619-757-7576

MUIRHEAD, 1101 Briston Rd., Mountainside, NJ 07092, Tel: 201-233-6010, Telex: 13-8275; Empl.: 60; *Sls. Mgr.:* Gerald M. Pochurek

MULTI-AMP CORP., Indian Head Corp., 4271 Bronze Way, Dallas, TX 75237, Tel: 214-333-3201, TWX: 910-861-9052; Empl.: 350; *Sls. Mgr.:* Robert D. Libbey

MULTICORE SOLDERS, Cantiague Rock Rd., Westbury, NY 11590, Tel: 516-334-7997, TWX: 510-222-5185; Empl.: 1000

MULTI-PLATE CO., INC., 2362 Lu Field Rd., Dallas, TX 75229, Tel: 214-243-1557; *Sls. Mgr.:* David A. Bartley

MULTI PRODS. INTL., 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, Tel: 201-239-8183, Telex: 13-0430; Empl.: 25; *Sls. Mgr.:* LeRoy Gray **1A**•1147, 2206, 2207; **3**•1658

Local Sales Offices & Reps

AL	Huntsville, Elctrns Mfrs. Agts	205-830-4030
AZ	Tempe, Tempe Assoc.	602-831-6720
AR	Little Rock, Erickson Sls. Inc.	501-225-7379
CA	Campbell, Kottmeier Assoc.	408-866-5153
CA	El Monte, Cook Entprs	213-686-2120
FL	Coral Springs, PC Electronic Sales	305-755-3980
GA	Atlanta, Elctrn. Mfrs. Agts.	404-529-0530
IL	Chicago, Esco Assoc.	312-763-0800
IN	Frankfort, C-S Elctrns. Sls.	317-659-1874
KS	Overland Park, Electri-Rep	913-649-2168
LA	Chalmette, Erickson Sls. Inc.	504-271-1976
MA	Norwood, Mac Innis Co.	617-762-8090
MI	Jenison, R.C. Nordstrom & Co	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Proud Industries	612-646-9428
NJ	Cedar Grove, Legtonics Assoc.	201-239-4098
NJ	Cedar Grove, Legtronics Assoc.	201-239-4098
NC	Raleigh, Elctrns. Mfg. Agent	919-781-4139
OK	Oklahoma City, Erickson Sls. Inc.	405-682-2947
OR	Portland, Eltech	503-238-0805
PA	Albrightsville, Centurion Linear	717-722-0166
TN	Knoxville, Elctrn. Mfrs. Agents	615-966-1286
TX	Austin, Erickson Sls. Inc.	512-445-2952
TX	Dallas, Erickson Sls. Inc.	214-739-5833
TX	Houston, Erickson Sls. Inc.	713-980-9606
WA	Bellevue, Eltech	206-643-4330

MULTITECH ELCTRNS. INC., 195 W. El Camino Real, Sunnyvale, CA 94086, Tel: 408-773-8400, Telex: 176004 MAC SUVL; *Sls. Mgr.:* James Tseng

MULTI-TECH INDS., 64 South Main St., P.O. Box A, Marlboro, NJ 07746, Tel: 201-431-0550; Empl.: 40; *Sls. Mgr.:* James L. Bernard

MULTI-TECH SYSTEMS, INC., 82 Second Ave. S.E., New Brighton, MN 55112, Tel: 612-631-3550, TWX: 910-563-3610; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon

MULTI-PLATE
COMPANY, INC.

A custom manufacturer of sophisticated printed circuitry

- prototype & pre-production quantities
- multi-layers up to 20+ layers
- surface mount technology
- high-temperature substrates
- commercial and miltitary

Recipient of the Texas Instrument Semiconductor Group TOP VENDOR award 1981, 1982 and 1983!

MULTI-PLATE COMPANY, INC.
.... when only perfect boards will do

2362 Lu Field Rd. Dallas, Tx. 75229
214/243-1557

MULTI-TRONIX, 3210 Terry Dr, Toledo, OH 43613, Tel: 419-472-0723; *Sls. Mgr.:* K. L. Schepler

MULTIWIRE DIV., Kollmorgen Corp., Andrews Rd., Hicksville, NY 11801, Tel: 516-938-2000, TWX: 510-223-0639

Local Sales Offices & Reps

CA	Anaheim, Multiwire West	714-632-7770
NH	Nashua, Multiwire New England	603-889-0083
NY	Hicksville, Advanced Mfg. Grp.	516-938-2000
NY	Hicksville, Multiwire	516-933-8300; 800-447-0007

MUPAC, 10 Mupac Dr., Brockton, MA 02401, Tel: 617-588-6110, TWX: 710-345-8458; Empl.: 100

Local Distributors

CA	San Francisco, Peters - de Laet, Inc.	415-873-9595
CA	Santa Clara, Peters - de Laet, Inc.	408-727-9440
CT	Wallingford, Sager Electrical Supp. Co.	203-265-4600
MA	Hingham, Sager Electrical Supp. Co.	617-749-6700

MURA CORP., 177 Cantiague Rock Rd., Westbury, NY 11590, Tel: 516-935-3640, Telex: 967-879; Empl.: 165; *Sls. Mgr.:* William Mercurio .. **1A**•2047; **1B**•1090; **2**•2109; **3**•1040, 1041

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-533-5165
CA	Los Alamitos, Santana Sls.	714-827-9100
CA	San Diego, Littlefield & Smith Assocs.	619-455-0055
CA	San Jose, Frequency Control Assocs.	408-446-0200
CA	Saratoga, Frequency Control Assocs.	408-446-0200
CT	Manchester, G. M. Assocs.	203-646-4443
FL	Casselberry, HAI Elctrns., Inc.	305-831-4892
FL	Coral Springs, HAI	305-752-7520
GA	Atlanta, DHR Mktg.	404-451-9848
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IA	Bettendorf, Weisler & Assocs., Inc.	319-344-0566
IA	Davenport, Weisler Assocs.	319-386-5905
LA	Manderville, Design Mktg.	713-237-2319
MA	Framingham, G.M. Assocs.	617-872-4871
MN	Minneapolis, O.E.M. Elctrl. Sls., Inc.	612-559-2448
MS	Jackson, Welch & Doby, Inc.	601-932-5534
MO	Ellisville, Weisler Assocs.	314-394-4543
MO	N. Kansas City, Weisler Assocs.	816-421-1679
NH	Exeter, G. M. Assocs.	603-778-7472
NY	Jericho (Downstate), J-Square Mktg., Inc.	516-935-3200
NC	Charlotte, DHR Mktg., Inc.	704-335-1215
NC	Greensboro, DHR Mktg., Inc.	919-273-2671
NC	Raleigh, DHR Mktg.	919-876-5450
OH	Cleveland, Arthur H. Baier & Assocs.	216-461-6161
OH	Dayton, Arthur H. Baier & Assocs.	513-276-4128
OK	Broken Arrow, Design Mktg., Inc.	918-258-8656
OR	Portland, Jas J. Backer Co.	503-297-2218
OR	Salem, Jas J. Backer Co.	503-362-0717
PA	Stewartstown, Eastern Comps.	301-323-7104
PA	W. Conshohocken, Eastern Comps.	215-825-8610
SC	Greenville, DHR Mktg.	803-235-3594
TN	Knoxville, DHR Mktg., Inc.	615-584-5286
TN	Memphis, Welch & Doby, Inc.	901-683-8099
TX	Conroe, Design Mktg., Inc.	713-273-2319
TX	Dallas, Design Mktg., Inc.	214-680-9767
TX	Hurst, Design Mktg.	817-268-2004
TX	Round Rock, Design Mktg., Inc.	512-255-9896
VA	Manassas, Eastern Comps.	703-471-1025
WA	Seattle, Jas J. Backer Co.	206-285-1300
WI	Cedarburg, Bransky Sls.	414-377-6837

Local Distributors

AZ	Phoenix, Elctrn. Parts	602-277-7281
AR	Little Rock, Carlton-Bates	501-462-9100
CA	Costa Mesa, Marvac Elec.	714-540-3280
CA	Dublin, Valley Elctrns.	415-829-5960
CA	Lakeside, Mouser Corp.	714-449-2220
CA	Mt. View, U-DO Elctrns.	415-968-8894
CA	N. Hollywood, Mitchell Co.	213-875-1552
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	Sunnyvale, Com-Kyl	408-734-9660
CO	Colorado Springs, Colorado Springs Walker Elec.	303-636-1661
CO	Denver, Fistell's	303-629-1312
CO	Denver, Denver Walker Elec.	303-935-2401
CO	Denver, Elctrn. Parts	303-744-1992
CT	W. Hartford, Signal Center	203-233-8551
FL	Ft. Lauderdale, Southeastern Elctrns.	305-536-4131
FL	Miami, Gulf Elctrns.	305-592-6538
FL	Miami, Electro Standards	305-663-6973
FL	Tallahassee, Dell Elctrns.	904-224-5145
ID	Twin Falls, Idaho Central Elctrns.	
IL	Chicago, McMaster-Carr	312-834-9600
IL	La Salle, Warren Radio	815-223-4028
IL	Rockford, Jay Tronics	851-965-8786
IN	Evansville, Ohio Valley Sound	812-425-6173
IN	Evansville, Hutch & Son	812-425-7201
IN	Michigan City, Tri-State Elctrns.	219-872-5551
IA	Des Moines, Mid State Dist.	515-244-7231
LA	New Orleans, Wm. B. Allen Co.	504-525-8222
MI	Augusta, Great Lakes	616-731-4156
MI	Grand Rapids, Stotts Freidman	616-459-0216
MN	Minneapolis, Acme Elctrns.	612-338-4755
MS	Jackson, Ellington Elctrns.	601-355-0561
MO	St. Louis, Olive Elctrns.	314-426-4500
MT	Missoula, Northwest Distrs.	406-543-5181
NE	Lincoln, Scott Elctrns.	402-466-8221
NJ	Edison, Willian Elctrns.	201-985-3700
NJ	Marlton, Resco Elctrns.	609-983-6552
NJ	Raritan, Masters Supp.	201-725-3533
NM	Carslbad, Indl. Elctrns.	505-887-1121
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Jamaica, All State Elctrns.	212-739-3916
NY	Levittown, Eddie Elctrns.	
NY	NYC, B&B Elctrns.	212-446-5120
NY	NYC, Barry Elctrns.	212-925-7000
NY	Plainview, Atlas West	516-576-9100
NC	Charlotte, United Elctrns. Supp.	704-372-2650
ND	Fargo, S&S Elctrns.	701-237-5003
OH	Columbus, Whitehead Radio	614-224-1186
OH	Columbus, Comps. Unltd.	614-252-0728
OH	Freemont, J&B Elctrns.	419-332-9334
OR	Beaverton, Norvac Elctrns.	503-644-1025
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Pittsburgh, CRS Elctrns.	412-431-7700
TX	Dallas, Wholesale Radio	214-824-3001
TX	Ft. Worth, Indl. Elctrns.	817-731-7321
TX	Houston, Lenert Co.	713-225-1465
WA	Seattle, Westlake Distrs.	206-282-3660
WV	Arlington, Arlington Elctrns.	703-524-2412
WV	Fairmont, State Elctrns.	304-366-4520
WI	Madison, Superior Elctrns.	608-257-1477
WI	Madison, Satterfield Elctrns.	608-257-4801
WI	Oskosh, Elctrn. Inds.	414-235-8930

MURATA ERIE NORTH AMERICA, INC., 1148 Franklin Rd., S.E., Marietta, GA 30067, Tel: 404-952-9777, Telex: 54-2329, TWX: 810-766-1531; Empl.: 1800; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* C. Augello ....**1A**•1148-1151, 1394, 1395, 1576, 1604, 1605, 1903-1905, 2016, 2048, 2049, 2107, 2209; **3**•1042, 1659

Local Sales Offices & Reps

AL	Huntsville, Jack W. Harvey & Assocs.	205-536-4414
AZ	Scottsdale, Murata Erie N. America	602-941-2667
CA	Los Altos, Recht. Assocs.	415-964-6321
CA	Palo Alto, Murata Erie North America	415-327-1520
CA	Santa Ana, Murata Erie North America	714-835-4822
FL	Maitland, Murata Erie North America	305-644-0954
FL	Plantation, Innovative Mktg., Inc.	305-583-8895
GA	Marietta, Murata Erie N. America	404-952-9777
IL	Des Plaines, Murata Erie North America	312-297-5560
IN	Ft. Wayne, Murata Erie North America	219-484-1528
IN	Indianapolis, Jack Harvey & Assocs.	317-872-1031
IN	Kokomo, Jack Harvey & Assocs.	317-453-4260
MD	Columbia, Murata Erie North America	301-992-6612
MA	Wakefield, Murata Erie North America	617-245-7880
MN	Plymouth, Murata Erie North America	612-553-1594
NJ	Springfield, Radix	201-467-4970
NC	Greensboro, Murata Erie North America	919-299-1905
OK	Tulsa, Murata Erie N. America	918-663-2882
OR	Beaverton, Caruso & Northcutt, Inc.	503-646-4973
TN	Johnson City, Jack Harvey & Assocs.	615-928-7588
TX	Richardson, Murata Erie North America	214-238-8211
WA	Bellevue, Caruso & Northcutt, Inc.	206-454-9699

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, R.V. Weatherford	602-272-7144
AZ	Tempe, Arrow Elctrns.	602-968-4800
AZ	Tempe, Powell Elctrns.	602-967-7538
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Anaheim, R.V. Weatherford Co.	714-547-0981
CA	Belmont, Varitech Elctrns.	415-593-3300
CA	Chatsworth, Shelley Elctrns.	213-998-3333
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	Garden Grove, Inductive Prods. Inc.	714-892-7749
CA	Garden Grove, Natl. Capacitor Supp.	213-598-9611
CA	Glendale, R.V. Weatherford Co.	213-849-3451
CA	Inglewood, Newark Elctrns.	213-678-0441
CA	Mountain View, Shelly Elctrns.	415-969-1820
CA	Newport Beach, Arrow Elctrns.	714-851-8961
CA	Pomona, R.V. Weatherford Co.	714-623-1261
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Diego, R.V. Weatherford Co.	714-695-1700
CA	San Diego, Arrow Elctrns.	714-565-4800
CA	Santa Clara, Pyramid Elctrns. Supp.	408-727-9810
CA	Santa Clara, Intl. Standard Comps.	408-496-0411
CA	Sunnyvale, Acacia Sls.	408-745-7200
CA	Sunnyvale, R.V. Weatherford Co.	408-738-8694
CA	Sunnyvale, Capsco	408-734-3020
CA	Sunnyvale, Powell Elctrns.	408-739-4321
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Aurora, Arrow Elctrns.	303-696-1111
CO	Boulder, Shelley Elctrns.	303-442-2718
CO	Denver, Newark Elctrns.	303-423-7941
CO	Denver, R.V. Weatherford Co.	303-428-6900
CO	Englewood, Time Electrns.	303-850-7701
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Orange, Milgray Elctrns.	263-795-0711
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
FL	Palm Bay, Arrow Elctrns.	305-725-1480
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
GA	Norcross, Newark Elctrns.	404-448-1300
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Bell Inds.	312-982-9210
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IA	Cedar Rapids, Advent Elctrns. Inc.	319-363-0221
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Baltimore, Resco	301-823-0070
MD	Beltsville, Resco	301-937-9100
MD	Columbia, Time Elctrns.	301-964-3090
MD	Columbia, Powell Elctrns.	301-621-4070
MD	Rockville, Milgray Elctrns.	301-468-6400
MA	Burlington, Milgray Elctrns.	617-272-6800
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Westboro, Powell Elctrns.	617-366-6100
MA	Woburn, Time Elctrns.	617-935-8080
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-7220
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Arrow Elctrns.	616-243-0912
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, The Joel Co.	612-545-5669
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	St. Louis, Time Elctrns.	314-391-6444
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Marlton, Arrow Elctrns.	609-596-8000
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NJ	Whippany, Tonar Inds.	201-884-1400
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Buffalo, Newark Elctrns.	716-892-4321
NY	Farmingdale, Powell Elctrns.	516-293-6363
NY	Farmingdale, Arrow Elctrns.	516-694-6800
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Lynbrook, Varitech Elctrns.	516-593-9300
NY	Melville, Arrow Elctrns.	516-391-1485
NY	Pittsford, Milgray Elctrns.	711-385-9330
NY	Rochester, Arrow Elctrns.	716-275-0300
NC	Cary, Powell Elctrns.	919-467-1212
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Raleigh, Resco/Raleigh	919-781-5700
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Cleveland, Newark Elctrns.	216-361-4700
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Columbus, Newark Elctrns.	614-451-0002
OH	Dayton, Elctrn. Mktg. Corp.	513-439-3441
OH	Highland Hts., Elctrn. Mktg. Corp.	216-442-3441
OH	Solon, Arrow Elctrns.	216-248-3990
OK	Tulsa, Arrow Elctrns.	918-665-7700
OR	Lake Oswego, Moore Elctrns.	503-684-3100
OR	Portland, Newark Elctrns.	503-257-0741
OR	Tigard, Arrow Elctrns.	503-684-1690
PA	Broomall, Time Elctrns.	215-359-1200
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Versailles, Newark Elctrns.	412-834-8504
TX	Addison, R.V. Weatherford Co.	214-931-7333
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Dallas, Powell Elctrns.	214-350-4186
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Houston, R.V. Weatherford Co.	713-688-7406

UT	Salt Lake City, Arrow Elctrns.	801-539-1135
VA	Richmond, Arrow Elctrns.	804-282-0413
WA	Bellevue, Arrow Elctrns.	206-634-4800
WA	Seattle, R.V. Weatherford Co.	206-575-1340
WI	Oak Creek, Arrow Elctrns.	414-764-6600
WI	Waukesha, Bell Inds.	414-784-0235

MURATA ERIE NORTH AMERICA, INC., 5 Fraser Ave., Trenton, ON K8V551, Canada, Tel: 613-392-2581

MURATA MFG. CO. LTD., 26-10 2-chome-Temjin, Nagaoka-Kyo-Shi, Kyoto, Japan, Tel: 075-921-9111, Telex: J64270; Empl.: 1700; *Sls. Mgr.:* O. Otaka

MUSHIELD CO., Div. Bomco, Inc., 121 Madison St., P.O. Box W, Malden, MA 02148, Tel: 617-321-4410; FSC No.: 22780; Empl.: 10; *Sls. Mgr.:* Mark Standley .... **2**•1915

Local Sales Offices & Reps

CA	Los Angeles, Yarbrough Sls.	213-254-5101
CA	San Anselmo, Technology Sys.	415-459-2774
CO	Littleton, The McCarthy Co.	303-773-0643
GA	Atlanta, Biondo Assoc.	404-394-9640
MA	Newtonville, Shain Assocs.	617-965-3060
MN	Edina, Wendell Lee & Assoc.	612-831-5056
OH	Akron, Augnat Assoc.	216-273-1211
PA	Orwigsburg, Jase Assoc.	717-366-1109
TX	Cypress, Wessco	713-469-7814

MVP ELCTRNS., 1161 N. Tustin, Orange, CA 92667, Tel: 714-639-9246, Telex: 678401; Empl.: 4; *Sls. Mgr.:* M. Vander Plaats

MWS

MWS WIRE INDS., 31200 Cedar Valley Dr., Westlake Village, CA 91362, Tel: 818-991-8553, TWX: 910-336-1689; FSC No.: 51668; *Sls. Mgr.:* M. D. McClure .... **2**•2110, 2111

ncc NATIONAL CONTROLS

AUTHORIZED DISTRIBUTOR

E S I

ELECTRIC SWITCHES
INCORPORATED

2478 FLETCHER DR., LOS ANGELES, CA. 90039

(213) 660-1310

CALL TOLL FREE
NATIONAL:

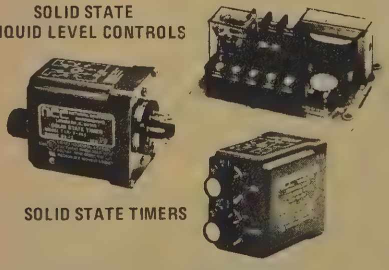
800-421-8855

CALIFORNIA (except 213):

800-252-4640

TWX: 910-321-2971

SOLID STATE
LIQUID LEVEL CONTROLS



SOLID STATE TIMERS

SEE COMPLETE PRODUCT LINE UNDER
SWITCHES — SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

MYLEE DIGITAL SCIENCES, 155 Weldon Pkwy., Maryland Heights, MO 63043, Tel: 314-567-3420; Empl.: 100; *Sls. Mgr.:* G. Graves

NAE, 69 Bennett St., Lynn, MA 01905, Tel: 617-598-4800, TWX: 710-334-0254; FSC No.: 51182; Empl.: 100; *Sls. Mgr.:* Rick Kassiotis; *Dist. Mgr.:* Ellen Madden

NAMCO CONTROLS, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, Telex: 24-1566; Empl.: 200; *Sls. Mgr.:* Jon Slaybaugh, V.P./Sales-Mktg.

NAMCO-LEUZE, A Namco Controls Affiliate Co., 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, Telex: 24-1566; *Sls. Mgr.:* Jon Slaybaugh, V.P./Sales-Mktg.

NAMIKI PRECISION JEWEL CO., LTD., 15 Essex Rd., Paramus, NJ 07652, Tel: 201-368-8310, TWX: 710-990-1273; FSC No.: 201-569-2170

NANMAC CORP., 9 Mayhew St., Framingham, MA 01701, Tel: 617-872-4811; Empl.: 32; *Sls. Mgr.:* G. Nanigian; *Dist. Mgr.:* J. Manigian

NARDA MICROWAVE CORP., 435 Moreland Rd., Hauppauge, NY 11788, Tel: 516-231-1700, TWX: 510-221-1867; *Sls. Mgr.:* John Coppola

NASHUA CORP., 44 Franklin St., Nashua, NH 03061, Tel: 603-880-2889, Telex: 943406; *Sls. Mgr.:* Chet Mielcarz

NATEL ENGRG. CO., INC., 4550 Runway St., Simi Valley, CA 93063, Tel: 805-581-3950, TWX: 910-494-1959; Empl.: 89 .... **1A**•1678, 1679

NATIONAL BERYLLIA CORP., Greenwood Ave., Haskell, NJ 07420, Tel: 201-839-1600, TWX: 710-988-5363; Empl.: 200

Distributor

NATIONAL CAPACITOR, 11731 Markon Dr., Garden Grove, CA 92641, Tel: 714-892-7749, 213-598-9611, 800-854-2451, TWX: 910-596-1316 .... **1A**•1180

NATIONAL CONTROLS CORP., 931 N. DuPage Ave., Lombard, IL 60148, Tel: 312-932-6900; Empl.: 200

NATIONAL ELECTRIC CABLE

NATIONAL ELECTRIC CABLE, 16566 S.W. 72nd Ave., Portland, OR 97223, Tel: 503-620-9400, Telex: 36-0963; FSC No.: 5P935; Empl.: 125; *Sls. Mgr.:* Jeff Cook .... **2**•2114, 2115

Local Sales Offices & Reps

CA	Hayward	415-493-1100
CO	Englewood	303-797-8448
IL	Elk Grove Village	312-593-8100
OR	Portland	503-620-9400
TX	Houston	713-464-8555

NATIONAL ELCTRN. DISTRS. ASSN., 1420 Renaissance Dr., Ste. 211, Park Ridge, IL 60068, Tel: 312-298-9747

NATIONAL INSTRUMENTS, 12109 Technology Blvd., Austin, TX 78759, Tel: 512-250-9119, Telex: 756737 NAT INST AUS; *Sls. Mgr.:* Don Nadon .... **3**•1266

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
CA	Mountain View, Thorson West	415-964-9300
CO	Castle Rock, Odyssey 1	303-688-3555
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
MD	Linthicum, KD Assocs.	301-859-5151
MA	Reading, Scheinfein Assocs.	617-944-2304
MN	Bloomington, Sector Engrg. Sls.	612-888-6920
NM	Albuquerque, Odyssey	505-265-6645
OH	Chesterland, EQS Systems	216-729-2222
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280

Local Distributors

AZ	Phoenix, Odyssey 1	602-246-8846
CA	Mountain View, Thorson West	415-964-9300
CO	Castle Rock, Odyssey 1	303-688-3555
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
MD	Linthicum, KD Assocs.	301-859-5151
MA	Reading, Scheinfein Assoc.	617-944-2304
MN	Bloomington, Sector Engrg. Sls.	612-888-6920
NM	Albuquerque, Odyssey 1	505-265-6645
OH	Chesterland, EQS	216-729-2222
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280

NATIONAL MICRONETICS, Route 28, West Hurley, NY 12136, Tel: 914-338-0333, TWX: 510-247-8046; Empl.: 900; *Sls. Mgr.:* P. A. Rivelli

NATIONAL POWER TECHNLG., Natl. Technlg., 2111 Howell Ave., Anaheim, CA 92806, Tel: 714-937-1301; Empl.: 85; *Sls. Mgr.:* Harold Myers .... **3**•1660

Local Sales Offices & Reps

CA	Canoga Park, Cummings & Assocs.	818-340-6035
CA	Palo Alto, Abbott Engrg. Co., Inc.	415-968-2265
CA	San Diego, Mesa Engrg.	619-278-8021
CO	Denver, Cummings & Assocs.	303-455-6860
FL	Orlando, Gillum Sls., Inc.	305-857-2110
KY	Ft. Mitchell, G. W. Thelen	606-341-8181
MD	Randallstown, Beacon North	301-655-2265
MA	Chelmsford, Encotronics	617-256-4207
NY	Wantagh, Bytec	516-781-7400; 201-531-7792
OH	Medina, G. W. Thelen	216-727-1293
TX	Irving, Kite Elctrn. Sls. Co., Inc.	214-438-9336
UT	Salt Lake City, Cummings & Assocs.	801-263-8131
VA	Fairfax, Beacon North	703-591-1300
VA	Forest, Beacon North	804-239-8486
WA	Bellevue, Underwood-Hanify	206-451-8223
WA	Vancouver, Underwood-Hanify	206-695-2311
WI	Greenfield, Olympic	414-281-9294

NATIONAL SEMICONDUCTOR CORP., 2900 Kifer Rd., 23-200, Santa Clara, CA 95051

NATIONAL SEMICONDUCTOR OPTOELECTRONICS, 365 Jordan Road, Troy, NY 12180-8396, Tel: 518-271-2100, TWX: 710-444-4962; *Dist. Mgr.:* Donna McLaughlin

NATIONAL SEMICONDUCTORS, LTD., See Silonex Inc.

NATIONAL SOLID STATE DEVELOPMENT, INC., See NSD

NATIONAL SONICS/XERTEX CORP., 250 Marcus Blvd., Hauppauge, NY 11787, Tel: 516-273-6600, Telex: 14-4545; Empl.: 140; *Sls. Mgr.:* John Kristoffersen

NATIONAL-STANDARD CO., 601 N. 8th, Niles, MI 49120, Tel: 616-683-8100, Telex: 25-8453, TWX: 810-270-3153; Empl.: 1000; *Sls. Mgr.:* J. L. Dayton; *Dist. Mgr.:* J. L. Dayton

NATIONAL TELEPHONE & ELCTRNS. INC., 7561 N.W. 77th Terr., Miami, FL 33166, Tel: 305-885-9423; Empl.: 30

ntt
NATIONAL
TEL·TRONICS

NATIONAL TEL-TRONICS, State Road Hill, Meadville, PA 16335, Tel: 814-724-6440, Telex: NATL TELMEAD 91-4405; Empl.: 250; *Sls. Mgr.:* Marion K. Manzi; *Dist. Mgr.:* Marion K. Manzi .... **2**•1530, 1531

Local Sales Offices & Reps

AL	Birmingham, Southeastern First Rep	205-967-7082
AZ	Phoenix, Finn-Pat Co.	602-954-0301
CA	Garden Grove, West Elctrn. Sls. Co.	714-898-0120
CA	San Diego, CK Associates	619-279-0420
CA	Santa Ana, Electrotechnical Sales	714-546-9305
CA	Sunnyvale, Ward Elctrn. Packaging Sls.	408-730-0993
CO	Denver, Donohue Sls. Co.	303-455-1719
CT	Wallingford, Marathon Sls. Ltd.	
FL	Kissimmee, Southeastern First Rep	305-846-1306
FL	Melbourne, Southeastern First Rep	305-784-4723

FL	North Palm Beach, Southeastern First Rep	305-844-3758
GA	Atlanta, Southeastern First Rep	404-393-2073
IL	Chicago, Electro-Mech Sls. Co.	312-777-0554
IN	Columbus, Tech. Reps.	812-376-9226
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MA	Hopkinton, Marathon Sls. Ltd.	617-435-6984
MI	Union Lake, Randall Sales Inc.	313-363-7129
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Beams Co.	314-569-1069
NJ	Cherry Hill, Ned Krouse Assocs.	609-424-3543
NJ	Nutley, Falk-Baker Assocs.	201-661-2430
NY	E. Syracuse, Nycom	315-437-8343
NC	Raleigh, RepCo Mktg.	919-787-7887
OH	Akron, Imtech	216-666-1185
OH	Dayton, Imtech	513-278-6507
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Pittsburgh, Imtech	412-344-0844
TN	Greeneville, Dimark	615-639-0113
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-988-1600
TX	Hurst, Allied Comps.	817-589-0456
TX	Round Rock, Allied Comps.	512-244-1166
UT	Salt Lake City, Meridian Mktg.	801-968-4177
WA	Bellevue, Panoco	206-454-2503

Local Distributors

AZ	Phoenix, Tri-Tek, Inc.	602-995-9352
CA	Anaheim, Besco Industries	714-635-0380
CA	Haywood, Allied Elctrns.	415-487-5250
CA	Industry, Ital Electronics	818-968-8515
CA	Redondo Beach, Mark Elctrns.	213-772-2141
CA	San Jose, Besco Industries	408-946-8980
CA	Santa Ana, Compu Serv	714-546-5140
CA	Santa Ana, CR Elctrns.	714-556-2040
CO	Arvada, Denver Wintronics	303-431-7161
CO	Denver, CSID	303-292-9594
CT	Bethel, Heilind Elctrns.	203-797-8600
FL	Pompano Beach, Components South	305-971-0350
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Franklin Park, Besco Industries	312-451-1230
IN	Fort Wayne, Graham Elctrn.	219-423-3422
IN	Indianapolis, Graham Elctrn.	317-634-8202
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Lynn, Land Elctrns.	617-592-2220
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
NH	Dover, American Radio	603-742-6800
NH	Hudson, Heilind Elctrns.	603-883-9536
NJ	Clifton, Meltronics, Inc.	201-340-3200
NY	Buffalo, Summit Distributors	716-884-3450
NY	Port Washington, Connector Concepts	516-883-3800
NY	Rochester, Summit Distributors	716-334-8110
NC	Winston-Salem, Kirkman Elctrns. Inc.	919-722-9131
OH	Centerville, Charles V. Clark	513-435-3000
OR	Portland, United Radio Supp.	503-233-7151
PA	Huntingdon Valley, Shap Elctrns.	215-322-7150
TX	Dallas, Heilind Elctrns.	214-351-2058
TX	Ft. Worth, Allied Elctrns.	817-336-5401
WA	Seattle, Pacific Elctrns.	206-575-1050

NATIONAL WIRE & CABLE CORP., 136 San Fernando Rd., Los Angeles, CA 90031-1780, Tel: 213-225-5611, Telex: 181409, TWX: 910-321-4155; FSC No.: 04569; Empl.: 225 .... **2**•2116-2132

Local Sales Offices & Reps

AZ	Phoenix, Coker Assoc.	602-277-7148
AR	Fort Smith, Electro-Related Prod.	501-452-4130
CA	Redwood City, National Wire & Cable	415-365-1952
CA	San Diego, McKinley Elctrn. Sls.	619-271-7221
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Arvada, Arrowhead Sls.	303-423-5556
FL	Altamonte Springs, Gugel-Tuttle Assocs.	305-788-0845
FL	Orlando, National Wire & Cable	305-898-3801
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
HI	Hilo, Kirco Corp.	808-959-3888
IL	Northfield, H. S. Tollaksen	312-441-6644
KS	Baxter Springs, P.M.I. Sls.	316-856-2133
MD	Glen Burnie, Faion Lott	301-744-4611
MA	Needham, Mullin Tech. Sls.	617-444-4740
MI	Livonia, Luebbe Sls.	313-477-3131
MN	Edina, Electro Sls. Inc.	612-941-2143
NJ	Wayne, GT Assoc.	201-694-6040
NY	Farmingdale, National Wire & Cable	516-752-8038
NY	Sodus, Kehoe Comp. Sls.	315-483-9122
OH	Cincinnati, Luebbe Sls.	513-891-5770
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Dayton, Luebbe Sls.	513-294-0426
PA	Hatboro, Jacobsen Assocs.	215-674-2937
TX	Fort Worth, J. H. Gibbs Assocs.	817-430-1861
WA	Olympia, Bergford Assocs.	206-866-2001

NATIONWIDE ELECTRONIC SYSTEMS, See NES, Inc.

NAUGLER ENGRG., Off Dunham Rd., Beverly, MA 01915, Tel: 617-922-5634; FSC No.: 05222; Empl.: 10; *Sls. Mgr.:* Charles A. Osborn

NAZ-DAR INTL., 1087 N. Branch St., Chicago, IL 60622, Tel: 312-943-8338, Telex: 25-3303; Empl.: 53; *Sls. Mgr.:* Don Finwall; *Dist. Mgr.:* Don Finwall

N.C.E., Mail Station 331, 9925 Lyndale Ave. S., Bloomington, MN 55420, Tel: 612-890-1360; *Sls. Mgr.:* Hortense M. Rowe .... **3**•1420, 1421

NCR COMTEN, INC., NCR Corp., 2700 Snelling Avenue N., St. Paul, MN 55113, Tel: 612-638-7777, Telex: 6879018 COMTEN, TWX: 910-563-3661; FSC No.: 7025-0010; *Sls. Mgr.:* Lewis M. Meador

NCR MICROELECTRONICS DIV., NCR Corp., 8181 Byers Rd., Miamisburg, OH 45342, Tel: 800-543-5618, 513-866-7471, Telex: 241669 NCR NVEM MSBG; FSC No.: 60924; *Sls. Mgr.:* W. David Major

NCR CORP., Terminal Sys Div., Babcock Hall, Terrace Hill, Ithaca, NY 14850, Tel: 607-273-5310

NEC ELCTRNS. USA INC., NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086, Tel: 408-745-6520, Telex: 35-7475, TWX: 910-339-9539; *Sls. Mgr.:* Robert Buchanan; *Dist. Mgr.:* Jason Stewart

NEC INFOR. SYS., 5 Militia Dr., Lexington, MA 02173, Tel: 617-862-3120, Telex: 92-3434; Empl.: 250; *Sls. Mgr.:* Harry Segal

NEDA, See National Elctrn. Distrs. Assn.

NEFF INSTR., 700 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-2281, TWX: 910-585-1833; Empl.: 125; *Sls. Mgr.:* James T. Barber

NELSON STUD WELDING TRW INC., 28th & Toledo Ave., Lorain, OH 44055, Tel: 216-245-6931, Telex: 980466; Empl.: 350; *Sls. Mgr.:* B. Robinson

NEPENTHE/YAMAICHI, 2471 E. Bayshore, #520, Palo Alto, CA 94303, Tel: 415-856-9332, TWX: 910-373-2060; FSC No.: 415.856 8650; *Sls. Mgr.:* G. Hall

NESHAMINY TRANSFORMER, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925, Tel: 215-794-7411; *Sls. Mgr.:* Philip Klein

NES

For the finest in Panel Meters!

NES, INC., 1536 Brandy Pkwy., Streamwood, IL 60103, Tel: 312-289-8820; Empl.: 293; *Sls. Mgr.:* David A. Voelker; *Dist. Mgr.:* David A. Voelker .... **1B**•1091; **3**•1088, 1136, 1167, 1338-1341

Local Sales Offices & Reps

CA	Palo Alto, Priz Co.	415-326-9333
IL	Moline, Jim Otis & Assocs.	309-762-9311
IN	Indianapolis, Electro Dev. & Engrg. Co.	317-547-5274
LA	Baton Rouge, Control Sys. Consultants	504-292-1462
MD	Baltimore, Wistex, Inc.	301-366-6303
NE	Lincoln, Jim Otis & Assocs.	402-474-2390
NY	Albany, L-Tron Assocs. Corp.	518-482-1987
NY	Rochester, L-Tron Assocs. Corp.	716-436-4410
OH	Cincinnati, Anderson-Bolds	513-528-5680
OH	Cleveland, Anderson-Bolds	216-229-4700
PA	Wayne, Wistex, Inc.	215-687-5930
UT	Sandy, Priz Co.	801-571-7311
WI	Brookfield, Bil, Inc.	414-783-5252

Local Distributors

IL	Bridgeview (Chicago), Norman Equip. Co.	312-430-4000
KY	Louisville, Main Elec.	502-587-6511
MN	St. Paul, Century Controls	612-222-7355
NC	Charlotte, General Elctrn. of Charlotte	704-568-6793
SC	Charleston, Flow Control	803-722-0176
TX	Houston, Quality Instr. Lab	713-524-0528

NETCOM, 3002 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-5100, TWX: 910-686-5478; FSC No.: 57193; Empl.: 85; *Sls. Mgr.:* Wayne Roeder

NEUTRIK PRODUCTS, 77 Selleck St., Stamford, CT 06902, Tel: 203-348-2121; Empl.: 40; *Sls. Mgr.:* Peter Wellikoff

Local Sales Offices & Reps

CA	North Hollywood, MCS Mktg.	818-980-1188
CA	Santa Clara, Warren Assocs.	408-988-7762
CO	Wheatridge, Brake & Assocs.	303-431-5791
FL	Miami, World Wide Products	305-754-5475
GA	Atlanta, Millar Elctrns.	404-261-6160
IL	Northbrook, Steffey Mktg.	312-480-3575
IN	Fort Wayne, N. Browning & Co.	219-432-9738
KS	Kansas City, BC Elctrn. Sls.	913-342-1211
KS	Wichita, BC Elctrn. Sls.	316-942-9840
KY	Louisville, N. Browning & Co.	502-955-6473
MD	Wheaton, Taub Sls.	301-942-3100
MA	Braintree, Anderson Sls.	617-848-9194
MI	Ann Arbor, Audio Mktg. Concepts	313-663-9733
MN	Golden Valley, Ambassador Indl. Mktg.	612-542-8437
MO	Bridgeton, BC Elctrn. Sls.	314-291-1101
NJ	Englewood, Baum & Epstein Assocs.	212-564-4105
NY	Baldwinsville, Darmstedter Assocs.	315-638-1261
NC	Raleigh, Millar Elctrns.	919-787-9564
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Erie, N. Browning & Co.	814-456-6435
TX	Dallas, Dimenson Mktg.	214-348-9657
WA	Seattle, Earl & Brown Co.	206-284-1121

NEW ENGLAND INSTR., 14 Kendal Lane, Natick, MA 01760, Tel: 617-875-9711, TWX: 710-346-0398; Empl.: 600

NEW ENGLAND SMELTING WORKS, INC., 502 Union St., W. Springfield, MA 01090, Tel: 413-734-6491; FSC No.: 3439; Empl.: 35; *Sls. Mgr.:* David R. Saffer

Local Sales Offices & Reps

MI	Southfield, New England Smelting Wks. Sls.	313-355-0393; 800-521-0352

NEW HAMPSHIRE BALL BEARINGS, INC., Rte. 202, Peterborough, NH 03458, Tel: 603-924-3311, TWX: 710-364-1805; Empl.: 1000

NEW HAVEN WIRE & CABLE, P.O. Box 266, New Haven, IN 46774, Tel: 219-493-4489, Telex: 232414; Empl.: 52

NEWMAN, M. M., CORP., Heli-Tube Div., P.O. Box 615, Marblehead, MA 01945, Tel: 617-631-7100; FSC No.: 09106; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel .... **2**•2133

NEW MEDIA GRAPHICS CORP., 279 Cambridge St. #5, Burlington, MA 01803, Tel: 617-272-8501

NEWPORT

DIGITAL PANEL METERS & PRINTERS

AUTHORIZED DISTRIBUTORS

METERMASTER

FOR

Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration

METERMASTER LOCATIONS:

ARIZONA	
Phoenix	(602) 243-4111
Tucson	(602) 792-3411
CALIFORNIA	
Los Angeles	(213) 685-4340
Palo Alto	(415) 968-0313
San Diego	(619) 560-4841
GEORGIA	
Atlanta	(404) 446-0166
ILLINOIS	
Chicago	(312) 593-8650
MASSACHUSETTS	
Boston	(617) 523-2580
MINNESOTA	
Minneapolis	(612) 332-6117
MISSOURI	
St. Louis	(314) 454-0241
NEW MEXICO	
Albuquerque	(505) 292-3330
OHIO	
Cleveland	(216) 651-4100
OKLAHOMA	
Tulsa	(918) 582-1444
PENNSYLVANIA	
Pittsburgh	(412) 261-4548
TEXAS	
Austin	(512) 473-8876
Dallas	(214) 271-5671
Houston	(713) 733-9814
WISCONSIN	
Milwaukee	(414) 643-0554
ALL OTHER STATES	**(800) 962-8128**

NEWPORT ELECTRONICS, 630 E. Young St., Santa Ana, CA 92705, Tel: 714-540-4914, TWX: 910-595-1787; Empl.: 150 .... 3•1342, 1343

Local Sales Offices & Reps

AZ	Phoenix, PLS Assocs.	602-246-6614
CA	Campbell, Luscombe Engrg. Co.	408-370-2020
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CO	Englewood, PLS Assocs.	303-773-1218
FL	Orlando, Gra-Mar	305-894-3351
IL	Arlington Hgts., Brainard-Wilson	312-437-2700
IN	Carmel, Brainard-Wilson	317-844-2800
KS	De Soto, Midtec Assocs.	913-441-6565
LA	Baton Rouge, Alpha Engrg.	504-769-3740
MD	Perry Hall, Electra-Tech	301-256-2723
MA	Bedford, Eastronix, Inc.	617-275-5775
MI	Farmington, Amtech Reps.	313-474-8300
MN	Eden Prairie, Rockmore Sls. Corp.	612-941-1390
MO	Florissant, Midtec Assocs.	314-837-5200
NJ	Parlin, JMR Sls.	201-727-5335
NM	Albuquerque, PLS Assocs.	505-345-5501
NY	East Setauket, JMR Sls., Inc.	516-689-8871
NY	Skaneateles, ADN Entprs.	315-685-8991
OH	Centerville, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
PA	Bridgeville, Dolfuss-Root & Co.	412-221-4420
PA	King of Prussia, J. E. Cuesta & Co., Inc.	215-265-5800
TX	Addison, Associated Dynamics, Inc.	214-387-3800
TX	Sugarland, Alpha Engrg.	713-491-4505
UT	Midvale, PLS Assocs.	801-566-0671
VA	Dumfries, Electra-Tech	703-670-6962
WI	Menomonee Falls, Brainard-Wilson	414-255-3400

Local Distributors

AL	Birmingham, Brownell-Electro, Inc.	205-322-3374
AL	Muscle Schoals, Jones Elctrns.	205-383-1241
AZ	Phoenix, Metermaster	602-437-1425
AZ	Scottsdale, Beta Distrs.	602-947-7841
CA	Costa Mesa, FLW, Inc	714-751-7512
CA	Hayward, FLW, Inc.	415-487-2222
CA	Los Angeles, EIL Instrs., Inc.	213-685-7020
CA	Los Angeles, Metermaster	213-685-4340
CA	Van Nuys, FLW, Inc.	818-989-5238
CO	Englewood, Beta Distrs.	303-779-4494
CT	Middletown, EIL Instrs., Inc.	203-346-6646
FL	Miami, Brownell Electro, Inc.	305-591-3215
GA	Atlanta (Hapeville), Brownell Electro	404-762-5181
GA	Marietta, FLW, S.E.	404-424-1731
IL	Chicago, Data Elctrns. Co.	312-283-0300
IL	Elk Grove Village, Metermaster	312-593-8650
IN	Indianapolis, Data Elctrns.	317-359-5368
IA	Davenport, Universal Precision Instr.	319-326-5757
KS	Kansas City, Kornfeld Thorp	913-321-7070
KY	Louisville, EIL Instrs.	502-454-3420
LA	Baton Rouge, Beta Distrs.	504-924-6826
MD	Gaithersburg, Pioneer Instrs.	301-921-0660
MD	Sparks, EIL Instr.	301-771-4800
MA	Waltham, Calibron Instrs.	617-894-6440
MI	Livonia, Pioneer Instr.	313-525-1800
MI	Madison Heights, NIDI	313-588-2300
MN	Plymouth, Data Elctrns.	612-559-1434
MO	St. Louis, Universal Precision Inst.	314-394-4693
NJ	North Caldwell, Hosica Labs.	201-256-7724
NM	Albuquerque, Beta Distrs.	505-299-7658
NY	Buffalo, Robert F. Lamb Co.	716-874-4900
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Hauppauge, EIL Instrs., Inc.	516-231-6333
NY	NYC, Brownell Electro	212-691-1171
NY	Rochester, Robert F. Lamb Co.	716-323-1250
NC	Concord, FLW Southeast	704-782-6615
NC	Raleigh, Brownell Electro	919-876-6524
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Cleveland, Metermaster	216-651-4100
OH	Cleveland, Pioneer Instr.	216-587-3600
OH	Dayton, EIL Instrs., Inc.	513-435-2134
OH	Dayton, Pioneer Instr.	513-236-9900
OH	Dayton, NIDI	513-434-7500
OK	Tulsa, Inotek	918-622-8570
OR	Portland, Westcon	503-283-0132
PA	Pittsburgh, Pioneer Instr.	412-782-2300
TN	Memphis, FLW Southeast	901-345-3563
TN	Nashville, Brownell Electro, Inc.	615-889-8230
TX	Austin, Beta Distrs.	512-452-0199
TX	Dallas, Dallas Meter Tek	214-349-6044
TX	Dallas, Inotek	214-243-7000
TX	Ft. Worth, Inotek	817-831-2126
TX	Garland, Metermaster	214-271-5671
TX	Houston, American Analog	713-941-7265
TX	Houston, Inotek	713-688-7000
TX	Houston, Beta Distrs.	713-688-9971
TX	Richardson, Beta Distrs.	214-231-2573
UT	Murray, Beta Distrs.	801-262-3000
VA	Richmond, Metermetrics	804-275-1431
WA	Seattle, EIL Instrs., Inc.	206-762-0880
WI	Milwaukee, E-M Instrs.	414-272-7799

NEWPORT
DIGITAL PANEL METERS & PRINTERS
AUTHORIZED DISTRIBUTORS
METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration
METERMASTER LOCATIONS:
ARIZONA
Phoenix .... (602) 437-1425
Tucson .... (602) 792-3411
CALIFORNIA
Los Angeles .... (213) 685-4340
Palo Alto .... (415) 968-0313
San Diego .... (619) 560-4841
GEORGIA
Atlanta .... (404) 446-0166
ILLINOIS
Chicago .... (312) 593-8650
MASSACHUSETTS
Boston .... (617) 523-2580
MINNESOTA
Minneapolis .... (612) 332-6117
MISSOURI
St. Louis .... (314) 454-0241
NEW MEXICO
Albuquerque .... (505) 292-3330
OHIO
Cleveland .... (216) 651-4100
OKLAHOMA
Tulsa .... (918) 582-1444
PENNSYLVANIA
Pittsburgh .... (412) 261-4548
TEXAS
Austin .... (512) 473-8876
Dallas .... (214) 271-5671
Houston .... (713) 733-9814
WISCONSIN
Milwaukee .... (414) 643-0554
ALL OTHER STATES .... (800) 962-8128

NEW-TONE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, TWX: 710-994-4780; Empl.: 50; *Sls. Mgr.:* Dominick Gagliano

N.Y. TESTING LABS., INC., 81 Urban Ave., Westbury, NY 11590, Tel: 516-334-7770, TWX: 212-297-1449; Empl.: 50

NIC COMPONENTS CORP., 238 Rte. 109, Farmingdale, NY 11735, Tel: 516-694-0060, 800-645-9333, Telex: 221-228; Empl.: 50; *Sls. Mgr.:* Ronald J. Travis; *Dist. Mgr.:* Nancy Lamendola .... **1A**•1152, 1153, 1906

Local Sales Offices & Reps

AL	Huntsville, Novus Group	205-881-2207
AZ	Phoenix, Sterling Elctrns.	602-258-4531
AZ	Phoenix, Tech Sls.	602-246-1614
AR	Little Rock, Carlton Bates	501-562-9100
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Mission Viejo, Par Mktg.	714-768-6021
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, Ryno	619-292-6022
CA	San Diego, Bestronic South	619-452-5500
CA	Santa Ana, Projections Unlimited	714-641-1472
CA	Sun Valley, QC Comps.	213-768-6111
CT	Bloomfield, SLR Assocs.	203-243-9343
CT	Danbury, Pilgrim Elctrns.	203-792-7274
FL	Clearwater, Perrott Assocs.	813-443-5214
FL	Largo, Graham Elctrns.	813-541-4434
IL	Champaign, Klaus Radio	217-356-1896
IL	Lisle, W. G. Controls	312-963-5954
IL	Melrose Park, Belford Elctrns,	312-865-2400
IN	Fort Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Elctrn. Rep. Inc.	317-894-1414
IA	Cedar Rapids, Deeco	319-365-7551
KS	Shawnee Mission, K&M Sls.	913-262-1444
KY	Louisville, Peerless	502-637-7674
LA	Harvey, AFG	504-368-9696
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MD	Rockville, MS Elctrns.	301-340-6400
MA	Bedford, SLR Assocs.	617-275-5550
MA	Burlington, TLC	617-273-0140
MI	Detroit, Burcaw Co.	313-533-7700
MI	Grand Rapids, SF Elctrns.	616-459-0216
MI	Livonia, Reptron	313-525-2700
MN	Bloomington, NWR	612-854-7329
MN	Golden Valley, Ambassador Ino Mktg.	612-542-8437
NH	Londonderry, S Squared	603-434-2033
NJ	Perth Amboy, Sterling	201-442-8000
NJ	Union, Cougar	201-687-7722
NY	Hauppauge, Belmont Elctrns.	516-273-1333
NY	Jericho, J-Square Mktg. Inc.	516-935-3200
NY	Suffern, M&M Assoc.	914-368-0583
NC	Greensboro, United Sls.	919-674-9849
OH	Cincinnati, Stegman Blaine Mktg. Inc.	513-729-1969
OH	Cincinnati, Graham Elctrns.	513-772-1661
OH	Dayton, Dulian	513-445-0424
OH	Vandalia, Stegman Blaine Mktg. Inc.	513-890-7975
OR	Beaverton, ACACIA	503-646-3377
PA	Philadelphia, Paragon Sls.	215-563-7060
TN	Nashville, Graham	615-242-2682
TX	Dallas, Heiland Elctrns.	214-351-2050
TX	Dallas, Design Mktg.	214-680-9767
TX	Hurst, Design Mktg.	817-268-2004
UT	S. Jordan, Mac III	801-566-3781
EXP	New York Farmingdale, NIC Comps. Corp.	516-694-0060

NICHICON (AMERICA) CORP., 927 E. State Pkwy., Schaumburg, IL 60195, Tel: 312-843-7500, Telex: 20-6577; FSC No.: 312-843-2798; *Sls. Mgr.:* Russ Edwards; *Dist. Mgr.:* Robert Poteracki .... **1A**•1154-1159

Local Sales Offices & Reps

AL	Huntsville, Intrep Assocs.	205-533-1730
AZ	Phoenix, Compass Mktg.	602-266-5400
CA	Huntington Bch., J. J. Riley & Assoc.	714-841-1411
CA	Santa Clara, I2 Inc.	408-988-3400
CO	Denver, West Inc.	303-692-0131
CT	Stratford, Gerald Rosen Co.	203-375-5456
FL	Clearwater, Delmac Sls.	813-447-5192
FL	Miami, Delmac Sls.	305-726-1330
FL	Orlando, Delmac Sls.	305-898-4688
GA	Norcross, Intrep Assocs.	404-449-8680
IL	Chicago, IRI	312-647-7755
IN	Indianapolis, Jack Harvey Assoc.	317-453-4260
MA	Framingham, Gerald Rosen Co.	617-879-5505
MI	Gross Pointe, Greiner Assoc.	313-499-0188
MN	Minneapolis, R. W. Marshall	612-929-0457
MO	Earth City, Centech	314-291-4230
MO	Raytown, Centech	816-358-8100
NJ	Springfield, Radix Inc.	201-467-4970
NM	Albuquerque, Compass Mktg.	505-292-7377
NY	Syracuse, T-Squared Elctrns.	315-463-8592
NY	Victor, T-Squared Elctrns.	716-924-9101
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Columbus, KW Elctrn. Sls.	614-888-0483
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Shaker Hgts., KW Elctrn. Sls.	216-491-9177
PA	Allison Park, KW Elctrn. Sls.	412-287-4300
PA	Huntingdon Valley, Omega Elctrns.	215-947-4135
TX	Austin, Southern States Mktg.	512-452-9459
TX	Dallas, Southern States Mktg.	214-238-7500
TX	Houston, Southern States Mktg.	713-558-4900
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Milwaukee, IRI	414-259-0965

Local Distributors

AL	Huntsville, Hall Mark Elctrns.	205-837-8700
AZ	Phoenix, TTI	602-966-1616
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Shelley Elctrns.	602-894-2058
CA	Chatsworth, Shelley Elctrns.	213-998-3333
CA	Chatsworth, Integrated Elctrns.	213-998-2200
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Irvine, Ryno Elctrns.	714-261-2500
CA	Irvine, Integrated Elctrns.	714-660-1055
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Sacramento, Integrated Elctrns.	916-424-4297
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Diego, Hall-Mark	619-268-1201
CA	San Diego, Ryno Elctrns.	619-252-6022
CA	San Jose, Shelley Elctrns.	408-942-9111
CA	San Jose, Eric Electronics	408-262-1111
CA	San Jose, Integrated Electronics	408-287-6488
CA	Sunnyvale, Hall-Mark	408-773-9990
CO	Boulder, Shelley Elctrns.	303-442-2718
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Denver, Hall-Mark	303-694-1662
CT	Hamden, Almo	203-288-6556
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Clearwater, Hall-Mark	813-530-4543

FL	Ft. Lauderdale, Hall-Mark	305-971-9280
FL	Orlando, Hall Mark Elctrns.	305-855-4020
FL	Orlando, T.T.I 2	305-859-1000
FL	Tampa, Reptron	813-855-4656
GA	Norcross, Hall-Mark	404-447-8000
GA	Norcross, Spectrum	404-448-1516
IL	Arlington Hts., Reptron	312-593-7070
IL	Bensenville, Hall Mark Elctrns.	312-860-3800
IL	Chicago, Century Elctrns.	312-777-9700
IL	Elkgrove, GBL/Goold	312-593-3220
IL	Hoffman, Estates Intercomp	312-843-2040
IN	Ft. Wayne, Graham Elctrns.	619-423-3422
IN	Indianapolis, Advent Elctrn.	317-872-4910
IA	Cedar Rapids, Deeco	319-365-7551
KS	Lenexa, Hall Mark Elctrns.	913-888-4747
MD	Baltimore, Hall Mark Elctrns.	301-796-9300
MD	Rockville, Almo Elctrn.	301-251-1161
MA	Canton, Almo	617-821-1450
MA	Hingham, Saager Elctrn.	617-749-6700
MA	Needham, Cronin Elctrn.	617-449-5000
MA	Woburn, T.T.I.	617-938-8800
MA	Woburn, Hall-Mark Electr.	617-935-9777
MI	Livonia, Reptron	313-525-2700
MN	Bloomington, Hall Mark Elctrns.	612-854-3223
MN	Minneapolis, Joel	612-545-5669
MO	Earth City, Hall Mark Elctrns.	314-291-5350
NJ	Cherry Hill, Hall Mark Elctrns.	609-424-7300
NJ	Fairfield, Hall-Mark	201-575-4415
NJ	Perth Amboy, Sterling Elctrns.	201-442-8000
NY	Buffalo, Summit	716-887-2800
NY	Hauppauge, Fairmont	516-231-3313
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Rochester, Masline	716-546-5373
NY	Rome, Rome Elctrns.	800-962-2153
NY	Ronkonkoma, Hall-Mark	516-737-0600
NC	Charlotte, Dixie	704-377-5413
NC	Raleigh, Hall Mark Elctrns.	919-872-0712
NC	Raleigh, Resco/Raleigh	919-781-5700
NC	Winston-Salem, Dixie	919-724-5961
OH	Cincinnati, Hall-Mark	513-563-5980
OH	Dayton, Pioneer	513-236-9900
OH	Englewood, Argent Inds.	513-836-8633
OH	Solon, Hall-Mark	216-349-4632
OH	Solon, Repco	216-248-8900
OH	Westerville, Hall Mark Elctrns.	614-891-4555
OK	Tulsa, Hall Mark Elctrns.	918-665-3200
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Harrisburg, Cumberland	717-232-5999
PA	Harrisburg, Advacom	717-545-5674
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Almo	215-698-4000
SC	Columbia, Dixie	803-779-5332
TN	Knoxville, Dixie	615-938-4131
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Captronics	214-340-3592
TX	Dallas, Hall Mark Elctrns.	214-341-1147
TX	Ft. Worth, T.T.I 2	817-831-0441
TX	Houston, Hall-Mark	713-781-6100
WA	Bellevue, Integrated Electr.	206-455-2727
WA	Bellevue, Bell Inds.	206-747-1515
WI	Oak Creek, Hall Mark Elctrns.	414-761-3000

NICHIFU AMERICA, INC., 1494 N. Charlotte St., Pottstown, PA 19464, Tel: 215-323-7120; *Sls. Mgr.:* Roy Allen

NICOLET COMPUTER GRAPHICS DIV., P.O. Box 3020, 777 Arnold Dr., Martinez, CA 94553, Tel: 415-372-7568, TWX: 910-481-5951 ZETAPLOTS MART; FSC No.: 52893; *Sls. Mgr.:* Bill Manos

NICOLET INSTR. CORP., Oscilloscope Div., 5225 Verona Rd., Madison, WI 53711, Tel: 608-271-3333, TWX: 910-286-2737; Empl.: 525; *Sls. Mgr.:* Dean Dawson

Local Sales Offices & Reps

AZ	Phoenix, Axtec Entprs.	602-944-9185
CA	Los Angeles, Nicolet Instr.	714-549-7611
CA	San Diego, Nicolet Instr.	619-454-6274
CA	San Jose, Nicolet Instr.	408-946-3310
CO	Littleton, Aztec Entprs.	303-795-0250
FL	Valrico, Nicolet Instr.	813-685-0444
GA	Tucker, Nicolet Instr.	404-491-0127
IL	Chicago, Nicolet Instr.	312-843-2905
MD	Lanham, Nicolet Instr.	301-459-2940
MA	Burlington, Nicolet Instr.	617-273-4404
MI	Brighton, Nicolet Instrument	313-229-4655
MN	Minneapolis, Nicolet Instr.	612-933-0048
MO	St. Louis, Nicolet Instr.	314-821-2868
NJ	Cherry Hill, Nicolet Instr.	609-665-5100
NJ	Cranford, Nicolet Instr.	201-276-6677
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Schenectady, Nicolet Instr.	518-346-2503
NC	Charlotte, Nicolet Instr. Corp.	704-364-0240
OH	Chardon, Nicolet Instr.	216-951-8249
OH	Hamilton, NIC Inst.	513-868-3611
PA	Beaver Falls, Nicolet Instrument	412-847-0100
TX	Plano, Nicolet Instr.	214-422-4014
UT	Salt Lake City, Aztec Entprs.	801-621-1655
WA	Edmonds, Nicolet Instr. Corp.	206-771-2400
WI	Madison, Nicolet Instr.	608-273-5008

NICOLET PARATRONICS, 201 Fourier Ave., Fremont, CA 94539, Tel: 415-490-8300, TWX: 910-381-7030; FSC No.: 6625; Empl.: 95; *Sls. Mgr.:* Ernie Marsh

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Phoenix, Zeus	602-263-6022
CA	Carson, Amasco	213-516-8561
CA	Sunnyvale, Amasco	408-733-8690
CO	Denver, Zeus	303-321-4246
CT	Danbury, Martindale Assoc.	203-748-2253
FL	Orlando, Datarep, Inc.	305-843-5224
FL	Tampa, Datarep, Inc.	813-962-7555
GA	Atlanta, Magaro & Assocs.	404-451-8862
IL	Downers Grove, Charles Menshek	312-964-8700
IN	Carmel, Carter, McCormic, & Peirce, Inc.	317-844-4175
MD	Burtonsville, Eastern Instr.	301-384-8500
MA	North Reading, Martindale Assoc.	617-942-0514
MI	Farmington, Carter, McCormic, & Peirce, Inc.	313-477-7700
MO	Kansas City, Eir Company	816-452-7030
MO	Leasburg, Eir Company	314-895-4100
NJ	Ridgefield, Rical Assocs.	201-945-5250
NM	Albuquerque, Zeus Elctrns.	505-256-9831
NY	Earlton, Martindale-Paul, Inc.	518-634-7617
NY	Rochester, Martindale-Paul, Inc.	716-288-8611
NY	Syracuse, Martindale-Paul, Inc.	315-432-1141
NC	Greensboro, Magaro & Assocs.	919-294-4783
OH	Englewood, Carter, McCormic & Peirce, Inc.	513-836-0951
OH	Fairview Park, Carter, McCormic, & Peirce, Inc.	216-779-1700
PA	Jenkintown, Monument Techn. Assoc.	215-884-3737
PA	Monroeville, Carter, McCormic & Peirce, Inc.	412-372-4415
TX	Austin, Testech	512-327-7033
TX	Houston, Testech	713-956-0837
TX	Richardson, Testech	214-644-5010
UT	Salt Lake City, Zeus Elctrns.	801-534-0500
VT	Jericho, Martindale Assocs.	802-899-2329
WA	Edmond, Nicolet Instrument Corp.	206-771-2400

NISSEI SANGYO AMERICA, LTD., 1701 Golf Rd., Ste. 401, Rolling Meadows, IL 60008, Tel: 312-981-8989, Telex: 28-0547, TWX: 910-233-5865; *Sls. Mgr.:* Y. Hamada

NITRON, 10420 Bubb Rd., Cupertino, CA 95014, Tel: 408-255-7550, TWX: 910-338-0222; Empl.: 150; *Sls. Mgr.:* R. Gardner

NITTO DENKO AMERICA, INC., 27 Seaview Blvd., Port Washington, NY 11050, Tel: 516-484-9700, Telex: 96-1386; *Sls. Mgr.:* Steven E. Schoenstadt

NJE CORPORATION, Box 50, Culver Rd., Dayton, NJ 08810, Tel: 201-329-4611, TWX: 710-480-5674; FSC No.: 98380; Empl.: 125; *Sls. Mgr.:* John M. Slavik .... **3**•1661

Local Sales Offices & Reps

AZ	Phoenix, Sigma Engrg. Sls.	602-241-1334
CA	Garden Grove, Elsco Elctrns.	714-891-4621
CO	Englewood, F. G. Mktg.	303-795-9176
CT	Ansonia, R. H. Sturdy Co.	203-734-2186
ID	Boise, Underwood Hanify Co.	208-343-0964
IA	Davenport, Ensco Rep	319-386-6600
KS	Overland Park, Ensco Rep	913-381-7557
KS	Wichita, Ensco Rep	316-683-1070
MA	Salisbury, R. H. Sturdy Co.	617-465-1505
MA	Wellesley Hills, R. H. Sturdy Co.	617-235-2330
MI	Brighton, A. P. Assocs.	313-229-6550
MN	Edina, Grayden & Flemmer	612-941-1120
MO	Maryland Heights, Ensco Rep	314-423-3935
NY	Clark Mills, KLM Garner	315-853-6126
NY	N. Syracuse, KLM Garner	315-458-6214
NY	Pittsford, KLM Garner	716-381-8350
OH	Englewood, Allen Nace Co.	513-836-0931
OH	Richfield, Allen Nace Co.	216-659-7178
PA	Glenshaw, Allen Nace Co.	412-487-1217
WA	Bellevue, Underwood Hanify Co.	206-451-8223
WA	Vancouver, Underwood Hanify Co.	503-641-4463
EXP	NJ, Dayton, NJE Corp.	201-329-4611

nkk switches
OF AMERICA INC.

NKK SWITCHES OF AMERICA, INC., 14415 N. Scottsdale Rd., Ste. 600, Scottsdale, AZ 85260, Tel: 602-991-0942, TWX: 910-950-1167; FSC No.: FSCN 63426; *Sls. Mgr.:* Samuel L. Porcelli; *Dist. Mgr.:* Samuel L. Porcelli .... **1B**•1723-1731

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Scottsdale, Mahaffey & Assocs.	602-991-9790
CA	Granada Hills, C & W Component Sls.	213-368-4032
CA	Mountain View, Caltron Components Corp.	415-964-3244
CA	San Diego, McKinley Elctrn. Sls.	619-271-7221
CO	Parker, TMA of Colorado	303-841-3435
FL	Orlando, Over & Over, Florida, Inc.	305-857-4057
GA	Norcross, Over & Over	404-449-6205
IL	Rolling Meadows, KMA Sales	312-398-5300
IN	Fort Wayne, Frank E. Kahsar Sls.	219-422-0311
IN	Indianapolis, Frank E. Kahsar Sls.	317-888-8396
KS	Merriam, Midwest Tech. Sls.	913-236-8557
MA	Needham Hgts., Newscott Co.	617-444-1923
MN	Minnetonka, SAI Mktg. Corp.	612-935-0777
MS	Jackson, Welch & Doby, Inc.	601-932-5534
NY	De Ruyter, NET Sales Co.	315-662-7996
NY	Fairport, NET Sales Co.	716-467-4538
NY	Oceanside, Bittan	516-678-6222
NY	Troy, NET Sales Co.	716-467-4538
NY	Webster, NET Sales Co.	716-467-4538
NC	Charlotte, Over & Over	704-527-3070
NC	Raleigh, Over & Over	919-872-2262
OH	Cincinnati, Frank E. Kahsar Sls.	513-922-3133
OH	Hudson, Frank E. Kahsar Sls.	216-650-1089
OR	Portland, James J. Backer, Inc.	503-297-8744
OR	Salem, James J. Backer, Inc.	503-362-0717
PA	West Conshohocken, Eastern Comps. Sls.	215-825-8610
RI	Stewartstown, Eastern Comps. Sls.	301-323-7104
TX	Dallas, Rem Air Components Corp.	214-234-1069
UT	Salt Lake City, TMA of Colorado	801-483-1009
VA	Manassas, Eastern Comps. Sls.	703-471-1025
WA	Seattle, James J. Backer, Inc.	206-285-1300
WI	Milwaukee, KMA Sales	414-259-1771

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supply	602-275-2885
AZ	Tempe, Powell Elctrns.	602-438-1505
CA	Burlingame, Rose Electronic Dist. Co.	415-348-2740
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Dimas, Mrs. Switch, Inc.	714-599-6639
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Torrance, Cypress Elctrns.	213-533-6005
CA	Tustin, Western Switches & Controls	714-731-4333
CO	Arvada, Denver Wintronics	303-431-7161
CO	Aurora, Jet Elctrns. Supp. Co.	303-364-1000
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	Stamford, Bond Elctrns.	203-348-2663
FL	Miami, Elctrn. Equip. Co.	305-871-3500
FL	West Palm Beach, Nurmi Elctrn. Supply	305-686-8553
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Fort Wayne, Graham Elctrns. Supply	219-423-3422
IN	Indianapolis, Graham Elctrns. Supply	317-634-8202
IN	Indianapolis, MAR Elctrn.	317-875-4510
KS	Wichita, Radio, Inc.	316-264-2798
KS	Wichita, Air Technics	316-267-2849
MD	Kensington, Marine Air Supply Co.	301-949-9560
MA	Boston, Controller Svc. & Sls.	617-269-1300
MA	Woburn, EPC, Inc.	617-935-0400
MI	St. Clair Shores, Spemco Switches	313-771-2700
MN	Minneapolis, The Joel Co.	612-545-5669
MO	St. Louis, Franklin Elctrns.	314-993-5333
NJ	Englewood, Powell	201-894-0800
NY	Hempstead, Elctrn. Equip. Co.	516-538-5510
NY	Mt. Vernon, Kin-Tronics	914-668-9882
NY	Oceanside, Tritech Elctrn. Distr.	516-678-6222
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rome, Rome Elctrns.	315-337-5400
NY	Troy, Trojan Elctrn. Supp. Co.	518-274-4481
NC	Cary, Powell Elctrns.	919-467-1212
OH	Cincinnati, Schuster Elec. Co.	513-489-1400
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OK	Oklahoma City, Radio, Inc.	405-789-0741
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Lake Oswego, Rose Elctrn. Distr. Co.	503-635-8823
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Wayne, Peak Elctrns. Corp.	215-293-9000

TN	Chattanooga, Techni-Tronics	615-875-5449
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Dallas, Wallace Elctrns. Co.	214-340-0400
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Houston, Powerline Prods.	713-578-3222
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Stafford, Southwest Elctrns.	713-491-4900
WA	Seattle, Priebe Elctrns.	206-682-8242
WI	Hartland, GW Elctrns.	414-367-6003

NKR PRECISION MFG., Rte. 17M, Box 333, Harriman, NY 10926, Tel: 914-782-8562; Empl.: 17

NL BEARINGS/NL INDUSTRIES INC., PO Box 934, Toledo, OH 43694, Tel: 419-381-3100; Empl.: 1000; *Sls. Mgr.:* James Doherty; *Dist. Mgr.:* B. Sexauer

NMB CORP., MOTOR DIV., 9730 Independence Ave., Chatsworth, CA 91311, Tel: 213-709-1555

NOBEX DIV., Griffith Plastics Corp., 1027 California Dr., Box 4365, Burlingame, CA 94010, Tel: 415-342-8170, TWX: 910-374-2840; FSC No.: 32767; Empl.: 35

NOBLE U.S.A., INC., 151 Stanley St., Elk Grove Vllg., IL 60007, Tel: 312-364-6038, Telex: 206745; FSC No.: 1-3123646045; *Sls. Mgr.:* Vyto Omilijonas; *Dist. Mgr.:* Vyto Omilijonas

NOLATRON, P.O. Box 4042, Harrisburg, PA 17111, Tel: 717-564-3398; Empl.: 10

NOLL, J. A., CO., P.O. Box 447, Cumberland, MD 21502, Tel: 301-777-7887; *Sls. Mgr.:* P. Carson; *Dist. Mgr.:* P. Carson

NON-LINEAR SYSTEMS/DIV. OF KAYPRO CORP., 533 Stevens Ave., Solana Bch., CA 92075, Tel: 619-481-3900, TWX: 910-322-1132; Empl.: 55; *Sls. Mgr.:* Ben W. Fisher; *Dist. Mgr.:* Jeanne Simmons

Local Sales Offices & Reps

GA	Norcross, Hollingsworth & Still	404-447-1700
MA	N. Scituate, W. A. Hendrickson Co.	617-545-0652
OH	Dayton, Shamrock Elctrn. Sls.	513-258-1227
PA	Abington, Mid-Atlantic Sls.	215-657-2815
TX	Dallas, Berthold Sls.	214-328-0067

Local Distributors

AZ	Phoenix, Metermaster	602-273-7331
CA	Costa Mesa, Marvac Elctrns.	714-540-3280
CA	Garden Grove, Allied Electronics	714-554-0731
CA	Hayward, Allied Electronics	415-487-5250
CA	Irvine, Meter Craft	714-979-1420
CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CA	Los Angeles, Metermaster	213-685-4340
CA	Oakland, Western Electro. Mech.	415-452-1936
CA	Palo Alto, Metermaster	415-968-0313
CA	San Diego, Metermaster	619-560-4841
CA	San Jose, Allied Electronics	408-727-1690
CA	Santa Clara, Eil Instruments	408-272-0396
FL	Ft. Lauderdale, Allied Electronics	305-486-0550
FL	Miami, Brownell Electro	305-591-3215
FL	Orlando, Brownell Electro	305-843-6770
FL	Palm City, Eil Instruments	305-725-8300
GA	Atlanta, Allied Electronics	404-237-3366
GA	Atlanta, Metermaster	404-446-0166
GA	Atlanta, Brownell Electro	404-762-5181
IL	Bridgeview, Eil Instruments	312-430-2292
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Elk Grove, Metermaster	312-593-8650
IL	Niles, Joseph Elctrns.	312-297-4200
IL	Peoria, Klaus Radio	309-691-4840
IN	Indianapolis, Eil Instruments	317-545-1373
KY	Louisville, Eil Instruments	502-637-7677
LA	Harahan, Indus. Instru. Works	504-733-8355
LA	Shreveport, Indl. Elctrns. Supp.	318-222-9459
MD	Elkridge, Sunshine Sci. Instrs.	301-796-5600
MD	Marlow Heights, Allied Electronics	301-423-0161
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MD	Sparks, E. I. L. Instrs	301-252-1260
MA	Boston, Allied Electronics	617-942-0150
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Hingham, Sager Electrical Supply	617-542-2281
MI	Ferndale, Ram Meter	313-547-1000
MN	Minneapolis, Instrumentation Serv.	612-544-8916
MO	Kansas City, Electronic Supply	816-931-0250
MO	St. Louis, Eil Instruments	317-545-1373
NV	Las Vegas, Hurley Electronics	702-384-5666
NJ	N. Caldwell, Hosica Labs	201-256-7724
NJ	So. Plainfield, Brownell Electro	201-753-4600
NM	Albuquerque, Electronic Parks	505-293-6161
NY	Albany, Edwin E. Taylor	518-438-7811
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Hauppauge, Eil Instruments	516-231-6333
NY	Mineola, Allied Electronics	516-248-2360
NY	New York, Advance Electronics	212-687-2224
NY	Port Chester, Wise Electronics	914-939-3940
NY	Rochester, Eil Instruments	716-424-5750
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Charlotte, Brownell Electro	704-597-1270
NC	Raleigh, Brownell Electro	919-876-6524
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, Metermaster	216-651-4100
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Eil Instruments	513-435-2134
OH	Wickliffe, Gateway-Megatech	216-944-8565
OH	Willoughby, Allied Electronics	216-951-0908
OK	Oklahoma City, Trice	405-524-4411
OK	Tulsa, Trice	918-585-5718
OK	Tulsa, Radio Inc.	918-587-9123
OR	Portland, United Radio Supply	503-434-2171
PA	Bala Cynwyd, Allied Electronics	215-667-6940
PA	Philadelphia, Sunshine Sci. Instrs.	215-673-5600
PA	Pittsburgh, CAM/RPC	412-782-3770
PA	Pittsburgh, Eil Instruments	412-731-5230
PA	Reading, Barbey	215-376-7451
PA	York, Cumberland	717-845-8791
SC	Columbia, Dixie Electronics	803-779-5332
TN	Chattanooga, Curle Elctrns.	615-266-4728
TN	Knoxville, Brownell Electro	615-966-3441
TN	Memphis, Brownell Electro	901-795-8487
TN	Nashville, Brownell Electro	615-889-8230
TX	Austin, Electrotex	512-454-0318
TX	Dallas, Eil Instruments	214-931-1236
TX	Dallas, Metermaster	214-271-5671
TX	Dallas, Dallas Meter Tek	214-349-6044
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Electronics	713-681-2983
TX	Houston, Electrotex	713-526-3456
TX	Houston, Eil Instruments	713-271-3100
TX	San Antonio, Sherman Elctrns.	512-224-1001
VA	Alexandria, Eil Instruments	703-354-4330
VA	Virginia Beach, Eil Instruments	804-499-3746
WA	Seattle, Allied Electronics	206-547-2827
WA	Seattle, Eil Instruments	206-762-0880
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Milwaukee, Allied Electronics	414-355-8866

NORELCOM INDS., 63 Marine St., Farmingdale, NY 11735, Tel: 516-249-7245; Empl.: 55; *Sls. Mgr.:* Richard E. Thaw; *Dist. Mgr.:* Regina Vena

NORITAKE ELCTRNS., INC., Noritake Co., Ltd. (Japan), 22410 Hawthorne Blvd., #6, Torrance, CA 90505, Tel: 213-373-6704, Telex: 67-4910; *Sls. Mgr.:* T. Ohki

NORLAND, Norland Dr., Ft. Atkinson, WI 53538, Tel: 414-563-8456, Telex: 26-5448; Empl.: 275; *Sls. Mgr.:* Robert J. Millar

Local Sales Offices & Reps

CA	San Jose, Norland	408-972-2248
FL	Orlando, Micro Spec	305-299-6508
MD	Silver Spring, Seltronics	301-589-3391
MI	Coloma, Norland	800-558-0158
MI	Farmington Hills, Anderson Elctrns.	313-553-7600
NM	Las Cruces, Sota-Com	505-523-4480
NY	Rensselaer, Norland	518-477-2329
SC	Rock Hill, Micro Spec	803-366-3015
TX	Arlington, Norland	817-261-5284
WA	Bellevue, Showalter Instrs.	206-746-7970

NORPLEX DIV., 10 V.O.P. Plaza, Des Plaines, IL 60016, Tel: 312-391-2000

NORSAL INDS., 85 D Hoffman Lane So., Central Islip, NY 11722, Tel: 516-234-1200, TWX: 510-227-1045; *Sls. Mgr.:* Lauren Kent

Local Sales Offices & Reps

CA	El Segundo, Fetty/Schoenduve, Inc.	213-322-4991
CA	Santa Clara, Donahue Assocs.	408-727-6694
GA	Kennesaw, BWS Mktg.	800-824-7888
MD	Pasadena, Spectro-Lambda Inc.	301-279-2010
MA	Lexington, Eugene Delfino Inc.	617-862-1118
MN	Minneapolis, Deming & Assocs.	612-888-5000
OH	Dayton, Frederick Ohmer Assoc.	513-434-1454
OH	Dayton, Ohmer Assocs.	513-434-1454
PA	Elkins Park, Snow Assocs.	215-379-4700
TX	Dallas, Texas Microwave	214-351-4773
WA	Seattle, Datacom	206-285-2525
EXP	NY, Central Islip, Norsal Export, Ltd.	516-234-1200

Local Distributors

CA	El Segundo, Fetty/Schoenduve, Inc.	213-322-4991
CA	Santa Clara, Donahue Assocs.	408-727-6694
GA	Kennesaw, BWS Mktg.	800-824-7888
MD	Pasadena, Spectro-Lambda, Inc.	301-279-2010
MA	Lexington, Eugene Delfino, Inc.	617-862-1118
MN	Minneapolis, Deming & Assocs.	612-999-5000
OH	Dayton, Frederick Ohmer Assocs.	513-434-4454
PA	Elkins Park, Snow Assocs.	215-379-4700
TX	Dallas, Texas Microwave	214-351-4773
WA	Seattle, Datacom	206-285-2525

NORTH AMERICAN PHILIPS CONTROLS CORP., See Airpax Corporation, Cheshire Div.

NORTH AMERICAN PHILIPS LIGHTING, Bank St., Hightstown, NJ 08520, Tel: 609-448-4000, TWX: 510-685-5651; Empl.: 600; *Sls. Mgr.:* C. J. Lehmann

NORTH AMERICAN PRINTED CIRCUIT DIV., Tyco Labs., Inc., Box 145, Stafford, CT 06075, Tel: 203-684-2703; Empl.: 230

NORTH AMERICAN SOAR CORP., 11126 Cornell Ave., Cherry Hill, NJ 08002, Tel: 609-488-1060; Empl.: 7; *Sls. Mgr.:* Robert Liska .... **3**•1267-1275, 1360, 1372-1374

NORTH ATLANTIC INDS., Instrument Div., 60 Plant Ave., Hauppauge, NY 11788, Tel: 516-582-6500, TWX: 510-227-9660; FSC No.: 07342; Empl.: 320; *Sls. Mgr.:* K. Salz .... **3**•1277, 1345

Local Sales Offices & Reps

AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Cupertino, T. Louis Snitzer Co.	408-257-8333
CA	Delmar, T. Louis Snitzer Co.	714-226-0305
CA	Los Angeles, T. Louis Snitzer Co.	213-836-6170
CO	Littleton, Aztec Entprs.	303-795-0250
CT	Enfield, Meco	800-225-3409
FL	Cocoa Beach, TeqSpec	305-783-3444
FL	Palm Harbor, Teqspec	813-785-2296
GA	Atlanta, Teqspec II	404-399-6780
IL	Chicago, Pat Lind Elctrns.	312-726-3513
IN	Indianapolis, Pat Lind Elctrns.	317-632-7444
MD	Wheaton, Brimberg Sls. Co.	301-946-2670
MA	Reading, Meco	617-944-6660
MI	Madison Hgts., WKM Assoc.	313-588-2300
MN	Circle Pines, P. Lind	612-786-5770
NM	Albuquerque, Aztec Entprs.	505-262-1688
NC	Winston-Salem, Teqspec III	919-723-8102
OH	Cleveland, WKM Assoc.	216-524-5930
OH	Dayton, WKM Assoc.	513-434-7500
OR	Beaverton, Northwest Test & Meas.	503-646-9966
PA	Philadelphia, Tech. Instr. Sls.	215-836-2222
PA	Pittsburgh, WKM Assoc.	412-892-2953
TN	Morristown, Teqspec	615-587-0980
TX	Houston, Scientific Sls.	713-460-9170
TX	Richardson, Sci. Sls.	214-231-6541
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Redmond, Northwest Test & Meas.	206-881-8857
WI	Milwaukee, Pat Lind Elctrns.	414-224-0146

NORTHEAST SCIENTIFIC CORP., 30 Wetherbee St., Acton, MA 01720, Tel: 617-263-2711; Empl.: 10; *Sls. Mgr.:* C. Moritz

NORTHERN ENGRG. LABS., See Midland-Ross Corp., NEL Unit

NORTHERN PRECISION LABS., 11 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-4800, TWX: 710-734-4301; Empl.: 95; *Sls. Mgr.:* M.P. Nigro

NORTH HILLS ELCTRNS., Alexander Pl., Glen Cove, NY 11542, Tel: 516-671-5700, Telex: 64-0476; FSC No.: 98821; Empl.: 85; *Sls. Mgr.:* H. H. Marx .... **1A**•1247, 1774, 2210; **3**•1393, 1662

Local Sales Offices & Reps

MA	Burlington, Microwave Comps. Mktg.	617-273-3106
MN	Minneapolis, Hei-Lite Sls.	612-861-6051

NORTHLAKE ENGRG., 999 Anita Ave., Antioch, IL 60002, Tel: 312-395-5710; FSC No.: 50638; Empl.: 100; *Sls. Mgr.:* M. R. Whitman

NORTHWEST MICROCIRCUITS, 2115 N. College, Newburg, OR 97132, Tel: 503-538-7081; Empl.: 5; *Sls. Mgr.:* Wm. H. Ferwalt

Advertisement

NORTHWEST MICRO produces custom Hybrid Circuits from customer schematics, layouts, or film positives. Turn around time for prototypes runs 4 to 6 weeks with engineering costs usually ranging from $500 to $900. NWµ also does complete circuit design to customer performance specifications. Hybrid ckt experience includes voltage regulators, R & RC networks, digital & analog timing, and medical products. Services include solder sealing of flat packs and chip carriers for hermeticity.

NORTON, One New Bond St., Worcester, MA 01606, Tel: 617-853-1000, Telex: 920428, TWX: 710-340-1126; Empl.: 19000

NORTON ASSOCS., 10 Di Tomas Ct., Copiague, NY 11726, Tel: 516-842-4666; FSC No.: 08739

NORTON CHEMPLAST, 31-150 Dey Rd., Wayne, NJ 07470, Tel: 201-696-4700, TWX: 710-988-5834; Empl.: 300; *Dist. Mgr.:* Wes Wheeler

NORTRAN, Power Elctrns. Corp., 96 Milton Rd., Rochester, NH 03867, Tel: 603-332-3334, TWX: 510-297-4462; *Sls. Mgr.:* Robert S. Karstedt

NOTHELFER WINDING LABS, See NWL Transformers

NOUMENON CORP., 512 Westline Dr., Alamdea, CA 94501, Tel: 415-521-2145, Telex: 176340; *Sls. Mgr.:* Michael C. Mead

NOVA

TAURUS™ by Nova

NOVA ELEC., 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-661-3434, Telex: 219077; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Carlton C. Applegate ....**3**•1895

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
AZ	Phoenix, Adtek	602-931-9289
CA	Los Alamitos, Sci. Devices	213-598-7678
CA	San Diego, Sci. Devices	619-279-6642
CA	San Jose, Sci. Devices	408-554-0455
CO	Boulder, Sci. Devices	303-449-9466
CO	Denver, Sci. Devices	303-449-9466
FL	Orlando, Data Rep	305-843-5224
IL	Chicago, Ampol Svcs. & Engrg.	312-685-1350
IN	Carmel, CMP	317-844-4175
KS	Shawnee Mission, W. Hickman	913-362-4300
LA	Abbeville, Data Mktg. Assoc.	318-989-1265
MD	Silver Spring, Spectro Sls.	301-949-8261
MA	Wakefield, Bordewieck Engrg.	617-659-4915
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Eden Prairie, Compusite	612-944-8552
MO	St. Louis, F. Gilliam	314-961-5555
NJ	Northvale, Comp-Tran	201-768-2060
NY	Binghamton, Tae-Rep	607-772-6952
NY	Fishkill, Tae-Rep	716-586-8710
NY	Rochester, Tae-Rep	716-586-8710
NC	Charlotte, J. Rudisill Assoc.	704-377-6901
OH	Cleveland, CMP	216-779-5100
OH	Englewood, CMP	513-836-0951
OK	Oklahoma City, Data Mktg. Assoc.	918-496-1497
PA	Bala Cynwyd, Electrical Distribution	215-665-5654
PA	Monroeville, CMP	412-372-4415
TX	Austin, Data Mktg. Assoc.	512-451-5174
TX	Dallas, Data Mktg. Assoc.	214-661-0300
TX	Houston, Data Mktg. Assoc.	713-780-2511
TX	San Antonio, Data Mktg. Assoc.	512-342-3031
VA	Richmond, J. Rudisill Assoc.	704-377-6901
WA	Seattle, Al Smith Co.	206-746-6770

NOVA TRAN, 100 Deposition Dr., Clear Lake, WI 54005, Tel: 715-263-2333; FSC No.: 56643; Empl.: 45; *Sls. Mgr.:* R. Schley

NOVATRONICS, Box 878, Pompano Beach, FL 33061, Tel: 305-942-5200, TWX: 510-956-9878; Empl.: 225; *Sls. Mgr.:* W. G. Peters

NRD, Mark IV Inds., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, Telex: 91578 NRD GRDI; *Sls. Mgr.:* James R. Curtis; *Dist. Mgr.:* Larry Keating

NSD, 10936 Portal Dr., Los Alamitos, CA 90720, Tel: 714-527-4896; *Sls. Mgr.:* Paul Pomerantz; *Dist. Mgr.:* Paul Pomerantz

NTK

NTK TECHNICAL CERAMICS, NGK Spark Plugs (U.S.A.), Inc., 1701 N. Greenville Ave. #205, Richardson, TX 75081, Tel: 214-235-8332; FSC No.: 95-246-1286; *Sls. Mgr.:* K. C. Ogawa; *Dist. Mgr.:* Mark Ota ....**1A**•1396, 1397; **1B**•1853; **3**•1043

Local Sales Offices & Reps

AL	Huntsville, L&D, Inc.	919-292-3201
CA	Culver City, DeAngelo Rothman and Co. Inc.	213-827-2202
CA	San Jose, Frequency Control Assocs.	408-446-0200
CT	Bloomfield, Zaslow Sales Co.	203-242-7781
FL	Maitland, D.J. Ellis & Assocs. Inc.	305-645-1101
GA	Atlanta, L&D Inc.	404-455-3483
IN	Indianapolis, Intl. Elctrns. Corp. of Indiana	317-257-8115
IN	Scottsburg, Intl. Elctrns. Corp. of Indiana	812-752-4611
IA	Chanhassen, Barnes Sls. Assocs.	612-934-2907
KS	Overland Park, Barnes Midwest Sls.	913-341-9317
MD	Baltimore, Espy Sls. Co.	301-441-6982
MI	Ann Arbor, Elliott Sls. Co.	313-662-4087
MN	Chanhassen, Barnes Sales Assocs.	612-934-2907
NJ	Boonton, Pafi Assocs.	201-335-0680
NY	Smithtown, Pafi Assocs.	516-360-0940
NC	Raleigh, L&D Inc.	919-876-5301
PA	Rydal, Espy Sls. Assocs.	215-576-0780
TN	Seymour, Espy Sls. Assocs.	315-573-6511
VA	Richmond, Espy Sls. Assocs.	804-359-0125
WA	Seattle, Northmar Inc.	206-524-5170

NUCLEAR RESCH. CORP., 125 Titus Ave., Warrington, PA 18976, Tel: 215-343-5900, Telex: 510-665-8525 NRC WNTN; FSC No.: 96696; Empl.: 85; *Sls. Mgr.:* D.T. McIntyre, V.P.

NUCLEONIC PRODS., See Thomson-CSF Comps. Corp., Passive Comps. Div.

NU-CONCEPT COMPUTER SYS., Rte. 309 & Advance La., Colmar, PA 18915, Tel: 215-822-8400; Empl.: 17; *Sls. Mgr.:* Thomas Dvorak

NU DATA, 32 Fairview Ave., Little Silver, NJ 07739, Tel: 201-842-5757, Telex: 132405, TWX: 710-722-5754; Empl.: 20; *Sls. Mgr.:* S. L. Houcke

NUMARK ELCTRNS. CORP., 503 Raritan Ctr., Edison, NJ 08817

NUMERIX CORP., 320 Needham St., Newton, MA 02161, Tel: 617-964-2500, Telex: 948032; *Sls. Mgr.:* Harold Messias

NU-METRICS, P.O. Box 800, Connellsville, PA 15425, Tel: 412-628-0400; Empl.: 12; *Sls. Mgr.:* Waide Miller

NURAD, INC., 2165 Druid Pk. Dr., Baltimore, MD 21211, Tel: 301-462-1700, TWX: 710-234-1071; Empl.: 80

NWL TRANSFORMERS

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645; Empl.: 230; *Sls. Mgr.:* C. W. Harrison ....**1A**•2211; **3**•1663

NWL TRANSFORMERS, Megatran Electronic Power, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645; Empl.: 195; *Sls. Mgr.:* C. W. Harrison ....**3**•1663

NYE, WILLIAM F., INC., P.O. Box G-927, New Bedford, MA 02742-0927, Tel: 617-996-6721, Telex: 940807; Empl.: 15

NYLTITE, 3451 S. Clinton Ave., S. Plainfield, NJ 07080, Tel: 201-561-1300; *Sls. Mgr.:* Frances Gould

Nytronics Components Group, Inc.

NYTRONICS COMPS. GROUP INC., Orange St., Darlington, SC 29532, Tel: 803-393-5421, TWX: 810-665-2182; FSC No.: 83125; Empl.: 450 ....**1A**•1160-1172, 1218, 1248-1267, 1554-1557, 1907-1909

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tucson, Clemick Neenan & Assoc.	802-749-4003
CA	San Diego, Clemick Neenan & Assocs.	619-268-8540
CA	Sherman Oaks, Clemick Neenan & Assocs.	213-990-3150
CA	Sunnyvale, W.W. Posey	408-746-0771
CO	Denver, Component Sls.	303-759-1666
GA	Chamblee, B.C.I.	404-455-0405
IL	Rolling Meadows, Sumer Inc.	312-991-8500
IN	Indianapolis, Southern Sls.	317-875-8750
KS	De Soto, Mid-Tec Assoc.	913-441-6565
MA	Bedford, F.R. Lesser	617-275-7558
MI	Rockford, H.C. Heym Assoc.	616-874-7443
MN	Minneapolis, Dunlop Conslts.	612-529-7626
MO	Florissant, Mid-Tec Assoc.	314-837-5200
NJ	West Orange, National Atlantic	201-731-0703
NY	Pittsford, W.A. Franklin Sls.	716-248-8251
NY	Valley Cottage, LRC Assocs.	914-268-4435
NC	Charlotte, B.C.I. Inc.	704-567-0473
NC	Raleigh, B.C.I.	919-781-9426
OH	Akron, Imtech	216-666-1185
OH	Dayton, Imtech	513-278-6507
OK	Tulsa, Design Mktg.	918-742-2589
PA	Narberth, Bresson Assocs.	215-664-6460
TX	Dallas, Design Mktg.	214-680-9767
TX	Round Rock, Design Mktg.	512-255-9896
UT	Salt Lake City, Component Sls.	801-466-8623
VA	Lynchburg, Bresson Assocs.	703-237-1304
WA	Bellevue, Eltec	206-643-4330
WI	Brookfield, Sumer, Inc.	414-784-6641

Local Distributors

CA	Garden Grove, Hi Rel	213-594-9571
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Mock III	619-560-0515
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Newark Elec.	303-757-3351
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Ft. Lauderdale, Newark Elect.	305-587-2372
IL	Chicago, Newark Elect.	312-638-4411
IL	Chicago, Bell Inds.	312-982-9210
IN	Indianapolis, Graham Elect.	317-634-8202
IA	Cedar Rapids, Newark Elect.	312-362-1171
MD	Baltimore, Radio Elect.	301-823-0070
MD	Beltsville, Newark Elec.	301-937-5085
MA	Needham, Cronin Elctrns.	617-449-0500
MA	Waltham, Sterling Elec.	617-894-6200
MN	Minneapolis, Newark Elect.	216-361-4700
MN	Minneapolis, Joel Co.	612-545-5669
NJ	Kenilworth, Newark Elect.	201-272-8410
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Hauppauge, Jaco Elect.	516-273-5500
NY	Plainview, ACI Elect.	516-293-6630
NY	Rome, Rome Elect.	315-337-5400
NC	Raleigh, Radio Elec. Svc.	919-781-5700
OH	Centerville, C.V. Clark	513-435-3000
OH	Cleveland, Newark Elect.	216-361-4700
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Philadelphia, Herback Rademan	215-426-1700
TX	Dallas, Wholesale Elect.	214-824-3001
UT	Salt Lake City, Newark Elect.	801-486-1048
WA	Bellevue, Bell Inds.	206-747-1515
WI	Brookfield, Newark Elect.	414-781-2450

OAK MATERIALS GROUP INC., Laminates Div., 174 N. Main St., Franklin, NH 03235, Tel: 603-934-5736, TWX: 510-298-1170; FSC No.: 53240

OAK Switch Systems Inc.

OAK SWITCH SYS., 100 S. Main St., Crystal Lake, IL 60014, Tel: 815-459-5000, Telex: 72-2447, TWX: 910-634-3353; FSC No.: 76854; Empl.: 1200 ....**1B**•1092, 1732, 1733, 1789

Local Sales Offices & Reps

AZ	Phoenix, Shefler/Kahn	602-257-9015
AR	Little Rock, Erickson Sls., Inc.	501-562-2159
CA	Huntington Bch., Oak Switch Sys.	714-963-0577
CA	Irvine, Oak Switch Sys. Inc.	714-786-8028
CA	Palo Alto, Oak Switch Sys. Inc.	415-493-0960
CA	San Jose, Oak Switch Sys. Inc.	408-729-1200
CA	Saratoga, Oak Switch Sys. Inc.	408-741-0372
CO	Denver, I.W. Strong Assoc.	303-292-6900
FL	Altamonte Springs, Oak Switch Sys.	305-831-5411
GA	Marietta, Oak Switch Sys. Inc.	404-953-9279
IL	Crystal Lake, Oak Switch Sys. Inc.	815-459-5000
IN	Speedway, Oak Switch Sys. Inc.	317-241-4424
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MA	Framingham, Oak Switch Sys. Inc.	617-256-1414
MA	Hudson, Oak Switch Sys. Inc.	617-562-3328
MI	Southfield, R.E.P. Assocs.	313-352-0110
MI	St. Joseph, R.E.P. Assocs.	616-983-7702
MN	Minnetonka, Gibb Elctrns. Sls.	612-935-4600
MO	Florissant, Oak Switch Sys.	314-355-8732
NJ	Haddonfield, Gray Assoc.	609-429-5300
NJ	Mountainside, Henry G. Richter	201-233-4615
NM	Albuquerque, Shefler/Kahn	505-296-0749
NY	Fayetteville, Henry G. Richter	315-637-6713
NC	Raleigh, Oak Switch Sys.	919-876-7591
OH	Eastlake, Oak Switch Sys. Inc.	216-946-0970
OK	Oklahoma City, Erickson Sls., Inc.	405-682-2947
OR	Beaverton, Oak Switch Sys.	503-642-4675
TX	Austin, Erickson Sls., Inc.	512-244-3068
TX	Dallas, Erickson Sls., Inc.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-980-9606
UT	Salt Lake City, I.W. Strong Assoc.	801-363-1014

Local Distributors

AL	Huntsville, Marshall Elctrns.	205-881-9235
AZ	Tempe, Marshall Elctrns.	602-968-6181
AZ	Tempe, Fisher-Brownell	602-967-1464
CA	Alhambra, Fisher-Brownell	213-289-0255
CA	Canoga Park, Marshall Elctrns.	213-999-5001
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Irvine, Marshall Elctrns.	714-556-6400
CA	Mountain View, I/O Sls. Inc.	415-968-1080
CA	San Diego, Marshall Elctrns.	619-578-9600
CA	San Diego, Fisher-Brownell	619-560-8545
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	Santa Clara, Fisher-Brownell	408-988-6041
CA	Sunnyvale, Marshall Elctrns.	408-732-1100
CO	Denver, CSID	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CO	Denver, Marshall Elctrns.	303-427-1818
CT	Hamden, Impact Elctrns.	203-281-1331
CT	Wallingford, Marshall Elctrns.	203-265-7338
FL	Ft. Lauderdale, Component Distr.	305-971-4950
FL	Orlando, Marshall Elctrns.	305-841-1878
GA	Norcross, Marshall Elctrns.	404-923-5750
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
IL	Palatine, Ohm/Elctrns.	312-359-5500
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Schaumburg, Marshall Elctrns.	312-490-0155
IN	Indianapolis, Graham Elctrns.	317-634-8202
MD	Baltimore, C.E.I. Distr.	301-744-7711
MD	Beltsville, Newark Elctrns.	301-937-5085
MD	Gaithersburg, Marshall Elctrns.	301-840-9450
MA	Burlington, Marshall Elctrns.	617-272-8200
MA	Canton, Impact Sls.	617-821-1500
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, Marshall Elctrns.	313-525-5850
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Northern Elec. Supp.	612-944-1167
MN	Plymouth, Marshall Elctrns.	612-559-2211
MO	St. Louis, Olive Elctrns.	314-426-4500
NJ	Fairfield, Marshall Elctrns.	201-882-0320
NJ	Mt. Laurel, Marshall Elctrns.	609-234-9100
NJ	Springfield, Newark Elctrns.	201-376-9500
NJ	Springfield, Route Elctrns.	201-379-7710
NM	Albuquerque, Walker Radio	505-247-2288
NY	Endwell, Marshall Elctrns.	607-754-1570
NY	Hauppauge, Marshall Elctrns.	516-273-2424
NY	Hauppauge, Fairmont Elec.	516-231-3313
NY	Jamaica, Calson Co.	212-525-5900
NY	Rochester, Marshall Elctrns.	716-235-7620
NY	Rochester, Modutex Corp.	716-647-9700
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Centerville, IPD	513-435-2086
OH	Dayton, Marshall Elctrns.	513-236-8088
OH	Solon, Marshall Elctrns.	216-248-1788
OH	Wickliffe, Gateway Megatech	216-944-8565
OR	Portland, Radar Elec.	503-232-3404
PA	Pittsburgh, Newark Elctrns.	412-787-7740
TX	Austin, Marshall Elctrns.	512-458-5654
TX	Dallas, Marshall Elctrns.	214-233-5200
TX	El Paso, Ideal Indl. Elect.	915-779-6647
TX	Houston, Marshall Elctrns.	713-789-6600
TX	Richardson, Fisher-Brownell	214-235-3177
UT	Salt Lake City, Newark Elctrns.	801-484-8611
WA	Bellevue, Marshall Elctrns.	206-747-9100
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053

OAKTRON INDS., 1000 30th St., Monroe, WI 53566, Tel: 608-328-5560; Empl.: 250 ....**3**•1045

Local Sales Offices & Reps

AZ	Phoenix, S. Fisher Assoc.	602-247-7865
CA	Mill Valley, Roy Colen Sls., Inc.	415-383-8700
CA	Newhall, Lessing Assoc.	213-348-6662
CO	Arvada, C B Elctrn. Mktg.	303-422-0561
FL	Tampa, SRT Marketing	813-884-4805
GA	Atlanta, Millar Elect.	404-261-6160
IL	Elmhurst, E.S.I.	312-941-0710
IN	Mulberry, Maish Sls.	317-296-2322
MA	Lexington, Six States Sls.	617-376-2044
MN	Minneapolis, Kodo Assoc.	612-881-1255
MO	Kansas City, Nevco	816-421-1751
MO	St. Louis, Nevco	314-843-7406
NY	Rochester, J. Brown Elect. Sls.	716-266-2728
NY	Whitestone, J. Brown Elect. Sls.	212-767-1977
NC	Raleigh, Millar Elect.	919-787-9564
OH	Akron, Shamrock Elect.	216-645-0363
OH	Dayton, Shamrock Elect.	513-298-1227
TX	Richardson, Campion Sls.	214-238-8145
VA	Great Falls, Kendall & Assoc.	703-759-3128
WA	Seattle, Vector/RMC	206-322-4343
EXP	IL, Chicago, Magnus Elect.	312-679-6070

OAL ASSOCS., P.O. Box J, Escondido, CA 92025, Tel: 619-743-7143; Empl.: 10; *Sls. Mgr.:* Mark Lohkemper

Local Sales Offices & Reps

CA	Costa Mesa, Pat Dooley Co.	714-548-2232
IL	Palatine, Jos. Clark Co.	312-358-5095
NY	Great Neck, W&A Holland	516-487-8877

OAR CORP., A CompuDyne Co., 10447 Roselle St., San Diego, CA 92121, Tel: 619-453-4013, Telex: 697852; *Sls. Mgr.:* Michael A. Duke

OAS INC., See Optimum Applied Systems

OCEAN RESCH. EQUIP., INC., Box 709, Falmouth, MA 02541, Tel: 617-548-5800, Telex: 94-0859; Empl.: 125; *Sls. Mgr.:* J. Angell

OCLI PHOTOELCTRNS. DIV., See Applied Solar Energy

ODELL, M. P., CO., 1620 Chesapeake Dr., Hoffman Estates, IL 60195, Tel: 312-991-2828, 800-633-5526; *Sls. Mgr.:* Maria McClurkin ....**3**•1927

OECO CORP., 712 S.E. Hawthorne Blvd., Portland, OR 97214, Tel: 503-238-2440, Telex: 36-0350; FSC No.: 95266; Empl.: 575; *Sls. Mgr.:* Bob Bunker

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093; Empl.: 37; *Sls. Mgr.:* H. L. Harrington

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561, TWX: 810-482-1630; FSC No.: 12066; Empl.: 46; *Sls. Mgr.:* G. Clagett .... **1B**•1854-1867; **3**•1278-1283

Local Sales Offices & Reps

AL	Huntsville, Guest Assocs.	205-534-2487
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Hayward, FLW, Inc.	415-467-2222
CO	Boulder, Meas. Consits.	303-449-7506
CT	North Haven, Pat Jenks Assocs.	203-239-6201
FL	Orlando, Datarep	305-843-5224
GA	Stone Mountain, Zelco Assocs.	404-498-2181
IL	Columbia, R. L. Weisheimer & Assocs.	618-281-4148
IL	Park Ridge, Elctrn. Instr. Assocs.	312-298-2290
MA	Woburn, Pat Jenks Assocs.	617-938-0488
MN	Minneapolis, Mark Co.	612-920-6280
NJ	Springfield, E. R. Mertz, Inc.	201-232-4643
NY	Latham, L-Tron Corp.	518-785-5032
NC	Charlotte, Zelco Assocs.	704-523-2961
OH	Dayton, Mohawk Intronics	513-434-8873
PA	Carnegie, Flow Media	412-923-1619
PA	King of Prussia, FLW, PA, Inc.	215-337-4343
TX	Houston, Scientific Sls. Co.	713-460-9170
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, Meas. Consits.	801-364-3174
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

Distributor

OHIOSWITCH, INC., 6534 Singletree Dr., Columbus, OH 43229, Tel: 614-885-0319 ....**1B**•1742

OHMITE MFG. CO., 3601 W. Howard St., Skokie, IL 60076, Tel: 312-675-2600, Telex: 72-4433, TWX: 910-223-0805 ....**1A**•1910-1917, 2050, 2051

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AK	Anchorage, H. J. Lang Assoc.	907-279-5741
AZ	Phoenix, Stitzer-Dodd Inc.	602-944-2237
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Palo Alto, Ohmite Mfg. Co.	415-494-6954
CA	San Diego, Wiley Co.	619-571-2881
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Coakley, Boyd & Abbett	203-239-6217
FL	Ft. Lauderdale, Cartwright & Bean	305-735-4900
FL	Orlando, Cartwright & Bean	305-422-4531
GA	Atlanta, Cartwright & Bean	404-233-2939
LA	Kenner, Cartwright & Bean	504-466-0020
MA	Needham Hgts., Coakley, Boyd & Abbett	617-444-5470
MI	Grosse Pointe Park, Greiner Assoc.	313-499-0188
MN	Bloomington, PWC Inc.	612-831-5999
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Gladstone, Delltron Co.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NH	Plaistow, Coakley, Boyd & Abbett	617-444-5470
NJ	River Edge, Ohmite Mfg. Co.	201-488-3690
NJ	Willingboro, Ohmite Mfg. Co.	609-871-1691
NY	Rochester, Electra Sls. Corp.	716-461-5252
NY	Syracuse, Electra Sls. Corp.	315-463-1248
NC	Charlotte, Polytech Svcs.	704-372-4161
OH	Chardon, Ohmite Mfg. Co.	216-286-7454
OH	Dayton, Ohmite Mfg. Co.	513-277-6543
OK	Oklahoma City, Erickson Sls.	405-682-2947
OR	Tigaird, Electronic Comp Sales	503-245-2342
PA	Monroeville, Ohmite Mfg. Co.	412-373-2695
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Austin, Erickson Sls.	512-445-2952
TX	Dallas, Erickson Sls.	214-739-5833
TX	Houston, Erickson Sls.	713-980-9606
UT	Salt Lake City, Lindberg Co.	801-467-1794
WA	Mercer Island, Electronic Comp Sales	206-232-9301

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supp.	602-258-8151
CA	El Monte, Kimball & Stark	213-444-2594
CA	Hollywood, Yale Radio Elec.	213-465-3186
CA	Mountain View, Abacus Elctrns. Co.	415-961-1500
FL	Tampa, Leader Elctrn. Distr.	813-870-3315
FL	West Palm Beach, Nurmi Elec. Supp.	305-684-0320
GA	Atlanta, Specialty Distr. Co.	404-873-2521
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Peoria, Klaus Radio	309-691-4840
IN	East Chicago, Acro Elctrns. Corp.	219-397-8681
KS	Wichita, Radio Supp. Co.	316-267-5213
MA	Hingham, Sager Electrical Supp.	617-749-6700
MI	Grand Rapids, S-F Elctrn. Supp.	616-459-0216
MO	Kansas City, Walters Radio Supp.	816-531-7015
NJ	Camden, General Radio Supp.	609-964-8560
NY	Hempstead, Electronic Equip.	516-538-5510
NY	Richmond Hill, Anchor Elctrn. Distr.	212-846-2420
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
OH	Cleveland, Specialized Comp. Sls.	216-464-0405
OH	Dayton, Stotts-Friedman Co.	513-224-1111
PA	Drexel Hill, Kass Elctrns. Distr.	215-449-2300
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
PA	Reading, Barbey Elctrns.	215-376-6116
VA	Charlottesville, Virginia Radio Supp.	804-296-4186
WI	Milwaukee, Marsh Elctrns.	414-475-6000

ohmtek INC.

OHMTEK, INC., 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025, TWX: 710-524-1653; FSC No.: 57489; Empl.: 115; *Sls. Mgr.:* John Burger ....**1A**•1919-1921

Local Sales Offices & Reps

CA	Santa Clara, I² Inc.	408-988-3400
CA	Woodland Hills, Interstate Mktg. Assoc.	213-883-7606
CO	Aurora, High Tech. Assocs.	303-695-1990
FL	Hollywood, Askland Elctrn. Comps.	305-987-1074
KS	Overland Pk., Advanced Techn. Sls.	913-642-6675
MA	Shrewsbury, Compatible Comps.	617-842-2022
MN	Mendota Hgts., G-II Sales	612-454-3086
NJ	Englewood, Harold Gray Assocs.	201-894-0894
NM	Albuquerque, Power Entprs.	505-298-1918
NY	Rochester, Fritz Dasson	716-338-1699
OH	Cincinnati, John F. Kilfoil Co.	513-791-6150
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TX	Lewisville, Jim Hughes Co.	214-221-1536

OK INDUSTRIES, INC., 3455 Conner St., Bronx, NY 10475, Tel: 212-994-6600, Telex: 12-5091; Empl.: 100; *Sls. Mgr.:* David Leventhal

OKONITE, Box 340, Ramsey, NJ 07446, Tel: 201-825-0300, TWX: 710-988-1017; Empl.: 1900; *Sls. Mgr.:* A. C. Coppola

OLIVER ADVANCED ENGRG., 676 W. Wilson Ave., Glendale, CA 91203, Tel: 818-240-0080, Telex: 194773; Empl.: 28; *Sls. Mgr.:* Dane Hutchins; *Dist. Mgr.:* Dane Hutchins

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-7996, Telex: 75-2217; Empl.: 18; *Sls. Mgr.:* Robert T. Mello; *Dist. Mgr.:* Robert T. Mello

® OMEGA ENGINEERING, INC.

OMEGA ENGRG., Box 4047, Stamford, CT 06907, Tel: 203-359-1660, Telex: 99-6404; Empl.: 400; *Sls. Mgr.:* George Vermilyea ..... **1B**•1735, 1818, 1819, 1868, 1869; **2**•2135; **3**•1013, 1089, 1137, 1168, 1284, 1346, 1347, 1386

OMNETICS, P.O. Box 2577, Syracuse, NY 13220, Tel: 315-699-5262, TWX: 710-545-0235; FSC No.: 52516; Empl.: 85; *Sls. Mgr.:* Dennis G. Conard; *Dist. Mgr.:* Dennis G. Conard

OMNIBYTE CORP., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185, Tel: 312-231-6880; Empl.: 30; *Sls. Mgr.:* Susan Cochran

Local Sales Offices & Reps

AZ	Scottsdale, Frontier Technology	602-998-4438
CA	Santa Clara, Applied Micro Tech.	408-730-1289
CA	Woodland Hills, Applied Micro Tech.	213-888-2027
FL	Melbourne, Reynolds & Assoc.	305-259-7000
IL	Park Ridge, Ad Tech Inc.	312-692-7320
MA	Belmont, E.S.M.	617-489-4414
MI	Southfield, Infinity, Inc.	313-557-7230
MN	Minneapolis, Jen-Ray Systems	612-831-5060
NJ	Boonton, Winter Assoc.	201-334-3434
NY	Caledonia, E. F. Sls.	716-538-4754
PA	Philadelphia, Systems Plus	215-677-2985
TX	Houston, Dyna Marketing	713-460-0314
EXP	IL, Chicago, Computer Overseas Corp.	312-332-3272

OMNI SPECTRA, 21 Continental Blvd., Merrimack, NH 03054, Tel: 603-424-4111, Telex: 953053, TWX: 710-366-0674; FSC No.: QUIP; Empl.: 750; *Sls. Mgr.:* Ernest J. Devita; *Dist. Mgr.:* Terri Hastings

OMNI SPECTRA, INC., Microwave Connector Div., 140 Fourth Ave., Waltham, MA 02154, Tel: 617-890-4750

OMNI SPECTRA, INC., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282, Tel: 602-966-1471, TWX: 910-950-1296; *Sls. Mgr.:* Carl Seburn; *Dist. Mgr.:* Carl Seburn

OMNITEC DATA INC., 2405 S. 20th St., Phoenix, AZ 85034, Tel: 602-258-8244, 800-528-8423, TWX: 910-951-4247; *Sls. Mgr.:* Dan J. Mitchell; *Dist. Mgr.:* Dan J. Mitchell

OMNITEK, INC., P.O. Box 102, 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-4443, TWX: 510-667-1730; FSC No.: 54316; *Sls. Mgr.:* Frank Shandelman

OMNI-WAVE ELECTRONICS CORP., P.O. Box 660, Gloucester, MA 01930, Tel: 617-281-2800

OMRON ELCTRNS., INC., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60195, Tel: 312-843-7900, TWX: 910-291-2494; Empl.: 209; *Sls. Mgr.:* D. Nelson

ONSET COMPUTER CORP., 199 Main St., P.O. Box 1016, N. Falmouth, MA 02556, Tel: 617-563-2267, Telex: 469915; Empl.: 6; *Sls. Mgr.:* Elaine Boyd

ONTEL CORP., 250 Crossways Park Dr., Woodbury, NY 11797, Tel: 516-364-2121, Telex: 961-382; Empl.: 430; *Sls. Mgr.:* Ed Heinze

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566; FSC No.: 24699; Empl.: 18 ....**3**•1046

OPTEK, Crown Semi, 345 Industrial Blvd., McKinney, TX 75069, Tel: 214-542-9461, TWX: 910-860-5625; Empl.: 320; *Sls. Mgr.:* James Trautwein; *Dist. Mgr.:* Dave Kimbrough .... **1B**•1232

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Verein Corp.	602-861-1141
CA	Escondido, Uni Rep	714-746-5131
CA	Santa Clara, Criterion	408-988-6300
CA	Thousand Oaks, Sc Cubed	805-496-7307
CA	Tustin, Sc Cubed	714-731-9206
CO	Wheatridge, Waugaman Assocs.	303-423-1020
CT	Madison, Conti-Younger Assocs.	203-245-1136
FL	Ft. Lauderdale, APM Assocs.	305-565-0056
FL	Longhorn, APM Assocs.	305-869-6831
FL	Tampa, APM Assocs.	813-886-2457
GA	Norcross, Montgomery Mktg.	404-447-6124
ID	Rathdrum, Vantage Corp.	208-772-7235
IL	Rolling Meadows, KMA Sales	312-398-5300
IN	Indianapolis, J & W Sales	317-842-3740
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grosse Pointe Pk., Greiner Assocs.	313-499-0188
MN	Eden Praire, Elctrn. Innovators	612-941-0830
NH	Melvin Village, Conti-Younger Assocs.	603-544-7278
NY	Clark Mills, KLM/Garner	315-853-6126
NY	Manhasset, Win-Cor Elec.	516-627-9474
NY	Pittsford, KLM/Garner	716-381-8350
NY	Syracuse, KLM/Garner	315-458-6214
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Cincinnati, Makin & Assocs.	513-871-2424
OH	Columbus, Makin & Assocs.	614-459-2423
OH	Ravenna, Makin & Assocs.	216-297-9748
OR	Silverton, Vantage Corp.	206-455-3460
TX	Austin, Kruvand Assocs.	512-458-9204
TX	Dallas, Kruvand Assocs.	214-691-4592
TX	Houston, Kruvand Assocs.	713-780-9710
UT	Salt Lake City, Waugaman Assocs.	801-254-0570
WA	Bellevue, Vantage Corp.	206-455-3460
WI	Milwaukee, KMA	414-259-1771

OPTELECOM, 15940 Lauanne Dr., Gaithersburg, MD 20760, Tel: 301-948-4232; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* F. C. Eggleston

OPTICAL & CONDUCTIVE COATINGS, Meridian Inds., Inc., 428 N. Buchanan Cir., #8, Pacheco, CA 94553, Tel: 415-798-6066, Telex: 171309 HQ WNCK; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.:* Glenn G. Grupe

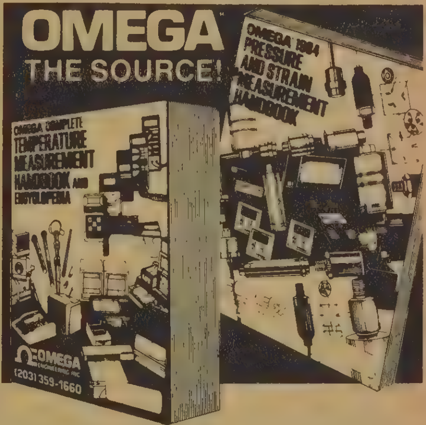
OPTICAL ELECTRONICS, INC., Box 11140, Tucson, AZ 85734, Tel: 602-624-8358, TWX: 910-952-1283; FSC No.: 5962; Empl.: 16; *Sls. Mgr.:* George L. Hill

Local Sales Offices & Reps

CA	San Diego, California Elctrn. Mktg.	619-692-3551
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
CA	Santa Clara, Comtronics	408-773-9800
MA	Burlington, Tritek Inc.	617-272-4550
NJ	Paramus, Design Elctrns.	201-845-6224
TX	Hurst, El-Tec Sls.	817-268-2896

OPTICAL FIBER TECHNOLOGIES, INC., P.O. Box 148, Nutting Lake, MA 01865, Tel: 617-663-6629, Telex: 948-288; *Sls. Mgr.:* Patricia Whalen

OMRON ELECTRONICS
AUTHORIZED DISTRIBUTOR
E S I
ELECTRIC SWITCHES INCORPORATED
2478 Fletcher Dr., Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971
IMMEDIATE DELIVERY FROM STOCK
Switches Relay
Proximity Photoelectric Timer
SEE COMPLETE PRODUCT LINE UNDER SWITCHES -- SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST


OMEGA
THE SOURCE!
OMEGA 1984 PRESSURE AND STRAIN MEASUREMENT HANDBOOK
OMEGA COMPLETE TEMPERATURE MEASUREMENT HANDBOOK AND ENCYCLOPEDIA
OMEGA
(203) 359-1660

✓ Temperature
✓ Pressure
✓ Strain
Measurement and Control
Plus Interfacing
Transducers to Computers
Call for your FREE! Handbook
(203) 359-1660
OMEGA ENGINEERING, INC.
One Omega Drive, Box 4047, Stamford, CT 06907 USA
Telex 996404 Cable OMEGA 203 FAX 359-7700
©Copyright 1984 OMEGA ENGINEERING, INC.

OPTICAL PUBLISHING CO., INC., Berkshire Common, Pittsfield, MA 01201, Tel: 413-499-0514, Telex: 232-005-ASAS Attention: Optical; *Sls. Mgr.:* George Cominsky

OPTICAL TECHNIQUES INTL., 1800 E. Garry, Ste. #214, Santa Ana, CA 92705, Tel: 714-540-9040; *Sls. Mgr.:* Robert Theriault; *Dist. Mgr.:* Robert Theriault

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, Telex: 130-224; *Sls. Mgr.:* Donald K. Wilson

OPTICS INTERNATIONAL, Box 101, Tenafly, NJ 07670, Tel: 201-567-4799; Empl.: 10

OPTIMA ENCLOSURES, 2166 Mountain Indl. Blvd., Tucker, GA 30084, Tel: 404-939-6340, TWX: 810-766-3967; FSC No.: 10110; Empl.: 250; *Sls. Mgr.:* Al Waters .... **2**•1047-1052

Local Sales Offices & Reps

AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	Santa Clara, Optima Div.	408-496-1040
CA	Santa Fe Springs, Optima Div.	213-949-9302
CO	Denver, Quorum 3	303-696-8480
FL	Orlando, OEM Mktg.	305-299-1000
GA	Atlanta, Optima Div.	404-449-2530
IL	Arlington Heights, Diethert/Angel	312-593-7600
KS	Kansas City, BC Elctrn. Sls.	913-342-1211
KS	Wichita, BC Elctrn. Sls.	316-942-9840
MD	Gaithersburg, Beacon North	301-869-3289
MD	Randallstown, Beacon North	703-591-1300
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Golden Valley, Diethert/Angel	612-546-6099
MO	Bridgeton, BCElctrn. Sls.	314-291-1101
NJ	Fair Lawn, Optima Div.	201-794-3100
NY	Rochester, Apex Assoc.	716-254-6050
OH	Cleveland, C. A. Robinson Co.	216-381-9049
OH	Dayton, C. A. Robinson Co.	513-278-7969
OR	Beaverton, Caruso & Northcutt, Inc.	503-646-4973
TX	Richardson, Optima Div.	214-238-1116
UT	Sandy, Quorum 3	801-943-9227
VA	Fairfax, Beacon North	703-591-1300
VA	Forest, Beacon North	804-239-8486
WA	Bellevue, Caruso & Northcutt, Inc.	206-454-9699
WI	Waukesha, Diethert/Angel	414-547-6575

OPTIMATION, See Julie Research Labs

OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100; Empl.: 30

OPTIMUM APPLIED SYSTEMS, 145 Palisade St., Dobbs Ferry, NY 10522-1696, Tel: 914-693-9001, Telex: 646689 PANGIA-YONKERS; Empl.: 30; *Sls. Mgr.:* H. Joseph Brakl

opt INDUSTRIES INC.

OPT INDS. INC., 300 Red School La., Phillipsburg, NJ 08865, Tel: 201-454-2600, TWX: 510-235-2920; Empl.: 240 .... **1A**•1268, 1269, 1398, 2212, 2213; **3**•1665

Local Sales Offices & Reps

CA	Palo Alto, Sheehan McCristall Assocs.	415-494-8244
FL	Lauderhill, Innovative Mktg.	305-485-6869
FL	Melbourne, EMS, Inc.	305-724-1027
IL	Chicago, LGS Elctrns. Co.	312-456-9616
IN	Ft. Wayne, Corrao Marsh, Inc.	219-637-5548
IA	Cedar Rapids, Cahill, Schmitz & Cahill	319-377-8219
MI	Ann Arbor, Technical Sls. Assocs.	313-995-4082
MI	Union Lake, Technical Sls. Assocs.	313-363-1427
MN	Minneapolis, White Sls. Co.	612-755-0855/3511
NJ	Freehold, Sal Giaconne	201-462-7410
NJ	Palisades Park, Janco Technlg.	201-941-4008
NY	Pittsford, Franklin Sls. Corp.	716-248-8251; 315-737-7121
OH	Dayton, Technical Sls. Assocs.	513-222-1892
OH	Dayton, Patrick Montplaisir	513-434-4316
OH	Lyndhurst, Technical Sls. Assocs.	216-461-0826
TX	Plano, Zeus Engrg. Co.	214-423-2027

OPTOELECTRONICS, INC., 1309 Dynamic St., Petaluma, CA 94952, Tel: 707-763-4181, Telex: 34-0186; Empl.: 40; *Sls. Mgr.:* Victor Yen

OPTOELECTRONICS, INC., 5821 N.E. 14th Ave., Ft. Lauderdale, FL 33334, Tel: 305-771-2050, Telex: 514849; Empl.: 25; *Sls. Mgr.:* L. R. Hufft; *Dist. Mgr.:* L. R. Hufft

OPTOMICRONIX, 10080 N. Wolfe Rd., SW 3-360, Cupertino, CA 95014, Tel: 408-725-1220; *Sls. Mgr.:* W. M. Otsuka

OPTO TECHNLG., 1674 S. Wolf Rd., Wheeling, IL 60090, Tel: 312-537-4277, TWX: 910-687-1490; Empl.: 25; *Sls. Mgr.:* William E. Hegberg; *Dist. Mgr.:* Richard Hegberg

opto 22

OPTO 22, 15461 Springdale St., Huntington Bch., CA 92649, Tel: 714-891-5861, Telex: 692-386; Empl.: 120; *Sls. Mgr.:* Jim Pancake .... **1B**•1470, 1471

Local Distributors

AL	Birmingham, Industrial Elec. Supply	205-956-8504
AL	Huntsville, Hamilton Avnet Elctrns.	205-837-7210
AZ	Tempe, Hamilton Avnet Elctrns.	602-231-5100
AR	Little Rock, Carlton Bates	501-562-9100
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Costa Mesa, Hamilton Electro Sls. Orange County	714-641-4100
CA	Culver City, Hamilton Electro Sls.	213-558-2121
CA	Huntington Beach, Opto 22 Distibutor Sls.	714-891-5861
CA	Laguna Hills, Automated Dynamics	714-855-8235
CA	Milpitas, Automated Dynamics	408-946-0222
CA	Sacramento, Hamilton Avnet Electronics	916-925-2216
CA	San Diego, Hamilton Avnet Elctrns.	619-571-7510
CA	Sunnyvale, Hamilton Avnet Elctrns.	408-743-3355
CO	Arvada, Automated Dynamics	303-425-5242
CO	Denver, Hamilton Avnet Elctrns.	303-740-1000
CT	Danbury, Hamilton Avnet Elctrns.	203-797-2800
FL	Fort Lauderdale, Hamilton Avnet Elctrns.	305-971-2900
FL	Orlando, Hamilton Avnet Elctrns.	305-628-3888
FL	St. Petersburg, Hamilton Avnet Elctrns.	813-576-3930
GA	Norcross, Professional Control Corp.	404-449-4577
GA	Norcross, Hamilton Avnet	404-447-7507
IL	Bensenville, Hamilton Avnet Elctrns.	312-860-7700
IL	Berkeley, Tara	312-449-6434
IL	Elk Grove Village, GBL Goold Elctrns.	312-593-3220
IL	Moline, Jim Otis	309-762-9311
IN	Carmel, Hamilton Avnet Elctrns.	317-844-9333
IN	Indianapolis, Process Automation Devices	317-849-3682
KS	Overland Park, Hamilton Avnet Elctrns.	913-888-8900
MD	Baltimore, Automation Indl. Control	301-944-8400
MD	Columbia, Hamilton Avnet Elctrns.	301-995-3500
MD	Mount Airy, Thermal Devices	301-442-1007
MA	N. Redding, Martindale Assocs.	617-942-0514
MA	Woburn, Hamilton Avnet Elctrns.	617-273-7500
MI	Grand Rapids, Hamilton Avnet Elctrns.	616-243-8805
MI	Livonia, Hamilton Avnet Elctrns.	313-522-4700
MI	Madison Heights, McNaughton-McKay Elect.	313-399-7500
MN	Minneapolis, Cassidy Elctrns.	612-944-0100
MN	Minnetonka, Hamilton Avnet Elctrns.	612-932-0600
MN	St. Paul, Kim Controls	612-780-2991
MO	Earth City, Hamilton Avnet Elctrns.	314-344-1200
NJ	Cherry Hill, Hamilton Avnet Elctrns.	609-424-0100
NJ	Fairfield, Hamilton Avnet Elctrns.	201-575-3390
NM	Albuquerque, Hamilton Avnet Elctrns.	505-765-1500
NY	East Syracuse, Hamilton Avnet Elctrns.	315-437-2641
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NY	Melville, Hamilton Avnet Elctrns.	516-454-6060
NY	Rochester, Hamilton Avnet Elctrns.	716-475-9130
NC	Charlotte, Regan Controls	704-523-9137
NC	Raleigh, Hamilton Avnet Elctrns.	919-878-0810
OH	Centerville, I. P. D.	513-435-2086
OH	Cincinnati, Richard Equip.	513-271-8666
OH	Cleveland, Hamilton Avnet Elctrns.	216-831-3500
OH	Columbus, Great Lakes Controls Corp.	614-451-7872
OH	Dayton, Hamilton Avnet Elctrns.	513-433-0610
OH	North Royalton, Great Lakes Controls Corp.	216-582-0020
OK	Tulsa, Quality Comps.	918-664-8812
OR	Lake Oswego, Hamilton Avnet Elctrns.	503-635-8831
OR	Portland, Pacific Control Supply	503-249-2033
PA	King of Prussia, Applied Controls	215-265-3832
PA	Pittsburgh, Great Lakes Controls Corp.	412-341-6084
PA	Pittsburgh, Customized Control Sys.	412-921-3196
TX	Addison, Quality Comps.	214-387-4949
TX	Austin, Quality Comps.	512-835-0220
TX	Austin, Hamilton Avnet Elctrns.	512-837-8911
TX	Houston, Hamilton Avnet Elctrns.	713-780-1771
TX	Houston, Quality Comps.	713-491-2255
TX	Irving, Hamilton Avnet Elctrns.	214-659-4111
UT	Salt Lake City, Hamilton Avnet Elctrns.	801-972-2800
WA	Bellevue, Hamilton Avnet Elctrns.	206-643-3950
WA	Kent, Shannon, Ltd.	206-763-0545
WA	Redmond, Cascade Controls	206-881-8843
WI	Milwaukee, Taylor Elctrns.	414-241-4321
WI	Milwaukee, Hamilton Avnet Elctrns.	414-784-4510
WI	Sussex, Professional Control Corp.	414-246-3220

OPTRON, INC., See TRW Optron

ORAM ELCTRNS., Rte. 22, Brewster, NY 10509, Tel: 914-279-2966; Empl.: 25; *Sls. Mgr.:* Vincent A. Gianguzzi

ORBIT INDS., 2670 Lockheed Way, Carson City, NV 89701, Tel: 702-882-6123; Empl.: 10

ORBIT INSTRUMENT CORP.

ORBIT INSTRUMENT CORP., 80 Cabot Ct., Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Bruce Reissman, Dennis Sunshine ...**1B**•1790, 1791; **3**•1138

Local Sales Offices & Reps

CA	San Diego, Orbit Instr. Corp.	619-566-3437

ORBIT INSTRUMENT OF CAL., 6431 Global Dr., Cypress, CA 90630, Tel: 714-527-0561, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Bruce Reissman

ORIEL CORP., 250 Long Beach Blvd., Stratford, CT 06497-0872, Tel: 203-377-8282, TWX: 710-453-8719

ORIONICS, INC., 34368E Frontage Rd., Bozeman, MT 59715, Tel: 406-586-8256, TWX: 910-963-2063

ORTEL CORP., 2015 W. Chestnut St., Alhambra, CA 91803, Tel: 213-281-3636; *Sls. Mgr.:* Andrew Hilbert

OSBORNE TRANSFORMER, 19636 Derby St., Detroit, MI 48203, Tel: 313-368-4136; Empl.: 30; *Sls. Mgr.:* J. R. Osborne

OSCILLATEK CORP., 620 North Lindenwood Dr., Olathe, KS 66062, Tel: 913-829-1777, Telex: 437045; Empl.: 20; *Sls. Mgr.:* A. Ghafoor .... **1A**•1399

OSHINO ELECTRIC LAMP WORKS, LTD., 5-2, Mianami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, Japan, Tel: 03-471-8548, Telex: 0242-2117; Empl.: 300; *Sls. Mgr.:* T. Koyama .... **1B**•1093

Local Sales Offices & Reps

CA	Fountain Valley, WAMCO Inc.	714-545-5560

OSLO CONTROLS, 328 Industrial Ave, Cheshire, CT 06410, Tel: 203-272-2794, TWX: 710-455-3774; *Sls. Mgr.:* J. J. Martinez .... **1B**•1736, 1737

Local Sales Offices & Reps

AZ	Scottsdale, Semi-Systems	602-991-1151
CA	Brea, Masco	714-529-0866
CA	Mountain View, Westech Sls.	415-961-1422
CO	Englewood, Computech Mkt.	303-773-3981
CT	Bloomfield, Zaslow Sls.	203-242-7781
FL	Tampa, J-R Controls	813-961-9478
IL	Lisle, W-G Controls	312-963-5954
MD	Silver Spring, L. G. White & Co.	301-434-1555
MI	Grosse Pointe Park, Greiner Assoc.	313-499-0188
MN	Minneapolis, JOS-CO/Melius	612-861-3343
MO	St. Louis, Hill & Co.	314-432-1136
NJ	Caldwell, Grimm Siegel Assoc.	201-575-9300
NY	Syracuse, Canavan-Scanlon Assoc.	315-437-1271
OH	Cincinnati, O. H. Bromberg & Assoc.	513-771-9333
OH	Mentor, KT/DEPCO	216-729-3588
PA	Broomall, White-Whiddett	215-353-6347
TX	Dallas, Glidden Electro Equip.	214-341-0610
WA	Mercer Island, J. H. Andersen & Assocs.	206-232-0484

Local Distributors

CA	Gardena, California Switch & Signal	213-770-2330; 213-538-9830
CA	Los Angeles, Master Distrs.	213-829-4656
CA	Los Angeles, Minarik Elect.	213-485-1291
CA	Riverside, Elctrn. Supply	714-683-7300
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Tustin, Western Switches	714-731-4333
CA	Van Nuys, Pacific Switch Controls	213-873-4802
CT	Shelton, Century Elec. Supply	203-736-2684
CT	West Hartford, Atlantic Switch Controls	203-527-7705

FL	Lakeland, A A Elec.	800-237-8274
FL	Lakeland, Switch Controls	813-644-7564
IL	Lombard, R. M. Elctrns.	312-932-5150
IL	Wheaton, Conectrix	312-653-1460
MA	Canton, Impact Elctrns.	617-821-1500
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Elctrn. Center	612-338-5881
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Mt. Laurel, Jersey Switch	609-778-8190
NY	Woodside, Switches Unltd.	212-478-5000
OH	Cincinnati, Cartessa Mfg.	513-522-3100
OH	Columbus, Ohio Switch	614-885-0319
TX	Dallas, Glidden Electro Equip. Co.	214-341-0610
TX	Dallas, Texaswitch	214-357-1768
WI	Mequon, Taylor Elec.	414-241-4321
PR	Ponce, Distributronics	809-843-3321

OSTBY & BARTON, 487 Jefferson Blvd., Warwick, RI 02886, Tel: 401-739-7310, Telex: 927573; *Sls. Mgr.:* Jos. E. Burns

OTTO
CONTROLS

OTTO ENGRG., 2 E. Main St., Carpentersville, IL 60110, Tel: 312-428-7171, Telex: 722426; FSC No.: 21649; Empl.: 120; *Sls. Mgr.:* R. E. Sparks .... **1B**•1738, 1739

Local Sales Offices & Reps

AL	Decatur, El Tech	205-353-7899
AZ	Mesa, Temp Assoc.	602-829-1901
CA	Costa Mesa, Gabriel Assocs.	714-957-1981
CA	San Jose, Mollard Mktg.	415-961-0456
FL	Ft. Lauderdale, Newell-Hynes Assocs.	305-761-1113
IL	Glen Ellyn, Rockford Controls Co.	312-469-6016
MA	Needhan Heights, Newscott	617-444-1923
MO	Kansas City, Harris-Hanson Co.	816-444-9494
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NJ	Medford, Jack McCoy Inc.	609-953-0770
NY	Great Neck, F. Tylinski Co.	516-466-9070
OH	Cleveland, Electro-Com	216-676-8154
OH	Dayton, Electro-Com	513-898-5140
SC	Irmo, Heritage Sls. Assoc.	803-781-8259
TX	Dallas, Control Comps. Corp.	214-458-8877
WA	Bellevue, James Findlay Co.	206-455-9597

Local Distributors

CA	Los Angeles, Electric Switches, Inc.	213-664-2125
CA	N. Hollywood, Flame Enterprises	213-769-2442
CA	Sunnyvale, Pyramid Elctrns.	408-744-1900
MD	Kensington, Marine Air Supp.	301-949-1353
MA	Hingham, Sager Elec. Supp.	617-749-6700
NY	Farmingdale, Harrison Radio Corp.	516-293-7990
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Woodside, Durham Aircraft Srvc.	212-274-9000
TX	Dallas, Associated Aircraft Supp.	214-331-4381

ovenaire

OVENAIRE, 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 510-587-5461; FSC No.: 12020; Empl.: 150; *Sls. Mgr.:* Andy Bell .... **1A**•1400-1403

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	San Mateo, Melvin Sls.	415-349-7445
CA	Van Nuys, R.L. Assocs.	213-782-7826
CO	Loveland, Morbak Mktg.	303-669-8900
FL	Maitland, Ellis & Assocs.	305-645-1101
GA	Atlanta, L & D Inc.	404-455-3483
IL	Des Plaines, Janus Inc.	312-298-9330
IN	Fort Wayne, TX Sls., Inc.	219-489-4447
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Milton, Naton Assocs.	617-698-0670
MN	St. Paul, Countryman	612-645-9151
MO	Blue Springs, Chesco	816-229-1404
MO	St. Charles, Chesco	314-946-6677
NJ	Cherry Hill, H. J. White Co.	609-428-4544
NJ	Paramus, Eltech Sls.	201-967-1309
NY	Buffalo, Quality Comps.	716-837-5430
NC	Greensboro, L & D, Inc.	919-292-3201
NC	Raleigh, L&D Inc.	919-876-5301
TN	Seymour, L&D Inc.	615-577-1549
TX	Arlington, W. Pat Fralia Co.	817-640-9101
VA	Richmond, L & D, Inc.	804-359-1025
WA	Seattle, Carlyle Tech. Sls.	206-575-6750
WI	Milwaukee, Janus Inc.	414-476-9104

OVEN INDS., 191 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055, Tel: 717-766-0721; FSC No.: 21302; Empl.: 50; *Sls. Mgr.:* T. M. Nolan

OXLEY INC., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028, Tel: 213-463-5120, TWX: 910-321-2903; *Sls. Mgr.:* Norman R. Sutherland

PACCOM, 3928 148th NE, Redmond, WA 98052, Tel: 206-883-9200, 800-426-6254, TWX: 910-449-2592; Empl.: 15; *Sls. Mgr.:* D. Tully; *Dist. Mgr.:* C. Beaudette

PACE INC., 9893 Brewers Ct., Laurel, MD 20707, Tel: 301-490-9860, Telex: 87446; Empl.: 75; *Sls. Mgr.:* James K. Bausell

PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, Telex: 260391; FSC No.: 60162; *Sls. Mgr.:* Steven Prince; *Dist. Mgr.:* Steven Prince

PACIFIC ATLANTIC ELCTRNS., Box 754, El Cerrito, CA 94530, Tel: 415-237-5837, TWX: 910-366-7296; Empl.: 4; *Sls. Mgr.:* P. Yen; *Dist. Mgr.:* P. Yen

Advertisement

We Specialize in Triggering Systems for Lasers and Spark Gaps. Using latest Solid State techniques, our PT00 series Pulsers will accept TTL level input, and output over 600V/50 Ohms. The PT-55 series have output ranges from 50-60kV., positive or negative polarity, all with nanosec. risetime. Our products include DC/DC HV. power supplies and Fid. Generators.

Local Sales Offices & Reps

CA	El Cerrito, Patronix	415-237-5837

PACIFIC CYBER/METRIX INC., 6800 Sierra Ct., Dublin, CA 94568, Tel: 415-829-8700, TWX: 910-389-6890; *Sls. Mgr.:* R. Nelson

PACIFIC COMMUNICATIONS, 2041-A S. Grand Ave., Santa Ana, CA 92705, Tel: 714-546-0147; Empl.: 35

PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 213-532-6600, TWX: 910-346-7619; Empl.: 600; *Sls. Mgr.:* W. A. Fiechtner; *Dist. Mgr.:* Gary M. Payne

PACIFIC ELECTRO DYNAMICS, INC., 11465 Willows Rd. N.E., Redmond, WA 98052, Tel: 206-881-1700, TWX: 910-449-2977

PACIFIC INSTRS. INC., 2355 Whitman Rd., Concord, CA 94518, Tel: 415-827-9010, TWX: 910-481-9977; Empl.: 45 .... **3**•1015

Local Sales Offices & Reps

AL	Huntsville, Lee Assocs.-Mid South, Inc.	205-533-5896
AZ	Phoenix, Vic Myers Assocs.	602-241-9324
AZ	Phoenix, Trembly Assocs.	602-967-2058
CA	Alhambra, Dale-Dahl Assocs.	213-682-3417
CA	Walnut Creek, Dale-Dahl Assocs.	415-933-9595
CO	Denver, Vic Myers Assocs.	303-629-9676
CO	Denver, Trembly Assocs.	303-759-1195
CT	Hamden, Applied Measurements	203-288-5288
FL	Maitland, Wade H. Boggs, Inc.	305-647-2226
IL	Park Ridge, EIA, Inc.	312-298-2290
IN	Indianapolis, EIA, Inc.	317-257-7231
ME	Freeport, Applied Measurements	207-773-4580
MA	Acton, Applied Measurements	617-263-2766
MI	Farmington Hill, Anderson Elctrns., Inc.	313-553-7608
NJ	Marlboro, Cook & Weil	201-536-3964
NM	Albuquerque, Vic Myers Assocs.	505-884-6878
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Latham, L-Tron Corp.	518-785-5032
NY	New York, Cook & Weil	212-246-6599
PA	Radnor, Roberts Engrg.	215-688-6525
TN	Nashville, Lee Assocs.-Mid South, Inc.	205-533-5896
TX	Arlington, John T. Houston Assocs., Inc.	817-265-2931
UT	Salt Lake City, Trembly Assocs.	801-486-5292
UT	Salt Lake City, Vic Myers Assocs.	801-581-1760
VT	Bennington, Applied Measurements	802-442-2222
VA	Arlington, Gans & Pugh Assocs.	703-527-3262

PACIFIC MAGNETICS CORP., 2602 Transportation Ave., Ste. F, National City, CA 92050, Tel: 619-474-8216; *Sls. Mgr.:* Mary Hill

PACIFIC MEAS., INC., 488 Tasman Drive, Sunnyvale, CA 94086, Tel: 408-734-5780, TWX: 910-339-9273; Empl.: 100; *Sls. Mgr.:* Ed Mendel

PACIFIC MICROCOMPUTERS, INC., 119 Aberdeen, Cardiff, CA 92007, Tel: 619-436-8649; Empl.: 27; *Sls. Mgr.:* Sherrell Harper

PACIFIC MICRO SYS., INC., 160 Gate 5 Rd., Sausalito, CA 94965, Tel: 415-331-2525; Empl.: 12; *Sls. Mgr.:* Donald Shipley; *Dist. Mgr.:* Donald Shipley

PACIFIC
POWER SOURCE CORP.

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433; Empl.: 49; *Sls. Mgr.:* A. F. Hatlestad .... **3**•1897-1901

Local Sales Offices & Reps

KS	Overland Park, Ramsey Assocs.	913-649-6996
MA	Burlington, Intersell, Inc.	617-273-3844
MN	Minneapolis, Loren Green Assocs.	612-571-6666
MO	Maryland Heights, Ramsey Assocs.	314-878-5042
NY	Dewitt, D. B. Assocs. Inc.	315-446-0220
NY	Wantagh, Bytec Reps.	516-781-7400
VA	Springfield, Tech Reps. Inc.	703-569-6868
WA	Bellevue, Al Smith	206-746-6770
WA	Vancouver, Al Smith	206-892-9912

Local Distributors

EXP	Los Angeles, CA, Trans World Trade	213-476-8406

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 213-345-7811 .... **1A**•1922, 1923

Local Sales Offices & Reps

CA	San Jose, Silcon Valley	408-286-7510
MN	St. Paul	612-642-2828

PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61105, Tel: 815-966-3600, Telex: 257-315; Empl.: 400

Distributor

PACIFIC SWITCH CONTROLS, INC., 16116 Leadwell St., Van Nuys, CA 91406, Tel: 213-873-4802 .... **1B**•1742

PACIFIC TIMER INC., 21739 N.E. 18th Way, Redmond, WA 98052, Tel: 206-881-1785; *Sls. Mgr.:* Karen A. Pettyjohn

PACIFIC TRANSDUCER, 2301 Federal, Los Angeles, CA 90064, Tel: 213-478-1134; Empl.: 23

PACTEC DIV., LaFrance Corp., Enterprise & Executive Avenues, Philadelphia, PA 19153, Tel: 215-365- 8400, Telex: 83- 1732; *Dist. Mgr.:* Edward Fitzpatrick .... **2**•1002, 1042, 1043

Local Sales Offices & Reps

AL	Huntsville, Hollingsworth & Still	800-241-5712
AZ	Phoenix, Gramer & Co.	602-995-9455
CA	Fallbrook, Martronix	619-728-7678
CA	Santa Clara, Warren Assoc.	408-988-7762
CO	Denver, High Plains Mktg.	303-751-7150
CT	Middletown, Gerber Sls.	203-347-3000
FL	Ft. Lauderdale, Hollingsworth & Still	305-748-8964
GA	Norcross, Hollingsworth & Still	404-447-1700
IL	Arlington, Brainard-Wilson Mktg.	312-437-2700
IN	Carmel, Brainard-Wilson Mktg.	317-844-2800
MA	Newton, Gerber Sls.	617-969-2620
MI	Detroit, Burcaw Co.	313-533-7700
MN	St. Louis Park, Lestronix	612-926-8466
MO	Grandview, Harris Hanson Co.	816-763-6200
MO	St. Louis, Harris Hanson Co.	314-432-3611
NJ	Broomall, L. D. Lowery, Inc.	215-528-5170
NJ	Woodcliff Lake, Joe Freid & Assoc.	201-391-8091
NY	Great Neck, F & F Metro	516-482-4080
NY	Mendon, Tech-Mark	716-624-3840
OH	Richfield, Bear Mktg.	216-659-3131
OR	Portland, James J. Backer Co.	503-297-8744
PA	Broomall, L.D. Lowery, Inc.	215-528-5170
TX	Dallas, MGR Elctrn.	214-238-5246
UT	Salt Lake City, High Plains Mktg.	801-968-9456
WA	Seattle, James J. Backer Co.	206-285-1300
WI	Colgate, Rep 1 & Assocs.	414-628-4016

Local Distributors

AL	Decatur, Forbes Distrs.	205-353-4762
AZ	Phoenix, R. V. Weatherford	602-272-7144

AZ	Phoenix, Tri-Tek	602-995-9352
AZ	Phoenix, Lion Elctrns.	602-869-9611
AZ	Tucson, Elliot Elctrns.	602-884-7394
CA	Anaheim, R. V. Weatherford	714-634-9600
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	Cucamonga, Abletronics	714-987-7606
CA	Gardena, California Switch & Signal	714-522-8600
CA	Glendale, R. V. Weatherford	213-849-3451
CA	Glendale, R. V. Weatherford	213-849-3451
CA	Monterey, Zackit (Monterey)	408-375-3144
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Palo Alto, R. V. Weatherford	415-493-5373
CA	Pomona, R. V. Weatherford	714-623-1261
CA	Sacramento, Zackit/Sacramento	916-446-3131
CA	San Diego, R. V. Weatherford	619-278-7400
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Rafael, Electronics Plus	415-457-0456
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Valleyo, Zackit (Valleyo)	707-644-6676
CO	Denver, Intergrated Elctrns.	303-292-6121
CO	Denver, Gateway Elctrns.	303-458-5444
CO	Denver, R. V. Weatherford	303-428-6900
CO	Greeley, Greely Walker	303-353-3241
CT	Middletown, Midstate Elctrns.	203-347-5638
CT	New Haven, Hatry Elctrns.	203-787-5921
CT	New London, Jan Elctrns.	203-442-4386
CT	Stratford, Utronics	203-378-4201
DE	Wilmington, Wholesale Elctrns.	302-656-9988
FL	Longwood, MRP Micro Elctrns.	305-331-8787
FL	Miami, Electronic Equip. Co.	305-871-3500
FL	Orlando, EMSCO	305-849-6362
FL	West Palm Beach, Nurmi Elctrns.	305-686-8553
GA	Atlanta, Ack Radio	404-351-6340
IL	Arlington Hgts., Martec Assocs.	312-437-2700
IL	Berwyn, BB & W Inc.	312-242-1533
IL	Champagne, Klaus Radio	217-356-1896
IL	Chicago, R. W. Elctrns.	312-248-2480
IL	Chicago, Electronic Distrs.	312-283-4800
IL	Elk Grove, Martec Assocs.	312-956-8090
IL.	Mt. Prospect, Tri State Elctrns.	312-255-0600
IL	Niles, Joseph Elctrns.	312-297-4200
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Bloomington, Stansifer Radio Co.	812-336-6339
IN	Gary, Calumet Elctrns.	317-887-4961
IN	Indianapolis, Electronic Service Parts	317-632-8586
IN	Jasper, Elex Mart	812-882-3615
IA	Cedar Rapids, Iowa Radio Supply	319-393-5410
KS	Salina, Electronics, Inc.	913-827-7377
KY	Bowling Green, Randolph, Hale & Meredith	502-781-1460
KY	Louisville, Peerless Elctrns.	502-637-7674
MD	Aberdeen, Harco Elctrns.	301-838-7990
MD	Baltimore, Almo Elctrns.	301-247-5955
MD	Beltsville, P.S.I.	301-937-4960
MD	Hyattsville, Mark Elctrns.	301-559-7700
MD	Rockville, Capitol Radio	301-881-2270
MD	Rockville, Heath Kit Elctrns.	301-881-5420
MD	Towson, Baynesville Elctrns.	301-823-0082
MA	Hingham, Sager Elec. Supp.	617-749-6700
MI	Augusta, Great Lakes Elctrns.	616-731-4156
MI	Berrien Springs, Data Comms.	616-471-2119
MI	Detroit, Radio Supp. & Engrg.	313-TE1-3174
MI	Grand Rapids, S. F. Elctrns.	616-459-0216
MI	Lansing, Fulton Radio	517-394-5020
MI	Livonia, RS Elctrns.	313-525-1155
MN	Edina, Northern Elctrns.	612-944-1167
MO	Kansas City, Burstein & Assocs.	816-BA1-4100
MO	St. Louis, Gateway Elctrns.	314-427-6116
NE	Lincoln, Scott Elctrns.	402-466-8221
NJ	Milford, Sintec/Aries	201-996-4093
NJ	Pine Brook, Parts Masters	201-227-7797
NM	Albuquerque, Walker Radio Co.	505-247-2288
NY	Buffalo, Summit Distr.	716-887-2800
NY	Freeport, KRP Elctrns.	516-623-3346
NY	New York, Advance Elctrns.	212-687-2224
NY	Rochester, Summit Distr.	716-334-8110
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Rockville Centre, Midway Indl. Elctrns.	212-895-2443
NY	Rockville Centre, Midway Indl.	516-764-2400
NY	Troy, Trojan Elctrn. Supp.	518-274-4481
NC	Burlington, Womack Elctrns.	919-227-7486
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes-Peters	614-294-5351
OH	Solon, Hart Elctrns.	216-248-8855
OK	Oklahoma City, Electronic Supp.	405-232-5215
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Norvac Elctrns.	503-644-1025
OR	Portland, Radar Elec.	206-233-3691
PA	Allentown, A.A. Peter, Inc.	215-434-5237
PA	Coatesville, County Supply	215-384-4585
PA	Enola, Almo Elctrns.	717-732-3681
PA	Marcus Hook, Linwood Wholesalers	215-485-0777
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Willow Grove, Resco Elctrns.	215-659-4575
PA	York, Rosen Elctrns.	717-843-3875
RI	Pawtucket, Jabbour Elctrns.	401-728-4600
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Chattanooga, Techni-Tronics	615-875-5449
TN	Clarksville, Randolph, Hale & Matthews	615-647-2325
TN	Columbus, Randolph & Williams	615-388-7566
TN	Gray, Dixie Elctrns.	615-477-3838
TN	Memphis, Bluff City	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5602
TN	Tullahoma, Randolph, Rice & Williams	615-455-4531
TX	Austin, Galtronics	512-452-9311
TX	Dallas, R. V. Weatherford	214-243-1571
TX	Dallas, Solid State Elctrns.	214-438-5700
TX	Houston, Ace Elctrns.	713-688-8114
TX	Houston, R. V. Weatherford	713-688-7406
TX	Houston, Gateway Elctrns.	713-978-6575
TX	San Antonio, Altex Elctrns.	512-828-0503
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Arlington, Arlington Elctrns.	703-524-2415
VA	Charlottesville, Virginia Radio	804-296-4184
VA	Falls Church, Crossroads Elctrns.	703-931-0600
VA	Richmond, ITR (Instr. Tech. Reps.)	804-275-1431
WA	Seattle, Zephyr Elctrn. Sls.	206-241-1980
WA	Seattle, Radar Elec.	206-282-2511
WA	Seattle, R. V. Weatherford	206-575-0922
WI	Madison, Satterfield Elctrns.	608-257-4801
WI	Milwaukee, E-M Instruments	414-272-7799
WI	Milwaukee, Marsh Elctrns.	414-475-6000

PAINE INSTRS., 2401 S. Bayview St., Seattle, WA 98144, Tel: 800-426-0366, TWX: 910-444-2164; FSC No.: 13624; Empl.: 69; *Sls. Mgr.:* R. E. Helmick .... **1B•1870**

PAK-TRONIC, See Tracor Paktronics

PALADIN, 3543 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-0318, Telex: 910-494-2799; Empl.: 9; *Sls. Mgr.:* Ronald Vogel

PALL TRINITY MICRO, Rte. 281, Cortland, NY 13045, Tel: 607-753-6041, Telex: 93-7295, TWX: 510-252-0791; Empl.: 500; *Sls. Mgr.:* R. H. Simkins; *Dist. Mgr.:* R. H. Hauslein

PALL ULTRAFINE FILTRATION CORP., 30 Sea Cliff Ave., Glen Cove, NY 11542, Tel: 516-759-1900, Telex: 64-9491, TWX: 510-223-0606; Empl.: 3500

Local Distributors

CA	Fremont, Mensco	408-739-8690
CO	Englewood, Ross Equip.	303-740-9400
CT	Hamden, Pont Tech. Sls.	203-281-0005
FL	Cocoa Beach, Sys. Comps. Corp.	305-783-1002
MI	Kalamazoo, Flowtech Corp.	616-375-1290
MI	Livonia, Flowtech Corp.	313-471-5660
MO	Maryland Heights, Process & Chemical Equip.	314-878-6161
NY	Cortland, Prosco Prods., Inc.	607-753-8231
RI	Cranston, Chisholm	800-556-6436
TX	Houston, AWC Texas, Inc.	713-486-5800
TX	Odessa, Engineered Equip.	915-367-1821

PALOMAR ENGRS., Box 455, Escondido, CA 92025, Tel: 619-747-3343; Empl.: 9

PAMOTOR

ONE OF THE PURDY GROUP OF COMPANIES

PAMOTOR, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203, TWX: 910-374-2353; Empl.: 35; *Sls. Mgr.:* F. L. Nelson; *Dist. Mgr.:* F. L. Nelson .... **2•1840-1850**

Local Sales Offices & Reps

AL	Huntsville, Conley & Assocs.	205-882-0316
AZ	Tempe, Foley, Tallent & Lee	602-438-1564
AR	Little Rock, J.Y. Schoonmaker	501-375-2168
CA	Burlingame, W. J. Purdy	415-347-7701
CA	Costa Mesa, Berman-Gravley	714-549-2122
CO	Denver, W. J. Purdy	303-777-1411
CT	Hartford, Sturgeon	203-249-7800
FL	Boca Raton, Conley & Assocs.	305-395-6108
FL	Oviedo, Conley & Assocs.	305-365-3283
FL	Tampa, Conley & Assocs.	813-885-7658
GA	Atlanta, Conley & Assocs.	404-447-6992
IL	Elmhurst, Hill-Gray	312-832-4101
IN	Indianapolis, Sukup & Cox	317-253-5501
IA	Marion, MSB Assocs.	319-377-6261
KS	Shawnee Mission, MSB Assocs.	913-432-2131
MD	Lisbon, S. K. MacDonald	301-924-5880
MA	Needam, Sturgeon	617-444-6603
MI	Ferndale, Hilltronics	313-398-5556
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Englewood, Harold Gray	201-894-0894
NM	Albuquerque, W. J. Purdy	505-266-7959
NY	Syracuse, Paston-Hunter	315-437-2843
NC	Raleigh, Conley & Assocs.	919-876-9862
OH	Beachwood, Electronic Salesmasters	216-831-9555
OK	Tulsa, J.Y. Schoonmaker	918-446-0373
OR	Beaverton, William J. Purdy	503-641-9373
PA	Philadelphia, S. K. MacDonald	215-545-1205
TX	Austin, J. Y. Schoonmaker	512-480-9257
TX	Dallas, J. Y. Schoonmaker	214-349-1650
TX	Houston, J.Y. Schoonmaker	713-738-2427
UT	Salt Lake City, W. J. Purdy	801-486-8557
WA	Redmond, William J. Purdy	206-882-3144

Local Distributors

AL	Birmingham, Forbes Distributing	205-251-4104
AL	Birmingham, JLS Indl. Elctrns.	205-322-2486
AL	Huntsville, Pioneer/Huntsville	205-837-9300
AZ	Phoenix, Electronic Parts	602-277-7281
AZ	Phoenix, Wyle/Distribution	602-249-2232
AZ	Tempe, Waltronic Sls.	602-967-1020
AZ	Tucson, Inland Elctrn. Supp.	602-294-2628
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Buena Park, RPS Elctrns.	213-744-0355
CA	El Segundo, Wyle/Distribution	213-322-8100
CA	Fresno, J. C. Arbuckle	209-264-6554
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Inglewood, Newark	213-678-0441
CA	Irvine, Ratel Elctrns.	714-549-8611
CA	Irvine, Wyle/Distribution	714-641-1600
CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	Sacramento, Dunlap Elctrns.	916-444-8070
CA	San Diego, Wyle/Distribution	619-565-9171
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Ratel Elctrns.	408-946-4300
CA	Santa Clara, Waltronic Sls.	408-727-1200
CA	Santa Clara, Wyle/Distribution Grp.	408-727-2500
CA	Van Nuys, Nesco	213-781-0505
CO	Colorado Springs, Centennial Elctrns.	303-633-4666
CO	Denver, Ragon Elctrns.	303-744-3601
CO	Denver, Fistell Elctrns. Supp.	303-244-4691
CO	Denver, CW Elctrn. Sls. Co.	303-832-1111
CO	Denver, Newark	303-757-3351
CO	Lakewood, Acacia Sls.	303-232-2882
CO	Thornton, Wyle/Distribution	303-457-9953
CT	New Haven, Hatry Elctrns.	203-787-5921
CT	Norwalk, Bond Radio Elctrns.	203-348-2663
CT	Wallingford, Sager Elect. Supp. Co.	203-265-4600
FL	Altamonte, Pioneer/Orlando	305-834-9090
FL	Jacksonville, Southeast Elctrns.	904-356-3007
FL	Miami, ESL Elctrn. Distrs.	305-633-6973
FL	Miami, Electronic Equip.	305-871-3500
FL	Tampa, Leader Elctrn. Distrs.	813-870-3315
FL	West Palm Beach, Dolphin Elctrn. Supp.	305-659-7166
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Addison, L Comp/Chicago	312-628-1400
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Newark/Chicago	312-638-4411
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rockford, Midwest Assocs.	815-962-8036
IN	E. Chicago, Acro Distrs.	219-397-8681
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Genesis Elctrns.	317-637-5571
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Michigan City, Tri-State Elec. Supp.	219-872-5551
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
KY	Lexington, Radio Elctrn. Equip.	606-255-6661
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
LA	Lafayette, Ralph's Elctrns.	318-234-4507
LA	New Orleans, Southern Radio Supp.	504-524-2343
LA	New Orleans, William B. Allen Co.	504-525-8222
LA	Shreveport, Industrial Elctrn. Supp.	318-222-9459
MD	Baltimore, Resco/Baltimore	301-823-0070
MD	Gaithersburg, Pioneer/Wash.	301-948-0710
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MA	Needham, Cronin Electrns.	617-449-5000
MA	No. Wilbraham, Industrial Comps.	413-596-3854
MA	Waltham, Sterling Elctrns.	617-894-6200
MI	Ann Arbor, Wedemeyer Elctrn. Supp.	313-665-8611
MI	Battle Creek, Great Lakes Elctrns.	616-731-4156
MI	Flint, Shand Elctrns.	313-743-8940
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark	313-967-0600
MN	Minneapolis, Electrn Center	612-371-5200
MN	Minneapolis, Newark	612-331-6350
MN	St. Paul, Gopher Elctrns. Co.	612-483-3322

MS	Jackson, Ellington Elctrns. Supp.	601-355-0561
MO	Kansas City, L Comp/Kansas City	816-221-2400
MO	Maryland Hgts., L Comp/St. Louis	314-291-6200
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
MO	St. Louis, Van-Sickle Radio Elctrns.	314-621-5000
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Clifton, J-Mar	201-772-6400
NJ	Cranford, Garden State Indl. Elect.	201-272-6400
NJ	Springfield, Newark	201-376-9500
NM	Albuquerque, Elctrn. Parts Co.	505-293-6161
NM	Albuquerque, Walker Radio	505-247-2288
NY	Albany, E. E. Taylor	518-438-7811
NY	Buffalo, Genessee Radio & Parts	716-873-9661
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Hauppauge, Fairmont Elctrn. Sls.	516-231-3313
NY	Millbrook, Villarreal Elctrns.	914-677-3447
NY	Rochester, Summit Distrs.	716-334-8110
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Sun Radio Co.	216-434-2171
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes-Peters	614-294-5351
OH	Solon, Repco	216-248-8900
OK	Oklahoma City, Elctrn. Supp.	405-232-5215
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Hillsboro, Wyle/Distribution	503-640-6000
OR	Portland, United Radio Supp.	503-233-7151
OR	Portland, Radar Elec. Co.	503-232-3404
PA	Altoona, Allegheny Elctrns.	814-946-0871
PA	Erie, Rem Elctrns.	814-453-5626
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Pittsburgh, CAM/RPC Ind'l Elctrns.	412-782-3770
RI	Pawtucket, Major/Edwards Elctrns.	401-725-7400
SC	Charleston, Wholesale Ind'l. Elctrns.	803-722-2634
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Kingsport, Radio Elec. Supp.	615-247-8111
TN	Knoxville, Indl. Elctrns.	615-573-7135
TN	Memphis, Bluff City Dist.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5601
TX	Austin, Wholesale Elctrns. Supp.	512-478-9568
TX	Austin, Harrison Equip.	512-458-3555
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Corpus Christi, Wicks Radio Equip.	512-883-4481
TX	Dallas, Wholesale Elctrns. Supp.	214-824-3001
TX	El Paso, Midland Specialty Co.	915-533-9555
TX	El Paso, Ideal Ind'l Elctrn. Supp.	915-779-6647
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	San Antonio, Sherman Elctrns.	512-224-1001
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Newark	801-486-1048
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VA	Norfolk, Avec Elctrns.	804-627-3502
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Wyle/Distribution	206-453-8300
WA	Seattle, Radar Elec.	206-282-2511
WV	Beckley, Halley Elctrns.	304-253-2561
WV	Charleston, McJunkin Corp.	304-348-4906
WI	Mequon, Taylor Elec.	414-241-4321
WI	Milwaukee, Indl. Elctrn. Corp. of WI	414-276-1212
PR	San Turce, Elctrn. Centre	809-724-3823

PAMRAN, 1101 Cedar Creek, Racine, WI 53402, Tel: 414-639-9076; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02254, Tel: 617-899-2740, Telex: 6817337, 951006; Empl.: 200; *Sls. Mgr.:* Bob Mel

Local Sales Offices & Reps

CA	Oxnard, Quality Testing Consultants	805-985-1144
IL	Bensenville, Sonoscan	312-766-7088
MA	Westboro, N.E. N.D.T. Sls. Co.	617-366-9800
MI	Chelsea, Michigan Nondestructive Gage Co.	313-475-2979
NJ	Swartswood, E.M.C.O.	201-362-9306
TX	Houston, General Svcs.	713-931-1201
WA	Poulsbo, Engineering Technig.	206-779-5550

PANASONIC, IND'L. ELCTRN. COMPS., Panasonic, Elctrn. Comps. Div., Box 1503, Secaucus, NJ 07094, Tel: 201-348-7000, Telex: 701 992-8920; Empl.: 25 .... **3**•1414-1419

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Phoenix, Stitzer-Dodd	602-944-2237
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	San Diego, Tauber & Assoc.	619-274-7242
CA	Van Nuys, K & R Sls.	213-781-0522
CO	Denver, Component Sls.	303-759-1666
CT	Madison, Conti-Younger Assoc.	203-245-1136
FL	Ft. Lauderdale, Reynolds & Assoc.	305-581-6611
FL	Melbourne, Reynolds & Assoc.	305-259-7000
FL	St. Petersburg, Reynolds & Assoc.	813-360-1484
GA	Tucker, Rep, Inc.	404-938-4358
IL	Palatine, Techn. Sls.	312-991-6600
IN	Indianapolis, Mktg. Engrs.	317-872-5665
KS	Olathe, Rush & West	913-764-2700
MD	Ellicott City, Mktg. Techn.	301-465-5944
MA	Burlington, Conti-Younger Assoc.	617-273-1582
MI	Birmingham, Favco Assoc.	313-644-0173
MN	Eden Prairie, Electro Mark	612-944-5850
MO	Ballwin, Rush & West	314-394-7271
NH	Melvin Village, Conti-Younger Assoc.	603-544-7378
NJ	Mount Laurel, Comtek	609-235-8505
NY	Great Neck, Cooper-Simon & Co.	516-487-1142
NY	N. Syracuse, Advanced Comp. Corp.	315-699-2671
NC	Raleigh, REP. Inc.	919-851-3007
OH	Cleveland, Del Steffen & Assoc.	216-461-8333
OH	Dayton, Del Steffen & Assoc.	513-293-3145
OH	Lexington, Del Steffen & Assoc.	419-884-2313
OR	Tigard, Elec. Sources	503-684-0040
PA	Pittsburgh, Del Steffen & Assoc.	412-276-7366
TN	Jefferson City, Rep Inc.	615-475-9012
TX	Austin, Dunbar Assoc.	
TX	Dallas, Dunbar Assocs.	214-239-7151
UT	Salt Lake City, Comp. Sls.	801-268-8440
VA	Lynchburg, Marketing Techn.	804-384-6459
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
CA	Burlingame, Rose Elect. Distr. Co.	415-348-2740
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Cypress Elctrns.	800-538-5112
CA	Van Nuys, NESCO	213-781-0505
IL	Chicago, Power Pak	312-286-5566
MA	Canton, Impact Sls. Co.	617-821-1500
MI	Brighton, AP Sls.	313-229-6550
NJ	Plainfield, Mars Elctrns.	201-757-4332
NY	Commack, Brentronics	516-499-5155
TX	Dallas, Computer Comp. Corp.	214-239-0271

PANAVISE PRODS., 2850 E. 29th St., Long Beach, CA 90806, Tel: 213-569-8108, Telex: 18-2135; Empl.: 29; *Sls. Mgr.:* Michael Steffen; *Dist. Mgr.:* Michael Steffen

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 312-532-1800, Telex: 25-4560; Empl.: 1200 .... **2**•1532-1534, 2136-2139

Local Sales Offices & Reps

AL	Birmingham, Frank Parker & Assoc.	205-853-3152
AZ	Phoenix, Panduit Corp.	602-252-4515
AR	Little Rock, Byron Carson Co.	501-568-6798
CA	Los Altos, Ewing-Foley	415-941-4525
CA	San Diego, Tak Sls.	619-287-6141
CA	Santa Ana, Panduit Corp.	714-546-5700
CO	Denver, I. W. Strong & Assocs.	303-292-6900
FL	Lakeland, Panduit Corp.	813-665-5850
GA	Atlanta, Panduit Corp.	404-256-5940
HI	Honolulu, Agencies Co./Pacific	808-847-6581
IN	Fort Wayne, Panduit Corp.	219-424-4082
IN	Indianapolis, Panduit Corp.	317-251-8332
IA	Des Moines, Panduit Corp.	515-280-8343
KS	Kansas City, Panduit Corp.	913-764-7170
KY	Louisville, A. L. Pickens Co.	502-491-4215
LA	New Orleans, Panduit Corp.	504-581-7181
MD	Landover, Agency Group, Inc.	301-773-9292
MI	Fraser, Panduit Corp.	313-791-1700
MI	Grand Rapids, Panduit Corp.	616-942-0420
MN	Minneapolis, Electric Comp. Sls.	612-933-2594
MO	St. Louis, Panduit Corp.	314-894-7800
NH	Salem, Sales Eng. Co.	603-893-5521
NJ	Leonia, Panduit Corp.	201-461-7790
NY	Buffalo, Panduit Corp.	716-632-5182
NY	Rochester, Panduit Corp.	716-244-9480
NY	Syracuse, Panduit Corp.	315-476-6161
NC	Winston-Salem, L. G. White Southern	919-725-3612
OH	Cincinnati, Panduit Corp.	513-874-0660
OH	Cleveland, Panduit Corp.	216-835-2050
OH	Columbus, Panduit Corp.	614-262-6052
OK	Tulsa, Panduit Corp.	918-745-1420
OR	Portland, Panduit Corp.	503-248-1971
PA	Carnegie, Myles F. Smith & Assoc.	412-276-5363
PA	Glenside, Kunz, Powell & Assoc.	215-224-2434
TN	Knoxville, Panduit Corp.	615-588-2476
TN	Memphis, Byron Carson Co.	901-345-5187
TX	Dallas, Panduit Corp.	214-620-7713
TX	Houston, Panduit Corp.	713-580-0100
UT	Salt Lake City, I. W. Strong & Assocs.	801-942-6998
VA	Richmond, L. G. White Southern	804-740-7093
WA	Bellevue, Panduit Corp.	206-454-7267
WV	Dunbar, Myles F. Smith & Assoc.	304-768-9910
WI	Appleton, H. Mercer Co.	414-739-6223
WI	Brookfield, H. Mercer Co.	414-786-6431

PANEL COMPONENTS CORP., P.O. Box 6626M, Santa Rosa, CA 95406, Tel: 707-523-0600, Telex: 176-747; Empl.: 18 .... **1A**•1606-1610; **1B**•1282, 1283; **2**•1536-1539, 2140, 2141

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg. Inc.	205-533-5165
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Littleton, Omega Ltd.	303-798-7040
GA	Atlanta, DHR Mktg., Inc.	404-451-9848
IL	Northbrook, Raines & Assocs.	312-498-0890
IA	Marion, M-S-B Assocs., Inc.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs., Inc.	913-432-2131
MA	Lexington, Zieco	617-861-8300
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Charles, M-S-B Assocs., Inc.	314-946-5577
NM	Albuquerque, Burt Dieruf Assocs.	505-299-0989
NY	Great Neck, Tylinski Assocs.	516-466-9070
NY	Rochester, Lloyd Hart Assocs.	716-244-3253
NC	Raleigh, DHR Mktg., Inc.	919-876-5450
OH	Chesterland, K-T Depco	216-729-3588
OR	Portland, Earl & Brown Co.	503-245-2283
PA	Doylestown, T.O.E. Sls.	215-348-2212
PA	Pittsburgh, K-T Depco	412-487-8777
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TN	Knoxville, DHR Mktg. Inc.	615-584-5286
TX	Lewisville, Jim Hughes Co.	214-221-1536
TX	Stafford, Jim Hughes Co.	713-343-0673
WA	Seattle, Earl & Brown Co.	206-284-1121

PANEL CONTROLS, 1000 Mt. Elliott Ave., Detroit, MI 48207, Tel: 313-568-2400; Empl.: 24

PANELGRAPHIC CORP., 10 Henderson Dr., W. Caldwell, NJ 07006, Tel: 201-227-1500, TWX: 710-734-4367; FSC No.: 52657; Empl.: 100

PAN-MAGNETICS INTL., INC., 455-A Carson Plaza Dr., Carson, CA 90746, Tel: 213-532-1790, Telex: 664-759; *Sls. Mgr.:* W. Dull .... **1A**•2215-2221

Local Sales Offices & Reps

AZ	Scottsdale, E.D.P. & Assocs.	602-991-6119
CT	Marlborough, Precision Sls.	203-295-0580
IN	South Bend, Schillinger Assoc.	219-282-4570
KS	Overland Park, Electri-Rep	913-649-2168
MD	Towson, Electronic Comp. Mktg.	301-321-8611
MA	Newton, Precision Sls.	617-969-0594
MN	Minneapolis, DeBeck-Hays Assocs.	612-835-3610
MO	St. Louis, Electri-Rep	314-878-0583
OR	Tigard, Electronic Sources	503-684-0040
WA	Bellevue, Electronic Sources	206-643-0400

PANNIER CORP., Graphics Div., John Fitch Industrial Park, Warminster, PA 18974, Tel: 215-672-3600; Empl.: 45; *Sls. Mgr.:* Barry Stefaniw

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-5930, Telex: 952092; *Sls. Mgr.:* Emanuel V. Lauria

PARABAM, INC., 3017 E. Las Hermanas St., Rancho Dominguez, CA 90221, Tel: 213-537-1771; Empl.: 85

PARAGON ELECT., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, Telex: 26-3450; Empl.: 1000; *Sls. Mgr.:* Don Karman

PARALINE
TRANSFORMER SPECIALISTS

PARALINE TRANSFORMER CORP., 511 South Palm Ave., Alhambra, CA 91803, Tel: 213-281-0222; FSC No.: 59465; Empl.: 34 .... **1A**•2223-2225

PARAMOUNT TUBE, INC., 1430 Progress Rd., Ft. Wayne, IN 46808, Tel: 219-484-4111; Empl.: 46; *Sls. Mgr.:* D. F. Weimer

PARKER SEAL GRP., P.O. Box 11751, Lexington, KY 40512, Tel: 606-269-2351; Empl.: 2,200; *Sls. Mgr.:* Frand Chesnik

PARLEX CORP., 145 Milk St., Methuen, MA 01844, Tel: 617-685-4341, TWX: 710-342-1538; Empl.: 450; *Sls. Mgr.:* J. Pollack Kutchin

PARSONS MFG., 1055 O'Brien Dr., Menlo Park, CA 94025, Tel: 415-324-4726, TWX: 910-373-2106; Empl.: 85; *Sls. Mgr.:* C. E. Plummer

Local Sales Offices & Reps

CO	Boulder, Scientific Devices	303-449-9466
FL	Melbourne, Reynolds & Assocs.	305-259-7000
GA	Doraville, South Pack, Inc.	404-452-0773
IL	Elmhurst, Cougar Package Designers	312-833-0346
OH	Cleveland, Donray Co.	216-449-6450
PA	Philadelphia, Thermo-Pak Co.	215-742-0447
TX	Fort Worth, Dyna Rep	817-451-1392

PASO SOUND PRODS., 14 First St, Pelham, NY 10803, Tel: 914-738-4800, Telex: 646783 Paso Pelm; Empl.: 50

PASS & SEYMOUR, INC., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211; *Sls. Mgr.:* Jack Wells

PATHCOM, INC., Pace Two-Way Radio Prods., 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 213-325-1290; Empl.: 600

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000; FSC No.: 77147; Empl.: 55; *Sls. Mgr.:* J. Allen

PAYNE ENGRG., Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, Telex: 88-5452; Empl.: 30; *Sls. Mgr.:* Matthew J. Gilberto; *Dist. Mgr.:* Diane Nelson

PCA ELCTRNS., 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, Telex: 67-4681, TWX: 910-496-1525; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Janice Fowler ....**1A**•1558-1564

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	San Diego, Littlefield & Smith Assoc.	619-455-0055
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800
FL	Boca Raton, Lawrence Assocs.	305-368-7373
FL	Clearwater, Lawrence Assocs.	813-584-8110
IL	Westchester, W. G. Brouillette & Assocs.	312-345-6500
MA	Framingham, KSA of New England	617-879-3835
MN	Minneapolis, Bill Deming and Assocs.	612-888-5000
NJ	Wayne, Howard Kagan Assocs.	201-694-1115
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
OR	Portland, Elctrn. Comp. Sls.	503-245-2342
TX	Dallas, Blackburn Assocs.	214-692-8885
TX	Houston, Blackburn Assocs.	713-463-1354
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WA	Seattle, Elctrn. Comp. Sls.	206-232-9301

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371; Empl.: 110; *Sls. Mgr.:* Roy Maines

PCK TECHNLG. DIV./KOLLMORGEN CORP., 322 South Service Rd., Melville, NY 11747, Tel: 516-454-4400, Telex: 6852163; Empl.: 200; *Sls. Mgr.:* J. F. Dennis-Browne

PCM-PAC CYBER-METRIC, 6800 Sierra Ct., Dublin, CA 94568, Tel: 415-829-8700, TWX: 910-389-6890; Empl.: 19; *Sls. Mgr.:* T. J. Netoff

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300; FSC No.: 62281; Empl.: 6; *Sls. Mgr.:* Stanley L. Goldstein ....**1A**•2226-2229

PEARSON ELCTRNS., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, Telex: 171-412; FSC No.: 05280; Empl.: 18; *Sls. Mgr.:* Patricia L. Pearson ....**1A**•2230

PECA, INC., 4957 Pearson Ave., Philadelphia, PA 19114, Tel: 215-824-1550; Empl.: 15; *Sls. Mgr.:* Jean Douglass

PENFIELD, INC., West & W. Main Sts., Plantsville, CT 06479, Tel: 203-621-9141; Empl.: 25

PENN AIRBORNE PRODS., Industrial Hwy., Southampton, PA 18966, Tel: 215-355-3400, Telex: 834759; FSC No.: 25805; Empl.: 25; *Sls. Mgr.:* W. Williams

PENN ENGRG. & MFG., P.O. Box 1000, Danboro, PA 18916, Tel: 215-766-8853; FSC No.: 46384; Empl.: 370; *Sls. Mgr.:* John E. O'Brien

PENN FIBRE & SPEC., 4343 "G" St., P.O. Box 4890A, Philadelphia, PA 19124, Tel: 215-288-7366; Empl.: 66; *Sls. Mgr.:* L. C. Jones

PENN KEYSTONE CORP., Unimax Switch Corp., Ives Rd., P.O. Box 152, Wallingford, CT 06492, Tel: 203-269-8701, Telex: 96-3485, TWX: 710-476-1397; FSC No.: 03034; *Sls. Mgr.:* Jack Fitzgerald

PENN RESCH. CORP. (PRC), 2652 South Main St., P.O. Box 3357, Kennesaw, GA 30144, Tel: 404-429-9061, Telex: 753010; *Sls. Mgr.:* Wallace Hundley

PENN TRANSFORMER CO., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, Telex: EASY LINK 706473

Local Sales Offices & Reps

MN	Minneapolis, Intl. Sls. Co.	612-831-8423
OR	Portland, Intertech Sls.	503-775-7885
PA	Glenside, Koebert Assocs. Inc.	215-887-2301
UT	Salt Lake City, Aspen Sls., Inc.	801-467-2401

PENNTUBE PLASTICS, Madison Ave. & Holly St., Clifton Heights, PA 19018, Tel: 215-622-2300, Telex: 845-212; Empl.: 145

PENN VIDEO INC., 929 Sweitzer Ave., Akron, OH 44311, Tel: 216-762-4840, Telex: 98-6327 PVI-AKR; *Sls. Mgr.:* Sandra Donaldson

PENNWALT CORP., Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7000, TWX: 215-569-9748

PENRIL, 5520 Randolph Rd., Rockville, MD 20852, Tel: 301-984-8225, TWX: 710-828-0522; Empl.: 250; *Sls. Mgr.:* Dave L. Johnson

PERFECT GEAR & INSTR., 55 S. Denton Ave., New Hyde Park, NY 11040, Tel: 516-328-3300, TWX: 510-223-0642; Empl.: 210

PERFECTION MICA CO., see Magnetic Shield Div.

PERFORMANCE CONTROLS INC., 333 Byberry Rd., Hatboro, PA 19040, Tel: 215-675-6500; Empl.: 22; *Sls. Mgr.:* M. Edward Wokulich

PERIPHERALS, 3001 Red Hill, Bldg. 6, Ste. 107, Costa Mesa, CA 92626, Tel: 714-540-4925; *Sls. Mgr.:* Jone Ford; *Dist. Mgr.:* Jone Ford

PERITEK CORP., 5550 Redwood Rd., Oakland, CA 94619, Tel: 415-531-6500, TWX: 910-366-2029; *Sls. Mgr.:* John Brogan

PERKIN-ELMER

PERKIN-ELMER CORP., Elctrn. Prods. Dept., Main Ave., Norwalk, CT 06856, Tel: 203-762-4786, TWX: 710-468-3213; Empl.: 70 ....**1A**•2231

Local Sales Offices & Reps

CA	Encino, C.D.H. Assocs.	213-707-1970

PERMAG, 400 Karin La., Hicksville, NY 11801, Tel: 516-822-3311, TWX: 710-581-5264; Empl.: 50

PERMAGILE-SALMON LTD., Insulcast Div., 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, Telex: 221720 PERM UR; *Sls. Mgr.:* A. Zack Zarcadoolas; *Dist. Mgr.:* Edward R. Salmon

Local Distributors

FL	Boca Raton, Olson Assocs.	305-368-1845
IL	Algonquin, Adhesive Sys., Inc.	312-658-4583
OH	Dayton, Electro Supply	513-299-5020

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 818-849-4543; Empl.: 9; *Sls. Mgr.:* J. Ross

PERMANENT MAGNET, 4437 Bragdon St., Indianapolis, IN 46226, Tel: 317-547-1336; Empl.: 85; *Sls. Mgr.:* Jack Amigh

PERMA POWER ELCTRNS., 5615 W. Howard Ave., Chicago, IL 60648, Tel: 312-647-9414; Empl.: 85-100; *Sls. Mgr.:* Michael Shatz ....**1B**•1284; **2**•1862, 1863

Local Sales Offices & Reps

AR	El Dorado, D. Bellew Sls.	214-373-4590
CA	San Francisco, Techn. Sls.	415-467-1434
CA	Sun Valley, Tegni-Rep	213-768-4223
CO	Denver, Stan Sliz & Assoc.	303-666-4760
CT	West Hartford, Smith Co.	203-523-0512
IN	Indianapolis, Green-Wissler	317-291-2232
MI	Plymouth, J. Malcolm Flora	313-453-4296
MN	St. Paul, Skor	612-426-1160
MO	Jefferson City, C. A. Vignola	314-636-3121
NJ	Marlton, Fahy Mktg.	609-983-2366
NY	Phelps, L. S. M. Assocs.	315-548-4891
NY	Plainview, Landau & Mack	516-293-3310
NC	Greensboro, Adams & Assocs.	919-272-6838
OH	Whitehall, Mandabach-Lehner	614-235-0265
TX	Dallas, Berthold Sls.	214-328-0067
WA	Seattle, Northmar Inc.	206-524-5170
EXP	N.Y., Plainview, Morhan Export.	516-293-5582

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844; Empl.: 18; *Sls. Mgr.:* N. Geskos

PERSONAL MICRO COMPUTERS, 475 Ellis St., Mountain View, CA 94043, Tel: 415-962-0224, TWX: 910-379-5022

PERTEC PERIPHERALS CORP., P.O. Box 2198, Chatsworth, CA 91311, Tel: 818-882-0030, TWX: 910-494-2093; Empl.: 650

PERVEL INDS., INC., Bemis, P.O. Box 61, Community Ave., Plainfield, CT 06374, Tel: 203-564-2741, Telex: 966450; Empl.: 350; *Sls. Mgr.:* Stan Furman

Advertisement

Pervel produces CONDULON, a second-generation conductive coating for EMI shielding. CONDULON features lower resistance, easy handling and mixing, exceptional smoothness, superior corrosion resistance and improved settling resistance. CONDULON can be used on *both* solvent-sensitive and solvent-insensitive substrates, and is available in an easy-to-evaluate spray can. Product information upon request.

Local Sales Offices & Reps

CA	Cerritos, Specialized Plastic Svcs.	213-402-6225
CA	Los Gatos, Specialized Plastic Svcs.	408-866-5786
CO	Castle Rock, Romulus Elctrns. Ltd.	303-688-5127
FL	Clearwater, Brennan Assocs., Inc.	813-446-5006
IL	Chicago, Brock and Cushman, Inc.	312-622-4110
MI	Grand Rapids, R. P. Urban & Assoc.	616-245-0511
MN	St. Paul, Bonament Heyda Co., Inc.	612-484-8531
WA	Mercer Island, Cirkits Co.	206-236-2380

PFC, See Southern Elctrns. Co. Inc.

PHALO CORP., Transitron Elctrn. Corp., 530 Boston Tpke., Shrewsbury, MA 01545, Tel: 617-845-5000, Telex: 92-0416, TWX: 710-392-1383; Empl.: 450

PHAOSTRON INSTRUMENT & ELECTRONIC CO., 151 Pasadena Ave., South Pasadena, CA 91030, Tel: 213-255-1471

PHELPS DODGE CABLE & WIRE, Box 2100, Greenwich, CT 06836, Tel: 203-625-3200, TWX: 710-560-0006; Empl.: 750; *Sls. Mgr.:* T. P. Reilly

PHELPS DODGE INTL., 2121 Ponce de Leon Blvd., Ste. 850, Coral Gables, FL 33134, Tel: 212-775-1395, 800-221-3333

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-456-4444, TWX: 810-332-1501; *Sls. Mgr.:* G. H. Guyer; *Dist. Mgr.:* W. H. Deininger

PHILADELPHIA INSULATED WIRE CO. INC., 333 New Albany Rd., Moorestown, NJ 08057, Tel: 609-235-6700, TWX: 710-897-0187; Empl.: 110; *Sls. Mgr.:* Fred Newman

PHILAMON, INC., 33 Dubon Ct., Farmingdale, NY 11735, Tel: 516-249-2700, TWX: 510-224-6512; FSC No.: 95267; Empl.: 27; *Sls. Mgr.:* B.F. Grib

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS ECG, See Sylvania Electronic Components

PHILIPS ECG, INC., 3101 Pleasant Valley Blvd., Altoona, PA 16603, Tel: 814-943-1126

PHILIPS ELMET, 1560 Lisbon Rd., Lewiston, ME 04240, Tel: 207-784-3591, TWX: 710-223-0675; Empl.: 250

PHILIPS TELEVISION SYS., INC., P.O. Box 618, 900 Corporate Dr., Mahway, NJ 07430, Tel: 201-529-1550, Telex: 37-62558; *Sls. Mgr.:* Warren Anderson, Dir. of Mktg.

PHILIPS TEST & MEASURING INSTRS., 85 McKee Dr., Mahwah, NJ 07430, Tel: 201-529-3800; Empl.: 70; *Sls. Mgr.:* Bob Hynes

PHILMORE MFG., 40 Inip Dr., Inwood, NY 11696, Tel: 516-239-6161; Empl.: 22

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 901-831-3286; Empl.: 60; *Sls. Mgr.:* Gary Zebrowski ....3•1090

PHOENIX CONTACT, 1900 Greenwood St., Harrisburg, PA 17104, Tel: 717-232-0500, TWX: 510-650-4913; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford ....2•1540-1542

Local Sales Offices & Reps

AZ	Scottsdale, Mahaffey & Assocs. Inc.	602-991-9790
CA	Fremont, Vontek	415-651-7966
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CA	San Diego, Luscombe Engrg. Co.	619-295-4300
CO	Denver, Spectrum Sls.	303-696-1601
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Tampa, J-R Controls	813-961-9478
GA	Atlanta, Holman-Lobsinger Co.	404-256-9120
IL	Mt. Prospect, Magnuson Assocs./Magnuson Elctrns.	312-956-0700
KS	Merriam, Mid-West Tech. Sls.	913-236-8557
MD	Baltimore, McCourt Co., Inc.	301-747-0044
MI	Canton, R. W. Barrick & Assocs.	313-453-0591
MN	Minneapolis, Grissinger-Johnson Sls. Inc.	612-544-5451
NJ	Rockaway, R.O.I. Sls. Co.	201-627-8879
NY	North Syracuse, Lachut Electrical Sls.	315-422-2575
NC	Charlotte, Mec-Tric Control Co.	704-376-8555
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Carnegie, Brown-Yates Electrical Equip. Co.	412-279-1101
PA	Willow Grove, Jacobson-Rodger Assocs.	215-657-4300
TX	Dallas, Lynn Elliott Co., Inc.	214-239-8533
TX	Houston, Lynn Elliott Co., Inc.	713-499-1571
VA	Richmond, McCourt Co., Inc.	804-741-3253
WA	Bellevue, Comtec	206-453-1188

Local Distributors

AZ	Phoenix, Sterling Elctrns.	602-268-2121
CA	Concord, Control Room Prods.	415-671-7796
CA	Duarte, Nelson West Coast, Inc.	213-303-1526
CA	Gardenia, Cal Switch	213-770-2330
CA	Riverside, Elctrn. Supply Co.	714-787-9220
CT	Wallingford, Sager Electrical	203-265-4600
FL	Lakeland, A-A Elec.	813-665-6941
GA	Atlanta, A-C Equip.	404-451-2747
IL	Lombard, MacGregor & Co., Inc.	312-629-5752
LA	Baton Rouge, Ralph's Indl. Elctrns.	504-344-3761
LA	Lafayette, Ralph's Indl. Elctrns.	318-234-4507
LA	New Orleans, Long Elec. Supp.	504-524-8383
MD	Baltimore, A.I.C.	301-747-0044
MA	Hingham, Sager Electrical	617-749-6700
MI	Flint, Roth Elec. Supply Co.	313-234-8661
MI	Roseville, Madison Elec.	313-778-7640
MO	St. Charles, Lectronix Inc.	314-946-6424
NJ	East Rutherford, A-A Elec.	201-777-5477
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Orchard Park, Park Elec.	716-662-7070
NY	Rochester, Rochester Radio	716-454-7800
NY	Syracuse, Salmon Motor Repair Svc.	315-454-9278
NC	Charlotte, Dixie Elctrns.	704-377-5413
OH	Cincinnati, Schuster Elec. Co.	513-489-1400
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, United Radio Supp.	503-233-7151
PA	Bradford, B-B Elec. Supp. Co.	814-368-4173
PA	Pittsburgh, Grant Industrial Controls	412-787-9770
PA	Reading, R.A.M. Motors and Controls	215-376-7102
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Timers & Controls, Inc.	713-894-0714
TX	Port Arthur, All-Phase Elec.	409-983-3315
WI	Cedarburg, A-A Elec.	414-377-8000

PHOENIX DATA, 3384 W. Osborn Rd., Phoenix, AZ 85017, Tel: 602-278-8528, TWX: 910-951-1364; Empl.: 55; *Sls. Mgr.:* Srini Iyer

PHOENIX MICROSYSTEMS, P.O. Box 4206, Huntsville, AL 35802, Tel: 205-881-2173, Telex: 752592; Empl.: 28; *Sls. Mgr.:* Mel Mayo

PHOENIX WIRE, INC., 100 Teflon Ave., S. Hero, VT 05486, Tel: 802-372-4561; Empl.: 25

Advertisement

MicroMiniature ****** High-Reliability Wires & Cables for Electronic, Medical, Mechanical & Packaging applications. Teflon Magnet Wire — Twin & Tri-Lead . In addition to its standard line of Micro Miniature Hook-up Wires, Flat & Twisted Cables, Phoenix Wire specializes in the Custom application of Teflon to Fine Wire. Wires .001 to .064 of any composition can be Insulated with less than .000025 to over .020 inches of True Concentric Teflon.
***** Also High Flexibility Wires *****

PHOTOBELL, 26 Just Rd., Fairfield, NJ 07006, Tel: 201-227-3613, TWX: 710-734-4387; Empl.: 50; *Sls. Mgr.:* Bernard M. Clongoli

PHOTO CHEM. PRODS. CAL., 18031 Susana Rd., Compton, CA 90224, Tel: 213-603-0400; FSC No.: 16339; Empl.: 65

PHOTOCIRCUITS CORP., Multi-Wire Div., 491 Amherst St., Nashua, NH 03060, Tel: 609-889-0083

PHOTOCIRCUITS GLEN COVE, DIV., KOLLMORGEN CORP., 31 Sea Cliff Ave., Glen Cove, NY 11542, Tel: 516-448-1000, TWX: 516-671-3155; Empl.: 850

PHOTOCIRCUITS RIVERHEAD DIV., KOLLMORGEN CORP., See Additive Products Div., Kollmorgen Corp.

PHOTODYNE INC.

PHOTODYNE, 1175 Tourmaline Dr., Newbury Park, CA 91320, Tel: 818-889-8770, Telex: 18-1159; FSC No.: 59912; Empl.: 35; *Sls. Mgr.:* Eamon Murphy; *Dist. Mgr.:* Eamon Murphy ....1B•1118, 1119

Local Sales Offices & Reps

AL	Huntsville, JMS	205-533-5450
CA	Burlingame, BHL Assocs.	415-342-7850
CA	San Luis Obispo, Johnson Assocs.	213-670-4794
IL	Rosemont, Synmark Sls. Co.	312-825-3455
IN	Ossian, Science Sls.	219-622-7383
MA	Sudbury, Poulin Assocs.	617-443-7333
MN	Minneapolis, All Phase Agency	612-835-4940
NJ	Pennsauken, Scientific Reps.	609-662-5222
NM	Albuquerque, Grady Moore Assocs.	505-262-1416
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NC	Fayetteville, Zim-Tek	919-485-2222
OH	Risingsun, Mecom Inc.	419-457-3231
TX	Dallas, Southwestern Engrg. & Equip. Co.	214-340-1741
TX	Houston, Southwestern Engrg. & Equip. Co.	713-820-2500
VA	Fairfax, Scientific Assocs.	703-385-0600
WA	Walla Walla, Northwest Tech. Co.	509-529-2051

PHOTON TECHNLG., 14125 Capri Dr. #4, Los Gatos, CA 95030, Tel: 408-866-0566, Telex: 17-1618 refer: Photon; Empl.: 12; *Sls. Mgr.:* John M. Fleischer

PHOTO RESCH., 3000 N. Hollywood Way, Burbank, CA 91505, Tel: 213-843-6100, Telex: 69-1427; FSC No.: 92434; Empl.: 68; *Sls. Mgr.:* M. L. Woolsey

PHOTRONIC LABS., Secor Rd., Brookfield Ctr., CT 06805, Tel: 203-775-0465; Empl.: 55; *Sls. Mgr.:* Deno Macricostas

PHO-TRONICS, 8701 W. Bradley Rd., Milwaukee, WI 53224, Tel: 414-355-6704, TWX: 910-262-3099; Empl.: 85; *Sls. Mgr.:* John R. Henry

PIC DESIGN, P.O. Box 1004, Middlebury, CT 06762, Tel: 203-758-8272, TWX: 710-477-5234; Empl.: 150; *Sls. Mgr.:* J. Baldwin

PICO CRIMPING TOOLS, 9832 Jersey Ave., Santa Fe Springs, CA 90670, Tel: 213-723-2150; Empl.: 12

PICO ELCTRNS., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, Tel: 914-699-5514, 800-431-1064; FSC No.: 31669; *Sls. Mgr.:* Joe Sweeney ....1A•1271-1275, 2233-2255

Local Sales Offices & Reps

AZ	Scottsdale, Piper Sls. Co.	602-946-4437
CA	Santa Clara, Fisher Assocs.	408-733-7350
CO	Arvada, Piper Sls. Co.	303-420-4646
WA	Seattle, W. Spaulding Co.	206-282-9173

PICONICS, Cummings Rd., Tyngsboro, MA 01879, Tel: 617-649-7501, TWX: 710-347-6663; FSC No.: 26618; Empl.: 48; *Sls. Mgr.:* I. Kadesh ....1A•1277, 1611, 1680

Local Sales Offices & Reps

AZ	Scottsdale, Semper-Fi Sls.	602-991-4601
CA	N. Hollywood, Jewett Co.	213-789-8103
CA	Palo Alto, J/M Assocs.	415-857-1260
CO	Parker, Mikro Sls. Co.	303-841-4131
FL	Lighthouse Point, R. C. Simon	305-941-2757
IL	Chicago, Shaumberg Phoenix Co.	312-980-7060
MA	Natick, Wayland Engrg. Sls. Co.	617-655-6080
MN	Minneapolis, Peterson, Snater & Assocs.	612-884-3483
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NY	Huntington, Regulus Indl. Sls. Co.	516-673-6252
NY	Rochester, J. G. Welch Assocs.	716-244-1100
OH	Cincinnati, G&H Sls. Co.	513-272-0580
PA	Glenside, R. F. Koebert & Assocs.	215-887-2310
TX	Ft. Worth, El-Tec Sales	817-268-2896
VA	Gladys, Ralley Entprs.	804-283-5656

PIEZO CRYSTAL, 100 "K" St., Box 619, Carlisle, PA 17013, Tel: 717-249-2151, TWX: 510-650-2280; Empl.: 250; *Sls. Mgr.:* Roy Burkholder

PIEZO ELEC. PRODS., INC., 212 Durham Ave., CN-15, Metuchen, NJ 08840, Tel: 201-548-2800, TWX: 710-998-0592; Empl.: 125; *Sls. Mgr.:* Jack Gray ....1B•1820, 1821, 1871

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
CA	Mountain View, IFM, Inc.	415-961-2828
FL	Melbourne, Beacon Elctrns.	305-724-8010
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Lisle, W-G Controls	312-963-5954
IN	Ft. Wayne, Given Corp.	219-432-5585
MD	Ellicott City, Mktg. Techn.	301-465-5944
MA	Lexington, Hathaway Elctrns. Inc.	617-861-7010
MN	Minneapolis, Elctrn. Innovators	612-941-0830
NJ	Middlesex, Cornell Assocs.	201-469-1303
NY	Rochester, Canavan-Scanlon Assocs.	716-424-1830
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Dayton, Berberich Assocs.	513-433-0342
PA	Harleysville, Thomas Jackson Assocs.	215-643-5560
TX	El Paso, El Paso Elctrn. Comps.	915-593-8481
TX	Houston, Aid Elctrns.	713-937-3373
TX	Irving, Aid Elctrns.	214-259-4761

PIEZO TECHNOLOGY INC., 2525 Shader Rd., Orlando, FL 32804, Tel: 305-298-2000, TWX: 810-850-4136; FSC No.: 25120; Empl.: 610; *Sls. Mgr.:* Dave Stewart ....1A•1308, 1404-1409

Local Sales Offices & Reps

AZ	Scottsdale, Faser Tech. Sls.	602-948-4404
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Van Nuys, R.L. Assocs.	213-782-7826
CT	Milford, Bengal Assocs.	203-878-3946
DC	Washington, M. Lader Co.	202-296-2497
FL	Maitland, D. J. Ellis & Assocs.	305-645-1101
IN	South Bend, Schillinger & Assocs.	219-282-4570
KS	Overland Park, Barnes Mid-West Sls.	913-341-9317
MA	Randolph, Bengal Assocs.	617-961-4120
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NY	Buffalo, Quality Comps.	716-837-5430
NY	Great Neck, Phase 4, Inc.	516-482-1790
TX	Richardson, Vector Sls. Co.	214-234-4291

PIHER INTL., 565 W. Golf Rd., Arlington Hgts., IL 60005, Tel: 312-640-8300, 800-323-6693, Telex: 254190, TWX: 710-393-6784; Empl.: 100; *Sls. Mgr.:* Gus Stoltz; *Dist. Mgr.:* Wm. Pragit

PINLITES, See Refac Elctrns.

PIONEER COMPS., 2352 E. 66th St., Brooklyn, NY 11234, Tel: 212-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

PIONEER MAGNETICS, 1745 Berkeley St., Santa Monica, CA 90404, Tel: 213-829-6751, Telex: 182-093, TWX: 910-343-6249; FSC No.: 08676; Empl.: 450; *Sls. Mgr.:* A. Hagiwara ....3•1666, 1667

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Santa Monica, Pioneer Magnetics, Inc.	213-829-6751

CO	Commerce City, Williams Assocs.	303-289-5647
FL	Deerfield Beach, Pen-Tech Assocs.	305-421-4989
KS	Olanthe, Rush & West Assocs.	913-754-2700
MA	Waltham, Daner-Hayes	617-894-7290
MN	Eagan, Pioneer Magnetics	612-452-7747
OH	Westlake, KRW Sales	216-871-7521
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, Remtek	214-387-2855
WA	Vashon, RTS, Inc.	206-285-1363

PIRELLI CABLE CORP., Special Cable Div., P.O. Box 50, Wallingford, CT 06492, Tel: 203-265-5533, 800-243-3959, TWX: 710-476-0764; Empl.: 110; *Sls. Mgr.:* Art Fabritiis

PIRELLI CIMCO, 800 Rahway Ave., Union, NJ 07083, Tel: 201-687-8444, Telex: 138918, TWX: 6874009; Empl.: 80; *Sls. Mgr.:* John N. Vanderbeek

PITTMAN CORP., 343 Godshall Dr., Harleysville, PA 19438, Tel: 215-256-6601, TWX: 510-661-8696; FSC No.: 98938; Empl.: 135 .... **1B**•1170, 1171

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Commerce City, Williams-Assocs.	303-289-5647
FL	Bradenton, Tropi-Tec, Inc.	813-748-2868
FL	Plantation, Tropi-Tec	305-581-0101
GA	Atlanta, Electro-Rep Assocs.	404-320-1134
IL	Mount Prospect, K-W Assocs.	312-253-6680
IN	Fort Wayne, Neal Engrg.	219-436-2300
IN	Indianapolis, Neal Engrg.	317-849-4201
MA	Ashland, M. L. Assocs.	617-485-6190
NJ	Summit, R.A. Potter	201-277-0220
NM	Albuquerque, Williams-Assocs.	505-255-1638
NY	Buffalo, Application Spec.	716-834-3377
NY	Rochester, Application Spec.	716-586-6226
NY	Syracuse, Application Spec.	315-437-2813
NC	Charlotte, Electro-Rep Assocs.	704-527-2530
OH	Cleveland, Servo-Mark	216-871-2353
OK	Tulsa, Blair Engrg.	918-747-3100
TX	Austin, Blair Engrg.	512-458-3107
TX	Dallas, Blair Engrg.	214-241-5655
TX	Houston, Blair Engrg.	713-776-0011
UT	Salt Lake City, Williams-Assocs.	801-485-6511
WA	Redmond, Halbar Assocs.	206-882-0990
WA	Vancouver, Halbar Assocs.	206-696-0170
PR	Hato Rey, Tropi-Tec	809-759-7303

PLAINVIEW ELCTRNS., 28 Cain Dr., Plainview, NY 11803, Tel: 516-249-6677, Telex: 125043; Empl.: 6; *Sls. Mgr.:* B. Erde

PLANT SPECIALTIES, INC., PO Box 1097, Carrollton, TX 75006, Tel: 214-245-9673; *Sls. Mgr.:* J. E. Bryer

PLASMAGRAPHICS CORP., 141 Mount Bethel Rd., P.O. Box 4903, Warren, NJ 07060, Tel: 201-757-5000, Telex: 83-3456-0, TWX: 710-997-9529; *Dist. Mgr.:* Ronald Pignatello

PLASMA-THERM, INC., Rt. 73, Kresson, NJ 08053, Tel: 609-767-6120, Telex: 837220; *Sls. Mgr.:* John D. Raffl

Local Sales Offices & Reps

AZ	Phoenix, Plasma-Therm	602-962-4522
CA	San Jose, Plasma-Therm	408-945-9000
CA	San Jose, PT Analytical	408-943-0777
IL	Hinsdale, Plasma-Therm	312-789-2636
MA	Wakefield, Plasma-Therm	617-246-4800
MA	Woburn, Plasma Sys.	617-933-9170
NJ	Kresson, Plasma-Therm Sys.	609-767-6120
PA	Whitehall, Plasma-Therm	215-776-0330

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-489-2229, TWX: 910-221-1354; FSC No.: 99120; Empl.: 105; *Sls. Mgr.:* F. J. Pavey

PLASTIC FORMING CO., INC., 5 Lunar Dr., P.O. Box N, Woodbridge, CT 06525, Tel: 203-397-1338, Telex: 963437; Empl.: 37; *Sls. Mgr.:* John C. Womer

PLASTIGLIDE MFG., 2701 W. El Segundo Blvd., Hawthorne, CA 90250, Tel: 213-777-8108; Empl.: 425; *Dist. Mgr.:* J. Shulman

PLASTOID CORPORATION, 45 Gingerbread Castle Rd., Hamburg, NJ 07419, Tel: 201-827-7141

PLASTRONICS INC., 3111 Gardenbrook, Dallas, TX 75234, Tel: 214-243-0611, TWX: 910-860-5542; Empl.: 47

PLATO PRODS., 2120 E. Allen Ave., Glendora, CA 91740, Tel: 800-423-4510, Telex: 673-488; FSC No.: 32399; Empl.: 75; *Sls. Mgr.:* Walter Schaub

Local Distributors

AZ	Phoenix, Scottsdale Tool & Supply	602-273-7376
CA	El Segundo, Wassco	213-640-1060
CA	Sunnyvale, COM-KYL	408-734-9660
CO	Arvada, Western Tool	303-422-3413
CO	Denver, Grenfell Supp.	303-893-3111
FL	Orlando, Deanco	305-851-2480
GA	Marietta, Deanco	404-429-0126
IL	Chicago, E M F	312-889-8323
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
KS	Overland Park, Burke Sls	913-492-1880
MD	Gaithersburg, Deanco	301-948-5444
MA	Boston, Hub Material	617-542-7531
MA	Burlington, Contact East	617-272-5051
MN	St. Paul, R.G. Ragon	612-488-0201
NM	Albuquerque, Intl. Elctrns	505-265-6456
NC	Raleigh, Deanco	919-851-2065
OR	Portland, Murphy Indl Supp.	503-620-8680
TX	Dallas, Roy E. Davis	214-688-0652
TX	El Paso, Intl Elctrns	915-778-9761
UT	Salt Lake City, Techn. Devices	801-972-5935
VA	Virginia Beach, Deanco	804-499-3322

PLESSEY CERAMIC DIV., 8th & Harrison Sts., Frenchtown, NJ 08825, Tel: 201-996-2121, TWX: 510-235-3399; Empl.: 198; *Sls. Mgr.:* William Blackford

PLESSEY ELECTRO-PRODUCTS, 3860 Centinela Ave., Los Angeles, CA 90066, Tel: 213-390-3585, TWX: 910-343-6483; Empl.: 60; *Sls. Mgr.:* Joan Marie Hill

PLESSEY MICROSYSTEMS, Plessey Trading Corp., 1641 Kaiser Ave., Irvine, CA 92714, Tel: 714-540-9931/9932, TWX: 910-595-1930; *Sls. Mgr.:* Garry T. Tomlins

PLESSEY MICROSYSTEMS, 451 Hungerford Dr., Rockville, MD 20850, Tel: 301-279-2892, TWX: 710-828-9815; *Sls. Mgr.:* Garry Tomlins; *Dist. Mgr.:* Randy Williams

PLESSEY SEMICONDUCTORS, 1641 Kaiser Ave., Irvine, CA 92714, Tel: 714-540-9979, TWX: 910-595-1930; FSC No.: 52648; Empl.: 75; *Sls. Mgr.:* Jerry Surloff

PLUMER PRECISION OPTICS, 601 Montgomery Ave., Pennsburg, PA 18073, Tel: 215-679-6272; Empl.: 160; *Sls. Mgr.:* Ray Boulay

PMI MOTORS, KOLLMORGEN CORP., 5 Aerial Way, Syosset, NY 11791, Tel: 516-938-8000, TWX: 510-221-1875; Empl.: 230; *Sls. Mgr.:* F. Sarstedt; *Dist. Mgr.:* R. Malton

Local Sales Offices & Reps

AR	El Dorado, Indl. Controls Assocs.	501-862-2051
CA	San Jose, Motion Control	408-997-0544
CA	San Marino, Motion Control	213-796-0189
CO	Denver, Control Agency	303-936-6641
FL	Altamonte Springs, A. Lovisek	305-788-6606
IL	Bartlett, T. Meyer	312-830-3374
IN	Elkhart, Shaum Mfg.	219-264-0771
IN	Spencer, Shaum Mfg. Inc.	317-842-2255
IA	Marion, Design Solutions, Inc.	319-377-1129
KS	Shawnee Mission, Design Solutions, Inc.	913-432-3109
KS	Wichita, Design Solutions, Inc.	316-529-0114
LA	Baton Rouge, Industrial Controls Assocs.	800-643-1109
MA	Beverly, Electro Kinetics	617-922-4007
MA	Wellesley, Electro Kinetics	617-235-9415
MI	Ann Arbor, Pyramid Integrated Control Sys.	313-996-4162
MI	Belding, Shaum Mfg. Inc.	616-897-5385
MN	Newport, Applied Motion Technig.	612-459-0600
MO	St. Louis, Design Solutions, Inc.	314-961-7170
NY	Cazenovia, D & O Engrg.	315-655-8602
NY	Syosset, B. Lewis	516-938-8000
NY	Syosset, Motion Control Sls.	516-921-5656
NY	Youngstown, D & O Engrg.	716-745-3915
NC	Greensboro, Engrg. & Mktg. Corp. of Virginia	919-275-1309
NC	Plymouth, Engrg. & Mktg. Corp. of Virginia	919-793-4461
OH	Chagrin Falls, Exonic Sys.	216-247-4788
PA	Pittsburgh, Exonic Systems	412-784-8400
TX	Fort Worth, Industrial Controls Assocs.	800-643-1109
TX	Spring, Industrial Controls Assocs.	800-643-1109
UT	Salt Lake City, Control Agency	801-328-4305
VA	Roanoke, Engrg. & Mktg. Corp. of Va	703-986-1410
WA	Renton, Drive Motor Control Sys. Co.	206-226-9294
WI	Racine, T. Beyer	414-632-6100

Distributor

POCO SALES, 8925 Fullbright St., Chatsworth, CA 91311, Tel: 818-700-8727 .... pgs. 642, 680, 685, 687

POLARAD ELCTRNS., INC., 5 Delaware Dr., Lake Success, NY 11042, Tel: 516-328-1100, TWX: 510-223-0414; FSC No.: 82199; Empl.: 175; *Sls. Mgr.:* Ron Ramirez

POLAROID CORP., 784 Memorial Dr., Cambridge, MA 02139, Tel: 617-577-2024, Telex: 921482, TWX: 710-320-0610; *Sls. Mgr.:* Sal La Rocca

POLYCORE ELCTRNS., 1107 Tourmaline Dr., Newbury Pk., CA 91320, Tel: 213-991-1061, Telex: 910-336-1547; Empl.: 30; *Sls. Mgr.:* S.K. Leong

POLYMER CORP., P.O. Box 422, Reading, PA 19603, Tel: 215-320-6600, Telex: 836-440, TWX: 510-651-5396; Empl.: 1000; *Sls. Mgr.:* R. S. Spangler

POLYPHASE INSTR., 175 Commerce Dr., Ft. Washington, PA 19034, Tel: 215-643-6950, Telex: 84-6327; FSC No.: 98330; Empl.: 175; *Sls. Mgr.:* R.H. Simmons

POLYPHASER CORPORATION, P.O. Box 1237, Gardnerville, NV 89410, Tel: 702-782-2511, Telex: 215406 TBYT UR: PolyPhaser .... **1B**•1285

Local Sales Offices & Reps

CA	North Hollywood, Crown Elctrns.	818-877-3550
CO	Aurora, Electro-Tek Sls.	303-343-8937
GA	Marietta, Consumer Mktg.	404-424-9097
HI	Honolulu, Manon Engrg.	808-833-9545
IL	Elk Grove Village, IRO Co.	312-593-0644
MI	Rochester, Webster Assocs.	313-375-0420
MN	Stillwater, Ned Gordon & Assocs.	612-430-1572
MO	Liberty, LectroReps	816-781-2522
NV	Gardnerville, PolyPhaser Corp.	702-782-2511
NM	Albuquerque, Electro-Tek Sls., Inc.	505-883-4871
NC	Pineville, Consumer Mktg.	704-527-4045
OH	Toledo, Webster Assocs.	419-535-0708
OK	Tulsa, Horizon Engrg. Sls. Co.	918-252-7222
OR	Portland, Manon Engrg.	503-245-7553
PA	Venetia, Webster Assocs.	412-941-8848
RI	Lincoln, Adams-McGregor	401-726-1300
TX	Houston, Horizon Engrg. Sls. Co.	713-495-1018
TX	Rockwall, Horizon Engrg. Sls. Co.	214-226-4712
TX	Rowlett, Horizon Engrg.	214-475-1179
UT	Salt Lake City, Electro-Tek Sls.	801-973-8435
WA	Kirkland, Manon Engrg.	206-827-7449
WY	Sheridan, Electro-Tek Sls., Inc.	307-672-9368

Local Distributors

CO	Aurora, Electro-Tek Sls.	303-343-8937
IL	Elk Grove Village, IRO-Co.	312-593-0644
KS	Dodge City, Teletron	316-225-3736
NV	Gardnerville, PolyPhaser Corp.	702-782-2511
NC	Greensboro, West Antenna	919-621-2473
TX	Rockwall, Horizon Engrg. Sls. Co.	214-226-4712
TX	Rowlett, Horizon Engrg. Sls.	214-475-1179

POLY-SCIENTIFIC, 1213 N. Main St., Blacksburg, VA 24060, Tel: 703-552-3014, TWX: 710-875-3694; Empl.: 625

POLYTRON DEVICES, Box 398 - River St. Sta., Paterson, NJ 07544, Tel: 201-345-5885; Empl.: 10

POMFRET RESEARCH OPTICS, 817 Long Ridge Rd., Stamford, CT06902, Tel: 203-322-6386; Empl.: 5

POMONA ELECTRONICS, See ITT Pomona

POP FASTENERS DIV., 510 River Rd., Shelton, CT 06484, Tel: 203-735-9341, Telex: 963465, TWX: 710-451-3734; Empl.: 375; *Sls. Mgr.:* James Lynch

PORTESCAP TRANSICOIL, Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990, Tel: 215-277-1300, TWX: 510-660-0132; FSC No.: 82686; Empl.: 220; *Sls. Mgr.:* P. Schoenacker **1B**•1172, 1185

Local Sales Offices & Reps

CA	Huntington Beach, Portescap Transicoil	714-963-3069
MA	Medfield, Portescap Transicoil	617-359-2336
MA	Plymouth, Portescap Transicoil	216-224-6533
NJ	Kinnelon, Avionics Engrg. Sls.	201-838-8105
OR	Beaverton, Portescap Transicoil	503-645-7523
PA	Andalusia, Portescap Transicoil	215-245-5366
PA	Media, Homersmith, Inc.	215-543-2434
TX	Richardson, Portescap Transicoil	214-690-9000
EXP	PA, Worcester, Portescap Transicoil	215-277-1300

PORTESCAP U.S., 1547 Trooper Rd., P.O. Box 666, Worcester, PA 19490, Tel: 215-277-0433, Telex: 846367; *Sls. Mgr.:* George Beauchemin **1B**•1172, 1873

Local Sales Offices & Reps

CA	Pomona	714-622-4185
MA	Medfield	617-359-2336
NJ	Ft. Lee	201-461-8803
OR	Beaverton	503-645-7523
TX	Richardson	214-690-9000

POSITRONIC INDS., 423 North Campbell, Springfield, MO 65806, Tel: 417-866-2322, Telex: 436445; FSC No.: 28198; Empl.: 196; *Sls. Mgr.:* J.E. Myers; *Dist. Mgr.:* Linda Haley

POTTER & BRUMFIELD, P.O. Box 322, Princeton, IN 47671, Tel: 812-386-1000, Telex: 27-8451, TWX: 810-350-2343; Empl.: 3000; *Sls. Mgr.:* Don Morrow; *Dist. Mgr.:* Gordon Collins

POTTER CO., P.O. Box 337, North Hwy. 51, Wesson, MS 39191, Tel: 601-643-2215, TWX: 510-981-4072; FSC No.: 601-643-5126; Empl.: 300 **1A**•1612

Local Sales Offices & Reps

CA	Los Angeles, Potter Co.	818-704-1151
CA	San Jose, Potter Co.	408-297-6222
FL	Orlando, Potter Co.	305-831-2782
IL	Chicago, Potter Co.	312-364-0424
MA	Boston, Potter Co.	617-449-1242
MN	Minneapolis, Potter Co.	612-933-7712
NY	Mineola, Colucci Sls.	516-746-0397
OH	Dayton, Allen Nace Co.	513-836-0931
PA	Philadelphia, Potter Co.	215-525-4752
TX	Austin, Potter Co.	512-451-5721

Local Distributors

AZ	Phoenix, Kachina Elctrn. Distrs.	602-269-6201
AZ	Tucson, Kachina Elctrn. Distrs.	602-792-2223
CA	Cerritos, El-Com, Inc.	714-739-5656
CA	San Diego, El-Com, Inc.	619-578-0900
CA	San Francisco, KEA Elctrn. Distributing	415-481-5588
CA	Santa Clara, Western Electromotive	408-727-7411
CT	New Haven, Cronin Elctrns.	203-265-3134
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Orlando, Intertec Comps.	305-834-7777
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
IL	Chicago, Advent Elctrns.	312-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Kansas City, Milgray Elctrns.	913-236-8800
MD	Rockville, Milgray Elctrns.	301-468-6400
MA	Boston, Cronin Elctrns.	617-449-5000
MA	Burlington, Milgray Elctrns.	617-272-6800
MI	Detroit, Advent Elctrns.	313-477-1650
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Freeport, Milgray Elctrns.	516-546-6000
NY	North Syracuse, ANDCO	315-699-2660
OH	Cleveland, Milgray Elctrns.	216-447-1520
OR	Portland, Radar Electric	503-232-3404
PA	Philadelphia, Century Elctrn. Comps.	215-631-5400
WA	Seattle, Radar Electric	206-282-2511
WA	Spokane, Radar Electric	509-747-3053

POTTER INSTR., 10 Main St., Gonic, NH 03867, Tel: 603-332-1991, Telex: 94-4483; FSC No.: 11-1563382; Empl.: 20; *Sls. Mgr.:* S. Alexander

POULIN ASSOCIATES, INC., 302 North Rd., Sudbury, MA 01776, Tel: 617-443-7333; *Sls. Mgr.:* Scott Spalding

POWERBOX, INC., 1860 Broadway, New York, NY 10023, Tel: 212-586-1992; *Sls. Mgr.:* Len Elmlund

POWER COMPONENTS
Power Components Company
Subsidiary of Vanguard Electronics Co., Inc

POWER COMPS. CO., Vanguard Elctrns. Co., 1480 W. 178th St., Gardena, CA 90248, Tel: 213-323-8120, TWX: 910-346-7067; *Sls. Mgr.:* Ken Finley **3**•1668, 1669

Local Sales Offices & Reps

AZ	Tempe, Sys. Sls. of AZ.	602-829-9338
CA	Canoga Park, Chandler Assoc.	213-340-6103
CA	San Diego, T.D.I.	619-286-5107
CA	San Jose, Silicon Valley Sls.	408-286-7510
CO	Denver, W. H. Howard	303-426-3499
IL	Franklin Park, Dekotech, Inc.	312-455-5100
IN	Fort Wayne, Tx Sls. Indiana	219-489-4447
MD	Columbia; Raleigh, Robert Elect. Sls.	301-995-1900
MA	Medfield; Concord, Nortech Engr. Sls.	617-359-6063
MI	Jackson, Norwood Scroggs Co.	517-878-0434
MN	Minneapolis, Bill Deming & Assoc.	612-888-5000
NY	Commack, RC Engr. Sls.	516-543-3325
OH	Akron, Arkay	216-836-8497

POWER CONTROL, 122 Gamma Dr., Pittsburgh, PA 15238, Tel: 412-782-3120; Empl.: 75

POWER CONTROLS, P.O. Box 5860, San Antonio, TX 78201, Tel: 512-734-7155, Telex: 767222; Empl.: 90; *Sls. Mgr.:* Robert A. McAlister

POWER CONVERSION PRODS., 42 East St., Box 380, Crystal Lake, IL 60014, Tel: 815-459-9100, TWX: 910-634-3356; FSC No.: 31751; Empl.: 130; *Sls. Mgr.:* C. Seyer

POWERCUBE CORP., Sub. Unitrode Corp., 8 Suburban Pk. Dr., Billerica, MA 01821, Tel: 617-667-9500, TWX: 710-347-6792; FSC No.: 31557; Empl.: 140; *Sls. Mgr.:* James A. Ward

POWER DESIGNS, INC., 1700 Shames Dr., Westbury, NY 11590, Tel: 516-333-6200, TWX: 510-222-6561; Empl.: 100; *Sls. Mgr.:* Lillian Kelly **3**•1672-1679

Local Sales Offices & Reps

CA	North Hollywood, O'Halloran Assocs.	818-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-326-1493
CA	San Diego, O'Halloran Assocs.	619-224-2824
CT	South Windsor, Addelco Corp.	203-644-1233
FL	Melbourne, Reynolds & Assocs.	305-259-7000
IL	Elk Grove Village, Loren Green & Assocs.	312-593-0282
IN	Indianapolis, Loren Green & Assocs.	317-293-9827
MD	Gaithersburg, Powell Pendergraph	301-921-4200
MA	Needham, Addelco Corp.	617-444-4754
MN	Minneapolis, Loren Green & Assocs.	612-781-1611
NY	Port Chester, Radiation Elctrns.	914-937-2300
PA	Willow Grove, Powell-Pendergraph	215-657-0330
VA	Richmond, Powell-Pendergraph	703-264-2341
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

POWER DYNAMICS, 177 Valley, S. Orange, NJ 07079, Tel: 201-762-6886, Telex: 666 173, TWX: 136567 (PDI); FSC No.: 60046; *Sls. Mgr.:* James Papianni; *Dist. Mgr.:* Lyle Scott **1B**•1286, 1287, 1740; **2**•1544-1546, 1782, 1783

Local Sales Offices & Reps

CA	Laguna Niguel, David Budge & Assoc.	714-831-7720
CA	Mountain View, Bart Budge Assocs.	415-961-0940
CT	Vernon, GM Assoc.	203-646-4443
FL	Coral Springs, E.P.M. Corp.	305-755-5387
GA	Lawrenceville, BTF, Inc.	404-963-9495
IL	Crystal Lake, E. S. Healy & Assocs.	815-459-4386
KY	Louisville, KW Elctrn. Sls.	502-451-1860
MA	Framingham, GM Assoc.	617-872-4871
MI	Ypsilanti, Tamco Inc.	313-572-1950
MN	Minneapolis, R. K. Sls.	612-786-5713
NH	Exeter, GM Assoc.	603-778-7472
NJ	Englewood Cliffs, Ed Glass Assoc.	201-592-0200
NC	Raleigh, BTF, Inc.	919-782-3493
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Shaker Heights, KW Elctrn. Sls.	216-491-9177
OH	Worthington, KW Elctrn. Sls.	614-888-0483
OR	Tigard, Electronic Comp. Sls.	503-245-2342
PA	Allison Park, KW Elctrn. Sls.	412-487-4300
PA	Prospect Park, Elf Sls.	215-534-3340
TX	Dallas, Rem-Air Comps.	214-234-1069
UT	Salt Lake City, Aspen Sls.	801-467-2401
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301

Local Distributors

CA	Burlingame, Rose Elctrns.	415-348-2740
CA	Inglewood, Force Elctrns.	213-670-8570
CA	San Jose, Force Elctrns.	408-943-1324
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
IL	Crystal Lake, Sub-Sem	312-782-3954
MN	St. Paul, Munsee Elctrns.	612-228-0267
NC	Raleigh, Century Elctrns.	919-755-0537
PA	Norristown, Century Elctrns.	215-631-5400
TN	Memphis, Electrotec	901-362-1350
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Stafford, Southwest Elctrns.	713-491-4900
WA	Redmond, Murphy Elctrns.	206-881-1234

POWER ELCTRNS., 96 Milton Rd., Rochester, NH 03867, Tel: 603-332-3334; Empl.: 125; *Sls. Mgr.:* Robert S. Karstedt

POWER FUNCTIONS ENGRG., 3831 Cavalier Dr., Garland, TX 75042, Tel: 214-278-0996; Empl.: 9

POWER
GENERAL
A SUBSIDIARY OF **UNITRODE** CORPORATION

POWER GENERAL, 152 Will Dr., Canton, MA 02021, Tel: 617-828-6216, TWX: 710-348-0200; Empl.: 200; *Sls. Mgr.:* Steve Dutton; *Dist. Mgr.:* John H. Gallagher **3**•1680-1691

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Scottsdale, TC Electrn. Sls.	602-994-5153
CA	Milpitas, Sales One	408-945-1250
CA	Orange, XBX Sls.	714-998-8200
CA	Redwood City, Sales One	415-367-1188
CO	Englewood, Grimes Mktg.	303-799-6063
CT	Avon, Power Mark	203-678-0123
FL	Melbourne, EMS	305-724-1027
FL	Plantation, EMS	305-587-7146
FL	Sarasota, EMS	813-924-7415
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Palatine, T-Squared Assoc.	312-991-2144
IA	Cedar Rapids, Palatine Eng. & Sls.	319-365-8071
KS	Mission, Palatine Eng. & Sls.	913-831-0555
MA	Canton, Power General	617-828-6216
MI	Birmingham, Favco	313-644-0173
MI	Grand Rapids, Favco	616-459-4425
MN	Minneapolis, Comtek Sls.	612-888-7011
MO	Hazelwood, Palatine Eng. & Sls.	314-839-0800
NJ	Perth Amboy, AstroRep	201-826-8050
NY	Babylon, AstroRep Inc.	516-422-2500
NY	Babylon, AstroRep Inc.	201-624-4408
NY	DeRuyter, Net Sls.	315-662-7996
NY	Fairport, Net Sls.	716-467-4538
NY	Troy, Net Sls.	518-274-4758
NC	Winston Salem, Murcota	919-722-9445
OH	Columbus, McFadden Sls.	614-459-1280
OR	Lake Oswego, Huntley Assoc.	503-636-7558
TX	Austin, Mech-Tron Mktg.	512-835-0980
TX	Dallas, Mech-Tron Mktg.	214-343-3786
TX	Houston, Mech-Tron Mktg.	713-462-1432
VA	Fairfax, Beacon North	800-572-0405
VA	Falls Church, Beakon North Inc.	703-591-1300
WA	Everett, Huntley Assoc.	206-353-1833

Local Distributors

Intl	Belgium, Gent, Belgium Computer Prods.	
Intl	France, Orsay, Microel	907.08.24
Intl	W. Germany, Muenchen, Fey Elektronik Bauelemente	(089) 184041

POWER GROUP INTERNATIONAL, 1137 Cliff Rd., Burnsville, MN 55337, Tel: 612-890-1360; FSC No.: 25441; Empl.: 500; *Sls. Mgr.:* Hortense M. Rowe **3**•1420, 1421

POWER INSTRS., INC., 7352 N. Lawndale Ave., Skokie, IL 60076, Tel: 312-676-2300, TWX: 910-223-0835; Empl.: 45; *Sls. Mgr.:* Tony Ruggiero

POWER INTEGRITY CORP., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27408, Tel: 919-379-9773; *Sls. Mgr.:* James T. Fesmire

POWER LABS, INC., 5 Towle Ave., Dover, NH 03820, Tel: 603-742-4613; Empl.: 9

POWERMARK, 3855 Ruffin Rd., San Diego, CA 92123, Tel: 619-565-8363; Empl.: 75; *Sls. Mgr.:* Ron Baietto **3**•1904-1906

Local Sales Offices & Reps

AL	Birmingham, Sesco	205-988-8304
AK	Anchorage, John P. Bagoy & Assocs.	907-274-8531

AZ	Phoenix, Bob Anderson Co.	602-266-2070
CA	Milpitas, Lee/Allan Assocs.	408-946-8300
CO	Denver, Cleveland Entprs. of Colo.	303-751-3252
FL	St. Petersburg, Sesco	813-576-6991
GA	Atlanta, Sesco	404-458-6423
HI	Honolulu, Ind'l. Elctrns.	808-533-6095
ID	Boise, Underwood-Hanify Assocs.	208-343-5600
IL	Elk Grove Village, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Loren Green Assocs.	317-293-9827
KS	Shawnee, Atech	913-268-9644
LA	Baton Rouge, Sesco	504-928-4951
LA	Metairie, Sesco	504-456-2684
MD	Bethesda, Powell-Pendergraph	301-656-4535
MA	Wellesley, Power Conversion Sys.	617-235-7884
MI	Mt. Clemens, O'Hara Assocs.	313-791-7140
MN	Minneapolis, Loren Green Assoc.	
MO	St. Louis, Atech	314-428-7447
NH	Londonderry, Power Conversion Sys.	603-434-2371
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Pittsford, Trott Elctrns.	716-586-8251
NC	Cary, Sesco	919-467-7482
NC	Charlotte, Sesco	704-535-4920
OH	Cleveland, Jim Finnegan & Co.	215-238-5905
OK	Tulsa, Sesco	918-622-3868
PA	Brunnerville, J. E. Cuesta & Co.	717-626-2020
PA	Valley Forge, J. E. Cuesta & Co.	215-265-5800
TX	Austin, Sesco	512-892-2490
TX	Dallas, Sesco	214-231-9364
TX	Houston, Sesco	713-999-3510
UT	Salt Lake City, Cleveland Entprs. of Colo	801-355-8424
VA	Richmond, Powell-Pendergraph	804-270-1400
WA	Bellevue, Underwood-Hanify Assocs.	206-451-8223
WA	Vancouver, Underwood-Hanify Assocs.	503-641-4463

POWER/MATE CO., 514 S. River St., Hackensack, NJ 07601, Tel: 201-440-3100, TWX: 710-990-5023; Empl.: 650; *Sls. Mgr.:* J. R. Hoeffler; *Dist. Mgr.:* G. Vardakas

POWER-ONE

DC POWER SUPPLIES

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

Power-One

POWER-ONE, INC., Power-One Dr., Camarillo, CA 93010, Tel: 805-484-2806, TWX: 910-336-1297; FSC No.: 54407; Empl.: 531 .... 3•1692-1695

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States	602-998-2444
CA	Los Angeles, A-F Sls. Engrg.	213-681-5631
CA	Pasadena, A-F Sls. Engrg.	213-681-5631
CA	San Diego, A-F Sls. Engrg.	619-274-2225
CA	San Jose, Richards Assocs.	408-297-3010
CO	Denver, Quorum 3	303-696-8480
FL	Casselberry, Elctrn. Mktg.	305-339-7070
GA	Marietta, ELW Southeast	404-424-1731
IL	Itasca, L-Tec	312-773-2900
IN	Ft. Wayne, J&B Engrg.	219-483-2813
IN	Indianapolis, J&B Engrg.	317-894-8697
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, ATS	913-642-6675
MA	Brockton, Forsberg	617-522-6300
MI	Southfield, L. H. Dickelman	313-353-8210
MN	Minneapolis, Components Grp. Corp.	612-374-1250
MO	St. Louis, ATS	314-227-4448
NE	Lincoln, Lorenz Sls.	402-475-4660
NM	Albuquerque, Thorson Desert States	505-293-8555
NY	Great Neck, Trionic Assocs.	516-466-2300
NY	Pittsford, C. W. Beach	716-586-3200
NY	Syracuse, C. W. Beach	315-446-9587
OH	Columbus, Tom Mulligan Co.	614-457-2242
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	Beaverton, W3	503-641-5790
PA	Philadelphia, Eastern Comp. Sls.	215-825-8610
PA	Stewartstown, Eastern Comp. Sls.	800-223-3850
TX	Austin, Advance Tech. Sls.	512-459-1351
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
UT	Sandy, Quorum 3	801-943-9227
VA	Manasas, Eastern Comp. Sls.	703-368-3936
WA	Seattle, W3	206-285-2667
WI	Milwaukee, L-Tec	414-774-1000

Local Distributors

AZ	Phoenix, Arrow Elctrns.	602-968-4800
AZ	Phoenix, Aero Space Southwest	602-861-1785
AZ	Phoenix, PLS Assocs.	602-246-6614
CA	Chatsworth, Diplomat Elctrns.	818-341-4411
CA	Chatsworth, Arrow Elctrns.	213-701-1133
CA	Costa Mesa, FLW	818-989-5237
CA	Los Angeles, Hanex, Inc.	213-556-3807
CA	Newport Beach, Arrow Elctrns.	714-851-8961
CA	San Diego, Diplomat Elctrns.	619-292-5693
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Jose, Compumech Elctrns.	408-289-9171
CA	Sunnyvale, Diplomat Elctrns.	408-734-1900
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CO	Denver, Arrow Elctrns.	303-696-1111
CO	Denver, PLS Assocs.	303-773-1218
CO	Englewood, Diplomat Elctrns.	303-799-8300
CT	Danbury, Diplomat Elctrns.	203-797-9674
CT	Wallingford, Sterling Elctrns.	203-265-9535
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Clearwater, Diplomat Elctrns.	813-443-4514
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Miami, Elctrn. Equip. Co.	305-871-3500
FL	Palm Bay, Arrow Elctrns.	305-725-1480
GA	Norcross, Diplomat Elctrns.	404-449-4133
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Arlington Heights, C. W. Elctrns.	312-489-9810
IL	Bensenville, Diplomat Elctrns.	312-595-1000
IL	Northbrook, Classic Comps.	312-272-9650
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KS	Edwardville, C. Tennant & Sons	913-441-1801
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Columbia, Diplomat Elctrns.	301-995-1226
MD	Timonium, Zebra Elctrns.	301-252-6576
MA	Canton, Impact Sales	617-821-1500
MA	Woburn, Arrow Elctrns.	617-933-6770
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Battle Creek, Great Lakes Elctrns.	616-731-4156
MI	Livonia, Reptron	313-525-2700
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, Aero Space Computer	612-884-4725
MO	St. Charles, Finnigan Elctrns.	314-946-6201
MO	St. Louis, Arrow Elctrns.	314-567-6888
NE	Omaha, Scott Elctrns.	402-734-6750
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NJ	Perth Amboy, Sterling Elctrns.	201-442-8000
NJ	Saddle Brook, Arrow Elctrns.	201-797-5800
NJ	Totawa, Diplomat Elctrns.	201-785-1830
NM	Albuquerque, Sterling Elctrns.	505-854-1900
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Mamaroneck, Logicomp Elctrns.	914-698-9332
NY	Melville, Diplomat Elctrns.	516-454-6400
NY	Rochester, Zeller Elctrns.	716-254-8840
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Rochester, CAM/RPC Elctrns.	716-865-2080
NC	Raleigh, Southeastern Elctrns.	919-828-2311
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cincinnati, Applied Data Mgt.	513-579-8108
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Columbus, Reptron	614-436-6675
OH	Solon, Arrow Elctrns.	216-248-3990
OK	Tulsa, Sterling Elctrns.	918-663-2410
PA	Lancaster, CAM/RPC Elctrns.	717-392-8141
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Pittsburgh, Alder Tronics	412-821-5565
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
PA	Wayne, Peak Elctrns.	215-293-9000
RI	Warwick, Major Edwards Elctrns.	401-781-3000
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Dallas, Solid State Elctrns.	214-438-5700
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Solid State Elctrns.	713-772-8483
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Diplomat Elctrns.	801-486-4135
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bellevue, Arrow Elctrns.	206-643-4800
WA	Seattle, Radar Electric	206-282-2511
WI	Oak Creek, Arrow Elctrns.	414-764-6600
EXP	CA, Los Angeles, Hanex, Inc.	213-556-3807

POWER PAC INC.

POWER PAC, 32 Meadow St., S. Norwalk, CT 06856, Tel: 203-866-4484; FSC No.: 53998; Empl.: 175; *Sls. Mgr.:* Abe Partner .... 3•1696-1700

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
CA	Los Altos, AARD Engr.	415-948-5740
CA	Westlake Village, Jayess Co.	213-991-0632
CT	Hamden, Digital Sls. Assoc.	203-248-3641
GA	Chamblee, BCI	403-455-0405
IL	Des Plaines, Synmark Sls. Co.	312-296-0180
MD	Seabrook, W. A. Brown-Equip. Co.	301-577-6105
MA	Waltham, Digital Sls. Assoc.	617-899-4300
MI	Dearborn Hgts., Electro Sls. Assoc.	313-474-7320
MN	Minneapolis, R.J. Inc.	612-866-3661
NJ	E. Hanover, Emtec	201-428-0600
NJ	Princeton, Murtronics	609-394-3737
NJ	Teaneck, SGL Sls.	201-837-2352
NY	Cazenovia, S.T. Woolard	315-655-8145
NY	Melville, Emtec	516-752-1630
NC	Raleigh, BCI	919-781-9426
OH	Cleveland, Electro Sls. Assoc.	216-261-5440
OH	Dayton, Electro Sls. Assoc.	513-426-5551
PA	Harrisburg, Beil & Whitaker	717-564-6900
TX	Houston, Scientific Sls.	713-666-5318
TX	Richardson, Scientific Sls.	214-231-6541

Local Distributors

CT	Hamden, Digital Sls. Assoc.	203-248-3641
MA	Waltham, Digital Sls. Assoc.	617-899-4300

POWER-PAK, INC., 6232 N. Pulaski Rd., Chicago, IL 60646, Tel: 312-286-5566, TWX: 910-221-5928; *Sls. Mgr.:* Robert Villari

POWER PRODUCTS DIV., COMPUTER PRODS., INC., See Power Products Group

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIV., Computer Products, Inc., 2801 Gateway Dr., Pompano Beach, FL 33060, Tel: 305-974-2442, TWX: 510-956-3098; FSC No.: 62125; Empl.: 700 ....3•1438, 1701-1725

POWER-SCIENCE, 7667 Vickers St., San Diego, CA 92111, Tel: 619-292-4322; Empl.: 6; *Sls. Mgr.:* E. Cooper

POWER PS SONIC
RECHARGEABLE BATTERIES

POWER-SONIC, Box 5242, 3106 Spring St., Redwood City, CA 94063, Tel: 415-364-5001, Telex: 348400; Empl.: 30; *Sls. Mgr.:* B. A. Ender; *Dist. Mgr.:* B. A. Ender ....3•1422

Local Sales Offices & Reps

CA	Irvine, English/Damco	714-837-3801
FL	Tampa, SRT Mktg.	813-884-4805
IL	River Forest, Pete Collins	312-366-7076
MA	Natick, Steve Dworkin	617-653-7188
MS	Jackson, Welch & Doby	601-932-5534
NY	Wantagh, Dony Tech. Sls.	516-826-5550
NC	Raleigh, DHR Mktg.	919-876-5450
PA	Media, W. Reeves Assocs.	215-566-6709
SC	Greenville, DHR Mktg.	803-235-3594
TX	Dallas, Power Connection	214-357-8207

Local Distributors

CA	Chatsworth, Mil-Comm Distr.	213-998-3111
CA	Fountain Valley, Components Center	714-979-0433
CA	Mountain View, Cornett Electronics	415-969-5420
CA	Santa Clara, Components Center	408-988-3751
CO	Denver, Hensley Battery	303-455-3643
CT	Westport, Secres Distr.	203-226-7371
FL	Miami, ESL Elctrn. Distr.	305-633-6973
FL	Tampa, Leader Elctrns.	813-870-3315
GA	Atlanta, Allied Elctrns.	404-237-3366
GA	Atlanta, Security Wherehouse	404-955-1006
IL	Chicago, Allied Elctrns.	312-697-8200
IL	Villa Park, Melvin Elctrns.	312-378-7741
LA	Lafayette, Ralph's Elctrns.	318-234-4507
MA	Sharon, Adcour	617-784-3996
MI	Detroit, Alarm Supp.	313-425-2500
MO	St. Louis, Olive Elctrns.	314-426-4500
NM	Albuquerque, Detatron, Inc.	505-344-2381
NY	Ridgewood, J.A. McDermott Corp.	212-456-3606
OK	Tulsa, Radio, Inc.	918-587-9123
PA	Pittsburgh, Triangle Elctrns.	412-441-9659
TX	Austin, Harrison Indl. Elctrns.	512-458-3555
TX	Ft. Worth, Allied Elctrns.	817-265-9341
TX	Houston, Harrison Equip.	713-652-4700
TX	San Antonio, Sherman Elctrns.	512-224-1001
VA	Richmond, Sterling Elctrns.	804-226-2190

POWER SYSTEMS, 12 Tobey Rd., Bloomfield, CT 06002, Tel: 203-243-0357, TWX: 710-425-8778; FSC No.: 50463; Empl.: 375; *Sls. Mgr.:* Leon Gedacht ....3•1726, 1727

Local Sales Offices & Reps

AZ	Phoenix, Tech Sls./Powerhouse	602-246-1614
CA	San Jose, Powerhouse	408-748-1555
CA	Santa Ana, Powerhouse	714-549-9599
MA	Tyngsboro, Comptech	617-649-3030

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803; Empl.: 40

POWER SYS. GRP., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Daniel L. Esau

POWERTEC, INC.

POWERTEC, INC., 20550 Nordhoff St., Chatsworth, CA 91311, Tel: 818-882-0004, TWX: 910-494-2092; Empl.: 349 ....3•1728-1745

POWERTECH, INC., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, Tel: 201-791-5050, Telex: 130389; FSC No.: 32953; Empl.: 49

Local Sales Offices & Reps

CA	Tarzana, Power Comp. Sls.	213-881-9111

Power Technology Inc.

POWER TECHNOLOGY, INC., P.O. Box 9769, Little Rock, AR 72219, Tel: 501-568-1995, TWX: 910-722-7313; Empl.: 40; *Sls. Mgr.:* Thomas H. Burgess ....3•1746

Local Sales Offices & Reps

IN	Ossian, Science Sales, Inc.	219-622-7383
PA	Glenside, Koebert Assoc., Inc.	215-887-2310

POWERTREND, INC., 3139-G Los Feliz Dr., Thousand Oaks, CA 91362, Tel: 805-496-2945; *Sls. Mgr.:* R. Jones

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, Telex: 172588 SNLO; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio

POWERTRON, See Industrial Test Equipment Co., Inc.

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, Telex: 572-444; *Sls. Mgr.:* Sam LoBue

POWR-UPS CORP., 50 Orville Drive, Bohemia, NY 11716, Tel: 516-567-9620; Empl.: 6; *Sls. Mgr.:* Steve Summer ....1B•1173

Local Sales Offices & Reps

CA	Fullerton, ESCO	714-879-7260
CA	San Diego, Total Elctrns. Int'l.	619-224-3291
MA	Southborough, Motion Engrg.	617-485-2144
NY	Cazenovia, D & O Engrg.	315-655-8602
OH	Dover, AJ Assocs.	216-343-2224
VA	Roanoke, Engrg. & Mktg. Corp. of Va.	703-986-1410

PPC PRODS., 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 305-848-9606, TWX: 510-952-7611; FSC No.: 33178; Empl.: 50; *Sls. Mgr.:* Nick Ernick

PPD, INC., Hwy. 70W, Resco Ct., P.O. Box 31347, Raleigh, NC 27612, Tel: 919-781-3955; *Sls. Mgr.:* Wm. Bagliani ....1A•1173-1179

PPM, INC., 23945 Mercantile Rd., Cleveland, OH 44122, Tel: 216-292-6006; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher ....3•1285

Local Sales Offices & Reps

AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CO	Denver, J. Smith & Assocs.	303-597-5343
MI	Ferndale, Tiby Co.	313-547-3550
NM	Albuquerque, J. Smith & Assocs.	505-265-3406
NC	Charlotte, Binco	704-366-5092
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822

PRACTICAL AUTOMATION, Trap Falls Rd., Shelton, CT 06484, Tel: 203-929-5381, Telex: 6813310; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

PRACTICAL TECHNOLOGY, 12 Village Ctr., Box 449, Carmel Valley, CA 93924, Tel: 408-659-3128; FSC No.: 59089; Empl.: 7; *Sls. Mgr.:* Keith Rosburg

PRAGMATIC DESIGNS, INC., 950 Benicia Ave., Sunnyvale, CA 94086, Tel: 408-736-8670, Telex: 17-1627, TWX: Nanet D Suvl; FSC No.: 94-2543110; Empl.: 45

PRD ELCTRNS., DIV. OF HARRIS CORP., see Harris Corp., PRD Electronics Div.

PRECICONTACT, INC., Ultra Precision, 1150 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, Telex: 83-4253; FSC No.: FSCM 60197; *Sls. Mgr.:* Edward W. Swirsky; *Dist. Mgr.:* John Dirado ....2•1547, 1892

Local Sales Offices & Reps

AZ	Litchfield Park, G. B. Elctrns.	602-935-3984
CA	Mountain View, Gene C. Woempner Co.	415-964-5454
CA	Orange, Elctrn. Tech. Assoc.	714-998-2901
CO	Englewood, White Sls. Co.	403-694-9555
FL	Orlando, Over & Over	305-857-4057
GA	Norcross, Over & Over	404-449-6205
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
IN	Indianapolis, Hoster & Sieloff Assoc.	317-842-3700
MD	Gaithersburg, Mechtronics Sls.	301-340-2130
MA	S. Dartmouth, Kentronics	617-999-2188
MA	Wakefield, Kentronics	617-246-0245
MO	Ravtown, Cadon Tech. Sls.	816-356-7685
MO	St. Louis, Cadon Tech Sls. Co.	314-645-8670
NJ	Mountain Lakes, Components for Elctrns.	201-334-2921
NY	Albion, Sys. Hardware Rep.	716-589-4908
NY	Corbettsville, SHR, Inc.	717-967-2607
NY	East Northport, Comps. For Elctrns.	516-266-5020
NY	Kew Gardens, Ayer Business Sys.	212-621-9002
NC	Charlotte, Over & Over	704-527-3070
NC	Raleigh, Over & Over	919-872-2262
OH	Cincinnati, Makin Assoc.	513-871-2424
OR	Portland, Elctrn. Mktg. Grp.	503-289-5320
PA	Hatboro, Jacobsen Assocs.	215-674-2937
PA	Lebanon, Jacobsen Assocs.	717-273-9746
PA	Pittsburgh, Kneip Sls.	412-824-1600; 823-0169
TN	Antioch, Over & Over	615-834-0140
TX	Austin, OM Sls.	512-452-1838
TX	Houston, OM Sls.	713-789-4426
TX	Richardson, OM Sls.	214-690-6746
UT	Salt Lake City, Charles Fields & Assocs.	801-277-4859
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Milwaukee, Heartland Tech. Mktg.	414-931-0606

Local Distributors

AZ	Litchfield Park, GB Elctrns.	602-935-3984
CA	Chatsworth, I.E.C./Jaco	800-423-5731
CA	Fremont, Term. Sls.	415-656-7722
CA	Orange, Elctrn. Connexions Corp.	714-998-2901
CA	San Diego, Park West	619-277-8433
CA	San Jose, Cypress Elctrns.	408-945-8400
CO	Denver, CSID, Inc.	303-292-9594
CT	Norwalk, Park Distrs.	203-853-2010
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Clearwater, Elctrn. Precepts of Florida	813-530-9781
FL	Lake Park, Park South	305-863-7275
FL	Pompano Beach, Components South	305-971-0350
IL	Palatine, OHM Elctrns.	312-359-5500
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Westwood, Emtel Elctrns.	617-326-6522
MA	Wilmington, Aved Elctrns.	617-657-8310
NJ	Bellmawr, Mid-Atlantic Elctrns.	609-931-5303
NJ	Berlin, GCI Corp.	609-768-6767
NJ	Englewood, T.E.D./Powell	201-894-0800
NJ	Springfield, Route Elctrns.	201-379-7710
NM	Albuquerque, Connecting Comps. Div. T.M.A. Inc.	505-345-8921
NY	Bohemia, Norelcom Elctrns. Corp.	516-567-8866
NY	Brooklyn, Beryl Elctrns.	212-383-2208
NY	Brooklyn, Connector Resources	212-383-2208
NY	East Syracuse, Future Elctrns.	315-463-6633
NY	Hauppauge, Jaco Elctrns.	516-273-5500
OH	Mansfield, Rush Elctrns.	419-756-2311
OR	Beaverton, Component Resources	503-641-8488
PA	Wayne, Peak Elctrns.	215-293-9000
PA	York, E.C.I.	717-843-8971
TX	Allen, Prime Distrbg. Co.	214-231-0170
TX	Grand Prairie, Dial Supp.	214-647-2371
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Richardson, Jaco Elctrns.	214-235-9575
TX	Stafford, Southwest Elctrns.	713-491-4900
WA	Bellevue, I.E.C./Jaco	206-455-2727
WA	Seattle, Pacific Elctrns.	206-575-1050

PRECISION COMPONENTS, INC., 1110 W. National Ave., Addison, IL 60101, Tel: 312-543-6400; *Sls. Mgr.:* B. A. Gravens ....3•1747

PRECISION ELCTRN. COMPS. LTD., 19 Hafis Rd., Toronto, Ont., Canada M6M 2V6, Tel: 416-249-7103, Telex: 06-969671 ....1A•2052

PRECISION ELCTRNS., 9101 King Ave., Franklin Park, IL 60131, Tel: 312-678-5350; Empl.: 25

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 312-766-0340; *Sls. Mgr.:* Jim Achen

PRECISION FILTERS, INC.

PRECISION FILTERS, 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, Telex: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 49; *Sls. Mgr.:* Tom Rockwell ....**1A**•1613-1617; **3**•1016-1020, 1286

Local Sales Offices & Reps

AZ	Tempe, Cleveland Entprs.	602-820-1127
CA	La Crescenta, Beckrep	213-957-1111
CO	Denver, Cleveland Entprs.	303-751-3252
FL	Osprey, Dick Ridgewell Co.	813-966-4401
IL	Park Ridge, Electronic Instr.	312-298-2290
IN	Indianapolis, Electronic Instr.	317-257-7231
MD	Fulton, Gans & Pugh Assocs.	301-953-3724
MN	Eden Prairie, Electronic Instr. Conslts.	612-937-9701
NM	Albuquerque, Cleveland Entprs.	505-265-7893
OH	Cleveland, Comtel Instr.	216-442-8080
OH	Dayton, Comtel Instr.	513-298-7573
OH	Hilliard, Comtel Instr.	614-876-8305
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Pittsburgh, Comtel Instr.	412-922-5720
UT	Salt Lake City, Cleveland Entprs.	801-355-8424
VA	Arlington, Gans & Pugh Assocs.	703-527-3262
WA	Bellevue, Topp Engrg. Sls.	206-747-5400

PRECISION LAMP, INC., 480 Aaron Dr., Cotati, CA 94928, Tel: 707-792-0333, Telex: 348498; Empl.: 25

PRECISION LEVEL VIAL CO., Warren Industries Inc., 1800-D Mearns Rd., Warminster, PA 18974, Tel: 215-675-2355; *Sls. Mgr.:* Michael Joyce; *Dist. Mgr.:* Michael Joyce

PRECISION MECHANISMS, 44 Brooklyn Ave., Westbury, NY 11590, Tel: 516-ED3-5955; FSC No.: 08127; Empl.: 26; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODS. CO., Centennial Indl. Pk., Peabody, MA 01960, Tel: 617-532-5500, TWX: 710-347-0123; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert H. Degnan

PRECISION MICRO IMAGES, Box 1330, Altamonte Springs, FL 32701, Tel: 305-830-7244, Telex: 56-4303; *Sls. Mgr.:* Williams S. Hodges

PRECISION MOLDED PRODUCTS, INC., 582 Meyer Lane, Redondo Beach, CA 90278, Tel: 213-372-7373

PRECISION MONOLITHICS, 1500 Space Dr., Santa Clara, CA 95050, Tel: 408-727-9222, TWX: 910-338-0218; FSC No.: 06665; Empl.: 700; *Sls. Mgr.:* Steve Pass; *Dist. Mgr.:* Mike Dennison

PRECISION RESISTIVE PRODS., INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131; Empl.: 90; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline .... **1A**•1925

Local Sales Offices & Reps

CA	Los Altos, Frauman Assoc.	415-941-0660
CA	San Diego, KCE	619-278-7640
CO	Denver, Williams Assocs.	303-373-4730
CT	Milford, Cuming Assocs.	203-878-3946
FL	Cocoa Beach, Reynolds & Assocs.	305-784-4700
IL	Chicago, Ellinger Sls.	312-763-1570
IN	Greenwood, Valentine Assocs.	317-888-2200
MA	Waltham, Jesco, Inc.	617-893-0094
MI	Warren, DEM Elctrns. Sls.	313-575-9444
MN	Minneapolis, Intl. Sls.	617-831-8423
MO	St. Charles, Chesco	314-946-6677
NJ	Paramus, Design Elctrns.	201-845-6224
NY	Syracuse, Electra Sls. Corp.	315-463-1248
TX	Richardson, Campion Sls. Co.	214-238-8145
WA	Seattle, Arneson Assoc.	206-762-7664

PRECISION RESISTOR CO., INC., 109 U.S. Hwy. 22, Hillside, NJ 07205, Tel: 201-926-3036, Telex: 13-6479-413; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* R. L. Wright .... **1A**•1926, 1927

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128

PRECISION TIMER, 13 Westbrook Ind'l. Pk., Westbrook, CT 06498, Tel: 203-399-6253; Empl.: 25; *Sls. Mgr.:* A. Hockert

PRECISION TUBE, Church Rd. & Wissahickon, N. Wales, PA 19454, Tel: 215-699-5801, Telex: 84-6439; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

Local Sales Offices & Reps

CA	Mountain View, Walter Assoc.	415-965-4131
CA	Santa Ana, RMS Assocs.	714-556-4155
CO	Golden, J. R. Hurlbut Co.	303-279-7796
FL	Melbourne, Hanson Assocs.	305-727-7474
IN	Indianapolis, Sukup & Cox	317-253-1215
IA	Cedar Rapids, Snider Sls. Co.	319-362-4410
MA	Burlington, Tri Tek	617-272-4550
MO	St. Charles, Buse Sls. Co.	314-946-6430
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NY	Huntington, CDB Enterprises	516-692-5200
TX	Garland, Carey McMahill & Zerbe	214-681-1414
UT	Salt Lake City, J. R. Hurlbut Co.	801-973-4443
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Redwood City, Woodworth Co.	

PREFERRED ELCTRNS., INC., Main Line Dr, P.O. Box 954, Westfield, MA 01086, Tel: 413-568-2301, Telex: 955-339; Empl.: 250; *Sls. Mgr.:* Merton I. Rosenberg

PREMAX PRODS. DIV., Highland & College Aves., Niagara Falls, NY 14305, Tel: 716-285-9186, Telex: 91-531; FSC No.: 74183; Empl.: 350

PREMIER METAL

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 212-993-9200; Empl.: 75 .... **2**•1044, 1045

Local Sales Offices & Reps

AZ	Phoenix, PLS Assocs.	602-246-6477
CA	City of Industry, Premier Metal	818-336-4534
CA	Garden Grove, West Elctrn. Sls. Co.	714-898-0120
CO	Englewood, PLS Assocs.	303-773-1218
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Lake Worth, Adams & Assocs.	305-588-7630
GA	Marietta, Adams & Assocs.	404-973-0853
IL	Elmhurst, Utronix Sls.	312-834-1100
KS	Overland Park, Delltron Co.	913-649-2078
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Minneapolis, J.E.M. Anderson Co.	612-823-6459
MO	St. Louis, Delltron Co.	314-869-4779
NM	Albuquerque, PLS Assocs.	505-255-2330
NY	Mt. Vernon, Sonkin Assocs.	914-668-9809
NY	New Hyde Park, Harris & Aldrich Sls.	516-488-2622
NY	Syracuse, Lewis-Dunnigan Co.	315-446-5522
NC	Greenboro, Adams & Assocs.	919-272-6838
OH	Akron, ImTech Inc.	216-666-1185
PA	Bensalem, Eastern Instrmn.	215-245-6660
TN	Knoxville, Adams & Assocs.	615-577-4241
TX	Arlington, W. Pat Fralia Co. Inc.	817-640-9101
TX	Houston, W. Pat Fralia Co. Inc.	713-772-1572
UT	Salt Lake City, PLS Assocs.	801-466-8729
EXP	FL, Miami, Emec, Inc.	305-871-3124

Local Distributors

AL	Huntsville, Mock Elctrns.	205-539-2401
AL	Opelika, Southern Elctrns.	205-745-5298
AZ	Phoenix, Dalis Elctrns.	602-275-2885
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	San Jose, Quement Elctrns.	408-998-5900
CT	Middletown, Midstate Elctrns.	203-347-5638
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Dania, Summit Elctrns.	305-920-6253
FL	Miami, Electronic Equip. Co.	305-871-3500
IL	Elk Grove Village, GBL/Gould Elctrns.	312-593-3220
IN	Fort Wayne, Graham Elctrns.	219-423-3422
LA	Baton Rouge, Menard Elctrns.	504-355-0323
MD	Baltimore, ASI Elctrns.	301-265-5100
MD	Baltimore, Resco	301-823-0070
MD	Bethesda, Empire Elctrns.	301-656-3300
MA	Hingham, Sager Electrical Supp.	617-749-6700
MA	Newton, Greene-Shaw Co.	617-969-8900
MI	Ann Arbor, Purchase Radio Supp.	313-668-8696
MO	Kansas City, Walters Radio Supp.	816-531-7015
NJ	Cranford, Garden State Indl. Elec.	201-272-6400
NJ	Green Brook, Green Brook Elctrn.	201-968-3500
NJ	Hanover, State Elctrns. PTS	201-887-2550
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Hauppauge, Broadline Elec. Dist.	516-231-4100
NY	Hempstead, Davis Elctrn. Corp.	516-483-9200
NY	LIC, H. L. Dalis Inc.	212-361-1100
NY	Lynbrook, Peerless Radio Dist. Corp.	212-523-3456
NY	New York, Martin Audio/Video Corp.	212-541-5900
NY	New York, Argil Elec. LTD	212-691-8111
NY	Port Chester, Wise Comps.	914-939-8600
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rockville Centre, Midway Industrial	516-764-2400
NY	Yonkers, Yonkers Elec. Supp.	914-969-6044
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Warren, Rem Elctrns.	814-453-5626
PA	Allentown, Federated Elctrns.	215-437-4481
PA	Braddock, Leff Elctrns.	412-271-7100
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Reading, Barbey Elctrns.	215-376-6116
PA	West Chester, West Chester Elec. Supp.	215-696-7500
RI	Warwick, Edwards Elctrns.	401-732-3200
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Farmers Branch, Summers Elec. Co.	214-748-6533
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, TWX: 710-569-1609; FSC No.: 15870; Empl.: 60 .... **1A**•1775

Local Sales Offices & Reps

CA	Los Angeles, R.F. Assocs.	213-478-1586
CA	Mountain View, Mark V. Assocs.	415-964-6275
FL	Orlando, BC Elctrns. Sls.	305-894-6071
GA	Smyrna, BC Elctrn. Sls.	404-436-5169
IL	Chicago, L.G.S. Elctrns. Sls.	312-456-9616
MD	Catonsville, Callas Elctrns. Dist.	301-744-7711
MA	Natick, Gerald Rosen	617-879-5505
MO	St. Louis, Boweng Tech. Rep.	314-429-7327
NY	Huntington, C.D.B. Entprs.	516-692-5220
OH	Dayton, BEK Assocs.	513-278-1343
EXP	CA, N. Hollywood, Air Frame Mfg. & Supp.	213-765-2600

PREM MAGNETICS, 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700, TWX: 910-642-3763; Empl.: 300; *Sls. Mgr.:* D. Hertel;D. Brooke (Tech.) .... **1A**•2257-2259

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Vista, Sado Sls.	714-941-2654
CT	Bristol, Texell Co.	203-583-0703
IL	McHenry, Mesa, Inc.	815-344-2820
IA	Hiawatha, Gassner & Clark Co.	319-393-5763
NJ	Springfield, F. F. Sylvester Assoc.	201-376-3324
OR	Portland, Components West	503-643-5588
PA	W. Conshohocken, Eastern Comps. Sls. Corp.	215-825-8610
WA	Renton, Components West	206-271-5252

PRES-AIR-TROL CORP., 895 Mamaroneck Ave., Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625 (exc NY); Empl.: 6 .... **1B**•1741

PRESIDIO COMPS., INC., 7185 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, TWX: 910-335-1254 .... **1A**•1181

Local Sales Offices & Reps

AZ	Phoenix, Eltron	602-266-2164
CA	La Mirada, Select Elctrns.	714-739-8891

CA	San Jose, Meade Assocs.	408-446-1991
CA	Santa Clara, Meade Advantage	408-748-1991
FL	Orlando, Micro Mktg.	305-788-0886
IL	Palantine, R-Tek	312-991-4404
IN	Fort Wayne, R-Tek	219-432-8783
MA	Shrewsbury, Compatible Comps.	617-842-2022
MA	W. Boylston, Compatible Comps.	617-835-3614
MN	Minneapolis, Peterson Sls. & Assoc.	612-944-0030
NY	Chappaqua, Micrel	914-238-4961
NY	Fair Haven, Feikert Assocs.	315-652-5577
PA	Colmar, E & L Assocs.	215-822-2510
TX	Dallas, Merino Sls.	214-233-6002
TX	El Paso, EPEC, Inc.	915-593-8481
WA	Bellevue, MARS	206-747-3292

Local Distributors

TX	Richardson, Central States Comps.	214-644-2070

PRESS-ON PRODS., 39 Factory Rd., Addison, IL 60101, Tel: 312-628-2255; Empl.: 40; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 681 Main St., Belleville, NJ 07109, Tel: 201-751-5002; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYS., 15 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, Telex: 901406; Empl.: 30; *Sls. Mgr.:* John Whytsell

Local Sales Offices & Reps

AL	Birmingham, Hile Controls-Alabama	205-879-2990
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mountain View, Saber Entprs.	415-968-0427
CA	San Diego, Saber Entprs.	619-271-1523
CO	Lakewood, Trembly Assocs.	303-233-9544
CT	Hamden, Applied Measurements	203-288-5288
IL	Chicago, Comtel-Midwest	312-539-4838
IN	Indianapolis, RDP Corp.	317-788-4296
IN	Indianapolis, Comtel-Midwest	317-253-1681
IA	Cedar Rapids, Comtel-Midwest	319-377-9434
KS	Mission, Comtel-Midwest	913-722-1030
ME	Waterville, Applied Measurements (Kentrol)	207-873-7741
MA	Acton, Applied Measurements	617-263-2766
MI	Charlotte, RDP Corp.	517-543-6212
MN	Wayzata, Comtel-Midwest	612-476-1551
MO	St. Louis, Comtel-Midwest	314-991-5363
NJ	Garwood, E. R. Mertz & Assocs.	201-232-4643
NM	Albuquerque, Trembly Assocs.	505-266-8616
NC	Charlotte, Zelco Assocs.	704-523-2961
OH	Cleveland, RDP Corp.	216-659-3138
OH	Dayton, RDP Corp.	513-253-6175
PA	Jenkintown, PDC Corp.	215-887-9610
PA	Pittsburgh, RDP Corp.	412-487-2217
TN	Knoxville, Hile Controls of TN	615-584-0208
TX	Houston, T. D. Stringer Assocs.	713-469-9209
UT	Salt Lake City, Trembly Assocs.	801-486-5292
VT	Bennington, Applied Measurements	802-442-2222
VA	Richmond, Hile Controls of VA	804-796-3001
WI	New Berlin, Comtel-Midwest	414-544-6042

PRESTOLITE WIRE DIV., 3529 24th St., Port Huron, MI 48060, Tel: 313-987-6300

PRESTON SCIENTIFIC, 805 E. Cerritos Ave., Anaheim, CA 92805, Tel: 714-776-6400, Telex: 655-321; Empl.: 61; *Sls. Mgr.:* Charles J. McGuire ......3•1169

Local Sales Offices & Reps

AL	Huntsville, Mo-Co	205-881-5968
AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	La Crescenta, Beckrep	213-957-1111
CA	Santa Clara, PBC Assocs.	408-727-7244
CO	Denver, Williams Assocs.	303-289-5647
CT	Avon, Power Mark	203-678-0123
FL	Orlando, Truex Assocs.	305-859-2160
IL	Arlington Heights, Coombs Assocs.	312-439-9810
IN	Ft. Wayne, Coombs Assocs.	219-747-7661
KS	Shawnee Mission, Techn. Sls. Assocs.	913-888-3330
MD	Greenbelt, Riffe Assocs.	301-474-8600
MA	Falmouth, RJC Assocs.	617-540-8832
MN	St. Paul, Vikeland Sls.	612-645-4647
MO	Ferguson, Techn. Sls. Assocs.	314-725-5361
NJ	Ridgewood, Hansen/Hughes	201-652-7055
NM	Albuquerque, Williams Assocs.	505-255-1638
NC	Winston-Salem, Radco	919-722-9671
OH	Dayton, Hocker Assocs.	513-298-8638
OH	N. Olmsted, Hocker Assocs.	216-734-4433
OR	Portland, Sci. Dvcs.	503-292-6934
PA	Cheltenham, Stein Instrmn.	215-379-1990
TX	Richardson, Lear Assocs.	214-231-5388
TX	Spring, Lear Assocs.	713-370-7449
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Bellevue, Sci. Dvcs.	206-747-5169
WI	Milwaukee, Coombs Assocs.	414-351-6123

PRIMELINE™
A SOLTEC® PRODUCT

PRIMELINE-SOLTEC DISTBN., Soltec Corp., P.O. Box 818, Sun Valley, CA 91353-0818, Tel: 800-525-5554, 818-764-5400, Telex: 67-4188 Soltec LSA; *Dist. Mgr.:* Byron G. McIntire ......3•1387

Local Sales Offices & Reps

AZ	Temple, J. F. Hurlbut	602-968-5962
CA	Mill Valley, Roy Colen Sls.	415-383-8700
CA	Sun Valley, Soltec Distbn.	818-764-5400
CO	Golden, J. F. Hurlbut	303-279-7796
FL	Orlando, Cartwright & Bean Inc.	305-422-4531
IL	Park Ridge, Bob Burns & Assocs.	312-823-9360
MN	Minneapolis, Kodo Assocs.	612-881-1255
NJ	Englewood, Baum & Epstein	201-569-7600
NJ	Medford, Champion Elctr. Sls. Co.	609-983-0932
NC	Raleigh, Rick Burns	919-876-2224
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	614-885-7643
PA	Pittsburgh, Marlow Assocs.	412-367-8886
TX	Irving, Kite Elctrn. Sls. Co.	214-438-9336
UT	Salt Lake City, J. F. Hurlbut	801-973-4443
WA	Redmond, CMS, Inc.	206-885-0278

Local Distributors

AZ	Phoenix, MeterMaster	602-243-4111
CA	Los Angeles, MeterMaster	213-685-4340
CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CA	Santa Clara, E.I.L. Instrs.	408-727-0396
CO	Denver, E.I.L. Instrs.	303-534-4160
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Palm Bay, E.I.L. Instrs.	305-725-8300
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Niles, Joseph Elctrns.	312-297-4200
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
KY	Louisville, E.I.L. Instrs.	502-454-3420
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Braintree, Burton Forrester Assoc.	617-848-7234
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	N. Billerica, AST Servo	617-667-8541
NJ	Pennsauken, E.I.L. Instrs.	609-488-0474
NY	Hauppauge, E.I.L. Instrs.	516-231-6333
NY	Rochester, E.I.L. Instrs.	716-424-5750
NY	Rochester, E.I.C. Elctrns.	716-544-4392
OH	Cleveland, MeterMaster	216-651-4100
OH	Dayton, E.I.L. Instrs.	513-435-2134
PA	Philadelphia, Sunshine Sci. Instr.	215-673-5600
TN	Oak Ridge, R & H Sci.	615-482-1315
TX	Dallas, MeterMaster	214-271-5671
TX	Houston, E.I.L. Instrs.	713-271-3100
WA	Seattle, E.I.L. Instrs.	206-762-0880

PRIME POWER

PRIME POWER, INC., Prime Technology Co., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; *Sls. Mgr.:* J. L. Jamieson ......3•1671

Local Sales Offices & Reps

CA	Buena Park, Chuck Cooper Co.	714-739-8526
CT	Washington, Tri-Com Assocs.	2-3-563-2241
GA	Stone Mountain, DTM, Inc.	404-962-2530
MA	Waltham, Betronic Assocs.	617-894-8400
NJ	Fort Lee, FJK Assocs., Inc.	201-592-1002

PRIME TECHNOLOGY, See General Resistance, Inc., Transducers and Systems Inc. and Prime Power, Inc.

PRIMO, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan, Tel: 0422-43-3121, Telex: 2822-326; Empl.: 350; *Sls. Mgr.:* S. Shirota

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 201-687-1750; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELCTRN. PRODS., Box 101, North Brunswick, NJ 08902, Tel: 201-297-4448, TWX: 710-380-3832; Empl.: 70; *Sls. Mgr.:* R. Shermister; *Dist. Mgr.:* R. Shermister

PRINCO INSTRS., INC., 1020 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-1500; FSC No.: 48620; Empl.: 66; *Sls. Mgr.:* S. A. Clayton

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-854-1519, 800-772-1519; *Sls. Mgr.:* Dick Press ......3•1287

PROBE-RITE, INC., 2725 Lafayette St., Santa Clara, CA 95050, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Marilyn Bailey

PROCESS ANALYZERS, INC., 3 Headley Pl., Fallsington Ind'l Pk, Fallsington, PA 19054, Tel: 609-921-7330, TWX: 510-685-9254

PRODUCTS FOR RESCH., 88 Holten St., Danvers, MA 01923, Tel: 617-774-3250, Telex: 940-287; Empl.: 22; *Sls. Mgr.:* Harry Martin

PTS
FREQUENCY SYNTHESIZERS

PROGRAMMED TEST SOURCES, Beaver Brook Rd., Littleton, MA 01460, Tel: 617-486-3008; Empl.: 20 ......3•1288

Local Sales Offices & Reps

CA	La Crescenta, Beckrep, Inc.	213-957-1111

PROJECTS UNLTD., 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, TWX: 810-450-2523; Empl.: 75; *Sls. Mgr.:* Greg Kimpton

PRO-LOG, 2411 Garden Rd., Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 200

PROTEON, INC., 4 Tech Circle, Natick, MA 01760, Tel: 617-655-3340, Telex: PROTEON; Empl.: 50; *Sls. Mgr.:* Barney Strobel

PROTO STAMPING CORP., 850 Charter St., Redwood City, CA 94063, Tel: 415-365-0498, Telex: 709241; *Sls. Mgr.:* David Duncan

PROTO SYSTEMS OF ATLANTA, 11510 N. Fulton Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, Telex: 469432; *Sls. Mgr.:* John Gregory

PT PROTOTEK INC

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094; FSC No.: 60813 ......2•1893

Local Sales Offices & Reps

EXP	CT, Litchfield, Intrade, Inc.	800-243-5252

PROTOTYPE TRANSFORMER CORP., 545 N. Arlington Ave, East Orange, NJ 07017, Tel: 201-672-2400; Empl.: 50-75

PSG INDS., 1225 Tunnel Road, Perkasie, PA 18944, Tel: 215-257-3621, Telex: 827361; FSC No.: 18509; Empl.: 150; *Sls. Mgr.:* John Feldermann, Jr.

PTK CORPORATION, 1173 Los Olivos Ave., Los Osos, CA 93402, Tel: 805-528-5858, TWX: 910-351-5802; FSC No.: 60132; Empl.: 114; *Sls. Mgr.:* Wayne Hamari

PTL ELCTRNS., 10211 Vinemont St., Dallas, TX 75218, Tel: 214-327-3180; Empl.: 10

PTS ELECTRONICS INC., Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 525; *Sls. Mgr.:* R. W. King; *Dist. Mgr.:* J. Hamilton

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, Telex: 23-0398; Empl.: 21; *Sls. Mgr.:* J. Schultz

PULNIX AMERICA, INC., 453F Ravendale Dr., Mountain View, CA 94043, Tel: 415-964-0955, Telex: 172541 PULNIX AMERICA; *Sls. Mgr.:* Toshi Hori

PULSAR PRODUCTS DIV., 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 24

PULSE ENGRG. INC., A Varian Sub., P.O. Box 12235, San Diego, CA 92112, Tel: 619-268-2400, TWX: 910-335-1527; Empl.: 1200; *Sls. Mgr.:* Leonard M. Luner

Local Sales Offices & Reps

CA	Irvine	714-250-0551
CA	Los Angeles	818-704-1151

CA	San Jose	408-297-6222
FL	Orlando	305-831-2782
IL	Chicago	312-364-0424
MA	Boston	617-449-1242
MN	Minneapolis	612-933-7712
PA	Philadelphia	215-525-4752
TX	Austin	512-451-5721

PULSE INSTRS. CO., 1536 W. 25th St., San Pedro, CA 90732, Tel: 213-548-1327; Empl.: 12; *Sls. Mgr.:* Ron Perry

PYLE INDS., INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200; Empl.: 175; *Sls. Mgr.:* Frank Pyle, Jr.; *Dist. Mgr.:* Mark Pyle

PYLE-NATIONAL CO., 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300

PYLON CO., 452 John Dietsch Blvd., Attleboro Falls, MA 02763, Tel: 617-699-7646, TWX: 948095; Empl.: 200; *Sls. Mgr.:* Andy Fontaine

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535

PYROFERRIC INTL., INC., 200 Madison St., Toledo, IL 62468, Tel: 217-849-3300, TWX: 910-663-0616; Empl.: 50; *Sls. Mgr.:* John A. Roberts

PYROFILM RESISTOR CO., See KDI Pyrofilm

Q-MATIC CORP., 3194-D Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-545-8233, Telex: 67-8389

Q-S PRODUCTS CO., INC., 3605 S.W. Snoqualmie St., Seattle, WA 98126, Tel: 206-937-5505

Q-SYSTEMS, PO Box 35879, Tucson, AZ 85740, Tel: 602-293-4923, TWX: 910-952-1185; Empl.: 7; *Sls. Mgr.:* M. Lloyd

Q-TECH CORP., 2201 Carmelina Ave., Los Angeles, CA 90064, Tel: 213-820-4921, Telex: 69-6140; FSC No.: 51774; Empl.: 65; *Sls. Mgr.:* H. Phillips .... **1A**•1410, 1411

Local Sales Offices & Reps

CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
CA	Northridge, Tauber-Dreyer	213-993-0048
FL	Melbourne, Reynolds & Assocs.	305-259-7000
GA	Acworth, Reynolds & Assocs.	404-451-9558
MA	Malden, J-K Assocs.	617-321-2922
NJ	Paramus, Eltech Sls.	201-967-1309
NY	Kings Park, Eltech Sls.	201-967-1309
NC	Winston Salem, Reynolds & Assocs.	919-725-6196
TX	Houston, TCI Elctrns.	713-774-5019

QUADRA SALES CORP., 14825 NE 40th, Suite 340, Redmond, WA 98052, Tel: 206-833-3550

QSI

QUALIDYNE SYS., 2256 Main St., Chula Vista, CA 92011, Tel: 619-429-7440, Telex: 622-43860; FSC No.: 619-429-1011; *Sls. Mgr.:* James J. Louden .... **3**•1748-1750

Local Sales Offices & Reps

AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Chatsworth, Raltech, Inc.	818-700-0933
CA	San Diego, Power Assocs.	619-275-0641
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CO	Denver, Grimes Mktg.	303-740-6063
CT	Guilford, O.E.M. Mktg. & Sls.	203-453-5424
FL	Ft. Lauderdale, Beacon Elctrns.	305-491-1054
MN	Burnsville, Electromec Sales	612-894-8200
NH	Salem, O.E.M. Mktg. & Sls.	603-893-0009
NY	Glen Cove, F&F Assoc.	516-671-8900
TX	Dallas, Jim D. Gray & Assocs.	214-341-7190
UT	Ogden, Grimes Mktg.	801-546-4029

QUALITY THERMISTOR, 2147 Centurion Pl., Boise, ID 83705, Tel: 208-377-3373; FSC No.: 56866; Empl.: 12; *Sls. Mgr.:* John Mahoney

Local Sales Offices & Reps

AZ	Scottsdale, ARCOM Sls.	602-947-5745
CA	San Jose, Silicon Vally Sls.	408-984-6354
CA	Temple City, HMC Incorporated	213-285-0485
CO	Wheat Ridge, C-Tech	303-431-7025
FL	Casselberry, Elctrn. Mktg. Corp.	305-339-7070
IL	Arlington Heights, C. L. Greenslade Sls.	312-253-9620
IN	Ft. Wayne, John F. Kilfoil Co.	219-424-7719
MA	Needham, Hatch Assocs.	617-444-3310
MO	St. Louis, Forristal-Young Sls.	816-358-6771
NJ	Plainfield, Glassman Assocs.	201-561-3866
NY	Glen Cove, Glassman Assocs.	516-676-1039
OH	Cincinnati, John F. Kilfoil Co.	513-791-6150

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago, IL 60637, Tel: 312-488-5800, Telex: 701676; Empl.: 200; *Sls. Mgr.:* William G. Little; *Dist. Mgr.:* Greg Johns .... **3**•1048, 1049

QUANTRONIX, 225 Engineers Rd., Smithtown, NY 11787, Tel: 516-273-6900, Telex: 967-782; Empl.: 175; *Sls. Mgr.:* R. J. Bruno; *Dist. Mgr.:* R. J. Bruno

QUANTUM, Barnes Indl. Pk., Wallingford, CT 06492, Tel: 203-265-2811, Telex: 953-543; Empl.: 200; *Sls. Mgr.:* D. Felt

QUANTUM DATA, INC., 455 E. Kehoe, Carol Stream, IL 60188, Tel: 312-668-3301, Telex: 206725; Empl.: 35 .... **3**•1289

QUARTIC SYSTEMS, INC., 3575 South West Temple #4, Salt Lake City, UT 84115, Tel: 801-268-9264; *Sls. Mgr.:* Jim Elwell

QUARTZITE PROCESSING, INC., 6 Holyoke St., Malden, MA 02148, Tel: 617-322-1380; Empl.: 11; *Sls. Mgr.:* P. S. Yanofsky

QUAY CORP., 22 Meridian Rd., P.O. Box 783, Eatontown, NJ 07724, Tel: 201-542-7340; *Sls. Mgr.:* George Hill

QUME, 2350 Qume Dr., San Jose, CA 95131, Tel: 408-942-4000, TWX: 910-338-0232; Empl.: 3500; *Dist. Mgr.:* Jerry Kaplan, Steve Kadash

Q.V.S., INC., 20 North 15th St., East Orange, NJ 07017, Tel: 201-673-3996; FSC No.: 89820; Empl.: 45

QWINT SYSTEMS, 3693 Commercial Ave., Northbrook, IL 60062, Tel: 312-498-5060, Telex: 27-0498, TWX: 910-686-0625; Empl.: 105; *Sls. Mgr.:* K. S. Berland; *Dist. Mgr.:* Anita Stickling

RACAL-DANA INSTRS., 18912 Von Karman Ave., Irvine, CA 92715, Tel: 714-833-1234, Telex: 67-8341, TWX: 910-595-1136; FSC No.: 21793; Empl.: 230

RACAL-MILGO, 8600 N.W. 41st St., Miami, FL 33166, Tel: 305-592-8600, TWX: 510-955-4145; FSC No.: 06602; Empl.: 3164; *Sls. Mgr.:* Maurice Bailey

RACOM CORP., 1028 W. Maude Ave. Ste. 401, Sunnyvale, CA 94086, Tel: 408-737-2460; *Sls. Mgr.:* Ken Mills

RADIAL CONTROLS, 2555 E. 55th Place, Indianapolis, IN 46220, Tel: 317-255-2796; Empl.: 25; *Sls. Mgr.:* R. L. Newsom

RADIATION DEVICES CO., See LeCroy Research Sys. Corp.

RADIO MATERIALS CORP., 4242 W. Bryn Mawr, Chicago, IL 60646, Tel: 312-478-3600, TWX: 910-221-2915

RADIOMETRICS, INC., 12021 South Memorial Pkwy., Huntsville, AL 35803, Tel: 205-881-1272; FSC No.: 62951; *Sls. Mgr.:* George A. Bailey; *Dist. Mgr.:* George A. Bailey

Advertisement

Radiometrics, Inc. designs/manufactures customized electro-optics systems including IR calibration equipment, radiometers, active and passive detection systems, laser designator trainers, IR and fiber optic imaging systems for both industrial and military applications. Write or call for literature.

RADIO RESCH. INSTR. CO., INC., Two Lake Ave. Extension, Danbury, CT 06811-5295, Tel: 203-792-6666, Telex: 962444 RADAR DURY; FSC No.: 57174; *Sls. Mgr.:* E. B. Doyle

RADIO SWITCH CORP., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746, Tel: 201-462-6100; FSC No.: 74217; Empl.: 40; *Sls. Mgr.:* J. L. Bernard .... **1B**•1743

RADIX MICROELECTRONICS INC., 4182 Sandberg Dr., Colorado Springs, CO 80911, Tel: 303-390-5168

RAF ELCTRN. HARDWARE, 95 Silvermine Rd., Seymour, CT 06483, Tel: 203-888-2133, TWX: 710-472-6216; FSC No.: 55566; Empl.: 120; *Sls. Mgr.:* William R. Basley Jr.; *Dist. Mgr.:* Jeff Balko

Distributor

RAG ELECTRONICS, INC., 21418 Parthenia St., Canoga Park, CA 91304, Tel: 818-998-6500, 800-732-3457 ....pgs. 621, 674, 689, 707, 714, 804

RAG ELECTRONICS, INC., 1 Pollack Ave.,Ocean, NJ 07712, Tel: 201-544-0666, 800-922-0945 ....pgs. 621, 674, 689, 707, 714, 804

RAGEN CORP., Systems Div., 9 Porete Ave., N. Arlington, NJ 07032, Tel: 201-997-1000, TWX: 710-995-4752; Empl.: 400; *Sls. Mgr.:* Robert H. Michaels

RAGEN DATA SYSTEMS, INC., 3 Oval Dr., Central Islip, NY 11722, Tel: 516-234-3800, TWX: 510-227-4901; Empl.: 52

RAM CHEMICALS, DIV. WHITTAKER CORP., 210 E. Alondra Blvd., Gardena, CA 90248, Tel: 213-321-0710; Empl.: 65; *Sls. Mgr.:* G. M. Steinman

RAMCOM SYSTEMS, 4121 Redwood Ave., Los Angeles, CA 90066, Tel: 213-827-4432; *Sls. Mgr.:* Ralph Tisdale

RAMKO RESCH., INC., 11355A Folsom Blvd., Rancho Cordova, CA 95670, Tel: 800-821-2545, Telex: 176493; *Sls. Mgr.:* Jim Lucy; *Dist. Mgr.:* Jim Lucy

RAMSEY ENGINEERING, 1853 W. County Rd. C, St. Paul, MN 55113, Tel: 612-633-5150, Telex: 29-7001; Empl.: 160

RAMTEK, 2211 Lawson Lane, Santa Clara, CA 95050, Tel: 408-988-2211, Telex: 171954, TWX: 910-339-9379; Empl.: 465; *Sls. Mgr.:* Tony Glinskas

R & D CIRCUITS, 2381B S. Clinton Ave. Dept. 1202, Plainfield, NJ 07080, Tel: 201-561-8286; *Sls. Mgr.:* Barbra Shemitz

RANSCO
A Subsidiary of DESPATCH
INDUSTRIES. INC

RANSCO INDS., 2201 Statham Blvd., Oxnard, CA 93033, Tel: 805-487-7777, Telex: 6-59235; Empl.: 170; *Sls. Mgr.:* L. W. Benjamin .... **3**•1178

Local Sales Offices & Reps

CA	Santa Clara, Ransco Inds.	408-244-4000
CT	Greenwich, Inman Assocs., Inc.	203-869-2144
FL	Altamonte Springs, Ransco Inds.	305-862-2617
IL	Schaumburg, Ransco Inds.	312-843-2223
MA	N. Billerica, Eastern Regional Facility	617-667-0070
MI	Farmington Hills, Schaffer Eng. Co.	313-553-8920
MI	Grosse Pointe, Hartmann Equip. Co.	313-886-1345
NJ	Belford, Inman Assocs., Inc.	201-787-5504
NY	Buffalo, H.R. Nickles Assocs., Inc.	716-631-3411
NY	Rochester, H.R. Nickles Assocs., Inc.	716-586-4988
OH	Cleveland, Wagner-Sullivan Co.	216-464-8350
OR	Lake Oswego, Hartley Corp.	503-635-4361
TX	Lewisville, Ransco Inds.	214-434-1311
WA	Bellevue, Hartley Corp.	206-644-2222

RAPIDSYN, 3233 Roymar Rd., Oceanside, CA 92054, Tel: 619-439-7500, Telex: 18-1196; FSC No.: 32423; Empl.: 100; *Sls. Mgr.:* Andrew Boyer

RASTER GRAPHICS, PO Box 23334, Tigard, OR 97223, Tel: 503-620-2241

RATELCO, 1260 Mercer, Dept. EEM, Seattle, WA 98109, Tel: 206-624-7770, Telex: 32-1200; Empl.: 100; *Sls. Mgr.:* D. Terpstra

RATH MICROTECH CORP., Rath Affiliated Cos., 2505 Foster Ave., Janesville, WI 53545, Tel: 608-754-2222, 800-356-9464, Telex: 26-5409; *Sls. Mgr.:* Jim Coenen

RAULAND-ZENITH RADIO CORP., 2407 W. North Ave., Melrose Pk., IL 60160, Tel: 312-345-4700, Telex: 72-1488; Empl.: 2300

RAWAY BEARING, 8 Melnick Rd., Monsey, NY 10952, Tel: 914-352-4944; FSC No.: 3110-3120; Empl.: 6; *Dist. Mgr.:* Rachel Baskin

RAYCHEM CORP., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025, Tel: 415-361-3860, Telex: 34-8316, TWX: 910-373-1728; *Sls. Mgr.:* Robert Simpson; *Dist. Mgr.:* Joseph Rodgers

RAYMOND ENGRG. INC., Raycorder Prods. Div., 217 Smith St., Middletown, CT 06457, Tel: 203-632-1000, TWX: 710-428-7944; FSC No.: 92059; Empl.: 550; *Sls. Mgr.:* Bruce Greenfield

RAYOVAC CORPORATION, 101 E. Washington Ave., Madison, WI 53703, Tel: 608-252-7400, Telex: 26-5462, TWX: 910-286-2730; FSC No.: 6135; Empl.: 2400; *Sls. Mgr.:* Ed Peterson ....**3•1423**

Local Sales Offices & Reps

CA	North Hollywood, The Bassett Sls. Corp.	213-877-7129
CO	Denver, W. J. Purdy Co.	303-777-1411
FL	Coral Springs, Frank Peck & Assocs.	305-753-3136
IL	Chicago, G. McL Cole Co.	312-774-3535
IN	Indianapolis, Electronic Mktg. Consultants	317-253-1668
MA	Framingham, G/M Assocs., Inc.	617-872-4871
MI	Southfield, R. C. Merchant Co.	313-354-4300
MI	St. Joseph, R. C. Merchant Co.	616-983-7378
MN	Minneapolis, HMR, Inc.	612-831-7400
MO	Kansas City, Forristal-Young Sls. Co.	816-358-6771
MO	St. Louis, Forristal-Young Sls. Co.	314-968-9975
NE	Omaha, Forristal-Young Sls. Co.	402-333-0800
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NJ	Teaneck, Fisher Elctrn. Assoc.	201-837-1200
NM	Albuquerque, W. J. Purdy Co.	505-266-7959
NY	East Syracuse, NYCOM, Inc.	315-437-8343
NY	Grand Island, L. J. McTaggart Assoc., Inc.	716-773-9222
NY	Port Washington, Paul D. Aaron Assoc.	516-883-0600
NC	Greensboro, Adams & Assocs., Inc.	919-272-6838
OH	Richfield, Bear Mktg. Inc.	216-659-3131
TX	Garland, Tesco Co.	214-681-1376
WA	Seattle, Don Dussault & Assoc.	206-527-5454

Local Distributors

AL	Birmingham, American Elctrns. Supp.	205-254-3280
AL	Huntsville, Mock Elctrns.	205-539-2401
AZ	Phoenix, Elctrn. Parts Co.	602-277-7281
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Costa Mesa, House of Batteries	714-642-8222
CA	Long Beach, Battery Specialties	213-437-1809; 213-435-5058
CA	Sacramento, The Supp. Station, Inc.	916-920-2919
CO	Colorado Springs, Centennial Elctrns. Inc.	303-633-4666
CT	Danbury, Pilgrim Elctrns., Inc.	203-792-7247
ID	Idaho Falls, Schwendiman's Wholesale, Inc.	208-522-2492
ID	Pocatello, Kimball Elctrns.	208-232-2201
IL	Arlington Heights, Reptron Elctrns., Inc.	312-593-7070
IL	Elk Grove, GBL Goold Elctrns. Inc.	312-593-3222
IN	Indianapolis, Graham Elctrns. Supp., Inc.	317-634-8202
IN	Indianapolis, Battery Man, Inc.	317-257-1998
IA	Cedar Rapids, Bergquist	319-366-8733
KS	Wichita, RSC Elctrns. Inc.	316-267-5213
MD	Gaithersburg, Pioneer-Washington Elctrns. Inc.	301-948-0710
MA	Sharon, Adcour, Inc.	617-784-8123
MN	Minneapolis, Bergquist	612-835-2322
MO	Springfield, HTD Entprs., Inc.	417-865-3993
MO	St. Louis, Olive Elctrns.	314-426-4500
MT	Billings, Interstate Distrb.	406-245-5141
NJ	Saddle Brook, Tide Elctrns.	201-794-9660
NJ	Springfield, Route Elctrns.	201-467-0166
NM	Albuquerque, Elctrn. Parts Co., Inc.	505-293-6161
NY	Buffalo, Goldcrest Elctrns.	716-885-5878
NY	Plainview, Trace Elctrns.	516-249-4455
NY	Port Washington, Connector Concepts	516-883-3800
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
OK	Tulsa, Norvell Elctrns.	918-663-1247
OR	Portland, Radar Electric	503-232-3404
OR	Salem, J. W. Elctrns.	503-399-8565
PA	McKeesport, Barno Radio	412-751-5966
PA	Philadelphia, Jan Industrial Elctrn. Co., Inc.	215-922-1321
SC	Columbia, Hesco, Inc.	803-254-4575
TX	Dallas, Norvell Elctrns. Inc.	214-233-0020
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	El Paso, Ideal Indl. Supp.	915-779-6647
UT	Salt Lake City, Kimball Elctrns. Inc.	801-328-2075
VA	Norfolk, Priest Elctrns., Inc.	804-855-0105
WA	Seattle, Robert E. Priebe Co.	206-682-8242
WA	Seattle, Radar Elec Co., Inc.	206-282-2511
WA	Tumwater, JW Electronics	206-943-1071
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000

RAYTHEON CO., 465 Centre St., Quincy, MA 02169, Tel: 617-479-5300, TWX: 710-337-1020; *Sls. Mgr.:* R. Whitt

RAYTHEON CO., Laser Center, Fourth Ave., Burlington, MA 01803, Tel: 617-272-6402, Telex: 92-3455, TWX: 710-324-6568; Empl.: 45; *Sls. Mgr.:* L. Smetana

RAYTHEON CO., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154, Tel: 617-899-8400, TWX: 710-324-6568; *Sls. Mgr.:* A. F. Vacaro; *Dist. Mgr.:* R. K. Whitt

RAYTHEON CO., Submarine Signal Div., 1847 W. Main Rd., P.O. Box 360, Portsmouth, RI 02871, Tel: 401-847-8000, Telex: 927787, TWX: 710-382-6923; FSC No.: 94404; Empl.: 2600; *Sls. Mgr.:* Jerry K. Martin

RAYTHEON OCEAN SYS. CO., Submarine Signal Div., Risho Ave., Westminster Pk., E. Providence, RI 02914, Tel: 401-438-1780, Telex: 6814078; Empl.: 90

RAYTHEON SEMICONDUCTOR, 350 Ellis St., Mountain View, CA 94043, Tel: 415-968-9211, TWX: 910-379-6481; FSC No.: 07933; Empl.: 950; *Sls. Mgr.:* R. Goedjen; *Dist. Mgr.:* R. Johnson

RAYTHEON/TAG SEMICONDUCTORS LTD., 43 Third Ave., Burlington, MA. 01803, Tel: 617-272-3704 (3705), Telex: 92-3455, TWX: 710-324-6568; Empl.: 7; *Sls. Mgr.:* B. Cavender; *Dist. Mgr.:* Pat Mobilia

RCA DISTR. & SPECIAL PRODS. DIV., RCA Corp., 2000 Clements Bridge Rd., Deptford, NJ 08096, Tel: 609-541-3636; *Sls. Mgr.:* H. L. Craton

RCA SOLID STATE DIV., Route 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333; FSC No.: 19089; *Sls. Mgr.:* J. M. Cleary; *Dist. Mgr.:* V. R. Bonanno

RCA SOLID STATE DIV., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

RCA SOLID STATE DIV., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

RCA SOLID STATE DIV., Micro Processors, Route 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

RCA SOLID STATE DIV., Thyristors & Rectifiers, Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

RCA SOLID STATE DIV., Transistors, Rte. 202, Somerville, NJ 08876, Tel: 201-685-6000, TWX: 710-480-9333

RCD COMPONENTS, INC., 330 Bedford St., Manchester, NH 03101, Tel: 603-669-0054, Telex: 943-512 RCD COMP MAN; Empl.: 350 ....**1A•1928, 1929**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg. Inc.	205-830-0498
AZ	Phoenix, Elec-Com Assoc.	602-967-8644
CA	Canoga Park, Cummings & Assocs.	213-340-6035
CA	Santa Clara, Cummings & Assocs.	408-247-8656
CA	Woodland Hills, Cummings & Assocs.	213-340-6035
CO	Denver, Cummings & Assocs.	303-455-6860
FL	Apopka, G. F. Bohman	305-886-1882
GA	Norcross, Montgomery Mktg. Inc.	404-447-6124
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Elk Grove Village, The John G. Twist Co.	312-593-0200
KS	Overland Park, Ensco-Rep Inc	913-381-7557
MI	Livonia, Electronic Salesmasters	800-321-1848
MO	Maryland Heights, Ensco-Rep Inc	314-423-3935
NJ	Cherry Hill, Trinkle Sales Inc.	609-795-4200
NM	Alburquerque, Elec-Com Assocs.	505-898-6101
NY	Hempstead, Kahgan Sls.	516-538-2300
NY	Kingston, R. P. Kennedy Co., Inc.	914-876-2700
NY	Rochester, R. P. Kennedy Co., Inc.	716-271-6322
NC	Cary, Montgomery Mktg. Inc.	919-467-6319
OH	Beachwood, Electronic Salesmasters	216-831-9555
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Allentown, Trinkle Sls. Inc.	800-257-8210
TX	Dallas, Design Mktg. Inc.	214-680-9767
TX	Irving, Design Mktg.	214-255-2110
TX	Round Rock, Design Mktg.	512-255-9686
WA	Bellevue, N. R. Schultz Co.	206-454-0300
WI	Brookfield, The John G. Twist Co.	414-782-2670

R. C. ELCTRNS. INC., 5386 Hollister Ave., Santa Barbara, CA 93111, Tel: 805-964-6708, Telex: 295281; *Sls. Mgr.:* Chao-Sun Pang; *Dist. Mgr.:* Chao-Sun Pang

RCI/DATA, 1992 Lakewood Rd., Toms River, NJ 08753, Tel: 201-341-8361; Empl.: 15; *Sls. Mgr.:* Robert Fierro

RCL·Shallcross

RCL ELECTRONICS, INC., 195 McGregor St., Manchester, NH 03102, Tel: 603-627-3831, TWX: 710-220-1876; FSC No.: 01686; Empl.: 300 ....**1A•1930-1936**

SHALLCROSS, INC., U.S. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463; FSC No.: 54294; Empl.: 150 ....**1A•1930-1936**

RCL-Shallcross Local Sls. Offs. & Reps.

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, ISDS	602-971-6250
CA	Chatsworth, WCV Co.	818-700-0933
CA	Palo Alto, Mollard Mktg.	415-961-0456
CO	Denver, Elcom	303-337-2300
CT	North Haven, Kitchen & Kutchen	203-239-0212
FL	Ft. Lauderdale, APM Assoc.	305-565-0056
FL	Longwood, APM Assoc.	305-869-6831
FL	Merritt Island, APM Assoc.	305-453-4322
FL	Tampa, APM Assoc.	813-886-2457
GA	Dunwoody, CSR Elctrns.	404-396-3720
IL	Schaumburg, Gassner & Clark	312-882-8608
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MD	Columbia, Delta III Assoc.	301-730-4700
MA	Burlington, Kitchen & Kutchen	617-229-2660
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Grandview, Harris/Hanson Co.	816-763-6200
MO	St. Louis, Harris/Hanson Co.	312-432-3611
NE	Lincoln, Lorenz Sls. Co.	402-475-4660
NJ	Marlton, BGR Assoc.	609-983-1020
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Melville, Comtronic Assoc.	516-249-0505
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OK	Tulsa, Bonser/Philhower	918-496-3236
OR	Portland, James J. Backer Co.	503-297-8744
OR	Salem, James J. Backer Co.	503-362-0717
PA	Pittsburgh, Luebbe Sls. Co.	412-931-0414
SC	Taylors, CSR Elctrns.	803-292-2292
TX	Austin, Bonser/Philhower	512-458-3569
TX	Dallas, Bonser/Philhower	214-234-8438
TX	El Paso, Q. T. Wiles Assoc.	602-971-6250
TX	Houston, Bonser/Philhower	713-531-4144
UT	Salt Lake City, Elcom	801-532-7940
WA	Seattle, James J. Backer Co.	206-285-1300

RCL-Shallcross Local Distributors

AZ	Phoenix, TTI	602-966-1616
AZ	Tempe, Shelley Elctrns.	602-894-2058

CA	Chatsworth, Shelley Elctrns.	818-998-3333
CA	N. Hollywood, TTI	818-982-0201
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Jose, T.T.I.	408-943-9155
CA	San Jose, Shelley Elctrns.	408-942-9111
CO	Boulder, Shelley Elctrns.	303-442-2718
CT	Hamden, Almo Elctrns.	203-288-6556
CT	Stratford, Utronics	203-378-4201
FL	Ft. Lauderdale, Dielco	305-973-8700
FL	Orlando, TTI	305-859-1000
FL	Tampa, Impala Elctrns.	813-885-4747
FL	Tampa, Shelley Elctrns.	813-884-0946
IL	Melrose Park, Belford Elctrns.	312-865-2400
IL	Northbrook, Classic Comps.	312-272-9650
MD	Columbia, Aztech Elctrns.	301-995-1760
MA	Billerica, A.W. Mayer Co.	617-229-2255
MA	Wilmington, RC Comps.	617-273-1860
MA	Woburn, TTI	617-938-8800
MN	Minneapolis, Aerospace Computer Supplies	612-884-4725
NY	Bohemia, TTI	516-567-1500
NY	Farmingdale, Command Elctrns.	516-293-1212
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Rochester, Simcona	716-328-3230
NY	Rome, Rome Elctrns.	315-337-4500
NC	Raleigh, Resco-Raleigh	919-781-5700
OH	Dayton, Stotts Friedman	513-298-5555
OH	Englewood, Argent Inds.	513-836-8633
OH	Solon, REH-Electra	216-248-1636
OK	Tulsa, Altair	918-252-5781
PA	McKean, Advacom	814-476-7774
PA	McKeesport, Barno Radio	412-751-5966
PA	Norristown, Century Elctrn. Comps.	215-631-5400
PA	Pittsburgh, Aldertronics	412-821-5565
TX	Ft. Worth, TTI	817-429-1440
TX	Houston, Altair	713-462-3029
TX	Richardson, Altair	214-231-5166
WA	Bellevue, Almac Elctrns.	206-643-9992
WI	New Berlin, Classic Comps.	414-786-5300

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 312-432-7915; Empl.: 20

RDI
Reed Devices Inc.
AUTHORIZED DISTRIBUTOR
ESI
ELECTRIC SWITCHES
INCORPORATED
2478 Fletcher Drive, Los Angeles, Calif. 90039
(213) 660-1310
TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640
TWX 910-321-2971
SOCKETS & SNAPTRACKS
See complete product line under
SWITCHES ——section 5100
FREE linecard and catalog on request

RDF CORPORATION, 23 Elm Ave., Hudson, NH 03051, Tel: 603-882-5195, TWX: 710-228-1882; Empl.: 120; *Sls. Mgr.:* Arthur Di Venuti

AUGAT® RDI®

RDI/REED DEVICES INC., 525 Randy Rd., Carol Stream, IL 60188, Tel: 312-682-4100, TWX: 910-252-2118; FSC No.: 53337; Empl.: 85; *Sls. Mgr.:* H. J. Roeser .... **2**•1548-1551

Local Sales Offices & Reps

AL	Huntsville, Alpha	205-533-0766
AZ	Glendale, Adtek	602-931-9289
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Sunnyvale, Schwerin/Merrill	408-735-7900
FL	Ft. Lauderdale, APM Assoc.	305-565-0056
FL	Longwood, APM Assoc.	305-869-6831
FL	Merritt Island, APM Assoc.	305-453-4322
FL	Tampa, APM Assoc.	813-886-2457
GA	Atlanta, Alpha	404-491-9430
IL	Glen Ellyn, Rockford Controls	312-469-6016
IN	Indianapolis, Rockford Controls	317-248-2518
IA	Cedar Rapids, Palatine Sls.	319-365-8071
KS	Mission, Palatine Sls.	913-831-0555
KS	Rosehill, Palatine Sls.	316-776-0065
KY	Louisville, K W Elctrn. Sls.	502-451-1860
LA	New Orleans, D. Bellew Sls.	504-283-8979
MA	Norwood, Augat Sls.	612-792-3164
MI	Novi, Lektronics	313-349-3304
MN	Minneapolis, HMR	612-831-7400
MO	Hazelwood, Palatine Sls.	314-839-0800
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	Woodcliff Lake, J. Freid & Assoc.	201-391-8091
NY	Albany, H.C. Johnson	518-459-1239
NY	Great Neck, F & F Metro	516-482-4080
NY	Rochester, H.C. Johnson	716-586-0777
NY	Williamsville, H.C. Johnson	716-632-7880
NC	Kernersville, Wallace Elctrn.	919-996-2742
OH	Columbus, K.W. Elec. Sls.	614-888-0483
OH	Dayton, K W Elctrn. Sls.	513-890-2150
OH	Shaker Hts., K.W. Elec. Sls.	216-496-9177
OR	Portland, Eltech	503-238-0805
PA	Allison Park, K.W. Elec. Sls.	412-487-4300
TN	Memphis, D. Bellew Sls.	901-452-1468
TN	Oak Ridge, Alpha Mktg.	615-482-1660
TX	Austin, Barry Sls.	512-836-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
VA	Reston, Colrud Corp	804-353-6320
WA	Bellevue, Eltech	206-643-4330

Local Distributors

AL	Huntsville, Comp. Dist.	205-883-7501
AZ	Phoenix, Tri-Tek	602-995-9352
AZ	Phoenix, Dalis	602-275-2885
AZ	Tucson, Inland Elec. Supp.	602-889-5301
AR	Little Rock, Southern Elec.	501-372-4196
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Buena Park, Control Des.	714-521-5040
CA	Burlingame, Rose Elec.	415-348-2740
CA	Fremont, Term. Sls.	415-656-7722
CA	Gardena, Calif. Switch & Signal	213-538-9830
CA	Los Angeles, Elec. Switches	213-660-1310
CA	San Carlos, Control Des.	415-592-4808
CA	San Diego, Lectro Comp.	714-578-4290
CA	San Jose, Con. Parts	408-263-9521
CA	Santa Monica, Master Distr.	213-452-1229
CO	Denver, CSID	303-292-9594
CO	Englewood, Indl. Elctrns.	303-694-9444
CT	Stratford, Utronic	203-378-4201
FL	Ft. Lauderdale, Comp. Dist.	305-971-4950
GA	Atlanta, Elctrl. Control Prod.	404-455-1216
GA	Stone Mountain, Control Des.	404-979-3500
IL	Addison, Lectro Comps.	312-543-1680
IL	Arlington Heights, Lo Dan Elctrns.	312-398-5311
IL	Oak Park, Newark Elctrns.	312-524-1800
IL	Rockford, Mid-West Assoc.	815-962-8036
IN	Ft. Wayne, Graham Elec.	219-423-3422
IN	Indianapolis, Control Des.	317-788-4559
IA	Cedar Rapids, Deeco	319-365-7551
KY	Louisville, CED/E & H Elec. Supp. Co.	502-587-0991
LA	Lafayette, Ralph's Indl. Elec.	318-234-4507
LA	New Orleans, Wm. B. Allen Supp.	800-535-9593
LA	Shreveport, Indl. Elctrn. Supp.	318-222-9459
MD	Beltsville, Treeko Sls.	301-937-8260
MA	Burlington, QPL Elec. Dist.	617-229-2424
MA	Middleboro, The Stockroom	617-947-4262
MI	Southfield, Michigan Lectrols	313-353-1350
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
MN	Minneapolis, Newark Elec.	612-331-6350
MN	Minneapolis, Control Des.	612-721-1628
MO	St. Louis, Olive Indl.	314-426-4500
MO	St. Louis, Control Des.	314-426-3150
NE	Lincoln, Scott Elctrn.	402-466-8221
NJ	Fairlawn, Relay Specialties	201-797-3313
NJ	Jersey City, Cuny & Gerber	201-653-0222
NY	Buffalo, Summit	716-884-3450
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Mt. Vernon, QAR Indl. Elec. Sls.	914-699-2224
NY	Rochester, R. Baker Elctrns.	716-586-9164
NC	Charlotte, Control Des.	704-588-4410
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Akron, Akron Elctrn.	216-762-8818
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Columbus, Elctrns. Mktg. Co.	614-299-4161
OH	Dayton, ESCO	513-226-1133
OH	Wickliffe, Gateway Megatech	216-944-8565
OK	Tulsa, Radio	918-587-9123
OR	Eugene, Vitus Elec. Supp.	503-484-6333
OR	Portland, Radar	503-232-3404
PA	Malvern, Control Des.	215-296-0150
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Phila. Elec.	215-568-7400
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Memphis, Brownell Electro	901-795-8487
TX	Dallas, Control Des.	214-358-1441
TX	Dallas, Dallas Meter-Tech.	214-349-6044
TX	Houston, Angie Elctrns.	713-659-8386
TX	Longview, Summers Elec.	214-757-6021
UT	Salt Lake City, Stuart Elctrns. Supp.	801-466-8603
WA	Seattle, Pacific Elctrns.	206-575-1050
WA	Seattle, Radar Elec.	206-282-2511
WV	Redmond, Murphy Elctrns.	206-881-1234
WI	New Berlin, Control Des.	414-784-1015
WI	West Allis, Marsh Elctrns.	414-475-6000

REACTEL, INC.

REACTEL, INC., 687-D Lofstrand La., Rockville, MD 20850, Tel: 301-279-5535; FSC No.: 60458; Empl.: 20; *Sls. Mgr.:* D. E. Claycomb

Local Sales Offices & Reps

CA	North Hollywood, Crown Elctrns.	213-877-3550
CA	Sunnyvale, ESCO Assocs.	408-745-1410
FL	Largo, Electro Craft	813-530-4749
MA	Wakefield, Nerem	617-245-4426
VA	Fairfax, Beacon North	703-591-1300

REAL TIME SYS., 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-0425; *Sls. Mgr.:* A. Citrin

REBLING PLASTICS CO., 150 Franklin Drive, Warrington Ind. Park, Warrington, PA 18976

RECORDER SYS. DIV., See Gulton Inds., Inc., Graphic Instrs. Div.

RECOTON CORP., 46-23 Crane St., Long Island City, NY 11101, Tel: 212-392-6442, Telex: 236047 RCTN; Empl.: 150; *Sls. Mgr.:* George Calvi

REDINGTON COUNTERS, 130 Addison Rd., Windsor, CT 06095, Tel: 203-688-6205, Telex: 64-3390 REDCO WSOR; *Sls. Mgr.:* Alan Schoenhut

REED SWITCH DEV. CO. INC., PO Box 1464, Kerrville, TX 78028, Tel: 512-896-4444; Empl.: 1

RE-EL CIRCUITS, INC., See RCI/Data

REEVE ELCTRNS., 444 N. Orleans, Chicago, IL 60610, Tel: 312-670-0150; Empl.: 25; *Sls. Mgr.:* George Elliott

REEVES-HOFFMAN
Division, Dynamics Corporation of America

REEVES-HOFFMAN DIV., 400 W. North St., Carlisle, PA 17013, Tel: 717-243-5929, TWX: 510-650-3510; Empl.: 291; *Sls. Mgr.:* Edward J. Sweeney .... **1A•**1413-1417; **2•**1795-1797

Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns.	602-252-0897
CA	Culver City, Westaironics	213-641-4123
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Boulder, R.G. Entprs.	303-447-9211
FL	Fern Park, EIR Inc.	305-830-9600
GA	Kennesaw, BWS Marketing	404-974-5107
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Chicago, ESCO Assocs.	312-763-0800
KS	DeSoto, Midtec Assocs.	913-441-6565
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Wakefield, H. Jappe	617-245-9359
MN	Minneapolis, Intl. Elctrns.	612-571-0000
MO	Florissant, Midtec Assocs.	314-837-5200
NY	Huntington, Compar New York Inc.	516-423-5660
NC	Winston-Salem, Murcota	919-722-9445
OH	Cincinnati, Tri-State Mktg.	513-761-7993
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Hatboro, Electro Rep Engrg.	215-674-4421
TX	Irving, Kite Elctrns. Sls.	214-438-9336
WA	Bellevue, N. R. Schultz Co.	206-454-0300

REFAC ELCTRNS. CORP., P.O. Box 809, Winsted, CT 06098, Tel: 203-379-2731, TWX: 710-449-6464; FSC No.: 28564; Empl.: 80; *Sls. Mgr.:* Chuck Altschul .... **1B•**1094

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Campbell, Luscombe Engrg.	408-370-2020
CA	Pasadena, Luscombe Engrg.	818-684-2000
CA	San Diego, Luscombe Engrg.	619-295-4300
CO	Boulder, Luscombe Engrg.	303-772-3342
CT	Kensington, Norman Stachelek Co.	203-828-6161
FL	Clearwater, Delmac Sls.	813-447-5192
FL	Orlando, Delmac Sls.	305-898-4688
FL	Palm Bay, Delmac Sls.	605-724-8377
FL	Tamarac, Delmac Sls.	305-726-1330
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Mt. Prospect, Interep	312-577-8899
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Canton, New England Elctrn. Sls.	617-828-4835
MI	Madison Heights, Pine Sls.	313-539-0350
MN	Spring Lake Park, Holmgren Assocs.	612-786-7641
MO	Gladstone, Delltron Co.	816-436-6445
MO	St. Louis, Delltron Co.	314-869-4779
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	E. Syracuse, Nycom Co.	315-437-8343
NY	Williamsville, Nycom Co.	716-633-9395
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Dayton, J. C. Hoffstetter Co.	513-296-1010
OH	Medina, J. C. Hoffstetter Co.	216-241-4880
OK	Tulsa, Ion Assocs.	918-664-0186
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Pittsburgh, J. C. Hoffstetter Co.	412-356-2305
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Austin, Ion Assocs.	512-346-7160
TX	Grand Prairie, Ion Assocs.	214-647-8225
TX	Houston, Ion Assocs.	713-977-4354
VA	Lynchburg, Burgin-Kreh Assocs.	804-239-2626
WI	Milwaukee, Interep	414-774-1100

REGDON CORP., 3713 Grand Blvd., Brookfield, IL 60513, Tel: 312-485-5152, TWX: 910-691-2214; FSC No.: 27190; Empl.: 65 .... **1B•**1497

Local Sales Offices & Reps

AL	Decatur, Tenn Tech	205-350-0630
CA	Los Altos, J. W. Wilhoit	415-961-3660
CA	Valencia, DJM Elctrns.	213-362-4309
CT	Woodbury, Mark-Rep Assocs.	203-263-3047
FL	Fern Park, EIR, Inc.	305-830-9600
GA	Clarkston, Tenn Tech	404-292-5368
IL	Downers Grove, Richmar Elect. Corp.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-846-6383
MN	Edina, T.H. Hanson & Co.	612-893-9960
MN	Edina, Wendell Lee & Assoc.	612-831-5056
NH	Atkinson, Mark-Rep Assocs.	603-362-4526
NJ	Livingston, Varrelman-Gorman Co.	201-992-2505
NY	Ilion, NHA	315-894-9943
NY	Pittsford, NHA	716-586-9002
NC	Raleigh, Tenn Tech	919-266-3610
OH	New Lebanon, J. N. Bailey	513-687-1325
PA	Abington, Indl. Mktg. Specialists Co.	215-659-0444
TX	Austin, K & H Sales	512-258-8841
TX	Plano, K & H Sales	214-423-6520
WI	Milwaukee, Richmar Elctrns.	414-781-1730

Local Distributors

CA	Burlingame, Logan Elctrn. Supp.	415-697-6481
MA	Lynn, Land Elctrns.	617-592-2220
NJ	Fairlawn, Relay Specialties	201-797-3313

REGENT CONTROLS, 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-736-2924; *Sls. Mgr.:* Wendell E. Carroll

REHLANDER ASSOCS., 363 Rantoul St., Beverly, MA 01915, Tel: 617-922-5961; *Sls. Mgr.:* Michael Rehlander

REICH ASSOCS., P.O. Box 73, Plano, TX 75074, Tel: 214-424-7904, Telex: 794783, TWX: 910-989-1691; FSC No.: 55916; Empl.: 10

RE • INSTRUMENTS re
Electronics for Test and Communication

RE INSTRUMENTS CORP., 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617, TWX: 810-427-9257; Empl.: 15; *Sls. Mgr.:* B. A. Gravens .... **3•**1291

Local Sales Offices & Reps

CA	Los Gatos, Pacific Coast Mktg.	408-395-7021

REI SLS., 19525 Business Centre Dr., Northridge, CA 91324, Tel: 617-938-0900; Empl.: 5; *Sls. Mgr.:* T. P. Fitzgerald

RELATIONAL MEMORY SYS., 1650 Berry Essa Rd., Ste. B, San Jose, CA 95133-1082, Tel: 408-729-3011, TWX: 910-379-0014

R. E. LAW INSTRU. INC., 7735 W. 112th Pl., Palos Hills, IL 60465, Tel: 312-974-4000; FSC No.: 6685-6695; *Sls. Mgr.:* Harry Booth; *Dist. Mgr.:* R. Gene Law

RELAY SERVICE CO., 1310 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-AL2-2700; Empl.: 30; *Sls. Mgr.:* Chas. H. Badger

Local Sales Offices & Reps

CA	Danville, Stuart Assoc.	415-837-8197
CA	Vista, Sado Sls.	619-941-2654
CT	Bethany, Reps. Corp.	203-393-0024
IL	Woodridge, Trend-Tronics	312-985-0626
MD	Fulton, Samuel A. Jeffries	301-792-7452
MA	Wellesley, Reps. Corp.	617-237-6476
OH	Cincinnati, John O. Olsen	513-574-7711
OH	Cleveland, John O. Olsen	216-662-3454
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
PA	Narbreth, Samuel A. Jeffries	215-664-8500
PA	Pittsburgh, John O. Olsen	412-279-2550
TX	Dallas, Elctrn. Prod. Reps.	817-467-0377
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

RELAY SPECIALTIES, 1300 Plaza Rd., Fair Lawn, NJ 07410, Tel: 201-797-3313, 800-526-5376, Telex: 642751; Empl.: 48; *Sls. Mgr.:* S. R. Gershberg

Local Sales Offices & Reps

CA	Cypress, The Rep House	213-596-4922
IN	Noblesville, Newton & Assocs.	317-845-4087
MD	Baltimore, Com Tech Assocs.	301-583-1993
TX	Dallas, Art Brawner & Assocs.	214-824-4013

RELCO PRODS., 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

RELIABILITY INC., 16400 Park Row, P.O. Box 218370, Houston, TX 77218, Tel: 713-492-0550, TWX: 910-881-1739; FSC No.: 54098; Empl.: 350; *Sls. Mgr.:* J. Marcussen .... **3•**1752-1755

Local Sales Offices & Reps

AZ	Phoenix, PLS Assocs.	602-246-6477
CA	Carson, Amasco	213-516-8561
CA	Sunnyvale, Amasco	408-733-8690
CO	Englewood, PLS Assocs.	303-773-1218
CT	Hamden, Digital Sls. Assocs.	203-248-3641
FL	Orlando, Gra-Mar	305-894-3351
IL	Elk Grove, Loren Green & Assocs.	312-593-0282
IN	Ft. Wayne, Jim Finnegan & Co.	219-747-9525
IA	Davenport, Ensco-Rep	319-386-6600
KS	Overland Park, Ensco	913-381-7557
KS	Wichita, Ensco-Rep	316-683-1070
MD	Wheaton, Brim Berg Sls.	301-946-2670
MA	Waltham, Digital Sls. Assocs.	617-899-4300
MO	St. Louis, Ensco-Rep	314-567-3935
NM	Albuquerque, PLS & Assocs.	505-345-5501
NY	Mt. Vernon, Sonkin Assocs.	914-668-9809
NC	Raleigh, Barker & Assocs.	919-876-0282
OH	Cinncinatti, Jim Finnegan & Co.	513-931-1686
OH	Cleveland, Jim Finnegan & Co.	216-238-5905
OH	Mansfield, Jim Finnegan & Co.	419-526-3564
OH	Maumee, Jim Finnegan & Co.	419-893-1052
OK	Tulsa, Advanced Techn. Sls.	918-664-0482
OR	Beaverton, General Elctrns.	503-641-5288
PA	Glenside, Koebert Assocs.	215-887-2310
PA	Pittsburg, Jim Finneagan & Co.	412-561-4687
TX	Austin, Advance Techn. Sls.	512-459-1351
TX	Dallas, Advance Techn. Sls.	214-361-8584
TX	Houston, Advance Techn. Sls.	713-440-8066
UT	Salt Lake City, PLS Assocs.	801-466-8729
WA	Tukwila, General Elctrns.	206-575-4030

Local Distributors

AZ	Phoenix, Weatherford	602-272-7144
CA	Anaheim, Weatherford	714-634-9600
CA	Glendale, Weatherford	213-849-3451
CA	Pomona, Weatherford	713-623-1261
CA	San Diego, Weatherford	619-695-1700
CA	Santa Barbara, Weatherford	805-965-8551
CA	Sunnyvale, Weatherford	408-738-8694
CO	Denver, Weatherford	303-428-6900
CO	Englewood, PLS Assocs.	303-773-1218
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
IL	Elk Grove, Dot-Tronics	312-593-0282
MD	Baltimore, Whitney Distrs.	301-944-8080
MA	Hingham, Sager Elctrl. Supp.	617-749-6700
MA	Middleboro, Stockroom	617-947-4262
MO	Maryland Heights, Ensco	314-423-3935
NY	Mt. Vernon, Kintronics	800-431-1658
OH	Dayton, Koehlke Comps.	513-435-5435
TX	Austin, S. W. Elctrns.	512-837-8977
TX	Dallas, Weatherford	214-931-7333
TX	Houston, Weatherford	713-688-7406
TX	Richardson, Southwest Elctrn. Supp.	214-234-3050
TX	Stafford, Southwest Elctrn. Supp.	713-491-4900
WA	Seattle, Weatherford	206-575-1340

RELMS, See Relational Memory Systems, Inc.

REMEE PRODS. CORP., 41 Bridge St., Florida, NY 10921, Tel: 914-651-4451, Telex: 64-6715; *Sls. Mgr.:* Joseph R. Fichtl; *Dist. Mgr.:* Joseph R. Fichtl

REMEX, Ex-Cell-O Corp., 1733 Alton St., Irvine, CA 92714, Tel: 714-957-0039, Telex: 681-333, TWX: 910-595-1715; *Sls. Mgr.:* Rich McGowan; *Dist. Mgr.:* Don Schulze

RENBRANDT, INC., 6 Parmelee St., Boston, MA 02118, Tel: 617-445-8910; FSC No.: 99934; Empl.: 25; *Sls. Mgr.:* M. Rogers

RENCO
Division of Electro-Craft Corporation
Industrial Automation Group

RENCO, 26 Coromar Dr., Goleta, CA 93017-3094, Tel: 805-968-1525, TWX: 910-334-1180; FSC No.: 34479; Empl.: 110; *Sls. Mgr.:* Don Risk .... **1B•**1874, 1875; **3•**1139

Local Sales Offices & Reps

CA	Garden Grove, Advanced Digital Group, Inc.	714-897-0319
CA	San Jose, Renco/Electrocraft	408-554-0234
CA	Westlake Village, Electro-Craft Corp.	818-889-3631
CO	Englewood, Integrated Motion Sys., Inc.	303-762-1817
CO	Englewood, Renco Corp.	303-762-1754
CT	Vernon, Renco/Electrocraft	203-871-8053
GA	Atlanta, Renco Corp.	404-971-2669
GA	Marietta, Renco/Electrocraft	404-971-2669
IL	Palatine, Renco/Electrocraft	312-991-4570
MI	Troy, Renco/Electrocraft	313-528-2940

MN	Hopkins, Electro-Craft Corp.	612-931-2700
NH	Salem, Electro-Craft Corp.	603-893-5552
NJ	Cherry Hill, Electro-Craft Corp.	609-662-0555
NJ	Monmouth Junction, Renco Corp	201-329-6233
NY	Ballston Lake, Ross Equip. Co., Inc.	518-877-5533
NY	Buffalo, Ross Equip. Co., Inc.	716-634-0990
NY	Elmira, Ross Equip. Co., Inc.	607-734-4175
NY	Rochester, Ross Equip Co.	716-271-5660
NY	Syracuse, Ross Equip. Co., Inc.	315-463-6691
OH	Cincinnati, Renco/Electrocraft	513-474-4171
WA	Bellevue, Sweo Engrg.	206-644-2725

RENCO ELCTRNS., 60 Jefryn Blvd. E., Deer Park, NY 11729, Tel: 516-586-5566, Telex: RCA 220883; Empl.: 70; *Sls. Mgr.:* Ed Rensing ....**1A**•1278-1280, 2260, 2261

Advertisement

For sales and sales service information about RENCO products, please call (516) 586-5566. For engineering assistance please dial our toll-free number (800) 645-5828.

REPCO, 2421 N. Orange Blossom Trail, Box 7065, Orlando, FL 32854, Tel: 305-843-8484, Telex: 56-6536 ....3•1065

Local Sales Offices & Reps

CT	Niantic, Northeast Reg. Sls. Off.	203-739-6877
TX	Lewisville, Southwest Reg. Sls. Off.	214-434-1139
WA	Seattle, Western Reg. Sls. Off.	206-542-6500

REPRODUCTION TECHNOLOGIES INC., Dept. EM, P.O. Box 815, Bristol, IN 46507-0518, Tel: 219-848-5233; Empl.: 8 ....3•1050, 1051

All sales are factory direct.

REPUBLIC ELCTRNS. CORP., 176 E. 7th St., Paterson, NJ 07524, Tel: 201-279-0300, TWX: 710-988-5908; FSC No.: 93958; Empl.: 125; *Sls. Mgr.:* W. Eisenberger ....**1A**•1182

Local Sales Offices & Reps

CA	Los Angeles, Corcoran Assocs.	213-823-2425
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Commerce City, Williams Assocs.	303-289-5647
FL	Sunrise, Arnold Milrot & Assoc.	305-748-6446
IL	Chicago, Ropek, Cahill & Vogt	312-631-0070
IN	Ft. Wayne, Given Corp.	219-432-5585
IA	Cedar Rapids, Ard Sales Co.	319-393-6392
MD	Ellicott City, Nelson Elecs.	301-747-7887
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MN	Edina, Grayden & Flemmer	612-941-1120
MO	Grandview, R. R. Burton & Assocs.	816-763-5385
MO	Maryland Hgts., R. R. Burton & Assocs.	314-434-1678
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	Liverpool, Precision Sls.	315-451-3480
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628
NY	Pittsford, Precision Sls.	716-381-2820
NY	Pleasant Valley, Precision Sls.	914-635-3233
NC	Charlotte, Jake Rudisill Assocs.	704-377-6901
OH	Columbus, Tom Mulligan & Assocs.	614-457-2242
OK	Tulsa, Hugh J. Daly Co.	918-627-4159
PA	Lancaster, Electro Rep.	717-299-5877
TX	Houston, Rainwater Reps.	713-376-0442
WA	Seattle, Blum & Assocs.	206-777-6656

Local Distributors

CA	San Fernando, Petell Elctrns.	213-365-9841
IL	Skokie, Kellner Elctrns.	312-677-1120
NJ	Perth Amboy, Metuchen Capacitors	201-442-0500
NY	Hauppauge, Semi Cap Elctrns.	516-582-4400

REPUBLIC ELECTRONICS, INC., 575 Broad Hollow Rd., Melville, NY 11747, Tel: 516-249-1414, Telex: 96-1460; FSC No.: 95750; Empl.: 100; *Sls. Mgr.:* J. Anderson

REPUBLIC PACKAGING CORP., 9160 S. Green St., Chicago, IL 60620, Tel: 312-233-6530, Telex: 25-4621; *Sls. Mgr.:* Hal Grossman; *Dist. Mgr.:* Herb Fasth

RESDEL ENGRG., 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 213-684-2600, TWX: 910-582-3219; Empl.: 190

RESEARCH, INC., Box 24064, Minneapolis, MN 55424, Tel: 612-941-3300, Telex: 29-0502; Empl.: 250; *Sls. Mgr.:* Brian Callahan

RESEARCH PRODS., 1015 E Washington Ave., Madison, WI 53701, Tel: 608-257-8801, TWX: 910-286-2781

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770; *Sls. Mgr.:* Roger H. Falde; *Dist. Mgr.:* Roger H. Falde

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 312-652-7555; Empl.: 50 ....**1A**•1937

Local Sales Offices & Reps

CT	Plantsville, Parnetics Co.	203-628-9343
FL	Melbourne, Jerry Williams, Inc.	305-259-7700
IL	Arlington Hgts., Resistance Specialists	312-259-6571
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MI	Lathrup Village, R.C. Nordstrom & Co.	313-559-7373
NY	New York City, Symon Assocs.	212-757-3638
OH	Wickliffe, W.J. Brauer & Assocs.	216-943-0601
WI	Milwaukee, Honkamp Sls. Co.	414-463-2530

RES-NET, 110 Route 10, Whippany, NJ 07981, Tel: 201-887-2260, out of state 800-526-0704; FSC No.: 55 877; Empl.: 42; *Sls. Mgr.:* Henry Brandi ....**1A**•1938

Local Sales Offices & Reps

CA	Irvine, Angle Assocs.	714-833-0692
CA	Palo Alto, Mollard Mktg.	415-961-0456
MA	Waltham, Dynasel Assocs.	617-890-6777
NJ	Florham Park, Harry Thaw Sls.	201-992-2711
TX	Houston, Rep Master	713-692-8204

REVERE CORP. OF AMER., 845 N. Colony Rd., Wallingford, CT 06492, Tel: 203-269-7701, Telex: 96-3482, TWX: 710-476-3197; Empl.: 389; *Sls. Mgr.:* J. McGurkin

REXNORD CHEMICAL PRODS. INC., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, Telex: 45-0331; *Sls. Mgr.:* Michael P. Manegold

Local Sales Offices & Reps

CA	Glendora, Rexnord Chem. Prods.	818-963-1109
IL	Northfield, Special Elec.	312-446-5113
MI	Roseville, Special Elec. Co.	800-558-0604
MN	Excelsior, JPM Assocs.	612-474-3408
MO	St. Louis, Special Elec. Co.	314-962-1150
OH	Cleveland, Special Elec. Co.	216-441-5244
RI	Lincoln, Special Elec. Co.	401-727-1136
WI	Milwaukee, Special Elec.	414-383-6370

RFD, INC., 5024 Nassau St., Tampa, FL 33607, Tel: 813-872-1502, TWX: 810-876-9146; *Sls. Mgr.:* Thomas W. Facer

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, TWX: 510-227-6233; FSC No.: 13619; Empl.: 250 ....**1A**•1618

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, Williams-Assocs.	602-947-4297
CA	Monterey Park, M.W. Riedel Co.	213-283-7694
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Denver, Williams-Assocs.	303-373-4730
FL	St. Petersburg, Tech-Rep Assocs.	813-577-2779
IL	North Riverside, J. Popp Sls.	312-447-6124
IN	Ft. Wayne, Denton Mktg., Inc.	219-627-5515
IA	Davenport, Ensco-Rep	319-386-6600
KS	Overland Park, Ensco-Rep	913-381-7557
MD	Rockville, Mechtronics Sls.	301-340-2130
MO	St. Louis, Ensco-Rep	314-423-3935
NH	Hudson, EMC Sls. Inc.	603-880-3671
NJ	Cherry Hill, H.J. White Co.	609-428-4544
NM	Albuquerque, Williams-Assocs.	505-255-1638
NY	Great Neck, Trionic Assocs.	516-466-2300
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	McKean, Ecco Elctrn. Sls.	814-476-1376
TX	Garland, McBride Sci. Sls.	214-494-5000
WA	Seattle, Granville Gillette Assocs.	206-284-3344

RFL INDS., A Dowty Grp. Co./Comms. Div., Powerville Rd., Boonton, NJ 07005, Tel: 201-334-3100, TWX: 710-987-8352; FSC No.: 49673; Empl.: 300

RFL INDS., A Dowty Grp. Co./Instr. Div., Powerville Rd., Boonton, NJ 07005, Tel: 201-334-3100, TWX: 710-987-8352; FSC No.: 49673; Empl.: 300

RFL INDS., Thermocontrol Div., W. Prospect St., Box 250, Brandon, VT 05733, Tel: 802-247-6811, TWX: 710-987-8352; Empl.: 350; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75234, Tel: 214-233-2903, TWX: 910-860-5474; Empl.: 90; *Sls. Mgr.:* William Spurgeon

RHG ELECTRONICS LAB., INC., 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, TWX: 510-227-6083; Empl.: 150; *Sls. Mgr.:* Martin D. Markson

RHOMBUS INDS., 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, TWX: 910-596-1826; Empl.: 60

Local Sales Offices & Reps

CA	Irvine, J. V. Earley & Assocs.	714-833-1806
CA	Redwood City, James S. Heaton Co.	415-367-9000
CO	Parker, A-5 Co.	303-841-3651
TX	Irving, Space Elctrns.	214-251-3636

RICHARD-LEE CO., Box 724, New Providence, NJ 07974, Tel: 201-276-0710; Empl.: 8

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161, Tel: 617-527-1512; *Sls. Mgr.:* L. K. Richards

RICHCO PLASTIC CO., 5825 N. Tripp Ave., Chicago, IL 60646, Tel: 312-539-4060, TWX: 910-221-1938; Empl.: 400; *Sls. Mgr.:* Craig Richardson; *Dist. Mgr.:* Mike Dornik

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, Telex: 0243420

RIFA INC., Greenwich Office Park 3, P.O. Box 3110, Greenwich, CT 06836-3110, Tel: 203-625-7300, TWX: 710-579-2970 ANCONERICS-GRC ....3•1756, 1757

RIL ELCTRNS., INC., 125 Titus Ave., P.O. Box H, Warrington, PA 18976, Tel: 215-EL5-1361; Empl.: 25

RIPLEY, 46 Nooks Hill Rd., Cromwell, CT 06416, Tel: 203-635-2200, TWX: 710-428-9567; Empl.: 100; *Sls. Mgr.:* R. S. Clark

RISK, GEORGE, INDS., GRI Plaza, Kimball, NE 69145, Tel: 308-235-4645, TWX: 910-620-9040; FSC No.: 24229; Empl.: 100; *Sls. Mgr.:* J. Fisher; *Dist. Mgr.:* J. Fisher ....**1B**•1792

Local Sales Offices & Reps

AZ	Tempe, Cleveland Entprs. of Ariz.	602-820-1127
CA	Anaheim, Galaxie Sales Int'l.	714-752-1580
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	San Carlos, Kafco	415-591-6758
FL	Tamarac, SRT Marketing	305-920-2222
GA	Atlanta, Young & Lawrence	404-255-5450
IL	Wheaton, Chadra-Schilke & Assoc.	312-653-8126
MD	Baltimore, Stemler Assocs.	301-944-8262
MA	Milton, Naton Assocs.	617-698-0670
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	Maryland Heights, Kebco	314-576-4111

Local Distributors

AZ	Phoenix, TRI Tek, Inc.	602-995-9352
CA	Hawthorne, Jade Computers	213-973-7707
CA	Los Angeles, Electric Switches	213-660-1310
CA	Santa Ana, Advanced Computer Prods.	714-558-8813

RLC ELCTRNS., INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, TWX: 710-571-2103; FSC No.: 12598; *Sls. Mgr.:* Philip H. Wright

RMF PRODS., INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 312-879-0020; Empl.: 11; *Sls. Mgr.:* R. Frieders ....**2**•1785

RMS ELECTRONICS INC., 50 Antin Pl., Bronx, NY 10462, Tel: 212-892-6700; Empl.: 100; *Dist. Mgr.:* Seymour Goldberg

Local Sales Offices & Reps

CA	Santa Ana, RMS Electronics Inc. Western	714-662-1041

RMS TECHN., 706 Industry Dr., Hampton, VA 23661, Tel: 804-838-2458; Empl.: 7

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, TWX: 710-581-6555; FSC No.: 82872; Empl.: 200; *Sls. Mgr.:* A. W. Mazzeo; *Dist. Mgr.:* A. W. Mazzeo

Local Sales Offices & Reps

CA	N. Hollywood, Jewett Co.	818-789-8103

RO ASSOCIATES

RO ASSOCS., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94086, Tel: 408-744-1450, TWX: 910-339-9304; Empl.: 90; *Sls. Mgr.:* R. D. Okada .... **3**•1758

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Phoenix, Sigma	602-241-1334
AR	Little Rock, Beacon Elctrns.	501-224-5449
CA	Los Angeles, Amasco	213-516-8561
CA	San Francisco, Amasco	408-733-8690
CO	Denver, F.G. Mktg.	303-795-9176
DC	Washington, Gans & Pugh	703-527-3262
FL	Melbourne, Beacon Elctrns.	305-724-8010
GA	Atlanta, Beacon Elctrns.	404-256-9640
HI	Honolulu, Aloha Assoc.	808-941-1574
IL	Chicago, John Kennaugh & Assoc.	312-980-2570
IN	Indianapolis, SAI Mktg.	317-241-9276
KS	Shawnee Mission, Midtec	913-441-6565
MD	Baltimore, Gans & Pugh	703-527-3262
MA	Boston, Intersell	617-273-3844
MI	Detroit, SAI Mktg.	313-227-1786
MN	Minneapolis, R-J Inc.	612-866-3661
MO	St. Louis, Midtec	314-837-5200
NM	Albuquerque, Sigma	602-241-1334
NY	Mt Vernon, Sonkin Assoc.	914-668-9809
NY	Utica, B. D. Hummel Co.	315-736-7821
NC	Raleigh, Beacon Elctrns.	919-787-9330
OH	Cleveland, SAI Mktg.	216-751-3633
OH	Columbus, SAI Mktg.	614-454-8942
OH	Dayton, SAI Mktg.	513-435-3181
OK	Tulsa, Cunningham Components Corps.	918-492-0390
PA	Philadelphia, Gans & Pugh	703-527-3262
TX	Dallas, Cunningham Comps. Corp.	214-233-4303
TX	Houston, Cunningham Comps. Corp.	713-461-4197
WA	Seattle, Huntley Assocs.	206-353-1833

ROBBINS & MEYERS, INC., Motor & Control Sys. Div., Rte. 4, Bob McCormick Rd., Gallipolis, OH 45631, Tel: 614-446-9868, Telex: 205-427 .... **1B**•1175

ROBERT BOSCH CORP., See Bosch, Robert, Corp.

ROBINSON-HALPERN, One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248, Tel: 215-825-9200, TWX: 510-660-8637; Empl.: 65; *Sls. Mgr.:* J. Lanza

ROBINSON-NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-945-0211, TWX: 810-540-4082; Empl.: 567; *Sls. Mgr.:* Hap Taylor .... **2**•1552-1555

Local Sales Offices & Reps

AL	Huntsville, Electronic Mktg.	205-837-7363
AZ	Phoenix, Stitzer Dodd	602-944-2237
CA	El Monte, Cook Ent.	213-686-2120
CA	San Diego, Cook Entprs.	619-584-0936
CA	Santa Clara, Logan Sls.	408-496-0660
CO	Denver, W. J. Purdy	303-777-1411
FL	Boca Raton, Conley Assoc.	305-395-6108
FL	Oviedo, Conley Assoc.	305-365-3283
FL	Tampa, Conley Assoc.	813-885-7658
GA	Atlanta, Elctrn. Mktg.	404-448-1215
IL	Park Ridge, Metcom	312-696-1490
IN	Indianapolis, Mktg. Engrs.	317-872-5665
IA	Cedar Rapids, PMR Corp.	319-362-9177
KS	Overland Park, PMR Corp.	913-381-0004
KS	Wichita, PMR Corp.	316-684-4141
MA	Lexington, John E. Boeing Co.	617-862-2500
MN	Minneapolis, Professional Sls. for Ind.	612-944-8545
MS	Jackson, Welch and Doby	601-932-5534
MO	Maryland Heights, PMR Corp.	314-569-1220
NM	Albuquerque, W. J. Purdy	505-266-7959
NY	Manhasset, Win-Cor	516-627-9474
NY	Rochester, Canavan-Scanlon	716-424-1830
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Raleigh, Elect. Mktg.	919-847-8800
OH	Beachwood, Electronic Salesmasters	216-831-9555
OR	Silverton, Vantage Corp.	503-873-5090
PA	Broomall, L. D. Lowery	215-356-5300
SC	Greenville, Elect. Mktg.	803-233-4637
TX	Austin, Space Elctrns.	512-451-3173
TX	Houston, Space	713-266-9245
TX	Irving, Space	214-251-3636
UT	Salt Lake City, William J. Purdy Co.	801-486-8557
VA	Charlottesville, L. D. Lowery	804-973-6672
WA	Seattle, Vantage Corp.	206-455-3460
WI	West Allis, Metcom Assocs.	414-476-1300

Local Distributors

AL	Huntsville, Schweber Elctrns.	205-882-2200
AL	Huntsville, RM Elctrns. Co.	205-852-1550
AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Phoenix, Cetec	602-272-7951
AZ	Tempe, Bell Inds.	602-267-7774
AZ	Tempe, Acacia Sls.	602-894-2874
CA	Buena Park, RPS Elctrns.	714-521-5230
CA	Canoga Park, Schweber Elctrns.	213-999-4702
CA	Chatsworth, Diplomat Elctrns.	314-700-8700
CA	Costa Mesa, Diplomat Elctrns.	714-549-8401
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Irvine, Schweber Elctrns.	714-556-3880
CA	Irvine, Cetec Elctrns.	714-250-4141
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Sacramento, Schweber Elctrns.	916-929-9732
CA	San Diego, Diplomat Elctrns.	619-292-5693
CA	San Diego, Sigma Elctrn.	619-565-2000
CA	San Diego, Cetec	619-278-5020
CA	San Jose, Anthem Elctrns.	408-946-8000
CA	San Jose, Cetec	408-263-7373
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Santa Clara, Schweber Elctrns.	408-748-4700
CA	South Gate, Cetec	213-773-6521
CA	Sunnyvale, Diplomat Elctrns.	408-734-1900
CA	Sunnyvale, Acacia Sls.	408-745-7200
CO	Denver, Ragon Elctrn. Parts	303-744-3601
CO	Englewood, Diplomat Elctrns.	303-799-8300
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Danbury, Diplomat Elctrns.	203-797-9674
CT	Danbury, Schweber Elctrns.	203-792-3500
CT	Hamden, ALmo Elctrns.	203-288-6556
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Clearwater, Diplomat Elctrns.	813-443-4514
FL	Hollywood, Schweber Elctrns.	305-927-0511
FL	Orlando, Hammond Elec.	305-849-6060
GA	Norcross, Diplomat Elctrns.	404-449-4133
GA	Norcross, Schweber Elctrns.	404-449-9170
IL	Bensenville, Diplomat Elctrns.	312-595-1000
IL	Chicago, Nep Elctrns.	312-625-8400
IL	Elk Grove Village, Schweber Elctrns.	312-364-3750
IL	Lombard, RM Elctrns.	312-932-5150
IL	Northbrook, Classic Comps.	312-272-9650
IN	Evansville, Hutch & Son	812-425-7201
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, RM Elctrns. Co.	317-247-9701
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Overland Park, Schweber Elctrns.	913-492-2922
KY	Louisville, P. I. Burks	502-589-3960
MD	Baltimore, Resco	301-823-0070
MD	Beltsville, Resco/Washington	301-937-9100
MD	Columbia, Diplomat Elctrns.	301-995-1226
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Canton, Almo Elctrns.	617-821-1450
MA	Westboro, Future Elctrns.	617-366-2400
MA	Woburn, Diplomat Elctrns.	617-366-2400
MI	Grand Rapids, R-M Michigan	616-531-9300
MI	Livonia, Schweber Elctrns.	313-525-8100
MI	Walled Lake, Ambur Elctrns.	313-669-3710
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, Schweber Elctrns.	612-941-5280
MO	Earth City, Schweber Elctrns.	314-739-0526
MO	Kansas City, LComp	816-221-2400
MO	Maryland Heights, LComp	314-291-6200
NE	Lincoln, Scott Elec.	402-466-8221
NE	Omaha, Scott Elctrns.	402-734-6750
NH	Hudson, C & H Elctrns.	603-882-1133
NH	Manchester, Schweber Elctrns.	603-625-2250
NJ	Fairfield, Schweber Elctrns.	201-227-7880
NJ	Totowa, Diplomat	201-785-1830
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Dist.	716-887-2800
NY	Farmingdale, Harrison Elec.	516-293-7990
NY	Liverpool, Diplomat Elctrns.	315-652-5000
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Melville, Diplomat Elctrns.	516-454-6400
NY	Mt. Vernon, QAR Elect.	914-699-2224
NY	Rochester, Schweber Elctrns.	716-424-2222
NY	Rochester, CAM/RPC Indl. Electrns.	716-865-2080
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Westbury, Schweber Elctrns.	516-334-7474
NC	Greensboro, Hammond Elec.	919-275-6391
NC	Raleigh, Schweber Elctrns.	919-876-0000
OH	Beachwood, Schweber Elctrns.	216-464-2970
OH	Cleveland, CAM/RPC Indl. Electrns.	216-461-4700
OH	Dayton, Stotts Friedman	513-298-5555
OH	Dayton, Schweber Elctrns.	513-439-1800
OH	Maumee, R S Elctrns.	419-893-0721
OK	Tulsa, Schweber Elctrns.	918-622-8000
OK	Tulsa, Connec-Tek	918-664-8812
OR	Beaverton, Acacia Sls.	503-646-3377
OR	Portland, Radar Elec.	503-232-3404
OR	Wilsonville, Zepher Inds.	503-682-2929
PA	Horsham, Schweber Elctrns.	215-441-0600
PA	Lancaster, CAM/RPC Indl. Electronics	717-392-8141
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Almo	215-698-4000
PA	Pittsburgh, CAM/PRC Indl. Elctrns.	412-782-3770
PA	Pittsburgh, Schweber Elctrns.	412-782-1600
SC	Columbia, Dixie Elctrn.	803-779-5332
SC	Greenville, Hammond Elec.	803-233-4121
TX	Addison, Connec-Tek	214-239-7552
TX	Austin, Schweber Elctrns.	512-458-8253
TX	Austin, Connec-Tek	512-835-0220
TX	Austin, Southwest	512-837-8971
TX	Dallas, RM Elctrns. Co.	214-263-8361
TX	Dallas, Schweber Elctrns.	214-661-5010
TX	Ft. Worth, Allied	817-336-5401
TX	Houston, Schweber Elctrns.	713-784-3600
TX	Houston, Powerline Prods.	713-578-3222
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Richardson, Fisher Brownell	214-235-3177
TX	Stafford, Southwest Elctrns.	713-491-4900
TX	Sugar Land, Connec/Tek	713-491-2255
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Diplomat-Alta	801-486-4134
VA	Charlottesville, Virginia Radio	804-296-4184
WA	Kent, Pyramid Elctrns.	206-872-5800
WA	Seattle, Zepher Elctrns.	206-241-1980
WA	Seattle, Radar Elec.	206-282-2511
WI	Brookfield, Schweber Elctrns.	414-784-9020
WI	New Berlin, RM Elctrns. Co.	414-784-4420
WI	New Berlin, Classic Comps. Supply	414-786-5300
WI	New Berlin, NEP Elctrns.	414-785-9100

ROBISON ELECTRONICS, INC.

ROBISON ELCTRNS., P.O. Box Y, San Luis Obispo, CA 93406, Tel: 805-544-8000; FSC No.: 19080; Empl.: 45 .... **2**•1870, 1887

ROCHESTER INSTR. SYS., 255 N. Union St., Rochester, NY 14605, Tel: 716-263-7700, Telex: 978457; Empl.: 330

ROCKBESTOS CO., P.O. Box 1102, New Haven, CT 06504, Tel: 203-772-2250

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103; FSC No.: 12111

ROCKLAND SYS. CORP., See Wavetek Rockland Inc.

ROCKWELL FILTER PRODS., 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-540-7640, Telex: 685532; Empl.: 100; *Sls. Mgr.:* Lee Cornett

ROCKWELL INT'L., 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 800-854-8099, TWX: 910-591-1654; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* K. MacDonald; *Dist. Mgr.:* K. Foster

ROCKWELL INTL., Commercial Elctrns. Opers., 1200 N. Alma Rd., Richardson, TX 75081, Tel: 214-996-5000, Telex: 73-307, 73-2490, TWX: 910-867-4709; Empl.: 15,000

RODALE ELCTRNS. CORP., 603 Chestnut St., Garden City, NY 11530, Tel: 516-222-0050, TWX: 510-222-0274; *Sls. Mgr.:* John B. Clement

RODELCO ELCTRNS. CORP., 356A Comac Rd., Deer Park, NY 11729, Tel: 516-643-5110; Empl.: 28

ROD-L
ELECTRONICS, INC.

ROD-L ELECTRONICS, INC., 1098 Hamilton Ct., Menlo Park, CA 94025, Tel: 415-322-0711, TWX: 296210 .... 3•1292-1295

Local Sales Offices & Reps

AL	Huntsville, Sci. Svcs. SE	205-536-1969
AZ	Phoenix, Venturesearch	602-894-5216
CA	Carson, Amasco	213-516-8561
CA	Sunnyvale, Amasco	408-733-8690
CO	Conifer, Energy Equip. Sls.	303-674-8111
FL	Orlando, Sci. Dvcs. SE	305-841-8180
IL	Elk Grove, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Loren Green Assocs.	317-293-9827
MD	Baltimore, Sci. Reps.	301-321-1411
MA	Reading, Scheinfein Assocs.	617-944-2304
MN	Minneapolis, Instrmn. Svcs. Inc.	612-544-8916
MO	Florissant, Web Elctrns.	314-921-5720
MO	Kansas City, Paloma Sls. Co.	816-358-7272
NJ	Fairfield, Addem Sls.	201-882-0993
NJ	Pennsauken, Sci. Reps.	609-662-5222
NY	De Witt, DB Assocs.	315-446-0220
NC	Winston-Salem, Sci. Dvcs.	919-765-5776
OH	Centerville, Micro Sls.	513-433-8171
OK	Tulsa, Spectra Sls.	919-633-7188
OR	Portland, Control Tek Sls. Limited	503-641-8180
TX	El Paso, Venturesearch	915-594-4094
TX	Houston, Spectra Sls.	713-747-2798
TX	Richardson, Spectra Sls.	214-234-3600
VA	Fairfax, Sci. Reps.	703-385-0600
WA	Spokane, Control Tek Sls. Ltd.	509-922-2971

ROEAN INDUSTRIES, INC., 12970 Branford, Ste. C, Pacoima, CA 91331, Tel: 818-767-7047, Telex: 758630 TGMC FTW; Empl.: 8

ROEDERSTEIN ELCTRNS., INC., P.O. Box 5588, Statesville, NC 28677, Tel: 704-872-8101

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 312-498-2300, TWX: 910-686-0008; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier .... 2•1786

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Southwest	602-944-9542
CA	San Diego, O'Donnell Assocs.	619-578-1645
CA	San Jose, O'Donnell Assocs.	408-263-6500
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Arvada, Challange Sls.	303-427-3149
IN	Fort Wayne, Aktron Corp.	219-747-3650
IA	Cedar Rapids, Dytronix	319-377-8275
MA	Westwood, Apex Assocs.	617-326-5042
MN	Minneapolis, R. W. Marshall	612-929-0457
MO	Bridgeton, Dytronix	314-731-5799
MO	Independence, Dytronix	816-373-6600
NJ	Pitman, Colrud Co.	609-589-5866
NY	Mount Vernon, Sonkin Assocs.	914-668-9809
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, SD-R2 Prods. & Sls.	503-295-6779
PA	Pittsburgh, J. C. Hofstetter Co.	412-327-1410
TX	Dallas, W. Reese Assocs.	214-638-6575
TX	Houston, W. Reese Assocs.	713-621-3134
WA	Bellevue, SD-R2 Sls.	206-747-2483

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
AR	Little Rock, Component Distrs.	501-227-6278
CA	Sunnyvale, Cazco Sls.	408-745-7221
CA	Torrance, Cazco Sls.	213-328-9710
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
IL	Northbrook, Classic Comps.	312-272-9650
IL	Rosemont, Advent Elctrns.	312-297-6200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Newton, Greene-Shaw Co.	617-969-8900
MI	Livonia, RS Elctrns.	313-525-1155
NJ	Bellmawr, Mid-Atlantic Elctrns.	609-931-5303
NJ	East Hanover, State Elctrns.	201-887-2550
NC	Raleigh, Component Distrs.	919-781-0177
OH	Medina, Electro-Supply	216-241-4880
TX	Austin, SW Elctrns.	512-837-8971
TX	Richardson, SW Elctrns.	214-234-3050
TX	Stafford, SW Elctrns.	713-494-6021
Can	Pointe Claire, Quebec, Future Elctrns.	514-694-7710

ROGERS CORP., Box 700, Chandler, AZ 85224, Tel: 602-963-4584, TWX: 910-950-1961; Empl.: 400; *Sls. Mgr.:* Paul Anderson

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500; *Sls. Mgr.:* Paul L. Anderson .... 2•1894

Local Sales Offices & Reps

AL	Huntsville, G. S. Jordan	205-881-7971
AZ	Scottsdale, H.R. Crowder	602-991-8908
AZ	Tempe, M. F. Iosue	602-839-5478
CA	Corona, R. A. Forester	714-734-5881
CA	Granada Hills, W. E. Pollock	213-368-0703
CA	Mission Viejo, A. C. Young	714-859-8028
CA	Palo Alto, R. A. Greenman	408-947-7797
CA	Poway, A.W. Riel	619-487-1065
CA	Redwood City, K. R. Sinisgalli	408-947-7797
CA	San Clemente, W. A. J. Waters	714-496-7305
CA	San Jose, R.H. Jackson	408-947-7797
CA	San Jose, W. J. Stolp	408-947-7797
CA	Van Nuys, D. Bergheimer	213-988-7138
CA	Westminster, D. Bergheimer	714-775-0179
CA	Woodland Hills, A. W. Riel	213-347-7435
CO	Littleton, G. B. Lange	303-795-3600
CT	Bristol, J. F. Witkewicz	203-583-4341
CT	Brooklyn, A. J. Boulia	203-774-0729
CT	Jewett City, G. R. Jessel	203-376-0276
CT	Norwich, G.R. Jessel	203-376-0276
FL	Melbourne Beach, P. R. Pratt	305-725-6105
GA	Roswell, J. N. Anderson	404-992-4307
IL	Chicago, R. E. Albright	312-798-5800
IL	Edwardsville, W. T. Davison	618-288-7786
IL	Hazel Crest, J. R. Menees	312-798-5800
KY	Prospect, G. A. Keibler	502-228-5792
MI	Garden City, L. J. Bradley	313-422-7150
MI	Rochester, Kent & Assocs.	313-651-1890
MN	Minneapolis, E. J. Sandor	612-330-3663
MN	Minneapolis, H. R. Crowder	612-574-7440
MN	Northfield, W. P. Kelly	507-663-1050
NH	Londonderry, W. J. Coyne	603-434-5358
NJ	Pitman, R. M. Neidig	609-582-1666
NJ	Springfield, S. D. Wellen	201-944-7777
NY	Endwell, T. H. Johnston	914-471-4707
NY	Rochester, R. C. Bangs	716-454-6520
NC	Cary, D. C. Reed	919-836-0415
OH	Shaker Hgts., E. R. Perme	216-283-5486
OH	Xenia, J. L. Forte	513-426-8993
PA	Downingtown, T. G. Sleasman	215-873-0180
PA	Hermitage, H. A. Harriman	412-983-3742
SC	Rock Hill, E. E. Wild	803-366-2952
TX	Carrollton, K. W. Norvell	214-446-1095
TX	Round Rock, B.D. Duke	512-244-3074
VA	Lynchburg, L.J. Rodrigue	804-384-9517
VA	Roanoke, J. L. Settles	703-774-8478
WA	Seattle, L. B. Keen	206-575-4175

R-OHM (EASTERN OPER.), 2303 W. Meadowview Rd. #3, Kingston Bldg., Greensboro, NC 27407, Tel: 919-855-0217

ROLM CORP., 1 River Oaks Pl., San Jose, CA 95134, Tel: 408-988-2900, TWX: 910-338-0247; FSC No.: 14345; Empl.: 6240; *Sls. Mgr.:* Dave Pidwell (MSC); R. Nugent (CBX); *Dist. Mgr.:* Ken Batorski (CBX)

ROLYN OPTICS CO., 738 Arrowgrand Cir., Covina, CA 91722-2199, Tel: 818-915-5707/5717, Telex: 67-0380

ROHM CORP., 8 Whatney, Irvine, CA 92714, Tel: 714-855-2131, TWX: 910-595-1721; Empl.: 100; *Sls. Mgr.:* Mike Hammel

ROME CABLE CORP., P.O. Box 71, Rome, NY 13440, Tel: 315-337-3000

RONOR SYSTEMS, 145 N. Plains Ind. Pk. Rd., Wallingford, CT 06492, Tel: 203-265-2110; Empl.: 12

RONTRON ENGINEERING, 25 Rose St., Branford, CT 06405, Tel: 203-488-5020

ROSE

ROSE ENCLOSURES SYS., INC., 12140 Parklawn Dr., Rockville, MD 20852, Tel: 301-984-1783, Telex: 908-107 Resi Rove; *Sls. Mgr.:* Richard Ramsey .... 2•1046

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSS ENGRG. CORP., 559 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621, TWX: 910-590-8033; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Hugh C. Ross .... 1B•1472

Local Sales Offices & Reps

CA	Mountain View, Energy Devices	415-969-0330

ROSTONE CORP., P.O. Box 7497, Lafayette, IN 47903, Tel: 317-474-2421, TWX: 810-342-1887; Empl.: 600

ROTEK INSTR. CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611; *Sls. Mgr.:* Eliot Warner

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
CA	Calabasas, Max Shovlowsky	805-498-6547
CA	Cupertino, Patterson Control Sys.	408-973-1050
CT	Mount Carmel, Sci. Dev.	203-248-9361
FL	Palm Harbor, Teqspec	813-785-2276
IL	La Grange, PVA Co.	312-579-9300
KS	Wichita, Aero Hill Sls.	316-682-2052
MA	Waltham, Sci. Dev.	617-890-2252
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NJ	Parlin, JMR Sls.	201-727-5335
NY	Rochester, Sci. Dev.	716-334-2445
NC	Winston-Salem, Radco	919-722-9671
PA	Philadelphia, Techn. Instr. Sls.	215-836-2222
PA	Pittsburgh, Meas. Instr. East	412-459-8090
TX	Dallas, True Techn.	214-691-7870
VA	McLean, Sci. Dev. DC	703-893-6513
WA	Seattle, Eicher Richards	206-523-7888

ROTRON, INC., See EG & G Rotron

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761, TWX: 810-442-1734; FSC No.: 82878; Empl.: 85; *Sls. Mgr.:* D. L. Mang; *Dist. Mgr.:* D. L. Mang .... 2•1556-1558, 2143

Local Sales Offices & Reps

AZ	Chandler, Blackhart Assocs.	602-831-2566
CA	San Jose, V. C. Robinson	415-969-4831
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Fern Park, EIR, Inc.	305-830-9600
KS	Leawood, Thunderbird	913-642-7220
KS	Wichita, Thunderbird	316-684-3941
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Burlington, Don C. Richard	617-272-1595
MA	Lowell, Underwood Sls.	617-256-8191
MI	Holland, Com-Tek Sls.	616-399-5719
MN	Hopkins, KITS Co.	612-933-1888
MO	Maryland, Thunderbird	314-567-6488
NJ	Haddonfield, Mills-Brown Assocs.	609-429-1005
NJ	Middletown, Astrorep	201-826-8050
NJ	Perth Amboy, Astrorep	201-826-8050
NM	Albuquerque, Ron-tek	505-299-4124
NY	Babylon, Astrorep	516-422-2500
NY	Farmingdale, Astrorep	201-624-4408
NC	Charlotte, Dula Assocs.	704-334-7090
NC	Winston-Salem, Dula Assocs.	919-768-7166
OH	Beachwood, RC Assocs.	216-292-4954
OH	Cuyahoga Falls, Lee Tronics	216-928-8584
TX	Richardson, Thunderbird	214-690-0763

RTE AEROVOX INC., P.O. Box B-970, 740 Belleville Ave., New Bedford, MA 02741, Tel: 617-994-9661, TWX: 710-344-6985; FSC No.: 4K459; Empl.: 700; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Matthew Simon .... 1A•1619-1621

RTE DELTEC CORP., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, TWX: 910-335-1246; FSC No.: 52297; Empl.: 200; *Sls. Mgr.:* John J. Waterman .... 3•1907

Local Sales Offices & Reps

AL	Huntsville, FM Assocs., Ltd.	205-882-0689
AK	Soldotna, Air Tek	907-262-5937
AZ	Scottsdale, Barnhill Assocs.	602-947-7841
CA	Los Altos, Jay Stone & Assocs.	415-948-4563
CO	Englewood, Barnhill Assocs.	303-779-3600
CT	Avon, Power Mark	203-678-0123
FL	Jupiter, FM Assocs., Ltd.	305-746-2996
FL	Orlando, FM Assocs., Ltd.	305-851-5710
GA	Atlanta, FM Assocs., Ltd.	404-451-2293
HI	Honolulu, EMC	808-836-1138
IL	Chicago, PoweReP, Inc.	312-641-3321
IN	Indianapolis, Tech Sls. & Mktg.	317-849-6612
IA	W. Des Moines, Data Power Technlg. Corp.	515-255-6113
KS	Lenexa, Engineered Equip. Co.	913-492-9221
LA	Baton Rouge, Barnhill Assocs.	504-924-6826
MN	Golden Valley, JR Assocs.	612-546-4110
MO	St. Louis, Applied Power Sys.	314-383-5858
NE	Omaha, Data Power Technlg. Corp.	402-592-7860
NJ	Lodi, SDM Reps.	201-368-0125
NJ	Pennsauken, Scientific Reps.	609-662-5222
NM	Albuquerque, Barnhill Assocs.	505-299-7658
NY	Rochester, SDM Reps.	716-247-8770
NC	Ramseur, FM Assocs., Ltd.	919-824-2196
OH	Cleveland, Instrumentation Sys.	216-845-8800
OH	Dayton, Instrumentation Sys.	513-294-2838
PA	Pittsburgh, Instrumentation Sys.	412-243-1111
TX	Austin, Barnhill Assocs.	512-451-0217
TX	Houston, Barnhill Assocs.	713-688-9971

TX	Richardson, Barnhill Assocs.	214-231-2573
UT	Murray, Barnhill Assocs.	801-262-3000
VA	McLean, Creative Mktg. Assocs., Ltd.	703-442-9100
WA	Seattle, F/M Sales Co.	206-628-9620
WI	Milwaukee, PoweReP	414-272-4684
EXP	CA, San Diego, RTE Deltec Corp.	619-291-4211

Local Distributors

AL	Huntsville, RTS Distributing	205-882-0689
AZ	Scottsdale, Beta Distrs.	602-947-7841
CO	Englewood, Beta Distrs.	303-779-4494
CT	Ridgefield, Data Set Cable Co.	203-438-9684
FL	Fort Lauderdale, Nabra Entprs.	305-584-9105
FL	Jupiter, RTS Distributing	305-746-2996
FL	Orlando, RTS Distributing	305-851-5710
GA	Atlanta, RTS Distributing	404-451-2293
HI	Honolulu, EMC Assocs.	808-836-1138
LA	Baton Rouge, Beta Distrs.	504-924-6826
NV	Las Vegas, Data Set Cable Co.	702-382-6777
NJ	Lodi, SSI Distribution	201-368-1025
NM	Albuquerque, Beta Distrs.	505-299-7658
NY	Rochester, SSI Distribution	716-247-8770
NC	Ramseur, RTS Distributing	919-824-2196
TX	Austin, Beta Distrs.	512-452-0199
TX	Houston, Beta Distrs.	713-688-9971
TX	Richardson, Beta Distrs.	214-231-2573
UT	Murray, Beta Distrs.	801-262-3000

RTE POWER/MATE, See Power/Mate Co.

RTRON CORP., 7324 Lawndale, Skokie, IL 60076, Tel: 312-679-7180, TWX: 910-223-0810; FSC No.: 19130; *Sls. Mgr.:* R. McLean

Local Sales Offices & Reps

AZ	Tucson, J.J. Riley & Assocs.	602-888-4627
CA	Redondo Beach, J.J. Riley & Assocs.	213-374-3468
CT	Washington, Tri-Com	205-563-2241
MA	Burlington, Tri-Com	617-272-8163
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MN	Brooklyn Center, Northwest Savespro	612-566-0196
NJ	Plainfield, S. Glassman Assoc.	201-561-3866
NY	Glen Cove, S. Glassman Assoc.	516-676-1039
OH	Cincinnati, J. Olsen Co.	513-451-5995
OH	Cleveland, J. Olsen Co.	216-662-3454
OR	Aloha, Elctrnc. Comp. Sls.	503-245-2342
PA	Jenkintown, Arnold Assoc.	215-PI 2-0600
PA	Pittsburgh, J. Olsen Co.	412-279-2550
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

RTS SYSTEMS, INC., Compact Video, Inc., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-843-7022, Telex: 194855, TWX: 910-498-4987; Empl.: 40; *Sls. Mgr.:* Bob Tourkow .... 3•1066

Local Sales Offices & Reps

AL	Birmingham, Sonics Assocs.	205-942-9631
AL	Birmingham, Gray Comms. Conslt.	205-942-2824
AL	Cropwell, Broadcast Sys.	205-525-5467
AL	Huntsville, Central Dynamics Corp.	205-837-5180
AL	Mobile, Gray Comms. Conslt.	205-343-0662
AK	Anchorage, N V S Sys.	907-349-3523
AZ	Cottonwood, R I A Corp.	602-634-8065
AZ	Phoenix, Siboney Communications Inc. (SCI)	602-252-5992
AZ	Tucson, SCI	602-881-5432
CA	Berkeley, Curtis M. Karplus, Esq.	415-642-1942
CA	Burbank, H N E Inc.	213-508-7543
CA	Burbank, Tri Tronics	213-843-2170
CA	City of Industry, SCI	213-965-2281
CA	El Monte, Cetec Vega	213-442-0782
CA	Encino, Everything Audio	213-995-4175
CA	Glendale, Paramount Sound Sys. Corp.	213-956-3222
CA	Inglewood, Audio Visual Hdqtrs. Corp.	213-419-4040
CA	Lawndale, Omega Video	213-679-9021
CA	Long Beach, K T Elctrns.	213-424-0979
CA	Los Angeles, Acromedia Corp.	213-410-4141
CA	Los Angeles, Tourkow & Co.	213-664-8884
CA	Los Angeles, Shoreline Ltd.	213-851-1236
CA	Los Angeles, Hollywood Sound Sys.	213-466-2416
CA	Los Angeles, Skaggs Video Los Angeles	213-556-2133
CA	N. Hollywood, Audio Svcs. Corp.	213-980-9891
CA	N. Hollywood, Doc Siegel Audio	213-877-2300
CA	N. Hollywood, Best Audio	213-763-2378
CA	N. Hollywood, Theatre Vision	213-769-0928
CA	Newbury Park, Westlake Audio	213-655-0303
CA	Nipomo, Broadcast Sys.	805-929-4476
CA	Pasadena, Audio Engrg. Assocs.	213-798-9127
CA	San Diego, Skaggs Video San Diego	619-578-9640
CA	San Diego, SCI	714-578-7777
CA	San Diego, Pacific Recorders & Eng. Corp.	619-453-3255
CA	San Diego, Centro Corp.	619-560-1578
CA	San Francisco, Sound Genesis	415-285-8900
CA	Santa Clara, Video Comms. Corp.	408-988-2968
CA	Sun Valley, Burns Audio	213-768-1701
CA	Sunnyvale, Video Media	408-733-6500
CA	Walnut, Video Comms. Corp.	714-594-2442
CO	Denver, Film/Video Equip. Svc.	303-778-8616
CO	Denver, R I A Corp.	303-320-5521
CO	Englewood, Skaggs Video Denver	303-740-9031
CT	Shelton, Anton Bauer	203-929-1100
FL	Gainesville, Gray Comms. Conslt.	904-376-2435
FL	Miami, Hubbard Comms.	305-594-0744
FL	Miami, Midwest Corp.	305-592-5355
FL	Miami, Gray Comms. Conslt.	305-591-3637
FL	Orlando, Gray Comms. Conslt.	305-896-7414
FL	St. Petersburg, Hubbard Comms.	813-577-7759
FL	Tampa, SCI	813-985-4687
FL	Tampa, Gray Comms. Conslt.	813-885-1411
GA	Albany, Gray Comms. Conslt.	912-883-2121
GA	Doraville/Atlanta, Gray Comms. Conslt.	404-455-3121
GA	Norcross, SCI	404-441-3300
GA	Norcross/Atlanta, Tech. Video Sys.	404-447-6621
GA	Union City/Atlanta, Allied Broadcast Equip.	404-964-1464
IL	Chicago, Allied Broadcast Equip.	312-794-0224
IL	Elk Grove Vlg., Swiderski Elctrns.	312-364-1900
IL	Harvey, Bridgewater Custom Sound	312-596-0309
IL	Morton Grove, Roscor Corp.	312-539-7700
IL	Quincy, Harris Corp.	217-222-8200
IN	Evansville, Kavco	812-476-6327
IN	Indianapolis, Kavco	317-251-0800
IN	Indianapolis, R C A Corp.	317-273-3547
IN	Indianapolis, Midwest Corp.	317-251-5750
IN	Richmond, Allied Broadcast Equip.	317-962-8596
IA	Davenport, Video Midwest	319-322-1525
IA	Des Moines, Video Midwest	515-244-1447
KY	Edgewood, Midwest Corp.	800-543-1584
KY	Lexington, Midwest Corp.	606-277-4994
KY	Louisville, Midwest Corp.	502-491-2888
LA	Harahan/New Orleans, Gray Comms. Conslt.	504-733-7265
MD	Bethesda, Professional Prods.	301-657-2141
MD	Lanham, Midwest Corp.	301-577-4903
MD	Rockville, Peirce Phelps Inc.	301-984-7979
MA	Boston, Professional Recording & Sound	617-254-2110
MA	Framingham, Landy Assocs.	617-877-9570
MA	Needham Hgts., Capron Lighting & Sound Co.	617-444-8850
MA	Newton, Lake Sys. Corp.	617-244-6881
MI	Ann Arbor, Hy James Audio Professionals	313-994-0934
MI	Oak Park, Midwest Corp.	313-399-6361
MI	Troy/Detroit, Midwest Corp.	313-689-9730
MN	Burnsville, Emmons Assocs.	612-890-8920
MN	Minneapolis, Video Midwest	612-831-2248
MN	Minneapolis, Todd Comms.	612-941-0556
MS	Bay St. Louis, Harris Corp. S. Central Reg.	601-255-3337
MO	Chesterfield, Television Engrg. Corp.	314-532-4700
MO	El Dorado Springs, Broadcast Sys.	417-876-6254
MO	St. Louis, Antech Labs	314-997-5666
NE	Omaha, Todd Comms.	402-341-7600
NV	Las Vegas, Western Media Entprs.	702-873-2014
NV	Las Vegas, Acromedia Corp. Las Vegas	702-362-7552
NJ	Atlantic City, Telemeasurements	609-345-2670
NJ	Cherry Hill, Landy Assocs.	609-424-4660
NJ	Clifton, Telemeasurements	201-473-8822
NJ	Mahwah, Philips Television Sys.	201-529-1550
NJ	Mountain Lakes, Turner Engrg.	201-263-0023
NJ	Northvale, A F Assocs.	201-767-1000
NM	Albuquerque, SCI	505-884-6858
NM	Los Lunas, Dyma Engrg.	505-865-6700
NY	New York, Martin Audio/Video Corp.	212-541-5900
NY	New York, Westec Audio Video	212-586-1662
NY	New York, Tech. Video Sys.	212-580-3104
NY	New York, M P C S Video Inds.	212-586-3690
NY	New York, Adcom Comms.	212-265-1760
NY	New York, Camera Mart	212-757-6977
NC	Charlotte, Reliable Music	704-375-8662
NC	Charlotte, Midwest Corp.	704-399-6336
NC	RTP, Broadcast Sys.	919-851-1956
NC	Raleigh, Southeastern Sight & Sound	919-828-2311
NC	Winston-Salem, Tech. Video Sys.	919-748-0916
OH	Cleveland, Midwest Corp.	216-447-9745
OH	Columbus, Midwest Corp.	614-476-2800
OH	Columbus, Kavco	614-274-0180
OH	Dayton, Kavco	513-898-2003
OH	Dayton, Midwest Corp.	513-275-3339
OH	N. Royalton, Kavco	216-237-1950
OH	Parma Hgts., Reddish Sound	216-885-1222
OK	Claremore, R I A Corp.	918-341-9066
OK	Tulsa, M Z B & Assocs.	918-743-2661
OR	Portland, Baldwin Mktg. Co.	503-234-1359
PA	Allentown, Daveland Co.	215-439-8701
PA	Carnegie, Alpha Video & Elctrns.	412-923-2070
PA	Gibsonia, Midwest Corp.	412-443-6720
PA	King of Prussia, Maris Equip. Corp.	215-275-9300
PA	Philadelphia, Peirce Phelps Inc.	215-879-7205
PA	Philadelphia, Lerro Elctrl. Corp.	215-223-8200
PA	Pittsburgh, R P C Elctrns.	412-782-3770
TN	Knoxville, Gray Comms. Conslt.	615-523-3107
TN	Nashville, Gray Comms. Conslt.	615-883-9175
TN	Nashville, Consolidated Media Sys.	615-244-3933
TX	Amarillo, Magnetic Media Corp.	806-358-2468
TX	Arlington, Midcom	817-640-4573
TX	Austin, SCI	512-454-7194
TX	Austin, M Z B & Assocs.	512-837-7240
TX	Austin, Magnetic Media Corp.	512-451-0138
TX	Austin, Broadcast Sys.	512-836-6014
TX	Corpus Christi, SCI	512-883-6688
TX	Dallas, Video Sys.	214-349-0951
TX	Dallas, Magnetic Media Corp.	214-931-0404
TX	Dallas, M Z B & Assocs.	214-233-5535
TX	El Paso, SCI	915-598-8538
TX	Houston, L D Systems	713-695-9400
TX	Houston, M Z B & Assocs.	713-448-0881
TX	Houston, SCI	713-686-9685
TX	Houston, Magnetic Media Corp.	713-771-9125
TX	Houston, Video Sys.	713-686-9651
TX	Irving, SCI	214-258-8470
TX	Lubbock, Video Sys.	806-792-2325
TX	Madison, SCI	615-865-1980
TX	Plano, Allied Broadcast Equip.	214-423-8667
TX	Plano, Broadcast Sys.	214-867-8775
TX	San Antonio, Video Sys.	512-824-2311
UT	Salt Lake City, R I A Corp.	801-486-8822
UT	Salt Lake City, Skaggs Video Sls.	801-539-1420
UT	Salt Lake City, Skaggs Telecom Svc.	801-539-1420
VA	Richmond, Professional Prods.	804-794-2585
VA	Virginia Beach, Midwest Corp.	804-464-6256
VA	Woodbridge, Broadcast Sys.	703-494-4998
WA	Federal Way, Allied Broadcast Equip.	206-927-4337
WV	Charleston, Midwest Corp. Corporate H/Q	304-343-8874
WV	Nitro/Charleston, Midwest Corp.	304-722-2921
WI	Madison, Full Compass Sys.	608-271-1100

RUSH/HOUSTON, INC., 600 Kealrick, Ste C-40, Houston, TX 77060, Tel: 713-682-5151; *Sls. Mgr.:* Fred Murphy

RUSSELL INDS., 3000 Lawson Blvd., Oceanside, NY 11572, Tel: 516-536-5000; Empl.: 20; *Sls. Mgr.:* H. Russell

RUTHERFORD RESCH. PRODS., Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

RYAN INTL. CORP., 4800 Evanswood Dr., Columbus, OH 43229, Tel: 614-885-3303; Empl.: 26 .... **3•1219**

RYE INDS., INC., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543, Tel: 914-698-0080; Empl.: 50

SABRE COMMS. CORP., 117 Main St., Soiux City, IA 51102, Tel: 712-258-6690; FSC No.: 60348; *Sls. Mgr.:* Bailey Aalfs; *Dist. Mgr.:* Richard Krone

Local Sales Offices & Reps

FL	Coral Springs, SECOM Sys.	305-753-6777
GA	Chamblee, SECOM Sys.	404-455-0672
NC	Kings Mountain, SECOM Sys.	704-739-9297
TN	Bloomington Springs, SECOM Sys.	615-653-4363

Local Distributors

FL	Coral Springs, SECOM Sys.	305-753-6777
GA	Chamblee, SECOM Sys.	404-455-0672
NC	Kings Mountain, SECOM Sys.	704-739-9297
TN	Bloomington Springs, SECOM Sys.	615-653-4363

SABRITEC, 16631 Noyes Ave., Irvine, CA 92714, Tel: 714-549-7350, Telex: 678401; *Sls. Mgr.:* M. J. Bennett

SAFEWAY PRODUCTS, 440 Middlefield St., Middletown, CT 06457, Tel: 203-346-6601, TWX: 710-428-7225; Empl.: 241

SAFT AMERICA INC., Box 1886, Valdosta, GA 31601, Tel: 912-247-2331, Telex: 547620, TWX: 810-786-5866

SAFT AMERICA INC., Advanced Battery Sys. Div., 107 Beaver Ct., Cockeysville, MD 21030, Tel: 301-666-3200

SAFT AMERICA INC., Elctrn. Sys. Div., 2414 W. 14th St., Tempe, AZ 85281, Tel: 602-894-6864

SAFT

SAFT AMERICA INC., Power Sources Div., 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, Telex: 547-620; Empl.: 1300; *Sls. Mgr.:* R. Bartmes ....**3**•1398, 1424-1429

Local Sales Offices & Reps

CA	Chatsworth	818-998-0626
CO	Denver	303-740-7781
FL	Orlando	305-282-2245
IL	Chicago	312-991-6396
MA	Quincy	617-773-7980
MN	Minneapolis	612-770-0082
NC	Winston-Salem	919-765-6690
OH	Columbus	216-861-1877
PA	Philadelphia	215-831-9520
TX	Dallas	214-436-0757
VT	Rutland	802-773-8748

Local Distributors

AL	Montgomery, Aviall	205-284-3001
AK	Anchorage, Standard Aero Ltd.	907-349-9655
AK	Anchorage, Aviall	907-248-4624
AK	Anchorage, Van Dusen Aircraft Supp.	907-561-1644
AZ	Phoenix, Aviall	602-275-4434
AZ	Phoenix, Van Dusen Aircraft Supp.	602-275-4493
AZ	Phoenix, Standard Aero Ltd.	602-273-7451
AR	Little Rock, Aviall	501-376-0379
CA	Burbank, Aero Quality Sls.	818-841-6163
CA	El Cajon, Aviall	619-448-2885
CA	Fresno, Van Dusen Aircraft Supp.	209-292-2222
CA	Long Beach, Standard Aero Ltd.	213-421-8431
CA	S. San Francisco, Van Dusen Aircraft Supp.	415-589-3133
CA	San Jose, Standard Aero Ltd.	408-926-2505
CA	San Leandro, Aviall	415-638-8736
CA	Van Nuys, Van Dusen Aircraft Supp.	818-988-7308
CA	Van Nuys, Aviall	818-997-0242
CO	Broomfield, Aviall	303-457-2461
CO	Denver, Van Dusen Aircraft Supp.	303-393-0813
FL	Hollywood, Aviall	305-925-8330
FL	Miami, Aero Quality Sls.	305-592-5055
FL	Miami Springs, Van Dusen Aircraft Supp.	305-885-3481
FL	Orlando, Aviall	305-277-2191
GA	Atlanta, Van Dusen Aircraft Supp.	404-766-8334
GA	College Park, Aviall	404-997-3935
HI	Honolulu, Van Dusen Aircraft Supp.	808-833-0061
HI	Honolulu, Standard Aero Ltd.	808-833-2447
ID	Boise, Van Dusen Aircraft Supp.	208-384-0030
IL	Elk Grove Village, Van Dusen Aircraft Supp.	312-437-5230
IL	Wheeling, Aviall	312-541-7040
KS	Kansas City, Van Dusen Aircraft Supp.	913-321-4200
KS	Overland Park, Aviall	913-341-2999
KS	Wichita, Van Dusen Aircraft Supp.	316-943-2418
LA	Lafayette, Aviall	318-233-8930
LA	Lafayette, Standard Aero Ltd.	318-269-1111
LA	New Orleans, Van Dusen Aircraft Supp.	504-246-3166
MA	East Boston, Van Dusen Aircraft Supp.	617-567-3000
MA	Stow, Aviall	617-897-3400
MI	Pontiac, Van Dusen Aircraft Supp.	313-666-2240
MI	Romulus, Aviall	313-946-9110
MI	St. Clair Shores, Aero Quality Sls.	313-772-7810
MN	Edina, Van Dusen Aircraft Supp.	612-835-6988
MN	Minneapolis, Standard Aero Ltd.	612-835-9250
MN	Minneapolis, Aviall	612-884-4441
MS	Southaven, Van Dusen Aircraft Supp.	601-393-5500
MO	Chesterfield, Aviall	314-532-3458
MO	Kansas City, Standard Aero Ltd.	816-842-3903
MO	St. Louis, Van Dusen Aircraft Supp.	314-731-1700
MT	Billings, Van Dusen Aircraft Supp.	406-245-2309
NE	Lincoln, Van Dusen Aircraft Supp.	402-474-3512
NV	Las Vegas, Van Dusen Aircraft Supp.	702-739-9322
NJ	Lyndhurst, Aero Quality Sls.	201-288-5510
NJ	Teterboro, Van Dusen Aircraft Supp.	201-288-1500
NY	Bohemia, Aviall	516-567-2002
OH	Cincinnati, Aviall	513-871-6623
OH	Cleveland, Van Dusen Aircraft Supp.	216-473-6711
OH	Vandalia, Van Dusen Aircraft Supp.	513-898-4672
OK	Bethany, Aviall	405-787-4630
OK	Oklahoma City, Van Dusen Aircraft Supp.	405-682-4496
OK	Tulsa, Aviall	918-838-3316
OR	Fairview, Aviall	503-667-5068
PA	New Cumberland, Van Dusen Aircraft Supp.	717-774-3511
PA	Philadelphia, Aviall	215-677-9700
PA	Pittsburgh, Aviall	412-664-4440
TN	Mt. Juliet, Van Dusen Aircraft Supp.	615-754-7700; 800-251-5775
TN	Nashville, Aviall	615-833-7431
TX	Addison, Aviall	214-458-0525
TX	Dallas, Van Dusen Aircraft Supp.	214-352-2611
TX	Dallas, Aviall	214-688-0811
TX	Dallas, Standard Aero Ltd.	214-931-7480
TX	Dallas, Aero Quality Sls.	214-350-8881
TX	Ft. Worth, Aviall	817-626-3795
TX	Houston, Aviall	713-645-3376
TX	Houston, Aero Quality Sls.	713-943-3906
TX	Houston, Van Dusen Aircraft Supp.	713-643-8566
TX	Midland, Van Dusen Aircraft Supp.	915-563-0907
TX	San Antonio, Aviall	512-340-3938
UT	Salt Lake City, Aviall	801-355-2717
UT	Salt Lake City, Van Dusen Aircraft Supp.	801-532-5194
VA	Richmond, Van Dusen Aircraft Supp.	804-222-7287
WA	Bellevue, Standard Aero Ltd.	206-643-4220
WA	Seattle, Standard Aero Ltd.	206-762-0550
WA	Seattle, Aviall	206-763-1350
WA	Seattle, Van Dusen Aircraft Supp.	206-763-1544

TNR
TECHNICAL, INC.
MASTER CONTRACT DISTRIBUTORS & ENGINEERING SALES REPRESENTATIVES.
SAFT
GOULD
BATTERIES
- CYLINDRICAL CELLS
- MODULAR PAKS
- BUTTON CELLS - LITHIUM
- GELYTE® LEAD ACID
- RECHARGEABLE NICADS®
- CUSTOM PACKS

(516) 249-3777
63 Marine St, Farmingdale, N.Y. 11735

SAGE LABORATORIES, INC., 3 Huron Dr., Natick, MA 01778, Tel: 617-653-0844, TWX: 710-346-0390; FSC No.: 07180; *Sls. Mgr.:* Tony Cieri

SAI TECHNLG. CO., Science Applications Inc., 4060 Sorrento Valley Blvd., San Diego, CA 92121, Tel: 619-452-9150, TWX: 756769; FSC No.: 54779; Empl.: 300

SAMARIUS, INC., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, Tel: 203-735-7405, TWX: 710-451-2495; FSC No.: 18065; Empl.: 90 ....**1A**•2053

SAMTEC, 810 Progress Blvd., P.O. Box 1147, New Albany, IN 47150, Tel: 812-944-6733, TWX: 810-540-4095; FSC No.: 55322; Empl.: 50; *Sls. Mgr.:* B. Shine; *Dist. Mgr.:* C. Roll

S & EI MFG., Box 832, Northridge, CA 91324, Tel: 818-349-4111, TWX: 910-493-1252; FSC No.: 24152; Empl.: 85

Local Sales Offices & Reps

CA	Sacramento, John Wayner	916-689-1281
CA	San Diego, Qualtronics	619-560-8955
FL	Ft. Lauderdale, Electro Comp. Assocs.	305-491-4141
IL	Chicago, Ropek-Cahill	312-631-0070
KS	Parker, S. W. Wollard Co.	913-898-6552
MA	Boston, TEC Sys.	617-834-4663
MO	St. Louis, Abrams & Assocs.	314-569-0047
NJ	Cherry Hill, Danco Corp.	609-627-2218
OH	Dayton, Berberich & Assocs.	513-433-0342

SANDERS ASSOCS., Flexprint Prods. Div., Grenier Fld., Manchester, NH 03103, Tel: 603-669-4615, TWX: 710-220-9999; FSC No.: 4L 277; Empl.: 500; *Sls. Mgr.:* Martin S. Schwartz

Local Sales Offices & Reps

AL	Huntsville, BJR	205-881-3569
AZ	Tempe, Spectrum Assoc. S.W.	602-966-1788
CA	Downey, Trimarco	213-861-8244
CA	Downey, Trimarco	213-861-8244
CA	Los Altos, El Repco	415-941-4990
CA	San Jose, Cero	408-298-1918
FL	Cocoa Bch., JEPCO	305-783-3037
IL	Downers Grove, Momak Sls.	312-963-6400
MD	Baltimore, R. A. Wafer Assoc.	301-744-1133
MD	Glen Burnie, New Era Sls.	301-768-6666
MA	Burlington, Microwave Mktg. Spec.	617-272-7530
MN	New Brighton, TWC	612-636-1770
NH	Amherst, Callahan & Tremblay	603-883-9000
NJ	Wayne, GT Assocs.	201-694-6040
NY	Great Neck, Phase 4	516-482-1790
PA	Hatboro, Jacobsen Assoc.	215-674-2937
TX	Austin, Kruvand Assoc.	512-441-6777
TX	Dallas, Kruvand Assoc.	214-691-4592

S & H INDUSTRIES, INC.

S & H INDS., 119 Glen Cove Dr., Glen Head, NY 11545, Tel: 516-671-5600; Empl.: 50; *Sls. Mgr.:* R. Smith ....**3**•1767, 1908, 1928

SAN DIEGO INSTR. LAB, See SANLAB

SAN FERNANDO ELEC. MFG., See SFE Techn.

SANFORD-MILLER CORP., 8 John St., Lynbrook, NY 11563, Tel: 516-593-2025, Outside NY 800-645-5900; Empl.: 10

SANGAMO CAPACITOR DIV., Box 128, Pickens, SC 29671, Tel: 803-878-6311, Telex: 57-0441, TWX: 810-397-2496; FSC No.: 00853; *Sls. Mgr.:* J. Kolkowski; *Dist. Mgr.:* J. Kolkowski

SANKEN ELEC. CO., 1-22-8 Nishi-Ikebukuro, Toshima-Ku, Tokyo, Japan, Tel: 03-986-6151, Telex: 272-2323; Empl.: 2,500; *Sls. Mgr.:* K. Imaizumi; *Dist. Mgr.:* S. Muramoto

SANKEN ELEC. U.S.A. CORP., 3848 Carson St., Ste. 105, Torrance, CA 90503, Tel: 213-540-2209, Telex: 181839; Empl.: 5; *Sls. Mgr.:* Mr. Tack Kunimi; *Dist. Mgr.:* Mr. Tack Kunimi

SAN-O INDUSTRIAL CORP., 85 Orville Dr., Bohemia, NY 11716, Tel: 516-567-5556, TWX: 510-228-7701; Empl.: 50; *Sls. Mgr.:* M. Castellano

SANTA BARBARA RESCH. CTR., 75 Coromar Dr., Goleta, CA 93117, Tel: 805-968-3511, Telex: 910-334-1885, TWX: Hacsbar; Empl.: 2025; *Sls. Mgr.:* D.K. Smith

SANTA FE TEXTILES, 3151 W. Adams St., Santa Ana, CA 92704, Tel: 714-751-7733; FSC No.: 31415; Empl.: 20; *Sls. Mgr.:* J. Tressen; *Dist. Mgr.:* J. Abbey

SANYO ELEC. INC., 200 Riser Rd., Little Ferry, NJ 07643, Tel: 201-641-2333, Telex: 134-394; Empl.: 500; *Sls. Mgr.:* H. Matsuoka ....**3**•1430

Local Sales Offices & Reps

CA	Compton	213-537-5830
IL	Schiller Park	312-671-3261
NJ	Little Ferry	201-641-2333

SANYO SEMICONDUCTOR CORP., 7 Pearl Ct., Allendale, NJ 07401, Tel: 201-825-8080, Telex: 135138 SANYOSEMI ALNJ; Empl.: 16; *Sls. Mgr.:* Koichi Takahashi; *Dist. Mgr.:* Aki Goto

SAPHIKON, 51 Powers St., Milford, NH 03055, Tel: 603-673-5831, Telex: 95-3067; Empl.: 45; *Sls. Mgr.:* K. G. Lonie

..SaRonix....

SARONIX, 4010 Transport at San Antonio, Palo Alto, CA 94303, Tel: 415-856-6900, Telex: 348465; FSC No.: 61441; Empl.: 24; *Sls. Mgr.:* Michael N. Blewett; *Dist. Mgr.:* Michael N. Blewett ....**1A**•1418, 1419

Local Sales Offices & Reps

AZ	Tempe, Elec Com	602-967-8644
CA	Culver City, Bestronics Inc.	213-870-9191
CA	Fallbrook, Matronix/Chilcote	619-728-7678
CA	Irvine, Bestronics Inc.	714-261-7233
CA	Southern California, Bestronics Inc.	213-704-5616
CA	Woodland Hills, Bestronics Inc.	213-704-5616
CO	Denver, Lindberg Co.	303-758-9033
FL	Orlando, Delmac Sls.	305-898-4688
GA	Marietta, Rick Burns Assoc.	404-951-1181
IL	Elk Grove Vlg., John G. Twist Co.	312-593-0200
IN	South Bend, Schillinger Assoc. Inc.	219-291-6258
KS	Overland Park, EPI Inc.	314-962-1411
MA	Andover, Richard Purinton	617-475-7055
MN	Bloomington, John G. Twist Co.	612-835-2120
MO	St. Louis, EPI Inc.	314-962-1411
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Englewood, Harold Gray Assocs.	201-894-0894
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Cazenovia, S. T. Woolard Co.	315-655-8145
NC	Raleigh, Rick Burns Assoc.	919-876-2224
OH	Dayton, J. C. Hofstetter	513-296-1010
OH	Medina, J. C. Hofstetter	216-241-4880
TX	Austin, Logic 1 Sls.	512-459-1297
TX	Houston, Logic 1 Sls.	713-462-0641
TX	Richardson, Logic 1 Sls.	214-234-3375
UT	Salt Lake City, Lindberg Co.	801-969-2400
WA	Bellevue, Hood Engrg.	206-953-9375
WI	Brookfield, John G. Twist Co.	414-782-2670
WI	Milwaukee, The John G. Twist Co.	414-782-2670
EXP	CA, Palo Alto, SaRonix	415-856-6900

Local Distributors

AZ	Tempe, Anthem Elctrns.	602-244-0900
CA	Chatsworth, Anthem Elctrns.	213-700-1000
CA	Costa Mesa, Deco Elctrns.	714-754-1322
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Diego, Anthem Elctrns.	619-279-5200
CA	San Jose, Anthem Elctrns.	408-946-8000
CA	Tustin, Anthem Elctrns.	714-730-8000
CO	Englewood, Anthem Elctrns.	303-790-4500
IN	Indianapolis, MAR Elctrns. Inc.	317-875-4510
MA	Andover, R² Elctrns.	617-475-3777
OR	Lake Oswego, Anthem Elctrns.	503-684-2661
TX	Addison, Active Comp. Technlg.	214-980-1888
TX	Austin, Active Comp. Technlg.	512-452-5254
TX	Houston, Active Comp. Technlg.	713-496-4000
UT	Salt lake City, Anthem Elctrns.	801-973-8555
WA	Redmond, Anthem Elctrns.	206-881-0850
Intl	England, Kent, Electrautom Ltd.	0622 673131
Intl	France, St. Quentin En Yvelines, A S A P	604 7878
Intl	Germany, Munich, LSI-Electronic Vertriebs	089 310-7272
Intl	Switzerland, Duebendorf-Zuerich, Compona	01 821-3737

SAVOY ELCTRNS., P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-327-1282, TWX: 510-955-9766; FSC No.: 59-1672492; Empl.: 60; *Sls. Mgr.:* Lorayne Beardsley

SAWTEK INC., P.O. Box 18000, Orlando, FL 32860, Tel: 305-886-8860, Telex: 514083, TWX: 810-862-0835; FSC No.: 58068; Empl.: 140 ....**1A**•1420, 1565, 1622, 1623

Local Sales Offices & Reps

AL	Huntsville, L&D Inc.	205-837-1469
AZ	Scottsdale, Faser Tech. Sls.	602-948-4404
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Van Nuys, R-L Assocs.	213-782-7826
FL	Maitland, D. J. Ellis & Assoc.	305-645-1101
GA	Atlanta, L & D	404-455-3483
IL	Palatine, R. Tek	991-222-1830
IN	Fort Wayne, R-Tek	219-432-8783
KS	Overland Park, Barnes-Midwest Sls.	913-341-9317
MD	Burtonsville, Eastern Instrmn. Corp.	301-384-8500
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
NH	Amherst, Callahan & Tremblay Inc.	603-883-9000
NJ	East Windsor, Micro-Lambda	609-443-3113
NY	Buffalo, Quality Comps.	716-837-5430
NY	Great Neck, Phase 4 Technical Rep., Inc.	516-482-1790
NY	Manlius, Quality Comps.	315-682-8885
NC	Greensboro, L & D	919-292-3201
NC	Raleigh, L & D	919-876-5301
OH	Fairfield, Selectron Sls. Assocs.	513-829-2251
TX	Richardson, Vector Sls.	214-234-4291

SAWYER INDS., 5649 Peck Rd., Arcadia, CA 91006, Tel: 213-442-5981, TWX: 910-587-3534; FSC No.: 18098; Empl.: 167

SAXTON PRODS., 215 N. Rte. 303, Congers, NY 10920, Tel: 914-268-6848, 800-431-2774, Telex: 13-1538; FSC No.: 16164; Empl.: 130; *Sls. Mgr.:* Bill Cullen; *Dist. Mgr.:* Steve Shelley ....**2**•2144-2149

Local Sales Offices & Reps

CA	Cerritos, Saxton Prod.	213-926-5596
CA	Livermore, Reptronixx	415-443-5343
CA	Pleasanton, Electro Des.	415-846-9257
CA	San Jose, Reptronixx	408-995-6433
CA	Santee, Southwestern Mktg.	619-562-2422
CO	Denver, J & B Sls.	303-698-2211
CT	Guilford, Phil Orzell Assocs.	203-453-6488
GA	Atlanta, Atlanta Cable Sls.	404-448-6311
GA	Marietta, Consumer Mktg.	404-424-9097
IN	Angola, Waid Assocs.	219-833-3523
MA	Milford, Jonel Sales Assocs.	617-478-4650
MA	Sharon, Adcour	617-784-8123
MN	Burnsville, Strong & Assocs.	612-890-3168
MS	Jackson, Welch & Dolby	601-932-5524
NJ	Livingston, Accurate Wire & Cable	201-533-0103
NY	Mohegan Lake, Travano & De Palma Assocs.	914-245-5269; 914-968-1084
OR	McMinnville, Electro Des.	503-472-0481
PA	Collegeville, Steve Linton	215-489-9473
TX	Austin, TPC	512-443-1577
TX	Dallas, TPC	214-357-8207
VA	Arlington, Howard Golen Paul & Assocs.	703-525-5898

Local Distributors

CA	Downey, David Levy Co.	213-869-2539
CA	Montebello, Atlas Wire & Cable	213-723-2401
CA	San Jose, Sundown Sls.	408-995-6433
CT	Manchester, Inventory Mgt. Svs.	203-649-4415
CT	Meriden, New England Insulated Wire	203-204-8927
MS	Hattiesburg, Wright Elctrn.	601-545-2545
NY	Brooklyn, Ceco Comm.	212-646-1617
NC	Greenville, Pair Elctrns.	919-756-8007
PA	Broomall, Omni Cable	215-544-7766
SC	Columbia, Hesco	803-254-4575
VA	Arlington, Arlington Elctrn.	703-524-2412
VA	Leesburg, Elctrn. Wire & Cable	703-777-3551

SCANBE DIV., 3445 Fletcher Ave., El Monte, CA 91731, Tel: 213-579-2300, TWX: 910-587-3437; Empl.: 125

SCANNING DEVICES, 108 Elm St., Waltham, MA 02154, Tel: 617-891-8991; Empl.: 25; *Sls. Mgr.:* Louis Goldenberg

SCHAEVITZ ENGRG., U.S. 130, Union Ave., Pennsauken, NJ 08110, Tel: 609-662-8000, TWX: 710-892-0714; FSC No.: 93190; Empl.: 325; *Sls. Mgr.:* F. R. Pisaro

Local Sales Offices & Reps

AZ	Scottsdale, Dave Menegay Assoc.	602-994-9519
CA	Long Beach, Saber Entprs.	213-595-5646
CA	San Carlos, Elctrn. Engrg.	415-593-2189
CA	San Diego, Saber Entprs.	714-271-1523
CO	Boulder, Meas. Conslts. of CO	303-449-7506
CT	Tolland, R.G. Assoc.	203-875-4201
FL	Orlando, MicroSpec, Inc.	305-299-6508
GA	Lawrenceville, MicroSpec	404-979-3444
IL	Deerfield, Torkelson Assoc.	312-945-8700
IL	Lombard, Patrick & Douglas	312-971-1800
IN	Indianapolis, Torkelson Assoc.	317-244-7867
KS	Mission, Vertec Assoc.	913-677-3200
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MI	Farmington Hills, Anderson Elctrns.	313-553-7600
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	Manchester, Vertec Assocs.	314-394-6242
NJ	Cherry Hill, Ana Lectro, Inc.	609-424-2883
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Latham, L-Tron Corp.	518-785-5032
NY	Rockaway Park, Metropolitan Sls.	212-634-3100
OH	Columbus, R. D. Cloon Assoc.	614-459-2890
PA	Pittsburgh, Wainwright Tech. Sls.	412-487-5055
SC	Rock Hill, MicroSpec	803-366-3015
TX	Dallas, Measurement Sys. & Sls.	214-243-5782
UT	Salt Lake City, Meas. Conslts. of UT	801-364-3174
WA	Seattle, Brett Assocs.	206-935-8054
WI	Brookfield, Torkelson Assoc.	414-784-7736
WI	Glendale, Stapleman Corp.	414-352-5777

SCHAFFNER EMC INC., Component Div., 825 Lehigh Ave., Union, NJ 07083, Tel: 201-851-0644, Telex: 685-3444; FSC No.: 201-467-1330; *Sls. Mgr.:* Thomas Pate

Local Sales Offices & Reps

AL	Brownsboro, JHU Assoc. Inc.	205-536-7455
AZ	Tuscon, Clemick & Assoc. Inc.	602-749-4003
CA	Burlingame, Jack Logan & Assoc.	415-348-8822
CA	Costa Mesa, Berman Gravley Co., Inc.	714-549-2122
CA	Fallbrook, Martronix	619-728-7678
CO	Westminster, D/Z Assoc. Inc.	303-429-9369
CT	No. Haven, Kitchen & Kutchin Inc.	203-239-0212
FL	Orlando, OEM Mktg. Corp.	305-293-7117
GA	Atlanta, JHU Assoc. Inc.	404-634-1000
MA	Burlington, Kitchen & Kutchin Inc.	617-229-2660
NJ	Teaneck, R T Reid Assoc. Inc.	201-692-0200
OH	Cleveland, Jim Finnegan & Co., Inc.	216-238-5905
OR	Portland, Harry Levinson Co.	503-245-1902
TN	Talbot, JHU Assoc. Inc.	615-581-4141
TX	Richardson, Lone Star Technlg. Inc.	214-238-2709
UT	Salt Lake City, D/Z Assoc. Inc.	801-486-4233
WA	Seattle, Harry Levinson Co.	206-382-1300

SCHAFFNER EMC INC., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083, Tel: 201-851-0644, Telex: 685-3444

Local Sales Offices & Reps

CA	Fullerton, GRU Assoc.	714-738-0903
CO	Boulder, Herb Bass Assoc.	303-530-7509
IL	Elk Grove Village, Loren F. Green Assoc./Cen.	312-593-0282
IN	Indianapolis, Loren F. Green Assoc. of Indiana	317-293-9827
MI	Northville, Micro Sls. Corp.	315-459-1670
MN	Minneapolis, Loren F. Green Assoc. of Minnesota	612-571-6666
OH	Centerville, Micro Sls. Corp.	513-433-8171
OH	N. Olmstead, Micro Sls. Corp.	216-734-3080
OR	Portland, Harry Levinson Co.	503-245-1902
WA	Seattle, Harry Levinson Co.	206-382-1300

SCHAUER MFG., 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, Telex: 21-4576; Empl.: 195; *Sls. Mgr.:* A. A. Groenewold; *Dist. Mgr.:* Dan Shaw

SCHNEIDER INSTR., 8115 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-6803; Empl.: 23; *Sls. Mgr.:* C. A. Schneider, Pres.

SCHONSTEDT INSTR. CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, TWX: 710-833-9880; Empl.: 45

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, TWX: 910-576-2964; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* A. Schmitt

SCHOTT ELCTRNS., Hershey Dr., Ansonia, CT 06401, Tel: 203-736-2677, Telex: 170 451 8911; *Sls. Mgr.:* Don Davis

SCHOTT OPTICAL GLASS INC., York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535; FSC No.: 23-169-1403; Empl.: 600; *Sls. Mgr.:* J. Nimmerfroh

SCHRACK NORTH AMERICA CORP., 76 N. Broadway, Irvington, NY 10533, Tel: 914-591-7900, Telex: 646149; Empl.: 4; *Sls. Mgr.:* Zach Zager

Schroff®

19" Systems for Electronics Packaging

SCHROFF INC., 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, Telex: 952175; *Sls. Mgr.:* Thomas Kennedy ....**2**•1053

Local Sales Offices & Reps

AL	Decatur, Tenn. Tech.	205-350-0630
AZ	Scottsdale, Luscombe Engr.	602-949-9333
CA	Campbell, Luscombe Engr.	408-370-2020
CA	Pasadena, Luscombe Engr.	213-684-2000
CA	San Diego, Luscombe Engr.	619-295-4300
FL	Pompano Beach, EMA	305-943-3732
FL	Winter Park, EMA	305-671-6800
GA	Atlanta, Tenn Tech.	404-622-5784
IL	Berkeley, Cadre Tech. Rep.	312-449-3900
MI	Troy, C. B. Jensen	313-643-0506
MN	Minneapolis, D. A. Case Assoc.	612-869-3700
NH	Salem, Sales Engr.	603-893-5521
NJ	Englewood, Sprung-Nussbaum	201-569-5666
NY	Central Sqare, Bastian Sls.	315-668-2957

NY	Fairport, Bastian Sls.	716-223-0237
NY	Port Crane, Bastian Sls. Agency Inc.	607-722-3421
NC	Raleigh, Tenn Tech.	919-266-3610
OH	Aurora, EMA	216-562-6104
OH	Centerville, EMA	513-433-2800
PA	Huntington Valley, Omega Elctrn. Sls.	215-947-4135
TX	Austin, CMZ	512-255-1663
TX	Garland, CMZ	214-681-1414
TX	Houston, CMZ	713-771-1500

SCHROFF UK LTD., Maylands Ave., Hemel Hempstead, Herts, HP2 4SG, England, Tel: 0442-40471/6, Telex: 825658; *Sls. Mgr.:* Mr. B-U Kaupisch

SCHULZ CONTROLS, INC., P.O. Box 9555, New Haven, CT 06511, Tel: 203-562-2555, 800-243-4570; Empl.: 35; *Sls. Mgr.:* Paula Calabrese; *Dist. Mgr.:* Paula Calabrese

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94952, Tel: 707-778-6311, Telex: 176-084; FSC No.: 61935; *Sls. Mgr.:* Bruno H. Schurter

Local Sales Offices & Reps

CA	Fullerton, Gru Assocs.	714-738-0903
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Lakewood, Cristee-Meade Co.	303-232-0287
FL	Ft. Lauderdale, IMR, Inc.	305-741-2449
IL	Arlington Hgts., MJ Petersen & Assoc., Ltd.	312-577-8200
MN	Minnetonka, Frank Anthony Mktg.	612-934-0773
MS	Jackson, Welch & Doby.	601-932-5534
NH	Nashua, Bell Controls	603-882-6984
NJ	Ho-Ho-Kus, D. J. Fisher Co.	201-652-0090
NJ	Medford, Champion Elctrn. Sls. Co.	609-983-0932
NY	Fairport, TAC Sls, Inc.	716-425-1070
OH	Beachwood, Electronic Salesmasters	216-831-9555
OR	Portland, Dussault & Associates Inc.	503-641-8780
TX	Austin, OM Sls., Inc.	512-452-1838
TX	Dallas, OM Sls., Inc.	214-241-3876
TX	Houston, OM Sls., Inc.	713-789-4426
WA	Seattle, Dussault & Associates Inc.	206-527-5454

Local Distributors

CA	San Jose, Quail Elctrns.	408-995-0812
FL	Clearwater, Elctrn. Hardware for Industry	813-577-2998
IL	Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc.	312-437-7120
MD	Rockville, FIC Corp.	800-638-6594
TX	Dallas, Fuses, Inc.	214-341-6407

SCHWEITZER, DIV., Kimberly Clark Corp., Lee, MA 01238, Tel: 413-243-1000, TWX: 413-243-2121; Empl.: 750

SCIENCE ACCESSORIES CORP., 970 Kings Hwy. W., Southport, CT 06490, Tel: 203-255-1526, Telex: 964300 SAC SPRT; *Sls. Mgr.:* H. A. Cleveland

SCIENCE/ELCTRNS., 1224-26 McCook Ave., Dayton, OH 45404, Tel: 513-228-6011, Telex: 288-004; Empl.: 25; *Sls. Mgr.:* E. E. Pohl; *Dist. Mgr.:* J. Tanksley

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994; Empl.: 57

Local Sales Offices & Reps

CA	Hayward, Avionics Liaison	415-783-1131
CA	San Jose, Scientific Spectrum	408-289-9733
CO	Englewood, SCT Sls., Inc.	303-761-2934
GA	Atlanta, Schoonover	404-396-8877
IL	Crystal Lake, Stanmatic Sls.	815-459-1741
MD	Silver Spring, SOC Assocs.	301-439-3200
NH	Deerfield, Kronk Scientific	603-463-7866
NJ	Oakland, Non-Linear Devices	201-337-0666
WA	Seattle, Avionics Liaison	206-767-3870

SCIENTIFIC-ATLANTA, INC., P.O. Box 105600, Atlanta, GA 30348, Tel: 404-441-4000, Telex: 0542898, TWX: 810-766-4912

SCIENTIFIC-ATLANTA, INC., New Jersey Div., Randolph Park W., Rte 10, Randolph Township, NJ 07801, Tel: 201-361-3100, TWX: 710-987-7946; Empl.: 100; *Sls. Mgr.:* E. Stagnitti

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

SCIENTIFIC COLUMBUS, INC., Esterline Corp., 1900 Arlingate La., Columbus, OH 43228, Tel: 614-274-7160, Telex: 245-426; Empl.: 210; *Sls. Mgr.:* Don Yore; *Dist. Mgr.:* Don Yore .... **1B**•1876, 1877

Local Sales Offices & Reps

AL	Birmingham, Spader & Assocs.	205-879-1366
AZ	Scottsdale, Young of Ariz.	602-991-9191
CA	Glendale, R. A. Young & Co.	213-242-2171
CA	S. San Francisco, Wrathall & Krusi	415-777-0226
CO	Denver, Cliff Beabout Co.	303-831-7259
FL	Orlando, RJC Assocs.	305-894-7371
GA	Decatur, Spader & Assocs.	404-296-3024
HI	Honolulu, Berkley Engrg. & Equip. Co.	808-845-9377
IL	La Grange, PVA Co.	312-579-9300
IN	Nobelsville, C. D. Arnold Co.	317-773-5821
IA	Cedar Rapids, Harry Ferris Co.	319-377-1226
IA	Des Moines, Harry E. Ferris Co.	515-255-5008
KS	Kansas City, Power Equip. Sls. Co.	913-384-3848
LA	Baton Rouge, Mid-South Sls. Co.	504-924-0106
LA	Slidell, Mid-South Sls. Co.	504-641-7480
MA	Needham Heights, Danek Assocs.	617-444-8838
MI	Troy, George R. Peters Assocs.	313-362-1220
MN	Minneapolis, Arjay Sls.	612-854-4972
MO	St. Louis, Ken Way Co.	314-567-0051
NE	Lincoln, Harry Ferris Co.	402-464-6148
NM	Albuquerque, Bryant Co.	505-843-9450
NY	Albany, Robert F. Lamb Co.	518-869-3355
NY	Buffalo, Robert F. Lamb Co.	716-874-4900
NY	Rochester, Robert F. Lamb Co.	716-544-5580
NY	Syracuse, Robert F. Lamb Co.	315-455-2469
NC	Charlotte, Robert W. Chapman & Co.	704-525-2421
NC	Greensboro, Robert W. Chapman & Co.	919-282-0740
NC	Raleigh, Robert W. Chapman & Co.	919-782-2524
OH	Cincinnati, Annett Indl. Sls.	513-271-0030
OH	Cleveland, M. A. Blankenburg & Co.	216-251-7010
OK	Tulsa, C. B. Anderson Elec. Co.	918-836-4661
OR	Portland, McLaren Inc.	503-297-2248
PA	Dylestown, The Gee Co.	215-348-3300
PA	Philadelphia, Gee Co.	215-348-3300
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
SC	West Columbia, Robert W. Chapman & Co.	803-256-0072
TN	Murfreesboro, Robert W. Chapman & Co.	615-895-1019
TX	Amarillo, C. B. Anderson Electric Co.	806-376-6443
TX	Arlington, Ev Smith Sls. Co.	817-572-2911
TX	Houston, Ev Smith Sls. Co.	713-649-5756
UT	Salt Lake City, Instrumentation Sls.	801-277-2044
VA	Alexandria, Hildenbrand Co.	703-998-0445
VA	Richmond, Robert W. Chaman & Co.	804-744-4848
WA	Bellevue, McLaren Inc.	206-454-3400
WI	Wauwatosa, T. R. Bickler Assocs.	414-784-2600

SCIENTIFIC COMMUNICATIONS, INC., 3425 Kingsley Rd., Garland, TX 75041, Tel: 214-271-3685, TWX: 910-860-5172; *Sls. Mgr.:* Donald G. Luiken

SCIENTIFIC RADIATION CORP., 1201 San Antonio Rd., Mountain View, CA 94043, Tel: 415-965-0910, Telex: 345506; *Dist. Mgr.:* James A. Lazzara

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

SCIENTIFIC TECHNLG., 1201 San Antonio Rd., Mountain View, CA 94043, Tel: CA 415-965-0910, 800-221-7060, Telex: 34-5506; Empl.: 50

SCOTT AVIATION, Figgie International Inc., 123 East Montecito Ave., Sierra Madre, CA 91024, Tel: 213-355-4281

SCREENPRINT/DOW INDUSTRIES, 271 Ballardvale St., Wilmington, MA 01887, Tel: 617-935-6395, Telex: 948227; *Sls. Mgr.:* W. F. Donovan Jr.

SEABOARD ELCTRNS., 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, Telex: 646289; Empl.: 78; *Sls. Mgr.:* Dr. Richard Ader; *Dist. Mgr.:* Dr. R. Ader

SEACLIFF TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-661-4800

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600, Telex: 135-354; Empl.: 45 .... **1A**•1183

Local Sales Offices & Reps

AZ	Scottsdale, Arcom Sales	602-947-5745
CA	Santa Ana, Seacor West	714-641-4040
IL	Skokie, Mar-Con	312-675-6450
MI	Farmington, Amtech Reps.	313-474-8300
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NY	Rochester, Sweetco	716-225-2383
NY	Utica, Sweetco Assoc.	315-797-6721
OH	Northfield, Val-Skol Sls.	216-467-1392
PA	King of Prussia, D. Freedman	215-279-5767
TN	Chattanooga, Dimark	615-892-7630
TN	Greenville, Dimark	615-639-0113
TX	Cypress, Wessco Prods.	713-469-7814
TX	Garland, Wessco Prods.	214-530-8857
PR	San Juan, David S. Ternent	809-762-2688

Local Distributors

AZ	Tempe, T.T.I	602-966-1616
CA	Burbank, TAW Elctrns.	213-846-3911
CA	Cypress, On-Line Elect.	714-826-8200
CA	Garden Grove, Natl. Cap. Supp.	800-854-2451
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	Santa Clara, California Capacitor	408-980-8495
CT	Stratford, Utronics	203-378-4201
IL	Chicago, Bell Indus.	312-982-9210
MD	Beltsville, Resco/Wash.	301-937-9100
MA	Burlington, TLC	617-273-0140
MA	N. Chelmsford, Pilgrim Elect.	617-251-8746
MA	Needham, Cronin	617-449-0500
MI	Westland, Westland Elctrns.	
MN	Minneapolis, The Joel Corp.	612-545-5669
NY	Farmingdale, SAI	516-293-2710
NY	Lynbrook, Varitech Elctrns.	516-593-9300
OH	Cleveland, Roberts Elctrns.	
OK	Pryor, Combined Technology	918-825-5715
PA	Philadelphia, Jan Indl. Elec.	215-922-1321
TX	Addison, Captronics	214-980-0123
TX	Austin, Captronics	512-459-4328
TX	Ft. Worth, Allied Elect.	817-336-5401
TX	Ft. Worth, T.T.I	817-831-0441
TX	Houston, Captronics	713-776-2100

SEA DATA CORP., One Bridge St., Newton, MA 02158, Tel: 617-244-3216, Telex: 951107; Empl.: 40; *Sls. Mgr.:* W. Hill

SEALECTRO, 225 Hoyt St., Mamaroneck, NY 10543, Tel: 914-698-5600; Empl.: 1600; *Sls. Mgr.:* T. Lynn; *Dist. Mgr.:* N. Buonanno .... **2**•1561

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Phoenix, M/R Engrg.	602-956-4670
CA	Carlsbad, Addem Elctrns.	619-729-9216
CA	Manhattan Beach, Sealectro West	213-318-3326
CA	Mountain View, Sealectro West	415-965-1212
CO	Denver, Spectrum Sls.	303-696-1601
FL	Orlando, OEM Mktg.	305-299-1000
GA	Norcross, Montgomery Mktg.	404-447-6124
ID	Boise, N. R. Schultz	208-377-8686
IL	Arlington Hgts., Diethert-Angel	312-593-7600
KS	Overland Park, Advanced Tech. Sls.	913-642-6675
MD	Rockville, Mechtronics Sls.	301-340-2130
MO	Ellisville, Advanced Tech. Sls.	314-227-4448
NH	Salem, Sls. Engrg.	603-893-5521
NJ	Marlton, BGR Assocs.	609-428-2440
NY	Mt. Vernon, Friedman-Smith	914-664-4866
NY	Syracuse, I. A. Hotze Assoc.	315-479-6641
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Columbus, McFadden Sls.	614-459-1280
OR	Beaverton, N. R. Schultz	503-643-1644
TX	Dallas, Allied Comps.	214-238-0408
WA	Bellevue, N. R. Schultz	206-454-0300

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, R. V. Weatherford	602-272-7144
CA	Glendale, R. V. Weatherford	213-849-3451
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Sunnyvale, R. V. Weatherford	408-738-8694
FL	Altamonte Springs, Pioneer/Fla.	305-834-9090
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Deeco	319-365-7551
KS	Wichita, Radio Supp.	316-267-5213
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Columbia, Powell Elctrns.	301-995-0410
MD	Gaithersburg, Pioneer Elctrns.	301-921-0660
MA	Burlington, Milgray Elctrns.	617-272-6800
MA	Westboro, Powell Elctrns.	617-366-6100
MN	Minneapolis, Indl. Comps.	612-831-2666
MO	Maryland Hgts., L Comp	314-291-6200
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Bohemia, Car Lac Elctrns.	516-567-4200
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Rochester, Summit Distrs.	716-334-8110
NC	Charlotte, Pioneer Elctrns.	704-527-8188
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Solon, Repco Elctrns.	216-248-8900
PA	Horsham, Pioneer/Delaware Valley	215-674-4000
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Dallas, Pioneer/Dallas	214-386-7300
TX	Dallas, R. V. Weatherford	214-931-7333
WA	Seattle, R. V. Weatherford	206-575-1340

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400

SEASTROM MFG. CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 818-245-9121, TWX: 910-497-2271; FSC No.: 86928; Empl.: 75

SEATTLE COMPUTER PRODUCTS, INC., 1114 Ind. Dr., Seattle, WA 98188, Tel: 206-575-1830, 800-426-8936; *Sls. Mgr.:* Max Gerdts

SECURITY PLASTICS INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, Telex: 803303; Empl.: 350; *Sls. Mgr.:* J. Licht

SEIKO INSTRUMENTS

SEIKO INSTRS. U.S.A., INC., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-530-8777, TWX: 910-347-7307; *Sls. Mgr.:* John Hawkins, Lee Guio; *Dist. Mgr.:* Lee Guio, John Hawkins .... **1A**•1421; **1B**•1095; **3**•1091

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-533-2100
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Los Alamitos, Santana Sls.	714-827-9100
CA	San Diego, SR Elctrns.	619-560-8330
CA	Santa Clara, Quorum Tech. Sls.	408-980-0812
CT	Madison, Forsberg Sls.	203-245-4314
FL	Clearwater, Gallagher & Assocs.	813-726-3187
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Atlanta, Electro-Mech	404-447-6478
IA	Cedar Rapids, Coombs Assocs.	319-362-4116
KS	Overland Park, Kebco	913-541-8431
KS	Wichita, Kebco	316-733-1301
MD	Annapolis, Vince Iorio Assocs.	301-261-1716
MA	Brockton, Forsberg Sls.	617-522-6300
MI	Grosse Pointe Pk., Greiner Assoc.	313-499-0188
MN	Bloomington, Quantum Sls.	612-884-4700
MO	Maryland Hgts., Kebco	314-576-4111
NM	Albuquerque, Fred Board Assocs.	505-293-1399
NY	Kingston, R. P. Kennedy Co.	914-876-2700
NY	Rochester, R. P. Kennedy Co.	716-271-6322
NY	Rochester, R. P. Kennedy Co.	607-271-6322
OH	Akron, Imtech	216-666-1185
OH	Dayton, Imtech	513-278-6507
OR	Tigard, Components West	503-684-1671
PA	Broomall, TCA Assocs.	215-353-2022
TN	Nashville, Electro-Mech	615-753-5841
TX	Austin, TL Mktg.	512-453-4586
TX	Dallas, TL Mktg.	214-357-1752
WA	Redmond, Components West	206-885-5880

Local Distributors

AL	Huntsville, Contact Elctrns.	205-881-9321
AZ	Phoenix, Sterling Elctrns.	602-268-2121
CA	Santa Ana, Pacesetter Elctrns. USA	714-557-7131
CA	Sunnyvale, Pacesetter Elctrns. USA	408-734-5470
CA	Walnut, A.C.I. Elctrns. Corp.	213-331-0735
CO	Denver, A.C.T.	303-422-9229
CT	Wallingford, Sterling Elctrns.	203-265-9535
LA	Metairie, Sterling Elctrns.	504-887-7610
MD	Middletown, Current Comps.	301-473-5333
MA	Waltham, Sterling Elctrns.	617-894-6200
MA	Woburn, A.C.I. Elctrns. Corp.	617-935-7230
MO	St. Louis, Ric-Tronics	314-576-9816
NJ	Perth Amboy, Sterling Elctrns.	201-442-8000
NM	Albuquerque, Sterling Elctrns.	505-884-1905
NY	Plainview, A.C.I. Elctrns. Corp.	516-293-6630
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Lake Oswego, Moore Elctrns.	503-684-3100
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-627-9800
UT	Salt Lake City, A.C.T.	801-487-8131
VA	Richmond, Sterling Elctrns.	804-226-2190
Can	Downsview, Westburne Indl. Entprs.	416-635-2950

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-530-8777; *Sls. Mgr.:* John Dudley

SEKAI ELCTRNS. OF AMER., INC., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638, Tel: 714-670-1854, Telex: 685521; FSC No.: 8V398; Empl.: 4; *Sls. Mgr.:* Larry Klementowski

SELCO PRODUCTS CO., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673, Telex: 65-5457; Empl.: 18; *Sls. Mgr.:* Bill Wilkinson; *Dist. Mgr.:* Ray McDowell

SELEC-KEY, Microdot, 302 Roma Jean Pkwy., Streamwood, IL 60103, Tel: 312-837-7970; *Sls. Mgr.:* Charles Stelzner

SEL-REX DIV., OMI Intl. Corp., 75 River Rd., Nutley, NJ 07110, Tel: 201-667-5200, Telex: 133-320, TWX: 710-989-1423; Empl.: 250; *Sls. Mgr.:* Larry Price

SEMCO, Rte. 6, No. Windham, CT 06226, Tel: 203-423-6316; *Sls. Mgr.:* Alan Giordano

SEMICOA, 333 McCormick Ave., Costa Mesa, CA 92626, Tel: 714-979-1900, Telex: 678-315, TWX: 910-595-1961; FSC No.: 34156; Empl.: 65; *Sls. Mgr.:* Mark Ellsberry

SEMICON, 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, TWX: 710-332-1919; Empl.: 550; *Sls. Mgr.:* Tom Le Blanc; *Dist. Mgr.:* L. Le Bow

SEMICONDUCTOR CIRCUITS, INC.

SEMICONDUCTOR CIRCUITS, 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, TWX: 710-366-0505; Empl.: 500; *Sls. Mgr.:* Steven Troscianecki; *Dist. Mgr.:* Marc Gauthier .... **3**•1759-1766

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Scottsdale, Sls. Engrg.	602-994-3230
CA	Milpitas, Lee/Allan Assocs.	408-946-8300
CA	San Diego, Tauber & Associates	619-274-7242
CA	Thousand Oaks, SC^3	805-496-7307
CA	Tustin, SC^3	714-731-9206
CO	Denver, Component Sls.	303-759-1666
CT	Westport, Compass Technology, Inc.	203-222-1787
FL	Ft. Meyers, Rainbow Sales, Inc.	813-332-2210
FL	Melbourne, Rainbow Sls. Inc.	305-259-6692
GA	Atlanta, Remco	404-447-6937
IL	Des Plaines, Janus	312-298-9330
IN	Fort Wayne, Wilson Technical Sales	219-424-5288
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
IA	Des Moines, The Beams Company	515-255-1148
KS	Shawnee Mission, The Beams Company	913-631-0300
MD	Baltimore, Micro Comp.	301-247-0400
MA	Woburn, Compass Technology, Inc.	617-933-3336
MI	Brighton, A.P. Associates	313-299-6550
MN	Minneapolis, Northstar Comps.	612-553-1888
MO	St. Louis, The Beams Company	314-434-8448
NJ	Livingston, Varrelman-Gorman Co.	201-992-2505
NY	Clark Mills, KLM Garner	315-853-6126
NY	North Syracuse, KLM Garner	315-458-6214
NY	Pittsford, KLM Garner	716-381-8350
NC	Raleigh, Remco	919-847-5079
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter Co.	210-241-4880
OK	Tulsa, Southern States Mktg.	918-665-8338
PA	Hickory, J.C. Hofstetter Co.	412-356-2305
PA	King of Prussia, KSI	215-783-6400
TX	Austin, Southern States Mktg.	512-473-2741
TX	Houston, Southern States Mktg.	713-988-0991
TX	Richardson, Southern States Mktg.	214-238-7500
UT	Salt Lake City, Component Sls.	801-466-8623
WA	Maple Valley, Electronic Sls. N.W.	206-432-1002
WI	Milwaukee, Janus	414-476-9104

Local Distributors

CA	Milpitas, Power Systems Distrs.	408-946-8300
GA	Atlanta, Trans-Southern Elctrns.	404-451-4425
IL	Elk Grove Village, GBL/Goold Elctrns.	312-593-3222
IN	Carmel, Altex Elctrns.	317-848-1323
MD	Baltimore, MPI	800-368-2527
MA	Wellesley Hills, Target Elctrn. Supp.	617-235-2545
MI	Brighton, A.P. Sales, Inc.	313-229-6550
NY	Rochester, Simcona Elctrns.	716-328-3230
OR	Lake Oswego, Moore Elctrns.	503-684-3100
TX	Stafford, Southwest Elctrns.	713-240-4000

SEMICONDUCTOR PACKAGING MATLS. CO. INC., 700 Waverly Avenue, Mamaroneck, NY 10543, Tel: 914-698-5353, TWX: 710-566-1103

SEMICONDUCTOR TECHNLG., INC., 3131 S.E. Jay St., Stuart, FL 33494, Tel: 305-283-4500, TWX: 510-953-7511; Empl.: 45

SEMIKRON INTL., INC., 11 Executive Dr., P.O. Box 66, Hudson, NH 03051, Tel: 603-883-8102, TWX: 710-228-1494; FSC No.: 58687; Empl.: 40; *Sls. Mgr.:* Frank Haase

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Phoenix, Trembly Assocs.	602-967-2058
CA	Downey, Trimarco	213-861-8244
CA	Redwood City, Ault Assocs.	415-367-1710
CO	Denver, Trembly Assocs.	303-233-9544
FL	Oldsmar, Boggs & Assocs.	813-855-1812
GA	Atlanta, Remco	404-447-6937
HI	Honolulu, Aloha Assocs.	808-951-1574
IL	Chicago, Ropek, Cahill & Vogt	312-631-0070
KS	Kansas City, Harris-Hanson Co.	816-763-6200
MI	Detroit, Favco	313-644-0173
MN	Eden Prairie, Bohlig & Assocs.	612-944-8404
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NV	Las Vegas, Trembly Assocs.	702-369-8700
NH	Hudson, Eva-Tec Mktg.	603-888-7478
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Albany, H.C. Johnson Agencies	518-459-1239
NY	Buffalo, H. C. Johnson Agencies	716-632-7880
NY	Rochester, H. C. Johnson Agencies	716-586-0777
NC	Raleigh, Remco	919-847-5079
OH	Dayton, Cleary Sls. Co.	513-890-8642
OH	Hamilton, B & J Entprs.	513-863-1353
OR	Portland, Doran Sls. Assocs.	503-357-3333
PA	Pittsburgh, Electrosystems Sls.	412-468-8811
TX	Kingwood, Coulomb Elctrns. & Assocs.	713-358-9595
UT	Salt Lake City, Trembly Assocs.	801-486-5292
WA	Seattle, Doran Sls. Assocs.	206-885-1885

Local Distributors

MI	Detroit, Osborne Transformer Co.	313-368-4136
NJ	Roselle, Lectron Inds.	201-245-5858
NC	Gastonia, JMT Elctrns. & Controls	704-867-4401
WA	Seattle, Pacific Elctrns.	206-575-1050

SEMTECH, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 213-628-5392, TWX: 910-336-1264; FSC No.: 14099; Empl.: 350

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 605-339-0100, TWX: 910-660-0300; Empl.: 250

SENSITEK CORPORATION, 1000 Lincoln Drive, Marlton, NJ 08053, Tel: 609-983-3600, TWX: 710-897-1648; *Sls. Mgr.:* E. F. Bickel

Sensitive Research

SENSITIVE RESEARCH INSTRS., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590; Empl.: 35 .... **3**•1296-1298

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CO	Commerce City, Williams Assocs.	303-289-5647
DC	Washington, Whitcomb Assocs.	202-737-0763
IL	Lincolnwood, Saffro & Assocs.	312-677-9720
KS	Shawnee Mission, Comtel - Midwest	913-722-1030
MD	Baltimore, Whitcomb Assocs.	301-889-1245
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Comtel - Midwest	314-991-5363
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Dayton, Comtel Instrs. Co.	513-298-7573
OH	Hilliard, Comtel Instrs. Co.	614-876-8305
OK	Tulsa, Data Mktg. Assocs.	918-438-4911
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
UT	Salt Lake City, Williams Assocs.	801-532-7701
WI	Lake Mills, Saffro & Assocs.	414-648-2605

SENSOR CORP., Box 140, Scottdale, PA 15683, Tel: 412-887-4080; Empl.: 6

SENSOR ELECTRONICS, INC., 105 Fairway Terrace, Mt. Laurel, NJ 08054, Tel: 609-778-0850; *Sls. Mgr.:* J. M. Langberg; *Dist. Mgr.:* J. M. Langberg

SENSOR SCIENTIFIC, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006, Tel: 201-227-7790; *Sls. Mgr.:* Bob Brinley

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, Telex: 69-1583; *Sls. Mgr.:* E. Schneider

SENSORTEK, INC., 154 Huron Ave., Clifton, NJ 07013, Tel: 201-779-5577; Empl.: 24

SENSOR TECHN., 21012 Lassen St., Chatsworth, CA 91311, Tel: 213-882-4100, TWX: 910-494-4776; Empl.: 350; *Sls. Mgr.:* Robert Bryden

SENSOTEC INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, Telex: 176376, TWX: 910-339-9625; *Sls. Mgr.:* Joe Fijak; *Dist. Mgr.:* Joe Fijak

SENTRY MFG., Crystal Park, Chickasha, OK 73018, Tel: 405-224-6780, 800-654-8850, TWX: 910-830-6425; Empl.: 150; *Sls. Mgr.:* R. Stephens

SEQUENTIAL INFO. SYS., 249 N. Saw Mill River Rd., Elmsford, NY 10523, Tel: 914-592-5930, TWX: 710-567-1212; Empl.: 90; *Sls. Mgr.:* Murray E. Vinarub

Local Sales Offices & Reps

AL	Jasper, Smith Lake Automation	205-221-2492
CA	Campbell, Sedillo Co.	408-374-5220
CA	Huntington Beach, Wheatcroft Engrg.	714-964-4681
HI	Honolulu, Aloha Assocs.	808-941-1574
IL	Schaumberg, Control Sys. Research	312-228-8061
MA	Bedford, Datasource	617-275-8460
MI	Detroit, Automatic Controls	313-533-8890
MN	Minneapolis, Busch Elctrns.	612-835-2044
MO	St. Louis, Prod. Automation	314-441-6600
NJ	Point Pleasant, A. Ackerman (E. Reg. Sls. Mgr.)	201-295-2737
NY	Elmira, Powertrain	607-962-3291
OH	Cincinnati, J. W. Murray	513-574-8500
OH	Cincinnati, J.W. Murray	513-574-8500
OH	Cleveland, Automatic Controls	216-631-0333
PA	King of Prussia, Freedman & Malta	215-337-9211
TX	Houston, Scientific Sls.	713-460-9170
TX	Richardson, Scientific Sls.	214-231-6541
VA	Springfield, Mid-States Mktg.	703-569-2661
WA	Seattle, Penryn Sls. & Engrg.	203-783-4334
WI	Shorewood, Werking Indl. Sls.	414-964-2225

SERIAL LAB PRODS., INC., 50 Brigham St., P.O. Box 766, Marlboro, MA 01752, Tel: 617-481-1684, Telex: 955318 Attn: SERIAL LAB; Empl.: 12; *Sls. Mgr.:* R. L. Wiedeman; *Dist. Mgr.:* D. Kreck

Local Sales Offices & Reps

CA	San Carlos, Electronic Engrg. Assocs.	415-593-2189
CT	Hamden, Digital Sls. Assocs.	203-248-3641
FL	Indian Rocks Beach, Par Assocs.	813-596-8841
GA	Atlanta, Par Assocs.	404-448-4181
IL	Chicago, Electro Tech Mktg.	312-588-4535
MD	Gaithersburg, Wright Mktg. Co. Ltd.	301-840-1928
MA	Waltham, Digital Sls. Assocs.	617-899-4300
MN	Minneapolis, Deerland Distrs.	612-331-6433
MO	Grandview, Digital Systems Sls.	816-765-3337
TX	Houston, Dalton Systems	713-556-1216
TX	Lewisville, Dalton Systems	214-221-5611
WI	Milwaukee, Deerland Distrs.	414-258-7660

SERMETEL, 155 Limerick Rd., Limerick, PA 19468, Tel: 215-948-5100, Telex: 84-6335, TWX: 710-637-1263; Empl.: 177; *Sls. Mgr.:* Luke McLaughlin

SERVO-INSTRS. CORP., See Valley Electromagnetics

SERVOMETER CORP., 501 Little Falls Rd., Cedar Grove, NJ 07009, Tel: 201-785-4630; FSC No.: 18469; Empl.: 105; *Sls. Mgr.:* D. Walker

SERVO-TEK PRODS. CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100; Empl.: 86; *Sls. Mgr.:* J. Duffy .... **1B**•1177

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Denver, Anderson Controls	303-692-0290
DC	Washington, Automation Indl. Control	301-944-8400
FL	Orlando, Seybert Sls.	305-299-6508
GA	Lawrenceville, MicroSpec	404-979-3444
IL	Hinsdale, Patton Sls.	312-325-2170
IN	Ft. Wayne, Aktron Corp.	219-747-3650
MA	Salem, Forbes Engrg. Sales	617-744-1693
MN	St. Paul, Northstar Motion & Control	612-770-5311
OH	Chagrin Falls, K. F. Nauerz Co.	216-338-8450
OH	Cincinnati, Drivex Corp.	513-474-5100
OR	Beaverton, Halbar Assoc.	503-226-0451
SC	Rock Hill, Johnson Sls.	803-366-3015
TN	Knoxville, Stephenson Controls & Sys.	615-588-7474
VA	Richmond, Automation Indl. Control	804-741-3253
WA	Redmond, Halbar Assocs.	206-882-0990

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 617-263-1400, Telex: 948440; FSC No.: 53367; Empl.: 65; *Sls. Mgr.:* William R. Stern

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno Metrics	205-533-9073
CA	Los Altos, Qcon, Inc.	415-941-5530
CA	Los Angeles, Dynasales Co.	213-268-1175
CO	Westminster, RMS Sls.	303-429-1111
FL	Orlando, Datarep	305-843-5224
GA	Atlanta, Craft Assocs.	404-256-0420
IL	Chicago, Data Elctrns.	312-283-0300
IN	Indianapolis, Data Elctrns.	317-359-5368
LA	Metairie, Slaton & Assocs. Inc.	504-455-3855
MA	Framingham, J. M. Lancaster Co.	617-875-8893
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Plymouth, Data Elctrns.	612-559-1434
MO	St. Louis, Adelphi, Inc.	314-821-1232
NJ	Cedar Grove, KLS Assocs.	201-785-4450
NY	E. Rochester, A&D Devices	716-385-2778
OH	Cleveland, Tiby Co.	216-371-5335
OH	Tulsa, Inotek Corp.	918-622-8570
OR	Portland, McLaren, Inc.	503-297-2248
PA	Cheltenham, Stein Instrumentation	215-379-1990
TX	Dallas, Inotek Corp.	214-243-7000
TX	Houston, Inotek Corp.	713-688-7000
WA	Bellevue, McLaren, Inc.	206-454-3400

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91341, Tel: 213-365-9411, TWX: 910-496-1535; FSC No.: 96733; Empl.: 2000; *Sls. Mgr.:* J. Lucia; *Dist. Mgr.:* J. Lucia

SGL ELECTRONICS, 300 Harvard Ave., Westville, NJ 08093, Tel: 609-456-7300, TWX: 710-944-0758; Empl.: 60; *Sls. Mgr.:* Dan Holdstein

Local Sales Offices & Reps

AZ	Phoenix, Conductors & Dielectrics, Inc.	602-263-0042
CA	S. Pasadena, Deniston/JDA	213-289-2844
CA	San Francisco, Conductors & Dielectrics, Inc.	415-494-1044
FL	St. Petersburg, K-Square	813-381-1893
IL	Hanover Park, J. R. Ripley Assocs.	312-289-5365
MA	Newton Upper Falls, Anchor Engrg. Corp.	617-964-6205
MN	Minneapolis, Charles D. Atwater Assoc.	612-925-1672
NJ	Berkeley Heights, Cambridge Allen	201-464-0203
NY	Camillus, Ontec Elctrn. Mktg. Inc.	315-672-5626
NY	New York, Cambridge Allen Assoc.	212-592-6361
NY	Rochester, Ontec Elctrn. Mktg. Inc.	716-464-8636
NY	Wappingers Falls, Ontec Elctrn. Mktg. Inc.	914-462-7188
NC	Garner, Candor Co.	919-876-4999
OH	Akron, Augnat Assocs.	216-239-1621
OR	Portland, Conductors & Dielectrics, Inc.	503-242-1456
SC	Myrtle Beach, Candor Co.	803-448-8361
TX	Dallas, Southwest Elctrn. Inds.	214-690-9881
TX	Houston, Dunkel Elctrns. Assoc.	713-729-1670
WA	Seattle, Conductors & Dielectrics, Inc.	206-282-5032

SGL HOMALITE, Div. of SGL Inds., 11 Brookside Dr., Wilmington, DE 19804, Tel: 302-652-3686, TWX: 510-666-3450; Empl.: 70; *Sls. Mgr.:* R. L. Quell

SGL INDUSTRIES, 76 Euclid Ave, Haddonfield, NJ 08033

SGL PLASTICS, Route 248, Nazareth, PA 18064, Tel: 215-759-0280; Empl.: 60; *Sls. Mgr.:* W. Tomko

SGL PRINTED CIRCUITS, 827 Black Oak Ridge Rd., Wayne, NJ 07470, Tel: 201-835-2765; Empl.: 34; *Sls. Mgr.:* R. J. Puzo

SGL WABER®

SGL WABER, 300 Harvard Ave., Westville, NJ 08093, Tel: 609-456-5400, 800-257-8384; Empl.: 170; *Sls. Mgr.:* R. C. Waldron .... **2**•1864; **3**•1909

Local Sales Offices & Reps

AL	Huntsville, Hollingsworth & Still	205-859-5562
CA	Burlingame, Carelli-EMA	415-342-5546
CA	Gardena, Ungar Sls. Assocs.	213-538-2811
CO	Denver, Walter Engrg.	303-777-5585
FL	Miami, Hollingsworth & Still	305-431-1631
FL	Orlando, Hollingsworth & Still	305-859-9423
FL	Winter Park, Hollingsworth & Still	305-678-2858
GA	Norcross, Hollingsworth & Still	404-447-1700
HI	Honolulu, Lee Gabor Co.	808-536-2457
IL	Northbrook, Wm. M. Linz Assocs.	312-498-9600
IN	Indianapolis, Robert Milsk Co.	317-842-3400
MD	Silver Spring, David S. Linz Co.	301-593-2477
MA	Scituate, K. J. Walsh & Assocs.	617-545-3145
MI	Southfield, Robert Milsk Co.	313-354-3310
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	Blue Springs, Kathrinus-Kelly-Baumhauer	816-229-0001
MO	St. Louis, Kathrinus-Kelly-Baumhauer	314-627-2400
NM	Albuquerque, C. T. Carlberg & Assocs.	505-888-3883
NY	Rochester, Warren Kaufman & Assocs.	716-266-2728
NY	Whitestone, Jack Brown Sls.	212-769-1979
NC	Kernersville, Hollingsworth & Still	919-996-4622
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OR	Beaverton, Wm. J. Purdy Co.	503-641-9373
PA	Philadelphia, David S. Linz Co.	215-379-0734
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
TX	Dallas, Forner Sls. Co.	214-241-2166
WA	Redmond, Wm. J. Purdy Co.	206-882-3144

Local Distributors

AL	Huntsville, Mock Elctrns.	205-539-2401
AZ	Phoenix, Parts Elctrn.	602-258-6476
AZ	Tucson, Inland Elect.	602-889-5301
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Berkeley, Al Lasher's Dealer Elect.	415-843-5915
CA	Canoga Park, Sandy's Elctrn. Supp.	213-346-8353
CA	Costa Mesa, MarVac Elctrns.	714-540-3280
CA	El Monte, Claude Michael	213-696-0141
CA	Fullerton, Orvac Elctrns.	714-871-1020
CA	Gardena, California Switch & Signal	213-770-2330
CA	Glendale, Western Elctrns.	213-246-4861
CA	Hollywood, Pacific Radio Exch.	213-462-1393
CA	Hollywood, Yale Radio	213-465-3186
CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Pasadena, Dow Radio	213-793-1195
CA	Riverside, Electronic Supp.	714-836-7300
CA	San Diego, Shanks & Wright	714-239-0176
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Sunnyvale, Com-Kyl	408-734-9660
CO	Denver, Denver Wintronics	303-934-2406
CO	Denver, Elctrn. Parts	303-744-1992
CT	Stamford, Mar Le Co.	203-348-2645
CT	Waterbury, Suburban Supp.	203-757-1251
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Miami, ESL Elctrn. Distrs.	305-633-6973
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Pensacola, Grice Elctrns.	904-434-2481
GA	Atlanta, Ack Radio Supp.	404-351-6340
GA	Atlanta, Specialty Distrib.	404-873-2521
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Elk Grove Village, GBL Elctrns.	312-593-3220
IL	Niles, Joseph Elctrns.	312-297-4200
IL	Northbrook, Classic Comps.	312-272-9650
IL	Palatine, Ohm Elctrns.	312-359-5500
IL	Peoria, Klaus Radio & Elctrns.	309-691-4840
IL	Rockford, Mid-West Associated	815-962-8036
IN	East Chicago, Acro Elctrns.	312-357-1269
IN	Ft. Wayne, Ft. Wayne Elctrns.	219-423-3422
IN	Indianapolis, Meunier Elect.	317-635-3511
IN	Indianapolis, Radio Distrib.	317-257-2231
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Terre Haute, Midwest Supp. Elec.	812-232-0187
KY	Lexington, Radio Elctrn. Equip.	606-255-6661
KY	Louisville, P.I. Burks Co.	502-589-3960
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
LA	Lafayette, Ralphs of Lafayette	318-234-4507
LA	Shreveport, Industrial Elect.	318-222-9459
MD	Baltimore, Radio Elctrn. Svc. Co.	301-823-0700
MD	Baltimore, ASI Elctrns.	301-265-5100
MD	Gaithersburg, Pioneer/Wash. Elect.	301-948-0710
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Lynn, Land Elec. Supp.	617-592-2220
MA	Needham, You-Do-It Elctrns.	617-449-1005
MA	Newton Upper Falls, In-Stock Prods. Co.	617-964-6200
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	W. Newton, A. W. Mayer Co.	617-965-1111
MI	Ann Arbor, Wedemeyer Elect. Supp.	313-665-8611
MI	Detroit, RS Elctrns.	313-491-1012
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minneapolis, Electronics Ctr.	612-371-5200
MS	Jackson, Ellington Elect. Supp.	601-355-0561
MO	Kansas City, Electronic Supp. Co.	816-921-0250

MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	St. Louis, Van Sickle Radio	314-621-5000
MO	St. Louis, Olive Indl. Elect.	314-863-7800
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NE	Omaha, Radio Equip.	402-341-7700
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Camden, General Radio Supp.	609-964-8560
NJ	Hanover, State Elctrn. Parts	201-887-2550
NJ	Springfield, Route Elctrns.	201-467-0166
NJ	Springfield, Federated Purchaser	201-376-8900
NM	Albuquerque, Electronic Parts	505-293-6161
NM	Albuquerque, Walker Radio Co.	505-247-2288
NY	Buffalo, Summit Distrib.	716-884-3450
NY	Farmingdale, Fordham Radio	516-752-0500
NY	Hauppauge, Broadline Elctrns.	516-420-8320
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Long Island City, H. L. Dalis, Inc.	212-361-1117
NY	New York, Argil Elctrns.	212-691-8111
NY	Portchester, Wise Comps.	203-531-4880
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rome, Rome Elctrns.	315-337-5400
NY	Schenectady, Adirondack Elctrns.	518-842-8350
NC	Raleigh, Southeastern Radio Supp.	919-828-2311
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, United Radio	513-662-2610
OH	Cleveland, Pioneer-Standard Elect.	216-587-3600
OH	Cleveland, Pattison Supp.	216-441-3000
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Dayton, Becker Elctrns.	513-226-1341
OH	Dayton, ESCO, Inc.	513-226-1133
OH	Dayton, Pioneer Elctrns.	513-236-9900
OH	Solon, Repco	216-248-8900
OH	Toledo, Warren Radio	419-248-3364
OK	Oklahoma City, Trice Whlsl. Elect.	405-524-4411
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, EOFF Elec.	503-222-9411
PA	Allentown, A. A. Peters	215-434-5237
PA	Huntingdon Valley, Shap Elctrns.	215-322-7150
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Plymouth Meeting, Techni-Tool	215-825-4900
PA	Reading, Barbey Elctrns.	215-376-6116
RI	Providence, Wm. Dandreta & Co.	401-861-2800
SC	Charleston, Wholesale Radio Supp.	803-747-9672
TN	Chattanooga, Curle Elctrns.	615-266-4727
TN	Kingsport, Radio Elect. Supp.	615-247-8111
TN	Nashville, Electra Distrib.	615-329-3971
TN	Nashville, Randolph & Rice	615-255-5602
TX	Austin, Harrison Ind. Elctrns.	512-458-3555
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Dallas, KA Elect. Sls.	214-634-7870
TX	Dallas, Wholesale Elect. Supp.	214-824-3001
TX	Ft. Worth, Sweico	817-335-6521
TX	Houston, City Electronic Supp.	713-621-1060
TX	Houston, Electrotex	713-941-7016
TX	Houston, Harrison Ind. Elctrns.	713-652-4700
TX	Houston, Lenert Co.	713-225-1465
TX	San Antonio, Sherman Elect. Supp.	512-224-1001
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Arlington, Arlington Elctrn.	703-524-2412
VA	Portsmouth, Distributors	804-399-2446
VA	Richmond, Avec Elctrns.	804-359-6071
VA	Roanoke, Peoples Radio & TV Supp.	703-342-8933
WA	Seattle, Radar Elect.	206-282-2511
WI	Madison, Satterfield Elctrns.	608-257-4801
WI	Milwaukee, Marsh Elctrns.	414-475-6000

SGS-ATES SEMICONDUCTOR CORP., 240 Bear Hill Rd, Waltham, MA 02154, Tel: 617-890-6688, Telex: 923495; Empl.: 9000

SHALLCO, Box 1089, Smithfield, NC 27577, Tel: 919-934-3135, TWX: 510-939-1479; Empl.: 35; *Sls. Mgr.:* M. D. Sutton .... **1B**•1744-1747; **3**•1052, 1053

Local Sales Offices & Reps

CA	Chatsworth, WCV/RALTECH	818-700-0933
CA	Santa Clara, Fischer Assocs.	408-733-7350
IL	Northfield, Imex	312-446-8934
IA	Cedar Rapids, S & O Sls.	310-393-1845
KS	Shawnee Mission, Tech. Sls.	913-888-3330
MD	Towson, Holden Engrg. Sls.	301-823-3763
MA	Norwood, MPS Elctrn.	617-769-8700
MN	Minneapolis, R. J. Inc.	612-866-3661
MO	Ferguson, Tech. Sls.	314-725-5361
NY	Lynbrook, HLJ	516-599-2999
NY	Manhattan, Lothar Sanford Corp.	212-757-3881
NY	Pittsfield, D. Hurley Sls.	716-586-6159
OH	Englewood, Allen Nace Co.	513-836-0931

Local Distributors

FL	Jacksonville, Southeast Elctrns.	904-356-3007
MI	Grand Rapids, Audio Distrib.	616-452-1596
NY	Lynbrook, Peerless Radio	516-593-2121
OH	Cincinnati, United Radio	513-761-4030
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TN	Bristol, Broadcast Equip. & Supp.	615-878-2531
TX	Dallas, Wholesale Elctrns.	214-824-3001
Can	Montreal, Que., Braydon Electro	514-332-5650

SHALLCROSS, INC., See RCL-Shallcross

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346; FSC No.: 58258; *Sls. Mgr.:* Joe Deans .... **3**•1299

Local Sales Offices & Reps

TX	Arlington, Electronic Prod. Reps.	817-467-0377

SHAPE MAGNETRONICS, INC., 901 DuPage Ave., Lombard, IL 60148, Tel: 312-620-8394, TWX: 910-991-2352; *Sls. Mgr.:* J. Hilgenberg .... **3**•1910, 1911

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024; Empl.: 7

SHELLY ASSOCIATES, INC., 2942 Dow Ave., Tustin, CA 92680, Tel: 714-544-9970, TWX: 910-595-1589; FSC No.: 00303; Empl.: 30; *Sls. Mgr.:* Chuck Feeney .... **1B**•1096

Local Sales Offices & Reps

CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Redondo Beach, Vedax, Inc.	213-540-1255
CT	Madison, Eastronix, Inc.	203-421-4514
FL	Ft. Lauderdale, Reynolds & Assocs.	305-581-6611
FL	Melbourne, Reynolds & Assocs. Inc.	305-259-7000
FL	St. Petersburg, Reynolds & Assocs.	813-360-1384
GA	Acworth, Reynolds & Assocs. Inc.	404-451-9558
IL	Downers Grove, Splon Assocs. Inc.	312-963-7011
IN	Ft. Wayne, Scott Elctrns.	219-484-7865
IN	Indianapolis, Scott Elctrns. Inc.	317-897-9976
KS	Shawnee Mission, Florence and Meyer, Inc.	913-722-5210
LA	Covington, HBT Assocs. Inc.	504-892-4045
MA	Bedford, Eastronix	617-275-5775
MI	Lake Orion, C C Elctrns. Inc.	313-338-7400
MN	Edina, Splon Assocs. Inc.	612-927-6744
NJ	Boonton, TMA	201-263-2946
NY	Port Washington, TMA	516-883-2432
NC	Spring Hope, Reynolds & Assocs. Inc.	305-259-7000
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns. Inc.	216-473-5050
OH	Dayton, Scott Elctrns. Inc.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
PA	Pittsburgh, Scott Elctrns.	412-963-6116
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TX	Dallas, Tag Techn. Sls.	214-986-0568
TX	Irving, Tag Tech. Sls.	214-253-1310
UT	Salt Lake City, Sunbird Inds. Inc.	801-272-1303
VT	Shelburne, Eastronix, Inc.	802-985-3743

Local Distributors

CA	Anaheim, Bisco Inds. Inc.	714-635-0380
CA	San Jose, Bisco Inds. Inc.	408-946-8980
CT	Norwalk, Park Distrs. Inc.	203-853-2010
CT	Wallingford, Midstate Elctrns. Co.	203-265-9900
IL	Franklin Park, Bisco Inds. Inc.	312-451-1230
MA	Chelmsford, Pilgrim Elctrns.	617-251-8746
MA	Woburn, Elctrn. Packaging Comps.	617-935-0400
NJ	Cranford, Garden State Indl. Elctrns.	201-272-6400
NJ	East Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Saddle Brook, Tide Elctrns.	201-794-9660
NY	Elmsford, White Plains Elctrl. Supp. Co.	914-592-9555
OH	Strongsville, Roberts Elctrns. Co., Inc.	216-238-1711
OK	Tulsa, Radio, Inc.	918-587-9123
TX	Dallas, Wilkinson Brothers Co.	214-941-9963
WI	Mequon, Lakeview Elctrns.	414-377-8250

SHIELDING TECHNOLOGY, INC., 120 Ethel Rd. West, Piscataway, NJ 08854, Tel: 201-985-8800, TWX: 710-480-6297; *Sls. Mgr.:* Mason Carter

SHINANO KENSHI CORP. (SKC), 7525 Ethel Ave., Ste. 1, N. Hollywood, CA 91605, Tel: 818-764-4266; Empl.: 5; *Sls. Mgr.:* William F. Dowis .... **1B**•1181

Local Sales Offices & Reps

CA	North Hollywood, Shinano Kenshi Corp.	818-764-4266
CA	Santa Clara, Logan Sales	408-496-0660
CO	Denver, Tech Rep Sls. Co.	303-758-7031
CT	Madison, SIR Assocs.	203-245-2242
FL	Orlando, Irby & Connolly Inc.	305-894-8471
IL	Barrington, Richard Fisk Mktg.	312-381-0653
MA	Bedford, SIR Assocs.	617-275-5550
MI	Southfield, Fred Gehrke & Assoc.	313-559-5363
MN	Eagan, J. Jorgenson & Assoc.	612-452-9541
NJ	Hatboro, PA, Electro Rep	215-674-4421
NJ	Oxford, Malin Assocs.	201-689-7398
NY	Rochester, The Robert F. Lamp Co.	716-323-1250
NC	Greenville, Ranico Representatives	615-639-7696
OK	Richardson, TX, Precision Technology Assocs.	214-234-8071
OR	Portland, Intertech Sls.	503-775-7885
TN	Greenville, Lamons Sales Co.	615-639-8711
TX	Austin, Precision Technlg. Assocs.	512-250-0201
TX	Fort Worth, Gene Moody Entprs.	817-572-1068
TX	Houston, Precision Technlg. Assocs.	713-463-6801
TX	Richardson, Precision Technlg. Assoc.	214-234-8071
WA	Seattle, Rep West	206-283-8351

Local Distributors

CA	N. Hollywood, Digilog Devices	818-764-9777

SHOGYO INTL. CORP., 287 Northern Blvd., Great Neck, NY 11021, Tel: 516-466-0911, Telex: 4758024, TWX: 12218 .... **1A**•2055, 2263; **1B**•1097; **2**•1562-1564, 2150; **3**•1054, 1348, 1349

SHOKAI FAR EAST LTD., 280 North Central Ave., Hartsdale, NY 10530, Tel: 914-681-0700, Telex: 22-4219; Empl.: 362; *Sls. Mgr.:* Martin N. Rubin .... **3**•1055

SHOW 'N TELL PRODUCTS, AMG, Inc., 155 Franklin Street, Dayton, OH 45402, Tel: 513-223-8211; *Sls. Mgr.:* Jon A. Bloyd

SHUGART ASSOCS., 475 Oakmead Pkwy., Sunnyvale, CA 94086, Tel: 408-733-0100, TWX: 910-339-9355; Empl.: 3000; *Sls. Mgr.:* Gary Galusha; *Dist. Mgr.:* Gary Galusha

SHURE BROS., 222 Hartrey Ave., Evanston, IL 60204, Tel: 312-866-2200, Telex: 72-4381, TWX: 910-231-0048; *Sls. Mgr.:* R. T. Murphy, Sales Manager

SHURITE METERS, INC., 577 Grand Ave., P.O. Box 1848, New Haven, CT 06508, Tel: 203-624-1188; Empl.: 30; *Sls. Mgr.:* Joseph V. LeBlanc; *Dist. Mgr.:* Joseph V. LeBlanc

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Los Angeles, Modco	213-848-2215
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Denver, Nelson	303-295-1017
FL	Longboat, R. S. Cushing	813-383-1770
IL	Park Ridge, Bob Burns & Assoc.	312-823-9360
IN	Indianapolis, Sukup & Cox	317-253-5501
IA	Des Moines, The Beams Co.	515-255-1148
MI	E. Detroit, Jack M. Thorpe	313-779-6363
MN	Minneapolis, Lestronix	612-926-8466
NJ	Belleville, D. F. Tobias & Co.	201-751-8680
NY	Rochester, H. C. Johnson Agen.	716-586-0777
NC	Raleigh, B. T. Funderburk	919-782-3493
OH	Cincinnati, John O. Olsen	513-574-7711
PA	Ardmore, John Wurtz	215-649-6300
RI	Lincoln, Adams-McGregor	401-726-1300
TX	Dallas, Crockett Sls.	214-350-3377
WA	Seattle, Don Smith Sls.	206-633-3160

SIDEREAL CORP., 9600 S.W. Barnes Rd., Portland, OR 97225, Tel: 503-297-5531, Telex: 36-0640, TWX: 910-464-6139; *Sls. Mgr.:* Jim Miller & Jeff Gretz; *Dist. Mgr.:* Joy Sakata

SIECOR CORP., Box 489, Hickory, NC 28603, Tel: 704-328-2171, Telex: 800-510, TWX: 510-934-1204; Empl.: 600; *Sls. Mgr.:* J. English

SIEMENS COMPS., INC., Optoelectronics Div., 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, Telex: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Gary Durgin; *Dist. Mgr.:* Merv Stamberger

SIEMENS CORP., 186 Wood Ave., S., Iselin, NJ 08830, Tel: 201-494-1000, TWX: 710-998-0588; Empl.: 800

SIEMENS CORP., Colorado Comps. Div., 800 Hoyt St., Broomfield, CO 80020, Tel: 303-469-2161, Telex: 45-4357; Empl.: 373; *Sls. Mgr.:* Bill Hacker

Sierracin/Magnedyne

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., P.O. Box 458, Carlsbad, CA 92008, Tel: 619-438-3321, Telex: 910 322-1391; Empl.: 190 .... 1B•1178, 1179

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
CA	Campbell, Luscombe Engrg. Co.	408-370-2020
CA	Laguna Beach, Comar Co.	619-540-1219
CA	Torrance, Carl J. Aguirre	213-375-9485
CA	W. Los Angeles, Mike McNeil	213-478-6942
FL	Ft. Lauderdale, Electrocomp Assocs.	305-491-4141
GA	Atlanta, L & D Inc.	404-455-3483
IL	Rolling Meadows, KMA Sls. Co.	312-398-5300
MD	Churchville, Atlantic Tech. Sls.	301-879-2236
MN	St. Paul, North Star Motion & Controls	612-770-5311
NJ	Paramus, Carnes Diamond Assocs.	201-967-1309
NY	Centerport, Carnes Diamond Assocs.	516-261-8100
NY	Pittsford, Controlled Motion Prods. Co.	716-381-1933
NC	Greensboro, L & D Inc.	919-292-3201
OH	Cleveland, Servo-Mark	216-871-2353
PA	King of Prussia, Rivco January	215-265-5211
TX	Dallas, Thorson Co.	214-233-5744
WI	Milwaukee, KMA Sls. Co.	414-259-1771

Sierracin/Power Systems

SIERRACIN/POWER SYSTEMS, 20500 Plummer St., Chatsworth, CA 91311, Tel: 818-998-9873, TWX: 910-494-4830; FSC No.: 58999; Empl.: 450; *Sls. Mgr.:* Nick Freyling; *Dist. Mgr.:* Nick Freyling .... 3•1768-1770

Local Sales Offices & Reps

AZ	Tempe, Chapman Assocs.	602-894-6775
CA	San Diego, Interstate Mktg.	619-292-8117
CA	Santa Clara, Fahner-Miller	408-727-9800
CA	Woodland Hills, Interstate Mktg.	818-883-7606
CT	Guilford, Whitehead Assoc.	203-453-3762
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronics	305-730-2484
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IA	Cedar Rapids, Comstrand	319-377-1575
KS	Merriam, Midwest Tech. Sls.	913-236-8555
KS	Wichita, Midwest Tech. Sls.	316-262-7240
KY	Louisville, KW Elctrn. Sls.	502-451-1860
MA	Lynnfield, Whitehead Assoc.	617-246-5070
MI	Novi, Lektronics	313-349-3304
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Charles, Midwest Tech. Sls.	314-441-1012
NJ	Ridgewood, Hansen & Hughes	201-652-7055
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NC	Raleigh, J & B Sls.	919-878-8600
OH	Dayton, K. W. Elctrn. Sls.	513-890-2150
OH	Shaker Heights, K. W. Elctrn. Sls.	216-491-9177
OH	Worthington, K. W. Elctrn. Sls.	614-888-0483
OR	Beaverton, Wm. J. Purdy Co.	503-641-9373
PA	Allison Park, K. W. Elctrn. Sls.	412-487-4300
PA	Huntingdon Valley, Omega Elctrn. Sls.	215-947-4135
TN	Tullahoma, J & B Sls.	615-455-7487
VA	Alexandria, Scott Data	703-765-7901
WA	Seattle, Wm. J. Purdy Co.	206-284-8020
WI	Brookfield, Sumer, Inc.	414-784-6641

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Hall-Mark	602-243-6601
CA	Chatsworth, Priority One	818-709-5464
CA	Citrus Heights, Hall-Mark	916-722-8600
CA	Costa Mesa, FLW	714-751-7512
CA	El Segundo, Hall-Mark	213-643-9101
CA	San Diego, FLW	619-277-0993
CA	San Diego, Hall-Mark	619-268-1201
CA	Sunnyvale, Hall-Mark	408-773-9990
CA	Tustin, Hall-Mark	714-669-0681
CO	Englewood, Hall-Mark	303-694-1662
FL	Clearwater, Hall-Mark	813-530-4543
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
FL	Orlando, Hall-Mark	305-855-4020
FL	Tampa, Reptron	813-855-4656
GA	Norcross, Hall-Mark	404-447-8000
IL	Arlington Hgts., Reptron Elctrns.	312-593-7070
IL	Bensenville, Hall-Mark	312-860-3800
KS	Lenexa, Hall-Mark	913-888-4747
MD	Columbia, Hall-Mark	301-988-9800
MI	Grand Rapids, Calder Elctrns.	616-949-2900
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Bloomington, Hall-Mark	612-854-3223
MO	Maryland Hgts., Hall-Mark	314-291-5350
NJ	Cherry Hill, Hall-Mark	609-424-7300
NJ	Fairfield, Hall-Mark	201-575-4415
NY	Ronkonkoma, Hall-Mark	516-737-0600
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cincinnati, Hall-Mark	513-563-5980
OH	Englewood, Argent/Electra	513-836-8633
OH	Solon, Hall-Mark	216-349-4632
OH	Solon, REH Elctrns.	216-248-1636
OH	Westerville, Hall-Mark	614-891-4555
OK	Tulsa, Hall-Mark	918-665-3200
OR	Wilsonville, Zepher Ind.	503-682-2929
PA	Pittsburgh, ATI/Electra	412-821-5565
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Hall-Mark	214-341-1147
TX	Houston, Hall-Mark	713-781-6100
WA	Seattle, Zepher Ind.	206-241-1980
WI	Oak Creek, Hall-Mark	414-761-3000

SIERRACIN/THERMAL SYS., 13920 S. Broadway, Los Angeles, CA 90061, Tel: 213-321-4350, TWX: 910-346-6774; FSC No.: 11416; Empl.: 175

SIERRA ELEC., See Pass & Seymour, Inc.

SIGMA INSTRS., 170 Pearl St., Braintree, MA 02184, Tel: 617-843-5000, Telex: 94-0645, TWX: 710-348-1161; Empl.: 1,500

SIGMA INSTRS., Intl. Instr. Div., 88 Marsh Hill Rd., Orange, CT 06477, Tel: 203-795-4711, Telex: 714-465-2897; Empl.: 150; *Dist. Mgr.:* J. Connolly

SIGMA-NETICS, INC., One Washington Ave., Fairfield, NJ 07006, Tel: 201-227-6372

SIGMA PLASTRONICS, 14531-33 Tireman Ave, Dearborn, MI 48126, Tel: 313-846-4410; Empl.: 10; *Sls. Mgr.:* S. J. Hirshfield

SIGMAPOWER, INC., 20790 Leapwood Ave., Carson, CA 90746, Tel: 213-32-Sigma; FSC No.: 55196; Empl.: 61; *Sls. Mgr.:* Bill Adams

SIGMA SYSTEMS CORP., 3163 Adams Ave., San Diego, CA 92116, Tel: 619-283-3193; Empl.: 14; *Sls. Mgr.:* T. Stewart .... 3•1179

SIGNAL SYS. INTL., P.O. Box 198, Holmdel, NJ 07733, Tel: 201-741-1120; Empl.: 7; *Sls. Mgr.:* D. Roy

SIGNAL TRANSFORMER, 500 Bayview Ave., Inwood, NY 11696, Tel: 516-239-4510, Telex: 96-8112, TWX: 510-225-8440; FSC No.: 08779; Empl.: 280; *Sls. Mgr.:* G. Carlin .... 1A•2267-2279

Direct sales only. Inwood, NY 516-239-4510 or 516-239-7200

SIGNATRON, 12 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-1500, Telex: 955329XTLSRVC ATTN:SIGNATRON; FSC No.: 59371; Empl.: 120; *Sls. Mgr.:* Joseph T. McNamara

SIGNETICS, 811 E. Arques Ave., Sunnyvale, CA 94086, Tel: 408-739-7700, TWX: 910-339-9220; Empl.: 6000; *Sls. Mgr.:* J. Luke; *Dist. Mgr.:* J. Abram

SIGNUM SYS., 726 Santa Monica Blvd., Santa Monica, CA 90401, Tel: 213-451-5382; Empl.: 7

SILICON DETECTOR CORP., 855 Lawrence Dr., Newbury Park, CA 91320, Tel: 805-498-6737, Telex: 182229; *Sls. Mgr.:* F. W. Sullivan

Local Sales Offices & Reps

MA	Holden, Poulin Assocs.	617-829-6948
NC	Fayetteville, Zimtec	919-485-2222
OH	Cleveland, Geotronix Inc.	216-526-2535
VA	Fairfax, Beacon North	703-591-1300

SILICON GENERAL, 11651 Monarch St., Garden Grove, CA 92641, Tel: 714-892-5531, Telex: 692-411, TWX: 910-596-1804; FSC No.: 34333; Empl.: 150; *Sls. Mgr.:* Joe Castellano; *Dist. Mgr.:* Larry Baumgardner

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell and Assoc.	205-883-5100
AZ	Phoenix, I.S.D.S.	602-971-6250
CA	Cupertino, Thresum Assoc.	408-996-9889
CA	Los Angeles, I.S.D.S.	213-478-0183
CA	San Diego, I.S.D.S.	619-571-1544
CA	Santa Ana, I.S.D.S.	714-973-2162
CA	Woodland Hills, I.S.D.S.	213-883-7130
CO	Littleton, Lange Sls.	303-795-3600
FL	Clearwater, H.H.P	813-797-4447
FL	Ft. Lauderdale, H.H.P.	305-971-5750
FL	Maitland, H.H.P.	305-831-2474
GA	Norcross, Glen White Assoc.	404-441-1447
ID	Boise, N. R. Schultz	208-377-8686
IL	Rolling Meadows, Sumer	312-991-8500
IN	Ft. Wayne, R. O. Whitesell and Assoc.	219-432-5591
IN	Indianapolis, R. O. Whitesell and Assoc.	317-359-9283
IN	Kokomo, R. O. Whitesell and Assoc.	317-457-9127
IA	Cedar Rapids, Rep Assoc.	319-373-0152
KS	Overland Park, PMR	913-381-0004
KS	Wichita, PMR	316-684-4141
KY	Louisville, R. O. Whitesell and Assoc.	502-426-7696
MD	Baltimore, Conroy Sls.	301-296-2444
MI	Grand Rapids, R. O. Whitesell and Assoc.	616-942-5420
MI	Southfield, R. O. Whitesell and Assoc.	313-559-5454
MI	St. Joseph, R. O. Whitesell and Assoc.	616-983-7337
MN	Minneapolis, Comstrand	612-788-9234
MO	Maryland Hgts., PMR	314-569-1220
NH	Nashua, Bell Controls	603-882-6984
NJ	Cherry Hill, Danco Elect. Sls.	609-424-5590
NJ	Teaneck, R. T. Reid Assocs.	201-692-0200
NM	Albuquerque, Straube Assoc.	505-292-0428
NY	Rochester, Ontec	716-464-8636
NC	Raleigh, Glen White Assoc.	419-787-7023
OH	Cincinnati, R. O. Whitesell and Assoc.	513-521-2290
OH	Cleveland, R. O. Whitesell and Assoc.	216-447-9020
OH	Columbus, R. O. Whitesell and Assoc.	614-888-9396
OH	Dayton, R. O. Whitesell and Assoc.	513-298-9546
OK	Tulsa, Ion Associates Inc.	918-664-0186
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Greeneville, R. O. Whitesell and Assoc.	615-639-6154
TX	Austin, Ion Associates Inc.	512-346-7160
TX	Grand Prairie, Ion Associates Inc.	214-647-8225
TX	Houston, Ion Associates Inc.	713-977-4354
UT	Salt Lake City, Lange Sls.	801-478-0843
VA	Lynchburg, Glen White Assoc.	804-237-6291
WA	Bellevue, N. R. Schultz	206-454-0300
WI	Brookfield, Sumer	414-784-6641

SILICONIX, INC., 2201 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-988-8000, TWX: 910-338-0227; Empl.: 1000; *Sls. Mgr.:* Walter Senges; *Dist. Mgr.:* Richard Otsuka

SILICON SENSORS, Hwy. 18 East, Dodgeville, WI 53533, Tel: 608-935-2707, Telex: 910-997-0072; FSC No.: 54822; Empl.: 26; *Sls. Mgr.:* Robert L. Bachner

SILICON SYSTEMS INC., 14351 Myford Rd., Tustin, CA 92680, Tel: 714-979-0941, TWX: 910-595-2809; Empl.: 92; *Sls. Mgr.:* Jim Meyer

SILICON TRANSISTOR CORP., Katrina Rd., Chelmsford, MA 01824, Tel: 617-256-3321, TWX: 710-343-0576; FSC No.: 07256; Empl.: 150; *Sls. Mgr.:* William A. Schromm; *Dist. Mgr.:* William A. Schromm

SILONEX INC., 331 Cornelia St., Plattsburgh, NY 12901, Tel: 518-561-3160, TWX: 610-421-3362; Empl.: 140; *Sls. Mgr.:* Carol Larsen .... 1B•1233

Local Sales Offices & Reps

AL	Huntsville, Glen White Assocs.	205-883-7938
CA	Arcadia, Van Gott & Assocs.	213-445-9728
CA	San Mateo, Service Inds.	415-573-1816
CT	North Branford, LJM Assocs.	203-488-4244
IL	Rolling Meadows, Hill Sls. Corp.	312-259-5190
KS	Overland Park, Kebco	913-541-8431
MD	Timonium, Glen White Assocs.	301-252-6360
MA	Topsfield, RFC Assocs.	617-887-8545
MI	Farmington, Amtech Reps.	313-474-8300
MN	Bloomington, Northport Engrg.	612-854-5556
MO	St. Louis, Kebco	314-576-4111
NJ	Fairfield, T. J. Saes Inc. of N.J.	201-667-5900
TX	Dallas, J. Clay Co.	214-350-1281
VA	Lynchburg, Glen White Assocs.	804-237-6291
WA	Kent, R&R Elctrn. Assoc.	206-251-5396

SILTRAN DIGITAL, 2250 Monterey Rd., Atascadero, CA 93422, Tel: 805-466-3209; *Sls. Mgr.:* M. F. Hordeski

SILTRONICS LTD., P.O. Box 456, Dover, MA 02030, Tel: 617-329-4068; Empl.: 55; *Sls. Mgr.:* G. Urban

SILVERED ELECTRONIC MICA CO., INC. (SEMCO), Route 6 N. Windham Rd., Williamantic, CT 06226, Tel: 203-423-6316

SIMCO CO., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-2171, Telex: 846130; Empl.: 71; *Sls. Mgr.:* Merle Roberts

Local Sales Offices & Reps

AZ	Tempe, Foley, Tallent & Lee	602-894-2345
CA	Anaheim, Simco Co.	714-632-9512
CA	Camarillo, C. C. Stevens & Assoc.	805-484-5819
CA	Santa Clara, Dryden Engrg.	408-727-7321
FL	Clearwater, Marketiers Corp.	813-443-4302
GA	Atlanta, John R. Davis, Inc.	404-955-5600
GA	Gainesville, Simco Co.	404-869-3515
IL	Aurora, Dwight Smith & Assocs.	312-896-9501
IN	Columbus, Bildico, Inc.	812-342-3721
MA	North Billerica, Julie Assocs.	617-667-1958
MN	Burnsville, Aquapoly Equip.	612-890-3939
NY	Rochester, Holter Assoc.	716-381-7988
OR	Beaverton, Dryden Engrg. Co.	503-644-7070
PA	Furlong, Avenir, Inc.	215-348-8290
PA	Montgomeryville, J. F. Kafer Co.	215-855-3050
SC	Columbia, Roy Smith	803-771-7709
TX	Dallas, Newby & Assocs.	214-357-8354
TX	Houston, Haylett O'Neill & Son	713-771-5838

SIMMONDS PRECISION, P.O. Box 310, Norwich, NY 13815, Tel: 607-335-5000, TWX: 510-261-7776; Empl.: 750; *Sls. Mgr.:* L.S. Colwell

Simpson®

SIMPSON ELEC. CO., 853 Dundee Ave., Elgin, IL 60120, Tel: 312-697-2260, Telex: 72-2416; Empl.: 1500; *Sls. Mgr.:* M. O. Buehring; *Dist. Mgr.:* George Oskandy .... **3**•1302, 1350

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AK	Anchorage, H. J. Lang	907-279-5741
CA	Burlingame, Wm. J. Purdy Co.	415-347-7701
CA	Downey, Simpson Elec. Co.	213-862-4259
CA	Sacramento, Wm. J. Purdy Co.	916-920-9091
CO	Denver, Wm. J. Purdy Co.	303-777-1411
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Lauderdale Lakes, Seacom Sls. Co.	305-486-0260
GA	Atlanta, Cartwright & Bean	404-233-2939
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
LA	Kenner, Cartwright & Bean	504-466-0020
MD	Lisbon, Samuel K. Macdonald	301-924-5880
MD	Silver Spring, A. H. Swanson Co.	301-949-7440
MA	Needham, Sturgeon Co.	617-444-6603
MI	Southfield, R. C. Merchant Co.	313-354-4300
MI	St. Joseph, R. C. Merchant Co.	616-983-7378
MN	Edina, M. Foster Tech. Sls.	612-941-9790
MS	Jackson, Cartwright & Bean Co.	601-981-1170
MO	Blue Springs, Kathrinus-Kelly-Baumhauer Co.	816-229-0001
MO	St. Louis, Kathrinus-Kelly-Baumhauer & Co.	314-647-2400
NM	Albuquerque, C. T. Carlberg	505-888-3883
NY	Buffalo, L. D. Allen Inc.	716-837-1955
NY	Fairport, L. D. Allen Inc.	716-377-3530
NY	Great Neck, Simpson Instrs. Sls.	516-482-3103
NY	N. Syracuse, L. D. Allen Inc.	315-437-8387
NC	Charlotte, Cartwright & Bean	704-377-5673
NC	Raleigh, Cartwright & Bean	919-781-6560
OH	Cleveland, Baehr-Greenleaf & Assoc.	216-221-9030
OH	Columbus, Baehr-Greenleaf & Assoc.	614-486-4046
OH	Dayton, Baehr-Greenleaf & Assoc.	513-439-0724
OH	Kettering, A. H. Swanson Co.	513-433-6668
OK	Oklahoma City, J. Y. Schoonmaker Co.	214-349-1650
OR	Portland, Earl & Brown	503-245-2283
PA	Philadelphia, Samuel K. Macdonald	215-545-1205
PA	Pittsburgh, Samuel K. Macdonald	412-366-2643
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean Co.	901-276-4442
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
TX	Houston, J. Y. Schoonmaker Co.	214-349-1650
TX	San Antonio, A. H. Swanson Co.	512-342-4439
UT	Salt Lake City, Wm. J. Purdy Co.	801-486-8557
WA	Seattle, Earl & Brown	206-284-1121
WI	Milwaukee, D. Dolin Sls. Co.	414-482-1111
EXP	IL, Elgin, Simpson Elec.	312-697-2260

SIMULASER CORP., 4943 McConnell Ave, Ste. Y, Los Angeles, CA 90066, Tel: 213-822-0667; FSC No.: 8T239; Empl.: 5

SINCLAIR & RUSH, 6900 S. Broadway, St. Louis, MO 63111, Tel: 314-481-2450, Telex: 442564; Empl.: 100; *Sls. Mgr.:* Fred Hogenkamp; *Dist. Mgr.:* George Genung

SINCLAIR RADIO LABS., 122 Rayette Rd., Concord, ON , Canada, Tel: 416-669-1244, Telex: 06-964598; Empl.: 100; *Sls. Mgr.:* J. M. Colthart

SINGER CO., Kearfott Div., 1150 McBride Ave., Little Falls, NJ 07424, Tel: 201-785-6000, Telex: 133340, TWX: 710-988-5700; FSC No.: 88818; Empl.: 6000; *Sls. Mgr.:* C. H. Wheatley

SINGER CO., Librascope Div., 833 Sonora Ave., Glendale, CA 91201, Tel: 818-244-6541, Telex: 674912; Empl.: 1600

S.I.R. ATLANTA, 331 Luckie St., N.W., Atlanta, GA 30313, Tel: 404-522-6317, Telex: 804330; FSC No.: FSCM 62151; Empl.: 15

SITCO ANTENNAS, 10330 N.E. Marx St., Portland, OR 97220, Tel: 503-253-2000, Telex: 360-836; Empl.: 18; *Sls. Mgr.:* G. Berliner

SITRONIX, See Siemens Corp., Colorado Comps. Div.

SIVERS LAB, Box 90339, Los Angeles, CA 90009, Tel: 213-390-7477, TWX: 910-343-6583; Empl.: 300; *Sls. Mgr.:* Marshal Cleland

SJOBERG, C., & SON, INC., 415 Station St., Cranston, RI 02910, Tel: 401-461-8220; Empl.: 20

SKAN-A-MATIC, Box S, Elbridge, NY 13060, Tel: 315-689-3961, TWX: 710-545-0220; Empl.: 175

Advertisement

Manufacturer of photoelectric/bar code components and systems. Photoelectric line includes thru-beam pairs, reflective and retroreflective scanners, electronic controls and custom industrial systems. Bar code products include fixed beam scanners, incandescent and laser moving beam scanners and hand held code pens; also, a portable unit, a data entry terminal, microcomputer decoders and reading systems designed for all popular bar codes. National and international sales representative network.

SKYDYNE DIVISION, AAR/Brooks & Perkins, River Rd., Port Jervis, NY 12771, Tel: 914-856-6655, TWX: 510-260-1249; Empl.: 45 .... **2**•1054

SKYO INDUSTRIES INC., 171 Brook Ave., Deer Park, NY 11729, Tel: 516-586-4702; Empl.: 49

SLAUGHTER CO., Moore & Hailey Sts., P.O. Box 1805, Ardmore, OK 73401, Tel: 405-223-4773; FSC No.: 05611 .... **3**•1300, 1301

SLEPIAN, ARTHUR, & CO., 412 Housatonic Ave., Bridgeport, CT 06608, Tel: 203-366-5294; Empl.: 5; *Sls. Mgr.:* M. Madow

SLOAN
INDICATOR LIGHTS

SLOAN CO., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, Tel: 213-875-1123, TWX: 910-498-2250; Empl.: 25; *Sls. Mgr.:* John E. Bailey .... **1B**•1098-1101

Local Sales Offices & Reps

CA	Garden Grove, West Elctrns. Sls.	714-898-0120
CA	Saratoga, Testco	408-253-1900
CO	Commerce City, Williams Assoc.	303-289-5647
CT	E. Haven, Eagle Assocs.	203-467-6542
FL	Pompano Beach, Cole-Tek Assocs.	305-781-8110
GA	Stone Mountain, DTM, Inc.	404-962-2530
IL	Park Ridge, Bob Burns & Assoc.	312-775-1233
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
MD	Glen Burnie, Macrotech Assoc.	301-437-5588
MI	Birmingham, Forand Sls.	313-644-0087
MN	Minneapolis, Loren Green Assoc. of Minn.	612-571-6666
MO	St. Charles, C. F. Elctrns.	314-946-8500
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	212-586-8440
NY	Rochester, R. P. Kennedy Co.	716-271-6322
OH	Cleveland, Allan Scraga	216-662-6080
TX	Dallas, IBL Engrg. & Sls.	214-363-2921

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
CA	Hawthorne, Radio Hardware	213-679-3381
CA	Santa Clara, Patane Santa Clara	408-496-6151
CA	Sunnyvale, Powell Elctrns.	408-739-4321
CA	Torrance, Cypress Elctrns.	213-533-6005
CA	Van Nuys, Patane Avionics	213-988-4455
CT	W. Hartford, Signal Inds.	203-236-6005
FL	Ft. Lauderdale, Powell Elctrns.	305-972-4300
FL	Miami, Elctrn. Equip. Co.	305-871-3500
FL	Winter Park, Elctrn. Equip.	305-644-4833
IL	Des Plaines, Edmar Elctrns.	312-298-8580
KS	Wichita, Lee Prods.	316-264-2172
MD	Beltsville, Powell Elctrns.	301-937-4030
NY	Buffalo, Genesee Radio & Parts	716-873-9661
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
OH	Solon, R.E.H. Elctrns.	216-248-1636
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
VT	South Burlington, Hooker Elctrns.	802-864-0885

SLOAN TECHNOLOGY, P.O. Box 4608, Santa Barbara, CA 93103, Tel: 805-963-4431, TWX: 910-334-4901; Empl.: 115; *Sls. Mgr.:* Leonard Cardoza

Local Sales Offices & Reps

CA	San Jose, Process Physics	408-942-1611
CA	Santa Ana, Micro-tech West	714-547-5941
CO	Colorado Springs, Semitorr	303-593-7881
GA	Longwood, Lenz Eng.	305-831-9797
IL	Des Plaines, B. Ellis & Assocs.	312-298-7626
MA	Boston, Indl. Equip. & Sls.	617-426-4406
NY	Bohemia, Hybrid Sls. Corp.	516-589-1700
OH	Berea, Byron Ellis Assoc.	216-826-0559
PA	Bethlehem, Hybrid Sls. Corp.	215-867-0612
TX	Richardson, THT Sls. Co.	214-783-1501
WA	Seattle, Demarest	206-523-3210

Simpson®
INSTRUMENTS THAT STAY ACCURATE

PANEL METERS, VOM's & DIGITAL TEST EQUIPMENT

AUTHORIZED DISTRIBUTORS

METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration

METERMASTER LOCATIONS:

ARIZONA
Phoenix .... (602) 437-1425
Tucson .... (602) 792-3411
CALIFORNIA
Los Angeles .... (213) 685-4340
Palo Alto .... (415) 968-0313
San Diego .... (619) 560-4841
GEORGIA
Atlanta .... (404) 446-0166
ILLINOIS
Chicago .... (312) 593-8650
MASSACHUSETTS
Boston .... (617) 523-2580
MINNESOTA
Minneapolis .... (612) 332-6117
MISSOURI
St. Louis .... (314) 454-0241
NEW MEXICO
Albuquerque .... (505) 292-3330
OHIO
Cleveland .... (216) 651-4100
OKLAHOMA
Tulsa .... (918) 582-1444
PENNSYLVANIA
Pittsburgh .... (412) 261-4548
TEXAS
Austin .... (512) 473-8876
Dallas .... (214) 271-5671
Houston .... (713) 733-9814
WISCONSIN
Milwaukee .... (414) 643-0554
ALL OTHER STATES .... (800) 962-8128

SMC SOFTWARE SYS., Science Management Corp., 1011 Rte. 22, Bridgewater, NJ 08807, Tel: 201-685-9000; Empl.: 35; *Sls. Mgr.:* Edwin J. Schnell; *Dist. Mgr.:* Margaret Langsett

SMD TECHNOLOGY SVC. CTR., North American Philips, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209, Tel: 800-431-4444

HHSmith

KULKA SMITH, INC., 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400, TWX: 710-723-4410; FSC No.: 83330; Empl.: 250; *Sls. Mgr.:* S. Fleischman; *Dist. Mgr.:* S. Fleischman ....**2**•1565; **3**•1303

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Los Angeles, E.E. Strassner Co.	213-242-8823
CA	Santa Clara, Warren Assocs.	408-988-7762
CO	Denver, Component Sls.	303-759-1666
CT	North Haven, Coakley, Boyd & Abbett	203-239-6217
FL	Ft Lauderdale, Hollingsworth & Still	404-447-1700
FL	Miami, Hollingsworth & Still	404-447-1700
FL	Tampa, Hollingsworth & Still	404-447-1700
IL	Chicago, RMP/McBride Sls.	312-932-9090
IN	Indianapolis, Elctrn. Reps.	317-894-1414
KS	Shawnee Mission, Lowell Kangas & Assoc.	913-631-3515
LA	Folsom, J.F. McKinney Sls.	504-893-0130
MA	Needham Hgts, Coakley, Boyd & Abbett	617-444-5470
MA	Woburn, W&D Mktg.	617-935-5610
MI	Ferndale, Shalco	313-547-4771
MN	St. Paul, Murnco	612-484-8200
MO	St. Louis, Lowell Kangas & Assoc.	314-821-4050
NH	Manchester, W&D Mktg.	603-622-5097
NM	Albuquerque, Shefler-Kahn	505-296-0749
NY	Buffalo, L.D. Allen	716-837-1955
NY	N. Syracuse, L.D. Allen	315-437-8387
NY	Rochester, Warren Kaufman	716-266-2728
NY	Whitestone, Jack Brown Electr.	212-767-1977
OH	Richfield, Bear Mktg.	216-659-3131
OR	Portland, Weber & Schwab	503-234-7671
PA	Broomall, L.D. Lowery	215-356-5300
RI	Hummelstown, L.D. Lowery	717-533-7095
TX	Bellaire, J.F. McKinney Sls.	713-444-3817
TX	Dallas, J.F. McKinney Sls.	214-631-9450
VA	Charlottesville, L.D. Lowery	804-973-6672
WA	Seattle, Weber & Schwab	206-623-5990

SMK ELCTRNS. CORP., U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960, Telex: 18-3081; FSC No.: 637-7400; Empl.: 84; *Sls. Mgr.:* Chuck Davies; *Dist. Mgr.:* Rudy Cicciarelli

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-533-2100
CA	Burbank, J. H. Sales	213-840-8679
CA	San Diego, S. R. Elctrns.	619-560-8330
CA	Sunnyvale, Schwerin & Merrill, Inc.	408-735-7900
CO	Englewood, Dynatech, Inc.	303-773-2830
FL	Ft. Lauderdale, R. M. Intl.	305-975-7500
GA	Atlanta, Electro-Mech	404-447-6478
IL	Chicago, Metcom Assoc.	312-696-1490
IN	Columbus, John H. Weaver Co., Inc.	812-372-3625
IN	South Bend, Valentine Assocs.	219-288-7070
KS	Overland Park, Electri-Rep	913-649-2168
MD	Annapolis, Vince Iorio Assoc.	301-261-1716
MA	Woburn, Compass Tech. Inc.	617-933-3336
MN	Minneapolis, Quantum Sls.	612-884-4700
MO	St. Louis, Electri-Rep	314-878-8209
NY	Plandome, Fred Spellman Co.	516-627-3399
NY	Syracuse, Electra Sales Corp.	315-463-1248
NC	Raleigh, Electro-Mech	919-851-8165
OH	Chesterland, KT Depco	216-729-3588
PA	Essington, Tri-Com Sales, Inc.	215-521-3080
TN	Nashville, Electro-Mech	615-885-0073
TX	Dallas, Blackburn Assoc.	214-692-8888
TX	Houston, Blackburn Assoc.	713-463-1354
WA	Redmond, Electronic Mktg. Grp.	206-882-0962
WI	West Allis, Metcom Assoc., Inc.	414-476-1300

SOFTWARE DYNAMICS, 2111 W. Crescent Ave-G, Anaheim, CA 92801, Tel: 714-635-4760; Empl.: 4; *Sls. Mgr.:* Ira E. Baxter

SOKOL CRYSTAL PRODS. DIV., 6050 N. 52nd Ave., Glendale, AZ 85301, Tel: 602-934-2108

Sokol Crystal Products, Inc

SOKOL CRYSTAL PRODS. INC., 121 Water St., Mineral Point, WI 53565, Tel: 608-987-3363, Telex: 467581; FSC No.: 56187; Empl.: 150; *Sls. Mgr.:* Steven M. Sokol ....**1A**•1422-1425

Local Sales Offices & Reps

CA	Los Angeles, Cain Tech.	213-477-9054
CA	Pinole, Ron May	415-724-1203
CA	San Diego, Cain Technology	619-224-6911
CO	Englewood, CM Mktg. Ind.	303-850-9841
FL	Clearwater, Brennan & Assocs.	813-446-5006
IL	Medinah, Wavan Assoc.	312-893-0210
IN	Fort Wayne, John Kilfoil Co.	219-436-7233
IA	Marion, Rep. Assoc.	319-373-0152
KS	Parker, S. W. Wollard Co.	913-898-6552
MA	Malden, J-K Assocs.	617-321-2922
MN	Bloomington, V. J. Gensmer Assocs.	612-888-2492
MO	St. Louis, Abrams & Assoc.	314-569-0447
NJ	Medford, Jack McCoy, Inc.	215-363-0350
NY	Centerport, Bill Carnes	516-261-8100
TX	Austin, Pro-Comp Sls. Co.	817-640-4336
WA	Kirkland, Manon Engrg., Inc.	206-827-7449

GS SOLA

SOLA ELEC., 1717 Busse Rd., Elk Grove Village, IL 60007, Tel: 312-439-2800, Telex: 280538; *Sls. Mgr.:* Fred Lemke ....**3**•1772, 1773, 1912-1915

SOLAR ELCTRNS. CO., 901 N. Highland, Hollywood, CA 90038, Tel: 213-462-0806; FSC No.: 13222; Empl.: 15

SOLAREX CORP., 1335 Piccard Dr., Rockville, MD 20850, Tel: 301-948-0202, TWX: 710-828-9709; *Sls. Mgr.:* Ted Blumemstock

SOLARTRON INSTRUMENTS, Sangamo Weston Inc., 17972 Sky Park Cir., Ste. F, Irvine, CA 92714, Tel: 714-250-1172, TWX: 910-595-1593; *Sls. Mgr.:* R. F. Fenner

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), South End Bridge Circle, Agawam, MA 01001, Tel: 800-628-8862, TWX: 710-350-6466; Empl.: 8

SOLDER REMOVAL, 1077 E. Edna Pl., Covina, CA 91724, Tel: 213-967-3681, TWX: 910-584-1820; FSC No.: 34605

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003, Tel: 201-429-8700, TWX: 710-994-4780; Empl.: 110; *Sls. Mgr.:* T. King

SOLID STATE CIRCUITS, 616 Boonville, Springfield, MO 65806, Tel: 417-869-4678, TWX: 910-775-4762; Empl.: 165; *Sls. Mgr.:* Gary Bollinger

SOLID STATE DEVICES, 14830 Valley View Ave., La Mirada, CA 90638, Tel: 213-921-9660, TWX: 910-583-4807; FSC No.: 30043; Empl.: 100; *Sls. Mgr.:* D. Peden

SOLID STATE ELCTRNS. CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257; FSC No.: 11911; Empl.: 15

SOLID STATE RELAYS, 213 Eisenhower Lane So., Lombard, IL 60148, Tel: 312-932-1660; *Sls. Mgr.:* D. E. Wienke

SOLID STATE SCIENTIFIC, 3900 Welsh Rd., Willow Grove, PA 19090, Tel: 215-657-8400, Telex: 476-1101, TWX: 510-661-7267; Empl.: 650; *Dist. Mgr.:* David DeLane

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls. Assoc.	602-957-3570
CA	Fallbrook, Martronix	619-728-7678
CA	Mountain View, Technlg. Sls.	415-960-0600
CA	San Jose, Solid State Sci.	408-241-7111
CA	Sherman Oaks, Solid State Sci.	213-995-6666
CA	Woodland Hills, Interstate Mktg. Assoc.	213-883-7606
CO	Englewood, Todd & Fry Assoc.	303-447-9358
CT	Guilford, Datamark	203-453-0575
FL	Coral Springs, Electrocraft	305-753-8666
FL	Largo, Electrocraft	813-530-4749
FL	Tampa, Solid State Sci.	813-935-8203
GA	Clarkston, Electramark	404-292-0369
GA	Lawrenceville, Electramark	404-963-4793
IL	Arlington Hgts., Solid State Sci.	312-255-3883
IL	Rolling Meadows, Hartland Tech. Mktg.	312-577-9222
MD	Towson, Arbotek Assoc. Inc.	301-825-0775
MA	Lexington, Nova Sales	617-861-1820
MA	Waltham, Solid State Sci.	617-891-7530
MN	Eden Prairie, Electronic Innovators	612-941-0830
MO	Blue Springs, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Bellmawr, TAI Corp.	609-933-2600
NY	Camillus, Ontec Inc.	315-672-5626
NY	Commack, ERA Inc.	516-543-0510
NY	Rochester, Ontec Inc.	716-464-8636
NY	Wappinger Falls, Ontec Inc.	914-462-7188
OH	Beachwood, Electronic Salesmaster	216-831-9555
OR	Beaverton, Caruso & Northcutt	503-646-4973
PA	Willow Grove, Solid State Sci.	215-657-8400
TX	Austin, EMA	513-837-0893
TX	Grapevine, EMA	817-481-7502
TX	Houston, EMA	713-498-8120
WA	Bellevue, Caruso & Northcutt	206-454-9699
WI	Milwaukee, J. M. Sales	414-546-0040
WI	Milwaukee, Heartland Technical Mktg.	414-931-0606

SOLID STATE SYSTEMS, 1990 Delk Industrial Blvd., Marietta, GA 30067, Tel: 404-952-9401; Empl.: 140; *Sls. Mgr.:* H. Ivester; *Dist. Mgr.:* J. Schloss

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, TWX: 710-332-1620; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, 8808 Balboa Ave., San Diego, CA 92123, Tel: 619-278-8780, TWX: 910-335-1221; Empl.: 900

SOLITRON DEVICES, INC., Semiconductor Group, 1177 Blue Heron Rd., Riviera Beach, FL 33404, Tel: 305-848-4311, Telex: 51-3435, TWX: 510-952-7610; FSC No.: 21845; Empl.: 646; *Sls. Mgr.:* John Flynn; *Dist. Mgr.:* Kevin O'Shea

SOLITRON/MICROWAVE, Box 278, Port Salerno, FL 33492, Tel: 305-287-5000, TWX: 510-953-7500; FSC No.: 95077; Empl.: 300; *Sls. Mgr.:* James J. McCann

SOLTEC® CORPORATION

SOLTEC CORP., 11684 Pendelton St., Sun Valley, CA 91352, Tel: 818-767-0044, 800-423-2344, Telex: 67-4188; Empl.: 46; *Sls. Mgr.:* Gary A. Purser ....**3**•1388, 1389

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Scottsdale, Barnhill Assocs.	602-947-7841
CA	San Carlos, Elctrn. Engrg. Assocs.	415-593-2189
CA	San Diego, Mesa Engrg.	619-268-3500
CO	Englewood, Barnhill Assocs.	303-779-3600
DE	Wilmington, Elctrn. Mktg. Assocs.	302-652-5333
FL	Melbourne, Saber Assocs.	800-432-6288
GA	Cummings, Saber Assocs.	800-327-0853
IL	Arlington Heights, Dytec/Central	312-394-3380
KS	Mission, Vertec Assocs.	913-677-3200
LA	Baton Rouge, Barnhill Assocs.	504-924-6826
MD	Baltimore, Elctrn. Mktg. Assocs.	301-744-7700
MD	Rockville, Elctrn. Mktg. Assocs.	301-881-5300
MA	Acton, Applied Measurements	617-646-7250
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Minneapolis, Trask Engrg	612-537-2434
MO	Manchester, Vertec Assocs.	314-394-6242
NJ	Lodi, SDM Reprs.	201-368-0123
NM	Albuquerque, Barnhill Assocs.	505-299-7658
NY	Rochester, SDM Reps	716-247-8770
NC	Clayton, Saber Assocs.	800-327-0853
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Beaverton, Northwest Test & Meas.	503-646-9966
PA	King of Prussia, Elctrn. Mktg. Assocs.	215-265-1600
PA	Philadelphia, Elctrn. Mktg. Assocs.	215-248-5050
PA	Pittsburgh, WKM Assocs.	412-892-2953
PA	Plymouth Meeting, Elctrn. Mktg. Assocs.	215-828-7400
SC	Columbia, Saber Assocs.	800-327-0853
TX	Austin, Barnhill Assocs.	512-451-0217

TX	Houston, Barnhill Assocs.	713-688-9971
TX	Richardson, Barnhill Assocs.	214-231-2573
UT	Murray, Barnhill Assocs.	801-262-3000
VA	Norfolk, Elctrn. Mktg. Assocs.	804-461-8133
VA	Richmond, Elctrn. Mktg. Assocs.	804-320-8801
WA	Redmond, Northwest Test & Meas.	206-881-8857

SONIC INTERNATIONAL CORP., 2515 N.E. Riverside, Portland, OR 97211, Tel: 503-665-0187, Telex: 36-0325; Empl.: 130

Sonnenschein

SONNENSCHEIN BATTERIES INC., 525 New Britain Ave., Unionville, CT 06085, Tel: 203-677-5846, Telex: 710-4238 723; *Sls. Mgr.:* Robert McCarthy .... **3•1431**

Local Sales Offices & Reps

AL	Huntsville, Raycom, Inc.	205-859-2017
CA	Anaheim, Impact Elctrns.	714-533-1351
CA	Milipitas, Lee-Allan Assoc.	408-946-8300
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Bethel, G/M Assocs.	203-744-1426
CT	Manchester, G/M Assocs.	203-646-4443
FL	Melbourne, Raycom, Inc.	305-259-7988
IL	Park Ridge, Metcom Assocs. Corp.	312-696-1490
MA	Framingham, G/M Assocs.	617-872-4871
MI	Southfield, R. C. Merchant & Co.	313-354-4300
MI	St. Joseph, R. C. Merchant & Co.	616-983-7378
MN	St. Paul, Arkco Sls.	612-777-7454
MO	Florissant, Web Assocs/Elctrns.	314-921-5720
NH	Exeter, G/M Assocs.	603-778-7472
NJ	Linden, C. E. Kite Assocs.	201-925-1899
NY	Huntington, Registration Elec. Supp.	516-266-2808
NC	Raleigh, Raycom, Inc.	919-847-8276
OH	Chesterland, KT/Depko	216-729-3588
TX	Austin, Delta Comps.	512-458-4288
TX	Seagoville, Delta Comps.	214-287-6333
WA	Portland, Harry Levinson Co.	503-245-1902
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	West Allis, Metcom Assocs. Corp.	414-476-1300

SONICOR INSTRUMENT CORP., 1365 Marconi Blvd., Copiague, NY 11726, Tel: 516-842-3344, Telex: 649494; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONOBOND, 200 E. Rosedale Ave., West Chester, PA 19380, Tel: 215-696-4710, Telex: 834511; Empl.: 50; *Sls. Mgr.:* John Harper

SONY CORP. OF AMERICA, Component Prods. Div., 15 Essex Road, Paramus, NJ 07652, Tel: 201-368-5000

SORENSEN CO., 676 E. Island Pond Rd., Manchester, NH 03103, Tel: 603-668-4500, Telex: 94-3459, TWX: 710-220-1339; Empl.: 850; *Sls. Mgr.:* Roy Allman

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, TWX: 710-425-4093; Empl.: 100; *Sls. Mgr.:* Tom D'Allesantro .... **1B•1102, 1103**

Local Sales Offices & Reps

CA	Anaheim, Galaxie Sls.	714-752-1580
CA	Mt. View, Del Bucchia & Assoc.	415-965-8045
CT	Hartford, Atlantic Switch Co.	203-527-7705
FL	Lakeland, Switch Controls	813-644-7564
IL	Wheaton, Chadra-Schilke	312-653-8126
IN	Fort Wayne, Menze Sls.	219-747-5616
MA	Canton, Comtek Assoc.	617-828-2948
MI	Birmingham, Favco	313-644-0173
MN	Edina, Monroe/Hanna	612-566-1324
MO	Clayton, Mertens Co.	314-993-6600
NJ	Marlton, Naudain Assoc.	609-596-1562
NY	Great Neck, Pacent Eng. Co.	516-482-4678
NY	Roslyn Heights, November Elctrn. Sls.	516-621-6378
NC	Raleigh, Rick Hadley	919-362-4099
TX	Dallas, Texaswitch	214-357-1768
WA	Mercer Island, Elctrn. Comp.	206-232-9301

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
CA	Tustin, Western Switches	714-731-4333
CA	Van Nuys, Pacific Switch Controls	213-873-4802
CO	Denver, Waco Elctrns.	303-371-4370
CT	Hartford, Atlantic Switch Controls	203-527-7705
FL	Lakeland, Switch Controls	813-644-7564
GA	Augusta, Dixie Elctrns.	404-722-2055
IL	Wheaton, Conectrix	312-653-1460
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
MN	Minneapolis, Carl Berquist	612-835-2322
NJ	Mt. Laurel, Jersey Switch	609-778-8190
NY	Woodside, Switches Unltd.	212-478-5000
NC	Charlotte, Dixie Elctrns.	704-377-5413
OH	Columbus, Ohio Switch	614-885-0319
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Texaswitch	214-357-1768
EXP	NJ, Ft. Lee, Joseph Gross	201-944-3609

SOSHIN ELEC. CO., 1-18-18 Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 775-2111, Telex: 246-6377; Empl.: 800; *Sls. Mgr.:* N. Hiraide, Exp. & Imp. Dept. .... **1A•1184**

Local Sales Offices & Reps

NY	Commack, Arco Elctrns.	516-864-7000

Local Distributors

CA	Chatsworth, Arco Elctrns.	213-882-8707
NY	Commack, Arco Elctrns.	516-864-7000

SOURIAU, INC., 25158 Avenue Stanford, Valencia, CA 91355, Tel: 805-257-4830, Telex: 4720328, TWX: 910-495-2028; Empl.: 55; *Sls. Mgr.:* Bill Vockerath/ Richard Monstein .... **2•1566, 1567**

Local Sales Offices & Reps

AL	Brownsboro, JHU Assocs.	205-536-7455
AZ	Scottsdale, Summit Sls.	602-998-4850
AR	Fort Smith, Electra Reps	501-452-4030
CA	Los Altos, Recht Assocs.	415-964-6321
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CO	Westminster, D/Z Assocs.	303-429-9369
FL	Altamonte Springs, Gugel-Tuttle Assoc.	305-788-0845
GA	Atlanta, JHU Assocs.	404-634-1000
IL	Lisle, WG Controls	312-963-5954
IN	Indianapolis, CC Elctrns.	317-255-1508
MD	Ellicott City, Doss Elctrns.	301-465-1336
MA	Stow, Today Comp. Sls.	617-897-7500
MI	Lake Orion, CC Elctrns.	313-338-7400
MO	Raytown, Centech	816-358-8100
NJ	West Caldwell, Grimm Siegel Assoc.	201-575-9300
NY	Poughkeepsie, C.W. Floring & Assoc.	914-471-2973
NY	Scottsville, C.W. Floring & Assoc.	716-271-6865
NY	Syracuse, C.W. Floring & Assoc.	315-478-2149
NC	Greensboro, JHU Assocs.	919-852-9097
OH	Dayton, Dircksen & Assoc. (DESC only)	513-294-3657
OH	Galion, CC Elctrns.	419-468-4817
OR	Aloha, Venture Elctrns.	503-642-9090
PA	Glenside, PWC	215-576-0110
TN	Talbott, JHU Assoc.	615-581-4141
TX	Dallas, Electra Reps	214-387-3594
TX	Houston, Electra Reps	713-530-2208
UT	Salt Lake City, D/Z Assocs.	801-486-4233
WA	Bellevue, Venture Elctrns.	206-454-4594

Local Distributors

AL	Huntsville, Marshall Elctrns.	205-881-9235
AZ	Scottsdale, Contech Elctrns.	602-948-3330
AZ	Tempe, Marshall Elctrns.	602-968-6181
AZ	Tempe, Acacia Sls.	602-894-2874
CA	Anaheim, Compucable	714-635-7330
CA	Canoga Park, Marshall Elctrns.	818-999-5001
CA	El Monte, Marshall Elctrns.	818-442-7204
CA	Fullerton, Pyramid Elctrns. Supp.	714-773-0781
CA	Irvine, Marshall Elctrns.	714-556-6400
CA	Irvine, Acacia Sls.	714-660-0834
CA	San Diego, Marshall Elctrns.	619-578-9600
CA	San Diego, Acacia Sls.	619-565-4365
CA	Santa Ana, Norstan Elctrns.	714-540-4165
CA	Santa Clara, Pyramid Elctrns. Supp.	408-727-9810
CA	Sunnyvale, Acacia Sls.	408-745-7200
CA	Sunnyvale, Marshall Elctrns.	408-732-1100
CA	Van Nuys, Air Electro Supp.	818-988-4400
CO	Denver, Marshall Elctrns.	303-427-1818
CO	Lakewood, Acacia Sls.	303-232-2882
CT	East Haven, J V Elctrns.	203-469-2321
CT	Norwalk, Park Distrs.	203-853-2010
CT	Wallingford, Marshall Elctrns.	203-265-3822
FL	Casselberry, Afcom	305-699-9500
FL	Clearwater, Diplomat Elctrns.	813-443-4514
FL	Orlando, Marshall Elctrns.	305-841-1878
FL	Winter Park, Zebra Elctrns.	305-677-6661
GA	Norcross, Marshall Elctrns.	404-923-5750
IL	Schaumburg, Marshall Elctrns.	312-490-0155
MD	Gaithersburg, Marshall Elctrns.	301-840-9450
MD	Timonium, Zebra Elctrns.	301-252-6576
MD	White Marsh, Resco/Baltimore	301-529-0500
MA	Burlington, Marshall Elctrns.	617-272-8200
MA	Natick, Tec-con Elctrns.	617-655-9333
MI	Livonia, Marshall Elctrns.	313-525-5850
MN	Plymouth, Marshall Elctrns.	612-559-2211
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Fairfield, Marshall Elctrns.	201-882-0320
NJ	Maple Shade, Zebra Elctrns.	609-779-8073
NJ	Mt. Laurel, Marshall Elctrns.	609-234-9100
NM	Albuquerque, Betatron Elctrns.	505-344-2381
NM	Albuquerque, Connecting Comps.	505-345-8921
NY	Endwell, ASI	607-754-3823
NY	Endwell, Marshall Elctrns.	607-754-1570
NY	Farmingdale, Iris Elctrns.	516-420-8400
NY	Farmingdale, Resource for Elctrns.	516-420-8555
NY	Farmingdale, Midway Indl. Elctrns.	516-293-6800
NY	Hauppauge, Marshall Elctrns.	516-273-2424
NY	Port Washington, Restart Elctrns.	516-883-3500
NY	Rochester, Marshall Elctrns.	716-235-7620
OH	Cincinnati, Schuster Elec.	513-489-1400
OH	Dayton, Marshall Elctrns.	513-236-8088
OH	Solon, Marshall Elctrns.	216-248-1788
OH	Twinsburg, Schuster Elec.	216-425-8134
OK	Oklahoma City, Electro Entprs.	405-427-6591
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Allentown, P.A. Peters	215-434-5237
PA	Norristown, Comp. Entprs.	215-272-7900
TX	Addison, Connec/Tek	214-239-7552
TX	Austin, Marshall Elctrns.	512-458-5654
TX	Dallas, Target Elctrns.	214-788-0761
TX	Dallas, Marshall Elctrns.	214-233-5200
TX	Grand Prairie, Dial Supp.	214-647-2371
TX	Houston, Marshall Elctrns.	713-789-6600
TX	Sugarland, Connec/Tek	713-491-2566
UT	Salt Lake City, Diplomat Elctrns.	801-486-4134
WA	Bellevue, Marshall Elctrns.	206-747-9100
WA	Seattle, Radar Elec.	206-282-2511

SOUTHCO, INC., Concordville, PA 19331, Tel: 215-459-4000, Telex: 83-1485, TWX: 710-760-1715; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 3720 N. Stratford Rd. N.E., Atlanta, GA 30342, Tel: 404-231-5363; *Sls. Mgr.:* Raymond F. Marley; *Dist. Mgr.:* Robert Morris

SOUTHERN ELECTRONICS, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 213-845-2458, TWX: 910-498-5707; Empl.: 100; *Sls. Mgr.:* Ron Head

SOUTH SHORE METAL PRODS., 88 E Allen Blvd., Farmingdale, NY 11735, Tel: 516-249-3322; Empl.: 30; *Sls. Mgr.:* A. G. Bauer

SOUTHWEST TECH PRODS CORP., 219 W. Rhapsody, San Antonio, TX 78216, Tel: 512-344-0242; Empl.: 34

SPACE ELECTRONICS, INC., Box 2166, Meriden, CT 06450, Tel: 203-235-7755; Empl.: 16; *Sls. Mgr.:* Richard Boynton

SPACE POWER ELCTRNS., Jeffrey Lane, RD 1, Glen Gardner, NJ 08826, Tel: 201-537-2184

SP AMERICA INC., Shin-Etsu Polymer, 1754 Technology Dr., Ste. 128, San Jose, CA 95110, Tel: 408-947-0311, TWX: 910-338-2229; *Sls. Mgr.:* R. L. Bucholtz

SPARKOMATIC, Rte. 6 & 209, Milford, PA 18337, Tel: 717-296-6444, TWX: 510-260-2682; Empl.: 300; *Sls. Mgr.:* Robert Schuler

SPEC, INC., 3014 N. Hayden Rd., Ste. 115, Scottsdale, AZ 85251, Tel: 602-994-1511; *Sls. Mgr.:* James J. Edwards

SPECIALIZED ELCTRN. MAGNETIC PRODS., 272 Loudon Ridge Rd. Route 8, Loudon, NH 03301, Tel: (603) 267-6892; *Sls. Mgr.:* Grant D. Avery

SPECIALTY CONNECTOR CO., 2620 Endress Place, Greenwood, IN 46141, Tel: 317-535-5353

SPECO DIV., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, 800-645-5516, Telex: 96-7754; Empl.: 33; *Sls. Mgr.:* Mel Hulkower; *Dist. Mgr.:* Stan Hulkower

SPECTRACOM, 320 N. Washington St., Rochester, NY 14625, Tel: 716-381-4827; Empl.: 12

SPECTRAGRAPHICS CORP., 10260 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-450-0611; Empl.: 100

SPECTRAL DYNAMICS DIV., Scientific-Atlanta, Box 671, San Diego, CA 92112, Tel: 619-268-7100, TWX: 910-335-2022; Empl.: 600; *Sls. Mgr.:* Robert N. Saunders

SPECTRA LUX CORP., 12840 N.E. 21 St. Pl., Bellevue, WA 98005, Tel: 206-747-0560; FSC No.: 51896; *Sls. Mgr.:* Ron Bustad

SPECTRAN CORP., Hall Rd., P.O. Box 650, Sturbridge, MA 01566, Tel: 617-347-2261; FSC No.: 6V569; Empl.: 25

SPECTRAN INSTRUMENTS, INC., Box 891, La Habra, CA 90631, Tel: 213-694-3995

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84403, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP, 7100 Lampson Ave., Garden Grove, CA 92642-0415, Tel: 714-892-3361, TWX: 910-596-1314; Empl.: 300; *Sls. Mgr.:* Jerry Campbell

SPECTRO EQUIPMENT, INC., 6021 Royalton Rd., N. Royalton, OH 44133, Tel: 216-237-8910; Empl.: 25

SPECTROLAB, INC., 12500 Gladstone Ave., Sylmar, CA 91342, Tel: 213-365-4611, TWX: 910-496-1488; Empl.: 250

SPECTROL ELCTRNS., 17070 East Gale Ave., City of Industry, CA 91749, Tel: 818-964-6565, TWX: 910-584-1314; Empl.: 600; *Sls. Mgr.:* R. Shackelford .... **1A**•2056-2062

Local Sales Offices & Reps

AL	Huntsville, Beacon Sls.	205-881-5031
AZ	Phoenix, Thom Luke Sls.	602-941-1901
CA	San Diego, Hadden Assoc.	619-565-9444
CA	Santa Clara, I²	408-988-3400
CA	Ventura, Astralonics	805-653-5991
CO	Denver, Spectrum Sls.	303-696-1601
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Clearwater, Beacon Sls.	813-796-2378
FL	Ft. Lauderdale, Beacon Sls.	305-491-1054
IL	Downers Grove, Momak Sls.	312-963-6400
IA	Hiawatha, Gassner & Clark	319-393-5763
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
MD	Baltimore, Component Sls.	301-484-3647
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Livonia, Luebbe Sls.	313-477-3131
MN	St. Paul, Murnco	612-484-8200
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NY	Commack, E.R.A.	516-543-0510
NY	Liverpool, Precision Sls.	315-451-3480
NY	Syracuse, L Mar	315-437-7779
NC	Raleigh, Beacon Sls.	919-787-0330
OH	Cincinnati, Luebbe Sls.	513-891-5770
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
OR	Beaverton, Barrett-Squibb & Assocs.	503-642-1661
PA	Pittsburgh, R. F. Clark	412-242-9500
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-988-1600
TX	Hurst, Allied Comps.	817-589-0456
WA	Redmond, Barrett-Squibb & Assocs.	206-885-6991

SPECTRON CORP., 344 New Albany Rd., Moorestown, NJ 08057, Tel: 609-234-5700, Telex: 83-1488, TWX: 710-897-1359

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840, TWX: 510-222-5877; *Sls. Mgr.:* Henry K. Lee; *Dist. Mgr.:* James J. Weglarz

SPECTRONICS, DIV. HONEYWELL, See Honeywell Optoelctrns.

SPECTRUM CONTROL, INC., 8061 Avonia Rd., Fairview, PA 16415, Tel: 814-474-1571

SPECTRUM CONTROL, INC., 2185 W. 8th St., Erie, PA 16505, Tel: 814-455-0966, TWX: 510-699-6871; FSC No.: 33095; Empl.: 450; *Sls. Mgr.:* R. Greer; *Dist. Mgr.:* C. Pirro .... **1A**•1625-1627; **2**•1569-1573

Local Sales Offices & Reps

CA	Sunnyvale, Spectrum Control	408-735-9015
CA	Valencia, Spectrum Control	805-257-2280
MA	Chelmsford, Spectrum Control	617-256-3565
NJ	Brielle, Spectrum Control	201-528-8420
NJ	Fairfield, Pantronics	201-575-1177
NY	New York, Landseas	212-265-8323
TX	Irving, Spectrum Control	214-251-1669
EXP	PA, Erie, Spectrum Control	814-455-0966

Local Distributors

CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Torrance, Cypress Elctrns.	213-533-6005
FL	Dania, Summit Distrs.	305-920-6253
IL	Chicago, Newark Elctrns.	312-638-4411
NJ	Perth Amboy, Metuchen Capacitors	201-442-0500
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Rochester, Summit Distrs.	716-334-8110
OH	Dayton, Aschbacher	513-252-7785
TX	Addison, Captronics	214-980-0123
TX	Austin, Captronics	512-459-4328
TX	Houston, Captronics	713-776-2100
Intl	Australia, Rifa	03-480 1211
Intl	Denmark, E.V.J. Johanssen Elektronics	01-839022
Intl	Eng., Birmingham, Steatite Insulations	021 454-6961-2
Intl	France, Gentilly, Radio Television Franchise S.A.	664.11.01
Intl	Israel, Tel-Aviv, Landseas, Ltd.	247291-4
Intl	Japan, Tokyo, Jepico	Tokyo (03) 348-0621/0622
Intl	Netherlands, Zaandam, Bodamer Intl. BV	075-351521
Intl	Norway, H.C.A. Melbye/AS	02-106050
Intl	S. Africa, Bryanston, Taltronics Pty. Ltd.	618-2014/5
Intl	Sweden, Farsta, Traco AB	08-93-0960
Intl	Switzerland, Ebmatingen, EME, Ernst Egli	01-980-11-11
Intl	W. Germany, Ettlingen, Bodamer GmbH	(07243) 79263
Intl	W. Germany, Hamburg, Bodamer GmbH	(040) 7111091
Intl	W. Germany, Munchen, Bodamer GmbH	(089) 641801

SPECTRUM TECHNOLOGY, INC., 300 Lopez Rd., Goleta, CA 93116, Tel: 805-964-7791, TWX: 910-334-1163; FSC No.: 32464; Empl.: 100; *Sls. Mgr.:* Wm. L. Bishop .... **1A**•1426, 1427

Local Sales Offices & Reps

AZ	Tempe, Sedco Sls.	602-835-6281
AZ	Tucson, Sedco Sls.	602-298-1758
CA	Culver City, Westaironics	213-641-4122
CA	San Jose, Frequency Control Assocs.	408-446-0200
CT	Milford, Todino Engrg. Sls.	203-874-6643
FL	Ft. Myers, Rainbow Sls.	813-332-2210
FL	Melbourne, Rainbow Sls.	305-727-3305
IL	Elgin, R.K. Elctrns.	312-695-8552
MA	Needham, Todino Engrg. Sls.	617-444-7925
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NM	Albuquerque, I.M.E.C.	505-883-9010
NY	Huntington, Compar N.Y.	516-423-5660
OK	Tulsa, Ion Assocs.	918-664-0186
TX	Austin, Ion Assocs.	512-458-2108
TX	Grand Prairie, Ion Assocs.	817-640-8282
TX	Houston, Ion Assocs.	713-461-5311
VA	Fairfax, Schibley Assocs.	703-591-3008

Spellman
High Voltage Electronics Corporation

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 175; *Sls. Mgr.:* James R. Usher .... **3**•1774-1776

Local Sales Offices & Reps

CA	El Cajun, Atronics	619-444-1501
CA	Woodland Hills, Atronics	213-703-7212
FL	Orlando, Gra-Mar, Inc.	305-894-3351
MA	Concord, Nortech Engrg. Sls.	617-259-0032
MA	Medfield, Nortech Engrg.	617-359-6063
MN	St. Paul, Knox Assocs.	612-488-5402
TX	Dallas, Seaton Corp.	214-380-0414
TX	Houston, Seaton Corp.	713-731-2649

SPEMCO SWITCHES, 23425 Harper, St. Clair Shores, MI 48080, Tel: 800-482-2828; Empl.: 9

A.W. SPERRY
INSTRUMENTS INC.

SPERRY, A. W., INSTRS., P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, Telex: 645104; Empl.: 40; *Sls. Mgr.:* Dennis W. Carroll .... **3**•1304

Local Sales Offices & Reps

AL	Birmingham, Russell Elctrn. Assocs.	205-822-2196
CA	N. Hollywood, Don Starr Co.	213-875-2766
CA	San Francisco, Flair Electro Sls.	415-864-0444
CA	Santa Fe Springs, New West Agency	213-921-6812
CO	Denver, E. O. Sales Co.	303-778-1900
FL	Longwood, Ralph Joyner Mktg.	305-339-0181
HI	Kailua, Don Thomas Assocs.	808-262-4818
IL	Chicago, Ken Levy & Assocs., Ltd.	312-763-5000
IL	Forest Park, J. K. Neuhauser Sls. Co.	312-771-7800
IN	Indianapolis, Blind & Assocs.	317-844-1314
IA	Council Bluffs, Bob Smith Co.	712-322-1233
LA	Mandeville, Corrigan Agency	504-626-5231
MD	Kensington, Forti Assocs.	301-949-1706
MA	Northboro, W. B. Pray Sls.	617-393-3434
MI	Detroit, Burcaw Co.	313-533-7700
MN	Minneapolis, Fruen's Sales	612-546-7173
MO	Kansas City, Johnson Elec. Sls. Co.	816-421-4891
NY	Buffalo, Rudell-Merrifield Assoc.	716-634-4300
NY	Oceanside, Bittan Assocs.	516-678-6222
NY	Syracuse, Electro-Lines	315-455-5701
NC	Charlotte, W. H. Lassiter	704-523-2736
OH	Chagrin Falls, Thomas R. Eby Co.	216-543-8141
OH	Columbus, Mandabach-Lehner	614-235-0265
TX	Dallas, Kopiuitz Co.	214-484-7557
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
WA	Bellevue, Topp Engrg. Sls.	206-747-5400

SPERRY UNIVAC, Mini-Computer Operations, Box C-19504, Irvine, CA 92713, Tel: 714-754-6900, TWX: 910-596-1358; Empl.: 500

SPIRICON INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729; Empl.: 5; *Sls. Mgr.:* Carlos Roundy

SPRAGUE ELEC. CO., 481 Marshall St., No. Adams, MA 01247, Tel: 413-664-4411, Telex: 92-6415, TWX: 710-369-1360; FSC No.: 56289; Empl.: 10,500; *Dist. Mgr.:* J. J. Judge

SPRAGUE ELEC. CO., Semiconductor Div., 115 Northeast Cutoff, Worcester, MA 01606, Tel: 617-853-5000, TWX: 710-340-6304; FSC No.: 56289; Empl.: 650

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385, Telex: 14-4533; FSC No.: 52769; Empl.: 100; *Sls. Mgr.:* David Taub; *Dist. Mgr.:* David Taub .... **1A**•1185

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	Burlingame, W. J. Purdy Co.	415-347-7701
CA	Los Angeles, R.F. Assocs.	213-478-1586
CA	San Diego, R. D. Miner Inc.	619-566-9891
CO	Denver, W. J. Purdy Co.	303-777-1411
FL	Pompano Beach, Cole-Tek	305-781-8110
GA	Smyrna, Spartech	404-432-3644
IL	Chicago, B.N.I. Elctrns.	312-447-0581
IN	Ft. Wayne, Denton Mktg. Inc.	219-627-5515
IA	Marion, M.S.B. Assoc.	319-377-6261
KS	Shawnee Mission, M.S.B. Assoc.	913-432-2131
MD	Pikesville, Imagitron Sls.	301-521-2020
MA	Southboro, KSA of New England	617-485-9432
MI	Jackson, Sprague Elec. Co.	517-787-3934
MN	Chanhassen, Barnes Sls. Assoc.	612-934-2907
MO	St. Charles, M.S.B. Assoc.	314-946-5577
NJ	Wayne, Richman Salesco - Kagan	201-694-1115
NY	Commack, Richman Salesco	516-543-5532
NY	Utica, Sweetco Assoc.	315-797-6721
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
TX	Austin, Delta Comps.	512-458-4288
TX	Seagoville, Delta Comps.	214-287-6333
WA	Seattle, Sprague Elec. Co.	206-632-7761
WA	Vancouver, Sprague Elec.	206-892-0361

Local Distributors

CA	Belmont, Varitech Electronics	415-593-3300
CA	Garden Grove, National Capacitor Corp.	714-892-7749
CA	Santa Ana, Projections Unlimited	714-641-1472
IL	Skokie, Kellner Elctrns.	312-677-1120
MA	Burlington, T.L.C.	617-273-0140
MA	Needham, Cronin Elctrns.	617-449-5000
NY	Hauppauge, Prime Comps.	516-582-6258
NY	Lynbrook, Varitech Elctrns.	516-593-9300
NY	Stony Brook, Bomark Elctrns.	516-689-8999
PA	State College, ALVO Elctrns.	814-238-0505
TX	Addison, Captronics	214-980-0123
TX	Ft. Worth, PATCO Supp.	
WA	Seattle, KAM Elctrns.	206-285-5622

SPRAGUE PRODUCTS CO., 481 Marshall St., No. Adams, MA 01247, Tel: 413-664-4481, TWX: 710-369-1363; FSC No.: 56289; *Sls. Mgr.:* J. Judge; *Dist. Mgr.:* A. Bascomb, Vice President

SPRINGFIELD MOULDERS, INC., See ITT Thermotech

SPRUCE PINE MICA CO., Mtn. Laurel Dr., Spruce Pine, NC 28777, Tel: 704-765-4241; Empl.: 45; *Sls. Mgr.:* Hugh M. Wiseman

Local Sales Offices & Reps

CA	Mountain View, Straube Assocs.	415-969-6060
NC	Smithfield, Agents & Distrs.	919-934-7592

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 312-397-2600, Telex: 255274; Empl.: 21100; *Sls. Mgr.:* R. A. Hegeman

SR ENGINEERING INC., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200; FSC No.: 21441; *Sls. Mgr.:* Coleman W. Conrad

Local Sales Offices & Reps

AZ	Phoenix, Runyon Co.	602-840-6060
IA	Cedar Rapids, Howard Brown Sls. Co.	319-366-0635

SRS INDUSTRIES, INC., 903 S. Alta Vista Ave., Monrovia, CA 91016, Tel: 213-357-3287, TWX: 910-585-3486; FSC No.: 015362; *Sls. Mgr.:* John B. McCaffery

S S A C, Box 395, Liverpool, NY 13088, Tel: 315-622-1000, Telex: 646221, TWX: SSAC LIPL; FSC No.: 16-0985719; Empl.: 220; *Sls. Mgr.:* R. Shutt

STACKBIN CORP., Albion Road, Lincoln, RI 02865, Tel: 401-333-1600; Empl.: 75; *Sls. Mgr.:* J. J. Patterson

STACKPOLE (THE STACKPOLE CORP.), Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, Telex: 914-514, TWX: 510-693-4511; FSC No.: 78488

STACKPOLE, CARBON DIV., St. Marys, PA 15857, Tel: 814-781-1234, Telex: 914-514, TWX: 510-693-4511; *Sls. Mgr.:* T. M. Eynon

STACKPOLE COMPONENTS CO., 3400 Yonkers Rd., Raleigh, NC 27604, Tel: 919-828-6201, TWX: 510-928-0520, 29; *Sls. Mgr.:* Patrick J. Ryan; *Dist. Mgr.:* Tish Gibson

STACKPOLE COMPONENTS CO., Box M, Farmville, VA 23901, Tel: 804-392-4111, TWX: 510-928-0520/29; *Sls. Mgr.:* P. J. Ryan; *Dist. Mgr.:* Tish Gibson

STACKPOLE, ELECTRONIC COMPONENTS DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, Telex: 914-514, TWX: 510-693-4511; *Sls. Mgr.:* D. L. Almquist

STACKPOLE, MAGNET DIV., 700 Elk Ave., Kane, PA 16735, Tel: 814-837-7000, TWX: 510-695-8360; *Sls. Mgr.:* V. D. Venigni

STACO, INC., See Staco Transpower

STACO
ENERGY PRODUCTS CO.

STACO ENERGY PRODS. CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, Telex: 288-032, TWX: 810-459-1798; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Robert Simpson ....**1A•2280, 2281**

Local Sales Offices & Reps

CA	Costa Mesa, Stacoswitch	714-549-3041
CA	Santa Clara, Thomas Assocs.	408-988-4484
CO	Denver, West, Inc.	303-692-0131
FL	Ft. Lauderdale, Hutto-Hawkins-Peregoy	305-917-5750
FL	Maitland, Hutto-Hawkins-Peregoy	305-831-2474
GA	Atlanta, Millar Elctrn. Sls.	404-261-6160
HI	Honolulu, Elctrns. Sls. & Svc.	808-845-8207
IL	Evanston, Saffro & Assocs.	312-328-0140
IN	Indianapolis, Electronic Mktg.	317-842-4155
LA	Folsom, McKinney Sls. Co.	504-796-5861
MA	Lexington, Hathaway Elctrns.	617-861-7010
MN	St. Paul, SKOR	612-645-6461
MO	Kansas City, J. O. Schmitz	816-363-3414
NM	Albuquerque, C. T. Carlberg & Assocs.	505-265-1579
NY	Alexander, B. F. Tollefson Assocs.	716-591-1219
NY	Auburn, B. F. Tollefson Assocs.	315-253-4109
NY	Rochester, B. F. Tollefson Assocs.	716-271-4141
NY	Valley Stream, Levison Sls. Co.	516-561-9696
NC	Raleigh, Millar Elctrns.	919-787-9564
OH	Dayton, Dircksen & Assoc.	513-294-3657
OH	Dayton, Rockford Controls	513-898-5452
OH	Euclid, Rockford Controls	216-731-5250
OK	Tulsa, McKinney Sls. Co.	918-492-8882
OR	Portland, James J. Backer	503-297-3776
OR	Salem, Jas. J. Backer	503-362-0717
PA	Flourtown, Eastern Comps.	215-836-1616
PA	Stuartstown, Eastern Comps. Sls.	717-993-3288
PA	York, Eastern Comps.	717-764-3114
TX	Bellaire, McKinney Sls. Co.	713-444-3817
TX	Dallas, McKinney Sls. Co.	214-631-9450
VA	Herndon, Eastern Comps.	703-471-1025
WA	Seattle, James J. Backer	206-285-1300
WI	Lake Mills, Saffro & Assocs.	414-648-2605
EXP	FL, Hialeah, West Indes Sls. Co., Ltd.	305-888-1676
EXP	NY, New York, Allied Intl.	212-986-3222

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, TWX: 910-595-1507; FSC No.: 12522; Empl.: 100; *Sls. Mgr.:* D. Sugg

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg., Inc.	205-533-9281
CA	San Jose, Snyder Sls.	408-559-4444
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Marion, Sands Co.	203-628-4363
FL	Orlando, EMA, Inc.	305-671-6800
GA	Stone Mountain, 20th Century Mktg., Inc.	404-292-7088
IL	Oak Brook, MSL Assoc.	312-655-8977
IN	Richmond, EMA, Inc.	513-433-2800
IA	Cedar Rapids, H. R. Brown Sls.	319-366-0635
KS	Kansas City, B-C Elctrn. Sls.	913-342-1211
MD	Silversprings, Youth & Nelson	301-598-5740
MA	Woburn, Sands Co.	617-935-7495
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MO	St. Louis, B-C Elctrn. Sls.	314-731-1255
NJ	Wayne, G.T. Assocs.	201-694-6040
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, C.A. Robinson Co.	216-381-9049
OH	Dayton, C.A. Robinson	513-278-7969
OR	Portland, Frank Jackson Assoc.	503-292-2638
PA	Media, W. Reeves Assocs.	215-566-6709
TN	Knoxville, 20th Century Mktg., Inc.	615-690-1618
TX	Austin, Delta Comps.	512-458-4288
TX	Dallas, Delta Comp.	214-358-4288
TX	Houston, Delta Comps.	713-664-6777
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
WA	Redmond, Frank Jackson Assoc.	206-881-7277

STACO
TRANSPOWER

STACO TRANSPOWER, 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, Telex: 288-032, TWX: 810-459-1798; FSC No.: 83008; Empl.: 100; *Sls. Mgr.:* T. D. McNulty ....**1A•2283**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Scottsdale, Power Specialists	602-996-4100
CA	Buena Park, Chuck Cooper Co.	714-739-8526
CA	Los Altos, Frauman Assoc.	415-941-0660
CT	Natick, Benchmark Assoc.	617-899-3390
GA	Atlanta, Remco	404-447-6937
KY	Cinci, Tri-State Mktg.	513-761-7993
MA	Natick, Benchmark Assocs.	617-655-9333
MI	Southfield, Fred Gehrke & Assocs.	313-559-5363
MN	Arlington Hgts., Diethert-Angel	312-593-7600
MN	Minneapolis, Diethert Angel	612-546-6099
NJ	King of Prussia, Freeman-Malta Assoc.	215-337-9211
NJ	Mountain Lakes, Levison Sls. Co. Inc.	201-334-2921
NY	Ilion, Noeth-Honsinger Assoc.	315-894-9943
NY	Pittsford, Noeth-Honsinger Assoc.	716-586-9002
NY	Valley Stream, Levison Sls.	516-561-9698
NC	Raleigh, Remco	919-847-5079
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Marlow Assocs.	614-885-7643
PA	Pittsburgh, Marlow Assocs.	412-367-8886
UT	Salt Lake City, Aspen Sales	801-467-2401
WI	Menomonee Falls, Walter M. Braun & Assocs.	414-251-8685

STAFFALL INC., 7 Woodland St., Providence, RI 02908, Tel: 401-351-8282, TWX: 710-381-6964; Empl.: 25

STAINLESS, INC., 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097; Empl.: 80; *Sls. Mgr.:* Jess C. Rodriguez

STANCOR/HAMILTON STANDARD CONTROLS, 131 Godfrey St., Logansport, IN 46947, Tel: 219-722-2244, TWX: 810-295-0699; FSC No.: 80089; *Sls. Mgr.:* Hubert Daubs ...... **1A•2284-2292; 1B•1474**

Local Sales Offices & Reps

AZ	Scottsdale, Thom Luke Sls.	602-941-1901
CA	San Diego, Haddeu Assoc. Inc.	619-565-9444

Solenoid, Actuator, Reed Relay Problems?

Solution:

SR Engineering. We have been serving aerospace, military, space and industrial users since 1961. For help solving your electro-magnetic device problems call (714) 554-4200.

SR
ENGINEERING
INCORPORATED

THE PROBLEM SOLVERS

13961 Nautilus Drive, Dept. E
Garden Grove, California 92643

STACKPOLE

AUTHORIZED DISTRIBUTOR

E S I

ELECTRIC SWITCHES
INCORPORATED

2478 Fletcher Dr., Los Angeles, Calif. 90039

(213) 660-1310

TOLL FREE WATS
NATIONAL: 800-421-8855
CALIFORNIA: 800-252-4640

TWX 910-321-2971

IMMEDIATE DELIVERY FROM STOCK

KEYBOARD

Slide Switch

Rocker Switch

CUSTOM ENGRAVING SERVICE AVAILABLE FOR KEY CAPS

SEE COMPLETE PRODUCT LINE UNDER
SWITCHES — SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

CA	San Jose, Silicon Valey Sls.	408-286-7510
CA	Santa Fe Springs, Direct Sls.	213-946-4807
CO	Colorado Springs, Norris & Warren Assoc.	303-576-8697
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Glenview, Reigel Assoc.	312-729-3824
IN	Indianapolis, Electronic Reps. Inc.	317-894-1414
IA	Cedar Rapids, Gassner & Clark	319-393-5763
KS	Shawnee Mission, Lowell Kangas & Assoc. Inc.	913-631-3515
MD	Baltimore, Component Sls.	301-484-3647
MA	Needham Heights, Newscott Co., Inc.	617-444-1923
MI	East Detroit, Jack M. Thorpe Co.	313-779-6363
MN	St. Paul, Murnco	301-833-2039
NJ	Haddonfield, Sunday O'Brien	609-429-4013
NY	Commack, Engineering Reps. Assoc.	516-543-0510
NY	Liverpool, Precision	315-451-3480
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Dallas, Allied Comps. Inc.	214-238-0408
WA	Bellevue, B & P Sls.	206-454-6571

STANDARD CONDENSER CORP., 1065 W. Addison St., Chicago, IL 60613, Tel: 312-327-5440

STANDARD ENERGY, Div. WBH Scientific, Inc., Rte. 32, Greenville, NY 12083, Tel: 518-966-4197, Telex: 754180 ......**3**•1777-1779

STANDARD ENGRG., 44800 Girmmer, Fremont, CA 94538, Tel: 415-657-7555, TWX: 910-381-6048; Empl.: 40

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, TWX: 710-988-5722; Empl.: 50

STANDARD GRIGSBY, INC., 920 Rathbone Ave., Aurora, IL 60507, Tel: 312-844-4300, TWX: 910-232-3138; Empl.: 350; *Sls. Mgr.:* Ed Barry; *Dist. Mgr.:* Bob Lynch ......**1B**•1626, 1627

Local Sales Offices & Reps

AL	Huntsville, L. & D., Inc.	205-837-1469
AZ	Tempe, Piper Sls.	602-949-0048
CA	Laguna Hills, Jack Fitch & Assocs.	714-951-0196
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Casselberry, Southern Elctrn. Mktg.	305-695-3335
FL	Clearwater, Southern Elctrn. Mktg.	813-441-3902
FL	Ft. Lauderdale, Southern Elctrn. Mktg.	305-475-3686
GA	Dunwoody, L. & D., Inc.	404-455-3483
IN	Ft. Wayne, Wilson Tech. Sls.	219-424-5299
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
IA	Cedar Rapids, Rep Assocs.	319-373-0152
MI	Ann Arbor, R. L. Rowe & Assocs.	313-995-8711
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	St. Paul, Murnco	612-484-8200
NJ	Mountain Lakes, Comps. For Elctrns.	201-334-2921
NM	Ithaca, L-Mar Assoc.	607-256-5712
NY	E. Syracuse, L-Mar Assoc.	315-437-7779
NY	East Northport, Comps. for Elctrncs.	516-266-5020
NY	Rochester, L-Mar Assoc.	716-323-1000
NY	W. Seneca, L-Mar Assoc.	716-675-1277
NC	Greensboro, L. & D., Inc.	919-292-3201
NC	Raleigh, L. & D., Inc.	919-876-5301
OH	Cincinnati, Luebbe Sls.	513-891-5770
OH	Cleveland, Luebbe Sls.	216-333-0424
OH	Columbus, Luebbe Sls.	614-431-0464
OH	Dayton, Luebbe Sls.	513-294-0427
OK	Broken Arrow, Design Mktg.	918-258-8656
OR	Aloha, Micro Sls.	513-642-1818
PA	Feasterville, Knowles Assocs.	215-322-7100
PA	Pittsburgh, Luebbe Sls.	412-931-0414
TN	Seymore, L. & D., Inc.	615-557-1549
TX	Conroe, Design Mktg.	713-273-2319
TX	Dallas, Design Mktg.	214-680-9767
TX	Hurst, Design Mktg.	817-268-2004
TX	Round Rock, Design Mktg.	512-255-9896
VA	Richmond, L. & D., Inc.	804-359-0125
WA	Bellevue, Micro Sls.	206-451-0568

Refer to Gordos Corporation, Bloomfield, New Jersey for Authorized Distributor information.

STANDARD GRIGSBY INC., W. Günther GMBH, Virnsberger Strasse 51, D 8500 Nürnberg 51, West Germany, Tel: 0911-65521, Telex: 622351

STANDARD LOGIC, 2215 S. Standard Ave., Santa Ana, CA 92707, Tel: 714-979-4770, TWX: 910-595-1707; Empl.: 150; *Sls. Mgr.:* B. L. Billington

STANDARD MICROSYSTEMS, 35 Marcus Blvd., Hauppauge, NY 11787, Tel: 516-273-3100, TWX: 510-227-8898; Empl.: 310; *Dist. Mgr.:* William Rotoli

STANDARD PNEUMATIC MOTOR, Box 10530, Reno, NV 89510, Tel: 702-329-6311, Telex: 354-467; FSC No.: 53623; Empl.: 125

STANDARD POWER, INC., 1400 S. Village Way, Santa Ana, CA 92705, Tel: 714-558-8512, TWX: 910-595-1760; Empl.: 221; *Sls. Mgr.:* Sydele M. Petch; *Dist. Mgr.:* Sydele M. Petch ......**3**•1780-1783

Local Sales Offices & Reps

AL	Huntsville, Electronic Mfrs. Agts.	205-830-4030
AZ	Phoenix, O'Donnell Assocs.	602-944-9542
CA	San Diego, Martronix	619-728-7678
CA	Sunnyvale, O'Donnell Assocs.	408-263-6500
CA	Torrance, Orion Sls.	213-240-3151
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Altamonte Springs, WMM Assocs.	305-831-4530
FL	Clearwater, WMM Assocs.	813-442-3913
FL	Davie, WMM Assocs.	305-432-2628
FL	Indialantic, WMM Assocs.	305-773-1157
GA	Atlanta, Electronic Mfrs. Agts.	404-329-0503
IL	Elmhurst, Utronix Sls.	312-834-1100
IN	Ft. Wayne, Needler Sls.	219-447-2123
IN	Indianapolis, Needler Sls.	317-255-8056
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
KY	Louisville, Needler Sls.	502-241-4046
MA	Needham Hgts., Sturgeon Co.	617-444-6603
MN	Bloomington, Northport Engrg.	612-854-5556
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NY	Great Neck, Cooper-Simon & Co.	516-487-1142
NY	Syracuse, T Squared Elctrns.	315-463-8592
NY	Victor, T Squared Elctrns.	716-924-9101
NC	Pineville, Electronic Mfrs. Agts.	704-541-2628
NC	Winston-Salem, Electronic Mfrs. Agts.	919-784-7304
OH	Cleveland, Marlow Assoc.	216-991-6500
OH	Columbus, Marlow Assoc.	614-885-7643
OR	Portland, Westerberg & Assocs.	503-297-1719
PA	Pittsburgh, Marlow Assoc.	412-367-8886
PA	Prospect Park, Elf Sls.	215-534-3340
TN	Donelson, Electronic Mfrs. Agts.	615-883-1414
TX	Houston, Milco Mktg.	713-946-2841
WA	Bellevue, Westerberg & Assocs.	206-453-8881

Local Distributors

AL	Huntsville, Arrow Elctrns.	205-882-2730
AL	Huntsville, R.M. Elctrns.	205-852-1550
AZ	Phoenix, Wyle Distr. Grp.	602-249-2232
AZ	Phoenix, Kachina Elect. Dist.	602-269-6201
AZ	Phoenix, R.V. Weatherford Co.	602-272-7144
CA	Anaheim, R.V. Weatherford Co.	714-634-9600
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	El Segundo, Wyle Distr. Grp.	213-322-8100
CA	Glendale, R.V. Weatherford Co.	213-849-3451
CA	Irvine, Wyle Distr. Grp.	714-641-1600
CA	Los Angeles, Arrow Elctrns.	213-701-7500
CA	Pomona, R.V. Weatherford	714-623-1261
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Diego, Wyle Distr. Grp.	619-565-9171
CA	San Diego, R.V. Weatherford	619-695-1700
CA	San Francisco, Arrow Elctrns.	408-745-6600
CA	Santa Barbara, R.V. Weatherford Co.	805-965-8551
CA	Santa Clara, Wyle Distr. Grp.	408-727-2500
CA	Sunnyvale, R.V. Weatherford Co.	408-738-8694
CA	Tustin, Arrow Elctrns.	714-838-5422
CO	Denver, Arrow Elctrns.	303-758-2100
CO	Denver, R.V. Weatherford Co.	303-428-6900
CO	Thornton, Wyle Distr. Grp.	303-457-9953
CT	Wallingford, Sager Elect.	203-265-4600
CT	Wallingford, Arrow Elctns.	203-265-7741
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Melbourne, Arrow Elctrns.	305-725-1480
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Atlanta, Hammond Elctrns.	404-524-7502
GA	Norcross, Arrow Elctrns.	404-449-8252
HI	Honolulu, Industrial Elctrns.	808-533-6095
IL	Addison, LComp-Chicago	312-628-1400
IL	Chicago, Arrow Elctrns.	312-893-9420
IL	Lombard, RM Elctrns.	312-932-5150
IN	East Chicago, Acro Elctrns.	219-397-8681
IN	Ft. Wayne, Graham Elect. Supp.	219-423-3422
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, RM Elctrns.	317-247-9701
IN	Lafayette, Graham Elect. Supp.	317-423-5564
IA	Cedar Rapids, Iowa Radio Supp. Co.	319-393-4510
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
KS	Wichita, L Comp Inc.	316-265-5100
KS	Wichita, Radio Inc.	316-264-2798
LA	Marrero, AFG Elctrn. Supp.	504-368-9696
LA	New Orleans, Radio Parts	504-581-5959
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Baltimore, Resco/Baltimore	301-823-0070
MD	Beltsville, Resco	301-937-9100
MD	Beltsville, Treeko Sls.	301-937-8260
MA	Hingham, Sager Elec. Supply	617-749-6700
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Grand Rapids, R.S. Elctrns.	616-241-3483
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Kalamazoo, R.S. Elctrns.	616-381-5470
MI	Livonia, R.S. Elctrns.	313-525-1155
MI	Roseville, R.S. Elctrns.	313-779-2450
MI	Wynadotte, R.S. Elctrns.	313-282-5880
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, Northern Elctrns.	612-944-1167
MO	Kansas City, LComp-Kansas City	816-221-2400
MO	Maryland Hgts., LComp-St. Louis	314-291-6200
MO	St. Louis, Van Sickee Radio Supp.	314-621-5000
MO	St. Louis, Arrow Elctrns.	314-567-6888
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NH	Manchester, Arrow Elctrns.	604-668-6968
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Farmingdale, Arrows Elctrns.	516-694-6800
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Mt. Vernon, QAR Ind'l. Sls.	914-699-2224
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Rochester, Rochester Radio Supp. Co.	716-454-7800
NY	Syracuse, Arrow Elctrns.	315-652-1000
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Cincinnati, Graham Elctrn. Supp.	513-772-1661
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cleveland, CAM/Ohio	216-461-4700
OH	Cleveland, Arrow Elctrns.	216-248-3990
OH	Columbus, Graham Elctrn. Supp.	614-895-1590
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Arrow Elctrns.	513-435-5563
OH	Dayton, Esco, Inc.	513-226-1133
OH	Toledo, R.S. Elctrns.	419-893-0721
OK	Oaklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Lake Oswego, Rose Elctrns.	503-635-8823
OR	Portland, Wyle Distr. Grp.	503-640-6000
PA	Drexel Hill, Kass Elctrns.	215-449-2300
PA	Pittsburgh, CAM/RPC Ind'l. Elctrns.	412-782-3770
PA	Pittsburgh, Arrow Elctrns.	415-856-7000
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Knoxville, Hammond Elctrns.	615-691-3491
TN	Nashville, Graham Elctrn. Supp.	615-242-2682
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Dallas, R.V. Weatherford	214-931-7333
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	El Paso, ERA Elctrns.	915-592-4126
TX	Houston, R.V. Weatherford Co.	713-688-7406
TX	Houston, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Wyle Distr.	801-974-9953
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
WA	Bellevue, Wyle Distr. Grp.	206-453-8300
WA	Bellevue, Arrow Elctrns.	206-643-4800
WA	Seattle, R.V. Weatherford Co.	206-575-1340
WI	Madison, Arrow Elctrns.	608-273-4977
WI	Mequon, Taylor Elec. Co.	414-241-4321

STANDARD REFERENCE LABS, INC., Coan Pl., Metuchen, NJ 08840, Tel: 201-549-9280, TWX: 710-998-0503; FSC No.: 57114; Empl.: 5; *Sls. Mgr.:* Dennis M. Koep; *Dist. Mgr.:* Dennis M. Koep ......**3**•1305

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	San Diego, Mesa Engrg.	619-278-8037
CA	Torrance, Cutlas Elctrns.	213-324-7360
CO	Commerce City, Williams Assocs.	303-289-5647
FL	Winter Haven, Lee Assocs., Florida	813-294-5815
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-924-3568
IA	Cedar Rapids, Marsland Assocs.	319-296-8030
MD	Wheaton, Brimberg Sls.	301-946-2670
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-878-2404
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Binghamton, Tae-Rep	607-722-9265
NY	Rochester, Tae-Rep	716-586-8710
UT	Salt Lake City, Williams Assocs.	801-532-7701
WA	Portland, Westcon	503-283-0132
WI	New Berlin, Marsland Assoc.	414-786-6611

STANDARD WIRE & CABLE CO., 2345 Alaska Ave., El Segundo, CA 90245, Tel: 213-536-0006, Telex: 65-3423, TWX: 910-340-6758; FSC No.: 04946; Empl.: 125; *Sls. Mgr.:* J. Gaither; *Dist. Mgr.:* Jerry Gaither

STANDEX ELCTRNS., 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777, Telex: 212066; Empl.: 1,039; *Sls. Mgr.:* Charles C. Johnson ......**1A**•1628, 1629; **1B**•1475

STANFORD APPLIED ENGRG. INC., 3520 De La Cruz Blvd., Santa Clara, CA 95050, Tel: 408-980-1600, TWX: 910-338-0132; Empl.: 1300; *Sls. Mgr.:* Dick Hudspeth; *Dist. Mgr.:* Dick Hudspeth

Local Sales Offices & Reps

Filters/Power Devices

AL	Huntsville, K & E Assocs.	205-883-9720
AZ	Scottsdale, American Mktg.	602-948-2778
AZ	Scottsdale, F. Board Assoc.	602-994-9388
AR	Tulsa, Kemp Engrg.	918-663-4501
CA	San Diego, Vinco	619-569-6959
CA	San Diego, Stanford Applied Engrg.	619-569-6959
CA	Santa Ana, Caltronics	714-751-9162
CA	Santa Ana, Stanford Applied Engrg.	714-751-9162
CA	Santa Clara, Caltronics	408-727-7552
CO	Denver, Quorum 3: Sls. Grp.	303-696-8480
CO	Englewood, Quorum 3: Sls. Grp.	303-696-8480
FL	Osteen, Bolton Assocs.	305-321-3077
FL	Pompano Beach, Electrocraft	305-781-5778
GA	Doraville, K & E Assocs.	404-448-7025
HI	Honolulu, Adtech	808-941-0708
IL	Barrington, Stanford Applied Engrg.	312-382-6960
IL	Wheeling, P.G. Applied Sls.	312-459-5750
IN	Indianapolis, SAI Mktg.	317-241-9276
IA	Cedar Rapids, Electromec Sls.	319-362-6413
KS	Shawnee, BAKA Corp.	913-268-5065
KS	Wichita, Baka	316-262-0179
MD	Ellicot City, Arbotek Assoc.	301-461-1323
MA	Millis, Selmark Assocs.	617-376-2914
MI	Brighton, SAI Mktg.	313-227-1786
MN	Burnsville, Electromec Sls.	612-894-8200
MN	Minneapolis, Electromec Sls.	612-894-8200
NJ	Medford, Component Consits.	609-654-5300
NJ	Perth Amboy, Astrorep, Inc.	201-826-8050
NJ	Teaneck, Norest Techn. Sls.	201-833-0061
NM	Albuquerque, Power Entprs.	505-298-1918
NY	Babylon, Astrorep, Inc.	516-422-2500
NY	Melville, Stanford Applied Engrg.	516-420-8111
NY	North Syracuse, Advanced Comp. Sls.	315-699-2671
NY	Syracuse, Pitronics	315-455-7346
NC	Raleigh, K & E Assocs.	919-781-1406
OH	Dayton, SAI Mktg.	513-435-3181
OH	Shaker Heights, SAI Mktg.	216-751-3633
OH	Zanesville, SAI Mktg.	614-454-8942
OK	Tulsa, Kemp Engrg.	918-663-4501
OR	Beaverton, Huntley Assocs.	503-649-5288
TN	Jonesboro, K & E Assocs.	615-753-2921
TX	Austin, Mech-Tron Mktg.	512-835-0980
TX	Dallas, Mech-Tron Mktg.	214-343-3786
TX	Houston, Mech-Tron Mktg.	713-462-1432
UT	Salt Lake City, Quorum 3: Sls. Grp.	801-943-7441
WA	Everett, Huntley Assocs.	206-353-1833
WA	Kirkland, Elec. Technical Sls.	206-827-8086

Interconnections & Packaging

AL	Huntsville, K & E Assocs.	205-883-9720
AZ	Scottsdale, American Mktg.	602-948-2778
AR	Tulsa, Kemp Engrg.	918-663-4501
CA	San Diego, Vinco	619-569-6959
CA	Santa Ana, Caltronics	714-751-9162
CA	Santa Clara, Caltronics	408-727-7552
CO	Boulder, Stanford Applied Engrg.	303-530-1900
CO	Denver, Quorum 3: Sls. Grp.	303-696-8480
CT	Farmington, Stanford Applied Engrg.	203-677-6046
FL	Apopka, Bohman Assocs.	305-886-1882
GA	Doraville, K & E Assocs.	404-448-7025
HI	Honolulu, Adtech, Inc.	808-941-0708
IL	Barrington, Lancastle, Ltd.	312-381-6780
IL	Wheeling, P.G. Applied Sls.	312-459-5750
IA	Cedar Rapids, Electromec Sls.	319-362-6413
KS	Shawnee, Baka	913-268-5065
KS	Wichita, Baka	316-262-0179
MD	Ellicott City, Marketing Tech	301-465-5944
MA	Lexington, Circuit Sls. Co.	612-861-0567
MN	Burnsville, Electromec Sls.	612-894-8200
MO	Ferguson, Baka Corp.	314-878-4224
NJ	Medford, Component Consits.	609-654-5300
NJ	Perth Amboy, Astrorep, Inc.	201-826-8050
NJ	Teaneck, Noreast Techn. Sls.	201-833-0061
NM	Albuquerque, Power Entprs.	505-298-1918
NY	Babylon, Astrorep, Inc.	516-422-2500
NY	North Syracuse, Advanced Comp. Sls.	315-699-2671
NC	Raleigh, K & E Assocs.	919-781-1406
OH	Beachwood, Electronic Salesmasters	216-831-9555
OK	Tulsa, Kemp Engrg.	918-663-4501
PA	Springhouse, Deltatronics	215-542-0250
TN	Jonesboro, K & E Assocs.	615-753-2921
TX	Austin, Mech-Tron Mktg.	512-835-0980
TX	Dallas, Mech-Tron Mktg.	214-343-3786
TX	Houston, Mech-Tron Mktg.	713-462-1432
UT	Salt Lake City, Quorum 3: Sls. Grp.	801-943-7441
WA	Tukwila, General Elctrns.	206-241-7990

Local Distributors

AL	Huntsville, RM Alabama, Inc.	205-852-1550
AL	Huntsville, Component Distrs.	205-883-7501
AZ	Phoenix, Hieland Elctrns.	602-243-7171
AZ	Phoenix, Arizona Components	602-279-9446
AZ	Tempe, Time Elctrns.	602-967-2000
AZ	Tempe, Bell Industries	602-966-7800
AR	Little Rock, Component Distrs.	501-227-6278
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Integrated Elctrns.	213-988-2200
CA	Costa Mesa, Escot	714-557-3252
CA	Irvine, Ryno Elctrns.	714-557-5021
CA	Irvine, Ratel Elctrns.	714-549-8611
CA	Los Angeles, Connector Distbn. Corp.	213-670-2266
CA	San Diego, Ryno Elctrns.	619-292-6022
CA	San Jose, Ratel Elctrns.	408-946-4300
CA	Santa Clara, Escot	408-988-4991
CA	Santa Clara, Caltronics	408-727-7552
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Broomfield, Escot	303-465-2346
CO	Colorado Springs, Ratel Elctrns.	303-599-9043
CO	Englewood, Industrial Elctrns.	303-694-9444
CO	Wheatridge, Bell Industries	303-424-1985
CT	Bethel, Beilind Elctrns.	203-797-8600
FL	Ft. Lauderdale, Dielco	305-973-8700
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Ft. Lauderdale, Component Distrs.	305-971-4950
HI	Honolulu, Adtech, Inc.	808-941-0708
IL	Chicago, Bell Industries	312-982-9210
IL	Lombard, RM Illinois, Inc.	312-932-5150
IL	Mt. Prospect, Magnuson	312-956-0700
IL	Wheeling, Escot	312-459-5750
IN	Indianapolis, RM Indiana, Inc.	317-247-9701
IN	Indianapolis, Magnuson	317-247-5108
MD	Savage, Pyttronic Inds.	301-953-9650
MA	Burlington, Schaal Assocs.	617-272-7940
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Woburn, Time Elctrns.	617-935-8080
MI	Grand Rapids, RM Michigan, Inc.	616-531-9300
MN	Edina, Northern Elctric. Supply	612-944-1167
MN	St. Paul, Magnuson Elctrns.	612-227-8495
MO	St. Louis, Time Elctrns.	314-391-6444
NH	Hudson, Heilind Elctrns.	603-883-9536
NJ	Oakland, Gordon/Horne Inc.	201-337-5200
NM	Albuquerque, Bell Industries	505-292-2700
NY	Buffalo, Summit Elctrns.	716-884-3450
NY	Hauppauge, Schaal Assocs.	516-234-4600
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Rochester, Modutex Corp.	716-424-1620
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	716-337-5400
NC	Raleigh, Component Distrs.	919-781-0262
NC	South Charlotte, Elctrn. Mktg. Corp.	704-394-6195
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Highland Heights, Elctrn. Mktg. Corp.	216-442-3441
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OK	Tulsa, Altair	918-252-5781
OR	Oswego, Bell Industries	503-241-4115
PA	Broomall, Time Elctrns.	215-359-1200
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Pittsburgh, Pyttronic Inds.	412-276-6722
TX	Austin, Altair Co.	512-837-4490
TX	Dallas, Heilind Elctrns.	214-351-2058
TX	Dallas, RM Texas, Inc.	214-235-3100
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
UT	Midvale, Ratel Elctrns.	810-562-2600
UT	Salt Lake City, Bell Industries	801-972-6969
WA	Bellevue, Bell Industries	206-747-1515
WA	Bellevue, Integrated Elctrns.	206-455-2727
WI	New Berlin, RM Wisconsin	414-784-4420
WI	Waukesha, Bell Industries	414-784-0235

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95050, Tel: 408-748-1010, TWX: 910-339-9531; FSC No.: 61362; Empl.: 300; *Sls. Mgr.:* J. A. Kirby

STANLEY/AC INTERFACE, 2925 College Ave., Unit A 1, Costa Mesa, CA 92626, Tel: 714-979-9830, Telex: 655328; *Sls. Mgr.:* R. D. Henwood; *Dist. Mgr.:* R. D. Henwood

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600; *Sls. Mgr.:* Ernie Gitlin

STANPAT PRODS., 366 Main St., Port Washington, NY 11050, Tel: 516-883-8400; Empl.: 25

STANTON MAGNETICS, INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-0200, TWX: 510-221-1845; Empl.: 300

STANTRON

STANTRON DIV., 6900 Beck Ave., N. Hollywood, CA 91605, Tel: 818-875-0800, TWX: 910-499-2177; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier ..... 2•1055

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
CA	Los Angeles, Landa/Minyard	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Farmington, Ray Perron & Co.	203-673-4825
CT	Seymour, Ray Perron & Co.	203-888-4849
FL	Pompano Beach, T. G. & Assocs.	305-781-8328
FL	Tampa, T. G. & Assocs.	813-753-5632
GA	Jonesboro, Wallace Elctrn. Sls.	404-471-6297
HI	Honolulu, J.C. Elctrns.	808-841-7477
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	De Soto, Midtec Assoc.	913-441-6565
MD	Ellicott City, Sci-Rep	301-321-1411
MA	Needham, Ray Perron & Co.	617-449-6162, 800-225-4280
MI	Jackson, Norwood Scroggs	517-750-1170
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Florissant, Midtec Assocs.	314-837-5200
NH	Dover, Ray Perron & Co.	603-742-2321
NJ	Pennsauken, Sci-Rep	609-662-5222
NJ	Wayne, G.T. Assocs.	201-694-6040
NM	Albuquerque, Shefler-Kahn Co.	505-265-7049
NY	Rochester, Gislason Sls.	716-454-4741
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Cincinnati, J. O. Olsen Co.	513-574-7711
OH	Cleveland, J. O. Olsen Co.	216-662-3454
OK	Tulsa, Barry Sls.	918-749-7775
PA	Pittsburgh, J. O. Olsen Co.	412-279-2550
TN	Chattanooga, Wallace Elctrn. Sls.	615-870-2080
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls. Co.	713-784-5860
TX	Richardson, Barry Sls. Co.	214-234-0255
UT	Salt Lake City, J. F. Hurlbut Co.	801-973-4443
VA	Fairfax, Sci-Rep	703-385-0600
WA	Seattle, D. Smith Sls.	206-633-3160
WI	Milwaukee, Berndt Assocs.	414-545-8400

star micronics inc
COMPONENTS DIVISION

STAR MICRONICS, INC., Components Div., 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 201-572-9512; Empl.: 120; *Sls. Mgr.:* R. Messer ..... 3•1056-1059, 1092, 1093

Local Sales Offices & Reps

AZ	Phoenix, MacDonald Assocs.	602-998-1848
CA	Fullerton, Groh Assoc.	714-738-7105
CA	Menlo Pk., G. R. McKnight Co.	408-942-0880
CA	San Diego, Groh Assoc.	714-738-7105
FL	Casselberry, Southern Elctrn. Mktg.	305-695-3334
FL	Fort Lauderdale, Southern Elctrn. Mktg.	
GA	Atlanta, Magaro & Assoc.	404-451-8826
IL	Elk Grove Village, Oasis Sls. Corp.	312-640-1850
IN	Carmel, Shamrock Sls.	317-848-5265
IA	Cedar Rapids, Elctrn. Innovators	319-362-2217
MD	Baltimore, Adcour	301-889-1211
MA	Sharon, Adcour	617-784-8123
MI	Southfield, Component Assoc.	313-557-3232
MN	Eden Prairie, Elctrn. Innovators	612-941-0830
NJ	Sparta, Instr. & Equip.	201-729-4293
NY	Queens, Metropolitan Sls.	212-634-3100
NC	Greensboro, Magaro & Assocs.	919-294-4783
OH	Bedford, A.S.A. Assocs.	216-662-6080
OR	Portland, Controltek Sls.	503-641-0877
TX	Houston, Repmaster-Houston	713-692-8204
TX	Richardson, McCoy Assocs.	214-238-1017
WA	Bellevue, Controltek	206-451-8163

WV	Spokane, Controltek	509-922-2971
WI	Brookfield, Oasis	414-783-6660
EXP	Markham, Lenbrook	416-477-7722

Local Distributors

CA	Costa Mesa, Marvac	714-540-3280
CA	Los Angeles, Elect. Switches	213-660-1301
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Santa Clara, Waltronics Sls.	408-727-1200
IL	Wheeling, Hawk Elctrns.	312-459-4040
MA	Sharon, Adcour	617-784-8123
MN	Minneapolis, Voyager Elctrns.	612-571-7766
NJ	Sparta, Instrument & Equip.	201-729-4293
NJ	Sparta, Instr. & Equip.	201-447-3525
NJ	Waldwick, Production Supp. & Equip.	201-447-3525
NY	Rockaway Park, Metropolitan Sls.	212-634-3100
OH	Cincinnati, United Radio Inc.	513-761-4030
OR	Portland, United Radio Supp.	503-233-7151
TX	Channelview, R. T. Henry Elctrns.	713-452-4451
TX	Houston, Copper Alarm Supp. Co.	713-868-1794
UT	Dallas, Wholesale Elctrns.	214-824-3001
WA	Bellevue, Solomon Inds.	206-643-5644
EXP	Markham, Ont., Lenbrook Elctrns.	416-477-7722

STAR PORCELAIN, 71 Muirhead Ave., Trenton, NJ 08638, Tel: 609-392-3154; Empl.: 100; *Sls. Mgr.:* Art Hobson

STAR-TRON CORP., 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, Telex: 929490; FSC No.: 32494; Empl.: 50; *Sls. Mgr.:* Anna Coski

STATEK

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, Telex: 67-8394, TWX: 910-593-1355; FSC No.: 51791; Empl.: 100; *Sls. Mgr.:* J. Ownby .... **1A**•1429-1431

Local Sales Offices & Reps

AL	Huntsville, Mackay Smith & Assoc.	205-539-8000
AZ	Phoenix, Eltron	602-266-2164
CA	El Toro, Martronix	714-855-6397
CA	Mountain View, Weseloh/Swanson & Assocs.	415-961-0565
CA	San Diego, Mesa Engrg. & Sls. Assocs.	619-278-8021
CO	Denver, Elcom	303-337-2300
FL	Madeira Beach, MacKay, Smith & Assoc.	813-393-7144
FL	Orlando, MacKay, Smith & Assoc.	305-277-1513
GA	Norcross, MacKay, Smith & Assoc.	404-449-7444
IL	Northbrook, Raines & Assocs.	312-498-0890
IN	Fort Wayne, M/S Sls. & Assocs.	219-484-1904
IN	Indianapolis, M/S Sls. & Assocs.	317-257-8916
KS	Overland Park, Thomas L. Dowell & Assoc.	913-648-7373
MD	Baltimore, Professional Reps.	301-653-3600
MA	Woburn, Radian Assocs.	617-933-7386
MO	St. Louis, Thomas L. Dowell & Assocs.	913-648-7373
NJ	Bellmawr, TAI Corp.	609-933-2600
NJ	Manhasset, Win-Cor Elect. Sales Corp.	516-627-9474
NY	Syracuse, Pl' Tronics	315-455-7340
NC	Charlotte, MacKay, Smith & Assoc.	704-372-1188
NC	Raleigh, MacKay, Smith & Assoc.	919-851-5000
OK	Tulsa, Norcom	918-832-7747
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Salt Lake City, Elcom	801-532-7940
WA	Redmond, Halbar Assoc.	206-882-0990
WA	Vancouver, Halbar Assoc.	206-696-0170

Local Distributors

AL	Huntsville, Contact Elctrns.	205-881-9321
CA	Irvine, Ryno Elctrns.	714-261-2500
CA	Mountain View, Target Elctrns.	415-961-1170
CA	San Diego, Ryno Elctrns.	619-292-6022
FL	Longwood, Intertec	305-834-7777
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Mar Elctrns. Inc.	317-875-4510
MD	Columbia, Aztech Elctrns.	301-995-1760
MA	Woburn, First Frequency	617-935-3885
MO	St. Louis, Olive Elctrns.	314-426-4500
NY	Buffalo, Summit Distrs.	716-884-3450
OR	Lake Oswego, Rose Elctrn. Distrg. Co.	503-635-8823
TX	Richardson, Ewing Elctrns. Inc.	214-231-6725
WA	Seattle, Rose Elctrn. Distrbg. Co.	206-721-4997

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16801, Tel: 814-355-8004

STATIC INC., Rte. 113 & Mensch Rd., P.O. Box 80, Skippack, PA 19474, Tel: 215-584-9600, Telex: 846079; Empl.: 50; *Sls. Mgr.:* R. J. Hoffman

STAVER CO., INC., 47 Saxon Ave., Bay Shore, NY 11706, Tel: 516-666-8000, TWX: 510-227-6142; Empl.: 140; *Sls. Mgr.:* Arnold Lazarus .... **1B**•1105

Local Sales Offices & Reps

CA	Woodland Hill, R. H. McDonald & Assocs.	213-348-3766
IL	Lombard, RMP/McBride Corp.	312-932-9090
MA	Scituate, Jack Goss	617-545-6327
MI	Ann Arbor, Elliott Sls.	313-662-4087
MN	St. Louis Park, Lestronix	612-926-8466
NH	Hancock, Eisenbeis Sls.	603-357-4892
NY	East Northport, Levison Sls. Co.	516-266-5020
NY	Manlius, Bowser & Sapecky Assocs.	315-682-8885
NC	Cary, Tom G. Santel	919-467-7595
OK	Tulsa, Jerry Robinson & Assocs.	918-492-0390
OR	Portland, J. J. Backer Co.	503-297-3776
PA	Colmar, Eastern Scientific Mktg.	215-822-0157
PA	Sewickley, T. H. Stewart Co.	412-741-8665
SC	Mauldin, Carl Hart	803-288-2323
TX	Houston, Cunningham Co.	713-461-4197
VA	Portsmouth, F.B.D. Sls.	804-484-3162
WA	Seattle, J. J. Backer Co.	206-285-1300

STD MICROSYSTEMS, 399 Sherman Ave., Palo Alto, CA 94306, Tel: 415-327-6800; *Sls. Mgr.:* Gary Whittaker; *Dist. Mgr.:* Gary Whittaker

STENNING INSTRUMENTS, INC., 671 Enchanted Way, Pacific Palisades, CA 90272, Tel: 213-459-2930; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 61166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506; Empl.: 30; *Sls. Mgr.:* Stan Trumbull

STERLING INSTR., Div. Designatronics, Inc., 55 S. Denton Ave., New Hyde Pk., NY 11040, Tel: 516-328-3300, TWX: 510-223-0642; Empl.: 150

STERLING TRANSFORMER CORP., 510 Driggs Ave., Brooklyn, NY 11211, Tel: 212-782-4200; FSC No.: 97102; Empl.: 45; *Sls. Mgr.:* P. H. Odessey .... **1A**•2293-2297

Local Sales Offices & Reps

OH	Dayton, George Lessis	513-294-1551

STETTNER ELCTRNS., 6135 Airways Blvd., Chattanooga, TN 37421, Tel: 615-892-0291, TWX: 810-573-5224; FSC No.: 52763; *Sls. Mgr.:* Ralph S. Souders

COMPUTER PRODUCTS™
POWER CONVERSION

STEVENS-ARNOLD DIV., Computer Prods., Inc., 7 Elkins St., So. Boston, MA 02127, Tel: 617-268-1170, Telex: 95-1465 STEARCO, TWX: 710-339-0855; FSC No.: 80640; Empl.: 300; *Sls. Mgr.:* John T. Parent .... **3**•1705, 1717-1724

Refer to Computer Products, Inc., Pompano Beach, Fl for sales offices and representatives and for distributor listings.

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140; Empl.: 50; *Sls. Mgr.:* John Thomson

STEWARD, D. M., MFG. CO., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, Telex: 558490; Empl.: 185; *Sls. Mgr.:* Arlin Grant

STOCK DRIVE PRODS., Div. of Designatronics, Inc., 55 S. Denton Ave., New Hyde Pk., NY 11040, Tel: 516-328-0200, TWX: 510-223-0642; Empl.: 210

STOELTING CO., 1350 S. Kostner Ave., Chicago, IL 60623, Tel: 312-522-4500; Empl.: 50; *Sls. Mgr.:* D. A. Peterson

STONE CITY PRODUCTS CO., 1206 Seventh Street, Bedford, IN 47421, Tel: 812-275-3373

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 312-323-9121, TWX: 910-651-0850; *Sls. Mgr.:* John W. Holland

STOW LABS., INC., Kane Ind'l. Dr., Hudson, MA 01749, Tel: 617-562-9347, Telex: 94-8330; Empl.: 15

STRATEGIC SYS. DIV. POWER SYS. OPERATIONS, GTE Prods. Corp. Sylvania Sys. Grp., 520 Winter St., Waltham, MA 02254, Tel: 617-466-3000, Telex: 951-953, TWX: 710-290-0376

STREET ELECTRONICS CORP., 1140 Mark Ave., Carpinteria, CA 93013, Tel: 805-684-4593

STROBE, INC., 897 Independence Ave., Mountain View, CA 94043, Tel: 415-969-5130

STRONGBOX, P.O. Box 84508, Los Angeles, CA 90073, Tel: 213-204-0472; Empl.: 3; *Sls. Mgr.:* Larry Martinek .... **2**•1056, 1057

Advertisement

STRONGBOX Heavy-Duty aluminum Rack-Mount Chassis. EIA-Standard heights, 3½″ to 8¾″. Available 9½″, 12″, 19″ deep. Extension kits for intermediate, extra-long sizes. All fit 19″ racks. Solid or Perforated Covers. Slides, Mounting Panels available. Non-standard heights, depths available. Write/call for free brochure. See catalog, EEM.

Local Sales Offices & Reps

CA	San Diego, Edmonson Co.	714-846-9086
NM	Albuquerque, Betatron	505-344-2381

STRUCTURED DESIGN, INC., 1700 Wyatt Dr. #7, Santa Clara, CA 95054, Tel: 408-988-0725, Telex: 172931; *Sls. Mgr.:* Noel C. Hendricks; *Dist. Mgr.:* Noel C. Hendricks

STRUTHERS-DUNN, Lamb's Rd., Pitman, NJ 08071, Tel: 609-589-7500, TWX: 510-686-7510; FSC No.: 78290; Empl.: 700; *Sls. Mgr.:* W.L. Capewell; *Dist. Mgr.:* A. B. Kinney .... **1B**•1477

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Phoenix, Hecht, Henscher & Assoc.	602-275-4411
AR	Little Rock, Controls & Power	501-661-1737
CA	Culver City, DeAngelo, Rothman & Co.	213-827-2202
CA	San Diego, Struthers-Dunn	619-560-9922
CA	Santa Clara, Mollard Mktg.	408-727-2050
CO	Denver, Lindberg Co.	303-758-9033
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Miami, Ludlum Assocs.	305-592-6524
FL	Orlando, Ludlum Assocs.	305-894-7761
GA	Tucker, Rep, Inc.	404-938-4358
IL	Glen Ellyn, Rockford Controls Co.	312-469-6016
IA	Bettendorf, BSI, Ltd.	319-355-5623
KS	Wichita, Avionics Engrg.	316-264-6201
LA	Lafayette, Kemp Engrg.	318-269-9452
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, HMR, Inc.	612-831-7400
MO	Maryland Heights, Hitt & Assocs.	314-878-5404
MO	Raytown, E. A. Mais Co.	816-356-0800
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NY	Buffalo, H. C. Zang Agency	716-877-3677
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cincinnati, Struthers-Dunn	513-772-3108
OH	Strongsville, Struthers-Dunn	216-572-1333
PA	Pittsburgh, R. F. Clark Co.	412-242-9500
TN	Jefferson City, REP, Inc.	615-475-4105
TN	Memphis, Controls & Power	901-332-0036
TX	Arlington, W. Pat Fralia Co.	817-640-9101
TX	Houston, W. Pat Fralia Co.	713-772-1572
WA	Seattle, Eicher-Richards Co.	206-523-7888

ST-SEMICON, 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402, Tel: 812-332-1435, TWX: 810-351-1384; Empl.: 100; *Sls. Mgr.:* Robert Muldoan

SUCKLE CORP., 733 Davis St., Dept. EM, Scranton, PA 18505, Tel: 717-346-3871; Empl.: 200; *Sls. Mgr.:* M. H. Brenner .... **2**•1058

Local Sales Offices & Reps

GA	Lilburn, R. Panyik Assoc.	404-923-3703
NJ	Cherry Hill, T. Cammaroto	609-772-2321
PA	Scranton, J. Castellino	717-346-4097

Sullins

SULLINS ELCTRNS. CORP., P.O. Box 189, 801 Mission Rd., San Marcos, CA 92069, Tel: 619-744-0125, TWX: 910-322-1472; Empl.: 100; *Sls. Mgr.:* Chip Bruss; *Dist. Mgr.:* Chip Bruss .... 2•1574, 1575

Local Sales Offices & Reps

AL	Decatur, Tenn Tech, Inc.	205-350-0630
AZ	Phoenix, Robert E. Lee Assoc.	602-269-6206
CA	Los Angeles, K.C.P. Ent.	213-796-1813
CA	Sunnyvale, Schwerin & Merril, Inc.	408-735-7900
CO	Arvada, Cluff & Assocs.	303-423-9354
CT	Hamden, Impact Sls.	203-281-1331
IL	Downers Grove, Circuit Sls., Inc.	312-964-9090
IN	Indianapolis, Sukup & Cox	317-253-5501
IA	Marion, M-S-B Assoc.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Laurel, CSDS, Inc.	301-490-3800
MA	Needham, Impact Sls.	617-444-3971
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	St. Charles, M-S-B Assoc.	314-946-5577
NJ	Medford, Comp. Consultants	609-654-5300
NY	Lynbrook, HLJ Comp-Tech	516-599-2999
NY	Syracuse, Lenard Co.	315-479-9191
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
PA	The Fairway Rydal, Espy Sls.	215-576-0780
TX	Austin, T.L. Mktg.	512-453-4586
TX	Dallas, T.L. Mktg.	214-357-1752
WA	Bellevue, Elctrn. Mktg. Grp.	206-746-5915
WI	Mequon, Artmor Ltd.	414-241-4040

Local Distributors

AL	Birmingham, Forbes Distr. Co.	205-251-4104
AL	Decatur, Forbes Distr. Co.	205-353-4762
AL	Huntsville, RM Elctrns.	205-852-1550
AL	Mobile, Forbes Distr. Co.	205-479-4535
AZ	Phoenix, Arizona Comps.	602-279-9446
AZ	Phoenix, Kachina Elctrn. Dist.	602-269-6201
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	Pasadena, Empire Elctrn. Distrs.	213-681-2700
CA	San Diego, Patane Avionics, Inc.	619-271-9877
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Simi Valley, Lee Johnson Sls.	213-346-5412
CA	Torrance, Cypress Elctrns.	213-530-1900
CA	Van Nuys, Mil Conn Dvcs. Inc.	800-824-7885
CA	Van Nuys, Patane Avionics, Inc.	818-988-4455
CA	Ventura, Bond Electro Sls.	805-653-6487
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Denver, Denver Wintronics	303-431-7161
CO	Ragon, Elctrn. Parts	303-744-3601
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Pensacola, Forbes Distr. Co.	904-944-5551
GA	Atlanta, Ack Radio Supp.	404-351-6340
IL	Addison, Lectro Comps.	800-323-2282
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Melrose Pk., Belford Elctrns.	312-865-2400
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, RM Elctrns.	317-247-9701
MA	Canton, Impact Sls.	617-821-1500
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Walled Lake, Ambur Elctrns.	313-669-3710
NJ	Audobon, Action Elctrns.	609-858-2450
NJ	Bellmawr, Mid-Atlantic Elctrns.	609-931-5303
NM	Albuquerque, Electronic Parts	505-293-6161
NC	Charlotte, Southeastern Elctrns.	704-523-1122
NC	Durham, Southeastern Radio Supp.	919-688-8204
NC	Raleigh, Southeastern Radio Supp.	919-828-2311
OH	Cincinnati, Schuster Electr.	513-489-1400
OH	Solon, REH Elctrns.	216-248-1636
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, Dunn Elctrns.	503-285-0214
TN	Chattanooga, Indl. Elctrns. Dist.	615-698-3413
TN	Knoxville, Indl. Electrns.	615-573-7135
TX	Dallas, RM Elctrns.	214-235-3100
TX	Garland, J&S Elctrns.	214-487-8808
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WA	Seattle, Carlyle Techn. Sls.	206-575-6750
WI	Mequon, Lake-View Elctrns.	414-377-8250

SUMITA OPTICAL GLASS MFG. CO., LTD., P.O. Box 521, Millwood, NY 10546, Tel: 914-762-4959; FSC No.: 914-762-7497; *Sls. Mgr.:* Mike Sumita

SUMMAGRAPHICS CORP., 35 Brentwood Ave., Fairfield, CT 06430, Tel: 203-384-1344, Telex: 964348; *Sls. Mgr.:* Anthony Joyce; *Dist. Mgr.:* Ron McClure

SUMMIT CAD CORP., 5222 FM 1960 W100, Houston, TX 77069, Tel: 713-440-1468, Telex: 792831; *Sls. Mgr.:* Gregg Young; *Dist. Mgr.:* Harold Thornton

SUMMIT ELCTRNS., 750 S. Sherman, Richardson, TX 75081, Tel: 214-231-1456; *Sls. Mgr.:* Jack W. Barry .... 3•1784, 1785

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-533-2100
AZ	Phoenix, MacDonald Assoc.	602-998-1848
CA	Agoura, Cal Rep	213-991-1940
CA	Sunnyvale, Sourcetronics	408-773-1931
CA	Woodland Hills, Craig Assocs.	213-887-2444
CO	Broomfield, Wescom Mktg.	303-741-4900
FL	Pompano Beach, Electrocraft	
FL	Winter Park, Electrocraft	305-628-4705
GA	Atlanta, Electro-Mech	404-447-6478
IL	Barrington, Omni Elctrns. Mktg.	312-381-9087
IL	Roselle, Omni Elctrns. Mktg.	312-351-2507
IN	Indianapolis, Wilson Tech. Sls.	317-298-3345
MD	Timonium, Heller Sales	301-252-4780
MA	Braintree, R. F. Duffy & Assocs.	617-848-3550
MI	Detroit, Jack M. Thorpe	313-779-6363
MN	Minneapolis, Electro Serve	612-338-3475
MO	Hazelwood, Stone & Assocs.	314-895-4564
NJ	N. Plainfield, T & K Sls.	201-755-2878
NJ	Upper Sadle River, Bob Cameron	201-825-1304
NM	Albuquerque, McDonald & Assoc.	505-883-0500
NY	Smithtown, T & K Sales	516-724-3456
NC	Raleigh, Electro-Mech	919-851-8165
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Dayton, Arthur Baier Co.	513-276-4128
OK	Tulsa, Barry Sls.	918-749-7775
PA	Horsham, TMI	215-441-4300
TN	Nashville, Electro-Mech	615-885-0073
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255

SUMMIT ENGINEERING CORP., Box 938, Bozeman, MT 59715, Tel: 406-587-4511, TWX: 910-975-1950; Empl.: 300; *Sls. Mgr.:* Marty Connor

SUMX CORP., Box 14864, Austin, TX 78761, Tel: 512-835-0330; Empl.: 30

SUNBANK ELCTRNS., 1740 Commerce Way, Paso Robles, CA 93446, Tel: 805-238-2840, TWX: 910-351-5805; FSC No.: 07418; Empl.: 260; *Sls. Mgr.:* Lou F. Holland; *Dist. Mgr.:* Robert Haldeman

Local Sales Offices & Reps

CA	Mission Viejo, Par Mktg.	714-768-6021
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Altamonte Springs, Gugel-Tuttle-Assocs.	305-788-0845
KS	Leawood, Thunderbird Tech. Sls. & Serv.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls. & Serv.	316-684-3941
MD	Phoenix, Milk-Brown Assocs.	301-628-4848
MA	Lowell, Underwood Sls.	617-256-8191
MI	Farmington Hills, Elcon Michigan Sls.	313-855-3240
MN	Minneapolis, Marsh Sls.	612-729-9345
MO	St. Louis, Thunderbird Tech. Sls.	314-567-6488
NJ	Haddonfield, Mills-Brown	609-429-1005
NJ	Pompton Plains, T. A. Adamo Sls.	201-835-5344
NY	Kings Park, T. A. Adamo Sls.	516-724-2039
TX	Dallas, E. F. Aymond Co.	214-826-7620
TX	San Antonio, Edward F. Aymond Co.	512-366-1526
WA	Bellevue, Comtec Mktg. & Sls. Eng.	206-453-1188

SUNDSTRAND DATA CONTROL, Overlake Ind'l. Pk., Redmond, WA 98052, Tel: 206-885-3711, Telex: 15-2308; Empl.: 2000

SUN ELECTRONIC SYSTEMS, INC., 1331 S. Dixie Hwy., Pompano, FL 33060, Tel: 305-785-1155

SUN-FLEX CO., INC., 20 Pimentel Ct., Novato, CA 94947, Tel: 415-883-1221, Telex: 172-208; *Sls. Mgr.:* Frederick Juer; *Dist. Mgr.:* Frederick Juer

SUN RESEARCH INC., Phase-R, Box 210, Old Bay Rd., New Durham, NH 03855, Tel: 603-859-7110, TWX: 510-297-4444; *Sls. Mgr.:* Michael Mathieson

SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1924, TWX: 910-584-3847; *Sls. Mgr.:* Richard K. Armstrong

Local Sales Offices & Reps

AZ	Phoenix, Odyssey I	602-246-8846
CA	Inglewood, Basic Sys. Corp.	213-673-4300
CA	San Diego, Basic Sys. Corp.	619-268-8000
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
CO	Castle Rock, Odyssey I	303-688-3555
CT	Hamden, Burton Forrester	203-248-4380
FL	Cocoa Beach, Teqspec	305-783-3444
FL	Hobe Sound, Teqspec	305-746-4987
FL	Palm Harbor, Teqspec	813-785-2276
GA	Atlanta, Teqspec	404-399-6780
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Indianapolis, Carter, McCormic & Peirce	317-844-4175
MA	Braintree, Burton Forrester	617-848-7234
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Cheska, Electronic Instrmn. Consultants	612-445-7056
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NJ	Ridgefield, Rical Assocs.	201-945-5250
NM	Albuquerque, Odyssey I	505-265-6645
NY	Penfield, R. Barthel Entprs., Inc.	716-377-3018
NC	Winston-Salem, Teqspec	919-723-8102
OH	Cleveland, Carter, McCormic & Peirce	216-779-5100
OH	Englewood, Carter, McCormic & Peirce	513-836-0951
OK	Broken Arrow, Genzel Sales & Assocs.	918-258-8656
PA	Pittsburgh, Carter, McCormic & Peirce	412-372-4415
TN	Morristown, Teqspec	615-587-0980
TX	Austin, Crockett Southwest Co.	512-250-1776
TX	Irving, Crockett Southwest Co.	214-438-2776
TX	Katy, Crockett Southwest Co.	713-578-1836
WA	Redmond, Seattle Telecom & Data	206-883-6336
WI	Milwaukee, Berndt Assocs.	414-545-8400

Distributor

SUNSHINE SCI. INSTR., 1810 Grant Ave., Philadelphia, PA 19115, Tel: 215-673-5600; *Sls. Mgr.:* Al Stiles .... 3•1290

SUPEREX ELECTRONICS CORP., 151 Ludlow St., Yonkers, NY 10705, Tel: 914-965-6906, Telex: 13-1584; Empl.: 112; *Sls. Mgr.:* M. Solomon, Mktg

SUPERIOR CABLE CORP., See Siecor Corp.

SUPERIOR CARBON PRODS. INC., 9115 George Ave., Cleveland, OH 44105, Tel: 216-883-4880; Empl.: 120; *Sls. Mgr.:* Paul Merrill Kling

SUPERIOR ELECTRIC
(POWERSTAT STABILINE)
•
STANCOR/ESSEX
•
DORMEYER

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

SUPERIOR ELECTRIC
(POWERSTAT STABILINE)
•
STANCOR/ESSEX
•
DORMEYER

Franchised
Stocking
Distributor

LOGICOMP
ELECTRONICS, INC.

895 MAMARONECK AVENUE
MAMARONECK, NEW YORK 10543
PHONE: (914) 698-9332

TOLL FREE
(Outside N.Y.)
800/431-2625

SWITCHCRAFT INC.

AUTHORIZED DISTRIBUTOR

E S I

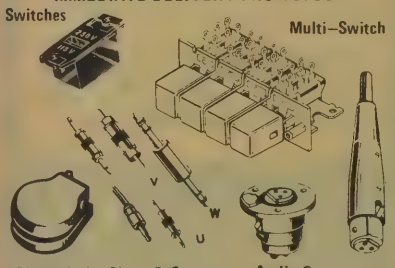
ELECTRIC SWITCHES
INCORPORATED

2478 Fletcher Dr., Los Angeles, Calif. 90039
(213) 660-1310

TOLL FREE WATS
NATIONAL: 800–421–8855
CALIFORNIA: 800–252–4640

TWX 910–321–2971

IMMEDIATE DELIVERY FROM STOCK



Phone Jacks, Plugs, & Covers
Audio Connectors

SEE COMPLETE PRODUCT LINE UNDER
SWITCHES –– SECTION 5100
FREE LINECARD AND CATALOG ON REQUEST

SUPERIOR ELEC. CO., 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, Telex: 962-446, TWX: 710-454-0682; FSC No.: 58474; Empl.: 1000; *Sls. Mgr.:* H. W. Lorenson; *Dist. Mgr.:* A. Nicholson .... **1A**•2298, 2299; **1B**•1182, 1183; **2**•1577; **3**•1917

Local Sales Offices & Reps

CA	Burlingame, W. J. Purdy Co.	415-347-7701
CA	Santa Clara, Superior Elec.	408-748-7772
CA	Woodland Hills, Superior Elec.	818-999-2150
CO	Denver, W. J. Purdy Co.	303-777-1411
FL	Apopka, G. F. Bohman Assocs.	305-886-1882
FL	Boca Raton, Power Solutions	305-368-3922
FL	Ft. Lauderdale, Bredesen & Assocs.	305-566-3289
GA	Atlanta, Jarrett Eng. Sls.	404-256-0378
HI	Honolulu, B. F. Wittenberg Co.	808-833-1602
IL	Glen Ellyn, Superior Elec.	312-858-2960
IA	W. Des Moines, JPS Assoc. Ltd.	515-225-0607
MA	Wellesley Hills, Superior Elec.	617-237-0750
MI	Detroit, Superior Elec.	313-229-2381
NY	Rochester, R. L. Kistler, Inc.	716-436-1940
NY	Rochester, Ross Equip. Co. Inc.	716-271-5660
NY	Smithtown, Superior Elec.	516-361-9177
NC	Charlotte, Superior Elec.	704-535-7777
OH	Medina, Superior Elec.	216-725-8887
PA	Blue Bell, Superior Elec.	215-825-9123
TX	Dallas, Superior Elec.	214-350-1368
VA	Arlington, Gans & Pugh Assoc., Inc.	703-527-3262
WA	Issaquah, Superior Elec.	206-392-8559

SUPERIOR FLUX & MFG. CO., 95 Alpha Pk., Cleveland, OH 44143, Tel: 216-461-3315; Empl.: 5

SUPERIOR MFG. & INSTR., 19-36 38th St., Long Island City, NY 11105, Tel: 212-932-1800, TWX: 710-582-2626; Empl.: 120; *Sls. Mgr.:* C. J. Robison

SUPERTEX, INC., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94086, Tel: 408-744-0100, TWX: 910-339-9388; *Sls. Mgr.:* Richard Siegel

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Scottsdale, SMS & Assocs.	602-998-0831
CA	Los Altos, Ewing-Foley	415-941-4525
CA	San Diego, Earle Assocs.	619-278-5441
CA	Thousand Oaks, Sc Cubed	805-496-7307
CA	Tustin, Sc Cubed	714-731-9206
CO	Denver, Elcom	303-337-2300
CT	Englewood, Ed Glass Assocs.	201-592-0200
FL	Apopka, G. F. Bohman & Assocs.	305-886-1882
IL	Des Plaines, Janus	312-298-9330
IN	Indianapolis, Sai Mktg.	317-241-9276
MA	Burlington, Mill-Bern Assocs.	617-273-1313
MI	Brighton, Sai Mktg.	313-227-1786
MN	Bloomington, Smiley-Scott Assocs.	612-888-5551
NJ	Central Islap, Vera Assocs.	516-582-3795
NJ	Haddonfield, Tritek Sls.	609-429-1551
NY	Liverpool, Precision Sls.	315-451-3480
NY	Pittsford, Precision Sls.	716-381-2820
OH	Centerville, Sai Mktg.	513-435-3181
OH	Shaker Heights, Sai Mktg.	216-751-3633
TX	Austin, OM Sls.	512-452-1838
TX	Dallas, OM Sls.	214-241-3876
UT	Salt Lake City, Elcom, Inc.	801-532-7940
VA	Fairfax, Beacon North	703-591-1300
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WI	Milwaukee, Janus	414-476-9104

SUPPORT SYSTEMS INTL. CORP., 150 South Second St., Richmond, CA 94804, Tel: 415-234-9090, TWX: 910-382-8130; Empl.: 60; *Sls. Mgr.:* Greg Richey; *Dist. Mgr.:* Greg Richey

SWEDA INT'L., See WESTREX

Distributor

SWITCH CONTROLS, INC., 3815 Industry Blvd., Lakeland, FL 33803, Tel: 813-644-7564 ....**1B**•1742

SWITCHCRAFT

SWITCHCRAFT, INC., 5555 N. Elston, Chicago, IL 60630, Tel: 312-792-2700, TWX: 910-221-5199; FSC No.: 82389; Empl.: 1100; *Sls. Mgr.:* R. T. Rasmussen; *Dist. Mgr.:* J. J. Weber .... **1B**•1498, 1748-1752; **2**•1096, 1578-1585

Local Sales Offices & Reps

AZ	Phoenix, Howe & Hoew Sls.	602-264-7971
CA	San Diego, Wiley Co.	213-666-1611
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Moss Mktg.	303-455-7205
CT	Stamford, Unesco/Genex	203-322-9308
FL	Orlando, Delmac Sls.	305-898-4688
FL	Tamarac, Delmac Sls.	305-726-1330
GA	Marietta, Rick Burns & Assocs.	404-951-1180
HI	Honolulu, Snider Campbell & Sutton Co.	808-941-2400
IL	Park Ridge, Bob Burns & Assoc.	312-823-9360
IN	Carmel, Marketing Engrs.	317-872-5665
IA	Des Moines, Thomas L. Dowell & Assoc.	515-225-1620
KS	Overland Park, Thomas L. Dowell & Assoc.	913-648-7373
MA	Waltham, Unesco/Genex	617-890-1535
MI	Southfield, R. C. Merchant & Co.	313-354-4300
MI	St. Joseph, R. C. Merchant & Co.	616-983-7378
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, Welch & Doby Mktg.	601-932-5534
MO	St. Louis, Thomas L. Dowell & Assoc.	314-849-4234
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Englewood Cliffs, Masin-Esco	201-569-8868
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Syosset, Masin-Esco	201-569-8868
NY	Syracuse, Paston-Hunter Co.	315-437-2843
NC	Raleigh, Rick Burns & Assocs.	919-876-2224
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OK	Tulsa, J. Y. Schoonmaker Co.	918-446-0373
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
TX	Houston, J. Y. Schoonmaker Co.	713-738-2427
UT	Bountiful, Moss Mktg.	801-292-8660
WA	Bellevue, Comtec	206-453-1188

SWITCHES INC., 949 Stierlin Rd., Mountain View, CA 94043, Tel: 415-962-8649

SYLVANIA CHEMICALS/METALS, Hawes St., Towanda, PA 18848, Tel: 717-265-2121; Empl.: 1400; *Sls. Mgr.:* J.F. Barnyak

SYLVANIA CONNECTOR PRODS. OPER., GTE Prods. Corp., Box 29, Titusville, PA 16354, Tel: 814-589-7071, TWX: 510-692-6763; *Sls. Mgr.:* R. Sanders

Simpson®
INSTRUMENTS THAT STAY ACCURATE
PANEL METERS, VOM's & DIGITAL
TEST EQUIPMENT

AUTHORIZED DISTRIBUTORS
METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration

METERMASTER LOCATIONS:
ARIZONA
Phoenix .... (602) 437-1425
Tucson .... (602) 792-3411
CALIFORNIA
Los Angeles .... (213) 685-4340
Palo Alto .... (415) 968-0313
San Diego .... (619) 560-4841
GEORGIA
Atlanta .... (404) 446-0166
ILLINOIS
Chicago .... (312) 593-8650
MASSACHUSETTS
Boston .... (617) 523-2580
MINNESOTA
Minneapolis .... (612) 332-6117
MISSOURI
St. Louis .... (314) 454-0241
NEW MEXICO
Albuquerque .... (505) 292-3330
OHIO
Cleveland .... (216) 651-4100
OKLAHOMA
Tulsa .... (918) 582-1444
PENNSYLVANIA
Pittsburgh .... (412) 261-4548
TEXAS
Austin .... (512) 473-8876
Dallas .... (214) 271-5671
Houston .... (713) 733-9814
WISCONSIN
Milwaukee .... (414) 643-0554
ALL OTHER STATES .... (800) 962-8128

SYLVANIA CONTROL DEVICES, Rte. 35, Standish, ME 04084, Tel: 207-642-4535, TWX: 710-365-0145; Empl.: Over 1,000; *Sls. Mgr.:* J. T. Dougherty; *Dist. Mgr.:* J. T. Dougherty .... **1B**•1822

Local Sales Offices & Reps

AL	Huntsville, Rakes Engrg. & Mktg. Corp.	205-533-3763
CA	Hayward, Pacific Mktg. Inc.	415-887-1620
GA	Atlanta, Rakes Engrg. & Mktg. Corp.	404-447-6937
IL	Arlington Heights, Thermek Inc.	312-577-6900
MA	Hingham, Northeast Reps., Inc.	617-749-8700
MI	Dearborn	313-582-8754
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Manville, Dynorep Inc.	201-685-0135
NY	Albany, H. C. Johnson Agencies, Inc.	518-459-1239
NY	Buffalo, H. C. Johnson Agencies, Inc.	716-632-7880
NY	Rochester, H. C. Johnson Agencies, Inc.	716-586-0777
NC	Raleigh, Rakes Engrg. & Mktg. Corp.	919-847-5079
OH	Dayton	513-223-6227
OR	Portland, SPS Elctrns.	503-297-6919
PA	Glenshaw, H. C. Johnson Agencies, Inc.	412-961-0414
WA	Redmond, SPS Elctrns.	206-323-4140

SYLVANIA ELECTRONIC, Box 360, Muncy, PA 17756, Tel: 717-546-3191; Empl.: 395; *Sls. Mgr.:* A. M. Serang; *Dist. Mgr.:* S. R. Sisak

PhilipsECG

SYLVANIA ELECTRONIC COMPONENTS, Philips ECG Inc., A North American Philips Co.; 100 First Ave., Waltham, MA 02254, Tel: 617-890-6107; Empl.: 4213; *Sls. Mgr.:* D. R. Kronenwetter; *Dist. Mgr.:* E. H. Frost .... **1A**•2108, 2109

Local Sales Offices & Reps

CA	Los Angeles	714-953-6735
FL	Tampa	813-446-8602
NJ	Teterboro	201-768-3280
NY	Seneca Falls	315-568-5881
OH	Cleveland	216-331-1088
TX	Dallas	214-239-9370

Local Distributors

AL	Andalusia, Wholesale Elctr. Supps. Co.	205-222-5100
AL	Anniston, Radio Dist. & Sup. Co.	205-236-8654
AL	Birmingham, Forbes Distributing Co.	205-251-4104
AL	Decatur, Forbes Distributing Co.	205-353-4762
AL	Dothan, Carmichael Elctrns. Inc.	205-793-7066
AL	East Gadsden, Radio Dist. & Supp. Co.	205-547-1636
AL	Mobile, Specialty Distributing Co.	205-344-0450
AL	Mobile, Electronic Supp. Co.	205-478-0455
AL	Mobile, Forbes Elctrn. Distrs. Inc.	205-479-4535
AL	Montgomery, Forbes-Godfrey TV Elctrns. Inc.	205-263-0283
AL	Muscle Shoals, Jones Elctrns.	205-383-1241
AL	Opelika, Southern Elctrns. Corp.	205-745-5298
AK	Anchorage, Alaska Elctrn. Supp.	907-563-3774
AK	Juneau, Juneau Elctrns.	907-586-2260
AZ	Phoenix, Parts Elctrn. of AZ	602-258-6476
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
AZ	Phoenix, Elctrn. Parts Co. Inc.	602-277-7281
AZ	Phoenix, Electronic Distrs.	602-955-8303
AZ	Tucson, Inland Elctrn. Supp.	602-889-5301
AZ	Tucson, Elliott Elctrns., Inc.	602-884-7394
AR	El Dorado, Electra Inc.	501-862-4901
AR	Fayetteville, Southern Elctrns. Co.	501-442-6582
AR	Ft. Smith, Wise Wholesale Elctrns.	501-783-8925
AR	Little Rock, Lavender Elctrn. Supp. Inc.	501-372-0248
AR	Little Rock, Southern Elctrns. Co.	501-372-4196
AR	Little Rock, David White Elctrns.	501-376-1391
AR	Little Rock, Carlton Bates Co.	501-562-9100
AR	Paragould, Martin Wholesale Radio Supp.	501-236-6049
AR	Pine Bluff, David White Elctrns.	501-534-0612
AR	Springdale, Wise Wholesale Elctrns.	501-751-4814
AR	Texarkana, Lavender Elctrns. Inc.	501-773-4631
CA	Anaheim, Ball Elctrns.	714-828-1310
CA	Berkeley, Al Lasher Elctrns.	415-843-5915
CA	Concord, Pacific Radio Supp. Inc.	415-682-4700
CA	Downey, Net Elctrns.	213-923-4591
CA	Dublin, Pacific Radio Supp. Inc.	415-829-5960
CA	Eureka, Redwood Elctrn. Supp.	707-443-3107
CA	Fresno, B. J. De Jarnatt Wholesale Co., Inc.	209-268-8544
CA	Fullerton, Orvac Elctrns.	714-871-1020
CA	Garden Grove, Sav-On	714-530-0555
CA	Huntington Park, Martin Distributing Co.	213-582-7111
CA	Los Angeles, Radio Equip. Distrs.	213-668-1100
CA	Modesto, Inland Elctrns.	209-524-7945
CA	Mtn. View, Associated Radio	415-968-1689
CA	Oakland, Cass Elctrns.	415-834-4225
CA	Oakland, Chuck Hurley Elctrns.	415-834-9185
CA	Oxnard, Dow Radio, Inc.	805-486-6353
CA	Pasadena, Dow Radio, Inc.	213-681-3416
CA	Sacramento, Dunlap Elctrns. Inc.	916-442-5801
CA	Sacramento, Popkey Distributing	916-448-8848
CA	Sacramento, Chuck Hurley Elctrns. Inc.	916-927-5891
CA	San Diego, Hurley Elctrns.	619-235-6245
CA	San Francisco, Associated Radio	415-431-0212
CA	San Jose, John E. Schad Inc.	408-275-6484
CA	San Jose, Peninsula Elec. Supp.	408-294-8781
CA	San Luis Obispo, Midstate Wholesale Elctrns.	805-543-2770
CA	San Rafael, Beaver Elctrns.	415-453-1130
CA	Santa Ana, Hurley Elctrns., Inc.	714-971-2203
CA	Santa Rosa, Chuck Hurley Elctrns. Inc.	707-542-5423
CA	South Lake Tahoe, Cal Pine Elctrns.	916-541-3777
CA	Torrance, Cash Elctrns.	213-373-6333
CA	Vallejo, Associated Radio	707-552-2363
CO	Colorado Springs, Walker Colorado Springs Elect.	303-636-1661
CO	Denver, Denver Wintronics	303-934-2406
CO	Denver, Elliott Elctrn. Supp. Inc.	303-778-0333
CO	Denver, Walker Denver Elctrns.	303-935-2401
CO	Grand Junction, Walker Grand Junction Elctrns.	303-242-4435
CO	Greeley, Walker Greeley Elctrns. Co.	303-353-3241
CO	Pueblo, Walker Pueblo Elctrns.	303-542-1924
CT	Hartford, Signal Center, Inc.	203-233-8551
CT	New London, Aikins Elctrn. Supp.	203-442-4406
CT	South Windsor, Sceli Elctrns.	203-289-6853
CT	West Haven, Amerling Co.	203-934-7901
DE	Wilmington, Wholesale Elctrns.	302-656-9988
FL	Bradenton, Leader Elctrns.	813-756-9571
FL	Cocoa, Cape Elctrns.	305-636-6331
FL	Ft. Lauderdale, Vance Baldwin Inc.	305-523-3461
FL	Ft. Lauderdale, Southeastern Elctrns.	305-563-4131
FL	Ft. Myers, Dow Elctrns.	813-334-6577
FL	Ft. Walton Beach, Key Elctrn. Supp.	904-863-2191
FL	Gainesville, Dow Elctrns. Inc.	904-376-3231
FL	Homestead, United Elctrn. Supp. Inc.	305-245-0955
FL	Jacksonville, Mitchell Elctrns.	904-356-8427
FL	Jacksonville, The Bay Co.	904-255-2614
FL	Lakeland, Leader Elctrns.	813-686-8193
FL	Largo, Chester Elctrn. Supp. Co.	813-585-4736
FL	Melbourne, Leader Elctrn. Distributing Inc.	305-254-5274
FL	Miami, Elctrn. Equip. Co., Inc.	305-871-3500
FL	Miami, Walder Elctrn. Distr. Co.	305-379-9393
FL	Miami, Vance Baldwin Inc.	305-693-2921
FL	Miami, Southeastern Wholesalers Inc., D/B/A Herman Elctrns.	305-634-6591
FL	Naples, Joe Coomes Distr. Inc.	813-775-4442
FL	Orlando, Sun Elctrn. Supp. Inc.	305-841-4650
FL	Orlando, Dow Elctrns. Inc.	305-299-2771
FL	Orlando, C & S Elctrn. Supp. Co., Inc.	305-299-4300
FL	Panama City, Central Elctrn. Supp. Co.	904-785-0237
FL	Pensacola, Grice Elctrns. Inc.	904-477-8100
FL	Pensacola, Forbes Elctrn. Distributing Inc.	904-456-7452
FL	Pensacola, Pensacola Elctrns.	904-478-3771
FL	Pensacola, Elctrn. Supp. Co.	904-432-6916
FL	Sarasota, Dow Elctrns.	813-365-3393
FL	St. Petersburg, Dow Elctrns.	813-525-1131
FL	Tallahassee, Dell Elctrns. Inc.	904-224-5145
FL	Tallahassee, Fouraker Elctrns. Inc.	904-224-5101
FL	Tampa, Leader Elctrns. Distrs.	813-870-3315
FL	Venice, Ferguson Elctrns. Co.	813-493-0000
FL	W. Palm Beach, Vance Baldwin Inc.	305-832-5671
FL	W. Palm Beach, Dolphin Elctrn. Supp. Inc.	305-659-7166
GA	Albany, Specialty Distributing Co.	912-435-1711
GA	Athens, Specialty Distributing Co.	404-458-1334
GA	Atlanta, Specialty Distributing Co.	404-873-2521
GA	Atlanta, Wholesale Indl. Elctrns.	404-447-8431
GA	Atlanta, Specialty Distributing Co.	404-458-6341
GA	Augusta, Specialty Distributing Co.	404-722-1526
GA	Brunswick, Specialty Distributing Co.	912-265-1927
GA	College Park, Specialty Distributing Co.	404-763-3828
GA	Columbus, Specialty Distributing Co.	404-327-7414
GA	Macon, Specialty Distributing Co.	912-743-5421
GA	Marietta, Specialty Distributing Co.	404-422-4333
GA	Savannah, Specialty Distributing Co.	912-234-1684
GA	Valdosta, Specialty Distributing Co.	912-242-4910
HI	Honolulu, Admor Distr. Corp.	808-537-4501
HI	Honolulu, Electrical Equip. Co., Ltd.	808-533-3884
HI	Honolulu, Nylen Brothers Co. Ltd.	808-538-1171
HI	Honolulu, Precision Radio Ltd.	808-537-5291
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Pocatello, Kimball Elctrns.	208-232-2201
IL	Alton, Ebinger Radio Co.	618-462-9783
IL	Aurora, Mainline Supp. Co., Inc.	312-892-9026
IL	Benton, Lampley Radio Co.	618-435-8194
IL	Berwyn, B-B & W Inc.	312-749-1710
IL	Chicago, U. S. Electronics	312-925-4111
IL	Chicago, Howard Elctrn. Sls.	312-254-1777
IL	Chicago, Alpha Elctrns.	312-525-2840
IL	Elgin, Mainline Supp. Co., Inc.	312-697-6746
IL	Evergreen, Beaty Elctrns. Inc.	312-423-5500
IL	Geneva, Melvin Elctrns., Inc.	312-232-8050
IL	Harrisburg, Standard Distrs.	618-252-1478
IL	Jacksonville, Baptist Elctrn. Supp. Co., Inc.	217-243-6464
IL	Joliet, Mainline Supp. Co., Inc.	815-436-3900
IL	Kankakee, S&S Elctrn. Supp. Co.	815-933-5595
IL	Mattoon, Mattoon Radio & TV Supp. Co.	217-235-5457
IL	Moline, Lofgren Distributing Co.	309-764-7436
IL	Niles, Joseph Elctrns. Inc.	312-297-4200
IL	Oak Forest, Melvin Elctrns. Inc.	312-687-5050
IL	Peoria, Warren Radio Co.	309-674-5998
IL	Quincy, Show Me Elctrns.	217-223-9880
IL	Rockford, Midwest Associated	815-962-8036
IL	Rockford, Jay-tronics	815-965-8786
IL	Salem, Laco Elctrns. Inc.	618-548-3150
IL	Springfield, Baptist Elctrn. Supp. Co., Inc.	217-753-0111
IL	Villa Park, Melvin Elctrns., Inc.	312-279-5010
IN	Angola, Lakeland Elctrn. Supp.	219-665-6311
IN	Bedford, Elex Mart Inc.	812-275-5941
IN	Bloomington, Stansifer Radio Co.	812-336-6339
IN	Chesterton, Chesterton Elctrn. Supp.	219-926-2109
IN	Elkhart, Warren Radio Co.	219-295-4205
IN	Evansville, Ohio Valley Sound	812-425-6173
IN	Evansville, Hutch & Son, Inc.	812-425-7201
IN	Ft. Wayne, Pembleton Elctrns.	219-426-1812
IN	Ft. Wayne, Warren Radio Co.	219-426-5344
IN	Gary, Calumet Elctrn. Supp. Inc.	219-887-4961
IN	Gary, B&B Elctrn. Supp.	219-980-8200
IN	Indianapolis, Warren Radio Co.	317-634-5566
IN	Indianapolis, Elctrn. Svc. Parts	317-632-8586
IN	Indianapolis, Graham Elctrns. Supp. Inc.	317-634-8202
IN	Kokomo, Television Radio Distr.	317-457-5942
IN	Logansport, Television Radio Distr., Inc.	219-753-2879
IN	Marion, J&W Elctrns. Inc.	317-662-1114
IN	South Bend, Television Supp., Inc.	219-289-7036
IN	Terre Haute, Mid West Supp.	812-232-0187
IA	Ames, Electronic Supp. Inc.	515-232-7020
IA	Burlington, Union Supp. Co.	319-754-5745
IA	Cedar Rapids, Iowa Radio Supp. Co.	319-393-4510
IA	Council Bluffs, Meyerson Distributing Co.	712-328-2351
IA	Davenport, Warren Radio Co.	319-322-5301
IA	Des Moines, Gifford-Brown of Des Moines	515-243-1257
IA	Des Moines, Mid State Distributing Co.	515-244-7231
IA	Mason City, Mid State Distributing Co.	515-423-8012
IA	Sioux City, Molstad Dist.	712-255-8023
KS	Kansas City, Video Elctrn. Supp. Co.	913-371-5731
KS	Salina, RSC Electronics	913-823-6353
KS	Wichita, RSC Electronics	316-267-5213
KY	Ashland, Electronic Supp. Inc.	606-325-1511
KY	Bowling Green, Randolph, Hale & Meredith	502-885-5357
KY	Hopkinsville, Randolph & Hale	502-885-5327
KY	Lexington, Service Elctrn. Supp.	606-254-5786
KY	Louisville, P. I. Burks & Co.	502-589-3960
KY	Newport, Holub Dist. Co.	606-431-4211
KY	Paducah, Warren Radio Co.	502-442-4367
LA	Alexandria, Elctrn. Svc. Supp.	318-443-8483
LA	Baton Rouge, Menard Elctrns.	504-355-0323
LA	Gretna, Pelican Elctrn. Supp. Inc.	504-361-4187
LA	Houma, Pelican Elctrn. Supp. Inc.	504-868-1285
LA	Lafayette, Lafayette Radio Equip.	318-234-2364
LA	Lafayette, Ralph's of Lafayette	318-233-0105
LA	Lake Charles, Wholesale Radio Equip.	318-439-2431
LA	Marrero, AFG Elctrn. Supply Inc.	504-368-9696
LA	Metairie, Pelican Elctrn. Supp.	504-888-4720
LA	Monroe, Martin Elctrns. Inc.	318-388-4224
LA	Monroe, Tri-State Elctrns.	218-387-9711
LA	New Orleans, Wm. B. Allen, Inc.	504-525-8222
LA	New Orleans, Radio Parts	504-581-5959
LA	New Orleans, Southern Radio Supp. Co.	504-524-2343
LA	Opelousas, Opelousas Radio Equip.	318-942-5702
LA	Shreveport, Elctrn. Supp. of Shreveport	318-227-9080
LA	Shreveport, Indl. Elctrn. Supp. Inc.	318-222-9459
LA	West Monroe, Brooks Supp. of La	318-323-0344
ME	Bangor, Maine Elctrns. Distr. Inc.	207-947-7396
ME	Lewiston, Stark Wholesale Elctrns.	207-784-6979
ME	Portland, LAD Elctrns. Distrs.	207-772-2174
MD	Baltimore, Modern Elctrns.	301-282-5300
MD	Baltimore, Tritronics	301-256-4400
MD	Baltimore, Fairway Elctrns. of MD Inc.	301-247-8383
MD	Frederic, Hankey's Radio Inc.	301-662-1381
MD	Hagerstown, Fairway Elctrns. Inc.	301-791-0200
MD	Kensington, Fairway Elctrns. Inc.	301-933-4420
MD	Salisbury, Standard Elctrns. Inc.	301-749-7593
MD	Towson, Radio Elec. Svc. Co.	301-823-0070
MD	Towson, Baynesville Elctrns.	301-823-0082

MA	Boston, Tee Vee Supp. Co.	617-522-9330
MA	Brockton, Ware Radio Supp. Corp.	617-583-0810
MA	Fall River, E. A. Ross Co.	617-673-0921
MA	Hyannis, Capewide Elctrn. Supp Corp.	617-775-3277
MA	Lawrence, Lawrence Elctrn. Distrs.	617-683-0257
MA	Lowell, Frank P. McCartin Co.	617-454-9101
MA	New Bedford, Burns Elctrn. Supp. Co.	617-998-3344
MA	New Bedford, C. E. Beckman Co.	617-994-9674
MA	North Woburn, Abbott Elctrns. Co.	617-935-2040
MA	Norwood, Morrison Elctrn. Supp.	617-769-7280
MA	Peabody, Tee Vee Supp. Co.	617-531-5777
MA	Quincy, Electronic Dists. Corp.	617-328-7800
MA	Springfield, Signal Electr. Ctr. of Springfield	413-739-3893
MA	Waltham, MIL Elctrns. Inc.	617-891-6730
MA	Worcester, Stark Wholesale Elctrns. Inc.	617-756-7136
MI	Adrian, Wedemeyer Elctrn. Supp. Co.	313-263-2925
MI	Ann Arbor, Wedemeyer Elctrns.	313-665-8611
MI	Battle Creek, Warren Radio Co.	616-965-3338
MI	Bay City, Kinde Distributing	517-892-1594
MI	Dearborn, West Side Radio	313-933-6972
MI	Detroit, Elctrn. Parts Co.	313-891-7400
MI	Detroit, S & S Elctrns.	313-521-0588
MI	Flint, Shand Elctrns.	313-743-8940
MI	Grand Rapids, T & W Elctrns.	616-241-3645
MI	Grand Rapids, Warren Radio Co.	616-456-5385
MI	Kalamazoo, Warren Radio Co.	616-381-4203
MI	Lansing, Wedemeyer Elctrns.	517-489-9047
MI	Livonia, Norwest Elctrns.	313-261-4551
MI	Livonia, RS Electronics	313-525-1155
MI	Madison Hgts., Warren Radio Co.	313-588-3327
MI	Muskegon, Fitzpatrick Electric Supp.	616-722-6621
MI	Owasso, Warren Radio Co.	517-723-5239
MI	Pontiac, Joe Coomes	313-334-1526
MI	Port Huron, Port Elctrns.	313-985-6185
MI	Saginaw, Ryder Distributing	517-799-2411
MI	Traverse City, Traverse City Elctrns.	616-946-5153
MN	Minneapolis, Electronic Center	612-371-5230
MN	Minneapolis, Ness Elctrns. Inc.	612-824-2646
MN	Minneapolis, Stark Elctrn. Supp. Co.	612-332-1325
MN	Rochester, Pace Elctrns. Inc.	507-288-1853
MN	St. Paul, Ness Elctrns.	612-224-5411
MS	Biloxi, Hooper Elctrn. Supp. Co.	601-432-0584
MS	Biloxi, Electronic Parts Co.	601-435-3221
MS	Greenville, Tri-State Elctrns. Co.	601-335-3594
MS	Greenwood, Moor Elctrns.	601-453-4241
MS	Hattiesburg, N & H Elctrn. Distr. Co.	601-582-5571
MS	Jackson, Tri-State Elctrns. Co.	601-355-3431
MS	McComb, Risher Radio Supp. Co.	601-684-3731
MS	Meridian, Hooper Elctrn. Supp. Co., Inc.	601-693-2668
MS	Pascagoula, Hooper Elctrn. Supp. Co.	601-762-9383
MO	Columbia, Show-Me Elctrns.	314-449-2944
MO	Flat River, Show-Me Elctrns.	317-431-4816
MO	Jefferson City, Central Missouri Distributing Co.	314-636-3149
MO	Jefferson City, Show-Me Elctrns.	314-636-2191
MO	Kansas City, Elctrn. Supp. Co.	816-931-0250
MO	Rolla, Show-Me Elctrns.	314-364-1515
MO	Sikeston, Baileys Elect. Supp.	314-471-6142
MO	Springfield, Mason Elect. Supp.	417-865-5542
MO	Springfield, Show-Me Elctrns.	417-869-0752
MO	St. John, Ralph Toler Radio Co.	314-426-3260
MO	St. Louis, Olive Elctrns. Inc.	314-426-4500
MO	St. Louis, Deltronics Distributing Co.	314-725-6060
MT	Billings, Television & Elec. Supp. Co.	406-252-7193
MT	Great Falls, The Source Inc.	406-761-2420
MT	Havre, Northern Elctrns.	406-265-5568
NE	Lincoln, Leuck Radio Co.	402-476-2797
NE	Omaha, Radio Equip. Co.	402-341-7700
NE	Scottsbluff, D&H Elctrns. Supp. Inc.	308-632-2181
NV	Reno, Bennett Elctrn. Supp. Co.	702-322-2127
NV	Reno, Dunlap Elctrns.	702-329-1308
NH	Dover, American Radio Corp.	603-742-6800
NH	Manchester, Stark Wholesale Elect. of N.H. Inc.	603-688-7611
NH	Nashua, Tee Vee Supp. Co.	603-889-4171
NJ	Eatontown, Atkinson & Smith Co.	201-542-2447
NJ	Edison, William Elctrn. Supp. Inc.	201-985-3700
NJ	Hillside, Leader Elctrn. Supp. Corp.	201-354-4200
NJ	Pleasantville, Kearns Elctrn. Prods. Co.	609-646-7010
NJ	Raritan, Masters Elctrn. Supp.	201-725-3583
NJ	Trenton, Service Parts & Supp. Co.	609-393-7135
NM	Albuquerque, Southwest Elctrns.	505-345-8611
NM	Albuquerque, Elctrn. Parts Co.	505-293-6161
NM	Albuquerque, North American Module Corp.	505-345-4546
NM	Albuquerque, US Module	505-345-7968
NM	Farmington, Walker Farmington Elctrns. Inc.	505-327-6356
NM	Hobbs, Trice Wholesale Elctrns.	505-393-5107
NM	Santa Fe, Sepco Inc.	505-982-1621
NY	Amherst, Standard Elctrns. Inc.	716-691-3061
NY	Brooklyn, Mill Elctrns. Supp. Co.	212-336-4575
NY	Brooklyn, Ceco Communications	212-646-6300
NY	Brooklyn, Alpha Elctrns., Inc.	212-633-2800
NY	Buffalo, Goldcrest Elctrn. Supp.	716-885-5878
NY	Buffalo, Genesee Radio Parts Co.	716-873-9661
NY	Centereach, GTE Elctrn. Supp.	516-585-8111
NY	Commack, Spartan Elctrns. Inc.	516-499-9500
NY	Corning, Corning Elctrns., Inc.	607-962-0555
NY	Cortland, Cortland Elctrn. Supp.	607-756-2523
NY	Endicott, Standard Elctrns. Inc.	607-754-3102
NY	Hempstead, Davis Elctrns. Corp.	516-483-9200
NY	Hicksville, Elctrn. City	516-938-8330
NY	Horseheads, Southern Tier Elctrns. Inc.	607-734-4138
NY	Jamaica, All Parts Elctrns. Whlers., Inc.	212-291-3388
NY	Jamestown, Warren Radio Co.	716-484-1141
NY	Johnson City, Goldcrest Elctrns. Supp.	607-797-2389
NY	Kingston, Greylock Elctrn. Distrs.	914-338-5300
NY	Lackawanna, Metromill Distrs. Inc.	716-826-2600
NY	Massapequa, A&P Elctrns. Corp.	516-541-4200
NY	New Hyde Park, Electronic City	516-352-7145
NY	New York, United Teletronic Parts Corp.	212-569-2330
NY	New York, Dale Elctrns. Corp.	212-255-3660
NY	New York, Consolidated Radio Sls.	212-865-4900
NY	Olean, Standard Elctrns. Inc.	716-372-1800
NY	Port Chester, Wise Comps.	914-939-3940
NY	Rochester, Goldcrest Elctrns. Supp.	716-546-8464
NY	Rochester, Masline Elctrns. Inc.	716-546-5373
NY	Rochester, Standard Elctrns. Inc.	716-254-7590
NY	Schenectady, Goldcrest Elctrns. Supp.	518-377-6424
NY	Syracuse, Standard Elctrns. Inc.	315-422-0421
NY	Syracuse, Goldcrest Elctrns. Supp.	315-471-7115
NY	Troy, Troy Television	518-235-1521
NY	Utica, Grapac Elctrns. Co.	315-732-4674
NY	Watertown, Gateway Elctrns.	315-788-7251
NC	Burlington, Womack Elc. Supp.	919-227-7485
NC	Charlotte, United Elctrns. Supp.	704-372-2650
NC	Concord, Mac Victor Elctrns.	704-786-4175
NC	Durham, Knight Elctrns.	919-682-9371
NC	Fayetteville, Brantley Elctrns.	919-868-8038
NC	Fayetteville, Eastern Radio Supp.	919-485-2161
NC	Gastonia, JMT Elctrns.	704-867-4401
NC	Goldsboro, Womack Elctrns.	919-734-3221
NC	Greensboro, Guilford Elctrns.	919-275-1385
NC	Greenville, Pair Elctrns.	919-756-2291
NC	High Point, Mac Victor Elctrns.	919-889-8024
NC	Lumberton, Knight Elctrns.	919-739-2870
NC	Raleigh, Knight Elctrns.	919-833-6417
NC	Sanford, Knight Elctrns.	919-776-4249
NC	Statesville, Mills Elctrns. Inc.	704-872-8949
NC	Wilmington, Buck's Elctrns.	919-392-4262
NC	Winston Salem, Electronic Distributing Inc.	919-723-1097
ND	Fargo, Radio & TV Inc.	701-232-8993
ND	Fargo, S/S Elctrns., Inc.	701-237-5003
OH	Akron, Akron Elctrn. Supp., Inc.	216-762-8818
OH	Akron, Warren Radio Co.	216-434-6668
OH	Akron, Main TV Supp. Co.	216-253-8161
OH	Alliance, Glasska Elctrns.	216-823-5780
OH	Canton, Electronic Ctr. Inc.	216-456-7133
OH	Cincinnati, United Radio Inc.	513-761-4030
OH	Cleveland, Winteradio Elctrn. Supp. Corp.	216-621-9383
OH	Cleveland, Warren Radio Co.	216-888-5225
OH	Columbus, Whitehead's	614-224-1186
OH	Columbus, Thompson Elctrn. Supp., Inc.	614-228-6191
OH	Dayton, Srepco Elctrns. Div. Pioneer Standard Elctrns. Inc.	513-224-0871
OH	Dover, TV Specialties, Inc.	216-364-6678
OH	Elyria, EL-A-Co	216-323-1805
OH	Fremont, J & B Elctrns.	419-332-9334
OH	Lancaster, Electronic Supp. Co.	614-653-9344
OH	Lima, Warren Radio Co.	419-228-1691
OH	Lima, LRP Elctrns., Inc.	419-228-1220
OH	Marion, Mid Ohio Elctrns. Co.	614-382-1101
OH	Newark, Turner Wilson Co.	614-349-7454
OH	Parma, Superior Elctrn. Parts Co.	216-842-7940
OH	Portsmouth, Fullers Sound Elctrn. Supplier	614-353-0965
OH	Toledo, Warren Radio Co.	419-248-3364
OH	Willowick, Euclid Radio Parts Co.	216-585-5115
OH	Youngstown, Ross Radio Co.	216-746-8881
OH	Youngstown, Glen Elctrns.	216-743-1119
OK	Ardmore, Trice Wholesale Elctrns.	405-223-8540
OK	Enid, Trice Wholesale Elctrns.	405-234-6078
OK	Enid, Enid Walker Elctrns.	405-234-2218
OK	Lawton, Walker Lawton Elctrns. Inc.	405-355-0603
OK	Lawton, Trice Wholesale Elctrns.	405-223-8540
OK	McAlester, Trice Wholesale Elctrns.	918-423-6716
OK	Muskogee, Sooner Radio & TV Supp.	918-682-1384
OK	Muskogee, Trice Wholesale Elctrns.	918-682-2457
OK	Oklahoma City, Radio Supp. Co.	405-232-6127
OK	Oklahoma City, Trice Wholesale Elctrns.	405-681-4647
OK	Oklahoma City, Miller-Jackson Co.	405-235-8426
OK	Oklahoma City, Trice Wholesale Elctrns.	405-524-4411
OK	Ponca City, Trice Wholesale Elctrns.	405-762-5621
OK	Tulsa, Trice Wholesale Elctrns.	918-585-5718
OR	Eugene, United Radio Supp., Inc.	503-342-3381
OR	Portland, United Radio Supp., Inc.	503-233-7151
OR	Portland, Radar Elec.	503-232-3404
OR	Salem, JW Elctrns.	503-399-8565
PA	Allentown, A. A. Peters, Inc.	215-434-5237
PA	Altoona, Hollenback Radio Supp.	814-944-6171
PA	Ambridge, Television Parts Co.	412-266-7700
PA	Braddock, M Leff Radio Parts Co.	412-351-5000
PA	Butler, Bacher Elctrns.	412-283-2095
PA	Clifton Heights, Lazar Elctrns.	215-284-2440
PA	Drexel Hill, Kass Elctrn. Distr.	215-449-2300
PA	Elkins Park, AG Radio Inc.	215-886-5100
PA	Erie, J. V. Duncombe Co.	814-454-5278
PA	Erie, Warren Radio Co.	814-454-5285
PA	Harrisburg, Cumberland Elctrns.	717-233-5885
PA	Marcus Hook, Linwood Wholesale	215-485-0777
PA	New Brighton, Television Parts Co., Inc.	412-846-3000
PA	Philadelphia, JEM Elctrns.	215-743-3030
PA	Philadelphia, HBF Elctrns. Inc.	215-338-1100
PA	Philadelphia, Arlen Supply Co.	215-472-3810
PA	Pittsburgh, South Hills Elctrns.	412-341-6200
PA	Pottsville, Moyer Elctrn. Supp. Co., Inc.	717-622-7866
PA	Reading, Barbey Elctrns.	215-376-7451
PA	Scranton, Key Radio & Supp. Co.	717-342-0161
PA	State College, University Elctrns.	814-238-3093
PA	Tarentum, Huston Elctrn. Distrs.	412-224-8002
PA	Wayne, Peak Elctrns. Corp.	215-293-9000
PA	Wilkes-Barre, Wallco Inc. Elctrn. Dist.	717-823-6181
PA	Williamsport, Williamsport Radio Supp.	717-326-1534
RI	Providence, A&J Distrs. Inc.	401-421-0991
RI	Providence, William Dandreta & Co.	401-861-2800
RI	Providence, Hope Elctrn. Supp.	401-521-5600
RI	Woonsocket, Lectronic Supp. Co.	401-762-0131
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
SC	Charleston, Wholesale Indl. Elctrns.	803-747-9672
SC	Columbia, Wholesale Indl. Elctrns.	803-256-0746
SC	Columbia, Hesco Inc.	803-254-4575
SC	Florence, J&M Supply Co.	803-662-7281
SC	Greenville, Sawyer Elctrns.	803-235-0438
SC	Greenville, Wholesale Indl. Elctrns.	803-235-8334
SC	Taylors, Cantrell Wholesale	803-268-1194
SD	Watertown, Burghardt Supp. Co.	605-886-5749
TN	Chattanooga, Specialty Distributing Co.	615-267-9460
TN	Columbia, Randolph & Williams	615-388-7566
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Dyersburg, Warren Radio	901-285-3850
TN	Jackson, Lavender Elctrns. Inc.	901-422-6585
TN	Johnson City, L & S Elctrns.	615-926-3021
TN	Kingsport, Radio Elec. Supp. Co.	615-247-8111
TN	Knoxville, Roden Electrical Supp. Co.	615-546-8755
TN	Knoxville, Bondurant Bros. Co.	615-573-9151
TN	Memphis, Warren Radio	901-274-2460
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Memphis, Frank G. Uffer Co.	901-725-6743
TN	Morristown, L & S Elctrns.	615-581-7983
TN	Nashville, Curreys Inc.	615-242-4221
TN	Nashville, Randolph & Rice	615-255-5602
TN	Tullahoma, Randolph Vandergriff Inc.	615-455-4531
TX	Abilene, R & R Elctrn. Supp. Co.	915-677-2974
TX	Amarillo, Trice Wholesale Elctrns.	806-372-5668
TX	Amarillo, R & R Elctrn. Supp. Co.	806-374-2866
TX	Austin, C&M Elctrns. Inc.	512-451-6595
TX	Austin, Wholesale Elctrn. Supp. Co.	512-478-9568
TX	Beaumont, Ralph's Indl. Elctrns.	713-833-9443
TX	Beaumont, Covington Distr.	713-835-5392
TX	Beaumont, Buddy's Wholesale Elctrn. Inc.	713-842-5019
TX	Borger, Trice Wholesale Elctrns.	806-274-5281
TX	Bryan, Mid-State Elctrns.	713-779-1226
TX	Corpus Christi, Elctrn. Suppliers Inc.	512-993-1303
TX	Corpus Christi, Leader Elctrn. Supp. Co.	512-884-5527
TX	Dallas, Wholesale Elect. Supp. Co.	214-824-3001
TX	Denison, Denison Radio Supp.	214-465-2336
TX	El Paso, Midland Specialty Co.	915-533-9555
TX	Ft. Worth, Wholesale Elctrn. Supp.	817-336-0461
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Ft. Worth, Byron's Radio & TV Supp.	817-534-5911
TX	Ft. Worth, Trice Wholesale Elctrns.	817-335-9515
TX	Greenville, Lavender Elctrns. Inc.	214-455-4360
TX	Harlingen, Elctrn. Suppliers, Inc.	512-423-5895
TX	Houston, Ralph's Indl. Elctrns.	713-748-4902
TX	Houston, Houston Wholesale	713-644-8320
TX	Houston, Angie Elctrn. Supp. Co.	713-659-8386
TX	Laredo, Guarantee Radio Supp. Co.	512-723-6913
TX	Longview, VIDCO Elctrns. Inc.	214-757-4911
TX	Lubbock, Trice Wholesale Elctrns.	806-747-2888
TX	Lubbock, R & R Elctrns. Supp. Co.	806-765-7727
TX	McAllen, Richards Elctrns.	512-682-6337
TX	McAllen, Rio Radio Supp. Inc.	512-682-5224
TX	Midland, Trice Wholesale Elctrns.	915-563-0866
TX	Paris, Lavender Elctrns. Inc.	214-785-1711
TX	Port Arthur, Diehl Radio & TV Supp.	713-985-8888
TX	Richardson, Trice Wholesale Elctrns.	214-690-4646
TX	San Antonio, Sherman Elctrns.	512-224-1001
TX	San Antonio, M-Tronics Inc.	512-736-2481
TX	Sherman, Lavender Elctrns. Inc.	214-892-9155
TX	Sherman, Trice Wholesale Elctrns.	214-893-7421
TX	Stafford, Harrison Equip. Co.	713-879-2600
TX	Temple, L & M Wholesale Elctrns.	817-778-7679

TX	Texarkana, McCulloch Elctrn. Supp. Co.	214-792-6923
TX	Texas City, Elctrn. Supp. Co.	713-945-4401
TX	Tyler, Lavender Elctrns. Inc.	214-597-6315
TX	Tyler, East Texas Elctrn. Inc.	214-593-8253
TX	Victoria, Lavender Elctrns. Inc.	512-575-4738
TX	Waco, L & M Wholesale Elect.	817-754-4644
TX	Wichita Falls, Trice Wholesale Elctrns.	817-322-2151
TX	Wichita Falls, Wholesale Elect. Supp. Co.	817-723-8106
UT	Provo, Central Utah Elctrns.	801-373-7522
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VT	Burlington, Greylock Elctrns.	802-863-3100
VT	Rutland, Rutland Elctrn.	802-775-4690
VT	White River Jct., Vermont Appliance	802-295-3143
VA	Alexandria, Certified Elctrns.	703-548-5115
VA	Arlington, Arlington Elctrn. Wholesale	703-524-2412
VA	Charlottesville, Virginia Radio Supp. Co., Inc.	804-296-4184
VA	Danville, Womack Radio Supp. Co., Inc.	804-793-5131
VA	Grundy, Rife Wholesale Inc.	703-935-2188
VA	Lynchburg, Womack Radio Supp. Co., Inc.	804-845-5983
VA	Martinsville, Womack Radio Supp. Co., Inc.	703-638-2327
VA	Norfolk, Radio Parts Dist. Co.	804-461-8095
VA	Portsmouth, Distrs. Inc.	804-399-2446
VA	Richmond, Banner Elctrns. Inc.	804-321-7255
VA	Staunton, Southern Elec. Corp.	703-886-6218
WA	Bellevue, United Radio Supp.	206-451-9393
WA	Bellingham, Seattle Radio Supp.	206-734-3400
WA	Everett, JW Electronics	206-258-4339
WA	Seattle, Pearl Elctrns.	206-622-6200
WA	Seattle, Electronic Supp. Co.	206-632-2222
WA	Seattle, Radar Elec.	206-282-2511
WA	Seattle, Westlake Elctrn. Supp.	206-622-6600
WA	Spokane, Amfac Elec. Supp.	509-534-0611
WA	Tacoma, C & G Elctrns.	206-272-3181
WA	Tumwater, JW Elctrns.	206-943-1071
WA	Yakima, JW Electronics	509-575-1234
WV	Beckley, Halley Elctrns.	304-253-2561
WV	Charleston, Elctrn. Materials	304-325-3638
WV	Fairmont, State Elctrns.	304-366-4520
WV	Morgantown, State Elctrns.	304-292-1641
WV	Morgantown, Electro Distributing Co.	304-296-5637
WI	Appleton, Appleton Radio	414-734-5767
WI	Eau Claire, Indianhead Elctrns.	715-834-3606
WI	Fond du Lac, Fedco Elctrns. Inc.	414-922-6490
WI	Green Bay, G. M. Popkey Co.	414-437-5445
WI	Kenosha, Chester Elctrn. Supp.	414-658-4616
WI	Madison, Superior Elctrn. Parts Co.	608-257-1477
WI	Madison, G. M. Popkey Co.	608-257-2266
WI	Marinette, G. M. Popkey Co.	715-732-0121
WI	Milwaukee, Marmax Sls. Div. of World Prod., Inc.	414-272-4048
WI	Milwaukee, G. M. Popkey Co.	414-444-4730
WI	Racine, Superior Racine, Inc.	414-632-5142
WI	Wausau, G. M. Popkey Co.	715-845-4255
WY	Casper, Walker Casper Elctrn. Co.	307-237-1943

SYLVANIA MINIATURE LIGHTING, W. Main St., Hillsboro, NH 03244, Tel: 603-464-5533, TWX: 710-366-0387; Empl.: 450; *Sls. Mgr.:* Tom Izbicki .... **1B**•1059-1061

Local Sales Offices & Reps

CA	Laguna Hills, English/Damco	714-837-3801
CA	Sunnyvale, W.W. Posey Co.	408-746-0771
CO	Arvada, Cluff & Assocs.	303-425-6604
CT	No. Haven, Coakley, Boyd & Abbett	800-225-8402
FL	Ft Lauderdale, Hutto, Hawkins, Peregoy	305-971-5750
FL	Maitland, Hutto, Hawkins, Peregoy	305-831-2474
GA	Atlanta, Millar Elctrns.	404-261-6160
IL	Chicago, I.R.I.	312-647-7755
IN	Ft. Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
KS	Prairie Village, R.W. Kunz	913-648-3535
KY	Louisville, R.O. Whitesell & Assocs.	502-426-7696
LA	Kenner, Cartwright & Bean	504-466-0020
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Stoss & Assocs.	612-925-2757
MO	St. Louis, R.W. Kunz	314-966-4977
NJ	Long Valley, Paul A. Sweeney	201-852-1434
NY	Rochester, Electra Sls.	716-461-5252
NY	Syracuse, Electra Sls.	315-463-1248
NC	Raleigh, Millar Elctrns.	919-787-9585
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OK	Oklahoma City, Erickson Sls.	405-682-2947
OR	Tigard, Electronic Sources Inc.	503-684-0040
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
PA	Trevose, P.S.A. Inc.	215-245-0513
TN	Memphis, Cartwright & Bean	901-276-4442
TX	Dallas, Erickson Sales	214-739-5833
TX	Houston, Erickson Sales	713-980-9606
UT	Salt Lake City, Cluff & Assocs.	801-486-7297
WA	Bellevue, Electronic Sources Inc.	206-451-3500
WI	Milwaukee, F.C. DuBois & Assocs.	414-774-3100

SYLVANIA PARTS, 816 Lexington Ave., Warren, PA 16365, Tel: 814-723-2000, 800-221-3333; Empl.: 1880; *Sls. Mgr.:* R. F. Scalise

SYLVANIA SYS. GRP., Comm. Sys. Div., GTE Prods. Corp., 77 A St., Needham Hgts., MA 02194, Tel: 617-449-2000, Telex: 92-2497; *Sls. Mgr.:* Ken Tong

SYMBEX CORP., 72 Corwin Dr., Box 938, Painesville, OH 44077, Tel: 216-354-0925, TWX: 810-425-2256; Empl.: 130 .... **2**•1586, 1587, 1895

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls.	205-533-1735
AZ	Tempe, Elctrn. Dev. and Sls.	602-438-1547
AR	Little Rock, Erickson Sls.	501-225-7379
CA	Anaheim, West Rep.	714-527-2822
CA	Chico, Symbex Corp.	916-891-6410
CA	San Diego, D2 Sls.	619-560-6266
CA	Santa Clara, Symbex Corp.	408-727-5817
CO	Denver, West, Inc.	303-773-8080
CT	Madison, Omni-Rep	203-421-4561
FL	Ft. Lauderdale, Interface Dynamics	305-565-5075
GA	Norcross, Elctrn. Sls.	404-448-6554
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
LA	Chalmette, Erickson Sls.	504-271-1976
MD	Baltimore, C.E. Heller Co.	301-256-0245
MA	Burlington, Omni-Rep	617-938-0039
MA	Canton, Symbex Corp.	617-828-8114
MI	Franklin Village, I.E. Hampton & Assocs.	313-851-0820
MI	St. Joseph, I.E. Hampton & Assocs.	616-983-0862
MN	Minneapolis, Parler, Shoap & Assocs.	612-755-6904
MO	Blue Springs, Kathrinus Kelly Baumhauer	816-229-0001
MO	St. Louis, Kathrinus Kelly Baumhauer	314-647-2400
NJ	Englewood, Axelrod, Busch, Sullivan Assoc.	201-871-0020
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Bainbridge, R.W. Meischer Co.	607-967-7192
NY	Buffalo, R.W. Mitscher Co.	716-633-7970
NY	Pittsford, R.W. Mitscher Co.	716-586-4012
NY	Rochester, R.W. Mitscher Co.	716-227-0839
NY	Syracuse, R.W. Mitscher Co.	315-458-1321
NC	Cary, Elctrn. Sls.	919-467-8486
OH	Painesville, Symbex Corp.	216-354-0925
OH	Rocky River, Norm Case Assocs.	216-333-0400
OK	Oklahoma City, Erickon Sls.	405-682-2947
OR	Falls City, Ecco Mktg.	503-787-3509
PA	Southampton, Symbex Corp.	215-322-8040
TX	Austin, Erickson Sls.	512-244-3068
TX	Dallas, Erickson Sls.	214-739-5833
TX	El Paso, Epec., Inc.	915-593-8481
TX	Euless, Symbex Corp.	817-540-2687
TX	Houston, Erickson Sls.	713-980-9606
UT	Salt Lake City, Meridian West	801-968-4177
WA	Seattle, Ecco Mktg.	206-364-0200
WV	Spokane, Ecco Mktg.	509-924-4410
WI	Colgate, Rep. 1 & Assoc.	414-628-4016

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Santa Ana, C.R. Elctrns.	714-556-2040
CT	Danbury, Pilgrim Elctrns	203-792-7274
LA	Shreveport, Indl. Elctrns. Supp.	318-222-9459
MA	Framingham, Now Elctrns.	617-235-9501
MA	Middleboro, Glynn Elctrns.	617-947-4262
MO	St. Charles, Finnigan Elctrns.	314-946-6201
OK	Tulsa, Combined Tech. Comps.	918-582-8242
WA	Seattle, Carlyle Tech. Sls.	206-575-6750
WI	Madison, Schrenk Sls.	608-255-7400
WI	Milwaukee, Marsh Elctrns.	414-475-6000

SYMBICON, 89 Route 101A, Amherst, NH 03031, Tel: 603-673-8898, Telex: 553-059; *Sls. Mgr.:* S. Harrington

SYM-TEK SYS., INC., 3912 Calle Fortunada, San Diego, CA 92123, Tel: 619-569-6800, Telex: 695450; Empl.: 250; *Sls. Mgr.:* Guy Whitlock

Local Sales Offices & Reps

AZ	Phoenix, Scientific Dvs.	602-957-0401
CA	Escondido, Scientific Dvs.	619-480-1287
CA	Los Alamitos, Scientific Dvs.	213-598-7678
CA	San Jose, Scientific Dvs.	408-554-0455
CO	Boulder, Scientific Dvs.	303-449-9466
FL	Longwood, Richard Schoonovier Inc.	305-788-3344
GA	Marietta, More	404-992-5172
MA	Hudson, System Sls.	617-562-9777
NM	Albuquerque, Scientific Devices	505-883-3668
NY	Valley Stream, Levison Sls.	516-266-5020
OH	Brecksville, WRR Assoc.	216-526-2023
TX	Austin, Crockett Southwest	512-250-1776
TX	Dallas, Crockett Southwest	214-251-1776
TX	Houston, Crockett Southwest	713-578-1836

SYMTRON CORP., 2415 E. Charleston Rd., Mountain View, CA 94043, Tel: 415-965-4500, TWX: 910-379-5002; Empl.: 250; *Sls. Mgr.:* Don Atkins .... **2**•1896

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Glendale, Symtron Corp.	602-978-6595
CA	Glendale, Orion Sls.	213-240-3151
CA	San Diego, Hadden Assoc.	619-565-9444
CA	Simi Valley, Symtron Corp.	213-961-4536
CA	Tustin, Orion Sls.	714-832-9687
CO	Golden, Symtron Corp.	303-642-7656
CT	Norwalk, Wendell & Assocs.	203-846-4377
FL	Casselberry, H.A.I.	305-695-8592
FL	Largo, H.A.I.	813-595-8170
GA	Atlanta, Remco	404-447-6937
IL	Lisle, Symtron Corp.	312-420-8100
MD	Rockville, Mechtronics Sls.	301-340-2130
MN	Eden Prairie, Symtron Corp.	612-934-8318
MO	Grandview, Harris-Hanson Co.	816-763-6200
MO	St. Louis, Harris-Hanson Co.	314-432-3611
NH	Seabrook, Symtron Corp.	603-431-6296
NY	Manhasset, Wincor Elctrn.	516-627-9474
NC	Raleigh, Remco	919-847-5079
OH	Cleveland, Arthur H. Baier	216-461-6161
OR	Portland, Component Tech.	503-292-1518
PA	Hatboro, Electro Rep	215-674-4421
TX	Addison, Centurion Mktg.	214-348-0382
TX	Addison, Symtron Corp.	214-233-8991

SYNERGETICS INTL., INC., 6565 Odell Pl., P.O. Box E, Boulder, CO 80306-1236, Tel: 303-530-2020; *Sls. Mgr.:* Mike Sharkey

SYNERTEK, 3001 Stender Way, Santa Clara, CA 95051

SYNTEL DIV., Tegam, Inc., 7230 North Ridge Rd., Madison, OH 44057, Tel: 216-428-7505; Empl.: 15

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752, Tel: 617-481-7827, TWX: 710-390-7659; *Sls. Mgr.:* Curtis P. Hoffman .... **3**•1094

Local Sales Offices & Reps

CA	Enceno, King Engrg.	213-981-8677
IN	Columbus, Miltronics	812-376-6321
MD	Silver Spring, Source Assoc.	301-431-0587
MA	Waltham, Digital Assocs.	617-899-4300
NY	Canandaigua, Burt Mamula	716-394-5560
PA	Newtown Square, SWR Assoc	215-356-8550
TX	Dallas, Dean Assocs.	214-458-1321

SYNTRONIC INSTRUMENTS, INC., 100 Industrial Rd., Addison, IL 60101, Tel: 312-543-6444, TWX: 910-651-2191; Empl.: 175; *Sls. Mgr.:* Paul Evans

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Woodland Hills, Tronics	213-703-7212
CO	Wheatridge, Waugaman Assocs.	303-423-1020
IA	Davenport, Ensco-Rep	319-386-6600
KS	Overland Park, Ensco-Rep	913-381-7557
KS	Wichita, Ensco-Rep	316-683-1070
MA	Norwood, MPS Elctrns.	617-796-8700
MN	Minneapolis, Torkelson Assocs.	612-835-2414
MO	Maryland Heights, Ensco-Rep	314-423-3935
NJ	Fair Lawn, G. D. Harris Assocs.	201-796-5200
NM	Albuquerque, Waugaman Assocs.	505-294-1436
OR	Portland, Rep-West	503-771-1555
PA	W. Conshohocken, Eastern Comps.	215-825-8610
PA	York, Eastern Comps.	717-764-3114
TX	Austin, Space Elctrns.	512-451-3173
TX	Houston, Space Elctrns.	713-266-9245
TX	Irving, Space Elctrns.	214-251-3636
UT	S. Jordan, Waugaman Assocs.	801-254-0570
VA	Manassas, Eastern Comps.	703-471-1025
WA	Seattle, Rep-West	206-283-8351
EXP	NJ, Fairfield, Pantronics	201-575-1177
EXP	NJ, Oradell, S. Ginsbury Ltd.	201-261-3200

SYRACUSE ELCTRNS., P.O. Box 4770, Syracuse, NY 13221, Tel: 315-488-4911, Telex: 937-232; Empl.: 200

SYSCON INTL., INC., 1108 So. High St., So. Bend, IN 46618-1096, Tel: 219-232-3900, 800-348-2993, TWX: 810-299-2523; Empl.: 40; *Sls. Mgr.:* Les Barney

SYSTEMS FURNITURE CO., 2727 Maricopa St., Torrance, CA 90503, Tel: 213-533-1212, TWX: 910-349-7518; *Sls. Mgr.:* Rick Labowitz

SYSTEMS PLUS, 1120 San Antonio Rd., Palo Alto, CA 94303, Tel: 415-969-7047, TWX: 910-373-2096; Empl.: 35

SYSTEMS RESCH. LABS., INC., 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, TWX: 810-450-2621; FSC No.: 14590; Empl.: 1000

SYSTONICS, INC., Box 121, Winchester, MA 01890, Tel: 617-729-4439; Empl.: 11

SYSTRON-DONNER INERTIAL DIV., 2700 Systron Dr., Concord, CA 94518, Tel: 415-682-6161, TWX: 910-481-9478; Empl.: 416

SYSTRON-DONNER INSTR. DIV., 2727 Systron Dr., Concord, CA 94518, Tel: 415-676-5000, Telex: 171996, TWX: 910-481-9472; FSC No.: 52542; Empl.: 1400; *Sls. Mgr.:* Howard W. Mette

SYSTRON-DONNER MICROWAVE DIV., 14844 Oxnard St., Van Nuys, CA 91409, Tel: 818-786-1760, TWX: 910-495-1786; Empl.: 160; *Sls. Mgr.:* Richard Valleroy

SYT, 1220 Barranca, El Paso, TX 79935, Tel: 915-593-1234; Empl.: 70; *Sls. Mgr.:* Larry Crum; *Dist. Mgr.:* John Sullivan

SYTEK, INC., 1225 Charleston Rd., Mountain View, CA 94043, Tel: 415-966-7300; *Sls. Mgr.:* Rhonda St. James

TAB BOOKS, Monterey & Pinola Aves., Blue Ridge Summit, PA 17214, Tel: 717-794-2191; Empl.: 175; *Sls. Mgr.:* B. Sites

TACHTRONIC INSTRUMENTS, INC., New Ulm, MN 56073, Tel: 507-354-3105

TADIRAN BATTERIES, See Plainview Elctrns.

TAFA INC., Dow Rd., Bow, NH 03301, Tel: 603-224-9585, Telex: 94-3424; Empl.: 50; *Sls. Mgr.:* Rick Mitchner; *Dist. Mgr.:* Leon Grant

TA INSTR. CASE CO., 4625 Alger St., Los Angeles, CA 90039, Tel: 213-242-8855, TWX: 910-497-4780; Empl.: 60; *Sls. Mgr.:* Jackie Garrison; *Dist. Mgr.:* Jackie Garrison ....**2**•1059

Local Sales Offices & Reps

AL	Huntsville, Intl. Sci. Instrs.	205-533-6880
AZ	Phoenix, Tri-Fab Sls.	602-265-3341
CA	Mountain View, Connolly & Co.	415-967-6988
CO	Littleton, Omega Ltd.	303-798-7040
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Ft. Lauderdale, Tech-Rep Assocs.	305-968-7792
FL	Melbourne Beach, Tech-Rep Assocs.	305-725-4655
FL	St. Petersburg, Tech-Rep Assoc.	813-577-2779
IL	Chicago, Aktron Corp.	312-658-3538
IN	Ft. Wayne, Aktron Corp.	219-747-3650
IA	Davenport, Ensco-Iowa	319-386-6600
KS	Overland Pk., Ensco-Kansas	913-381-7557
KS	Wichita, Ensco Wichita	316-683-1070
MD	Lanham, Data Sys. Mktg.	301-577-3700
MA	Boston, Sturgeon Co.	617-444-6603
MO	St. Louis, Ensco-Rep	314-423-3935
NJ	Ridgewood, Balloou Inc.	201-444-6990
NM	Albuquerque, C. T. Carlberg Assocs.	505-888-3883
NY	New York, Ballou	212-964-4640
NY	Rochester, Gis Lason Sls.	716-454-4741
PA	Blue Bell, Macron Dynamics	215-643-0400
TX	Arlington, Bell Comps.	817-461-5303
WA	Bellevue, Caruso & Northcutt	206-454-9699

TAKEDA RIKEN IND., 1-32-1 Asahi-cho Nerima-ku, Tokyo 176, Japan, Tel: 930-4111, Telex: 272-2140; Empl.: 800; *Sls. Mgr.:* Hiroshi Yasui

T&B/ANSLEY CORP., Sub. Thomas & Betts, 920 Route 202, Raritan, NJ 08869, Tel: 201-685-1600; Empl.: 250; *Dist. Mgr.:* Roland Kolu

TANO CORP., 4301 Poche Ct., New Orleans, LA 70129, Tel: 504-254-3500, TWX: 810-951-5229; Empl.: 390; *Sls. Mgr.:* T. M. Lowrey, Energy Control Sys.;M. A. Cushman, Marine Sys.

TANSITOR ELCTRNS., West Rd., Bennington, VT 05201, Tel: 802-442-5473, TWX: 710-360-1782; FSC No.: 05079; Empl.: 200; *Sls. Mgr.:* Tom Moore; *Dist. Mgr.:* Tom Moore

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel: 716-621-8400; Empl.: 80

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd., Farmingdale, NY 11735, Tel: 516-694-6312, Telex: 14-4611; Empl.: 100 ....**1B**•1753

TAPPAN WIRE & CABLE, 256 Oak Tree Rd., Tappan, NY 10983, Tel: 914-359-9300; Empl.: 10; *Sls. Mgr.:* S. Grant

TASKER SYSTEMS, 20131 Sunburst St., Chatsworth, CA 91311, Tel: 213-341-3010, TWX: 910-494-1214; FSC No.: 09017; Empl.: 250; *Sls. Mgr.:* Gary B. Etzler

TAUBER ELCTRNS. INC., 4901 Morena Blvd., Bldg. 314, San Diego, CA 92117, Tel: 619-274-7242; Empl.: 12; *Dist. Mgr.:* Doug Bennett ....**3**•1433

Local Sales Offices & Reps

AL	Huntsville, Macro-Marketing	205-883-9630
AZ	Phoenix, MacDonald & Assocs.	602-998-1848
CA	Fallbrook, Martronix	619-728-7678
CA	Fullerton, Hawk Assocs.	714-773-4152
CA	Northridge, Tauber-Dreyer Assocs.	818-993-0048
CA	San Jose, Al E. Dusseau	408-226-4375
CA	Sunnyvale, GFA Sales	408-738-4751
IL	Wheeling, Ed Joyner & Co.	312-520-1200
OK	Tulsa, Cunningham Comps. Corp.	918-492-0390
OR	Portland, Frank Jackson Assocs.	503-292-2638
TX	Dallas, Cunningham Comps. Corp.	214-233-4303
TX	Houston, Cunningham Comps. Corp.	713-451-4197
WA	Redmond, Frank Jackson Assocs.	206-881-7277

TAURUS CORP., Academy Hill, P.O. Box 278, Lambertville, NJ 08530, Tel: 609-397-2390 ....**3**•1095

Local Sales Offices & Reps

CA	Pasadena, Sci. Sls.	213-793-1244
FL	Clearwater, Brennan Assoc.	813-446-5006
OH	Wickliffe, W. J. Brauer	216-943-0601

TAU-TRON INC., 27 Industrial Ave., Chelmsford, MA 01824, Tel: 617-256-9013, Telex: 951-952; Empl.: 200; *Sls. Mgr.:* Herbert K. Clark

TAYLOR ELECTRONICS, 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523; *Sls. Mgr.:* Junius Taylor ....**3**•1786

T-BAR INCORPORATED, Switching Components Div., P.O. Box T, 141 Danbury Rd., Wilton, CT 06897, Tel: 203-834-8227, Telex: 68 19 129, TWX: 710 479 3216; *Sls. Mgr.:* Bill Kruppenbacher ....**3**•1308

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
CA	Arcadia, Van Gott & Assocs.	213-445-9728
CA	Palo Alto, Horne Electro Sls.	415-494-6777
CT	Wilton, T-Bar, Inc.	203-834-8227
FL	St. Petersburg, Tech-Rep Assocs.	813-577-2779
GA	Atlanta, CSR Elctrns.	404-396-3720
MD	Silver Spring, Carwithen Assocs.	301-589-9040
NY	Mount Vernon, Sonkin Assocs.	914-668-9809
NC	Raleigh, CSR Elctrns.	919-878-9200
TX	Richardson, McCoy Assocs. Co.	214-238-1017

Local Distributors

CA	Chatsworth, Integrated Elctrns.	213-998-2200
IL	Chicago, Newark Elctrns.	312-638-4411
MA	Hingham, Sager Elctrl. Supp. Co.	617-749-6700
NY	Hauppauge, JACO Elctrns.	516-273-5500
TX	Fort Worth, Allied Elctrns.	817-336-5401

TDJ CO., INC., 1154 Morena Blvd., San Diego, CA 92110, Tel: 619-276-5920; Empl.: 6; *Sls. Mgr.:* R. Scherr ....**2**•1060, 1061

TDK CORPORATION OF AMERICA, 4711 Golf Rd., Skokie, IL 60076, Tel: 312-679-8200 ....**1A**•1189, 1281, 1567, 1630, 2300; **2**•1798, 1799; **3**•1061, 1787

Local Sales Offices & Reps

AL	Birmingham, Robert Warnock Co.	205-879-0576
CA	Cupertino, Thresum Assoc.	408-996-9889
CA	Irvine, English-Damco	714-751-8054
CA	Torrance, TDK Corp. of America	213-539-6631
FL	St. Petersburg, Tech. Rep. Assoc.	813-577-2779
ID	Meridian, Intermountain Techn.	208-888-5708
IL	Palatine, Technology Sls.	312-991-6600
IN	Indianapolis, TDK Corp. of America	317-872-0370
MA	Westwood, Comp. Rep. Assoc.	617-329-3454
MN	Bloomington, Smiley-Scott Assoc.	612-888-5551
NJ	Mount Laurel, Comtek Inc.	609-235-8505
NY	East Syracuse, Nycom Inc.	315-437-8343
NY	Port Washington, TDK Corp. of America	516-625-0100, Ext. 2300
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Luebbe Sls. Co.	512-871-4211
TN	Knoxville, Insul-Reps	615-691-7586
TX	Richardson, Logic I Sls.	214-234-0765
WA	Seattle, Harry Levinson Co.	206-285-5622

TEAC CORP. OF AMERICA, Indl. Prod. Div., 7733 Telegraph Rd., Montebello, CA 90640, Tel: 213-726-0303, Telex: 67-7014; Empl.: 200; *Sls. Mgr.:* Al Astor; *Dist. Mgr.:* Al Astor

TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703, Tel: 602-792-2230, TWX: 910-952-1377; Empl.: 400; *Sls. Mgr.:* Barry Hamilton; *Dist. Mgr.:* Barry Hamilton

TECA, THERMOELECTRIC COOLING AMERICA CORP., 448 N. Halsted St., Chicago, IL 60622, Tel: 312-666-1600; Empl.: 50 ....**2**•1805

TECCOR ELCTRNS., P.O. Box 619009, Dallas, TX 75261-9009, Tel: 214-252-7651, Telex: 79-1600, TWX: 910-860-5068; Empl.: 700; *Sls. Mgr.:* Gerry Wiley; *Dist. Mgr.:* Don Davis ....**1A**•2110, 2111

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AZ	Tempe, System Sls. of Ariz.	602-829-9338
CA	San Diego, Sr Electronics	619-560-8330
CA	San Jose, Quantum Coefficient	408-942-1070
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Aurora, Electrodyne	303-695-8903
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Clearwater Beach, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
FL	Sunrise, Perrott Assocs.	305-792-2211
GA	Norcross, Interep Assocs.	404-449-8680
IL	Arlington Heights, MSI	312-956-1000
IN	Fort Wayne, Robert O. Whitesell & Assoc.	219-432-5591
IN	Indianapolis, Robert O. Whitesell & Assoc.	317-359-9283
IN	Kokomo, Robert O. Whitesell & Assoc.	317-457-9127
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KY	Louisville, Robert O. Whitesell & Assoc.	502-426-7696
MD	Towson, C. H. Newson & Assocs.	301-296-2292
MA	Walpole, JEF Components	617-668-6695
MI	Detroit, Rathsburg Assocs.	313-882-1717
MN	Minneapolis, Electric Comp. Sls.	612-933-2594
MO	Bridgeton, Dy-Tronix	314-731-5799
MO	Independence, Dy-Tronix	816-373-6600
NM	Albuquerque, Sys. Sls. of Arizona Inc.	505-881-8877
NY	Canandaigua, Bensman/Upstate Assocs.	716-396-2498
NY	Jamaica, S-J Assocs.	212-291-3232
NY	Johnson City, Bensman/Upstate Assoc.	607-722-2242
NC	Raleigh, J & B Sales	919-772-3546
OH	Cincinnati, Robert O. Whitesell & Assoc.	513-521-2290
OH	Cleveland, Robert O. Whitesell & Assoc.	216-447-9020
OH	Columbus, Robert O. Whitesell & Assoc.	614-888-9396
OH	Dayton, Robert O. Whitesell & Assoc.	513-298-9546
OK	Tulsa, Bonser Philhower Sls.	918-496-3236
PA	Flourtown, C. H. Newson & Assocs.	215-248-3377
PA	Glenside, CMS Marketing	215-885-5106
PA	Pittsburgh, Robert O. Whitesell & Assoc.	412-963-6161
TX	Austin, Bonser Philhower Sls.	512-458-3569
TX	Houston, Bonser Philhower Sls.	713-495-3115

TX	Richardson, Bonser Philhower Sls.	214-234-8438
UT	Salt Lake City, Electrodyne	801-486-3801
WA	Redmond, Quadra Sls.	206-883-3550
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

AL	Huntsville, RM Electronics	205-852-1550
AZ	Phoenix, Tri-Tek	602-995-9352
AZ	Tempe, Anthem Elctrns.	602-244-0900
AZ	Tempe, Bell Inds.	602-966-7800
CA	Burlingame, Rose Elctrns. Dist.	415-348-2740
CA	Chatsworth, Integrated Elctrns.	213-998-2200
CA	Chatsworth, Anthem Elctrns.	213-700-1000
CA	Irvine, Integrated Elctrns.	714-540-5600
CA	San Diego, Anthem Elctrns.	619-279-5200
CA	San Jose, Anthem Elctrns.	408-946-8000
CA	San Leandro, Electro Comp Dist.	415-352-5210
CA	Santee, Mouser Elctrns.	619-449-2220
CA	Tustin, Anthem Elctrns.	714-730-8000
CO	Englewood, Anthem Elctrns.	303-790-4500
CO	Lakewood, Active Comp. Technlg.	303-233-4431
CO	Wheatridge, Bell Inds.	303-424-1985
CT	East Haven, JV Electronics	203-469-2321
CT	Hamden, Almo Elctrns.	203-288-6556
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Longwood, Intertec Distr.	305-834-7777
FL	Winterpark, Milgray Elctrns.	305-647-5747
IL	Hoffman Estates, Inter Comp	312-843-2040
IL	Lombard, RM Electronics	312-932-5150
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, RM Electronics	317-247-9701
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Overland Park, Milgray Elctrns.	913-236-8800
LA	Baton Rouge, Indl. Elctrns. Supply	504-926-0513
LA	Shreveport, Indl. Elctrns. Supply	318-222-9459
MD	Rockville, Milgray Elctrns.	301-468-6400
MD	Rockville, Almo Elctrns.	301-251-1161
MD	Savage, Pyttronic Inds.	301-792-0780
MA	Burlington, Milgray Elctrns.	617-272-6800
MA	Burlington, Zeus Comps.	617-273-0750
MA	Woburn, ACI Elctrns.	617-935-7230
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Wyoming, RM Electronics	616-531-9300
MN	Minneapolis, Stark Elctrns.	612-332-1325
NE	Lincoln, Scott Elctrns.	402-466-8221
NJ	Camden, Gen. Radio Supply	609-964-8560
NJ	Marlton, Milgray Elctrns.	609-983-5490
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Freeport, Milgray Elctrns.	516-546-5600
NY	Jamaica, Archer Indl. Dist.	212-291-3232
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rochester, Summit Distrs.	716-334-7376
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Winston-Salem, Almo Elctrns.	919-760-0432
OH	Cincinnati, Graham Elctrns.	513-772-1661
OH	Cleveland, CAM/Ohio Indl. Elctrn.	216-461-4700
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Columbus, Graham Elctrns.	614-895-1590
OH	Dayton, Stotts Friedman	513-298-5555
OR	Portland, Radar Elc. Co.	503-232-3404
PA	Enola, Almo Elctrns.	717-732-3681
PA	Mc Kean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Pittsburgh, Almo Elctrns.	412-931-5990
PA	Pittsburgh, CAM/RPC Indl. Elctrns.	412-782-3770
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Chatanooga, Techni-Tronics	615-875-5449
TN	Nashville, Graham Elctrns.	615-242-2682
TX	Austin, Active Comp. Technlg.	512-452-5254
TX	Dallas, Active Comp. Technlg.	214-980-1888
TX	Dallas, RM Electronics	214-235-3100
TX	El Paso, ERA Elctrns.	915-592-4126
TX	Houston, Active Comp. Technlg.	713-496-4000
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Redmond, Anthem Elctrns.	206-881-0850
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, RM Electronics	414-784-4420

TECHCON SYSTEMS INC., 1059 E. Bedmar St., Carson, CA 90746, Tel: 213-603-8888; Empl.: 25; *Sls. Mgr.:* S. L. Morse

TECH-ETCH INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 617-747-0300; Empl.: 125; *Sls. Mgr.:* P. A. Thomas

TECH LABS., INC., Bergen & Edsall Blvds., Palisades Pk., NJ 07650, Tel: 201-944-2221; FSC No.: 83332; Empl.: 31 .... **1B**•1754, 1755

Local Sales Offices & Reps

CA	Granada Hills, C & W Comp. Sls.	213-368-4032
CA	Palo Alto, Mollard Mktg.	415-961-0456
CT	New Preston, NBS Assoc.	203-868-0501
GA	Atlanta, Grady Duckett Sls.	404-451-3529
IL	Glenview, Crimson Engrg. Co.	312-470-0024
KS	DeSoto, Midtec Assocs.	913-441-6565
MI	Jackson, N. Scroggs Co.	517-750-1170
MO	Florissant, Midtec Assocs.	314-837-5200
NJ	Haddonfield, Gray Assocs.	609-429-5300
NJ	Upper Saddle River, Bob Cameron, Inc.	201-825-1304
NY	Huntington Station, Haner Assocs.	516-242-7855
NY	Pittsford, Net Sls.	716-467-4538
OH	Cincinnati, Patco	513-931-3311
PA	Pittsburgh, VerHill Assocs.	412-241-5202
TX	Dallas, Southwest Elctrns.	214-690-9881
TX	Houston, Southwest Elctrns.	713-729-1670
WA	Seattle, SPS Elctrns.	206-323-4140

TECHMAR CORP., 2232 S. Cotner Ave., Los Angeles, CA 90064, Tel: 213-478-0046, 800-TECHMAR; Empl.: 12; *Sls. Mgr.:* Karena Bennetto .... **2**•1062, 1063

TECH MATERIALS, 5 Wellington Rd., Lincoln, RI 02865, Tel: 401-333-1700, TWX: 710-384-0600; Empl.: 150; *Sls. Mgr.:* C.B. Harlan

TECHNAR INC., 205 N. 2nd Ave., Arcadia, CA 91006, Tel: 818-445-1143; *Sls. Mgr.:* James Rhodes

TECHNIC, INC., Box 965, Providence, RI 02901, Tel: 401-781-6100, Telex: 927514; Empl.: 100; *Sls. Mgr.:* A. A. Amtos

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 213-618-8437; FSC No.: 04772; Empl.: 21; *Sls. Mgr.:* J. Cochran; *Dist. Mgr.:* J. Cochran

TECHNICAL PANELS, INC., 9162 La Rosa Dr., Temple City, CA 91780, Tel: 213-285-3105; Empl.: 13; *Sls. Mgr.:* Janlyn Prendic; *Dist. Mgr.:* Douglas Welch

Local Sales Offices & Reps

AZ	Scottsdale, TC Elctrn. Sls. Inc.	602-994-5153
CA	Temple City, HMC, Inc.	213-285-0485
MO	Ellisville, Larco Sls.	314-394-7141

TECHNICAL RESEARCH & MFG., INC., R.F.D. #10, Manchester, NH 03103, Tel: 603-627-6000, TWX: 710-220-6765; Empl.: 25; *Sls. Mgr.:* A. Marin .... **1B**•1014

Local Sales Offices & Reps

AZ	Mesa, RLS Instrs.	602-892-9329
CA	Los Angeles, RF Assoc./L.A.	213-478-1586
CA	Palo Alto, RF Assoc./P.A.	415-494-3331
CO	Greeley, Howard Assocs.	303-426-3499
CT	Norwalk, Neal Cockerham Assocs.	203-853-2618
CT	Stamford, Ashworth & Assocs.	203-968-0656
FL	Orlando, Gra-Mar	305-894-3351
IL	Chicago, Electro-Tech	312-588-4535
MA	Lowell, Matrix Sales	617-458-2096
MA	Reading, Geder Assocs.	617-544-3105
MO	Grandview, R. R. Burton and Assoc.	816-763-5385
NM	Las Cruces, Sierra Tech. Grp.	505-524-8092
NY	Guilderland, Nu-Tekneex	716-741-9138
NY	My Vernon, Friedman-Smith	914-664-4866
NY	White Plains, SCA Intl.	914-761-1042
PA	Lancaster, Electro-Rep	914-664-4866
TX	Arlington, N & W Sls.	817-461-4443
TX	Dallas, Texas Avionics	214-368-3566
VA	Fairfax, Beacon North	703-591-1300
VA	Fairfax, Schibley Assoc.	703-591-3008

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06810, Tel: 203-748-7001, TWX: 710-456-9280; FSC No.: 13850; Empl.: 135; *Sls. Mgr.:* Ivan Bourgoin; *Dist. Mgr.:* Gerard F. Voity .... **1A**•2301, **3**•1789

Local Sales Offices & Reps

Power Supply Product Line

TX	Houston, Scientific Sls. Co.	713-460-9170
TX	Richardson, Scientific Sls. Co.	214-231-6541

Variac Product Line

TX	Houston, Scientific Sls. Co.	713-460-9170
TX	Richardson, Scientific Sls. Co.	214-231-6541

Local Distributors

Variac Product Line Only

CA	Hollywood, Yale Radio Elctrn.	213-465-3186, 800-421-4144
CA	Los Angeles, Cal-State Elctrns.	213-933-8187
CA	Oakland, N. A. D'Arcy	415-638-7773
CA	Santa Ana, Action Elctrns.	714-547-5169
CT	Old Saybrook, M.L. Elctrns.	203-388-9718
IL	Chicago, Delta Tech. Prods. Co.	312-478-1134
MD	Baltimore, Philadelphia Elctrns.	800-638-4784
MA	Woburn, Abbott Elctrns. Co.	617-935-2040
MI	Dearborn, Indl. Temperature & Control	313-278-2210
MN	St. Paul, Gopher Elctrns. Co.	612-483-3322
MO	St. Louis, Olive Elctrns.	314-426-4500
NY	Amsterdam, Adirondack Radio Supp.	518-842-8350
NY	Rockville Centre, Midway Indl. Elctrns.	516-764-2400
NC	Charlotte, Jenkins Elec. Co.	704-392-7371
OH	Dayton, Esco Inc.	513-226-1133
OK	Oklahoma City, Inotek	405-495-4620
OK	Tulsa, Inotek	918-622-8570
PA	Philadelphia, Phila. Elctrns.	215-568-7400
TX	Dallas, Inotek	214-243-8370
TX	Ft. Worth, Inotek	817-831-2126
TX	Houston, Inotek	713-688-4494
TX	San Antonio, Inotek	512-654-7811

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900; Empl.: 60

TECHNISERV INC., 1560 Teaneck Rd., Teaneck, NJ 07666, Tel: 201-837-0032; *Sls. Mgr.:* L. G. Mansoor

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, Telex: 834-763; Empl.: 40

Local Sales Offices & Reps

CA	W. Covina, Electra-Tec	213-964-9772
FL	Ft. Pierce, Hyber-Sem	305-464-0461
IL	Wauconda, Champion & Assoc.	312-526-3700
KS	De Soto, Midtec Assocs.	913-441-6565
LA	Kenner, EDS Assocs.	504-466-7475
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Hudson, Data Rep	617-481-0333
MI	Detroit, Qualitron Co.	313-534-1511
MO	Florissant, Midtec Assocs.	314-837-5200
NJ	Butler, Genl. Techn.	201-492-1292

Technitrol, Inc.

TECHNITROL, 1952 E. Allegheny, Philadelphia, PA 19134, Tel: 215-426-9105, Telex: 834245; FSC No.: 90095; Empl.: 350; *Sls. Mgr.:* G. Shilling .... **1A**•1568-1574; **1B**•1015-1017

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Scottsdale, SMS & Assoc.	602-998-0831
CA	San Rafael, Wright Assocs.	415-457-9940
CA	Torrance, Detomasi & Grupp, Inc.	213-327-1775
IL	Wauconda, Cudahy Sls.	312-526-2484
MD	Baltimore, Callas Elctrns.	301-744-7711
MA	Newton, Normell Assoc.	617-969-5478
NY	Fairport, TAC Assoc.	716-425-1070
NY	Jericho, J. Square Mktg.	516-935-3200
NY	Syracuse, Tac Sls.	315-637-9861
NC	Winston-Salem, Murcota	919-722-9445
OH	Galion, Retronics	419-468-4568
PA	Easton, The Kendon Co.	215-253-3100
PA	Pittsburgh, Robert Kneip	412-823-0169
TX	Austin, Elctrns. Mktg. Assoc.	512-837-0893
TX	Grapevine, Elctrns. Mktg. Assoc.	817-481-7502
TX	Houston, Elctrns. Mktg. Assoc.	713-498-8120
WA	Redmond, General Technlg., Inc.	206-881-6456

TECHNO, INC., 14 Crandall Ave., Pompton Lakes, NJ 07442, Tel: 201-839-0740; Empl.: 10; *Sls. Mgr.:* Fredric S. Miller

TECHNO

TECHNO-COMPONENTS CORP., 7803 Lemona, Van Nuys, CA 91405, Tel: 818-781-1642, TWX: 910-495-2015; FSC No.: 17826; Empl.: 135; *Sls. Mgr.:* Vivian Meranda .... **1A**•1939, 2064, 2065

Local Sales Offices & Reps

AZ	Scottsdale, Argus Sls.	602-949-0873
CA	Costa Mesa, Balzer-Wolf Assocs.	714-751-3001

CA	Cupertino, F & F Assocs.	408-446-2349
CA	Sherman Oaks, Clemick-Neenan & Assoc.	818-990-3150
CO	Westminster, Western Region Mktg.	303-430-8883
FL	Casselberry, S-A Assocs.	305-695-6010
GA	Roswell, Edco Sls.	404-587-1886
IL	Crystal Lake, Oak Switch Sys.	815-459-5000
IN	Fort Wayne, Denton Mktg.	219-627-5515
KS	Wichita, Baka Corp.	316-682-8411
MD	Baltimore, Pro Rep	301-653-3600
MA	Newton, Gerber Sls.	617-969-2620
MN	Minnetonka, Gibb Elctrns.	612-935-4600
NJ	Haddonfield, Mills-Brown	609-429-1005
NY	N. Syracuse, Advanced Comps.	315-699-2671
NY	New Hyde Park, R. P. Luce & Co.	516-437-4550
OH	Centerville, E.M.A.	513-433-2800
TX	Bedford, W. Pat Fralia Co.	817-640-9101

Local Distributors

CA	Chatsworth, Shelley Elctrns.	818-998-3333
CA	El Monte, Marshall Elctrns.	213-686-0141
CA	Fullerton, Carden Elctrns.	714-526-7882
CA	San Fernando, Petell Elctrns.	818-365-9841
FL	Tampa, Impala Elctrns.	813-885-4747
MD	Columbia, Aztech Elctrns.	301-995-1760
MA	Burlington, TLC Inc.	617-273-0140
NJ	Oakland, Gordon/Horne	201-337-5200
NY	Farmingdale, Command Elctrns.	516-293-1212
NY	N. Syracuse, ANDCO	315-699-2660
OH	Centerville, I.P.D.	513-435-2086
OH	Dayton, Televox	513-294-4499
TX	Ft. Worth, TTI	817-831-0441
TX	Ft. Worth, Patco Supply	817-429-8596

TECHNOLOGY DYNAMICS inc.

TECHNOLOGY DYNAMICS, 91 E. Carver Ave., Westwood, NJ 07675, Tel: 201-664-7636; Empl.: 36; *Sls. Mgr.:* James Logan .... **3**•1790-1795

Local Sales Offices & Reps

FL	De Barg, DJE Assocs., Inc.	305-668-6827
MA	Westboro, RJC Assocs.	617-366-0399

TECHNOLOGY PRODS., INC., 8900 Eton Ave., Canoga Park, CA 91304, Tel: 213-998-8555; FSC No.: 8K984; *Sls. Mgr.:* N. Lerman

TECHSONICS. Halfway, OR 97834, Tel: 503-742-7475; Empl.: 6

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, Telex: 738450; Empl.: 25; *Sls. Mgr.:* R. G. Russell; *Dist. Mgr.:* Jack Swanson

TCI

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, TWX: 510-650-7003; FSC No.: 4P572; Empl.: 18; *Sls. Mgr.:* James M. Griffith .... **1A**•1432, 1433

Local Sales Offices & Reps

CA	San Carlos, Westronics Assoc.	415-592-1417
CA	Signal Hill, Thorson Co.	213-595-0361
FL	Clearwater, Brennan Assoc.	813-446-5006
MD	Ellicott City, Nelson Elctrns. Inc.	301-747-7887
MA	Topsfield, R F Assoc.	617-887-9762
NY	Brooklyn, Pensky Assocs.	212-763-4936
PA	Ambler, W & M Assocs.	215-643-4119
TX	Dallas, Airep Elctrns.	214-349-4360

TECKNIT® a TWP company

TECKNIT (EASTERN FACILITY), 129 Dermody St., Cranford, NJ 07016, Tel: 201-272-5500, Telex: 6853079 TCKNT, TWX: 710-996-5961; FSC No.: 07700; Empl.: 300; *Sls. Mgr.:* Robert Bjornsen (East);James L. Fletcher (West) .... **2**•1588-1591, 1916-1923

Local Sales Offices & Reps

AZ	Tempe, Tempe Assoc.	602-829-1901
CA	Granada Hills, C & W Comp. Sls.	213-368-4032
CA	San Diego, Cerco	619-274-1901
CA	Santa Barbara, Tecknit (Western Facility)	809-963-5811
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Boulder, Comp. Prod. Sls.	303-530-2800
CO	Westminster, Tecknit	303-428-9169
FL	Boca Raton, Lawrence Assocs.	305-368-7373
FL	Clearwater, Lawrence Assocs.	813-584-8110
FL	Fern Park, EIR	305-830-9600
FL	N. Lauderdale, EIR, Inc.	305-830-9600
FL	West Melbourne, Lawrence Assocs.	305-724-8294
IL	Arlington Hgts., Diethert/Angel	312-593-7600
IL	Chicago, Industrial Reps.	312-647-7755
IN	Eden Prairie, Elctrn. Innovators	612-941-0830
IA	Davenport, Ensco-Rep Inc.	319-386-6600
KS	Overland Park, Ensco-Rep Inc.	913-381-7557
KS	Wichita, Ensco-Rep Inc.	316-683-1070
MD	Pikesville, White & Co.	301-484-5400
MA	Waltham, Com-Sale	617-890-0011
MI	Lavonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	Eden Prairie, Elctrn. Innovators Inc.	612-941-0830
MN	St. Paul, Repco	612-642-2828
MO	Maryland Heights, Ensco-Rep Inc.	314-423-3935
NH	Hudson, EMC Sales	603-889-5751
NJ	N. Plainfield, Brady Co.	201-753-7988
NJ	Union, Meridian Entprs.	201-687-6220
OH	Columbus, McFadden Sls.	614-459-1280
OH	Dayton, Jay Engrg.	513-253-2151
OH	N. Royalton, Jay Engrg.	216-237-4235
TX	Austin, P. J. Scanlon & Co.	512-258-7717
TX	Dallas, P. J. Scanlon	214-231-4661
TX	Houston, P. J. Scanlon & Co.	713-370-4908
WA	Vancouver, Ray Over Sls.	206-695-6179

TECMAR, INC., 6225 Cochran Rd., Solon, OH 44139, Tel: 216-349-0600; Empl.: 400; *Sls. Mgr.:* Carolyn Alpert

TECNETICS, Box 910, Boulder, CO 80306, Tel: 303-442-3837, TWX: 910-940-3246; Empl.: 225; *Sls. Mgr.:* V.L. Garrison

TECOM INDS., 21526 Osborne St., Canoga Pk., CA 91304, Tel: 213-341-4010, Telex: 69 8476; FSC No.: 59850001; Empl.: 94; *Sls. Mgr.:* Chester E. Rowley

Tecron

TECRON INDUSTRIAL PRODS., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-5571, Telex: 810-294-2160; Empl.: 300; *Sls. Mgr.:* Howard King .... **3**•1022-1025, 1306, 1307

Local Sales Offices & Reps

CA	Mountain View, IFM Inc.	415-961-2828
CA	Thousand Oaks, HTEC	805-492-2889
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Tampa, Applied Science Mktg.	813-870-0664
IL	Chicago, Berndt Assocs.	312-283-0713
IA	Cedar Rapids, MAI Assocs.	319-396-8030
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	St. Paul, Skor	612-426-1160
NJ	Wayne, Ramapo, Inc.	201-839-6767
NM	Albuquerque, R. A. Mayes Co.	505-292-2330
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	King of Prussia, Freedman-Malta Assoc.	215-337-9211
WA	Bellevue, Showalter Instrs., Inc.	206-746-7970

TED CORP., 11415 Johnson Dr., Shawnee Mission, KS 66203, Tel: 913-631-6211; FSC No.: 05209; Empl.: 48

TEDEA USA

TEDEA USA, 7800 Deering Ave., Canoga Park, CA 91304, Tel: 818-884-8818, Telex: 67-3382, TWX: 910-494-1951; Empl.: 10; *Sls. Mgr.:* Tony Smalarz .... **1B**•1878; **3**•1172

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Carlsbad, Elotek Sys.	714-438-4856
CA	Palo Alto, Gado Instr. Sls.	415-961-2222
GA	Atlanta, Physimetrics	404-955-0155
IL	Hinsdale, I & C Sales	312-323-8201
KS	Shawnee Mission, Tech. Sls. Assocs.	913-888-3330
MA	Lexington, Jodan Technology	617-862-2354
MI	Trenton, I & C Sales	313-671-1320
MN	Minneapolis, CMI	612-566-6930
MO	St. Louis, Tech. Sls. Assocs.	314-725-5361
NJ	Hillsdale, C B Assocs.	201-664-6230
NM	Albuquerque, Trembly Assocs.	505-266-8616
OH	Cincinnati, I & C Sales	513-772-3101
PA	Bethayres, Control Instr. Sls.	215-676-1808
WA	Bellevue, Westerberg & Assocs.	206-453-8881
WA	Bothell, Pacific N.W. Controls Inc.	206-821-0448

TEGAM, 7230 N. Ridge Rd., Madison, OH 44057, Tel: 216-428-7505; Empl.: 25

TEGAL SCIENTIFIC, INC., Box 5905, Concord, CA 94524, Tel: 415-827-1054; *Sls. Mgr.:* L. Rigali

TEKA PRODS., 45 Salem, Providence, RI 02907, Tel: 401-785-4110, TWX: 710-582-4946; Empl.: 28; *Sls. Mgr.:* Jim Mills; *Dist. Mgr.:* Jim Mills

TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620, Tel: 716-232-1291; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKTITE CORP., 4756 Platt Rd., Ann Arbor, MI 48104, Tel: 313-971-9379; *Sls. Mgr.:* Jose Padilla

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 305-844-2383, Telex: 51-3438; FSC No.: 59-1500771; Empl.: 50; *Sls. Mgr.:* Carlos Mira; *Dist. Mgr.:* Carlos Mira

TEKTRONIX, INC., P.O. Box 500, V3-314, Beaverton, OR 97077, Tel: 800-547-1512, Oregon only 800-452-1877, TWX: 910-467-8708; FSC No.: 80009; Empl.: 20000 .... **3**•1376, 1377

Local Sales Offices & Reps

AL	Huntsville	205-881-2912
AZ	Phoenix	602-268-8861
CA	Concord	415-254-5353
CA	Irvine	714-660-8080
CA	San Diego	619-292-7330
CA	Santa Clara	408-496-0800
CA	Woodland Hills	213-999-1711
CO	Englewood	303-799-1000
CT	Milford	203-877-1494
DC	Gaithersburg	301-948-7151
FL	Ft. Lauderdale	305-973-9300
GA	Atlanta	404-449-4770
IL	Chicago	312-259-7580
IN	Indianapolis	317-545-2351
KS	Overland Park	913-341-3344
LA	New Orleans	504-466-4445
MD	Baltimore	301-628-6400
MA	Boston	617-861-6800
MI	Detroit	313-478-5200
MN	St. Paul	612-484-8571
MO	St. Louis	314-429-7707
NJ	Woodbridge	201-636-8616
NM	Albuquerque	505-265-5541
NY	Albany	518-458-7291
NY	Long Island	516-364-9060
NY	Rochester	716-424-5800
NC	Raleigh	919-782-5624
OH	Cleveland	216-243-8500
OH	Dayton	513-859-3681
OK	Oklahoma City	405-943-8127
OR	Tigaro	503-620-9100
PA	Pittsburgh	412-244-9800
TN	Knoxville	615-690-6422
TX	Houston	713-933-3000
TX	San Antonio	512-496-1161
UT	Salt Lake City	801-486-1091
VA	Arlington	703-920-7770
WA	Seattle	206-575-0180

TELAUTOGRAPH, 8700 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-3690, TWX: 910-328-6117; Empl.: 300

TELCOM INC., 8027 Leesburg Pike, Vienna, VA 22180, Tel: 703-893-7700, Telex: 89-2321; Empl.: 125; *Sls. Mgr.:* D. Desmond

TELCO PRODUCTS CO., 44 Sea Cliff, Glen Cove, NY 11542, Tel: 516-759-0300; Empl.: 34

TELEBYTE TECHNOLOGY, INC., Remark Datacom Div., 4 Sycamore Dr., Woodbury, NY 11797, Tel: 516-423-3232, TWX: 510-226-0449; Empl.: 10; *Sls. Mgr.:* Curt DeForest

TELECOMMUNICATIONS DEVICES, 2320 Wisconsin Ave., Downers Grove, IL 60515, Tel: 312-971-3460, TWX: 910-695-3222; Empl.: 45; *Sls. Mgr.:* Joel Peterson;Chuck Pokonosky; *Dist. Mgr.:* Theresa Kanaga

Local Distributors

AL	Birmingham, American Elctrns.	205-254-3280
OH	Cleveland, Pruit Energy Sources	216-566-1545
OH	Harrisburg, Cumberland Elctrns.	717-232-5999
OH	Solon, Repco	216-248-8900
TN	Knoxville, Bondurant Bros.	615-573-9151

TELECOMMUNICATIONS TECHNIQUES CORP., 444 N. Frederick Ave., Gaithersburg, MD 20877, Tel: 301-258-5011, Telex: 908736; Empl.: 66; *Sls. Mgr.:* John Farrell

Local Sales Offices & Reps

AZ	Scottsdale, Barnhill Assocs.	602-947-7841
CA	La Crescenta, Beckrep	818-957-1111
CA	Mountain View, CSS Telecommunications	415-964-4335
CO	Englewood, Barnhill Assocs.	303-779-3600
FL	Indian Harbour Beach, General Technlg.	305-777-1133
GA	Atlanta, General Technlg.	404-433-0350
IL	Arlington Heights, Dytec/Central	312-394-3380
IN	Noblesville, Gerhard & Assocs.	317-877-3710
KS	Lenexa, Dytec/South	913-888-0215
LA	Baton Rouge, Barnhill Assocs.	504-924-6826
MD	Silver Spring, GT Assocs.	301-949-8060
MI	Northville, Gerhard & Assocs.	313-348-6560
MN	Edina, RAE Assocs.	612-941-3221
MO	Maryland Heights, Dytec/South	314-569-2990
NH	Concord, Concord Coms.	603-224-8602
NJ	Union, Friedman Assocs.	201-946-6200
NM	Albuquerque, Barnhill Assocs.	505-299-7658
NC	Greensboro/High Point, General Technlg.	919-883-6523
OH	Cleveland Heights, Gerhard & Assocs.	216-382-5838
OH	Columbus, Gerhard & Assocs.	614-488-9751
OH	Dayton, Gerhard & Assocs.	513-435-7696
OR	Milwaukee, Control Q	503-654-9295
PA	Pittsburgh, Gerhard & Assocs.	412-241-6250
TX	Austin, Barnhill Assocs.	512-451-0217
TX	Houston, Barnhill Assocs.	713-688-9971
TX	Murray, Barnhill Assocs.	801-262-3000
TX	Richardson, Barnhill Assocs.	214-231-2573
WA	Redmond, Control Q	206-881-7440

TELECTRO SYS., 96-18 43rd Ave., Corona, NY 11368, Tel: 212-651-8900; Empl.: 75; *Sls. Mgr.:* H. Sussman

TELEDYNE AEROSPACE SYS., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, 507-235-9712, 507-238-9494, TWX: 910-565-2120; FSC No.: 24600; Empl.: 150; *Sls. Mgr.:* Robert L. Johnson

Local Sales Offices & Reps

AL	Huntsville, Lew Wright	205-536-7961
CO	Denver, Donohue Sls. Co.	303-458-6384
NJ	Neshanic Station, J & L Assocs.	201-369-3791
TX	Dallas, R. D. Spooner Co.	214-357-6636
VA	Shipman, R.P. Assocs	804-263-5981

TELEDYNE ANSONIA, Riverside Dr., Ansonia, CT 06401, Tel: 203-735-9311, Telex: 963408; *Sls. Mgr.:* James Cutler

TELEDYNE CAMERA SYS., 131 N. Fifth Ave., Arcadia, CA 91006, Tel: 213-359-6691, Telex: 675-423; FSC No.: 14440; Empl.: 96; *Sls. Mgr.:* D. Mathews

TELEDYNE-CRYSTALONICS, 147 Sherman St., Cambridge, MA 02140, Tel: 617-491-1670, TWX: 710-320-1196; FSC No.: 12498; Empl.: 185; *Sls. Mgr.:* A. H. Pauk; *Dist. Mgr.:* W. J. Kilgarriff

TELEDYNE/GEOTECH, 3401 Shiloh Rd., Garland, TX 75041, Tel: 214-271-2561, Telex: 73-2394; FSC No.: 99019; Empl.: 440

TELEDYNE GURLEY, 514 Fulton St. P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, TWX: 710-443-8156; *Sls. Mgr.:* G. S. Gordon

TELEDYNE INET, 2750 W. Lomita Blvd., Torrance, CA 90509, Tel: 213-325-5040, Telex: 67-7228; Empl.: 600

TELEDYNE KINETICS, 410 S. Cedros Ave., Solana Beach, CA 92075, Tel: 619-755-1181, TWX: 910-322-1135; Empl.: 80

TELEDYNE MECCA, Box 36393, Houston, TX 77036, Tel: 713-772-2811, TWX: 913-881-7039; Empl.: 75; *Sls. Mgr.:* T. G. Roach

TELEDYNE MICRONETICS, 7155 Mission Gorge Rd., San Diego, CA 92120, Tel: 619-583-3525, TWX: 910-335-2085; Empl.: 120; *Sls. Mgr.:* S. Amarillas

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, TWX: 910-379-6939; FSC No.: 24022; Empl.: 325

TELEDYNE PHILBRICK, Allied Dr. Rte 128, Dedham, MA 02026, Tel: 617-329-1600, TWX: 710-348-6726; Empl.: 250

TELEDYNE RELAYS, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; *Sls. Mgr.:* Tom Garland; *Dist. Mgr.:* Charles Fein

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	San Jose, Teledyne Relays	408-996-9944
CO	Denver, Quorum 3	303-696-8480
CT	Stratford, G. Rosen Co.	203-375-5456
FL	Clearwater, Hutto, Hawkins & Peregoy	813-797-4447
FL	Ft. Lauderdale, Hutto, Hawkins & Peregoy	305-971-5750
FL	Maitland, Hutto, Hawkins & Peregoy	305-831-2474
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Glen Ellyn, Teledyne Relays	312-858-1090
IN	South Bend, Schillinger Asso.	219-282-4570
IA	Cedar Rapids, Stan Clothier Co.	319-395-0245
KS	Olathe, C-Tron	913-829-0073
MD	Towson, Arbotek Assocs.	301-825-0075
MA	Framingham, G. Rosen Co.	617-879-5505
MN	Minneapolis, S. Clothier Co.	612-944-3456
MO	St. Louis, R. F. Carlson Co.	314-961-4485
NJ	Cranford, Teledyne Relays	201-272-0020
NM	Albuquerque, Reptronix	505-292-1718
NY	Mount Vernon, Friedman-Smith Elctrns.	914-664-4866
NY	Syracuse, I.A. Hotze Co.	315-479-6641
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter Co.	216-241-4880
OR	Beaverton, B & P Sls.	503-641-3486
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Pennsauken, Vantage Sls.	609-663-6660
TX	Austin, Kruvand Assocs.	512-441-6777
TX	Dallas, Kruvand Asso.	214-691-4592
TX	Houston, Kruvand Asso.	713-780-9710
UT	Salt Lake City, Quorum 3	801-943-9227
WA	Renton, B & P Asso.	206-454-6571

Local Distributors

AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Wyle	602-249-2232
AZ	Tempe, Time-Arizona	602-967-2000
CA	Anaheim, Time-Anaheim	714-937-0911
CA	El Segundo, Wyle Dist. Grp.	213-322-8100
CA	Irvine, Wyle Dist. Grp.	714-863-9953
CA	Rancho Cordova, Wyle	916-638-5282
CA	San Diego, Wyle Dist. Grp.	619-565-9171
CA	Santa Clara, Wyle Dist. Grp.	408-727-2500
CA	Sunnyvale, Time-N. Cal.	408-734-9888
CA	Torrance, Time-West	213-320-0880
CO	Englewood, Time-Colorado	303-850-7701
CO	Thornton, Wyle Dist. Grp.	303-457-9953
CT	Orange, Milgray/Conn.	203-795-0711
FL	Altamonte Springs, Pioneer Elctrns.	305-834-9090
FL	Dana, Summit	305-920-6253
FL	Ft. Lauderdale, Time-Florida	305-974-4800
FL	Winter Pk., Milgray/Fla.	305-647-5747
GA	Atlanta, Milgray	404-393-9666
GA	Atlanta, Electro-Air-Georgia	404-351-3545
GA	Norcross, Pioneer	404-448-1711
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IN	Indianapolis, Pioneer/Indianapolis	317-849-7300
KS	Overland Pk., Milgray/Kansas City	913-236-8800
MD	Columbia, Time-Maryland	301-964-3090
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MD	Rockville, Milgray/Wash.	301-468-6400
MA	Burlington, Milgray/New England	617-272-6800
MA	Woburn, Time-New England	617-935-8080
MI	Livonia, Pioneer/Mich.	313-525-1800
MN	Minnetonka, Pioneer	612-935-5444
MO	St. Louis, Time-Mid West	314-391-6444
NJ	Marlton, Milgray/Delaware Valley	609-983-5010
NY	Buffalo, Summit Dist.	716-887-2800
NY	Freeport, Milgray Elctrns.	516-420-9800
NY	Hauppauge, Time-NY	516-273-0100
NY	Pittsford, Milgray	716-385-9330
NY	Rochester, Summit Dist.	716-334-8110
NC	Charlotte, Pioneer	704-527-8188
OH	Cleveland, Milgray/Cleveland	216-447-1520
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OR	Hillsboro, Wyle Dist. Grp.	503-640-6000
PA	Broomall, Time-Mid Atlantic	215-359-1200
PA	Horsham, Pioneer/Delaware Valley	215-674-4000
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
TX	Austin, Pioneer	512-835-4000
TX	Dallas, Electro-Air-Southwest	214-385-0566
TX	Dallas, Pioneer Std.	214-386-7300
TX	Houston, Kierulff Elctrns.	713-530-7030
TX	Houston, Pioneer Elctrns.	713-988-5555
TX	Richardson, Wyle-Dallas	214-235-9953
UT	Salt Lake City, Wyle Dist. Grp.	801-974-9953
WA	Bellevue, Electro-Air-Northwest	206-641-3640
WA	Bellevue, Wyle Dist. Grp.	206-453-8300

TELEDYNE ROTOLITE, 150 Mt. Bethel Rd., Warren, NJ 07060, Tel: 201-647-1040, TWX: 710-986-3017; *Sls. Mgr.:* Ted Killeen

TELEDYNE SEMICONDUCTOR, 1300 Terra Bella Ave., Mountain View, CA 94040, Tel: 415-968-9241, TWX: 910-379-6494; FSC No.: 15818; Empl.: 2000; *Sls. Mgr.:* Ralph Granchelli

TELEDYNE WESTERN WIRE & CABLE, 2425 E. 30th St., Los Angeles, CA 90051, Tel: 213-587-7103, Telex: 67-7110; Empl.: 250; *Sls. Mgr.:* W. Drolet, Jr.; *Dist. Mgr.:* M. Ibrahim

TELEFUNKEN, See AEG Telefunken

TELEMET, 185 Dixon Ave., Amityville, NY 11701, Tel: 516-842-2300, TWX: 510-227-9850; Empl.: 60

TELERAM COMMUNICATIONS, 2 Corporate Park Dr., White Plains, NY 10604, Tel: 914-694-9270, Telex: 64-6658; Empl.: 50; *Sls. Mgr.:* R. R. Ansell

PAPER TAPE READERS AND READER / PUNCH COMBINATIONS.

- READER ■ READER/PUNCH
- SERIAL INTERFACE (RS 232 AND CURRENT LOOP)
- PARALLEL INTERFACE
- RACK MOUNTED ■ TABLE MOUNTED

TELETERMINAL CORPORATION
PAPER TAPE READERS / PUNCHES
GREENLAND, NH 03840
603/431-1200

TELETERMINAL CORP., Greenland, NH 03840, Tel: 603-431-1200; Empl.: 13

TELETYPE, 5555 Touhy Ave., Skokie, IL 60076, Tel: 312-982-2000, Telex: 25-4051, TWX: 910-223-3611; FSC No.: 5815; Empl.: 6,000; *Sls. Mgr.:* D. M. Printz

TELEVIDEO SYS., INC., 1170 Morse Ave., Sunnyvale, CA 94086, Tel: 408-745-7760, TWX: 910-338-7633; *Sls. Mgr.:* Steve Tatum (VDT Div.); Chuck Kempton (Sys. Div.)

TELEVISION EQUIP. ASSOCS., Box 393, So. Salem, NY 10590-0393, Tel: 914-763-8893, TWX: 710-575-2600; Empl.: 10

TELEVISION MICROTIME, INC., 1280 Blue Hills Ave., Bloomfield, CT 06002, Tel: 203-242-4242, TWX: 710-425-2390; Empl.: 80

TEL LABS, inc.

TEL LABS, INC., 154 Harvey Rd., Londonderry, NH 03053, Tel: 603-625-8994, TWX: 710-220-1844; FSC No.: 94322; Empl.: 225 ....**1A**•1941-1943

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Sls.	205-881-5031
AZ	Phoenix, MR Engrg. Sls. Co.	602-956-4670
CA	La Mirada, Select Elec.	714-739-8891
CA	Mountain View, Serra Assoc.	415-964-4300
CO	Aurora, Sage Sales	303-750-3501
FL	Clearwater, Beacon Elec. Sls.	813-796-2378
FL	Ft. Lauderdale, Beacon Elec. Sls.	305-491-1054
FL	Maitland, Beacon Elec. Sls.	305-647-3498
FL	Melbourne, Beacon Elec. Sls.	305-724-8010
GA	Atlanta, Beacon Elec. Sls.	404-256-9640
IL	Downers Grove, Richmar Elec. Corp.	312-968-0118
IN	West Lafayette, Richmar Elec. Corp.	317-846-6383
MD	Randallstown, Precision Mktg.	301-521-5353
MA	Topsfield, RFC Assoc.	617-887-8545
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Clifton, Ossmann	201-778-8888
NY	Rochester, Ossmann Comps.	716-424-4460
NY	Syracuse, Ossmann Comp.	315-455-6611
NC	Greensboro, Beacon Elec. Sls.	919-275-9997
NC	Raleigh, Beacon Elec. Sls.	919-787-0330
OH	Akron, Augnat Assoc.	216-535-4396
OH	Dayton, Augnat Assoc.	513-298-1507
OK	Tulsa, ION Assoc.	918-664-0186
OR	Aloha, Caruso & Northcutt	503-624-1606
PA	Ardmore, Precision Mktg.	215-649-6301
PA	Pittsburgh, Augnat Assoc.	412-281-8283
TN	Johnson City, Beacon Elec. Sls.	615-282-2421
TX	Austin, ION Assoc.	512-458-2108
TX	Grand Prairie, ION Assoc.	214-647-8225
TX	Houston, ION Assoc.	713-681-6266
UT	Salt Lake City, Sage Sales	801-467-5451
WA	Bellevue, Caruso & Northcutt	206-454-9699
WI	Butler, Richmar Elec. Corp.	414-781-1730

PAPER TAPE READERS AND READER / PUNCH COMBINATIONS.

- READER ■ READER / PUNCH
- SERIAL INTERFACE (RS 232 AND CURRENT LOOP)
- PARALLEL INTERFACE
- RACK MOUNTED ■ TABLE MOUNTED

TELETERMINAL CORPORATION
PAPER TAPE READERS / PUNCHES
GREENLAND, NH 03840
603/431-1200

TELONIC/BERKELEY, 2825 Laguna Canyon Rd., Laguna Beach, CA 92652, Tel: 714-494-9401, Telex: 182720; FSC No.: 04423; Empl.: 75; *Sls. Mgr.:* H. Elmes ....**1A**•1777

Local Sales Offices & Reps

AZ	Phoenix, RLS Instrs.	602-892-9329
CA	Agoura Hills, Relcon	818-991-4221
KS	Overland Park, Advanced Tech. Sls.	913-642-6675
OH	Cincinnati, Delta Sls. Engrg.	513-271-5444
WA	Bellevue, SDR Squared	206-747-9424

TELPAR, INC., P.O. Box 796, 4132 Billy Mitchell Rd., Addison, TX 75001, Tel: 214-233-6631, Telex: 73-2561; Empl.: 28; *Sls. Mgr.:* Wm. Konrad ....**3**•1096

TELTONE, 10801-120 Ave. NE, Kirkland, WA 98033, Tel: 206-827-9626, TWX: 910-449-2862; Empl.: 450; *Sls. Mgr.:* D. E. Johnson; *Dist. Mgr.:* Mike Arndt

TEMESCAL, 2850 Seventh St., Berkeley, CA 94710, Tel: 415-841-5720, TWX: 910-366-7366; Empl.: 300

TEMPIL DIV., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080, Tel: 201-757-8300, Telex: 138-662; Empl.: 38; *Sls. Mgr.:* A. P. Jeanguenin

TEMPO INSTRUMENT, INC., 87 Modular Ave., Commack, NY 11725, Tel: 516-694-4400, TWX: 510-224-6421; FSC No.: 07031; Empl.: 120

TEMPOSONICS, 131 East Ames Ct, Plainview, NY 11803, Tel: 516-349-1950, TWX: 510-226-3787; *Sls. Mgr.:* W. Brenner

TEMPTRONIC
CORPORATION

TEMPTRONIC, 55 Chapel St., Newton, MA 02158, Tel: 617-969-2501, Telex: 200-119; Empl.: 95; *Sls. Mgr.:* H. P. Mierop

Local Sales Offices & Reps

AZ	Scottsdale, Allen Assocs.	602-994-1305
CA	Santa Clara, Comtronics	408-773-9800
CO	Boulder, Specialty Sls.	303-444-0954
FL	West Palm Beach, PSA, Inc.	305-689-0575
IN	Kokomo, AW, Inc.	317-453-7671
KS	De Soto, Gary Yantis	913-441-6565
MD	Laurel, ARA Electrn. of VA	301-953-1733
MA	Boston, TEC Systems	617-834-4663
MI	Milford, Technical Sls. Assoc.	313-363-1427
MN	St. Paul, Dytec-North Inc.	612-645-5816
MO	Florissant, Midtec Assocs.	314-837-5200
NM	Albuquerque, Allen Assoc.	505-345-4245
NY	New City, RMC Assocs.	914-634-0054
NY	Rochester, Scientific Devices of N. Y.	716-334-2445
NC	Durham, PSA Inc.	919-832-3896
OH	Dayton, Tech. Sls. Assoc.	513-222-1892
OH	Lyndhurst, Technical Sls. Assoc.	216-461-0826
OR	Beaverton, Systems Specialists	503-641-7771
PA	Willow Grove, Harry Nash Assoc.	215-657-2213
TX	Austin, Alphatech	512-458-9179
UT	Salt Lake City, Specialty Sls. Co.	801-561-0222
VA	Richmond, ARA Electrn. of UA	804-285-9309
WA	Mukilteo, System Specialists	206-355-0404

TENCOR INSTR., 2400 Charleston Road, Mountain View, CA 94043, Tel: 415-969-6767; *Sls. Mgr.:* Barry Hart

TENNELEC, 601 Turnpike, Oak Ridge, TN 37830, Tel: 615-483-8405, TWX: 810-572-1018; Empl.: 50

TNY Tenney
ENGINEERING, INC.

TENNEY ENGRG., 109 Springfield Rd., Union, NJ 07083, Tel: 201-686-7870, TWX: 710-985-4725; Empl.: 204; *Sls. Mgr.:* Jerome Perlstein ....**3**•1181

Local Sales Offices & Reps

AL	Huntsville, Equipment Sales Co., Inc.	205-536-5399
AZ	Phoenix, Jayson Co.	602-867-1964
CA	Sunnyvale, Equip. Sls.	408-739-8011
CA	Van Nuys, Environment Assocs.	213-997-3791
CO	Englewood, Tenney Engrg.	303-798-0955
CT	Hamden, Equip. Sls.	203-281-4578
FL	Altamonte Springs, Equip. Sls.	305-339-2972
FL	Coral Springs, Equip. Sls.	305-781-3522
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Lowell, Equip. Sls. Co.	617-459-7000
MI	Warren, Dietrich & Assoc.	313-751-4990
MO	Blue Springs, Tenney Engrg., Inc.	816-229-7667
NJ	Mt. Laurel, Dittco	609-235-4565
NJ	Union, Richard Wenke	201-686-7870
NY	Fayetteville, M. P. Andrews	315-637-3144
NC	Raleigh, Equip. Sls.	919-872-8376
OH	Cleveland, Dietrich & Assocs.	216-781-1855
OH	Dayton, Dietrich & Assoc.	513-223-6042
PA	Pittsburgh, Dietrich & Assoc.	412-892-2992
TX	Garland, Carey, McMahill & Zerbe Co.	214-681-1414
TX	Houston, Carey, McMahill & Zerbe Co.	713-771-1500
WA	Redmond, Tenney Engrg., Inc.	206-885-2054
WI	New Berlin, Marsland Assocs., Inc.	414-786-6611

TENOR, 17020 W. Rogers Dr., New Berlin, WI 53151, Tel: 414-782-3800, Telex: 26-706; Empl.: 30; *Sls. Mgr.:* P. Yoblin; *Dist. Mgr.:* P. Yoblin

TENSOLITE, Old Post Rd., Rte. 9A, Buchanan, NY 10511, Tel: 914-737-5600, TWX: 710-573-2341; Empl.: 350; *Sls. Mgr.:* David Yellin

TENSOR, Box 14843, Austin, TX 78761, Tel: 512-251-4131; Empl.: 15

TEN-TEC, Industrial Park, Sevierville, TN 37862, Tel: 615-453-7172, Telex: 261337 ACTAUR; Empl.: 110; *Sls. Mgr.:* Daniel Tomcik

TEPRO OF FLORIDA, 2608 Enterprise Rd., Clearwater, FL 33575, Tel: 813-796-1044; FSC No.: 15915; Empl.: 97; *Sls. Mgr.:* Roger C. Mayo; *Dist. Mgr.:* Olga G. Sumner

TERADO, 1068 Raymond Ave., St. Paul, MN 55108, Tel: 612-646-2868; Empl.: 17; *Sls. Mgr.:* Don Munson; *Dist. Mgr.:* Fred Munson

TERADYNE, INC., 183 Essex St., Boston, MA 02111, Tel: 617-482-2700, TWX: 710-321-1055; Empl.: 3200; *Sls. Mgr.:* D. O'Connell

TERADYNE CONNECTION SYS., 44 Simon St., Nashua, NH 03060, Tel: 603-889-5156, TWX: 710-228-1431; FSC No.: 31413; Empl.: 1,400; *Sls. Mgr.:* D. Murphy

TERMINAL DATA CORP., 11878 Coakley Circle, Rockville, MD 20852, Tel: 301-881-7655; Empl.: 12

TERMINAL SYS., See A & B Technical Services

TERRA TECHNLG. CORP., 3860 148th Ave. N.E., Redmond, WA 98052, Tel: 206-883-7300, Telex: 15-2070; *Sls. Mgr.:* Irl Davis

TEST & MEASUREMENT SYSTEMS, INC., 349 Cobalt Way, Ste. 301, Sunnyvale, CA 94086, Tel: 408-720-8877, Telex: 297584 TEAM UR; *Sls. Mgr.:* George Stoeppel

TESTLINE, See Fairchild Test Sys. Grp., Testline Instrs.

TESTOTERM, P.O. Box 111509, Nashville, TN 37211, Tel: 615-834-5082, Telex: 55-5112

TEST PROBES, INC., Box 2113, La Jolla, CA 92038, Tel: 619-459-4197, Telex: 697192; *Sls. Mgr.:* Hal Wardein; *Dist. Mgr.:* Hal Wardein ....3•1379

Local Distributors

AL	Huntsville, W. A. Brown Instrs.	205-883-8860
AZ	Phoenix, Metermaster	602-243-4111
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Irvine, Western Elctrn. Supp.	714-751-3941
CA	Los Angeles, Metermaster	213-685-7340
CA	Los Angeles, Allied Elctrns.	213-725-7111
CO	Englewood, Beta Distrs.	303-779-4494
CT	Monroe, Connecticut Cal Labs	203-261-9518
FL	Fort Lauderdale, Allied Elctrns.	305-486-0500
GA	Norcross, Metermaster	404-446-0166
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rolling Meadows, Commodore 1	312-394-5441
IN	Indianapolis, Commodore 1	317-636-3318
KS	Kansas City, Commodore 1	816-842-8585
LA	Baton Rouge, Beta Eistrs.	504-924-6826
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Burlington, Contact East	617-272-5051
MA	Natick, Calcotron	617-879-7650
MI	Royal Oak, The Satullo Co.	313-549-3910
MN	Minneapolis, Commodore 1	612-370-0881
MO	St. Louis, Commodore 1	314-454-0138
NJ	Belle Meade, Gestalt Sys.	201-359-0018
NM	Albuquerque, Beta Distrs.	505-299-7658
NY	Bayshore, Caesar Elctrns.	516-242-8477
NY	Great Neck, The Instr. Mart	516-487-7430
NY	Mineola, Allied Elctrns.	516-248-2360
NY	New York City, Advance Elctrns.	212-730-7030
NC	Pineville, E.M.I.S.	704-588-4624
OH	Cleveland, Metermaster	216-651-4100
OH	Willoughby, Allied Elctrns.	216-951-0908
OR	Portland, Westcon	503-283-0132
PA	Bala Cynwood, Allied Elctrns.	215-667-6940
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Garland, Metermaster	214-271-5671
UT	Murray, Beta Distrs.	801-262-3000
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Milwaukee, Allied Elctrns.	414-463-2662

TETTEX INSTRUMENTS, INC., P.O. Box 281, Fairview Village, PA 19409-0281, Tel: 215-539-6050, Telex: 753-899 TETTEX; Empl.: 100; *Sls. Mgr.:* R. E. Seeberger ....3•1309

TEXAS INSTRS., INC., Box 225012-MS-84, Dallas, TX 75265, Tel: 214-995-6611, TWX: 910-867-4702; Empl.: 85,000

TEXAS INSTRS., Data Sys. Group, P.O. Box 2909 MS 2222, Austin, TX 78769, Tel: 214-995-6611, Telex: 73324 TEXINS DAL, TWX: 910-867-4702; Empl.: 80,696

TEXAS INSTRS., Matls. & Controls Grp., 34 Forrest St., Attleboro, MA 02703, Tel: 617-699-3800, Telex: 92-7708, TWX: 710-346-0566

TEXAS TRANSFORMER CORP., P.O. Box 220, Plano, TX 75074, Tel: 214-424-1581; *Sls. Mgr.:* David Keeler

Distributor

TEXASWITCH, INC., 2512 Program Dr., #108, Dallas, TX 75220, Tel: 214-357-1768 ....1B•1742

TEXMATE INC

TEXMATE, INC., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075, Tel: 619-481-7177, TWX: 910-322-1738; Empl.: 36 ....3•1351-1355

Texmate employs no sales reps or local salesmen in the USA. Instead we offer factory direct contact, fast delivery, and lower prices.

Local Distributors

Intl	Australia, Melbourne	(03) 329-8873
Intl	Australia, Sydney	(02) 792-9222
Intl	France, Paris	(1) 575-53-53
Intl	Germany, Darmstadd	0 61 51/2 64 46
Intl	Germany, Dusseldorf	02 11/66 61 45
Intl	Germany, Hanover	05 11/88 6086
Intl	Germany, Munich	089-47 3023
Intl	Germany, Quickborn	041 06/612-1
Intl	Germany, Stuttgart	07 11/73 63 57
Intl	India, Bangalore	812-52321; 812-52322
Intl	Spain, Barcelona	(93) 692-35-19
Intl	Sweden, Stockholm	08-710 06 20
Intl	Taiwan, Taipei	595-7655; 592-3509
Intl	United Kingdom, Walsall	(0922) 27266
Can	Edmonton	403-432-7746
Can	Montreal	514-337-0425
Can	Ottawa	613-238-7077
Can	Toronto	416-238-3193

TEXSCAN INSTRUMENTS, 3169 N. Shadeland, Indianapolis, IN 46226, Tel: 317-545-4196, Telex: 810-341-3184, TWX: 27-2110; FSC No.: 23042; Empl.: 765; *Sls. Mgr.:* Alan Whitlock; *Dist. Mgr.:* Rob Shenlot

TEX-TECHS INTL., 10021 Cayuga, Dallas, TX 75228, Tel: 214-328-6200, Telex: 73-0796 TEX TECH DAL; *Sls. Mgr.:* Rick Prindle

TEXTOOL PRODUCTS, Electronic Products Division/3M, 1410 W. Pioneer Dr., Irving, TX 75061, Tel: 214-259-2676; *Sls. Mgr.:* Marlan Carlson

Local Sales Offices & Reps

AK	Anchorage	907-561-1030
CA	Los Angeles	213-726-6300
CA	So. San Francisco	415-761-1155
GA	Atlanta	404-447-7000
HI	Honolulu	808-422-2721
IL	Chicago	312-496-6500
MA	Boston	617-449-0300
MI	Detroit	313-477-5000
MN	St. Paul	612-733-3300
MO	St. Louis	314-997-8500
NJ	West Caldwell	201-575-2000
NC	High Point	919-889-7181
OH	Cincinnati	513-482-3100
OH	Cleveland	216-362-1700
PA	Philadelphia	215-728-5300
TX	Dallas	214-324-8100
WA	Seattle	206-244-7200

T-F ELCTRNS., 9415 Neils Thompson Dr., Austin, TX 78759, Tel: 512-836-7323, Telex: 77-6427; FSC No.: 50307; Empl.: 55

TGM DETECTORS, INC., 166 Bear Hill Rd., Watham, MA 02154, Tel: 617-890-2090

THERMAL AMER. FUSED QUARTZ, Change Bridge Rd., Montville, NJ 07045, Tel: 201-334-7770, Telex: 136477; Empl.: 65; *Sls. Mgr.:* G.A. Miller

THERMALLOY, INC., 2021 W. Valley View, Dallas, TX 75234, Tel: 214-243-4321, TWX: 910-860-5542; Empl.: 250; *Sls. Mgr.:* L. Tucker

THERMAX WIRE, 32-02 Linden Pl., Flushing, NY 11354, Tel: 212-939-8300, Telex: 645587, TWX: 710-582-2551; FSC No.: 12814; Empl.: 220; *Sls. Mgr.:* R. Prusak

Therm-O-Disc®

THERM-O-DISC, INC., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907, Tel: 419-756-5911, Telex: 987455; *Sls. Mgr.:* J. A. Kight ....1B•1823

THERMODYNE INTERNATIONAL LTD., 20850 S. Alameda, Long Beach, CA 90810, Tel: 213-603-1976; *Sls. Mgr.:* Walter Wolf

THERMO ELEC., 109 Fifth St., Saddle Brook, NJ 07662, Tel: 201-843-5800, TWX: 710-990-5108; Empl.: 350; *Sls. Mgr.:* H. Korman

THERMOELECTRICS, See Borg-Warner Thermoelectrics.

THERMOGRAPHICS MEASUREMENTS LTD., 3733 W. 139th St., Hawthorne, CA 90250, Tel: 213-675-9182, Telex: 674432; *Sls. Mgr.:* Andrew Hilbert

THERMOLAB, 13345 Saticoy St., N. Hollywood, CA 91605, Tel: 213-875-0105, Telex: 662494, TWX: 910-499-2156

THERMOMETRICS, INC., 808 U.S. Hwy. #1, Edison, NJ 08817-4695, Tel: 201-287-2870, Telex: 844-387; FSC No.: FSCM 58090; Empl.: 150; *Sls. Mgr.:* Harold Broitman ....1B•1825

Local Sales Offices & Reps

CA	Garden Grove, Elsco Elctrns.	714-891-4621
CA	San Diego, Elsco Elctrns.	619-292-1771
NY	Central Square, Bastian Sls. Agy.	315-668-2957
NY	Fairport, Bastian Sls. Agy.	716-223-0237

THERMONICS, 3350 Scott Blvd., Bldg. 32, Santa Clara, CA 95051, Tel: 408-496-6838, Telex: 172-353; *Sls. Mgr.:* James D. Martin; *Dist. Mgr.:* James D. Martin

THERMOPLASTIC PROCESSES, INC., 1268 Valley Rd., Stirling, NJ 07980, Tel: 201-647-1000, TWX: 710-997-9583; FSC No.: 08230; *Sls. Mgr.:* Robert B. Scheffler; *Dist. Mgr.:* William Kaufman

THERMOSEN, P.O. Box 1254, Stamford, CT 06904, Tel: 203-324-6125, Telex: 965846; FSC No.: 00428; Empl.: 33

Local Sales Offices & Reps

CA	San Carlos, Elctrn. Engrg. Assoc.	415-593-2189
CA	Santa Monica, REP Assoc.	213-393-9666
CO	Denver, Lindberg Co.	303-758-9033
FL	Melbourne, Electro Mechanical Standards	305-724-1027
MA	Newton, Normell Assocs.	617-969-5478
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
NM	Albuquerque, Lindberg Co.	505-881-1006
OH	Cincinnati, John O. Olsen Co.	513-574-7711
OH	Cleveland, John O. Olsen Co.	216-662-3454
OR	Portland, Syscom	503-644-2505
PA	Glenside, Elcom, Inc.	215-885-1715
PA	Pittsburgh, John O. Olsen Co.	412-279-2550
TX	Austin, John B. Guenther, Inc.	512-472-3825
TX	Dallas, John B. Guenther, Inc.	214-691-8500
TX	Houston, John B. Guenther, Inc.	713-974-0383
UT	Salt Lake City, Lindberg Co.	801-467-1794
VT	Bennington, Magyar Assocs.	802-442-5858
WA	Kirkland, Syscom Sls.	206-821-4575

THERMOTECH, See ITT Thermotech.

THETA INSTR. CORP., 24 Dwight Pl., Fairfield, NJ 07006, Tel: 201-227-1700, Telex: 13-8621; Empl.: 85; *Sls. Mgr.:* R. Kemp

THICKFILM INT'L., Rt. 1-Box 85-0, Indian Head, MD 20640, Tel: 301-375-8666, TWX: 710-829-0590; Empl.: 14; *Sls. Mgr.:* P. Gundotra

THIELEX PLASTICS CORP., 201 11th St., Piscataway, NJ 08854, Tel: 201-968-5300, TWX: 710-997-9662; *Sls. Mgr.:* M. A. DeMatteo

THINCO DIV., HULL CORP., Davisville Rd., Hatboro, PA 19040, Tel: 215-672-7800, TWX: 510-665-6822; Empl.: 8; *Sls. Mgr.:* John L. Hull

THIRD DOMAIN, P.O. Box 35400, Tucson, AZ 85740-5400, Tel: 602-293-6310; Empl.: 26; *Sls. Mgr.:* Julia Gerdes

T&B
Electronics Group

THOMAS & BETTS, Electronics Group Hdqtrs., 920 Route 202, Raritan, NJ 08869, Tel: 201-469-4000, Telex: 844372; FSC No.: 59730; Empl.: 2000 .... **2**•1593-1612

Local Sales Offices & Reps

CA	Burbank, T & B Elctrns. Grp.	213-841-9670
CA	San Jose, T & B Elctrns. Grp.	408-248-9111
IL	Naperville, T & B Elctrns. Grp.	312-357-0404
NJ	Flemington, T & B Elctrns. Grp.	201-788-5900

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Hall-Mark	602-243-6601
AZ	Phoenix, Wyle Labs., Elctrns. Mktg. Grp.	602-249-2232
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	El Segundo, Hall-Mark	213-643-9101
CA	Irvine, Wyle Labs., Elctrns. Mktg. Grp.	714-863-1611
CA	Los Angeles, Wyle Labs., Elctrns. Mktg. Grp.	213-322-8100
CA	Orange County, Hall-Mark	714-669-0662
CA	Riverside, Electronic Supp.	714-683-7300
CA	San Diego, Hall-Mark	619-268-1201
CA	San Diego, Wyle Labs., Elctrns. Mktg. Grp.	619-565-9171
CA	San Fernando, Hall-Mark	818-716-7300
CA	San Jose, Hall-Mark	408-946-0900
CA	Santa Clara, Wyle Labs., Elctrns. Mktg. Grp.	408-727-2500
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Denver, Hall-Mark	303-790-1662
CO	Denver, Wyle Labs., Elctrns. Mktg. Grp.	303-457-9953
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
FL	Orlando, Pioneer	305-834-9090
FL	Orlando, Hall-Mark	305-855-4020
FL	Tampa Bay, Hall-Mark	813-530-4543
GA	Atlanta, Marshall Inds.	404-923-5750
GA	Atlanta, Hall-Mark	404-447-8000
IL	Chicago, Pioneer	312-437-9680
IL	Chicago, Hall-Mark	312-860-3800
IN	Indianapolis, Pioneer	317-849-7300
KS	Kansas City, Hall-Mark	913-888-4747
MD	Baltimore, Hall-Mark	301-988-9800
MD	Columbia, Time Elctrns.	301-964-3090
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MA	Boston, Marshall Inds.	617-272-8200
MA	Burlington, Lionex Corp.	617-272-9400
MA	Woburn, Time Elctrns.	617-935-8080
MI	Livonia, Pioneer	313-525-1800
MN	Minneapolis, Hall-Mark	612-854-3223
MN	Twin Cities, Pioneer	612-935-5444
MO	St. Louis, Hall-Mark	314-291-5350
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Cherry Hill, Hall-Mark/Philadelphia	609-424-7300
NJ	Fairfield, Lionex Corp.	201-227-7960
NJ	Fairfield, Hall-Mark	201-575-4415
NY	Binghamton, Marshall Inds.	607-754-1570
NY	Farmingdale, Iris Elctrns.	516-420-8400
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Hauppauge, Lionex Corp.	516-273-1660
NY	Mt. Vernon, QAR Indl. Elctrns.	516-484-9207
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Marshall Inds.	716-235-7620
NC	Charlotte, Pioneer	704-527-8188
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cleveland, Hall-Mark	216-473-2907
OH	Cleveland, Pioneer	216-587-3600
OH	Columbus, Hall-Mark	614-891-4555
OH	Dayton, Pioneer	513-236-9900
OK	Tulsa, Hall-Mark	918-665-3200
OR	Beaverton, Almac Elctrns.	503-641-9070
OR	Portland, Wyle Labs., Elctrns. Mktg. Grp.	503-640-6000
PA	Broomall, Time Elctrns.	215-359-1200
PA	Delaware Valley, Pioneer	215-674-4000
PA	Horsham, Lionex Corp.	215-443-5150
PA	Pittsburgh, Pioneer	412-782-2300
TX	Austin, Hall-Mark	512-258-8848
TX	Austin, Pioneer	512-835-4000
TX	Dallas, Southwest Elctrns.	214-234-3050
TX	Dallas, Pioneer	214-386-7300
TX	Dallas, Hall-Mark	214-341-1147
TX	Houston, Hall-Mark	713-781-6100
TX	Houston, Southwest Elctrns.	713-491-4900
TX	Houston, Pioneer	713-988-5555
UT	Salt Lake City, Wyle Labs., Elctrns. Mktg. Grp.	801-974-9953
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Seattle, Wyle Labs., Elctrns. Mktg. Grp.	206-453-8300
WI	Milwaukee, Electronic Expeditors	414-228-8100
WI	Milwaukee, Hall-Mark	414-761-3000

THOMAS & SKINNER, Box 150 B, Indianapolis, IN 46206, Tel: 317-923-2501, Telex: 02-7335; Empl.: 250; *Sls. Mgr.:* Sherman Smith

THOMAS ELCTRNS., 100 Riverview Dr., Wayne, NJ 07470, Tel: 201-696-5200, TWX: 710-988-5836; Empl.: 380; *Sls. Mgr.:* Ben Setticase

Local Sales Offices & Reps

CA	Los Altos, Cain-White & Co.	415-948-6533
CO	Wheatridge, Waugaman Assocs.	303-423-1020
MA	Norwood, MPS Elctrns.	617-769-8700
NJ	Fairfield, Pantronics	201-575-1177
OR	Portland, Components West	503-643-5588
PA	Flourtown, Eastern Comps.	215-836-1616
TX	Irving, Space Elctrns.	214-251-3636
VA	Herndon, Eastern Comp.	703-471-1025
WA	Seattle, Components West	206-243-2133
EXP	NJ, Oradell, Sylvan Ginsbury	201-261-3200
EXP	NY, New York, Far East Mercantile (KBK)	212-687-8564

THOMSON-CSF COMPS CORP., Dumont Div., 550 Mt. Pleasant Ave., Dover, NJ 07801, Tel: 201-328-1400

THOMSON-CSF COMPS. CORP., DuMont Div., 750 Bloomfield Ave., Clifton, NJ 07015, Tel: 201-773-2000; FSC No.: 18778; Empl.: 250; *Sls. Mgr.:* George Petro

THOMSON-CSF COMPS. CORP., Electron Tube Div., 301 Route 17 N., Rutherford, NJ 07070, Tel: 201-438-2300, TWX: 710-989-7286; *Sls. Mgr.:* Stephen Barthelmes

THOMSON-CSF COMPS. CORP., Metals & Chemicals Div., 6660 Variel Ave., Canoga Pk., CA 91303, Tel: 213-887-1010, Telex: 69-8481, TWX: 910-494-1954; Empl.: 3; *Sls. Mgr.:* Wm. E. Wheeler

THOMSON-CSF COMPS. CORP., Passive Comp. Div., 6660 Variel Ave., Canoga Park, CA 91303, Tel: 818-887-1010, Telex: 69-8481, TWX: 910-494-1954; Empl.: 250; *Sls. Mgr.:* R. Silverstein; *Dist. Mgr.:* M. St Amant

Local Sales Offices & Reps

AL	Huntsville, E.S.I.	205-533-1735
AZ	Phoenix, Sanford Sls. Assocs.	602-957-3570
CA	Chatsworth, WCV-Raltech	818-700-0933
CA	Mountain View, Gene Woempner Co.	415-964-5454
CO	Englewood, Grimes Mktg. Co.	303-740-6063
FL	Casselberry, Semi	305-695-3334
IL	Itasca, L-Tec, Inc.	312-773-2900
IN	Indianapolis, Frank J. Campisano Co.	317-253-7651
KS	Merriam, Midwest Techn. Sls.	913-236-8557
MA	Framingham, Stone Comp. Sls.	617-875-3266
MI	Bloomfield Hills, Enco Mktg.	313-642-0203
MN	Bloomington, John G. Twist Co.	612-835-2120
NY	Buffalo, Quality Comps.	716-837-5430
NY	Hauppauge, Masin-Esco	516-273-3500
NY	Manlius, Quality Comps.	315-682-8885
NC	Raleigh, DHR Mktg.	919-876-5450
OH	Cincinnati, Frank J. Campisano Co.	513-574-7111
OR	Tigard, Elctrn. Comp. Sls.	206-232-9301
TX	Dallas, Design Mktg.	214-680-9767
WA	Mercer Island, Elctrn. Comp Sls.	206-232-9301

THOMSON-CSF COMPS. CORP., Semiconductor Div., 6660 Variel Ave., Canoga Pk., CA 91304, Tel: 213-887-1010, Telex: 69-8481, TWX: 910-494-1954; *Sls. Mgr.:* Les Kilpatrick; *Dist. Mgr.:* David Johnson

THOMSON-CSF COMPS. CORP., Socapex Div., 6660 Variel Ave., Canoga Pk, CA 91303, Tel: 213-887-0750, Telex: 69-8481, TWX: 910-494-1954

THOMSON-CSF COMPS. CORP., Special Prods. Div., 301 Rte. 17 North, Rutherford, NJ 07070, Tel: 201-438-2300, TWX: 710-989-7286; *Sls. Mgr.:* Hans H. Sandager

THORDARSON

THORDARSON MEISSNER, Electronic Center, Mt. Carmel, IL 62863, Tel: 618-262-5121, TWX: 510-525-2254; FSC No.: 96256; Empl.: 600; *Sls. Mgr.:* R. Keas .... **1A**•2302-2307

THOR ELCTRNS., 321 Pennsylvania Ave., Linden, NJ 07036, Tel: 201-486-3300, Telex: 138 968; Empl.: 50; *Sls. Mgr.:* Jack Rose

THORN EMI GENCOM INC., 23 Madison Rd., Fairfield, NJ 07006, Tel: 516-433-5900, Telex: 22-1236 TEGI UR; Empl.: 35; *Sls. Mgr.:* L. Lieberman .... **1A**•2366, 2367

Local Sales Offices & Reps

AZ	Phoenix, Odessey-1	505-883-4019
CA	N. Hollywood, O'Halloran Assocs.	213-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-326-1493
CO	Denver, Odessey-1	505-883-4019
FL	Orange Park, Pulcir	904-264-7615
NM	Albuquerque, Odessey-1	505-883-4019
PA	Elkins Park, Snow Assocs.	215-379-4700
TN	Oak Ridge, Pulcir	615-483-6358
TX	Dallas, SW Eng. & Equip.	214-340-1741
TX	Houston, SW Eng. & Equip.	713-820-2500
WA	Seattle, Underwood Assocs.	206-451-8223

THORN EMI TECHNOLOGY INC., 8601 Dunwoody Pl., Atlanta, GA 30338, Tel: 404-587-0017, 800-243-2572, TWX: 810-766-2267 .... **3**•1310

Local Sales Offices & Reps

CA	Irvine	714-261-0141
CA	Sunnyvale	408-732-9027
MA	Framingham	617-875-5858
NM	Albuquerque	505-884-0541
VA	Reston	703-620-6056

THORSON ENGRG. CO., 6225 76th St. S.E., Snohomish, WA 98290, Tel: 206-334-4214

3D OPTICS, Box 224, 4 Strathmore Cir., Braintree, MA 02184, Tel: 617-848-8002; Empl.: 2

3M CO., see listing under letter "M"

THUNDER SCI. CORP., 623 Wyoming S.E., Albuquerque, NM 87123, Tel: 505-265-8701; Empl.: 26; *Sls. Mgr.:* J. L. Bennewitz

TIDEWATER TECHNOLOGICAL, INC., 611 Industrial Pk. Dr., Newport News, VA 23602, Tel: 804-874-2800; Empl.: 25

TIF INSTRS., INC., 9101 N.W. 7th Ave., Miami, FL 33150; Tel: 305-757-8811; *Sls. Mgr.:* Tom Wolff

TII ELECTRONICS, INC.

TII ELECTRONICS, INC., Div. TII Industries, 226 Terminal Rd., E. Setauket, NY 11733, Tel: 516-751-6066, Telex: 144631; *Sls. Mgr.:* Steven D. Cogger (OEM) .... **3**•1796, 1797

Local Sales Offices & Reps

CA	Irvine, Quality Peripherals	714-549-8866
CA	San Jose, Quality Peripherals	408-559-3882
CT	Goshen, Northern Computer Sls. (OEM)	203-491-3585
FL	St. Petersburg, Southern Engrg. Assocs.	813-577-7700
GA	Marietta, Southern Engrg. Assocs.	404-953-3970
MA	Westwood, Northern Computer Sls. (OEM)	617-326-3454
MN	St. Paul, ACT Comms.	612-738-7794
TX	Bonham, ACT Comms.	214-583-9541

TIMBER-TOP, Hopkins Rd., Box 517E, Watertown, CT 06795, Tel: 203-274-6706; FSC No.: 06773; Empl.: 5; *Sls. Mgr.:* W. E. Fischer

Advertisement

TTI's SYNCLAMPS are the ONLY quick-releasing, self-locking and INSTANT NULLING SYNCHROCLAMPS! Their INTEGRAL STOPS permit component mounting and nulling (techniques that can save 70% OR MORE of the mounting and nulling time!). SYNCLAMPS meet the MAXIMUM MIL SHOCK AND VIBRATION: 2000 ft-lbs/2000 cps! They also have the LOWEST INSTALLED COST of any type of clamp! A size and style for ANY size component and ANY application!!

TIMECO, INC., 1035 - 26th St., P.O. Box 8036, Huntington, WV 25705, Tel: 304-523-5149; *Sls. Mgr.:* Wm. F. Ransbottom

TIMEPLEX, INC., 400 Chestnut Ridge Rd., Woodcliff Lake, NJ 07675, Tel: 201-930-4600, Telex: 178200, TWX: 710-990-7270; FSC No.: 7035-0001; Empl.: 700; *Sls. Mgr.:* Gary Dickey

TIMES FIBER COMMUNICATIONS, INC., 358 Hall Ave., Wallingford, CT 06492, Tel: 203-265-8500, TWX: 710-476-0763; Empl.: 1,100; *Sls. Mgr.:* Jack J. Barbera; *Dist. Mgr.:* Al Criscuolo

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Phoenix, Mercury Engrg. Corp.	602-954-6964
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	714-276-0751
CA	Santa Clara, Westrep	408-988-8833
CO	Denver, Lindberg Co.	303-758-9033
CT	Hamden, MacArthur & Co.	203-281-5847
FL	Coral Springs, CBC Elctrns.	305-755-1111
FL	Orlando, CBC Electronics	305-831-5380
GA	Stone Mountain, 20th Century Mktg.	404-292-7088
HI	Honolulu, Dougherty Enterprises	808-395-4114
IL	Berkeley, Cadre Technical Reps.	312-449-3900
IN	Indianapolis, Baehr, Greenleaf & Assoc.	317-842-6204
IA	Cedar Rapids, PMR, Inc.	319-362-9177
KS	Overland Park, PMR, Inc.	913-381-0004
KS	Wichita, PMR, Inc.	316-684-4141
MD	Rockville, Mechtronics Sls.	301-340-2130
MA	Burlington, QPL Electronics	617-229-2424
MA	Clinton, F.J. Coleman Co.	617-368-0116
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	Bloomington, E.S.A.	612-884-8291
MO	Maryland Hgts., PMR, Inc.	314-569-1220
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Rochester, Electra Sls. Corp.	716-461-5252
NY	Syracuse, Electra Sls. Corp.	315-463-1248
NC	Charlotte, D.G.W., Inc.	704-334-7090
NC	Winston-Salem, D.G.W., Inc.	919-768-7166
OH	Columbus, Baehr, Greenleaf & Assoc.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assoc.	513-439-0724
OH	Lakewood, Baehr, Greenleaf & Assoc.	216-221-9030
OK	Oklahoma City, Ammon & Rizos	405-942-2552
OR	Tigard, Elctrn. Sources	503-684-0040
PA	Glenside, Griffin Co.	215-576-0110
PA	Pittsburgh, Baehr, Greenleaf & Assoc.	412-765-2330
TN	Knoxville, 20th Century Mktg.	615-966-3608
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Dallas, Ammon & Rizos	214-233-5591
TX	Houston, Ammon & Rizos	713-781-6240
UT	Salt Lake City, Lindberg Co.	801-969-2400
WA	Bellevue, Elctrn. Sources	206-643-0400

Local Distributors

AZ	Scottsdale, Copper State Cable	602-272-1383
CA	Los Angeles, Radio Hardware	213-679-3381
CA	San Jose, RFI Electronics	408-298-5406
CA	Santa Ana, Republic Elctrn. Sls.	714-540-5703
CT	E. Hartford, E.J. Stephens	203-568-1927
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Orlando, Cablematic	305-293-5729
MD	Beltsville, Vertex Elctrns.	301-937-0180
MD	Gaithersburg, Pioneer/Wash.	301-948-0710
NJ	Passaic, Seacoast Elec. Supp.	201-779-5151
NY	Farmingdale, Vertex Elctrns.	516-293-9880
NY	Freeport, Mil-Spec Wire & Cable	516-546-5454
NY	Port Washington, Restart Elctrns.	516-883-3500
NY	Rochester, Simcona Elctrns.	716-328-3230
PA	Folcroft, Delphi Elctrns.	215-534-3900
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Garland, Vonn Wire & Cable	214-494-0355

TITAN TRANSFORMER CO., 134 Coolidge Ave., Watertown, MA 02172, Tel: 617-923-1200

TITCHENER, E. H., & CO., 1 Titchener Pl., Binghamton, NY 13902, Tel: 607-772-1161, TWX: 510-252-1985; Empl.: 235

TMC SYSTEMS (ARIZ.) INC., See Dale Electronics, Inc.

Distributor

TNR TECHNICAL INC., Saft & Gould/Portable Battery Div., 63 Marine St., Farmingdale, NY 11735, Tel: 516-249-3777; *Sls. Mgr.:* Wayne Thaw p.762

TOBE DEUTSCHMANN LABS., INC., 550 Turnpike St., Canton, MA 02021, Tel: 617-828-3366, Telex: 92-4427; FSC No.: 21966; Empl.: 40; *Sls. Mgr.:* T. Deutschumann, Jr.

TODD PRODS. CORP., 50 Emjay Blvd., Brentwood, NY 11717, Tel: 516-231-3366, TWX: 510-227-4905; Empl.: 200; *Sls. Mgr.:* F. Sposato .... **3**•1798-1801

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-882-6050
AZ	Phoenix, PLS Assocs.	602-246-6614
CA	Brea, Masco	714-529-0866
CA	Oceanside, Todd Prods. West	619-439-6073
CA	Sunnyvale, Qualtech	408-732-4800
CO	Englewood, PLS Assocs.	303-773-1218
CT	Weston, Northeast Reps.	203-866-6030
FL	Largo, Electrocraft	813-530-4749
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Palatine, Kingston Comps.	312-359-7990
MA	Hingham, Northeast Reps.	617-749-8700
MI	Union Lake, Imtech	313-363-7129
MN	Minneapolis, R. K. Sales Assocs.	612-786-5713
MO	St. Louis, AME Sls.	314-965-1779
NH	Nashua, Northeast Reps.	603-880-8199
NJ	Marlton, BGR Assocs.	609-983-1020
NJ	Ridgefield, Rical Assocs.	201-945-5240
NM	Albuquerque, PLS Assocs.	505-345-5501
NY	Charlotte, R. W. Mitscher Co.	704-598-8644
NY	E. Syracuse, Nycom	315-437-8343
NC	Raleigh, R. W. Mitscher Co.	919-848-0941
OH	Akron, Imtech, Inc.	216-666-1185
OH	Dayton, Imtech, Inc.	513-278-6507
PA	Pittsburgh, Imtech, Inc.	412-344-0844
TN	Johnson City, R. W. Mitscher Co.	615-929-7258
TX	Austin, J. Clay Co.	512-346-7340
TX	Dallas, J. Clay Co.	214-350-1281
UT	Midvale, PLS Assocs.	801-566-0671
VA	McLean, Creative Mktg. Assocs.	703-442-9100
WA	Bellevue, Venture Elctrns.	206-454-4594

TODD SYSTEMS, 50 Ash St., Yonkers, NY 10701, Tel: 914-963-3400; Empl.: 45; *Sls. Mgr.:* S. Edwards .... **1A**•2308-2311

Local Distributors

AL	Mobile, Irving Ripps Supp.	205-432-3068
CA	San Francisco, Aris Co.	415-433-2021
CA	San Francisco, Delray Distr.	415-397-5855
FL	Miami, Southeastern Wholesalers	305-634-6591
FL	Miami, Electronic Equip.	305-871-3500
FL	Miami, Graybar Elec.	305-325-0910
GA	Savannah, Southern Supp.	912-234-6646
IL	Chicago, Broadway Sls.	312-897-8688
IL	Chicago, Irv. Wolfson Co.	312-267-7828
LA	New Orleans, Trestman Sls.	504-522-9387
MD	Bethesda, Albee Sales	301-897-8088
MD	Bethesda, Empire Elec. Supp.	301-656-3300
NY	Bronx, Rim Elctrns.	212-295-4300
NY	L.I.C., H.L. Dalis Elctrns.	212-361-1100
NY	New York City, Rosetta Elec.	212-247-6430
OH	Lima, Lima Elec. Parts	419-227-7327
PA	Philadelphia, Phila. Elctrns.	215-568-7400
PA	Philadelphia, H & Z Sls.	215-WA2-2500
TX	Houston, Mermaid Sight & Sound	713-921-5613
TX	Houston, Benjamin Distr.	713-923-5334
TX	Houston, Applebaum & Co.	713-695-5866
TX	Houston, Western Sls.	713-869-6671
TX	Houston, Central Supp.	713-224-0033
VA	Norfolk, H. Belkov Co.	804-625-2491
WA	Seattle, Pearl Elctrns.	206-622-6200

TOHOKU METAL INDS., 5-8, 2-Chome, Kitaaoyama Minato-Ku, Tokyo, Japan, Tel: Tokyo 03-402-6161, Telex: 242 2695 TOKIN J; Empl.: 2000; *Sls. Mgr.:* H. Ishihara; *Dist. Mgr.:* T. Ikeda

TOKO AMERICA, INC., 5520 W. Touhy Ave., Skokie, IL 60077, Tel: 312-677-3640, Telex: 230-724372; *Sls. Mgr.:* Greg Dugan .... **1A**•1282, 1575, 1631

Local Sales Offices & Reps

AL	Madison, Kathy Leverock	205-837-9350
AZ	Scottsdale, Semi-Systems Arizona, Inc.	602-991-1151
CA	Cupertino, Toko America Inc.	408-996-7575
IL	Chicago, Esco Assocs.	312-763-0800
IL	Skokie, Ultech Assocs.	312-674-3820
IL	Skokie, Toko America Inc.	312-674-3640
MI	Troy, Zimmerman & Sons	313-879-1150
VA	Lynchburg, M&S Mfg.	804-528-0681

TOKYO ELEC. CO., LTD., 1-1 Nishiki-Cho, Kanda, Chiyoda-Ku, Tokyo, 101, Japan, Tel: (03) 292-1011, Telex: 0222-3575, TWX: S

TOPAZ ELECTRONICS, 9192 Topaz Way, San Diego, CA 92123-1164, Tel: 619-279-0831, TWX: 910-335-1526; FSC No.: 06049; Empl.: 450; *Sls. Mgr.:* Ruxton Tucker; *Dist. Mgr.:* Chuck Roberts

TOPFLIGHT, 160 East 9th Ave., York, PA 17404, Tel: 717-843-9901, TWX: 510-657-4849; Empl.: 250; *Sls. Mgr.:* James Danser

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO INC., 14 Paine Ave., P.O. Box 108, Irvington, NJ 07111, Tel: 201-374-8641; Empl.: 20; *Sls. Mgr.:* Stewart H. Cook

Local Sales Offices & Reps

MA	Norwood, MacInnis Co.	617-762-8090

TORIN CORP., 100 Franklin Drive, Torrington, CT 06790, Tel: 203-482-4422, Telex: 962-456, TWX: 710-439-2343; Empl.: 1300; *Sls. Mgr.:* Robert S. Sobolewski

TOROID CORP. OF MARYLAND, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, Tel: 301-464-2100, TWX: 710-826-0414; *Sls. Mgr.:* Egil Angeid .... **1A**•2312, 2313

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030, Tel: 816-761-6314, TWX: 910-777-7037; Empl.: 275; *Sls. Mgr.:* H. Foland .... **1A**•1283-1297, 2314-2320

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AL	Westlake, OH, JN Bailey & Assocs.	216-892-1513
AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Redwood City, Hickey Industrial Sls.	415-368-3849
CA	San Diego, California Elctrn. Mktg.	619-692-3551
CA	Santa Ana, Calif. Elctrn. Mktg.	714-835-2702
CO	Broomfield, Ramark	303-469-1758
GA	Atlanta, L & D Inc.	404-455-3483
IL	Schaumburg, Gassner & Clark	312-882-8608
IA	Hiawatha, Gassner & Clark Co.	319-393-5763

KS	Overland Park, AME Sls.	913-262-3971
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Weston, J. J. Goode Assocs.	617-235-3900
MO	St. Charles, AME Sls.	314-947-0333
NY	Clinton, Advanced Comps.	315-853-6438
NY	Endicott, Advanced Comps.	607-785-3191
NY	Manhasset, Win-Cor Elec. Sls.	516-627-9474
NY	Rochester, Advanced Comps.	716-544-7017
NY	Scottsville, Advanced Comps.	716-889-1429
NY	Syracuse, Advanced Comps.	315-699-2671
NC	Greensboro, L & D Inc.	919-292-3201
NC	Raleigh, L & D Inc.	919-876-5301
OH	New Lebanon, J. N. Bailey Assoc.	513-687-1325
OH	Westlake, JN Bailey & Assocs.	216-892-1513
PA	Birchrunville, Jadelectronic Assocs.	215-296-3800
PA	Philadelphia, Jadelectronics	215-455-0664
TN	Seymour, L & D, Inc.	615-577-1549
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
TX	Houston, Oeler & Menelaides	713-772-0730

TOROTRON, 230 E. 7th St., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Lee Abramson .... **3**•1311

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100; Empl.: 135

TORRINGTON CO., 59 Field St., Torrington, CT 06790, Tel: 203-482-9511; *Sls. Mgr.:* N. W. Couch

TORWICO ELCTRNS. INC., Rte. 70, Lakewood, NJ 08701, Tel: 201-364-1800, TWX: 710-723-8343; Empl.: 240 .... **1A**•2322, 2323

Local Sales Offices & Reps

CA	El Cajon, KCE Corp.	619-588-1198
CA	Menlo Park, Long and Assocs.	415-327-1300
FL	Orlando, Gra-Mar	305-894-3351
IN	Noblesville, Patco & Assocs.	317-877-5986
IA	Davenport, Ensco Rep	319-386-6600
KS	Overland Park, Ensco Rep	913-381-7557
KS	Wichita, Ensco Rep	316-683-1070
MD	Riderwood, W. S. Warrington & Assoc.	301-823-8759
MA	Hingham, N.E. Reps.	617-749-8700
MO	Maryland Heights, Ensco Rep	314-423-3935
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Albany, H. C. Johnson	518-459-1239
NY	Buffalo, H. C. Johnson	716-632-7880
NY	Great Neck, Trionic	516-466-2300
NY	Rochester, H. C. Johnson	716-586-0777
OH	Copley, Eljay Assoc.	216-666-3774
OR	Portland, Abacus Sls.	503-777-8111
PA	Glenshaw, H. C. Johnson	412-961-0414
TX	Irving, Kite Elctrns. Sls. Co.	214-438-9336

TOSHIBA CORPORATION, See General Products Corp.

TOWNSEND INDUSTRIES, 51 Carl Rd., Orange, CT 06477, Tel: 203-795-0241, TWX: 710-465-1898; *Sls. Mgr.:* Charles Dorsa

TOYO COMM. EQUIP. CO., LTD., No. 8 Nori Bldg., 20-4, Nichi-Shimbashi, 3-Chome Minato-Ku, Tokyo 105, Japan, Tel: 03-436-2180, Telex: 02423115 Toyocoj.; Empl.: 1800; *Sls. Mgr.:* T. Nagai

TRACEWELL ENCLOSURES, 7032 Worthington Galenda Rd., Columbus, OH 43085, Tel: 614-846-6175, 800-848-4525; Empl.: 30 .... **2**•1065-1067

TRA-CON, INC., 55 North St., Medford, MA 02155, Tel: 617-391-5550; Empl.: 35

Local Sales Offices & Reps

CA	Sunnyvale, K. R. Anderson Co.	408-736-6730
GA	Augusta, Southeastern Ind. Sls.	404-724-0715
IN	Indianapolis, Emmtronics Supp. & Engr., Inc.	317-899-2333
NY	Hamburg, W. J. Ferenczy Assocs.	716-648-4193
PA	Philadelphia, Air-Draulics	215-457-1940
TX	Richardson, C. J. Garvey Co.	214-234-3371
UT	Salt Lake City, Technology Mktg., Inc.	801-363-3303
VA	Roanoke, Cox Sls. Co.	703-345-2636
WA	Mukilteo, Krippner & Assoc.	206-743-3579
WI	Milwaukee, Ellsworth Systems	414-352-1230

TRACOR INSTRUMENTS, 6500 Tracor La., Bldg. 27, Austin, TX 78721, Tel: 512-929-2051, TWX: 910-874-1366; Empl.: 7800; *Sls. Mgr.:* Harry L. Thomas; *Dist. Mgr.:* Will Hoover

TRACOR PAKTRONICS, 2441 Northeast Pkwy., Ft. Worth, TX 76106, Tel: 817-625-2311, Telex: 758-273; Empl.: 10; *Sls. Mgr.:* Harold Whittenton

TRAK MICROWAVE
A TECH-SYM CORPORATION

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, Tel: 813-884-1411, Telex: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Thomas L. Roberts .... **1A**•1778-1783

TRAK MICROWAVE, 735 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-735-9660, TWX: 910-339-9309; FSC No.: 29111; *Sls. Mgr.:* Thomas L. Roberts .... **1A**•1783

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E4, Tampa, FL 33614, Tel: 813-884-1411, Telex: 52-827, TWX: 810-876-9140; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts .... **3**•1097-1102

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Phoenix, Jim Smith Assocs.	602-267-0981
CA	Mountain View, Pacific Tech. Mktg.	415-969-3010
CA	San Diego, L. L. Stoakes, Inc.	619-452-1600
CO	Denver, W. H. Howard Assocs.	303-426-3499
FL	Sarasota, Bass Assocs.	813-922-9538
GA	Atlanta, Magaro & Assocs.	404-451-8862
IN	Ft. Wayne, TX Sales	219-489-4447
MD	Ashton, Blackwood Assocs.	301-924-2858
MA	Cochituate, High-Tech Sls., Inc.	617-653-3838
NM	Albuquerque, Jim Smith Assocs.	505-265-3406
NC	Greensboro, Magaro & Assocs.	919-294-4783
PA	Huntingdon Valley, Rabal Assocs.	215-947-4825
TX	Arlington, J. T. Houston Assocs.	817-265-2931
EXP	CT, Stamford, Dage Corp.	203-324-3123

TRANSAMERICA DELAVAL, Gems Sensors Div., Cowles Rd, Plainville, CT 06062-9990, Tel: 203-677-1311, Telex: 99-306; Empl.: 203; *Sls. Mgr.:* M. W. Brown; *Dist. Mgr.:* M. W. Brown

TRANS AMERICAN TRANSFORMER, 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1880; Empl.: 23; *Sls. Mgr.:* Joe Latimer .... **1A**•2325

Local Sales Offices & Reps

CT	Washington, Tri-Com Assocs.	203-563-2241
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
GA	Acworth, Reynolds & Assocs., Inc.	404-451-9558
MA	Burlington, Tri-Com Assocs.	617-272-8163
NC	Winston-Salem, Reynolds & Assocs.	919-725-6196
PA	Philadelphia, Technical Instr. Sls. Co.	215-836-2222

TRANSCO PRODS., 4241 Glencoe Ave., Marina del Rey, CA 90291, Tel: 213-822-0800, Telex: 65-2448, TWX: 910-343-6469; Empl.: 400; *Sls. Mgr.:* T. G. Katter

Local Sales Offices & Reps

CA	Marina del Rey, Michael Robinson	213-822-0800
CA	San Jose, Jon Walker	408-244-6150
CA	San Juan Capistrano, Bruce Ridill	714-643-0506
GA	Marietta, John Underhill	404-977-5819
MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Acton, Rollie Merrick	617-275-1247
MO	Ellisville, Hi Grant Wilson	314-227-0737
NY	Bayside, R. L. Diamond Inc.	212-423-7330
PA	Dresher, Joseph Belcher	215-886-4806
TX	Richardson, Ronald B. Patton	214-669-1951
WA	Bellevue, Poggi Assocs., Inc.	206-454-2026

TRANSDUCERS and SYSTEMS

TRANSDUCERS AND SYSTEMS INC., A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson .... **1B**•1880

Local Sales Offices & Reps

CA	Huntington Beach, Transducer Sys.	714-840-5357
CA	Palo Alto, Gado Instr. Sls.	415-961-2222
CT	Washington, Tri-Com Assocs.	203-563-2241
FL	Indian Rocks Beach, PAR Assocs.	813-596-8841
GA	Atlanta, PAR Assocs.	404-391-9117
IL	Des Plaines, Marsland Assocs.	312-298-2620
IA	Cedar Rapids, Marsland Assocs.	319-396-8030
MA	Burlington, Tri-Com Assocs.	617-272-8163
MI	Mt. Clemens, O'Hara Assocs.	313-791-7140
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NY	Binghamton, TAE-REP	607-772-6952
NY	Fishkill, TAE-REP	914-896-6966
NY	Rochester, TAE-REP	716-586-8710
OH	Dayton, RIXAN Assocs.	513-278-4216

TRANSDUCER SYSTEMS, INC., 1510 Delp Dr., Kulpsville, PA 19443, Tel: 215-256-4611, Telex: 846078; Empl.: 310 .... **1B**•1879

Local Sales Offices & Reps

CA	Burbank, J. D. Hannam & Assocs.	213-846-9378
CA	Santa Clara, Nelson Elctrn. Sls.	408-980-1950
MI	Madison Heights, L. C. Nyman & Co.	313-543-6520
MN	Mendota, GII Sls.	612-454-3086
OH	Chagrin Falls, K. F. Nauerz Co.	216-338-8450
OH	Cleveland, Staffco	216-331-5100

Transduktor ®

TRANSDUKTOR INC., 600 Steamboat Rd., Greenwich, CT 06830, Tel: 203-661-5726, Telex: 996491 SID; *Sls. Mgr.:* Carl A. Svensson .... **1A**•2326-2328

TRANSENE, Rte. 1, Rowley, MA 01969, Tel: 617-948-2501; Empl.: 21; *Sls. Mgr.:* J. Doucette

TRANSFORMATION ELCTRNS. CORP., 170 Wilbur Pl., Bohemia, NY 11716, Tel: 516-563-1117, TWX: 510-222-0972; *Sls. Mgr.:* Ken Isabelle;David Baum .... **3**•1802

Local Sales Offices & Reps

CA	Pasadena, EMI	213-795-7193
CA	Sunnyvale, Schwerin & Merrill	408-735-7900
CO	Englewood, Elctrn. Comp. Sys.	303-781-5904
FL	Longwood, Boetto Corp.	305-331-1771
GA	Norcross, New South Mktg. Ltd.	404-449-1140
IL	Downers Grove, Splon Assocs.	312-963-7011
KS	Kansas City, BC Elctrns.	913-342-1211
MD	Pikesville, Imagitron Sls. Co.	800-638-3592
MA	Wakefield, Kentronics	617-246-0245
MN	Minneapolis, Bohlig & Assocs.	612-698-6921
TN	Morristown, New South Mktg. Ltd.	615-646-0154
TX	Arlington, Hite Elctrn. Sls. Co.	817-265-2912
WA	Bellevue, Elctrn. Mktg. Grp.	206-746-5915
WI	Brookfield, Sumer, Inc.	414-784-6641

TRANSFORMER DESIGN, INC., 78th & Clinton, Milwaukee, WI 53223, Tel: 414-358-5300

TRANSISTOR DEVICES, 274 S. Salem St., Randolph, NJ 07869, Tel: 201-361-6622; Empl.: 350; *Sls. Mgr.:* J. A. Gilson .... **3**•1312, 1313

Local Sales Offices & Reps

CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Los Altos, Cain-White Co.	415-948-6533
GA	Atlanta, Magaro & Assocs.	404-252-6609
IL	Elmhurst, Scott Assocs.	312-279-5681
MD	Ellicott City, Dyna-Rep Co.	301-992-4350
MA	Lexington, E. F. Delfino, Inc.	617-862-1118
NJ	Ridgewood, Hansen Assocs.	201-652-7055
NY	North Syracuse, Advance Components	315-699-2671
OH	Medina, McShane Inc.	216-725-4568
OR	Hillsboro, Controlek Sls.	503-640-8444
PA	Fort Washington, GCM Inc.	215-646-7535
TX	Lewisville, J. Hughes Co.	817-430-1683
VA	Alexandria, Dyna-Rep Co.	703-354-1222
EXP	NY, New York, Singer Prods.	212-432-1400

TRANSKINETIC SYS., 110 Shawmut Rd., Canton, MA 02021, Tel: 617-828-3000; Empl.: 7

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, TWX: 510-224-6420; FSC No.: 17755; Empl.: 40; *Sls. Mgr.:* Fred Haber .... **3**•1170, 1171

Local Sales Offices & Reps

CA	Santa Clara, Industrial Modules, Inc.	408-988-1911
TX	Bellaire, Seaton Corp.	713-731-2649
TX	Carrollton, Seaton Corp.	214-380-0414

TRANSMET CORP., 4290 Perimeter Dr., Columbus, OH 43228, Tel: 614-276-5522, 800-245-5253, TWX: 810-482-1016; *Sls. Mgr.:* Ronald A. Crossman; *Dist. Mgr.:* Robert M. Simon

TRANS-MET ENGRG., 601 S. Palm St., La Habra, CA 90631, Tel: 213-691-2266; Empl.: 25; *Sls. Mgr.:* Robert J. Powers

TRAN-SPECTRA, INC., Rte. 1-Box 27A, Greenfield, TN 38230, Tel: 901-235-2218; Empl.: 50; *Sls. Mgr.:* D. Cole

TRANS-TECH, 12 Meem Ave., Gaithersburg, MD 20760, Tel: 301-948-3800, Telex: 898-303, TWX: 710-828-0549; FSC No.: 14591; Empl.: 74; *Sls. Mgr.:* Blair W. Stiles; *Dist. Mgr.:* Blair W. Stiles

TRANS-TECH, INC., Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, Telex: 949436, TWX: 710-396-1236; FSC No.: 17540; *Sls. Mgr.:* Blair Stiles

TRANS-TEK, P.O. Box 338, Rte. 83, Ellington, CT 06029, Tel: 203-872-8351, Telex: 99207; FSC No.: 27109; Empl.: 35; *Sls. Mgr.:* William R. Padin

TRAN-TEC, Box 1044, Columbus, NE 68601, Tel: 402-564-2748; Empl.: 46; *Sls. Mgr.:* Cliff Schroeder

Local Sales Offices & Reps

CA	Redwood City, Woodworth Co.	415-365-0252
CA	Tustin, Sierra-Pacific Engrg. Co.	714-731-3411
CO	Golden, Pierce-Robbins Assocs.	303-399-6618
FL	Winter Park, Russell Assocs.	813-526-1134
GA	Atlanta, Russell Assocs.	404-225-8422
IN	Indianapolis, Scott Elctrns, Inc.	317-897-9976
IA	Cedar Rapids, Ard Sls. Co.	319-366-8733
MD	Bel Air, Russell Assocs.	301-879-9180
MA	Wakefield, H.C. Jappe Co.	617-245-9359
NJ	Fair Haven, Russell Assocs.	201-747-0600
NY	Bay Shore, Russell Assocs.	516-666-6500
NY	Cazenovia, Naylor Electric Co.	315-655-8174
OH	Cleveland, D. Steffen & Assocs.	216-461-8333
TX	Dallas, Russell Assocs.	214-699-0383
WA	Bellevue, Russell Assocs.	206-455-3694

TRAN-TROL CO., 2525 N. Alvernon Way, C-6, Tucson, AZ 85712, Tel: 602-795-8008

TRENDATA/STANDARD MEMORIES, 3400 W. Segerstrom, Santa Ana, CA 92704, Tel: 714-540-3605, TWX: 910-595-1596; Empl.: 200; *Sls. Mgr.:* M.S. Efron

TRENT, INC., 201 Leverington Ave., Philadelphia, PA 19127, Tel: 215-482-5000; Empl.: 55

TRIAD POWER SYSTEMS, 10362 Miller Road, Dallas, TX 75238, Tel: 214-341-8700; FSC No.: 214-341-1804; *Sls. Mgr.:* Jack Conn

Local Sales Offices & Reps

ME	Acton, Array Prods., Inc.	617-263-1128
MD	Bethesda, Powell-Pendergraph	301-656-4535
MI	Detroit, Datacenter Power	313-592-1082
NY	Piermont, Elctrl. Information Svcs.	914-359-4909
OK	Oklahoma City, Computer Power of Oklahoma	405-521-1163
OK	Tulsa, Computer Power of Oklahoma	918-252-5406
PA	Willow Grove, Powell-Pendergraph	215-657-0330
TX	Houston, SGA & Assocs., Inc.	713-688-6159
TX	San Antonio, Environmental & Power Sys. Inc.	512-699-0684
VA	Richmond, Powell-Pendergraph	804-270-1400

TRIAD-UTRAD
Standard Products

TRIAD-UTRAD, 1124 E. Franklin St., Huntington, IN 46750, Tel: 219-356-6500, TWX: 810-333-1532; Empl.: 750; *Dist. Mgr.:* Dave N. Miller .... **1A**•2330-2337; **3**•1918, 1919

Local Sales Offices & Reps

AK	Anchorage, H.J. Lang & Assocs.	907-279-5741
AZ	Phoenix, Steve Fisher Assocs.	602-247-7865
AR	Little Rock, J. Y. Schoonmaker Co.	501-375-2168
CA	Chino, Tracy Elec. Sls.	714-591-4736
CA	Santa Clara, Logan Sls.	408-496-0660
CO	Denver, West Inc.	303-692-0131
CT	Guilford, A&M Elctrn. Reps.	203-453-1612
FL	Maitland, Hutto-Hawkins-Peregoy	305-831-2474
GA	Atlanta, Effective Mktg. Force	404-948-6023
HI	Honolulu, Hawaii Elctrn. Svc.	808-845-8207
IL	Wilmette, J. Wasserman Assocs.	312-256-3566
KS	Overland Park, T.L. Dowell, Inc.	913-648-7373
LA	Little Rock, J. Y. Schoonmaker	501-375-2168
MA	Needham, A&M Elctrn. Reps.	617-444-8170
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	St. Louis, T.L. Dowell, Inc.	314-849-4234
NJ	Medford, Champion Elctrn. Sls.	609-654-0475
NY	Rochester, Marchese, Marsey, Barden	716-544-4300
NY	Rockville Centre, Schmitt Industrial Mktg.	516-486-3510
OH	Cincinnati, F.E. Kahsar Sls.	513-922-3133
OH	Hudson, F.E. Kahsar Sls.	216-650-1089
OK	Tulsa, J.Y. Schoonmaker	918-936-1423
OR	Portland, J.J. Backer Co.	503-297-3777
OR	Salem, J. J. Backer Co.	503-362-0717
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
WA	Seattle, J.J. Backer Co.	206-285-1300
EXP	Westbury, N.Y., Minthorne Int'l.	516-546-4700

Local Distributors

AL	Birmingham, Forbes Distributing	205-251-4104
AZ	Phoenix, Dalis Elctrn. Supply	602-275-2885
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Glendale, R. V. Weatherford	213-849-3451
CA	Mountain View, Abacus Elctrns.	415-961-1500
CA	Palo Alto, Zack Elctrns.	415-326-5432
CA	Riverside, Elctrn. Supply	714-683-7300
CO	Denver, Integrated Elctrns.	303-534-6121
FL	Ft. Lauderdale, Peerless Radio Corp. of Florida	305-973-4141
GA	Atlanta, Ack Radio Supply	404-351-6340
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Bell Inds.	312-982-9210
IN	Lafayette, CWY Elctrns.	317-448-1611
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KY	Louisville, P. I. Burks Co.	502-589-3960
LA	New Orleans, William B. Allen Co.	504-525-8222
MD	Rockville, Capitol Radio Whls.	301-881-2270
MA	Burlington, Marshall Wilshire Elctrns.	617-272-8200
MA	Wilmington, Cronin Elctrns.	617-449-0500
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MI	Livonia, R. S. Elctrns.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-483-4450
MO	St. Louis, Olive Industrial Elctrn.	314-426-4500
NE	Lincoln, Scott Elctrn. Supp. Corp.	402-466-8221
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Camden, General Radio Supp.	215-922-7037
NJ	Springfield, Route Elctrns.	201-379-7710
NM	Albuquerque, Electronic Parts Co.	505-293-6161
NY	Hauppauge, Broadline Elctrn. Distr.	516-231-4100
NY	Rochester, Simcona	716-328-3230
NY	Rockville Centre, Midway Indl. Elctrns.	516-764-2400
NY	Rome, Rome Elctrns.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer Standard Elctrns.	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Tulsa, Combined Technlgs.	918-582-8242
OR	Portland, United Radio Supply	503-233-5346
PA	Philadelphia, Almo Electronics	215-698-4000
RI	Warwick, W. H. Edwards Elctrns.	401-781-8000
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Altair Co.	713-462-3029
UT	Provo, Omega Elctrns.	801-375-4664
WA	Seattle, Almac	206-643-9992
WI	New Berlin, RM/Wisconsin	414-784-4420

TRI-COM, INC., 7304 Grove Rd., Frederick, MD 21701, Tel: 301-694-6666, Telex: 64828 TRICOM; Empl.: 35; *Sls. Mgr.:* Marc Vivori

TRIDAK, 1120 Federal Rd., Brookfield, CT 06804, Tel: 203-775-1287, TWX: 710-456-1372; Empl.: 20; *Sls. Mgr.:* Alan Boucher; *Dist. Mgr.:* F.C. Herot

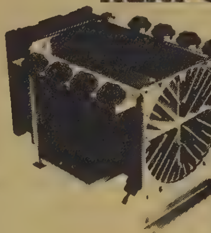
TRI-DATA CORP., 505 E Middlefield Rd., Mountain View, CA 94043, Tel: 415-969-3700, Telex: 910-379-6978; Empl.: 173

TRILOG, 17391 Murphy Ave., Irvine, CA 92714, Tel: 714-549-4079, TWX: 910-595-2798; Empl.: 35; *Sls. Mgr.:* Jack Rice

TRIMM, INC., Div. of Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048, Tel: 312-362-3700; Empl.: 90; *Dist. Mgr.:* H. Lewis

TRIM-TRONICS, INC., 67 Albany St., Cazenovia, NY 13035, Tel: 315-655-9528, TWX: 710-541-1530; Empl.: 20; *Sls. Mgr.:* James E. Dowd

tran-tec
IMPROVED-DESIGN
HEAT SINKS
COMPLETE
LINE OF
FORCED AIR
PRESS PACK
HEAT SINKS
COMPLETE LINE
OF NATURAL AIR
We fabricate heat sinks to your specifications. Write for NEW CATALOG.
tran-tec
CORPORATION
P.O. Box 1044 — Columbus, NE 68601
Phone (402) 564-2748



TRIPLETT
PANEL METERS, VOM's & DIGITAL
TEST EQUIPMENT
AUTHORIZED DISTRIBUTORS
METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration
METERMASTER LOCATIONS:
ARIZONA
Phoenix .... (602) 243-4111
Tucson .... (602) 792-3411
CALIFORNIA
Los Angeles .... (213) 685-4340
Palo Alto .... (415) 968-0313
San Diego .... (619) 560-4841
GEORGIA
Atlanta .... (404) 446-0166
ILLINOIS
Chicago .... (312) 593-8650
MASSACHUSETTS
Boston .... (617) 523-2580
MINNESOTA
Minneapolis .... (612) 332-6117
MISSOURI
St. Louis .... (314) 454-0241
NEW MEXICO
Albuquerque .... (505) 292-3330
OHIO
Cleveland .... (216) 651-4100
OKLAHOMA
Tulsa .... (918) 582-1444
PENNSYLVANIA
Pittsburgh .... (412) 261-4548
TEXAS
Austin .... (512) 473-8876
Dallas .... (214) 271-5671
Houston .... (713) 733-9814
WISCONSIN
Milwaukee .... (414) 643-0554
ALL OTHER STATES .... (800) 962-8128

TRINETICS

TRINETICS INC., 55807 Currant Rd., Mishawaka, IN 46545-4899, Tel: 219-259-8535; Empl.: 100; *Sls. Mgr.:* T. J. Dawson

Local Sales Offices & Reps

AZ	Phoenix, Bill Earl & Assocs.	602-994-3813
CA	N. Hollywood, Bert Moore & Assocs.	818-877-5455
CA	San Rafael, Wright Assocs.	415-457-9940
FL	Tampa, J. R. Controls	813-961-9478
IL	Chicago, Jerry Golten Co.	312-792-1991
IN	Ft. Wayne, Walter W. Bieberich	219-432-2537
IN	New Albany, Walter W. Bieberich	812-945-3187
LA	Metairie, Automation Supplies	504-831-2183
MA	Hopkinton, Berkshire Elctrns.	617-435-9356
MI	Sturgis, Kesler Assocs.	616-651-7619
MO	St. Louis, Hill & Co.	314-432-1136
NJ	Burlington, V.D.E. Elctrn. Sls.	609-387-9331
NY	Rochester, V.D.E. Elctrn. Sls.	716-473-5015
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Vandalia, Stegman Blaine Mktg.	513-890-7975

TRIO LABS., 80 Dupont St., Plainview, NY 11803, Tel: 516-349-0400, TWX: 510-221-1861; FSC No.: 00638; Empl.: 60; *Sls. Mgr.:* John Crawford

TRIO-TECH INTL., 2040 N. Lincoln St., Burbank, CA 91504, Tel: 818-846-9200, Telex: 194811; Empl.: 266

TRIPLE I, See PHI Technologies, Inc.

TRIPLETT
PANEL METERS, VOM's & DIGITAL TEST EQUIPMENT
AUTHORIZED DISTRIBUTORS
METERMASTER
FOR
Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration

METERMASTER LOCATIONS:
ARIZONA
Phoenix
Tucson (602) 792-3411
CALIFORNIA
Los Angeles (213) 685-4340
Palo Alto (415) 968-0313
San Diego (619) 560-4841
GEORGIA
Atlanta (404) 446-0166
ILLINOIS
Chicago (312) 593-8650
MASSACHUSETTS
Boston (617) 523-2580
MINNESOTA
Minneapolis (612) 332-6117
MISSOURI
St. Louis (314) 454-0241
NEW MEXICO
Albuquerque (505) 292-3330
OHIO
Cleveland (216) 651-4100
OKLAHOMA
Tulsa (918) 582-1444
PENNSYLVANIA
Pittsburgh (412) 261-4548
TEXAS
Austin (512) 473-8876
Dallas (214) 271-5671
Houston (713) 733-9814
WISCONSIN
Milwaukee (414) 643-0554
ALL OTHER STATES (800) 962-8128

TRIPLETT
A Penril COMPANY

TRIPLETT CORP.—A PENRIL CO., One Triplett Dr., Bluffton, OH 45817-9987, Tel: 419-358-5015, TWX: 810-490-2400; *Sls. Mgr.:* J. Weldy .... **3**•1314, 1315, 1320, 1356, 1357

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Burlingame, Polach & Bensinger	415-697-2525
CA	Costa Mesa, Berman-Gravley, Inc.	714-549-2122
CO	Arvada, Cluff & Associates	303-423-9354
CO	Aurora, R & R Instrmn.	303-364-8325
FL	Lighthouse Pt., Jack Krutek & Assocs.	305-941-6544
FL	Maitland, Jack Krutek & Assocs.	305-628-4837
GA	Atlanta, Millar Elctrns.	404-261-6160
IL	Berkeley, G. Petitt Co.	312-449-8000
IN	Ft. Wayne, W. Bieberich	219-432-2537
IN	New Albany, W. Bieberich	812-945-3187
KS	Olathe, SPS Associates Ltd	913-764-4460
MD	Baltimore, Sunshine Sci. Inst.	301-661-5900
MD	Reisterstown, Massey Assoc.	301-833-2039
MI	Grosse Point Woods, A & D Elctrn. Sls.	313-884-1956
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NJ	Englewood Cliffs, Masin Esco	201-569-8868
NY	Hauppauge, Masin Esco	516-273-3500
NY	Rochester, Marchese, Marsey & Barden	716-544-4300
NC	Charlotte, Brownell-Electro Inc.	704-597-1270
NC	Raleigh, Millar Elctrns.	919-787-9564
OH	Centerville, Dolfuss-Root	513-433-6776
OH	Strongsville, Dolfuss-Root	216-238-0300
OR	Portland, J.J. Backer	503-297-8744
PA	Bridgeville, Dolfuss-Root	412-221-4420
PA	Trevose, PSA	215-245-0513
RI	Lincoln, Adams-McGregor	401-726-1300
RI	West Warwick, Adams McGregor Inc.	401-822-0896
TX	Dallas, Forner Sls.	214-241-2166
WA	Seattle, J.J. Backer	206-285-1300

Local Distributors

AL	Birmingham, Brownell-Electro	205-322-3374
AL	Mobile, Brownell-Electro	205-479-8581
AZ	Phoenix, Metermaster Div.	602-243-4111
CA	Glendale, Western Elctrn. Supp.	213-245-1226
CA	Irvine, Meter Craft/Larson	714-261-7135
CA	Los Angeles, Metermaster Div.	213-685-4340
CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CA	Palo Alto, Metermaster Div.	415-968-0313
CA	San Diego, Metermaster Div.	619-560-4841
CA	Santa Clara, Dynametron	408-727-6531
CA	Santa Clara, Fisher/Brownell	408-988-6041
CO	Denver, Meter-master	303-722-5766
CT	Middletown, E. I. L. Instruments	203-346-6646
FL	Hialeah, Kimball Elctrn. Lab.	305-822-5792
FL	Miami, Brownell-Electro	305-591-3215
FL	Orlando, Brownell-Electro	305-843-6770
GA	Atlanta, Brownell-Electro	404-762-5181
GA	Atlanta, Process Measurement Control	404-696-7481
HI	Honolulu, Kems, Inc.	808-845-6402
IL	Bridge View, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, Metermaster	312-593-8650
IL	Elk Grove Village, Meter-Makers	312-439-5050
IL	Oak Park, Pacific Indicator	312-261-1330
IN	Evansville, Electro-Lab Svcs.	812-423-5211
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
KS	Overland Park, Brooks Elec.	913-648-3131
KY	Louisville, E. I. L. Instr.	502-454-3432
LA	New Orleans, Indl. Instr. Works	504-733-8355
MD	Gaithersburg, Pioneer/Instrumentation	301-921-0660
MD	Savage, Pyttronic	301-792-0780
MD	Sparks, E.I.L.	301-771-4800
MA	Burlington, E. I. L. Instr.	617-272-9450
MA	Waltham, Calibron	617-894-6440
MI	Ferndale, Ram Meter	313-398-6767
MN	Minneapolis, Instr. Control	612-871-2514
MO	St. Louis, ISL Corporation	314-535-5760
NJ	Belleville, Marshall Inst.	201-751-1190
NJ	N. Caldwell, Hosica Labs	201-256-7724
NY	Clarence, Trott Elctrns.	716-634-8500
NY	L.I.C., Metermod Instr.	212-726-4850
NC	Charlotte, Brownell-Electro	704-597-1270
NC	Raleigh, Brownell-Electro Inc.	919-876-6524
NC	Raleigh, Meter-Meterics, Div. of I.T.R.	919-872-5456
NC	Raleigh, Speed Instr. Div. Owen-Barbot	919-876-4919
OH	Cleveland, Pioneer/Instrumentation	216-587-3600
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Tulsa, Tri-State Instr.	918-836-0286
PA	Philadelphia, Sunshine Sci.	215-673-5600
PA	Pittsburgh, E.I.L.	412-731-5230
PA	Pittsburgh, CAM/RPC	412-963-1885
TN	Knoxville, Brownell-Electro	615-966-3441
TN	Memphis, Instrument Repair Service	901-278-0762
TN	Memphis, Brownell-Electro	901-795-8487
TN	Nashville, Brownell-Electro	615-889-8230
TX	Beaumont, Straughn Elec.	409-838-4563
TX	Dallas, Ultra Instr.	214-357-0297
TX	Garland, Metermaster	214-271-5671
TX	Houston, Meters & Instrs.	713-644-1631
TX	Houston, Quality Instr.	713-524-0528
TX	Odessa, Whitlock Instr.	915-337-3412
VA	Richmond, Meter Metrics (I.T.R.)	804-275-1431
WA	Seattle, E&L Instrs. Inc.	206-762-0880
WA	Seattle, Eicher-Richards	206-523-7888
WI	Milwaukee, E-M Instrs.	414-272-7799

TRIPP-LITE, 500 No. Orleans, Chicago, IL 60610, Tel: 312-329-1777; Empl.: 80; *Sls. Mgr.:* Priscilla Galgan; *Dist. Mgr.:* Priscilla Galgan

TRI-STAR ELCTRNS., INC., 362 Main Street #2, Venice, CA 90291, Tel: 213-823-5779, Telex: 182058 Tristarel Vnce, TWX: 910-343-7448; FSC No.: 5935, 5999, 5120, 5280; *Sls. Mgr.:* Tom Magdalik

TRITON MFG. CO., P.O. Box 361, East Haddam, CT 06423, Tel: 203-838-4666, Telex: 955439; FSC No.: 54195; *Sls. Mgr.:* Jack Spangler

TRI-TRONICS CO. INC., 13420 Wright Cir., Tampa, FL 33624, Tel: 813-855-4453; Empl.: 27; *Sls. Mgr.:* Robert A. Warner

TRIVEX, 3180 Redhill Ave., Costa Mesa, CA 92626, Tel: 714-546-7781, TWX: 910-595-2589; Empl.: 180; *Sls. Mgr.:* R. Martin

TRO DYNE CORP., 900 Corporate Dr., Mahwah, NJ 07430, Tel: 201-529-1800, TWX: 710-988-2138; FSC No.: 17346; Empl.: 55; *Sls. Mgr.:* T. Mazzaccaro

TROMPETER ELECTRONICS, INC., 8936 Comanche, Chatsworth, CA 91311, Tel: 818-882-1020, TWX: 910-494-1210; FSC No.: 14949; Empl.: 95; *Sls. Mgr.:* Paul Cox; *Dist. Mgr.:* E. Fischle

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak and Frazier	205-536-1506
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Los Angeles, Trompeter Elctrns.	818-882-1020
CA	Menlo Park, Long & Assocs.	415-327-1300
CO	Littleton, Aztec Entprs.	303-795-0250
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Orlando, Currie, Peak & Frazier	305-855-0843
GA	Norcross, Currie, Peak & Frazier	404-449-7662
IL	Wheeling, Engineering Prods	312-537-4860
IN	Indianapolis, Engrg. Prods. Assoc.	317-894-7156
IA	Iowa City, Engineering Prods. Assoc.	319-354-5344
MD	Silver Spring, Sel-Tronics	301-589-3391
MA	Lowell, Underwood Sls.	617-256-8191
MN	Edina. Engineering Prods. Assoc.	612-835-9022
NJ	Elmwood Park, L & M Assoc. Eng. Rep.	201-797-0441
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Binghamton, T.A.E. Rep.	607-772-6952
NY	New York, L & M Assocs. Eng. Rep.	212-243-6155
NY	Rochester, T A E Reps.	716-586-8710
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-854-5939
PA	Andalusia, L & M Assocs.	215-245-6658
TX	Lewisville, Milestek	214-436-1597
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Lynnwood, Blum & Assocs.	206-775-6656

TRUE DATA, 17092 Pullman St. #B, Irvine, CA 92714, Tel: 714-979-4842, TWX: 910-595-1917; Empl.: 37

TRULINE CORP., P.O. Box 1469, Visalia, CA 93279, Tel: 209-625-3237; *Sls. Mgr.:* Charlie Torres

TRW CAPACITOR DIV., 301 West "O" St., Ogallala, NE 69153, Tel: 308-284-3611, TWX: 910-620-0321; *Sls. Mgr.:* Dennis Lienemann; *Dist. Mgr.:* Ron Hollmann .... **1A**•1191-1199

Local Sales Offices & Reps

AL	Huntsville, TRW/ECG	205-533-7600
AZ	Scottsdale, TRW/ECG	602-994-0441
CA	Los Angeles, ISDS	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, ISDS	619-571-1544
CA	Santa Ana, ISDS	714-973-2162
CA	Woodland Hills, ISDS	213-883-7130
CO	Westminster, Straube Assocs.	303-426-0890
CT	Rowayton, TRW/ECG	203-853-4466
FL	Ft. Lauderdale, TRW/ECG	305-772-3000

FL	Orlando, TRW/ECG	305-857-3650
GA	Norcross, TRW/ECG	404-447-6154
IL	Chicago, TRW/ECG	312-693-7730
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assoc.	319-393-8703
KS	De Soto, Midtec Assoc.	913-441-6565
KY	Louisville, R. O. Whitesell & Assocs.	502-426-7696
MD	Columbia, TRW/ECG	301-964-9110
MA	Framingham, TRW/ECG	617-620-0625
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. C. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, TRW/ECG	612-854-6616
MO	St. Louis, John G. Macke Co.	314-432-2830
NE	Panama, Norris Stricker	402-788-2700
NY	Rochester, TRW/ECG	716-425-3775
NC	Greensboro, TRW/ECG	919-852-4676
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Tigard, TRW/ECG	503-620-5032
PA	Bala Cynwyd, TRW/ECG	215-667-3400
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-963-6161
TN	Greeneville, R. O. Whitesell & Assocs.	615-639-6154
TX	Austin, Technlg. Sls. Co.	512-346-9940
TX	Dallas, TRW/ECG	214-248-8000
TX	El Paso, TRW/ECG	915-594-8259
TX	Houston, TRW/ECG	713-772-5541
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Richmond, TRW/ECG	804-288-8334
WA	Bellevue, TRW/ECG	206-641-9996
WI	Brookfield, TRW/ECG	414-784-7773

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Phoenix, R. V. Weatherford Co.	602-272-7144
AZ	Tempe, Arrow Elctrns.	602-968-4800
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Gardena, Bell Inds.	213-515-1800
CA	Glendale, R. V. Weatherford Co.	213-849-3451
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Aurora, Arrow Elctrns.	303-696-1111
CO	Denver, R. V. Weatherford Co.	303-428-6900
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
FL	Palm Bay, Arrow Elctrns.	305-725-1480
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Bensenville, Hall-Mark Elctrns.	312-860-2678
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Arrow Elctrns.	317-243-9353
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MA	Norwood, Gerber Radio Supp. Co.	617-769-6000
MA	Woburn, Hall-Mark Elctrns.	617-935-9777
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
MN	Edina, Arrow Elctrns.	612-830-1800
MO	Maryland Hgts., Hall-Mark Elctrns.	314-291-5350
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Cherry Hill, Hall-Mark Elctrns.	609-424-7300
NJ	Fairfield, Hall-Mark Elctrns.	201-575-4415
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Marlton, Arrow Elctrns.	609-596-8000
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Arrow Elctrns.	716-427-0300
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Columbus, Elctrn. Mktg.	614-299-4161
OH	Solon, Arrow Elctrns.	216-248-3990
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OH	Westerville, Hall-Mark Elctrns.	614-891-4555
OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Philadelphia, Phila. Elctrn.	215-568-7400
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Austin, Hall-Mark Elctrns.	512-258-8848
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Dallas, Hall-Mark Elctrns.	214-341-1147
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Houston, Hall-Mark Elctrns.	713-781-6100
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
WA	Seattle, R. V. Weatherford Co.	206-575-1340
WI	Oak Creek, Hall-Mark Elctrns.	414-761-3000
WI	Oak Creek, Arrow Elctrns.	414-764-6600

TRW/CINCH-GRAPHIK, 200 S. Turnbull Canyon Rd., City of Industry, CA 91744, Tel: 213-333-1201, TWX: 910-584-1861; *Sls. Mgr.:* James Kirby

TRW CONNECTOR DIV., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007, Tel: 312-981-6000, TWX: 910-222-1796; *Sls. Mgr.:* B. Walthall; *Dist. Mgr.:* Jim Hartranft Jr. ....**2•1613-1715**

Local Sales Offices & Reps

AL	Huntsville, TRW/ECG	205-533-7600
AZ	Scottsdale, TRW/ECG	602-994-0441
CA	Los Angeles, IS DS	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, IS DS	619-571-1544
CA	Santa Ana, IS DS	714-973-2162
CA	Woodland Hills, IS DS	213-883-7130
CO	Westminster, Straube Assocs.	303-426-0890
CT	Rowayton, TRW/ECG	203-853-4466
FL	Ft. Lauderdale, TRW/ECG	305-772-3000
FL	Orlando, TRW/ECG	305-857-3650
GA	Norcross, TRW/ECG	404-447-6154
IL	Chicago, TRW/ECG	312-693-7730
IN	Fort Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	De Soto, Midtec Assocs.	913-441-6565
KY	Louisville, R. O. Whitesell & Assocs.	502-426-7696
MA	Framingham, TRW/ECG	617-620-0625
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, TRW/ECG	612-854-6616
MO	St. Louis, J. G. Macke Co.	314-432-2830
NM	El Paso, Straube Assocs.	915-594-8259
NY	Fairport, TRW/ECG	716-425-3775
NC	Greensboro, TRW/ECG	919-852-4676
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Tigard, TRW/ECG	503-620-5032
PA	Bala Cynwyd, TRW/ECG	215-667-3400
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-963-6161
TN	Greeneville, R. O. Whitesell & Assocs.	615-639-6154
TX	Austin, TRW/ECG	512-345-2331
TX	Dallas, TRW/ECG	214-248-8000
TX	El Paso, TRW/ECG	915-594-8259
TX	Houston, TRW/ECG	713-772-5541
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Richmond, TRW/ECG	804-288-8334
WA	Bellevue, TRW/ECG	206-641-9996
WI	Brookfield, TRW/ECG	414-784-7773

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Phoenix, Kierulff Elctrns.	602-243-4101
AZ	Phoenix, R. V. Weatherford Co.	602-272-7144
AZ	Tempe, Fisher-Brownell	602-967-1464
AZ	Tempe, Arrow Elctrns.	602-968-4800
AZ	Tempe, Hamilton/Avnet Elctrns.	602-231-5100
AR	Ft. Smith, Carlton Bates Co.	501-646-8201
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Alhambra, Fisher-Brownell	213-289-0255
CA	Anaheim, R. V. Weatherford Co.	714-634-9600
CA	Chatsworth, Arrow Elctrns.	213-700-8668
CA	Costa Mesa, Avnet Elctrns.	714-754-6088
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4100
CA	Culver City, Hamilton Electro Sls.	213-558-2121
CA	El Segundo, Hallmark Elctrns.	213-643-9101
CA	Glendale, R. V. Weatherford Co.	213-849-3451
CA	Los Angeles, Newark Elctrns.	213-671-7066
CA	Los Angeles, Kierulff Elctrns.	213-725-0325
CA	Newport Beach, Arrow Elctrns.	714-851-8961
CA	Palo Alto, Kierulff Elctrns.	415-968-6292
CA	Pomona, R. V. Weatherford Co.	714-623-1261
CA	Riverside, Elctrn. Supp.	714-787-9220
CA	Sacramento, Hamilton/Avnet Elctrns.	916-920-3150
CA	San Diego, Fisher-Brownell	619-560-8545
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Hamilton/Avnet Elctrns.	619-571-7510
CA	San Diego, Kierulff Elctrns.	619-278-2112
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Diego, R. V. Weatherford Co.	619-695-1700
CA	San Francisco, Zack Radio Supp.	415-626-1444
CA	Santa Clara, Fisher-Brownell	408-988-6041
CA	Santa Clara, Wyle Dist. Grp.	408-727-2500
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3355
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Tustin, Kierulff Elctrns.	714-731-5711
CO	Denver, Kierulff Elctrns.	303-371-6500
CO	Denver, Newark Elctrns.	303-757-3351
CO	Denver, Arrow Elctrns.	303-758-2100
CO	Denver, Integrated Elctrn.	303-292-6121
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Englewood, R. V. Weatherford Co.	303-770-9762
CO	Englewood, Hamilton/Avnet Elctrns.	303-779-9998
CO	Thornton, Wyle Dist. Grp.	303-457-WYLE
CT	Danbury, Hamilton/Avnet Elctrns.	203-797-2800
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Ft. Lauderdale, Kierulff Elctrns.	305-463-4940
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Ft. Lauderdale, Hamilton/Avnet Elctrns.	305-971-2900
FL	Largo, Lodan Elctrns.	813-586-2851
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
FL	Palm Bay, Arrow Elctrns.	305-725-1480
FL	St. Petersburg, Kierulff	813-576-1966
FL	St. Petersburg, Hamilton/Avnet Elctrns.	813-576-3930
GA	Norcross, Kierulff Elctrns.	404-447-5252
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Hamilton/Avnet Elctrns.	404-447-7507
GA	Norcross, Arrow Elctrns.	404-449-8252
HI	Honolulu, Precision Radio Ltd.	808-537-5291
IL	Bensenville, Hamilton/Avnet Elctrns.	312-860-7780
IL	Bensenville, Hall-Mark Elctrns.	312-860-3800
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Electronic Connector	312-767-2200
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Chicago, Bell Elctrns.	312-982-9210
IL	Elk Grove Village, Kierulff Elctrns.	312-640-0200
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IL	La Salle, Klaus Radio	815-223-7400
IL	Palatine, Ohm Elctrns.	312-359-5500
IL	Peoria, Klaus Radio	309-691-4840
IL	Quincy, Klaus Radio	217-223-7560
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Ft. Wayne, Graham Elctrn.	219-423-3422
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, Hamilton/Avnet Elctrns.	317-844-9333
IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Pioneer/Ind.	317-849-7300
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
IA	Cedar Rapids, DEECO, Inc.	319-365-7551
IA	Eldridge, Klaus Radio	319-285-8484
KS	Lenexa, Hall-Mark Elect.	913-888-4747
KS	Overland Park, Hamilton/Avnet Elctrns.	913-888-8900
LA	Baton Rouge, Indl. Elctrn. Supp.	504-926-0513
LA	Lafayette, Ralph's of Lafayette	318-234-4507
LA	Shreveport, Indl. Elctrn. Supp.	318-222-9459
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Baltimore, Hall-Mark Elctrns.	301-796-9300
MD	Columbia, Powell Elctrn.	301-621-4070
MD	Columbia, Hamilton/Avnet Elctrns.	301-995-3500
MD	Gaithersburg, Pioneer/Washington	301-948-0710
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MD	Timonium, Zebra Elctrns.	301-252-6576
MA	Billerica, Kierulff Elctrns.	617-935-5134
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Radio Supp.	617-329-2400
MA	Woburn, Hall-Mark Elctrns.	617-935-9777
MA	Woburn, Arrow Elctrns.	617-933-8130
MA	Woburn, Hamilton/Avnet Elctrns.	617-935-9700
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Ann Arbor, Wedemeyer Elec. Supp.	313-665-8611
MI	Grand Rapids, Hamilton/Avnet Elctrns.	616-243-8805
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	Livonia, R.S. Elect. Corp.	313-525-1155
MI	Livonia, Hamilton/Avnet Elctrns.	313-522-4700
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Bloomington, Hall-Mark Elect.	612-854-3223
MN	Edina, Kierulff Elctrns.	612-941-7500
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minnetonka, Hamilton/Avnet Elctrns.	612-932-0600
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	Earth City, Hamilton/Avnet Elctrns.	314-344-1200
MO	Maryland Hgts., Kierulff Elctrns.	314-739-0855
MO	Maryland Hgts., Hall-Mark Elect.	314-291-5350
MO	St. Louis, Arrow Elctrns.	314-567-6888
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NE	Omaha, Scott Elctrn. Supp.	402-734-6750
NH	Manchester, Arrow Elect.	603-668-6968
NJ	Cherry Hill, Hall-Mark Elctrns.	609-424-0880
NJ	Cherry Hill, Hamilton/Avnet Elctrns.	609-424-0100

NJ	Fairfield, Hall-Mark Elctrns.	201-575-4415
NJ	Fairfield, Kierulff Elctrns.	201-575-6750
NJ	Fairfield, Hamilton/Avnet Elctrns.	201-575-3390
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Hanover, State Elec. Parts Corp.	201-887-2550
NJ	Marlton, Arrow Elctrns.	609-596-8000
NJ	Moorestown, Arrow Elect.	609-235-1900
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NM	Albuquerque, Hamilton/Avnet Elctrns.	505-765-1500
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Binghamton, Harvey Elctrns.	607-748-8211
NY	Buffalo, Summit Dist.	716-884-3450
NY	East Syracuse, Hamilton/Avnet Elctrns.	315-437-2641
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Jaco Elect.	516-273-5500
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Melville, Hamilton/Avnet Elctrns.	516-454-6060
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Rochester, Simcona Elctrns. Corp.	716-328-3230
NY	Rochester, Hamilton/Avnet Elctrns.	716-475-9130
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600
NY	Ronkonkoma, Conco Elctrns. Corp.	516-467-8200
NC	Cary, Powell Elctrns.	919-467-1212
NC	Greensboro, Kierulff Elctrns.	919-852-9440
NC	Greensboro, Hammond Elec. of Carolina	919-275-6391
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Raleigh, Hamilton/Avnet Elctrns.	919-829-8030
NC	Raleigh, Hall-Mark Elect.	919-872-0712
NC	Winston-Salem, Arrow Elect.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cincinnati, Hall-Mark Elctrns.	513-563-5980
OH	Cincinnati, Hughes Peters, Inc.	513-351-2000
OH	Cleveland, Newark Elctrns.	216-447-8860
OH	Cleveland, Hamilton/Avnet Elctrns.	216-831-3500
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Columbus, Hughes Peters, Inc.	614-294-5351
OH	Dayton, Hamilton/Avnet Elctrns.	513-433-6010
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Highland Hgts., Hall-Mark Elctrns.	216-473-2907
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OH	Solon, Arrow Elctrns.	216-248-3990
OH	Westerville, Hall-Mark Elctrns.	614-891-4555
OK	Oklahoma City, Trice Wholesale Elctrns.	405-524-4411
OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
OR	Lake Oswego, Hamilton/Avnet Elctrns.	503-635-8157
OR	Portland, Kierulff Elctrns.	503-641-9150
OR	Tigard, Arrow Elctrns.	503-684-1690
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
PA	Pittsburgh, CAM/RPC	412-782-3770
PA	Wayne, Peak Elect.	215-293-9000
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Austin, Hall-Mark Elect.	512-258-8848
TX	Austin, Hamilton/Avnet Elctrns.	512-837-8911
TX	Dallas, Kierulff Elctrns.	214-343-2400
TX	Dallas, Intl. Elctrns.	214-233-9323
TX	Dallas, R. V. Weatherford Co.	214-980-1110
TX	Dallas, Hall-Mark Elctrns.	214-341-1147
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	El Paso, Intl. Elctrns.	915-778-9761
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Hamilton/Avnet Elctrns.	713-780-1771
TX	Houston, R. V. Weatherford Co.	713-688-7406
TX	Houston, Hall-Mark Elctrns.	713-781-6100
TX	Irving, Hamilton/Avnet Elctrns.	214-659-4111
TX	Richardson, Fisher Brownell	214-235-3177
TX	Stafford, Harrison Equip.	713-879-2729
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Kierulff Elctrns.	801-973-6913
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
UT	Salt Lake City, Hamilton/Avnet Elctrns.	801-972-4300
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Bellevue, Arrow Elctrns.	206-643-4800
WA	Bellevue, Hamilton/Avnet Elctrns.	206-643-3950
WA	Bellevue, Wyle Dist. Grp.	206-453-8300
WA	Bellevue, Almac/Stroum Elctrns.	206-643-9992
WA	Seattle, R. V. Weatherford Co.	206-243-6340
WA	Tukwila, Kierulff Elctrns.	206-575-4420
WI	Madison, Arrow Elctrns.	608-273-4977
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	New Berlin, Hamilton/Avnet Elctrns.	414-784-4510
WI	Oak Creek, Hall-Mark Elctrns.	414-761-3000
WI	Oak Creek, Arrow Elctrn.	414-764-6600

TRW CYLINDRICAL CONNECTOR DIV., TRW Electronic Components Grp., 8821 Science Center Dr., Minneapolis, MN 55428, Tel: 612-537-1010, TWX: 910-576-2748; *Sls. Mgr.:* Gene Schmidt; *Dist. Mgr.:* Gene Schmidt .... 2•1716-1735

Local Sales Offices & Reps

AL	Huntsville, TRW/ECG	205-533-7600
AZ	Scottsdale, TRW/ECG	602-994-0441
CA	Los Angeles, ISDS	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, ISDS	714-571-1544
CA	Santa Ana, ISDS	714-973-2162
CA	Woodland Hills, ISDS	213-883-7130
CO	Westminster, Straube Assocs.	303-426-0890
CT	Rowayton, TRW/ECG	203-853-4466
FL	Ft. Lauderdale, TRW/ECG	305-772-3000
FL	Orlando, TRW/ECG	305-857-3650
GA	Norcross, TRW/ECG	404-447-6154
IL	Chicago, TRW/ECG	312-693-7730
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	De Soto, Midtec Assocs.	913-441-6565
KY	Louisville, R. O. Whitesell & Assocs.	502-426-7696
MA	Framingham, TRW/ECG	617-620-0625
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, TRW/ECG	612-854-6616
MO	St. Louis, J. G. Macke Co.	314-432-2830
NY	Rochester, TRW/ECG	716-424-2830
NC	Greensboro, TRW/ECG	919-852-4676
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Tigard, TRW/ECG	503-620-5032
PA	Bala Cynwyd, TRW/ECG	215-667-3400
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-963-6161
TN	Greeneville, R. O. Whitesell & Assocs.	615-639-6154
TX	Austin, TRW/ECG	512-345-2331
TX	Dallas, TRW/ECG	214-248-8000
TX	El Paso, TRW/ECG	915-594-8259
TX	El Paso, Straube Assocs.	915-594-8259
TX	Houston, TRW/ECG	713-772-5541
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Richmond, TRW/ECG	804-288-8334
WA	Bellevue, TRW/ECG	206-641-9996
WI	Brookfield, TRW/ECG	414-784-7773

Local Distributors

CA	Brea, Aeroflite	714-773-4251
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Newport Beach, Arrow Elctrns.	714-851-8961
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CO	Denver, Arrow Elctrns.	303-758-2100
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Palm Bay, Arrow Elctrns.	305-725-1480
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Chicago, Electronic Connector	312-767-2200
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
MD	Baltimore, Arrow Elctrns.	301-247-5200
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MN	Edina, Arrow Elctrns.	612-830-1800
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Ronkonkoma, Conco	516-467-8200
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Solon, Arrow Elctrns.	216-248-3990
PA	Monroeville, Arrow Elctrns.	412-856-7000
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Dallas, Hall-Mark	214-341-1147
TX	Houston, Hall-Mark	713-781-6100
TX	Stafford, Arrow Elctrns.	713-491-4100
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
WA	Bellevue, Arrow Elctrns.	206-643-4800
WI	Madison, Arrow Elctrns.	608-273-4977
WI	Oak Creek, Arrow Elctrns.	414-764-6600

TRW, Dynalco Controls Div., 5200 NW 37th, P.O. Box 8187, Ft. Lauderdale, FL 33310, Tel: 305-739-4300, Telex: 514833; Empl.: 125; *Sls. Mgr.:* Kurlin Wilson; *Dist. Mgr.:* Joe Stephens

TRW ELECTRONIC COMPONENTS GRP., 2525 E. El Segundo Blvd., El Segundo, CA 90245, Tel: 213-536-0600

TRW FIBER OPTIC PRODS., CONNECTOR DIV., TRW Elctrn. Comps. Grp., 401 N. Broad St., Philadelphia, PA 19108, Tel: 215-922-8900, TWX: 710-670-2286; *Sls. Mgr.:* James Finnerfock .... 2•1693, 1694

TRW INDUCTIVE PRODUCTS DIV., 150 Varick St., New York, NY 10013, Tel: 212-255-3500, TWX: 710-581-2722; Empl.: 325; *Sls. Mgr.:* A. Profeta .... 1A•1298-1305, 1642, 2338-2363

Local Sales Offices & Reps

AL	Huntsville, TRW/ECG	205-533-7600
AZ	Scottsdale, TRW/ECG	602-994-0441
CA	Los Angeles, Integrated Sls.	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Integrated	619-571-1544
CA	Santa Ana, Integrated	714-973-2162
CA	Woodland Hills, Integrated Sls.	213-883-7130
CO	Westminster, Straube Assocs.	303-426-0890
CT	Rowayton, TRW/ECG	203-853-4466
FL	Fort Lauderdale, TRW/ECG	305-772-3000
FL	Orlando, TRW/ECG	305-857-3650
GA	Norcross, TRW/ECG	404-447-6154
IL	Chicago, TRW/ECG	312-693-7730
IN	Fort Wayne, R.O. Whitesell Assoc.	219-432-5591
IN	Indianapolis, R.O. Whitesell Assoc.	317-359-9283
IN	Kokomo, R.O. Whitesell Assoc.	317-457-9127
IA	Cedar Rapids, C.H. Horn & Assocs.	319-393-8703
KS	DeSoto, Midtec Assocs.	913-441-6565
KY	Louisville, R.O. Whitesell Assoc.	502-426-7696
MD	Columbia, TRW/ECG	301-964-9110
MA	Framingham, TRW/ECG	617-620-0625
MI	Grand Rapids, R.O. Whitesell Assoc.	616-942-5420
MI	Southfield, R.O. Whitesell Assoc.	313-559-5454
MI	St. Joseph, R.O. Whitesell Assoc.	616-983-7337
MN	Minneapolis, TRW/ECG	612-854-6616
MO	St. Louis, John G. Macke Co.	314-432-2830
NJ	Rowayton, TRW/ECG	203-853-4466
NM	El Paso, S.W. Sales	915-594-8259
NY	Fairport, TRW/ECG	716-425-3775
NY	Rowayton, Conn., TRW/ECG	203-853-4466
NC	Greensboro, TRW/ECG	919-852-4676
OH	Cincinnati, R.O. Whitesell Assoc.	513-521-2290
OH	Cleveland, R. O. Whitesell Assoc.	216-447-9020
OH	Columbus, R.O. Whitesell Assoc.	614-888-9396
OH	Dayton, R.O. Whitesell Assoc.	513-298-9546
OR	Portland, TRW/ECG	503-620-5032
PA	Bala Cynwyd, TRW/ECG	215-667-3400
PA	Pittsburgh, R.O. Whitesell Assoc.	412-963-6161
TN	Greeneville, R.O. Whitesell Assoc.	615-639-6154
TX	Austin, Technology Sls. Co.	512-345-2331
TX	Dallas, TRW/ECG	214-248-8000
TX	El Paso, S.W. Sls.	915-594-8259
TX	Houston, TRW/ECG	713-772-5541
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Richmond, TRW/ECG	804-288-8334
WA	Bellevue, TRW/ECG	206-641-9996
WI	Brookfield, TRW/ECG	414-784-7773
EXP	PR, Rio Piedras, Elctrn. Sls. Assocs.	809-769-2911

Local Distributors

AZ	Tempe, Arrow	602-968-4800
CA	Chatsworth, Arrow	213-701-7500
CA	El Segundo, Hall-Mark	213-643-9101
CA	Garden Grove, Bell	714-220-0681
CA	San Diego, Arrow	619-565-4800
CA	San Diego, Weatherford	619-695-1700
CA	San Diego, Hall-Mark	619-268-1201
CA	San Jose, Hall-Mark	408-946-0900
CA	San Jose, Irvine	714-540-5600
CA	Sunnyvale, Arrow	
CA	Sunnyvale, Weatherford	408-738-8694
CO	Denver, Weatherford	303-428-6900
CT	Wallingford, Arrow	203-265-7741
FL	St. Petersburg, Hall-Mark	813-576-8691
IL	Schaumburg, Arrow	312-397-3440
IN	Indianapolis, Pioneer/Indiana	317-849-7300
IN	Indianapolis, Arrow	317-243-9353
MD	Columbia, Hall-Mark	301-988-9800
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MA	Hall-Mark, Woburn	617-935-9777
MN	Minneapolis, Newark	612-331-6350
NJ	Cherry Hill, Hall-Mark	609-424-7300
NJ	Fairfield, Hall-Mark	201-575-4415
NJ	Fairfield, Arrow	201-575-5300
NJ	Malton, Arrow	609-596-8000
NM	Albuquerque, International Elctrns.	505-345-8127
NY	Rochester, Newark	716-473-6600
NC	Charlotte, Pioneer/Carolina	704-527-8188
NC	Hall-Mark, Arrow	919-872-0712
NC	Raleigh, Arrow	919-876-3132

OH	Centerville, Arrow	513-435-5563
OH	Valley View, Newark	216-447-8860
OH	Westerville, Hall-Mark	614-891-4555
OR	Tigard, Arrow	503-684-1690
TX	Addison, Weatherford	214-931-7333
TX	Austin, Arrow	512-835-4180
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Hall-Mark	214-341-1147
TX	El Paso, International Elctrns.	915-598-3406
TX	Garland, Newark	214-487-8144
WA	Bellevue, Arrow	206-643-4800

TRW LSI PRODUCTS, PO Box 2472, La Jolla, CA 92038, Tel: 619-457-1000, Telex: 697957, TWX: 910-335-1571; Empl.: 400; *Sls. Mgr.:* Doug Turnage; *Dist. Mgr.:* Ron Courtois

TRW MICROWAVE, 825 Stewart Dr., Sunnyvale, CA 94086, Tel: 408-732-0880, TWX: 910-339-9207; FSC No.: 21847; Empl.: 600; *Sls. Mgr.:* J. Moore

TRW MOTOR DIVISION, Industrial/Commerical Products, Napierfjeld Road, Postal Route 6, Box M-30A, Dothan, AL 36303, Tel: 205-983-3542, Telex: 810-744-1000; *Sls. Mgr.:* Dave Hall .... 1B•1120

TRW MOTOR DIV. (MILITARY), 2275 Stanley Ave., Dayton, OH 45404, Tel: 513-228-3171, Telex: 288-224, TWX: 810-459-1642; Empl.: 580; *Sls. Mgr.:* Bill Pelfrey; *Dist. Mgr.:* Tom Coyle .... 1B•1186-1204; 2•1852, 1853

Local Sales Offices & Reps

AL	Huntsville, TRW/ECG	205-533-7600
AZ	Scottsdale, TRW/ECG	602-994-0441
CA	Los Angeles, Integrated Sls.	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Integrated Sls.	619-571-1544
CA	Santa Ana, Integrated Sls.	714-973-2162
CA	Woodland Hills, Integrated Sls.	213-883-7130
CO	Westminster, Straube Assocs.	303-426-0890
CT	Rowayton, TRW/ECG	203-853-4466
FL	Ft. Lauderdale, TRW/ECG	305-772-3000
FL	Orlando, TRW/ECG	305-857-3650
GA	Norcross, TRW/ECG	404-447-6154
IL	Chicago, TRW/ECG	312-693-7730
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	De Soto, Midtec Assoc.	913-441-6565
KY	Louisville, R. O. Whitesell & Assocs.	502-426-7696
MD	Baltimore, TRW/ECG	301 964-9110
MA	Framingham, TRW/ECG	617-620-0625
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, TRW/ECG	612-854-6616
MO	St. Louis, John G. Macke Co.	314-432-2830
NY	Fairport, TRW/ECG	716-425-3775
NC	Greensboro, TRW/ECG	919-852-4676
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Tigard, N. R. Schultz Co.	503-620-5032
PA	Bala Cynwyd, TRW/ECG	215-667-3400
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-963-6161
TN	Greeneville, R. O. Whitesell & Assocs.	615-639-6154
TX	Austin, Technlg. Sls.	512-346-9940
TX	Dallas, TRW/ECG	214-248-8000
TX	El Paso, TRW/ECG	915-594-8259
TX	Houston, TRW/ECG	713-772-5541
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Richmond, TRW/ECG	804-288-8334
WA	Bellevue, TRW/ECG	206-641-9996
WI	Brookfield, TRW/ECG	414-784-7773

Local Distributors

AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Huntsville, Arrow Elctrns.	205-882-2730
AL	Huntsville, Hallmark Elctrns.	205-837-8700
AZ	Phoenix, Hallmark Electronics	602-243-6601
AZ	Tempe, Fisher Brownell	602-967-1464
AZ	Tempe, Arrow Elctrns.	602-968-4800
AZ	Tempe, Hamilton/Avnet Elctrns.	602-231-5100
CA	Alhambra, Fisher Brownell	213-289-0255
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Chatsworth, Avnet Elctrns.	213-700-2600
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Culver City, Hamilton/Avnet Elctrns.	213-558-2252
CA	El Segundo, Hallmark Elctrns.	213-643-9101
CA	Sacramento, Hamilton/Avnet Elctrns.	916-925-2216
CA	San Diego, Hallmark Elctrns.	619-268-1201
CA	San Diego, Fisher Brownell	619-560-8545
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Diego, Hamilton/Avnet Elctrns.	619-571-7510
CA	San Jose, Hallmark Elctrns.	408-946-2575
CA	Santa Clara, Fisher Brownell	408-988-6041
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Sunnyvale, Hallmark Elctrns.	408-946-0900
CA	Sunnyvale, Hamilton/Avnet Elctrns.	408-743-3355
CA	Tustin, Arrow Elctrns.	714-838-5422
CO	Aurora, Arrow Elctrns.	303-696-1111
CO	Englewood, Hallmark Elctrns.	303-790-1662
CO	Englewood, Hamilton/Avnet Elctrns.	303-740-1000
CT	Danbury, Hamilton/Avnet Elctrns.	203-797-2800
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Clearwater, Hallmark Elctrns.	813-530-4543
FL	Ft. Lauderdale, Hamilton/Avnet Elctrns.	305-971-2900
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Ft. Lauderdale, Hallmark Elctrns.	305-971-9280
FL	Orlando, Hallmark Elctrns.	305-855-4020
FL	Palm Bay, Arrow Elctrns.	305-725-1480
FL	St. Petersburg, Hamilton/Avnet Elctrns.	813-576-3930
FL	Winter Park, Hamilton/Avnet Elctrns.	305-628-3888
GA	Norcross, Hamilton/Avnet Elctrns.	404-447-7507
GA	Norcross, Hallmark Elctrns.	404-447-8000
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Bensenville, Hamilton/Avnet Elctrns.	312-860-7700
IL	Bensenville, Hallmark Elctrns.	312-860-3800
IL	Elk Grove Village, Pioneer/Chicago	312-437-9680
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Carmel, Hamilton/Avnet Elctrns.	317-844-9333
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, Pioneer/Indiana	317-849-7300
KS	Lenexa, Hallmark Elctrns.	913-888-4747
KS	Overland Park, Hamilton/Avnet Elctrns.	913-888-8900
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Bethesda, Arrow Elctrns.	301-564-3000
MD	Columbia, Hallmark Elctrns.	301 988-9800
MD	Columbia, Hamilton/Avnet Elctrns.	301-995-3500
MA	Woburn, Hallmark Elctrns.	617-935-9777
MA	Woburn, Arrow Elctrns.	617-933-8130
MA	Woburn, Hamilton/Avnet Elctrns.	617-273-7500
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Grand Rapids, Hamilton/Avnet Elctrns.	616-243-8805
MI	Livonia, Pioneer/Michigan	313-525-1800
MI	Livonia, Hamilton/Avnet Elctrns.	313-522-4700
MN	Bloomington, Hallmark Elctrns.	612-854-3223
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minnetonka, Pioneer/Twin Cities	612-935-5444
MN	Minnetonka, Hamilton/Avnet Elctrns.	612-932-0600
MO	Earth City, Hamilton/Avnet Elctrns.	314-344-1200
MO	Maryland Heights, Hallmark Elctrns.	314-291-5350
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Cherry Hill, Hallmark Elctrns.	609-424-7300
NJ	Cherry Hill, Hamilton/Avnet Elctrns.	609-424-0100
NJ	Fairfield, Hamilton/Avnet Elctrns.	201-575-3390
NJ	Fairfield, Hallmark Elctrns.	201-575-4415
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Marlton, Arrow Elctrns.	609-596-8000
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NM	Albuquerque, Hamilton/Avnet Elctrns.	505-765-1500
NY	E. Syracuse, Hamilton/Avnet Elctrns.	315-437-2641
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Hamilton/Avnet Elctrns.	516-434-7421
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Rochester, Hamilton/Avnet Elctrns.	716-475-9130
NY	Rochester, Arrow Elctrns.	716-427-0300
NY	Ronkonkoma, Hallmark Elctrns.	516-737-0600
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Raleigh, Hallmark Elctrns.	919-872-0712
NC	Raleigh, Hamilton/Avnet Elctrns.	919-878-0819
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cincinnati, Hallmark Elctrns.	513-563-2980
OH	Cleveland, Hamilton/Avnet Elctrns.	216-831-3500
OH	Cleveland, Pioneer/Cleveland	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Dayton, Hamilton/Avnet Elctrns.	513-443-0610
OH	Solon, Arrow Elctrns.	216-248-3990
OH	Solon, Hallmark Elctrns.	216-349-4632
OH	Westerville, Hallmark Elctrns.	614-891-4555
OK	Tulsa, Hallmark Elctrns.	918-665-3200
OR	Lake Oswego, Hamilton/Avnet Elctrns.	503-635-8157
OR	Tigard, Arrow Elctrns.	503-684-1690
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Pittsburgh, Pioneer/Pittsburgh	412-782-2300
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Austin, Hallmark Elctrns.	512-258-8848
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Houston, Hamilton/Avnet Elctrns.	713-780-1771
TX	Houston, Hallmark Elctrns.	713-781-6100
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Irving, Hamilton/Avnet Elctrns.	214-659-4111
TX	Richardson, Fisher Brownell	214-235-3177
UT	Salt Lake City, Hamilton/Avnet Elctrns.	801-972-2800
WA	Bellevue, Hamilton/Avnet Elctrns.	206-643-3950
WA	Bellevue, Arrow Elctrns.	206-643-4800
WI	New Berlin, Hamilton/Avnet Elctrns.	414-784-4510
WI	Oak Creek, Arrow Elctrns.	414-764-6600
WI	Oak Creek, Hallmark Elctrns.	414-761-3000

TRW OPTOELECTRONICS DIV., 1201 Tappan Circle, Carrollton, TX 75006, Tel: 214-323-2200, TWX: 910-860-5958; *Sls. Mgr.:* Ron Komatz; *Dist. Mgr.:* Robert Linker .... 1B•1235 -1252

Local Sales Offices & Reps

AL	Huntsville, TRW/ECG	205-533-7600
AZ	Scottsdale, TRW/ECG	602-994-0441
CA	Los Angeles, Integrated Sys. & Device Sls.	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Integrated Sys. & Device Sls.	619-571-1544
CA	Santa Ana, Integrated Sys. & Device Sls.	714-973-2162
CA	Woodland Hills, Integrated Sys. & Device Sls.	213-883-7130
CO	Westminster, Straube Assocs.	303-426-0890
CT	Rowayton, TRW/ECG	203-853-4466
FL	Ft. Lauderdale, TRW/ECG	305-772-3000
FL	Orlando, TRW/ECG	305-857-3650
GA	Norcross, TRW/ECG	404-447-6154
IL	Chicago, TRW/ECG	312-693-7730
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-359-9238
IN	Kokomo, Robert O. Whitesell	317-457-9127
IA	Cedar Rapids, C. H. Horne & Assocs.	319-393-8703
KS	DeSoto, MIDTEC Assocs.	913-441-6565
KY	Louisville, Robert O. Whitesell	502-426-7696
MD	Columbia, TRW/ECG	301-964-9110
MA	Framingham, TRW/ECG	617-620-0625
MA	Maynard, Byrne Assoc.	617-897-3131
MI	Farmington Hills, TRW/ECG	313-478-7210
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-559-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Minneapolis, TRW/ECG	612-854-6616
MO	St. Louis, John G. Macke Co.	314-432-2830
NM	Albuquerque, S. W. Sales	505-883-1388
NY	Fairport, TRW/ECG	716-425-3775
NC	Greensboro, TRW/ECG	919-852-4676
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Tigard, TRW/ECG	503-620-5032
PA	Bala Cynwyd, TRW/ECG	215-667-3400
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
TN	Greenville, Robert O. Whitesell	615-639-6154
TX	Austin, Technology Sls. Co.	512-346-9940
TX	Dallas, TRW/ECG	214-248-8000
TX	El Paso, S.W. Sls.	915-594-8259
TX	Houston, TRW/ECG	713-772-5541
UT	Salt Lake City, Straube Assoc.	801-263-2640
VA	Richmond, TRW/ECG	804-288-8334
WA	Bellevue, TRW/ECG	206-641-9996
WI	Brookfield, TRW/ECG	414-784-7773
PR	Rio Piedras, Electronics Sls. Assoc.	809-769-2911

Local Distributors

AL	Huntsville, Arrow Elctrns.	205-882-2730
AL	Huntsville, Hamilton-Avnet	205-837-7210
AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Tempe, Fisher/Brownell	602-967-1464
AZ	Tempe, Hamilton-Avnet	602-231-5100
AZ	Tempe, Arrow Elctrns.	602-968-4800
CA	Alhambra, Fisher/Brownell	213-289-0255
CA	Chatsworth, Anthem Elctrns.	213-700-1000
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Chatsworth, Integrated Elctrns. Corp.	213-998-2200
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4100
CA	Culver City, Hamilton Electro Sls.	213-558-2121
CA	El Segundo, Hall-Mark Elctrns.	213-643-9101
CA	Garden Grove, Bell Inds.	714-220-0681
CA	Gardena, Bell Inds.	213-515-1800
CA	Manhattan Beach, Prime Electro	213-379-3642

CA	Sacramento, Hamilton-Avnet	916-925-2216
CA	San Diego, Hamilton-Avnet	619-571-7510
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Diego, Anthem Elctrns.	619-279-5200
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Fisher/Brownell	619-560-8545
CA	Santa Ana, Pacesetter Elctrns.	714-557-7131
CA	Santa Clara, Fisher/Brownell	408-988-6041
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Hamilton-Avnet	408-743-3355
CA	Sunnyvale, Pacesetter Elctrns.	408-734-5470
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Tustin, Anthem Elctrns.	714-730-8000
CA	Tustin, Arrow Elctrns.	714-851-8961
CA	Woodland Hills, Avnet Elctrns.	213-883-0000
CO	Aurora, Arrow Elctrns.	303-696-1111
CO	Englewood, Hamilton-Avnet	303-740-1000
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Danbury, Hamilton-Avnet	203-797-2800
CT	Wallingford, Arrow Elctrns.	303-740-1000
FL	Altamonte Spring, Pioneer Elctrns.	305-834-9090
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Ft. Lauderdale, Pioneer Elctrns.	305-771-7520
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
FL	Orlando, Chip Supp. Co.	305-298-7100
FL	Palm Bay, Arrow Elctrns.	305-725-1480
FL	Winter Park, Hamilton-Avnet	305-628-3888
GA	Norcross, Pioneer Elctrns.	404-448-1711
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Hamilton-Avnet	404-447-7507
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Bensenville, Hall-Mark Elctrns.	312-806-3800
IL	Bensenville, Hamilton-Avnet	312-860-7700
IL	Elk Grove Vlg., Pioneer Elctrns.	312-437-9680
IL	Lombard, R M Elctrns.	312-932-5150
IL	Northbrook, Classic Comps.	312-272-9650
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Carmel, Hamilton-Avnet	317-844-9333
IN	Indianapolis, Pioneer Elctrns.	317-849-7300
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, R M Elctrns.	317-247-9701
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
KS	Overland Park, Hamilton-Avnet	913-888-8900

TRIPLETT

PANEL METERS, VOM's & DIGITAL TEST EQUIPMENT

AUTHORIZED DISTRIBUTORS

METERMASTER

FOR

Panel Meters • Test Equipment • Components
Sales, Modifications, Repair and Calibration

METERMASTER LOCATIONS:

ARIZONA
Phoenix (602) 437-1425
Tucson (602) 792-3411
CALIFORNIA
Los Angeles (213) 685-4340
Palo Alto (415) 968-0313
San Diego (619) 560-4841
GEORGIA
Atlanta (404) 446-0166
ILLINOIS
Chicago (312) 593-8650
MASSACHUSETTS
Boston (617) 523-2580
MINNESOTA
Minneapolis (612) 332-6117
MISSOURI
St. Louis (314) 454-0241
NEW MEXICO
Albuquerque (505) 292-3330
OHIO
Cleveland (216) 651-4100
OKLAHOMA
Tulsa (918) 582-1444
PENNSYLVANIA
Pittsburgh (412) 261-4548
TEXAS
Austin (512) 473-8876
Dallas (214) 271-5671
Houston (713) 733-9814
WISCONSIN
Milwaukee (414) 643-0554
ALL OTHER STATES (800) 962-8128

MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Columbia, Hamilton-Avnet	301-995-3500
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MD	Gaithersburg, Pioneer Elctrns.	301-921-0660
MA	Newton, Greene-Shaw Elctrns.	617-969-8900
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Woburn, Hall-Mark Elctrns.	617-935-9777
MA	Woburn, Arrow Elctrns.	617-933-8130
MA	Woburn, Hamilton-Avnet	617-273-7500
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Grand Rapids, Hamilton-Avnet	616-243-8805
MI	Livonia, Hamilton-Avnet	313-522-4700
MI	Livonia, Pioneer Elctrns.	313-525-1800
MI	Wyoming, R M Elctrns.	616-531-9300
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minnetonka, Hamilton-Avnet	612-932-0600
MN	Minnetonka, Pioneer Elctrns.	612-935-5444
MO	Earth City, Hamilton-Avnet	314-344-1200
MO	Maryland Hts., Hall-Mark Elctrns.	314-291-5350
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Cherry Hill, Hamilton-Avnet	609-424-0100
NJ	Cherry Hill, Hall-Mark Elctrns.	609-424-7300
NJ	Fairfield, Hall-Mark Elctrns.	201-575-4415
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Fairfield, Hamilton-Avnet	201-575-3390
NJ	Marlton, Arrow Elctrns.	609-235-1900
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NM	Albuquerque, Hamilton-Avnet	505-765-1500
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	East Syracuse, Hamilton-Avnet	315-437-2641
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Melville, Hamilton-Avnet	516-454-6060
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Rochester, Hamilton-Avnet	716-475-9130
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600
NC	Charlotte, Pioneer Elctrns.	704-527-8188
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
NC	Raleigh, Hamilton-Avnet	919-878-0819
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cincinnati, Hall-Mark Elctrns.	513-563-5980
OH	Cleveland, Pioneer Elctrns.	216-587-3600
OH	Cleveland, Hamilton-Avnet	216-831-3500
OH	Dayton, Hamilton-Avnet	513-433-0610
OH	Dayton, Pioneer Elctrns.	513-237-9900
OH	Highland Heights, Hall-Mark Elctrns.	216-473-2907
OH	Solon, Arrow Elctrns.	216-248-3990
OH	Westerville, Hall-Mark Elctrns.	614-891-4555
OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
OK	Tulsa, Quality Comps.	918-664-8812
OR	Lake Oswego, Hamilton-Avnet	503-635-8157
OR	Lake Oswego, Bell Inds.	503-241-4115
OR	Tigard, Arrow Elctrns.	503-684-1690
PA	Dallas, Arrow Elctrns.	214-386-7500
PA	Horsham, Pioneer Elctrns.	215-674-4000
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Pittsburgh, Pioneer Elctrns.	412-782-2300
TX	Addison, Quality Comps.	214-387-4949
TX	Austin, Hall-Mark Elctrns.	512-258-8848
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Austin, Pioneer Elctrns.	512-835-4000
TX	Austin, Quality Comps.	512-835-0220
TX	Austin, Hamilton-Avnet	512-837-8911
TX	Dallas, Hall-Mark Elctrns.	214-341-1147
TX	Dallas, Pioneer Elctrns.	214-386-7300
TX	Dallas, Intl. Elctrns.	214-233-9323
TX	El Paso, Intl. Elctrns.	915-598-3406
TX	Houston, Hamilton-Avnet	713-780-1711
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Houston, Pioneer Elctrns.	713-988-5555
TX	Houston, Hall-Mark Elctrns.	713-781-6100
TX	Irving, Hamilton-Avnet	214-659-4111
TX	Richardson, Fisher/Brown	214-235-3177
TX	Sugarland, Quality Comps.	713-491-2255
UT	Salt Lake City, Hamilton-Avnet	801-972-2800
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
UT	Salt Lake City, Bell Inds.	801-972-6969
VA	Richmond, Arrow Elctrns.	804-282-0413
WA	Bellevue, Hamilton-Avnet	206-453-5844
WA	Bellevue, Arrow Elctrns.	206-653-4800
WA	Bellevue, Bell Inds.	206-747-1515
WI	New Berlin, Classic Comps.	414-786-5300
WI	New Berlin, Hamilton-Avnet	414-784-4510
WI	Oak Creek, Hall-Mark Elctrns.	414-761-3000
WI	Oak Creek, Arrow Elctrns.	414-764-6600

TRW RESISTIVE PRODUCTS DIV., TRW Electronic Components Grp., 401 N. Broad St., Philadelphia, PA 19108, Tel: 215-922-8900, TWX: 710-670-2286; Empl.: 600; *Dist. Mgr.:* Hugh Bolen .... **1A**•1944-1991

Local Sales Offices & Reps

AL	Huntsville, TRW/ECG	205-533-7600
AZ	Scottsdale, TRW/ECG	602-994-0441
CA	Los Angeles, Integrated Sls.	213-478-0183
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Integrated Sls.	619-571-1544
CA	Santa Ana, Integrated Sls.	714-973-2162
CA	Woodland Hills, Integrated Sls.	213-883-7130
CO	Westminster, Straube Assocs.	303-426-0890
CT	Rowayton, TRW/ECG	203-853-4466
FL	Ft. Lauderdale, TRW/ECG	305-772-3000
FL	Orlando, TRW/ECG	305-857-3650
GA	Norcross, TRW/ECG	404-447-6154
IL	Chicago, TRW/ECG	312-693-7730
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	De Soto, Midtec Assocs.	913-441-6565
KY	Louisville, R. O. Whitesell & Assocs.	502-426-7696
MD	Columbia, TRW/ECG	301-964-9110
MA	Framingham, TRW/ECG	617-620-0625
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, TRW/ECG	612-854-6616
MO	St. Louis, Jack Macke Co.	314-432-2830
NY	Fairport, TRW/ECG	716-425-3775
NC	Greensboro, TRW/ECG	919-852-4676
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Portland, TRW/ECG	503-620-5032
PA	Bala Cynwyd, TRW/ECG	215-667-3400
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-963-6161
TN	Greeneville, R. O. Whitesell & Assocs.	615-639-6154
TX	Austin, Technlg. Sls. Co.	512-345-2331
TX	Dallas, TRW/ECG	214-248-8000
TX	El Paso, S. W. Sales	915-594-8259
TX	Houston, TRW/ECG	713-772-5541
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Richmond, TRW/ECG	804-288-8334
WA	Bellevue, TRW/ECG	206-641-9996
WI	Brookfield, TRW/ECG	414-784-7773

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
AL	Huntsville, Arrow Elctrns.	205-882-2730
AZ	Phoenix, R. V. Weatherford	602-272-7144
AZ	Phoenix, Hamilton/Avnet	602-231-5100
AZ	Phoenix, Kierulff	602-243-4101
AZ	Tempe, Arrow Electronics	602-968-4800
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tucson, Kierulff	602-624-9986
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Gardena, Bell Inds.	213-515-1800
CA	Glendale	213-849-3451
CA	Glendale, R. V. Weatherford	213-849-3451
CA	Los Angeles, Avnet	213-558-2345
CA	Los Angeles, Hamilton	213-558-2121
CA	Los Angeles, Kierulff	213-725-0325
CA	Orange County, Hamilton	714-641-4100
CA	Orange County, Arrow Electronics	714-838-5422
CA	Orange County, Avnet	714-754-6111
CA	Sacramento, Arrow Electronics	916-925-7456
CA	Sacramento, Hamilton/Avnet	916-925-2216
CA	San Diego, Hamilton/Avnet	619-571-7510
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	San Fernando Valley, Hamilton	213-558-2323
CA	San Fernando Valley, Avnet	818-700-2600
CA	San Francisco, Hamilton/Avnet	408-743-3355
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CO	Denver, Hamilton/Avnet	303-779-9998
CO	Denver, Arrow Elctrns.	303-758-2100

CO	Englewood, Intl. Elctrns.	303-740-2266
CT	Danbury, Hamilton/Avnet	203-797-2800
CT	Wallingford, Midan Elctrns.	203-265-2077
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Melbourne, Hamilton/Avnet	305-725-2700
FL	Miami, Hamilton/Avnet	305-971-2900
FL	Orlando, Hamilton/Avnet	305-628-3888
FL	Orlando, Kierulff	305-352-8475
FL	Palm Bay, Arrow Elctrns.	305-725-1480
FL	St. Petersburg, Hamilton/Avnet	813-576-3930
FL	Tampa, Impala Elctrns.	813-885-4747
GA	Atlanta, Hamilton/Avnet	404-447-7507
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Chicago, Hamilton/Avnet	312-860-7700
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Schaumburg, Arrow Elctrns.	312-893-9420
IN	Indianapolis, Hamilton/Avnet	317-844-9333
IN	Indianapolis, Arrow Elctrns.	317-243-9353
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
IA	Cedar Rapids, Deeco	319-365-7551
KS	Kansas City, Hamilton/Avnet	913-888-8900
KS	Wichita, Hamilton/Avnet	800-532-6702
KY	Lexington, Hamilton/Avnet	800-543-4783
KY	Louisville, Hamilton/Avnet	800-428-6012
MD	Baltimore, Hamilton/Avnet	301-995-3500
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Timonium, Zebra Elctrns.	301-252-6576
MA	Boston, Hamilton/Avnet	617-273-7500
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wilmington, R.C. Components	617-273-1860
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MI	Detroit, Hamilton/Avnet	313-522-4700
MI	Grand Rapids, Arrow Elctrns.	616-243-0912
MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Livonia, R.S. Elctrns.	313-525-1155
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, Hamilton/Avnet	612-932-0600
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	St. Louis, Hamilton/Avnet	314-344-1200
MO	St. Louis, Arrow Elctrns.	314-567-6888
NE	Lincoln, Hamilton/Avnet	800-255-6702
NE	Omaha, Hamilton/Avnet	800-255-6702
NH	Manchester, Arrow Elctrns.	603-668-6968
NH	Windham, Newark Elctrns.	603-893-6100
NJ	Cherry Hill, Hamilton/Avnet	609-424-0100
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Fairfield, Hamilton/Avnet	201-575-3390
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Marlton, Arrow Elctrns.	609-596-8000
NJ	Mountainside, Enox Resistors	201-654-7600
NM	Albuquerque, Hamilton/Avnet	505-765-1500
NM	Albuquerque, Intl. Elctrns.	505-345-8127
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Liverpool, Arrow Elctrns.	315-652-1000
NY	Melville, Hamilton/Avnet	516-454-6060
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Rochester, Hamilton/Avnet	716-475-9130
NY	Rochester, Arrow Elctrns.	716-275-0300
NY	Rochester, Rochester Radio	716-454-7800
NY	Syracuse, Hamilton/Avnet	315-437-2641
NC	Raleigh, Hamilton/Avnet	919-878-0810
NC	Raleigh, Resco/Raleigh	919-781-5700
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Cleveland, Hamilton/Avnet	216-831-3500
OH	Columbus, Electronic Mktg.	614-299-4161
OH	Dayton, Bell Inds.	513-434-8231
OH	Dayton, Hamilton/Avnet	513-433-0610
OH	Kettering, Elctrns. Mktg. Corp.	513-439-4711
OH	Solon, Arrow Elctrns.	216-248-3990
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Tulsa, Arrow Elctrns.	918-665-7700
OR	Portland, Hamilton/Avnet	503-635-8831
PA	Philadelphia, Hamilton/Avnet	215-831-1300
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
PA	Pittsburgh, Hamilton/Avnet	800-321-6890
PA	Pittsburgh, Arrow Elctrns.	412-351-4000
PA	Wayne, Peak Elctrns.	215-293-9000
SC	Columbia, Hamilton/Avnet	800-334-1597
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Austin, Hamilton/Avnet	512-837-8911
TX	Dallas, Hamilton/Avnet	214-659-4111
TX	Dallas, Intl. Elctrns.	214-233-9323
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Dallas, R. V. Weatherford	214-980-1110
TX	El Paso, Intl. Elctrns.	915-598-3406
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Houston, Hamilton/Avnet	713-780-1771
TX	Houston, R. V. Weatherford	713-688-7406
TX	Richardson, Jaco Elctrns.	214-235-9575
UT	Salt Lake City, Hamilton/Avnet	801-972-2800
UT	Salt Lake City, Arrow Elctrns.	801-539-1135
VA	Richmond, Arrow Elctrns.	804-282-0413
WA	Bellevue, Arrow Elctrns.	206-643-4800
WA	Seattle, Hamilton/Avnet	206-453-5844
WA	Seattle, Robert E. Priebe Co.	206-682-8242
WV	Charleston, Hamilton/Avnet	800-543-4783
WV	Huntington, Hamilton/Avnet	800-543-4783
WI	Madison, Arrow Elctrns.	608-273-4977
WI	Milwaukee, Hamilton/Avnet	414-784-4510
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Oak Creek, Arrow Elctrns.	414-764-6600

TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260, Tel: 213-536-0888, TWX: 910-325-6206; Empl.: 1000; *Sls. Mgr.:* D. Faigenblat; *Dist. Mgr.:* G. Vegvari

TRW UTC TRANSFORMERS, See TRW Inductive Products Div.

T S PRODUCTS, 12455 Brandford St., Unit 22, Arleta, CA 91331, Tel: 818-896-6676; *Sls. Mgr.:* Wm. Denzel; *Dist. Mgr.:* Wm. Denzel ....**3**•1119

TTE

TTE, INC., 2214 S. Barry Ave., Los Angeles, CA 90064, Tel: 213-478-8224; FSC No.: 07766; *Sls. Mgr.:* S. J. Sodaro ....**1A**•1632-1641

Local Sales Offices & Reps

CA	Culver City, Sodaro	213-478-7733

TTS-TELECOM TERMINAL SYSTEMS, 3877 Grandview Blvd., Los Angeles, CA 90066, Tel: 213-390-9494, Telex: 182405, TWX: 910-343-6453; Empl.: 18; *Sls. Mgr.:* L. Winters

TUCKER ELCTRNS., Box 461060, Garland, TX 75046, Tel: 214-348-8800, 800-527-4642, Telex: 79-1726; Empl.: 45; *Sls. Mgr.:* Clay Aclin

TUNGSTONE BATTERIES, INC., 18 Billings St., Sharon, MA 02067, Tel: 617-784-2000, Telex: 951908; Empl.: 8; *Sls. Mgr.:* J. McMahon

TURNER DESIGNS, 2247 Old Middlefield Way, Mountain View, CA 94043-2489, Tel: 415-965-9800; Empl.: 16; *Sls. Mgr.:* John Griffin

Local Sales Offices & Reps

CA	Garden Grove, Advanced Digital Grp.	714-897-0319
CA	Santa Clara, MANCO	408-496-6611
CO	Wheat Ridge, Active Component Technlg.	303-422-9229
MD	Baltimore, Rep-Tron, Inc.	301-799-7490
MA	North Reading, Martindale Assocs.	617-942-0514
NY	Fayetteville, Martin P. Andrews	315-637-5291
TX	Addison, Active Component Technlg.	214-980-1888
TX	Austin, Active Component Technlg.	512-452-5254

TUSONIX

TUSONIX, INC., 7741 N. Business Park Drive, P.O. Box 37144, Tucson, AZ 85740-7144, Tel: 602-744-0400, Telex: 102-299640, TWX: 310-299640; FSC No.: 59660; *Sls. Mgr.:* Robert H. Jones; *Dist. Mgr.:* John Hohlrich ....**1A**•1201-1207

Local Sales Offices & Reps

AZ	Tucson, Tusonix, Inc.	602-744-0400
CA	N. Hollywood, Tusonix	818-509-0449
CA	Redwood City, James S. Heaton Co.	415-367-9000
FL	Winter Park, Tusonix	305-647-2936
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MA	Andover, Richard Purinton Inc.	617-475-7055
NY	Rochester, Tusonix, Inc.	716-328-4070
NC	Greensboro, Tusonix	919-292-4286
OR	Portland, Components West	503-643-5588
WA	Renton, Components West	206-271-5252

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AZ	Tempe, Arrow Elctrns.	602-968-4800
CA	Chatsworth, Arrow Elctrns.	213-701-7500
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	Inglewood, Newark Electrns.	213-678-0441
CA	San Diego, Arrow Elctrns.	619-565-4800
CA	Sunnyvale, Powell Elctrns.	408-739-4321
CA	Sunnyvale, Arrow Elctrns.	408-745-6600
CA	Tustin, Arrow Elctrns.	714-838-5422
CO	Aurora, Arrow Elctrns.	303-696-1111
CO	Denver, Newark Elctrns.	303-423-7941
CT	Wallingford, Arrow Elctrns.	203-265-7741
FL	Dania, Summit	305-920-6253
FL	Ft. Lauderdale, Arrow Elctrns.	305-776-7790
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
FL	Palm Bay, Arrow Elctrns.	305-725-1480
GA	Norcross, Arrow Elctrns.	404-449-8252
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Arrow Elctrns.	317-243-9353
MD	Baltimore, RESCO	301-529-0500
MD	Baltimore, Arrow Elctrns.	301-247-5200
MD	Beltsville, RESCO	301-937-9100
MD	Beltsville, Powell Elctrns.	301-937-4030
MA	Westborough, Powell Elctrns.	617-366-6100
MA	Woburn, Arrow Elctrns.	617-933-8130
MI	Ann Arbor, Arrow Elctrns.	313-971-8220
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, Newark Electrns.	612-331-6350
MO	St. Louis, Arrow Elctrns.	314-567-6888
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Fairfield, Arrow Elctrns.	201-575-5300
NJ	Moorestown, Arrow Elctrns.	609-235-1900
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit	716-884-3450
NY	Hauppauge, Arrow Elctrns.	315-652-1000
NY	Hauppauge, Fairmont Elctrns. Sls.	516-231-3313
NY	Liverpool, Arrow Elctrns.	516-694-6800
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Rochester, Summit	716-334-8110
NY	Rochester, Arrow Elctrns.	716-275-0300
NC	Gary, Powell Elctrns.	919-467-1212
NC	Raleigh, RESCO	919-781-5700
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centerville, Arrow Elctrns.	513-435-5563
OH	Solon, Arrow Elctrns.	216-248-3990
OK	Tulsa, Altair	918-252-5781
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	Philadelphia, Powell Elctrns.	215-365-1900
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Dallas, Arrow Elctrns.	214-386-7500
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Houston, Altair	713-462-3029
TX	Irving, Powell Elctrns.	214-350-4186
TX	Richardson, Altair	214-231-5166
WA	Bellvue, Arrow Elctrns.	206-643-4800
WI	Oak Creek, Arrow Elctrns.	414-764-6600

TUSTIN ELCTRNS. CO., 1431 E. Saint Andrews Pl., Santa Ana, CA 92705, Tel: 714-549-0391; FSC No.: 7025-0010; *Sls. Mgr.:* Saul Tunkelrott

TWP, INC., 2133 4th St., Berkeley, CA 94710, Tel: 415-548-4434, Telex: 717-267; Empl.: 10; *Sls. Mgr.:* R. Moreno

TYCO INSTR. DIV., See Data Instrs.

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, TWX: 910-262-3094; *Sls. Mgr.:* Tom Bednar

Local Sales Offices & Reps

CA	Encinitas	619-692-3144
CA	Manhattan Beach	714-581-3334
CA	Palmdale	818-343-3527
CO	Denver	303-447-2141
FL	Lake Mary	305-323-0120
GA	Smyrna	404-433-8818
IL	Homewood	312-964-6225
IL	Plano	312-964-6225
IN	Noblesville	317-872-9573
MA	Sekonk	617-376-2166
MI	Holly	313-647-7399
MI	Ypsilanti	313-647-7399
MO	Grandview	314-344-9237
NJ	Middletown	201-671-7034
NY	E. Islip	516-277-6098
NY	Liverpool	315-422-7539
NC	Charlotte	704-376-5269
OH	Elyria	216-888-2800
PA	Drexel Hill	215-853-3330
TN	Nashville	615-747-5888
TX	Dallas	214-253-6611
TX	Humble	713-525-1713
WA	Alderwood Manor	206-622-3195
WI	Milwaukee	414-355-1130

UBER GRAFIC INSTRS., Box 4, Palo Alto, CA 94302, Tel: 415-327-4732; Empl.: 2

UCE, INC., 24 Fitch St., Norwalk, CT 06855, Tel: 203-838-7509; Empl.: 20; *Sls. Mgr.:* Richard Eicher

UID SWITCHES INC., Sub. of ITW, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, Telex: 4330130, TWX: 910-221-0275; *Sls. Mgr.:* R. Schmidt; *Dist. Mgr.:* R. Scrivner

ULTRA CARBON, Box X-747, Bay City, MI 48707, Tel: 517-894-2911, TWX: 810-265-1222; Empl.: 200; *Sls. Mgr.:* R. J. Anthony

ULTRONIX, INC., P.O. Box 1090, Grand Junction, CO 81502, Tel: 303-242-0810, TWX: 910-929-6965; FSC No.: 05347; Empl.: 220; *Sls. Mgr.:* Gerald Krebill; *Dist. Mgr.:* Gerald Krebill .... **1A**•1992-1999

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-276-0751
CA	Santa Clara, Westrep	408-988-8833
CO	Denver, West Inc.	303-692-0131
FL	Orlando, Donato & Assocs.	305-352-0727
FL	Palm Harbor, Donato & Assocs.	813-785-3327
GA	Atlanta, Remco	404-447-6937
IL	Elk Grove Village, Parcom	312-228-6360
IN	Ft. Wayne, Giesting & Assocs.	219-486-1912
IA	Cedar Rapids, Stan Clothier Co.	319-395-0245
KS	Parker, S. W. Wollard Co.	913-893-6552
MD	Beltsville, Applied Engrg. Consultants	301-792-2211
MA	Newton Upper Falls, Anchor Engrg.	617-964-6205
MI	Coloma, Giesting & Assoc.	616-468-4200
MI	Novi, Giesting & Assoc.	313-348-3811
MN	Minneapolis, S. Clothier Co.	612-944-3456
MO	St. Louis, Abrams & Assoc.	314-569-0447
NJ	Cherry Hill, Danco Corp.	609-424-5590
NY	Jericho, J-Square Mktg.	516-935-3200
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, Remco	919-847-5079
OH	Cincinnati, Giesting & Assoc.	513-521-8800
OH	Mentor, Giesting & Assocs.	216-942-3407
PA	Pittsburgh, Giesting & Assocs.	412-963-0727
TX	Austin, O. M. Sls.	512-452-1838
TX	Dallas, O. M. Sls.	214-241-3876
TX	Houston, O. M. Sls.	713-789-4426
UT	Salt Lake City, West Inc.	801-466-5739
WA	Bellevue, Vantage Corp.	206-455-3460
WA	Kent, R & R Assoc.	206-251-5396
EXP	CT, Stamford, Dage Corp.	203-324-3123

Local Distributors

CA	Chatsworth, IEC/JACO	213-998-2200
CA	North Hollywood, T.T.I., Inc.	213-982-0201
CA	Orange, IEC/JACO	714-540-5600
CA	Sacramento, IEC/JACO	916-424-5297
CA	San Fernando, Petell Electronics	213-365-3984
CA	San Jose, IEC/JACO	408-263-1100
CO	Denver, IEC/JACO	303-292-6121
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, T.T.I-2	305-859-1000
FL	Tampa, Impala Elctrns.	813-885-4747
IL	Chicago, IEC/JACO	312-843-2040
MD	Columbia, Azteck Elctrns.	301-995-1760
MA	Burlington, TLC Elctrns.	617-273-0140
MA	Woburn, T.T.I., Inc.	617-938-8800
NY	Bohemia, T.T.I., Inc.	516-567-1500
NY	Farmingdale, SAI, Inc.	516-293-2710
NY	Hauppauge, JACO	516-273-5500
NY	Valley Stream, L&S Elctrns.	800-645-2235
OH	Dayton, Electro-Line	513-461-5683
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Fort Worth, T.T.I., Inc.	800-433-7092
UT	Salt Lake City, IEC/JACO	801-298-1868
WA	Bellevue, Integrated Elctrns. Corp.	206-455-2727
WA	Kent, Shannon Ltd.	206-763-0545
WA	Seattle, IEC/JACO	206-455-2727

ULVAC NORTH AMERICA, P.O. Box 890, Kennebunk, ME 04043, Tel: 207-985-7169, TWX: 510-299-0007; Empl.: 600; *Sls. Mgr.:* C. Carman

UNARCO-ROHN, See UNR-Rohn

UNDERWRITERS SAFETY DEVICE, An Allied Co., 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-4600, TWX: 910-221-3474; Empl.: 200; *Sls. Mgr.:* J. A. VanCura; *Dist. Mgr.:* R. S. Heyne

UNGAR, Div. Eldon Inds., Inc., 100 W. Manville St., Compton, CA 90224-6005, Tel: 213-774-5950, Telex: 4720750 Eldon; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* George Mellevold

Local Sales Offices & Reps

AZ	Scottsdale, R.F. Rich & Assoc.	602-941-1475
CA	Gardena, Ungar Sls. Assocs.	213-538-2811
CA	Hawthorne, Eldon Inds.	213-642-7716
CA	Los Altos, Ewing-Foley	415-941-4525
CO	Colorado Springs, MID-MTI-REP	303-598-1369
CT	Woodstock, Neff Co.	203-974-1281
FL	Lauderdale Lakes, Seacom Sls.	305-486-0260
HI	Compton, Ungar	213-774-5950
IL	Chicago, Restronics	312-960-1205
IN	Indianapolis, Robert Milsk Co.	317-842-3400
KS	Kansas City, Thomas L. Dowell & Assoc.	913-648-7373
MA	Boston, Neff Co.	617-582-4216
MI	Southfield, R. Milsk Co.	313-354-3310
MN	Minneapolis, Restronics	612-941-9135
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NJ	Marlton, Fahy Mktg. Assocs.	609-983-2366
NY	Oceanside, Bittan Assocs.	516-678-6222
TX	Houston, Rich Sls.	713-695-9240
TX	Rockwall, Rich Sls.	214-257-0761
WA	Seattle, Sproul & Assoc.	206-789-3300
EXP	Inglewood, Eldon Industries, Inc.	213-642-7716

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, Telex: 643802; Empl.: 49

unibox® *PACKAGING SYSTEM*

UNIBOX, Div. of Amerex, P.O. Box 2815, Riverside, CA 92516, Tel: 714-686-1400; *Sls. Mgr.:* Roger Orton .... **2**•1005

UNICO, 3725 Nicholson Rd., Franksville, WI 53126-0505, Tel: 414-886-5678, TWX: 910-271-2385; Empl.: 175; *Sls. Mgr.:* A. L. Engle

UNICORN ENGRG. CO., Membrane Keyboard Div., 6201 Harwood Ave., Oakland, CA 94618, Tel: 415-428-1626; *Sls. Mgr.:* Steve Gensler

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700; FSC No.: 04729; Empl.: 50; *Sls. Mgr.:* B. Levine .... **2**•1868

Local Sales Offices & Reps

CT	Milford, Todino Engrg. Sls.	203-874-6643
CT	Stamford, George Reiss	203-348-0007
FL	Melbourne Beach, Brennan Assoc.	305-724-0854
IL	Palatine, Claeson Assocs.	312-359-7230
IN	Indianapolis, M&L Elctrn. Sls.	317-359-4742
MA	Needham Hgts., Todino Engrg. Sls.	617-444-7925
MI	Farmington, Amtech Rep.	313-474-8300
MN	Bloomington, Termatech	612-854-2001
OR	Portland, Frank Jackson Assocs.	503-292-2638
TX	Richardson, Precision Techn. Assocs.	214-234-8071
TX	Round Rock, Precision Techn. Assocs.	512-250-0201
WA	Seattle, Frank Jackson Assocs.	206-523-6300

UNIFORM TUBES, Collegeville, PA 19426, Tel: 215-539-0700, Telex: 84-6428, TWX: 510-660-6107; FSC No.: 93306; Empl.: 400; *Sls. Mgr.:* Lloyd Deery

UNILATOR TECHNICAL CERAMICS INC., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028, Tel: 213-463-5618, TWX: 910 321-2903; *Sls. Mgr.:* Norman R. Sutherland

Local Sales Offices & Reps

AL	Lake Guntersville, Kelley Sys.	205-582-8677
AZ	Tempe, Qualtech	602-967-4655
CA	Los Angeles, Yarbrough Sls. Co.	213-254-5101
FL	Tampa, APM Assocs.	813-886-2457
IL	La Grange Park, Bierhaus Sls.	312-354-5100
KS	Wichita, Electro Mechanical Assocs.	316-682-9433
MD	Baltimore, Stitzer Assocs.	301-823-2600
MA	Waltham, Carlisle Tech. Sls.	617-890-1456
MI	Union Lake, Ashby Assocs.	313-363-1100
MO	Bridgeton, Electro Mechanical Assocs.	314-291-8661
NH	Amherst, Carlisle Tech. Sls.	603-673-4690
NJ	Ridgewood, Ballou Inc.	212-964-4640
NM	Albuquerque, Qualtech	505-243-5605
NY	Rochester, R. P. Kennedy Co.	716-271-6322
OH	Dayton, Ashby Assocs.	513-252-5627
OH	Lyndhurst, Ashby Assocs.	216-461-0826
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Richardson, Eagle Mktg. Inc.	214-238-5383
WI	Elm Grove, Bierhaus Sls.	414-784-5212

UNIMAX SWITCH CORP., Ives Rd., Wallingford, CT 06492, Tel: 203-269-8701, Telex: 96-3485, TWX: 710-476-1397; FSC No.: 80207; Empl.: 300; *Dist. Mgr.:* Richard Brache .... **1B**•1756

Local Sales Offices & Reps

AZ	Phoenix, Mercury Engrg. Sls., Inc.	602-244-0123
CA	Brea, M. A. Stolaroff Co.	714-529-0866
CA	Los Altos, Ewing-Foley	415-941-4525
CA	Los Angeles, M. A. Stolaroff Co.	213-295-7781
CA	Santee, M. A. Stolaroff Co.	
CA	Simi Valley, M. A. Stolaroff Co.	
CO	Englewood, CompuTech Marketing	303-773-2981
CT	Ansonia, Zaslow Sls.	203-735-9581
CT	Bloomfield, Zaslow Sls.	203-242-7781
FL	Tampa, J. R. Controls	813-961-9478
IL	Lisle, Wasson-Gallagher	312-963-5954
IN	Ft. Wayne, O. H. Bromberg & Assocs.	219-744-1636
KY	Louisville, O. H. Bromberg & Assocs.	502-245-8916
LA	Metairie, Automation Supps.	504-831-2183
MD	Silver Spring, NKA, Inc.	301-585-6141
MD	Silver Spring, L. G. White & Co.	301-434-1555
MA	Northboro, Zaslow Sls.	617-393-8150
MA	Waltham, Zaslow Sls.	617-894-8393
MA	Watertown, Zaslow Sls. Co.	617-823-8118
MI	Grosse Pointe Park, Greiner Assoc.	313-499-0188
MN	Minneapolis, Jos-Co. Sls. Engrg.	612-861-3343
MO	Creve Coeur, Hill & Co.	314-432-1136
NH	Londonderry, Zaslow Sls.	603-432-8907
NJ	West Caldwell, Grimm, Siegel Assoc.	201-575-9300
NY	Ballston Lake, Nycom	518-899-4104
NY	E. Syracuse, Nycom	315-437-8343
NY	Williamsville, Nycom	
NC	Winston-Salem, L. G. White & Co.	919-725-3612
OH	Cincinnati, O. H. Bromberg & Assocs.	513-771-9333
OH	Dayton, O. H. Bromberg & Assocs.	513-434-8788
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Broomall, White-Whiddett	215-353-6343
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
SC	Greenville, Sunbelt Sls.	803-877-0771
SC	Greenville, L. G. White & Co.	803-271-0630
TN	Taft, Sunbelt Sls.	615-425-6164
TX	Arlington, W. Pat Fralia Co.	817-640-9101
VA	Richmond, L. G. White & Co.	804-740-7093
WA	Mercer Island, J. H. Andersen	206-232-0484

Local Distributors

AL	Decatur, Forbes Distr. Co.	205-353-4762
AL	Montgomery, Southern Controls	205-277-5030
AZ	Phoenix, Continental Light & Supp.	602-263-6000
AZ	Phoenix, Electro Comps.	602-258-2665
AR	Fort Smith, Southern Elec.	501-646-5500
CA	Belmont, Lodan Elctrns.	415-592-4600
CA	Belmont, Arndt Elctrns.	415-592-6718
CA	Covina, Selecta Switch	213-915-3409; 213-967-4123
CA	Fountain Valley, Components Ctr.	213-582-0667
CA	Gardena, California Switch & Signal	213-538-9830

CA	Los Angeles, Master Distrs.	213-829-4956
CA	Riverside, Electronic Supp.	714-683-7300
CA	Sacramento, Dunlap Elctrns.	916-442-5801
CA	Santa Clara, Cypress Elctrns.	408-727-7080
CA	Santa Monica, Master Distrs.	213-452-1229; 213-829-4656
CA	Van Nuys, Pacific Switch	213-873-4802
CO	Denver, Fistell's Elec. Supp.	303-629-1312
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	Manchester, Economy Elec. Supp.	203-646-2830
CT	W. Hartford, Atlantic Switch Controls	203-525-6907
FL	Hialeah, Atlas Elec. Supp.	305-885-8941
FL	Lakeland, Switch Controls	813-644-7564
FL	Largo, Lodan Elctrns.	813-586-2851
FL	Miami, Electronic Equip.	305-871-3500
IL	Arlington Hgts., LoDan	312-398-5311
IL	Chicago, Newark Elctrns.	312-638-4411
IL	Lombard, R.M. Elctrns.	312-932-5150
IL	Wheaton, Connectrix	312-653-1460; 800-323-9431
IA	West Des Moines, Ramco	515-225-6933
KY	Louisville, Main Elect. Equip.	502-587-6511
LA	Marrero, AFG Elctrns.	504-368-9696
LA	New Orleans, William B. Allen Supp.	504-525-8222
ME	Portland, Rockingham Elect. Supp.	207-772-4614
MA	Hingham, Sager Elec. Supp.	617-749-6700
MI	Augusta, Great Lakes Elctrns.	616-731-4156
MI	St. Claire Shores, Specialties Mfg. Co.	313-771-2700
MN	Minneapolis, Joel Co.	612-545-5669
MO	Maryland Hgts., Western Extralite	314-432-4560
NJ	Fair Lawn, Relay Specialities	201-797-3313
NJ	Mt. Laurel, Jerseyswitch	609-778-8190
NJ	Paterson, Feldman Brothers Elec. Supp.	201-742-7330
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Geneva, Gersh	315-789-4505
NY	Hempstead, Elctrn. Equip.	516-538-5510
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Sodus, AED Distrs.	315-483-6561
NY	Woodside, Switches Unltd.	212-478-5000
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Cincinnati, Cartessa Corp.	513-385-7700
OH	Cincinnati, Rilco	513-231-3400
OH	Columbus, Ohio Switch	614-885-0319
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Johnstone	503-231-4833
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Pittsburgh, Alder-tronics	412-821-5565
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Texaswitch	214-357-1768
TX	El Paso, Ideal Indl. Elctrn. Supp.	915-779-6647
TX	San Antonia, Purvis Bearing	512-299-1010
TX	Waco, Purvis Bearing	
TX	Waco, Hargis Co.	817-754-5667
VA	Alexandria, Techn. Distrs.	703-971-8979
VA	Roanoke, Peoples Elctrn. Supp.	703-342-8933
WI	Mequon, Taylor Elec.	414-241-4321

EVEREADY ENERGIZER®
UNION CARBIDE CORPORATION

UNION CARBIDE CORPORATION, Battery Prods. Div., Old Ridgebury Rd., Danbury, CT 06817, Tel: 203-794-5300 .... **3•**1434, 1435

Local Sales Offices & Reps

CA	San Francisco	415-765-1000
CT	Danbury, Military & Govt. App. Only	203-794-7547
GA	Norcross	404-446-2400
IL	Itasca	312-773-3444
NJ	Saddle Brook	201-845-5400
OH	Middleburg Hgts.	216-826-4444
TX	Dallas	214-241-9100

UNION CARBIDE CORP., ELCTRNS. DIV., Component Dept., Box 5928, Greenville, SC 29606, Tel: 803-963-6348, Telex: 57-0496, TWX: 810-287-2536; FSC No.: 31433; *Sls. Mgr.:* C. E. Volpe; *Dist. Mgr.:* J. A. Bruorton .... **1A•**1096-1118

Refer to Kemet, Union Carbide Corp., Elctrns. Div. for sales office information and for distributor listings.

UNION CARBIDE CORPORATION, Elctrns. Div., Crystal Prods. Dept., 9320 Chesapeake Dr., Ste. 104, San Diego, CA 92123, Tel: 619-279-4500, Telex: 695-465; Empl.: 125; *Sls. Mgr.:* J. J. Beeman

UNION ETCHANTS INTL., INC., 8-10 Green St., Bldg. G, Woburn, MA 01801, Tel: 617-935-8878

UNIQUE OPTICAL CO., Diversified Optical Corp., P.O. Box 585, Farmingdale, NY 11735, Tel: 516-420-0288, TWX: 510-224-6598

UNITED CHEMI-CON UNITED CHEMI-CON

UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 312-696-2000, Telex: 28-3557, TWX: 910-253-2964; Empl.: 50; *Sls. Mgr.:* Joe Tanney .... **1A•**1208, 1209

Local Sales Offices & Reps

AL	Huntsville, R. D. Whitesell	205-883-5110
AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Culver City, DeAngelo, Rothman Co.	213-827-2202
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, De Angelo, Rothman Co.	619-758-8129
CO	Westminster, Straube Assocs. Mountain States, Inc.	303-426-0890
FL	Altamonte Springs, Semtronic Assocs., Inc.	305-831-8233
FL	Clearwater, Semtronic Assocs., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs., Inc.	305-731-2484
ID	Boise, Cascade Comps., Inc.	208-343-9886
KY	Louisville, R. D. Whitesell	502-426-7696
MD	Baltimore, Pro-Rep, Inc.	301-653-3600
MA	Lexington, John E. Boeing Co., Inc.	617-862-2500
MN	Bloomington, Twist Co.	612-835-2120
NJ	Medford, Mack McCoy Inc.	609-953-0770
NM	Albuquerque, Straube Assocs. Mountain States, Inc.	303-426-0890
NY	Jamaica, S-J Assocs., Inc.	212-291-3232
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
OH	Cincinnati, Makin Assoc.	513-871-2424
OH	Cleveland, Makin & Assocs.	216-921-0080
OH	Columbus, Makin Assoc.	513-871-2424
OK	Tulsa, ION Assocs., Inc.	918-664-0186
OR	Portland, Earl & Brown	503-245-2283
PA	Dowington, Jack McCoy Inc.	215-363-0350
TN	Greeneville, R. D. Whitesell	615-639-6154
TX	Austin, ION Assocs., Inc.	512-346-7160
TX	Grand Prairie, ION Assocs., Inc.	214-647-8225
TX	Houston, ION Assocs., Inc.	713-977-4354
UT	Salt Lake City, Straube Assocs. Mountain States, Inc.	801-263-2640
WA	Seattle, Earl & Brown	206-284-1121
WI	Wauwatosa, Twist Co.	414-782-2670

Local Distributors

AL	Huntsville, Contact Elctrn. Inc.	205-881-9321
CA	Mountain View, Cornett Elctrns.	415-969-5420
CA	San Diego, Cetec Elctrns.	619-278-5020
CA	San Jose, Cetec Elctrns.	408-263-7373
CA	Santa Ana, National Electro Sls.	714-541-6184
CA	Santa Ana, Projections Unltd., Inc.	714-641-1472
CA	Santa Clara, Intl. Standard Comps., Inc.	408-496-0411
CA	South Gate, Cetec Elctrns.	213-773-6521
CA	Van Nuys, National Electro Sls.	213-781-0505
FL	Orlando, Hammond Elctrns., Inc.	305-849-6060
GA	Norcross, Hammond Elctrns., Inc.	404-524-7502
IL	Northbrook, Classic Comps. Supp., Inc.	312-272-9650
MA	Hopkinton, Interface Elctrns. Corp.	617-435-6858
MA	Middleboro, Glynn Elctrns.	617-947-4262
MN	Minneapolis, The Joel Co.	612-545-5669
NJ	Clifton, J-Mar Elctrns., Inc.	201-772-6400
NC	Greensboro, Hammond Elctrns., Inc.	919-275-6391
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Exton, VSH	215-876-8654
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
SC	Greenville, Hammond Elctrns., Inc.	803-233-4121
TX	Austin, Captronics, Inc.	512-459-4328
TX	Dallas, Captronics, Inc.	214-340-3592
WA	Bellevue, Bell Inds.	
WI	New Berlin, Classic Comps. Supp., Inc.	414-786-5300

UNITED DETECTOR TECH., 12525 Chadron Ave., Hawthorne, CA 90250, Tel: 213-978-0516, Telex: 18-2458; FSC No.: 50486; Empl.: 200; *Sls. Mgr.:* Michael Feeney; *Dist. Mgr.:* Al Seck

UNITED ELEC. CONTROLS, 85 School St., Watertown, MA 02172, Tel: 617-WA6-1000, Telex: 92 2445; Empl.: 420; *Dist. Mgr.:* Susan Janes

UNITED FOAM PLASTICS, 172 E. Main St., Georgetown, MA 01833, Tel: 617-352-2200, TWX: 710-347-0315; FSC No.: 55900; Empl.: 163

Local Sales Offices & Reps

CT	Pawcatuck	203-599-1242
FL	Orlando	305-843-7075
GA	Fairburn	404-964-5888
NJ	Somerset	201-560-9550

UNITED SOLDER WRAP INC., 2608 Electronic La., Ste 509, Dallas, TX 75220, Tel: 214-350-4978, Telex: 79-1535; Empl.: 80; *Sls. Mgr.:* Perry L. Gross

UNITED STATES CRYSTAL CORP., 3605 McCart St., Ft. Worth, TX 76110, Tel: 817-921-3014, TWX: 910-893-4084; FSC No.: *; Empl.: 75

UNITED STATES TESTING CO., INC., 1415 Park Ave., Hoboken, NJ 07030, Tel: 800-631-3096, 201-792-2400, Telex: 126493, TWX: 219504; FSC No.: 93282; *Sls. Mgr.:* R. Donohue

UNITED TECHNOLOGIES, Terminal Prods., 1230 Sabine St., Huntington, IN 46750, Tel: 219-356-2700, Telex: 23-2461, TWX: 810-332-1519; Empl.: 465

UNITED WIRE & CABLE, 425 Shrewsbury St., Worcester, MA 01604, Tel: 617-757-3872, TWX: 710-340-0635; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDS., 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161; Empl.: 40

UNITRACK DIV., Calabro Inds., Inc., Goshen Corp. Pk., P.O. Box 1927, 1372 Enterprise Dr., West Chester, PA 19380, Tel: 215-692-0800, TWX: 510-663-0000; Empl.: 25 .... **2•**1068

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co.	602-954-0301
CA	Agoura, Robert A. Borden	213-991-1940
CA	Sunnyvale, Ruby Sls.	408-224-0881
CO	Aurora, Dellron Co.	303-373-0300
FL	Coral Springs, H.A., Inc.	305-752-7520
GA	Atlanta, Magaro & Assoc.	404-252-6609
IL	Des Plaines, Lincoln, Hodges & Assoc.	312-297-3810
IN	Ft. Wayne, Aktron Corp.	219-747-3650
MA	Northboro, Henik Assoc.	617-393-3127
MI	Grand Rapids, C.A. Geer Co.	616-534-9449
MN	St. Paul, Countrymen Assoc.	612-645-9151
MO	Blue Springs, Chesco	816-229-1404
NJ	Lebanon, Churchill Assocs.	201-735-8971
NY	Melville, Jarms	516-752-0404
NY	Syracuse, Lenard Co.	315-479-9191
OH	Akron, Augnat Assocs.	216-273-1211
PA	King of Prussia, Rivco January	215-265-5211
TX	Houston, Milco Mktg.	713-946-2841
TX	Richardson, Air Quip/Robleyco	214-234-3285
VA	Herndon, Eastern Comps.	703-471-1025
WA	Bellevue, Eltech	206-643-4330

Local Distributors

CA	Los Angeles, El-Com	213-404-2961
CO	Denver, Integrated Elctrns.	303-534-6121
MA	Northboro, Papi Supp.	617-393-3127
MA	Woburn, Rush Indus.	617-935-2400
MI	Grand Rapids, S-F Elctrn. Supp. Co.	616-459-0216
NC	Winston-Salem, Kirkman Elctrns.	919-724-0541
OH	Dayton, ESCO	513-226-1133
TX	Richardson, Air Quip/Robleyco	214-234-3285

UNITRODE CORP., 5 Forbes Rd., Lexington, MA 02173, Tel: 617-861-6540, Telex: 95-1064, TWX: 710-326-6509; Empl.: 2,000; *Sls. Mgr.:* Frederick Myers; *Dist. Mgr.:* John Flannery .... **1A•**1681-1683

UNITRODE CORP., Capacitor Div., 11494 Sorrento Valley Road, San Diego, CA 92121, Tel: 619-453-8020

Unitron INCORPORATED

UNITRON INC., 2826 W. Kingsley Rd., Dept. G, Box 472159, Garland, TX 75041, Tel: 214-271-4531, Telex: 73-0644; FSC No.: 6130; Empl.: 95; *Sls. Mgr.:* R. L. Beutel .... **3•**1831, 1832

Local Sales Offices & Reps

CA	Sunland, Unitron (Jim Crevier)	818-352-7348
GA	Byron, Unitron (Joe Joiner)	912-956-2866
PA	Landsdowne, Unitron (Douglas S. Feisler)	215-622-4811

UNITRONIX CORP., 197 Meister Ave., Somerville, NJ 08876, Tel: 201-231-9400, Telex: 833184; Empl.: 35; *Sls. Mgr.:* Frank Zimmer; *Dist. Mgr.:* Joseph Murawski

Local Sales Offices & Reps

FL	Winter Park, Unitronix Corp.	305-671-9600
NJ	Somerville, Unitronix Corp.	201-231-9400

UNIVERSAL AD-YU ELCTRNS., INC., 2517 E. Norwich St., Milwaukee, WI 53207, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10

UNIVERSAL CAPACITORS, See TRW/Capacitor Div.

UNIVERSAL ELECTRONICS INC., 3475 A. Victor St., Santa Clara, CA 95050, Tel: 408-970-0455, Telex: 3719249 UNIVESAL; FSC No.: 94-2845455; *Sls. Mgr.:* Paul Shieh

UNIVERSAL INSTRS., P.O. Box 825, Binghamton, NY 13902, Tel: 607-775-1102, TWX: 510-252-1990; Empl.: 1,600

UNIVERSAL INSTRS. CORP., MECHANIZED ELCTRN. ASSEMBLY (MEA) DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

UNIVERSAL MFG. CO., INC., 1168 Grove St., Irvington, NJ 07111, Tel: 201-374-9800, TWX: 710-995-4647; Empl.: 70; *Sls. Mgr.:* M. Mayer

UNIVERSAL SHIELDING CORP., 20 W. Jefryn Blvd., Deer Park, NY 11729, Tel: 516-667-7900, Telex: 221213 TTC UR; Empl.: 35

UNIVERSAL VOLTRONICS, 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; Empl.: 135; *Sls. Mgr.:* Bob Pampin .... 3•1803

Local Sales Offices & Reps

FL	Winter Park, McMahan Assocs.	305-645-0463
IL	Chicago, Ropek, Cahill & Vogt	312-631-0070
MI	Detroit, EQS	313-961-3042
MN	Minneapolis, R.J. Sls.	612-866-3661
NM	Albuquerque, Fry Gates Co.	505-262-1525
NY	Commack, RC Engrg. Sls.	516-543-3325
OH	Chesterland, EQS	216-729-2222
OH	Dayton, EQS	513-294-2476
PA	Audubon, Holmes Assocs.	215-666-0636
TX	Richardson, Spectra Sls.	214-234-3600

UNIVERSITY COMPUTING CO., UCC Tower Exchange Park, Dallas, TX 75235, Tel: 214-688-7100, TWX: 910-861-4990; Empl.: 700 (U.S.), 900 (Europe)

UNIVERSITY SOUND, 9500 W. Reno, Oklahoma City, OK 73126, Tel: 405-354-5311, Telex: 748-510

UNIVERSITY SOUND, Altec Corp., 1250 N. Red Gum St., Anaheim, CA 92806, Tel: 714-632-7117, Telex: 655415; Empl.: 200; *Sls. Mgr.:* G. H. Rilling

UPSYSTEMS, INC., 15737 Garfield Ave. Bldg. #18, Paramount, CA 90723, Tel: 213-634-0621, TWX: 910-346-7814; FSC No.: 3698; *Sls. Mgr.:* Howard Pendleberry

URBAN ELCTRNS., P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, TWX: 710-325-1579; Empl.: 50; *Sls. Mgr.:* G. Urban

U S CAPACITOR CORP., See U S Microtek Components

U.S. DIGITAL, 12371 Kensington Rd., Los Alamitos, CA 90720, Tel: 213-594-0094 .... 1B•1881

Local Distributors

MA	Waltham, SSC Instrmn. Inc.	
Intl	UK, Bedford, Control Transducers, Ltd.	

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 213-786-9388, TWX: 910-495-1700; Empl.: 250

U.S. INSTR. RENTALS, 2988 Campus Dr., San Mateo, CA 94403, Tel: 415-572-6600; Empl.: 300; *Sls. Mgr.:* David G. Fletcher

U S MICROTEK COMPONENTS CORPORATION, 11144 Penrose St., Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 180; *Sls. Mgr.:* Donald F. Hosmer .... 1A•1211

Local Sales Offices & Reps

AZ	Tucson, Clemick & Assocs.	602-749-4003
CA	Cupertino, F & F Assocs.	408-446-2349
CA	San Diego, Clemick-Neenan & Assoc.	619-268-8540
CA	Sherman Oaks, Clemick-Neenan & Assoc.	818-990-3150
CO	Denver, High Plains Mktg.	303-751-7150
FL	Coral Springs, EPM Corp.	305-755-5387
FL	Orlando, EPM Corp.	305-425-6149
GA	Roswell, Edco Sls.	404-587-1886
IL	Schaumburg, Gassner & Clark	312-882-8608
IA	Marion, MSB Assocs. Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs. Inc.	913-532-2131
MA	Needham, Hatch Assocs.	617-444-3310
MN	Bloomington, Merrill Franklin Co.	612-854-9446
MO	St. Charles, MSB Assocs. Inc.	314-946-5577
NY	Cazenovia, S. T. Woolard	315-655-8145
NY	Commack, Kaelber & Mack	516-499-2924
OH	Cleveland, Baehr, Greenleaf & Assocs.	216-221-9030
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OR	Hillsboro, Gentech	503-640-6324
PA	Broomall, Sapinosa Assocs.	215-353-7267
TX	Austin, OM Sales Co., Inc.	512-452-1838
TX	Dallas, OM Sales Co., Inc.	214-241-3876
TX	Houston, OM Sales Co., Inc.	713-789-4426
UT	Salt Lake City, High Plains Mktg.	801-968-9456
WA	Redmond, Gentech	206-881-6456

U.S. SCIENTIFIC INSTRS., 61 North Beacon St., Boston, MA 02134, Tel: 617-787-2411; Empl.: 50; *Sls. Mgr.:* S. Eric Kondi

U.S. TERMINALS, 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, TWX: 810-461-2290; FSC No.: 12615; *Sls. Mgr.:* G.L. Stepp

Local Sales Offices & Reps

AZ	Phoenix, Gramer & Co.	602-995-9455
FL	Melbourne, Jerry Williams, Inc.	305-259-7700
1L	Chicago, L-Tec, Inc.	312-773-2900
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232

U.S. TOYO FAN CORPORATION

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 213-287-5297, TWX: 910-589-1540; Empl.: 20; *Sls. Mgr.:* R. L. Rosenthal; *Dist. Mgr.:* R. L. Rosenthal .... 2•1854, 1855

Local Sales Offices & Reps

AL	Huntsville, Par Mktg.	205-837-6534
AZ	Tempe, Delta Elctrn. Sls.	602-224-1601
CA	San Diego, Noo Rep Tech Sls.	619-483-4861
CA	San Gabriel, U.S. Toyo Fan Corp.	213-287-5297
CA	Santa Clara, U.S. Toyo Fan Corp.	408-984-2618
CO	Denver, Troy Sls./Wintronics	303-934-2406
FL	Clearwater, WMM Assoc.	813-442-3913
GA	Marietta, Par Mktg.	404-953-4168
ID	Boise, Quest Mktg.	208-343-9969
IL	Elk Grove, Martec Assoc.	312-956-8090
KS	DeSoto, Midtec Assoc.	913-441-6565
MA	Westboro, Tech. Mktg. Svcs. Co.	617-366-6655
MN	Osseo, Gaffney Sls. Co.	612-425-5484
MO	Florissant, Midtec Assoc.	314-837-5200
NH	Windham, Tech. Mktg. Svcs. Co.	603-434-2716
NJ	Madison, Livera-Polk Assoc.	201-377-3220
NY	Cooperstown, Fitzelle Assoc.	607-547-9333
NY	Glen Head, Livera-Polk Assoc.	516-759-9300
NC	Raleigh, Par Mktg.	919-872-2726
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-854-5939
OR	Beaverton, Quest Mktg.	503-644-8077
PA	Horsham, Dalbrook Corp.	215-441-8380
TX	Richardson, Zonk Assoc.	214-238-7651
WA	Renton, Quest Mktg.	206-223-1541

Local Distributors

AZ	Phoenix, Aero-Space Southwest	602-861-1785
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Santa Ana, Pacesetter Elctrns.	714-557-7131
CA	Torrance, Cypress Elctrns.	213-530-1900
CA	Tustin, Added Value Elctrns. Distrib.	714-730-5848
CO	Denver, Wintronics	303-934-2406
FL	Longwood, Intertec Comps.	305-834-7777
IL	Elk Grove, Martec Assoc.	312-956-8090
MA	Westboro, TMSC Elctrns. Supp.	617-366-8462
NV	Las Vegas, Kiesub Corp.	702-733-3888
NJ	Collingswood, Index	609-429-4055
NJ	Middleville, Allegri Comps.	201-383-0086
NY	Elmsford, Multimeterics	914-347-3666
NY	Glen Head, Livera-Polk Assoc.	516-759-9300
OH	Cleveland, Alpha Distr. Corp.	216-526-3716
OR	Beaverton, Hansen Elctrns.	503-642-4455
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Richardson, Zec Sales	214-238-7651
WA	Kent, Shannon Ltd.	206-763-0545

USUS, INC., UCSD Pascal Sys. User's Society, P.O. Box 1148, La Jolla, CA 92038

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 201-922-1009, Telex: 13-2461; FSC No.: 23261; Empl.: 20

Local Sales Offices & Reps

AZ	Phoenix, Sigma Eng. Sls.	602-997-1822
CA	Goleta, Thorson Co.	805-964-8751
CA	Palo Alto, R-V Assocs.	415-967-5994
FL	Melbourne, EMS Assocs.	305-724-1027
MA	Wakefield, Nerem	617-245-4426
NY	Commack, Richman Sls.	516-543-5532
OH	Dayton, Fred Ohmer Assocs.	513-434-1454
TX	Dallas, Airep Elctrns.	214-349-4360
VA	Annandale, Q.T. Elctrn.	703-941-4242
EXP	FL, Boca Raton, Microwave Intl. Corp.	305-391-7475

UTI INSTRUMENTS CO., 325 N. Mathilda Ave., Sunnyvale, CA 94086, Tel: 408-738-3301, TWX: 910-339-9546; Empl.: 80; *Sls. Mgr.:* Jim Nicholson

UVP, INC., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778, Tel: 818-285-3123, Telex: 688-461; Empl.: 100; *Sls. Mgr.:* Paul Gilchrist

VACO PRODS., 1510 Skokie Blvd., Northbrook, IL 60062, Tel: 312-564-3300, TWX: 910-686-0658; Empl.: 250; *Sls. Mgr.:* Fred Grede

VACTRONIC LAB. EQUIP., 65 Brightside Ave., E. Northport, NY 11731, Tel: 516-AN1-2660; Empl.: 18

VALHALLA SCIENTIFIC, 7576 Trade St., San Diego, CA 92121, Tel: 619-578-8280, Telex: 181750 VALHALLA SDG; Empl.: 30; *Sls. Mgr.:* Kerry Clark

VALIDYNE ENGRG. CORP., 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, Telex: 65-1303; Empl.: 200; *Sls. Mgr.:* Max J. Kopp

VALLEY ELECTROMAGNETICS CORP., P.O. Box 557, Crystal Lake, IL 60014, Tel: 815-459-3080, Telex: 72-2417

VALLEY ELECTROMAGNETICS, P.O. Box 131, Spring Valley, IL 61362, Tel: 815-664-2348; Empl.: 70; *Sls. Mgr.:* G. Adair

VALOR ELECTRONICS, INC., 2950 Airway Ave., Bldg. C-5, Costa Mesa, CA 92626, Tel: 714-540-9261, TWX: 910-595-2480; FSC No.: 15003; *Sls. Mgr.:* T. N. Kasabali

VALPEY-FISHER, 75 South St, Hopkinton, MA 01748, Tel: 617-435-6831, Telex: 94-8332; Empl.: 160; *Sls. Mgr.:* Donald Elliott .... 1A•1434-1436

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Verein Corp.	602-948-3571
CA	Carlsbad, Addem	714-695-2050
CA	Cupertino, F & F Assocs.	408-446-2349
CA	Orange, ETA/Cen-Tec Sales Corp.	714-998-9241
CT	Hamden, Impact Sls.	203-281-1331
FL	Altamonte Springs, WMM Assocs.	305-831-4530
FL	Clearwater, WMM Assocs.	813-422-3913
FL	Davie, WMM Assocs.	305-581-7036
FL	Indialantic, WMM Assocs.	305-773-1157
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Chicago, Indl. Reps.	312-647-7755
IN	Ft. Wayne, Dillon Sls.	219-486-1868
KS	Overland Park, Jones Mktg. Co.	913-649-3020
MA	Canton, Impact Sls.	617-821-1500
NJ	Cherry Hill, Danco Elctrns	609-424-5590
NM	Albuquerque, Reptronix, Ltd.	505-881-8001
NY	Hicksville, J. Square Mkt	516-935-3200
NY	Rochester, Eiss Assocs.	716-328-3000
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Rocky River, Norm Case Assoc.	216-333-0400
TX	Austin, Sundance Sls.	512-250-0320

TX	Plano, Sundance Sales	214-867-0592
TX	Stafford, Sundance Sls.	713-499-9671
WA	Blaine, O.E.M. Sls. Inc.	206-621-7249
WI	Milwaukee, Indl. Reps.	414-259-0965

VALTEC, Sub. of U.S. Philips, 99 Hartwell St., West Boylston, MA 01583, Tel: 617-835-6082, Telex: 92-0355; FSC No.: 8N865; Empl.: 220; *Sls. Mgr.:* Pieter M. deBruijn

VAMISTOR CORP., 115 Industrial Park, Sevierville, TN 37862, Tel: 615-453-0001, Telex: 810-570-4931; Empl.: 49; *Sls. Mgr.:* George Hebner; *Dist. Mgr.:* George Hebner

VANGUARD ELCTRNS. CO., 1480 W. 178th St., Gardena, CA 90248, Tel: 213-323-4100, TWX: 910-346-7067; FSC No.: 03550; Empl.: 250; *Sls. Mgr.:* T. A. Crawford; *Dist. Mgr.:* T. A. Crawford .... **1A**•1276

Local Sales Offices & Reps

AZ	Tempe, Piper Sales	602-949-0048
FL	Coral Springs, EPM Corp.	305-752-0054
IL	Franklin Park, Dekotech	312-455-5100
IN	Ft. Wayne, TX Sls., Indiana	219-489-4447
IA	Cedar Rapids, S&O Sls.	319-393-1845
MA	Lexington, JESCO	617-863-1598
MA	Topsfield, R. F. Assoc.	617-887-9762
MN	St. Paul, Murnco	612-484-8200
NJ	Wayne, SHL Assoc.	201-790-1714
NY	Cazenovia, ST Woolard Co.	315-655-8145
TX	Dallas, Tritex	214-350-1927

Local Distributors

MD	Baltimore, Radio Elec. Service Co.	301-823-0070

VANGUARD RELAY CORP., 225 Cortland St., Lindenhurst, NY 11757, Tel: 516-226-5000; *Sls. Mgr.:* B. S. Gilman

VANN INSTRUMENTS

VANN INSTRUMENTS, 1200 Schofield La., Farmington, NM 87401, Tel: 505-326-7557; *Sls. Mgr.:* Michael E. Vann .... **3**•1316

VARIAN ASSOCS., Indl. Equip. Grp., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TWX: 910-373-1731; Empl.: 1500

VARIAN ASSOCS., Instr. Grp., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TWX: 910-373-1731

VARIAN ASSOCIATES, INC., Microwave Tube Div., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, Telex: 910-373-1731; *Sls. Mgr.:* Frank Rich

VARIAN CANADA, INC., 45 River Drive, Georgetown, ON , Canada, Tel: 416-877-0161

VARIAN DATA MACHINES, See Sperry Univac, Mini-Comp. Opers.

VARO, INC., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75040, Tel: 214-272-3561, TWX: 910-860-5093; FSC No.: 27777; Empl.: 250; *Sls. Mgr.:* Lon Hodge

VARO SEMICONDUCTOR, INC., 2800 W. Kingsley Dr., Garland, TX 75046, Tel: 214-271-8511, TWX: 910-860-5178; Empl.: 550; *Sls. Mgr.:* Charlie Merz; *Dist. Mgr.:* Mike Hawkins .... **1A**•2112

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
AZ	Scottsdale, SMS & Assocs.	602-998-0831
CA	Los Angeles, Corcoran Assocs.	213-823-4589
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Parker, Technology Mktg. Assocs.	303-841-3435
CT	North Haven, Comp Rep Assocs.	203-239-9762
FL	Orlando, OEM Mktg. Corp.	305-299-1000
GA	Tucker, Rep, Inc.	404-938-4358
IL	Chicago, D. Dolin Sales Co.	312-286-6200
IN	Frankfort, C-S Electronic Sls.	317-659-1874
KS	Overland Park, Electri-Rep	913-649-2168
MD	Baltimore, Professional Rep.	301-653-3600
MD	Towson, DG Representatives	301-583-1360
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Farmington, Amtech Reps.	313-474-8300
MN	Minneapolis, Electric Comp. Sls.	612-933-2594
MO	St. Louis, Electri-Rep	314-878-8209
NY	Great Neck, Cooper-Simon & Co.	516-487-1142
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Raleigh, Rep, Inc.	919-851-3007
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OK	Oklahoma City, Ammon & Rizos Co.	405-942-2552
OR	Hillsboro, Western Tech. Sls.	503-640-4621
PA	Huntingdon Valley, Knowles Assocs.	215-322-7100
PA	Pittsburgh, J. C. Hofstetter Co.	412-356-2305
TN	Jefferson City, Rep, Inc.	615-475-9012
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	Dallas, Ammon & Rizos Co.	214-644-5591
TX	Houston, Ammon & Rizos Co.	713-781-6240
UT	Salt Lake City, Technology Mktg. Assocs.	801-364-3296
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Milwaukee, D. Dolin Sales Co.	414-482-1111

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Anthem Elctrns.	602-244-0900
CA	Chatsworth, Anthem Elctrns.	213-700-1000
CA	Garden Grove, Bell Inds.	714-220-0681
CA	Gardena, Bell Inds.	213-515-1800
CA	Hayward, Allied Elctrns.	415-487-5250
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Anthem Elctrns.	619-279-5200
CA	San Jose, Anthem Elctrns.	408-946-8000
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Tustin, Anthem Elctrns.	714-730-8000
CO	Denver, Integrated	303-292-6121
CO	Wheat Ridge, Bell Inds.	303-424-1985
CT	Hamden, Allied Elctrns.	203-248-8900
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Winterpark, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Elk Grove Village, Pioneer Std.	312-437-9680
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio	309-691-4840
IN	Fort Wayne, Graham Elctrns.	219-423-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco	319-365-7551
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Rockville, Milgray Elctrns.	301-468-6400
MA	Burlington, J. V. Elctrns.	617-273-4300
MA	Burlington, Milgray Elctrns.	617-272-6800
MI	Wyoming, RM Elctrns.	616-531-9300
MN	Minnetonka, Pioneer Std.	612-935-5444
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NY	Pittsford, Milgray Elctrns.	716-385-9330
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cincinnati, Graham Elctrns.	513-772-1661
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Cleveland, Pioneer Std.	216-587-3600
OH	Dayton, Pioneer Std.	513-236-9900
OH	Dayton, Stotts Friedman	513-298-5555
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Pittsburgh, Pioneer Std.	412-782-2300
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Dallas, Pioneer Std.	214-386-7300
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
UT	Salt Lake City, Standard Supply	801-486-3371
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515
WA	Seattle, Priebe Elctrns.	206-682-8242
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Waukesha, Bell Inds.	414-547-8879

VARTA BATTERIES, INC., 150 Clearbrook Rd., Elmsford, NY 10523, Tel: 914-592-2500, Telex: 996-548; *Sls. Mgr.:* Dominick Isola .... **3**•1436

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
CO	Denver, Moss Mktg.	303-455-7205
IL	Palatine, Technology Sls.	312-991-6600
KS	Shawnee Mission, K & M Sls.	913-262-1444
NY	Glen Head, Livera-Polk	201-377-3239
PA	Broomall, TCA Assocs.	215-353-2022

Local Distributors

CA	La Mirada, Energy Devices	213-921-8775
GA	Atlanta, Falcon Batteries	404-953-3500
IL	Downers Grove, Telecommunications Dvcs.	312-971-3460
MA	Sharon, Adcour	617-784-8123
NY	Commack, Brentronics	516-499-5155

VECTOR CABLE CO., 555 Industrial Rd., Sugarland, TX 77478, Tel: 713-240-9196

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Dept. EP, Box 4336, Sylmar, CA 91342, Tel: 818-365-9661, TWX: 910-496-1539; FSC No.: 82893; Empl.: 140; *Sls. Mgr.:* F. L. Hill .... **2**•1069, 1094, 1095; **3**•1117

VECTROL, Division of Westinghouse Elec. Corp., 110 Douglas Rd, Oldsmar, FL 33557, Tel: 813-855-4621, Telex: 803784; Empl.: 120; *Sls. Mgr.:* G. Lierman

VECTRONICS MICROWAVE CORP., 276 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-356-2377, Telex: 833560; FSC No.: 32846; *Sls. Mgr.:* John G. Vogler

Local Sales Offices & Reps

CA	N. Hollywood, Crown Elctrns.	818-877-3550
IL	Palatine, R-Tek, Inc.	312-991-4404
MA	Woburn, Microwave Comp. Mktg.	617-273-3106
NJ	Moorestown, Stern Assocs.	609-234-0661
TX	Garland, Tesco Elctrn. Sls. Co.	214-681-1376
VA	Fairfax, Schibley Assocs.	703-591-3008

VECTRON LABS., 166 Glover Ave., Norwalk, CT 06850, Tel: 203-853-4433, TWX: 710-468-3796; FSC No.: 27802; Empl.: 275; *Sls. Mgr.:* Larry Jawitz .... **1A**•1438-1442

Local Sales Offices & Reps

AZ	Phoenix, Fetty/Schoenduve	602-241-9009
CA	El Segundo, Fetty/Schoenduve	213-322-4991
CA	Mountain View, Fetty/Schoenduve	415-962-8330
CA	San Diego, Fetty/Schoenduve	619-292-5136
CO	Parker, Techn. Mktg. Assocs.	303-841-3435
CT	Cheshire, Meco	800-225-3409
FL	Melbourne, Saber Assocs.	800-432-6288
FL	Pensacola, Saber Assocs.	800-327-0853
GA	Atlanta, Saber Assocs.	800-327-0853
IL	Bannockburn, Heth, Inc.	312-295-8440
IN	Indianapolis, Ihrig Assocs.	317-783-7630
KS	OLATHE, C-Tron Inc.	913-829-0073
LA	Metairie, Automation Supplies	504-831-2183
MA	Reading, Meco	617-944-6660
MI	Detroit, R. P. Urban Assocs.	313-535-2355
MI	Grand Rapids, R. P. Urban Assocs.	616-245-0511
MN	Burnsville, Heth, Inc.	612-435-7876
MO	St. Louis, AME Sales	314-965-1779
NJ	Woodcliff Lake, F & F Assoc.	201-391-6792
NM	Albuquerque, J. Smith & Assocs.	505-265-3406
NY	Great Neck, F & F Assoc.	516-482-4080
NY	Syracuse, Rep Tech	315-437-2845
NC	Clayton, Saber Assocs.	800-327-0853
NC	North Hills, Saber Assocs.	800-327-0853
OH	Englewood, A. Nace Co.	513-836-0931
OH	Richfield, A. Nace Co.	216-659-7178
PA	Newtown Sq., SWR Assocs.	215-356-8550
PA	Pittsburgh, A. Nace Co.	412-922-7225
SC	W. Columbia, Saber Assocs.	800-327-0853
TX	Dallas, Texas Avionics	214-363-6324
UT	Salt Lake City, Techn. Mktg. Assocs.	801-364-3296
VA	Springfield, Tech-Reps	703-569-6868
WA	Seattle, Datacom	206-285-2525

VEECO INSTRS. INC., 370 San Aleso Ave., Sunnyvale, CA 94086, Tel: 408-733-3700, TWX: 910-339-9263; Empl.: 95; *Sls. Mgr.:* T. McKee

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300; *Sls. Mgr.:* Tony Carrozzo

VEEDER-ROOT, 70 Sargeant St., Hartford, CT 06102, Tel: 203-527-7201, Telex: 9-9219; Empl.: 1200; *Sls. Mgr.:* J. R. Garrison; *Dist. Mgr.:* K. Boyle

VEETRONIX, INC., Sub. Reach Electronics, Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Robert M. Wallace .... **1B**•1757

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assocs., Inc.	213-445-9728
CA	San Jose, Ruby Sls.	408-224-0881
CO	Denver, Moss Mktg.	303-455-7205
CT	Bethany, The Rep. Corp.	203-393-0024
MA	Wellesly, Reps. Corp.	617-237-6476
NM	Albuquerque, Moss Mktg.	505-292-7505
PA	Albrightsville, Centurion Linear	717-722-0166
UT	Bountiful, Moss Mktg.	801-292-8660

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, Telex: 89-2521; Empl.: 350; *Sls. Mgr.:* W. E. Kinsley

Local Sales Offices & Reps

CA	Camarillo	805-484-8584
FL	Ft. Walton Beach	904-863-2994

VELONEX, DISPLAY PRODS., 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, TWX: 910-338-0114; Empl.: 60; *Sls. Mgr.:* Douglas Greenwood 3•1359

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech	205-881-9298
AZ	Phoenix, R. A. Mayes Co.	602-279-5243
CA	Los Altos, Hoeke-Reeser	415-941-4080
CA	Pasadena, Beckrep	213-957-1111
CO	Denver, R. A. Mayes Co.	303-893-2264
FL	Melbourne, Saber Assoc.	305-724-0920
GA	Griffin, Saber Assoc.	404-228-2084
IL	Chicago, K. W. Meyers Co.	312-882-4808
IN	Indianapolis, K. W. Meyers Co.	317-243-6681
MD	Rockville, Electronic Mktg.	301-744-7700
MA	Needham, Addelco	617-444-4554
MN	Minneapolis, K. W. Meyers Co.	612-920-7080
NM	Albuquerque, R. A. Mayes Co.	505-292-2330
NY	Smithtown, PAF Assoc.	516-360-0940
OH	Medina, McShane, Inc.	216-725-4568
TX	Dallas, R. A. Mayes Co.	214-235-3043
TX	Houston, R. A. Mayes Co.	713-783-3856
WA	Lynnwood, Indl. Electhics	206-775-3516
WI	Brookfield, K. W. Meyers Co.	414-784-3790

VELONEX, INSTR. DIV., 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, TWX: 910-338-0114; Empl.: 60 3•1359

Local Sales Offices & Reps

AZ	Phoenix, R. A. Mayes Co.	602-279-5243
CA	S. Pasadena, Beckrep	213-957-1111
CA	Sunnyvale, Kousen Sls.	408-249-5858
CO	Denver, R. A. Mayes Co.	303-893-2264
DC	Washington, Electronic Mktg.	301-881-5300
FL	Orlando, Saber Assocs.	305-869-8417
GA	Atlanta, Saber Assocs.	404-945-1398
IL	Schaumberg, K. W. Meyers Co.	312-882-4808
IN	Indianapolis, K. W. Meyers Co.	317-243-6681
MD	Baltimore, Electronic Mktg.	301-744-7700
MA	Needham, Addelco	617-444-4754
MI	Detroit, Hocker Assocs.	313-549-3910
MN	Minneapolis, K. W. Meyers Co.	612-920-7080
NJ	Bloomingdale, Eastern Metro	201-492-1747
NM	Albuquerque, R. A. Mayes Co.	505-292-2330
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NC	Clayton, Saber Assocs.	919-553-5564
OH	Cleveland, Hocker Assocs.	216-235-6504
OH	Dayton, Hocker Assocs.	513-298-8638
PA	Plymouth Meeting, Electronic Mktg.	215-828-7400
TX	Houston, R. A. Mayes Co.	713-783-3856
TX	Richardson, R. A. Mayes Co.	214-235-3043
WA	Lynnwood, Indl. Elctrn.	206-775-3516

VEMALINE PRODS. DIV., 487 Jefferson Blvd., Warwick, RI 02886, Tel: 401-739-7600, Telex: 927573; FSC No.:08730; Empl.:30; *Sls. Mgr.:* Paul Vamvaketis; *Dist. Mgr.:* Paul Vamvaketis

VENABLE INDUSTRIES, INC., 3555 Lomita Blvd., Torrance, CA 90505, Tel: 213-539-2522, Telex: 752421; Empl.: 20; *Sls. Mgr.:* Wayne H. Tuttle; *Dist. Mgr.:* Shelley Scott

VENT-RAK DIV., P.O. Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000, Telex: 27-2169; Empl.: 150; *Sls. Mgr.:* J. Bradford 2•1034, 1035

Local Sales Offices & Reps

AZ	Phoenix, Synder Eng.	602-279-2010
CA	Fullerton, Groh Assocs.	714-964-7105
CA	Mountain View, G. C. Woempner Co.	415-964-5454
CO	Boulder, R. F. Mayo Assoc.	303-499-2155
CT	North Haven, Coakley, Boyd & Abbett	203-481-2828
FL	Maitland, J. Krutek & Assoc.	305-628-4837
FL	North Miami, J. Krutek & Assoc.	305-941-6544
IL	Glencoe, Howard Benjamin Assoc.	312-835-0150
IN	Noblesville, Century Elctrns.	317-849-2026
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MI	Plymouth, J. Plass Assoc.	313-455-8262
MN	Bloomington, Northport Engrg.	612-854-5556
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NH	Plaistow, Coakley, Boyd & Abbett	617-444-5470
NJ	Mountainside, H. G. Richter	201-233-4615
NY	Fayetteville, H. G. Richter	315-637-6713
OH	Cincinnati, Comp.	513-866-0661
OH	Cleveland, Comp.	216-243-9200
OK	Tulsa, Advance Tech. Sls.	918-664-0482
PA	Doylestown, Monteiro & Assoc.	215-345-5855
PA	Pittsburgh, Components	412-824-1600
TX	Austin, Advance Tech. Sls.	512-459-1351
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford & Assoc.	206-866-2001
EXP	IN, Indianapolis, General Devices Co.	317-897-7000

VENUS

VENUS SCIENTIFIC, INC., 399 Smith St., Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492; Empl.: 450; *Sls. Mgr.:* Jack Reilly 3•1805

Local Sales Offices & Reps

AZ	Scottsdale, Venus Scientific Inc.	602-991-9684
MA	Norwood, MPS Electronics Inc.	617-769-8700

VERBATIM CORP., 323 Soquel Way, Sunnyvale, CA 94086, Tel: 408-245-4400, Telex: 940-692, TWX: 910-339-9381; Empl.: 1800; *Sls. Mgr.:* S.P. Cochran; *Dist. Mgr.:* Earl Liebich

VERMONT AUTOMATION CO., INC., 18 Morse Dr., Essex Junction, VT 05452, Tel: 802-879-7571; Empl.: 7; *Sls. Mgr.:* J. Littlefield

VERMONT PRECISION RESISTOR, Box 1170, Stowe, VT 05672, Tel: 802-253-8567; Empl.: 5

VERMONT RESCH. CORP., Precision Pk., N. Springfield, VT 05150, Tel: 802-886-2256, TWX: 710-363-6533; Empl.: 175; *Sls. Mgr.:* Richard Simmons

Local Sales Offices & Reps

CA	Encinitas	619-942-5820
IL	Northfield	312-441-5811
PA	Lansdale	215-362-6440
VT	North Springfield	802-886-2256

VERNAY LABORATORIES, INC., S. College St., Yellow Springs, OH 45387, Tel: 513-767-7261; Empl.: 600; *Sls. Mgr.:* Alex Le Pera

VERNITECH, 300 Marcus Blvd., Deer Pk., NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; Empl.: 250; *Sls. Mgr.:* S. Wexler 1A•2066, 2067; 1B•1019, 1206, 1207, 1882, 1883; 3•1934

Local Sales Offices & Reps

AL	Huntsville, Remco	205-883-9260
AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Parker, Techn. Mktg. Assoc.	303-841-3435
CT	Cheshire, Selmark Assocs.	203-272-8764
FL	Maitland, MYR Assocs.	305-724-0350
GA	Atlanta, Remco	404-447-6937
IL	Glencoe, Howard Benjamin Assocs.	312-835-0150
IA	Cedar Rapids, Dytronix	319-377-8275
MD	Baltimore, R.P. Luce & Co.	301-752-8200
MA	Millis, Selmark Assocs.	617-376-2914
MA	Norwell, Bordewieck Eng. Sls.	617-659-4915
MI	Farmington Hills, C.P.&P. Inc.	313-477-7700
MN	St. Paul, Vikeland Sls.	612-645-4747
MO	Bridgeton, Dytronix	314-731-5799
MO	Independence, Dytronix	816-373-6600
NH	Concord, Selmark Assocs.	603-623-5774
NJ	Cherry Hill, Lanson Assocs.	609-424-4670
NM	Albuquerque, Technology Mktg.	505-265-5661
NY	Endicott, Tech-Mark	607-748-7473
NY	Melville, Comtronic Engrg. Sls.	516-249-0505
NY	Pittsford, Net Sls. Co.	716-467-4538
NC	Raleigh, Remco	919-847-5079
OH	Dayton, Rixan Assocs.	513-278-4216
OH	Dayton, George Lessis	513-294-1551
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Beaverton, Halbar Assocs.	503-226-0451
PA	Philadelphia, R.P. Luce & Co.	215-884-8365
TX	Bellaire, Seaton Corp.	713-731-2649
TX	Dallas, Seaton Corp.	214-380-0414
UT	Sandy, TMA, Inc.	801-254-6410
VA	Powhatan, R.P. Luce & Co.	804-598-4804
WA	Redmond, Halbar Assocs.	206-882-0990
WA	Seattle, G.M. Gillette & Assoc.	206-284-3344
WA	Vancouver, Halbar Assocs.	206-696-0170

VERNITRON CORP., Control Comps. Div., 1601 Precision Park La., San Diego, CA 92073, Tel: 619-428-5581, TWX: 910-322-1862; *Sls. Mgr.:* S. W. Silverman 1B•1208, 1209

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	213-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Parker, Techn. Mktg. Assocs.	303-841-3435
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Ft. Lauderdale, Electrocomp Assocs.	305-491-4141
FL	St. Petersburg, Electrocomp Assocs.	813-327-9677
IL	Glencoe, Howard Benjamin Assocs.	312-835-0150
MD	Baltimore, Callas Elctrns.	301-744-7711
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Lathrup Village, R. C. Nordstrom Co.	313-559-7373
MN	Edina Prairie, Techco Ltd.	612-929-9497
NJ	Cherry Hill, Lanson Assocs.	609-424-4670
NJ	Harrington Park, Metro Tech. Sls.	201-768-8495
NY	Fairport, NET Sls.	716-467-4538
NY	Jericho, Metro Tech. Sls.	516-935-3330
OH	Dayton, Rixan Assocs.	513-222-0011
TX	Dallas, M. Kruvand Co.	214-691-4592
TX	Houston, Kruvand Assocs.	713-780-9710
WA	Redmond, Halbar Assocs.	206-882-0990

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERNITRON PIEZOELECTRIC DIV., 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, TWX: 810-427-2274; Empl.: 120; *Sls. Mgr.:* William K. Dorn 1A•1437

Local Sales Offices & Reps

CA	Fullerton, GRU Assocs.	714-738-0903

VERSALOGIC, 87070 Dukhobar Rd., Eugene, OR 97402, Tel: 503-485-8575

VERTEL INC., P.O. Box 535, 125 Ellsworth St., Clifton, NJ 07012, Tel: 201-472-1331, TWX: 710-989-7021; *Sls. Mgr.:* Ron Byer

VERTOX CO., 9252 Garden Grove Blvd. #22, Garden Grove, CA 92644, Tel: 714-530-4541, Telex: 678401 TAB IRIN; FSC No.: 53688; *Sls. Mgr.:* Steve Hacker

VIABLE SYSTEMS INC., Box 438, Needham, MA 02192, Tel: 617-449-4570; Empl.: 15

VIBRAC, 1 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777; Empl.: 35; *Sls. Mgr.:* R. Searle

VIBRA-METRICS, 385 Putnam Ave., Hamden, CT 06517, Tel: 203-288-6158, TWX: 710-465-0169; Empl.: 25

Local Sales Offices & Reps

AZ	Scottsdale, Dave Menegay Assocs.	602-994-9591
CA	Long Beach, Saber Enterprises	213-595-5646
CA	Palo Alto, Gado Instr. Sls.	415-961-2222
CO	Boulder, Measurement Consultants	303-449-7506
CT	Hamden, JBL Assoc.	203-281-3161
FL	Ft. Lauderdale, Elctrn. Devices & Controls	305-974-2500
IL	Chicago, Comtel-Midwest	312-539-4838
IN	Indianapolis, Comtel Corp.	317-253-1681
IA	Cedar Rapids, Comtel Corp.	319-377-9434
KS	Shawnee Mission, Comtel Corp.	913-722-1030
MD	Rockville, Farrel Assocs.	301-424-9460
MA	Bedford, Claflin Assocs.	617-275-7428
MI	Southfield, Comtel Instrs.	313-358-2505
MN	Wayzata, Comtel Corp.	612-476-1551
MO	St. Louis, Comtel Corp.	314-991-5363
NJ	Basking Ridge, Blejwas Assocs.	201-221-1440
NM	Albuquerque, Measurement Consits.	505-265-6471
NY	Baldwinsville, Oshex Assocs., Inc.	315-635-6027
NC	Raleigh, Lee-Carolinas	919-848-8818
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-298-7573
OH	Hilliard, Comtel Instrs.	614-876-8305
PA	Pittsburgh, Comtel Instrs.	412-922-5720
TN	Knoxville, Mace Instr. Co.	615-938-3773
TX	Richardson, Scienfitic Sls. Co.	214-231-6541
UT	Salt Lake City, Measurement Consits.	801-364-3174
WA	Bellevue, Scientific Devices-NW	206-747-5169
WI	New Berlin, Comtel Corp.	414-544-6042

VIBRATION INSTRS. CO., 1614 Orangethorpe Way, Anaheim, CA 92801, Tel: 714-879-6085, Telex: 692433; FSC No.: 32102; Empl.: 21; *Sls. Mgr.:* L. Rothberg

VIBRO-METER CORP., 1 Progress Rd., Billerica, MA 01821, Tel: 617-663-7322, Telex: 948145, TWX: 710-320-1872; FSC No.: 617-667-1944; Empl.: 50; *Sls. Mgr.:* Carl Nicolino 1B•1885

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
AK	Anchorage, Arctic Technlg.	907-277-6418
AK	Anchorage, Harry J. Lang & Assocs.	907-279-5741
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	San Carlos, W. I. Carsons & Assocs.	415-591-8616
CA	San Diego, FLW Inc.	619-277-0993
CT	North Haven, Pat Jenks Assocs.	203-239-6201
FL	Maitland, Meagher & Assocs.	305-645-3063
HI	Honolulu, EMC Corp.	808-836-1138
IL	Cary, J.E.M. Entprs.	312-639-1770
IN	Indianapolis, Loren Green Assocs.	317-293-9827
MD	Towson, MRT Co.	301-685-7425
MA	Woburn, Pat Jenks Assocs.	617-938-0488
MI	Mt. Clemens, R. J. O'Hara Assocs.	313-791-7140
MN	St. Paul, Resource Technlg.	612-644-3064
MO	St. Louis, Ozark Elctrn. Mktg.	314-423-7200
NJ	Cedar Grove, KLS Assoc.	201-785-4450
NY	Dewitt, D. B. Assocs.	315-446-0220
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Columbus, R.D. Cloon Assoc.	614-459-2890
PA	Radnor, Roberts Engrg. Sls.	215-688-6526
TX	Dallas, Griffin Sls.	214-234-5013
WA	Monroe, Envirotest	206-794-6640

VICLAN, 7373A Engineers Rd., San Diego, CA 92138, Tel: 619-292-1411; TWX: 910-335-1264; FSC No.: 51959; Empl.: 250; *Sls. Mgr.:* Bob Goodman

VICON INDS., 125 E Bethpage Rd., Plainview, NY 11803, Tel: 516-293-2200, Telex: 144581; Empl.: 320

VICTOREEN, INC., Component Div., 10101 Woodland Ave., Cleveland, OH 44104, Tel: 216-795-8200, TWX: 810-421-8287 ....**1A**•2000-2003

Local Sales Offices & Reps

AZ	Tuscon, Shelley Elctrns.	602-622-2226
CA	Chatsworth, Shelley Elctrns.	818-998-3333
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Jose, Shelley Elctrns.	415-969-1820
CO	Boulder, Shelley Elctrns.	303-442-2718
MD	Gaithersburg, Axis Elctrns.	800-368-2815
MA	Boston, Precision Sls.	617-969-4905
MA	Newton, Precision Sls.	617-969-0594
OH	Cleveland, Pruitt Energy Sources	216-566-1545
WA	Edmonds, EDCO Sls.	206-776-8922

Local Distributors

AZ	Tuscon, Shelley Elctrns.	602-622-2226
CA	Chatsworth, Shelley Elctrns.	818-998-3333
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Jose, Shelley Elctrns.	415-969-1820
CO	Boulder, Shelley Elctrns.	303-442-2718
MD	Gaithersburg, Axis Elctrns.	800-368-2815
MA	Boston, Precision Sls.	617-969-4905
OH	Cleveland, Pruitt Energy Sources	216-566-1545
WA	Edmonds, EDCO Sls.	206-776-8922

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, Telex: 952122, TWX: 710-382-1534; Empl.: 900; *Sls. Mgr.:* E. M. Colasanto

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933; Empl.: 30

VICTORY ENGRG. CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, TWX: 710-983-4430; Empl.: 300; *Sls. Mgr.:* J. Bacek

VIDAIRE ELCTRNS., 150 Buffalo Ave., Freeport, NY 11520, Tel: 516-623-6696; Empl.: 20

VIDCO, P.O. Box 25452, Portland, OR 97225, Tel: 503-292-4104; Empl.: 4; *Sls. Mgr.:* Tom Inloes

VIDEO AUTOMATION SYSTEMS, Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613; Empl.: 5

VIDEO LOGIC CORP., 597 No. Mathilda Ave., Sunnyvale, CA 94086, Tel: 408-245-8622, Telex: 35-7400

VIDEO MONITORS, INC., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785; *Sls. Mgr.:* J. Carpentier

VIKING CONNECTORS, 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, TWX: 910-494-2094; FSC No.: 05574; Empl.: 500; *Sls. Mgr.:* Bob Ploudre ....**2**•1737

Local Sales Offices & Reps

AZ	Scottsdale, Southwest Mktg. Sys.	602-998-0831
CA	Los Gatos, Landia Sls. Grp.	415-490-5651
CA	Milpitas, Viking Connectors	408-943-0888
CA	San Diego, La Playa Co.	619-223-6580
CA	Tarzana, Viking Connectors	818-881-9980
CO	Castle Rock, Romulus Elctrns.	303-688-5753
FL	Casselberry, Elctrn. Mktg. Corp.	305-339-7070
FL	Lake Worth, Elctrn. Mktg. Corp.	305-969-0097
GA	Stone Mtn., Mountain Electro Prods.	404-469-0603
HI	Honolulu, Indl. Elctrns.	808-533-6095
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Lisle, W G Controls	312-963-5954
IL	Palatine, Viking Connectors	312-934-1278
IN	Indianapolis, C C Elctrns.	317-255-1508
KS	Merriam, Midwest Techl. Sls.	913-236-8557
KS	Wichita, Midwest Techl. Sls.	316-262-7240
KY	Louisville, KW Elctrn. Sls.	502-451-1860
MD	Phoenix, Chesapeake Mktg. Assoc.	301-628-4848
MA	Brockton, Forsberg Sls.	617-522-6300
MA	Wakefield, Viking Connectors	617-245-4110
MI	Livonia, Elctrn. Salesmasters	313-591-2433
MN	Minneapolis, D E Beck-Hats Assoc.	612-835-3610
MN	Minneapolis, Viking Connectors	612-925-9889
MN	St. Charles, Midwest Techl. Sls.	314-441-1012
NJ	Wayne, G. T. Assocs.	201-694-6040
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Durham, Mountain Electro Prods.	919-286-7737
OH	Benchwood, Elctrn. Salesmasters	216-831-9555
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Shaker Heights, KW Elctrn. Sls.	216-491-9177
OH	Worthington, KW Elctrn. Sls.	614-888-0483
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Allison Park, KW Elctrn. Sls.	412-487-4300
PA	New Cumberland, La Playa Co.	717-938-2439
PA	Prospect Park, Elf Sls.	215-534-3340
TX	Arlington, Pro-Comp Sls.	817-640-4336
TX	Dallas, Viking Connectors	214-680-9931
WA	Bellevue, N. R. Schultz Co.	206-454-0300
WA	Seattle, La Playa Co.	206-524-1111
PR	Rio Piedras, Klamco Elctrns.	809-752-6169

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Sterling Elctrns.	602-258-4531
AZ	Phoenix, Sterling Elctrns.	602-268-2122
AZ	Tempe, Richey Western	602-894-9251
AZ	Tempe, Time Elctrns.	602-967-2000
AZ	Tempe, Acacia Sls.	602-894-2874
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Belmont, LoDan Elctrns.	415-592-4600
CA	Citrus Heights, Hall-Mark Elctrns.	916-722-8600
CA	Irvine, Acacia Sls.	714-660-0834
CA	Los Angeles, Richey Western	213-820-3777
CA	San Diego, Richey Western	619-271-4511
CA	San Diego, Acacia Sls.	619-565-4365
CA	Santa Clara, Richey Western	408-727-7411
CA	Sun Valley, Richey Western	213-768-3800
CA	Sunnyvale, Acacia Sls.	408-745-7200
CA	Torrance, Time Elctrns.	213-320-0880
CO	Englewood, Hall-Mark Elctrns.	303-694-1662
CO	Lakewood, Acacia Sls.	303-232-2882
CT	New Canaan, Richey Western	203-972-1458; 203-972-1165
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Largo, LoDan Elctrns.	813-595-5811
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
IL	Arlington Hgts., LoDan Elctrns.	312-398-5311
IL	Bensenville, Hall-Mark Elctrns.	312-860-3800
IN	Indianapolis, MAR Elctrns.	317-875-4510
IN	Indianapolis, MAR Elctrns.	317-875-4510
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
LA	Metarie, Sterling Elctrns.	504-887-7610
MD	Columbia, Time Elctrns.	301-964-3090
MD	Columbia, Hall-Mark Elctrns.	301-988-9800
MA	North Chelmsford, Pilgrim Elctrns.	617-251-8746
MA	Waltham, Sterling Elctrns.	617-894-6200
MA	Woburn, Time Elctrns.	617-935-8080
MI	Livonia, LWC Dists.	313-464-7700
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
MN	Minneapolis, Indl. Comps.	612-831-2666
MO	Maryland Heights, Hall-Mark Elctrns.	314-291-5350
MO	St. Louis, Time Elctrns. Mid-West	314-391-6444
NJ	Bellmawr, Mid Atlantic Elctrns.	609-931-5303
NJ	Cherry Hill, Hall-Mark Elctrns.	215-355-7300
NJ	Fairfield, Hall-Mark Elctrns.	201-575-4415
NJ	Perth Amboy, Sterling Elctrns.	201-442-8000
NM	Albuquerque, Betatron	505-344-2381
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Buffalo, Summit Dists.	716-887-2800
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Plainview, Landmark Elctrns.	516-293-7441
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
OH	Cincinnati, Hall-Mark Elctrns.	513-563-5980
OH	Dayton, Electro Line, Inc.	513-461-5683
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OH	Westerville, Hall-Mark Elctrns.	614-891-4555
OK	Tulsa, Hall-Mark Elctrns.	918-665-3200
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Beaverton, Acacia Sls.	503-646-3377
PA	Broomall, Time Elctrns.	215-359-1200
TX	Austin, Sterling Elctrns.	512-836-1451
TX	Austin, Hall-Mark Elctrns.	512-258-8848
TX	Dallas, Hall-Mark Elctrns.	214-343-5000
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Dallas, Target Elctrns.	214-788-0761
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Hall-Mark Elctrns.	713-781-6100
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellvue, Electro Air	206-641-3640
WA	Seattle, Richey Western	206-575-1910
WI	Oak Creek, Hall-Mark Elctrns.	414-761-3000

VIKING ELECTRONICS, Industrial St., Hudson, WI 54016, Tel: 715-386-8861; Empl.: 24; *Sls. Mgr.:* Bill Wiese

VIKING LABS., INC., 440 Bernardo Ave., Mountain View, CA 94043, Tel: 415-969-5500, TWX: 910-379-6555; Empl.: 90; *Sls. Mgr.:* Jack Eagan, Prod. Reliability; *Dist. Mgr.:* M. J. Marchman, Comp. Test

Distributor

VILLARREAL ELECTRONICS, Box 43A, RD 2, South Rd., Millbrook, NY 12545, Tel: 914-677-3447 ....**2**•1064

V.I.P. INDS. INC., 246 Knickerbocker Ave., Paterson, NJ 07503, Tel: 201-345-5800; *Sls. Mgr.:* John M. Sonatore

VIRGINIA PANEL, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, TWX: 710-839-0406; Empl.: 225; *Sls. Mgr.:* Jeff Stowers

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-985-3811, TWX: 710-870-0440; FSC No.: 59608; Empl.: 120; *Sls. Mgr.:* Charles Bogese ....**2**•1738-1740, 2151

Local Sales Offices & Reps

AZ	Tempe, General Comps. Grp.	602-829-8124
CA	Granada Hills, C&W Comps.	213-368-4032
CA	San Jose, Pitts Sls. Assocs.	408-252-6177
CO	Parker, Mikro Sls. Co.	303-841-4131
CT	Middletown, Gerber Sls.	203-347-3000
CT	Old Saybrook, Gerber Sls.	203-388-4386
FL	Ft. Lauderdale, APM Assocs.	305-565-0056
FL	Longwood, APM Assocs.	305-869-6831
FL	Merritt Island, APM Assocs.	305-453-4322
FL	Tampa, APM Assocs.	813-886-2457
GA	Stone Mountain, H & H Mktg.	404-296-9830
IL	Palatine, Claeson Assocs.	312-359-7230
MD	Silver Spring, Carwithen Assocs.	301-589-9040
MA	Newton, Gerber Sls.	617-969-2620
MN	Minneapolis, Northstar Comps.	612-553-1888
NJ	Haworth, Kay Sls.	201-384-3261
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
PA	Southampton, Campbell Assocs.	215-322-6630
TX	Houston, AID Elctrns.	713-955-6204
TX	Irving, Aid Elctrns.	214-259-4761

Local Distributors

MA	Newton, Atlantic Comps.	617-969-2620
MN	Minneapolis, K&H Elctrn. Distributing	612-553-1312

VIRTIS CO., Rte. 208, Gardiner, NY 12525, Tel: 914-255-5000, Telex: 926474; Empl.: 92; *Sls. Mgr.:* J. D. Schmidt

Add Dept. EM to address to tell them you saw it in EEM.

VISHAY
...to be precise®

VISHAY RESISTIVE SYS. GRP., 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-8944; Empl.: 500 .... **1A**•2004-2015, 2070

Local Sales Offices & Reps

AL	Huntsville, Montgomery Marketing	205-830-0498
AZ	Phoenix, Compass Mktg. & Sls.	602-266-5400
CA	Cupertino, Vishay Resistive Sys. Grp.	408-730-1292
CA	La Habra, Vishay Resistive Sys. Grp.	714-738-1581
CO	Denver, Comps. Sls. Inc.	303-759-1666
CT	North Haven, Comp Rep Assocs.	203-239-9762
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2404
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Elk Grove Village, Oasis Sls. Corp.	312-640-1850
IN	Carmel, Shamrock Elctrn. Sls.	317-848-5265
MD	Lutherville, J. A. Dougherty Sls. Co.	301-321-7890
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Bloomfield Hills, Enco Mktg.	313-642-0203
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Flanders, K & R Engrg. Sls. Co.	201-584-5235
NY	E. Syracuse, L-Mar Assocs.	315-437-7779
NY	Rochester, L-Mar Assocs.	716-544-8000
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
TX	Dallas, Vishay Resistive Sys. Grp.	214-245-7306
TX	Houston, Vishay Resistive Sys. Grp.	713-550-0568
WA	Bellevue, SDR^2	206-747-9424
WI	Brookfield, Oasis Sls. Corp.	414-782-6660
EXP	Mayaguez, Comp Rep Assocs.	809-832-9529

Local Distributors

AZ	Tempe, Shelley Elctrns.	602-894-2058
CA	Chatsworth, Shelley Elctrns., Inc.	213-998-3333
CA	Los Alamitos, Semi-Dice, Inc.	213-594-4631
CA	North Hollywood, TTI, Inc.	213-982-0201
CA	San Diego, Shelley Elctrns., Inc.	619-453-7133
CA	San Jose, Shelley Elctrns., Inc.	408-942-9111
CA	San Jose, TTI, Inc.	408-943-9155
CA	Santa Clara, Semi-Dice, Inc.	408-980-9777
CO	Boulder, Shelley Elctrns., Inc.	303-442-2718
FL	Orlando, TTI, Inc.	305-859-1000
FL	Tampa, Impala Elctrns., Inc.	813-885-4747; 800-237-7777
IL	Palatine, Ohm Elctrns.	312-359-5500
MD	Beltsville, RESCO/Washington	301-937-9100
MD	Whitemarsh, RESCO/Baltimore	301-529-0500; 800-638-1242
MA	Canton, Semi-Dice, Inc.	617-821-0070
MA	Framingham, Cavalier Comps., Inc.	617-875-2000
MA	Woburn, TTI, Inc.	617-938-8800
NJ	Fairfield, CHPS, Inc.	201-882-0997
NJ	Flanders, VKR Svcs., Inc.	201-584-5235; Outside NJ 800-631-9362
NY	Bohemia, TTI, Inc.	516-567-1500
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
OH	Dayton, Micro Mil Div.	513-434-8231
PA	Royersford, Hybrid Service Lab	215-948-6880
TX	Fort Worth, TTI, Inc.	817-831-0441
TX	Houston, The Cunningham Co.	713-468-3882

VIZ

AUTHORIZED DISTRIBUTORS

RAG ELECTRONICS, INC.

WEST
21418 Parthenia Street
Canoga Park, CA 91304
Tel. (818) 998-6500

EAST
1 Pollack Avenue
Ocean, N.J. 07712
Tel. (201) 544-0666

NEW & RECONDITIONED TEST EQUIPMENT

• SALES • RENTALS • PURCHASE OPTIONS • REPAIR & CALIBRATION

Call Toll-Free
West (Outside CA) 1-800-732-3457
East (Outside NJ) 1-800-922-0945

VISHAY-MANN, Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, Telex: 510-668-5812 ...**1A**•2014, 2015

Please refer to sales representatives listed under Vishay Resistive Systems Group

Please see distributors listed under Vishay Resistive Systems Group.

VISHAY ANGSTROHM, 1 Precision Pl., Hagerstown, MD 21740, Tel: 301-739-8722, TWX: 710-853-6834; FSC No.: 17745; Empl.: 250; *Sls. Mgr.:* John Kinnaw; *Dist. Mgr.:* Jeff Reed ....**1A**•2011-2013

VISION ENGRG. INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, Telex: 643769; Empl.: 15; *Sls. Mgr.:* R. N. Gable

VISTAR CORP., 13740 McCormick Dr., Tampa, FL 33625, Tel: 813-855-6611; Empl.: 25; *Sls. Mgr.:* J. Looney ....**3**•1317

Local Sales Offices & Reps

AL	Huntsville, Synergetic Reps.	205-882-1691
CT	North Haven, Pat Jenks Assocs.	203-239-6201
FL	Largo, Synergetic Reps.	813-586-2871
GA	Lawrenceville, Synergetic Reps.	404-963-0968
IL	Rolling Meadows, Commodore I	312-394-5441
MD	Silver Springs, Sel-Tronics	301-589-3391
MA	Woburn, Pat Jenks Assocs.	617-938-0488
NY	Port Chester, Radiation Elctrns.	914-937-2300
NY	Syracuse, Labtonics, Inc.	315-455-7314
NC	Greensboro, Synergetic Reps.	919-272-9303
OH	Euclid, Bradcor Elctrns. Co.	216-261-0888
OR	Portland, Scientific Devices	503-292-6934
PA	Mechanicsville, John Bell Assocs.	215-794-7075
TX	Richardson, Scientific Dvcs.	214-231-8106
WA	Bellevue, Scientific Dvcs.	206-747-5169

VISUAL COMMUNICATIONS CO., P.O. Box 986, El Segundo, CA 90245, Tel: 213-822-4727; Empl.: 9; *Sls. Mgr.:* J. Savage ....**1B**•1106-1108

Local Sales Offices & Reps

AL	Huntsville, Remco	205-553-3763
AZ	Phoenix, Bob Anderson Co.	602-266-2070
CA	Mountain View, Westech Sls.	415-961-1422
CA	San Diego, Harvey King Inc.	619-566-5252
CA	Torrance, Assoc Reps.	213-328-6708
FL	Melbourne, Beacon Elctrns.	305-724-8010
GA	Atlanta, Remco	404-447-6937
IL	Elmhurst, Utronix Sls.	312-834-1100
MA	Peabody, Eastern Natl. Assoc.	617-535-5536
MI	Jenison, R. C. Nordstrom & Co.	616-457-5762
MI	Lathrup Village, R. C. Nordstrom & Co.	313-559-7373
MN	Eden Prairie, Bohlig & Assoc.	612-944-8404
NY	New York, Robert Smith Assocs.	212-541-4885
NY	Plainview, Robert Smith Assocs.	516-681-3155
NY	Spring Valley, Robert Smith Assocs.	914-354-6067
NC	Raleigh, Remco	919-847-5079
OH	Dayton, Dynel Co.	513-434-6467
PA	Philadelphia, Rayco Sls.	215-757-1899
TX	Austin, J. B. Guenther	512-472-3825
TX	Dallas, J. B. Guenther	214-691-8500
TX	Houston, J. B. Guenther	713-974-0383
VA	Fairfax, Beacon No.	703-591-1300
VA	Forest, Beacon North	804-239-8486
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
EXP	CT, Litchfield, Intrade	203-567-5901

Local Distributors

AL	Huntsville, Component Distr.	205-883-7501
AZ	Tempe, Anjon Entprs.	602-894-1332
AR	Little Rock, Component Distr.	501-227-6278
CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Los Angeles, Electric Switch	213-660-1310
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Torrance, WBC Electro Supp.	213-328-6871
CO	Englewood, Industrial Elctrns. Inc.	303-694-9444
FL	Ft. Lauderdale, Component Distr.	305-971-4950
GA	Norcross, Component Distrs.	404-441-3320
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MI	Grand Rapids, S. F. Elctrns. Supp.	616-459-0216
MN	Blaine, Chris Elctrn. Distr.	612-757-6341
NJ	Bellmawr, Midatlantic Elctrns.	609-931-5303
NY	Elmsford, Ancar Elctrn. Supp.	914-592-7100
NY	Plainview, Plainview Elctrns.	516-249-6677
NC	Raleigh, Component Distr.	919-834-9465
OH	Aurora, IPD	216-562-8113
OH	Centerville, IPD	513-435-2086
TX	Houston, Solid State Elctrns.	713-772-8483
TX	Irving, Solid State Elctrns.	214-438-5700
VA	Falls Church, Component Distr.	703-241-8227
WA	Redmond, Paccom	206-883-9200
EXP	CT, Litchfield, Intrade	203-567-5901

VISUAL INFO. INSTITUTE, Box 33, Xenia, OH 45385, Tel: 513-376-4361; FSC No.: 27432; Empl.: 45

Local Sales Offices & Reps

CA	San Diego, DRF Assocs.	619-292-9431
CA	San Diego, Perspective Meas.	619-278-8931
CA	San Jose, Fox Marketing	408-984-2221
CO	Bailey, Scientific Sys.	303-838-4615
FL	Melbourne, EME III, Inc.	305-259-2711
GA	Decatur, EME II, Inc.	404-325-0165
MA	Clemsford, Meritron Corp.	617-250-1774
NC	High Point, EME, Inc.	919-869-3335
VA	Williamsburg, EME IV, Inc.	804-253-0171

VITEK ELCTRNS., 4 Gladys Ct., Edison, NJ 08817, Tel: 201-287-3200; *Sls. Mgr.:* Joe Griffin

VITRAMON N.A., P. O. Box 544, Bridgeport, CT 06601, Tel: 203-268-6261, TWX: 710-450-3640; Empl.: 606; *Sls. Mgr.:* Paul Davis; *Dist. Mgr.:* S Judt

VIZ TEST EQUIPMENT, Div. VIZ Mfg., 335 E. Price St., Philadelphia, PA 19144, Tel: 215-844-2626, TWX: 710-670-2626; Empl.: 500

Local Sales Offices & Reps

CA	N. Hollywood, MCS Marketing	213-980-1188
CA	Sunnyvale, W. W. Posey	408-746-0771
CO	Denver, Mountain Reps.	303-623-0972
FL	Ft. Lauderdale, Unirep, Inc.	305-587-7481
GA	Roswell, Henry W. Phillips Co.	404-992-3070
IL	Park Ridge, Bob Burns & Assoc.	312-775-1233
IN	Carmel, Midwest Reps. & Assoc.	317-844-4555
MD	Columbia, Par-Nell Sls. Co.	301-992-5454
MA	Milford, Jonel Sls.	617-478-4650
MI	Ferndale, Hilltronics	313-398-5556
MN	White Bear Lake, Yore Co.	612-770-9760
MO	Raytown, Marty Taraski Sls. Co.	816-358-1442
NJ	Fort Lee, TMC Sls. Corp.	201-944-8340
NY	Grand Island, L. J. McTaggart Assocs.	716-773-9222
OH	Cincinnati, John O. Olson Co.	513-574-7711
OR	Portland, Joseph V. Belusko	503-222-4279
PA	Langhorne, Par-Nell Sls. Co.	215-750-0380
PA	Pittsburgh, John O. Olson Co.	412-341-8391
TX	Dallas, Crockett Sls. Co.	214-350-3377

VLSI TECHNOLOGY, INC., 1101 McKay Dr., San Jose, CA 95131, Tel: 408-942-1810, Telex: 278807; Empl.: 450; *Sls. Mgr.:* Ronald C. Kasper

Local Sales Offices & Reps

CA	San Jose	408-942-1810
IL	Arlington Heights	312-358-8000
MA	Burlington	617-229-6555
TX	Dallas	214-231-6716

VOICE IDENTIFICATION, Box 714, Somerville, NJ 08876, Tel: 201-526-3408; Empl.: 7

VOICE MACHINE COMMS., INC., KTI, 1000 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-541-0454; *Sls. Mgr.:* Rod Runge; *Dist. Mgr.:* Rod Runge

VOLITION SYSTEMS, P.O. Box 1236, Del Mar, CA 92014, Tel: 619-481-2286, Telex: 695000 COMEX SDG; Empl.: 7; *Sls. Mgr.:* Joe Caporaletti

VOLTAGE MULTIPLIERS, INC., 8711 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1402, Telex: 176-559; FSC No.: 60211; Empl.: 40; *Sls. Mgr.:* Ken Haag ....**1A**•2113

Local Sales Offices & Reps

AZ	Phoenix, High Voltage Sls., Inc.	602-861-9043
CA	Milpitas, Voltage Multipliers, Inc.	408-946-1254

CA	Tarzana, High Voltage Sls.	213-881-9194
CO	Castle Rock, Romulus Elctrns., Ltd.	303-688-5127
GA	Stone Mountain, Mountain Electro Prods., Inc.	404-469-0603
IL	Arlington Heights, M. J. Petersen & Assoc., Ltd.	312-577-8200
IN	Fort Wayne, Walter W. Bieberich, Inc.	219-432-2537
MD	Glen Burnie, Macrotech Assoc., Ltd.	301-437-5588
MA	Chelmsford, Encotronics	617-256-4207
MO	St. Louis, Robert J. Ruzicka Co.	314-353-7378
NY	Hicksville, J-Square Mktg., Inc.	516-935-3200
NY	Rochester, Robert F. Lamb Co. Inc.	716-323-1250
NY	Syracuse, Robert F. Lamb Co. Inc.	315-455-2469
OH	Dayton, L. D. Bruno Co.	513-434-1847
OK	Tulsa, Cunningham Comps. Corp.	918-492-0390
OR	Portland, Electronic Comp. Sls.	503-245-2342
PA	Washington Crossing, DVS Co.	215-493-4642
TX	Dallas, Cunningham Comps. Corp.	214-233-4303
TX	Houston, Cunningham Comps. Corp.	713-461-4197
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301

VOLTAMPERE CORP., 146 Horton Ave., Lynbrook, NY 11563, Tel: 516-887-9443; FSC No.: 7U805; Empl.: 10

VOLTARC TUBES, 176 Linwood Ave., Fairfield, CT 06430, Tel: 203-255-2633, Telex: 96-4337; Empl.: 180; *Sls. Mgr.:* Albert H. Katz

VOLTEX, 3460 Great Neck Rd., Amityville, NY 11701, Tel: 516-842-2772; Empl.: 55; *Sls. Mgr.:* S. Vogel ....3•1806

Local Sales Offices & Reps

CT	Milford, Cumming Assocs.	203-878-3946
MA	Randolph, Bengal Assocs.	617-961-4120
NJ	Oxford, Malin Assocs.	201-689-7398
NM	Albuquerque, RLS Instrs. Co.	505-293-7931
NY	Fulton, Jones Sudders, Inc.	315-598-3838

VOLTRONICS, West St., P.O. Box 366, E. Hanover, NJ 07936, Tel: 201-887-1517, TWX: 710-986-8253; FSC No.: 18736; Empl.: 70; *Sls. Mgr.:* Richard J. Newman

VOTAN, 4487 Technology Dr., Fremont, CA 94538, Tel: 415-490-7600; *Sls. Mgr.:* Robert Russo

VRN INTERNATIONAL
a Division of Vernitron Corp
Manufacturers of precision potentiometers, trimmers and dip switches

VRN INTERNATIONAL, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, Tel: 813-347-2181, Telex: 68105306, TWX: 810-863-0357; Empl.: 550; *Sls. Mgr.:* R. Fumr; *Dist. Mgr.:* R. Fumr ....1A•2068, 2069; 3•1067

Local Sales Offices & Reps

AL	Brownsboro, JHU Assoc.	205-536-7455
AZ	Tempe, System Sls. of Az.	602-829-9338
CA	Alhambra, MW Riedel & Co.	213-283-7694
CA	Cupertino, Thresum Assoc.	408-996-9889
CA	San Diego, D2 Sls.	619-560-6266
CO	Boulder, Front Range Mktg.	303-443-4780
CT	Stratford, Gerald Rosen Co.	203-375-5456
FL	Boca Raton, Lawrence Assoc.	305-368-7373
FL	Clearwater, Lawrence Assoc.	813-584-8110
GA	Atlanta, JHU Assoc.	404-634-1000
IL	Downers Grove, Circuit Sls.	312-964-9090
IN	Fort Wayne, Ro Whitesell & Assoc.	219-432-5591
IN	Indianpolis, Ro Whitesell & Assoc.	317-359-9283
IN	Kokomo, Ro Whitesell & Assoc.	317-457-9127
KS	Merriam, MTS	913-236-8557
KY	Louisville, Ro Whitesell & Assoc.	502-426-7696
MA	Framingham, Gerald Rosen Co.	617-879-5505
MI	Grand Rapids, Ro Whitesell & Assoc.	616-942-5420
MI	Southfield, Ro Whitesell & Assoc.	313-559-5454
MI	St. Joseph, Ro Whitesell & Assoc.	616-983-7337
MN	Minneapolis, PSI	612-944-8545
NM	Albuquerque, Sys. Sls. of Alb.	505-881-8877
NY	Buffalo, Quality Comps.	716-837-5430
NY	Great Neck, Mos Assoc.	516-487-3966
NY	Manlius, Quality Comps.	315-682-8885
NC	Greensboro, JHU Assoc.	919-852-9097
OH	Cincinnati, Ro Whitesell & Assoc.	513-521-2290
OH	Cleveland, Ro Whitesell & Assoc.	216-447-9020
OH	Columbus, Ro Whitesell & Assoc.	614-888-9396
OH	Dayton, Ro Whitesell & Assoc.	513-298-9546
OK	Broken Arrow, Genzel Sls.	918-258-8656
OR	Tigard, Elctrn. Sources	503-684-0040
PA	Broomall, LD Lowery	215-528-5170
PA	Hummelstown, LD Lowery	717-533-7095
PA	Pittsburg, Ro Whitesell & Assoc.	412-963-6161
TN	Talbott, JHU Assoc.	615-581-4141
TX	Austin, TL Mktg.	512-453-4586
TX	Dallas, TL Mktg.	214-357-1752
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Charlottesville, LD Lowery	804-973-6672
VA	Lanexa, LD Lowery	804-966-5455
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

CA	Chatsworth, IEC/JACO	213-998-2200
CA	Gardena, Bell Inds.	213-515-1800
CA	Manhattan Beach, Prime Electro Prods.	213-772-1724
CA	San Diego, Bell Inds.	619-268-1277
CA	San Fernando, Petell Elec.	213-365-9841
CA	San Jose, Cypress Elctrns.	408-945-8400
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Denver-Wintronics	303-431-7161
CT	Norwalk, Cobra Comps.	203-847-6442
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
FL	Ft. Lauderdale, Dielco	305-973-8700
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
FL	Orlando, TTI Inc.	305-849-1000
FL	Tampa, Impala Elctrns.	813-885-4747
IL	Addison, Lectro Comps.	312-543-1680
IL	Chicago, Bell Inds.	312-982-9210
IA	Cedar Rapids, Deeco	319-365-7551
ME	Woburn, TTI Inc.	617-938-8800
MD	Rockville, M S Elctrns.	301-340-6400
MA	Hingham, Sager Elctrl. Supp.	617-749-6700
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Aero-Space	612-884-4725
MN	Minneapolis, Merit Elctrns.	612-546-5383
NJ	East Hanover, State Elctrns.	201-887-2550
NJ	New Brunswick, Brothers Elctrns.	201-238-2200
NJ	Whippany, Tonar Ind.	201-884-1400
NY	Bohemia, TTI Inc	516-567-1500
NY	E. Syracuse, Add Elctrns. Corp.	315-437-0300
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Hauppauge, Fairmont Elec. Sls.	516-231-3313
NY	Huntington Station, Sherburn Elctrns.	516-231-4300
NY	Rochester, Rochester Radio Supp.	716-454-7800
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Charlotte, Elctrns. Mktg.	704-394-6195
OH	Columbus, Elctrns. Mktg.	614-299-4161
OH	Dayton, Bell Micro-Mil	513-434-8231
OK	Tulsa, Radio	918-587-9123
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Philadelphia, TRW Elctrn. Supp.	215-923-8230
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TX	Ft. Worth, TTI Inc.	817-831-0441
VA	Charlottesville, Virginia Radio	804-296-4184
WA	Bellevue, Bell Inds.	206-747-1515
WA	Seattle, Robert E. Priebe Co.	206-682-8242
WI	Milwaukee, Marsh Elctrns.	414-475-6000

VTM MICROWAVES, INC., 4975 W. 80 Ave., Westminster, CO 80030, Tel: 303-426-6866; Empl.: 15

V-TRON ELCTRNS. CORP., 84 Fountain St., Pawtucket, RI 02860, Tel: 401-728-6140; Empl.: 250; *Sls. Mgr.:* Richard E. French

VU-DATA, 7122 Convoy Ct., San Diego, CA 92111, Tel: 619-279-6572, TWX: 910-335-1586; FSC No.: 34160; Empl.: 15

WABASH, First & Webster Sts., Wabash, IN 46992, Tel: 219-563-3111, TWX: 810-333-1533; Empl.: 400; *Sls. Mgr.:* Stan Kalin

WABASH RELAY & ELCTRNS., First & Webster Sts., Wabash, IN 46992, Tel: 219-563-2191, TWX: 810-290-2722; Empl.: 250; *Sls. Mgr.:* David L. Snodgrass ....1B•1478, 1479

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Phoenix, M/R Engrg. Sls. Co.	602-956-4670
CA	Glendale, Halbar	213-246-8263
CA	San Mateo, Halbar	415-349-4700
CO	Aurora, Mountain View Mktg.	303-360-9641
DE	Medford, Comp. Conslt.	609-654-5300
FL	Ft. Lauderdale, APM Assocs.	305-565-0056
FL	Longwood, APM Assocs.	305-869-6831
FL	Tampa, APM Asocs.	813-886-2457
GA	Stone Mountain, 20th Century Mktg.	404-292-7088
IL	Arlington Heights, M. J. Petersen Assocs.	312-577-8200
IN	Fort Wayne, M/S Sales	219-484-1904
KS	De Soto, Midtec Assoc.	913-441-6565
MD	Glen Burnie, Macrotech Assocs. Ltd.	301-437-5588
MA	Andover, Crawford Assocs.	617-470-2122
MI	Novi, Lektronics	313-349-3304
MN	Edina, PWC Inc.	612-831-5999
MO	Florissant, Midtec Assoc.	314-837-5200
NJ	Watchung, Dolan Assocs.	201-753-2671
NY	Penfield, Upstate Comp. Sls.	716-381-6070
NC	Raleigh, Tingen Tech. Sls.	919-781-1100
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Shaker Heights, KW Elctrn. Sls.	216-491-9177
OH	Worthington, KW Elctrn. Sls.	614-888-0483
PA	Medford, Comp. Consultants	609-654-5300
TN	Knoxville, 20th Century Mktg.	615-690-1618
TX	Dallas, Stevens Sls. Co.	214-350-2476
VA	Glen Burnie, Macrotech Assocs. Ltd.	301-437-5588
WA	Redmond, Halbar Assocs. Inc	206-882-0990
WA	Vancouver, Halbar Assocs.	206-696-0170

Local Distributors

IL	Elk Grove Village, Nu-Way Elctrn. Distrs.	800-323-7957

WABER ELECTRIC, See SGL Waber Electric.

WADSWORTH ELEC., 20 W. 11th St., Covington, KY 41011, Tel: 606-431-0900; *Sls. Mgr.:* D. W. Phillips

WAGNER ELECTRIC CORP., Tung-Sol Div., 100 Misty Lane, Parsippany, NJ 07054, Tel: 201-386-9300

WAGO CORP., 6657 N. Sidney Pl., Milwaukee, WI 53209-3217, Tel: 414-352-1035, Telex: 260123; *Sls. Mgr.:* Michael A. Lane

WAHL INSTRUMENTS, INC., 5750 Hannum Ave., Culver City, CA 90230, Tel: 213-822-6144, TWX: 910-343-6867; Empl.: 48

WALDES KOHINOOR, 47-16 Austel Pl., Long Island City, NY 11101, Tel: 212-392-3100, Telex: 126-829; Empl.: 450

WALDOM ELCTRNS., 4301 W. 69th St., Dept. EEM, Chicago, IL 60629, Tel: 312-585-1212, Telex: 25-4604; FSC No.: 92219; Empl.: 143; *Sls. Mgr.:* E. R. Beutler

WALKER SCIENTIFIC, Rockdale St., Worcester, MA 01606, Tel: 617-852-3674, Telex: 92-0489; Empl.: 83; *Sls. Mgr.:* B. Langley

WALL, A. T., CO., 55 Service Ave., Warwick, RI 02886, Tel: 401-739-0740, TWX: 710-382-1535; Empl.: 75; *Sls. Mgr.:* Carl Gibbs; *Dist. Mgr.:* R. Huntsman

WALL-ABLE MANUFACTURING CORP., 1800 N. Clybourn Ave., Chicago, IL 60614, Tel: 312-440-1000; Empl.: 100; *Sls. Mgr.:* Dennis O'Brien ..2•1742, 1743

Local Sales Offices & Reps

IL	Wheeling, AL&W Sls. Co.	312-541-9080
MA	Norwell, Carl Morris & Assoc.	617-659-2968
NY	Dobbs Ferry, L. J. Valle, Inc.	914-693-5089

WALL INDS., 2 Franklin, Lawrence, MA 01840, Tel: 617-688-1287; Empl.: 55; *Sls. Mgr.:* Mark P. Aiello

WALL LENK, Box 3349, Dept. EEM-71, Kinston, NC 28501, Tel: 919-527-4186; Empl.: 60; *Sls. Mgr.:* Richard W. Cooper

Local Sales Offices & Reps

CA	Laguna Hills, Kendall Mktg.	714-581-9951
CO	Aurora, S.O.S. Mktg.	303-366-7667
FL	Tampa, SRT Mktg.	813-884-4805
GA	Stone Mountain, Advanced Elctrns. Equip.	404-289-6100
IN	Noblesville, R & D Electronics	317-849-2026
MA	Rochdale, Robert L. May Assoc.	617-885-4370
MI	Brighton, A. P. Assocs.	313-229-6550
MN	Minneapolis, John Anderson Co.	612-823-6459
MO	Kansas City, W. D. Burt & Assoc.	816-931-2384
NY	Guilderland, The Solder Pot	518-355-1829
NC	Raleigh, South States Mktg.	919-781-3220
TX	Houston, Natl. Mktg. Assoc.	713-460-0989
UT	Ogden, Johnson Co.	801-393-1202

WAMCO, INC., 11555-A Coley River Cir., Fountain Valley, CA 92708, Tel: 714-545-5560, Telex: 678-459; *Sls. Mgr.:* Gordon R. Calvert; *Dist. Mgr.:* Sheila A. Sherman

WARD LEONARD ELEC., 31 South St., Mt. Vernon, NY 10550, Tel: 914-664-1000, TWX: 710-562-0144; FSC No.: 63743; Empl.: 600; *Dist. Mgr.:* Barry Daly

WARREN COMMS., 101 Okner Pkwy., Livingston, NJ 07039, Tel: 201-992-6200, Telex: 139-384, TWX: 710-994-4852; Empl.: 200; *Sls. Mgr.:* William Vandertulip

Local Sales Offices & Reps

CA	Santa Ana, Comm. Prods.	714-730-1220
NJ	Glen Ridge, Michael Ostella	201-429-9377

Local Distributors

AZ	Phoenix, Dortan Enterprises	602-944-2947
CA	Los Angeles, M. A. Stolaroff Co.	213-295-7781
CA	San Diego, Masco Inc.	619-234-6905
CA	San Francisco, Blach & Bensinger	415-697-2525
FL	Indian Rocks Bch., Tech-Reps Assocs.	813-577-2779
IL	S. Elgin, R. K. Elctrns.	312-695-8552
MN	Minneapolis, HMR, Inc	612-831-7400
NJ	Westfield, Erich Maertz, Inc.	201-232-4643
NY	Rochester, R. P. Kennedy Co.	716-271-6322
TX	Carollton, Seaton Corp.	214-380-0414
VA	Alexandria, TDI	703-971-8982

WARREN-KNIGHT INSTR. CO., Warren Inds., Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WAVETEK ROCKLAND SCI., 245 Livingston St., Northvale, NJ 07647, Tel: 201-767-7100, TWX: 710-991-9619; Empl.: 200; *Sls. Mgr.:* Howard Siegerman

WASATCH HIGH VOLTAGE, P.O. Box 9027, Salt Lake City, UT 84109, Tel: 801-466-9561; Empl.: 9; *Sls. Mgr.:* T. J. Bruzenak

Local Sales Offices & Reps

CA	Encino, King-way Assocs.	213-788-4124

WATERS MFG., Longfellow Ctr., Wayland, MA 01778, Tel: 617-358-2777, Telex: 948441; Empl.: 125; *Sls. Mgr.:* Ralph Pietro

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, Telex: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 2800

WATKINS-JOHNSON CO., Stewart Div., 440 Mount Herman Road, Scotts Valley, CA 95060, Tel: 408-438-2100

WATT-CLOCK CORP., P.O. Box 697, Stratford, CT 06497, Tel: 203-378-2500; Empl.: 5; *Sls. Mgr.:* M. Dee

WAVECOM, 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TWX: 910-493-2172; FSC No.: 28979; Empl.: 93

WAVELINE, Box 718, W. Caldwell, NJ 07006, Tel: 201-226-9100, TWX: 710-734-4324; FSC No.: 00443; Empl.: 95; *Sls. Mgr.:* R. A. Powell

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrn. Assocs.	205-881-5031
AZ	Scottsdale, Territorial Mktg.	602-994-8665
CA	Mt. View, Pacific Technical Mktg.	415-969-3010
CA	Tarzana, Midwin & Olifson	213-996-9093
FL	Ft. Lauderdale, Beacon Elctrn.	305-491-1054
FL	Maitland, Beacon Elctrn. Assn.	305-647-3498
GA	Atlanta, Beacon Elctrn.	404-256-9640
KY	Ft. Mitchel, GW. Thelen	606-341-8181
MD	Glen Arm, Hodgins Assocs.	301-592-7047
MA	Needham Hgts., O'Sullivan & Murphy	617-449-4141
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Skaneateles, Robtron	315-685-5731
NC	Raleigh, Beacon Elctrns.	919-780-0330
OH	Medina, GW Thelen	216-723-1293
TX	Arlington, N&W Sls.	817-461-4443
WA	Seattle, Rep-West	206-283-8351
EXP	NJ, Oradell, Sylvan Ginsbury	201-261-3200

WAVETEK INDIANA, INC., 5808 Churchman, Beech Grove, IN 46107, Tel: 317-787-3332, TWX: 810-341-3226; FSC No.: 34280; Empl.: 900; *Sls. Mgr.:* Dick Koerner .... **1A**•1784, 1785; **3**•1318

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-883-8660
AZ	Scottsdale, Barnhill Assoc.	602-947-7841
CA	Redondo Beach, Ward/Davis	213-973-7772
CA	San Diego, Ward/Davis	619-292-1000
CA	Santa Clara, Ward/Davis	408-245-3700
CO	Englewood, Barnhill Assoc.	303-779-3600
CT	No. Haven, P. Jenks Assoc.	203-239-6201
FL	Ft. Lauderdale, W. A. Brown Instrs.	305-776-4800
FL	Melbourne, W. A. Brown Instrs.	305-723-0766
GA	Norcross, W. A. Brown Instrs.	404-441-2980
HI	Honolulu, EMC Corp.	808-836-2044
IL	Arlington Hgts., Dytec Central	312-394-3380
IN	Indianapolis, Dytec Central	317-247-1316
KS	Lenexa, Dytec South	913-888-0215
LA	Mandeville, W. A. Brown Instrs.	504-626-9701
MA	Woburn, P. Jenks Assoc.	617-938-0488
MI	Madison Hgts., WKM Assocs.	313-588-2300
MN	St. Paul, Dytec North	612-645-5816
MO	Maryland Hgts., Dytec South	314-569-2990
NM	Albuquerque, Barnhill Assoc.	505-299-7658
NY	Fairport, Naco Elctrns.	716-223-4490
NY	N. Syracuse, Naco Elctrns.	315-699-2651
NY	Utica, Naco Elctrns.	315-732-1801
NC	Durham, W.A. Brown Instrs.	919-682-2383
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OK	Tulsa, Data Mktg. Assoc.	918-496-1457
OR	Beaverton, Northwest Test & Meas.	503-646-9966
PA	Bensalem, Eastern Instrmn.	215-245-6660
PA	Pittsburgh, WKM Assocs.	412-892-2953
SC	Columbia, W. A. Brown Instrs.	803-798-8070
TN	Oak Ridge, W. A. Brown Instrs.	615-482-5761
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assoc.	214-661-0300
TX	Houston, Data Mktg. Assoc.	713-780-2511
TX	San Antonio, Data Mktg. Assoc.	512-342-3031
UT	Murray, Barnhill Assoc.	801-262-3000
VA	McLean, Creative Mktg. Assoc.	703-442-9100
WA	Redmond, Northwest Test & Meas.	206-881-8857

WAVETEK ROCKLAND SCIENTIFIC, INC., 10 Volvo Dr., Rockleigh Indl. Pk., Rockleigh, NJ 07647, Tel: 201-767-7900, TWX: 710-991-9852; Empl.: 100

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instr.	205-883-8660
AZ	Scottsdale, Barnhill Assoc., Inc.	602-947-7841
CA	Irvine, Wavetek Rockland Sci.	714-261-8600
CA	Redondo Beach, Ward/Davis Assoc.	213-643-6977
CA	San Diego, Ward/Davis Assocs.	619-292-1000
CA	San Jose, Wavetek Rockland Sci.	408-286-8040
CA	Santa Clara, Ward/Davis Assoc.	408-245-3700
CO	Englewood, Barnhill Assoc., Inc.	303-779-3600
CT	N. Haven, Pat Jenks Assocs.	203-239-6201
FL	Fort Lauderdale, W. A. Brown Instr.	305-776-4800
FL	Melbourne, W. A. Brown Instr.	305-723-0766
FL	Orlando, W. A. Brown Instrs.	305-425-5505
FL	Tampa, Wavetek Rockland Sci.	813-626-6333
GA	Atlanta, W. A. Brown Instrs.	404-455-2035
GA	Norcross, W. A. Brown Instr.	404-441-2980
GA	Tucker, Wavetek Rockland Sci.	404-491-7614
HI	Honolulu, EMC Corp.	808-836-1138
IL	Arlington Hgts., Dytec/Central	312-394-3380
IN	Indianapolis, Dytec/Central	317-247-1316
IA	Iowa City, Dytec/South	319-683-2282
KS	Lenexa, Dytec/South	913-888-0215
LA	Mandeville, W. A. Brown Instr.	504-626-9701
MA	Burlington, Wavetek Rockland Sci.	617-273-4557
MA	Woburn, Pat Jenks Assocs.	617-938-0488
MI	Madison Hgts., WKM Assocs.	313-588-2300
MN	St. Paul, Dytec/North	612-645-5816
MO	Maryland Hgts., Dytec/South	314-569-2990
NM	Albuquerque, Barnhill Assoc., Inc.	505-299-7658
NY	Fairport, Naco Elec. Corp.	716-223-4490
NY	Great Neck, RTI	516-829-3770
NY	N. Syracuse, Naco Elec. Corp.	315-699-2651
NY	Utica, Naco Elec. Corp.	315-732-1801
NC	Durham, W. A. Brown Instr.	919-683-1580
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5903
OH	Worthington, Wavetek Rockland Sci.	614-888-6060
OK	Tulsa, Data Mktg. Assocs.	918-496-1457
OR	Beaverton, Northwest Test & Meas.	503-646-9966
PA	Bensalem, Eastern Instrmn.	215-245-6660
PA	Montgomeryville, Wavetek Rockland Sci.	215-822-7001
PA	Pittsburgh, WKM Assocs.	412-892-2953
SC	Columbia, W. A. Brown Instr.	803-798-8070
TN	Oak Ridge, W. A. Brown Instr.	615-482-5761
TX	Austin, Data Mktg. Assocs.	512-451-5174
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-828-0937
UT	Murray, Barnhill Corp.	801-262-3000
VA	McLean, Wavetek Rockland Sci.	703-442-0600
VA	McLean, Creative Mktg. Assoc.	703-442-9100
WA	Redmond, Northwest Test & Meas.	206-881-8857

WAVETEK SAN DIEGO, Div. of Wavetek, 9045 Balboa Ave., P.O. Box 85265, San Diego, CA 92123, Tel: 619-279-2200, TWX: 910-335-2007; Empl.: 470; *Sls. Mgr.:* Sam Lewis

WAYNE KERR, INC., W.K.R. Ltd., 400 West Cummings Pk., Woburn, MA 01801, Tel: 617-938-8390, Telex: 6817257 WKERR WOBN; *Sls. Mgr.:* Ken Berquist

WAYNE TRANSFORMER CO., INC., 99 Hazel St., Paterson, NJ 07503, Tel: 201-278-7674; *Sls. Mgr.:* Fred DeMauro .... **1A**•2365

WECKESSER CO. INC., 4444 W. Irving Park Rd., Chicago, IL 60641, Tel: 312-282-8626; Empl.: 90

WECO

WECO ELCTRL. CONNECTORS INC., Weco Wester, Ebbinghaus & Co., P.O. Box 84, Ste. Anne DeBellevue P.Q., Canada H9X3L4, Tel: 514-457-3648, Telex: 05-821840; *Sls. Mgr.:* Heiner Kammann; *Dist. Mgr.:* Heiner Kammann .... **2**•1745-1747

Local Sales Offices & Reps

CA	Fullerton, ISI Mktg. Co.	714-773-0411
CO	Littleton, Protronics Grp.	303-973-3096
FL	Coral Springs, HAI Elctrns.	305-752-7520
IL	Carol Stream, Lectro Comps.	312-690-0520
NH	Nashua, Bell Controls Inc.	603-882-6984
OR	Portland, SPS Elctrns.	503-297-6919
WA	Redmond, SPS Elctrns.	206-323-4140

Local Distributors

CA	Fullerton, ISI Mktg. Co.	714-773-0411
IL	Carol Stream, Lectro Comps.	312-690-0520

WEED INSTR. CO., INC., 707 Jeffrey Way, P.O. Box 300, Round Rock, TX 78664-0300, Tel: 512-255-7043, Telex: 776492; Empl.: 110; *Sls. Mgr.:* Tom Kurys

WEI CORP., 1405 S. Village Way, Santa Ana, CA 92705, Tel: 714-834-9333, TWX: 910-595-1709; FSC No.: 51272; Empl.: 50; *Sls. Mgr.:* R. H. Thomason

WEIDMULLER TERMINATIONS, 821 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-2877, Telex: 828376; Empl.: 31; *Sls. Mgr.:* James G. Dunn; *Dist. Mgr.:* Mort Gelfand .... **2**•1748

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assoc.	602-994-3813
CA	Huntington Beach, Weidmuller Terminations	714-960-9264
CA	Lamesa, Weidmuller Terminations	619-466-5644
CA	Santa Clara, DC Elctrns.	408-980-1199
CA	Woodland Hills, Weidmuller Terminations	213-716-8929
CO	Denver, Weidmuller Terminations	303-753-1499
CT	Trumbull, Weidmuller Terminations	203-268-1496
FL	Apopka, Weidmuller Terminations	305-889-2791
GA	Marietta, Weidmuller Terminations	404-971-6472
IL	Barrington, R. Fisk Mktg.	312-381-0653
IL	Crete, Weidmuller Terminations	312-672-4460
LA	Baton Rouge, General Power & Control	504-924-3919
MA	Revere, Weidmuller Terminations	617-289-2122
MI	Highland, Holly & Upleger	313-363-8800
NJ	Port Reading, Weidmuller Terminations	201-636-7021
NY	E. Syracuse, L-Mar Assoc.	315-437-7779
NY	Rochester, L-Mar Assoc.	716-323-1000
NY	West Hempstead, Schmitt Indl. Mktg.	516-486-5510
OH	Cincinnati, J. W. Murray & Assoc.	513-574-8500
OH	Mentor, Weidmuller Terminations	216-255-1990
OK	Tulsa, Electrotech Sys.	918-496-2021
PA	Philadelphia, Weidmuller Terminations	215-698-8285
TX	Grapevine, Electrotech Sys.	817-481-1583
TX	Houston, Weidmuller Terminations	713-870-1515
TX	Missouri City, Weidmuller Terminations	713-437-2011
UT	Salt Lake City, Control Agency	801-320-4305
WA	Issaquah, Weidmuller Terminations	206-392-4333
WI	Milwaukee, Weidmuller Terminations	414-444-9441

WEINSCHEL ENGRG., One Weinschel La., Gaithersburg, MD 20877, Tel: 301-948-3434, 800-638-2048, Telex: ITT 440702, TWX: WU 89-8352; FSC No.: 93459; Empl.: 325; *Sls. Mgr.:* Ron Bastien .... **1A**•1787; **3**•1319

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns. Assoc.	205-881-5031
AZ	Tempe, Sierra Tech. Grp.	602-894-2335
AR	Little Rock, Beacon Elctrns. Assoc.	501-224-5449
CA	Malibu, G. McNamara	213-457-4563
CA	Rodondo Beach, Ward Davis Assoc.	213-643-6977
CA	San Diego, Ward Davis Assoc.	619-292-1000
CA	Santa Clara, Ward Davis Assoc.	408-245-3700
CO	Englewood, Sierra Tech. Grp.	303-790-1700
FL	Clearwater, Beacon Elctrns. Assoc.	813-796-2378
FL	Ft. Lauderdale, Beacon Elctrns. Assoc.	305-491-1054
FL	Maitland, Beacon Elctrns. Assoc.	305-647-3498
FL	Melbourne, Beacon Elctrns. Assoc.	305-724-8010
GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Arlington Heights, Dytec Central	312-394-3380
IN	Indianapolis, Dytec Central	317-247-1316
KS	Lenexa, Dytec South	913-888-0215
MA	Burlington, R. J. Sickles Assoc.	617-862-5100
MN	St. Paul, Dytec North	612-645-5816

MO	Maryland Hgts., Dytec South	314-569-2990
NJ	Hackensack, Tech. Mktg.	201-342-4008
NM	Las Cruces, Sierra Tech. Grp.	505-524-8092
NY	Fairport, Naco Elctrns.	716-223-4490
NY	No. Syracuse, Naco Elctrns.	315-699-2651
NY	Utica, Naco Elctrns.	315-732-1801
NC	Raleigh, Beacon Elctrns. Assoc.	919-787-0330
OR	Portland, Arva-Hudson	206-455-0773
PA	Bensalem, Eastern Inst.	215-245-6660
TX	Austin, Sci. Dvcs.-Southwest, Inc.	512-442-6215
TX	El Paso, Sierra Tech. Grp.	915-591-5890
TX	Houston, Scientific Dvcs. - Southwest	713-864-1711
TX	Richardson, Scientific Dvcs. - Southwest	214-231-8106
TX	San Antonio, Ashcraft Assocs.	512-681-0477
UT	Salt Lake City, Sierra Tech. Grp.	801-322-3069
VA	McLean, Creative Mktg. Assocs.	703-442-9100
WA	Bellevue, Arva-Hudson	206-455-0773

WELLMAN THERMAL SYS., 1 Progress Rd, Shelbyville, IN 46176, Tel: 317-398-4411, TWX: 810-260-2616; FSC No.: 4S017; Empl.: 600; *Sls. Mgr.:* E. W. Abel; *Dist. Mgr.:* W. L. McNamee

WELLS ELCTRNS., 1701 S. Main St., South Bend, IN 46613, Tel: 219-287-5941, Telex: 25-8325; Empl.: 180; *Sls. Mgr.:* Michael Myers .... 2•1750-1755

Local Sales Offices & Reps

AL	Huntsville, Southeastern Mktg.	205-882-1633
AZ	Tempe, Foley, Tallent & Lee, Inc.	602-894-2345
CA	Los Angeles, EESCO	213-242-8823
CA	San Jose, Western Indl. Network	408-559-8118
CO	Denver, Foley, Tallent & Lee, Inc.	303-973-4934
CT	Wethersfield, Com/Pak, Inc.	203-563-4784
FL	Maitland, Lobo Mktg. Assocs., Inc.	305-628-8911
IL	Glencoe, Howard Benjamin Assocs. Inc.	312-835-0150
IN	Greenfield, France Entprs., Inc.	317-462-6098
IA	Davenport, Electro Tech Assocs.	319-386-1134
MA	Woburn, Com/Pak, Inc.	617-938-8580
MI	Ypsilanti, TAMCO, Inc.	313-572-1950
MN	Minneapolis, Electro-Tech Assocs.	612-927-5878
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Berkeley Heights, Cambridge Allen and Assocs.	201-464-7987
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NY	Syracuse, T-Squared Elctrns. Co., Inc.	315-463-8592
NC	Raleigh, Tingen Tech. Sls., Inc.	919-781-1100
OR	Beaverton, Caruso & Northcutt, Inc.	503-646-4973
TX	El Paso, EPEC, Inc.	915-593-8481
TX	Irving, AID Elctrns., Inc.	214-259-4761
WA	Bellevue, Caruso & Northcutt, Inc.	206-454-9699
WI	Colgate, Rep 1 & Assocs.	414-628-4016

Local Distributors

AZ	Tempe, Waltronic Sls.	602-967-1020
CA	Anaheim, A To Z Elctrns., Inc.	714-634-3620
CA	North Hollywood, Elctrn. Hardware, Ltd.	213-982-6100
CA	San Jose, Cypress Elctrns., Inc.	408-945-8400
CO	Denver, CSID, Inc.	303-292-9594
FL	Pompano Beach, Comps. South	305-971-0350
IL	Chicago, Semiconductor Specialists, Inc.	312-279-1000
MA	Burlington, Schaal Assocs.	617-272-7940
MA	Mendon, Add Elctrn. Corp.	617-478-4200
MI	Southfield, L.S.I. Mktg.	313-356-7002
MN	Minneapolis, Semiconductor Specialists, Inc.	612-854-8841
MO	Kansas City, Semiconductor Specialists, Inc.	816-452-3900
NH	Hampstead, Astrum Elctrns.	603-329-5656
NJ	Bellmawr, Mid-Atlantic Elctrns. Corp.	609-931-5303
NY	East Syracuse, Add Elctrn. Corp.	315-437-0300
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Schaal Assocs.	516-234-4600
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OR	Tigard, Moore Elctrns. Inc.	503-684-3100
PA	Pittsburgh, Semiconductor Specialists, Inc.	412-963-7241
TX	Houston, Kent Elctrns. Inc.	713-780-7770
TX	Richardson, Kent Elctrns. Inc.	214-669-2600

WELTEK INTL., INC., 760 W. Cotter St., South Bend, IN 46613, Tel: 219-232-5400, Telex: 23-3131; Empl.: 28; *Sls. Mgr.:* Tom Gerschoffer

Local Sales Offices & Reps

CA	Fremont, HJR Entprs.	415-490-7911
CO	Littleton, Production Equip. Sls.	303-795-5022
DC	Washington, Harry Wise & Co.	202-363-9417
FL	Lake Worth, GRY Associates	305-965-5111
IN	Noblesville, King Sls	317-842-1035
KS	Prairie Village, Dougherty & Assoc.	913-649-3515
MA	Tewksbury, Hunt Assocs.	617-851-9042
MI	Royal Oak, Murray Percival & Co.	313-548-1971
MN	Edina, PEC/LEVI	612-94-8540
MO	St. Louis, John E. Metz Co.	314-993-1979
NY	Fair Haven, Feikert Assoc., Inc.	315-947-5994
NC	Cary, Interbit, Inc.	919-467-3200

WESCO ELECTRICAL CO., 201 Munson St., Greenfield, MA 01301, Tel: 413-774-4358; FSC No.: 12673; Empl.: 190; *Sls. Mgr.:* James R. DeSanty .... 1A•1212-1217

Local Sales Offices & Reps

CA	Costa Mesa, Electro-Mech Sls. Co.	714-642-2390
CA	La Jolla, Southwest Tech. Sls.	619-454-2034
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CT	Milford, Cuming Assoc.	203-878-3946
FL	Fern Park, EIR Inc.	305-830-9600
IL	Addison, Banner Tech. Sls.	312-279-6070
IN	Columbus, J. H. Weaver Co.	812-372-3625
MA	Framingham, Bengal Assocs.	617-877-2639
MA	Randolph, Bengal Assocs.	617-961-4120
MN	Bloomington, Electronic Sls. Agcy.	612-884-8291
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NC	Raleigh, Leigh Sls.	919-872-1484
OH	Wickliffe, W. Brauer & Assoc.	216-943-0601
OR	Beaverton, L-D Elctrns.	503-649-6177
PA	Pittsburgh, W. Brauer & Assoc.	412-921-3213
TX	Dallas, Blackburn Assocs.	214-692-8885
WA	Snohomish, L-D Elctrns.	206-568-0511

WESCOM, PO Box 1458, Downers Grove, IL 60515, Tel: 312-985-9000, Telex: 253656, TWX: 910-695-4735; *Sls. Mgr.:* R. Don Webster

WESCORP ANTISTATIC PRODS., 144 S. Whisman Rd., Mountain View, CA 94041, Tel: 415-969-7717, Telex: 345507; Empl.: 15; *Sls. Mgr.:* Lourdes Rivera

Distributor

WES-GARDE COMPONENTS GROUP, INC., 190 Elliott St., Hartford, CT 06114, Tel: 203-525-6907 .... 1B•1742

WESTAMP, 1542 15th St., Santa Monica, CA 90404, Tel: 213-393-0401, TWX: 910-343-7443; Empl.: 90

WESTBERG MFG., INC., 3400 Westach Way, Sonoma, CA 95476, Tel: 707-938-2121; *Sls. Mgr.:* R. R. Westberg

WEST-CAP ARIZONA, Sub. of San Fernando Electric Mftg. Co., 2201 East Elvira Road, Tucson, AZ 85706, Tel: 602-294-2646

WEST COAST ELEC. MFG., 14045 Garfield Ave, Paramount, CA 90723, Tel: 213-633-1010; FSC No.: 81823; Empl.: 25; *Sls. Mgr.:* W. E. Seal

WESTCODE SEMICONDUCTORS, INC., 0-02 Fair Lawn Ave., Fair Lawn, NJ 07410, Tel: 201-791-3020, Telex: 130389; *Sls. Mgr.:* E. Hultz, Jr.

Local Sales Offices & Reps

CA	Long Beach, Megawatt Corp.	213-634-9731
FL	Oldsmar, Boggs & Assocs.	813-855-1812
NY	Kings Park, JL Sales Assocs.	516-979-9086
OH	Cleveland, Electronic Salesmasters	216-831-9555
TX	Dallas, Delta Comps.	214-287-6333
WI	New Berlin, Reko, Inc.	414-784-3430

WESTEMP CORP., Box 767, Cardiff, CA 92007, Tel: 619-942-9800; Empl.: 20; *Sls. Mgr.:* J. Huston

WESTERN DIGITAL CORP., 2445 McCabe Way, Irvine, CA 92714, Tel: 714-557-3550, TWX: 910-595-1139; *Dist. Mgr.:* Ron Weaver

WESTERN ELECTRIC CO., INC., 222 Broadway, New York, NY 10038, Tel: 212-669-2345

WESTERN ELCTRN. PRODS., 107 Los Molinos, San Clemente, CA 92672, Tel: 714-492-4677; FSC No.: 13988

WESTERN ELECTRO. MECH. CO. INC., 300 Broadway, Oakland, CA 94607, Tel: 415-452-1936; *Sls. Mgr.:* W. J. Foster

WESTERN GEAR CORP., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744, Tel: 818-968-6525, TWX: 910-584-4856; Empl.: 1125; *Sls. Mgr.:* D. Waite

WESTERN GRAPHTEC, 12 Chrysler St., Irvine, CA 92714, Tel: 714-770-6010, 800-854-8385

WESTERN RESERVE ELCTRNS., 2150 Highland Rd., Twinsburg, OH 44087, Tel: 216-425-4951; Empl.: 45; *Sls. Mgr.:* Robert Rhodes

WESTINGHOUSE ELECTRIC CORP., Aerospace Electrical Div., P.O. Box 989, Lima, OH 45802, Tel: 419-226-3121

WESTINGHOUSE ELECTRIC CORP., Electronic Tube Div., P.O. Box 284, Elmira, NY 14902, Tel: 607-796-3211

WESTINGHOUSE ELEC. CORP., Lamp Div., Parts Sls., 1 Westghse Plaza, Bloomfield, NJ 07003, Tel: 201-429-3325

WESTINGHOUSE ELEC. CORP., Semiconductor Div., Armbrust Rd., Youngwood, PA 15697, Tel: 412-925-7272, TWX: 510-468-2840; Empl.: 600; *Sls. Mgr.:* D. E. Rieth; *Dist. Mgr.:* P. DelPalazzo

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-536-8410
AZ	Tempe, Quatra Assocs.	602-894-2808
CA	Agoura, Westpower Co.	818-706-0550
CA	Laguna Hills, Westpower Co.	714-380-0277
CA	Los Angeles, Westpower Co.	818-579-8230
CA	Mountain View, Westinghouse Elec.	415-949-0610
CA	Santa Clara, Engineering Assoc. Corp.	408-988-5001
CO	Denver, Lindberg Co.	303-758-9033
CT	Madison, HV Engrg.	203-401-4561
FL	Altamonte Springs, Semtronic Assoc.	305-831-8233
FL	Clearwater, Semtronic Assoc.	813-461-4675
GA	Atlanta, JWL Assocs.	404-429-8010
IL	Chicago, L & W Power Corp.	312-887-8909
IL	Wheaton, Westinghouse	312-462-0404
IA	Cedar Rapids, Dy-Tronix	319-377-8275
MD	Baltimore, Westinghouse Elect.	301-792-8857
MA	Boston, Westinghouse Elec.	617-237-6950
MA	Ludlow, Gerber Sls.	413-589-9837
MA	Newton Upper Falls, Gerber Sls.	617-969-2620
MI	Livonia, L & W Power, Corp.	313-525-1380
MN	Minneapolis, Comstrand	612-788-9234
MO	Independence, Dy-Tronix	816-373-6600
MO	St. Louis, Dy-Tronix	314-731-5799
NJ	Basking Ridge, Eastpower Co.	201-766-7886
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Charlotte, JWL Assocs.	704-523-3001
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, J. R. Thornberry Co.	513-874-0236
OH	Kettering, L & W Power, Corp.	513-293-3482
OH	South Euclid, J.R. Thornberry Co.	216-321-3328
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
PA	Youngwood, Westinghouse	412-925-7272
TX	Austin, NOVA Mktg.	512-835-1733
TX	Dallas, Nova Mktg.	214-750-6082
TX	Houston, Nova Mktg.	713-988-6082
UT	Salt Lake City, Lindberg Co.	801-969-2400
WI	Milwaukee, L & W Power Corp.	414-786-0260

WEST INSTRS, Gulton Inds, M. C. S. Div., Gulton Indl Pk, E. Greenwich, RI 02818, Tel: 401-884-6800, TWX: 710-387-1500; Empl.: 400; *Sls. Mgr.:* W. Hunt; *Dist. Mgr.:* W. Hunt

WESTLAKE CAPACITORS INC., 5334 Sterling Center Dr., Westlake Village, CA 91361, Tel: 818-889-4120, TWX: 910-494-4779; Empl.: 210; *Sls. Mgr.:* F. G. Edge; *Dist. Mgr.:* D. Lawrence

WESTON CONTROLS/POTS DIV., Div. Fairchild Weston Sys., Inc., Archbald, PA 18403, Tel: 717-876-1500, Telex: 83-1873, TWX: 510-656-2902; FSC No.: 94271; Empl.: 1077; *Sls. Mgr.:* J. Cousins .... 1A•2071-2084

Local Sales Offices & Reps

AZ	Phoenix, Sanford Sls. Assoc.	602-957-3570
CA	Carlsbad, Addem/San Diego	619-729-9216
CA	Mountain View, Westmark Assocs.	415-969-1700
CA	Van Nuys, Wes-K Assocs.	213-989-3070
CO	Denver, Quorum 3 Sls. Group	303-696-8480
CT	Ridgefield, Phoenix Sls. Co.	203-438-9644
FL	Clearwater Beach, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
FL	Sunrise, Perrott Assocs.	305-792-2211
GA	Stone Mountain, DTM, Inc.	404-962-2530
IL	Skokie, Marcon Assocs.	312-675-6450
KS	Olathe, Rush & West	913-764-2700
KS	Wichita, Repco	316-263-4238
MD	Baltimore, B. White & Co.	301-484-5400
MA	Stow, Today Comp. Sls. Corp.	617-897-7500
MI	Warren, DEM Elctrn. Sls.	313-575-9444
MN	St. Paul, Repco	612-642-2828
MO	Ballwin, Rush & West Assoc., Inc.	314-394-7271

MO	Independence, Repco	816-254-3410
NJ	Fairfield, Addem Sls.	201-882-0993
NY	Albany, Reagan/Compar	518-489-4777
NY	Endwell, Reagan/Compar	607-723-8743
NY	Endwell, Reagan/Compar	607-754-8946
NY	Fairport, Reagan/Compar	716-271-2230
NY	New Hartford, Reagan/Compar	315-732-3775
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Beaverton, LD Elctrns.	503-649-6177
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Rydal, ESPY Sls.	215-576-0780
TX	Austin, Delta Comps.	512-458-4288
TX	Seagoville, Delta Comps.	214-287-6333
UT	Salt Lake City, Quorum 3 Sls. Grp.	801-943-9227
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883

Local Distributors

AZ	Phoenix, TTI	602-861-0222
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Circuit Specialists, Inc.	602-966-2878
CA	Belmont, Arndt	415-592-6718
CA	Chatsworth, Diplomat Elctrns.	213-700-8700
CA	Chatsworth, Integrated Elctrns.	213-998-2200
CA	Chatsworth, Shelley Elctrns.	213-998-3333
CA	Costa Mesa, Diplomat Elctrns.	714-549-8401
CA	Garden Grove, Hi Rel Distr. Sls.	213-594-9571
CA	Gardena, Bell Inds.	213-515-1800
CA	Irvine, Kelex, Inc.	714-863-1230
CA	Irvine, Integrated Elctrns.	714-540-5600
CA	San Diego, DECO	619-693-1595
CA	San Diego, Diplomat Elctrns.	619-292-5693
CA	San Diego, Park West Distrs.	619-277-8433
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Fernando, Petell Elctrns.	213-365-9841
CA	San Jose, Shelley Elctrns.	415-969-1820
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Santee, Mouser Elctrns.	619-449-2222
CA	Sunnyvale, Diplomat Elctrns.	408-734-1900
CA	Van Nuys, Elctrn. Expediters	213-781-1910
CO	Denver, Ragon Elctrns.	303-744-3601
CO	Englewood, Diplomat Elctrns.	303-740-8300
CT	Danberry, Diplomat Elctrns.	203-797-9674
CT	Norwalk, Park Dist.	203-853-2011
CT	Orange, Milgray	203-795-0711
FL	Clearwater, Diplomat Elctrns.	813-443-4514
FL	Longwood, Intertec	305-834-7777
FL	Miami, Electronic Equip.	305-871-3500
FL	Orlando, TTI II	305-859-1000
FL	Tampa, Shelley Elctrns.	813-884-0946
FL	Tampa, Impala Elctrns.	813-885-4747
FL	Winter Park, Milgray	305-647-5747
GA	Norcross, Diplomat Elctrns.	404-449-4133
ID	Spirit Lake, Al Elctrns.	208-623-3111
IL	Bensenville, Diplomat Elctrns.	312-595-1000
IL	Chicago, Bell Inds.	312-982-9210
IL	Elk Grove Village, GBL/Goold Elctrns.	312-593-3220
IL	Skokie, Marcon Assocs., Inc.	312-675-6450
IN	Indianapolis, Meunier Elctrn. Supp.	317-635-3511
IN	Indianapolis, Graham Elctrns.	317-634-8202
KS	Overland Park, Milgray/Kansas City	913-236-8800
KY	Louisville, Peerless Elctrn. Equip. Co.	502-637-7674
MD	Columbia, Diplomat Elctrns.	301-995-1226
MD	Rockville, Milgray	301-468-6400
MD	Timonium, Zebra Elctrns.	301-252-6576
MA	Burlington, Milgray	617-272-6800
MA	Canton, Impact Sls.	617-821-1500
MA	N. Chelmsford, Pilgrim Elctrns.	617-251-8746
MA	Woburn, Diplomat Elctrns.	617-935-6611
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	St. Paul, Ragon Elctrns.	612-642-2828
MO	St. Louis, Olive Elctrns. Inc.	314-426-4500
NJ	Audubon, Action Elctrns.	609-858-2450
NJ	Marlton, Milgray	609-983-5010
NJ	Mountainside, Enox	201-654-7600
NJ	Nutley, Vantage Elctrns.	201-667-1840
NJ	Totowa, Diplomat	201-785-1830
NY	Bohemia, TTI	516-567-1500
NY	Bohemia, Justin Elctrns.	516-589-4000
NY	Buffalo, Summit Distr.	716-884-3450
NY	Dobbs Ferry, Gemini Elctrn. Co.	914-693-6363
NY	East Farmingdale, Tri-Start Elctrns. Inc.	516-293-0400
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Farmingdale, Command Elctrns.	516-293-1212
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Hauppauge, JACO	516-273-5500
NY	Hauppauge, Fairmont Elctrn. Sls.	516-231-3313
NY	Liverpool, Diplomat Elctrns.	315-652-5000
NY	Melville, Diplomat Elctrns.	516-454-6400
NY	New York City, Centaur Elctrns.	212-695-6984
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Valley Stream, L&S Elctrns.	516-561-2474
NY	West Babylon, Delmar Elctrns.	516-420-1234
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cleveland, Pruitt Energy Sources	216-566-1545
OH	Cleveland, Milgray/Cleveland	216-447-1520
OH	Dayton, Stotts Friedman	513-298-5555
OH	Dayton, Micro-Mil	513-434-8231
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Philadelphia, Encore Elctrns. Inc.	215-676-7200
PA	Philadelphia, Shap Elctrns.	215-969-3300
PA	Philadelphia, Herbach & Rademan	215-426-1700
PA	Pittsburgh, Alder-Tronics	412-821-5565
PA	Willow Grove, RESCO Elctrns.	215-659-4575
PA	York, Elctrn. Comps. for Inds.	717-843-8971
TX	Austin, Southwest Elctrns.	512-837-8971
TX	El Paso, Intl. Elctrns.	915-778-9761
TX	Ft. Worth, TTI	817-831-0441
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Richardson, Southwest Elctrns.	214-234-3050
TX	Richardson, JACO Elctrns.	214-235-9575
TX	Stafford, Southwest Elctrns.	713-491-4900
UT	Salt Lake City, Diplomat Elctrns.	801-486-4134
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Charlottesville, Virginia Radio	804-296-4184
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Seattle, Pacific Elctrns.	206-575-1050

WESTREX, 1140 Bloomfield Ave., W. Caldwell, NJ 07006, Tel: 201-227-7290, Telex: 64-1490, TWX: 710-734-4323; Empl.: 180; *Sls. Mgr.:* J. C. Murray

WESTREX OEM PRODUCTS, Litton Inds., 51 Penn St., Fall River, MA 02724, Tel: 617-676-1016, Telex: 651490-WNJW, TWX: 710-341-3099; *Sls. Mgr.:* J. C. Murray; *Dist. Mgr.:* Ed Cunnie

Local Sales Offices & Reps

CA	Granada Hills, Westrex OEM Prods.	818-363-7419
NJ	Iselin, Westrex OEM Prods.	201-634-5492

WESTRONICS INC. OF TEXAS, 2441 Northeast Pkwy., Box 4619, Ft. Worth, TX 76106, Tel: 817-625-2311, Telex: 75-8273; Empl.: 250; *Sls. Mgr.:* Paul Schultz

WEST-TRONICS, INC., 215 Park St., Bensenville, IL 60106, Tel: 312-860-3560; *Sls. Mgr.:* Will Allen

WHEDCO, INC., 6107 Jackson Rd., Ann Arbor, MI 48103, Tel: 313-665-5473; *Sls. Mgr.:* K. V. Chilton

WHEELOCK SIGNALS, INC., 273 Branchport Ave., Long Branch, NJ 07740, Tel: 201-222-6880, TWX: 710-722-6510; Empl.: 200; *Sls. Mgr.:* Brian Van Horn

WHITMOR WIRE & CABLE, 13161 Sherman Way, Bldg. B, N. Hollywood, CA 91605, Tel: 818-764-6296, Telex: 194479; FSC No.: 15851; Empl.: 29; *Sls. Mgr.:* Michael Weiss; *Dist. Mgr.:* Mark Lee

Local Sales Offices & Reps

CA	Sunnyvale, Wirenetics Co.	408-745-6673

Local Distributors

CA	Sunnyvale, Wirenetics Co.	408-745-6673
CA	Valencia, Wirenetics Co.	805-257-2400

WHITSO, 9326 Byron St., Schiller Pk., IL 60176, Tel: 312-678-5200; Empl.: 200; *Sls. Mgr.:* A. Paloian

WHITTAKER CORP., 10880 Wilshire Blvd., Los Angeles, CA 90024, Tel: 213-475-9411, Telex: 674891; Empl.: 17,000

WHITTAKER CORP., Electronic Resources Div., 100 E. Tujunga Ave., Burbank, CA 91502, Tel: 818-843-5770, TWX: 910-498-2751; FSC No.: 72152

WHITTAKER CORP., Providence Chemicals Div., King Philip Rd., E. Providence, RI 02914, Tel: 401-434-1770, Telex: 92-7652; Empl.: 42

WIDE BAND ENGRG. CO., INC., Box 21652, Phoenix, AZ 85036, Tel: 602-254-1570; Empl.: 10

WIDE RANGE ELCTRNS. CORP., 2119 Schultz Rd., St. Louis, MO 63141, Tel: 314-567-5366, Telex: 44-2560; Empl.: 16; *Sls. Mgr.:* Otto Rauhut

WILBRECHT ELCTRNS., 240 Plato Blvd., St. Paul, MN 55107, Tel: 612-222-2791, TWX: 910-563-3679; Empl.: 300

WILCO

WILCO CORP., 4030 W. Tenth St., Indianapolis, IN 46222, Tel: 317-241-2516 ....1A•1306, 1307

WILCOXON RESEARCH

WILCOXON RESCH., P.O. Box 5798, Bethesda, MD 20814, Tel: 301-770-3790, Telex: 898-342; Empl.: 26; *Sls. Mgr.:* W. Wilcoxon ....1B•1886

WILD ROVER, See Refac Elctrns.

WILKINSON, P.O. Box 4558, Westlake Village, CA 91359, Tel: 818-889-0050, 800-822-4653, Telex: 698213; Empl.: 34; *Dist. Mgr.:* R. Cook

WILMAR ELCTRNS., INC., 2430 Amsler St., Torrance, CA 90505, Tel: 213-326-6668, Telex: 182417; FSC No.: 25248; Empl.: 25; *Sls. Mgr.:* Zev Heifetz

WILMORE ELCTRNS. CO., Box 1329, Hillsborough, NC 27278, Tel: 919-732-9351, Telex: 292617; Empl.: 48; *Sls. Mgr.:* J. L. Harris ...3•1807-1809, 1920, 1921

WILSON, H.F., ENGRG. CO., 475 Taft Ave., Glen Ellyn, IL 60137, Tel: 312-469-8473, Telex: 72-1438; Empl.: 18; *Sls. Mgr.:* H. Wilson; *Dist. Mgr.:* R. Carroll

WILSON, H. M., CO., 11501 Chimney Rock Rd., Houston, TX 77035, Tel: 713-729-1183; Empl.: 3; *Sls. Mgr.:* H. M. Wilson

WILSON ELECTRONICS, PO Box 19000, Las Vegas, NV 89119, Tel: 702-739-1931, Telex: 684-522; Empl.: 175; *Sls. Mgr.:* J. Flatt; *Dist. Mgr.:* Mac Harrison

WILTRON, 805 E. Middlefield Rd., P.O. Box 7290, Mountain View, CA 94042-7290, Tel: 415-969-6500, TWX: 910-379-6578; FSC No.: 20944; Empl.: 500; *Sls. Mgr.:* W. Baxter

WINSLOW INTL., 2471 E. Bayshore #520, Palo Alto, CA 94303, Tel: 415-856-0552, TWX: 910-373-2060; Empl.: 8; *Sls. Mgr.:* G. Hall; *Dist. Mgr.:* M. Niland

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-742-8428, Telex: 70-9079; Empl.: 7; *Sls. Mgr.:* Stephen E. Belter ....3•1118

Local Sales Offices & Reps

CA	Santa Clara, PBC Assocs.	408-727-7244
CO	Parker, Western Mktg. Assocs.	303-841-2788
IL	Downers Grove, Physics Equip.	312-960-4053
UT	Logan, Western Mktg. Assocs.	801-753-0073

WIRE GRAPHICS, 215 B. Central Ave., Farmingdale, NY 11735, Tel: 516-293-1525; Empl.: 43; *Sls. Mgr.:* Nat Stettin

WIREMOLD COMPANY, W. Hartford, CT 06110, Tel: 203-233-6251, TWX: 710-425-6281; Empl.: 800; *Sls. Mgr.:* F. F. Keating

WONDER CORP OF AMERICA, 22 Elizabeth St., South Norwalk, CT 06856, Tel: 203-866-3033, Telex: 965838; Empl.: 140; *Sls. Mgr.:* Peter Schub

WOODWARD MEASUREMENT INSTRS. LTD., 236 Wineva Ave., Toronto, ON M4E 2T4, Canada

WORKMAN ELCTRN. PRODS., Box 3828, Sarasota, FL 33578, Tel: 813-371-4242, TWX: 810-864-0401; Empl.: 150; *Sls. Mgr.:* Frank Pounds

"WORLD" ENTERPRISES, INC., 550 N. Bayard Ave., Waynesboro, VA 22980, Tel: 703-942-4159; *Sls. Mgr.:* B. F. Baber

WORLD STORAGE TECHNOLOGY, LTD., 14251 Franklin Ave., Tustin, CA 92680, Tel: 714-838-1491, Telex: 182727; Empl.: 250; *Sls. Mgr.:* Richard McGowan

WOVEN ELCTRNS., Box 189, Mauldin, SC 29662, Tel: 803-963-5131, TWX: 810-287-2091; Empl.: 180; *Sls. Mgr.:* E. A. Ross Jr.

WRIGHT CAPACITORS, 3000 So. Orange, Santa Ana, CA 92707, Tel: 714-546-2490; Empl.: 25; *Sls. Mgr.:* Curtiss Wright

WYCO METAL, See Stantron

XANADU CONTROLS, Electroid Corp., 45 Fadem Rd., Springfield, NJ 07081-3189, Tel: 201-467-8100, Telex: 139241; FSC No.: 57841; *Sls. Mgr.:* Peter Mesniaeff; *Dist. Mgr.:* Peter Mesniaeff

XCP INC., 8 W. Main St., Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Mary Dove

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441, Telex: 910-940-2512; *Sls. Mgr.:* Carol Hill

XENON CORP., 66 Industrial Way, Wilmington, MA 01887, Tel: 617-658-8940, Telex: 951142; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

Advertisement

XENON CORPORATION designs, develops and manufactures Flashtubes, UV Curing Equipment, Solar Simulators, and Pulsed Light Systems. Applications for Flashtubes include Laser Pumping, Beacon Light and Specialized Photography. Applications for UV Curing Equipment includes Wire Tacking, Photo Resist Curing, and Conformal Coating Curing, Curing Adhesive for Fibre Optic Connections, Cladding and Cladding Touch-up. Solar Simulators are used for testing Photo-Voltaic Cells and Panels. Applications for Pulsed Light Systems include Quality Control Processing and Research.

Xentek

XENTEK, INC., 279 S. Pacific St., San Marcos, CA 92069, Tel: 619-744-3346, TWX: 910-322-1155; FSC No.: 52360; Empl.: 430 .... 3•1810, 1811

Local Sales Offices & Reps

AL	Huntsville, Conley & Assocs.	205-882-0316
AZ	Scottsdale, Williams Assoc.	602-947-4297
CA	Goleta, Thorson Co.	805-964-8751
CA	Los Angeles, Thorson Co.	213-595-0361
CA	San Diego, Robert Posten	619-744-3346
CA	Sunnyvale, RDP Instr.	408-735-9040
CO	Commerce City, Williams Assoc.	303-289-5647
CT	Canton, Bell Controls	203-693-8926
FL	Boca Raton, Conley & Assocs.	305-395-6108
FL	Oveido, Conley & Assocs.	305-365-3283
FL	Tampa, Conley & Assocs.	813-885-7658
GA	Atlanta, Conley & Assocs.	404-447-6992
IL	Chicago, Berndt & Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
MD	Gaithersburg, Beacon North	703-591-1300
MI	Southfield, Fred Gehrke & Assoc.	313-559-5363
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Grandview, R. R. Burton	816-763-5385
NH	Nashua, Bell Controls	603-882-6984
NJ	Haddonfield, Tritek Sls.	215-627-0149
NM	Albuquerque, Williams Assoc.	505-255-1638
NY	East Syracuse, Nycom	315-437-8343
NY	Hartsdale, Spectrum Sls.	914-472-8600
NC	Raleigh, Conley & Assocs.	919-876-9862
OH	Cleveland, Geotronix	216-526-2535
OH	Trotwood, Geotronix	513-854-5939
OR	Beaverton, Huntley Assocs.	503-649-5308
TX	Dallas, Allied Comps.	214-238-0408
TX	Houston, Allied Comps.	713-988-1600
TX	Round Rock, Allied Comps.	512-244-1166
UT	Salt Lake City, Williams Assoc.	801-485-6511
VA	Fairfax, Beacon North	703-591-1300
WA	Everett, Huntley Assocs.	206-353-1833
WI	Milwaukee, Berndt Assocs.	414-545-8400

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-641-9525; *Sls. Mgr.:* G. Osgood

ΞXICO

XICO, INC., 120 Ocean Way, Santa Monica, CA 90402, Tel: 213-454-0302, Telex: 709577; *Sls. Mgr.:* Joe Sheppard .... 3•1104

XIT ROD, PO Box 128, Beaumont, CA 92223, Tel: 714-845-3986; Empl.: 4

XSIS ELECTRONICS

XSIS ELECTRONICS, INC., 12620 W. 63rd St., Shawnee, KS 66216, Tel: 913-631-0448, Telex: 437227; FSC No.: 57051; *Sls. Mgr.:* Jerry Dehnert .... 1A•1443

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Anderson Co.	602-266-2070
CA	Culver City, Westaironics Inc.	213-641-4122
CA	Sunnyvale, Loeswick's	408-745-6751
CO	Loveland, Morbak Mktg.	303-669-8900
IL	Rolling Meadows, Sieger Assoc.	312-991-6161
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI Inc.	301-461-2525
MA	Norwood, MPS Elctrns.	617-769-8700
MN	Eden Prairie, Aldridge Assoc. Inc.	612-944-8433
NJ	Fairfield, Addem Sls.	201-882-0993
NY	Fayettville, R. D. Sherman	315-637-9861
TX	Houston, Repmaster	713-692-8204
TX	Sherman, Repmaster	214-247-6236
EXP	NY, Great Neck, Ad Auriema	516-487-0700

XYCOM, 750 N. Maple Rd., Saline, MI 48176, Tel: 313-429-4971, TWX: 810-223-8153; Empl.: 225; *Sls. Mgr.:* Dan Lewis; *Dist. Mgr.:* Bill Nemeth

XYLOG CORP., 150 Tillman St., Westwood, NJ 07675, Tel: 201-664-7997; Empl.: 25; *Sls. Mgr.:* Milton Frank .... 3•1813, 1922

YARDNEY BATTERY DIV., Yardney Elec. Corp., 82 Mechanic St., Pawcatuck, CT 02891, Tel: 203-599-1100, Telex: 6813114, TWX: 710-470-0260; FSC No.: 87362; Empl.: 300; *Sls. Mgr.:* Herman G. Lewis, Jr.

YELLOW SPRINGS INSTR., Box 279, Yellow Springs, OH 45387, Tel: 513-767-7241, Telex: 205437; Empl.: 375; *Sls. Mgr.:* R. Heggemann

Local Sales Offices & Reps

AZ	Tempe, Elec-Com Assoc.	602-967-8023
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	Hayward, FLW, Inc.	415-487-2222
CA	Van Nuys, FLW, Inc.	213-989-5238
CO	Boulder, Grady Moore & Assocs.	303-494-3351
GA	Atlanta, Craft Assoc.	404-256-0420
GA	Marietta, FLW, Inc.	404-424-1731
IL	Lansing, Van Meter Inst.	312-474-3580
IN	Indianapolis, RDP Corp.	317-788-4296
MA	Norwell, Bordewieck Engrg.	617-659-4915
MI	Farmington Hills, Anderson Elctrns.	313-553-7600
MN	Minneapolis, Trask Engrg.	612-537-2434
NJ	Scotch Plains, RJM Sls.	201-322-7880
NM	Albuquerque, Elec-Com Assoc.	505-898-6101
NY	Syracuse, Labtronics	315-455-7314
OH	Cleveland, RDP Assoc.	216-659-3138
OH	Dayton, RDP Assocs.	513-253-6175
PA	Pittsburgh, RDP Assoc.	412-487-5055
TX	Houston, American Analog	713-941-7265
TX	Lewisville, Milestek	214-436-1597
VA	Richmond, Advance Control Equip.	804-270-7182
WA	Bellevue, Topp Engrg Sls.	206-747-5400

Local Distributors

MN	Minneapolis, Trask Engrg.	612-537-2434
NJ	Scotch Plains, RJM Sls.	201-322-7880
NY	Syracuse, Labtronics	315-455-7314
OH	Dayton, RDP Corp.	513-253-6175
TX	Lewisville, Milestek	214-436-1597

YEW CORP., See Yokogawa Corp. of America

YOKOGAWA CORP. OF AMERICA, 2 Dart Rd., Shenandoah, GA 30265, Tel: 404-253-7000, TWX: 714-567-1256; Empl.: 70; *Sls. Mgr.:* J. V. Stegenga

YORK METAL PRODUCTS, INC., 34-20 12th St., Long Island, NY 11367, Tel: 212-932-3660; *Sls. Mgr.:* Harold Miller

ZECO, INC., 2075 H Bering Dr., San Jose, CA 95131, Tel: 408-286-8856; *Sls. Mgr.:* Conie Johnson; *Dist. Mgr.:* Conie Johnson

YORK TECHNOLOGY, INC., 1101 State Rd., Bldg. O, Princeton, NJ 08540, Tel: 609-924-7676; *Sls. Mgr.:* Geoffrey R. Gamble

BATTERY YUASA

YUASA BATTERY (AMERICA), INC., 9728 Alburtis Ave., Santa Fe Springs, CA 90670, Tel: 213-949-4266, Telex: 696272; Empl.: 5,000; *Sls. Mgr.:* Les Biggins .... 3•1437

Local Sales Offices & Reps

AZ	Tempe, Elec-Com	602-967-8644
CA	Diablo, Main Engrg. & Mktg. Assocs.	415-837-2193
CA	Garden Grove, West Elctrn Sls.	213-493-5569
CO	Englewood, Grimes Mktg.	303-740-6063
CT	Horth Haven, Kitchen & Kutchin	203-239-0212
FL	Ft. Lauderdale, QXI, Inc.	305-485-6030
FL	St. Petersburg, QXI, Inc.	813-821-2281
IL	Cary, Ellinger Sls.	312-639-1850
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MD	Baltimore, S. K. Macdonald Co.	301-254-3380
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	St. Paul, SKOR	612-426-1160
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Fairfield, Yuasa Battery (Amer.) E. Reg. Off.	201-575-5848
NC	Asheville, Edco Sls.	704-253-1594
OH	Columbus, McFadden Sls.	614-459-1280
PA	Philadelphia, S. K. Macdonald Co.	215-545-1205
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255

ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176

ZAX CORP., 2572 White Rd., Irvine, CA 92714, Tel: 714-474-1170, 800-421-0982, Telex: 183829; Empl.: 25; *Sls. Mgr.:* Hal Horrocks

ZEHNTEL, INC., 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 415-932-6900, TWX: 910-385-6300; Empl.: 480; *Sls. Mgr.:* N. Vinson; *Dist. Mgr.:* N. Vinson

ZENDEX CORP., 6700 Sierra La., Dublin, CA 94566, Tel: 415-828-3000, TWX: 910-389-4009; *Sls. Mgr.:* James F. Bairey

ZENITH COMPONENTS & SYS. GRP., Zenith Radio Corp., 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733; *Sls. Mgr.:* Norm Berkowitz

ZENITH CONTROLS, 830 West 40th St., Chicago, IL 60609, Tel: 312-247-6400, Telex: 25-3703; Empl.: 125; *Sls. Mgr.:* V. Helford

ZENITH TRANSFORMER CO., INC., 1728 West 130th St., Gardena, CA 90249, Tel: 213-321-4551

ZENITH CRT & COMPONENTS OPERATIONS, 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733; *Sls. Mgr.:* Norm Berkowitz

ZENRAD CIRCUITS CO., 529 E. Gutierrez St., Santa Barbara, CA 93103, Tel: 805-963-3527; FSC No.: 33180; Empl.: 10; *Sls. Mgr.:* A. Radford

ZERO ZERO CORPORATION

ZERO CORP., 777 Front St., Burbank, CA 91503, Tel: 213-846-4191, TWX: 910-498-2237; Empl.: 1400; *Sls. Mgr.:* J. J. Roderer .... 2•1070-1079

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Burbank, Zero-West Div.	213-846-4191

CA	Palo Alto, Northern Cal. Sls. Off.	415-964-7700
CA	San Diego, San Diego Sls. Off.	619-271-7221
CO	Boulder, Component Prod. Sls. Co. Inc.	303-530-2800
FL	Clearwater, Richard Straker	813-531-8991
IL	Elk Grove Village, Carlson Elctrns. Sls.	312-956-8240
IN	Indianapolis, L.M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
LA	Metairie, Automation Supplies	504-831-2183
MD	Baltimore, R. P. Luce & Co.	301-752-8200
MA	Monson, Zero-East Div.	413-267-5561
MI	Grosse Pointe Park, Greiner Assoc. Inc.	313-499-0188
MN	Bloomington, Elctrn. Sls. Agcy.	612-884-8291
MO	Raytown, Cadon Tech. Sls.	816-356-7685
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NJ	Piscataway, R.P. Luce & Co.	201-752-8750
NM	Albuquerque, Fry-Gates	505-262-1525
NY	East Syracuse, Fountain Young & Co.	315-437-7733
NY	New Hyde Park, R.P. Luce & Co.	516-437-4550
NC	Wilson, Diemer Assoc.	919-237-8217
OH	Columbus, Tom Mulligan & Assocs.	614-457-2242
OR	Wilsonville, RTS, Inc.	503-638-5670
PA	Boswell, B.E. Gibson	814-629-6772
PA	Huntingdon Valley, Inacker Sls.	215-947-5660
SC	Greenville, Sunbelt Sls.	803-877-9088
TX	Dallas, J. Gibbs & Assocs.	817-430-1861
TX	Fort Worth, J. Gibbs & Assocs.	817-237-1455
TX	Houston, Milco Mktg.	713-946-2841
UT	Salt Lake City, Effective Sls.	801-266-9617
VA	Powhatan, R. P. Luce & Co	804-598-2095
WA	Vashon, RTS, Inc.	206-285-1316

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Phoenix, R.V. Weatherford	602-272-7144
AZ	Phoenix, Dalis Elctrn Supp.	602-275-2885
AZ	Tucson, Inland Elctrn Supp.	602-294-2628
CA	Anaheim, R. V. Weatherford Co.	714-634-9600
CA	Burlingame, Rose Elctrn. Distr.	415-348-2740
CA	Glendale, R.V. Weatherford Co.	213-849-3451
CA	Pomona, R.V. Weatherford Co.	714-623-1261
CA	San Diego, R. V. Weatherford Co.	714-695-1700
CA	Santa Barbara, Weatherford	805-965-8551
CA	Sunnyvale, R. V. Weatherford Co.	408-738-8694
CO	Denver, R. V. Weatherford Co.	303-428-6900
CT	Stratford, Utronics	203-378-4201
FL	Miami, Elctrn. Equip.	305-871-3500
IL	Addison, L-Comp	312-628-1400
IN	Indianapolis, Genesis Elctrns.	317-637-5571
LA	New Orleans, Wm. B. Allen Supp.	504-525-8222
MD	Beltsville, Treeko Sls., Inc.	301-937-8260
MD	Savage, Pyttronic Inds.	301-792-0780
MA	Westboro, Future Elctrns.	617-366-2400
MA	Winchester, Rush Inds., Inc.	617-729-5800
MI	Clawson, Empire Elect. Inc.	313-435-0460
MI	Wyoming, R.M. Elctrns.	616-531-9300
MN	Minneapolis, Indl. Comps.	612-831-2666
MO	Kansas City, L-Comp	816-221-2400
MO	Maryland Hghts, L-Comp	314-291-6200
NJ	Englewood, Technical Elctrns. Distr.	201-894-0800
NM	Albuquerque, Int'l. Elctrns.	505-345-8127
NY	Bohemia, CAR-LAC Elctrn. Inds. Sls.	516-567-4200
NY	Endwell, ASI Elctrns., Inc.	607-754-3823
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Columbus, Hughes-Peters Inc.	614-294-5351
OH	Middleburg Heights, Prehler Elect.	216-243-5510
OR	Beaverton, Zepher Elctrns.	503-643-1980
OR	Salem, Zepher Elctrns.	503-399-8503
PA	McKean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Wayne, Peak Elctrns.	215-293-9000
TX	Dallas, R.V. Weatherford Co.	214-931-7333
TX	Dallas, Solid State Elctrns. Co. of Texas	214-438-5700
TX	El Paso, Inter. Elctrns.	915-778-9761
TX	Houston, R. V. Weatherford	713-688-7406
TX	Houston, Solid State Elctrns.	713-772-8483
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Seattle, R.V. Weatherford	206-575-1340
WA	Seattle, Zepher Elctrn. Sls. Corp.	206-241-1980

ZERO-EAST DIV., 288 Main St., Monson, MA 01057

ZETA LABS., 3265 Scott Blvd., Santa Clara, CA 95051, Tel: 408-727-6001, TWX: 910-338-7336; FSC No.: 31260; Empl.: 195; *Sls. Mgr.:* C. W. Frank

ZEUS INDL. PRODS. INC., P.O. Box 298, Raritan, NJ 08869, Tel: 201-526-0800, 800-526-3842, TWX: 710-480-9346; FSC No.: 32039; Empl.: 110; *Sls. Mgr.:* John Worley; *Dist. Mgr.:* Arthur M. Silverman .... **2•1871**

ZEXCO, 7661 Densmore, #8, Van Nuys, CA 91406, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, Telex: 4992316; Empl.: 25; *Sls. Mgr.:* Jim Eckford

ZIERICK MFG. CORP., 44 Radio Circle, Mt. Kisco, NY 10549, Tel: 914-666-2911, TWX: 710-571-2143; Empl.: 120; *Sls. Mgr.:* L. T. Noyes

ZIPPERTUBING CO., P.O. Box 61129, Los Angeles, CA 90061, Tel: 213-321-3901, TWX: 910-346-6713; Empl.: 120; *Sls. Mgr.:* Terry Plummer

ZI-TECH INSTR. CORP., 2151 Park Blvd., Box 60490, Palo Alto, CA 94306, Tel: 415-326-2151, Telex: 334-447; Empl.: 15; *Sls. Mgr.:* J. Ziman

ZYMOS CORP., 477 N. Mathilda Ave., Sunnyvale, CA 94086, Tel: 408-730-8800, 408-730-5400, TWX: 910-339-9530; *Sls. Mgr.:* Jeff Jacobsen

LAST PAGE THIS SECTION

eem FILE SYSTEM

EEM FILE SYSTEM CATEGORIES

The 1984-85 EEM contains 61 Product Sections spread over four volumes. These same Sections are the basis for the famous EEM File System which is in daily use in thousands of engineering libraries. The subcategories of the System appear on the following pages. The complete System is available for only $25.

1100 AMPLIFIER ASSEMBLIES, INSTRUMENTATION
(Volume 3)

Amplifiers, Compressor
Amplifiers, Current, AC
Amplifiers, DC
Amplifiers, Decade
Amplifiers, Deflection-Also See Yokes, Deflection, Oscilloscopes, etc.
Amplifiers, Differential
Amplifiers, Distribution
Amplifiers, Fiber Optic
Amplifiers, IF
Amplifiers, Instrumentation
Amplifiers, Integrating-Also See Amplifiers, Operational; Integrators, Electronic
Amplifiers, Isolation
Amplifiers, Limiting
Amplifiers, Line
Amplifiers, Lock-in
Amplifiers, Logarithmic
Amplifiers, Magnetic
Amplifiers, Multichannel
Amplifiers, Narrow Band
Amplifiers, Null
Amplifiers, Operational
Amplifiers, Peak Limiting
Amplifiers, Phase-Lock Loop
Amplifiers, Power
Amplifiers, Programmable Gain
Amplifiers, Pulse
Amplifiers, Pulse Limiting
Amplifiers, RF
Amplifiers, Sample & Hold
Amplifiers, Sweep
Amplifiers, Transducer-Also See Signal Conditioners
Amplifiers, Travelling Wave Tube
Amplifiers, Ultrasonic
Amplifiers, Video
Amplifiers, Voltage Reference
Amplifiers, Wideband
Drivers, Chopper
Preamplifiers
Signal Conditioners & Equipment

1300 AUDIO EQUIPMENT & ACCESSORIES
(Volume 3)

Amplifiers, AF
Amplifiers, Equalization
Amplifiers, Mixing
Attenuators, Audio
Audible Alarms & Transducers-Also see Piezoelectric Ceramics; Transducers, Audio
Baffles, Speaker
Coders, AF
Controls, Fader
Drivers, Speaker
Duplicators, Magnetic Tape
Editing Equipment, Tape
Equalizers, Audio
Erasers, Magnetic Tape (Bulk)
Grilles & Accessories, Speaker
Handsets, Chestsets, Headsets, etc.
Headphones
Heads, Magnetic Recording
Microphone Accessories (Incl. Stands, Holders, Booms)
Microphones, Bone Conduction
Microphones, Carbon
Microphones, Cardioid
Microphones, Ceramic
Microphones, Condenser (Incl. Electret)
Microphones, Crystal
Microphones, Dynamic
Microphones, Lavalier
Microphones, Magnetic
Microphones, Omnidirectional
Microphones, Subminiature
Microphones, Velocity
Microphones, Wireless
Mixers, Audio
Monitors, Power, AF
Networks, Crossover, Attenuator (Audio)
Pickups, Telephone (For Recording)
Public Address Systems
Recorders, Sound Level
Speaker Systems
Speakers, Explosion & Flame Proof
Speakers, Horn
Speakers, Intercom
Speakers, Midrange
Speakers, Musical Instrument
Speakers, Pillow
Speakers, Public Address
Speakers, Replacement (Including Aircraft, Automotive & TV)
Speakers, Submergence Proof
Speakers, Subminiature-Also See Bells, Buzzers, Gongs, Sirens & Aural Warning Devices
Speakers, Tweeter
Speakers, Weatherproof
Speakers, Woofer
Splicing Equipment, Magnetic Tape
Switching Systems, Audio
Tape Recording Accessories
Tapes, Recording, Magnetic (All Types)
Tuners, AM/FM

1400 CABINETS, ENCLOSURES, RACKS, & CHASSIS
(Volume 2)

Benches, Consoles, Tables (Work Stations, Lab & Shop)-Also See Enclosures, Equipment and Panel Mounting
Boxes, Junction, Outlets & Wall Plates
Cable Retractors
Casters
Chassis, Circuit Board Mounting
Chassis, Metal
Drawers, Sliding
Enclosures, Circuit Board, Module, & Relay Mounting
Enclosures, Equipment & Panel Mounting
Enclosures, Keyboard
Enclosures, Nonmetallic
Enclosures, Portable, Metallic & Nonmetallic
Enclosures, Shielded
Frames, Cabinet & Rack
Grilles, Metal, Plastic
Guides, Circuit Board
Handles For Cabinets, Circuit Boards, Racks, etc.
Housings, Terminal
Kits, Enclosure Prototyping
Slides, Cabinet & Chassis
Stands, Instruments
Stands, Printer/Terminal
Swivel Units, Data Entry Terminals
Work Room, Shielded
Work Stations/Decks, Data Entry

1500 CAPACITORS
(Volume 1A)

Capacitors, Chip (For Microcircuits)
Capacitors, Energy Storage
Capacitors, Fixed, AC (Incl. Motor Start)
Capacitors, Fixed, Air
Capacitors, Fixed, Aluminum Electrolytic
Capacitors, Fixed, Ceramic, Disc & Tubular
Capacitors, Fixed, Ceramic, Monolithic
Capacitors, Fixed, Feedthru
Capacitors, Fixed, Film, Metallized & Nonmetallized
Capacitors, Fixed, Glass
Capacitors, Fixed, Laboratory Standard
Capacitors, Fixed, Mica
Capacitors, Fixed, Monolithic
Capacitors, Fixed, Oil Filled
Capacitors, Fixed, Paper, Metallized & Nonmetallized
Capacitors, Fixed, Porcelain
Capacitors, Fixed, Tantalum Electrolytic
Capacitors, Fixed, Vacuum
Capacitors, Variable, Air
Capacitors, Variable, Ceramic
Capacitors, Variable, Film
Capacitors, Variable, Gas Filled
Capacitors, Variable, Glass
Capacitors, Variable, HV (Lab Type)-Also See Decade Boxes, Capacitance
Capacitors, Variable, Mica
Capacitors, Variable, Padders & Trimmers
Capacitors, Variable, Vacuum

1600 CHEMICAL COMPOUNDS (ADHESIVES, CLEANERS, COATINGS)
(Volume 2)

Adhesives, Conducting
Adhesives, General Purpose
Adhesives, Insulating
Adhesives, Liquid Spray
Adhesives, Optical
Adhesives, UV Curing
Adhesives, Wire Tacking
Alloys, Metal/Ceramic
Chemicals, Electroplating
Chemicals, Epoxy Stripping
Chemicals, Wire Stripping
Cleaners & Solvents
Cleaners, Magnetic Medium
Coatings, Antistatic
Coatings, Compounds, Lubricants, etc., Heat Conductive
Coatings, Conductive, Electric
Coatings, Corrosion Resistant
Coatings, Electromagnetic Wave Absorbing
Coatings, Fungicidal
Coatings, Moisture Repellant & Waterproofing
Coatings, Protective
Coatings, Radioactive
Compounds, Encapsulating, Molding, Potting-Also See Plastic Raw Materials
Cups, Encapsulation
Dispensers, Adhesive
Etchants, Fluorocarbon
Lubricants
Paints, Finishing
Paints, Metallic, Conductive
Paints, Resistive-Also See Inks for Thick Film Microcircuits
Plastic Raw Materials, Liquids, Pellets, Powders, Resins
Refrigerants, Spray
Rubber, Conductive
Rubber, Silicone

1700 CIRCUIT BOARDS (PRINTED), MATERIALS, & ACCESSORIES
(Volume 2)

Boards, Circuit, Clad
Boards, Circuit, Unclad
Chemicals, Etching
Chemicals, Tin Plating
Circuits, Printed Flexible
Circuits, Printed, Multilayer
Circuits, Printed, Rigid, One & Two Sided
Clips, Board, Harness
Etchants, Printed Circuit
Inks for Thick Film Microcircuits
Kits, Printed Circuit
Screens, Printed Circuit

1800 COILS, CHOKES, & INDUCTORS
(Volume 1A)

Chokes, Filter
Chokes, Swinging
Coil Assemblies & Forms-Also See Bobbins, Winding, Coil & Transformer
Coil/Lens Aligners, Micropositioner
Coils, AF
Coils, Antenna (Incl. Loading Type)
Coils, Broadcast
Coils, Chip
Coils, Degaussing
Coils, Field
Coils, Focusing
Coils, Foil Wound
Coils, High Q, Low Frequency
Coils, Hybrid & Repeater
Coils, IF
Coils, Metallized Ceramic
Coils, Metallized Glass
Coils, Molded
Coils, Relay
Coils, RF
Coils, Saturable Reactor
Coils, Shielded
Coils, Solenoid
Coils, Telephone
Coils, Toroidal
Coils, Transducer
Coils, Transformer
Coils, TV (All Types)
Coils, Variable
Coils, Vidicon Alignment
Reactors, Saturable
Yokes, Deflection, CRT
Yokes, Deflection, Oscilloscope
Yokes, Deflection, Radar PPI
Yokes, Deflection, TV Camera

1900 COMMUNICATIONS & TELEMETRY EQUIPMENT
(Volume 3)

Amplifiers, Antenna
Amplifiers, Single Sideband
Amplifiers, Telemetering
Antenna Rotators
Antenna Switching Matrices
Antenna Towers
Antennas, Airborne
Antennas, Direction Finding
Antennas, Ground Plane
Antennas, Helical
Antennas, Log Periodic
Antennas, Loop
Antennas, Microwave
Antennas, Multiband, UHF/VHF
Antennas, Phased Array
Antennas, Rhombic
Antennas, Spiral
Antennas, Telescopic
Antennas, Whip & Accessories (Incl. Marine & Mobile Types
Attenuators, IF
Attenuators, RF
Boards, Plug-in Processor
Bridges, Telephone/Data
Cameras, Image Converter
Cameras, Television
CATV Systems & Equipment
Coders, Telephone, Dial
Communications Systems, FM
Communications Systems, Laser
Communications Systems, Multiplex
Communications Systems, Telemetering
Communications Systems, Telephone
Concentrators, Communications
Controllers, Error
Converters, Frequency Shift Keying
Converters, Frequency to Frequency
Converters, Telemetry
Converters, UHF to VHF
Converters, VLF to HF
Couplers, Acoustic
Couplers, Antenna
Couplers, Communications, Acoustic, Telephone
Decoders, Pulse
Decoders, Tone
Decoders, Video
Demodulators
Detectors, Tone
Diplexers, Antenna
Discriminators
Duplexers, Nonmicrowave
Earth Stations, TV, Receive Only
Encoders, Tone
Equalizers, Delay
Equalizers, Phase
Facsimile Equipment, Receive Only
Facsimile Equipment, Send/Receive
Facsmile Equipment, Send Only
Filters, Telemetering
Generators, Baud Rate
Isolators, Antenna
Keyers, Tone
Modems, Communications, Eliminator/Line Driver
Modems, Communications, Line Receivers
Modems, Communications, Long Haul
Modems, Communications, Short Haul (Limited Distance)
Modulators, AM
Modulators, FM
Modulators, Phase
Modulators, RF
Monitors, Data Link
Monitors, Error Rate
Monitors, Line & Program
Monitors, Video
Mounts, Antenna
Multiplexers, Frequency Division
Multiplexers, Statistical
Multiplexers, Time Division
Multiplexers, Transmission
Multiplexers, Video
Multipliers, Crystal
Multipliers, Diode
Networks, Directional Antenna Phasing
Networks, Matching
Oscillators, Telemetry
Preselectors
Processors, Communications, Front End
Processors, Communications, Message Switching
Processors, Communications, Network Node
Processors, Communications, Standalone
Receivers, Communication
Receivers, Frequency Shift
Receivers, Loran & Omega
Receivers, Monitoring, Communications
Receivers, Telemetry
Receivers, Tone
Recorders, Video
Scanners, Crossbar
Scanners, Flying Spot
Scramblers, Speech
Strips, Ground
Teleprinters, Auto Send/Receive
Teleprinters, Keyboard Send/Receive
Teleprinters, Receive Only
Teletypewriters & Equipment
Television Systems & Equipment Closed Circuit
Terminations, VHF, Video, Pulse
Transceivers
Transmitters, Fixed Frequency
Transmitters, Telemetry
Transmitters, Tone
Transponders

2000 COMPUTER PERIPHERAL EQUIPMENT
(Volume 3)

Card Equip., Punch
Card Equip., Reader
Card Equip., Reader/Punch
Card Equipment, Mark Sense
Cards, Data Communication/Interfaces
Cards, Linear Function
Cards, Logic
Character Recognition Equip., Magnetic Ink
Character Recognition Equip., Optical
Controllers, Card Reader/Punch, Add-in
Controllers, Card Reader/Punch, Standalone
Controllers, Floppy Disk Drive, Add-in
Controllers, Floppy Disk Drive, Standalone
Controllers, Hard Disk Drive, Add-in
Controllers, Hard Disk Drive, Standalone
Controllers, Magnetic Tape Drive, Add-in
Controllers, Magnetic Tape Drive, Standalone
Controllers, Memory Device, Add-in
Controllers, Memory Device, Standalone
Controllers, Paper Tape Reader/Punch, Add-in
Controllers, Paper Tape Reader/Punch, Standalone
Controllers, Plotter, Add-in
Controllers, Plotter, Standalone
Controllers, Printer, Add-in
Controllers, Printer, Standalone
Controllers, Protocol, Communications
Controllers, Terminal, Add-in
Controllers, Terminal, Standalone
Controls, Computer Input, Joysticks, Mouse Devices, etc.
Converters, Card to Tape
Converters, CRT Display
Converters, Digital to Paper Tape
Converters, Graphic to Digital
Converters, Paper Tape to Magnetic Tape
Converters, Serial to Parallel/Parallel to Serial
Converters, Tape to Card
Data Collection Equipment, Hand Held
Data Collection Equipment, Modular
Data Collection Equipment, Portable
Data Compressors, Digital
Data Links, Optical
Digitizers, Audio
Digitizers, Pencil Follower (Incl. Coordinate & Graphic)
Digitizers, Video
Disks, Magnetic, 5¼" Flexible
Disks, Magnetic, 8" Flexible
Disks, Magnetic, Front-loading Cartridge
Disks, Magnetic, Pack
Disks, Magnetic, Sub-4"
Disks, Magnetic, Top-loading Cartridge
Disks, Magnetic, Winchester Module
Displays, Graphic Systems
Drives, Disc, Flexible and Rigid
Drives, Subsystems, Disk, 8" Diskette
Drives/Subsystems, Core Disk Emulator
Drives/Subsystems, Disk, 14" Winchester
Drives/Subsystems, Disk, 3½ " Diskette
Drives/Subsystems, Disk, 5¼" Diskette
Drives/Subsystems, Disk, 5¼" Winchester
Drives/Subsystems, Disk, 8" Winchester
Drives/Subsystems, Disk, Fixed
Drives/Subsystems, Disk, Fixed/Removable
Drives/Subsystems, Magnetic Tape, Cassette
Drives/Subsystems, Magnetic Tape, Reel-to-Reel
Drives/Subsystems, Magnetic Tape, ¼" Cartridge
Drives/Subsystems, Semiconductor Emulator
Encoders, Proof
Generators, Time Code
Generators, Timing, Digital
Input/Output Equipment, Voice
Interfaces, Computer/Peripheral
Light Pens
Mark Recognition Equipment, Optical
Matrices, Switching-Also See Boards, Programming
Memory Devices/Controllers, Bipolar, Add-in
Memory Devices/Controllers, Bipolar, Add-on
Memory Devices/Controllers, Bubble, Add-in
Memory Devices/Controllers, Bubble, Add-on
Memory Devices/Controllers, CCD, Add-in
Memory Devices/Controllers, CCD, Add-on
Memory Devices/Controllers, Magnetic Core, Add-in
Memory Devices/Controllers, Magnetic Core, Add-on
Memory Devices/Controllers, MOS, Add-in
Memory Devices/Controllers, MOS, Add-on
Memory Systems, Bubble
Memory Systems, Core
Memory Systems, Delay Line
Memory Systems, Disk
Memory Systems, Disk, Flexible
Memory Systems, Semiconductor
Memory Systems, Tape
Microfilm, Computer Output (COM) Equipment
Modulator/Demodulators, Data
Networks, Computer, Local Area
Networks, Hybrid
Networks, RC
Paper Tape Equipment, Punch
Paper Tape Equipment, Reader
Paper Tape Equipment, Reader/Punch
Paper, Thermal
Perforators, Paper Tape (Electrically Powered)
Plotters/Hard-Copy Devices
Printer/Plotters
Printers, Daisywheel
Printers, Digital
Printers, Dot Matrix Impact
Printers, Page
Printers, Serial
Printers, Thermal
Processors, Image
Processors, Remittance
Programmers, Punched Card
Programmers, Tape
Readers, Badge
Readers, Bar Code
Readers, Character
Readers, Magnetic Card
Readers, Magnetic Stripe Card
Readers, Punched Card
Readers, Punched Tape
Readers, Static Card
Readers, Time Code
Recognition Equipment, Speech
Recorders, Computer Data
Recorders, Magnetic Tape
Recorders, Program Loading
Scanners, Bar Code
Tape Search Equipment
Tape Winders
Tapes, Magnetic, Digital Cassette
Tapes, Magnetic, ½", 2400' Reel
Tapes, Magnetic, ½", 3600' Reel
Tapes, Magnetic, ¼", 140' Cartridge
Tapes, Magnetic, ¼", 300' Cartridge
Terminal Equipment, Digital
Terminals, Credit Authorization
Terminals, Data Display (including Alphanumeric & Graphic)
Terminals, Data Entry, Multimedia
Terminals, Display
Terminals, Financial
Terminals, Intelligent/Programmable, Batch
Terminals, Intelligent/Programmable, Interactive
Terminals, Intelligent/Programmable, Multiprogramming

Add Dept. EM to address to tell them you saw it in EEM.

- Terminals, Intelligent/Programmable, Multiuser
- Terminals, Intelligent/Programmable, Real Time
- Terminals, Intelligent/Programmable, Transaction Processing
- Terminals, Point-of-Sale
- Translators, Time Code
- Transmission Systems, Data
- Transports, Tape (all kinds)

2025 COMPUTERS (MINI/MICRO)

(Volume 3)

- Array Processors
- Board Computers & Subassemblies, Multibus Compatible
- Board Computers & Subassemblies, Q Bus/Unibus Compatible
- Board Computers & Subassemblies, S100 Bus Compatible
- Board Computers & Subassemblies, STD Bus Compatible
- Computers, Analog
- Computers, CAD, CAM, & CAD/CAM
- Computers, Digital, Micro
- Computers, Digital, Mini
- Computers, Hybrid, Analog/Digital
- Computers, Mainframe
- Computers, Micro
- Computers, Mini, High End
- Computers, Mini, Low End
- Computers, Mini, Midrange
- Computers, Personal
- Computers, Small Business
- Services, Computer Systems Integration
- Word Processors, Shared Logic Systems
- Word Processors, Standalone Systems

2050 COMPUTER SOFTWARE

(Volume 3)

- Services, Computer Programming
- Services, Computer Systems, Builders
- Services, Computer Systems, Consulting
- Services, Computer Systems, Integrators
- Services, Computer Systems, Turnkey
- Services, Data Processing, Consulting
- Software, Applications
- Software, Communications
- Software, Compilers/Languages
- Software, Computer Performance Measurement
- Software, Data Base Management
- Software, Data Base Management Dictionaries
- Software, Data Base Query Language
- Software, Data Communications Control
- Software, Disk/Tape File Utilities
- Software, Emulation/Simulation
- Software, Information Storage & Retrieval
- Software, Job Scheduling/Accounting
- Software, Librarians
- Software, Operating Systems
- Software, Operating Systems Enhancement
- Software, Program Translators
- Software, Programming/Systems Development Aids
- Software, Report Generators
- Software, Security
- Software, Sort/Merge
- Software, Spoolers
- Software, Utilities

2100 CONNECTORS, TERMINALS, & SOCKETS

(Volume 2)

- Caps, Connector
- Clips, Alligator
- Clips, Battery
- Clips, Fahnestock
- Clips, Test
- Connector Adapters
- Connector Backshells
- Connector Blocks, Mother Board
- Connectors & Terminals, Push-on, Quick Disconnect
- Connectors, Audio
- Connectors, Battery
- Connectors, Cable
- Connectors, Circular, MS/AN
- Connectors, D Subminiature
- Connectors, DIN
- Connectors, Elastomeric
- Connectors, Filtered
- Connectors, Flat Cable (Incl. Flexible)
- Connectors, Fused
- Connectors, Heavy Duty, Power
- Connectors, Hermetically Sealed, Pressurized, or Waterproof
- Connectors, High Voltage (1,000 Volts & Over)
- Connectors, LCD
- Connectors, Magnetron
- Connectors, Miniature, Subminiature & Microminiature
- Connectors, Plug-in, Program Board
- Connectors, Printed Circuit (Other than Card Edge)
- Connectors, Printed Circuit, Card Edge
- Connectors, Rack & Panel
- Connectors, RF, Coaxial & Triaxial
- Connectors, Solderless
- Connectors, Stripline
- Connectors, Test
- Connectors, Thermocouple
- Connectors, Wirewrap (Z-3 Level)
- Connectors, Zero & Low Insertion Force
- Cords, Patch
- Holders & Carriers, Chip (Capacitor, IC, LSI)
- Jack Adapters (All Types)
- Jack Covers
- Jacks (All Types)
- Jumpers, Bonding
- Jumpers, Circuit Board
- Kits, Connector
- Kits, Terminal
- Pads, Transistor Mounting
- Panels, Jack
- Pins, Electrically Conductive
- Plug & Jack Sets
- Plug Adapters
- Plug Caps & Shells
- Plugs, Electrical (All Types)
- Plugs, Fused
- Posts, Binding
- Socket Adapters
- Sockets, Capacitor
- Sockets, Crystal
- Sockets, Diode
- Sockets, DIP and DIL
- Sockets, Integrated Circuit
- Sockets, Leadless Carrier
- Sockets, LIF & ZIF
- Sockets, Relay
- Sockets, SIP
- Sockets, Test
- Sockets, Transistor
- Sockets, Tube
- Terminal Blocks (Incl. Barrier Types)
- Terminal Boards
- Terminal Strips (Including Barrier Types)
- Terminals, Ferrule, Cable-End
- Terminals, Lug (All Types)
- Terminals, Miniature & Subminiature
- Terminals, Printed Circuit Board
- Terminals, RC (Module)
- Terminals, Solderless
- Terminals, Standoff
- Terminals, Threaded
- Terminals, Turret
- Terminals, Wirewrap

2200 CONTROL SYSTEMS & COMPONENTS

(Volume 3)

- Alarms & Alarm Systems
- Annunciators
- Bells, Buzzers, Gongs, Sirens & Aural Warning Devices
- Clocks, Time Keeping — Also See Oscillators, Clock
- Controllers, Energy Conservation
- Controllers, Programmable
- Controls, Audio System Consoles
- Controls, Capacitance Operated
- Controls, Counting & Sorting
- Controls, Density
- Controls, Fluid Conductivity
- Controls, Fluid Flow
- Controls, Frequency
- Controls, Gas
- Controls, Humidity
- Controls, Ignitron Firing
- Controls, Lamp Dimming, Flashing
- Controls, Level, Dry Material
- Controls, Level, Liquid
- Controls, Machine Tool
- Controls, Motor Speed
- Controls, Oscillator
- Controls, Photoelectric
- Controls, Pressure
- Controls, Proportional
- Controls, Proximity-Also See Controls, Capacitance Operated
- Controls, Remote
- Controls, Run, Shutdown Command, Start
- Controls, SCR
- Controls, Sensing/Monitoring-Voltage, Phase, Frequency
- Controls, Stepping Motor
- Controls, Temperature
- Controls, Torque, Electronic
- Controls, Vibrator
- Counters, Bidirectional
- Counters, Coil Winding
- Counters, Decade
- Counters, Directional
- Counters, Electromagnetic
- Counters, Event
- Counters, Mechanical
- Counters, Photoelectric
- Counters, Preset
- Counters, Printing
- Counters, Pulse
- Counters, Revolution
- Current Sensors-Also See Transducers, Volt, etc.
- Demodulators, Magnetic
- Energy Management Systems
- Flashers
- Gyros (All Types)
- Indicators, Directional
- Indicators, Elapsed Time
- Indicators, Liquid Level
- Indicators, Positioning
- Integrators, Mechanical & Electromechanical
- Measuring Equipment, Fiber Optic, Attenuation & Bandwidth
- Meters, Fluid Flow
- Modulators, Magnetic
- Modules, Control & Switching
- Monitors, Current
- Monitors, Laser Energy
- Monitors, Phase Sequence & Loss
- Monitors, Power Failure
- Monitors, Power, AC & DC
- Multipliers, Magnetic Analog
- Process Control Systems
- Programmers, Cam & Drum
- Sensors, Acoustic
- Sensors, Chemical
- Sensors, Proximity
- Timers, Counting
- Timers, Cycle & Reset
- Timers, Delay
- Timers, Electrolytic Cell
- Timers, Interval
- Timers, Programmed
- Timers, Sequence
- Timers, Solid State
- Totalizers, Digital
- Trackballs, XY Positioning

2300 CRYSTALS, OSCILLATORS, CRYSTAL & PIEZOELECTRIC FILTERS

(Volume 1A)

- Crystal Blanks
- Crystals, Frequency Control
- Crystals, Microprocessor
- Crystals, Piezoelectric
- Crystals, Quartz
- Crystals, Quartz, for Watches
- Crystals, Semiconductor (Ingots & Wafers)
- Crystals, YIG
- Detectors, Crystal
- Filters, Crystal (Incl. Monolithic Devices)
- Filters, Tuning Fork
- Holders, Crystal
- Modules, Oscillator
- Mounts, Crystal
- Oscillators, Audio (Module)
- Oscillators, Beat Frequency (BFO)
- Oscillators, Bias
- Oscillators, Cavity
- Oscillators, Clock
- Oscillators, Crystal Controlled (Module)
- Oscillators, LC
- Oscillators, Low Frequency (Module)
- Oscillators, Oven
- Oscillators, Power (Module)
- Oscillators, Pulse (Module)
- Oscillators, RC (Module)
- Oscillators, Reed
- Oscillators, RF (Module)
- Oscillators, Sinusoidal (Module)
- Oscillators, Square Wave (Module)
- Oscillators, Temperature Compensated
- Oscillators, Tuning Fork Controlled
- Oscillators, UHF/VHF (Module)
- Oscillators, Ultrasonic (Module)
- Oscillators, Voltage Controlled (Module)
- Ovens, Crystal & Component
- Piezoelectric Ceramics
- Resonators, SAW
- Timing Systems, Oscillators
- Tuning Forks

2325 DATA ACQUISITION/ HANDLING SYSTEMS & ACCESSORIES

(Volume 3)

- Cameras, Data Recording
- Cameras, Infrared
- Converters, Analog to Digital
- Converters, Analog to Pulse
- Converters, ASCII to Baudot
- Converters, ASCII to BCD
- Converters, BCD to ASCII
- Converters, Binary to BCD
- Converters, Binary to Decimal
- Converters, DC to Sine/Cosine
- Converters, DC to Synchro
- Converters, Digital to Analog
- Converters, Digital to Resolver
- Converters, Digital to Synchro
- Converters, Frequency to Voltage
- Converters, Multiplying, Analog to Digital & Digital to Analog
- Converters, Polar to Rectangular Coordinates
- Converters, Rectangular to Polar
- Converters, Resolver to Digital
- Converters, Synchro to Digital
- Converters, Synchro to Linear DC
- Converters, Synchro to Sine/Cosine
- Converters, Voltage to Frequency
- Data Acquisition & Reduction Systems-Also See Modules, Data Acquisition
- Data Loggers
- Generators, Character
- Integrators, Electronic
- Modules, Data Acquisition
- Multiplexers, Analog
- Multiplexers, Digital
- Multipliers, Analog
- Multipliers, Channel Electron
- Scalers, Binary, Decade
- Scramblers, Data
- Security Systems, Data
- Shift Registers
- Signal Systems, Fiber Optic
- Speech Compression & Synthesis Equipment
- Spoolers, Printer Buffers
- Switches, Data, Manual
- Switches, Data, Programmable
- Synthesizers, Speech
- Translators, Data

2350 DELAY LINES

(Volume 1A)

- Delay Lines, All Types
- Delay Lines, Cable
- Delay Lines, Digital
- Delay Lines, Distributed, Constant (Fixed)
- Delay Lines, Distributed, Constant (Variable)
- Delay Lines, Glass & Quartz
- Delay Lines, Liquid
- Delay Lines, Lumped Constant (Electrically Variable)
- Delay Lines, Lumped Constant (Fixed)
- Delay Lines, Lumped Constant (Mechanically Variable)
- Delay Lines, Magnetostrictive
- Delay Lines, Miniature & Subminiature-Also See Specific Types Of Delay Lines
- Delay Lines, Programmable
- Delay Lines, Strip
- Delay Lines, Trimmer
- Delay Lines, Ultrasonic
- Delay Lines, Waveguide
- Standards, Delay Line
- Surface Acoustic Wave Devices
- Surface Acoustic Wave, Delay Line
- Synthesizers, Delay Line

2400 PANEL HARDWARE (BEZELS, DIALS, KNOBS, ETC.)

(Volume 2)

- Bezels, Shielded & Unshielded
- Cords & Cable, Dial Drive
- Couplings, Shaft, Rigid & Flexible
- Decalcomania-Also See Labels, Pressure Sensitive
- Dials, Instrument, Metal, Plastic, etc.
- Dials, Turns Counting
- Drives & Drive Mechanisms (Dial)
- Escutcheons
- Kits, Marking (Dial, Instrument, Equipment, etc.)
- Knobs & Dials
- Knobs, Limit Stop
- Knobs, Locking, Control Shaft
- Knobs, Slip Clutch
- Knobs, Torque, Incremental, Ratio Drive
- Labels, Pressure Sensitive, Adhesive
- Locks, Dial & Shaft
- Pointers, Dial
- Scales, Dial

2440 MILITARY COMPONENTS

(Volume 1B)

- Adapters, RF (MIL)
- Antennas (MIL)
- Arresters, Electrical Surge/Lightning (MIL)
- Attenuators (MIL)
- Attenuators (MIL), Inductive
- Cable & Assemblies (MIL)
- Cable (MIL), Flat
- Cable (MIL), RF
- Capacitors (MIL)
- Caps (MIL)
- Chassis (MIL), Electrical
- Chokes (MIL)
- Choppers (MIL)
- Circuit Breakers, Boxes, Panel Boards, Enclosures (MIL)
- Clamps (MIL), Cable
- Clips (MIL), Electrical
- Coils (MIL), RF
- Connectors (MIL), Flat Cable
- Connectors (MIL), Power
- Connectors (MIL), Printed Circuit
- Connectors (MIL), RF
- Contactors (MIL)
- Contacts (MIL), Assemblies & Holders
- Couplers (MIL), Directional
- Crystals (MIL)
- Current Limiters (MIL)
- Diodes (MIL)
- Dummy Loads (MIL), RF
- Electrostatic Discharge (MIL)
- Fiber Optics (MIL)
- Filters (MIL), Electrical & Networks
- Flanges (MIL), Waveguide
- Flashers (MIL)
- Fuses, Fuseholders, Boxes & Panels (MIL)
- Hardware (MIL), Connector
- Headsets (MIL)
- Heat Sinks (MIL)
- Inductors (MIL)
- Jacks (MIL)
- Line Assemblies (MIL), RF Transmission
- Magnets (MIL), Permanent
- Meters (MIL)
- Microcircuits (MIL)
- Microcircuits (MIL), Linear
- Microcircuits (MIL), Low Power Schottky
- Microcircuits (MIL), Memories, CMOS, Hybrids
- Microcircuits (MIL), TTL, Schottky, Microprocessor
- Microphones (MIL)
- Modules (MIL), Electronic
- Modules (MIL), Standard Electronic
- Oscillators (MIL), Crystal & Ovens
- Oscillators (MIL), VCO, Solid State, RF
- Plugs (MIL)
- Potentiometers (MIL)
- Printed Circuits & Printed Circuit Materials (MIL)
- Reactors (MIL)
- Rectifiers (MIL), Semiconductor
- Relays (MIL)
- Resistors (MIL)
- Sockets (MIL)
- Soldering (MIL)
- Solenoids (MIL)
- Speakers (MIL)
- Switches (MIL), Non-RF
- Switches (MIL), RF
- Synchros & Resolvers (MIL)
- Test Methods (MIL)
- Thyristors (MIL)
- Transformers (MIL), Audio, Power, RF
- Transformers (MIL), Pulse & Variable
- Transistors (MIL)
- Transmission Lines (MIL), RF
- Tubes (MIL), Indicator & Pickup
- Tubes (MIL), Microwave
- Tubes (MIL), Power & Gas, Planar
- Tubes (MIL), Receiving, & Tube Shields
- Waveguides (MIL)
- Wire (MIL)
- Wire, Airframe

2450 DISPLAYS, READOUTS, LAMPS, & LIGHTS

(Volume 1B)

- Boards, Display, Graphic
- Caps, Lenses, Indicator Light
- Displays, Dot Matrix
- Displays, Edge Lighted & Back Lighted
- Displays, Electroluminescent
- Displays, Electromagnetic
- Displays, Electromechanical
- Displays, Fiber Optic
- Displays, Graphic
- Displays, Indicator Lights
- Displays, Laser
- Displays, Light-emitting Diode (LED)
- Displays, Lighted Segment
- Displays, Liquid Crystal (LCD)
- Displays, Planar Gas Discharge
- Displays, Plasma
- Displays, Projection Type (CRT; Electromechanical; Film; Light Valve)
- Displays, Status
- Displays, Touch Sensitive (Infrared & Membrane)
- Displays, Vacuum Fluorescent
- Drivers & Decoders For Readouts
- Filters, Color, Panel Light
- Filters, Display
- Indicators, Circuit Condition, On, Off, etc. (Electromechanical)-Also See Indicators, Instrument, Flag, Pointer, etc.
- Indicators, Instrument, Flag, Pointer, etc.
- Lamp Adapters
- Lamp Assembly Color Filters, Lens Mountable
- Lamp Drivers
- Lamps, Arc
- Lamps, Edge Lighting, Panel
- Lamps, Electroluminescent
- Lamps, Exciter, Photographic
- Lamps, Flashtube
- Lamps, Fluorescent
- Lamps, Incandescent
- Lamps, Infrared
- Lamps, Mercury Vapor
- Lamps, Miniature & Subminiature
- Lamps, Neon
- Lamps, Oil Tight
- Lamps, Press-to-Test
- Lamps, Projection
- Lamps, Stroboscopic Source
- Lamps, Tritium (Hydrogen 3) Powered
- Lamps, Tungsten Halogen
- Lamps, Ultraviolet
- Lamps, Xenon
- Lenses, Readout & Display
- Lights, Indicator
- Nameplates
- Panels, Back Lighted & Edge Lighted
- Panels, Electroluminescent
- Sockets, Lamp & Lamp Assemblies

2475 FIBER OPTIC EQUIPMENT & ACCESSORIES

(Volume 1B)

- Adapters, Fiber Optic
- Attenuators, Fiber Optic
- Cable, Fiber Optic
- Connectors, Fiber Optic
- Couplers, Fiber Optic
- Data Links, Fiber Optic
- Emitters, Fiber Optic-Also See Diodes, Laser
- Encoders, Fiber Optic
- Joints, Rotary, Fiber Optic
- Kits, Fiber Optic
- Light Sources, Fiber Optic
- Multiplexers, Fiber Optic
- Receivers, Fiber Optic
- Scanners, Fiber Optic
- Sensors, Fiber Optic
- Splicers, Fiber Optic
- Switches, Fiber Optic
- Terminations, Fiber Optic
- Test Equipment, Fiber Optic

2500 MECHANICAL COMPONENTS (BEARINGS, CORES, MAGNETS, ETC.)

(Volume 2)

- Bearings
- Belts, Drive
- Bobbins, Winding, Coil & Transformer-Also -See Coil Assemblies & Forms
- Bushings, Glass, Plastic, Metal, Rubber, etc.
- Cans, Capacitor, Relay, Semiconductor, Transformer, etc
- Cores, Ceramic
- Cores, Magnetic, Ferrite, L, E, etc.
- Cores, Magnetic, Ferrite, Pot/Cup
- Cores, Magnetic, Ferrite, Slug
- Cores, Magnetic, Ferrite, Toroid
- Cores, Magnetic, Ferrite, Yoke Section
- Cores, Magnetic, Metal Alloy (Other Than Silicon & Nickel-Iron)
- Cores, Magnetic, Nickel-Iron, L, EE, F, & Ring Laminations
- Cores, Magnetic, Nickel-Iron, Toroid
- Cores, Magnetic, Powdered Iron, Pot/Cup
- Cores, Magnetic, Powdered Iron, Slug
- Cores, Magnetic, Powdered Iron, Toroid
- Cores, Magnetic, Powdered Permalloy, Toroid
- Cores, Magnetic, Silicon C
- Cores, Magnetic, Silicon EI, EE, & F Laminations
- Cores, Magnetic, Silicon, Toroid
- Couplings, Quick-disconnect, Liquid or Gas
- Feedthrus & Seals, Environmental
- Ferrite Material & Parts
- Foil, Magnetic
- Gears & Gear Mechanisms (Precision)
- Glass Parts
- Graphite Parts
- Headers, Relay & Transformer
- Headers, Shrouded
- Headers, Transistor & Diode
- Holders, Diode
- Honeycomb Sheets, Panels, etc.
- Laminates, Metal Clad (Including Copper)
- Laminates, Plastic Impregnated (Unclad)
- Limit Stops, Mechanical
- Magnets (Lab. Type)
- Magnets, Permanent

Magnets, Superconducting
Materials, Shock, Noise, & Vibration Control
Mounts, CRT & Accessories
Pulleys
Quartz, Fused
Rings, Retaining
Seals, Ceramic To Metal
Seals, Glass To Metal
Seals, Hermetic-Also See Services, Hermetic Sealing
Seals, Pressure Sensitive
Silica, Fused
Springs (All Types)
Tubing, Ceramic
Tubing, Glass
Tubing, Metal
Windows, Sapphire

2550 ENVIRONMENTAL TEST EQUIPMENT

(Volume 3)

Chambers, Altitude
Chambers, Environmental
Chambers, Explosion
Chambers, Fluid Conditioner
Chambers, Humidity
Chambers, Pressure
Chambers, Radiation
Chambers, Shock
Chambers, Temperature
Chambers, Vacuum
Chambers, Vibration
Clean Room Equipment & Supplies
Controls, Environmental Test Equipment
Ovens, Aging, Burn-in, Life Test
Refrigerators, Environmental Test
Simulators, Motion
Testers, Burn-in, Aging
Testers, Heat, Manual
Testers, Life, Component
Testers, Material
Testers, Shock

2600 FANS, BLOWERS, COOLING EQUIPMENT, & HEAT EXCHANGERS

(Volume 2)

Air Cleaners & Filters (Shielded & Unshielded)
Air Conditioners (For Equipment)
Blowers, Centrifugal
Dehumidifiers (For Equipment)
Fans, Axial
Heat Exchangers & Systems
Heat Sinks, Semiconductor

2700 FILTERS (EXCL. CRYSTAL & PIEZO FILTERS)

(Volume 1A)

Filters, Active (All Types)
Filters, AF
Filters, Antenna
Filters, Band Elimination
Filters, Bandpass
Filters, Bandpass, SAW (Surface Acoustic Wave)
Filters, Ceramic
Filters, Coaxial
Filters, Comb
Filters, Continuously Variable
Filters, Digital
Filters, EMI/RFI
Filters, Equalizer
Filters, Harmonic
Filters, High Pass
Filters, Hybrid
Filters, IF
Filters, LC
Filters, Linear Phase
Filters, Low Pass
Filters, Mechanical
Filters, Miniature, Subminiature, Microminiature — Also see specific types of filters
Filters, Optical
Filters, RF
Filters, Single Sideband
Filters, Synchronous Tracking
Filters, Tone, Telegraph
Filters, UHF & VHF
Filters, Variable
Filters, Vestigial Sideband
Filters, Video
Hum Eliminators
Networks, LC
Networks, Phase
Networks, Pulse Forming
Networks, Video
Resonators, Ceramic
Suppressors, Noise
Surface Acoustic Wave, Filter

2800 HARDWARE (ELECTRONIC/ ELECTRICAL)

(Volume 2)

Capacitor Hardware
Clamps & Clips, Cable-Also See Wire & Cable Ties
Clamps, Synchro & Servo
Connector Boxes & Strips, Power Outlet
Contacts, Electrical
Grommets & Bushings
Resistor Hardware
Retainers, Battery
Rods, Ground
Strain Reliefs, Cable & Wire

Substrates, Ceramic
Substrates, Flexible
Substrates, Glass
Substrates, Metallic
Substrates, Sapphire
Switch Hardware
Switch Seals, Environmental
Terminals, Feedthru
Terminations, Antenna-Also See Dummy Loads
Tubing, Fiberglass
Tubing, Heat Shrinkable-Also See Caps, Forms & Tapes, Heat Shrinkable
Tubing, Paper
Tubing, Plastic-Also See Tubing, Spaghetti
Tubing, Spaghetti
Tubing, Spiral Wrap
Wire Nuts

2825 HARDWARE (MECHANICAL)

(Volume 2)

Bolts
Bumpers
Clamps & Clips, Component
Clamps & Clips, Ground
Eyelets
Fasteners, Metal
Fasteners, Nonmetallic
Ferrules, Cable-end
Hinges
Mounts, Shock & Vibration
Nuts, Metal
Pins, Cotter, Dowel, Taper, etc.
Pins, Mechanical
Plug Buttons
Preforms, Precious Metal
Rivets
Screws, Fastening
Sound Absorbing Materials
Spacers
Washers, Lock
Washers, Plain
Wire & Cable Ties

2900 INSTRUMENTS, TEST & MEASURING

(Volume 3)

Analyzers, AF
Analyzers, Antenna Pattern
Analyzers, Digital Signal
Analyzers, Harmonic
Analyzers, Impedance
Analyzers, Interference
Analyzers, Intermodulation
Analyzers, Logic
Analyzers, Magnetic
Analyzers, Modulation
Analyzers, Network
Analyzers, Noise
Analyzers, Phase & Voltage
Analyzers, Protocol
Analyzers, Pulse
Analyzers, Signature
Analyzers, Sonic & Subsonic
Analyzers, Spectrum
Analyzers, Transfer Function
Analyzers, Transient
Analyzers, Ultrasonic
Analyzers, Vibration
Analyzers, Waveform
Analyzers, Wow & Flutter
Blackbody Radiation Sources
Bolometers, Infrared
Bolometers, Microwave
Bridges, Admittance
Bridges, Audio
Bridges, Calorimeter
Bridges, Capacitance
Bridges, Deviation
Bridges, Impedance
Bridges, Inductance
Bridges, Kelvin
Bridges, LCR
Bridges, Power, RF
Bridges, Q
Bridges, Resistance
Bridges, RF
Bridges, Strain Gauge
Bridges, Synchro & Resolver
Bridges, Temperature
Bridges, Wheatstone
Cable Fault Locators
Calibrators, Accelerometer
Calibrators, Attenuation
Calibrators, Crystal
Calibrators, Current
Calibrators, Frequency
Calibrators, LVDT
Calibrators, Magnetic Field
Calibrators, Sound Level
Calibrators, Synchro
Calibrators, Time Base
Calibrators, Transducer
Calibrators, Voltage
Calibrators, VSWR
Calorimeters, Microwave
Clips, Logic Test
Collimators
Comparators, Digital
Comparators, Frequency
Comparators, Optical
Comparators, Phase
Comparators, Voltage
Controllers, IEEE 488 (GPIB) Bus
Counter/Timers
Counters, Frequency
Counters, Particle
Counters, Universal
Decade Boxes, Capacitance
Decade Boxes, Inductance
Decade Boxes, Resistance
Decade Boxes, Transformer

Detectors, Air Flow
Detectors, AM/FM
Detectors, Coaxial
Detectors, Flaw & Defect
Detectors, Phase Sensitive
Detectors, Radiation
Detectors, RF
Detectors, Standing Wave
Detectors, Synchronous
Detectors, Ultraviolet
Detectors, Video
Detectors, Voltage
Digitizers, Transient & Waveform
Dividers, Voltage-Also See Networks, Resistance; Transformers, Voltage Dividing
Dummy Loads, Electronic
Dummy Loads, Microwave
Dummy Loads, Power
Dummy Loads, Resistive
Electrodes, High Voltage
Electrostatic Discharge Guns — Also See Generators, ESD
Emulators, RTS
Gauges, Humidity
Gauges, Ionization
Gauges, Pressure-Also See Transducers, Pressure
Gauges, Temperature
Generators, AM
Generators, AM/FM
Generators, Arbitrary Waveform
Generators, Audio
Generators, Bar, Dot & Crosshatch
Generators, Color Bar
Generators, Electrostatic Discharge — Also See Electrostatic Discharge Guns
Generators, FM
Generators, FM/Stereo
Generators, Function
Generators, Gating/Timing
Generators, Harmonic
Generators, Light Pulse
Generators, Low Frequency
Generators, Marker
Generators, Noise, Random (Electrical)
Generators, Phase
Generators, Programmable, Function
Generators, Programmable, Pulse
Generators, Programmable, Synthesizers
Generators, Pulse
Generators, Pulse, Nuclear Instrumentation Module (NIM)
Generators, RF
Generators, Signal-Also See Generators, Specific Type
Generators, Sweep
Generators, Tone
Generators, Tone Burst
Generators, UHF/VHF
Generators, Ultrasonic
Generators, White Noise
Generators, Word
Holders, Test Lead
Imagers, Thermal
Indicators, Null
Insertion Loss Measurement Systems
Instruments, Test & Measuring, GPIB (IEEE 488) Compatible
Leads, Test & Adapters
Loads, Electronic, Variable-Also See Dummy Loads
Locators, Open Short
Magnetometers
Meters, Acceleration
Meters, Admittance
Meters, Ampere Hour
Meters, Ampere, AC
Meters, Ampere, DC
Meters, Ampere, RF
Meters, Ampere, True RMS
Meters, Attenuation
Meters, Audio Level
Meters, Capacitance, Inductance
Meters, Clamp-on
Meters, Conductance
Meters, Counting Rate, Nuclear
Meters, Decibel Indicating
Meters, Deviation
Meters, Digital ESR
Meters, Distortion & Noise
Meters, Electrometer
Meters, Field Strength
Meters, Flux
Meters, FM Deviation
Meters, Frequency
Meters, Frequency Deviation
Meters, Galvanometer
Meters, Gauss
Meters, Hand Held
Meters, Humidity
Meters, Impedance
Meters, Kilovolt
Meters, Light (Nonphotographic)
Meters, Megohm
Meters, Microwave
Meters, Modulation
Meters, Multifunction (Analog)
Meters, Multifunction (Digital)
Meters, Noise & Sound Level
Meters, Ohm
Meters, Peak Power
Meters, PH
Meters, Phase
Meters, Power
Meters, Power Factor
Meters, Power, RF
Meters, Q
Meters, Ratio
Meters, Reflectometer
Meters, RFI
Meters, S Unit
Meters, Standing Wave Ratio
Meters, Temperature (Contacting)
Meters, Temperature, Infrared
Meters, Thermal Transfer
Meters, Vacuum Tube Volt (VTVM)
Meters, VAR
Meters, Vibration
Meters, Volt, AC

Meters, Volt, DC
Meters, Volt, Digital
Meters, Volt, Potentiometric
Meters, Volt, RF
Meters, Volt, Sampling
Meters, Volt, True RMS
Meters, VU
Meters, Watt
Meters, Watt Hour
Meters, Watt, RF Directional
Meters, Wave
Microscopes, Measuring
Monitors, Frequency
Monitors, Modulation
Monitors, Phase & Phase Angle
Monitors, Power, Microwave
Monitors, Power, RF
Monitors, Response Time
Multipliers, Meter
Oscillators, Bridge (Test)
Oscillators, Decade (Test)
Prescalers
Probes, High Voltage (1,000 Volts & Over)
Probes, Logic Test
Probes, RF
Probes, Temperature
Probes, Test Lead
Pulsers, Logic Test
Pyrometers, Infrared
Pyrometers, Recording
Radiometers
Receivers, AM/FM (Incl. Precision Test)
Receivers, Fixed Frequency
Receivers, NBS
References, DC Voltage
RFI Measuring Equipment
Scanners, Infrared
Scanners, Instrument, Input/Output
Scanners, Optical
Scanners, Reed
Shunts, Meter
Signal Averagers
Simulators, Data
Simulators, Power Failure
Simulators, Powerline Disturbance
Simulators, Solar
Spectrometers
Standards, Atomic Beam
Standards, Capacitance
Standards, Current
Standards, Frequency
Standards, Inductance
Standards, Noise
Standards, Phase
Standards, Resistance
Standards, Temperature
Standards, Time
Standards, Voltage
Standards, Voltage Ratio
Switching Systems, Test & Measurement
Synthesizers, Frequency
Synthesizers, Waveform
Test Equipment, Closed Circuit TV-Also See Television Systems & Equipment, Closed-Circuit
Test Equipment, Color TV
Test Equipment, Mechanical Impedance
Test Equipment, Memory Systems, Disk
Test Equipment, Rental-Also See Services, Electrical Measurement & Test
Test Fixtures, ATC
Test Systems, Automatic DC
Test Systems, Board
Test Systems, Component
Test Systems, Computer Controlled (Automatic)
Test Systems, Functional
Test Systems, IC
Testers, Armature
Testers, Battery
Testers, Bit Rate
Testers, Cable
Testers, Capacitor
Testers, Coil & Transformer
Testers, Communication Equipment (Automatic)
Testers, Component Linearity
Testers, Corona
Testers, Diode
Testers, Electrical Parameter
Testers, Encoder
Testers, Fiber Optic
Testers, Insulation Breakdown
Testers, Integrated Circuit (Automatic)
Testers, Integrated Circuit (Manual)
Testers, Interface
Testers, LED & LED Arrays
Testers, Logic Card
Testers, Loopback
Testers, Magnetic Core
Testers, Magnetic Medium
Testers, Magnetron
Testers, Memory Board
Testers, Meter
Testers, Microwave
Testers, Modem
Testers, Motor
Testers, Potentiometer
Testers, Power Supply
Testers, Pulse Jitter
Testers, Relay
Testers, Resistivity
Testers, Resistor
Testers, Signal Tracing
Testers, Synchro/Resolver
Testers, Thickness (all types)
Testers, Thyristor
Testers, Tracking & Erosion Resistance (Insulation)
Testers, Transistor
Testers, Transmission & Delay
Testers, Tube
Testers, Vibration-Also See Services, Environmental Test
Testers, Voltage
Testers, Voltage Breakdown
Thermal Platforms
Thermographs
Thermometers, Resistance

Time Delays, Precision
Timer/Counters
Tracers, Curve

2950 PANEL METERS (ANALOG & DIGITAL)

(Volume 3)

Meters, Bar Graph
Meters, Digital, 2-wire, 4-20 mA Current Loop
Meters, Edgewise
Meters, Illuminated Scale
Meters, Moving Coil
Meters, Moving Iron
Meters, Moving Scale
Meters, Null
Meters, Panel (Analog)
Meters, Panel (Digital)
Meters, Taut Band

2975 OSCILLOSCOPES

(Volume 3)

Cameras, Oscilloscope
Hoods, Oscilloscope
Oscilloscope Plug-ins
Oscilloscopes, Digital
Oscilloscopes, General Purpose
Oscilloscopes, High Frequency (Above 200 MHz)
Oscilloscopes, Low Frequency (DC to 3 MHz)
Oscilloscopes, Mid Frequency (DC to 200 MHz)
Oscilloscopes, Multibeam
Oscilloscopes, Multiple Channel
Oscilloscopes, Portable, Battery Operated
Oscilloscopes, Programmable
Oscilloscopes, Sampling
Oscilloscopes, Storage
Oscilloscopes, Triggered Sweep
Probes, Oscilloscopes
Viewing Hoods, Cathode Ray Tube

3000 INSTRUMENTS, GRAPHIC RECORDING

(Volume 3)

Graphic Recording Paper & Supplies
Oscillographs, Direct Writing
Paper, Graphic Recording
Plotters, X-Y, & Accessories
Printers, Event
Recorders, Electrostatic
Recorders, Event/Multievent
Recorders, Polar
Recorders, Strip Chart
Recorders, Transient
Recorders, Vibration

3100 INSULATORS & INSULATING MATERIALS

(Volume 2)

Caps, Forms & Tapes, Heat Shrinkable-Also See Tubing, Heat Shrinkable
Coatings, Insulating
Compounds, Insulating
Films, Masking (Incl. Photographic)
Insulation Materials
Insulation Parts, Fabricated
Insulators, Antenna
Insulators, Clip, Test & Battery
Insulators, Mica
Tapes, Electrical Insulation

3130 INTEGRATED CIRCUITS, HYBRID CIRCUITS, & FUNCTION MODULES

(Volume 1A)

Circuits, Hybrid, Custom
Circuits, Hybrid, Thick Film
Circuits, Hybrid, Thin Film
Dividers, Analog
Erasing Equipment, EPROM
Generators, Sine/Cosine Function (Module)
Holders & Carriers, IC, LSI (Packaged)
Hybrid Voltage Regulators
Integrated Circuits, Custom/Semicustom
Integrated Circuits, Digital
Integrated Circuits, Interface
Integrated Circuits, Linear
Integrated Circuits, Memory
Integrated Circuits, Microprocessor
Integrated Circuits, Silicon Monolithic, Unpackaged Chips
Microcomputer Boards
Microprocessor Development Systems
Modules, Amplifier-Also See Amplifiers, Specific Types
Modules, Analog Multiplier
Modules, Analog-to-Digital Conversion
Modules, Digital-to-Analog Conversion
Modules, Encoding/Decoding
Modules, Filter
Modules, I/O Relay
Modules, Logic-Also See Cards; Circuits; Networks
Modules, RMS-to-DC Conversion
Modules, Sample & Hold
Networks, Hybrid Substrates
Packages, Integrated Circuit
Programmers, PROM & Logic Array

3200 INTERCONNECTION SYSTEMS (BACKPANELS, CARD HOLDERS, & PACKAGING SYSTEMS)
(Volume 2)

Backpanel Interconnect Systems
Bars, Shorting
Boards, Plug-in
Boards, Plug-in, Extender
Boards, Plug-in, Interface
Boards, Plug-in, Memory
Boards, Prewired, High Density
Boards, Programming
Bus Bars & Systems
Integrated Circuit Interconnect Systems
Panels, Power BUS for ICs

3400 MICROWAVE SYSTEMS & EQUIPMENT
(Volume 3)

Absorbers, Microwave
Amplifiers, Klystron
Amplifiers, Microwave
Amplifiers, Parametric
Analyzers, Microwave
Coders, Transponder
Communications Systems, Microwave
Comparators, Attenuation
Detectors, Microwave
Down Converters
Duplexers, Microwave
Generators, Microwave
Impedance Converters, Microwave
Modulators, Microwave
Modulators, Pulse
Receivers, Microwave

3450 MICROWAVE COMPONENTS
(Volume 1A)

Adapters, Waveguide
Antenna Feed Systems
Attenuators, Coaxial
Attenuators, Fixed
Attenuators, Impedance Matching
Attenuators, Logarithmic
Attenuators, Microwave
Attenuators, Programmable
Attenuators, Turret
Attenuators, Variable
Attenuators, Voltage Controlled
Bends & Twists, Microwave
Cavities, Microwave
Chokes, Waveguide
Circulators, Ferrite
Couplers, Directional
Couplers, Microwave
Couplers, Rotary
Detecters, GaAs
Dividers, Frequency
Dividers, Power (LF, HF, VHF, UHF)
Dividers, Power, Microwave
Drivers, Switch
Filters, Microwave
Filters, Waveguide
Flanges, Waveguide
Isolators, Ferrite
Isolators, Microwave (All Types)
Joints, Rotary, Microwave
Junctions, Hybrid, Microwave
Limiters, Microwave
Line Stretchers, Microwave
Microwave Integrated Circuits (MICs)
Mixers, Microwave
Mixers, RF
Mounts, Microwave
Multipliers, Frequency
Oscillators, Microwave
Preselector-Mixers
Probes, Microwave
Radar System Components
Radomes & Windows, Microwave
Seals, Waveguide
Shifters, Phase, Microwave
Shifters, Phase, RF
Shutters, Microwave
Slotted Lines, Microwave
Strip-Line Components, Microwave
Switches, Diode
Tees, Coaxial
Tees, Waveguide
Terminations, Microwave
Tubing, Waveguide
Tuners, Microwave
Waveguide-Coax Adapters
Waveguides

3475 MILITARY SYSTEMS & EQUIPMENT
(Volume 3)

Acoustic CM Equipment (MIL), Airborne
Acoustic Systems (MIL)
Analyzers (MIL), Antenna Pattern
Analyzers (MIL), Pulse
Analyzers (MIL), Spectrum
Antenna Groups (MIL)
Antenna Groups (MIL), Elint
Antenna Sets (MIL), DF
Antenna Systems (MIL)
Antenna Systems (MIL), DF
Antennas (MIL), DF
Antennas (MIL), ECM
Antennas (MIL), EW
Antennas (MIL), Multibeam
Antennas (MIL), Phased Array
Chaff Systems (MIL)
Chambers, Space Simulation
CM Sets (MIL), Conformal plus RWR
CM Sets (MIL), Internal
CM Sets (MIL), Mobile
Collection Systems (MIL)
Communications Intelligence (Comint) Systems (MIL)
Computer Sets (MIL), Digital Data
Computer Systems (MIL)
Connectors, Missile (Umbilicals, Interstage, Post Boost)
Consoles (MIL), ECCM
Control Systems, Air Traffic
Converters (MIL) DC to DC
Converters (MIL), Frequency
Countermeasures (CM) Sets (MIL), Airborne
Data Systems (MIL), Naval Tactical
Decoys (MIL), Buoy
Decoys (MIL), IR Flare
Detection & Ranging Systems (MIL)
Detection Sets (MIL), IR
Detection Systems (MIL), Passive
Detection Systems (MIL), Submarine
Detectors (MIL), IR
Detectors (MIL), Radar
Direction Finders (MIL), High Frequency
Direction Finders (MIL), Radio
Direction Finding Sets & Systems (MIL)
Dispenser Sets (MIL)
Dispensers (MIL), Chaff
Dispensers (MIL), Drone, Chaff/IR
Dispensers (MIL), IR Flare
Dispensers (MIL), Wing Chaff
Dispensing Pods (MIL), Chaff
Display Sets (MIL), Computer
ECM Sets (MIL)
ECM Sets (MIL), Close Air Support
ECM Sets (MIL), Shipboard
ECM Systems (MIL)
ECM Systems (MIL), Deceptive
ECMs (MIL), Torpedo Defense
Electronic Counter Countermeasures (ECCM) Fixes (MIL)
Electronic Countermeasures (ECM) (MIL), Cruise Missiles
Electronic Intelligence (Elint) (MIL)
Electronic Support Measures (ESM) Sets (MIL)
Electronic Warfare (EW) Sets (MIL)
Emitter Location & Identification System (MIL), Automatic Ground Transportable
ESM (MIL), Digitally Controlled
ESM (MIL), Ships
ESM Suites (MIL)
ESM Systems (MIL), Automated
ESM Systems (MIL), IFM Receiver
EW Sets (MIL), Ground Multitarget
EW Sets (MIL), Portable
EW Suites (MIL), Ships
EW Systems (MIL), Advanced Airborne Multitarget
Expanders, Data
Flare Sets (MIL), ECM
Generator Groups (MIL), Signal
Generators (MIL), Deception
Identification, Friend or Foe (IFF) ESM (MIL)
Indicators (MIL), Fault Locating
Infrared (IF) Equipment (MIL)
Jammers (MIL)
Jammers (MIL), Acoustic
Jammers (MIL), Advanced Self Protection
Jammers (MIL), Chaff, Flares
Jammers (MIL), Commjam, Truck Mounted
Jammers (MIL), Communications (Commjam)
Jammers (MIL), Drone Borne
Jammers (MIL), Expendable
Jammers (MIL), Fuze
Jammers (MIL), High Band
Jammers (MIL), Integrated Command
Jammers (MIL), J-band
Jammers (MIL), Low Band
Jammers (MIL), Multipurpose
Jammers (MIL), Portable
Jammers (MIL), Radar
Jammers (MIL), Shipboard
Jammers (MIL), Standoff
Jammers (MIL), Tactical
Jamming Pods (MIL), ECM
Jamming Sets (MIL), Multipurpose
Jamming Systems (MIL)
Jamming Systems (MIL), Mobile
Jamming Systems (MIL), Multipurpose
Jamming Systems (MIL), Tactical Communications (TACJAM)
Mappers (MIL), IR Recon.
Monitors (MIL), Data
Pods (MIL), Chaff Rocket
Pods (MIL), First Generation
Pods (MIL), Multiband Smart
Pods (MIL), Two Faired, Cut in Half
Power Supplies (MIL), DC
Radar (MIL), Tail Warning
Radar Forward-Looking Infrared (FLIR) Sets (MIL)
Radar Homing & Warning (RHAW) Systems (MIL)
Radar Intercept (MIL)
Radar Systems (MIL), Elint
Receivers (MIL)
Receivers (MIL), Acoustic Intercept
Receivers (MIL), Compass Sail/Clockwise
Receivers (MIL), Digital Warning
Receivers (MIL), Elint
Receivers (MIL), ESM
Receivers (MIL), Handoff
Receivers (MIL), IFM
Receivers (MIL), IR Warning
Receivers (MIL), Missile Launch Warning
Receivers (MIL), Radar Warning
Receivers (MIL), Radio
Receivers (MIL), Recon
Receivers (MIL), Search
Receivers (MIL), Shipboard
Receivers (MIL), Submarine
Receivers (MIL), Surveillance
Receivers (MIL), Warning
Receivers, (MIL), ECM
Recorders (MIL), Infrared
Recorders (MIL), Magnetic Tape
Recorders (MIL), RHAW
Recording Systems (MIL)
Search, Interceptor Set (MIL)
Sensors (MIL), Tactical Electronic Reconnaissance
Simulators (MIL), EW
Simulators (MIL), EW Quick Reaction Capability
Simulators (MIL), RHAW
Simulators (MIL), Weapon
Simulators, Radar
Sonar Systems
Space Surveillance Systems
Surveillance (MIL), EW Drone
Surveillance Sets (MIL)
Surveillance Systems (MIL), Optical
Surveillance Systems (MIL), Radio Frequency
Surveillance/Warning Systems (MIL), Control
Synchronizers (MIL), Antenna
Terminals (MIL), Ground Data
Test Assemblies (MIL)
Test Benches (MIL), ECM
Test Benches (MIL), Shop
Test Equipment (MIL)
Test Sets (MIL)
Test Sets (MIL), Airborne Radar
Test Sets (MIL), ECM
Test Sets (MIL), EW
Test Sets (MIL), Flight Line
Test Sets (MIL), IRCM
Test Sets (MIL), TJS
Testers, (MIL), ECM
Testers, (MIL), ECM Pod
Testers, (MIL), ESM
Track Breaker (MIL), I-band
Trackers (MIL), Laser
Tracking Systems (MIL)
Trainers (MIL), ECM
Trainers (MIL), Elint
Trainers (MIL), EW
Trainers (MIL), IR Detection
Trainers (MIL), Maritime
Training Systems (MIL)
Transmitters (MIL), ECM
Transmitters (MIL), Shipboard Jamming
Transmitters (MIL), TWTs
Viewers (MIL), Infrared
Warning Systems (MIL), Computerized
Warning Systems (MIL), EW
Warning Systems (MIL), IR
Warning Systems (MIL), Laser
Warning Systems (MIL), SAM Launch

3500 MOTORS, DRIVES, & ROTATING EQUIPMENT
(Volume 1B)

Brakes, Magnetic
Brakes, Mechanical
Brushes & Brush Assemblies
Clutches, Friction
Clutches, Magnetic
Clutches, Positive
Commutators
Gearheads & Speed Reducers
Indicators, Speed
Motor & Generator Armatures, Rotors, Stators
Motors, Brushless, DC
Motors, Clock & Timing
Motors, Control
Motors, DC Timing
Motors, Drag Cup
Motors, Fractional Horsepower
Motors, Gearhead
Motors, Gyro
Motors, Hysteresis
Motors, Induction
Motors, Linear
Motors, Permanent Magnet
Motors, Squirrel Cage
Motors, Stepping
Motors, Synchronous
Motors, Torque (Incl. Torquers)
Motors, Universal, AC or DC Operation
Reducers, Speed-Also See Gears & Gear Mechanisms
Shafts & Adapters-Also See Couplings, Shaft, Rigid & Flexible
Slip Rings & Assemblies
Steppers, Indexing, Motor

3700 ELECTRO-OPTICAL EQUIPMENT (EXCLUDING FIBER OPTICS)
(Volume 1B)

Alarms, Controls, Photoelectric
Cells, Photoconductive
Cells, Photoemissive
Cells, Photovoltaic
Detectors, Fiber Optic-Also See Diodes, PIN
Detectors, Infrared
Diode Arrays (Incl. Photo)
Diodes, Light Emitting (LEDs)
Diodes, Liquid Crystal (LCDs)
Diodes, Photoelectric
Heads, Reflective
Isolators, Optoelectronic
Laser Components & Laser Accessories
Lenses, Filters, Windows, Infrared
Lenses, Optical & Camera
Light Choppers
Light Sources, Photoelectric
Light Sources, Stroboscopic
Light Sources, Ultraviolet
Microscopes
Modulator/Demodulators, Laser
Modulators, Light
Optical Component Mounts & Accessories
Photodetectors, GaAs
Sensors, Light
Switches, Photoelectric
Transistors, Photo (Incl. Arrays)
Transmitters, Fiber Optic
Transmitters, Laser

3800 PACKING, SHIPPING, & STORAGE CONTAINERS & MATERIALS
(Volume 2)

Bins, Part Storage
Carts & Dollies, Instrument & Equipment
Containers, Storage
Covers, Protective (Incl. Dustcovers)
Enclosures, Shipping, Metallic & Nonmetallic
Packaging Materials, Antistatic
Packaging Materials, Foam & Plastic
Storage Equipment, Disk
Storage Equipment, Flexible Disk
Storage Equipment, Magnetic Card
Storage Equipment, Media Transport
Storage Equipment, Microform
Storage Equipment, Multifunctional
Storage Equipment, Paper Tape
Storage Equipment, Printout
Storage Equipment, Punched Card
Storage Equipment, Reel-to-Reel Tape
Storage Euipment, Cartridge/Cassette

3900 BATTERIES
(Volume 3)

Batteries, Alkaline Manganese
Batteries, Carbon Zinc
Batteries, Gelled Electrolyte
Batteries, Lead Acid
Batteries, Lead Dioxide
Batteries, Lithium
Batteries, Lithium Manganese Dioxide
Batteries, Lithium Thionyl Chloride
Batteries, Mercury
Batteries, Mercury Oxide
Batteries, Nickel Cadmium
Batteries, Rechargeable
Batteries, Silver Cadmium
Batteries, Silver Oxide
Batteries, Silver Zinc
Batteries, Standard Cell
Batteries, Thermal
Batteries, Zinc Air
Batteries, Zinc Carbon
Batteries, Zinc Chloride

4000 POWER SUPPLIES, DC
(Volume 3)

Chargers, Battery
Converters, DC to DC, 30 to 300 VDC Output
Converters, DC to DC, 300 to 1,000 VDC Output
Converters, DC to DC, Greater Than 1,000 VDC Output
Converters, DC to DC, Less Than 30 VDC Output
Converters, Frequency to DC-Also See Power Supplies, AC Input, DC Output
Current Sources
Discharge Systems, Energy
Flashlights & Lanterns
Generators, Electrical Power
Motor Generator Sets
Power Supplies, AC Input, 301 to 1,000 VDC Output
Power Supplies, AC Input, 31 to 300 VDC Output
Power Supplies, AC Input, Greater than 1,000 VDC Output
Power Supplies, AC Input, Up to 30 VDC Output
Power Supplies, AC to DC Adapter
Power Supplies, Bipolar
Power Supplies, Constant Current
Power Supplies, Encapsulated
Power Supplies, Enclosed
Power Supplies, Ferroresonant
Power Supplies, Isolated
Power Supplies, Lab (Including Metered Units)
Power Supplies, Linear
Power Supplies, Multiple Output
Power Supplies, Open Frame
Power Supplies, Plug In
Power Supplies, Printed Circuit Card
Power Supplies, Programmable
Power Supplies, Standby (Emergency)
Power Supplies, Submodular
Power Supplies, Switching
Power Supplies, Switching, Battery Backup
Power Supply Interfaces & Accessories
Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating; Hybrid Voltage Regulators
Regulators, Current
Voltage Sources

4050 POWER SUPPLIES, AC
(Volume 3)

Alternators
Choppers-Also See Light Choppers
Converters, Frequency, Logarithmic
Converters, Phase
Converters, Power Frequency, Electronic
Converters, Power Frequency, Rotary
Isolators, Line
Line Conditioners
Power Supplies, AC Output
Power Supplies, Uninterruptable (UPS)
Regulators, Frequency
Shifters, Phase 60/400 Hz
Stabilizers, Line Impedance
Vibrators

4100 PRODUCTION EQUIPMENT & MANUFACTURING SERVICES
(Volume 3)

Antistatic Devices, Blowers, Guns, etc.
Baths, Controlled Temperature (Air & Liquid)
Cleaners, Ultrasonic
Comparators, Dimension Calibrators
Controls, Dimension
Controls, Positioning
Dehydrators
Deposition Equipment, Vacuum & Accessories-Also See Evaporation Equipment, Electron Beam
Detectors, Vacuum
Dielectric Heating Equipment
Electroplating Equipment & Supplies
Evaporation Equipment, Electron Beam
Furnaces, Electric
Furnaces, Gas (Production)
Furnaces, Vacuum
Handlers, Integrated Circuit (Automatic)
Heaters, Immersion
Holders, Circuit Board (Production Type)
Installation Equipment, Fiber Optic
Instrumentation, Fiber Optic
Jigs And Fixtures, Chassis & Circuit Board
Lamps, Magnifying, Inspection
Laser Systems
Machines & Accessories, Semiconductor Manufacturing
Machines, Cleaning & Degreasing-Also See Cleaners, Ultrasonic
Machines, Coil Winding
Machines, Component Handling, Feeding, Insertion & Sorting
Machines, Hermetic Sealing
Machines, Induction Heating (Electronic)
Machines, Lead Cutting & Forming
Machines, Marking & Numbering
Machines, Mask Alignment & Exposure
Machines, Plastic Molding
Machines, Plating
Machines, Printed Circuit Drilling, Etching & Punching
Machines, Terminal Installing
Machines, Ultrasonic Bonding
Machines, Wire Marking, Manual & Automatic
Machines, Wire Measuring & Cutting
Magnetizers
Magnifying Glasses, Inspection
Microcircuit Production Equip.
Ovens, Vacuum
Positioning Systems, Multiple Axis, Computer Guided
Probe Cards, Semiconductor Testing
Pumps, Vacuum
Scribers, Wafer-Also See Machines & Accessories, Semiconductor Manufacturing
Sealing Equipment, Metal to Glass/Ceramic
Semiconductor Wafer Fabrication, Assembling (Packaging)
Semiconductor Wafer Fabrication, Designing (Topological)
Semiconductor Wafer Fabrication, Maskmaking (Tooling)
Semiconductor Wafer Fabrication, Processing
Semiconductor Wafer Fabrication, Testing
Services, Assembly & Fabrication (Incl. R & D)
Services, Backplane Wiring
Services, Calibration & Instrument Repair
Services, Coating (All Types)
Services, Crimping
Services, Custom Molding, Plastics
Services, Decapsulation
Services, Electrical Measurement & Test
Services, EMI/RFI Testing
Services, Encapsulation
Services, Environmental Testing
Services, Hermetic Sealing
Services, High Vacuum
Services, Instrument Design (Industrial)
Services, Metal Etching, Engraving
Services, Metal Parts Fabrication
Services, Metallizing (Incl. Electroforming)
Services, Microprocessor
Services, Molding
Services, Packaging
Services, Photographic
Services, Plastics Fabrication
Services, Plating
Services, Precious Metal Refining
Services, Precious Metal Resmelting
Services, PROM & Array Programming
Services, Silk Screening
Services, Training/Education
Services, Vibration Surveys
Services, Wire Cutting & Stripping
Services, Wirewrapping-Also See Services, Backplane Wiring
Soldering Equipment, Induction Heating
Soldering Equipment, Printed Circuit
Soldering Equipment, Resistance
Soldering Equipment, Ultrasonic
Soldering Systems, Temperature Controlled
Testers, Solderability
Ultraviolet Inspection Lighting-Also See Microscopes, Ultraviolet
Valves, Vacuum
Wire Strippers, Automatic
X-ray Inspection Equipment

4200 PROTOTYPE BOARDS, KITS, & DESIGN AIDS
(Volume 2)

Boards, Plug-in, Prototype
Breadboard Assemblies
Calculators, Electronic, Desk Top
Calculators, Electronic, Hand Held
Clips, Breadboard
Drafting Machines
Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)
Integrated Circuit Design Aids

Kits, Breadboarding (For Engineers)
Kits, Programming Board
Kits, Training Aid
Services, Computer-Aided Design (CAD)—Also See Computers, CAD, CAM, & CAD/CAM
Technical Books

4300 PROTECTIVE COMPONENTS (FUSES, CIRCUIT BREAKERS, ETC.)
(Volume 1B)

Circuit Breakers
Clips & Holders, Fuse-Also See Panels, Fuse
Detectors, Ground Fault
Fuse Elements
Fuses
Fuses, Failure Indicating
Fuses, Thermal
Interrupters, Ground Fault
Interrupters, Power
Interrupters, Vacuum
Limiters, Current
Limiters, Surge
Panels, Fuse
Protectors, Brownout
Protectors, Surge-Also See Suppressors, Transient Voltage
Resistors, Fuse
Spark Gaps
Suppressors, Transient Voltage (All Types)
Warning Systems, Lightning

4500 RELAYS
(Volume 1B)

Relay, Solid State
Relays, Cradle
Relays, Crystal Can, 1/2 Crystal Can
Relays, Current Sensing
Relays, Differential
Relays, Frequency Selective
Relays, General Purpose
Relays, High Voltage (500 Volts & Over)
Relays, Hybrid
Relays, Latching
Relays, Mercury-Wetted Contacts
Relays, Meter
Relays, Motor Start
Relays, Phase Sensing
Relays, Plug-in
Relays, Power
Relays, Printed Circuit Mounting (Including Transistor & DIP Case Types)
Relays, Programmable
Relays, Reed
Relays, RF (Incl. Antenna & Coaxial)
Relays, Sealed
Relays, Sensitive
Relays, Stepping
Relays, Telephone
Relays, Thermal
Relays, Time Delay
Relays, Vacuum
Relays, Voltage Sensitive
Retainers, Relay

4525 SHIELDS & SHIELDING
(Volume 2)

Chambers, Magnetic, Degaussing Coil
Conductive Elastomers
Conductive Plastic Materials & Parts
Contact Strips, Finger
Demagnetizers
Fabrics, Conductive
Gaskets, Shielding, RF-Also See Shields, RF
Kits, Shielding
Shielding Beads, Ferrite
Shielding, EMI/RFI
Shields, Cathode-Ray Tube
Shields, Coil
Shields, Corona
Shields, Indicator Light
Shields, Magnetic
Shields, Photomultiplier
Shields, RF-Also See Gaskets, Shielding, RF
Shields, Transformer
Shields, Tube
Static Eliminating Materials, Devices, & Equipment
Tapes, Films & Foils, Pressure Sensitive
Wire Shielding-Also See Braid, Cable

4550 SOLENOIDS
(Volume 1B)

Drivers, Solenoid
Solenoids, Linear
Solenoids, Proportional
Solenoids, Rotary
Valves, Solenoid

4600 SOLDERING & DESOLDERING EQUIPMENT
(Volume 2)

Flux, Brazing & Soldering Materials
Heat Sinks, Soldering
Solder (All Types)
Solder Pots & Baths
Soldering Accessories
Soldering Guns, Irons & Desoldering Tools
Torches, Soldering, Welding & Accessories

4700 RESISTORS
(Volume 1A)

Films, Resistance
Networks, Ladder
Networks, Resistance
Resistors, Adjustable-Also See Potentiometers; Rheostats
Resistors, Ballast (Incl. Tube & Solid State Devices)
Resistors, Bulk Ceramic
Resistors, Carbon Film
Resistors, Ceramic Core
Resistors, Ceramic Metal (Cermet)
Resistors, Chip (For Microcircuits)
Resistors, Composition, Carbon
Resistors, Decade
Resistors, Deposited Carbon
Resistors, Disk, Rod & Tube
Resistors, Film, Metallized & Nonmetallized
Resistors, Flame Retardant
Resistors, Flux Sensitive
Resistors, Foil, Ultraprecision
Resistors, Glass
Resistors, High Frequency
Resistors, High Megohm (Over 22 Megohms)
Resistors, High Temperature (Over 125°C)
Resistors, High Voltage (1,000 Volts & Over)
Resistors, Hot Molded
Resistors, Integral Heat Dissipator
Resistors, Low Temperature Coefficient
Resistors, Metal Glazed
Resistors, Microwave
Resistors, Negative Temperature Coefficient
Resistors, Noninductive
Resistors, Oil Filled
Resistors, Plug-in
Resistors, Positive Temperature Coefficient
Resistors, Power
Resistors, Precision
Resistors, Pressure Sensitive
Resistors, Rectilinear
Resistors, Strip
Resistors, Suppressor
Resistors, Surge
Resistors, Tapped
Resistors, Tin Oxide
Resistors, Voltage Sensitive
Resistors, Wirewound

4750 POTENTIOMETERS, TRIMMERS, CONTROLS, & RHEOSTATS
(Volume 1A)

Attenuators, Audio (T, L, LL Pads)
Kits, Potentiometer, Rheostat
Potentiometer Elements
Potentiometers, Carbon Ceramic
Potentiometers, Carbon Film
Potentiometers, Ceramic Metal (CERMET)
Potentiometers, Composition, Carbon
Potentiometers, Conductive Plastic
Potentiometers, Hot Molded
Potentiometers, Hybrid
Potentiometers, Lab Type
Potentiometers, Linear
Potentiometers, Metal Film
Potentiometers, Motorized
Potentiometers, Multiturn
Potentiometers, Nonlinear
Potentiometers, Rectilinear
Potentiometers, Servo Mount
Potentiometers, Trimmer
Potentiometers, Wirewound
Rheostats

4800 DISCRETE SEMICONDUCTORS
(Volume 1A)

Bridge Rectifiers, Silicon-Also See Rectifiers, Bridges & Assemblies
Bridges, Silicon Cell
Diacs
Diodes, Avalanche
Diodes, Backward
Diodes, Chip, Unpackaged
Diodes, Electroluminescent (Radiating)
Diodes, Frequency Multiplier
Diodes, Germanium
Diodes, Gunn
Diodes, High Voltage (1,000 Volts & Over)
Diodes, Hot Carrier
Diodes, Impatt
Diodes, Laser
Diodes, Limiting
Diodes, Matched Pairs
Diodes, Matched Quads
Diodes, Microwave Detector
Diodes, Microwave Mixer
Diodes, Noise
Diodes, PIN
Diodes, Schottky
Diodes, Silicon
Diodes, Step Recovery
Diodes, Switching
Diodes, Temperature Compensating
Diodes, Tunnel
Diodes, Varactor
Diodes, Zener & Stabistors (Forward Reference Diodes)
Doublers, Voltage-Also See Rectifiers, Bridges & Assemblies
Magnetoresistors, Hall
Multipliers, Hall
Probes, Hall
Rectifiers, Bridges & Assemblies
Rectifiers, Copper Oxide
Rectifiers, Copper Sulfide
Rectifiers, Germanium
Rectifiers, Selenium
Rectifiers, Silicon
Regulators & References, Silicon-Also See Diodes, Zener & Stabistors
Thyristors (Incl. Silicon Controlled Rectifiers)
Transistor Arrays
Transistors, Bipolar-Also See Transistors, Silicon
Transistors, Chip, Unpackaged
Transistors, Darlington
Transistors, Dual
Transistors, Field Effect
Transistors, Germanium
Transistors, Low Noise, GaAs, FETs — Also See Transistors, Microwave
Transistors, Microwave
Transistors, Power
Transistors, Power, Bipolar
Transistors, Power, FET
Transistors, Pressure Sensitive
Transistors, RF
Transistors, Silicon
Transistors, Switching
Transistors, Unijunction
Triacs

4900 SERVOMECHANISMS & ROBOTIC EQUIPMENT
(Volume 3)

Actuators, Servo, Linear
Actuators, Servo, Rotary
Amplifiers, Servo
Amplifiers, Synchro
Analyzers, Servo
Arms & Manipulators, Robotic
Control Systems, Robotics
Controls, Servo System
Dampers, Servo
Indicators, Servo
Motors, Servo
Multipliers, Servo
Repeaters, Servo
Resolvers, Synchro
Servo Systems
Synchro Transmitters, Solid State
Synchros
Tachometers, Generator
Tachometers, Pulse
Tachometers, Stroboscopic

5100 SWITCHES
(Volume 1B)

Steppers, Indexing, Switch
Switches, Backup
Switches, Cam
Switches, Coded
Switches, Decade
Switches, DIP
Switches, Foot Pedal, Mat, Ribbon, etc.
Switches, Hall Effect
Switches, High Voltage (Over 250 Volts)
Switches, Interlock
Switches, Key Lock
Switches, Lever
Switches, Limit
Switches, Matrix
Switches, Mercury Displacement
Switches, Momentary Action
Switches, Multiposition
Switches, Paddle Handle
Switches, Peripheral
Switches, Port Sharing
Switches, Power
Switches, Pressure
Switches, Program
Switches, Proximity
Switches, Pushbutton, Illuminated
Switches, Pushbutton, Nonilluminated
Switches, Reed
Switches, RF
Switches, Rocker
Switches, Rotary
Switches, Sealed
Switches, Slide
Switches, Snap Action (All Types)
Switches, Solid State
Switches, Step Type
Switches, Thumbwheel
Switches, Toggle
Switches, Touch Actuated

5150 KEYBOARDS & KEYPADS
(Volume 1B)

Keyboard Legends and Symbols
Keyboards, Address Encoded
Keyboards, Capacitive
Keyboards, Ferrite Core
Keyboards, Full Travel
Keyboards, Hall Effect
Keyboards, Hard Contact
Keyboards, Low Profile
Keyboards, Membrane
Keyboards, Modular
Keyboards, Pad
Keyboards, Photo-optical
Keyboards, Reed
Keyboards, Solid State
Keypads
Switches, Keyboard
Switches, Membrane

5300 THERMAL COMPONENTS
(Volume 1B)

Bimetals, Thermostatic
Cooling/Heating Modules, Thermoelectric
Heaters & Heating Elements (For Components & Equipment)-Also See Ovens
Heating Elements, Infrared
Indicators, Temperature (Not Meter Type)
Labels, Coatings, Crayons, Pellets, etc., Temperature Indicating
Laminates, Plastic (With Integral Heating Elements)
Monitors, Temperature-Also See Controls, Temperature
Mounts, Thermistor
Pyrometers, Optical, Noninfrared
Switches, Thermally Actuated
Thermistors
Thermocouples, Elements & Accessories
Thermostats-Also See Switches, Thermally Actuated; Controls, Temperature

5400 TOOLS (MANUAL & POWER)
(Volume 2)

Abrasive Belts, Compounds, Cords, Powders, etc.
Alloys, Brazing
Awls
Burnishers, Contact
Cutters, Wire, Manual
Drills & Accessories, Manual & Power
Drivers, Nut
Extractors, DIP, IC, & Pin Grid Array
Gauges, Displacement, Linear
Heat Guns, Production
Pliers
Pullers, Circuit Board
Pullers, Tube
Punches, Chassis
Reamers
Scissors
Screwdrivers
Scribers
Seizers
Splicers, Coaxial Cable
Splicers, Wire (Incl. Butt & Cap Types)
Splicing Equipment, Fiber Optic
Tool Kits & Sets
Tools & Kits, Contact Insertion/Removal
Tools, Alignment & Tuning
Tools, Cable Tie
Tools, Connector
Tools, Crimping & Swaging
Tools, Heat Sealing
Tools, Lead Bending & Insertion
Tools, Magnetic Pickup
Tools, Marking, Numbering, Engraving
Tools, Parts Handling, Vacuum Operated
Tools, Relay Servicing
Tools, Wire-Wrapping
Tweezers, Manual & Vacuum
Vises
Welding Equipment & Accessories (Excl. Equipment for Semiconductor Devices)
Wire Strippers, Manual
Wire Strippers, Thermal
Wire Twisters, Automatic
Wire Twisters, Manual
Wrenches

5500 TRANSDUCERS & ENCODERS
(Volume 1B)

Accelerometers
Cells, Load
Encoders, Displacement, Linear
Encoders, Magnetic Strip
Encoders, Shaft Angle, Contacting
Encoders, Shaft Angle, Magnetic
Encoders, Shaft Angle, Optical
Gauges, Strain
Generators, Hall
Indicators, Angle-Also See Encoders, Shaft Position
Indicators, Azimuth
Transducer Elements
Transducers, Audio
Transducers, Ceramic
Transducers, Displacement
Transducers, Flow
Transducers, Force
Transducers, Magnetic Pickup
Transducers, Piezoelectric
Transducers, Position, Linear
Transducers, Position, Rotary
Transducers, Pressure
Transducers, Proximity
Transducers, Sonic
Transducers, Strain Gauge
Transducers, Temperature
Transducers, Torque
Transducers, Ultrasonic
Transducers, Velocity
Transducers, Vibration
Transducers, Volt, Watt, Current VAR, Power Factor, Frequency
Transmitters, Pressure & Flow

5600 TRANSFORMERS
(Volume 1A)

Reactors, Charging
Reactors, Filter
Reactors, Loading
Transformers, 400 Hz
Transformers, Audio
Transformers, Autotransformer
Transformers, Chopper
Transformers, Constant Voltage
Transformers, Converter, DC To DC
Transformers, Decade
Transformers, Differential
Transformers, Discriminator
Transformers, Driver
Transformers, Ferroresonant
Transformers, Filament
Transformers, Flyback
Transformers, High Voltage (1,000 Volts & Over)
Transformers, Horizontal Sweep
Transformers, Hybrid
Transformers, IF
Transformers, Input
Transformers, Instrument
Transformers, Interstage
Transformers, Inverter
Transformers, Isolation
Transformers, Line
Transformers, Magnetic Amplifier
Transformers, Matching
Transformers, Microminiature
Transformers, Microphone
Transformers, Mixing
Transformers, Modulation
Transformers, Output
Transformers, Plate
Transformers, Power
Transformers, Power Distribution
Transformers, Printed Circuit Mounting
Transformers, Programmable Ratio
Transformers, Pulse
Transformers, Rectifier
Transformers, Reference
Transformers, RF
Transformers, Rotary
Transformers, Scott T
Transformers, Servo
Transformers, Split Bobbin
Transformers, Synchro Control
Transformers, Telephone Coupling
Transformers, Toroidal
Transformers, Transistor
Transformers, Variable
Transformers, Voltage Dividing
Transformers, Voltage Regulating-Also See Regulators & Stabilizers, Voltage
Transformers, Wideband

5700 ELECTRON TUBES
(Volume 1A)

Displays, CRT
Intensifiers, Image
Photomultiplier Tube Housings
Pin Straighteners, Tube
Retainers, Tube
Tube Heat Dissipators
Tubes, Backward Wave
Tubes, Cathode Ray, General Purpose
Tubes, Cathode Ray, Special Purpose
Tubes, Counting
Tubes, Electrometer
Tubes, Electron Multiplier
Tubes, Flash
Tubes, Gas
Tubes, Ignitron
Tubes, Image Converter
Tubes, Microwave
Tubes, Noise Source
Tubes, Photomultiplier
Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)
Tubes, Receiving
Tubes, Rectifying
Tubes, Switching
Tubes, Transmitting
Tubes, TV Camera Pickup
Tubes, Voltage Reference or Regulating
Tubes, X-ray

6000 WIRE & CABLE
(Volume 2)

Braid, Cable-Also See Wire Shielding
Cable Assemblies & Harnesses
Cable Assemblies, Microwave
Cable, Audio
Cable, Battery Booster
Cable, Coaxial
Cable, FEP Insulated
Cable, Flame Retardant
Cable, Flat
Cable, Heater
Cable, High Temperature (Over 125°C)
Cable, High Voltage (1,000 Volts & Over)
Cable, Instrumentation & Control
Cable, Irradiated
Cable, Low Capacitance
Cable, Microphone
Cable, Multiconductor
Cable, Plenum
Cable, Power
Cable, Security
Cable, Shielded
Cable, Telephone
Cable, TFE Insulated
Cable, Thermocouple
Cable, Transmission Line
Cable, Triaxial
Cable, TV (Incl. Camera)
Cable, Twisted Pair
Cable, Woven Conductor
Conduit, Electrical
Cords & Cord Sets, International
Cords & Tapes, Lacing
Cords, Line & Set, Extension
Cords, Line, Resistance
Cords, Retractile
Ducts, Wiring
Lead Assemblies, High Voltage-Also See Connectors; Cable Assemblies & Harnesses
Posts, Harness Board
Strips, Marker & Fanning
Tubing, Zipper
Wire Markers (All Types)-Also See Strips Marker & Fanning
Wire Ways
Wire, Antenna (All Types)
Wire, Bare, Copper
Wire, Bare, Nickel
Wire, Bare, Nickel-Chrome
Wire, Braid (Excluding Shielding)
Wire, Ceramic Insulated
Wire, Clad (All Types)
Wire, Flame Retardant
Wire, Glass Insulated
Wire, Guy
Wire, High Temperature (Over 125°C)
Wire, High Voltage (1000 Volts & Over)
Wire, Hookup (All Types)
Wire, Irradiated
Wire, Lead-in & Ground
Wire, Litz
Wire, Magnet
Wire, Plated (All Types)
Wire, Radiation Resistant
Wire, Resistance
Wire, Ribbon
Wire, Semiconductor Lead
Wire, Shielded
Wire, Strain Gauge
Wire, Test Lead
Wire, TFE Insulated
Wire, Thermocouple

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

NEED MORE INFORMATION?

USE ONE OF THE NEW EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

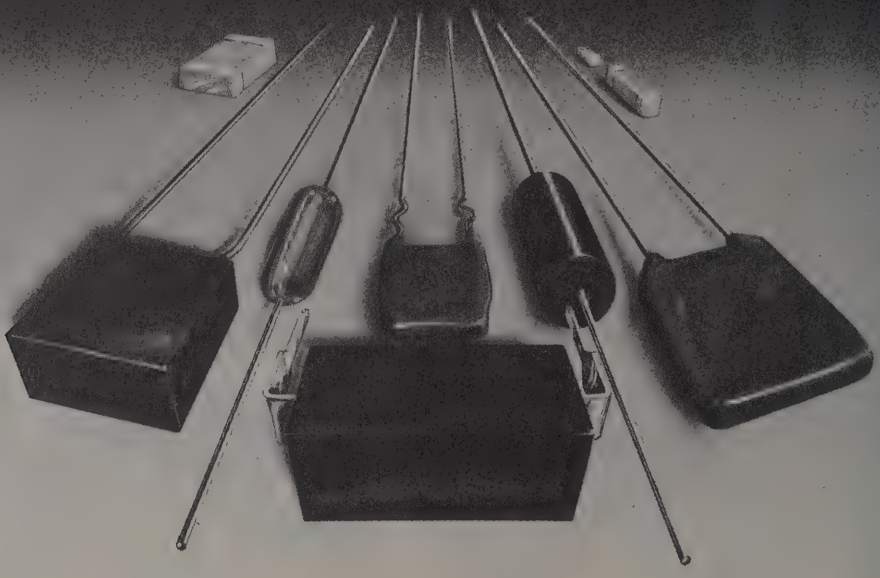
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

Buy by the numbers. Buy #1

Today multilayer ceramic capacitors (MLC's) are being sold in greater numbers than ever before. In fact, they make up over 60% of all the capacitor units sold in the industry. And, out of all these, AVX Ceramics is the leading manufacturer worldwide.

Here's some other impressive numbers. Follow them to link up with AVX MLC chips (1A•1014), SpinGuards (1A•1011), DipGuard (1A•1013), molded axials (1A•1012) and SkyCaps (1A•1010) listed in this catalog. For military radials and axials (1B•1008) and for military DipGuards and chips (1B•1009).

To locate the right MLC for your application, just follow the numbers. They'll lead you straight to number one.



AVX CORPORATION

Technology For The Times

P.O. Box 867, Myrtle Beach, SC 29577 (803) 448-9411

CAPACITORS, FIXED, ELECTROSTATIC

FILM/FOIL (NONMETALLIZED)

Manufacturer	Polyester (Mylar)		Polystyrene		Polycarbonate		Polypropylene		Teflon Axial	Paralene		Combinations
	Axial	Radial	Axial	Radial	Axial	Radial	Axial	Radial		Axial	Radial	
Capar Components	1A•1016	1A•1016					1A•1016	1A•1016				
Component Research			1A•1052*		1A•1058*		1A•1060*		1A•1048*			1A•1056*
Dai-Ichi Shoji		1A•1064		1A•1064								
Electronic Concepts	1A•1068*				1A•1068*							
Elpac Components	1A•1071	1A•1071	1A•1071	1A•1071	1A•1071							
Illinois Capacitor		1A•1073										
Intl. Components	1A•1074	1A•1074						1A•1074				
Inter-Technical/WIMA		1A•1075				1A•1075		1A•1075				
ISL Products Intl.	1A•1083	1A•1083		1A•1083		1A•1083		1A•1083				
Kahgan Elctrns.		1A•1119	1A•1119				1A•1119	1A•1119				
Kemet/Union Carbide										1A•1116*	1A•1116*	
Mepco/Electra	1A•1136	1A•1136	1A•1136	1A•1136	1A•1136		1A•1136	1A•1136				
NIC Components	1A•1153	1A•1153	1A•1153									
Nichicon		1A•1158										
Nytronics	1A•1160		1A•1162				1A•1163					
PPD							1A•1175					
Seacor	1A•1183	1A•1183	1A•1183				1A•1183	1A•1183				
TRW Capacitor	1A•1193	1A•1193	1A•1197				1A•1197					
Wesco Electrical	1A•1212		1A•1215				1A•1217					

METALLIZED FILM

Manufacturer	Polyester (Mylar)		Polysulfone		Polycarbonate			Polypropylene			Teflon Axial	Combinations
	Axial	Radial	Axial	Radial	Axial	Radial	Chip	Axial	Radial	AC Motor Run		
Capar Components	1A•1016	1A•1016										
Component Research					1A•1036			1A•1062			1A•1044	
Dai-Ichi Shoji	1A•1064	1A•1064										
Electronic Concepts	1A•1068*	1A•1068*			1A•1065 1A•1068*	1A•1065 1A•1068*	1A•1067					
Elpac Components	1A•1071	1A•1071	1A•1071		1A•1071			1A•1071	1A•1071			
Illinois Capacitor	1A•1073	1A•1073										
Intl. Components	1A•1074	1A•1074										
Inter-Technical/WIMA		1A•1075				1A•1075			1A•1075			1A•1075
Iskra Elctrns.	1A•1081	1A•1081										
ISL Products Intl.	1A•1083	1A•1083			1A•1083			1A•1083				
Kahgan Elctrns.	1A•1119	1A•1119										
Kemet/Union Carbide					1A•1117*							
Mallory Capacitor										1A•1133		
Mepco/Electra	1A•1136	1A•1136			1A•1136	1A•1136			1A•1136	1A•1136		1A•1136
NIC Components	1A•1153	1A•1153						1A•1153	1A•1153			
Nichicon	1A•1158	1A•1158										
Nytronics								1A•1164				
PPD	1A•1174	1A•1179						1A•1176				
Seacor	1A•1183	1A•1183			1A•1183	1A•1183		1A•1183	1A•1183	1A•1183		
TRW Capacitor		1A•1191			1A•1194	1A•1194		1A•1192				
Wesco Electrical	1A•1213	1A•1214			1A•1215			1A•1216				

* Mil. Spec.

CAPACITORS, FIXED, ELECTROSTATIC

CERAMIC

Manufacturer	General Purpose (Z5U)		Special Purpose (COG, X7R, NPO, etc.)				Monolithic					Feed Thru	High Voltage/ Power
								Encapsulated					
	Axial	Disc/ Radial	Axial	Disc/ Radial	DIP	Chip	Chip	Axial	Dipped Radial	Molded Radial	DIP		
AVX							1A•1014*	1A•1012	1A•1010		1A•1013*		
Capar Components		1A•1016		1A•1016					1A•1017				
Illinois Capacitor		1A•1073		1A•1073									
Intl. Components		1A•1074		1A•1074									
Iskra Elctrns.		1A•1080		1A•1080		1A•1080						1A•1080	
ISL Products Intl.		1A•1083		1A•1083		1A•1083			1A•1083			1A•1083	
Johanson Dielectrics							1A•1094*						1A•1094
Kemet/Union Carbide							1A•1111*	1A•1110*	1A•1115	1A•1110*			
Maida Development		1A•1122		1A•1122		1A•1122							1A•1121
Metuchen Capacitors							1A•1145	1A•1138	1A•1140	1A•1144*		1A•1142	
Microcap							1A•1186*						
Multi Products Intl.		1A•1147		1A•1147			1A•1147						
Murata Erie		1A•1149		1A•1149			1A•1148	1A•1148					1A•1150
NIC Components		1A•1153		1A•1153			1A•1153		1A•1153				
Presidio Comps.							1A•1181*						
Republic Elctrns.							1A•1182*	1A•1182*	1A•1182*	1A•1182*			
TDK							1A•1189	1A•1189	1A•1189				
TRW Capacitor		1A•1199		1A•1199									
Tusonix		1A•1201		1A•1201					1A•1202			1A•1206	1A•1203
US Microtek							1A•1211*	1A•1211*	1A•1211*	1A•1211*		1A•1211	

* Mil. Spec.

DOUBLE LAYER BATTERY/CAPACITOR

Manufacturer	DLC
Carborundum	1A•1020

CAPACITORS, VARIABLE, ELECTROSTATIC

CAPACITORS, VARIABLE

Manufacturer	Ceramic				Film	Mica	Air	Gas Filled	Vacuum	Sapphire	Glass
	Tubular		Disc								
	Piston	Other	Single	Multiple							
ITT Jennings								1A•1090	1A•1090		
Johanson Mfg.	1A•1095*	1A•1095*	1A•1095*	1A•1095*			1A•1095*				
Mepco/Electra	1A•1136							1A•1136			
Murata Erie			1A•1151	1A•1151			1A•1151				
Sprague-Goodman	1A•1185*	1A•1185*	1A•1185*	1A•1185*	1A•1185*	1A•1185*	1A•1185*			1A•1185*	1A•1185*
Tusonix			1A•1204*	1A•1204*							

CAPACITORS, FIXED, ELECTROSTATIC

MICA

Manufacturer	Stacked (Silvered Mica/Foil)				Reconstituted
	Dipped	Chip	Button	Transmitting	
Capar Comps.	1A•1018*				
CSI Capacitors				1A•1021	1A•1021
Kahgan Elctrns.	1A•1119				
Murata Erie			1A•1151*		
Soshin Elec.	1A•1184*	1A•1184			

PAPER & PAPER/FILM

Manufacturer	Paper/Foil (Dry)			Paper/Foil (Impregnated)		Metallized Paper			Paper/Film (Axial)
	Axial	Single End	Herm. Sealed	Energy Storage	Motor Run	Axial	Single Ended	Herm. Sealed	
CSI Capacitors		1A•1021	1A•1021	1A•1021			1A•1021	1A•1021	
Inter-Technical/ WIMA							1A•1075		
Nytronics	1A•1169*	1A•1169*	1A•1169*	1A•1169*					1A•1167

GLASS, PORCELAIN, VACUUM, GAS-FILLED

Manufacturer	Porcelain			Gas-Filled	Vacuum
	Axial	Radial	Flat		
American Tech. Ceramics	1A•1007*	1A•1007*	1A•1007*		
ITT Jennings				1A•1090	1A•1090

* Mil. Spec.

CAPACITORS, FIXED, ELECTROLYTIC

ALUMINUM

Manufacturer	Subminiature Tubular				Standard Tubular				Small Can		Large Can Energy Storage Cmptr. Grd.	Plastic Case	AC Motor Start
	Axial Leads		Single End		Axial Leads		Single End		Single Section	Multi-Section			
	Polar	Non-Pol.	Polar	Non-Pol.	Polar	Non-Pol.	Polar	Non-Pol.					
Capacitor Technology									1A•1015		1A•1015		
Capar Components	1A•1016	1A•1016	1A•1016	1A•1016	1A•1016	1A•1016	1A•1016	1A•1016	1A•1016				
Dai-Ichi Shoji	1A•1064	1A•1064	1A•1064	1A•1064	1A•1064	1A•1064	1A•1064	1A•1064					
Illinois Capacitor	1A•1072	1A•1072	1A•1072	1A•1072	1A•1072	1A•1072	1A•1072	1A•1072					
Intl. Components	1A•1074	1A•1074	1A•1074	1A•1074	1A•1074	1A•1074	1A•1074	1A•1074	1A•1074				
ISL Products Intl.	1A•1082	1A•1082	1A•1082	1A•1082	1A•1082	1A•1082	1A•1082	1A•1082	1A•1082		1A•1082		
ITT Components	1A•1084	1A•1089	1A•1084	1A•1089			1A•1087		1A•1087		1A•1088		
Kahgan Elctrns.	1A•1119	1A•1119	1A•1119	1A•1119	1A•1119	1A•1119	1A•1119	1A•1119					
Mallory Capacitor	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131	1A•1131
Mepco/Electra	1A•1135	1A•1135	1A•1135	1A•1135	1A•1135	1A•1135	1A•1135	1A•1135	1A•1135		1A•1135		1A•1135
NIC Components	1A•1152	1A•1152	1A•1152	1A•1152	1A•1152	1A•1152	1A•1152	1A•1152	1A•1152				
Nichicon	1A•1156	1A•1156	1A•1156	1A•1156	1A•1156	1A•1156	1A•1156	1A•1156	1A•1157	1A•1157	1A•1157		1A•1157
United Chemi-Con	1A•1209	1A•1209	1A•1209	1A•1209	1A•1209	1A•1209	1A•1209	1A•1209	1A•1209	1A•1209	1A•1209		

TANTALUM

Manufacturer	Solid Electrolyte						Wet-Slug		Foil	
	Dipped Radial	Axial	Molded Radial	DIP	Chip	Metal Case	Tubular Case	Large Case	Polar	Non-Pol.
Capar Components	1A•1016									
Dai-Ichi Shoji	1A•1064									
Intl. Components	1A•1074									
ISL Products Intl.	1A•1083									
ITT Components	1A•1085	1A•1086								
Kemet/Union Carbide	1A•1104	1A•1101	1A•1102	1A•1103	1A•1109*	1A•1098*				
Mallory Capacitor	1A•1125	1A•1129	1A•1129	1A•1129		1A•1129*	1A•1124*	1A•1130*		
Mepco/Electra	1A•1134	1A•1134	1A•1134	1A•1134	1A•1134*	1A•1134*	1A•1134*		1A•1134*	1A•1134*
NIC Components	1A•1152				1A•1152	1A•1152				

* Mil. Spec.

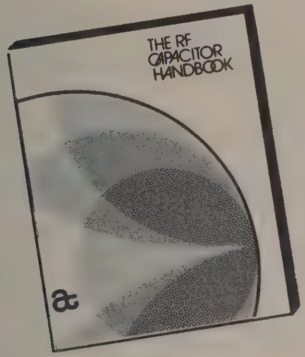
american technical ceramics

ATC UHF/MICROWAVE CHIP CAPACITORS

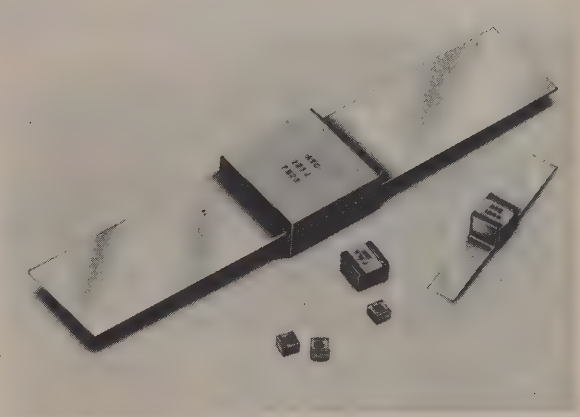
American Technical Ceramics, the recognized leader in RF capacitor technology, offers a product line of outstanding quality and reliability to meet the most demanding requirements of the design engineer.

Unique features of construction, enforced by the highest quality control standards, are responsible for the consistent quality and high performance of ATC porcelain and ceramic capacitors. ATC capacitors are available in a wide variety of sizes and styles, and there is a capacitor to meet the requirements of almost any design application.

The severe thermal shock to which capacitors are subjected by direct soldering during circuit assembly can destroy the integrity of conventional capacitors, permitting flux and solvents to penetrate the dielectric. ATC porcelain capacitors have outstanding reliability and ultra-stable performance due to their hermetic, self-encapsulated porcelain construction. Rare metal internal electrodes are molecularly bonded and sealed in a monolith of non-porous porcelain, providing a rugged and hermetic structure that is not degraded by the circuit assembly process. ATC's design of the chip capacitor internal structure has resulted in the most reliable porcelain capacitors available proven by extensive testing programs of approximately 2 million component hours per month.



The ATC UNI-TERM® Termination (Gold over Nickel over Silver) is now standard on all chips and the ATC BARRIER/CAP® Termination is now standard on all pellets (pre-tinned capacitors). The terminations remain intact under the most severe thermal shock, and are not dissolved away even by the most careless soldering. They easily withstand a 5-minute submersion in 260°C solder pot without leaching, while retaining complete solderability. Migration is virtually eliminated and a bond strength greater than 30 lbs. is typical for "B" Case capacitors (110 mils square) with nail head leads.



Laser Marking is available on ATC capacitors for quick and complete identification of capacity value and tolerance. This highly legible and permanent marking results in no degradation of performance or reliability and is impervious to all cleaning solvents.

The RF Capacitor Handbook presents over 190 pages of comprehensive detail design considerations and uses for miniature chip and leaded RF capacitors. You'll find theoretical and empirical high-frequency circuit design equations, especially at high RF power levels and frequencies, actual test data at frequencies from 100 MHz to 3 GHz, and practical design methods for increasing gain and power, DC to RF conversion efficiency, bandwidth, transistor lifetime, circuit MTBF, and low-noise performance. Request a copy from your representative or direct from ATC.

MILITARY PRODUCTS

American Technical Ceramics is QPL Listed for UHF/Microwave Capacitors in MIL-C-11272/16, /17 and /18 since May 25, 1973, and for established reliability UHF/Microwave Capacitors in MIL-C-55681/4 and /5 since August 3, 1977.

For MIL-C-11272/16, /17 and /18, the QPL List includes styles CY81 through CY89 (ATC 100 Series).

For MIL-C-55681/4 and /5, the QPL List includes BG (90 ±20 PPM/°C) characteristic (ATC 100 Series), and BP (0 ±30 PPM/°C) characteristic (ATC 700 Series). Styles CDR 11, 12, 13, 14, and 21 through 25 are available in both the above characteristics.

For MIL-C-55681/4 and /5, the QPL List includes the following terminations:

M — Palladium Silver (CDR 11, CDR 13)
*N — Gold over Nickel over Silver (ATC's UNI-TERM™ Termination), (CDR 11, CDR 13)
S — Solder Coated, Final (CDR 12, CDR 14, CDR 23, CDR 25)
T — Silver (CDR 21, CDR 22, CDR 24)
*U — Solder Coated, Nickel Barrier (ATC's BARRIER/CAP™ Termination) (CDR 12, CDR 14)

*"N" and "U" are preferred terminations for best solderability, thermocompression bonding, leach and migration resistance, and shelf life for chips and pellets.

ATC has complete Government approved Hi-Rel testing facilities as well as RF production testing capability through 18 GHz.

ATC's Military Product Manual includes a correlation between ATC sizes and lead styles and MIL-C-11272 and MIL-C-55681 sizes and styles.

one norden lane, huntington sta., n.y. 11746 516-271-9600 • twx 510-226-6993 • telex 221201

american technical ceramics

ATC UHF/MICROWAVE CHIP CAPACITORS

ATC 100 HIGH Q SUPERCHIPS™

UHF/MICROWAVE PORCELAIN CAPACITORS

Ultra High Q even at high ambient temperatures and at extremely high currents. High power operation through microwave frequencies. Extremely low ESR and high dielectric strength.

High self-resonant frequencies.

Low noise figure in receiving systems due to low ESR.

Ultra stable performance assured by hermetic, self-encapsulating porcelain construction.

Capacitance Range:
Case A-0.1 pF to 100 pF to 50 WVDC, standard values per RETMA 5% Table
Case B-0.1 pF to 1000 pF to 500 WVDC, standard values per RETMA 5% Table

IR: 10^6 Megohms Min. @ 25°C, 10^5 Megohms Min. @ 125°C up to and including 470 pF;
10^5 Megohms Min. @ 25°C, 10^4 Megohms Min. @ 125°C, 510 to 1000 pF.

Available in Case A and B Chips, Pellets and Case B Leaded Styles.
QPL Approved, MIL-C-11272, MIL-C-55681.

ATC 175

ULTRA HIGH Q PORCELAIN CAPACITORS

Q is typically four times higher than ATC 100 at Microwave frequencies.

Capacitance Range:
1.0 pF to 100 pF to 500 WVDC, standard values per RETMA 5% Table.

IR: 10^6 Megohms Min. @ 25°C, 10^5 Megohms Min. @ 175°C at rated voltage.

Available in Case B Pellets and Microstrip (MS) leaded.
Military Operating Temperature Range for all Series is −55°C to +125°C.

ATC 200

HIGH CAPACITY CERAMIC CAPACITORS

High packaging density, stable high K chip capacitors for coupling and bypass applications.

Capacitance Range:
Case A, 510 pF to 0.01 MF, 50 WVDC, standard values per RETMA 10% Table.
Case B, 0.005 MF to 0.1 MF, 50 WVDC, standard values per RETMA 10% Table.

IR: 10^4 Megohms Min.

Available in Case A and B Chips, Pellets and Case B Leaded Styles.
DWV: 300% of working voltage.

ATC 700

TEMPERATURE STABLE CERAMIC CAPACITORS

Ultra-stable NPO's with RF characterization.

Capacitance Range:
Case A, 0.1 pF to 1000 pF, 50 WVDC, standard values per RETMA 5% Table.
Case B, 0.1 pF to 5100 pF to 500 WVDC, standard values per RETMA 5% Table.

IR: 10^6 Megohms Min. up to 470 pF;
10^5 Megohms Min. above 470 pF @ 25°C; one-tenth these values @ 125°C.

Available in Case A and B Chips, Pellets and Case B Leaded Styles.
QPL Approved, MIL-C-55681

CALL FOR COMPLETE ATC PRODUCT CATALOG AND PERFORMANCE DATA • (516) 271-9600

ATC 111 Millimeter Wavelength Microcaps®

GENERAL SPECIFICATIONS FOR ALL STYLES

ELECTRICAL CHARACTERISTICS

OPERATING FREQUENCY: Up to 50 GHz.

CAPACITANCE VALUES: 0.1 to 1800 pF, 100 WVDC, standard values per RETMA 10% Table.

STANDARD MEASUREMENT FREQUENCY: 1 MHz for 0.1 to 100 pF; 1 KHz for values greater than 100 pF.

IR: 10^{11} Ohms Min. at 25°C and rated voltage for all dielectrics except CB; 10^9 Ohms Min. at 25°C and rated voltage for CB dielectric. The IR is 1/10 of 25°C value at 125°C and rated voltage.

MECHANICAL CHARACTERISTICS

HERMETICITY: The dielectric is virtually unaffected by moisture and commonly used cleaning solvents.

BODY DIMENSIONS

Case Size	S	T	U	X	Y	Z
W = L (Nom.)	.018 (.459)	.025 (.637)	.035 (.889)	.050 (1.27)	.070 (1.78)	.090 (2.29)

1. H is .005 (.127) to .011 (.279); H depends upon actual capacity value.
2. All dimensions are in inches except those in parentheses, which are in mm.

TERMINATION STYLES

	TERM. SUFFIX	MATERIAL
STANDARD	AP *	Platinum Gold (Thick Film)
	AC *	Gold Over Chromium (Thin Film)
SPECIAL	SP	Platinum Silver (Thick Film)
	AN	Gold Over Nickel (Thin Film)
	HT	Gold Over Base Metals (Thin Film)

* Preferred

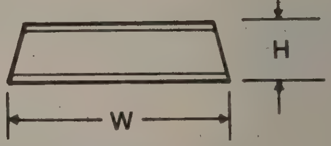
RUGGED CONSTRUCTION to minimize handling problems and circuit assembly problems. Impervious to static discharge failures.

BOND STRENGTH: Exceeds MIL-STD-883 Method 2011.2 for wire bondability of all terminations and method 2019.1 for die shear strength.

ENVIRONMENTAL CHARACTERISTICS

OPERATING TEMPERATURE RANGE: −55°C to +125°C.

ATC Microcaps™ are designed and manufactured to meet or exceed the requirements of MIL-C-55681 and MIL-C-11272. These include Hi-Rel tests in accordance with MIL-STD-202.



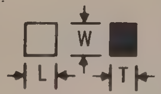
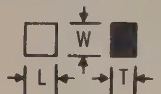
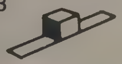
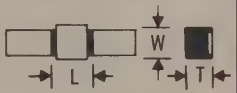
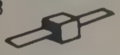
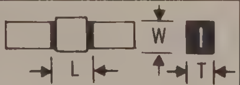
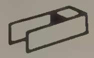
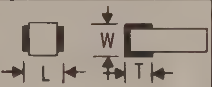
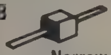
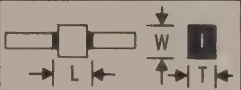
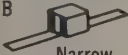
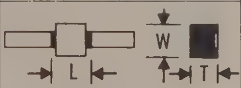
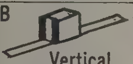
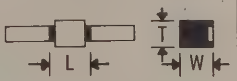
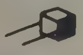
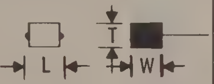
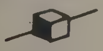
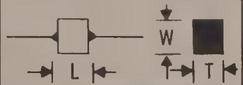
W = L (i.e., Width = Length)

RECOMMENDED BONDING TECHNIQUES

- Thermocompression, ultrasonic and thermosonic gold wire and aluminum silicon wire bonding are applicable with all termination materials.
- Lead/tin soldering is recommended for AP and SP.
- High temperature, gold content solders are recommended for HT. Gold-germanium, gold-silicon, and gold-tin solders are primarily used.
- Conductive epoxy can be used with all termination materials.

NOTE: ATC Microcaps® are now available in a variety of leaded styles. Request latest catalog.

MECHANICAL CONFIGURATIONS: CASE SIZES A & B

Case Size & Type	ATC Term. Code	ATC Series	QPL		Outlines	Body Dimensions			Lead and Termination Dimensions and Materials		
			MIL-C-11272C	MIL-C-55681		Length (L)	Width (W)	Thickness (T)	Length (L)	Width (W)	Thickness (T)
A Chip	CA	100	CY81	CDR11 BG	 W/T IS A TERMINATION SURFACE	.055 ±.010 (1.4 ±.25)		.055 (1.4) max.	Uni-Term ® Gold over Nickel over Silver		
		700	—	CDR11 BP							
B Chip	CA	100	CY83	CDR13 BG		.110 ±.015 (2.79 ±.38)		.100 (2.54) max.			
		700	—	CDR13 BP							
		175	—								
A Pellet	P	100	CY82	CDR12 BG	 W/T IS A TERMINATION SURFACE	Same as chip plus twice solder build-up: Solder build-up for size A is: .003 (.076) typ. Solder build-up for size B is: .005 (.127) typ.			barrier/Cap® Pellets are solder-coated chips with a nickel barrier over the termination. Solder melting temperature is 372°F, 179°C.		
		700	—	CDR12 BP							
B Pellet	P	100	CY84	CDR14 BG							
		700	—	CDR14 BP							
		175	—								
B  Microstrip	MS	100	CY85	CDR21 BG		.120 (3.05) min. .150 (3.81) max.	.110 ±.015 (2.79 ±.38)	.100 (2.54) max.	.250 (6.35) min.	.093 ±.005 (2.36 ±.13)	.004 ±.001 (.102±.025)
		700	—	CDR21 BP							
		175	—								
B  Axial Ribbon	AR	100	CY86	CDR22 BG							
		700	—	CDR22 BP							
B  Radial Ribbon	RR	100	CY88	CDR24 BG							
		700	—	CDR24 BP							
B  Narrow Axial Ribbon	NAR	100	—			.120 (3.05) min. .155 (3.94) max.	.110 ±.015 (2.79 ±.38)	.100 (2.54) max.	.250 (6.35) min.	.050 ±.005 (1.27 ±.13)	.006 ±.003 (.15 ±.08)
		700									
B  Narrow Microstrip	NMS	100	—								
		700									
B  Vertical Narrow MS	VNMS*	100	—								
B  Radial Wire	RW	100	CY87	CDR23 BG		.120 (3.05) min. .165 (4.19) max.	.110 ±.015 (2.79 ±.38)	.100 (2.54) max.	.500 (12.7) min.	#26 AWG., .016 (.375) dia. nominal.	
		700	—	CDR23 BP							
B  Axial Wire	AW	100	CY89	CDR25 BG							
		700	—	CDR25 BP							

Note: Mechanical configurations for the ATC200 Series are the same as those for ATC100 Series, except for VNMS which is not offered in the 200 Series.

All dimensions are in inches except those in parentheses which are in millimeters.

* VNMS improves the resonant frequency performance over that of the standard Microstrip. The first important parallel resonance is approximately twice as high in frequency as with "flat" mounting (NMS). Note that in this configuration, the marking is now on a vertical surface. For details, contact factory.

All leads are high purity silver and are attached with high temperature solder.

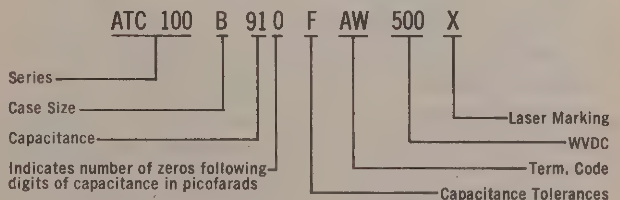
Palladium Silver Terminations (ATC Code C) are available on special order. Consult factory.

LASER MARKED CAPACITORS with manufacturer's indentification, capacity and tolerance code are available for any case size (including chips and pellets). To order, add suffix (X) to code.

Special parts for NMR are also available.

ATC has made every effort to have this information as accurate as possible. However, no responsibility is assumed by ATC for its use, nor for any infringements of rights of third parties which may result from its use. ATC reserves the right to revise the content or modify its product line without prior notice.

ATC PART NUMBER CODE:



barrier/Cap® and BARRIER/CAP® are registered trademarks of American Technical Ceramics.

Uni-Term ® and UNI-TERM® are registered trademarks of American Technical Ceramics.

one norden lane, huntington sta., n.y. 11746 516-271-9600 • twx 510-226-6993 • telex 221201

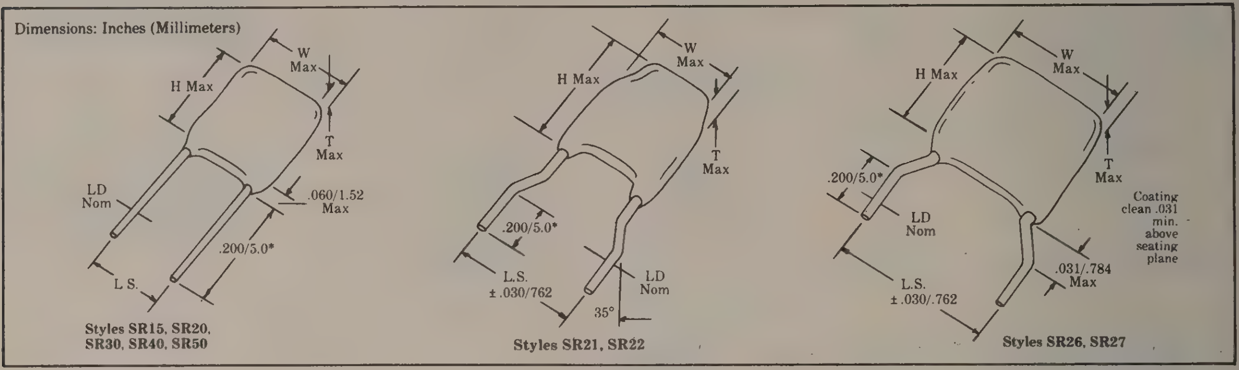
SkyCap®

AVX

GENERAL INFORMATION

AVX SR Series
Conformally Coated Radial Leaded MLC
Temperature Coefficients: NPO, X7R, Z5U
50, 100 Volts (200V available on request)
Case Material: Epoxy (Flame retardant to UL Bulletin 492, Pra. 280)
Lead Material: Solderable

Dimensions: Inches (Millimeters)



Styles SR15, SR20, SR30, SR40, SR50

Styles SR21, SR22

Styles SR26, SR27

*Lead length tolerance = +.060 (1.5 mm) -0. Also available with lead length of 1.25" (31.75)minimum.

SIZE AND CAPACITANCE SPECIFICATIONS

EIA Characteristic

Dimensions: Inches (Millimeters)

AVX Style	SR15	SR20	SR21	SR22	SR27	SR30	SR40	SR50
Width (W)	.150 (3.81)	.200 (5.08)	.200 (5.08)	.200 (3.08)	.260 (6.604)	.300 (7.62)	.400 (10.16)	.500 (12.70)
Height (H)	.150 (3.81)	.200 (5.08)	.200 (5.08)	.200 (5.08)	.250 (6.35)	.300 (7.62)	.400 (10.16)	.500 (12.70)
Thickness (T)	.100 (2.54)	.125 (3.175)	.125 (3.175)	.125 (3.175)	.160 (4.06)	.150 (3.81)	.150 (3.81)	.200 (5.08)
Lead Spacing (L.S.)	.100 (2.54)	.100 (2.54)	.200 (5.08)	.250 (6.35)	.300 (7.62)	.200 (5.08)	.200 (5.08)	.400 (10.16)
Lead diameter (L.D.)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)

Capacitance Range (pf)

EIA/TC	WVDC	SR15	SR20	SR21	SR22	SR27	SR30	SR40	SR50
NPO (COG)	100	10-330	390-2200	10-2200	1000-2200	1000-2200	3300-15,000	15,000-39,000	10,000-68,000
	50	10-470	470-4700	1000-4700	1000-4700	1000-4700	6800-22,000	33,000-68,000	10,000-100,000
X7R	100	470-4700	6800-47,000	1000-47,000	10,000-47,000	10,000-47,000	68,000-150,000	220,000-470,000	330,000-470,000
	50	470-15,000	22,000-100,000	1000-100,000	10,000-100,000	10,000-100,000	150,000-470,000	1.0mfd	1.0mfd-2.2mfd
Z5U	100	10,000	47,000-100,000	10,000-100,000	10,000-100,000	10,000-100,000	150,000-470,000	680,000-1.0mfd	1.0mfd-2.2mfd
	50	10,000	47,000-330,000	10,000-330,000	10,000-330,000	10,000-330,000	150,000-1.0mfd	1.0mfd-2.2mfd	1.0mfd-4.7mfd

HOW TO ORDER AVX Style: SR15, SR20, SR21, SR22, SR27, SR30, SR40, SR50

For values, tolerances, voltages, sizes and configurations, not shown, contact AVX facilities directly for information.

Part Number Example

SR20 5 E 10 4 M A T

AVX Style — SR20
Voltage — 5
Temperature Coefficient — E
Sig. Figures of Capacitance — 10
Multiplier (Additional no. of zeros) — 4
Capacitance Tolerance — M
Failure Rate Not Applicable — A
Leads — T

Part Number Codes

Voltages: 50V=5, 100V=1, 200 V=6 (available on request)

Temp. Coefficient: NPO=A, X7R=C, Z5U=E

Sig. Fig. of Capacitance and Multiplier:
First two digits are the significant figures of capacitance. Third digit indicates the additional number of zeros. For example, order 560pf as 561.

Capacitance Tolerances:
NPO: F=±1.0%, J=±5%, K=±10%, M=±20%
X7R: J=±5%, K=±10%, M=±20%
Z5U: M=±20%, Z=+80% −20%
Tolerance Code F is not available in SR15.

Failure Rate: A = Not Applicable

Leads:
T = Trimmed Leads, .230" ±.060
A = Long Leads, 1.25" minimum

WHERE TO ORDER

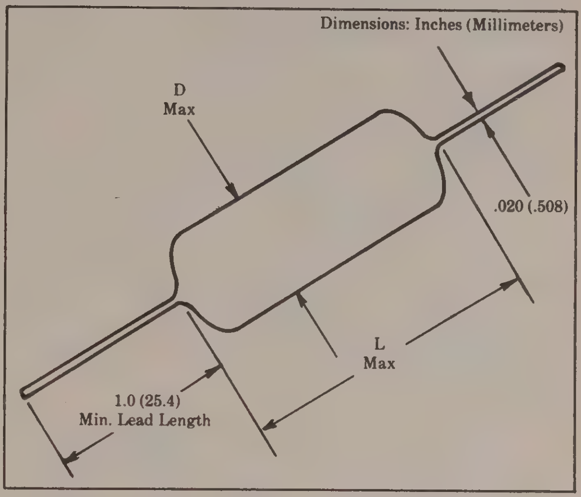
AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex:858473
AVX K.K., Tokyo, Japan Tel: 03-490-6501 Telex: AVXTYO 246 8091

SpinGuard®

AVX

GENERAL INFORMATION

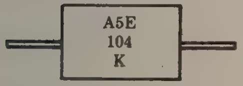
AVX SA Series
NPO (COG), X7R, Z5U Temperature Coefficients
50, 100 Volts
Lead Material: Solderable
Case Material: Epoxy
Packaging: Lead Taped and Reeled per EIA RS-296D
SA10, 20 - 5,000 parts per reel
SA30, 40 - 4,000 parts per reel



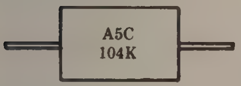
MARKING (Example)

Marking is as size permits in descending order: for code information see How to Order section.
A (AVX): Voltage Code, Temperature Coefficient Code
Capacitance Code
Tolerance Code

SA10, SA20



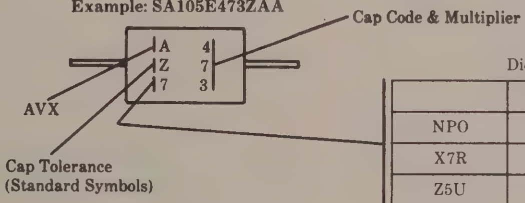
SA30, SA40



SA-10

ALTERNATE MARKING

Example: SA105E473ZAA



Dielectric/Voltage Rating Code

	50V	100V	200V
NPO	1	2	3
X7R	4	5	6
Z5U	7	8	9

SIZE AND CAPACITANCE SPECIFICATIONS

EIA Characteristic — Dimensions: Inches (Millimeters)

	AVX Style	SA10	SA20	SA30	SA40
	Length (L)	.170 (4.32)	.260 (6.60)	.290 (7.37)	.420 (10.66)
	Diameter (D)	.100 (2.54)	.100 (2.54)	.150 (3.81)	.150 (3.81)
EIA/TC	WVDC	Capacitance Range (pf)			
NPO (COG)	100	10-820	1000-1500	1800-3900	4700-8200
	50	1000	1800	4700	10,000
X7R	100	220-4700	5600-10,000	12,000-47,000	56,000-100,000
	50	5600-15,000	18,000-47,000	56,000-100,000	120,000-220,000
Z5U	100	10,000	15,000-22,000	33,000-100,000	100,000
	50	10,000-47,000	68,000-100,000	330,000	330,000-470,000

HOW TO ORDER

AVX Style: SA10, SA20, SA30, SA40

Part Number Example

SA10 5 E 47 3 Z A A

- AVX Style — SA10
- Voltage — 5
- Temperature Coefficient — E
- Sig. Figures of Capacitance — 47
- Multiplier (Additional no. of zeros) — 3
- Capacitance Tolerance — Z
- Failure Rate (not applicable) — A
- Leads standard — A

Part Number Codes

Voltages: 50V=5, 100V=1, 200V=6

Temp. Coefficient: NPO=A, X7R=C, Z5U=E

Sig. Fig. of Capacitance and Multiplier:
First two digits are the significant figures of capacitance. Third digit indicates the additional number of zeros. For example, order 560pf as 561.

Capacitance Tolerances:
NPO: J=±5%, K=±10%
X7R: K=±10%, M=±20%
Z5U: M=±20%, Z=+80, -20%

Failure Rate: A=Not Applicable

Leads Standard: A=Standard Solderable

WHERE TO ORDER

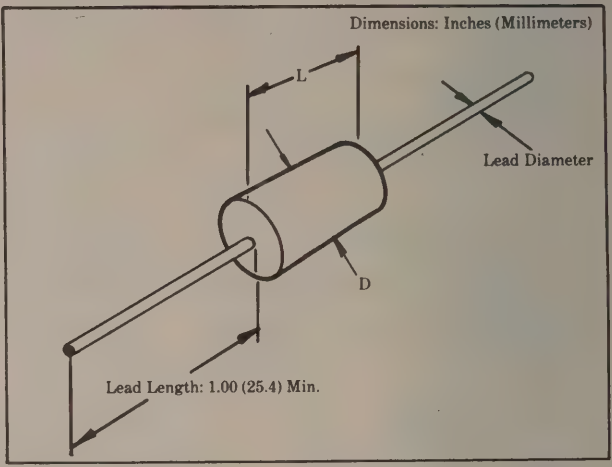
AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex:858473
AVX K.K., Tokyo, Japan Tel: 03-490-6501 Telex: AVXTYO 246 8091

Molded/Axial Lead

AVX

GENERAL INFORMATION

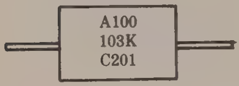
AVX MA Series
NPO (COG), X7R, Z5U Temperature Coefficients
50, 100 Volts
Case Material: Molded Epoxy
Lead Material: Solderable
Packaging: Lead Taped and Reeled per EIA RS-296D
MA-10, 20 - 4500 pcs/reel
MA-40 - 3000 pcs/reel
MA-50, 60 - 50 pcs/bag


Dimensions: Inches (Millimeters)
L
Lead Diameter
D
Lead Length: 1.00 (25.4) Min.

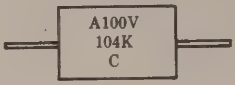
MARKING (Example)

Line 1. A=AVX, 100V=100 Volts (V is optional)
Line 2. 103=Capacitance and Tolerance
C=Voltage Code Rating
102=Temperature Coefficient
Date Code (optional)

MA10, MA20



MA40, MA50, MA60



SIZE AND CAPACITANCE SPECIFICATIONS

Dimensions: Inches (Millimeters)

AVX Style		MA10		MA20		MA40		MA50		MA60	
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Length		.170 (4.32)	.150 (3.81)	.260 (6.60)	.240 (6.10)	.400 (10.2)	.380 (9.65)	.520 (13.2)	.480 (12.2)	.720 (18.3)	.660 (16.8)
Diameter		.100 (2.54)	.080 (2.03)	.100 (2.54)	.080 (2.03)	.150 (3.81)	.130 (3.30)	.265 (6.73)	.235 (5.97)	.370 (9.40)	.330 (8.39)
Lead Diameter		.019±.002 (.483±.05)		.019±.002 (.483±.05)		.025±.002 (.635±.051)		.025±.002 (.635±.051)		.025±.002 (.635±.051)	
EIA/TC	WVDC	Capacitance Range (pf)									
NPO (COG)	100 50	10-680 1000		1000-1500 1500		2200-6800 10,000		10,000-33,000 47,000		47,000-100,000 150,000	
X7R	100 50	470-4700 5600-15,000		5600-10,000 22,000-47,000		15,000-100,000 100,000-220,000		150,000-330,000 470,000-1.0 mfd		330,000-1.0 mfd —	
Z5U	100 50	— 10,000-47,000		15,000-22,000 68,000-100,000		33,000-150,000 220,000-470,000		220,000-470,000 680,000-2.2 mfd		680,000-2.2 mfd 3.3 mfd-6.8 mfd	

HOW TO ORDER

AVX Styles: MA10, MA20, MA40, MA50, MA60

Part Number Example

MA20 5 E 10 4 Z A A

AVX Style
Voltage
Temperature Coefficient
Sig. Figures of Capacitance
Multiplier (Additional no. of zeros)
Capacitance Tolerance
Failure Rate (does not apply)
Leads standard

Part Number Codes

Voltages: 50V=5, 100V=1

Temp. Coefficient: NPO=A, X7R=C, Z5U=E

Sig. Fig. of Capacitance and Multiplier:
First two digits are the significant figures of capacitance. Third digit indicates the additional number of zeros. For example, order 100,000pf as 104.

Capacitance Tolerances:
NPO: F=±1%, J=±5%, K=±10%
X7R: J=±5%, K=±10%, M=±20%
Z5U: M=±20%, Z=+80, -20%

Failure Rate: A=Not Applicable
Leads: A=Standard solderable

Note: Minimum tolerance for values 10pf to 220pf is ±5%.

WHERE TO ORDER

AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex:858473
AVX K.K., Tokyo, Japan Tel: 03-490-6501 Telex: AVXTYO 246 8091

DIPGuard®

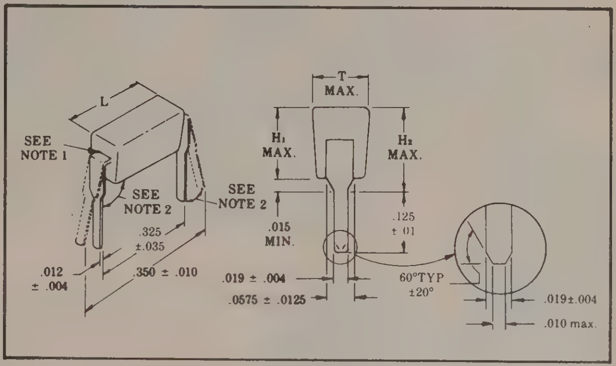
AVX

GENERAL INFORMATION

AVX MD Series
NPO (COG), X7R, Z5U Temperature Coefficients
50, 100 Volts

For established reliability DIPGuards see MIL-C-39014 section in the AVX Military Ceramic Capacitor Catalog.

Packaging: 200 pieces per slide pack

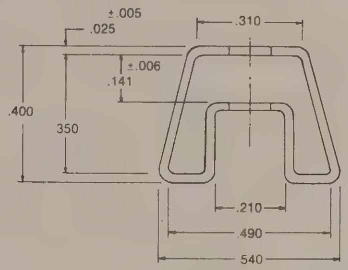

L
SEE NOTE 1
SEE NOTE 2
SEE NOTE 2
.325 ±.035
.350 ± .010
.012 ± .004
T MAX.
H₁ MAX.
H₂ MAX.
.015 MIN.
.125 ± .01
.019 ± .004
.0575 ± .0125
60°TYP ±20°
.019±.004
.010 max.

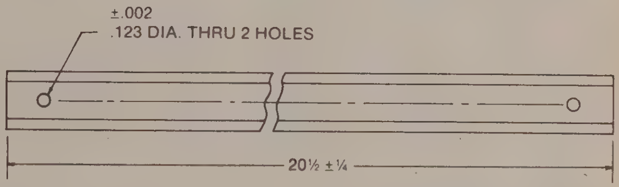
Note 1: Levels centered within ±.010
Note 2: The angle shall be 95°, +10°, −5°

SIZE SPECIFICATIONS

AVX Style		MD01	MD02
Length (L)		.260±.020 (6.60)	.260±.020 (6.60)
Height (H₁)		.135 max. (3.43)	.165 max. (4.19)
Height (H₂)		.165 max. (4.19)	.195 max. (5.08)
Thickness (T)		.098 max. (2.49)	.098 max. (2.49)
EIA/TC	WVDC	Capacitance Range (pf)	
NPO (COG)	100	10-150	—
	50	220-3300	4700-6800
X7R	100	220-10,000	—
	50	15,000-100,000	150,000-220,000
Z5U	100	—	—
	50	10,000-220,000	330,000-470,000

SLIDE PACKAGE DIMENSIONS:

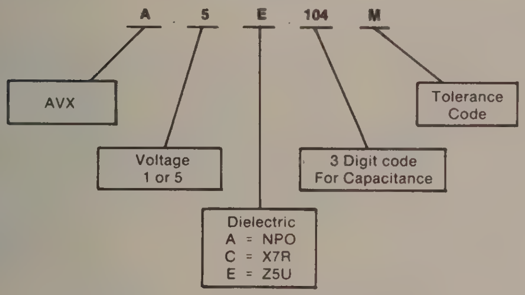

±.005
.025
.310
±.006
.141
.400
350
.210
.490
540


±.002
.123 DIA. THRU 2 HOLES
20½ ±¼

MARKING

PART NUMBER EXAMPLE
MD015E104MAA

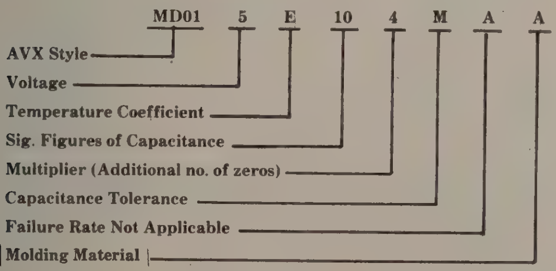
TOP OF UNIT:


A
5
E
104
M
AVX
Voltage
1 or 5
Dielectric
A = NPO
C = X7R
E = Z5U
3 Digit code
For Capacitance
Tolerance
Code

HOW TO ORDER

For values, tolerances, voltages, dielectrics and markings not shown, contact AVX facilities directly for information.

Part Number Example


MD01
5
E
10
4
M
A
A
AVX Style
Voltage
Temperature Coefficient
Sig. Figures of Capacitance
Multiplier (Additional no. of zeros)
Capacitance Tolerance
Failure Rate Not Applicable
Molding Material

AVX Style: MD01, CKR22*, MD02

Part Number Codes

Voltages: 50V=5, 100V=1**

Temp. Coefficient: NPO:=A, X7R=C, Z5U=E

Sig. Fig. of Capacitance and Multiplier:
First two digits are the significant figures of capacitance. Third digit indicates the additional number of zeros. For example, order 1000 pf as 102.

Capacitance Tolerances:
NPO: F=±1%, J=±5%, K=±10%
X7R: J=±5%, K=±10%, M=±20%
Z5U: M=±20%, Z=+80, -20%

Failure Rate: A = Not Applicable

Molding Material: A = Epoxy thermal set,
B = Ryton thermal plastic

***Reference AVX Military Multilayer Ceramic Capacitor Catalog**
****For 200V requirements consult factory.**

WHERE TO ORDER

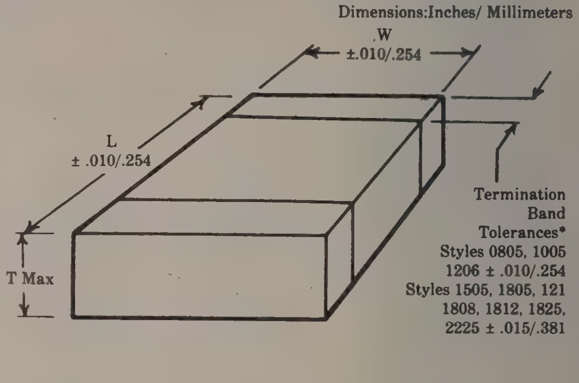
AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex:858473
AVX K.K., Tokyo, Japan Tel: 03-490-6501 Telex: AVXTYO 246 8091

MLC Chips

AVX

GENERAL INFORMATION

NPO (COG), X7R, Z5U Temperature Coefficients
25, 50, 100 Volts
MLC chips can be supplied with established reliability screening per MIL-C-55681, or high reliability screening upon request.



*For solder coated terminations:
Add .005 to max. L x W dimensions

Packaging

5000 pcs per vial or can be taped and reeled per EIA Specification RS 1460.

Tape and Reel packaging quantities:
Standard Carrier Tape (8mm) = 4000 pcs
Embossed Carrier Tape (8mm) = 2600 pcs

SIZE AND CAPACITANCE SPECIFICATIONS

Dimensions: Inches (Millimeters)

AVX Style	0805	1005	1206	1505	1805	1210	1808	1812	1825	2225
Length (L)	.080 (2.00)	.095 (2.41)	.125 (3.20)	.150 (3.81)	.180 (4.57)	.125 (3.18)	.180 (4.57)	.175 (4.45)	.185 (4.70)	.225 (5.72)
Width (W)	.050 (1.27)	.050 (1.27)	.062 (1.60)	.050 (1.27)	.050 (1.27)	.100 (2.54)	.080 (2.00)	.125 (3.18)	.250 (6.35)	.250 (6.35)
Thickness (T)	.050 (1.27)	.060 (1.52)	.060 (1.27)	.060 (1.52)	.060 (1.52)	.060 (1.52)	.060 (1.52)	.060 (1.52)	.060 (1.52)	.060 (1.52)
Termination Band	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)	.025 (.635)	.025 (.635)	.025 (.635)	.025 (.635)	.025 (.635)	.025 (.635)

Capacitance Range (pf)

EIA/TC	WVDC	0805	1005	1206	1505	1805	1210	1808	1812	1825	2225
NPO (COG)	100	10-560	10-680	10-1200	180-1200	220-1500	330-2700	330-3300	1000-4700	1800-8200	3300-10,000
	50	100-1500	100-1800	100-3300	180-2700	220-3300	330-5600	330-6800	1000-10,000	1800-27,000	3300-39,000
X7R	100	120-3900	120-3300	390-15,000	1200-12,000	3300-15,000	2700-22,000	2700-27,000	10,000-47,000	33,000-100,000	33,000-150,000
	50	120-22,000	120-27,000	390-47,000	1200-56,000	3300-56,000	2700-100,000	2700-120,000	10,000-220,000	33,000-470,000	33,000-470,000
	25	120-47,000	120-47,000	120-100,000	1200-68,000	3300-100,000	2700-150,000	2700-180,000	1000-330,000	33,000-680,000	33,000-1.0mfd
Z5U	100	2700-6800	2700-8200	6800-18,000	5600-18,000	8200-18,000	18,000-39,000	1800-47,000	33,000-82,000	100,000-220,000	100,000-270,000
	50	2700-22,000	2700-27,000	6800-27,000	5600-68,000	8200-68,000	18,000-120,000	18,000-150,000	33,000-220,000	100,000-470,000	100,000-560,000
	25	2700-4700	2700-47,000	6800-120,000	5600-100,000	8200-100,000	18,000-220,000	18,000-220,000	33,000-470,000	100,000-1.0mfd	100,000-1.0mfd

HOW TO ORDER

AVX Style: 0805, 1005, 1206, 1505, 1805, 1210, 1808, 1812, 1825, 2225

For values, tolerances, voltages, sizes, configurations and dielectrics not shown, contact AVX facilities directly for information.

Part Number Example

0805 5 A 56 1 K A 1 050

- **AVX Style** — 0805
- **Voltage** — 5
- **Temperature Coefficient** — A
- **Sig. Figures of Capacitance** — 56
- **Multiplier (Additional no. of zeros)** — 1
- **Capacitance Tolerance** — K
- **Failure Rate** — A
- **Termination** — 1
- **Thickness** — 050

Note: 0504 style available upon special request.

Part Number Codes

Voltages: 25V = 2, 50V = 5, 100V = 1

Temp. Coefficient: NPO: = A, X7R = C, Z5U = E

Sig. Fig. of Capacitance and Multiplier:
First two digits are the significant figures of capacitance. Third digit indicates the additional number of zeros. For example, order 560pf as 561. (For values below 10pf, use "R" in place of decimal point, e.g., 5R6 = 5.6pf.)

Capacitance Tolerances:
NPO: C = ±.25pf, D = ±.5pf, F = ±1%, G = ±2%, H = ±3%, J = ±5%, K = ±10%
X7R: J = ±5%, K = ±10%, M = ±20%
Z5U: M = ±20%, Z = +80, -20%, P = GMV

Failure Rate: A = Not applicable

Terminations: standard (non-standard terminations available upon request)
1 = Palladium Silver
2 = Palladium Silver Solder Alloy 62-36-2

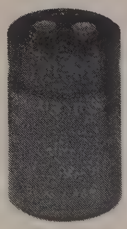
Thickness: mils (inches/1000)

WHERE TO ORDER

AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex:858473
AVX K.K., Tokyo, Japan Tel: 03-490-6501 Telex: AVXTYO 246 8091

capacitor technology, inc.

COMPUTER GRADE ALUMINUM ELECTROLYTIC CAPACITORS



PRODUCT DATA

TYPE FA0

GRADE: Standard computer
CAPACITANCE: 1 farad-170mfd
WVDC: 5-500
MIN. ESR, OHMS: .0057
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 1000hrs +85°C

TYPE FA2

GRADE: Miniaturized premium computer
CAPACITANCE: 670,000-500mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0031
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 3000hrs +85°C

TYPE FA3

GRADE: Miniaturized computer
CAPACITANCE: 880,000-200mfd
WVDC: 7.5-450
MIN. ESR, OHMS: .006
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 1000 +85°C

TYPE FA4

GRADE: Miniaturized long life computer
CAPACITANCE: 800,000-180mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0056
TEMPERATURE °C: −40 to +85°C
LIFE TEST:. 2000hrs +85°C

TYPE FA5

GRADE: Output switcher computer
CAPACITANCE: 67,000-2800mfd
WVDC: 5-55
MIN. ESR, OHMS: 20KHz
TEMPERATURE °C: −55 to +85°C
LIFE TEST: 1000hrs +85°C

TYPE FA6

GRADE: Long life computer
CAPACITANCE: 620,000-5600mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0056
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 2000hrs +85°C

TYPE FA7

GRADE: Premium computer
CAPACITANCE: 650,000-25000mfd
WVDC: 7.5-150
MIN. ESR, OHMS: .0065
TEMPERATURE °C: −55 to +85°C
LIFE TEST: 3000hrs +85°C

TYPE FA8

GRADE: Extended temperature computer
CAPACITANCE: 430,000-4200mfd
WVDC: 7.5-250
MIN. ESR, OHMS: .0031
TEMPERATURE °C: −55 to +85°C
LIFE TEST: 1000hrs +105°C
3000hrs +85°C

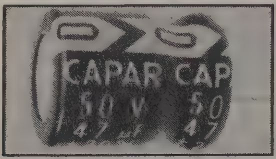
TYPE FA9

GRADE: Premium input switcher
CAPACITANCE: 7400-260mfd
WVDC: 200-250
MIN. ESR, OHMS: .020
TEMPERATURE °C: −40 to +85°C
LIFE TEST: 3000hrs +85°C

5015 speedway drive • fort wayne, indiana 46825 • 219/484-9054

CAPAR COMPONENTS CORPORATION

Capacitors



CAPAR CAPAR

ALUMINUM ELECTROLYTIC CAPACITORS

SERIES	CAPACITANCE RANGE	VOLTAGE RANGE	FEATURES
CAE Axial Aluminum, General Purpose	0.47 to 15,000 mfd	6.3 to 250 WVDC	+85°C (+105°C Available) ±20%
CLE Low Leakage Subminiature Aluminum, Radial	0.1 to 47 μf	6.3 to 63 WVDC	Leakage Current 0.002 CV
CLE-A Low Leakage Aluminum, Axial	0.1 to 47 mfd	10 to 63 WVDC	Leakage Current 0.002 CV
CLE-L Low Leakage Aluminum, Radial	0.1 to 2200 μf	6.3 to 50 WVDC	Leakage Current 0.002 CV
CNA & CNR Non-Polarized Aluminum, Axial and Radial	0.47 to 1000 mfd	16, 25, 50 WVDC	Leakage Current 0.01 CV + 3 μA
CRE Radial Aluminum, General Purpose	0.47 to 10,000 mfd	6.3 to 250 WVDC	+85°C (+105°C Available) ±20%
CRL Snap-in Lug Aluminum	100 to 22,000 mfd	10 to 350 WVDC	±20% Available
CRX Switching Power Supply Aluminum	2.2 to 1000 mfd	10 to 100 WVDC	Leakage Current 0.002 CV

DIPPED TANTALUM CAPACITORS

CDT Epoxy Dipped Tantalum	0.1 uf to 330 uf	3.15 to 50 WVDC	Instrument Grade

FILM CAPACITORS

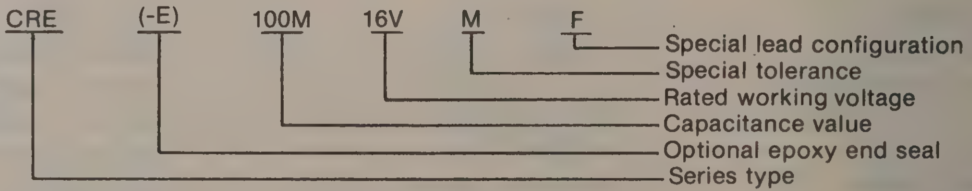
CAM Metalized Polyester, Oval Wrap and Fill	0.01 to 10.0 mfd	100, 250, 400 & 630 WVDC	Tol. ± 10% (±5%)
CAP Polyester Film, Axial	.001 to 1.0 mfd	100, 200, 400, 600 & 1000 WVDC	Tol. ± 10% (±5%)
CEM Polyester Film Subminiature Radial	.001 to .47 mfd	100, 250 & 400 WVDC	Tol. ±5%, 10%
CPAM Polypropylene Film, Axial	.001 to .33 mfd	100, 200, 400 & 630 WVDC	Tol. ±1% (F), 2% (G), 5% (J), 10% (K), 20% (M)
CPRM Polypropylene Film, Radial	.001 to .47 mfd	100, 200, 400 & 630 WVDC	Tol. ±1% (F), 2% (G), 5% (J), 10% (K), 20% (M)
CRM Metalized Polyester, Radial	0.01 to 4.7 mfd	100, 250, 400 & 630 WVDC	Tol. ±10% (±5%)
CRP Polyester Dipped Radial	.001 to .47 mfd	50, 100, 200, 400 & 600 WVDC	Tol. ±10% (K), ±20% (M)
CTM Metalized Polyester, Tubular Wrap & Fill	0.01 to 10.0 mfd	100, 250, 400 & 630 WVDC	Tol. ±10% (±5%)

CERAMIC DISC CAPACITORS

CCD-HI-K Ceramic Disc, Hi-K	100pf to .2 mfd	50, 100, 250 & 500 WVDC	High Dielectric Constant
CCD-SC Ceramic Disc, Low Voltage, Semiconductor Type	.01 to .47 mfd	12, 16 & 25 WVDC	Barium Titanate
CCD-TC Ceramic Disc, Temperature Compensating	1 pf to 1000 pf	50, 500 & 1000 WVDC	All T.C.'s Available

PART NUMBER SYSTEM

(Similar for all families)



EASTERN DIVISION & HEADQUARTERS

25 Dubon Court
Farmingdale, New York 11735
(516) 454-6390

EAST OF MISSISSIPPI:
TOLL FREE: (800) 645-9626 TELEX: 221794

WESTERN DIVISION

1701 East Edinger Avenue, Unit F2
Santa Ana, California 92705
(714) 547-7034

WEST OF MISSISSIPPI
TOLL FREE: (800) 628-5780 TELEX: 181604

CAPAR COMPONENTS CORPORATION

Monolithic Radial Lead Ceramic

NPO, X7R, Z5U TYPES

HOW TO ORDER

Style: CMC 15, CMC 20, CMC 30, CMC 40, CMC 50
(example)

CMC 15 - 100 - NPO - 120 J

Style — CMC
Case Size — 15
Voltage — 100
Temperature Characteristic — NPO
Capacitance — 120
Capacitance Tolerance — J

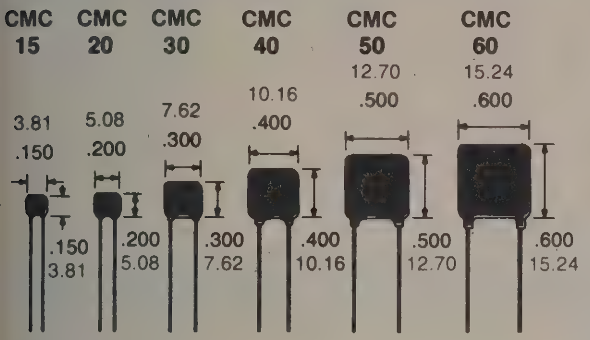
LEAD DIMENSIONS

CAPAR PART NO.	CMC 15	CMC 20	CMC 30	CMC 40	CMC 50	CMC 60
*S±.030	.100 2.54	.100 2.54	.200 5.08	.200 5.08	.400 10.16	.400 10.16
D +.004 −.001	.016 .406	.020 .508	.020 .508	.020 .508	.025 .635	.025 .635
AWG#	26	24	24	24	22	22

Temperature Coefficient

NPO: A Temperature Coefficient—0 ±30 ppm/°C, −55° to +125° C
X7R: C Temperature Coefficient—±15%, −55° to +125°C
Z5U: E Temperature Coefficient—+22, −56%, +10° to +85°C

CAPAR PART NUMBERS AND MAXIMUM PHYSICAL DIMENSIONS



NPO (COG)

NPO Low Loss, High Stability

CAPAR PART NO.	CAPACITANCE		L	W
	100 Volts	200 Volts		
CMC 15	5 pf ↓ 1800 pf	5 pf ↓ 820 pf	150 ↓	150 ↓
CMC 20	150 pf ↓ 3500 pf	100 pf ↓ 1500 pf	200 ↓	200 ↓
CMC 30	330 pf ↓ .015 mfd	220 pf ↓ 5600 pf	300 ↓	300 ↓
CMC 40	680 pf ↓ .033 mfd	420 pf ↓ 015 mfd	.400 ↓	.400 ↓
CMC 50	1000 pf ↓ .05mfd	680 pf ↓ .027mfd	500 ↓	500 ↓

X7R STABLE

CAPAR PART NO.	CAPACITANCE			L	W
	50 Volts	100 Volts	200 Volts		
CMC 15	45 pf ↓ .1 mfd	45 pf ↓ .047 mfd	45 pf ↓ .022 mfd	.150 3.81 ↓	.150 3.81 ↓
CMC 20	3300 pf ↓ .15 mfd	3300 pf ↓	2200 pf ↓ .047 mfd	.200 5.08 ↓	.200 5.08 ↓
CMC 30	6800 pf ↓ .47 mfd	6800 pf ↓ .33 mfd	4700 pf ↓ .15 mfd	.300 7.62 ↓	.300 7.62 ↓
CMC 40	.015 mfd ↓ 1.25 mfd	.015 mfd ↓ .68 mfd	.01 mfd ↓ .33 mfd	.400 10.16 ↓	.400 10.16 ↓
CMC 50	.022 mfd ↓ 2.2 mfd	.022 mfd ↓ 1.5 mfd	.015 mfd ↓ .47 mfd	.500 12.70 ↓	.500 12 70 ↓

Z5U General Purpose

CAPAR PART NO.	CAPACITANCE			L	W
	50 Volts	100 Volts	200 Volts		
CMC 15	220 pf ↓ .15 mfd	220 pf ↓ .068 mfd	220 pf ↓ .033 mfd	.150 3 81 ↓	.150 3 81 ↓
CMC 20	8200 pf ↓ .33 mfd	8200 pf ↓ .15 mfd	5600 pf ↓ .1 mfd	.200 5.08 ↓	.200 5.08 ↓
CMC 30	.022 mfd ↓ 1.5 mfd	.022 mfd ↓ .68 mfd	.015 mfd ↓ .33 mfd	.300 7.62 ↓	.300 7.62 ↓
CMC 40	.039 mfd ↓ 3.3 mfd	.039 mfd ↓ 1.5 mfd	.027 mfd ↓ .68 mfd	.400 10.16 ↓	.400 10.16 ↓
CMC 50	.056 mfd ↓ 4.7 mfd	.056 mfd ↓ 2.2 mfd	.027 mfd ↓ 1.5 mfd	.500 12.7 ↓	.500 12.7 ↓
CMC 60	6.8 mfd ↓ 10.0 mfd	3.3 mfd ↓ 3.3 mfd	1.5 mfd ↓ 1.5 mfd	.600 15.24 ↓	.600 15.24 ↓

Available values and sizes

EASTERN DIVISION & HEADQUARTERS
25 Dubon Court
Farmingdale, New York 11735
(516) 454-6390

EAST OF MISSISSIPPI:
TOLL FREE: (800) 645-9626 TELEX: 221794

WESTERN DIVISION
1701 East Edinger Avenue, Unit F2
Santa Ana, California 92705
(714) 547-7034

WEST OF MISSISSIPPI
TOLL FREE: (800) 628-5780 TELEX: 181604

CAPAR COMPONENTS CORPORATION

CAPAR COMPONENTS CORPORATION SOSHIN

MIL-C-5/18D Military Dipped Mica Capacitors

DM 05

Capacitance (PF)	ONE COAT Type									STANDARD Type								
	Size (mm)																	
	300WV			100WV			50WV			300WV			100WV			50WV		
	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX
1	6.3	4.0	2.2	6.3	4.0	2.2	6.3	4.0	2.2	6.8	4.8	2.7	6.8	4.8	2.7	6.8	4.8	2.7
2																		
3																		
5																		
6																		
7																		
8																		
10																		
12		4.0	2.2									2.7			2.7			
15		4.3	2.5								4.8	3.0			3.0			
18											5.0							
20						2.2												
22					4.0	2.5												
24			2.5		4.3							3.0						
27			2.7									3.3		4.8				
30														5.0				
33											5.0							
36		4.3									5.3							2.7
39		4.6	2.7					4.0	2.2			3.3						3.0
43			3.0					4.3	2.5			3.5			3.0			
47			3.0			2.5						3.5			3.3			
51			3.0			2.7					5.3	3.5						
56			3.3								5.6	3.8		5.0			4.8	
62		4.6	3.3		4.3						5.5	3.8		5.3	3.3		5.0	
68		4.8	3.3		4.5	2.7					5.5	4.0			3.5			
75			3.5			3.0					5.8	4.0						
82			3.5			3.0			2.5		5.8	4.3						3.0
91		4.8	3.8			3.0			2.7		5.8	4.5			3.5			3.3
100		5.0	4.0		4.5	3.3					6.0	4.5		5.5	3.8			
110		5.0	4.0		4.8	3.3					6.0	4.5		5.5	3.8			
120	6.3	5.3	4.3			3.5				6.8	6.3	4.8		5.5	4.0		5.0	
130						3.5		4.3	2.7					5.8	4.0		5.3	3.3
150					4.8	3.8		4.5	3.0					5.8	4.3			3.5
160					5.0	3.8								6.0	4.3			
170					5.0	4.0								6.0	4.5			
180					5.0	4.0			3.0					6.0	4.5		5.3	3.5
200				6.3	5.3	4.3		4.5	3.3				6.8	6.3	4.8		5.5	3.8
220								4.8	3.3								5.5	3.8
240									3.5								5.5	4.0
270									3.5								5.8	4.0
300								4.8	3.8								5.8	4.3
330								5.0	4.0								6.0	4.5
360								5.0	4.0								6.0	4.5
390								5.3	4.3								6.3	4.8
400							6.3	5.3	4.3							6.8	6.3	4.8

DM 10 (MIL CM04)

Capacitance (PF)	ONE COAT Type									STANDARD Type								
	Size (mm)																	
	500WV			300WV			100WV			500WV			300WV			100WV		
	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX
1 24	7.8	5.3	2.5	7.8	5.3	2.5	7.8	5.3	2.5	9.1	8.3	4.8	9.1	8.3	4.8	9.1	8.3	4.8
27										9.3	8.3		9.3	8.3				
30											8.6			8.6				
33																		
36																		
39																9.1		
43																9.3	8.3	
47																	8.6	
51																		
56			2.5															
62			2.7															
68						2.5						4.8						
75						2.7					8.6	5.0		8.6	4.8			
82											8.8			8.8	5.0			
91									2.5									
100		5.3	2.7						2.7	9.3								
110		5.5	3.0							9.6								4.8
120					5.3	2.7					8.8		9.3				8.6	5.0
130					5.5	3.0					9.1	5.0	9.6				8.8	
150											9.1	5.3		8.8				
160			3.0					5.3	2.7	9.6	9.1	5.3		9.1	5.0	9.3		
180			3.3					5.5	3.0	9.9	9.3	5.3		9.1	5.3	9.6		
200		5.5	3.3								9.3	5.5	9.6	9.1	5.3		8.8	5.0
220		5.8	3.5								9.3		9.9	9.3	5.3		9.1	5.3
240		5.8	3.5		5.5	3.0					9.6			9.3	5.5		9.1	
250	7.8	5.8	3.5		5.8	3.5			3.0	9.9	9.6	5.5		9.3			9.1	
270					5.8	3.5			3.3					9.6		9.6	9.3	
300					5.8	3.5			3.3				9.9	9.6	5.5	9.9	9.3	5.3
330					6.0	3.8		5.5	3.3				10.1	9.9	5.8		9.3	5.5
360				7.8	6.0	3.8		5.8	3.5				10.1	9.9	5.8		9.6	
390								5.8	3.5								9.6	
400								5.8	3.5							9.9	9.6	5.5
430								6.0	3.8							10.1	9.9	5.8
440								6.0	3.8							10.1	9.9	5.8
470							7.8	6.0	3.8							10.1	9.9	5.8

DM 15 (MIL CM05)

Capacitance (PF)	ONE COAT Type									STANDARD Type								
	Size (mm)																	
	500WV			300WV			100WV			500WV			300WV			100WV		
	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX
1 62	10.1	6.6	3.0	10.1	6.6	3.0	10.1	6.6	3.0	11.4	9.1	4.3	11.4	9.1	4.3	11.4	9.1	4.3
68												4.5			4.5			4.5
75																		
82										11.4			11.4			11.4		
91										11.6			11.6			11.6		
100		6.6			6.6			6.6			9.1			9.1			9.1	
110		6.8			6.8			6.8			9.4			9.4			9.4	
120			3.0			3.0			3.0									
130			3.3			3.3			3.3			4.5			4.5			4.5
150												4.8			4.8			4.8
160																		
180											9.4			9.4			9.4	
200		6.8									9.6	4.8		9.6	4.8		9.6	4.8
220		7.1									9.6	5.0			5.0			5.0
240		7.1								11.6	9.6	5.0						
270		7.1	3.3							11.9	9.9	5.3						
300		7.3	3.5															
330																		
360																		
390																		
430			3.5								9.9	5.3						
470			3.8								10.1	5.5						
510			3.8		6.8			6.8		11.9	10.1	5.5						
560		7.3	4.0		7.1			7.1		12.1	10.4	5.8						
620	10.1	7.6	4.0			3.3			3.3	12.1	10.4	5.8	11.6	9.6	5.0	11.6	9.6	5.0
680	10.4	7.6	4.3			3.5			3.5	12.4	10.6	6.0	11.9	9.9	5.3	11.9	9.9	5.3
750	10.6	7.6	4.5		7.1	3.5		7.1	3.5	12.7	10.9	6.3		9.9	5.3		9.9	5.3
820					7.3	3.5		7.3	3.5					9.9	5.3		9.9	5.3
910					7.3	3.8			3.8				11.9	10.1	5.5	11.9	10.1	5.5
1000				10.1	7.6	4.0	10.1		4.0				12.1	10.1	5.8	12.1	10.1	5.8
1100				10.4	7.6	4.3	10.4	7.3	4.0				12.4	10.6	6.0	12.1	10.1	5.8
1200				10.6	7.6	4.5	10.6	7.6	4.3				12.7	10.9	6.3	12.4	10.6	6.0
1300									4.5							12.7	10.9	6.3
1500																		
1600																		
1800																		
2000							10.6	7.6	4.5							12.7	10.9	6.3

DM 19 (MIL CM06)

Capacitance (PF)	ONE COAT Type									STANDARD Type								
	Size (mm)																	
	500WV			300WV			100WV			500WV			300WV			100WV		
	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX
10 - 240	15.4	11.4	3.3	15.4	11.4	3.3	15.4	11.4	3.3	16.2	12.7	4.8	16.2	12.7	4.8	16.2	12.7	4.8
270			3.5			3.5			3.5									
300																		
330											12.7	4.8		12.7	4.8		12.7	4.8
360											12.9	5.0		12.9	5.0		12.9	5.0
390																		
430																		
470										16.2			16.2			16.2		
510										16.5			16.5			16.5		
560		11.4	3.5		11.4	3.5		11.4	3.5									
620		11.6	3.8		11.6	3.8		11.6	3.8			5.0			5.0			5.0
680												5.3			5.3			5.3
750																		
820	15.4		3.8	15.4		3.8	15.4		3.8									
910	15.7		4.0	15.7		4.0	15.7		4.0		12.9	5.3		12.9	5.3		12.9	5.3
1000			4.0			4.0			4.0		13.2	5.5		13.2	5.5		13.2	5.5
1100			4.0			4.0			4.0	16.5			16.5			16.5		
1200			4.3			4.3			4.3	16.7			16.7			16.7		
1300			4.3			4.3			4.3			5.5			5.5			5.5
1500			4.3			4.3			4.3		13.2	5.8		13.2	5.8		13.2	5.8
1600			4.5			4.5			4.5	16.7	13.4	5.8	16.7	13.4	5.8	16.7	13.4	5.8
1800	15.7		4.5	15.7		4.5	15.7		4.5	17.0		6.0	17.0		6.0	17.0		6.0
2000	16.0		4.8	16.0		4.8	16.0		4.8			6.0			6.0			6.0
2200		11.6	4.8		11.6	4.8		11.6	4.8		13.4	6.3		13.4	6.3		13.4	6.3
2400		11.9	5.3		11.9	5.3		11.9	5.3	17.0	13.7	6.6		13.7	6.6		13.7	6.6
2700		11.9	5.5							17.2	13.7	6.8						
3000		11.9	5.8								13.9	7.1						
3300	16.0	12.1	6.0								13.9	7.3	17.0		6.6	17.0		6.6
3600	16.2	12.1	6.3							17.2	14.2	7.6	17.2		6.8	17.2		6.8
3900	16.2	12.1	6.6			5.3			5.3	17.5	14.2	7.8		13.7	6.8		13.7	6.8
4300	16.5	12.4	7.1			5.5			5.5	17.5	14.4	8.3		13.9	7.1		13.9	7.1
4700	16.5	12.4	7.6		11.9	5.8		11.9	5.8	17.8	14.7	8.8		13.9	7.3		13.9	7.3
5100	16.7	12.7	8.1	16.0	12.1	6.0	16.0	12.1	6.0	18.0	14.9	9.3		13.9	7.6		13.9	7.6
5600				16.2	12.1	6.3	16.2		6.3				17.2	14.2	7.8	17.2	14.2	7.8
6200				16.2	12.1	6.6	16.2		6.3				17.5	14.2	8.1	17.5	14.2	7.8
6800				16.2	12.4	6.9	16.2	12.1	6.6				17.5	14.4	8.3	17.5	14.4	8.1
7500							16.5	12.4	7.1							17.7	14.4	8.6
8200								12.4	7.6							17.7	14.7	8.8
9100								13.0	8.0							18.0	15.0	8.8
10000							16.5	13.0	8.0							18.0	15.0	8.8

Example: Military Part No. CMO5ED510J03

CM05 E D 510 J 0 3

Style
Characteristic
Working Voltage
Capacitance
Tolerance
Temperature Range
Vibration Grade

Example: Commercial Part No. DM15-510J

DM15 510 J

Tolerance
Capacitance
Style

LETTER	TEMPERATURE COEFFICIENT parts per million/degree C	CAPACITANCE DRIFT
C	−200 TO +200	MIL – ±(0.5% + 0.1 pF) EIOA – ±(015% + 0.5 pF)
*D	−100 TO +100	±(0.3% + pF)
E	−20 TO +100	±(0.1% + 0.1 pF)
F	0 TO + 70	±(0.05% + 0.1 pF)

* Obsolete for Military Designations

WORKING VOLTAGE:

The working DC voltage is expressed as a letter

Letter	VDCW
Y	50
A	100
C	300
D	500
F	1000

EASTERN DIVISION & HEADQUARTERS

25 Dubon Court
Farmingdale, New York 11735
(516) 454-6390

EAST OF MISSISSIPPI:
TOLL FREE: (800) 645-9626 TELEX: 221794

WESTERN DIVISION

1701 East Edinger Avenue, Unit F2
Santa Ana, California 92705
(714) 547-7034

WEST OF MISSISSIPPI
TOLL FREE: (800) 628-5780 TELEX: 181604

CAPAR COMPONENTS CORPORATION

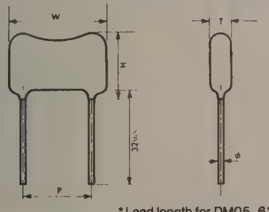
Military Dipped Mica Capacitors MIL-C-5/18D

SOSHIN

CAPAR COMPONENTS CORPORATION

DM 20

Capacitance (PF)	ONE COAT Type									STANDARD Type								
	Size (mm)																	
	500WV			300WV			100WV			500WV			300WV			100WV		
	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX
1～100	17.7	11.4	3.0	17.7	11.4	3.0	17.7	11.4	3.0	19.0	12.7	4.5	19.0	12.7	4.5	19.0	12.7	4.5
110	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	4.8	↑	↑	4.8	↑	↑	4.8
120												↑			↑			↑
130																		
150																		
160			↓			↓			↓									
180			3.0			3.0			3.0									
200			3.3			3.3			3.3									
220			↑			↑			↑									
240																		
270																		
300																		
330																		
360																		
390																		
430																		
470																		
510																		
560			↓			↓			↓		↓	↓		↓	↓		↓	↓
620			3.3			3.3			3.3		12.7	4.8		12.7	4.8		12.7	4.8
680			3.5			3.5			3.5		12.9	5.0		12.9	5.0		12.9	5.0
750			↑			↑			↑		↑	↑		↑	↑		↑	↑
820																		
910																		
1000																		
1100		↓	↓		↓	↓		↓	↓			↓			↓			↓
1200		11.4	3.5		11.4	3.5		11.4	3.5			5.0			5.0			5.0
1300		11.6	3.8		11.6	3.8		11.6	3.8			5.3			5.3			5.3
1500	↓	↑	↑	↓	↑	↑	↓	↑	↑	↓	↓	5.3	↓	↓	5.3	↓	↓	5.3
1600	17.7		↓	17.7		↓	17.7		↓	19.0	12.9	5.3	19.0	12.9	5.3	19.0	12.9	5.3
1800	18.0		3.8	18.0		3.8	18.0		3.8	19.3	13.2	5.5	19.3	13.2	5.5	19.3	13.2	5.5
2000	↑		4.0	↑		4.0	↑		4.0	19.3	13.2	5.5	19.3	13.2	5.5	19.3	13.2	5.5
2200			4.0			4.0			4.0	19.3	13.2	5.5	19.3	13.2	5.5	19.3	13.2	5.5
2400	↓	↓	5.0	↓	↓	5.0	↓	↓	5.0	19.5	13.4	6.3	19.5	13.4	6.3	19.5	13.4	6.3
2700	18.0	11.6	5.0	18.0	11.6	5.0	18.0	11.6	5.0	19.5	13.7	6.6	↑	13.7	6.6	↑	13.7	6.6
3000	18.2	11.9	5.5	18.2	11.9	5.3	18.2	11.9	5.3	19.5	13.7	6.8		↑	6.8		↑	6.8
3300	↑	11.9	5.5	↑	↑	↑	↑	↑	↑	19.8	13.9	7.1			↑			↑
3600		11.9	5.8							↑	13.9	7.3						
3900	↓	12.1	6.0			↓			↓	↓	14.2	7.6						
4300	18.2	12.1	6.3			5.3			5.3	19.8	14.2	7.8	↓	↓	↓	↓	↓	↓
4700	18.5	12.1	6.6		↓	5.5			5.5	20.0	14.2	8.1	19.5	13.7	6.8	19.5	13.7	6.8
5100	18.5	12.4	6.8		11.9	5.8			↑	↑	14.4	8.3	19.8	13.9	7.1	19.8	13.9	7.1
5600	18.5	12.4	7.1	↓	12.1	6.0			↓	↓	14.4	8.6	19.8	13.9	7.3	↑	13.9	7.3
6200	18.7	12.4	7.6	18.2	12.1	6.3		↓	5.5	20.0	14.7	8.8	19.8	14.2	7.6		13.9	7.3
6800	18.7	12.7	8.1	18.5	12.1	6.6		11.9	5.8	20.3	14.9	9.3	20.0	14.2	8.1		14.2	7.6
7500	19.0	12.7	8.6	18.5	12.4	6.8	↓	12.1	6.0	20.3	15.2	9.9	20.0	14.4	8.3	↓	14.2	7.6
8200	19.0	12.9	9.1	18.5	↑	7.1	18.2	12.1	6.3	20.5	15.4	10.4	20.0	14.4	8.6	19.8	14.2	7.8
9100	19.3	13.2	9.6	18.7	↓	7.3	18.5	12.1	6.6	20.5	15.7	10.9	20.3	14.7	9.1	20.0	14.4	8.3
10000	19.3	13.4	10.1	19.7	12.4	7.6	18.5	12.4	6.8	20.8	16.0	11.4	20.3	14.9	9.3	20.0	14.4	8.6
11000				18.7	12.7	8.1	18.5	↑	7.1				20.3	14.9	9.6	20.0	14.7	8.8
12000				19.0	12.7	8.6	18.7	↓	7.3				20.5	15.2	10.1	20.3	14.7	9.1
12300				19.0	12.9	9.1	18.7	12.4	7.6				20.5	15.2	10.1	20.3	14.7	9.1
13000							18.7	12.7	7.8							20.3	14.9	9.6
15000							19.0	12.7	8.3							20.5	15.2	10.1
16000							19.0	12.9	8.8							20.5	15.4	10.4
18000							19.3	13.2	9.3							20.8	15.7	11.1
20000							19.3	13.2	9.3							20.8	15.7	11.1



*Lead length for DM05 .6" minimum

Style	P(mm)	φ(mm)
DM05*	3.0±0.8	0.4±0.05
DM10	3.5±0.8	
DM15	5.9±0.8	0.64 +0.06 −0.05
DM19	8.7±0.8	0.8 +0.08 −0.05
DM20	11.0±0.8	
DM30	11.0±0.8	1.0 +0.1 −0.05
DM42	26.9±0.8	

Applicable Temperature Characteristics

Capacitance pF	D (±0.5pF)	F (±1%)	G (±2%)	J (±5%)	K (±10%)
1 3	C	—	—	—	—
5 10	C	—	—	—	C
12 18	C	—	—	C	C
20 24	—	—	—	CDE	CDE
27 47	—	—	CDE	CDE	CDE
51 82	—	CDE	CDE	CDE	CDE
More than 91	—	CDEF	CDEF	CDEF	CDEF

DM 30 (MIL CM07)

Capacitance (PF)	STANDARD Type								
	Size (mm)								
	500WV			300WV			100WV		
	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX
1000	19.3	21.3	5.8	19.3	21.3	5.8	19.3	21.3	5.8
1100	19.5	21.5	6.0	19.5	21.5	6.0	19.5	21.5	6.0
1200	↑	↑	↑	↑	↑	↑	↑	↑	↑
1300									
1500									
1600									↓
1800			↓			↓			6.0
2000			6.0			6.0			6.3
2200			6.3			6.3			↑
2400		↓	↑		↓	↑		↓	
2700		21.5	↓		21.5	↓		21.5	↓
3000		21.8	6.3		21.8	6.3		21.8	6.3
3300		↑	6.6		↑	6.6		↑	6.6
3600	↓		6.6	↓		6.6	↓		6.6
3900	19.5		6.6	19.5		6.6	19.5		6.6
4300	19.8		6.8	19.8		6.8	19.8		6.8
4700	↑	↓	6.8	↑		↑	↑		↑
5100		21.8	7.1						
5600		22.0	7.3						
6200	↓	22.0	7.3						
6800	19.8	22.0	7.6			↓			↓
7500	20.0	22.3	7.8		↓	6.8		↓	6.8
8200	20.0	22.3	8.1		21.8	7.1		21.8	7.1
9100	20.0	22.3	8.3		22.0	7.1		22.0	7.1
10000	20.3	22.6	8.6	↓	22.0	7.3	↓	22.0	7.3
11000	20.3	↑	8.8	19.8	22.0	7.6	19.8	22.0	7.6
12000	20.3	↓	9.1	20.0.	22.3	7.8	20.0	22.3	7.8
13000	20.5	22.6	9.3	20.0	22.3	7.8	20.0	22.3	7.8
15000	20.5	22.8	9.9	20.0	22.3	8.3	20.0	22.3	8.3
16000	20.8	22.8	10.4	20.3	22.6	8.6	20.3	22.6	8.6
18000	20.8	23.1	10.9	20.3	22.6	9.1	20.3	↑	9.1
20000	21.0	23.3	11.4	20.5	22.6	9.3	20.5	↓	9.3
22000	21.3	23.6	12.1	20.5	22.8	9.9	↑	22.6	9.3
24000				20.8	22.8	10.4	↓	22.8	9.6
27000				20.8	23.1	11.0	20.5	22.8	10.1
30000				21.0	23.3	11.6	20.8	23.1	10.6
33000							21.0	23.1	11.1
36000							21.0	23.3	11.4
39000							21.0	23.3	11.9
40000							21.3	23.3	11.9

DM 42 (MIL CM08)

Capacitance (PF)	STANDARD Type								
	Size (mm)								
	500WV			300WV			100WV		
	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX
16000	35.8	22.0	7.1	35.8	22.0	7.1	35.8	22.0	7.1
18000	35.8	22.0	7.3	35.8	↑	7.3	↑	↑	↑
20000	36.0	22.0	7.6	36.0		7.3			
22000	36.0	22.3	7.8	↑	↓	7.3			
24000	36.3	22.3	8.1	↓	22.0	7.6			↓
27000	36.3	22.3	8.3	36.0	22.3	7.8	↓		7.1
30000	36.5	22.6	8.8	36.3	22.3	8.1	35.8	↓	7.3
33000	36.5	22.6	9.1	36.3	22.3	8.6	36.0	22.0	7.6
36000	36.8	22.8	9.6	36.5	22.6	8.8	36.0	22.3	7.8
39000	36.8	22.8	10.1	36.5	22.6	9.1	36.3	22.3	8.1
43000	37.0	23.1	10.6	36.8	22.8	9.3	36.3	22.3	8.3
47000	37.3	23.1	11.4	36.8	22.8	9.9	36.3	22.6	8.6
51000	37.5	23.3	11.9	37.0	22.8	10.1	36.5	22.6	9.1
56000				37.0	23.1	10.6	36.5	22.8	9.3
62000				37.3	23.3	11.4	36.8	22.8	9.9
68000				37.5	23.3	11.9	37.0	22.8	10.4
69000				37.5	23.6	12.1	37.0	23.1	10.7
75000							37.3	23.1	11.1
82000							37.5	23.3	11.6
91000							38.1	23.8	12.7
100000							38.1	23.8	12.7

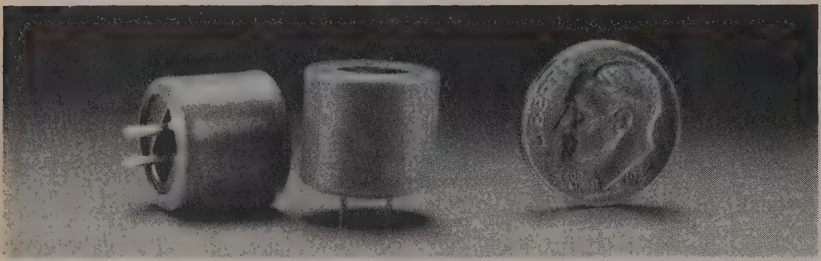
EASTERN DIVISION & HEADQUARTERS
25 Dubon Court
Farmingdale, New York 11735
(516) 454-6390
EAST OF MISSISSIPPI:
TOLL FREE: (800) 645-9626 TELEX: 221794

WESTERN DIVISION
1701 East Edinger Avenue, Unit F2
Santa Ana, California 92705
(714) 547-7034
WEST OF MISSISSIPPI
TOLL FREE: (800) 628-5780 TELEX: 181604

CAPAR COMPONENTS CORPORATION

Maxcap™ Double Layer Capacitor

New High Energy Storage Device



The ideal backup power source for microprocessors and memories. Maxcap DLC, the high-energy power source you never have to replace.

Maxcap Double Layer Capacitors (DLC's) combine extremely long life with many of the desirable electrical characteristics of traditional capacitors (such as rapid and frequent discharge/recharge capability), with energy densities and low leakage currents which approach those of batteries. Fifteen farads can be stored in a 1.6″ x 1.9″ package. Maxcap DLC's are ideal for providing the needed backup power for volatile semiconductor memories.

Conventional energy storage devices such as batteries and aluminum electrolytic capacitors must be replaced during the life of a product. Maxcap DLC's never need replacing because, unlike batteries, they do not undergo life limiting, irreversible chemical reactions, and unlike aluminum electrolytic capacitors, they do not experience dry-up problems.

Product Features

Very high capacity in small size. Circuit board space and equipment size can be reduced.

Ultra long life. Maxcap DLC's have no parasitic chemical reactions, no dry-up problems, and can be fully charged and discharged indefinitely.

Maintenance free. Maxcap DLC's can be placed in sealed or remote locations because they require no access ports. Warranty claims are minimized.

Five-volt output. Maxcap DLC's are ideally suited for powering integrated circuits in all types of equipment. Additional voltages are available.

Wide operating temperature range. -25°C to +70°C (-13°F to 158°F).

Long shelf life. Tests indicate performance is the same after ten years in storage.

Nonpolar. Assembly errors and costs are minimized.

Simple, low cost circuitry. Since Maxcap DLC's do not require current limiting resistors or special holdup capacitors, design and assembly times are reduced.

Safe. Maxcap DLC's are made from non-toxic materials. They will not explode or be damaged if short circuited.

Comparison with Batteries

When the energy of a battery is not needed, Maxcap DLC's have many attributes which make them the best solution to your backup requirements.

State of Charge. Unlike batteries, the charge state of Maxcap DLC's can be easily determined by measuring the voltage.

Simple Circuit. Unlike battery backup circuits, special current limiting charge resistors and holdup capacitors are not required with Maxcap DLC's. You save design time, assembly material and labor costs.

Installation/Assembly. Because Maxcap DLC's are non-polar, they can be inserted into electrical systems without creating reverse connection errors. Unlike batteries, they can be short circuited or have reverse current applied without damage or explosion. These features allow more freedom in using high speed assembly methods such as wave solder and auto insertion.

Equipment Design Flexibility. The unlimited cycle life and long life characteristics of Maxcap DLC's assure greater freedom in selecting their location in your product since access ports do not have to be provided for replacement. This feature, along with their small size, can result in a smaller end product and reduced usage of expensive printed circuit board space.

Product Value/Pricing. Since your product will not require battery replacement, reduced maintenance costs, smaller size, and higher reliability can result in higher profits.

Warranty costs. Your product will not have to be opened to replace batteries; warranty costs may be reduced.

Typical Maxcap DLC Backup Power Application

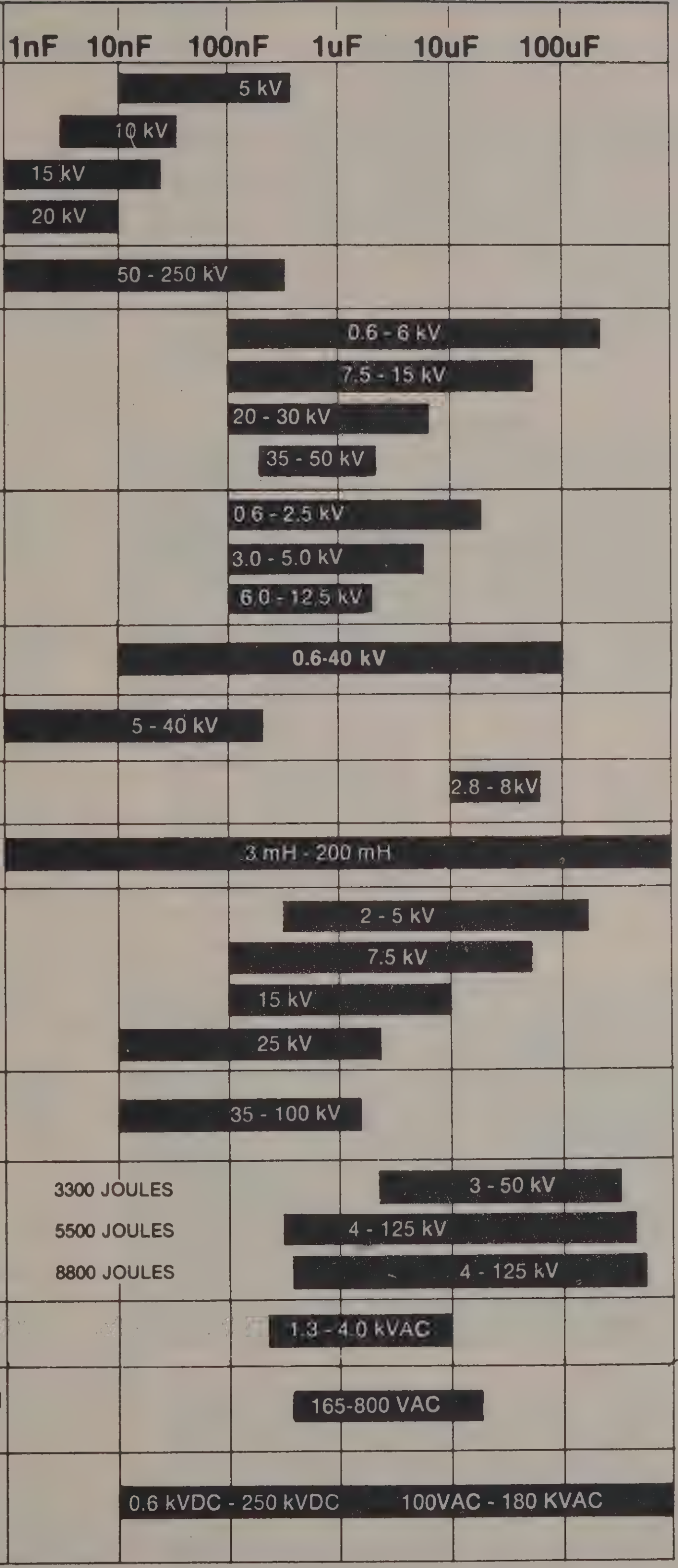
Type of Load	Appliance or Equipment
CMOS, NMOS, PMOS Rams and Microprocessors Timers for Integrated Circuits	Home Appliances (e.g. Microwave Ovens, Dishwashers, Refrigerators), Energy Management Controls, Thermostats, Vending Machines, Point of Sale Terminals, Telephone Autodialers, Programmable Controllers
Relays, Solenoids	**Starters, Igniters, Actuators**
Small Motors, Alarms	Disc Drives, Coin Metering Devices, Security Systems, Toys

SOHIO

Sohio Engineered Materials
Semiconductor Products Division
P.O. Box 664
Niagara Falls, New York 14302
Telephone 716-731-5150

CSI Capacitors

a division of
CSI Technologies, Inc.



SERIES	TYPE	FEATURE	1nF 10nF 100nF 1uF 10uF 100uF
NT	FILTER	DC/AC to 50KHZ	5 kV 10 kV 15 kV 20 kV
FT	FILTER	TUBULAR XHV	50 - 250 kV
FM	FILTER	LONG LIFE XMITTER	0.6 - 6 kV 7.5 - 15 kV 20 - 30 kV 35 - 50 kV
CP	FILTER	MIL SPEC	0.6 - 2.5 kV 3.0 - 5.0 kV 6.0 - 12.5 kV
M	FILTER	XMITTER	0.6-40 kV
AE	PULSE	RAILS X LOW L	5 - 40 kV
MED	DEFIB	SMALLEST	2.8 - 8kV
FC	INDUCTOR	LIGHT WEIGHT	3 mH - 200 mH
WM	PULSE	GENERAL PURPOSE FLASHLAMP	2 - 5 kV 7.5 kV 15 kV 25 kV
WPC	PULSE	RAILS LOW L HIGH E	35 - 100 kV
ES	ENERGY STORAGE	HIGH R.R. WIDE ΔT LOW ESR NON-FLAM.	3300 JOULES 3 - 50 kV 5500 JOULES 4 - 125 kV 8800 JOULES 4 - 125 kV
NB	AC	LOW D.F. BALLAST	1.3 - 4.0 kVAC
MR	AC	MOTOR RUN BALLAST	165-800 VAC
CUSTOM & SCR	ANY WOUND DIELECTRIC	150° C 5 n H 4000 KW 10 KJ	0.6 kVDC - 250 kVDC 100VAC - 180 KVAC

CSI Capacitors

810 RANCHEROS DR, SAN MARCOS, CA 92069 / WUI 697832 / RCA 295433 / (619) 747-4000

CRC
COMPONENT RESEARCH CO.

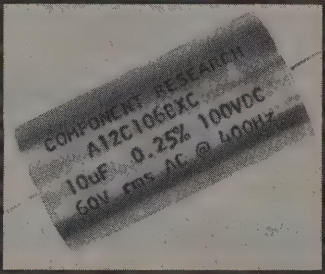
TABLE OF CONTENTS
CATALOG S

ESTABLISHED RELIABILITY CAPACITORS

TABLE OF CONTENTS

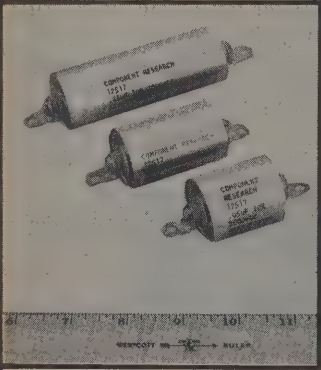
Product Features..1A•1022
General Product & Ordering Information ....1A•1024
Options Available For Standard Capacitors........1A•1025
High Peak Current Capacitor Information ....1A•1026
Manufacturing & Inspection Flow Plan ....1A•1027
Periodic Test Program For QPL ....1A•1028
High Reliability Screening ....1A•1029
Reliability Questions & Answers.........................1A•1031
Screening For Low Voltage Applications ....1A•1033
Environmental & Life Test Data ....1A•1034
A12 & K12 Metallized Polycarbonate ....1A•1036
G12 Sub-Miniature Metallized Polycarbonate ....1A•1040
J11 & K11 Metallized Teflon ....1A•1044
A91 Foil Teflon ....1A•1048
K93 Foil Polystyrene ....1A•1052
A10 Double Layer Plastic ....1A•1056
A52 Foil Polycarbonate ....1A•1058
B55 High Current Foil Polypropylene ....1A•1060
B15 High Current Metallized Polypropylene ......1A•1062

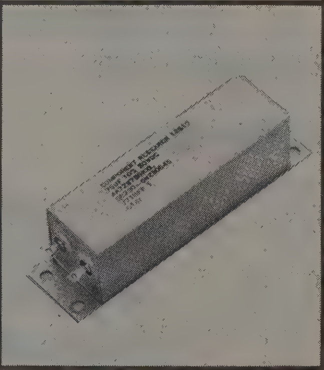
CRITICAL PROGRAMS QUALIFICATION



TRIDENT
LANCE MISSILE
F15 AIRCRAFT
F18 AIRCRAFT
SPACE SHUTTLE
ROLAND
MARK 46
MARK 48
SPARROW
NEARTIP
NOMI I
HARPOON
AND MANY OTHERS

CRC hermetically sealed plastic film capacitors are acknowledged world wide as the highest quality. Standard tubular metallized polycarbonate capacitor, AC rated to 40 KHz and qualified to MIL-C-83421/01 is shown above.





UPPER LEFT Type 55 foil polypropylene capacitors are used in power resonating applications up to 160KHz and with fast switching, high peak current devices. A typical 10uF capacitor measuring 1.25″ diameter x 3.375″ length can handle up to 50A rms under continuous duty operation. Its ESR at 100KHz is approximately 0.0016 ohms which is typical of the low loss inherent in these capacitors.

UPPER RIGHT This 75uF, 50VDC, metallized polycarbonate capacitor is 1″ square by 3¾″ long and is rated at 10A rms at 25KHz at 100°C. Each capacitor receives 168 hours of AC voltage at 25KHz to produce 10A rms in combination with 50VDC applied during burn-in at 100°C.

TYPE A12 & K12

DIELECTRIC: Metallized Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 30-400 VDC

A.C. RATING: 22 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +125° (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to 27uF, .1% to 10% tolerances

INSULATION RESISTANCE: 300,000 meg-uF (100,000 meg-uF for K12 @ 25°C)

DISSIPATION FACTOR: .15% max. @ 1KHz

DIELECTRIC ABSORPTION: .1% maximum

SCREENING: 100% Quality conformance inspection. Qualified to Failure Rate "S" of MIL-C-83421/01.

APPLICATIONS: Timing, filter and feed-back circuits, pulse-forming networks. A12 and K12 capacitors are used extensively in the Space Shuttle Program.

TYPE G12

DIELECTRIC: Miniaturized Metallized Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 30-200VDC

A.C. RATING: 22 to 120 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +125°C (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to 10uF, .1% to 10% tolerances

INSULATION RESISTANCE: 100,000 meg-uF @ 25°C

DISSIPATION FACTOR: .15% max. @ 1KHz

DIELECTRIC ABSORPTION: .1% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421.

APPLICATIONS: Timing, filter, feed-back circuits, and pulse-forming networks. Used where small size is critical. G12 capacitors are used in numerous Navy missile and torpedo projects.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

COMPARISON OF CAPACITOR TYPES

ESTABLISHED
RELIABILITY
CAPACITORS

TYPE J11 & K11

DIELECTRIC: Metallized Teflon

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-200VDC

OPERATING TEMPERATURE: −65°C to +125°C

CAPACITANCE RANGE: .001 to 2uF, .1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-uF

DISSIPATION FACTOR: .05% max. @ 1KHz

DIELECTRIC ABSORPTION: .01% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421. Will meet all environmental requirements of MIL-C-83421 except vibration at 20 g's and shock at 50 g's.

APPLICATIONS: Timing, sample and hold, integrating and tuning circuits. J11 and K11 are used in critical space, military applications which require lowest dielectric absorption and highest insulation resistance and low dielectric loss.

TYPE A52

DIELECTRIC: Foil Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 100-400VDC

A.C. RATING: 60 to 240 VRMS @ 40KHz

OPERATING TEMPERATURE: −65°C to +125°C (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to .47uF, 1% to 10% tolerances

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .1% max. @ 10KHz

DIELECTRIC ABSORPTION: .2% maximum

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber, high current pulse applications. A52 capacitors are used in the F18 aircraft.

TYPE A91

DIELECTRIC: Foil Teflon

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-400VDC

A.C. RATING: 36 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +150°C

CAPACITANCE RANGE: .001 to 1.2uF, 1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-UF

DISSIPATION FACTOR: .02% max. @ 1KHz

DIELECTRIC ABSORPTION: .01% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421. Will meet all environmental requirements of MIL-C-83421 except vibration at 20 g's and shock at 60 g's.

APPLICATIONS: Pulse-forming networks, timing, sample and hold, integration and tuning circuits. A91 is used in hi-rel programs which require a rugged low loss capacitor with high insulation resistance and low dielectric absorption.

TYPE B55

DIELECTRIC: Foil Polypropylene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 600 & 800VDC

A.C. RATING: 400 & 600 VRMS @ 400Hz, high current ratings to 40KHz, low E.S.R.

OPERATING TEMPERATURE: −55°C to +85°C

CAPACITANCE RANGE: .033 to .82uF

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .05% @ 10KHz

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber circuits, switching power supplies and where high RMS and peak current ratings are required.

TYPE K93

DIELECTRIC: Polystyrene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-400VDC

A.C. RATING: 36 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +85°C

CAPACITANCE RANGE: .001 to 2.7uF, .1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-uF

DISSIPATION FACTOR: .02% max. @ 1KHz

DIELECTRIC ABSORPTION: .02% maximum

SCREENING: 100% Quality conformance inspection

APPLICATIONS: Qualified for the Trident Program. Used in critical space and military applications that require stability, high insulation resistance, low dielectric absorption and low dissipation factor.

TYPE B15

DIELECTRIC: Metallized Polypropylene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 600 & 800 VDC

A.C. RATING: 400 & 600 VRMS @ 400Hz, high current ratings to 40KHz, low E.S.R.

OPERATING TEMPERATURE: −55°C to +85°C

CAPACITANCE RANGE: .01 to 1.2uF

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .05% max. @ 10KHz

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber circuits, switching power supplies and where high RMS and peak current ratings are required.

COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-6864

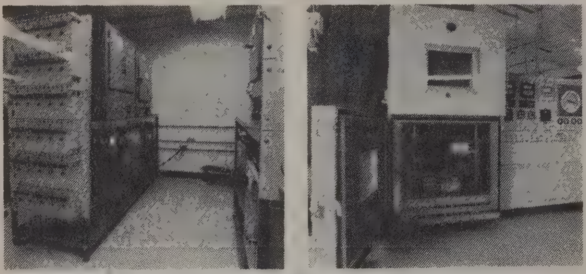
CRC
COMPONENT RESEARCH CO.

A VIEW OF CRC MANUFACTURING GENERAL PRODUCT INFORMATION

ESTABLISHED RELIABILITY CAPACITORS

CAPACITOR ASSEMBLY: Typical production area located within our award winning 50,000 sq. ft. manufacturing facility. Ideal assembly conditions enable CRC employees to produce high reliability precisely and efficiently.

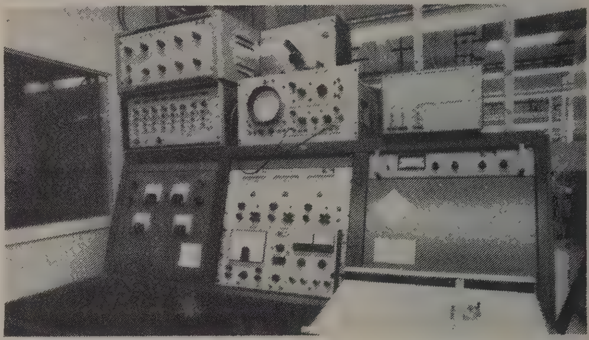
CALIBRATION EQUIPMENT: Hundreds of precision instruments for parametric measurement are maintained under constant calibration. One out of approximately four employees is dedicated to quality control assurance, and inspection. CRC supplies capacitors for laboratory standards use throughout the world.



BURN-IN AND TEMPERATURE CYCLING: Before and after hermetic sealing, CRC capacitors receive 100% burn-in.

The 12 foot high shock chamber above right, was used in performing 500 thermal shock cycles (−55°C to +125°C) on CRC metallized polycarbonate capacitors being qualified for the space shuttle program.

Vibration, shock, salt spray, humidity, pressure, and various other stress tests are conducted in our modern laboratories. During these tests, capacitance parameters are accurately monitored in order to study how our products can be constantly improved. CRC has over 200 cubic feet of thermal shock and aging work space available.



ENVIRONMENTAL TESTING: Our qualified testing laboratory contains equipment necessary to perform random and sinusoidal vibration, shock, acceleration, moisture resistance, salt spray, solderability, resistance to solvents, barometric pressure, and many other tests. This laboratory is used daily to qualify standard and special designs as well as to prove out new designs. These capabilities ensure the consistent quality of our established reliability capacitors.

ORDERING INFORMATION — Terms: Our terms are net 30 days to customers approved by our credit department. All shipments are F.O.B., Santa Monica, Calif. **Minimum Order:** Minimum billing per order is $50.00. **Complete Part Number:** Please make certain that you have complete part number to avoid any errors or delays. Please check part number instructions on individual specification pages.

PART NUMBER OBSOLESCENCE — Due to changes in military specifications for which we are qualified, upgrading of our catalog specifications, or size reduction, part numbers formerly used may now be obsolete. We urge our customers to change their existing drawings to indicate the new part numbers for old and new design, wherever possible. If you are unable to make this change, CRC will continue to supply and mark parts indefinitely to the old specifications.

CONSTRUCTION INFORMATION — Unless otherwise specified all parts listed are metal cased, tubular, with both wire terminals isolated from the metal case.

INSTALLATION INSTRUCTIONS — To prevent damage to the hermetic seal joint, use a tweezer type heat sink between the soldering iron and solder beads when soldering within ¼″ of beads. Prior to lead bending or twisting, protect glass seals and solder joints by gripping lead near solder bead with a small plier.

Contaminating films on the glass seal surfaces may appear during customer handling and installation of capacitors. To preserve the high insulation resistance inherent in CRC capacitors, clean the glass seal surfaces thoroughly with acetone or chlorinated hydrocarbon fluid.

CAPACITOR MEASUREMENT INFORMATION — The high quality of CRC capacitors may be difficult to evaluate unless sufficiently sensitive and accurate equipment is utilized in conjunction with proper measurement techniques.

Capacitance bridges equal to the General Radio 1620A are recommended for best accuracy of capacitance. This bridge is satisfactory for dissipation factor measurement of capacitors up to 1 uF. CRC has developed a special bridge capable of accurately measuring dissipation factor of capacitors up to 100 uF or more at frequencies up to 1 KHz. For inspection of DF of larger than 1 uF capacitors it is suggested that you use samples correlated by our measurement laboratory.

Insulation resistance measurement is performed by Component Research Co. using leakage current methods which are repeatable to 1 picoamp for capacitors less than 0.1 uF. Larger values require adequate charge time to minimize dielectric absorption effects. Guard boxes are used to perform leakage current and dielectric absorption measurements.

PATENT INFORMATION — CRC capacitors are exclusively manufactured under one or more of the following patents: 3,238,428; 3,260,906; 3,292,063; 3,506,895; 3,539,886; 3,603,849; 3,626,362. Additional patents pending.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

OPTIONS AVAILABLE FOR STANDARD CAPACITORS

ESTABLISHED RELIABILITY CAPACITORS

Following is a list of some options and characteristics available when you are required to meet special design or operating conditions.

SPECIAL CAPACITOR VALUES

If your application requires odd values such as 0.10015uF ±0.1% or 0.9999uF ±0.25%, such requirements are readily met from our large stock of standard and non-standard values. Individual capacitors can be permanently marked or tagged with discrete values accurate to six places if required.

SPECIAL VOLTAGE RATINGS

Problems of size may occur when replacement of a poor quality capacitor is required. Under certain conditions such as restricting the operating temperature, or limiting DC hipot to 150% of rated volts, a substantial size reduction is possible. Check with our applications engineering department for our recommendations in such cases.

LINEAR TC SLOPE for RESISTOR MATCHING

CRC Series A93 Polystyrene Capacitors provide the closest approximation to a straight line plot for capacitance vs temperature over the range of −50°C to +85°C, with less than 150PPM/°C in negative slope. Larger capacitor values appear to have lower TC than smaller capacitor values. Typically, values ranging 0.01uF average −100PPM/°C and 1.0uF range −40PPM/°C. The normal worst case limits in non-linearity of TC slopes are ±50PPM/°C for all A93 polystyrene capacitors. Slopes are available as low as ±10PPM/°C for the full temperature range of −50°C to +85°C. This slope is a permanent characteristic and will remain constant with temperature cycling and time.

±10PPM/°C TRACKING MATCHED CAPACITORS

In some applications it is desirable to have several capacitors of the same value track together over a specified temperature range.

Frequently good linearity is not mandatory, provided all capacitors although non-linear, follow the same pattern of varying in capacitance with temperature. In other applications a set of different capacitors must track within a defined ratio limit of each other as temperature changes.

From its large stock of 100% screened and batch controlled high reliability capacitors, CRC can furnish many combinations of desired matched capacitors in a minimum of time.

MATCHED SETS TO ±0.05% ACCURACY

CRC can provide matched sets of two or more capacitors with readings of ±0.05% of each other although the purchase tolerance is as high as ±1%. This is more economical than purchasing individual capacitors to ±0.1% or ±0.25% tolerances.

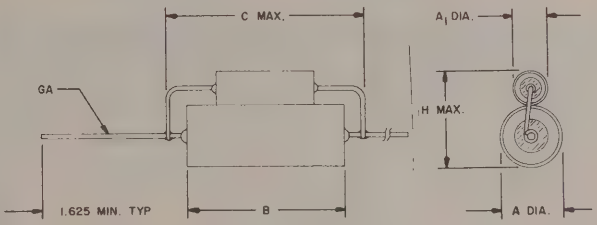
ZERO TEMPERATURE COEFFICIENT BY TC MATCHED PAIRS

It is difficult to obtain zero TC over a wide temperature range. But over a more limited range CRC can provide a TC as low as zero ±5PPM/°C by pairing two capacitors with opposing slopes. Typically an A93 polystyrene capacitor matched with the same value A12 polycarbonate capacitor will match to zero ±30PPM/°C from −10°C to +85°C, as off the shelf purchased items.

If lower TC than this is required, we can 100% measure and match for closer temperature coefficient.

"PIGGYBACK" PERMANENTLY CONNECTED MATCHED CAPACITORS

Customers sometimes prefer the matched capacitors connected together as one to prevent their separation prior to installation. CRC standards are made by "piggyback" connection of trimmers which can provide accuracies to ±0.05%. Shown below is a figure of a "piggyback" connected matched capacitor.



50,000,000 MEGOHMS INSULATION RESISTANCE

This may seem incredible but CRC is supplying special 1uF teflon capacitors which measure up to 5,000,000 megohms at 100°C, and up to 50,000,000 megohms at temperature from 25°C to −40°C.

CRC is developing new methods of measuring to higher levels of insulation resistance and believes it will be able to verify that specially selected smaller values such as 0.1uF can be supplied to meet a specification of 500,000,000 megohms. When you use capacitors in such sensitive applications certain errors and disturbances not normally observed become visible. Some of these are described below.

LOW "PIEZO ELECTRIC LIKE" VOLTAGE GENERATION CAPACITORS

When subjected to a temperature change, capacitors generate a voltage which may vary from one to another within the lot. Voltage up to ten millivolts per °C have been observed. While voltage outputs generally do not increase linearly with temperature, in some cases there has actually been voltage reversal during a temperature run in a given direction.

CRC supplies specially selected 0.5uF, 50VDC teflon capacitors similar to the J11B504 styles to meet requirement of 0.5 millivolts maximum/°C voltage generation, for a critical application.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

HIGH PULSE CURRENT METALLIZED CAPACITORS

ESTABLISHED RELIABILITY CAPACITORS

CRC PLASTIC FILM CAPACITORS have low loss electrode terminations that are unsurpassed for current handling after exposure to the extremes of thermal shock and operational life.

CRC FOIL CAPACITORS utilizing low loss plastic films such as polypropylene, teflon, polystyrene, and polysulfone are recommended for use with fast switching rates at very high peak currents.

CRC METALLIZED FILM CAPACITORS with lower repetition rates and relatively high currents, can be used to conserve space and weight.

As an example a 10uF, 30VDC, metallized polycarbonate capacitor type G12A106 was charged at 30VDC and discharged into a 0.02 ohm vacuum switch at a 1 PPS rate for days to determine if it would open up. There was no noticeable effect on ESR or dissipation factor as a result of this test.

During this test the first ½ sine discharge current pulse was approximately 180 amperes and decayed to zero current after several 100 KHz resonant cycles.

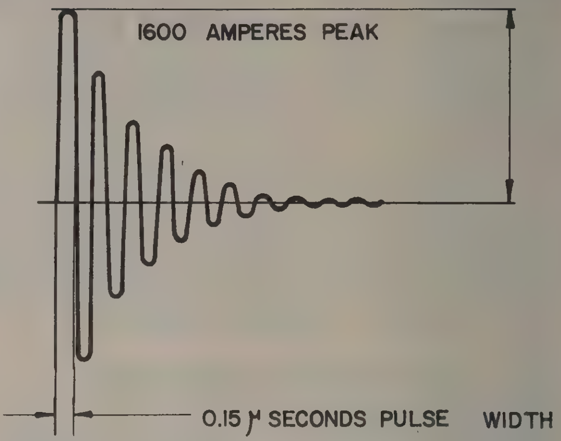
We attempted to open this miniature 10uF capacitor by charging it with 100VDC which resulted in a first ½ sine pulse current of 500 amperes peak at a 1 PPS rate for several hours. Despite the voltage overstress applied and the extremely high peak capacitor current developed, we could not degrade the termination quality of the G12A106 capacitor.

We can conclude that CRC miniature metallized polycarbonate capacitors are capable of handling enormous discharge current provided the repetition rate is slow.

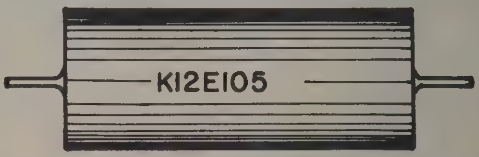
A study is now being conducted by CRC to determine the optimum AC operating conditions with maximum energy density under high current pulse conditions for metallized vs. metal foil capacitors.

These tests will determine what repetition rate conditions require a larger foil capacitor instead of a smaller metallized film capacitor for failure-free operation.

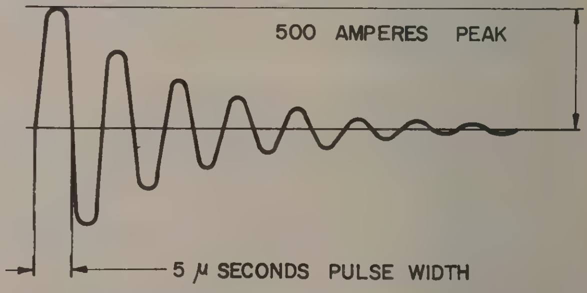
IF YOUR APPLICATION REQUIRES MAXIMUM RELIABILITY, SMALLEST SIZE, AND OPERATION IN CRITICAL AEROSPACE OR INDUSTRIAL ENVIRONMENTS, CRC APPLICATION ENGINEERS WILL BE PLEASED TO REVIEW YOUR SPECIFICATIONS FOR CORRECT CAPACITOR USAGE.



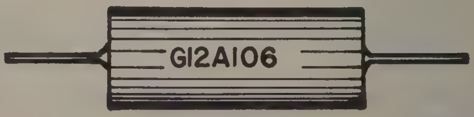
IN THIS TEST A 1 uF, 400VDC, METALLIZED POLYCARBONATE CAPACITOR, TYPE K12E105, IN A 0.750" X 1.875" CASE DEVELOPED 1600 AMPERES PULSE CURRENT WHEN DISCHARGED INTO A 0.02 OHM SWITCH LOAD AFTER CHARGE AT 800VDC. REPETITION RATE WAS 1 PPS AND NO DEGRADATION OF ESR OR DISSIPATION FACTOR OR CASE WARM-UP WAS MEASURABLE AFTER SEVERAL HOURS OF OPERATION.



Actual size of the 1uF, 400VDC capacitor tested at developed pulse currents up to 2600 amperes peak to peak at 1 PPS rate.



CAPACITOR DISCHARGE CURRENT SHOWN FOR TYPE G12A106 METALLIZED POLYCARBONATE CAPACITOR, 10 uF, 30VDC, AFTER CHARGE AT 100VDC AND DISCHARGE INTO A 0.02 OHM SWITCH LOAD. REPETITION RATE WAS ONE PULSE PER SECOND AND THE RESONANT FREQUENCY RESULTING FROM DISCHARGE INTO THE LOAD IS 100KHz.



Actual size of the 10uF, 30VDC capacitor tested at developed pulse currents up to 900 amperes peak to peak at 1 PPS rate.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

MIL-C-83421/1 - MIL-C-39022/9
MANUFACTURING & INSPECTION FLOW PLAN

ESTABLISHED RELIABILITY CAPACITORS

100% INSPECTION PER MIL-C-83421 & MIL-C-39022

The high reliability capacitor screening plans developed by Component Research Co. have been adopted by space and military contractors throughout the world for critical programs. The new general specification MIL-C-83421 incorporates much of the screening features shown below at an attempt to provide a "state of the art" capacitor specification for general industrial and aerospace use.

Our flow plan for manufacturing and inspection shown below covers the steps used to process and screen all of our polycarbonate, teflon, polystyrene and polysulfone film capacitors. The individual specifications shown in the catalog list the actual screening performed for each style. A choice of three quality levels provides different degrees of intensive screening to assure the highest possible quality at lowest cost. Special screening plans are available which include tests such as 100% corona inception inspection, 40KHz AC burn-in at 100°C, high impedance monitoring for intermittent conditions at low voltage during temperature cycling, ESR inspection at 100KHz, dielectric absorption effects with rapid switching rates and varying temperature, and many other sensitive measurement phenomena.

100% PROCESSED AND SCREENED

Steps 1-9 show the 100% processing (up to and including hermetic sealing), of MIL-C-39022/9 and MIL-C-83421/1 qualified polycarbonate and CRC standard capacitors — Polycarbonate, Teflon, Polystyrene and Polysulfone. The quality level selected will be determined by the individual capacitor specification.

PROCESSING STEPS

A. CAPACITOR MATERIAL INSPECTION
B. IDENTIFY PROCESS PAPERWORK WITH MATERIAL LOT NUMBERS
C. CAPACITOR SUB-ASSEMBLY INSPECTION
D. SPECIAL VACUUM PROCESSING
E. HERMETIC SEAL AFTER NITROGEN BACK-FILL
F. INITIAL INSPECTION OF COMPLETED CAPACITOR (7X POWER)

QUALITY LEVEL 1 MIL-C-83421/1 & MIL-C-39022/9

1. BURN-IN
2. TEMPERATURE CYCLING
3. HELIUM LEAK TEST AND GROSS LEAK TEST
4. AC-DIELECTRIC STRENGTH
5. DC-DIELECTRIC STRENGTH
6. INSULATION RESISTANCE
7. % CAPACITANCE TOLERANCE
8. % DISSIPATION FACTOR
9. SELECTION FOR PERFORMANCE GRADES
10. REPEAT ELECTRICAL MEASUREMENT AND RECORD DATA AS REQUIRED
11. CONDUCT SPECIAL MEASUREMENT WHEN REQUIRED BY CUSTOMER
12. FINAL VISUAL INSPECTION OF WORKMANSHIP, MARKING, PAPERWORK AND PACKAGING
13. SHIP CERTIFICATE OF COMPLIANCE WITH PARTS

Highest reliability capacitors with standard or special screening for Apollo, Viking, and other space programs. Also used in military and ultra high quality industrial applications.

Qualified for space, critical applications, F15 aircraft, Trident, space shuttle and other programs.

QUALITY LEVEL 2 MIL-C-39022/9

1. BURN-IN
2. TEMPERATURE CYCLING
3. HELIUM LEAK TEST AND GROSS LEAK TEST
4. AC-DIELECTRIC STRENGTH
5. DC-DIELECTRIC STRENGTH
6. INSULATION RESISTANCE
7. % CAPACITANCE TOLERANCE
8. % DISSIPATION FACTOR
9. FINAL VISUAL INSPECTION OF WORKMANSHIP, MARKING, PAPERWORK, AND PACKAGING
10. SHIP C OF C WITH PARTS

High reliability capacitors screened for space, missile and industrial applications. Qualified for many programs such as The Tow Missile, The Lance Missile and F15 aircraft.

QUALITY LEVEL 3 MIL-C-83421/1 & MIL-C-39022/9

1. TEMPERATURE CYCLING
2. HELIUM LEAK TEST AND GROSS LEAK TEST
3. AC-DIELECTRIC STRENGTH
4. DC-DIELECTRIC STRENGTH
5. INSULATION RESISTANCE
6. % CAPACITANCE TOLERANCE
7. %DISSIPATION FACTOR
8. FINAL VISUAL INSPECTION OF WORKMANSHIP, MARKING, PAPERWORK AND PACKAGING
9. SHIP C OF C WITH PARTS

High reliability capacitors with reduced screening and performance levels for lower cost high volume programs, such as missiles, aircraft and telephone equipment applications.

Random samples from completed production lots of all quality levels are periodically tested.

These tests may consist of Insulation Resistance at high temperature, Dielectric Absorption, Temperature Coefficient and AC stress analysis tests.

In addition, samples are life tested for retention of qualification.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

RETENTION OF QPL - MIL-C-83421/1 FAILURE RATE "S"

ESTABLISHED RELIABILITY CAPACITORS

PERIODIC TESTING PROGRAM

GROUP "B" INSPECTION PER MIL-C-83421, TABLE IV

GROUP B, SUBGROUPS 1, 2 and 3: In order to maintain qualification, CRC performs periodic testing. Capacitors from current production lots of CRH01 through CRH00 which have successfully completed "Group A" Inspection (see "A12 and K12 Quality Conformance Inspection") are selected.

SUBGROUP 1 TESTS

10 Each CRH Style Monthly

- Barometric Pressure
- Insulation Resistance at Max. Rated Temperature
- Temperature Coefficient
- Life (2,000 Hours)

SUBGROUP 2 TESTS

CRH01 Parts Jan., July
CRH02 Parts Feb., Aug.
100 Volt Parts March, Sept.
200 Volt Parts April, Oct.
400 Volt Parts May, Nov.

- AC Conditioning 250 Hours
- Dissipation Factor
- Insulation Resistance
- △ Capacitance

SUBGROUP 3 TESTS

18 Parts Every 6 Months, Consisting of CRH01, CRH02, CRH03, CRH04 and CRH05

- Vibration
- Salt Spray
- Immersion
- Solderability
- Shock
- Moisture Resistance
- Terminal Strength
- Resistance to Solvents

DC LIFE TEST PERFORMED MONTHLY

GROUP B, SUBGROUP 1 FOR ALL CRH STYLES COVERING ALL FAILURE RATE LEVELS

Capacitors are DC-Life tested at 100°C and at 140% of the rated D.C. voltage for 2,000 hours. (This is an acceleration factor of 5:1, approximately).

EXAMINATION OR TEST	CONDITIONS	POST TEST LIMITS	
		CRH01, CRH02, CRH03, CRH04, and CRH05	CRH06, CRH07, CRH08, CRH09, and CRH00
Barometric Pressure	Per MIL-C-83421	No breakdowns	No breakdowns
Insulation Resistance	@ Rated voltage @ 125°C	2,000 Megs-uF need not exceed 20,000 Megs	1,000 Megs-uF need not exceed 10,000 Megs
Temperature Coefficient	△ Cap. at −55°C Retrace at 25°C △ Cap. at +125°C	−1.5% to 0.5% max. ±0.1% max. +0.8% to −0.5% max.	−2.0% to −0.5% max. ±0.25% max. ±2.0% max.
POST LIFE TEST LIMITS AFTER 2,000 HOURS LIFE			
Insulation Resistance at Rated Voltage and 25°C	Insulation Sleeves	10,000 Megs min.	10,00 Megs min.
	Terminal to Terminal	100,000 Meg-uF need not exceed 1,000,000 Megs	33,333 Megs-uF need not exceed 333,333 Megs
	Terminals to Case	10,000 Megs min.	10,000 Megs min.
△ Capacitance % change with life	At 1KHz and 25°C	±2% max. of initial value	±4% max. of initial value
% Dissipation Factor	At 1KHz and 25°C	0.25% max.	0.35% max.

AC-SINUSOIDAL LIFE TEST PERFORMED MONTHLY

Capacitors are AC life tested for 250 hours at 100°C and at 140% of the rated RMS voltage at the applicable test frequency as shown in Table V. This test is performed monthly in order to verify the AC RMS voltage and current ratings.

POST AC TEST LIMITS

Insulation Resistance at Rated Voltage and 25°C	100,000 Megs-uF, need not exceed 1,000,000 Megs
Capacitance % Change at 1KHz and 25°C	2% max. of initial value
% Dissipation Factor at 25°C	0.25% max.

TABLE V AC-LIFE TEST PARAMETERS PER MIL-C-83421/1

CRH Style	Equiv. CRC Type	DC Volts Rating	400 Hz AC RMS Volts Rating	250 Hours at 100°C Life Test Conditions	
				AC RMS Volts	Frequency In Hertz
01	A12A	30	22	30	4,000
02	A12B	50	36	50	4,000
03	A12C	100	60	84	4,000
04	A12D	200	120	168	400
05	A12E	400	240	336	400

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

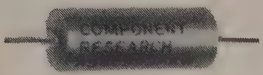
CRC
COMPONENT RESEARCH CO.

HIGHEST RELIABILITY SCREENING

ESTABLISHED RELIABILITY CAPACITORS

CRC SCREENS AND TESTS MANY ORDERS TO SPECIFIC CUSTOMER REQUIREMENTS FOR HIGHER RELIABILITY. IN ADDITION, CRC PERFORMS MANY IN-HOUSE TESTS THAT ARE NOT REQUIRED BY THE CUSTOMER, BUT WHICH CRC FEELS WILL IMPROVE QUALITY AND RELIABILITY. BELOW IS CRC'S MANUFACTURING AND INSPECTION FLOW PLAN FOR METALLIZED POLYCARBONATE CAPACITORS SUPPLIED TO TRIDENT SPECIFICATION 2864019.

MANUFACTURING AND INSPECTION FLOW PLAN



1. CAPACITOR MATERIAL INSPECTION
2. IDENTIFY PROCESS PAPERWORK WITH MATERIAL LOT NUMBERS
3. CAPACITOR SUB-ASSEMBLY
4. CAPACITOR SUB-ASSEMBLY INSPECTION
5. SPECIAL VACUUM PROCESSING
6. IN-PROCESS ELECTRICAL TESTING
7. VACUUM PROCESSING
8. NITROGEN BACKFILL
9. HERMETIC SEAL
10. INITIAL INSPECTION OF COMPLETED CAPACITOR AT 7X MAGNIFICATION

COMPONENT RESEARCH 100% PRE-SCREENING

1. 100% Screen and test per MIL-C-83421, table 4.
2. Select parts for Trident order.
3. Sample test capacitance, I.R. % D.F. & ESR at 25°C. Record readings on five samples.
4. Burn-in for 16 hours at 100°C at 40KHz at rated RMS voltage (100% test).
5. Thermal aging, 5 cycles −65°C to +125°C (100% test).
6. Seal test, fine leak (100% test).
7. I.R. at 125°C terminal to terminal (100% test, record samples).
8. I.R. at 25°C terminal to terminal (100% test, record samples).
9. Tolerance assort at 25°C at 10KHz (100% test).
10. Record capitance drift for 5 samples.
11. % dissipation factor at 25°C at 10KHz (100% test, record samples).
12. ESR at 25°C at 100KHz (record 5 samples only).
13. Select 2 random samples and dissect for product conformance.
14. Quality control manager review of data for lot acceptance.

QUALITY CONFORMANCE INSPECTION PER 2864019

TEST STEP	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	% CAPACITANCE TOLERANCE	At 25°C at 10KHz	4.7.8	±1%	100% TEST
2	BURN-IN	168 hrs. @ 100°C @ 40KHz @ maximum rated RMS voltage	4.7.2	There shall be no evidence of physical damage	100% TEST
3	THERMAL AGING	10 cycles from −65°C to +125°C	4.7.3	There shall be no evidence of physical damage	100% TEST
4	SEAL TEST (FINE LEAK)	Helium bomb and check for helium leak	4.7.5	1x10^{-6}atm/cm^3/sec. max. leak rate	100% TEST
5	SEAL TEST (GROSS LEAK)	Per MIL-STD-202 Meth. 112B, Cond. D.	4.7.5	No bubble stream	100% TEST
6	AC SQUARE WAVE TERMINAL TO TERMINAL	Apply 100Hz square wave at a peak to peak voltage of 3 times DC rated voltage	4.7.6	No shorts	100% TEST
7	DC HI-POT	Apply 200% of rated DC voltage from terminal to terminal and terminals to case for 60 seconds minimum	4.7.6	No shorts	100% TEST
8	INSULATION RESISTANCE TERMINAL TO TERMINAL	At +125°C at rated DC voltage	4.7.7	1,000 meg's-uF, need not exceed 10,000 megohms	100% TEST
9	INSULATION RESISTANCE TERMINAL TO TERMINAL	At 25°C at rated DC voltage	4.7.7	100,000 meg's-uF, need not exceed 1,000,000 megohms	100% TEST
10	% CAPACITANCE TOLERANCE	At 25°C at 10KHz	4.7.8	±1%	100% TEST
11	% CAPACITANCE DRIFT FROM STEP 1 TO 10	At 25°C at 10KHz referenced to initial reading	4.7.8	±0.5%	100% TEST
12	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.5%	100% TEST
13	RADIOGRAPHIC INSPECTION	Two views at 90° per OD 48491	N/A	Per OD 48491	100% TEST
14	VISUAL MECHANICAL INSPECTION	Per 2864019	4.7.1	Per 2864019	1.0% AQL

NOTE: 5% PDA (percent defective allowable) or 1 device, whichever is greater for each test step 7, 8, 9, 11, 12 and 13.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

CRITICAL APPLICATIONS SCREENING

ESTABLISHED RELIABILITY CAPACITORS

Component Research capacitors are used in critical applications where their reliability and performance can affect the success of an entire program involving years of preparation and billions of dollars of program cost. For over a decade, aerospace programs from Apollo to Space Shuttle have used CRC capacitors for timing circuits and other control circuits, essential for controlling spacecraft millions of miles from earth, after years of space travel.

DC burn-in, thermal aging (temperature cycling), and Group "A" testing generally is sufficient to assure that the capacitors will be reliable for aerospace applications. The standard CRC capacitors listed in this catalog are offered with screening options most commonly required. Special screening can also be provided for critical requirements.

You can depend upon CRC to provide the most reliable capacitor and screening plan for your critical applications. Following are typical screening plans for standard and special applications.

AC BURN-IN AT 400Hz TO 40KHz

400Hz burn-in at 140Vrms at 125°C is generally a standard screen for metallized polysulfone capacitors supplied for aircraft programs. Typically low-loss filter, shunt, and feed-thru capacitors ranging from 1 μF to 240 μF in value receive from 16 hours to 96 hours of 400Hz burn-in at 125°C to provide high reliability performance in programs such as the F18 fighter aircraft, space shuttle, and commercial aircraft equipment.

40KHz burn-in is used in screening small valued metallized polycarbonate capacitors at 100°C for 168 hours for the Trident Program. CRC capacitors used for this program are the A12 Series which undergo rigorous burn-in and special screening for elimination of any possible defects or unusual behavior modes. With incorporation of such severe inspection and surveillance restraints, CRC production standards are maintained at a very high caliber of performance suited to the most critical programs.

AC AND DC COMBINED BURN-IN SCREENING

Several customers specify that the AC and DC voltages be simultaneously applied during burn-in to assure that the capacitor will operate reliably in this mode. Typically we have applied 100VDC together with approximately 2Vrms at 40KHz at 100°C to 22μF, 100VDC metallized polycarbonate capacitors for 168 hours of burn-in time as a Group "A" screen. In this application the 1" diameter x 1.875" long capacitor handles approximately 8 AMPS RMS during burn-in. Following 100% Group "A" screening, a lot sample is tested for 2000 hours as above without DC voltage applied.

CORONA INCEPTION INSPECTION PREVENTS OPERATIONAL FAILURES

In AC applications at 240Vrms levels and higher or where peak voltages exceed 320 volts approximately, capacitors may fail short or long term due to corona attack.

For such applications, CRC recommends capacitors which are uniformly free from corona inception for at least 20% higher than operational voltage conditions.

100% Group "A" corona inspection for no indication of inception is an excellent substitute for dielectric withstanding voltage tests and is a better monitor of possible shorting problems.

RECORDED READINGS BEFORE AND AFTER BURN-IN

Some programs must have recorded data for each capacitor taken prior to and after completion of burn-in and thermal aging. The capacitors are serialized and readings of capacitance, insulation resistance at 25°C and sometimes at elevated temperature are recorded. In addition, readings of capacitance vs. temperature for purposes of determining temperature coefficient and drift can be recorded.

On occasion dissipation factor is recorded at 1KHz and 10KHz and ESR at 100KHz for determination of reliable electrode connections.

40KHz BURN-IN AND CORONA SCREENING

Type BF51 teflon foil capacitors are being used in a high frequency switching application with a rise time of less than 1 microsecond, in a limited space. Typically a 0.025 μF, 400VDC rated teflon foil, oil impregnated capacitor operates with; 200 volt peak to peak, 10KHz square wave voltage conditions, a rise and fall time of 100 nanoseconds, in a 0.312 x 1.063 case. Under these conditions this teflon capacitor is relatively cool with peak current of 30 amps developed at a 20KHz repetition rate.

Following is the 100% screening used for this AC application.

1. **Burn-in** for 48 hours at 125°C. Apply 180Vrms at 40KHz ±5%.
2. **Thermal aging** temperature cycle 5 times −65°C to +125°C. Per MIL-C-83421.
3. **Seal Test** Bake for 4 hours at 125°C. Check for oil leakage or visual damage.
4. **Corona Test** Apply 400Vrms at 60Hz and check for evidence of corona inception.
5. **AC Stress Test** Apply 100Hz square wave voltage, terminal to terminal, for 1 minute, per MIL-C-83421/1, at 1000 volts peak to peak.
6. **DC Hipot** Apply 800VDC terminal to terminal and to case at 25°C for 1 minute, per MIL-C-83421.
7. **Insulation Resistance** when measured with 400VDC at 25°C, 1,000,000 megohms minimum.
8. **% Capacitance** at 1 KHz
9. **% Dissipation** factor at 10KHz, 0.01% maximum.
10. **Final visual** and mechanical inspection.

COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA CALIF. 90404 • (213) 829-3615. TWX (910) 343-6864

CRC
COMPONENT RESEARCH CO.

FAILURE ANTICIPATION & IMPROVED RELIABILITY

ESTABLISHED RELIABILITY CAPACITORS

Plastic film dielectric type capacitors can provide remarkably good electrical characteristics and high reliability but it takes a combination of sound construction, suitable film quality, exacting process control, and 100% testing to achieve this.

Because we are concerned with a proliferation of marginal quality capacitors frequently used in high reliability level aerospace and industrial applications, we are listing below some pitfalls to avoid.

MIS-APPLICATION OF CAPACITORS IN AC CIRCUITS

The highest quality capacitor will fail if its ratings are exceeded by subjecting it to excessive voltage and current stresses. In sinusoidal applications metallized capacitors that warm up over 20°C after several hours of operation are considered a borderline case. You may be applying too high an RMS voltage or frequency.

If the capacitors you are using have higher than normal dissipation factor readings, this may be a sign of high series resistance caused by poor termination on the capacitor section. The square wave AC screening for one minute covered in MIL-C-83421/1 is a good way of eliminating capacitors with gross dissipation factor quality.

If dissipation factor limits are set too high as post test requirements, suspect capacitors will pass the square wave test. In fact terminations may have been damaged by this test, but are permitted to pass what we consider are abnormally high DF limits. A termination that is poor at room temperature generally should be worse at higher temperature and increased heating caused by power loss at the terminations may cause ultimate degeneration and possible failure. We consider 100% AC burn-in at elevated temperature an excellent method of checking for good terminations. Burn-in should be followed in 100% dissipation factor examination.

In SCR commutation and transistor switching type applications heat rise measurements by themselves are not a sufficient means of determining capacitor reliability. In these cases the capacitor is subjected to relatively high peak currents at a low duty cycle. A capacitor not designed for high peak current use while never exhibiting more than a few degrees of heat rise during operation, may open after hours or possibly months of operation.

We recommend that you forward copies of your oscilloscope current and voltage waveforms for analysis of your non-sinusoidal applications.

CAPACITOR OPENS & INTERMITTENTS AFTER ENVIRONMENTAL TESTING OR LONG TERM STORAGE

CRC is frequently requested to replace "Brand X" metallized capacitors (which may have cost 50% less) that fail after being qualified for the application and after passing initial breadboard and preproduction test.

Unfortunately many specifications and programs do not take the effects of temperature cycling into consideration. Capacitor termination may withstand DC burn-in, DC life and even AC life.

Dimensional changes between plastic and metal materials as a result of temperature cycling may result in microscopic ruptures of termination joints, possible electrode oxidation and generally unstable termination series resistance. This is the reason we recommend 100% temperature cycling or thermal aging followed by the screening as described above. Component Research Company patented stress-free termination designs and precise quality control eliminates the above problems.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

AC RATED CAPACITORS RELIABILITY QUESTIONS & ANSWERS

ESTABLISHED RELIABILITY CAPACITORS

What are the limiting factors restricting the use of metallized polycarbonate capacitors for AC applications?

A properly manufactured and screened capacitor can handle considerable RMS and peak currents from −55°C to +125°C without significant heat rise. The dissipation factor of capacitors to be used in AC applications must be uniformly low to limit watt loss.

We recommend a maximum dissipation factor of 0.15% at 1KHz as the acceptance test limit. All capacitors should be subjected to temperature cycling prior to final measurement of DF to insure that they remain less than 0.15%. This test eliminates failures which may occur after storage at extreme temperatures.

CRC specifications contain the maximum RMS current and voltage ratings for sinusoidal conditions, continuous duty cycle, at 400Hz and 40KHz. For conditions other than shown, send a sketch of the current and voltage waveforms under worst case and normal operating conditions to our sales office. Include all other information necessary for quotation purposes.

Is polycarbonate better than other dielectrics for AC applications?

If size, weight, cost, or operating temperatures were not important considerations, then other dielectric style capacitors would be superior to polycarbonate.

As an example, CRC can supply polystyrene, teflon, or polypropylene AC capacitors with approximately ten times lower loss than the series 12 polycarbonate capacitors.

Polysulfone is slightly better than polycarbonate for AC applications below 100° C, and can be used above 125°C (the limit for polycarbonate), to 150°C with proper voltage derating.

CRC considers mylar and paper dielectric styles too lossy for AC applications and therefore does not recommend this type for such requirements. Additional information on AC capacitors appears on other pages of this catalog.

What type of screening test will assure that the polycarbonate capacitors are reliable for AC applications?

Once it has been determined that your application requirements can be met by CRC standard polycarbonate series 12 capacitors, the screening test used by CRC and incorporated into MIL-C-83421/1 will be sufficient to provide the quality assurance needed.

As an example, 100% of the capacitors are temperature cycled then subjected to a square wave voltage at 100Hz at 300% of rated DC voltage for peak to peak amplitude.

During this test the capacitors must handle approximately 35 microsecond wide current pulses for one minute at a rate of 200 per second.

A routine examination of the current and voltage waveforms during square wave hipot of 10 uF, 50VDC type CRH capacitors, shows that with 150 volts peak to peak voltage at 100Hz applied, the peak current is 85 amps. This is equivalent to operation with a half sine wave peak current pulse of 8.5 amps/uF at a 200 PPS rate. SEE WAVEFORMS AT RIGHT.

Following the square wave voltage stress test the capacitors must meet 0.15% max. dissipation factor limits.

Life testing of CRC metallized polycarbonate capacitors at 400 Hz and 4000 Hz is performed continuously as retention of qualification to MIL-C-83421/1.

Why are CRC low dissipation factor polycarbonate capacitors replacing commonly manufactured capacitors in AC applications?

There is a risk that the dissipation factor of such capacitors will increase with use and result in hot spots at the terminations. Field failures of such capacitors have been reported where the capacitors have exploded and caused fire damage.

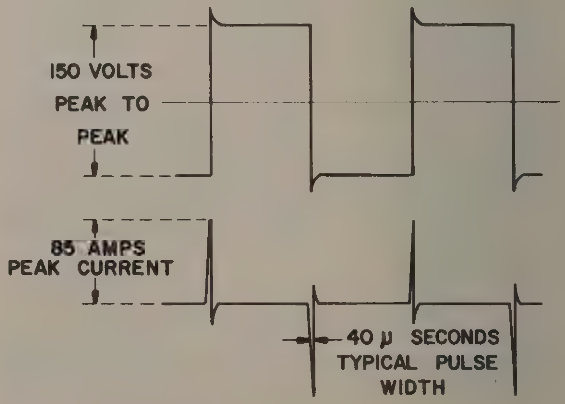
It may be possible to use ordinary higher DF capacitors without noticeable problems at 400Hz, provided that RMS voltage is sufficiently low such that the RMS current is limited. Heat sinking will also help prevent excess heat rise due to poor quality terminations.

Interestingly enough CRC polycarbonate capacitors have a lower dissipation factor at temperatures from 75°C to 125°C than at 25°C which lowers their effective heat rise at higher temperatures. Where the current source is limited, higher DF capacitors may not heat sufficiently to short, but may gradually suffer from increasing DF to the point where they are effectively open.

What is the maximum current that can be applied to MIL-C-83421/1 capacitors?

The 40 KHz current and voltage ratings listed in Table 1 of the Mil-Spec and CRC's specifications shown in this catalog, are based upon continuous operation under sinusoidal conditions. In order to eliminate failures it is essential that any use under conditions exceeding these limits be discussed further with our applications engineers. Under certain conditions, the capacitors can be used at higher frequencies and in square wave filtering applications. For good reliability it is best to study these special applications on an individual basis. CRC plans to provide data tables showing allowable working conditions during higher frequency sinusoidal, pulsed, and non-sinusoidal conditions.

TYPICAL VOLTAGE AND PEAK CURRENT WAVEFORMS SHOWN FOR A12B106, 10 uF, 50 V, METALLIZED POLYCARBONATE CAPACITOR DURING THE ONE MINUTE AC SQUARE WAVE SCREENING AT 100 Hz.



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

VOLTAGE TEMPERATURE SCANNING FOR CAPACITOR FAULTS

ESTABLISHED RELIABILITY CAPACITORS

SCREENING FOR HIGH IMPEDANCE FAULTS

All types of capacitors whether metallized or foil, single or dual dielectric construction, can behave intermittently when operated under certain combined conditions of temperature, and high impedance or low power.

As a result of testing thousands of capacitors using computer scanning techniques and analysis of discrepant parts, the following has been concluded:

1) Low resistance faults such as clearings are not visible in CRC capacitors when they are operated under specified conditions. The CRC method of inspection, processing, and grading all film used in a capacitor prior to winding, assures that low resistance faults will not occur. A low resistance fault can arbitrarily be called a conductive path of less than 10,000 ohms.

2) Electro-chemical effects of contamination within the capacitor enclosure can cause spurious, random conduction when the capacitor is operated at elevated temperature in current limited applications such as in the feedback loop of an operational amplifier. Under some conditions the effect is polar resulting in low leakage current with voltage applied in one direction and increased leakage current in the other direction.

The resistance levels for faulty metallized polycarbonate capacitors at 125°C may vary from 10,000 megohms to as low as 1 megohm for capacitors 1 μF and less.

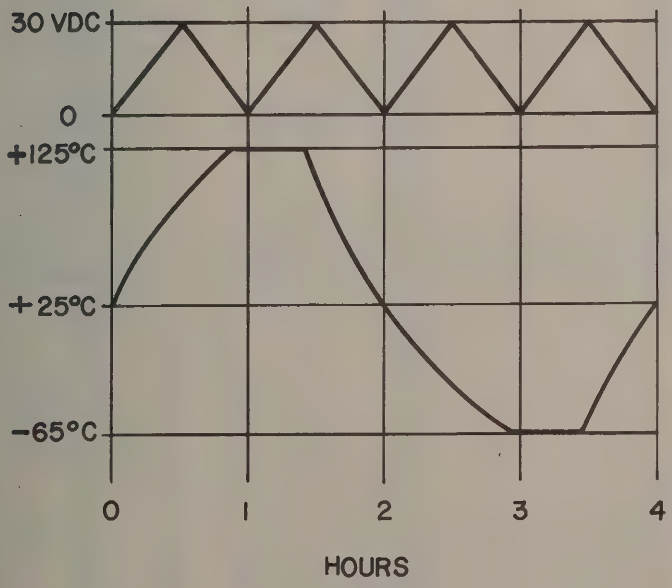
3) High resistance faults of this type are not readily detectable with conventional equipment and will not usually affect performance of most circuits particularly if kept in operation below 100°C.

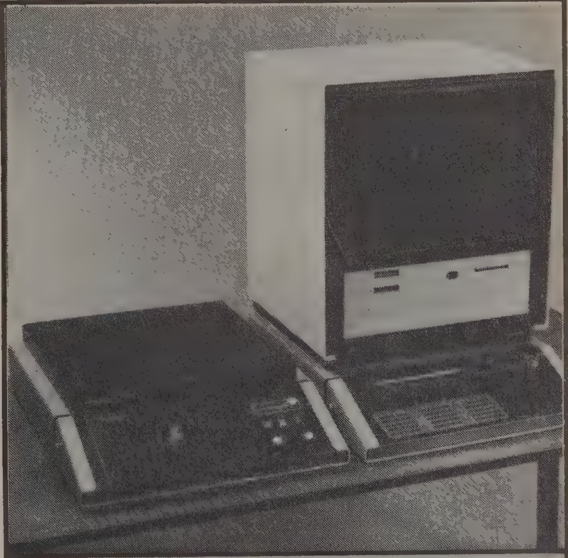
4) Non-hermetically sealed capacitors or hermetically sealed types with fine or gross leak conditions which have ingested water or other contaminates tend to develop electro-chemical activity within the capacitor enclosure. This type of fault may be accelerated by condensation or pressure changes when the equipment sees temperature differences such as in aircraft or varying humidity conditions.

5) CRC eliminates contamination from its product before sealing and can screen for low or high resistance faults under worst case operating conditions.

Contact CRC for special fault screening if your requirement must have freedom from clearings, intermittent conduction at high temperature and if it must in every way be noise-free electrically.

TYPICAL VOLTAGE/ TEMPERATURE RAMP SCREENING CYCLE





This General Radio model 2230 Component Test System is used in conjunction with CRC specially designed ramp generators, cycling chambers, and interface equipment for voltage/temperature capacitor fault-scanning.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

THERMAL SHOCK TEST
500 CYCLES

ESTABLISHED RELIABILITY CAPACITORS

DATA COVERS A12A 30VDC METALLIZED POLYCARBONATE CAPACITORS

Applications such as the space shuttle require capacitors which can withstand many thermal shock cycles without deterioration of terminations.

In 1976 George C. Marshall Space Flight Center contracted Component Research to manufacture and test MIL-C-83421/1 style parts to withstand 500 thermal shock cycles, while maintaining electrical integrity without becoming intermittent.

One hundred and fifty capacitors incorporating design improvements (which have been implemented in all standard parts since completion of the test) were manufactured and subsequently underwent 500 thermal shock cycles.

One hundred and forty nine (149) capacitors survived the tests. Failure analysis of the failed part was due to a poor solder joint, initially detected during acceptance tests as having poor dissipation factor and equivalent series resistance measurements. Operator error precluded the capacitor being eliminated from the test program.

HIGHLIGHTS OF 500 THERMAL SHOCK CYCLE TEST

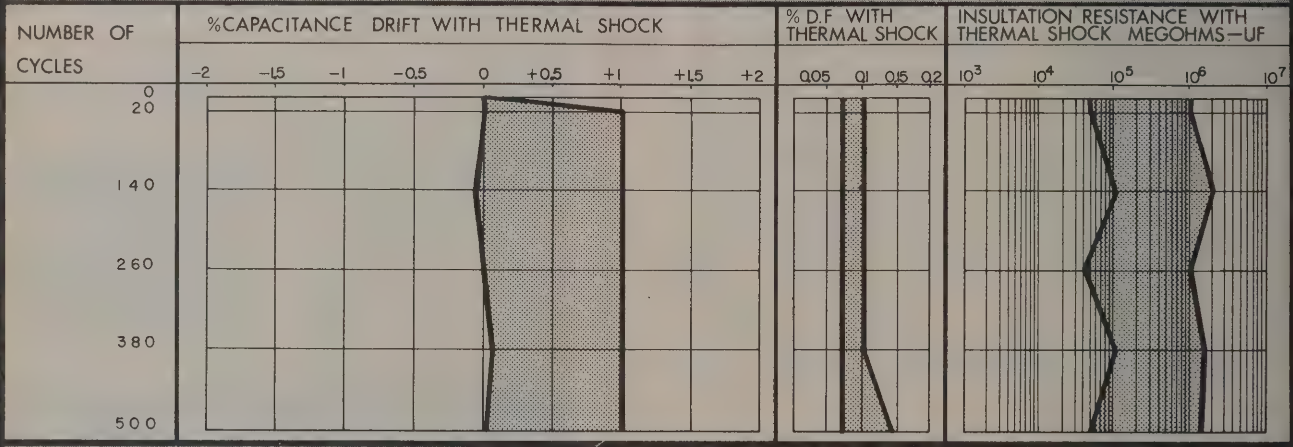
- **60 capacitors were subjected to 500 thermal shock cycles** for accelerated test in liquid to liquid, at the rate of fifty (50) cycles per day. The capacitors were immersed into each liquid for sixty (60) seconds and transferred from one bath to another within fifteen (15) seconds. The temperature extremes were −55°C and 125°C.

TEST RESULTS: (60 CAPACITORS)
+0.84% MAXIMUM CAPACITANCE DRIFT
0.11% MAXIMUM DISSIPATION FACTOR @ 1KHz
0.22% MAXIMUM DISSIPATION FACTOR @ 10KHz
0.19 OHMS MAXIMUM EQUIVALENT SERIES RESISTANCE @ 100KHz
1.6x10^7 MEG's-uF MINIMUM INSULATION RESISTANCE
■ ALL PARTS PASSED 1x10^{-6}ATM/CM^3/SEC MAX LEAK RATE

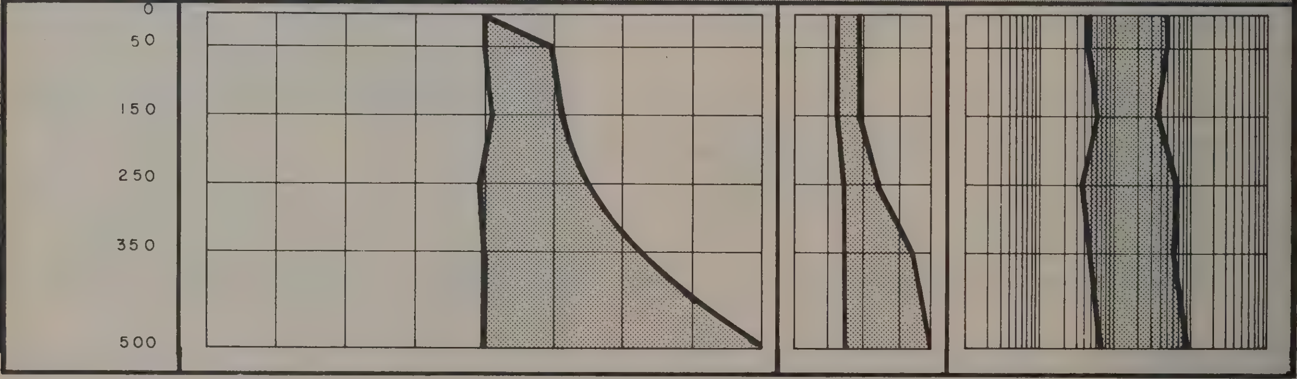
- **90 capacitors were subjected to 500 thermal shock cycles** in air to air, at the rate of one (1) cycle per hour. The dwell time at each temperature extreme was a minimum of thirty (30) minutes. The maximum transfer time from one chamber to another was sixty (60) seconds. The temperature extremes were −55°C to +125°C.

TEST RESULTS: (90 CAPACITORS)
+6.3% MAXIMUM CAPACITANCE DRIFT
0.095% MAXIMUM DISSIPATION FACTOR @ 1KHz
0.46% MAXIMUM DISSIPATION FACTOR @ 10KHz
0.53 OHMS MAXIMUM EQUIVALENT SERIES RESISTANCE @ 100KHz
9.7x10^5 MEG'S-uF MINIMUM INSULATION RESISTANCE

500 THERMAL SHOCKS AIR TO AIR −55°C TO +125°C



500 THERMAL SHOCKS LIQUID TO LIQUID −55°C TO +125°C



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

LIFE TEST - 40,000 HOURS

ESTABLISHED
RELIABILITY
CAPACITORS

PURPOSE OF 40,000 HOUR LIFE TEST

In 1972 CRC decided to conduct long term life tests on 50VDC metallized polycarbonate capacitors to study the effects of operation at 100°C and rated voltage on capacitance drift, insulation resistance, and dissipation factor.

After five years of test (including approximately 10 months of overstress at 125°C and 280% of rated DC), CRC is pleased to report that our capacitors are highly recommended for long life requirements.

In 1970 thousands of CRC metallized polycarbonate capacitors were used in an underwater cable application requiring a minimum of 20 years operation without failure. There have been no reported failures to date in this critical application or in others, such as long term space probes.

HIGHLIGHTS OF 40,000 HOUR LIFE TESTING

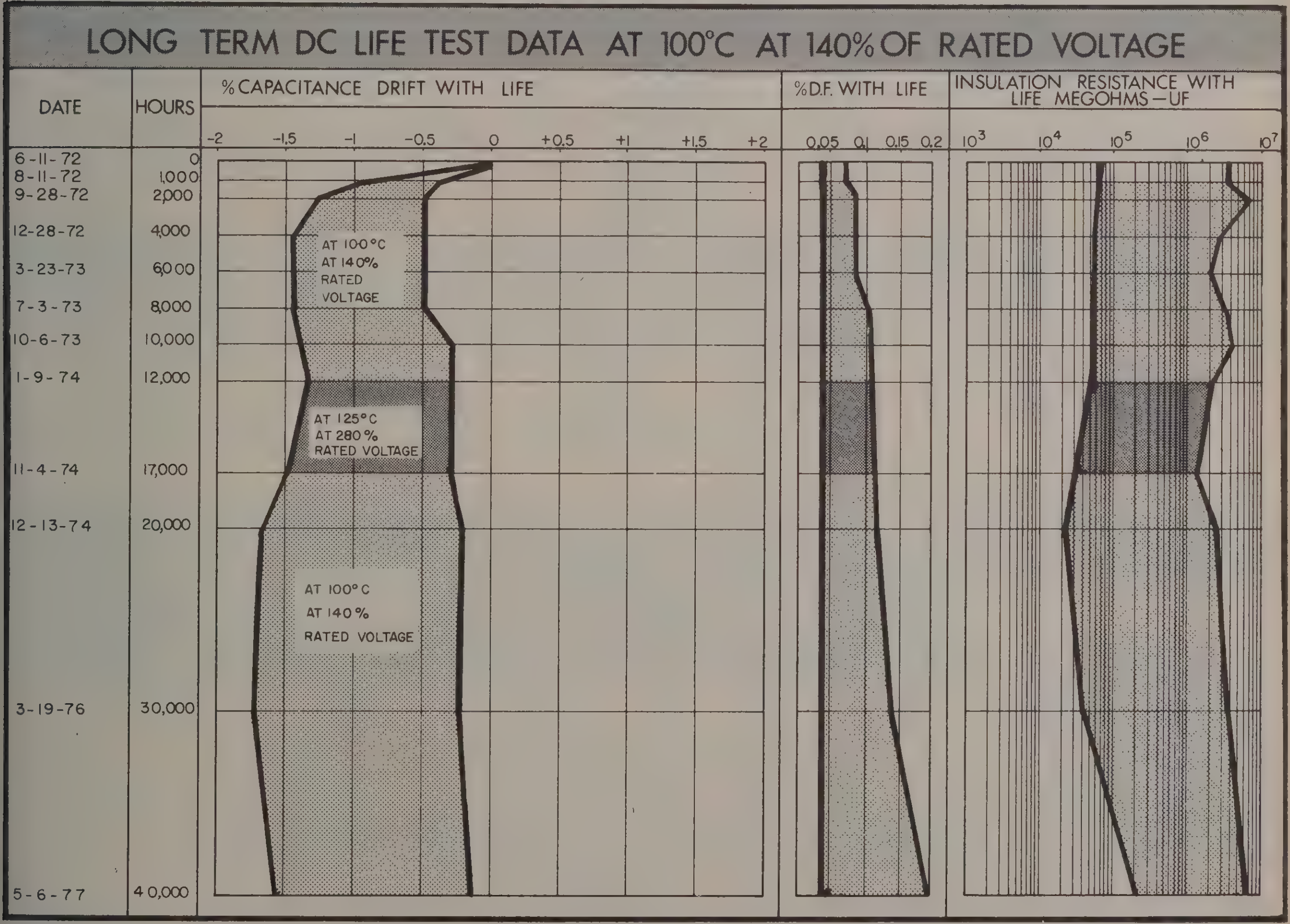
Test conditions were 50VDC at 100°C for 12,000 hours for 45 capacitors resulting in 0.27% max. capacitance drift, 0.17% max. dissipation factor, and 750,000 megs-uF minimum insulation resistance.

5000 additional hours (in error) were at 125°C and 70VDC which is actually at 280% of rated voltage considering that 50% derating is required from 100°C to 125°C.

As a result one capacitor shorted, capacitance drift was −1.5% worst case. Dissipation factor remained 0.17% max. and insulation resistance was 1,000,000 Megs-uF minimum.

Life testing was continued from 17,000 to 40,000 hours at 50VDC and 100°C with 1.25% max. capacitance drift, 0.19% max. dissipation factor, and 35,000 megs-uF minimum insulation resistance at end of test.

It is obvious that considerably reduced drift and parametric change would have resulted if the 5000 hr. overstress period had not occurred.



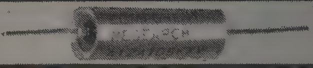
COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE A12 & K12

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES



1.0 µF 30VDC ACTUAL SIZE CAPACITOR

QUALIFIED TO MIL-C-83421/01 FAILURE RATE S.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 22VRMS TO 240VRMS AT FREQUENCIES FROM 0 TO 400Hz. RATINGS TO 40KHz AT LOWER VOLTAGE RATINGS, −65°C TO +100°C WITH DERATED OPERATION AT 125°C, DC RATED 30VDC TO 400VDC.

100% RELIABILITY SCREENING, INCLUDES BURN-IN, TEMPERATURE CYCLING, FINE LEAK TESTS, AND AC SQUARE WAVE TESTS.

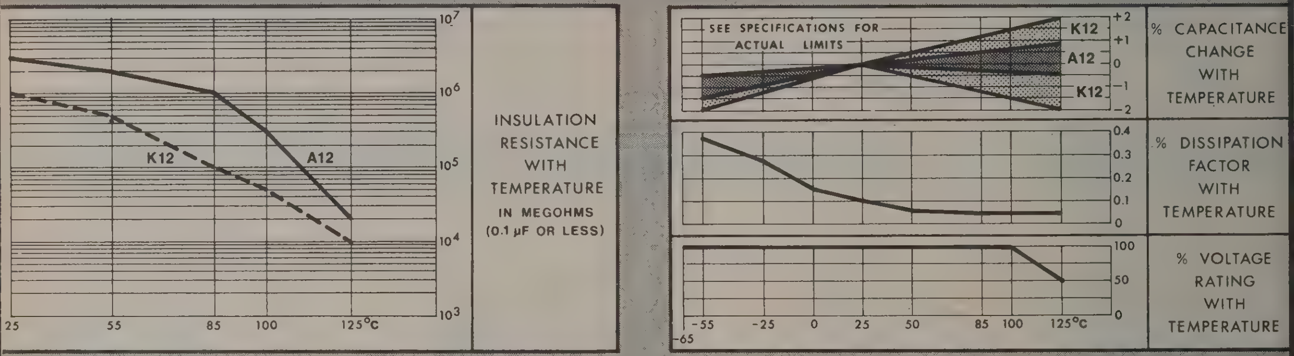
LOW LOSS, RUGGED INTERNAL TERMINATIONS QUALIFIED FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

CAPACITORS HAVE BEEN THERMAL SHOCK TESTED FOR 1000 CYCLES FROM −65°C to +125°C, AIR TO AIR AND LIQUID TO LIQUID, SEE THERMAL SHOCK TEST PAGE.

CAPACITORS OF SAME DESIGN AND CONSTRUCTION HAVE BEEN LIFE TESTED TO 40,000 HOURS, SEE 40,000 HOUR LIFE TEST DATA PAGE.

AVAILABLE IN STANDARD TOLERANCES: 0.25%, 0.5%, 1%, 2%, 5%, 10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #77TR116

TEST RESULTS FOR SERIES A12 CAPACITORS LIFE TESTED FOR 2000 HOURS AT 100°C AT 140% OF RATED DC VOLTAGE.

THERE WERE NO FAILURES FOR THIS TEST.

LIST OF CAPACITORS SUBMITTED TO LIFE TEST			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
A12A	.1	20	$1x10^6$	$3x10^6$	$4x10^6$	±2.0	0.00	+.40	.25	.07	.08
A12A	.001	20	$1x10^6$	$1x10^7$	$30x10^6$	±2.0	−.38	+.06	.25	.05	.05
A12B	1.0	20	$1x10^5$	$8x10^5$	$1x10^6$	±2.0	−.03	+.18	.25	.04	.05
A12B	.018	20	$1x10^6$	$1.2x10^7$	$2.5x10^7$	±2.0	−.33	−.16	.25	.07	.08
A12C	4.7	20	$2x10^4$	$1.1x10^5$	$5x10^5$	±2.0	−.13	−.06	.25	.04	.05
A12C	.039	20	$1x10^6$	$1.4x10^7$	$2x10^7$	±2.0	−.07	+.05	.25	.08	.08
A12D	.56	30	$1.8x10^5$	$1.6x10^6$	$1.8x10^6$	±2.0	−.03	+.05	.25	.05	.06
A12E	.01	30	$1x10^6$	$4x10^7$	$6.6x10^7$	±2.0	+.02	−.16	.25	.07	.07

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE A12 & K12

ESTABLISHED RELIABILITY CAPACITORS

A12 AND K12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.		
ENVIRONMENTAL	Capacitors meet all environmental requirements and are qualified to MIL-C-83421/1.		
OPERATING TEMPERATURE	−65°C to +100°C		At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum		At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum		At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum		At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated DC voltage		At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT (IN % CAPACITANCE)	A12	−1.0% to +1.2%	From +25°C to +125°C
	K12	±2%	
	A12	0% to −2.5%	From −55°C to 25°C
	K12	−0.5% to −2.0%	
CAPACITANCE STABILITY (IN % CAPACITANCE)	A12	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
	K12	±0.25%	
HERMETIC SEAL	1×10^{-6}atm/cm^3/sec.		Maximum leak rate.
INSULATION RESISTANCE	See Insulation Resistance Table		Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R.
EXAMPLE: A 0.5uF, SERIES A12 CAPACITOR AT 25°C IS 300,000 ÷ 0.5 = 600,000 MEGOHMS.

RANGE	STYLE	25°C	55°C	85°C	100°C	125°C
.001 TO 0.1uF	A12	3,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	300,000 Megohms	20,000 Megohms
	K12	1,000,000 Megohms	500,000 Megohms	100,000 Megohms	50,000 Megohms	10,000 Megohms
GREATER THAN 0.1uF	A12	300,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	30,000 Megohms-uF	2,000 Megohms-uF
	K12	100,000 Megohms-uF	50,000 Megohms-uF	10,000 Megohms-uF	5,000 Megohms-uF	1,000 Megohms-uF

A12 AND K12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL	
					A12	K12
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test	Not Req'd
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C (5 cycles min. for K12)	4.7.3	No physical damage	100% Test	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10^{-6}atm/cm^3/sec. max.	100% Test	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8.	Per part number	100% Test	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO

METALLIZED POLYCARBONATE A12 & K12 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE 12A 30VDC			TYPE 12B 50VDC			TYPE 12C 100VDC			TYPE 12D 200VDC			TYPE 12E 400VDC		
	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C
.001	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0033	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0039	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0047	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.005	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0056	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0068	.170	.500	.600	.170	.500	.600	.170	.562	.662	.170	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.012	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.015	.170	.500	.600	.170	.562	.662	.170	.687	.787	.235	.562	.662	.235	.813	.913
.018	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.02	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.022	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.039	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913
.047	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.05	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.056	.170	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	.813	.913
.068	.170	.687	.787	.193	.687	.787	.235	.813	.913	.312	.813	.913	.400	.813	.913
.075	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.562	.662	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.400	1.375	1.475
.18	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.2	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.22	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.27	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.33	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.39	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.47	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.5	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.56	.312	.687	.787	.400	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.68	.312	.687	.787	.400	.813	.913	.500	1.125	1.225	.562	1.375	1.475	.750	1.875	1.975
.75	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
.82	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
1.0	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
1.2	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	1.000	1.875	1.975
1.5	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475
1.8	.400	.813	.913	.400	1.063	1.163	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.0	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.2	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.5	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
2.7	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
3.0	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.3	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.9	.400	1.375	1.475	.562	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
4.7	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.0	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.6	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
6.8	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
7.5	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
8.2	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
10.0	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
12.0	.562	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475						
15.0	.562	1.875	1.975	.750	1.875	1.975									
18.0	.670	1.875	1.975	1.000	1.875	1.975									
20.0	.670	1.875	1.975	1.000	1.875	1.975									
22.0	.670	1.875	1.975	1.000	1.875	1.975									
25.0	.750	1.875	1.975	1.000	2.375	2.475									
27.0	.750	1.875	1.975	1.000	2.375	2.475									

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads. CRC "C" dimensions for A12 and K12 capacitors is 0.1″ less than MIL-C-83421/1 requires.

A12 | A | 104 | J | S | W

STYLE

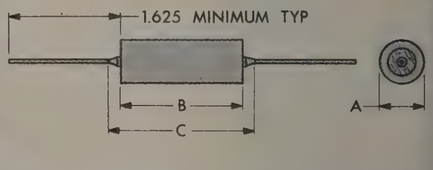
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC
E=400VDC

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET ■ SANTA MONICA, CALIF. 90404 ■ (213) 829-3615. TWX: (910) 343-6864

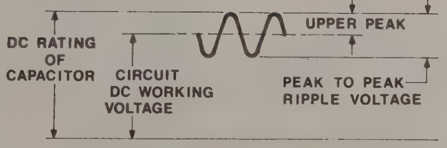
CRC
COMPONENT RESEARCH CO.

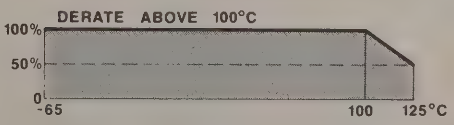
METALLIZED POLYCARBONATE A12 & K12 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE 12A 30VDC AC RATINGS			TYPE 12B 50VDC AC RATINGS			TYPE 12C 100VDC AC RATINGS			TYPE 12D 200VDC AC RATINGS			TYPE 12E 400VDC AC RATINGS		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.001	22.0	22.0	.0055	36.0	36.0	.0090	60.0	60.0	.015	120.0	120.0	.030	240.0	240.0	.060
.0012	22.0	22.0	.0066	36.0	36.0	.0108	60.0	60.0	.018	120.0	120.0	.036	240.0	240.0	.072
.0015	22.0	22.0	.0083	36.0	36.0	.0135	60.0	60.0	.0225	120.0	120.0	.045	240.0	240.0	.090
.0018	22.0	22.0	.0099	36.0	36.0	.0162	60.0	60.0	.027	120.0	120.0	.054	240.0	240.0	.108
.002	22.0	22.0	.0110	36.0	36.0	.0180	60.0	60.0	.030	120.0	120.0	.060	240.0	240.0	.120
.0022	22.0	22.0	.0121	36.0	36.0	.0198	60.0	60.0	.033	120.0	120.0	.066	240.0	240.0	.132
.0027	22.0	22.0	.0149	36.0	36.0	.0243	60.0	60.0	.0405	120.0	120.0	.081	240.0	240.0	.162
.0033	22.0	22.0	.0182	36.0	36.0	.0297	60.0	60.0	.0495	120.0	120.0	.099	240.0	240.0	.198
.0039	22.0	22.0	.0215	36.0	36.0	.0351	60.0	60.0	.0585	120.0	120.0	.117	240.0	240.0	.234
.0047	22.0	22.0	.0259	36.0	36.0	.0423	60.0	60.0	.0705	120.0	120.0	.141	240.0	240.0	.282
.005	22.0	22.0	.0275	36.0	36.0	.0450	60.0	60.0	.075	120.0	120.0	.150	240.0	240.0	.300
.0056	22.0	22.0	.0308	36.0	36.0	.0504	60.0	60.0	.084	120.0	120.0	.168	240.0	240.0	.336
.0068	22.0	22.0	.0374	36.0	36.0	.0612	60.0	60.0	.102	120.0	120.0	.204	240.0	240.0	.408
.0075	22.0	22.0	.0413	36.0	36.0	.0675	60.0	60.0	.1125	120.0	120.0	.225	240.0	240.0	.450
.0082	22.0	22.0	.0451	36.0	36.0	.0738	60.0	60.0	.123	120.0	120.0	.246	240.0	240.0	.492
.01	22.0	22.0	.0550	36.0	36.0	.090	60.0	60.0	.150	120.0	120.0	.30	240.0	240.0	.60
.012	22.0	22.0	.0660	36.0	36.0	.108	60.0	60.0	.180	120.0	120.0	.36	240.0	240.0	.72
.015	22.0	22.0	.0825	36.0	36.0	.135	60.0	60.0	.225	120.0	120.0	.45	240.0	240.0	.90
.018	22.0	22.0	.0990	36.0	36.0	.162	60.0	60.0	.270	120.0	120.0	.54	240.0	240.0	1.08
.02	22.0	22.0	.1100	36.0	36.0	.180	60.0	60.0	.300	120.0	120.0	.60	240.0	240.0	1.20
.022	22.0	22.0	.1210	36.0	36.0	.198	60.0	60.0	.330	120.0	120.0	.66	240.0	240.0	1.32
.027	22.0	22.0	.1485	36.0	36.0	.243	60.0	60.0	.405	120.0	120.0	.81	240.0	240.0	1.62
.033	22.0	22.0	.1815	36.0	36.0	.297	60.0	60.0	.495	120.0	120.0	.99	240.0	240.0	1.98
.039	22.0	22.0	.2145	36.0	36.0	.351	60.0	60.0	.585	120.0	120.0	1.17	240.0	220.51	2.15
.047	22.0	22.0	.2585	36.0	36.0	.423	60.0	60.0	.705	120.0	120.0	1.41	240.0	212.76	2.50
.05	22.0	22.0	.2750	36.0	36.0	.450	60.0	60.0	.750	120.0	120.0	1.50	240.0	200.00	2.50
.056	22.0	22.0	.3080	36.0	36.0	.504	60.0	60.0	.840	120.0	120.0	1.68	240.0	178.57	2.50
.068	22.0	22.0	.3740	36.0	36.0	.612	60.0	60.0	1.020	120.0	120.0	2.04	240.0	147.05	2.50
.075	22.0	22.0	.4125	36.0	36.0	.675	60.0	60.0	1.125	120.0	114.66	2.15	240.0	160.00	3.00
.082	22.0	21.95	.450	36.0	36.0	.738	60.0	60.0	1.23	120.0	104.87	2.15	240.0	146.34	3.00
.1	22.0	22.0	.550	36.0	36.0	.85	60.0	60.0	1.50	120.0	86.00	2.15	240.0	120.00	3.00
.12	22.0	22.0	.660	36.0	36.0	1.08	60.0	60.0	1.80	120.0	71.66	2.15	240.0	99.99	3.00
.15	22.0	22.0	.825	36.0	36.0	1.35	60.0	57.33	2.15	120.0	80.00	3.00	240.0	88.00	3.30
.18	22.0	22.0	.990	36.0	36.0	1.62	60.0	47.77	2.15	120.0	73.33	3.30	240.0	77.77	3.50
.2	22.0	22.0	1.100	36.0	34.4	1.72	60.0	43.00	2.15	120.0	66.00	3.30	240.0	70.00	3.50
.22	22.0	22.0	1.210	36.0	31.27	1.72	60.0	39.09	2.15	120.0	60.00	3.30	240.0	63.63	3.50
.27	22.0	22.0	1.485	36.0	30.37	2.05	60.0	33.33	2.25	120.0	51.85	3.50	240.0	63.70	4.30
.33	22.0	18.18	1.50	36.0	24.84	2.05	60.0	27.27	2.25	120.0	42.42	3.50	240.0	52.12	4.30
.39	22.0	15.38	1.50	36.0	22.05	2.15	60.0	30.76	3.00	120.0	35.89	2.50	240.0	46.15	4.50
.47	22.0	17.44	2.05	36.0	18.29	2.15	60.0	25.53	3.00	120.0	29.78	3.50	240.0	38.29	4.50
.5	22.0	16.4	2.05	36.0	17.20	2.15	60.0	24.00	3.00	120.0	28.00	3.50	240.0	36.00	4.50
.56	22.0	14.64	2.05	36.0	17.85	2.50	60.0	21.42	3.00	120.0	25.00	3.50	240.0	32.14	4.50
.68	22.0	12.05	2.05	36.0	14.70	2.50	60.0	19.41	3.30	120.0	25.29	4.30	240.0	35.29	6.00
.75	22.0	11.46	2.15	36.0	16.00	3.00	60.0	17.60	3.30	120.0	24.00	4.50	240.0	32.00	6.00
.82	22.0	10.48	2.15	36.0	14.63	3.00	60.0	16.09	3.30	120.0	21.95	4.50	240.0	29.26	6.00
1.0	22.0	8.6	2.15	36.0	12.00	3.00	60.0	16.00	4.00	120.0	18.00	4.50	240.0	24.00	6.00
1.2	22.0	7.16	2.15	36.0	9.99	3.00	60.0	13.33	4.00	120.0	15.00	4.50	240.0	21.33	6.40
1.5	22.0	6.66	2.50	36.0	8.00	3.00	60.0	11.46	4.30	120.0	14.13	5.30	240.0	18.66	7.00
1.8	22.0	5.55	2.50	36.0	6.66	3.00	60.0	11.11	5.00	120.0	13.33	6.00	240.0	15.55	7.00
2.0	22.0	5.0	2.50	36.0	6.60	3.30	60.0	10.00	5.00	120.0	12.00	6.00	240.0	14.00	7.00
2.2	22.0	4.54	2.50	36.0	6.00	3.30	60.0	9.09	5.00	120.0	10.09	6.00	240.0	12.72	7.00
2.5	22.0	4.8	3.00	36.0	5.60	3.50	60.0	8.48	5.30	120.0	9.60	6.00			
2.7	22.0	4.44	3.00	36.0	5.18	3.50	60.0	7.85	5.30	120.0	8.88	6.00			
3.0	22.0	3.99	3.00	36.0	4.66	3.50	60.0	7.06	5.30	120.0	8.53	6.40			
3.3	22.0	3.63	3.00	36.0	4.24	3.50	60.0	6.42	5.30	120.0	7.75	6.40			
3.9	22.0	3.38	3.30	36.0	4.41	4.30	60.0	6.15	6.00	120.0	7.17	7.00			
4.7	22.0	2.97	3.50	36.0	4.25	5.00	60.0	5.10	6.00	120.0	5.95	7.00			
5.0	22.0	2.8	3.50	36.0	4.00	5.00	60.0	4.80	6.00	120.0	5.60	7.00			
5.6	22.0	2.5	3.50	36.0	3.57	5.00	60.0	4.28	6.00	120.0	5.00	7.00			
6.8	22.0	2.52	4.30	36.0	3.11	5.30	60.0	4.11	7.00						
7.5	22.0	2.29	4.30	36.0	2.82	5.30	60.0	3.73	7.00						
8.2	22.0	2.09	4.30	36.0	2.58	5.30	60.0	3.41	7.00						
10.0	22.0	1.72	4.30	36.0	2.12	5.30	60.0	2.80	7.00						
12.0	22.0	1.50	4.50	36.0	2.00	6.00	60.0	2.33	7.00						
15.0	22.0	1.2	4.50	36.0	1.60	6.00									
18.0	22.0	1.17	5.30	36.0	1.42	6.40									
20.0	22.0	1.06	5.30	36.0	1.28	6.40									
22.0	22.0	0.96	5.30	36.0	1.16	6.40									
25.0	22.0	0.96	6.00	36.0	1.12	7.00									
27.0	22.0	0.88	6.00	36.0	1.03	7.00									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615, TWX: (910) 343-6864

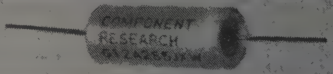
CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE G12

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

2.5 µF 30VDC ACTUAL SIZE CAPACITOR



MINIATURE SIZE TO REPLACE NON-HERMETIC WRAP AND FILL, AND MOLDED CAPACITORS.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 22VRMS TO 120VRMS AT FREQUENCIES UP TO 20KHz, −65°C to 100°C, WITH DERATED OPERATION AT 125°C. DC RATED 30VDC TO 200VDC.

100% RELIABILITY SCREENING, INCLUDES BURN-IN, TEMPERATURE CYCLING, FINE LEAK TESTS, AC SQUARE WAVE TESTS.

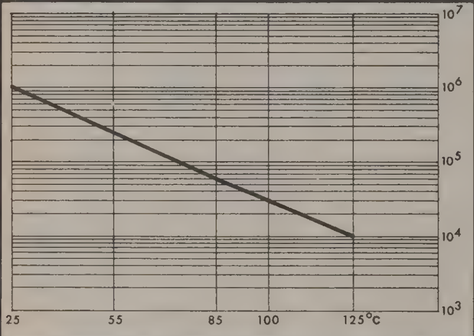
G12 CAPACITORS ARE PRESENTLY DESIGNED INTO MANY NAVY AND AIRFORCE PROGRAMS.

LOW LOSS, RUGGED INTERNAL TERMINATIONS QUALIFIED FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

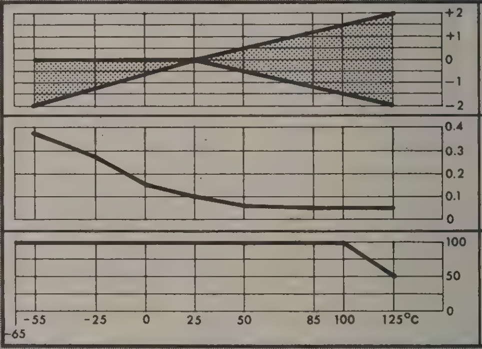
LOWEST PRICED, HIGH RELIABILITY, METALLIZED FILM CAPACITORS FOR HIGH VOLUME PROGRAM USE.

AVAILABLE IN STANDARD CAPACITANCE TOLERANCES, ±1%, ±2%, ±5%, ±10%. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 µF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #78TR129

TEST RESULTS FOR 180 SERIES G12 CAPACITORS LIFE TESTED FOR 2000 HOURS AT 100°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
G12A102	.001	20	3.3×10^5	1.5×10^7	3×10^7	±2	0.000	−.245	.25	.035	.055
G12A153	.015	20	3.3×10^5	1.5×10^7	3×10^7	±2	−.055	−.215	.25	.06	.08
G12B102	.001	20	3.3×10^5	2×10^7	5×10^7	±2	+.005	+.15	.25	.045	.055
G12B684	.68	20	4.9×10^4	1.9×10^6	5×10^6	±2	−.035	−.13	.25	.045	.055
G12C222	.0022	20	3.3×10^5	5×10^7	1×10^8	±2	+.01	−.225	.25	.055	.065
G12C305	3.0	20	1.1×10^4	2.7×10^5	8.3×10^5	±2	0.00	+.07	.25	.04	.045
G12D333	.033	20	3.3×10^5	2×10^7	2.8×10^7	±2	−.005	−.22	.25	.07	.075
G12D564	.56	20	5.9×10^4	1.7×10^6	3.4×10^6	±2	−.06	−.15	.25	.045	.055

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE G12

ESTABLISHED RELIABILITY CAPACITORS

G12 SPECIFICATIONS

CONSTRUCTION	Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminal to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1 × 10-6atm/cm3/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 100,000 ÷ 0.18 = 555,555 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	60,000 Megohms	30,000 Megohms	10,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	6,000 Megohms-uF	3,000 Megohms-uF	1,000 Megohms-uF

G12 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10-6atm/cm3/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED POLYCARBONATE G12 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE G12A 30VDC				TYPE G12B 50VDC				TYPE G12C 100VDC				TYPE G12D 200VDC			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	G12A102	.170	.500	.600	G12B102	.170	.500	.600	G12C102	.170	.500	.600	G12D102	.170	.500	.600
.0012	G12A122	.170	.500	.600	G12B122	.170	.500	.600	G12C122	.170	.500	.600	G12D122	.170	.500	.600
.0015	G12A152	.170	.500	.600	G12B152	.170	.500	.600	G12C152	.170	.500	.600	G12D152	.170	.500	.600
.0018	G12A182	.170	.500	.600	G12B182	.170	.500	.600	G12C182	.170	.500	.600	G12D182	.170	.500	.600
.002	G12A202	.170	.500	.600	G12B202	.170	.500	.600	G12C202	.170	.500	.600	G12D202	.170	.500	.600
.0022	G12A222	.170	.500	.600	G12B222	.170	.500	.600	G12C222	.170	.500	.600	G12D222	.170	.500	.600
.0027	G12A272	.170	.500	.600	G12B272	.170	.500	.600	G12C272	.170	.500	.600	G12D272	.170	.500	.600
.0033	G12A332	.170	.500	.600	G12B332	.170	.500	.600	G12C332	.170	.500	.600	G12D332	.170	.500	.600
.0039	G12A392	.170	.500	.600	G12B392	.170	.500	.600	G12C392	.170	.500	.600	G12D392	.170	.500	.600
.0047	G12A472	.170	.500	.600	G12B472	.170	.500	.600	G12C472	.170	.500	.600	G12D472	.170	.500	.600
.005	G12A502	.170	.500	.600	G12B502	.170	.500	.600	G12C502	.170	.500	.600	G12D502	.170	.500	.600
.0056	G12A562	.170	.500	.600	G12B562	.170	.500	.600	G12C562	.170	.500	.600	G12D562	.170	.500	.600
.0068	G12A682	.170	.500	.600	G12B682	.170	.500	.600	G12C682	.170	.500	.600	G12D682	.170	.500	.600
.0075	G12A752	.170	.500	.600	G12B752	.170	.500	.600	G12C752	.170	.500	.600	G12D752	.170	.562	.662
.0082	G12A822	.170	.500	.600	G12B822	.170	.500	.600	G12C822	.170	.500	.600	G12D822	.170	.562	.662
.01	G12A103	.170	.500	.600	G12B103	.170	.500	.600	G12C103	.170	.500	.600	G12D103	.170	.687	.787
.012	G12A123	.170	.500	.600	G12B123	.170	.500	.600	G12C123	.170	.500	.600	G12D123	.170	.687	.787
.015	G12A153	.170	.500	.600	G12B153	.170	.500	.600	G12C153	.170	.500	.600	G12D153	.170	.687	.787
.018	G12A183	.170	.500	.600	G12B183	.170	.500	.600	G12C183	.170	.562	.662	G12D183	.193	.687	.787
.02	G12A203	.170	.500	.600	G12B203	.170	.500	.600	G12C203	.170	.562	.662	G12D203	.193	.687	.787
.022	G12A223	.170	.500	.600	G12B223	.170	.500	.600	G12C223	.170	.562	.662	G12D223	.193	.687	.787
.027	G12A273	.170	.500	.600	G12B273	.170	.500	.600	G12C273	.170	.562	.662	G12D273	.193	.687	.787
.033	G12A333	.170	.500	.600	G12B333	.170	.500	.600	G12C333	.170	.562	.662	G12D333	.193	.687	.787
.039	G12A393	.170	.500	.600	G12B393	.170	.500	.600	G12C393	.170	.562	.662	G12D393	.235	.687	.787
.047	G12A473	.170	.500	.600	G12B473	.170	.500	.600	G12C473	.193	.562	.662	G12D473	.235	.687	.787
.05	G12A503	.170	.500	.600	G12B503	.170	.500	.600	G12C503	.193	.562	.662	G12D503	.235	.687	.787
.056	G12A563	.170	.500	.600	G12B563	.170	.500	.600	G12C563	.193	.562	.662	G12D563	.235	.687	.787
.068	G12A683	.170	.500	.600	G12B683	.170	.562	.662	G12C683	.235	.562	.662	G12D683	.312	.687	.787
.075	G12A753	.170	.500	.600	G12B753	.170	.562	.662	G12C753	.235	.562	.662	G12D753	.312	.687	.787
.082	G12A823	.170	.562	.662	G12B823	.170	.562	.662	G12C823	.235	.562	.662	G12D823	.312	.687	.787
.1	G12A104	.170	.562	.662	G12B104	.193	.562	.662	G12C104	.235	.687	.787	G12D104	.312	.687	.787
.12	G12A124	.170	.562	.662	G12B124	.193	.562	.662	G12C124	.235	.687	.787	G12D124	.312	.687	.787
.15	G12A154	.170	.562	.662	G12B154	.193	.562	.662	G12C154	.235	.687	.787	G12D154	.312	.813	.913
.18	G12A184	.193	.562	.662	G12B184	.235	.562	.662	G12C184	.235	.687	.787	G12D184	.312	.813	.913
.2	G12A204	.193	.562	.662	G12B204	.235	.562	.662	G12C204	.235	.687	.787	G12D204	.312	.813	.913
.22	G12A224	.193	.562	.662	G12B224	.235	.562	.662	G12C224	.235	.687	.787	G12D224	.312	.813	.913
.27	G12A274	.235	.562	.662	G12B274	.235	.687	.787	G12C274	.312	.687	.787	G12D274	.312	1.063	1.163
.33	G12A334	.235	.562	.662	G12B334	.235	.687	.787	G12C334	.312	.813	.913	G12D334	.312	1.063	1.163
.39	G12A394	.235	.687	.787	G12B394	.235	.687	.787	G12C394	.312	.813	.913	G12D394	.400	1.063	1.163
.47	G12A474	.235	.687	.787	G12B474	.312	.687	.787	G12C474	.400	.687	.787	G12D474	.400	1.063	1.163
.5	G12A504	.235	.687	.787	G12B504	.312	.687	.787	G12C504	.400	.687	.787	G12D504	.400	1.063	1.163
.56	G12A564	.235	.687	.787	G12B564	.312	.687	.787	G12C564	.400	.687	.787	G12D564	.400	1.063	1.163
.68	G12A684	.235	.813	.913	G12B684	.312	.687	.787	G12C684	.400	.813	.913	G12D684	.500	1.125	1.225
.75	G12A754	.235	.813	.913	G12B754	.312	.687	.787	G12C754	.400	.813	.913	G12D754	.500	1.125	1.225
.82	G12A824	.235	.813	.913	G12B824	.312	.687	.787	G12C824	.400	.813	.913	G12D824	.500	1.375	1.475
1.0	G12A105	.235	.813	.913	G12B105	.312	.813	.913	G12C105	.400	1.063	1.163	G12D105	.500	1.375	1.475
1.2	G12A125	.312	.813	.913	G12B125	.312	.813	.913	G12C125	.400	1.063	1.163	G12D125	.500	1.375	1.475
1.5	G12A155	.312	.813	.913	G12B155	.400	.813	.913	G12C155	.400	1.375	1.475				
1.8	G12A185	.312	.813	.913	G12B185	.400	.813	.913	G12C185	.400	1.375	1.475				
2.0	G12A205	.312	.813	.913	G12B205	.400	.813	.913	G12C205	.500	1.375	1.475				
2.2	G12A225	.312	.813	.913	G12B225	.400	.813	.913	G12C225	.500	1.375	1.475				
2.5	G12A255	.312	1.063	1.163	G12B255	.400	.813	.913	G12C255	.500	1.375	1.475				
2.7	G12A275	.312	1.063	1.163	G12B275	.400	1.063	1.163	G12C275	.500	1.375	1.475				
3.0	G12A305	.312	1.063	1.163	G12B305	.400	1.063	1.163	G12C305	.500	1.375	1.475				
3.3	G12A335	.312	1.063	1.163	G12B335	.400	1.063	1.163	G12C335	.500	1.375	1.475				
3.9	G12A395	.400	1.063	1.163	G12B395	.400	1.375	1.475								
4.7	G12A475	.400	1.063	1.163	G12B475	.500	1.375	1.475								
5.0	G12A505	.400	1.063	1.163	G12B505	.500	1.375	1.475								
5.6	G12A565	.400	1.063	1.163	G12B565	.500	1.375	1.475								
6.8	G12A685	.400	1.375	1.475	G12B685	.500	1.375	1.475								
7.5	G12A755	.400	1.375	1.475	G12B755	.500	1.375	1.475								
8.2	G12A825	.500	1.375	1.475	G12B825	.500	1.375	1.475								
10.0	G12A106	.500	1.375	1.475												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving +0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

G12 A 104 J S W

STYLE

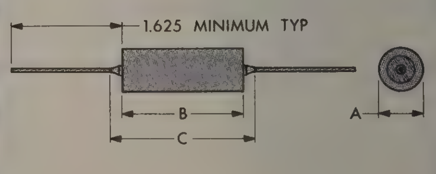
SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20 (.032") for .400" & .500" case dia.

VOLTAGE
A=30VDC
B=50VDC
C=100VDC
D=200VDC

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615, TWX: (910) 343-6864

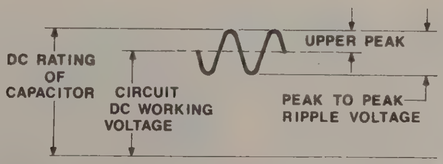
CRC
COMPONENT RESEARCH CO.

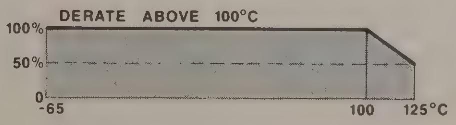
METALLIZED POLYCARBONATE G12 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE G12A 30VDC			TYPE G12B 50VDC			TYPE G12C 100VDC			TYPE G12D 200VDC		
	MAXIMUM RATING			MAXIMUM RATING			MAXIMUM RATING			MAXIMUM RATING		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.0010	22.0	22.0	.0055	36.0	36.0	.0090	60.0	60.0	.0150	120.0	120.0	.030
.0012	22.0	22.0	.0066	36.0	36.0	.0108	60.0	60.0	.0180	120.0	120.0	.036
.0015	22.0	22.0	.0083	36.0	36.0	.0135	60.0	60.0	.0225	120.0	120.0	.045
.0018	22.0	22.0	.0099	36.0	36.0	.0162	60.0	60.0	.0270	120.0	120.0	.054
.0020	22.0	22.0	.0110	36.0	36.0	.0180	60.0	60.0	.0300	120.0	120.0	.060
.0022	22.0	22.0	.0121	36.0	36.0	.0198	60.0	60.0	.0330	120.0	120.0	.066
.0027	22.0	22.0	.0149	36.0	36.0	.0243	60.0	60.0	.0405	120.0	120.0	.081
.0033	22.0	22.0	.0182	36.0	36.0	.0297	60.0	60.0	.0495	120.0	120.0	.099
.0039	22.0	22.0	.0215	36.0	36.0	.0351	60.0	60.0	.0585	120.0	120.0	.117
.0047	22.0	22.0	.0259	36.0	36.0	.0423	60.0	60.0	.0705	120.0	120.0	.141
.0050	22.0	22.0	.0275	36.0	36.0	.0450	60.0	60.0	.0750	120.0	120.0	.150
.0056	22.0	22.0	.0308	36.0	36.0	.0504	60.0	60.0	.0840	120.0	120.0	.168
.0068	22.0	22.0	.0374	36.0	36.0	.0612	60.0	60.0	.1020	120.0	120.0	.204
.0075	22.0	22.0	.0413	36.0	36.0	.0675	60.0	60.0	1125	120.0	120.0	.225
.0082	22.0	22.0	.0451	36.0	36.0	.0738	60.0	60.0	.123	120.0	120.0	.246
.010	22.0	22.0	.0550	36.0	36.0	.090	60.0	60.0	.150	120.0	120.0	.30
.012	22.0	22.0	.0660	36.0	36.0	.108	60.0	60.0	.180	120.0	120.0	.36
.015	22.0	22.0	.0825	36.0	36.0	.135	60.0	60.0	.225	120.0	120.0	.45
.018	22.0	22.0	.0990	36.0	36.0	.162	60.0	60.0	.27	120.0	120.0	.54
.020	22.0	22.0	.1100	36.0	26.0	.180	60.0	60.0	.30	120.0	120.0	.60
.022	22.0	22.0	.1210	36.0	36.0	.198	60.0	60.0	.33	120.0	120.0	.66
.027	22.0	22.0	.1485	36.0	36.0	.243	60.0	60.0	.405	120.0	120.0	.81
.033	22.0	22.0	.1815	36.0	36.0	.297	60.0	54.54	.45	120.0	103.03	.85
.039	22.0	22.0	.2145	36.0	31.79	.31	60.0	46.15	.45	120.0	120.0	1.17
.047	22.0	22.0	.2585	36.0	26.38	.31	60.0	60.00	.705	120.0	120.0	1.41
.050	22.0	22.0	.275	36.0	24.80	.31	60.0	60.00	.75	120.0	120.0	1.50
.056	22.0	22.0	.308	36.0	22.14	.31	60.0	60.00	.84	120.0	107.14	1.50
.068	22.0	18.23	.31	36.0	26.47	.45	60.0	60.00	1.02	120.0	120.00	2.04
.075	22.0	16.53	.31	36.0	24.00	.45	60.0	58.66	1.10	120.0	109.33	2.05
.082	22.0	21.95	.45	36.0	21.95	.45	60.0	53.65	1.10	120.0	100.00	2.05
.100	22.0	18.00	.45	36.0	34.00	.85	60.0	60.00	1.50	120.0	82.00	2.05
.12	22.0	15.00	.45	36.0	28.33	.85	60.0	50.00	1.50	120.0	68.33	2.05
.15	22.0	12.00	.45	36.0	22.66	.85	60.0	40.00	1.50	120.0	57.33	2.15
.18	22.0	18.88	.85	36.0	24.44	1.10	60.0	33.33	1.50	120.0	47.77	2.15
.20	22.0	17.00	.85	36.0	22.00	1.10	60.0	30.00	1.50	120.0	43.00	2.15
.22	22.0	15.45	.85	36.0	20.00	1.10	60.0	27.27	1.50	120.0	39.09	2.15
.27	22.0	16.29	1.10	36.0	22.22	1.50	60.0	30.37	2.05	120.0	33.33	2.25
.33	22.0	13.33	1.10	36.0	18.18	1.50	60.0	26.06	2.15	120.0	27.27	2.25
.39	22.0	15.38	1.50	36.0	15.38	1.50	60.0	22.05	2.15	120.0	30.76	3.00
.47	22.0	12.76	1.50	36.0	17.44	2.05	60.0	19.14	2.25	120.0	25.53	3.00
.50	22.0	12.00	1.50	36.0	16.40	2.05	60.0	18.00	2.25	120.0	24.00	3.00
.56	22.0	10.71	1.50	36.0	14.64	2.05	60.0	16.07	2.25	120.0	21.42	3.00
.68	22.0	10.11	1.72	36.0	12.05	2.05	60.0	14.70	2.50	120.0	19.41	3.30
.75	22.0	9.17	1.72	36.0	10.93	2.05	60.0	13.33	2.50	120.0	17.60	3.30
.82	22.0	8.39	1.72	36.0	10.00	2.05	60.0	12.19	2.50	120.0	17.07	3.50
1.0	22.0	6.88	1.72	36.0	8.60	2.15	60.0	12.00	3.00	120.0	14.00	3.50
1.2	22.0	7.16	2.15	36.0	7.16	2.15	60.0	9.99	3.00	120.0	11.66	3.50
1.5	22.0	5.73	2.15	36.0	6.66	2.50	60.0	8.80	3.30			
1.8	22.0	4.77	2.15	36.0	5.55	2.50	60.0	7.33	3.30			
2.0	22.0	4.30	2.15	36.0	5.00	2.50	60.0	7.00	3.50			
2.2	22.0	3.90	2.15	36.0	4.54	2.50	60.0	6.36	3.50			
2.5	22.0	3.60	2.25	36.0	4.00	2.50	60.0	5.60	3.50			
2.7	22.0	3.33	2.25	36.0	4.44	3.00	60.0	5.18	3.50			
3.0	22.0	2.99	2.25	36.0	3.99	3.00	60.0	4.66	3.50			
3.3	22.0	2.72	2.25	36.0	3.63	3.00	60.0	4.24	3.50			
3.9	22.0	3.09	3.00	36.0	3.38	3.30						
4.7	22.0	2.55	3.00	36.0	2.97	3.50						
5.0	22.0	2.40	3.00	36.0	2.80	3.50						
5.6	22.0	2.14	3.00	36.0	2.50	3.50						
6.8	22.0	1.94	3.30	36.0	2.05	3.50						
7.5	22.0	1.76	3.30	36.0	1.86	3.50						
8.2	22.0	1.71	3.50	36.0	1.70	3.50						
10.0	22.0	1.40	3.50									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829 3615. TWX: (910) 343-6864

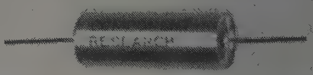
CRC
COMPONENT RESEARCH CO.

METALLIZED TEFLON J11 & K11

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

.068 µF 50VDC ACTUAL SIZE CAPACITOR



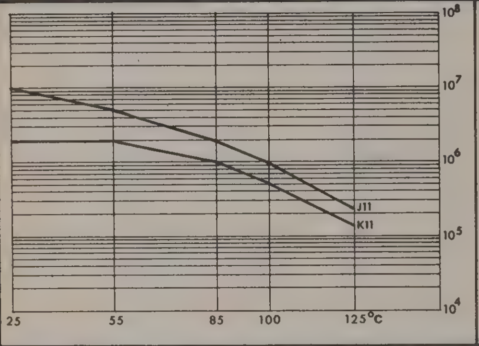
HIGH INSULATION RESISTANCE: 10,000,000 MEGOHMS MINIMUM. (FOR J11 SERIES, ALL VALUES UP TO 0.1uF).

LOW DIELECTRIC ABSORPTION: 0.01% MAXIMUM VOLTAGE RECOVERY.

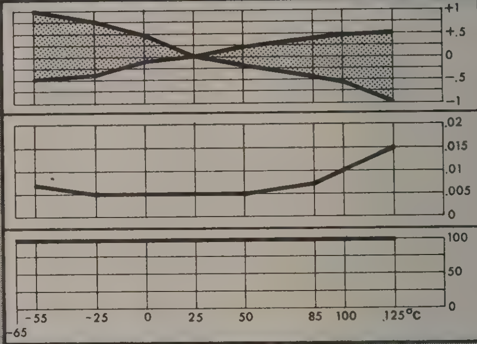
LONG TERM STABILITY: LESS THAN 0.5% CAPACITANCE DRIFT AFTER 2000 HRS. AT 125°C AT RATED VOLTS.

SERIES 11 CAPACITORS HAVE BEEN QUALIFIED FOR USE IN SPACE AND MISSILE SYSTEMS WHERE MAXIMUM RELIABILITY AND LOW DIELECTRIC LOSS ARE ESSENTIAL.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 µF OR LESS)



% CAPACITANCE CHANGE WITH TEMPERATURE

% DISSIPATION FACTOR WITH TEMPERATURE

% VOLTAGE RATING WITH TEMPERATURE

TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- GYRO CIRCUITS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1303

TEST RESULTS FOR 80 SERIES D11B CAPACITORS LIFE TESTED FOR 2000 HOURS AT 125°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. D11B CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN AS J11-K11 SERIES.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
D11B	0.1	12	5×10^5	3.9×10^6	5×10^7	±1	−.035	−.35	.2	.01	.065
D11B	0.22	32	5×10^5	2×10^6	2.5×10^7	±1	−.01	+.85	.2	.005	.075
D11B	0.47	11	5×10^5	1×10^6	1×10^6	±1	−.005	+.58	.2	.01	.10
D11B	1.0	6	2.5×10^5	5.2×10^5	3.8×10^6	±1	−.005	+.24	.2	.01	.12
D11B	0.5	20	5×10^5	3.8×10^6	5×10^7	±1	+.02	+.48	.2	.01	.02

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED TEFLON J11

ESTABLISHED RELIABILITY CAPACITORS

J11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.05% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	 From −0.5% to +1.0% From −0.35% to +0.75% From −0.1% to +0.45% From −0.2% to +0.2% From −0.45% to +0.4% From −0.65% to +0.45% From −1.0% to +0.5%
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm^3/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.68uF CAPACITOR AT 25°C IS 1,000,000 ÷ 0.68 = 1,475,000 MEGOHMS.

RANGE	25°	55°C	85°C	100°C	125°C
.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	25,000 Megohms-uF

J11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	**BURN-IN**	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	**THERMAL AGING**	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	**SEAL TEST (FINE LEAK)**	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6}atm/cm^3/sec. max.	100% Test
4	**SEAL TEST (GROSS LEAK)**	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	**DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)**	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	**INSULATION RESISTANCE (TERMINAL TO TERMINAL)**	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	**% CAPACITANCE TOLERANCE**	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	**% DISSIPATION FACTOR**	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.05% max.	100% Test
9	**VISUAL AND MECHANICAL INSPECTION**	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED TEFLON
K11

ESTABLISHED RELIABILITY CAPACITORS

K11 SPECIFICATIONS

CONSTRUCTION	Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.1% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	From −0.5% to +1.0% From −0.35% to +0.75% From −0.1% to +0.45% From −0.2% to +0.2% From −0.45% to +0.4% From −0.65% to +0.45% From −1.0% to +0.5%
CAPACITANCE STABILITY	±0.10%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1 × 10⁻⁶atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 200,000 ÷ 0.18 = 1,111,000 MEGOHMS.

RANGE	25°C	55°C	85°C	100°C	125°C
.001 TO 0.1uF	2,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	500,000 Megohms	150,000 Megohms
GREATER THAN 0.1uF	200,000 Megohms-uF	200,000 Megohms-uF	100,000 Megohms-uF	50,000 Megohms-uF	15,000 Megohms-uF

K11 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	THERMAL AGING	5 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
2	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10⁻⁶atm/cm³/sec, max.	100% Test
3	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
4	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
5	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
6	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
7	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.1% max.	100% Test
8	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. 2. Traceability to production and test records by permanent marking of parts with date code lot. 3. Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED TEFLON J11 & K11 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	50VDC					100VDC					200VDC				
	J11	K11	Diam. A	Length B	Length C	J11	K11	Diam. A	Length B	Length C	J11	K11	Diam. A	Length B	Length C
.001	J11B102	K11B102	.235	.687	.887	J11C102	K11C102	.235	.687	.887	J11D102	K11D102	.235	.687	.887
.0012	J11B122	K11B122	.235	.687	.887	J11C122	K11C122	.235	.687	.887	J11D122	K11D122	.235	.687	.887
.0015	J11B152	K11B152	.235	.687	.887	J11C152	K11C152	.235	.687	.887	J11D152	K11D152	.235	.687	.887
.0018	J11B182	K11B182	.235	.687	.887	J11C182	K11C182	.235	.687	.887	J11D182	K11D182	.235	.687	.887
.002	J11B202	K11B202	.235	.687	.887	J11C202	K11C202	.235	.687	.887	J11D202	K11D202	.235	.687	.887
.0022	J11B222	K11B222	.235	.687	.887	J11C222	K11C222	.235	.687	.887	J11D222	K11D222	.235	.687	.887
.0027	J11B272	K11B272	.235	.687	.887	J11C272	K11C272	.235	.687	.887	J11D272	K11D272	.235	.687	.887
.0033	J11B332	K11B332	.235	.687	.887	J11C332	K11C332	.235	.687	.887	J11D332	K11D332	.235	.687	.887
.0039	J11B392	K11B392	.235	.687	.887	J11C392	K11C392	.235	.687	.887	J11D392	K11D392	.235	.687	.887
.0047	J11B472	K11B472	.235	.687	.887	J11C472	K11C472	.235	.687	.887	J11D472	K11D472	.235	.687	.887
.005	J11B502	K11B502	.235	.687	.887	J11C502	K11C502	.235	.687	.887	J11D502	K11D502	.235	.687	.887
.0056	J11B562	K11B562	.235	.687	.887	J11C562	K11C562	.235	.687	.887	J11D562	K11D562	.235	.687	.887
.0068	J11B682	K11B682	.235	.687	.887	J11C682	K11C682	.235	.687	.887	J11D682	K11D682	.235	.687	.887
.0082	J11B822	K11B822	.235	.687	.887	J11C822	K11C822	.235	.687	.887	J11D822	K11D822	.235	.687	.887
.01	J11B103	K11B103	.235	.687	.887	J11C103	K11C103	.235	.687	.887	J11D103	K11D103	.235	.687	.887
.012	J11B123	K11B123	.235	.687	.887	J11C123	K11C123	.235	.687	.887	J11D123	K11D123	.235	.687	.887
.015	J11B153	K11B153	.312	.687	.887	J11C153	K11C153	.312	.687	.887	J11D153	K11D153	.312	.687	.887
.018	J11B183	K11B183	.312	.687	.887	J11C183	K11C183	.312	.687	.887	J11D183	K11D183	.312	.813	1.013
.02	J11B203	K11B203	.312	.687	.887	J11C203	K11C203	.312	.687	.887	J11D203	K11D203	.312	.813	1.013
.022	J11B223	K11B223	.312	.687	.887	J11C223	K11C223	.312	.687	.887	J11D223	K11D223	.312	.813	1.013
.027	J11B273	K11B273	.312	.687	.887	J11C273	K11C273	.312	.813	1.013	J11D273	K11D273	.312	.813	1.013
.033	J11B333	K11B333	.312	.687	.887	J11C333	K11C333	.312	.813	1.013	J11D333	K11D333	.400	.813	1.013
.039	J11B393	K11B393	.312	.687	.887	J11C393	K11C393	.400	.813	1.013	J11D393	K11D393	.400	1.063	1.263
.047	J11B473	K11B473	.312	.687	.887	J11C473	K11C473	.400	.813	1.013	J11D473	K11D473	.400	1.063	1.263
.05	J11B503	K11B503	.312	.687	.887	J11C503	K11C503	.400	.813	1.013	J11D503	K11D503	.400	1.063	1.263
.056	J11B563	K11B563	.312	.813	1.013	J11C563	K11C563	.400	.813	1.013	J11D563	K11D563	.400	1.063	1.263
.068	J11B683	K11B683	.312	.813	1.013	J11C683	K11C683	.400	.813	1.013	J11D683	K11D683	.400	1.063	1.263
.082	J11B823	K11B823	.312	.937	1.137	J11C823	K11C823	.400	1.063	1.263	J11D823	K11D823	.500	1.125	1.325
.1	J11B104	K11B104	.312	.937	1.137	J11C104	K11C104	.400	1.063	1.263	J11D104	K11D104	.500	1.125	1.325
.12	J11B124	K11B124	.312	1.063	1.263	J11C124	K11C124	.500	1.125	1.325	J11D124	K11D124	.500	1.375	1.575
.15	J11B154	K11B154	.312	1.063	1.263	J11C154	K11C154	.500	1.125	1.325	J11D154	K11D154	.562	1.375	1.575
.18	J11B184	K11B184	.400	1.063	1.263	J11C184	K11C184	.500	1.125	1.325	J11D184	K11D184	.562	1.375	1.575
.20	J11B204	K11B204	.400	1.063	1.263	J11C204	K11C204	.562	1.125	1.325	J11D204	K11D204	.562	1.375	1.575
.22	J11B224	K11B224	.400	1.063	1.263	J11C224	K11C224	.562	1.125	1.325	J11D224	K11D224	.562	1.375	1.575
.27	J11B274	K11B274	.400	1.063	1.263	J11C274	K11C274	.562	1.125	1.325	J11D274	K11D274	.670	1.375	1.575
.33	J11B334	K11B334	.500	1.125	1.325	J11C334	K11C334	.562	1.125	1.325	J11D334	K11D334	.670	1.375	1.575
.39	J11B394	K11B394	.500	1.125	1.325	J11C394	K11C394	.562	1.375	1.575	J11D394	K11D394	.562	1.875	2.075
.47	J11B474	K11B474	.562	1.125	1.325	J11C474	K11C474	.670	1.375	1.575	J11D474	K11D474	.670	1.875	2.075
.50	J11B504	K11B504	.562	1.125	1.325	J11C504	K11C504	.670	1.375	1.575	J11D504	K11D504	.670	1.875	2.075
.56	J11B564	K11B564	.562	1.125	1.325	J11C564	K11C564	.670	1.375	1.575	J11D564	K11D564	.670	1.875	2.075
.68	J11B684	K11B684	.562	1.125	1.325	J11C684	K11C684	.670	1.875	2.075	J11D684	K11D684	.750	1.875	2.075
.82	J11B824	K11B824	.562	1.375	1.575	J11C824	K11C824	.670	1.875	2.075	J11D824	K11D824	.750	1.875	2.075
1.0	J11B105	K11B105	.670	1.375	1.575	J11C105	K11C105	.670	1.875	2.075	J11D105	K11D105	.750	1.875	2.075
1.5	J11B155	K11B155	.670	1.875	2.075	J11C155	K11C155	.750	1.875	2.075	J11D155	K11D155	1.00	1.875	2.075
2.0	J11B205	K11B205	.670	1.875	2.075	J11C205	K11C205	1.00	1.875	2.075	J11D205	K11D205	1.00	2.375	2.575

J11 B 104 J S A

STYLE

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

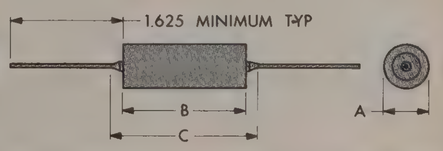
LEAD CODE
A=Solderable leads: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ case dia. & smaller.

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

VOLTAGE
B=50VDC
C=100VDC
D=200VDC

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-6864

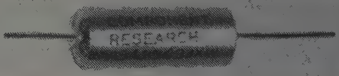
CRC
COMPONENT RESEARCH CO.

FOIL TEFLON
A91

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

.056 µF 50VDC ACTUAL SIZE CAPACITOR



AC AND DC RATED TO 125°C AT FULL RATED VOLTAGE.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE APPLICATIONS.

AC RATED FROM 36VRMS TO 240VRMS AT FREQUENCIES FROM 0 TO 400 Hz. RATINGS AT 40KHz AT LOWER VOLTAGE RATINGS.

HIGH INSULATION RESISTANCE, 10,000,000 MEGOHMS MINIMUM. ALL VALUES UP TO 0.1uF.

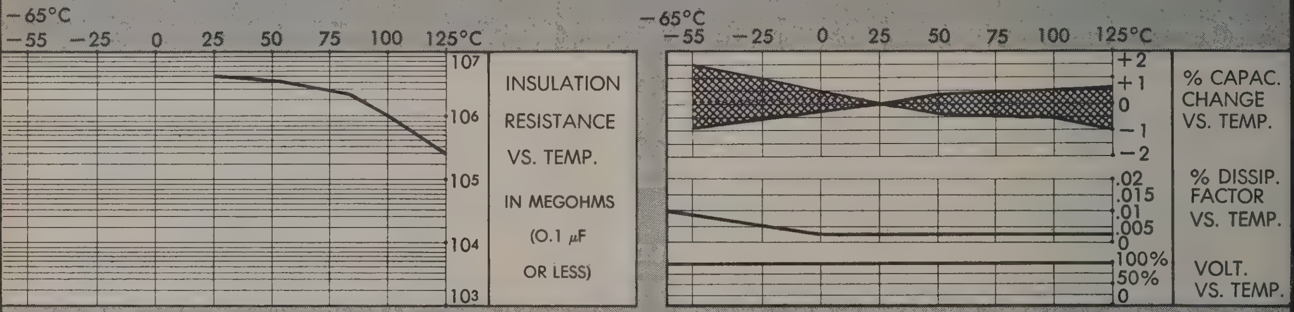
LOW DIELECTRIC ABSORPTION, 0.01% MAXIMUM VOLTAGE RECOVERY.

LOW LOSS, RUGGED INTERNAL TERMINATIONS FOR ALL HI-REL PROGRAMS (CRC PATENTED CONSTRUCTION).

0.1% MAXIMUM SHELF DRIFT FOR 10 YEARS (OR IN NORMAL USE).

AVAILABLE IN 1%, 2%, 5% AND 10%, CAPACITANCE TOLERANCE FROM 50VDC TO 400VDC. OTHER TOLERANCES AVAILABLE ON REQUEST.

TYPICAL CURVES



TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT-1306

TEST RESULTS FOR D51 SERIES CAPACITORS LIFE TESTED FOR 2000 HOURS AT 125°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. D51 CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN AS A91.

LIST OF CAPACITORS SUBMITTED TO LIFE TEST			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
CRC TYPE	uF VALUE	Q'TY TESTED	POST TEST LIMITS (MIN. I.R.)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. △C)	TEST RESULTS LOW	TEST RESULTS HIGH	POST TEST LIMITS (MAX. D.F.)	TEST RESULTS LOW	TEST RESULTS HIGH
D51C	.01	48	3.3×10^6	2.5×10^7	5×10^7	±2	−.01	−.56	.05	−.01	.02
D51C	.002	6	3.3×10^6	2.5×10^7	5×10^7	±2	−.15	−.64	.05	−.01	−.01
D51C	.0039	5	3.3×10^6	2×10^7	1×10^8	±2	−.075	−.64	.05	−.01	−.01
D51C	.02	10	3.3×10^6	2×10^7	1×10^8	±2	−.01	−.33	.05	−.01	−.01

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

FOIL TEFLON
A91

ESTABLISHED
RELIABILITY
CAPACITORS

A91 SPECIFICATIONS

CONSTRUCTION	Foil teflon, hermetically sealed, extended metallized film electrodes, axial leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmetal requirements of MIL-C-83421, except vibration at 20g and shock at 50g.	
OPERATING TEMPERATURE	−65°C to +125°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.01% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.02% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated DC voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	Referenced to 25°C −55°C −25°C 0°C 50°C 85°C 100°C 125°C	 +1.5% to −0.8% +1.0% to −0.5% +0.5% to −0.3% +0.3% to −0.3% +0.5% to −0.5% +0.5% to −0.8% +0.6% to −1.0%
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm^3/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

	RANGE	25°C	85°C	100°C	125°C
MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE	.001 TO 0.2uF	10,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
	GREATER THAN 0.2uF	1,000,000 Megohms	200,000 Megohms	100,000 Megohms	25,000 Megohms

A91 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	16 hrs. minimum at 125°C at 140% AC rated voltage, at 400Hz or 240VRMS, whichever is less	4.7.2	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb for 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1×10^{-6}atm/cm^3/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.02% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. **2.** Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

CRC
COMPONENT RESEARCH CO.

FOIL TEFLON
A91 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

	TYPE A91B 50VDC RATED				TYPE A91C 100VDC RATED				TYPE A91D 200VDC RATED				TYPE A91E 400VDC RATED			
uF	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	A91B102	.193	.562	.662	A91C102	.235	.562	.662	A91D102	.235	.687	.787	A91E102	.235	.687	.787
.0012	A91B122	.193	.562	.662	A91C122	.235	.562	.662	A91D122	.235	.687	.787	A91E122	.235	.687	.787
.0015	A91B152	.193	.562	.662	A91C152	.235	.562	.662	A91D152	.235	.687	.787	A91E152	.235	.687	.787
.0018	A91B182	.193	.562	.662	A91C182	.235	.562	.662	A91D182	.235	.687	.787	A91E182	.235	.687	.787
.002	A91B202	.193	.562	.662	A91C202	.235	.562	.662	A91D202	.235	.687	.787	A91E202	.235	.687	.787
.0022	A91B222	.193	.562	.662	A91C222	.235	.562	.662	A91D222	.235	.687	.787	A91E222	.235	.687	.787
.0027	A91B272	.193	.562	.662	A91C272	.235	.562	.662	A91D272	.235	.687	.787	A91E272	.312	.687	.787
.0033	A91B332	.193	.562	.662	A91C332	.235	.562	.662	A91D332	.235	.687	.787	A91E332	.312	.687	.787
.0039	A91B392	.193	.562	.662	A91C392	.235	.562	.662	A91D392	.235	.687	.787	A91E392	.312	.687	.787
.0047	A91B472	.193	.562	.662	A91C472	.235	.562	.662	A91D472	.235	.687	.787	A91E472	.312	.687	.787
.005	A91B502	.193	.562	.662	A91C502	.235	.562	.662	A91D502	.235	.687	.787	A91E502	.312	.687	.787
.0056	A91B562	.193	.562	.662	A91C562	.235	.562	.662	A91D562	.235	.687	.787	A91E562	.312	.687	.787
.0068	A91B682	.235	.562	.662	A91C682	.235	.687	.787	A91D682	.312	.687	.787	A91E582	.312	.813	.913
.0075	A91B752	.235	.562	.662	A91C752	.235	.687	.787	A91D752	.312	.687	.787	A91E752	.312	.813	.913
.0082	A91B822	.235	.562	.662	A91C822	.235	.687	.787	A91D822	.312	.687	.787	A91E822	.312	.813	.913
.01	A91B103	.235	.562	.662	A91C103	.235	.687	.787	A91D103	.312	.687	.787	A91E103	.312	.813	.913
.012	A91B123	.235	.562	.662	A91C123	.235	.687	.787	A91D123	.312	.687	.787	A91E123	.312	.813	.913
.015	A91B153	.235	.687	.787	A91C153	.312	.687	.787	A91D153	.312	.813	.913	A91E153	.400	.813	.913
.018	A91B183	.235	.687	.787	A91C183	.312	.687	.787	A91D183	.312	.813	.913	A91E183	.400	.813	.913
.02	A91B203	.312	.687	.787	A91C203	.312	.813	.913	A91D203	.400	.813	.913	A91E203	.400	1.063	1.163
.022	A91B223	.312	.687	.787	A91C223	.312	.813	.913	A91D223	.400	.813	.913	A91E223	.400	1.063	1.163
.027	A91B273	.312	.687	.787	A91C273	.312	.813	.913	A91D273	.400	.813	.913	A91E273	.400	1.063	1.163
.033	A91B333	.312	.687	.787	A91C333	.312	.813	.913	A91D333	.400	.813	.913	A91E333	.400	1.063	1.163
.039	A91B393	.312	.813	.913	A91C393	.400	.813	.913	A91D393	.400	1.063	1.163	A91E393	.500	1.125	1.225
.047	A91B473	.312	.813	.913	A91C473	.400	.813	.913	A91D473	.400	1.063	1.163	A91E473	.500	1.125	1.225
.05	A91B503	.312	.813	.913	A91C503	.400	.813	.913	A91D503	.400	1.063	1.163	A91E503	.500	1.125	1.225
.056	A91B563	.312	.813	.913	A91C563	.400	.813	.913	A91D563	.400	1.063	1.163	A91E563	.500	1.125	1.225
.068	A91B683	.400	.813	.913	A91C683	.400	1.063	1.163	A91D683	.500	1.125	1.225	A91E683	.500	1.375	1.475
.075	A91B753	.400	.813	.913	A91C753	.400	1.063	1.163	A91D753	.500	1.125	1.225	A91E753	.500	1.375	1.475
.082	A91B823	.400	.813	.913	A91C823	.400	1.063	1.163	A91D823	.500	1.125	1.225	A91E823	.562	1.375	1.475
.1	A19B104	.400	.813	.913	A91C104	.400	1.063	1.163	A91D104	.500	1.375	1.475	A91E104	.670	1.375	1.475
.12	A91B124	.400	.813	.913	A91C124	.400	1.063	1.163	A91D124	.500	1.375	1.475	A91E124	.670	1.375	1.475
.15	A91B154	.400	.813	.913	A91C154	.500	1.125	1.225	A91D154	.500	1.375	1.475	A91E154	.670	1.375	1.475
.18	A91B184	.400	1.063	1.163	A91C184	.500	1.125	1.225	A91D184	.562	1.375	1.475	A91E184	.670	1.875	1.975
.20	A91B204	.400	1.063	1.163	A91C204	.500	1.125	1.225	A91D204	.670	1.375	1.475	A91E204	.670	1.875	1.975
.22	A91B224	.400	1.063	1.163	A91C224	.500	1.125	1.225	A91D224	.670	1.375	1.475	A91E224	.670	1.875	1.975
.27	A91B274	.500	1.125	1.225	A91C274	.562	1.375	1.475	A91D274	.670	1.375	1.475				
.33	A91B334	.500	1.125	1.225	A91C334	.562	1.375	1.475	A91D334	.670	1.875	1.975				
.39	A91B394	.500	1.125	1.225	A91C394	.562	1.375	1.475	A91D394	.670	1.875	1.975				
.47	A91B474	.562	1.125	1.225	A91C474	.670	1.375	1.475	A91D474	.750	1.875	1.975				
.50	A91B504	.562	1.125	1.225	A91C504	.670	1.375	1.475	A91D504	.750	1.875	1.975				
.56	A91B564	.562	1.375	1.475	A91C564	.670	1.375	1.475								
.68	A91B684	.562	1.375	1.475	A91C684	.670	1.875	1.975								
.75	A91B754	.670	1.375	1.475	A91C754	.750	1.875	1.975								
.82	A91B824	.670	1.375	1.475	A91C824	.750	1.875	1.975								
1.0	A91B105	.670	1.375	1.475	A91C105	.750	1.875	1.975								
1.2	A91B125	.670	1.375	1.475												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads

A91 B 104 J S W

STYLE

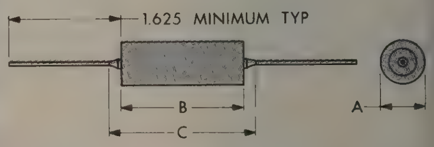
VOLTAGE
B=50VDC
C=100VDC
D=200VDC
E=400VDC

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CAPACITANCE TOLERANCE
K=10%
J=5%
G=2%
F=1%
D=½%
B=¼%

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-686

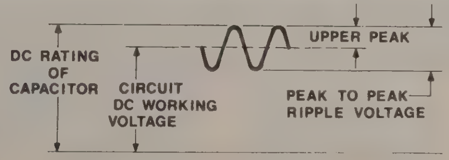
CRC
COMPONENT RESEARCH CO.

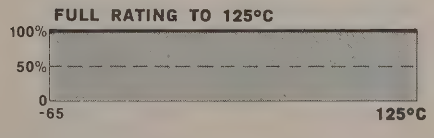
FOIL TEFLON A91 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE A91B 50VDC			TYPE A91C 100VDC			TYPE A91D 200VDC			TYPE A91E 400VDC		
	AC RATINGS			AC RATINGS			AC RATINGS			AC RATINGS		
	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps	RMS Volts 400Hz	RMS Volts 40KHz	Max. RMS Amps
.001	36.0	36.0	.009	60.0	60.0	.015	120.0	80.0	.020	240.0	100.0	.025
.0012	36.0	36.0	.011	60.0	60.0	.018	120.0	80.0	.024	240.0	100.0	.030
.0015	36.0	36.0	.013	60.0	60.0	.022	120.0	80.0	.030	240.0	100.0	.037
.0018	36.0	36.0	.016	60.0	60.0	.027	120.0	80.0	.036	240.0	100.0	.045
.002	36.0	36.0	.018	60.0	60.0	.030	120.0	80.0	.040	240.0	100.0	.050
.0022	36.0	36.0	.020	60.0	60.0	.033	120.0	80.0	.044	240.0	100.0	.055
.0027	36.0	36.0	.024	60.0	60.0	.041	120.0	80.0	.054	240.0	100.0	.068
.0033	36.0	36.0	.030	60.0	60.0	.050	120.0	80.0	.066	240.0	100.0	.083
.0039	36.0	36.0	.035	60.0	60.0	.058	120.0	80.0	.078	240.0	100.0	.097
.0047	36.0	36.0	.042	60.0	60.0	.071	120.0	80.0	.094	240.0	100.0	.12
.005	36.0	36.0	.045	60.0	60.0	.075	120.0	80.0	.10	240.0	100.0	.13
.0056	36.0	36.0	.050	60.0	60.0	.084	120.0	80.0	.11	240.0	100.0	.14
.0068	36.0	36.0	.061	60.0	60.0	.10	120.0	80.0	.14	240.0	100.0	.17
.0075	36.0	36.0	.067	60.0	60.0	.11	120.0	80.0	.15	240.0	100.0	.19
.0082	36.0	36.0	.074	60.0	60.0	.12	120.0	80.0	.16	240.0	100.0	.21
.01	36.0	36.0	.090	60.0	60.0	.15	120.0	80.0	.20	240.0	100.0	.25
.012	36.0	36.0	.11	60.0	59.0	.18	120.0	78.0	.23	240.0	100.0	.30
.015	36.0	36.0	.14	60.0	58.0	.22	120.0	76.0	.29	240.0	94.0	.35
.018	36.0	36.0	.16	60.0	57.0	.26	120.0	74.0	.33	240.0	90.0	.41
.02	36.0	36.0	.18	60.0	55.0	.28	120.0	71.0	.36	240.0	88.0	.44
.022	36.0	36.0	.20	60.0	53.0	.29	120.0	68.0	.37	240.0	85.0	.47
.027	36.0	36.0	.24	60.0	51.0	.34	120.0	65.0	.44	240.0	81.0	.55
.033	36.0	36.0	.30	60.0	50.0	.41	120.0	62.0	.51	240.0	78.0	.65
.039	36.0	36.0	.35	60.0	48.0	.47	120.0	60.0	.59	240.0	75.0	.73
.047	36.0	36.0	.42	60.0	47.0	.55	120.0	57.0	.67	240.0	71.0	.83
.05	36.0	36.0	.45	60.0	46.0	.58	120.0	56.0	.70	240.0	70.0	.88
.056	36.0	36.0	.50	60.0	46.0	.64	120.0	56.0	.78	240.0	67.0	.95
.068	36.0	34.0	.58	60.0	42.0	.71	120.0	50.0	.85	240.0	60.0	1.02
.075	36.0	33.0	.61	60.0	40.0	.75	120.0	47.0	.88	240.0	55.0	1.03
.082	36.0	32.0	.66	60.0	38.0	.78	120.0	44.0	.90	240.0	50.0	1.03
.1	36.0	30.0	.75	60.0	36.0	.90	120.0	42.0	1.10	240.0	46.0	1.20
.12	36.0	30.0	.90	60.0	35.0	1.05	120.0	40.0	1.20	240.0	44.5	1.34
.15	36.0	26.0	.98	60.0	33.0	1.24	120.0	36.0	1.34	240.0	40.0	1.50
.18	36.0	25.0	1.13	60.0	31.0	1.40	120.0	34.0	1.54	240.0	38.0	1.70
.20	36.0	24.0	1.20	60.0	30.0	1.50	120.0	33.0	1.65	240.0	37.0	1.85
.22	36.0	23.0	1.27	60.0	27.0	1.50	120.0	32.0	1.76	240.0	35.0	1.93
.27	36.0	19.0	1.28	60.0	24.0	1.62	120.0	29.0	1.96			
.33	36.0	18.0	1.48	60.0	23.0	1.90	120.0	28.0	2.31			
.39	36.0	17.0	1.66	60.0	22.0	2.15	120.0	27.0	2.63			
.47	36.0	15.7	1.85	60.0	21.0	2.47	120.0	26.0	3.06			
.50	36.0	15.2	1.90	60.0	20.0	2.50	120.0	25.0	3.13			
.56	36.0	14.4	2.01	60.0	19.0	2.64	120.0	23.0	3.17			
.68	36.0	14.0	2.38	60.0	16.0	2.72						
.75	36.0	13.0	2.44	60.0	15.0	2.81						
.82	36.0	12.0	2.46	60.0	14.0	2.87						
1.0	36.0	10.0	2.50	60.0	12.0	3.00						
1.2	36.0	9.1	2.73									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615, TWX: (910) 343-6864

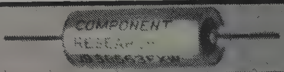
CRC
COMPONENT RESEARCH CO.

POLYSTYRENE K93

ESTABLISHED RELIABILITY CAPACITORS

PRODUCT FEATURES

.056 µF 50VDC ACTUAL SIZE CAPACITOR



5,000,000 MEGOHMS MIN. INSULATION RESISTANCE FOR VALUES 0.2uF AND LESS.

0.02% MAXIMUM DIELECTRIC ABSORPTION.

0.1% MAXIMUM SHELF DRIFT FOR 10 YEARS (OR IN NORMAL USE).

UTILIZES CRC UNIQUE PATENTED, RUGGED, LOW LOSS LEAD TERMINATIONS, QUALIFIED FOR ALL HI-REL PROGRAMS.

HERMETICALLY SEALED, HIGH RELIABILITY SCREENED FOR CRITICAL AEROSPACE PROGRAMS.

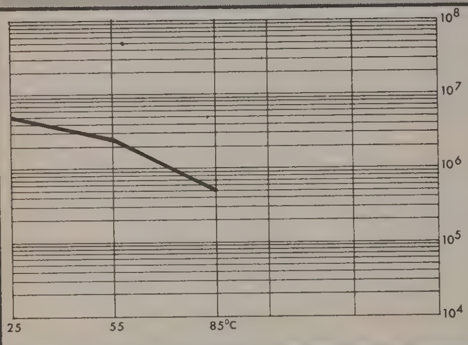
100% RELIABILITY SCREENING, INCLUDES TEMPERATURE CYCLING, FINE LEAK TEST, AC SQUARE WAVE TEST.

SIMILAR GENERIC PARTS HAVE BEEN QUALIFIED FOR TRIDENT PROGRAM.

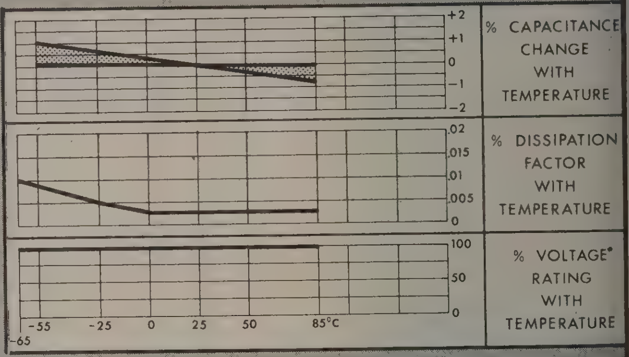
AVAILABLE IN ±0.1% TO ±10% CAPACITANCE TOLERANCE FROM 50VDC TO 400VDC.

AC AND DC RATED.

TYPICAL CURVES



INSULATION RESISTANCE WITH TEMPERATURE IN MEGOHMS (0.1 µF OR LESS)



TYPICAL APPLICATIONS

- CRITICAL TIMING CIRCUITS
- FIXED TUNING CIRCUITS
- FILTERING
- TEMPERATURE COMPENSATION
- COUPLING AND DECOUPLING
- FEEDBACK CIRCUITS
- POWER SUPPLY FILTERING
- GYRO CIRCUITS
- PULSE FORMING NETWORKS
- INTEGRATING CIRCUITS

LIFE TEST DATA CRC TEST REPORT #XT1304

TEST RESULTS FOR 75 SERIES N53 CAPACITORS LIFE TESTED FOR 2000 HOURS AT +85°C AT 140% OF RATED DC VOLTAGE. THERE WERE NO FAILURES FOR THIS TEST. N53 CAPACITORS ARE THE SAME CONSTRUCTION AND DESIGN AS K93 SERIES CAPACITORS.

LIST OF CAPACITORS LIFE TESTED			INSULATION RESISTANCE IN MEGOHMS AT 25°C			% CAPACITANCE CHANGE WITH LIFE			% DISSIPATION FACTOR AT 25°C WITH LIFE		
			POST TEST LIMITS	TEST RESULTS		POST TEST LIMITS	TEST RESULTS		POST TEST LIMITS	TEST RESULTS	
CRC TYPE	uF VALUE	Q'TY TESTED	(MIN. I.R.)	LOW	HIGH	(MAX. △C)	LOW	HIGH	(MAX. D.F.)	LOW	HIGH
N53B	.012	20	5×10^5	2×10^7	5×10^7	0.5	0.00	+.26	.05	.01	.01
N53B	.1	20	5×10^5	1×10^7	5×10^7	0.5	−.03	+.29	.05	.01	.01
N53B	.82	15	5×10^5	5×10^6	4×10^7	0.5	−.02	+.18	.05	.01	.01
N53C	.02	5	5×10^5	3.3×10^7	5×10^7	0.5	−.025	+.245	.05	.01	.01
N53C	.039	5	5×10^5	5.5×10^6	1×10^8	0.5	−.01	+.30	.05	.01	.01
N53C	.068	20	5×10^5	1×10^7	2×10^7	0.5	+.06	+.22	.05	.01	.01

COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-686

CRC
COMPONENT RESEARCH CO.

POLYSTYRENE
K93

ESTABLISHED RELIABILITY CAPACITORS

K93 SPECIFICATIONS

OPERATING TEMPERATURE	−65°C to 85°C	At full rated voltage.
DIELECTRIC ABSORPTION	0.02% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.02% maximum	At 25°C when measured per MIL-C-83421.
DIELECTRIC STRENGTH	200% rated voltage	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	−80 ±50 PPM/°C −60 ±50 PPM/°C	For values 0.001uF to 0.0082uF For values 0.01uF to 2.7uF Special polystyrene capacitors can be supplied with a temperature coefficient of −20 to −100 PPM/°C that is linear to ±30 PPM/°C and ±10 PPM/°C. A wide selection is available of large uF values in bathtub and custom cases.
CAPACITANCE STABILITY	0.03% maximum Drift	With five cycles from −25°C to +85°C
HERMETIC SEAL	1×10^{-6}atm/cm^3/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 1.0uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 2.0uF CAPACITOR AT 25°C IS 1,000,000 ÷ 2 = 500,000 MEGOHMS.

RANGE	25°C	55°C	85°C
0.001 TO 0.1uF	10,000,000 Megohms	5,000,000 Megohms	1,000,000 Megohms
GREATER THAN 0.1uF	1,000,000 Megohms-uF	500,000 Megohms-uF	100,000 Megohms-uF

K93 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	**THERMAL AGING**	From −65°C to +85°C, 5 cycles min.	4.7.3	There shall be no physical damage	100% Test
2	**SEAL TEST (FINE LEAK)**	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	$1x10^{6}$atm/cm^3/sec. max.	100% Test
3	**SEAL TEST (GROSS LEAK)**	Place in 85°C hot water for 60 seconds minimum and observe for bubbles	4.7.5	No continuous bubble stream	100% Test
4	**AC SQUARE WAVE (TERMINAL TO TERMINAL)**	Apply 100Hz square wave at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
5	**DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)**	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	**INSULATION RESISTANCE (TERMINAL TO TERMINAL)**	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	**% CAPACITANCE TOLERANCE**	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	**% DISSIPATION FACTOR**	At 25°C at 1KHz, values above 1uF measured at 0.1KHz	4.7.9	0.02% max.	100% Test
9	**VISUAL AND MECHANICAL INSPECTION**	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

POLYSTYRENE
K93 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE K93B 50VDC RATED				TYPE K93C 100VDC RATED				TYPE K93D 200VDC RATED				TYPE K93E 400VDC RATED			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	93B102	.193	.562	.662	93C102	.193	.687	.787	93D102	.235	.687	.787	93E102	.312	.687	.787
.0012	93B122	.193	.562	.662	93C122	.193	.687	.787	93D122	.235	.687	.787	93E122	.312	.687	.787
.0015	93B152	.193	.562	.662	93C152	.193	.687	.787	93D152	.235	.687	.787	93E152	.312	.687	.787
.0018	93B182	.193	.562	.662	93C182	.193	.687	.787	93D182	.235	.687	.787	93E182	.312	.687	.787
.002	93B202	.193	.562	.662	93C202	.193	.687	.787	93D202	.235	.687	.787	93E202	.312	.687	.787
.0022	93B222	.193	.562	.662	93C222	.193	.687	.787	93D222	.235	.687	.787	93E222	.312	.687	.787
.0027	93B272	.193	.562	.662	93C272	.193	.687	.787	93D272	.235	.687	.787	93E272	.312	.687	.787
.0033	93B332	.193	.562	.662	93C332	.193	.687	.787	93D332	.235	.687	.787	93E332	.312	.687	.787
.0039	93B392	.193	.562	.662	93C392	.193	.687	.787	93D392	.235	.687	.787	93E392	.312	.687	.787
.0047	93B472	.193	.562	.662	93C472	.193	.687	.787	93D472	.235	.687	.787	93E472	.312	.687	.787
.005	93B502	.193	.562	.662	93C502	.193	.687	.787	93D502	.235	.687	.787	93E502	.312	.687	.787
.0056	93B562	.193	.562	.662	93C562	.193	.687	.787	93D562	.235	.687	.787	93E562	.312	.687	.787
.0068	93B682	.193	.562	.662	93C682	.193	.687	.787	93D682	.235	.687	.787	93E682	.312	.687	.787
.0075	93B752	.193	.687	.787	93C752	.193	.813	.913	93D752	.235	.813	.913	93E752	.312	.813	.913
.0082	93B822	.193	.687	.787	93C822	.193	.813	.913	93D822	.235	.813	.913	93E812	.312	.813	.913
.01	93B103	.193	.687	.787	93C103	.193	.813	.913	93D103	.235	.813	.913	93E103	.312	.813	.913
.012	93B123	.193	.687	.787	93C123	.193	.813	.913	93D123	.235	.813	.913	93E123	.312	.813	.913
.015	93B153	.235	.687	.787	93C153	.235	.813	.913	93D153	.312	.813	.913	93E153	.400	.813	.913
.018	93B183	.235	.813	.913	93C183	.312	.813	.913	93D183	.400	.813	.913	93E183	.400	1.063	1.163
.02	93B203	.235	.813	.913	93C203	.312	.813	.913	93D203	.400	.813	.913	93E203	.400	1.063	1.163
.022	93B223	.235	.813	.913	93C223	.312	.813	.913	93D223	.400	.813	.913	93E223	.400	1.063	1.163
.027	93B273	.235	.813	.913	93C273	.312	.813	.913	93D273	.400	.813	.913	93E273	.400	1.063	1.163
.033	93B333	.235	.813	.913	93C333	.312	.813	.913	93D333	.400	.813	.913	93E333	.400	1.063	1.163
.039	93B393	.312	.813	.913	93C393	.400	.813	.913	93D393	.400	1.063	1.163	93E393	.500	1.125	1.225
.047	93B473	.312	.813	.913	93C473	.400	.813	.913	93D473	.400	1.063	1.163	93E473	.500	1.125	1.225
.05	93B503	.312	.813	.913	93C503	.400	.813	.913	93D503	.400	1.063	1.163	93E503	.500	1.125	1.225
.056	93B563	.312	.813	.913	93C563	.400	.813	.913	93D563	.400	1.063	1.163	93E563	.500	1.125	1.225
.068	93B683	.400	.813	.913	93C683	.400	1.063	1.163	93D683	.500	1.125	1.225	93E583	.500	1.375	1.475
.075	93B753	.400	.813	.913	93C753	.400	1.063	1.163	93D753	.500	1.125	1.225	93E753	.500	1.375	1.475
.082	93B823	.400	.813	.913	93C823	.400	1.063	1.163	93D823	.500	1.125	1.225	93E823	.500	1.375	1.475
.1	93B104	.400	.813	.913	93C104	.400	1.063	1.163	93D104	.500	1.125	1.225	93E104	.500	1.375	1.475
.12	93B124	.400	.813	.913	93C124	.400	1.063	1.163	93D124	.500	1.125	1.225	93E124	.500	1.375	1.475
.15	93B154	.400	1.063	1.163	93C154	.500	1.125	1.225	93D154	.500	1.375	1.475	93E154	.562	1.375	1.475
.18	93B184	.400	1.063	1.163	93C184	.500	1.125	1.225	93D184	.500	1.375	1.475	93E184	.562	1.375	1.475
.20	93B204	.400	1.063	1.163	93C204	.500	1.125	1.225	93D204	.500	1.375	1.475	93E204	.562	1.375	1.475
.22	93B224	.400	1.063	1.163	93C224	.500	1.125	1.225	93D224	.500	1.375	1.475	93E224	.562	1.375	1.475
.27	93B274	.500	1.125	1.225	93C274	.500	1.375	1.475	93D274	.562	1.375	1.475	93E274	.670	1.375	1.475
.33	93B334	.500	1.125	1.225	93C334	.500	1.375	1.475	93D334	.562	1.375	1.475	93E334	.670	1.375	1.475
.39	93B394	.500	1.375	1.475	93C394	.562	1.375	1.475	93D394	.670	1.375	1.475	93E394	.670	1.875	1.975
.47	93B474	.562	1.375	1.475	93C474	.670	1.375	1.475	93D474	.670	1.875	1.975	93E474	.750	1.875	1.975
.50	93B504	.562	1.375	1.475	93C504	.670	1.375	1.475	93D504	.670	1.875	1.975	93E504	.750	1.875	1.975
.56	93B564	.562	1.375	1.475	93C564	.670	1.375	1.475	93D564	.670	1.875	1.975	93E564	.750	1.875	1.975
.68	93B684	.670	1.375	1.475	93C684	.670	1.875	1.975	93D684	.750	1.875	1.975	93E684	1.000	1.875	1.975
.75	93B754	.670	1.875	1.975	93C754	.750	1.875	1.975	93D754	1.000	1.875	1.975	93E754	1.000	2.375	2.475
.82	93B824	.670	1.875	1.975	93C824	.750	1.875	1.975	93D824	1.000	1.875	1.975	93E824	1.000	2.375	2.475
1.0	93B105	.670	1.875	1.975	93C105	.750	1.875	1.975	93D105	1.000	1.875	1.975	93E105	1.000	2.375	2.475
1.2	93B125	.750	1.875	1.975	93C125	1.000	1.875	1.975								
1.5	93B155	.750	1.875	1.975	93C155	1.000	1.875	1.975								
1.8	93B185	1.000	1.875	1.975	93C185	1.000	2.375	2.475								
2.0	93B205	1.000	1.875	1.975	93C205	1.000	2.375	2.475								
2.2	93B225	1.000	1.875	1.975												
2.5	93B255	1.000	2.375	2.225												
2.7	93B275	1.000	2.375	2.225												

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

K93 | B | 104 | J | S | W

STYLE

VOLTAGE
B=50VDC
C=100VDC
D=200VDC
E=400VDC

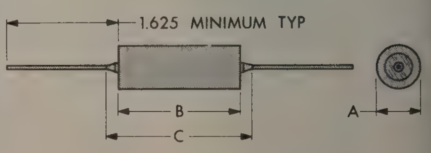
PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CAPACITANCE TOLERANCE
K=10% F=1% B=¼%
J=5% D=½% A=.1%
G=2%

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±0.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads



COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

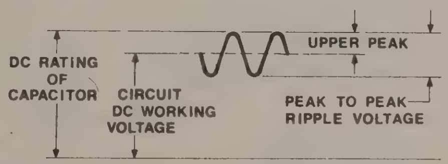
CRC
COMPONENT RESEARCH CO.

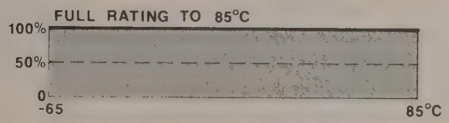
POLYSTYRENE K93 AC RATINGS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE K93B 50VDC			TYPE K93C 100VDC			TYPE K93D 200VDC			TYPE K93E 400VDC		
	MAXIMUM AC RATINGS			MAXIMUM AC RATINGS			MAXIMUM AC RATINGS			MAXIMUM AC RATINGS		
	RMS Volts	Freq. In KHz	RMS Amps	RMS Volts	Freq. In KHz	RMS Amps	RMS Volts	Freq. In KHz	RMS Amps	RMS Volts	Freq. In KHz	RMS Amps
.001	36.0	40.0	.009	60.0	40.0	.015	120.0	40.0	.03	240.0	40.0	.06
.0012	36.0	40.0	.011	60.0	40.0	.018	120.0	40.0	.036	240.0	40.0	.072
.0015	36.0	40.0	.013	60.0	40.0	.022	120.0	40.0	.044	240.0	40.0	.088
.0018	36.0	40.0	.016	60.0	40.0	.027	120.0	40.0	.054	240.0	40.0	.108
.002	36.0	40.0	.018	60.0	40.0	.03	120.0	40.0	.06	240.0	40.0	.12
.0022	36.0	40.0	.020	60.0	40.0	.033	120.0	40.0	.066	240.0	40.0	.132
.0027	36.0	40.0	.024	60.0	40.0	.041	120.0	40.0	.082	240.0	40.0	.16
.0033	36.0	40.0	.030	60.0	40.0	.045	120.0	40.0	.09	240.0	40.0	.18
.0039	36.0	40.0	.035	60.0	40.0	.059	120.0	40.0	.12	240.0	40.0	.24
.0047	36.0	40.0	.042	60.0	40.0	.071	120.0	40.0	.14	240.0	40.0	.28
.005	36.0	40.0	.045	60.0	40.0	.075	120.0	40.0	.15	240.0	40.0	.30
.0056	36.0	40.0	.050	60.0	40.0	.084	120.0	40.0	.17	240.0	40.0	.34
.0068	36.0	40.0	.061	60.0	40.0	.102	120.0	40.0	.2	240.0	40.0	.4
.0075	36.0	40.0	.067	60.0	40.0	.11	120.0	40.0	.22	240.0	40.0	.44
.0082	36.0	40.0	.074	60.0	40.0	.12	120.0	40.0	.24	240.0	40.0	.48
.01	36.0	40.0	.090	60.0	40.0	.15	120.0	40.0	.30	240.0	40.0	.60
.012	36.0	40.0	.11	60.0	40.0	.18	120.0	40.0	.36	240.0	40.0	.72
.015	36.0	40.0	.14	60.0	40.0	.22	120.0	40.0	.44	240.0	40.0	.88
.018	36.0	40.0	.16	60.0	40.0	.27	120.0	40.0	.54	240.0	40.0	1.1
.02	36.0	40.0	.18	60.0	40.0	.3	120.0	40.0	.6	240.0	40.0	1.2
.022	36.0	40.0	.20	60.0	40.0	.33	120.0	40.0	.66	240.0	40.0	1.3
.027	36.0	40.0	.24	60.0	40.0	.41	120.0	40.0	.82	240.0	40.0	1.6
.033	36.0	40.0	.30	60.0	40.0	.45	120.0	40.0	.9	240.0	40.0	1.8
.039	36.0	40.0	.35	60.0	40.0	.59	120.0	40.0	1.2	240.0	40.0	2.4
.047	36.0	40.0	.42	60.0	40.0	.71	120.0	40.0	1.4	240.0	40.0	2.9
.05	36.0	40.0	.45	60.0	40.0	.75	120.0	40.0	1.5	240.0	40.0	3.0
.056	36.0	40.0	.50	60.0	40.0	.84	120.0	40.0	1.7	240.0	35.5	3.0
.068	36.0	40.0	.61	60.0	40.0	1.0	120.0	40.0	2.0	240.0	34.1	3.5
.075	36.0	40.0	.67	60.0	40.0	1.1	120.0	40.0	2.2	240.0	30.9	3.5
.082	36.0	40.0	.74	60.0	40.0	1.2	120.0	40.0	2.4	240.0	28.3	3.5
.1	36.0	40.0	.90	60.0	40.0	1.5	120.0	40.0	3.0	240.0	23.2	3.5
.12	36.0	36.9	1.0	60.0	40.0	1.8	120.0	33.1	3.0	240.0	19.3	3.5
.15	36.0	40.0	1.4	60.0	40.0	2.2	120.0	30.9	3.5	240.0	17.7	4.0
.18	36.0	40.0	1.6	60.0	40.0	2.7	120.0	25.8	3.5	240.0	14.7	4.0
.20	36.0	40.0	1.8	60.0	40.0	3.0	120.0	23.2	3.5	240.0	13.2	4.0
.22	36.0	40.0	2.0	60.0	36.2	3.0	120.0	21.1	3.5	240.0	12.0	4.0
.27	36.0	40.0	2.4	60.0	34.4	3.5	120.0	19.6	4.0	240.0	11.0	4.5
.33	36.0	40.0	3.0	60.0	28.1	3.5	120.0	16.1	4.0	240.0	9.0	4.5
.39	36.0	40.0	3.5	60.0	32.6	4.0	120.0	15.3	4.5	240.0	8.5	5.0
.47	36.0	37.6	4.0	60.0	25.4	4.5	120.0	14.1	5.0	240.0	7.0	5.0
.50	36.0	35.4	4.0	60.0	23.8	4.5	120.0	13.2	5.0	240.0	6.6	5.0
.56	36.0	31.6	4.0	60.0	21.3	4.5	120.0	11.8	5.0	240.0	5.9	5.0
.68	36.0	28.6	4.5	60.0	19.5	5.0	120.0	10.7	5.5	240.0	5.8	6.0
.75	36.0	29.5	5.0	60.0	19.4	5.5	120.0	10.6	6.0	240.0	6.2	7.0
.82	36.0	27.0	5.0	60.0	17.8	5.5	120.0	9.7	6.0	240.0	5.6	7.0
1.0	36.0	22.1	5.0	60.0	14.6	5.5	120.0	7.9	6.0	240.0	4.6	7.0
1.2	36.0	20.4	5.5	60.0	13.2	6.0						
1.5	36.0	16.2	5.5	60.0	10.6	6.0						
1.8	36.0	14.7	6.0	60.0	10.3	7.0						
2.0	36.0	13.2	6.0	60.0	9.28	7.0						
2.2	36.0	12.06	6.0									
2.5	36.0	11.5	6.5									
2.7	36.0	10.66	6.5									

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. CAPACITORS CAN HANDLE PULSE CURRENTS UP TO 100 TIMES GREATER THAN THE PEAK CURRENTS CALCULATED FROM THE RATED RMS RATING (PROVIDED SLOW REPETITION RATES ARE USED). IF THERE IS ANY DOUBT, A SKETCH OF THE VOLTAGE AND CURRENT WAVE FORMS WITH TIME BASE SHOULD BE SENT TO CRC FOR ANALYSIS.





COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET • SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

DOUBLE LAYER A10

ESTABLISHED RELIABILITY CAPACITORS

A10 SPECIFICATIONS

CONSTRUCTION	Type A10 capacitors utilize a dual layer construction as extra assurance that clearings and low resistance faults will not occur. See Index for Capacitor Fault Scanning.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±1% 0% to −2%	From 25°C to +125°C. From 25°C to −55°C.
CAPACITANCE STABILITY	±0.2%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1×10^{-6}atm/cm^3/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A 0.18uF CAPACITOR AT 25°C IS 300,000 ÷ 0.18 = 1,666,666 MEGOHMS.

RANGE	25°C	85°C	100°C	125°C
.001 TO 0.1uF	3,000,000 Megohms	500,000 Megohms	200,000 Megohms	20,000 Megohms
GREATER THAN 0.1uF	300,000 Megohms-uF	50,000 Megohms-uF	20,000 Megohms-uF	2,000 Megohms-uF

A10 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (FINE LEAK)	Helium bomb 45 PSI for 1 hr. minimum, check for helium leak	4.7.5	1x10^{-6}atm/cm^3/sec. max.	100% Test
4	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	DC HI-POT (TERMINAL TO TERMINAL AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
7	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	300,000 megohm-uF, need not exceed 3,000,000 megohms	100% Test
8	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
9	% DISSIPATION FACTOR	At 25°C at 1KHz, values above 1uF measure at 0.1KHz	4.7.9	0.15% max.	100% Test
10	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. **2.** Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection data is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET ■ SANTA MONICA, CALIF. 90404 ■ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

DOUBLE LAYER A10 CASE DIMENSIONS

ESTABLISHED RELIABILITY CAPACITORS

uF	TYPE A10B 50VDC RATED				TYPE A10C 100VDC RATED				TYPE A10D 200VDC RATED				TYPE A10E 400VDC RATED			
	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	A10B102	.170	.500	.600	A10C102	.170	.500	.600	A10D102	.170	.562	.662	A10E102	.193	.562	.662
.0012	A10B122	.170	.500	.600	A10C122	.170	.500	.600	A10D122	.170	.562	.662	A10E122	.193	.562	.662
.0015	A10B152	.170	.500	.600	A10C152	.170	.500	.600	A10D152	.170	.562	.662	A10E152	.193	.562	.662
.0018	A10B182	.170	.500	.600	A10C182	.170	.500	.600	A10D182	.170	.562	.662	A10E182	.193	.562	.662
.002	A10B202	.170	.500	.600	A10C202	.170	.500	.600	A10D202	.170	.562	.662	A10E202	.193	.562	.662
.0022	A10B222	.170	.500	.600	A10C222	.170	.500	.600	A10D222	.170	.562	.662	A10E222	.193	.562	.662
.0027	A10B272	.170	.500	.600	A10C272	.170	.500	.600	A10D272	.170	.562	.662	A10E272	.235	.562	.662
.0033	A10B332	.170	.500	.600	A10C332	.170	.500	.600	A10D332	.170	.562	.662	A10E332	.235	.562	.662
.0039	A10B392	.170	.500	.600	A10C392	.170	.500	.600	A10D392	.170	.562	.662	A10E392	.235	.562	.662
.0047	A10B472	.170	.500	.600	A10C472	.170	.500	.600	A10D472	.170	.562	.662	A10E472	.235	.562	.662
.005	A10B502	.170	.500	.600	A10C502	.170	.500	.600	A10D502	.170	.562	.662	A10E502	.235	.562	.662
.0056	A10B562	.170	.500	.600	A10C562	.170	.500	.600	A10D562	.170	.562	.662	A10E562	.235	.562	.662
.0068	A10B682	.170	.500	.600	A10C682	.170	.562	.662	A10D682	.170	.562	.662	A10E582	.235	.687	.787
.0075	A10B752	.170	.562	.662	A10C752	.170	.562	.662	A10D752	.193	.562	.662	A10E752	.235	.687	.787
.0082	A10B822	.170	.562	.662	A10C822	.170	.562	.662	A10D822	.193	.562	.662	A10E822	.235	.687	.787
.01	A10B103	.170	.562	.662	A10C103	.170	.687	.787	A10D103	.193	.562	.662	A10E103	.235	.687	.787
.012	A10B123	.170	.562	.662	A10C123	.170	.687	.787	A10D123	.193	.562	.662	A10E123	.235	.687	.787
.015	A10B153	.170	.562	.662	A10C153	.170	.687	.787	A10D153	.235	.562	.662	A10E153	.235	.813	.913
.018	A10B183	.193	.562	.662	A10C183	.193	.687	.787	A10D183	.235	.687	.787	A10E183	.312	.813	.913
.02	A10B203	.193	.562	.662	A10C203	.193	.687	.787	A10D203	.235	.687	.787	A10E203	.312	.813	.913
.022	A10B223	.193	.562	.662	A10C223	.193	.687	.787	A10D223	.235	.687	.787	A10E223	.312	.813	.913
.027	A10B273	.193	.562	.662	A10C273	.193	.687	.787	A10D273	.312	.687	.787	A10E273	.312	.813	.913
.033	A10B333	.193	.562	.662	A10C333	.193	.687	.787	A10D333	.312	.687	.787	A10E333	.312	.813	.913
.039	A10B393	.170	.687	.787	A10C393	.235	.687	.787	A10D393	.312	.687	.787	A10E393	.312	.813	.913
.047	A10B473	.170	.687	.787	A10C473	.235	.687	.787	A10D473	.312	.687	.787	A10E473	.400	.813	.913
.05	A10B503	.170	.687	.787	A10C503	.235	.687	.787	A10D503	.312	.687	.787	A10E503	.400	.813	.913
.056	A10B563	.193	.687	.787	A10C563	.235	.687	.787	A10D563	.312	.813	.913	A10E563	.400	.813	.913
.068	A10B683	.193	.687	.787	A10C683	.235	.813	.917	A10D683	.312	.813	.913	A10E683	.400	.813	.913
.075	A10B753	.193	.813	.913	A10C753	.312	.687	.787	A10D753	.312	.813	.913	A10E753	.400	1.063	1.163
.082	A10B823	.193	.813	.913	A10C823	.312	.687	.787	A10D823	.312	.813	.913	A10E823	.400	1.063	1.163
.1	A10B104	.193	.813	.913	A10C104	.312	.687	.787	A10D104	.312	.813	.913	A10E104	.400	1.063	1.163
.12	A10B124	.235	.687	.787	A10C124	.312	.687	.787	A10D124	.312	.813	.913	A10E124	.400	1.063	1.163
.15	A10B154	.235	.687	.787	A10C154	.312	.813	.913	A10D154	.400	1.063	1.163	A10E154	.400	1.375	1.475
.18	A10B184	.235	.813	.913	A10C184	.312	.813	.913	A10D184	.400	1.375	1.475	A10E184	.500	1.375	1.475
.20	A10B204	.235	.813	.913	A10C204	.312	.813	.913	A10D204	.400	1.375	1.475	A10E204	.500	1.375	1.475
.22	A10B224	.312	.687	.787	A10C224	.312	.813	.913	A10D224	.400	1.375	1.475	A10E224	.500	1.375	1.475
.27	A10B274	.312	.687	.787	A10C274	.312	1.063	1.163	A10D274	.500	1.375	1.475	A10E274	.562	1.375	1.475
.33	A10B334	.312	.813	.913	A10C334	.312	1.063	1.163	A10D334	.500	1.375	1.475	A10E334	.562	1.375	1.475
.39	A10B394	.312	.813	.913	A10C394	.400	1.063	1.163	A10D394	.500	1.375	1.475	A10E394	.562	1.875	1.975
.47	A10B474	.400	.813	.913	A10C474	.400	1.063	1.163	A10D474	.500	1.375	1.475	A10E474	.562	1.875	1.975
.50	A10B504	.400	.813	.913	A10C504	.400	1.063	1.163	A10D504	.500	1.375	1.475	A10E504	.562	1.875	1.975
.56	A10B564	.400	.813	.913	A10C564	.400	1.063	1.163	A10D564	.500	1.375	1.475	A10E564	.562	1.875	1.975
.68	A10B684	.400	.813	.913	A10C684	.500	1.125	1.225	A10D684	.562	1.375	1.475	A10E684	.750	1.875	1.975
.75	A10B754	.400	1.063	1.163	A10C754	.500	1.125	1.225	A10D754	.562	1.875	1.975	A10E754	.750	1.875	1.975
.82	A10B824	.400	1.063	1.163	A10C824	.500	1.125	1.225	A10D824	.562	1.875	1.975	A10E824	.750	1.875	1.975
1.0	A10B105	.400	1.063	1.163	A10C105	.562	1.125	1.225	A10D105	.562	1.875	1.975	A10E105	.750	1.875	1.975
1.2	A10B125	.500	1.125	1.225	A10C125	.562	1.125	1.225	A10D125	.562	1.875	1.975	A10E125	1.000	1.875	1.975
1.5	A10B155	.500	1.125	1.225	A10C155	.562	1.375	1.475	A10D155	.670	1.875	1.975	A10E155	1.000	2.375	2.475
1.8	A10B185	.500	1.375	1.475	A10C185	.670	1.375	1.475	A10D185	.750	1.875	1.975	A10E185	1.000	2.375	2.475
2.0	A10B205	.500	1.375	1.475	A10C205	.670	1.375	1.475	A10D205	.750	1.875	1.975	A10E205	1.000	2.375	2.475
2.2	A10B225	.500	1.375	1.475	A10C225	.670	1.375	1.475	A10D225	.750	1.875	1.975				
2.5	A10B255	.500	1.375	1.475	A10C255	.670	1.875	1.975	A10D255	.750	1.875	1.975				
3.0	A10B305	.562	1.375	1.475	A10C305	.670	1.875	1.975	A10D305	1.000	1.875	1.975				
3.3	A10B335	.562	1.375	1.475	A10C335	.670	1.875	1.975	A10D335	1.000	1.875	1.975				
4.0	A10B405	.670	1.375	1.475	A10C405	.750	1.875	1.975	A10D405	1.000	2.375	2.475				
4.7	A10B475	.670	1.375	1.475	A10C475	.750	1.875	1.975								
5.0	A10B505	.670	1.375	1.475	A10C505	.750	1.875	1.975								
6.8	A10B685	.670	1.875	1.975	A10C685	1.000	2.375	2.475								
8.0	A10B805	.670	1.875	1.975	A10C805	1.000	2.375	2.475								
10.0	A10B106	.750	1.875	1.975	A10C106	1.000	2.375	2.475								

FOR SPECIAL VALUES AND TOLERANCES, PLEASE CONTACT OUR APPLICATION DEPARTMENT.

A10	B	104	J	S	W

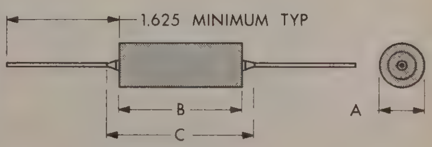
STYLE

SLEEVING CODE
S = Mylar sleeve
X = No sleeve

LEAD CODE
W = Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C = Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving +0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	The lengths shown in table are maximum and include solder beads.

CAPACITANCE TOLERANCE	K = 10%	G = 2%
	J = 5%	F = 1%



VOLTAGE
B = 50VDC
C = 100VDC
D = 200VDC
E = 400VDC

PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

COMPONENT RESEARCH CO., INC. ■ 1655 26TH STREET • SANTA MONICA, CALIF. 90404 ■ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

FOIL POLYCARBONATE
A52

ESTABLISHED RELIABILITY CAPACITORS

A52 SPECIFICATIONS

CONSTRUCTION	Polycarbonate dielectric, extended foil electrodes, hermetically sealed, leads isolated from case.	
ENVIRONMENTAL	Capacitors meet all environmental requirements of MIL-C-83421 except vibration and shock. Vibration is at 20g's and shock at 50g's.	
OPERATING TEMPERATURE	−65°C to +100°C	At full rated voltage, derate linearly to 50% of rated voltage at 125°C.
DIELECTRIC ABSORPTION	0.1% maximum	At 25°C when measured per MIL-C-83421.
DISSIPATION FACTOR	0.15% maximum	At 25°C when measured per MIL-C-83421.
AC SQUARE WAVE	100Hz, 60 seconds minimum	At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIL-C-83421.
DIELECTRIC STRENGTH	200% DC volts	At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.
TEMPERATURE COEFFICIENT	±2% maximum capacitance change	From −55°C to +125°C.
CAPACITANCE STABILITY	±0.25%	When measured at any two corresponding temperature points taken in five successive temperature cycles from −65°C to +125°C.
HERMETIC SEAL	1 × 10^{-6}atm/cm³/sec.	Maximum leak rate.
INSULATION RESISTANCE	See I.R. Table	Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1uF, allow an additional minute/uF charge time.

MINIMUM INSULATION RESISTANCE AT RATED DC VOLTAGE

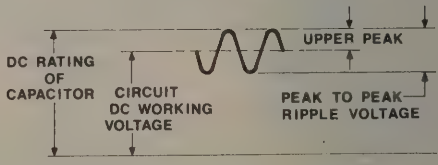
FOR VALUES OVER 0.1uF DIVIDE LIMIT SHOWN BY uF TO OBTAIN MINIMUM I.R. EXAMPLE: A0.18uF CAPACITOR AT 25°C is 100,000 ÷ 0.18 = 555,000 MEGOHMS.

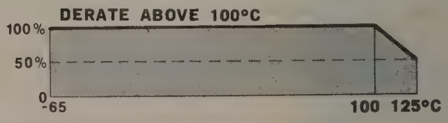
RANGE	25°C	85°C	125°C
.001 TO 0.1uF	1,000,000 Megohms	500,000 Megohms	30,000 Megohms
GREATER THAN 0.1uF	100,000 Megohms-uF	50,000 Megohms-uF	3,000 Megohms-uF

A52 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METH. MIL-C-83421	TEST LIMIT	QUALITY LEVEL
1	BURN-IN	48 hours minimum at 100°C, at 120% rated AC voltage at 400Hz not to exceed 240VRMS	4.7.2	No physical damage	100% Test
2	THERMAL AGING	10 cycles minimum from −65°C to +125°C	4.7.3	No physical damage	100% Test
3	SEAL TEST (GROSS LEAK)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
4	AC SQUARE WAVE (TERMINAL TO TERMINAL)	Apply 100Hz at a peak to peak voltage of 3 times DC rated voltage for 60 sec. min. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
5	DC HI-POT (TERMINAL TO TERMINAL) AND TERMINALS TO CASE)	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
7	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
8	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	.15 maximum	100% Test
9	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions, and workmanship as required.	4.7.1	Per specification	1.0% AQL

1. THE COMBINED DC AND AC VOLTAGES SHOULD NOT EXCEED THE DC RATINGS, SEE FIGURE.
2. CAPACITORS MAY BE OPERATED AT HIGHER FREQUENCIES, AT REDUCED RMS VOLTAGE SUCH THAT MAX. AC CURRENT RATINGS ARE NOT EXCEEDED.
3. TYPE A52 CAPACITORS CAN HANDLE MUCH HIGHER PULSE REPETITION RATES THAN METALLIZED CAPACITORS.





CRC
COMPONENT RESEARCH CO.

FOIL POLYCARBONATE A52

ESTABLISHED RELIABILITY CAPACITORS

CASE DIMENSIONS • AC RATINGS

	TYPE A52C 100VDC					TYPE A52D 200VDC					TYPE A52V 300VDC					TYPE A52E 400VDC				
			AC RATINGS					AC RATINGS					AC RATINGS					AC RATINGS		
uF	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps
.001	.193	.562	60	60	.038	.193	.562	120	120	.075	.193	.562	180	180	.113	.193	.687	240	240	.15
.0012	.193	.562	60	60	.045	.193	.562	120	120	.090	.193	.562	180	180	.135	.193	.687	240	240	.18
.0015	.193	.562	60	60	.056	.193	.562	120	120	.112	.193	.562	180	180	.169	.193	.687	240	240	.22
.0018	.193	.562	60	60	.067	.193	.562	120	120	.135	.193	.562	180	180	.202	.193	.687	240	240	.27
.002	.193	.562	60	60	.075	.193	.562	120	120	.150	.193	.562	180	180	.225	.193	.687	240	240	.30
.0022	.193	.562	60	60	.083	.193	.562	120	120	.165	.193	.562	180	180	.248	.193	.687	240	240	.33
.0027	.193	.562	60	60	.101	.193	.562	120	120	.202	.193	.687	180	180	.304	.193	.687	240	240	.4
.0033	.193	.562	60	60	.124	.193	.562	120	120	.247	.193	.687	180	180	.371	.193	.687	240	240	.5
.0039	.193	.562	60	60	.146	.193	.562	120	120	.293	.193	.687	180	180	.439	.193	.687	240	240	.6
.0047	.193	.562	60	60	.176	.193	.687	120	120	.353	.193	.687	180	180	.529	.235	.687	240	240	.7
.005	.193	.562	60	60	.188	.193	.687	120	120	.375	.193	.687	180	180	.562	.235	.687	240	240	.75
.0056	.193	.562	60	60	.210	.193	.687	120	120	.420	.193	.687	180	180	.623	.235	.687	240	240	.85
.0068	.193	.687	60	60	.255	.193	.687	120	120	.511	.235	.687	180	180	.766	.312	.687	240	240	1.0
.0075	.193	.687	60	60	.282	.235	.687	120	120	.563	.235	.687	180	180	.845	.312	.687	240	240	1.13
.0082	.193	.687	60	60	.308	.235	.687	120	120	.615	.235	.687	180	180	.923	.312	.687	240	240	1.23
.01	.235	.687	60	60	.375	.235	.687	120	120	.750	.312	.687	180	180	1.13	.312	.687	240	224	1.4
.012	.235	.687	60	60	.451	.235	.687	120	120	.902	.312	.687	180	172	1.3	.312	.687	240	200	1.5
.015	.235	.687	60	60	.561	.312	.687	120	120	1.12	.312	.687	180	150	1.4	.312	.813	240	190	1.8
.018	.312	.687	60	60	.674	.312	.687	120	120	1.35	.312	.687	180	134	1.5	.312	.813	240	178	2.0
.02	.312	.687	60	60	.750	.312	.687	120	112	1.4	.312	.813	180	132	1.65	.400	.813	240	168	2.1
.022	.312	.687	60	60	.822	.312	.687	120	110	1.5	.312	.813	180	130	1.8	.400	.813	240	158	2.2
.027	.312	.687	60	60	1.02	.312	.813	120	106	1.8	.312	.813	180	118	2.0	.400	.813	240	148	2.5
.033	.312	.687	60	60	1.22	.312	.813	120	98	2.0	.400	.813	180	108	2.2	.400	1.063	240	130	2.7
.039	.312	.813	60	60	1.46	.400	.813	120	90	2.2	.400	.813	180	98	2.4	.400	1.063	240	117	2.9
.047	.312	.813	60	60	1.76	.400	.813	120	82	2.4	.400	.813	180	85	2.5	.400	1.063	240	102	3.0
.05	.400	.813	60	60	1.88	.400	.813	120	80	2.5	.400	1.063	180	83.2	2.6	.500	1.125	240	102	3.2
.056	.400	.813	60	60	2.07	.400	.813	120	73	2.5	.400	1.063	180	78	2.7	.500	1.125	240	100	3.5
.068	.400	.813	60	53	2.2	.400	1.063	120	65	2.7	.400	1.063	180	67	2.8	.500	1.125	240	96	4.0
.075	.400	.813	60	50	2.4	.400	1.063	120	61	2.9	.400	1.063	180	63	3.0	.500	1.375	240	97	4.6
.082	.400	.813	60	49	2.5	.400	1.063	120	59	3.0	.500	1.125	180	61	3.15	.500	1.375	240	98	5.0
.1	.400	1.063	60	44	2.7	.500	1.125	120	55	3.4	.500	1.125	180	56	3.50	.562	1.375	240	85	5.3
.12	.400	1.063	60	37	2.8	.500	1.125	120	48	3.6	.500	1.125	180	53	4.00	.562	1.375	240	75	5.6
.15	.400	1.063	60	37	2.9	.500	1.125	120	43	4.00	.500	1.375	180	48	4.50	.562	1.375	240	53	6.0
.18	.400	1.063	60	27	3.0	.500	1.375	120	40	4.50	.500	1.375	180	45	5.00					
.2	.500	1.125	60	26	3.3	.500	1.375	120	38	4.75	.562	1.375	180	45	5.63					
.22	.500	1.125	60	25	3.4	.500	1.375	120	37	5.00	.562	1.375	180	45	6.00					
.27	.500	1.125	60	22	3.8	.562	1.375	120	33	5.50										
.33	.500	1.125	60	20	4.13	.562	1.375	120	29	6.00										
.39	.500	1.375	60	20	5.00															
.47	.562	1.375	60	20	6.00															

A52 C 104 J S W

STYLE

VOLTAGE
C=100VDC
D=200VDC
V=300VDC
E=400VDC

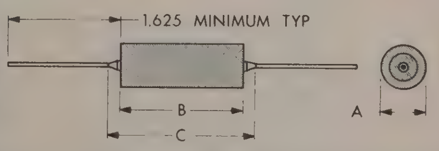
PICOFARAD CODE: First two digits represent significant figures. Last digit represents number of zeros to follow. Example: 104 = 100,000 picofarads.

CAPACITANCE TOLERANCE
K=10% G=2%
J=5% F=1%

SLEEVING CODE
S=Mylar sleeve
X=No sleeve

LEAD CODE
W=Tinned copper clad steel: #22 (.025″) for .312″ case dia. & smaller; #20 (.032″) for .400″ & .500″ case dia.
C=Tinned oxygen-free copper: #18 (.040″) for .562″ case dia. & larger.

CASE DIMENSIONS	TOLERANCE LIMITS (INCHES)
"A" Diameter	±.010 Without Sleeving
	+0.02 −0.00 With Mylar Sleeving
"B" Case Length	±0.03 With or Without Sleeving
"C" Bead to Bead Max. Length	"C" Dimension is 0.2″ maximum more than "B" dimension in table



COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

FOIL POLYPROPYLENE B55

ESTABLISHED RELIABILITY CAPACITORS

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED FROM −55°C TO +85°C (HIGHER RATINGS AVAILABLE)

Series B55 capacitors are designed for continuous duty operation over the full temperature range from −55°C to +85°C at the rating for voltage, current and frequency listed in the specifications.

The maximum RMS current or peak current can be exceeded with reduced duty cycle or tone burst operation, provided that peak rated voltages are not exceeded, and provided the heat rise measured at the terminals and within ¼″ of the hermetic seals does not exceed 20°C.

Heat rise is generally measured with the capacitor located in a room temperature environment allowing for non-cooled normal convection. Lead size and distance to the power source must be adequate to prevent undue heat sinking or generation during measurement.

HIGH CURRENT HANDLING WITH LOW LOSS

Series B55 capacitors have very low series resistance terminations, in the range of several milliohms at 100KHz, and can handle very high peak current discharge currents. Typically it is estimated that a 1uF capacitor can handle over 3000 amperes of peak current at repetition rates up to 10 pulses per second. Testing is now in process to develop meaningful pulse current limits to be added to future specifications for B55 capacitors.

FREEDOM FROM CORONA INCEPTION AND INTERNAL HOT SPOTS

Commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life. CRC capacitors are designed to operate up to 40KHz without abnormal hot spot conditions, without corona inception, with constant controlled low loss terminations which remain reliable after years of use, after operation during severe environmental conditions.

40KHz RATED FOR HIGH CURRENT HANDLING UP TO 85°C

CRC capacitors use a patented low loss termination which remains reliable after years of operation under severe environmental conditions. Whereas commercial type AC rated capacitors may be adequate for 60Hz and possibly 400Hz long term life, the use of CRC terminations enables these capacitors to operate up to 40KHz without abnormal hot spot conditions or corona inception.

HERMETICALLY SEALED, RUGGED AEROSPACE, MILITARY CONSTRUCTION

CRC true hermetic sealing preserves the high quality performance of Series B55 foil polypropylene capacitors and protects the dielectric materials from chemical attack. Merely potting non-hermetic type capacitors is poor insurance against long term loss of dielectric strength and life. It has been found that attack by vapor ingestion of chemicals of non-hermetic polypropylene capacitors has resulted in failure in life or long term operation.

AVAILABLE WITH 400Hz OR 40KHz BURN-IN OPTIONS

AC burn-in options at additional cost are available for critical applications. The most economical AC burn-in is at rated RMS voltage @ 400Hz at 85°C. Burn-in @ 40KHz at maximum rated current is also available for those applications where long term use at high current is anticipated. Group "A" testing is performed 100%. This testing consists of vital capacitor parameters performed after burn-in to tight specification limits. This ensures the high reliability required to assure our customers of fault free operation under harsh operating conditions.

TYPE B55 QUALITY CONFORMANCE INSPECTION

TEST NO.	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs. minimum at 120% rated AC voltage at 400Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −55°C to 85°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage, or at 600VDC. whichever is less	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	.05% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

FOIL POLYPROPYLENE
B55

ESTABLISHED RELIABILITY CAPACITORS

DIMENSIONS & AC RATINGS

	TYPE B55F 400VRMS RATED								TYPE B55P 600VRMS RATED							
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)				MAX. AC RATING −55°C TO 85°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)				MAX. AC RATING −55°C TO 85°C			
uF	Part No.	Fig.	Dia.	Leng.	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	Fig.	Dia.	Leng.	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B55F333KXD	BH	.400	1.083	400	400	400	4	B55P333KXD	BK	.500	1.395	600	600	600	6
.039	B55F393KXD	BH	.400	1.083	400	400	400	4	B55P393KXD	BK	.500	1.395	600	600	600	6
.047	B55F473KXD	BJ	.500	1.145	400	400	400	5	B55P473KXD	BK	.500	1.395	600	600	511	6
.056	B55F563KXD	BJ	.500	1.145	400	400	357	5	B55P563KXD	BK	.500	1.395	600	600	428	6
.068	B55F683KXD	BJ	.500	1.145	400	400	294	5	B55P683KXD	BL	.562	1.395	600	600	412	7
.075	B55F753KXD	BK	.500	1.395	400	400	320	6	B55P753KXD	BL	.562	1.395	600	600	373	7
.082	B55F823KXD	BK	.500	1.395	400	400	293	6	B55P823KXD	BL	.562	1.395	600	600	342	7
.092	B55F923KXD	BL	.562	1.395	400	400	305	7	B55P923KXD	BM	.670	1.395	600	600	348	8
.1	B55F104KXD	BL	.562	1.395	400	400	280	7	B55P104KXD	BM	.670	1.395	600	600	360	8
.12	B55F124KXD	BL	.562	1.395	400	400	233	7	B55P124KXD	BM	.670	1.395	600	600	266	8
.15	B55F154KXD	BL	.562	1.395	400	400	187	7	B55P154KXD	BN	.670	1.895	600	600	214	8
.18	B55F184KXD	BM	.670	1.395	400	400	178	8	B55P184KXD	BN	.670	1.895	600	600	200	9
.22	B55F224KXD	BM	.670	1.395	400	400	146	8	B55P224KXD	BN	.670	1.895	600	600	164	9
.27	B55F274KXD	BN	.670	1.895	400	400	133	9	B55P274KXD	BP	.750	1.980	600	600	178	12
.33	B55F334KXD	BN	.670	1.895	400	400	109	9	B55P334KXD	BP	.750	1.980	600	600	145	12
.39	B55F394KXD	BN	.670	1.895	400	400	92.7	9	B55P394KXD	BQ	.750	2.480	600	600	144	14
.47	B55F474KXD	BP	.750	1.895	400	400	102	12	B55P474KXD	BQ	.750	2.480	600	600	119	14
.56	B55F564KXD	BP	.750	1.895	400	400	85.7	12								
.68	B55F684KXD	BP	.750	2.480	400	400	70.6	12								
.75	B55F754KXD	BQ	.750	2.480	400	400	74.6	14								
.82	B55F824KXD	BQ	.750	2.480	400	400	68.3	14								

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

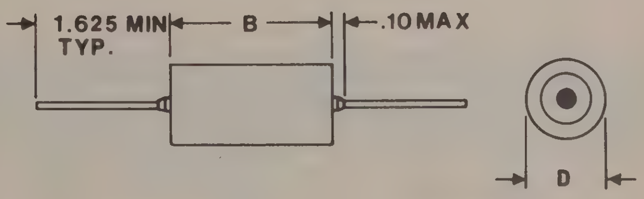
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



Case Figure	D Case Diameter	B Maximum Case Length	Leads Diam. ±.003	Leads AWG	D Max.	Approx. Wt. Grams
BH	.400	1.187	.041	18	.420	6
BJ	.500	1.250	.041	18	.530	10
BK	.500	1.500	.041	18	.530	11
BL	.562	1.500	.041	18	.592	13
BM	.670	1.500	.051	16	.700	14
BN	.670	2.000	.051	16	.700	22
BP	.750	2.000	.051	16	.780	27
BQ	.750	2.500	.051	16	.780	32

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615. TWX: (910) 343 6864

CRC
COMPONENT RESEARCH CO.

METALLIZED POLYPROPYLENE
B15

ESTABLISHED RELIABILITY CAPACITORS

SPECIFICATIONS & QUALITY CONFORMANCE

400VRMS, 600VRMS, RATED −55°C TO +85°C

Series B15 metallized polypropylene capacitors have lower loss than Series B14 metallized polysulfone capacitors and therefore are superior for power resonating applications requiring minimum loss. The B15 capacitors are however limited for use in 85°C or lower temperature applications. CRC can supply special high temperature low loss teflon capacitors for 200°C power resonating applications if required.

When Series B15 specifications are completed, RMS ratings above 600VRMS will be available together with information covering this product line.

LOW LOSS, HIGH Q, LIGHT WEIGHT, HIGH POWER RATED, HERMETICALLY SEALED

The B15 capacitors are lighter in weight than any other hermetically sealed capacitor with equivalent current and voltage ratings at 40KHz. Typically a 5.6uF, 400VRMS, capacitor in a 1.25″ x 3.440″ case weighs approximately 110 grams and is rated to handle 35 amps at 40KHz.

Polypropylene film like many other dielectrics is affected by chemical attack of solvents, epoxies and contamination. True hermetic sealing of CRC's capacitors protects them from outside chemical attack and assures that long term high quality performance can be maintained.

RUGGED LOW LOSS TERMINATIONS FOR 100% DUTY CYCLE OPERATING LIFE

The large amount of power that B15 capacitors can handle is a result of years of development searching for all possible means of reducing capacitor losses and preserving the integrity of CRC's rugged capacitor terminations. When CRC's metallized polypropylene capacitors are subjected to temperature extremes, they surpass commercial type products in their ability to maintain a constant low loss equivalent series resistance and can maintain their low power factor for critical aerospace applications. Where extremely high pulse currents may be encountered Series B55 should be considered.

AC RATED TO 40KHz UP TO 85°C

Series B15 capacitors are rated up to 40KHz and are ideal for power resonating circuits. Due to a negative temperature coefficient of approximately 200 PPM/°C a 10°C temperature increase due to applied power or applied temperature will cause the capacitance to decrease approximately 0.2%.

AVAILABLE WITH AC BURN-IN AND OTHER SCREENING OPTIONS

CRC manufactures larger capacitors of similar construction to the B15 series in rectangular cases for power inverter applications requiring low loss filtering of several hundreds of amperes of ripple at frequencies 20KHz and higher.

Further developments in lowering capacitor losses are currently being completed at CRC and will result in further improved ratings for B15 and other new model capacitors.

TYPE B15 QUALITY CONFORMANCE INSPECTION

NO. TEST	TEST	TEST CONDITIONS	TEST METHOD	TEST LIMIT	INSPECTION LEVEL
1	BURN-IN	16 hrs. minimum at 120% rated AC voltage at 400Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	THERMAL AGING	5 cycles minimum −55°C to 85°C	4.7.3	No physical damage	100% Test
3	SEAL TEST	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	INSULATION RESISTANCE (TERMINAL TO TERMINAL)	At 25°C at rated DC voltage, or at 600VDC, whichever is less	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 megohms	100% Test
5	% CAPACITANCE TOLERANCE	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% DISSIPATION FACTOR	At 25°C at 10KHz	4.7.9	0.05% maximum	100% Test
7	VISUAL AND MECHANICAL INSPECTION	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

NOW AVAILABLE: TYPE A15 METALLIZED POLYPROPYLENE LOW LOSS CAPACITORS. 100 VDC RATED .1 TO 22 μF. A.C. RATED TO 40 kHZ. CONTACT OUR APPLICATIONS DEPARTMENT FOR MORE INFORMATION.

COMPONENT RESEARCH CO., INC. ▪ 1655 26TH STREET ▪ SANTA MONICA, CALIF. 90404 ▪ (213) 829-3615, TWX: (910) 343-6864

CRC
COMPONENT RESEARCH CO.

METALLIZED POLYPROPYLENE B15

ESTABLISHED RELIABILITY CAPACITORS

DIMENSIONS & AC RATINGS

	TYPE B15F 400VRMS RATED								TYPE B15P 600VRMS RATED							
	600VDC RATED OR 600 VOLTS PEAK (AC PLUS DC VOLTS)				MAX. AC RATING −55°C TO 85°C				800VDC RATED OR 840 VOLTS PEAK (AC PLUS DC VOLTS)				MAX. AC RATING −55°C TO 85°C			
uF	Part No.	Fig.	Dia.	Leng.	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	Fig.	Dia.	Leng.	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B15F103KXD	BF	.312	.833	400	400	400	2.5	B15P103KXD	BH	.400	1.083	600	600	600	3.5
.012	B15F123KXD	BF	.312	.833	400	400	400	2.5	B15P123KXD	BH	.400	1.083	600	600	600	3.5
.015	B15F153KXD	BF	.312	.833	400	400	400	2.5	B15P153KXD	BH	.400	1.083	600	600	600	3.5
.018	B15F183KXD	BF	.312	.833	400	400	400	2.5	B15P183KXD	BH	.400	1.083	600	600	600	3.5
.022	B15F223KXD	BG	.400	.833	400	400	400	3.0	B15P223KXD	BH	.400	1.083	600	600	600	3.5
.027	B15F273KXD	BG	.400	.833	400	400	400	3.0	B15P273KXD	BH	.400	1.083	600	600	518	3.5
.033	B15F333KXD	BG	.400	.833	400	400	364	3.0	B15P333KXD	BH	.400	1.083	600	600	424	3.5
.039	B15F393KXD	BG	.400	.833	400	400	308	3.0	B15P393KXD	BH	.400	1.083	600	600	369	3.5
.047	B15F473KXD	BH	.400	1.083	400	400	298	3.5	B15P473KXD	BJ	.500	1.145	600	600	340	4
.056	B15F563KXD	BH	.400	1.083	400	400	250	3.5	B15P563KXD	BJ	.500	1.145	600	600	286	4
.068	B15F683KXD	BH	.400	1.083	400	400	206	3.5	B15P683KXD	BJ	.500	1.145	600	600	227	4
.075	B15F753KXD	BH	.400	1.083	400	400	187	3.5	B15P753KXD	BK	.500	1.395	600	600	267	5
.082	B15F823KXD	BJ	.500	1.145	400	400	195	4	B15P823KXD	BK	.500	1.395	600	600	244	5
.092	B15F923KXD	BJ	.500	1.145	400	400	174	4	B15P923KXD	BL	.562	1.395	600	600	261	6
.1	B15F104KXD	BJ	.500	1.145	400	400	160	4	B15P104KXD	BL	.562	1.395	600	600	240	6
.12	B15F124KXD	BK	.500	1.395	400	400	167	5	B15P124KXD	BL	.562	1.395	600	600	200	6
.15	B15F154KXD	BK	.500	1.395	400	400	134	5	B15P154KXD	BL	.562	1.395	600	600	160	6
.18	B15F184KXD	BL	.562	1.395	400	400	133	6	B15P184KXD	BM	.670	1.395	600	600	155	7
.22	B15F224KXD	BL	.562	1.395	400	400	109	6	B15P224KXD	BM	.670	1.395	600	600	127	7
.27	B15F274KXD	BL	.562	1.395	400	400	88.8	6	B15P274KXD	BN	.670	1.895	600	600	118	8
.33	B15F334KXD	BM	.670	1.395	400	400	84.7	7	B15P334KXD	BN	.670	1.895	600	600	96.8	8
.39	B15F394KXD	BM	.670	1.395	400	400	72.1	7	B15P394KXD	BN	.670	1.895	600	600	82.4	8
.47	B15F474KXD	BN	.670	1.895	400	400	68.1	8	B15P474KXD	BP	.750	1.980	600	600	93.6	11
.56	B15F564KXD	BN	.670	1.895	400	400	57	8	B15P564KXD	BP	.750	1.980	600	600	78.5	11
.68	B15F684KXD	BN	.670	1.895	400	400	47	8	B15P684KXD	BP	.750	1.980	600	600	64.7	11
.75	B15F754KXD	BP	.750	1.980	400	400	58.6	11	B15P754KXD	BQ	.750	2.480	600	600	69.3	13
.82	B15F824KXD	BP	.750	1.980	400	400	53.7	11	B15P824KXD	BS	1.0	2.480	600	600	63.4	15
.92	B15F924KXD	BQ	.750	2.480	400	400	56.6	13								
1.0	B15F105KXD	BQ	.750	2.480	400	400	52	13								
1.2	B15F125KXD	BQ	.750	2.480	400	400	43.3	13								

ORDERING INFORMATION: All part numbers listed in tables have a capacitance tolerance of ±10% and are supplied with bare metal (unsleeved) cases.

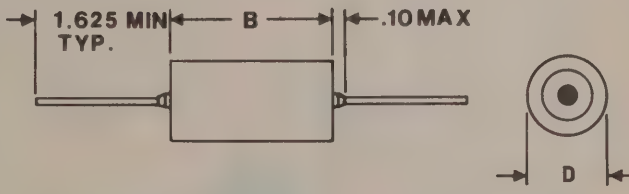
TECHNICAL INFORMATION: These capacitors can be damaged when you solder to the lead wires due to possible overheating that can occur. Place a suitable heat sink on the lead wire between the solder beads on the hermetic seal and the area of wire lead to be soldered.

For initial design, when operating the capacitors at high current levels it is suggested that you monitor the capacitor heat rise on the leads adjacent to the solder beads to verify that it does not exceed 20°C above ambient.

All maximum current ratings shown should result in less than 20°C heat rise with continuous duty operation under normal convection conditions.

Avoid tearing of solder beads when bending wire leads by using a suitable clamping fixture for lead bending.

PART DIMENSIONS AND TOLERANCES



Case Figure	D Case Diameter	B Maximum Case Length	Leads Diam. ±.003	Leads AWG	D Max.	Approx. Wt. Grams
BF	.312	.937	.032	20	.332	2.5
BG	.400	.937	.041	18	.420	3.5
BH	.400	1.187	.041	18	.420	5
BJ	.500	1.250	.041	18	.530	8
BK	.500	1.500	.041	18	.530	9
BL	.562	1.500	.041	18	.592	12
BM	.670	1.500	.051	16	.700	13
BN	.670	2.000	.051	16	.700	21
BP	.750	2.000	.051	16	.780	25
BQ	.750	2.500	.051	16	.780	30
BS	1.0	2.500	.051	16		50

COMPONENT RESEARCH CO., INC. • 1655 26TH STREET • SANTA MONICA, CALIF. 90404 • (213) 829-3615. TWX: (910) 343-6864

HIGH QUALITY CAPACITORS by DSA

ALUMINUM ELECTROLYTIC CAPACITORS

From 0.1mfd through 47,000mfd
6.3wv to 450wv

AXIAL & RADIAL LEAD		ULTRA MINIATURE	(SAA)
GENERAL USE	(SA/ST)	HIGH WORKING VOLTAGE	(SHT)
HIGH GRADE INDUSTRIAL	(SAL/STL)	LUG TERMINAL	(SL)
LOW LEAKAGE	(SAB)	BI-POLARIZED (Also Semi-Bi-Polarized)	

CUT & FORMED LEAD and TAPING in AMMO & REEL PACKAGING AVAILABLE

PLASTIC FILM CAPACITORS

POLYESTER FILM (CQ92)	0.001mfd to 0.47mfd	50wv to 400wv
METALIZED POLYESTER FILM		
TAPE-WRAPPED (MCT)	0.047mfd to 10.0mfd	100wv to 630wv
DIPPED (MCD)	0.047mfd to 2.2mfd	250wv, 400wv, 630wv
POLYSTYRENE FILM (SFC)	100pfd to 22,000pfd	50wv to 500wv

SOLID TANTALUM CAPACITORS

RESIN DIPPED : 0.047mfd to 470mfd
: 3.15wv to 50wv
Anti-solvent/nonflammable

OTHER PRODUCTS:
CERAMIC CAPACITORS
CERAMIC FILTERS
NOISE SUPRESSOR FOR AUTOMOBILE

RESISTORS

CARBON FILM FIXED RESISTORS (RD)
¼ W to 1W: 2.2ohm to 10Mohm (J ±5%)
SIZE: L 6.5mm/D 2.3mm
LOW-OHMAGE METAL FILM
RESISTORS (MF) and
METAL OXIDE FILM RESISTORS (MO)
0.22ohm to 180Kohm
TAPE & REEL, AMMO PACK

FOR COMPLETE INFORMATION ON OUR WIDE RANGE OF PRODUCTS PLEASE CONTACT:

DSA-DAI-ICHI SHOJI OF AMERICA, INC.
150 Fifth Avenue, Suite 516, New York, NY 10011, (212) 691-9050.

SWITCH-MODE POWER SUPPLY CAPACITORS

TYPE 5 MC METALLIZED POLYCARBONATE

A new innovation pioneered by Electronic Concepts, Inc. leads the way to a new era of miniature metallized polycarbonate film capacitors physically designed to minimize used circuit board real estate in switch mode power converters while maintaining a low ESR, excellent ripple capability and high resonant frequency.

Electronic Concepts offers, in addition to conventional axial leaded termination, a flat tinned copper tab termination for increased current carrying capability and higher resonant frequency.

To aid the best layout potential, the copper tab terminated version is offered in both high and low profiles for each capacitance/voltage rating.

Excellent electrical characteristics and super miniaturization are offered to switch mode power supply designers with his requirements in mind.

Additionally, the unique 5MC29 style features:

1. Internal coaxial lead wire configuration to minimize inductance thereby maximizing resonant frequency.
2. Solid copper #16 AWG wire leads to minimize ESR and to accommodate ripple current to 30 amperes.
3. Copper foil outerwrap shielding to minimize RFI and EMI.
4. Specially formulated epoxy end-seal to increase heat dissipation.
5. Radial plug-in lead wire configuration to conserve circuit board space and reduce parasitic inductance.

CAPACITANCE In MFD	AXIAL LEADS 5MC22			LOW PROFILE 5MC26			HIGH PROFILE 5MC27			TYPE 5MC29			ESR Milliohms 100 KHz	Ripple Current Max @ 25°	Resonant Frequency KHz 5MC22, 5MC26, 5MC27	Resonant Frequency KHz 5MC29
	T	H	L	T	H	L	T	H	L	T	W	H				
50 VDC																
1.0	.250	.343	.687										18	7.8	890	
3.0	.406	.593	.687										15	9.8	550	
5.0	.406	.593	.812										13	10.6	375	
10.0	.562	.812	.812	.812	.562	.750	.562	.812	.750	.562	.862	.750	11	12.6	265	318
20.0	.718	.968	.937	.968	.718	.875	.718	.968	.875	.718	.968	.875	10	14.8	178	214
50.0	1.000	1.375	1.062	1.375	1.000	1.000	1.000	1.375	1.000	1.000	1.375	1.000	6	23.5	108	130
75 VDC																
1.0	.281	.375	.812										19	7.9	840	
3.0	.468	.718	.812	.718	.468	.750	.468	.718	.750	.468	.718	.750	15	10.3	560	672
5.0	.500	.750	.937	.750	.500	.875	.500	.750	.875	.500	.750	.875	13	11.6	356	427
10.0	.718	1.031	.937	1.031	.718	.875	.718	1.031	.875	.718	1.031	.875	12	13.5	251	301
20.0	.937	1.312	1.062	1.312	.937	1.000	.937	1.312	1.000	.937	1.312	1.000	11	16.5	171	205
50.0	1.312	1.687	1.312	1.687	1.312	1.250	1.312	1.687	1.250	1.312	1.687	1.250	6	24.2	100	120
100 VDC																
1.0	.281	.375	.937										20	8.0	780	
3.0	.437	.750	.937	.750	.437	.875	.437	.750	.875	.437	.750	.875	15	10.6	570	684
5.0	.593	.906	.937	.906	.593	.875	.593	.906	.875	.593	.906	.875	13	12.4	356	427
10.0	.781	1.093	1.062	1.093	.781	1.000	.781	1.093	1.000	.781	1.093	1.000	12	14.6	242	290
20.0	.906	1.281	1.312	1.281	.906	1.250	.906	1.281	1.250	.906	1.281	1.250	11	17.1	160	192
50.0	1.437	1.812	1.437	1.812	1.437	1.375	1.437	1.812	1.375	1.437	1.812	1.375	6	23.6	96	115

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

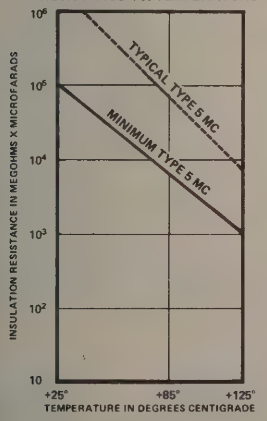
The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

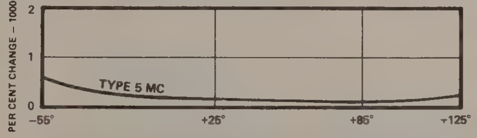
Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz.

ELECTRICAL CHARACTERISTICS VS TEMPERATURE

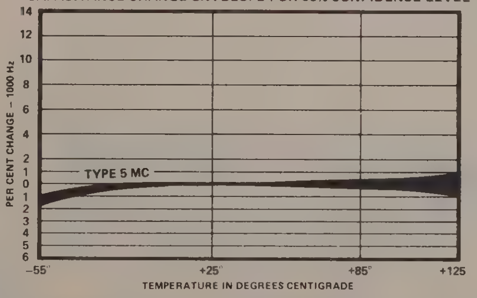
INSULATION RESISTANCE VS. TEMPERATURE



TYPICAL DISSIPATION FACTOR CHANGE WITH TEMPERATURE

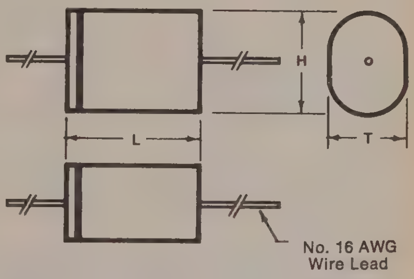


CAPACITANCE CHANGE ENVELOPE FOR 95% CONFIDENCE LEVEL

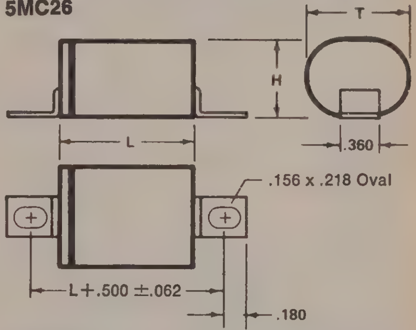


DIMENSIONAL DATA

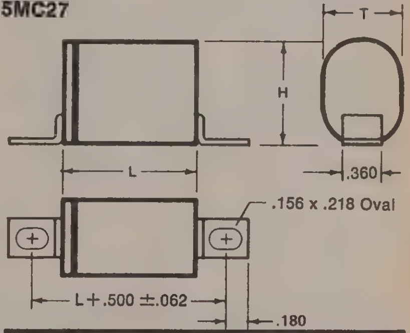
5MC22



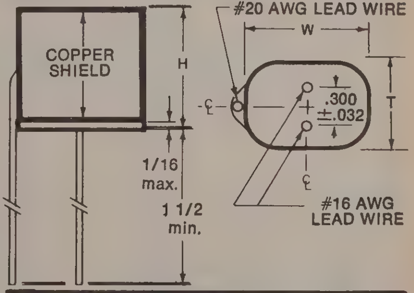
5MC26



5MC27



5MC29

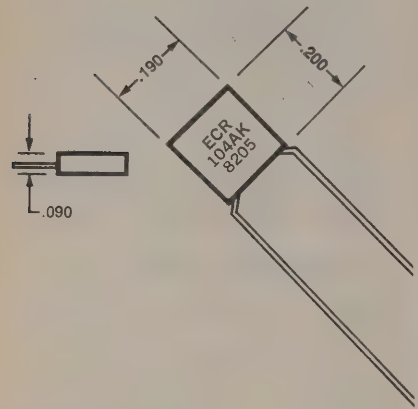


ELECTRONIC CONCEPTS INC.®

P.O. BOX 627E EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

AVIONICAPS® *The smallest film capacitor in the world*

METALLIZED POLYCARBONATE



TYPE ECR

- NO PIEZOELECTRIC EFFECT
- NOT FREQUENCY SENSITIVE
- NOT VOLTAGE SENSITIVE

A new innovation pioneered by Electronic Concepts leads the way to a new era of smaller metallized film capacitors. Now a combination of excellent electrical characteristics and compactness is offered the equipment designer in a size equal to a ceramic CK05 capacitor.

Besides the superior electrical characteristics Type ECR are self-healing, as is the case with all metallized capacitors.

Additionally, these capacitors do not exhibit any of the drawbacks inherent in all ceramic capacitors.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1KHz.

VALUE IN MFD	VDC	PHYSICAL SIZE T	H	L	LEAD SPACING LS	SEE FIGURE
.0010	250	.090	.190	.190	.200	1
.0012	250	.090	.190	.190	.200	1
.0015	250	.090	.190	.190	.200	1
.0018	250	.090	.190	.190	.200	1
.0022	250	.090	.190	.190	.200	1
.0027	250	.090	.190	.190	.200	1
.0033	250	.090	.190	.190	.200	1
.0039	200	.090	.190	.190	.200	1
.0047	200	.090	.190	.190	.200	1
.0056	200	.090	.190	.190	.200	1
.0068	150	.090	.190	.190	.200	1
.0082	150	.090	.190	.190	.200	1
.010	100	.090	.190	.190	.200	1
.012	100	.090	.190	.190	.200	1
.015	100	.090	.190	.190	.200	1
.018	100	.090	.190	.190	.200	1
.022	75	.090	.190	.190	.200	1
.027	75	.090	.190	.190	.200	1
.033	50	.090	.190	.190	.200	1
.039	50	.090	.190	.190	.200	1
.047	50	.090	.190	.190	.200	1
.056	50	.090	.190	.190	.200	1
.068	30	.090	.190	.190	.200	1
.082	30	.090	.190	.190	.200	1
.10	30	.090	.190	.190	.200	1
.12	30	.095	.295	.295	.200	2
.15	30	.095	.295	.295	.200	2
.18	30	.095	.295	.295	.200	2
.22	30	.095	.295	.395	.300	2
.27	30	.165	.395	.395	.300	2
.33	30	.165	.395	.395	.300	2
.39	30	.165	.395	.395	.300	2
.47	30	.165	.395	.395	.300	2
.56	30	.165	.395	.395	.300	2
.68	30	.195	.395	.395	.300	2
.82	30	.195	.395	.395	.300	2
1.0	30	.195	.395	.395	.300	2

DIMENSIONAL DATA

Figure 1

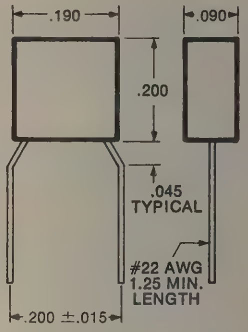
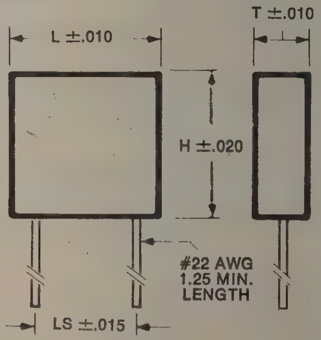
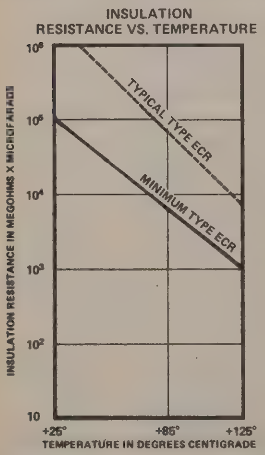
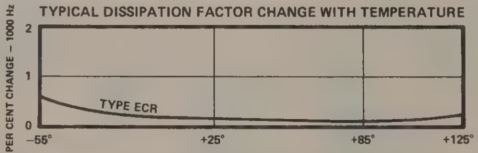


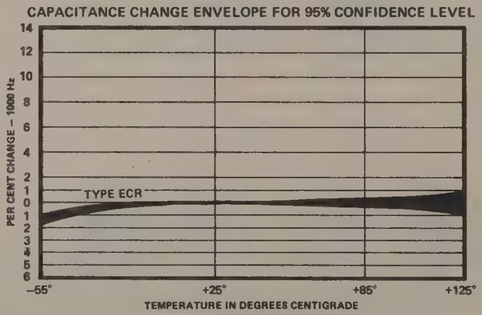
Figure 2



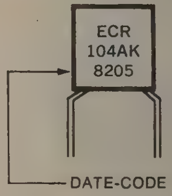
ELECTRICAL CHARACTERISTICS VS TEMPERATURE


INSULATION RESISTANCE VS. TEMPERATURE


TYPICAL DISSIPATION FACTOR CHANGE WITH TEMPERATURE


CAPACITANCE CHANGE ENVELOPE FOR 95% CONFIDENCE LEVEL

Part Marking



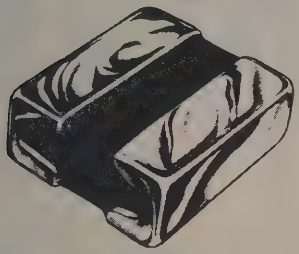
The first two digits represent the year, the second two digits represent the week ie: 7952 is the 52nd week of 1979, 8012 is the 12th week of 1980.

ELECTRONIC CONCEPTS INC.

P.O. BOX 627E EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

AVIONICAPS® *The first "surface mount" film capacitor*

METALLIZED POLYCARBONATE



TYPE SECR

Now realize all the benefits of automated solder reflow assembly and greater pc board density — with our new AVIONICAP® TYPE SECR METALLIZED POLYCARBONATE FILM CAPACITOR.

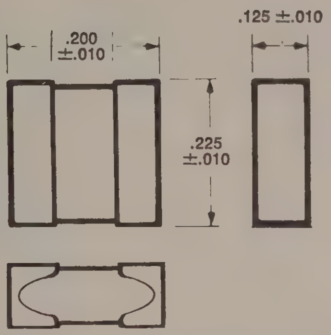
It's the first of its kind in a surface mount configuration — ideal for robotic and other pick and place equipment.

With the smallest package size available —measuring only .125″(T) x .200″ x .225″. That's as much as ⅓ size reduction. And there's no loss in electrical characteristics!

Surface mounting, a smaller package, excellent electrical/physical characteristics. Our new AVIONICAP® "surface mount" film capacitor...helping to light the way into the future.

VALUE IN MFD	VDC	PART NO.
.0010	250	SECR 102G-
.0012	250	SECR 122G-
.0015	250	SECR 152G-
.0018	250	SECR 182G-
.0022	250	SECR 222G-
.0027	250	SECR 272G-
.0033	250	SECR 332G-
.0039	200	SECR 392F-
.0047	200	SECR 472F-
.0056	200	SECR 562F-
.0068	150	SECR 682E-
.0082	150	SECR 822E-
.010	100	SECR 103D-
.012	100	SECR 123D-
.015	100	SECR 153D-
.018	100	SECR 183D-
.022	75	SECR 223C-
.027	75	SECR 273C-
.033	50	SECR 333B-
.039	50	SECR 393B-
.047	50	SECR 473B-
.056	50	SECR 563B-
.068	30	SECR 683A-
.082	30	SECR 823A-
.10	30	SECR 104A-

DIMENSIONAL DATA



CATALOG NUMBERING SYSTEM

When ordering, please use Electronic Concepts Catalog number.

SECR 104 A K

TOLERANCE
F = ±1%, G = ±2%
J = ±5%, K = ±10%, M = ±20%

VOLTAGE
A = 30 VDC, B = 50 VDC,
C = 75 VDC, D = 100 VDC,
E = 150 VDC, F = 200 VDC,
G = 250 VDC

CAPACITANCE
The first two digits are significant figures, the third digit represents the number of zeros to follow to express the capacitance in picofarads.

TYPE

FOR ADDITIONAL INFORMATION, PLEASE CONTACT ONE OF OUR REGIONAL OFFICES.

U.S. REGIONAL SALES OFFICES:

EASTERN
Eatontown, NJ/201-542-7880

CENTRAL
Wheaton, IL/312-668-8747

WESTERN
Colton, CA/714-824-2525
Los Gatos, CA/408-395-4224

HEADQUARTERS:

P.O. Box 627
Eatontown, NJ 07724
201-542-7880

NATIONAL DISTRIBUTION CENTER:

ELCON Sales
510A Industrial Ave.
Teterboro, NJ 07608
201-288-8170

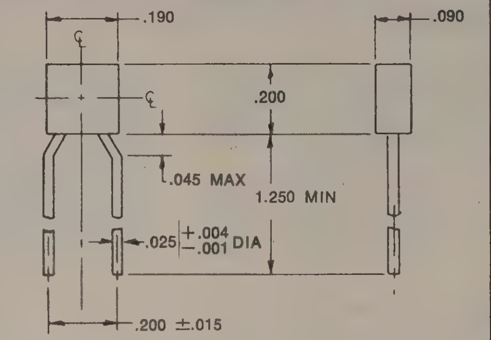
ELECTRONIC CONCEPTS INC.®

P.O. BOX 627E EATONTOWN, NEW JERSEY 07724 • (201) 542-7880

ESTABLISHED RELIABILITY CAPACITORS

FIXED, PLASTIC DIELECTRIC, DC, IN NON-METAL CASES PER MIL-C-55514

STYLE CFR12



World's smallest film capacitor (CKO size) now available as CFR12.

Dielectric: metallized polycarbonate film.

Construction: molded rectangular case, radial leaded. See previous page **AVIONICAPS®**.

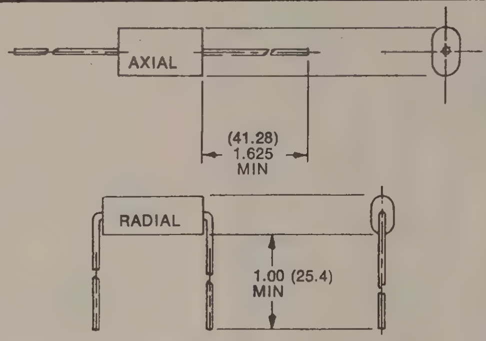
Capacitance values in MFD:

.0010 thru .10 30V
.0010 thru .056 50V
.0010 thru .027 75V
.0010 thru .018 100V
.0012 thru .0082 150V
.0012 thru .0056 200V
.0012 thru .0033 250V

Capacitance tolerance: ±1%, ±2%, ±5%, ±10%

Refer to MIL-C-55514 for additional specifics or call Electronic Concepts, Inc.

STYLE CFR06



Dielectric: metallized plastic film

Characteristic R: metallized polycarbonate
N: metallized polyester

Construction: oval configuration, axial or radial leaded

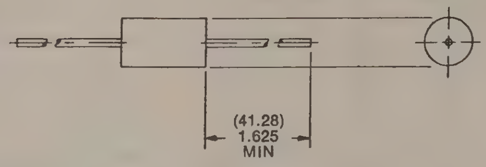
Capacitance values in MFD:

Characteristic "R"	**Characteristic "N"**
.0010 thru 50.0 50V	.010 thru 10.0 200V
.0010 thru 20.0 100V	.010 thru 3.3 400V

Capacitance tolerance:
"R" ±1%, ±2%, ±5%, ±10%
"N" ±2%, ±5%, ±10%

Refer to MIL-C-55514 for additional specifics or call Electronic Concepts, Inc.

STYLE CFR05



Dielectric: metallized polycarbonate plastic film. Characteristic R.

Construction: round configuration, axial leaded.

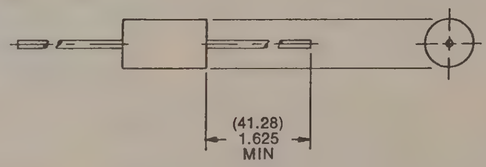
Capacitance values in MFD:

.0010 thru 50.0 50V
.0010 thru 20.0 100V
.010 thru 10.0 200V
.010 thru 5.0 400V

Capacitance tolerance: ±1%, ±2%, ±5%, ±10%

Refer to MIL-C-55514 for additional specifics or call Electronic Concepts, Inc.

STYLE CFR02



Dielectric: plastic film

Characteristic M: polyester film and foil
Q: polycarbonate film and foil

Construction: Round configuration, axial leaded

Capacitance values in MFD:

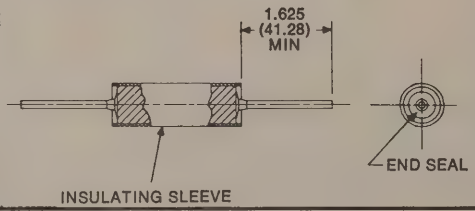
Characteristic "M"	**Characteristic "Q"**
.0068 thru 1.0 100V	.0010 thru 1.0 100V
.0010 thru 1.0 200V	.0010 thru 1.0 200V
.0018 thru 1.0 400V	
.0010 thru 0.1 600V	

Capacitance tolerance:
"M" ±2%, ±5%, ±10%
"Q" ±1%, ±2%, ±5%, ±10%

Refer to MIL-C-55514 for additional specifics or call Electronic Concepts, Inc.

STYLE CRH

FIXED, SUPERMETALLIZED PLASTIC FILM DIELECTRIC DC AND AC, HERMETICALLY SEALED IN METAL CASES PER MIL-C-83421



Dielectric: supermetallized polycarbonate film

Construction: hermetically sealed metal tube with axial leads.

Capacitance values in MFD:

.0010 thru 22.0 Avail. in 30 VDC, 22 VAC @ 400 HZ
.0010 thru 10.0 Avail. in 50 VDC, 36 VAC @ 400 HZ
.0010 thru 10.0 Avail. in 100 VDC, 60 VAC @ 400 HZ
.0010 thru 3.9 Avail. in 200 VDC, 120 VAC @ 400 HZ
.0010 thru 2.0 Avail. in 400 VDC, 240 VAC @ 400 HZ

Capacitance Tolerance:
±10%, ±5%, ±2%, ±1%, ±0.5%, ±0.25%

Refer to MIL-C-83421/1 for additional specifics or call Electronic Concepts, Inc.

P.O. BOX 627E, EATONTOWN, NEW JERSEY 07724 • (201) 542-7880.

ELECTRONIC CONCEPTS INC. ®

eem

MINIGLOSSARY
CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	−1
Brown	1	10	±0.1pF	±1%		−33		−10
Red	2	100		±2%		−75	1.0	−100
Orange	3	1000		±3%		−150	1.5	−1000
Yellow	4	10000			+100% −0%	−220	2.0	−10000
Green	5		±0.5pF	±5%	±5%	−330	3.3	+1
Blue	6					−470	4.7	+10
Violet	7					−750	7.5	+100
Gray	8	0.01	±0.25pF		+80% −20%	+150 to −1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to −750		+10000
Silver								
Gold								

ELPAC COMPONENTS

A DIVISION OF ELPAC ELECTRONICS, INC.

3131 S. STANDARD AV./SANTA ANA, CA 92705
TEL 714-979-4440/TWX 910-595-1513

METALLIZED POLYESTER (MYLAR*)

Metallized Polyester (Mylar) capacitors are among the smallest of all electrostatic types. These units possess excellent characteristics for general purpose coupling or bypassing in either high or low impedance circuits and are superior in precise filter applications. While they are most often used in dc applications, they have been successfully used in such ac applications as power factor correction and power line filtering. They are highly reliable due to the self-healing qualities of the metallized dielectric. *T.M. DuPont

Z Subminiature Series

SIZES AND PART NUMBERS
Other capacitances, voltages and tolerances available on special request.

MFD	50 VDC				100 VDC				200 VDC			
	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.
.001	.09	.18	.40	Z5A102	.09	.18	.40	Z1A102	.09	.18	.40	Z2A102
.0015	.09	.18	.40	Z5A152	.09	.18	.40	Z1A152	.09	.18	.40	Z2A152
.0018	.09	.18	.40	Z5A182	.09	.18	.40	Z1A182	.09	.18	.40	Z2A182
.0022	.09	.18	.40	Z5A222	.09	.18	.40	Z1A222	.09	.18	.40	Z2A222
.0033	.09	.18	.40	Z5A332	.09	.18	.40	Z1A332	.09	.18	.40	Z2A332
.0047	.09	.18	.40	Z5A472	.09	.18	.40	Z1A472	.09	.18	.40	Z2A472
.0082	.09	.18	.40	Z5A822	.09	.18	.40	Z1A822	.09	.18	.40	Z2A822
.01	.09	.18	.40	Z5A103	.09	.18	.40	Z1A103	.09	.18	.40	Z2A103
.015	.09	.18	.40	Z5A153	.09	.18	.40	Z1A153	.09	.18	.40	Z2A153
.018	.09	.18	.40	Z5A183	.09	.18	.40	Z1A183	.09	.18	.40	Z2A183
.022	.09	.18	.40	Z5A223	.09	.18	.40	Z1A223	.09	.18	.53	Z2A223
.033	.09	.18	.40	Z5A333	.11	.19	.40	Z1A333	.09	.18	.53	Z2A333
.047	.09	.18	.40	Z5A473	.12	.22	.40	Z1A473	.09	.18	.53	Z2A473
.082	.10	.20	.40	Z5A823	.10	.20	.53	Z1A823	.14	.23	.53	Z2A823
.1	.12	.22	.40	Z5A104	.12	.21	.53	Z1A104	.16	.25	.53	Z2A104
.15	.15	.25	.40	Z5A154	.15	.23	.53	Z1A154	.20	.29	.53	Z2A154
.18	.10	.20	.53	Z5A184	.17	.25	.53	Z1A184	.22	.32	.53	Z2A184
.22	.12	.22	.53	Z5A224	.19	.27	.53	Z1A224	.18	.31	.65	Z2A224
.33	.15	.25	.53	Z5A334	.17	.24	.65	Z1A334	.24	.36	.65	Z2A334
.47	.19	.29	.53	Z5A474	.17	.27	.78	Z1A474	.24	.37	.78	Z2A474
.82	.19	.32	.65	Z5A824	.23	.33	.78	Z1A824	.34	.47	.78	Z2A824
1.0	.22	.35	.65	Z5A105	.23	.34	.90	Z1A105	.33	.46	.90	Z2A105
1.5	.24	.36	.78	Z5A155	.29	.39	.90	Z1A155	.34	.48	1.17	Z2A155
1.8	.26	.39	.78	Z5A185	.32	.45	.90	Z1A185	.38	.52	1.17	Z2A185
2.0	.28	.41	.78	Z5A205	.34	.45	.90	Z1A205	.40	.55	1.17	Z2A205
4.0	.29	.44	1.17	Z5A405	.35	.46	1.40	Z1A405	.52	.66	1.40	Z2A405
5.0	.34	.48	1.17	Z5A505	.40	.55	1.70	Z1A505	.50	.69	1.70	Z2A505
10.0	.44	.58	1.40	Z5A106	.40	.80	1.98	Z1A106	.57	.87	2.20	Z2A106

Intermediate Values and High Voltages Available

METALLIZED POLYPROPYLENE

Elpac's Subminiature Series PMB Metallized Polypropylene Capacitors are non-inductively wound using thin gauge film to provide maximum packaging density. Physical protection is afforded by a polyester outer wrap and epoxy end seals. Leads are tinned copper clad steel for maximum strength and solderability.

SERIES PMB

SIZES AND PART NUMBERS
Other Capacitances, Voltages and Tolerances Available on Special Request

MFD	50 VDC			100 VDC			200 VDC			400 VDC			600 VDC		
	D	L	PART NO.	D	L	PART NO.	D	L	PART NO.	D	L	PART NO.	D	L	PART NO.
.018	.13	.40	PM5B183	.13	.40	PM1B183	.19	.40	PM2B183	.17	.53	PM4B183	.25	.53	PM6B183
.022	.14	.40	PM5B223	.14	.40	PM1B223	.20	.40	PM2B223	.19	.53	PM4B223	.27	.53	PM6B223
.033	.17	.40	PM5B333	.17	.40	PM1B333	.17	.53	PM2B333	.22	.53	PM4B333	.27	.65	PM6B333
.056	.21	.40	PM5B473	.20	.40	PM1B473	.20	.53	PM2B473	.26	.53	PM4B473	.32	.65	PM6B473
.047	.20	.40	PM5B563	.21	.40	PM1B563	.22	.53	PM2B563	.29	.53	PM4B563	.34	.65	PM6B563
.068	.23	.40	PM5B683	.23	.40	PM1B683	.24	.53	PM2B683	.26	.65	PM4B683	.33	.78	PM6B683
.082	.18	.53	PM5B823	.18	.53	PM1B823	.26	.53	PM2B823	.28	.65	PM4B823	.36	.78	PM6B823
.1	.20	.53	PM5B104	.20	.53	PM1B104	.29	.53	PM2B104	.31	.65	PM4B104	.40	.78	PM6B104
.15	.24	.53	PM5B154	.24	.53	PM1B154	.28	.65	PM2B154	.33	.78	PM4B154	.43	.90	PM6B154
.18	.26	.53	PM5B184	.25	.53	PM1B184	.31	.65	PM2B184	.36	.78	PM4B184	.47	.90	PM6B184
.22	.28	.53	PM5B224	.28	.53	PM1B224	.34	.65	PM2B224	.39	.78	PM4B224	.44	1.17	PM6B224
.33	.28	.65	PM5B334	.28	.65	PM1B334	.36	.78	PM2B334	.43	.90	PM4B334	.54	1.17	PM6B334
.47	.33	.65	PM5B474	.33	.65	PM1B474	.39	.90	PM2B474	.43	1.17	PM4B474	.64	1.17	PM6B474
.56	.32	.78	PM5B564	.32	.78	PM1B564	.42	.90	PM2B564	.47	1.17	PM4B564	.70	1.17	PM6B564
.68	.35	.78	PM5B684	.35	.78	PM1B684	.46	.90	PM2B684	.52	1.17	PM4B684	.77	1.17	PM6B684
.82	.38	.78	PM5B824	.38	.78	PM1B185	.43	1.17	PM2B824	.56	1.17	PM4B824	.84	1.17	PM6B824
1.0	.42	.78	PM5B105	.42	.78	PM1B105	.47	1.17	PM2B105	.62	1.17	PM4B105	.82	1.40	PM6B105
1.5	.46	.90	PM5B155	.46	.90	PM1B155	.57	1.17	PM2B155	.76	1.17	PM4B155	.91	1.68	PM6B155
1.8	.42	1.17	PM5B185	.42	1.17	PM1B185	.63	1.17	PM2B185	.83	1.17	PM4B185	.92	1.95	PM6B185
2.0	.44	1.17	PM5B205	.44	1.17	PM1B205	.66	1.17	PM2B205	.77	1.40	PM4B205	.96	1.95	PM6B205
4.0	.62	1.17	PM5B405	.62	1.17	PM1B405	.82	1.40	PM2B405	.91	1.95	PM4B405			
5.0	.69	1.17	PM5B505	.69	1.17	PM1B505	.83	1.68	PM2B505	.95	2.25	PM4B505			
6.0	.76	1.17	PM5B605	.76	1.17	PM1B605	.92	1.68	PM2B605	1.04	2.25	PM4B605			

Intermediate Values Available

METALLIZED POLYCARBONATE

Metallized Polycarbonate capacitors combine low dielectric absorption, low dissipation factor, high insulation resistance and stability with a very low temperature coefficient. These units possess excellent characteristics for general purpose coupling or bypassing in either high or low impedance circuits. They are ideal in precise filter, discriminator, RC timer, integrator, differentiator and computer circuits. They are highly reliable due to the self-healing qualities of the metallized dielectric.

C Subminiature Series

SIZES AND PART NUMBERS
Other capacitances, voltages and tolerances available on special request.

MFD	50 VDC				100 VDC				200 VDC			
	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.
.001	.09	.18	.40	C5A102	.09	.18	.40	C1A102	.09	.18	.40	C2A102
.0015	.09	.18	.40	C5A152	.09	.18	.40	C1A152	.09	.18	.40	C2A152
.0018	.09	.18	.40	C5A182	.09	.18	.40	C1A182	.09	.18	.40	C2A182
.0022	.09	.18	.40	C5A222	.09	.18	.40	C1A222	.09	.18	.40	C2A222
.0033	.09	.18	.40	C5A332	.09	.18	.40	C1A332	.09	.18	.40	C2A332
.0047	.09	.18	.40	C5A472	.09	.18	.40	C1A472	.09	.18	.40	C2A472
.0082	.09	.18	.40	C5A822	.09	.18	.40	C1A822	.09	.18	.40	C2A822
.01	.09	.18	.40	C5A103	.09	.18	.40	C1A103	.09	.18	.40	C2A103
.015	.09	.18	.40	C5A153	.09	.18	.40	C1A153	.14	.24	.40	C2A153
.018	.09	.18	.40	C5A183	.09	.18	.40	C1A183	.15	.25	.40	C2A183
.022	.09	.18	.40	C5A223	.09	.18	.40	C1A223	.16	.26	.40	C2A223
.033	.09	.18	.40	C5A333	.10	.21	.40	C1A333	.12	.22	.53	C2A333
.047	.09	.18	.40	C5A473	.11	.24	.40	C1A473	.14	.24	.53	C2A473
.082	.10	.20	.40	C5A823	.09	.22	.53	C1A823	.22	.32	.53	C2A823
.1	.12	.21	.40	C5A104	.11	.24	.53	C1A104	.25	.35	.53	C2A104
.15	.15	.25	.40	C5A154	.14	.27	.53	C1A154	.25	.35	.68	C2A154
.18	.10	.19	.53	C5A184	.16	.29	.53	C1A184	.28	.38	.68	C2A184
.22	.11	.21	.53	C5A224	.18	.30	.53	C1A224	.30	.40	.68	C2A224
.33	.15	.25	.53	C5A334	.17	.30	.68	C1A334	.25	.35	.90	C2A334
.47	.18	.28	.53	C5A474	.18	.30	.78	C1A474	.33	.43	.90	C2A474
.82	.26	.35	.53	C5A824	.25	.36	.78	C1A824	.39	.52	.90	C2A824
1.0	.22	.31	.68	C5A105	.26	.35	.90	C1A105	.37	.52	1.17	C2A105
1.5	.23	.33	.78	C5A155	.30	.41	.90	C1A155	.40	.60	1.17	C2A155
1.8	.26	.35	.78	C5A185	.32	.45	.90	C1A185	.41	.61	1.45	C2A185
2.0	.27	.37	.78	C5A205	.33	.49	.90	C1A205	.40	.60	1.70	C2A205
4.0	.36	.45	.90	C5A405	.37	.52	1.45	C1A405	.65	.78	1.70	C2A405
5.0	.31	.41	1.17	C5A505	.40	.56	1.70	C1A505	.75	.93	1.70	C2A505
10.0	.42	.59	1.17	C5A106	.60	.76	1.70	C1A106	.90	1.10	1.90	C2A106

Intermediate Values and High Voltages Available

METALLIZED POLYESTER

Type MEF capacitors possess excellent characteristics for general purpose coupling or bypassing in either high or low impedance circuits and are superior in precise filter applications. Although they are most often used in DC applications, they have been successfully used in such AC applications as power factor correction and power line filtering. Additionally, our type MEF capacitors are available in plastic cases filled with epoxy resin and coated with UL94V-1 fire retardent material (MEC Series). For further information, contact your factory represenatative or call Elpac today if you have any questions regarding our MEF or MEC Series.

MEF Series

SIZES AND PART NUMBERS
Other Capacitances, Voltages and Tolerances Available on Special Request

MFD	100VDC					250VDC					400VDC					630VDC				
	W	H	T	P	dθ	W	H	T	P	dθ	W	H	T	P	dθ	W	H	T	P	dθ
.01	.37	.35	.20	.30±.04	.02	.43	.39	.24	.33±.04	.02	.43	.39	.24	.33±.04	.02	.49	.39	.20	.45±.04	.02
.015	.37	.35	.20	.30±.04	.02	.43	.39	.24	.33±.04	.02	.43	.39	.24	.33±.04	.02	.49	.41	.24	.45±.04	.02
.022	.37	.35	.20	.30±.04	.02	.43	.39	.24	.33±.04	.02	.49	.35	18	.39±.04	.02	.49	.47	.28	.45±.04	.02
.033	.97	.35	.20	.30±.04	.02	.43	.39	.24	.33±.04	.02	.49	.41	.22	.39±.04	.02	.69	.45	.26	.59±.04	.02
.047	.37	.30	.18	.30±.04	.02	.49	.35	.20	.39±.04	.02	.49	.43	.26	.39±.04	.02	.69	.49	.30	.59±.04	.02
.068	.37	.31	.18	.30±.04	.02	.49	.39	.20	.39±.04	.02	.69	.37	.22	.59±.04	.02	.69	.55	.31	.59±.04	.02
.1	.49	.31	.18	.39±.04	.02	.49	.43	.24	.39±.04	.02	.69	.45	.26	.59±.04	.02	.69	.61	.39	.59±.04	.02
.15	.49	.35	.20	.39±.04	.02	.49	.51	.28	.39±.04	.02	.69	.49	.30	.59±.04	.02	.89	.65	.35	.79±.06	.03
.22	.49	.39	.22	.39±.04	.02	.69	.43	.26	.59±.04	02	.89	.57	.30	.79±.06	.03	.89	.75	.43	.79±.06	.03
.33	.69	.39	.22	.59±.04	.02	.69	.49	.28	.59±.04	.02	.89	.63	.35	.79±.06	.03	1.18	.77	.43	1.08±.06	.03
.47	.69	.43	.26	.59±.04	.02	.89	.49	.30	.79±.06	.03	.89	.73	.39	.79±.06	.03	1.18	.87	.49	1.08±.06	.03
.68	.69	.49	.30	.59±.04	.02	89	.57	.33	.79±.06	.03	1.18	.71	.39	1.08±.06	.03	1.30	.96	.55	1.18±.08	.03
1.0	.69	.55	.31	.59±.04	.02	.89	.67	.37	.79±.06	.03	1.18	.81	.47	1.08±.06	.03	1.30	1.10	.69	1.18±.08	.03
1.5	.89	.57	.33	.79±.06	.03	1.18	.70	.37	1.08±.06	.03	1.30	.94	.51	1.18±.08	.03	1.61	1.12	.71	1.48±.08	.04
2.2	.89	.65	.41	.79±.06	.03	1.18	.85	.45	1.08±.06	.03	1.61	1.02	.57	1.48±.08	.04	1.81	1.22	.83	1.67±.08	.04
3.3	.89	.83	.45	.79±.06	.03	1.30	.94	.51	1.18±.08	.03	1.61	1.18	.69	1.48±.08	.04					
4.7	1.18	.81	.43	1.08±.06	.03	1.61	1.00	.51	1.48±.08	.04	1.81	1.28	.81	1.67±.08	.04					
6.8	1.18	.89	.49	1.08±.06	.03	1.61	1.18	.55	1.48±.08	.04										
10.0	1.18	.98	.59	1.08±.06	.03	1.81	1.38	.75	1.67±.08	.04										

Intermediate Values and High Voltages Available

CONSULT FACTORY
FOR EXACT SIZES

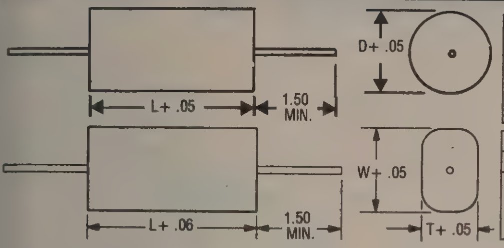
CUSTOM SHAPES AND CONFIGURATIONS ALSO AVAILABLE

SEE OUR YELLOW PAGES LISTING FOR COMPLETE SALES INFORMATION
FOR ELPAC POWER SUPPLIES, SEE PAGES 3•1554-3•1559, VOLUME 3

ELPAC COMPONENTS

A DIVISION OF ELPAC ELECTRONICS, INC.

3131 S. STANDARD AV./SANTA ANA, CA 92705
TEL 714-979-4440/TWX 910-595-1513

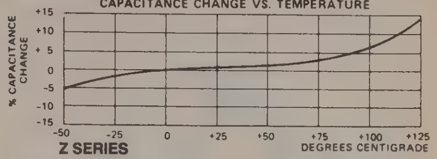


LEAD SIZE		
Case Length	**A.W.G.**	**Lead Dia.**
.40 thru .68 .78 thru .95 1.17 thru 2.25	No. 24 No. 22 No. 20	.020 .025 .032

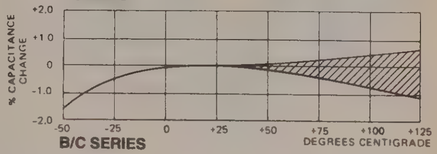
LEAD SIZE		
Case Length	**A.W.G.**	**Lead Dia.**
.40 thru .65 .78 thru .95 1.17 thru 2.25	No. 24 No. 22 No. 20	.020 .025 .032

TEMPERATURE CHARACTERISTICS

CAPACITANCE CHANGE VS. TEMPERATURE



Z SERIES



B/C SERIES

APPLICATION CHART

The applications chart below is taken from our 109-page full line catalog. It gives you a brief look at all our product lines and a rapid method of slecting he right caopacitor for your specific application.
For more details on any of the dielectrics or sizes and configurations, please contact our sales department.

APPLICATION	**ZD** **Metallized Polyester**	**MD** **Polyester & Foil**	**Z** **Miniature Metallized Polyester**	**B** **Metallized Polycarbonate**	**K** **Polycarbonate & Foil**	**C** **Miniature Metallized Polycarbonate**	**HS** **Highly Stable Metallized Polycarbonate**	**PD** **Polystyrene & Foil**	**S** **Metallized Polysulfone**	**P** **Metallized Polypropylene**	**PMB** **Metallized Polypropylene**	**PSB** **Metallized Polypropylene**
Coupling	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Occasional	Yes	Yes	Yes	AC Rated
Bypass & Filtering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Seldom	Yes	Yes	Yes	Low Esr
Timing	Occasional	Occasional	Occasional	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Switching Regulators
Pulse-Discharge	Yes	Yes	Occasional	Yes	Yes	Occasional	Seldom	No	Seldom	Seldom	Seldom	Critical Filtering
Arc Suppression	Yes	Yes	Yes	Occasional	Occasional	Occasional	Seldom	No	Seldom	Seldom	Seldom	High Frequency
Ripple Suppression	Occasional	Yes	Occasional	Occasional	Seldom	Occasional	Seldom	No	Seldom	Seldom	Seldom	
Freq. Determination (tuning)	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
CAPACITANCE RANGE Style												
A (W & F Oval)	.001/10.0	.001/5.0	.001/25.0	.001/10.0	.01/5.0	.001/12.0		.001/1.5	.001/20.0	.001/4.0	.001/40	—
B (W & F Tubular)	.001/10.0	.001/5.0	.001/25.0	.001/10.0	.01/5.0	.001/12.0	.001/10.0	.001/1.5	.001/20.0	.001/4.0	.001/10.0	.47/10.0
G (Hermetic Rectangular)	.001/4.0	.001/2.0	.001/8.0	.001/2.0	.01/1.0	.001/8.0		.001/1.0	.001/4.0	.001/.47	—	—
L (Hermetic Tubular)	.001/10.0	.001/5.0	.001/25.0	.001/10.0	.01/4.0	.001/12.0		.001/2.0	.001/20.0	.001/3.0	—	—
R (Epoxy Radial)	.001/5.0	.001/3.0	.001/15.0	.001/5.0	.01/3.0	.001/12.0		.001/	.001/6.0	.001/2.0	—	—
X (Epoxy Axial)	.001/4.0	.001/2.0	.001/10.0	.001/4.0	.01/1.5	.001/12.0		.001/1.0	.001/10.0	.001/1.0	—	—
VOLTAGE RANGE (VDC) (NOMINAL)	50 to 600	50 to 600	50 to 600	50 to 600	50 to 600	50 to 600	50 to 600	50 to 400	50 to 600	50 to 600	50 to 600	100 to 400
TEMP RANGE -55°C TO	125°C	125°C	125°C	125°C Full Rated	125°C Full Rated	125°C Full Rated	125°C Full Rated	85°C Max.	150°C	105°C Full Rated	105°C Full Rated	105°C Full Rated
DERATE FROM	85°C (to 50%)	85°C (to 50%)	85°C (to 50%)	Not Req'd	Not Req'd	Not Req'd	Not Req'd	Not Req'd	125°C (to 50%)	Not Req'd	Not Req'd	Not Req'd
TEMP. COEFF. (PPM/°C) -55°C to +125°C	960	960	960	120	120	120	120		50			
-55°C to +105°C										300	300	300
-55°C to + 85°C								90				
DISSIPATION FACTOR (%) 1 KHz*	1.0	0.5	1.0	0.3	0.3	0.3	0.3	0.1	0.3	0.1	0.1	0.1
INSULATION RES.** (Megohm x MFD)	10,000	50,000	10,000	25,000	100,000	25,000	50,000	100,000	100,000	50,000	50,000	50,000
Need Not Exceed (Megohms)	40,000	100,000	40,000	50,000	300,000	50,000	100,000	200,000	200,000	100,000	100,000	100,000
DIELECTRIC STRENGTH*** As % of DC Rating Term to Term.	150	200	150	150	200	150	150	200	150	150	150	150
Term to Case	200	200	200	200	200	200	200	200	200	200	200	200

*Except values over 1 uf at 60Hz
**Measured at rated voltage or 100 volts, whichever is less, after 2 minutes of electrification
***Measured at dc test potential for 60 seconds through limiting resistance of 100 ohms/volt except CQ case diameter of .312 or higher is 300% of dc rating, or 1500 vdc, whichever is smaller.

NOTE: OTHER CAPACITANCE TOLERANCES, VOLTAGES, AND SIZES AVAILABLE ON SPECIAL REQUEST

IMPORTED PRODUCTS ORDERING INFORMATION

PART NUMBERING KEY

PSA 221 K 1H

TYPE OF CAPACITOR

PEE: Polyester & Foil Epoxy Dipped
PEF: Polyester & Foil Epoxy Dipped (Flame Retardant)
PEI: Polyester & Foil Epoxy Dipped
PSE: Polystyrene & Foil Conformal Epoxy Coating (Radial)
PSA: Same as PSE (Axial)
PSI: Polystyrene & Foil Fused Case Axial
PSR: Same as PSI (Radial)
MEC: Polyester Metallize Film Minibox (Radial)

MEE: Polyester Metallized Film Axial (Oval)
MET: Same as MEE (Axial, Tubular)
MEF: Polyester Metallized Film (Radial Conformal Epoxy Coating)
MFF: Same as MEF (Flame Retardant)
PPN: Polypropylene Metallized Film (Radial, Conformal Epoxy Coating)
PPT: Polypropylene Metallized Film (Axial, Tubular)
MEC: Polyester Metallized Film (Epoxy Encapsulated, Radial)

NOMINAL CAPACITANCE

This is described in PF. First two digits are significant, third is number of zeroes to follow.

CAPACITANCE TOLERANCE

M=20%
K=10%
J= 5%
H= 3%
G= 2%
F= 1%

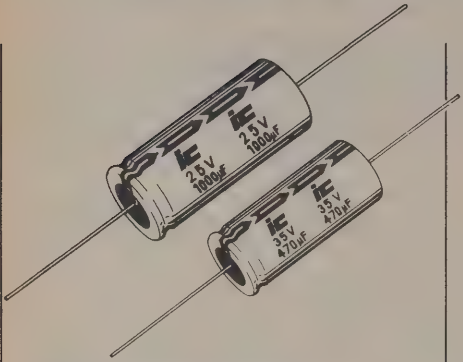
RATED VOLTAGE

1H= 50
2A=100
2E=250
2G=400
2J=630
2H=500
2B=125

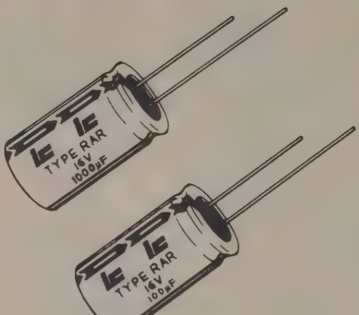
CUSTOM SHAPES AND CONFIGURATIONS ALSO AVAILABLE

SEE OUR YELLOW PAGES LISTING FOR COMPLETE SALES INFORMATION
FOR ELPAC POWER SUPPLIES, SEE PAGES 3•1554-3•1559, VOLUME 3

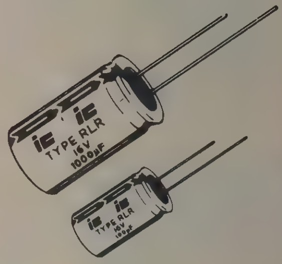
DEPENDABILITY


ic 25V 1000µF
ic 35V 470µF

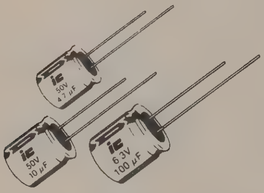
TYPE TTA COMMERCIAL/INDUSTRIAL ELECTROLYTIC CAPACITORS
0.47 Mfd. To 33,000 Mfd.
6.3 WVDC To 500 WVDC
−40°C To +85°C Min.
2000 HOUR +85°C Rating
EPOXY END SEAL Optional (TTA-PX)
TAPE & REEL Avail.


ic TYPE RAR 16V 1000µF
ic TYPE RAR 16V 100µF

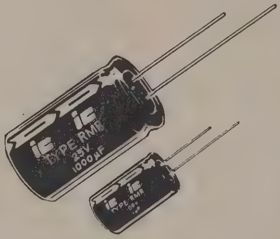
TYPE RAR COMMERCIAL/INDUSTRIAL ELECTROLYTIC CAPACITORS
0.47 Mfd. To 4,700 Mfd.
6.3 WVDC To 450 WVDC
−40°C To +85°C Min.
2000 HOUR, +85°C Rating
EPOXY END SEAL Optional (RAR-PX)
TAPE & REEL Avail.


ic TYPE RLR 16V 1000µF
ic TYPE RLR

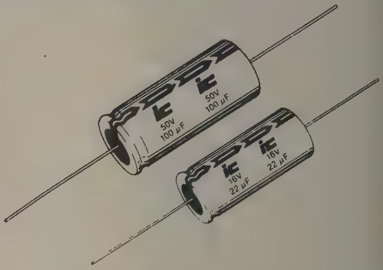
TYPE RLR LOW-LEAKAGE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 2,200 Mfd.
6.3 WVDC To 50 WVDC
−40°C To +85°C Min.
Leakage Current:≤0.002CV or 0.4 uA min.
EPOXY END SEAL Optional (RLR-PX)
TAPE & REEL Avail.


ic 50V
ic 50V 10µF
ic 6.3V 100µF

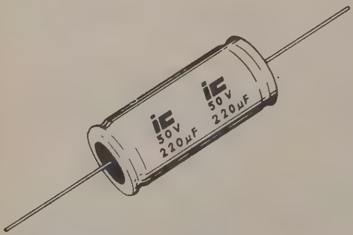
TYPE RSS SUB-SUBMINIATURE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 100 Mfd.
6.3 WVDC To 50 WVDC
Min. Dia. 0.15 in./4.0mm
Max. Length .28 in./7.0mm
−40° C To +85° C Min.
TAPE & REEL Avail.


ic TYPE RMR 25V 1000µF
ic TYPE RMR

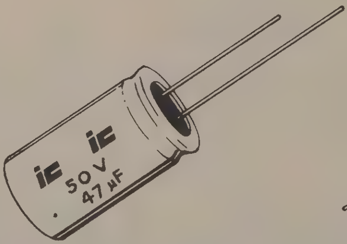
TYPE RMR SUBMINIATURE, +105°C ELECTROLYTIC CAPACITORS
0.47 Mfd. To 10,000 Mfd.
6.3 WVDC To 250 WVDC
−40°C To +105°C Min.
2000 HOUR +105°C Rating
EPOXY END SEAL Optional (RMR-PX)
TAPE & REEL Avail.


ic 50V 100µF
ic 16V 22µF

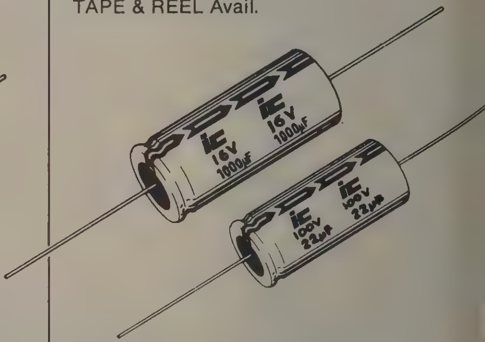
TYPE TLA LOW LEAKAGE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 100 Mfd.
6.3 WVDC To 50 WVDC
−40° C To +85° C Min.
Leakage Current: ≤0.002 CV or 0.4 μA min.
EPOXY END SEAL Optional (TLA-PX)
TAPE & REEL Avail.


ic 50V 220µF

TYPE BPA NON-POLARIZED ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 200 WVDC
−40°C To +85°C Min.
1000 HOUR +85° Rating
EPOXY END SEAL Optional (BPA-PX)



TYPE BPR NON-POLARIZED ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 50 WVDC
−40 °C To +85°C Min.
1000 HOUR +85°C Rating
EPOXY END SEAL Optional (BPR-PX)

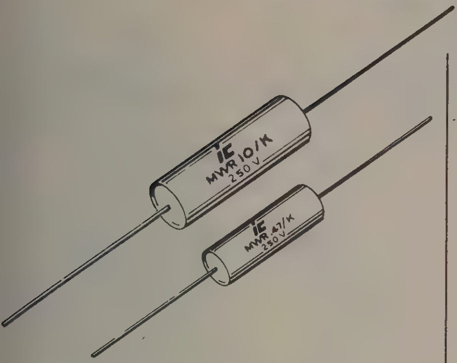

ic 16V 1000µF
ic 100V 22µF

TYPE THA +125°C OPERATION ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 100 WVDC
−40°C To +125°C Min.
EPOXY END SEAL Optional (THA-PX)

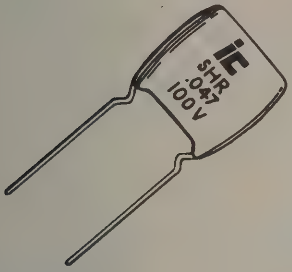
The source for Quality, Performance and Delivery

ILLINOIS CAPACITOR, INC.®
3757 West Touhy Avenue, Lincolnwood, IL 60645
(312) 675-1760 / Telex: 72-4361 / Cable: Illcon Lcwd

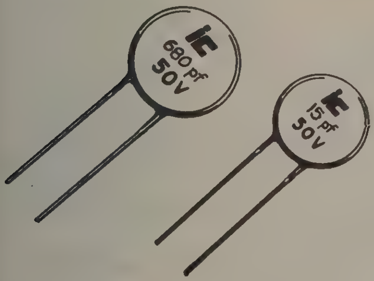
AVAILABILITY


ic MWR 10/K 250V
ic MWR .47/K 250V

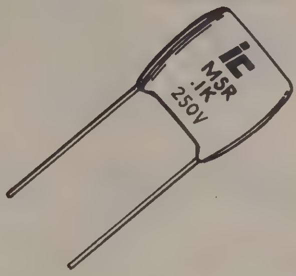
TYPE MWR METALLIZED MYLAR® POLYESTER FILM CAPACITORS
WRAP & FILLED CONSTRUCTION
NON-INDUCTIVE WINDING, +125°C
100 WVDC To 1,000 WVDC
0.01 Mfd. To 22 Mfd.
TOLERANCE: ±10% (±5% Opt.)


ic SHR .047 100V

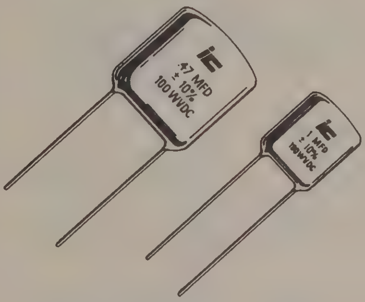
TYPE SHR POLYESTER FILM CAPACITORS
NON-INDUCTIVE WINDING, +125°C
100 WVDC
0.001 Mfd. To .47 Mfd.
TOLERANCE: ±10% (±5% Opt.)


ic 680 pf 50V
ic 15 pf 50V

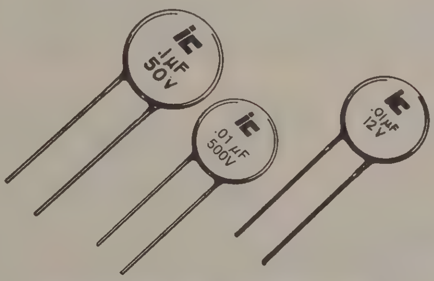
TYPE BCR TEMPERATURE STABLE CERAMIC DISC CAPACITORS
50 WVDC
1 pf to 680 pf
TEMP. CHAR.: Y5F
TOLERANCE: ±10%


ic MSR .1K 250V

TYPE MSR METALLIZED MYLAR® POLYESTER FILM CAPACITORS
NON-INDUCTIVE WINDING, +125°C
250 WVDC To 1,000 WVDC
0.01 Mfd. To 10 Mfd.
TOLERANCE: ±10% (±5%, Opt.)


ic .47 MFD ±10% 100 WVDC
ic .1 MFD ±10% 100 WVDC

TYPE UMR POLYESTER FILM CAPACITORS
INDUCTIVE WINDING
100 WVDC
.001 Mfd. To .47 Mfd.
TOLERANCE: ±10% (±5%, Opt.)

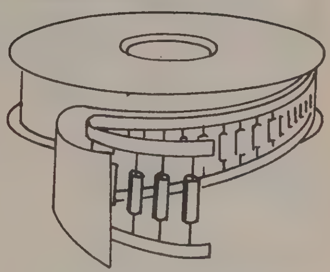

ic .1μF 50V
ic .01μF 500V
ic .01μF 12V

GENERAL PURPOSE CERAMIC DISC
Tolerances: −20% +80%, ±20%

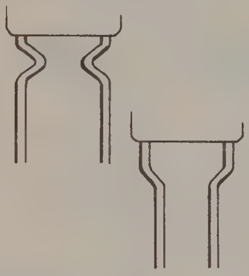
TYPE GCR: 50 WVDC
0.001 Mfd. To 0.1 Mfd. (Y5V, Y5S)

TYPE GMR: 12 WVDC
0.047 Mfd. To .47 Mfd. (Y5S)

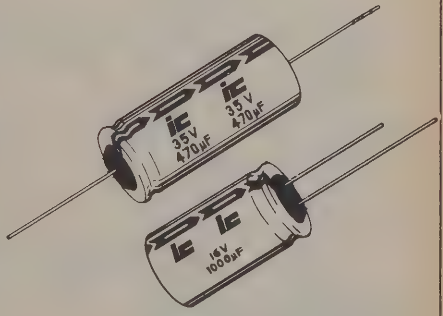
TYPE GQR: 500 WVDC
.001 Mfd. To .01 Mfd. (Z5V)



TAPE & REEL CONFIGURATIONS
FOR AUTOMATIC INSERTION OF
AXIAL AND RADIAL LEAD PARTS
AVAILABLE ON SPECIAL ORDER



CUT & FORMED LEADS
AVAILABLE ON SPECIAL ORDER


ic 35V 470μF
ic 35V 470μF
ic 16V 1000μF

EPOXY END SEALS
AVAILABLE OPTION ON ALL
ELECTROLYTIC CAPACITORS
FOR USE WITH CHLORINATED OR
HALOGENATED CLEANING SOLVENTS

Please Call for your specialized capacitor requirements.

The source for Quality, Performance and Delivery

ic® ILLINOIS CAPACITOR, INC.
3757 West Touhy Avenue, Lincolnwood, IL 60645
(312) 675-1760 / Telex: 72-4361 / Cable: Illcon Lcwd

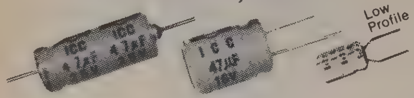
INTERCAP CAPACITORS

by International C

COMMERCIAL & INDUSTRIAL ALUMINUM ELECTROLYTIC CAPACITORS — AXIAL & RADIAL LEADS

General Purpose

TDA & PDA, PDS



Temp. Range −40°C to +85°C
Cap. Range 0.47μF – 22,000μF Axial
0.47μF – 10,000μF Radial
Cap. Tol. −10% +75%, −10% +50%, ±20%
Volt. Range 6.3VDC – 450VDC
Leakage (Max.) 6.3V – 80V .02CxV +4μA
100V – 450V .02CxV +100μA

Low Leakage

TDA-L, PDA-L, PDS-L

Low Profile

Temp. Range −40°C to +85°C
Cap. Range 0.1μF – 2200μF
Cap. Tol. ±20%, ±10%
Volt. Range 6.3VDC – 63VDC
Leakage (Max.) 0.002CxV or 0.4μA whichever is greater

Dipped Tantalum

DP (Straight & Snap-In Leads)

Temp. Range −55°C to +85°C
Cap. Range 0.1μF – 330μF
Cap. Tol. ±20%, ±10%
Volt. Range 3.15VDC – 50VDC
Leakage (Max.) .007CxV or .05μA whichever is greater

Extended Temperature

TDB & PDB (Close Tolerance)

Temp. Range −40°C to +105°C
Cap. Range 0.47μF – 10,000μF
Cap. Tol. ±20%
Volt. Range 6.3VDC – 250VDC
Leakage (Max.) .01CxV +3μA
Life Test 2,000 hrs. @ 105°C

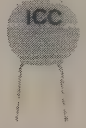
Non-Polar

NTD (General Purpose)
NTA (Superior Characteristics)

Temp. Range −25°C to +85°C
Cap. Range 0.47μF – 470μF
Cap. Tol. −10% +50%, ±30%, ±20%, ±10%
Volt. Range 16WV – 50WV
Leakage (Max.) 0.06CxV +10μA, 0.1CxV +10μA

Ceramic Disc

CD



Various lead forms are available in both bulk and tape & reel packaging.

Temperature Compensating
NPO – N750
100V – 1000V
General Purpose
100pF – 100,000pF
50V – 1000V
Semiconductor
10,000pF – 100,000pF
12V – 50V

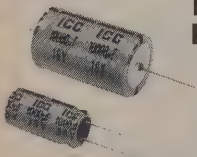
Radial Lead — Mechanical Support Third Lead

PDA-T

Temp. Range −40°C to +85°C
Cap. Range 100μF – 33000μF
Cap. Tol. ±20%
Volt. Range 6.3VDC – 250VDC
Leakage (Max.) −0.02CxV

Low Impedance Radial Lead for Switching Power Supply Output & Regulator Circuits

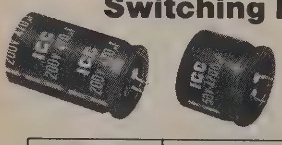
PZL



Temp. Range −55°C to +105°C
Cap. Range 2.2μF – 8200μF
Cap. Tol. −10% +75%
Volt. Range 7.5VDC – 100VDC
Leakage (Max.) $\leq$40V = 0.5$\sqrt{CxV}$μA
>40V = $\sqrt{CxV}$μA

Series Features Low Impedance, High E.S.R. & Ripple Current Specifications

Snap-In Capacitors — Switching Power Supply Input Circuit



PST — Standard Height
PSL — Low Profile Construction
PXT — Extra High Ripple — Standard Height
PXL — High Ripple Low Profile

Specifications	PST	PSL	PXT	PXL
Temp. Range	−40°C to +85°C			
Cap. Range	220μF – 22000μF	220μF – 22000μF	100μF – 820μF	100μF – 390μF
Cap. Tol.	±20%	±20%	±20%	±20%
Volt. Range	10VDC – 250VDC	10VDC – 250VDC	200VDC – 250VDC	200VDC – 250VDC
Leakage (Max.)	.02CxV or 2000μA whichever is smaller		.02CxV or 3000μA whichever is smaller	

FILM CAPACITORS

Polyester Film

EM (Radial Leads, Welded Construction)

Temp. Range −55°C to +85°C
Cap. Range .001μF – 0.47μF
Cap. Tol. ±5%, ±10%, ±20%
Volt. Range 100V, 200V, 400V

Metalized Polyester Film

PMG

Polyester Film/Foil

FM

(Radial Leads, Welded Construction)

	PMG	FM
Temp. Range	−55°C to +155°C	−40°C to +85°C
Cap. Range	.01μF – 4.7μF	.001μF – 0.47μF
Cap. Tol	±10% STD	±10% STD
Volt. Range	250V – 630V	100V

Metalized Polyester Film

YM

Polyester Film/Foil

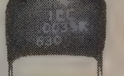
YFT

(Axial Leads, Welded Construction)

	YM	YFT
Temp. Range	−40°C to +85°C	−40°C to +85°C
Cap. Range	.01μF – 10μF	.001μF – 1.0μF
Cap. Tol.	±10%, ±20%	±10%, ±20%
Volt. Range	250V – 630V	100V – 1000V

Polypropylene Film

PP (Radial Leads, Welded Construction)



Temp. Range −40°C to +85°C
Cap. Range .001μF – 0.47μF
Cap. Tol. ±5%, ±10%, ±20%
Volt. Range 250V – 630V

CALL TOLL FREE
800-645-9154
IN N.Y. STATE
516-293-1500

INTERCAP
International C
International Components Corporation

105 Maxess Road
Melville, New York 11747
(516) 293-1500
TELEX # 221576

The Inter-Technical Group Inc.
WIMA Division

P.O. BOX 23 — IRVINGTON, NY 10533 • TELEPHONE (914) 591-8822 • TWX: 710-564-0802

Plastic Film Capacitors in Plastic Cases with Radial Leads

Capacitors		Dielectric	Type
Sub-miniature capacitors PCM 2.5 mm		Polyester film metallized	**WIMA MKS 02**
Miniature type capacitors PCM 5 mm **available taped and reeled**	0.01 µF to 1.0 µF	Polyester film metallized	**WIMA MKS 2**
	for pulse duty, low ESR	Polyester film metallized	**WIMA MKS 2-i**
	for pulse duty, low ESR	Polyester film metallized	**WIMA MKS 20**
	1000 pF to 0.01 µ	Polyester film with metal foil electrodes	**WIMA FKS 2**
	220 pF to 0.01 µF	Polycarbonate film with metal foil electrodes	**WIMA FKC 2**
		Polypropylene film with metal foil electrodes	**WIMA FKP 2**
Semi-miniature capacitors PCM 7.5 mm		Polyester film metallized	**WIMA MKS 3**
Metallized film capacitors for stringent requirements	CECC approval certificate Nr. 30 401-010	Polyester film	**WIMA MKS 4**
	CECC approval certificate Nr. 30 501-001	Polycarbonate film	**WIMA MKC 4**
	High reliability components	Polycarbonate film	**WIMA MKC 4 SV21**
Capacitors for high current ratings **High reliability components**	with double metallized film electrodes	Polyester film	**WIMA MKS 10**
		Polycarbonate film	**WIMA MKC 10**
		Polypropylene film	**WIMA MKP 10**
with two metal foil electrodes and a metallized plastic film electrode carrier (inner series connection)		Polypropylene film	**WIMA FKP 1**
Film capacitors with metal foil electrodes PCM 7.5 to 22.5 mm		Polyester film	**WIMA FKS 3**
		Polycarbonate film	**WIMA FKC 3**

Capacitors for special applications:

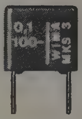
Radio Interference Suppression Capacitors in accordance with VDE 0565, part 1	inner series connection	Polyester film metallized	**WIMA MKS 4-R**
	epoxy resin impregnated	Paper metallized	**WIMA MP 3**

See last page for letter codes and dimensions.

WIMA is a Registered Trademark of: Wilhelm Westermann, Mannheim, West Germany.

The Inter-Technical Group Inc.
WIMA Division

P.O. BOX 23 — IRVINGTON, NY 10533 • TELEPHONE (914) 591-8822 • TWX: 710-564-0802

	Sub-miniature PCM 2.5 mm	Miniature capacitors 5 mm PCM/available taped and reeled										Semi-miniature PCM 7.5 mm	
													
	WIMA MKS 02	WIMA MKS 2			WIMA MKS 2-i	WIMA MKS 20	WIMA MKC 2		WIMA FKS 2	WIMA FKC 2	WIMA FKP 2	WIMA MKS 3	
Dielectric	Polyester film	Polyester film			Polyester Film	Polyester film	Polycarbonate film		Polyester film	Polycarbonate film	Polypropylene film	Polyester film	
Capacitor electrodes	Vacuum deposited aluminum	Vacuum deposited aluminum			Vacuum deposited aluminum	Double sided metallization	Vacuum deposited aluminum		Metal foil	Metal foil	Metal foil	Vacuum deposited aluminum	
Temperature ranges	−55°C to +100°C	−55°C to +100°C			−55°C to +100°C	−55°C to +100°C	−55°C to +100°C		−55°C to +100°C	−55°C to +100°C	−55°C to +85°C	−55°C to +100°C	
Insulation resistance at +20°C	1 x 10⁴ MΩ	1 x 10⁴ MΩ >0.33:3,300 sec.			1 x 10⁴ MΩ >0.33:3,300 sec.	1 x 10⁴ MΩ	1 x 10⁴ MΩ		5 x 10⁵ MΩ	5 x 10⁵ MΩ	5 x 10⁵ MΩ	1 x 10⁴ MΩ >0.33:3,300 sec.	
Power factor tan δ at 1 kHz and +20°C	5 to 8 x 10⁻³	5 to 8 x 10⁻³			6 x 10⁻³	5 to 7 x 10⁻³	3 x 10⁻³		5 to 8 x 10⁻³	1 to 3 x 10⁻³	2 to 4 x 10⁻⁴	5 to 8 x 10⁻³	
Voltage ranges	50 VDC	50 VDC	63 VDC	100 VDC	63 VDC	63 VDC	63 VDC	100 VDC	100 VDC	100 VDC	63 VDC	63 VDC	100 VDC
Capacitance tolerances	±20% ±10% ±5%	±20% ±10%			±20% ±10%	±20% ±10%	±20% ±10% ±5%		±20% ±10% ±5%	±20% ±10% ±5%	±10% ±5% ±2.5%	±20% ±10%	
100 pF													
220 pF										H	J		
680 pF										H	J		
1000 pF	A								H	H	J		
1500 pF	A								H	H	J		
2200 pF	A								H	H	J		
3300 pF	A								H	H	J		
4700 pF	A					C		C	H	E	K		
6800 pF	A					C		C	H	E	K		
0.01 µF	A		C	C	C	C		C	D	F	L		M
0.015 µF	A		C	C	C	C		C					M
0.022 µF	A		C	C	C	C		C					M
0.033 µF	A		C	C	C	D	C						M
0.047 µF	A		C	C	C	E	C						M
0.068 µF	B		C	E	C	F	E						M
0.1 µF	B	C	D	F	D	G	E						M
0.15 µF		C	E	QQ			F						M
0.22 µF		D	E	QQ			G					M	
0.33 µF		E	F	QQ			AK					N	
0.47 µF		F	G	AK			AK					P	
0.68 µF		G										Q	
1.0 µF		QQ										R	
1.5 µF													

Encapsulation Plastic Cases — All Types

See last page for letter codes and dimensions.

WIMA is a Registered Trademark of: Wilhelm Westermann, Mannheim, West Germany.

The Inter-Technical Group Inc.
WIMA Division

P.O. BOX 23 — IRVINGTON, NY 10533 • TELEPHONE (914) 591-8822 • TWX: 710-564-0802

Metallized capacitors for stringent requirements

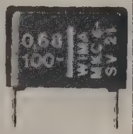
CECC approved

Frequency limit 21 kHz

Film capacitors with metal foil electrodes

WIMA MKS 4

WIMA MKC 4


WIMA MKC 4 SV 21

WIMA FKS 3

WIMA FKC 3

	WIMA MKS 4	WIMA MKC 4	WIMA MKC 4 SV 21	WIMA FKS 3	WIMA FKC 3
Dielectric	Polyester film	Polycarbonate film	Polycarbonate film flame-retardent	Polyester film	Polycarbonate film
Capacitor electrodes	Vacuum deposited aluminum	Vacuum deposited aluminum	Vacuum deposited aluminum	Metal foil	Metal foil
Temperature ranges	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C
Insulation resistance at +20°C	1.5 to 3 • 10⁴ MΩ >0.33:5,000 to 10,000 sec.	1.5 to 3 x 10⁴ MΩ >0.33:5,000 to 10,000 sec.	5,000 to 10,000 sec.	5 x 10⁵ MΩ >0.02:10,000 sec.	5 x 10⁵ MΩ >0.02:10,000 sec.
Power factor tan δ at 1 kHz and +20°C	5 to 8 x 10⁻³	1 to 3 x 10⁻³	1 to 3 • 10⁻³	5 to 8 x 10⁻³	1 to 2 x 10⁻³

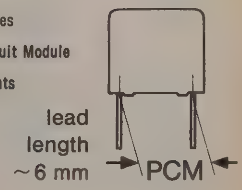
	MKS 4							MKC 4				MKC 4 SV 21		FKS 3			FKC 3		
Voltage ranges	63 VDC	100 VDC	160 VDC	250 VDC	400 VDC	630 VDC	1000 VDC	63 VDC	100 VDC	250 VDC	400 VDC	100 VDC	250 VDC	100 VDC	160 VDC	400 VDC	160 VDC	400 VDC	1000 VDC
Capacitance tolerances	±20% ±10% ±5%							±20% ±10% ±5%				±20% ±10% ±5%		±20% ±10% ±5%			±20% ±10% ±5%		
100 pF																	M	W	
220 pF																	M	W	
680 pF																	M	W	
1000 pF														M		W	M	W	W
1500 pF														M		W	M	W	CC
2200 pF														M		W	M	W	CC
3300 pF														M		W	M	W	CC
4700 pF														M	W	W	N/W	T	Y
6800 pF														M	W	W	N/T	U	Z
0.01 µF		N		S/N	S	T	Y				S			W	W	T	T	X	AA
0.015 µF		N		S	S	T	Z				S			M/W	W	U			
0.022 µF		N		S	T	U	Z				S			M/W	W	V			
0.033 µF		N		S	T	Y	PP			T	T			T	T				
0.047 µF		N		S	Y	Z	KK			T	Y			T	T				
0.068 µF		N		S	Y	AA	LL			U	Y			U					
0.1 µF		N/S	S	T/Y	Z	PP	A/C		T	U/Y	Z			V					
0.15 µF		N/S	T	Y	AA	KK	VV		T	Y	AA								
0.22 µF	N/T	T	U	Y	PP	LL	WW	T	U	Z	KK								
0.33 µF	P/T	Y	Y	Z	KK	ZZ	XX	T	Y	AA	LL								
0.47 µF	Q/T	Y	Z	KK	LL	VV	YY	U	Y	KK	MM	Y	KK						
0.68 µF	R/U	Z	AA	KK	VV	WW		Y	AA	KK	VV	AA	KK						
1.0 µF	U	AA	KK	LL	VV	YY		Z	AA	LL	WW	AA	LL						
1.5 µF	AA	KK	KK	ZZ	WW			AA	KK	ZZ	XX	KK	ZZ						
2.2 µF	BB	LL	LL	VV	YY			BB	LL	VV	YY	LL	VV						
3.3 µF	LL	MM	NN	WW				KK	MM			MM	WW						
4.7 µF	LL	VV	WW	YY				LL	VV			VV	YY						
6.8 µF	A/C	WW																	
10 µF																			

Encapsulation Plastic Cases — All Types

Important dielectric characteristics of plastic films:

Polyester = high dielectric strength
Polycarbonate = linear temperature curve
Polypropylene = extremely low losses (tan δ)

The figures in the tables of capacitances refer to the PCM = Printed Circuit Module (lead spacing) at the lead exit points



See last page for letter codes and dimensions.

WIMA is a Registered Trademark of: Wilhelm Westermann, Mannheim, West Germany.

The Inter-Technical Group Inc.
WIMA Division

P.O. BOX 23 — IRVINGTON, NY 10533 • TELEPHONE (914) 591-8822 • TWX: 710-564-0802

Capacitors for high current ratings* High reliability components

with double metallized film electrodes

with two metal foil electrodes and a floating electrode of plastic film metallized on both sides (internal series connection)

Radio interference suppression capacitors

in accordance with VDE 0565-1 class X 2

0.47
100-
WIMA MKS 10

WIMA MKS 10

0.15
400-
WIMA MKC 10

WIMA MKC 10

0.22
400-
WIMA MKP 10

WIMA MKP 10

WIMA FKP 1

WIMA MKS 4-R

WIMA MP 3**

	WIMA MKS 10			WIMA MKC 10				WIMA MKP 10					WIMA FKP 1						WIMA MKS 4-R	WIMA MP 3**
Dielectric	Polyester film			Polycarbonate film				Polypropylene film					Polypropylene film						Polyester film	Paper, epoxy resin impregnated
Capacitor electrodes	Carrier film metallized on both sides, self-healing												Metal foil and carrier film metallized on both sides, self-healing						Vacuum deposited aluminum, self-healing	Metallized self-healing
Temperature ranges	−55°C to +100°C			−55°C to +100°C				−55°C to +85°C					−55°C to +85°C						−40°C to +85°C	−40°C to +85°C
Insulation resistance at +20°C	3 x 10^4 MΩ >0.33:10,000 sec.			3 x 10^4 MΩ >0.33:10,000 sec.				3 x 10^4 MΩ >0.33:10,000 sec.					1 x 10^5 MΩ >0.1:10,000 sec.						1.5 x 10^4 MΩ >0.33:5,000 sec.	6 x 10^3 MΩ >0.33:2,000 sec.
Power factor tan δ at 1 kHz and +20°C	5 to 6 x 10^{-3}			1 to 4 x 10^{-3}				1 to 3 x 10^{-4}					1 to 3 x 10^{-4}						5 to 8 x 10^{-3}	6 to 10 x 10^{-3}
Voltage ranges	63 VDC	100 VDC	250 VDC	250 VDC	400 VDC	630 VDC	1000 VDC	160 VDC	250 VDC	400 VDC	630 VDC	1000 VDC	400 VDC	630 VDC	1000 VDC	1000 VDC	1600 VDC	2000 VDC	250 VAC	250/275 VAC
								100 VAC	180 VAC	220 VAC	400 VAC	400 VAC	250 VAC	300 VAC	350 VAC	400 VAC	500 VAC	600 VAC	ÖVE S	S ÖVE S D ÖVE
Capacitance tolerances	±20% ±10% ±5%			±20% ±10% ±5%				±20% ±10% ±5%					±20% ±10% ±5%						±20% ±10%	±20% ±10%
100 pF																				
220 pF																				
680 pF																				
1000 pF																Y	RR	RR		
1500 pF																Y	RR	PP		
2200 pF																Y	PP	KK		
3300 pF																Z	KK	LL		
4700 pF																AA	KK	ZZ		
6800 pF																BB	LL	VV		
0.01 µF			N			T	Z			T	Y	PP	Y	AA	PP	KK	MM	WW	Y	EE
0.015 µF			N			U	AA			U	Z	KK	Z	BB	KK	LL	VV		Y	EE
0.022 µF			N		U	Y	BB			U	AA	LL	AA	KK	LL	MM	WW		Z	EE
0.033 µF			P		V	Z	KK			Y	KK	MM	BB	LL	ZZ	VV			Z	FF
0.047 µF		P	S	U	Y	AA	LL	U	U	Z	LL	VV	KK	MM	VV	WW			AA	GG
0.068 µF	P	S	U	V	Z	KK	NN	V	Y	AA	MM	WW	LL	VV	A/J	A/J			BB	HH
0.1 µF	P	U	Y	Y	AA	KK	VV	Y	Z	BB	VV	A/E	MM	WW	A/E	A/F			DD	JJ
0.15 µF	U	V	Z	AA	KK	LL	WW	Z	AA	LL	WW	A/F	VV	A/E	A/F	A/H			LL	SS
0.22 µF	V	Y	BB	BB	LL	VV		AA	BB	LL	A/E	A/H	WW	A/F	A/G	A/G			NN	TT
0.33 µF	V	Z	KK	KK	NN	WW		BB	LL	MM	A/F								VV	UU
0.47 µF		BB	LL	LL	VV	XX		KK	LL	VV	A/G								WW	A/D
0.68 µF		KK	NN	MM	WW			LL	NN	XX									XX	
1.0 µF		LL	VV	VV				NN	WW	YY									YY	
1.5 µF		NN	WW	XX				WW	XX	A/B										
2.2 µF		WW	YY					XX	YY											
3.3 µF		XX	A/B					YY	A/B											
4.7 µF		YY																		
6.8 µF		A/B																		
10 µF																				

* Data regarding pulse ratings see general catalog

Encapsulation Plastic Cases — All Types

** MP3
Encapsulation
Surface-treated metal foil and epoxy resin

See last page for letter codes and dimensions.

is a Registered Trademark of: Wilhelm Westermann, Mannheim, West Germany.

The Inter-Technical Group Inc.
WIMA Division

P.O. BOX 23 — IRVINGTON, NY 10533 • TELEPHONE (914) 591-8822 • TWX: 710-564-0802

	W	H	L	PCM	Capacitor
A	2.5	7	4.6	2.5	MKS 02
B	3	7.5	4.6	2.5	MKS 02
C	2.5	7	7.2	5	MKS 2; MKS 20; MKC 2; MKS 2-i
D	3	7.5	7.2	5	MKS 2; FKS 2; MKS 2-i ; MKS 20
E	3.5	8.5	7.2	5	MKS 2; MKS 20; FKC 2; MKC 2
F	4.5	9.5	7.2	5	MKS 2; MKS 20; FKC 2; MKC 2
G	5	10	7.2	5	MKS 2; MKS 20; MKC 2
H	2.5	6.5	7.2	5	FKS 2; FKC 2
J	4.5	6	7.2	5	FKP 2
K	5.5	7	7.2	5	FKP 2
L	6.5	8	7.2	5	FKP 2
M	3	8.5	10	7.5	MKS 3; FKS 3; FKC 3
N	4	9	10	7.5	MKS 3; MKS 4; MKS 10; FKC 3
P	4.5	9.5	10.3	7.5	MKS 3; MKS 4; MKS 10
Q	5	10.5	10.3	7.5	MKS 3; MKS 4
R	5.7	12.5	10.3	7.5	MKS 3; MKS 4
S	4	9	13	10	MKS 4; MKC 4; MKS 10
T	4	9.5	13	10	MKS 4; MKC 4; MKC 10; MKP 10; FKC 3; FKS 3
U	5	11	13	10	MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKS 3; FKC 3
V	6	12.5	13	10	MKS 10; MKC 10; MKP 10; FKS 3
W	3	9	13	10	FKS 3; FKC 3
X	6	12	13	10	FKC 3
Y	5	11	18	15	MKS 4; MKC 4; MKC4SV21; MKS 4-R; MKP 10; FKP 1; FKC 3; MKS 10; MKC 10
Z	6	12.5	18	15	MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKP 1; FKC 3; MKS 4-R
AA	7	14	18	15	MKC 10; MKS 4; MKC 4; MKC4SV21; FKP 1; FKC 3; MKS 4-R; MKP 10
BB	8	15	18	15	MKS 4-R; MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKP 1
CC	4	10	18	15	FKC 3
DD	9	16	18	15	MKS 4-R
EE	5	13	19	15	MP 3
FF	6	14	19	15	MP 3
GG	7	15	19	15	MP 3
HH	8	17	19	15	MP 3
JJ	10	18	19	15	MP 3; FKP 1
KK	7	16.5	26.5	22.5	MKC 4; MKC4SV21; MKP 10; MKS 10; MKC 10; FKP 1; MKS 4
LL	8.5	18.5	26.5	22.5	MKS 4; MKC 4; MKC4SV21; MKP 10; FKP 1; MKC 10; MKS 10; MKS 4-R
MM	10.5	20.5	26.5	22.5	MKS 4; MKC4SV21; MKC 10; MKP 10; FKP 1; MKC 4
NN	11	21	26.5	22.5	MKS 4; MKS 10; MKC 10; MKP 10; MKS 4-R
PP	6	15	26.5	22.5	MKS 4; MKP 10; FKP 1
QQ	5.5	11.5	7.2	5	MKS 2
RR	5	14	26.5	22.5	FKP 1
SS	8	20	28	22.5	MP 3
TT	10	22	28	22.5	MP 3
UU	12	24	28	22.5	MP 3
VV	11	21	31.5	27.5	MKC 10; MKP 10; MKC4SV21; MKS 4-R; MKS 10; FKP 1; MKS 4 ; MKC 4
WW	13	24	31.5	27.5	MKS 4; MKS 4-R; MKS 10; MKC 10; MKP 10; MKC4SV21; FKP 1; MKC 4
XX	15	26	31.5	27.5	MKC 10; MKP 10; MKS 4-R; MKS 10; MKC 4; MKS 4
YY	17	34.5	31.5	27.5	MKS 10; MKP 10; MKS 4-R; MKC4SV21; MKS 4 ; MKC 4
ZZ	9	19	31.5	27.5	MKS 4; MKC 4; MKC4SV21; FKP 1
A/B	20	39.5	31.5	27.5	MKP 10; MKS 10
A/C	10.5	19	26.5	22.5	MKS 4
A/D	13	25	33	27.5	MP 3
A/E	13	24	41.5	37.5	MKP 10; FKP 1
A/F	15	26	41.5	37.5	MKP 10; FKP 1
A/G	19	32	41.5	37.5	MKP 10; FKP 1
A/H	17	29	41.5	37.5	MKP 10; FKP 1
A/J	11	22	41.5	37.5	FKP 1
A/K	7.2	13	7.2	5	MKC 2; MKS 2

WIMA is a Registered Trademark of: Wilhelm Westermann, Mannheim, West Germany.

ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

CERAMIC CAPACITORS

DISC — WAFER — TRAPEZOIDAL — TUBULAR — FEED-THROUGH

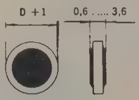
△ Exceptionally High Quality Control on Ceramic Materials
△ Complete (100%) Testing
△ Longer Shelf Life

DISC CAPACITORS HIGH VOLTAGE TYPES / KV1

From 1 kV to 8 kV — EIA Types (Y5P/25P) (Y5U/25U)

BUTTON DISC CAPACITORS 500V / K2P

EIA Types (Y5P/Z5P) (Y5U/Z5U)



WAFER CAPACITORS 50V / P1

Range 4700 to 4700 pF

TUBULAR CAPACITORS, HIGH VOLTAGE PULSE TYPE / CIM

1.5 kV to 4 kV

TUBULAR CAPACITORS 500V / C1

0,1 pF to 30,000 pF

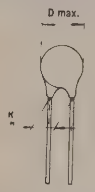
SAFETY TYPE DISC CAPACITORS / KZ

For AC Applications

REDUCED TITANATE DISC/KR1

.001 mFd to .18 mFd 50 V for bypass application

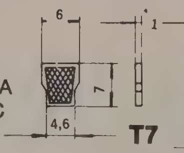
SUBMINIATURE DISC CAPACITORS 500V / K1

		C (pF)				
	D (mm)	5,5	7	10	14	18
	P 100 NP 0 N 150 N 750 N 1500	0,5 ...... 3 1,0 ...... 7,5 1,0 ...... 8,2 2,2 ...... 22 4,7 24	>3 ...... 4,7 >55 ...... 15 >75 ...... 16 >22 ...... 33 >24 56	>4,7 ...... 9,1 >15 ...... 27 >16 ...... 33 >33 ...... 62 >56 100	>9,1 ...... 18 >27 ...... 51 >33 ...... 62 >62 ...... 120 >100 220	 >120 ...... 160 >220 300
Tolerances Available: ±1% to −20 and +80% △ Engineering Note: Type No.'s (I.E. D10) also specifies nominal diameter of the part.	M 2000 M 3000 M 6000	47 ...... 330 150 ...... 360 270 680	>330 ...... 510 >360 ...... 510 >680 1200	>510 ...... 1200 >820 ...... 1800 >1200 3300	>1200 ...... 2200 >1800 ...... 3600 >3300 7500	 >7500 10000
	R (mm)	2,5	5	5	7,5	7,5

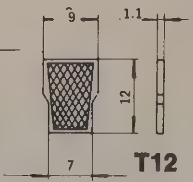
NICKEL PLATED

TRAPEZOIDAL CAPACITORS 500V / T7 / T12

1 ...... 56 pF
P 100 ...... N 1500
150 ...... 3600 pF
M 2000 ...... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC
4,7 ...... 91 pF
330 ...... 560 pF



T7

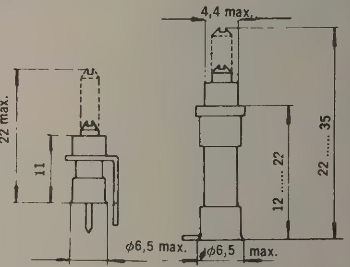


T12

△ All dimensions given in millimeters — tolerances ±0.5.

TUBULAR TRIMMERS / CT

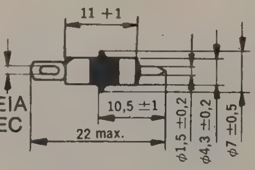
2,0 ...... 62 pF
8 16
470 ...... 1200 pF
0,7/3,7 pF ...... 4/13 pF
0,4/2 pF ...... 1/9 pF



FEED-THROUGH CAPACITORS 500V

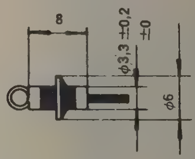
S1

1 ...... 68 pF
P 100 ...... N 1500
180 ...... 2400 pF
M 2000 ...... M 3000 ...... M 6000
(Y5P/Z5P) (Y5T/Z5T) (Y5U/Z5U) EIA
(2B4/2A5) (2D4/2C5) (2E4/2D5) IEC



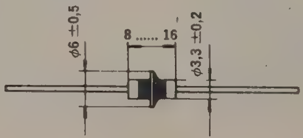
S2

1,5 ...... 270 pF
220 ...... 8200 pF
P 100 ...... N 1500
M 2000 ...... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC



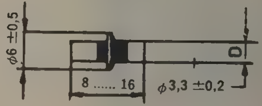
S5

1,5 ...... 100 pF
220 ...... 2700 pF
P 100 ...... N 1500
M 2000 ...... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC



S21

P 100 ...... N 1500
M 2000 ...... M 6000
(Y5P/Z5P) (Y5U/Z5U) EIA
(2B4/2A5) (2E4/2D5) IEC



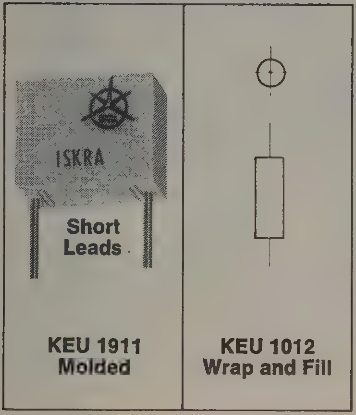
ISKRA ELECTRONICS INC.
8 GREENFIELD RD., SYOSSET, NY 11791 • (516) 364-2616

ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

METALLIZED POLYESTER FILM CAPACITORS

Configurations Available



KEU 1911
Molded

KEU 1012
Wrap and Fill

FEATURES

- △ High insulation resistance
- △ Low dielectric loss
- △ Wide temperature range
- △ High humidity resistance
- △ Very small dimensions
- △ Self-healing properties

CONSTRUCTION

- △ Metallized polyester foil with excellent electrical characteristics.
- △ Plastic coating permits operation under exceptionally humid climatic conditions.
- △ Contact surface applied by high pressure spraying and connecting wires are soldered reducing possibility of failures or unsatisfactory contact during operation.
- △ Self-healing properties guarantee greater than usual operating efficiency.
- △ Flammability per UL 492.
- △ Self-extinguishing plastic case and sealed with self-extinguishing epoxy resin.

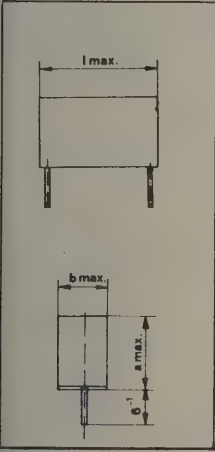
TECHNICAL DATA

Temperature Range: −40°C to +85°C.
Humidity test: Per EIA specifications RS 376
Capacitance tolerance: ±5%, ±10%, ±20%.
Rated voltage Vn: 100V-, 250V-, 400V-, 630V-, 1000V-.
Allowable a.c. voltage to 60 Hz: 63V∼, 160V∼, 200V∼, 220V∼, 250V∼.
Dielectric loss tg at 20°C: $\leqslant 80 \times 10^{-4}$ at 1 kHz
$\leqslant 200 \times 10^{-4}$ at 10 kHz.
Inductance: <20nH measured at terminal length of 6mm.
Test voltage (2s): 1.6×Vn.

Insulation resistance at 20°C and 100V-:

$C \leqslant 0.33\mu F$	$C > 0.33\mu F$
$V_n \leqslant 100V$-	$V_n \leqslant 100V$-
$R = 15 \times 10^3\ M\Omega$	$R \times C = 5 \times 10^3 s$
$V_n > 100V$-	$V_n > 100V$-
$R = 30 \times 10^3\ M\Omega$	$RR \times C = 10^4 s$

The capacitors can be used to a temperature of 100°C, by which the working voltage at a temperature above 85°C is less than the rated voltage by 1.25% for every °C.



CAPACITANCE VALUES	AVAILABLE HOUSING SIZES				
	100V	250V	400V	630V	1000V
0.01	1	1	1	2	4
0.015	1	1	1	3	5
0.022	1	1	1	3	5
0 033	1	1	2	4	7
0.047	1	1	3	5	7
0.068	1	2	4	6	9
0.1	1	3	5	8	10
0.15	2	4	5	9	11
0.22	3	5	7	9	12
0.33	4	6	8	11	
0.47	4	7	10	12	
0.68	5	8	11		
1	6	10	12		
1.5	8	11			
2.2	9	12			
3.3	10				
4.7	11				
6.8	12				

SIZE OF HOUSING	l (LENGTH)		a (HEIGHT)		b (WIDTH)		Lead Spacing ±0.5 ±0.02		Lead Dia. ±0.5 ±0.002	
	INCH	MM	INCH	MM	INCH	MM	INCH	MM	INCH	MM
1	0.512	13	0.413	10.5	0.177	4.5	0.40	10	0.024	0.6
2	0.512	13	0.453	11.5	0.217	5.5	0.40	10	0.024	0.6
3	0.512	13	0.492	12.5	0.256	6.5	0.40	10	0.024	0.6
4	0.709	18	0.472	12	0.236	6	0.60	15	0.031	0.8
5	0.709	18	0.531	13.5	0.295	7.5	0.60	15	0.031	0.8
6	0.709	18	0.610	15.5	0.374	9.5	0.60	15	0.031	0.8
7	1.063	27	0.630	16	0.276	7	0.90	22.5	0.031	0.8
8	1.063	27	0.650	16.5	0.295	7.5	0.90	22.5	0.031	0.8
9	1.063	27	0.728	18.5	0.354	9.0	0.90	22.5	0.031	0.8
10	1.063	27	0.787	20	0.433	11	0.90	22.5	0.031	0.8
11	1.260	32	0.827	21	0.472	12	1.10	27.5	0.031	0.8
12	1.260	32	0.925	23.5	0.551	14	1.10	27.5	0.031	0.8

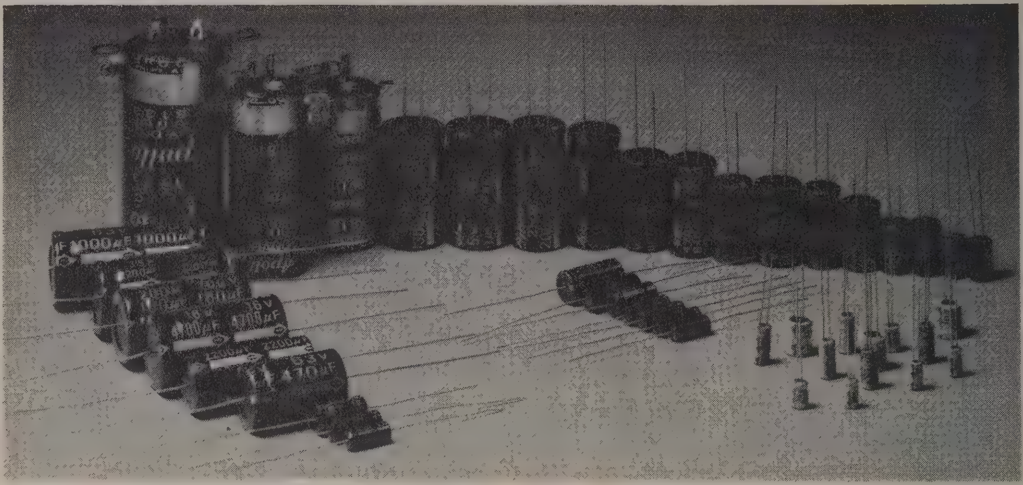
ISKRA ELECTRONICS INC.
8 GREENFIELD RD., SYOSSET, NY 11791 • (516) 364-2616

ISL PRODUCTS INTERNATIONAL LTD.

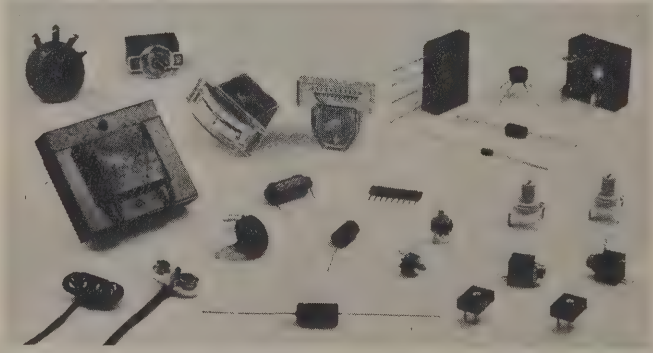
Dept. EM, 235-P Robbins Lane / Syosset, NY 11791 / (516) 822-9601 / TWX 510-221-2109 / ISL-SYST

CAPACITORS / SILICON DIODES / CARBON FILM RESISTORS / LEDS / POTENTIOMETERS / TRANSFORMERS ADAPTORS AND POWER SUPPLIES

ALUMINUM ELECTROLYTIC CAPACITORS



Application	Type R-Radial T-Axial	Operating Temperature Range	Rated Voltage Range	Leakage Current @ 25°C i_L μa, C mf, V volts (Rated)	Standard Tolerances
General Uses • Filter • By Pass • Radio • TV • Industrial	RS TS	Under 100V: −40°C +85°C Over 100V: −25°C +85°C	6.3V − 500V	$i_L < .03\,CV$ or 4 μa whichever is greater	−10 +75% <4.7 mf < −10 +50%
Sub Miniature Size Low Leakage • Timing Circuits • Pulse Circuits • Substitutes for Tantalums	SMR SMT	−40°C +85°C	6.3V − 50V	$i_L < .002\,CV$ or .3 μa whichever is greater	±20%
Epoxy Sealed • Same applications as SM Series, but impervious to chlorinated solvents	LMR LMT	−40°C +85°C	16V − 50V	$i_L < .002\,CV$ or .3 μa whichever is greater	±20%
Non Polar •General Use • Small Size	NPR NPT	−40°C +85°C	6.3V − 100V	$i_L < .01\,CV + 3$ μa	±30% − 20% & 10% available
Non Polar • Cross Over Networks • High Circulating Currents	BPR BTT	−25°C +85°C	16V − 63V	$i_L < .03\,CV + 4$ μa	±20%
Computer Grade • Low ESR values to 550,000 mf • ESR .009 Ω @ 6V & 2500 mf @ 350V ESR .091 Ω	CXR CXT	−40°C +85°C	3.5V − 450V	$i_L < .005\sqrt{CV}$ i_L in ma	−10 +100% <50V < −10 +75% −10 +75% <50V < −10 +50%
Computer Grade • Very Low ESR with high ripple current typically: .009 Ω, 22 Amps, 6V; 550,000 mf • Extended shelf life • 35,000 mf at 6V axial in less than 3 cu. in.	CXR CXT	−40°C +85°C	3.5V − 450V 6V − 450V	$i_L < .005\sqrt{CV}$ i_L in ma	−10 +100% <50V < −10 +75% −10 +75% <75V < −10 +50%
Military and Telecommunication • Hi Reliability	MTT	−55°C +125°C	3.5 − 250 VDC	$i_L < .01\,V\sqrt{C} + 2$ μa	−10 +75% <75V < −10 +50%
Horizontal Deflection • For "S" Correction in Transistor Circuits • Low Cost Substitutes for Film Capacitors	HD	−25°C +85°C	25 VAC	30 μa max	±20%



MANUFACTURERS OF QUALITY
ELECTRONIC COMPONENTS
WORLD WIDE

ISL PRODUCTS INTERNATIONAL LTD.

Dept. EM, 235-P Robbins Lane
Syosset, NY 11791
(516) 822-9601 TWX 510-221-2109
ISL-SYST

SEE OUR PAGE ON DIODES & BRIDGES SECTION 4800 PAGE 1A•2098

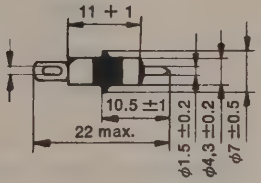
ISL PRODUCTS INTERNATIONAL LTD.

Dept. EM, 235-P Robbins Lane / Syosset, NY 11791 / (516) 822-9601 / TWX 510-221-2109 / ISL-SYST

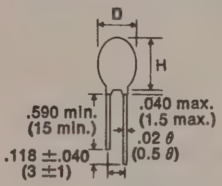
CAPACITORS / SILICON DIODES / CARBON FILM RESISTORS / LEDS / POTENTIOMETERS / TRANSFORMERS ADAPTORS AND POWER SUPPLIES

Ceramic Discs

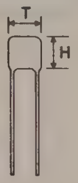
Feed Thru



Dipped Tantalum



Monolythic



DISC CAPACITORS HIGH VOLTAGE TYPES/KV1
From 1 kV to 8 kV—EIA Types (Y5P/25P) (Y5U/25U)

SAFETY TYPE DISC CAPACITORS/KZ
For AC Applications

MONOLITHIC CAPACITORS TO 200V
NPO X7R Z5U

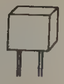
TRAPEZOIDAL CAPACITORS 500V/T7/T12
REDUCED TITANATE DISC/KR1
.001 mFd to .18 mFd 50V for bypass application

SUBMINIATURE DISC CAPACITORS 500V/K1
All TC's starting at 4mm
P100 .... N56000
HIK Y5P Z5V

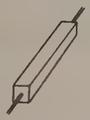
FEED-THROUGH CAPACITORS 500V
3 & 4mm With and Without Pin

FOIL CAPACITORS

1511
Molded
Radial

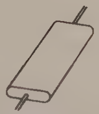


2710
Molded
Axial

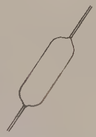


1012
Wrap
and Fill
Round

1011
Oval



1010
Axial



MPE104
Epoxy
DIP
Radial

Capacitor Type	KSC Polystyrene	KFU Polyester	KKU Polycarbonate	KLI-1511 Polypropylene	KEU Metallized Polyester	KCU Metallized Polycarbonate	KNU Metallized Polypropylene
Cap Range	33 pf to .82 μf	.001 to 1 μf	470 pf to .1 μf	.0022 to .1 μf	.01 μf to 10 μf	.01 to 10 μf	.002 to 1.8 μf
Avail. Tol. ±%	10, 5, 2.5	20, 10, 5	20, 10, 5	20, 10, 5	20, 10, 5	20, 10,5	20, 10, 5
VDC	63V to 1000V	100 to 1000	160, 400	630, 1000, 1500	100 to 1000	100 to 630	400 to 1500
AC Vrms	.4 × Rated DC	63 to 250	100, 200	300, 350, 400	63 to 250	63 to 220	≈ .4 VDC
Pdn Test Voltage	3 × Rated	2 × Rated	2 × Rated	2 × Rated	1.6 × Rated	1.6 × Rated	1.6V Rated
Dielectric Loss @ 1 kHz, 20°C	$\leq 2 \times 10^{-4}$ $\leq 5 \times 10^{-4}$ Cn <10 μf <Cn	Tan $\delta \leq 60 \times 10^{-4}$	Tan $\delta \leq 10^{-4}$	Tan δ @ 10 kHz $\leq 5 \times 10^{-4}$	Tan $\delta \leq 10^{-6}$	Tan δ 50×10^{-4} Cn <1 μf Tan δ 80×10^{-4} Cn ≥1 μf	$\leq 25 \times 10^{-4}$ C >/μf
Insulation Res.	Ri $\geq 10^{-5}$ Meg Cn ≤.1 μf Ri Cn $\geq 10^{-4}$ Sec Cn >.1 μf	Ri ≤30,000 Meg Cn ≤.33 μf Ri Cn=10,000 Sec Cn >.33 μf	Ri ≥30,000 Meg	Ri ≥30,000 Meg	Ri ≤3750 Meg Cn≤ .33 μf Ri Cn >1250 Cn ≥.33 μf	Ri ≤3750 Meg Cn . ≤33 μf Ri Cn >1250 Cn ≥.33 μf	≥20,000 Meg C ≤.33 μf Ri × Cn >6000 Sec C >.33
Operating °C Temp. Range	−40 to +70	−40 to +100	−40 to +100	−40 to +85	−40 to +85	−40 to +85	−25 to +85
Temp. Coefficient	$-(125 \pm 60) \times 10^{-6}$/°C	$\approx 10^{-4}$/°C	Less than 5×10^{-5}/°C	-200×10^{-6}/°C	$\approx 10^{-4}$/°C	Less than 5×10^{-5}/°C	-200×10^{-6}/°C
Pulse Loading	1000V/μsec	1000 v/μsec	1000V/μsec	750V/μsec	1.5 to 24V/μsec*	1.5 to 24V/μsec*	4 to 125V/μsec†
Inductance at Term Length 6 MM	10 nH/Cm Length of cap	20 nH	15 nH	10 nH	20 nH	20 nH	20 nH

* Varies with Case Size and Voltage Rating. † Depending on Value and Voltage Rating.

MANUFACTURERS OF QUALITY
ELECTRONIC COMPONENTS WORLD WIDE

ISL PRODUCTS
INTERNATIONAL LTD.
Dept. EM, 235-P Robbins Lane
Syosset, NY 11791
(516) 822-9601 TWX 510-221-2109
ISL-SYST

SEE OUR PAGE ON DIODES & BRIDGES SECTION 4800 PAGE 1A•2098

ITT Components
A Unit of ITT Corporation

Aluminum Electrolytic Capacitors

Miniature Radial
Miniature Axial

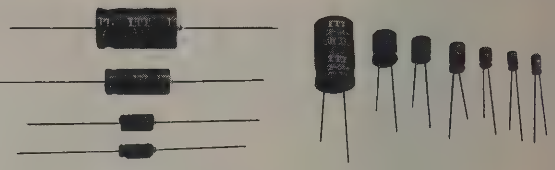
ORDERING INFORMATION:

SM 3.3 M 50 S

- Series Designation (SM-Subminiature Radial) — SM
- Nominal Capacitance (Micro Farads) — 3.3
- Tolerance Designation (as specified) — M
- Rated Voltage (DC) — 50
- Lead Style Designation — S

(AX-Miniature Axial) (CE04-W-Miniature Radial)
(SSM-Super Subminiature)

NOTE: For tape and reel packaging, use a T for the lead style designation. Available for case diameters through .315 (8.00).
For epoxy end sealing, use an E next to the lead style designation. Available for case diameters through .709 (18.00)

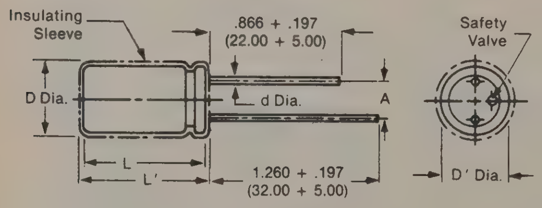


Standard Capacitance Range
(Case Diameters and Lengths in mm)

WV / μf	6.3	10	16	25	35	50	63	100
0.1								5x11
0.22								5x11
0.33								5x11
0.47								5x11
1								5x11
2.2								5x11
3.3								5x11
4.7							5x11	6.3x11
10						5x11	6.3x11	8x11.5
22				5x11	6.3x11	6.3x11	8x11.5	10x12.5
33			5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x16
47		5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x20
100		6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20	13x20
220		8x11.5	10x12.5	10x16	10x20	13x20	13x20	16x25
330		10x12.5	10x16	10x20	13x20	13x20	13x25	16x31.5
470	10x12.5	10x16	10x20	13x20	13x25	16x25	16x25	18x35.5
1000	10x20	13x20	13x20	13x25	16x25	16x31.5	18x35.5	
2200	13x25	16x20	16x25	16x35.5	18x35.5			
3300	16x25	16x31.5	16x35.5	18x40				
4700	16x31.5	16x35.5	18x35.5					
10000	18x40							

Case Sizes and Dimensions: All dimensions shown in inches (millimeters)

SM Series



D	.197(5.00)	.248(6.30)	.315(8.00)	.394(10.00)	.512(13.00)	.630(16.00)	.709(18.00)
A	.079(2.00)	.099(2.50)	.140(3.50)	.197(5.00)		.295(7.50)	
d	.020(0.50)			.024(0.60)		.026(0.65)	.032(0.80)

D′ = [D +.020(0.50)] Max.
L′ = [L +.039(1.00)] Max. at D ≤ .315(8.00)
L′ = [L +.079(2.00)] Max. at D ≥ .394(10.00)

PERFORMANCE SPECIFICATIONS:

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: Less than 3μa +.01 CV (measured after 3 minutes of applied voltage).
C = Nominal capacitance (μf)
V = Rated voltage

Capacitance Tolerance: ±20% (M) or 10% (K)
(measured at 20°C (68°F), 120Hz)

Dissipation Factor: (measured at 20°C (68°F), 120Hz)

Rated Voltage	6.3	10	16	25	35	50 to 100
0.1μf to 1000μf	0.24	0.20	0.17	0.15	0.12	0.10
1000μf to 10,000μf	Values above plus 0.02 for each 1000μf					

Impedance Ratio at Low Temperature: 120Hz

Rated Voltage	6.3	10	16	25	35	50 to 100
Z −25°C (−13°F)/Z @ 20°C (68°F)	4	3	2	2	2	2
Z −40°C (−40°F)/Z @ 20°C (68°F)	8	6	4	4	4	4

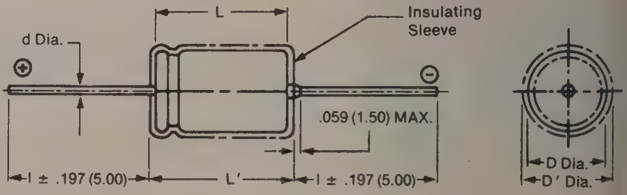
Surge Voltage:

DC Rated Voltage	6.3	10	16	25	35	50	63	100
Surge Voltage	8	13	20	32	44	63	79	125

Load Life: 1000 ±12 hrs @ +85°C (+185°F) and rated voltage.
Leakage Current: Within values specified above
Dissipation Factor: With ±150% of specified value

Shelf Life: 1000 hrs. @ +85°C (+185°F), No voltage applied
Leakage Current: Within ±200% of values specified above
Dissipation Factor: Within ±150% of specified value
Capacitance Change Max.: ±20% from initial value

AX Series



D	d	f
.248 ~ .315 (6.30 ~ 8.00)	.024 (0.60)	1.500 (38.00)
.394 ~ .512 (10.00 ~ 13.00)	.024 (0.60)	1.500 (38.00)
.630 ~ .870 (16.00 ~ 22.00)	.032 (0.80)	1.500 (38.00)
.984 (25.00)	.039 (1.00)	1.500 (38.00)

D′ = [D +.020(0.50)] Max.
L′ = [L +.039(1.00)] Max. at D ≤ .315(8.00)
L′ = [L +.079(2.00)] Max. at D ≥ .394(10.00)

ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone: (714) 751-3900 • TWX: 910-595-1744 • Telex: 69-1389

ITT Components
A Unit of ITT Corporation

Epoxy Dipped Solid Tantalum Capacitors

TAP

- Extremely Low Leakage Current
- High Surge Capability
- Small Size
- High Component Density
- Rugged Construction
- Reliability-Long Term Stability
- Outstanding Performance Over Wide Frequency Range
- Wide Temperature Range

Catalog Ordering Information

TAP F 2.2 M 15 **General Specifications**

Voltage
Tolerance
M ±20%, K ±10%
Capacity in µF
Lead Execution
S = 0.100″ Lead Spacing
C = 0.200″ with Shoulder
D = 0.125″ Lead Spacing
B = 0.250″ Lead Spacing
F = Lock-In Leads 0.200″ Spacing
Y = Special
E = Tape and Reel

Packed in the following quantities:

Case Size	Quantity (units per bag)
1—8	500
9—12	100
13—15	50
1—5	1500 pcs/reel
6—8	1000 pcs/reel

Ratings

Capacitance: 0.1 to 330 µF (values up to 680 µF available on request)
Tolerance Range: ±20% (±10%)
Voltage: 3 to 50 volts
Temperature Range: Continuous operation between −55°C to +85°C

Standard Ratings

*Insert Lead Execution Letter & Tolerance Letter in the 2nd and 4th space to complete Ordering Code.

3 Volts — DC; 3.9 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_10_3	10	1	1	3	9.5	8
TAP_15_3	15	2	2	2	8.5	
TAP_22_3	22	3	2	1.5	5	
TAP_33_3	33	4	3	0.8	3.5	
TAP_47_3	47	5	4	0.6	2	
TAP_68_3	68	6	5	0.5	2	8
TAP_100_3	100	7	10	0.5	1.5	10
TAP_150_3	150	9	10	0.4	0.9	10
TAP_220_3	220	9	15	0.4	0.9	10
TAP_330_3	330	11	20	0.3	0.7	10

6.3 Volts — DC; 8 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_4.7_6.3	4.7	1	1	5.6	19	6
TAP_6.8_6.3	6.8	2	1	4	10	6
TAP_10_6.3	10	3	2	3	9.5	8
TAP_15_6.3	15	4	2	2.3	6.8	8
TAP_22_6.3	22	5	2	1.5	4	8
TAP_33_6.3	33	6	3	0.8	3.5	8
TAP_47_6.3	47	7	4	0.6	2	8
TAP_68_6.3	68	8	5	0.5	2	8
TAP_100_6.3	100	9	10	0.5	1.5	10
TAP_150_6.3	150	11	10	0.4	0.9	10
TAP_220_6.3	220	12	15	0.4	0.9	10
TAP_330_6.3	330	14	20	0.3	0.7	10

10 Volts — DC; 13 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_3.3_10	3.3	1	1	8	22	6
TAP_4.7_10	4.7	2	1	5	12	6
TAP_6.8_10	6.8	3	2	3	9.5	6
TAP_10_10	10	4	2	2.4	7	8
TAP_15_10	15	5	2	1.8	4.5	8
TAP_22_10	22	6	3	1	3.5	8
TAP_33_10	33	7	5	0.8	2.2	8
TAP_47_10	47	8	5	0.6	2.2	8
TAP_68_10	68	9	10	0.5	1.8	8
TAP_100_10	100	11	15	0.4	1	10
TAP_150_10	150	13	20	0.4	0.9	10
TAP_220_10	220	14	20	0.3	0.8	10

15(16)† Volts — DC; 20 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_2.2_15	2.2	1	1	10	25	6
TAP_3.3_16	3.3	2	1	6.5	13.5	6
TAP_4.7_16	4.7	3	2	5.8	12.8	6
TAP_6.8_16	6.8	4	2	5	12	6
TAP_10_16	10	5	2	2.5	5	8
TAP_15_16	15	6	3	1.5	4	8
TAP_22_16	22	7	5	1	2.5	
TAP_33_16	33	8	5	0.8	2.2	
TAP_47_16	47	10	10	0.6	1.5	
TAP_68_16	68	11	10	0.5	1.1	
TAP_100_16	100	13	15	0.4	0.9	10
TAP_150_16	150	15	20	0.3	0.8	10

20 Volts — DC; 26 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_15_20	15	7	4	1.7	3.5	8
TAP_22_20	22	7	5	1.2	2.5	
TAP_33_20	33	9	10	0.8	2	
TAP_47_20	47	11	15	0.7	1.4	
TAP_68_20	68	12	15	0.6	1.1	
TAP_100_20	100	14	20	0.5	1.1	10

25 Volts — DC; 32 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_1.5_25	1.5	1	1	12	25	4
TAP_2.2_25	2.2	2	1	9	15	6
TAP_3.3_25	3.3	3	1	6.5	14.5	6
TAP_4.7_25	4.7	4	2	4.5	7.5	6
TAP_6.8_25	6.8	5	3	3	5.5	6
TAP_10_25	10	6	4	2.4	4.2	8
TAP_15_25	15	7	5	1.7	2.8	
TAP_22_25	22	9	10	1.2	2.5	
TAP_33_25	33	10	10	0.8	1.8	
TAP_47_25	47	12	15	0.7	1.4	
TAP_68_25	68	13	15	0.6	1	8

35 Volts — DC; 46 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_0.1_35	0.1	1	1	165	270	4
TAP_0.15_35	0.15			110	160	
TAP_0.22_35	0.22			75	130	
TAP_0.33_35	0.33			51	85	
TAP_0.47_35	0.47			37	58	
TAP_0.68_35	0.68	1	1	27	40	4
TAP_1.0_35	1.0	1	1	18	28	4
TAP_1.5_35	1.5	2	1	13	20	4
TAP_2.2_35	2.2	3	1	9	13	6
TAP_3.3_35	3.3	4	2	6	10	6
TAP_4.7_35	4.7	5	2	4	7	6
TAP_6.8_35	6.8	6	3	3	4.5	6
TAP_10_35	10	7	5	2.5	3.2	8
TAP_15_35	15	9	5	1.2	2.5	8
TAP_22_35	22	11	10	1	2	8
TAP_33_35	33	12	10	0.8	1.6	8
TAP_47_35	47	14	10	0.6	1.2	8

50 Volts — DC; 65 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_0.1_50	0.1	1	1	170	270	4
TAP_0.15_50	0.15	1	1	105	160	
TAP_0.22_50	0.22	1	1	80	130	
TAP_0.33_50	0.33	1	1	50	85	
TAP_0.47_50	0.47	2	1	32	55	
TAP_0.68_50	0.68	3	1	25	38	4
TAP_1.0_50	1.0	4	1	16	26	4
TAP_1.5_50	1.5	5	2	13	18	4
TAP_2.2_50	2.2	6	2	8	12	6
TAP_3.3_50	3.3	7	3	6.2	9	6
TAP_4.7_50	4.7	8	3	3.5	6.5	6
TAP_6.8_50	6.8	9	4	2.2	4.2	6
TAP_10_50	10	11	6	1.8	3	8

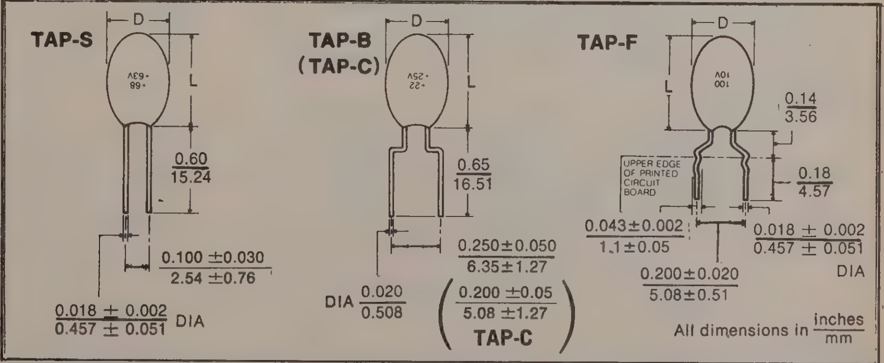
† Branded with voltage value in bracket.

For intermediate capacitance and voltage values, consult your local ITT representative.

Outline Dimensions (Maximum)

Case Size	Diameter-D Inches	Length-L Inches
1	0.157	0.275
2	0.177	0.275
3	0.196	0.314
4	0.196	0.334
5	0.216	0.354
6	0.236	0.374
7	0.255	0.393
8	0.334	0.452
9	0.374	0.531
10	0.374	0.551
11	0.393	0.551
12	0.413	0.591
13	0.413	0.630
14	0.433	0.650
15	0.433	0.669

TAP-S Standard Case Size 1-8
TAP-B Standard Case Size 1-15
TAP-F Standard Case Size 1-15



ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone: (714) 751-3900 • TWX: 910-595-1744 • Telex: 69-1389

TAR

ITT Components
A Unit of ITT Corporation

Subminiature Epoxy Molded Solid Tantalum Capacitors

- Axial Leads For Automatic Insertion
- Subminiature Size For High Component Density
- Rugged Precision Molded Construction
- Polarity Positively Identified By Tapered Nose
- Extremely Low Leakage Current
- High Surge Capability
- Reliability-Long Term Stability
- Outstanding Performance Over Wide Temperature Range

Catalog Ordering Information

TAR A 1.0 M 35 — **General Specifications**

35 — **Voltage**
M — **Tolerance**
M ±20%, K ±10%,
J ±5%
1.0 — **Capacity in µF**
A — **Case Size**

Standard Packaging is Tape and Reel

Case A 3000 pcs/reel
Case B 2000 pcs/reel
Case C 1000 pcs/reel

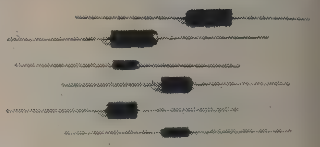
Standard Ratings

# Insert Tolerance Letter in the space to complete Ordering Code.

Code #	Capacitance µF	Case Size	Maximum Leakage µA @ 25°C	Maximum Dissipation Factor %
6.3 Volts — DC;	**8 volts — DC Surge @ 85°C**			
TARA8.2_6.3	8.2	A	1	6
TARA10_6.3	**10.0**	A	1	6
TARA12_6.3	12.0	A	1	6
TARB22_6.3	**22.0**	B	1	6
TARB27_6.3	27.0	B	2	6
TARB33_6.3	**33.0**	B	2	6
TARC56_6.3	56.0	C	4	6
TARC68_6.3	**68.0**	C	4	6
10 Volts — DC;	**13 volts — DC Surge @ 85°C**			
TARA4.7_10	**4.7**	A	1	6
TARA5.6_10	5.6	A	1	6
TARA6.8_10	**6.8**	A	1	6
TARA8.2_10	8.2	A	1	6
TARB18_10	**18.0**	B	1	6
TARB22_10	**22.0**	B	2	6
TARC39_10	39.0	C	4	6
TARC47_10	**47.0**	C	4	6
16 Volts — DC;	**20 Volts — DC Surge @ 85°C**			
TARA3.3_16	**3.3**	A	1	6
TARA3.9_16	3.9	A	1	6
TARA4.7_16	**4.7**	A	1	6
TARB12_16	12.0	B	2	6
TARB15_16	**15.0**	B	2	6
TARC27_16	27.0	C	4	6
TARC33_16	**33.0**	C	4	6
20 Volts — DC;	**26 Volts — DC Surge @ 85°C**			
TARA2.7_20	2.7	A	1	6
TARA3.3_20	**3.3**	A	1	6
TARA3.9_20	3.9	A	1	6
TARB8.2_20	8.2	B	2	6
TARB10_20	**10.0**	B	2	6
TARC18_20	18.0	C	4	6
TARC22_20	**22.0**	C	4	6

Outline Dimensions

Case Size	Diameter — D	Length — L	Lead Wire Diameter — W
	inches ±0.010	inches ±0.010	inches ±.0.002
A	0.10	0.29	0.02
B	0.17	0.34	0.02
C	0.19	0.53	0.02



Ratings

Capacitance: 0.1 to 68 µF
Tolerance Range: ±20%, ±10%, ±5%
Voltage: 6.3 to 35 volts DC
Temperature Range: Continuous operation between −55°C to +85°C
Impedance @ 100 kHz:

Case Size	Impedance maximum
A	< 06.8 µF = 26 ohms ≥ 0.68 µF = 10 ohms
B, C	5 ohms

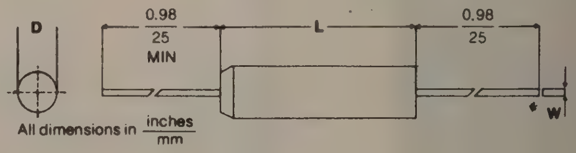
Temperature	−55°C	+85°C
% Change	−8	+12

Capacitance Change With Temperature: The change in capacitance from +25°C to a given temperature.

Code #	Capacitance µF	Case Size	Maximum Leakage µA @ 25°C	Maximum Dissipation Factor %
25 Volts — DC;	**33 Volts — DC Surge @ 85°C**			
TARA1.5_25	**1.5**	A	1	6
TARA1.8_25	1.8	A		
TARA2.2_25	**2.2**	A		
TARB2.7_25	2.7	A		
TARB3.3_25	**3.3**	A		
TARB3.9_25	3.9	B	1	6
TARB4.7_25	**4.7**	B	1	
TARB5.6_25	5.6	B	2	
TARB6.8_25	**6.8**	B	2	
TARC8.2_25	8.2	B	3	
TARC10_25	**10.0**	B	3	6
TARC12_25	12.0	C	4	
TARC15_25	**15.0**		4	
35 Volts — DC;	**46 Volts — DC Surge @ 85°C**			
TARA0.1_35	**0.1**	A	1	6
TAR0.12_35	0.12			
TARA0.15_35	**0.15**			
TARA0.18_35	0.18			
TARA0.22_35	**0.22**			
TARA0.27_35	0.27	A	1	6
TARA0.33_35	**0.33**			
TARA0.39_35	0.39			
TARA0.47_35	**0.47**			
TARA0.56_35	0.56			
TARA0.68_35	**0.68**	A	1	6
TARA0.82_35	0.82	A		
TARA1.0_35	**1.0**	A		
TARA1.2_35	1.2	A		
TARB1.5_35	**1.5**	A		
TARB1.8_35	1.8	B	1	6
TARB2.2_35	**2.2**		1	
TARB2.7_35	2.7		1	
TARB3.3_35	**3.3**		1	
TARB3.9_35	3.9		2	
TARB4.7_35	**4.7**	B	2	6
TARC5.6_35	5.6	C	3	
TARC6.8_35	**6.8**	C	3	
TARC8.2_35	8.2	C	4	
TARC10_35	**10.0**	C	4	

All capacitors are supplied in the highest voltage available at a given capacitance value and case size.

BOLDFACE items shown are preferred value (E6 range) readily available for delivery.



ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone: (714) 751-3900 • TWX: 910-595-1744 • Telex: 69-1389

ITT Components
A Unit of ITT Corporation

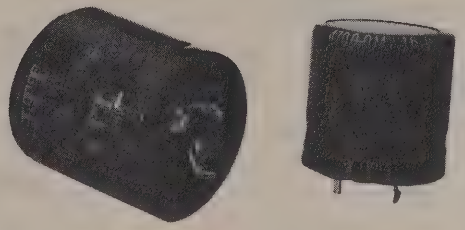
Aluminum Electrolytic Capacitors

PC Mount Power Filtering

ORDERING INFORMATION

FHW 470 M 200

Series Designation (FHW - Low Profile) — FHW
Nominal Capacitance (Micro Farads) — 470
Tolerance Designation (as specified) — M
Rated Voltage (DC) (FTW - small diameter) — 200

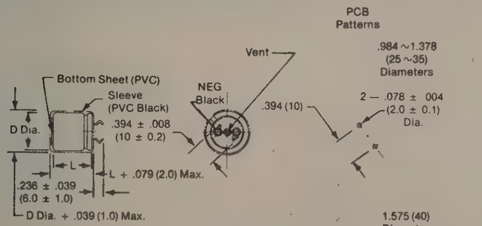


Standard Capacitance Range: FHW Series
(Case Diameters and Lengths in mm)

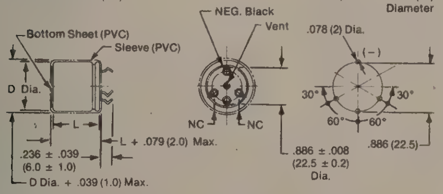
µF \ WV	16	25	35	50	63	80	100	160	180	200	250
100										25x25	25x25
220								25x25	30x25	30x25	30x30
330								30x25	30x30	30x30	35x30
470								30x30	35x30	35x30	40x30
680								35x30	40x30	35x40	40x40
1000				25x25	25x25	30x25	30x30	40x30	40x40	51x40	
2200			25x25	30x25	30x30	30x30	40x30				
3300		25x25	30x25	30x30	35x30	40x30	51x40				
4700	25x25	30x25	30x30	35x30	40x30	51x40	51x40				
6800	30x25	30x30	35x30	40x40	51x40	51x40	63.5x40				
10000	30x30	35x30	40x40	51x40	63.5x40	63.5x40	63.5x40				
15000	35x30	40x40	51x40	63.5x40	63.5x40	63.5x50					
22000	40x40	51x40	63.5x40	63.5x50							

Standard Capacitance Range: FTW Series
(Case Diameters and Length in mm)

µF \ WV	16	25	35	50	63	80	100	160	180	200	250
220									25x40	25x40	25x50
330								25x40	25x40	25x50	30x50
470					22.4x25	22.4x30	22.4x30	25x50	25x50	30x50	
680					22.4x30	22.4x40	22.4x40	30x50	30x50		
1000			22.4x25	22.4x25	22.4x30	22.4x40	25x40				
2200		22.4x25	22.4x30	22.4x40	25x40	25x50	30x50				
3300	22.4x25	22.4x30	22.4x40	25x40	25x50	30x50					
4700	22.4x30	22.4x40	25x40	25x50	30x50						
6800	22.4x40	25x40	25x50	30x50							
10000	25x40	25x50	30x50								
15000	30x50	30x50									



PCB Patterns
Vent
.984 ~1.378
(25 ~35)
Diameters
Bottom Sheet (PVC)
Sleeve
(PVC Black)
NEG
Black
.394 (10)
2 — .078 ± .004
(2.0 ± 0.1)
Dia.
D Dia.
.394 ± .008
(10 ± 0.2)
L
L + .079 (2.0) Max.
.236 ± .039
(6.0 ± 1.0)
D Dia. + .039 (1.0) Max.



1.575 (40)
Diameter
NEG. Black
Vent
.078 (2) Dia.
Bottom Sheet (PVC)
Sleeve (PVC)
(−)
D Dia.
30°
30°
60°
60°
NC
NC
L
L + .079 (2.0) Max.
.886 (22.5)
.236 ± .039
(6.0 ± 1.0)
.886 ± .008
(22.5 ± 0.2)
Dia.
D Dia. + .039 (1.0) Max.

PERFORMANCE SPECIFICATIONS:

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: 0.02 CV or 2 mA whichever is less
(measured after 3 minutes of rated voltage)
C = Nominal Capacitance
V = Rated Voltage

Capacitance Tolerance: ±20% (M)
(measured at 20°C (68°F), 120 Hz)

Dissipation Factor: (measured at 20°C (68°F), 120 Hz)

FHW Series:

Rated Voltage	16	25	35	50	63-100	160-250
Up to 2200µF	—	—	0.13	0.10	0.08	0.10
3300µF to 6800µF	0.20	0.18	0.15	0.13	0.15	—
10,000µF	0.25	0.20	0.18	0.18	0.18	—
15,000µF to 22,000µF	0.30	0.25	0.20	0.20	0.20	—

FTW Series:

Rated Voltage	16-25	36-63	80-100	160-250
Up to 2200µF	0.20	0.18	0.15	0.10
3300µF to 6800µF	0.25	0.20	0.20	—
10,000µF to 15,000µF	0.35	0.30	—	—

Impedance Ratio at Low Temperature: 120 Hz

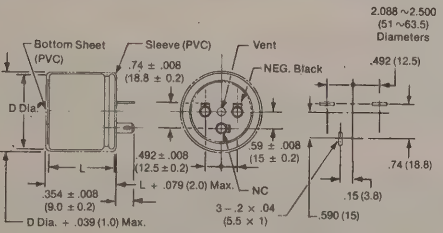
Ratio Z \ WV	16	25-35	50-100	160-250
Z @ −25°C (−68°F)/Z @ +20°C (+68°F)	3	2	1.5	2
Z @ −40°C (−40°F)/Z @ +20°C (+68°F)	12	4	3	8

Surge Voltage:

DC Rated Voltage	16	25	35	50	63	80	100	160	180	200	250
Surge Voltage	20	32	44	63	79	100	125	200	225	250	300

Load Life: 1000 hrs @ +85°C (185°F), rated voltage
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within specified value
Dissipation Factor: Within ±150% of specified value

Shelf Life: 1000 hrs @ +85°C (+185°F), no voltage applied
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within ±200% of specified value
Dissipation Factor: Within ±150% of specified value



2.088 ~2.500
(51 ~63.5)
Diameters
Bottom Sheet
(PVC)
Sleeve (PVC)
Vent
NEG. Black
.74 ± .008
(18.8 ± 0.2)
.492 (12.5)
D Dia.
.492 ± .008
(12.5 ± 0.2)
.59 ± .008
(15 ± 0.2)
.74 (18.8)
L
L + .079 (2.0) Max.
NC
.15 (3.8)
.354 ± .008
(9.0 ± 0.2)
3 – .2 × .04
(5.5 × 1)
.590 (15)
D Dia. + .039 (1.0) Max.

ITT Components
A Unit of ITT Corporation

FHR Aluminum Electrolytic Capacitors

Low ESR, High Ripple, PCB Mounting

ORDERING INFORMATION

FHR 470 M 200

Series Designation (FHR Low Profile PC Mount) — FHR
Nominal Capacitance (Micro Farads) — 470
Tolerance Designation (As Specified) — M
Rated Voltage (DC) — 200

Standard Item of FHR Series
(Case Diameters and Lengths in mm)

WV / D* / Cap (μF)	160			200			250		
	25	30	35	25	30	35	25	30	35
150	25x25			25x25			25x30	30x25	
220	25x30	30x25		25x35	30x25		25x40	30x30	
330	25x35	30x30			30x35		25x50	30x40	35x30
390	25x40			25x50	30x40	35x30			35x35
470	25x50	30x35	35x30		30x40	35x30		30x50	35x40
560		30x40			30x50	35x35			
680		30x50	35x35			35x40			35x50
820			35x40			35x50			
1000			35x50			35x50			

Ripple Current Max.
[In mA rms, 85°C (185°F) 120 Hz]

WV / D* / Cap (μF)	180			200			250		
	25	30	35	25	30	35	25	30	35
150	1000			1230			1300	1330	
220	1570	1610		1610	1610		1750	1700	
330	2000	2080			2200		2300	2300	2250
390	2300			2500	2450	2500			2600
470	2750	2600	2670		2730	2800		2940	2980
560		2980			3210	3060			
680		2500	3370			3600			3800
820			3950			4150			
1000			4200			4500			

ESR Maximum
[In ohms @ 25°C 120 Hz]

Cap.	150	220	330	390	470	560	680	820	1000
ESR	0.88	0.60	0.40	0.34	0.28	0.24	0.20	0.16	0.13

Impedance Ratio at Low Temperature: 120 Hz

Compartment Z / WV	160	200	250
Z @ −25°C (−13°F)/ Z @ +20°C (+68°F)	2	2	2
Z @ −40°C (−40°F)/ Z @ +20°C (+85°F)	8	8	8

MECHANICAL SPECIFICATIONS

Lead Solderability: Meets the requirements of MIL-STD-202, Method 208.

Marking: Consists of series type, nominal capacitance, rated voltage, temperature range, anode and/or cathode identification, vendor identification.

Recommended Cleaning Solvents: Methanol, isopropanol, ethanol, isobutanol, petroleum ether, propanol and/or commercial detergents. Halogenated hydrocarbon cleaning agents such as freon (MF, TF, or TC), trichloroethylene trichloroethane, or methylchloride are not recommended as they may damage the capacitor.

PERFORMANCE SPECIFICATIONS

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: I = 0.02 CV or 2 mA maximum whichever is less (measured 3 minutes after application of rated voltage.)
I = Leakage current (μA)
C = Nominal capacitance (μF)
V = Rated voltage (V)

Capacitance Tolerance: ±20% (M)
[measured at 20°C (68°F), 120 Hz]

Dissipation Factor: 0.1 Max. [measured at 20°C (68°F), 120 Hz]

PERMISSIBLE RMS RIPPLE CURRENT

Where the -HR series capacitors are operated at a temperature other than +85°C, the ripple current may be increased by the following factor.

Maximum RMS Ripple Current (120 Hz)

45°C	60°C	70°C	85°C	105°C
1.36	1.30	1.15	1.0	0.5

Where the FHR series capacitors are operated at frequencies other than 120 Hz, the ripple current may be increased by the following factor.

Maximum RMS Ripple Current (85°C)

Rated Voltage (V DC)	50 Hz	120 Hz	300 Hz	1 KHz	10 KHz	50 KHz
160-200	0.75	1.00	1.18	1.30	1.45	1.50
1.36	0.84	1.00	1.15	1.20	1.30	1.35

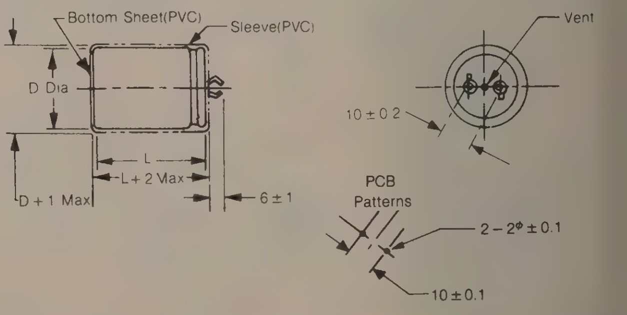
Surge Voltage:

DC Rated Voltage	160	200	250
Surge Voltage	200	250	300

Load Life: 1000 hrs @ +85°C (+185°F) and rated voltage, applied ripple current
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within specified value
Dissipation Factor: Within 200% of specified value

Shelf Life: 1000 hrs @ +85°C (+185°F) No voltage applied
Leakage Current: Within ±200% of specified value
Dissipation Factor: Within ±200% of specified value
Capacitance: Within ±20% of initial values

Case Sizes and Dimensions:

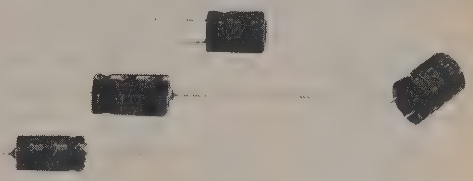


ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone: (714) 751-3900 • TWX: 910-595-1744 • Telex: 68-1389

ITT Components
A Unit of ITT Corporation

RND, TND Aluminum Electrolytic Capacitors

Bi-Polar Miniature (RND: Radial Leads, TND: Axial Leads)



Standard Items of RND Series
(Radia Lead Type)

Cap (μF) \ WV	10	16	25	50
0.47				5 x 11
1.0				5 x 11
2.2				5 x 11
3.3				5 x 11
4.7			5 x 11	6.3 x 11
10			5 x 11	8 x 11.5
22	5 x 11	6.3 x 11	6.3 x 11	10 x 12.5
33	6.3 x 11	6.3 x 11	8 x 11.5	10 x 16
47	6.3 x 11	8 x 11.5	10 x 12.5	10 x 20
100	8 x 11.5	10 x 12.5	10 x 16	13 x 20
220	10 x 16	10 x 20	13 x 20	
330	10 x 20	13 x 20		
470	13 x 20	13 x 25		
1000	16 x 25	16 x 25		

Ripple Current Maximum
[In mA rms 85°C (185°F) 120 Hz]

Cap (μF) \ WV	10	16	25	50
0.47				10
1.0				16
2.2				26
3.3				33
4.7			27	42
10			50	70
22	62	75	90	120
33	82	100	115	160
47	105	125	150	200
100	165	200	260	340
220	270	340	420	
330	340	430		
470	440	550		
1000	700	900		

Standard Items of TND Series
(Axial Lead Type)

Cap (μF) \ WV	16	25	50
0.47			6.3 x 20
1.0			6.3 x 20
2.2			6.3 x 20
3.3			6.3 x 20
4.7		6.3 x 20	8 x 20
10		8 x 20	8 x 20
22		8 x 20	10 x 31.5
33	8 x 20	10 x 20	10 x 31.5
47	10 x 25	10 x 25	13 x 31.5
100	10 x 31.5	13 x 31.5	16 x 31.5
220	13 x 31.5	16 x 31.5	
330	13 x 31.5	16 x 40	
470	16 x 31.5		

Ripple Current Maximum
[In mA rms 85°C (185°F) 120 Hz]

Cap (μF) \ WV	16	25	50
0.47			10
1.0			16
2.2			26
3.3			33
4.7		27	42
10		50	70
22		90	120
33	100	115	160
47	125	150	200
100	200	260	340
220	340	420	
330	430		
470	550		

ORDERING INFORMATION

RND 50V 3.3 μF

Series Designation — RND
(RND Bi-Polar Radial Type)
(TND Bi-Polar Axial Type)
Rated Voltage (DC) — 50V
Nominal Capacitance (Micro Farads) — 3.3 μF

PERFORMANCE SPECIFICATIONS

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: I = 0.03 CV +3 μA minimum (measured 3 minutes after application of rated voltage)
I = Leakage current (μA) V = Rated voltage (V)
C = Nominal capacitance (μF)

Capacitance Tolerance: ±20% (M) [measured at 20°C (68°F), 120 Hz]

Dissipation Factor: [measured at 20°C (68°F), 120 Hz]

Rated Voltage	10	16	25	50
0.47 μF to 1000 μF	0.25	0.20	0.17	0.15

Impedance Ratio at Low Temperature: 120 Hz

Comparison Z \ WV	10	16	25	50
Z @ −25°C (−13°F)/ Z @ +20°C (+68°F)	3	2	2	2
Z @ −40°C (−40°F)/ Z @ +20°C (+68°F)	8	6	4	3

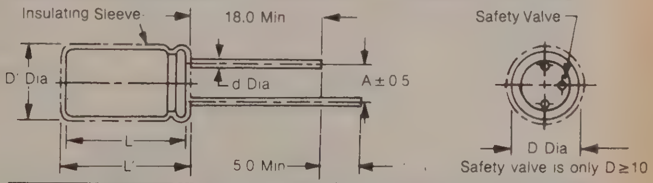
Surge Voltage:

DC Rated Voltage	10	16	25	50
Surge Voltage	13	20	32	63

Load Life: Rated voltage is applied at 85°C 250 hrs. and then rated voltage is applied at 85°C 250 hrs. after polarity inverts, and then return to 20°C
Leakage Current: Within values specified above
Dissipation Factor: Within 200% of specified value
Capacitance: Within 20% of initial values

Shelf Life: 500 hrs @ +85°C (+185°F) No voltage applied
Leakage Current: Within ±200% of values specified above
Dissipation Factor: Within ±150% of specified values
Capacitance Change Max.: Within ±20% from initial value

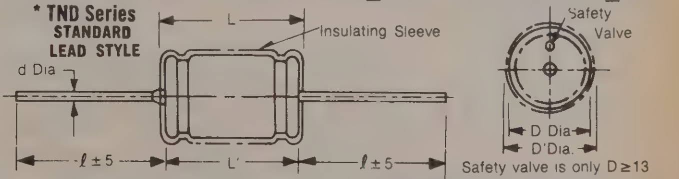
Case Sizes and Dimensions: *** RND Series** **STANDARD LEAD STYLE**



D	5.0	6.3	8.0	10.0	13.0	16.0
A	2.0	2.5	3.5	5.0		7.5
d		0.5		0.6		0.65

D = D +0.5 Max. L = L+1.0 Max. at D ≤8.0 L = L +2.0 Max. at D ≥10.0

*** TND Series**
STANDARD LEAD STYLE



D	6.3-8.0	10.0-13.0	16.0
d	0.6	0.6	.08
l	38.0	38.0	38.0

D = D +0.5 Max. L = L+1.0 Max. at D ≤8.0 L = L +2.0 Max. at D ≥10.0

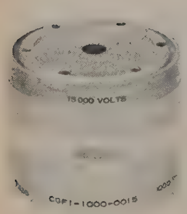
vacuum capacitors

ITT Jennings offers the broadest available line of high voltage capacitors for radio frequency applications. Units are available in glass and ceramic envelopes with working voltage ratings of 2 kv to 36 kv, at capacitance values to 5000 pfd, with current ranges to 420 Amps RMS (air-cooled) and 1,000 Amps RMS (water-cooled), depending upon capacity, frequency, and working voltage. The design of ITT Jennings Vacuum and Gas capacitors allows a number of electrical, mechanical and environmental advantages which include:

1) HIGH VOLTAGE—The high dielectric strength allows maximum voltage levels for a given capacitance rating.
2) HIGH CURRENT—Extremely low losses occur because of the dielectric, low loss glass and ceramic envelopes, and heavy copper construction. ITT Jennings capacitors are able to handle large currents at high RF frequencies that would destroy other types of capacitors.
3) COMPACT DESIGN—Units are quite small for their power handling capabilities.
4) HIGH Maximum to Minimum CAPACITY RATIO—Capacity change ratios are available to 140:1, making them desirable for wide tuning ranges.
5) SELF-HEALING—The design construction permits moderate overloads that would damage other materials.
6) RUGGED OPERATION — Vacuum capacitors are free from internal degradation due to extreme environmental conditions.

JENNINGS
MADE IN U.S.A.

VOLTS
KING
JENNINGS
MADE IN U.S.A.
CLFI-12-0030



VACUUM FIXED CAPACITORS

Peak Voltage Kilovolts					Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type*	Capacity pF	Continuous RMS Amperes[2] (Max.)	Length	Diameter
5	3	G JCSL	1000, 1500, 2000	75	4.0	2.9
15	9	JCSF	25, 40, 50, 80, 120, 150	40	1.7	1.7
15	9	JCS	250, 400, 500	90	4.0	3.1
15	9	MCI	500, 750, 1000	120	4.1	4.1
15	9	MMC	1500, 2000, 5000	220	13.0	9.3
15	9	MMCI	2000	200	4.9	6.1
15	9	C CFDP	1500, 2000	200	3.3	5.6
12	7	CFDS	1000	95	4.6	3.6
20	12	G MC	500, 750, 1000	150	8.4	5.0
30	18	MLC	500, 750, 1000	200	9.3	4.5
30	18	C CY	1, 2, 3, 5	12	3.3	0.8
35	25	CLF1	6, 12, 25, 50, 75, 100	85	6.5	2.3
30	20	CLF1	150, 200, 250	90	6.5	2.6
25	15	CFED	500, 750, 1000	160	3.8	4.6
35	21	CFFP	2000, 2500	400	5.8	8.2
55	33	G MMHC	450	210	9.3	6.1
60	36	C CFHD	12, 25, 50, 100, 200	145	5.2	3.4
55	33	CFHP	450	300	5.5	5.6
50	30	CFHP	1000, 2000	425	6.2	8.2

GAS FIXED CAPACITORS

Peak Voltage Kilovolts						Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF+DC	RF Working	Type*	Capacity pF	Continuous RMS Amperes[2] (Max.)	Length	Diameter
20	18	12	C CGF1-1000	1000	215	3.5	4.8
35	30	21	CGF2-1000	1000	270	4.0	6.0
50	40	25	CGF2-500	500	290	5.5	5.7

VACUUM CAPACITORS, TRIMMABLE

Peak Voltage Kilovolts					Nominal Dimensions (Inches)	
Test 60 Hz	RF Working (Peak)	Type	Capacity Range (pF)	Continuous RMS Amps, Max.	Length	Diameter
10	6	CTV3 (10 models)[4]	338-1377	150	5.3	4.5
20	12	CTV1 (5 models)[4]	76-346	125	5.3	4.5
50	35	CTV2 (6 models)[4]	18-137	85	5.3	4.5

* G = Glass; C = Ceramic

[1] The maximum RF working voltage that can be applied over the 2-32 MHz frequency range while not exceeding the RF current rating.

[2] RF current rating is dependent upon capacity, frequency and working voltage. Write for complete applications data.

[3] Dimensions of largest unit in a series.

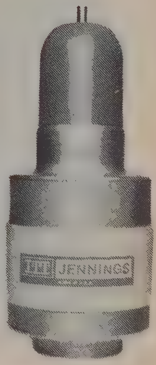
[4] Number of models required to cover capacity range.

SEND FOR CATALOG NO. C103A.

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

vacuum variable capacitors

Peak Voltage Kilovolts						Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type*	Capacity pF	Continuous RMS Amperes[2] (Max.)		Length	Diameter
5	3	G UCSL	4-250, 5-500	35		4.1	2.2
5	3	USL	5-500	35		5.8	2.4
5	3	UCSL	5-750, 7-1000, 10-1500, 20-2000	60		8.3	3.1
3	2	UCSL	50-3000, 100-5000	55		8.8	4.1
5	3	C CSV1	5-500	45		5.8	2.4
5	5	CMV2	6-500	38		3.6	1.8
5	5	CMV1	8-650	40		4.3	1.7
5	3	CVCE	10-750	80		7.1	3.4
3	3	CVCJ	7-1000	70		7.6	3.1
3	3	CMV1	8-1000	40		4.3	1.7
5	3	CSV1	10-1000	70		5.0	3.1
5	3	CVCD	10-1500, 20-2000, 50-3000	100		8.3	4.6
5	5	CMV2	20-2000	45		5.3	3.8
5	5	CMV1	25-4000	70		6.5	3.3
15	9	G UCSB	5-100	40		4.9	2.4
15	9	UCS	5-200, 10-300, 25-500	60		9.0	3.1
15	9	UCSXF	12-1000, 15-1200	70		10.0	4.3
15	9	UCSX	25-700, 25-1000	70		9.8	3.7
15	9	VMMC	50-1000, 100-2000	200		15.6	6.1
12	7	UCSXF	20-1500, 50-2300	70		10.0	5.1
15	9	C CVDP	35-1500, 50-2300	100		9.8	5.6
15	9	C CVED	100-5000	200		21.3	9.2
15	9	C CADD	3-30	20		4.1	1.3
15	9	CSVF	12-500	70		7.9	3.6
15	9	CVDD	6.5-50, 10-100	65		6.6	2.4
15	9	CVDD	10-300, 20-500	95		7.5	3.4
20	12	CVEP	25-500, 50-1000, 100-1500	210		10.2	7.2
15	9	CVDD	25-1000	150		8.0	4.6
15	9	CVEP	100-2000	200		10.2	7.2
30	18	CVFA	10-75	50		8.8	2.7
55	33	CVHP	10-250, 25-450, 30-650	240		11.9	7.2
40	24	CVFP	15-250, 25-450	170		9.6	5.6
50	30	CWV2	25-450, 30-650 (water cooled)	800		17.9	7.6
40	24	CAV2	35-1000 (air cooled)	425		11.7	7.6
40	24	CVFP	35-1000	225		11.7	7.2
50	30	CVHP	60-1000	250		14.5	8.0
50	30	CWV1	100-1000 (water cooled)	800		21.6	8.6
50	30	CAV3	40-1000 (air cooled)	500		14.5	8.6
60	36	CWV1	100-1600 (water cooled)	1000		23.0	12.5
40	24	CWV2	100-1600 (water cooled)	790		25.0	8.6
35	21	CVFP	100-1500, 100-2000	220		14.5	8.2



JENNINGS
MADE IN U.S.A.

GAS VARIABLE CAPACITORS

Peak Voltage Kilovolts					Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1]	Type*	Capacity pF	Continuous RMS Amperes[2] (Max.)	Length	Diameter
5	3	C CHV1	1.5-45	15	2.9	0.9
15	9	CHV1	2.5-50	25	6.4	1.4

5,000 VOLTS
JENNINGS
MADE IN U.S.A.

* G = Glass; C = Ceramic

[1] RF working voltage is the maximum RF voltage that can be applied to the capacitor over the 2-32 MHz frequency range, provided the RF current rating is not exceeded.

[2] RF current rating is dependent upon capacity, frequency and working voltage. Write for complete applications data.

[3] Dimensions of largest unit in a series.

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

DIVISION OF ITT CORPORATION

rf capacitors

ITT Jennings titanate capacitors offer the highest kVA ratings for use in applications where life and reliability are a prime requisite. A variety of dielectric materials are available to allow flexibility of design for application requirements in transmitter, radar, induction or dielectric heating, lasar, electronic welding or X-ray equipments.

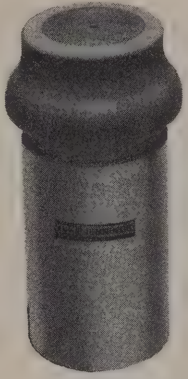
A complete high power RF testing laboratory is used to verify capacitor ratings under actual operate conditions. Power testing is available to 100 KW. A MIL approved environmental test laboratory guarantees full compliance for both military or commercial requirements.

Humidity resistant coatings on external surfaces of capacitors allow operation in open air without external flashovers. ITT Jennings application engineers are available to assist the equipment design engineer in the most cost effective approach for a variety of applications.

See note below.

J1WC01UJ (WATER COOLED)

J4SC01UJ



J4SC01TJ

J1HT57

J1HT50, 58

ITT JENNINGS Model Number	Capacitance (pF)	Cap. Tol. (± %)	Operate Volts (kVDC)	Temp. Coeff. (ppm/°C)	Temp. Coeff. Tol. (ppm/°C)	1 MHz		10 MHz		30 MHz	
						RF amps	KVAR	RF amps	KVAR	RF amps	KVAR
J1HT50CG250K752*	25	10	7.5	NPO	30	.84	4.4	3.1	6.1	5.6	6.6
J1HT50CG500K752*	50	10	7.5	NPO	30	1.7	8.8	4.2	5.6	7.6	6.0
J1HT50UJ620K752*	62	10	7.5	N750	120	2.1	9.0	5.6	5.9	10.1	5.4
J1HT50UJ750K752*	75	10	7.5	N750	120	2.5	13.2	6.2	8.1	9.0	5.6
J1HT50UJ101K752*	100	10	7.5	N750	120	3.4	19.0	7.3	8.7	9.2	4.6
J1HT57CG250K153*	25	10	15	NPO	30	1.7	18.5	6.2	22.0	6.7	8.6
J1HT57CG500K153*	50	10	15	NPO	30	3.3	35.0	7.4	18.0	8.1	7.1
J1HT57UJ101K153*	100	10	15	N750	120	4.6	35.0	12.0	22.0	15.0	11.1
J1HT57UJ201K752*	200	10	7.5	N750	120	5.1	23.0	8.5	6.2	15.0	6.0
J1HT58UJ500K752*	50	10	7.5	N750	120	1.7	8.9	5.0	5.6	8.5	6.0
J1HT58XX501M502	500	20	5.0	X5U	(Hi K)	1.1	0.4	2.5	0.2	3.0	0.1
J2HT60XX682N352	6800	30	3.5	X5U	(Hi K)	30		Available upon request			
J1FT40UJ202J852	2000	5	8.5	N750	120	50		Available upon request			
J1FT40UJ602M852	6000	20	8.5	N750	120	50		Available upon request			
J1FT40UJ122K852	1200	10	8.5	N750	120	50		Available upon request			
J1WC01UJ252M143	2500	20	14.0	N750	120	150		Available upon request			
J1WC01UJ502M123	5000	20	12.0	N750	120	150		Available upon request			
J1WC01UJ762M143	7600	20	14.0	N750	120	300		Available upon request			
J4SC01UJ402M323	4000	20	32.0	N750	120	72		Available upon request			
J4SC01TJ502K253	5000	10	25.0	N750	120	72		Available upon request			

NOTE:*In addition to those above, over 70 different capacities and models are available in this line of RF capacitors. If you have a special application please check with our applications department for capacitors with ratings other than those listed.

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

DIVISION OF ITT CORPORATION

eem

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \dfrac{.224\ K\ A}{t_D}$

Metric: $C = \dfrac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$$E = \tfrac{1}{2}\, CV^2$$

III. Linear charge of a capacitor (Amperes)

$$I = C\frac{dV}{dt}$$

IV. Total Impedance of a capacitor (ohms)

$$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$$X_c = \frac{1}{2\,\pi\, fC}$$

VI. Inductive Reactance (ohms)

$$X_L = 2\,\pi\, fL$$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°

Ideal Inductors: Current lags voltage 90°

Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\,\pi\, fC)\ (ESR)$$

IX. Power Factor

$PF = \text{Sine } \delta$ (loss angle) $= \text{Cos } \phi$ (phase angle)

$PF = DF$ (when less than 10%)

X. Quality Factor (dimensionless)

$$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$$

XI. Equivalent Series Resistance (ohms)

$$ESR = (DF)\ (Xc) = (DF)\ (\tfrac{1}{2}\,\pi\, fC)$$

XII. Power Loss (watts)

$$\text{Power loss} = (2\,\pi\, fCV^2)\ (DF)$$

XIII. KVA (Kilowatts)

$$KVA = 2\,\pi\, fCV^2 \times 10^{-3}$$

XIV. Temperature Characteristic (ppm/°C)

$$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$$

XV. Cap Drift (%)

$$C.D. = \frac{C_1 - C_2}{C_1} \times 100$$

XVI. Reliability of Ceramic Capacitors

$$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^{x} \quad \left(\frac{T_t}{T_o}\right)^{\tau}$$

XVII. Capacitors in Series (current the same)

Any number: $\dfrac{1}{C_T} = \dfrac{1}{C_1} + \dfrac{1}{C_2} \text{ --- } + \dfrac{1}{C_N}$

Two: $C_T = \dfrac{C_1\, C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$$C_T = C_1 + C_2 \text{ --- } + C_N$$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$$db = 20 \log \frac{V_1}{V_2}$$

Metric prefixes:

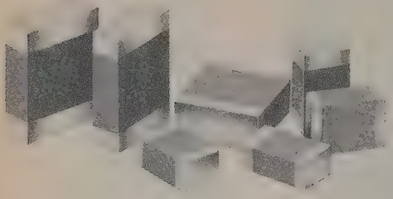
Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^{3}
Mega	X 10^{6}
Giga	X 10^{9}
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_s = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
φ = Phase angle
x + y = Exponent effect of voltage and temp
L_o = Operating life
L_t = Test life
V_t = Test voltage
V_o = Operating voltage
T_t = Test temperature
T_o = Operating temperature

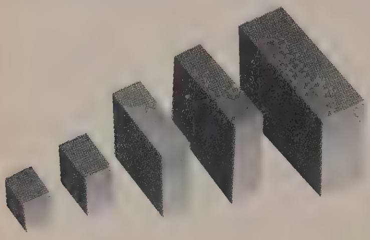
JOHANSON DIELECTRICS Ceramic Chip Capacitors

Ultra High Capacitance Chip Capacitors



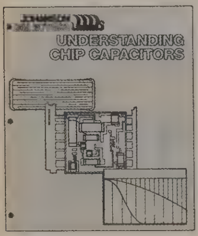
Fourteen configurations are available in four basic dielectrics: NPO/COG, BX/X7R, Z5U, and Y5V characteristics, to meet MIL-C-55681A and EIA 198B specifications. Capacitors feature high volume efficiency of capacitance, and are ideal for hybrid circuit applications.

High Voltage Chip Capacitors



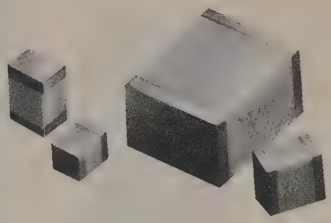
Available in either NPO/COG or BX/X7R dielectric, these units are designed to obtain high voltage values to 4000 VDCW. Typical applications include high voltage power supplies and voltage multiplier circuits.

Understanding Chip Capacitors



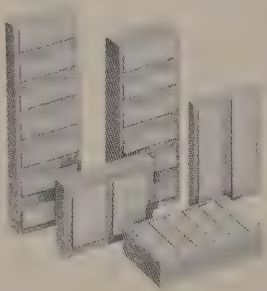
28 pages,
call or write
for your free copy.

High Q Microwave Chip Capacitors



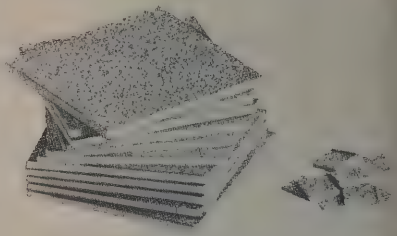
High Q microwave chip capacitors are available in four basic sizes, displaying excellent performance in the VHF, UHF and microwave ranges. The configuration, insertion loss and resonance-free performance make these chips ideal for microstrip and hybrid MIC applications.

Multiple Capacitor Arrays



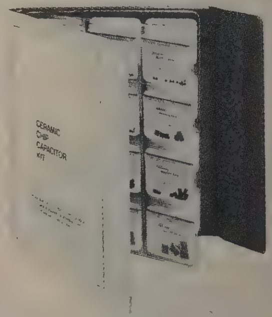
Custom designed multiple capacitor elements are ideal for multiple circuit coupling, filtering, bypass and high voltage multiplier circuits. Multiple capacitor arrays are practical replacements for individually bonded chips in hybrid circuits and are available in a variety of dielectric characteristics.

Ceramic Capacitor Wafers (Single Layer)



Ideally suited for micromodule and miniature hybrid integrated circuits where low profile requirements preclude the use of conventional multilayer chip capacitors. These units are used as bypass, shifter, blocking and filtering elements, (to 18 GHz in microwave applications). Custom configurations are also available for high voltage applications to 15 KV.

Chip Kit



Designer kits contain standard size chips in popular capacitance values and dielectric characteristics with palladium silver terminations. Kits are supplied in a special vinyl cover for convenient shelf storage with each chip value individually packaged for easy access. Available with NPO/COG dielectric No. S-900, BX/X7R and Y5V dielectric No. S-905 and ceramic capacitor wafers (single layer) No. S-910.

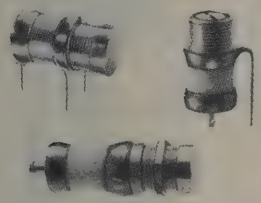
JOHANSON DIELECTRICS

2220 Screenland Drive
Burbank, California 91505

(213) 848-4465
TWX 910-498-2735

Johanson Variable Capacitors

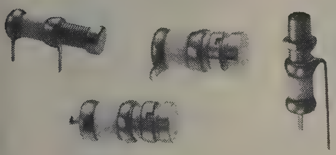
Standard Air Capacitors



- ☐ Capacitance ranges: .8-10pf to 1-30pf
- ☐ Q's to >10,000
- ☐ Excellent tuning stability and low dynamic noise
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ Engineering prototype kit JK-500

*U. S. Patent No. Re. 30,406

Miniature Air Capacitors



- ☐ Capacitance ranges: .35-3.5pf to .8-10pf
- ☐ Q's to >10,000
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Ideal for miniature microwave, VHF and UHF applications
- ☐ Engineering prototype kit JK-500

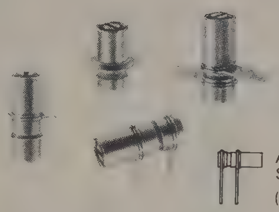
U. S. Patent No. Re. 30,406

Johanson

Manufacturing Corporation

Rockaway Valley Road
Boonton, New Jersey 07005
201) 334-2676
TWX 710-987-8367

Giga-Trim® Capacitors



- ☐ Capacitance ranges: .3-1.2pf to .8-8pf
- ☐ Q's over 4000 at 250 MHz
- ☐ Ideal for microwave oscillators and filters
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ New Zero TC versions
- ☐ Engineering prototype kit JK-272

U. S. Patent No. Re. 30,406

Thin-Trim®/ Seal-Trim® Ceramic Capacitors

- ☐ Capacitance ranges: .2-.6pf to 20-100pf
- ☐ Q's to >3000 at 100 MHz
- ☐ Ideal for sub-miniature hybrid circuit applications
- ☐ Seal-Trims impervious to all standard PCB cleaning solvents
- ☐ Conform to MIL-C-81 requirements
- ☐ Engineering prototype kits available

U. S. Patent No. 4,179,722

Microwave Tuning Elements

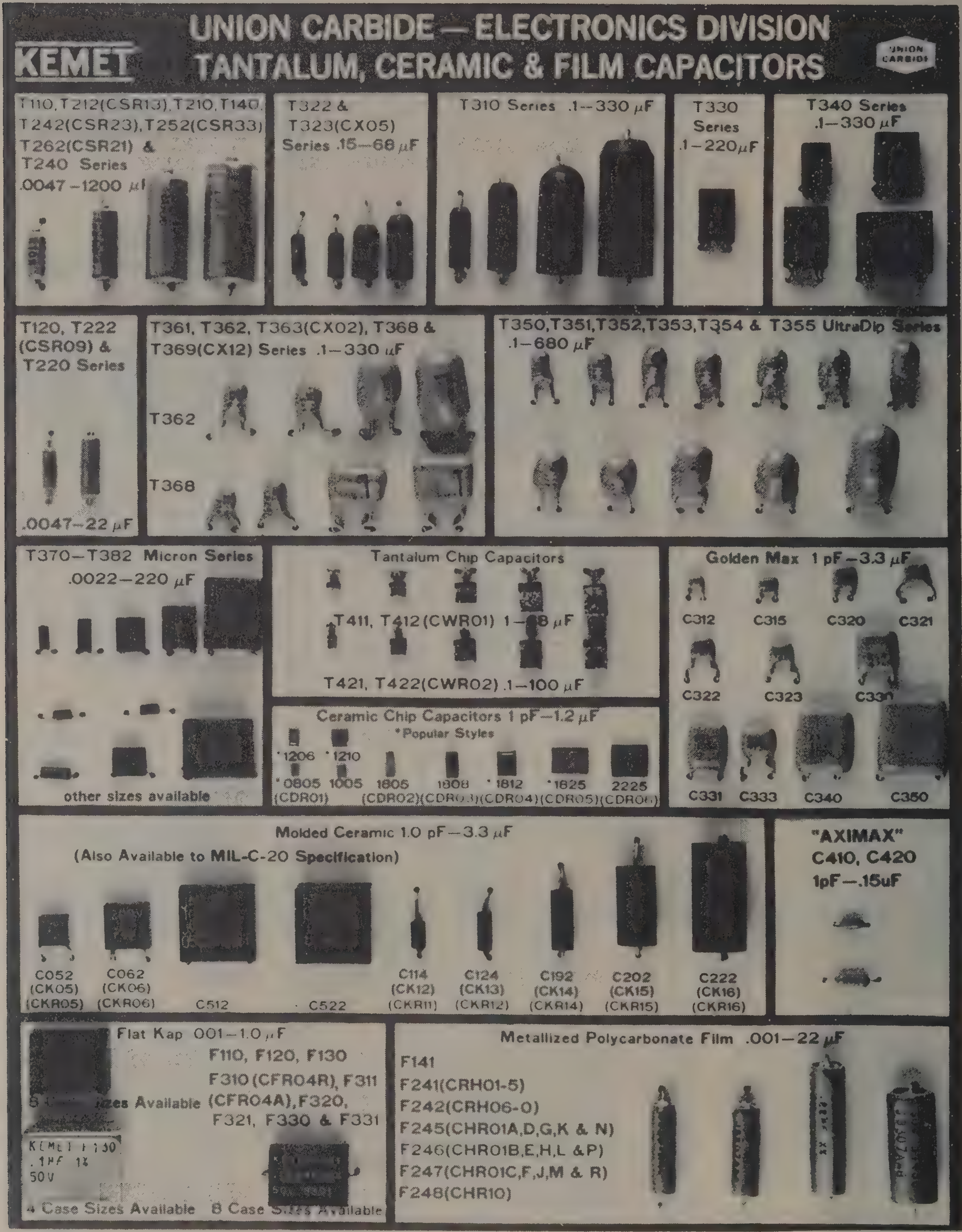
- ☐ Provide a unique money-saving means of introducing a variable reactance into waveguides, cavities, and other microwave structures
- ☐ High resolution
- ☐ Patented* self-locking constant torque adjustment mechanism

*U. S. Patent No. Re. 30,406

Variable Ceramic Capacitors

- ☐ Low cost
- ☐ Broad tuning ranges: 1.7-6pf to 6.0-70pf
- ☐ Top, side and bottom tuning styles available
- ☐ Ideal for crystal oscillators, CATV amplifiers and all varieties of test and communication equipment
- ☐ Engineering prototype kit JK-930

Call or write for our complete catalog.



KEMET

UNION CARBIDE — ELECTRONICS DIVISION
TANTALUM, CERAMIC & FILM CAPACITORS

T110, T212(CSR13), T210, T140, T242(CSR23), T252(CSR33) T262(CSR21) & T240 Series .0047—1200 µF

T322 & T323(CX05) Series .15—68 µF

T310 Series .1—330 µF

T330 Series .1—220µF

T340 Series .1—330 µF

T120, T222 (CSR09) & T220 Series .0047—22 µF

T361, T362, T363(CX02), T368 & T369(CX12) Series .1—330 µF

T362

T368

T350, T351, T352, T353, T354 & T355 UltraDip Series .1—680 µF

T370—T382 Micron Series .0022—220 µF

other sizes available

Tantalum Chip Capacitors

T411, T412(CWR01) 1—68 µF

T421, T422(CWR02) .1—100 µF

Ceramic Chip Capacitors 1 pF—1.2 µF

*Popular Styles

*1206 *1210

*0805 (CDR01)
1005
1805
1808
*1812
*1825
2225
(CDR02)(CDR03)(CDR04)(CDR05)(CDR06)

Golden Max 1 pF—3.3 µF

C312 C315 C320 C321

C322 C323 C330

C331 C333 C340 C350

Molded Ceramic 1.0 pF—3.3 µF
(Also Available to MIL-C-20 Specification)

C052 (CK05) (CKR05)
C062 (CK06) (CKR06)
C512
C522
C114 (CK12) (CKR11)
C124 (CK13) (CKR12)
C192 (CK14) (CKR14)
C202 (CK15) (CKR15)
C222 (CK16) (CKR16)

"AXIMAX"
C410, C420
1pF—.15uF

Flat Kap 001—1.0 µF

F110, F120, F130

F310(CFR04R), F311 (CFR04A), F320, F321, F330 & F331

8 Case Sizes Available

4 Case Sizes Available

8 Case Sizes Available

Metallized Polycarbonate Film .001—22 µF

F141
F241(CRH01-5)
F242(CRH06-0)
F245(CHR01A,D,G,K & N)
F246(CHR01B,E,H,L &P)
F247(CHR01C,F,J,M & R)
F248(CHR10)

NOTICE

Any capacitor misapplied may fail and thereby damage other circuit components. Please refer to specific KEMET Application Notes, available free of charge from the address below, for a more complete description of capacitor characteristics.

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET® CAPACITOR REFERENCE & INDEX

UNION CARBIDE

SOLID TANTALUM CAPACITORS*

KEMET STYLE

	Page
Hermetic seal, standard	4
Hermetic seal, extended range	5
Hermetic seal, GR500 High Reliability	5
Molded, axial lead	6
Molded, miniature axial lead	6
Molded, radial lead	7
Dipped, radial lead	9
Plastic encapsulated, subminiature, Micron	11
Chips	13

KEMET SERIES

	Page		Page
T110	4	T362	10
T210	5	T363	10
T211	5	T368	10
T212	4	T369	10
T220	5	T370	11
T240	5	T371	13
T310	6	T372	11
T322	6	T373	13
T323	6	T374	12
T330	7	T376	12
T340	8	T380	12
T350	9	T382	12
T351	9	T384	12
T352	9	T386	12
T353	9	T411	13
T354	9	T412	13
T355	9	T421	13
T361	10	T422	13

MILITARY STYLE

	Page
CSR13	4
CWR01	13
CWR02	13
CX02	10
CX05	6
CX12	10

MILITARY SPECIFICATION

MIL-C-39003	3
MIL-C-49137/2	10
MIL-C-49137/5	6
MIL-C-55365	13

MULTILAYER CERAMIC CAPACITORS

KEMET STYLE

	Page
Molded, radial lead	15
Conformal AXIMAX	17
Molded, axial lead	15
Molded, C0G (NP0), radial lead	15
Molded, C0G, (NP0), axial lead	15
Molded, GR900 High Reliability	18
Chips, GR900 High Reliability	19
Dipped, Golden Max	20
Chips, solder guard	16, 19

KEMET SERIES

	Page		Page
C052	15	C340	20
C062	15	C350	20
C114	15	C512	15
C124	15	C522	15
C192	15	C410, C420, C430, C440	17
C202	15	C0805	16
C222	15	C1005	16
C312	15	C1206	16
C315	20	C1210	16
C320	20	C1805	16
C321	20	C1808	16
C322	20	C1812	16
C323	20	C1825	16
C330	20	C2225	16
C331	20		
C333	20		

MILITARY STYLE

CC05	15	CC07	15
CC06	15	CC08	15

MILITARY STYLE (Contd.)

	Page		Page
CC75	15	CK05	15
CC76	15	CK06	15
CC77	15	CK12	15
CC78	15	CK13	15
CC79	15	CK14	15
CCR05	15	CK15	15
CCR06	15	CK16	15
CCR07	15	CKR05	15
CCR08	15	CKR06	15
CCR75	15	CKR11	15
CCR76	15	CKR12	15
CCR77	15	CKR14	15
CCR78	15	CKR15	15
CCR79	15	CKR16	15

MILITARY SPECIFICATION

MIL-C-20	15
MIL-C-11015	15
MIL-C-39014	15

FILM CAPACITORS

KEMET STYLE

	Page
arylene Film Flat Kap, molded	21
etallized Polycarbonate	22
etallized Polycarbonate, military	22

KEMET SERIES

241	22	F246	22
242	22	F247	22
245	22	F248	22

KEMET SERIES (Contd.)

	Page		Page
F310	21	F321	21
F311	21	F330	21
F320	21	F331	21

MILITARY STYLE

CFR04A	21	CHR01F	22
CFR04R	21	CHR01G	22
CHR01A	22	CHR01H	22
CHR01B	22	CHR01J	22
CHR01C	22	CHR01K	22
CHR01D	22	CHR01L	22
CHR01E	22	CHR01M	22

MILITARY STYLE (Contd.)

	Page		Page
CHR01N	22	CRH04	22
CHR01P	22	CRH05	22
CHR01R	22	CRH06	22
CHR10	22	CRH07	22
CRH01	22	CRH08	22
CRH02	22	CRH09	22
CRH03	22	CRH00	22

MILITARY SPECIFICATION

MIL-C-39022/9	22
MIL-C-39022/10	22
MIL-C-55514/3	21
MIL-C-83421/1	22

KEMET® CAPACITOR OEM SALES REPRESENTATIVES 23

KEMET

SOLID TANTALUM CAPACITORS

UNION CARBIDE

MIL-C-39003* ORDERING INFORMATION FOR CSR09 (T222), CSR13 (T212), CSR21 (T262), CSR23 (T242), CSR33 (T252), & CSR91 (T213) CAPACITORS

CSR XX B 565 K M

TYPE

Capacitors, Fixed, Solid
Electrolyte, Tantalum
Established Reliability

STYLE

Tubular Case — Always Sleeved
09 — Miniature — T222
13 — Standard — T212
21 — Standard, low ESR — T262
23 — Extended Range — T242
33 — Extended Range
Low Leakage — T252
91 — Non-Polar — T213

VOLTAGE

	VDC Working		VDC Surge	
Symbol	85°C	125°C	85°C	125°C
B	6	4	8	5
C	10	7	13	9
D	15	10	20	12
E	20	13	26	16
F	35	23	46	28
G	50	33	65	40
H	75	50	98	64
J	100	67	130	86

CAPACITANCE

Expressed in picofarads (1 microfarad = 1,000,000 picofarads). First two digits represent significant figures. Last digit specifies the number of zeros to follow.

Examples

565 — 5,600,000 = 5.60 μF
564 — 560,000 = .56 μF
563 — 56,000 = .056 μF

CAPACITANCE TOLERANCE

J — ±5%
K — ±10%
M — ±20%

FAILURE RATE LEVEL IN % PER 1000 HOURS

M — 1%
P — 0.1%
R — 0.01%
S — 0.001%

* This Military Part Numbering System is obsolete in accordance with the current specifications. The correct current designation for a CSR part number is the MIL Specification Number, followed by the Specification (slash) Sheet Number and Dash Number (i.e. — MIL-C-39003/01-2270). However, the part number breakdown shown above is still widely used and is shown for reference.

KEMET APPROVED FAILURE RATE LEVELS MIL-C-39003E

STYLE	DESCRIPTION	KEMET SERIES	APPROVED FAILURE RATE LEVEL
CSR09	Polar-Subminiature	T222	S (0.001% /K hrs.)
CSR13	Polar-Standard MIL Case	T212	S (0.001% /K hrs.)
CSR21	Polar-Standard, low ESR, MIL Case	T262	S (0.001% /K hrs.)
CSR23	Polar-Extended Range	T242	R (0.01% /K hrs.)
CSR33	Polar-Extended Range Low Leakage	T252	R (0.01% /K hrs.)
CSR91	Non-Polar	T213	S (0.001% /K hrs.)

SOLID TANTALUM CAPACITORS

T110 SERIES POLAR TYPE & T212 (CSR13)

KEMET standard MIL case hermetic sealed T110 Series are the leading solid tantalum capacitors in use today. They are compact, ruggedly built, designed for minaiturized circuitry, and are especially suited for coupling, by-pass, filtering and R-C timing circuits. They exhibit excellent stability, extremely ow DC leakage current, dissipation factor, and impedance over a wide temperature and frequency range.

Available in standard EIA capacitance values from .0047-330 μF n ±20%, ±10%, and ±5% tolerances and working voltages rom 6-125 VDC.

Higher CV values in comparable case sizes are available in KEMET T140 Series.

ncluded in the following T110 Series table is a complete listing of T212 Series, qualified as MIL-C-39003 CSR13 capacitors. KEMET is approved to manufacture to the S (0.001%/K hrs.) ailure rate level. For additional information refer to KEMET Cat. F-1851.

0047-330 μF
-125 VDC
CASE SIZES

T110 ORDERING INFORMATION*

T 110 A 105 K 050 A S - C

TANTALUM

SERIES
T110, T212 (CSR13),
T262 (CSR21)

CASE SIZE
A/B/C/D

PICOFARAD CODE
First two digits represent significant figures. Third digit specifies number of zeros to follow.

CAPACITANCE TOLERANCE
M — ±20%
K — ±10%
J — ±5%

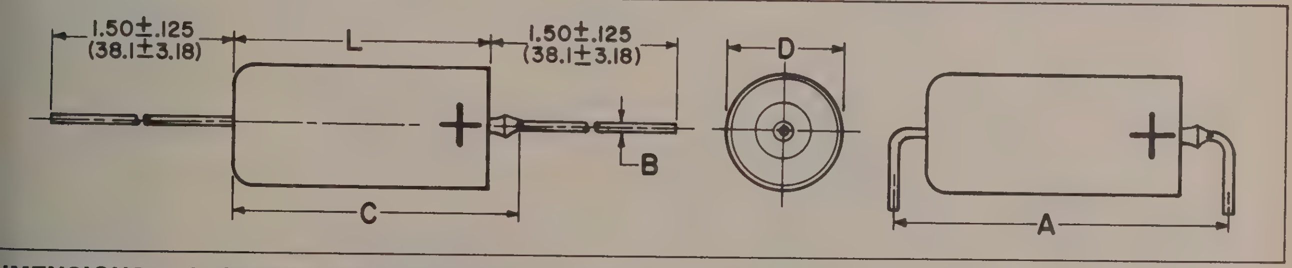
VOLTAGE
At 85°C

FAILURE RATE†
A — Not Applicable
L — Obsolete per MIL-C-39003
M — 1%/K hrs.
P — 0.1%/K hrs.
R — 0.01%/K hrs.
S — 0.001%/K hrs.
† L, M, P, R & S Failure Rates available for T212 capacitors only.

LEAD MATERIAL
S — Standard
Available on special order at additional cost:
(Contact your sales representative.)
F — Bare Nickel
G — Gold Plated Nickel
I — Alloy 180 (Bare)

SPECIFICATION
(when necessary)
C100 — Uncinsulated Capacitors
C7000 — Reeling Per EIA Specification RS-296C
C7200 — Reeling Per EIA Specification RS-296D
Other — As Applicable
(All capacitors are sleeved unless specified as above.)

APACITOR UTLINE DRAWINGS



IMENSIONS — INCHES & (MILLIMETERS)

Case Size	UNINSULATED		INSULATED		A Nominal	B ±0.001 (0.03)	C Maximum	Max. Wt. Grams
	D ±0.005 (0.13)	L ±0.031 (0.79)	D ±0.010 (0.25)	L ±0.031 (0.79)				
A	0.125 (3.18)	0.250 (6.35)	0.135 (3.43)	0.286 (7.26)	0.5 (12.7)	0.020 (0.51)	0.422 (10.72)	0.57
B	0.175 (4.45)	0.438 (11.13)	0.185 (4.70)	0.474 (12.04)	0.7 (17.78)	0.020 (0.51)	0.610 (15.49)	1.41
C	0.279 (7.09)	0.650 (16.51)	0.289 (7.34)	0.686 (17.42)	1.0 (25.4)	0.025 (0.64)	0.822 (20.88)	5.0
D	0.341 (8.66)	0.750 (19.05)	0.351 (8.92)	0.786 (19.96)	1.1 (27.94)	0.025 (0.64)	0.922 (23.42)	8.5

For Military Ordering Information, see page 3.

For further details consult T110 Series Catalog F-1851

nion Carbide Corporation, Electronics Division
.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET

SOLID TANTALUM CAPACITORS

UNION CARBIDE

T210, T211, T220, T240
GR500 SERIES
GRADED RELIABILITY

For the ultimate in high reliability and design in KEMET's GR500 Capacitors with failure rates as low as .001% per 1,000 hours. These Capacitors are manufactured to KEMET's Specification GR500 and meet or exceed all requirements of MIL-C-39003. Capacitance ranges are shown below in ordering information.

GR500 Capacitors offer a demonstrated failure rate calculated from the most sophisticated and accurate reliability measurement method in the capacitor industry. Each production lot of these capacitors is subjected to accelerated life testing on a 100% basis under low impedance circuit conditions. The subsequent accumulated data are applied to Weibull Analysis for establishing the demonstrated failure rate. These test results, including the Weibull plot and a summary of failure rate calculations, are supplied with each shipment of capacitors.

In addition, all KEMET GR500 Capaciotrs are temperature cycled 5 times from −65°C to +125°C and receive seal test, leakage current, capacitance, dissipation factor, X-Ray, and visual and mechanical inspection on a 100% basis.

For a copy of Graded Reliability Specification GR500 and additional information on these capacitors, contact your KEMET Sales Representative.

GR500 ORDERING INFORMATION

T 210 A 125 K 020 P S

TANTALUM

SERIES*
Solid electrolyte, graded high reliability, hermetically sealed.

CASE SIZE
A/B/C/D

CAPACITANCE PICOFARAD CODE
First two digits represent significant figures. Third digit specifies number of zeros to follow.

CAPACITANCE TOLERANCE
M — ±20%
K — ±10%
J — ±5%

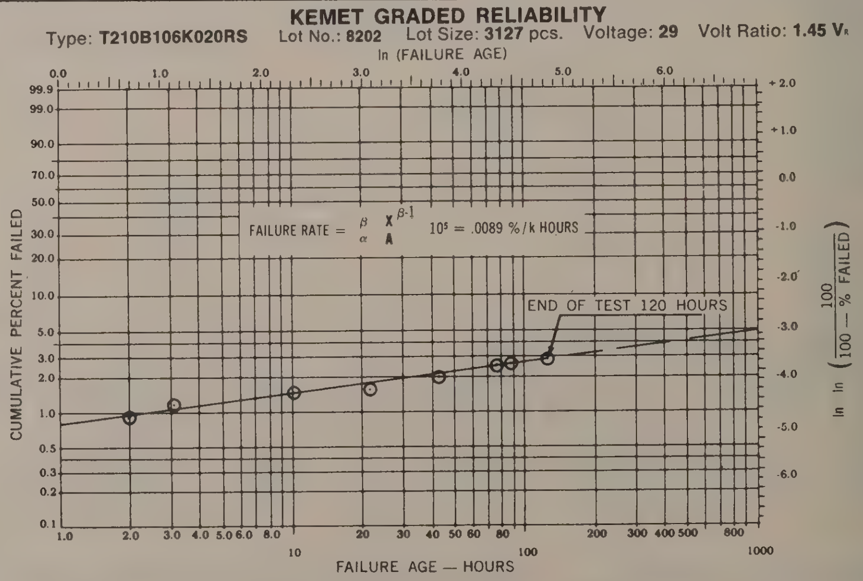
VOLTAGE
At 85°C

GRADED FAILURE RATE
% Per 1000 Hours
M — 1 R — 0.01
P — 0.1 S — 0.001

LEAD MATERIAL
S — Standard (Solder-coated nickel)
Available on special order at additional cost:
(Contact your sales representative.)
F — Bare Nickel
G — Gold Plated Nickel

SERIES*
210 — GR500/J — Axial lead, polar (0.0047-330.0 μF)
211 — GR500/N — Axial lead, non-polar (0.0023-160.0 μF)
220 — GR500/Z — Axial lead, subminiature, polar (0.0047-27.0 μF)
240 — GR500/A — Axial lead, super capacitance, polar (0.82-1000.0 μF)

KEMET GRADED RELIABILITY



For further details consult GR500/J & N (F-2697) & GR500/A (F-2792) & GR500/Z (F-2837) Specification Catalogs.

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

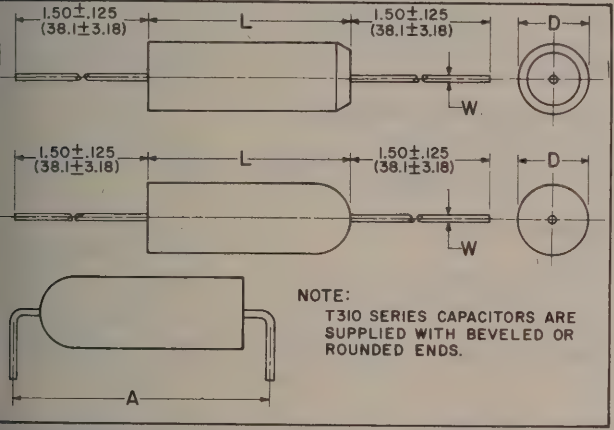
KEMET SOLID TANTALUM CAPACITORS UNION CARBIDE

T310 SERIES POLAR MOLDED

Plastic molded, self-insulating, using the same State-of-the-Art process techniques employed in the production of KEMET popular T110 capacitors. Designed for lead wire pre-forming and use in automatic insertion equipment. Exhibit low leakage current, good capacitance stability and low dissipation factor characteristics. C.V. range .10 to 330 μF, 6 to 50 VDC. Will operate continuously from −55°C to +85°C at full rated voltage and with ⅔ voltage to 125°C. Solderable and weldable, high purity solder coated lead wires. Ideal for application in commercial and industrial electronic equipment. For additional nformation refer to KEMET T310 Series Product Catalog.

0.1-330 μF; 6-50 VDC
4 CASE SIZES

CAPACITOR OUTLINE DRAWINGS



DIMENSIONS INCHES & (MILLIMETERS)

Case Size	D ±0.010 (0.25)	L ±0.010 (0.25)	Lead Wire Diameter - W ±0.001 (0.03)	For PC Board Layout - A
A	.138 (3.51)	.390 (9.91)	.025 (0.64)	0.6 (15.24)
B	.190 (4.83)	.562 (14.27)	.025 (0.64)	0.8 (20.32)
C	.300 (7.62)	.710 (18.03)	.025 (0.64)	1.0 (25.40)
D	.365 (9.27)	.875 (22.23)	.025 (0.64)	1.1 (27.94)

310
RDERING INFORMATION

T 310 A 104 M 050 A S

ANTALUM — T

ERIES — 310
olded Polar, Solid Tantalum

ASE SIZE — A
/B/C/D

APACITANCE IN PICOFARADS — 104
rst two digits are significant figures.
hird digit is the number of zeros following.

APACITANCE TOLERANCE — M
— ±20% K — ±10% J — ±5%

OLTAGE RATING — 050
t 85°C

AILURE RATE LEVEL — A
— Not Applicable

EAD MATERIAL — S
— Standard

r further details consult T310 Series Catalog F-2622

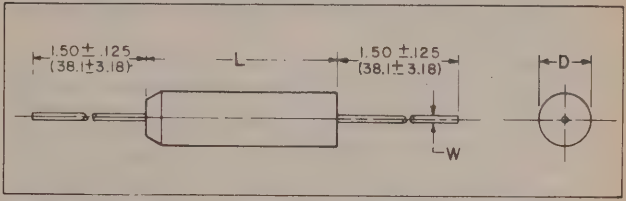
nion Carbide Corporation, Electronics Division
O. Box 5928, Greenville, SC 29606 / (803) 963-6300

T322 & T323 (CX01 & CX05) SERIES (MINIATURE) — EXTENDED RANGE — PRECISION MOLDED

0.1-68 μF; 2-50 VDC; 4 CASE SIZES

Extended range molded solid tantalum capacitors designed specifically for high speed automatic insertion applications. These capacitors offer an extremely high capacitance to volume ratio while still maintaining excellent performance characteristics. Supplied in four axial-lead tubular case sizes, these capacitors are ideally suited for use in printed wiring boards and all applications requiring a high degree of packaging density. The low impedance at high frequencies offered by this capacitor is especially suitable for decoupling required by high speed computers. T322 Series dimensions and tight lead wire-to-body concentricity permit installation by same automatic insertion equipment used for diodes and resistors. Available in working voltages of 2 (68 μF maximum), 4, 6, 10, 15, 20, 25, 35, and 50 (4.7 μF maximum) volts. Operating temperature range −55°C to +85°C at full rated voltage and with ⅔ voltage to 125°C with no voltage derating required. For additional information refer to KEMET T322 Product Catalog Form Number F-2875. These capacitors are also available in certain values per MIL-C-49137/1 & 5.

CAPACITOR OUTLINE DRAWINGS



DIMENSIONS — INCHES & (MILLIMETERS)

Case Size	D (Max.)	L (Max.)	W
A	0.095 (2.41)	0.260 (6.6)	0.020 (0.51)
B	0.110 (2.79)	0.290 (7.37)	0.020 (0.51)
C	0.180 (4.57)	0.345 (8.76)	0.020 (0.51)
D	0.180 (4.57)	0.420 (10.67)	0.020 (0.51)

T322 & T323 (CX01 & CX05) ORDERING INFORMATION

T 32X A 474 M 035 A S

TANTALUM — T

SERIES — 32X
Subminiature,
Molded, Polar,
Solid Tantalum.
Insert appropriate
number to replace
letter "X" —322 or 323
(CX01 & CX05).

CASE SIZE — A
A, B, C or D

CAPACITANCE IN PICOFARADS — 474
First two digits are significant
figures. Third digit is number
of zeros following.

CAPACITANCE TOLERANCE — M
M — 20% * J — ±5%
K — ±10% *

VOLTAGE RATING — 035

FAILURE RATE LEVEL — A
A — Not Applicable

LEAD MATERIAL — S
S — Standard

* M and K Tolerances available only for T323 Capacitors.

For further details consult T322 Series Catalog F-2875

KEMET SOLID TANTALUM CAPACITORS **UNION CARBIDE**

T330 SERIES — NEW LASER MARKED GOLD COLOR ON B, C, & D CASES PRECISION MOLDED — RADIAL LEAD

KEMET T330 Series, polar-type, radial lead rectangular Precision Molded Tantalum (PMT) capacitors are primarily designed for applications that demand full use of the premium space available in printed circuitry and high density packaging. Compact, space saving T330 Series capacitors provide superior packing factor and space utilization compared with tubular units of the same microcoulomb (CV) rating.

T330 Series capacitors employ a rectangular sintered, dry tantalum anode, transfer molded in precision dies with a high impact resistant plastic having excellent electrical, physical, and moisture resistant properties. The A Case is printed with polarity marking whereas B, C, and D Cases have the polarity symbol permanently molded on top of the plastic case. The radius on the two vertical edges at the positive end of B, C, and D Cases can also be used as a sensing dimension for automatic insertion processes. The location of the standoffs may serve a similar sensing function for the A Case. These standoffs, located in the base of all case sizes, provide vents for air circulation and also allow easy removal of flux residues from leadwire and circuit board solder joints.

T330 Series capacitors are highly reliable and exhibit performance characteristics typical of military test standards. They are available in capacitance values ranging from 0.1 to 220 microfarads in ±20, ±10, and ±5% tolerance levels, and in working voltages from 6 to 50 volts. At 85°C the capacitors will operate continuously at full rated voltage. They are rated to 125°C when operated at ⅔ of nameplate voltage. In addition, they feature exceptionally low DC leakage and Dissipation Factor characteristics. These capacitors meet or exceed the environmental requirements (except hermeticity tests) of MIL-C-39003.

They are ideal for by-pass, coupling, and timing applications in computers, military ordnance, industrial, entertainment, and consumer electronic equipment.

T330 ORDERING INFORMATION

T 330 A 104 M 035 A S

TANTALUM — T

SERIES — 330
Radial Lead
Precision Molded Polar
Solid Tantalum

CASE SIZE — A
A/B/C/D

CAPACITANCE IN PICOFARADS — 104
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE — M
M — ±20% — Standard
K — ±10% — Available on request
J — ±5% — Available on request

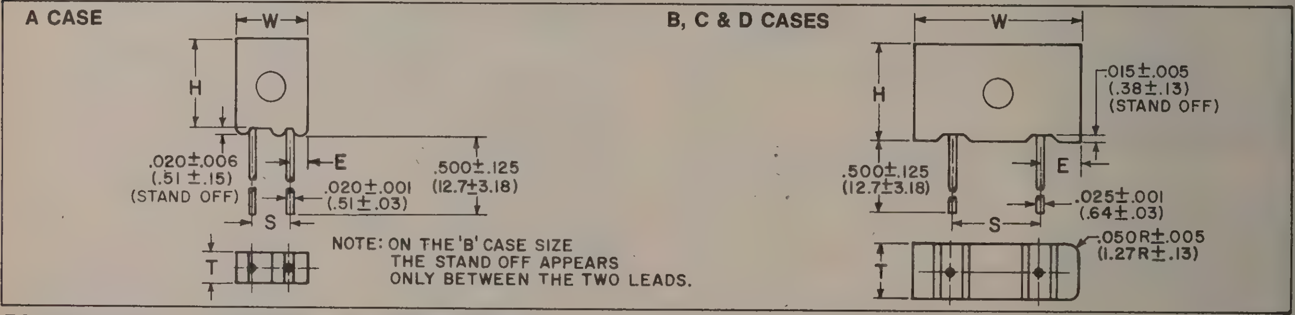
VOLTAGE RATING — 035

FAILURE RATE LEVEL — A
A — Not Applicable

LEAD MATERIAL — S
S — Standard (Solder-Coated Nickel)

0.1 — 220 µF
6 — 50 VDC
4 CASE SIZES

CAPACITOR OUTLINE DRAWINGS



DIMENSIONS — INCHES & (MILLIMETERS)

Case Size	H Case Height	W Case Width	T Case Thickness	E Case To Wire	S Lead Spacing
A	0.345 ±0.008 (8.76 ±0.203)	0.230 ±0.005 (5.84 ±0.127)	0.105 ±0.005 (2.67 ±0.127)	0.050 ±0.010 (1.27 ±0.25)	0.125 ±0.005 (3.18 ±0.127)
B	0.225 ±0.015 (5.71 ±0.38)	0.285 ±0.015 (7.24 ±0.38)	0.170 ±0.015 (4.32 ±0.38)	0.042 ±0.010 (1.07 ±0.25)	0.200 ±0.005 (5.08 ±0.127)
C	0.325 ±0.015 (8.26 ±0.38)	0.325 ±0.015 (8.26 ±0.38)	0.170 ±0.015 (4.32 ±0.38)	0.062 ±0.010 (1.57 ±0.25)	0.200 ±0.005 (5.08 ±0.127)
D	0.375 ±0.015 (9.53 ±0.38)	0.600 ±0.015 (15.24 ±0.38)	0.195 ±0.015 (4.95 ±0.38)	0.200 ±0.010 (5.08 ±0.25)	0.200 ±0.005 (5.08 ±0.127)

For further details consult T330 Series Catalog F-1885

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET

SOLID TANTALUM CAPACITORS

UNION CARBIDE

T340 SERIES — NEW LASER MARKED GOLD COLOR PRECISION MOLDED — RADIAL LEAD

The compact space saving T340 Series is transfer molded in precision dies with a high impact resistant plastic having excellent electrical, physical, and moisture resistant properties.

Marking is provided on the top of the case to allow visual inspection for proper polarity and placement after insertion. In addition, positive polarity identification is achieved by an easily recognized molded radius on the positive end of the case. This physical polarity identification is readily observed after capacitor placement as a further aid to the top marking in prevention of possible reverse insertion.

Standoffs, located in the base of all case sizes, provide vents for air circulation and also allow easy removal of flux residues from leadwire and circuit board solder joints. With very low impedance and ESR values, the T340 Series features exceptionally low DC leakage and DF characteristics.

T340 Series capacitors are highly reliable and exhibit performance characteristics typical of military test standards.

T340 ORDERING INFORMATION

T 340 A 105 M 035 A S

TANTALUM

SERIES
Radial Lead,
Precision Molded Polar,
Solid Tantalum

CASE SIZE
A/B/C/D/E/F

CAPACITANCE IN PICOFARADS
First two digits are significant
figures. Third digit is the
number of zeros following.

CAPACITANCE TOLERANCE
M — ±20% — Standard
K — ±10% — Available on request
J — ±5% — Available on request

VOLTAGE RATING

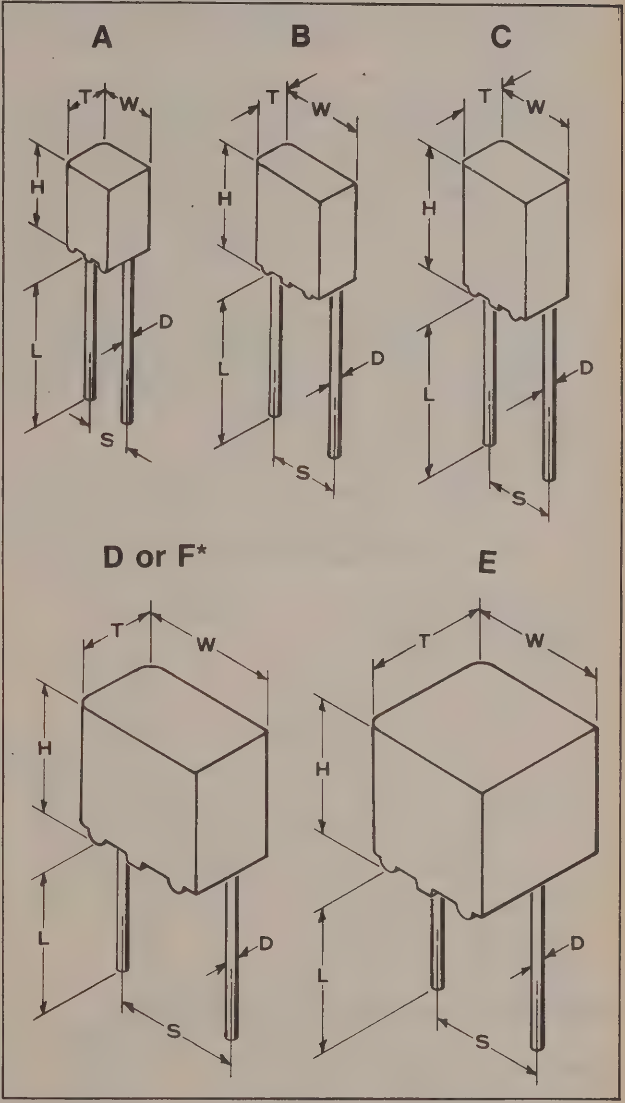
FAILURE RATE LEVEL
A — Not Applicable

LEAD MATERIAL
S — Standard (solder-coated copperweld)

0.1-330 μF 6-50 VDC 5 CASE SIZES

T340 SERIES

CAPACITOR OUTLINE DRAWINGS



* 'F' case size is same as 'D', but with .200" (5.0mm) lead spacing. Specify 'T340F' when ordering for this spacing.

DIMENSIONS INCHES & MILLIMETERS

Case Size	Maximum Case Height* H		Maximum Case Width W		Maximum Case Thickness T		Lead Spacing S		Lead Length L		Lead Diameter D	
	inches	mm	inches	mm	inches	mm	inches ±0.020	mm ±0.5	inches ±0.078	mm ±2.0	inches ±0.001	mm ±0.3
A	0.287	7.3	0.185	4.7	0.165	4.2	0.100	2.5	0.600	15.0	0.020	0.50
B	0.327	8.3	0.283	7.2	0.157	4.0	0.200	5.0	0.600	15.0	0.020	0.50
C	0.413	10.5	0.287	7.3	0.169	4.3	0.200	5.0	0.600	15.0	0.020	0.50
D	0.413	10.5	0.484	12.3	0.287	7.3	0.400	10.0	0.600	15.0	0.025	0.65
E	0.413	10.5	0.484	12.3	0.484	12.3	0.400	10.0	0.600	15.0	0.025	0.65
F	0.413	10.5	0.484	12.3	0.287	7.3	0.200	5.0	0.600	15.0	0.025	0.65

* Includes Standoff Height of 0.015 ±.005" (0.38 ±0.13mm) for All Case Sizes.

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET

SOLID TANTALUM CAPACITORS

UNION CARBIDE

T350, T351, T352, T353, T354 & T355 SERIES

FEATURES AND APPLICATIONS

The new KEMET 'UltraDip' Capacitors offers the designer of quality instruments and entertainment systems the widely recognized advantages inherent in solid tantalum capacitors at competitive prices.

The T350, T351, T352, T353, T354 and T355 Series are miniature dipped solid tantalum capacitors which provide the designer with the advantage of compactness plus low leakage and low DF performance characteristics for filtering, bypassing, coupling, blocking and RC timing circuits. This series features a capacitance range from 0.1 to 680 microfarads at voltages from 3 to 50 VDC. 'UltraDip' capacitors utilize the same sophisticated materials and processes which have advanced Union Carbide to the leadership position in solid tantalum capacitors.

The plastic case provides a tough barrier coating and maintains precision of lead wire spacing within ±0.015 inch. The new gold color epoxy utilized permits Laser marking with outstanding permanency and legibility. These Laser marked gold color epoxy products meet all visual requirements of MIL-I-46058. All case sizes are printed with capacitance, voltage, polarity and vendor identification.

Solid tantalum devices exhibit no degradation failure mode during shelf storage and show a constantly decreasing failure rate (i.e., absence of wearout mechanism) during life tests.

The 'UltraDip' Series provides self-insulating cases which are resistant to shock and vibration. These capacitors exhibit low DCL, ESR and Impedance and have excellent temperature stability.

0.1-680 µF 3-50 VDC 12 CASE SIZES

T350, T351, T352, T353, T354 & T355 SERIES ORDERING INFORMATION

T 35X A 105 M 035 A S

TANTALUM — T

SERIES — 35X
Insert appropriate number to replace letter "X" — 350, 351, 352, 353, 354 or 355.

CASE SIZE — A
A, B, C, D, E, F, & G

CAPACITANCE IN PICOFARADS — 105
First two digits are significant figures.
Third digit is the number of zeros following.

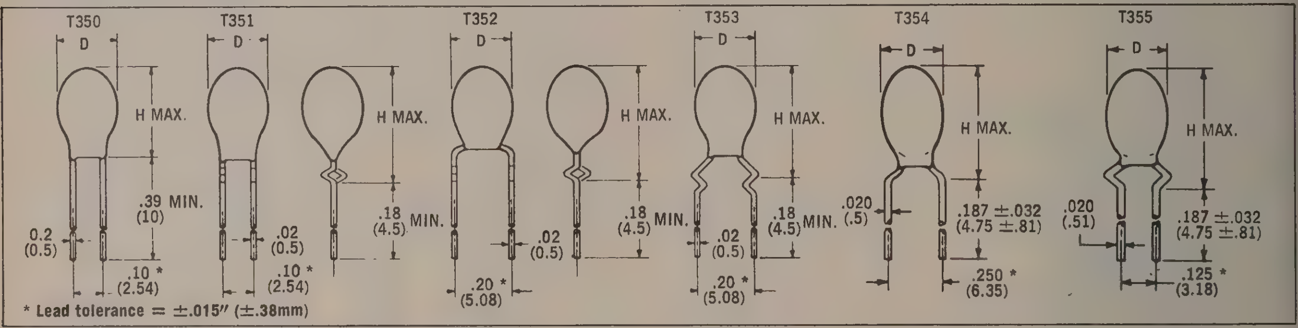
CAPACITANCE TOLERANCE — M
M — ±20%
K — ±10%

VOLTAGE RATING — 035
For 6.4 Volts Use 006

FAILURE RATE LEVEL — A
A — Not Applicable

LEAD MATERIAL — S
S — Standard

CAPACITOR OUTLINE DRAWINGS



* Lead tolerance = ±.015″ (±.38mm)

DIMENSIONS — INCHES (MILLIMETERS)

Case Size	All D Diameter	T350 H* Length	T351 H* Length	T352 H* Length	T353 H* Length	T354 H* Length	T355 H* Length
A	.175 (4.5)	.280 (7.1)	.380 (9.6)	.400 (10.2)	.400 (10.2)	.340 (8.6)	.340 (8.6)
B	.175 (4.5)	.300 (7.6)	.390 (9.9)	.410 (10.4)	.410 (10.4)	.350 (8.9)	.350 (8.9)
C	.196 (5.0)	.330 (8.4)	.420 (10.7)	.440 (11.2)	.440 (11.2)	.380 (9.6)	.380 (9.6)
D	.196 (5.0)	.340 (8.6)	.430 (10.9)	.450 (11.4)	.450 (11.4)	.390 (9.9)	.390 (9.9)
E	.216 (5.5)	.350 (8.9)	.440 (11.2)	.460 (11.7)	.460 (11.7)	.400 (10.2)	.400 (10.2)
F	.236 (6.0)	.390 (9.9)	.480 (12.2)	.500 (12.7)	.500 (12.7)	.440 (11.2)	.440 (11.2)
G	.250 (6.3)	.400 (10.2)	.490 (12.4)	.510 (13.0)	.510 (13.0)	.450 (11.4)	.450 (11.4)
H	.300 (7.6)	.400 (10.2)	.500 (12.7)	.520 (13.2)	.520 (13.2)	.470 (11.9)	.470 (11.9)
J	.330 (8.4)	.500 (12.7)	use T353	use T353	.580 (14.7)	.550 (14.0)	use T354
K	.350 (8.9)	.530 (13.5)			.630 (16.0)	.610 (15.5)	
L	.350 (8.9)	.630 (16.0)			.730 (18.5)	.710 (18.1)	
M	.400 (10.2)	.670 (17.0)			.760 (19.3)	.740 (18.8)	

* Note: All "H" Dimensions are from Capacitor seating plane to top of Capacitor.

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET

SOLID TANTALUM CAPACITORS

UNION CARBIDE

T361, T362, T363 (CX02), T368 & T369 (CX12) SERIES

DIPPED — ECONOMICAL/.1-330 μF 6-50 VDC/ LOW DC LEAKAGE/8 CASE SIZES

KEMET dipped solid tantalum capacitors offer the designer of quality instruments and entertainment systems the widely-recognized advantages inherent in solid tantalum capacitors at prices competitive to conventional electrolytic capacitors. Their concept is the result of the application of KEMET's superior know-how in the production of Military and High Reliability tantalum capacitors coupled with the unique antomated assembly methods developed for computer-part production. These capacitors are dipped in a new gold color resin with easy-to-read laser markings.

These capacitors are also available in certain values per MIL-C-49137/2: T363 (CX02) and T369 (CX12). T369 capacitors are available in A & B cases only.

T361, T362, T363 (CX02), T368 & T369 (CX12) ORDERING INFORMATION

T 36X B 155 M 050 A S

TANTALUM — T

SERIES — 36X
Insert appropriate number to replace letter "X" 361, 362, 363 (CX02), 368 or 369 (CX12)

CASE SIZE — B
A, B, C or D. T361 & T369 capacitors available only in A & B cases.

CAPACITANCE IN PICOFARADS — 155
First two digits are significant figures. Third digit is the number of zeros following.

CAPACITANCE TOLERANCE — M
M — ±20% *
K — ±10% *
J — ±5%

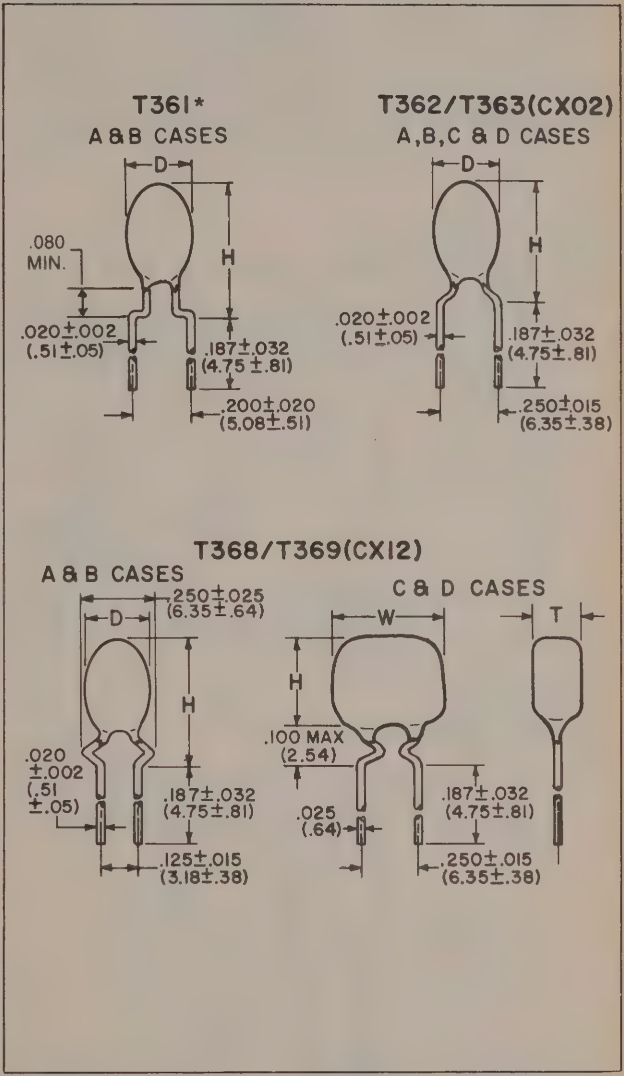
VOLTAGE RATING — 050

FAILURE RATE LEVEL — A
A — Not Applicable

LEAD MATERIAL — S
S — Standard

* T363 & T369 capacitors available only at M & K tolerances.

CAPACITOR OUTLINE DRAWINGS


T361*
A & B CASES
D
H
.080 MIN.
.020±.002 (.51±.05)
.187±.032 (4.75±.81)
.200±.020 (5.08±.51)
T362/T363(CX02)
A,B,C & D CASES
D
H
.020±.002 (.51±.05)
.187±.032 (4.75±.81)
.250±.015 (6.35±.38)
T368/T369(CX12)
A & B CASES
.250±.025 (6.35±.64)
D
H
.020 ±.002 (.51 ±.05)
.187±.032 (4.75±.81)
.125±.015 (3.18±.38)
C & D CASES
W
T
H
.100 MAX (2.54)
.025 (.64)
.187±.032 (4.75±.81)
.250±.015 (6.35±.38)

DIMENSIONS INCHES & (MILLIMETERS)

Case Size	T361		T362/T363		T368/T369			
	D Diameter	H Height	D Diameter	H Height	D Diameter	T Thickness	W Width	H Height
A	0.175 (4.45)	0.434 (11.02)	0.175 (4.45)	0.350 (8.89)	0.175 (4.45)	—	—	0.350 (8.89)
B	0.250 (6.35)	0.552 (14.02)	0.250 (6.35)	0.500 (12.70)	0.250 (6.35)	—	—	0.500 (12.70)
C	—	—	0.350 (8.89)	0.650 (16.51)	—	0.250 (6.35)	0.450 (11.43)	0.440 (11.18)
D	—	—	0.400 (10.16)	0.750 (19.05)	—	0.275 (6.99)	0.600 (15.24)	0.660 (16.76)

* T361 style is electrically identical to T362 style, except for lead spacing and lead diameter (available in A & B cases only).

For further details consult T361, T362, T363, T368 & T369 Catalog F-2638

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET **SOLID TANTALUM CAPACITORS** **UNION CARBIDE**

MICRON SERIES

The KEMET Micron Series is a complete line of microminiature solid tantalum capacitors designed to provide maximum electrical performance and capacitance-to-volume ratio for microminiaturized, high density, and integrated circuits. The capacitors consist of ultra-small anode assemblies encapsulated in epoxy. The CV range is 0.0022-220 µF, 2-50 volts. Capacitance values are identified by color codes. For additional information, including non-polar styles, refer to KEMET Micron Series Product Catalog (Form F-2710).

CAPACITANCE COLOR CODING
T370, T371, T372, T373, T374, T376, T380, T382, T384, T386

Color	Code for Capacitance in Picofarads	
	1st & 2nd Dot	3rd Dot Decimal Multiplier
Black*	0	1
Brown	1	10
Red	2	100
Orange	3	1,000
Yellow	4	10,000
Green	5	100,000
Blue	6	1,000,000
Violet	7	10,000,000
Grey	8	—
White	9	—

* Black Dot is not marked on black case.

MICRON ORDERING INFORMATION

T 3XX B 472 M 035 A S

TANTALUM — T

SERIES* — 3XX

CASE SIZE — B

CAPACITANCE IN PICOFARADS — 472
First two digits are significant figures. Third digit is the number of zeros following.

CAPACITANCE TOLERANCE — M
M — ±20% J — ±5%
K — ±10% L — +40%, −20%

VOLTAGE RATING — 035

FAILURE RATE LEVEL — A
A — Not Applicable

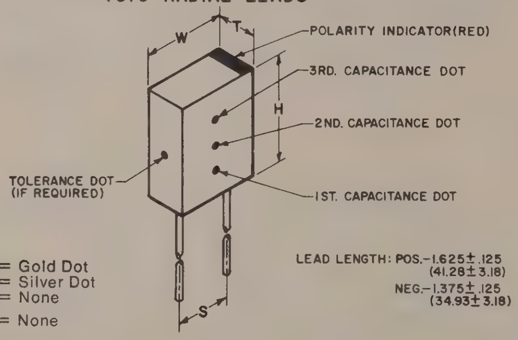
LEAD MATERIAL — S
S — Standard (solder-coated nickel)
G — Gold-plated nickel (optional for T380 & T382 Series. Consult your sales representative.)

*** Insert appropriate numbers to replace XX's for Series desired. T370, T371, T372, T373, T374, T376, T380, T382, T384 or T386.**

CAPACITOR OUTLINE DRAWINGS
T370 & T372

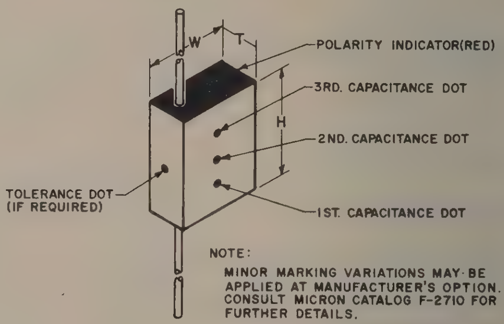
0.0022-220 µF
2-35 VDC

T370 RADIAL LEADS


W
T
POLARITY INDICATOR(RED)
3RD. CAPACITANCE DOT
H
2ND. CAPACITANCE DOT
TOLERANCE DOT (IF REQUIRED)
1ST. CAPACITANCE DOT
LEAD LENGTH: POS.–1.625±.125 (41.28±3.18)
NEG.–1.375±.125 (34.93±3.18)
S

±5% = Gold Dot
±10% = Silver Dot
±20% = None
+40% −20% = None

T372 AXIAL LEADS


W
T
POLARITY INDICATOR(RED)
3RD. CAPACITANCE DOT
H
2ND. CAPACITANCE DOT
TOLERANCE DOT (IF REQUIRED)
1ST. CAPACITANCE DOT

NOTE:
MINOR MARKING VARIATIONS MAY BE APPLIED AT MANUFACTURER'S OPTION. CONSULT MICRON CATALOG F-2710 FOR FURTHER DETAILS.

DIMENSIONS
INCHES & (MILLIMETERS)

Case Size	H Maximum	W Maximum	T Maximum	S LEAD SPACING	Lead Diameter ±0.001 (0.03)
A	0.125 (3.18)	0.070 (1.78)	0.040 (1.02)	0.050 ±0.015 (1.27 ±0.38)	0.010 (0.25)
B	0.165 (4.19)	0.120 (3.05)	0.070 (1.78)	0.100 ±0.020 (2.54 ±0.51)	0.010 (0.25)
C	0.225 (5.72)	0.185 (4.70)	0.075 (1.91)	0.150 ±0.020 (3.81 ±0.51)	0.010 (0.25)
D	0.290 (7.37)	0.220 (5.59)	0.110 (2.79)	0.180 ±0.025 (4.57 ±0.64)	0.016 (0.41)
E	0.310 (7.87)	0.230 (5.84)	0.130 (3.30)	0.200 ±0.025 (5.08 ±0.64)	0.016 (0.41)
F	0.475 (12.07)	0.375 (9.53)	0.150 (3.81)	0.300 ±0.025 (7.62 ±0.64)	0.016 (0.41)

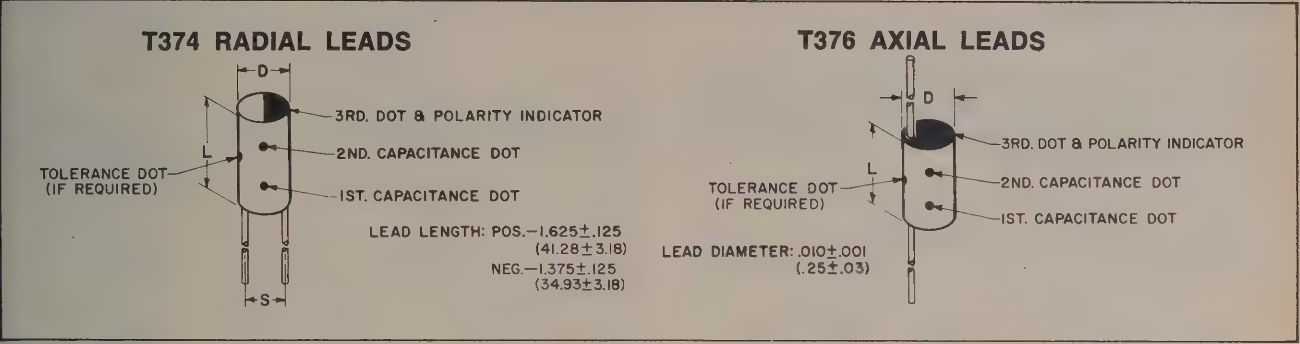
For further details consult Micron Catalog F-2710

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET® SOLID TANTALUM CAPACITORS UNION CARBIDE

T374 & T376 CAPACITOR OUTLINE DRAWINGS

0.0022-47 µF
2-50 VDC


T374 RADIAL LEADS

T376 AXIAL LEADS

D
3RD. DOT & POLARITY INDICATOR
2ND. CAPACITANCE DOT
1ST. CAPACITANCE DOT
L
TOLERANCE DOT (IF REQUIRED)
LEAD LENGTH: POS.—1.625±.125 (41.28±3.18)
NEG.—1.375±.125 (34.93±3.18)
S
D
3RD. DOT & POLARITY INDICATOR
2ND. CAPACITANCE DOT
1ST. CAPACITANCE DOT
L
TOLERANCE DOT (IF REQUIRED)
LEAD DIAMETER: .010±.001 (.25±.03)

DIMENSIONS INCHES & (MILLIMETERS)

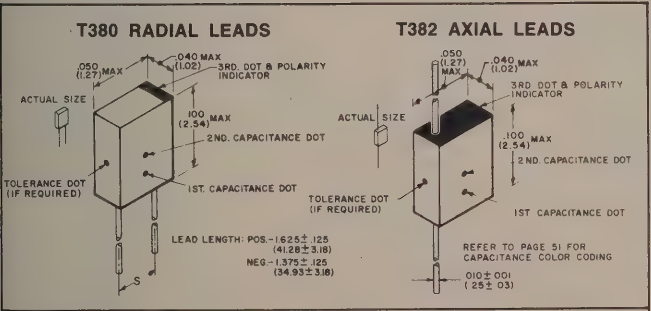
Case Size	L Maximum	D Maximum	S Lead Spacing	Lead Diameter ±0.001 (0.03)
A	0.125 (3.18)	0.070 (1.78)	0.050 ±0.015 (1.27 ±0.38)	0.010 (0.25)
B	0.160 (4.06)	0.070 (1.78)	0.050 ±0.015 (1.27 ±0.38)	0.010 (0.25)
C	0.200 (5.08)	0.080 (2.03)	0.050 ±0.015 (1.27 ±0.38)	0.010 (0.25)
D	0.225 (5.72)	0.100 (2.54)	0.070 ±0.020 (1.78 ±0.51)	0.010 (0.25)
E	0.250 (6.35)	0.150 (3.81)	0.120 ±0.025 (3.05 ±0.64)	0.016 (0.41)

For further details consult Micron Catalog F-2710

MICRON SERIES
T380, T382
(SMALLEST LEADED ENCAPSULATED SOLID TANTALUM CAPACITORS AVAILABLE) POLAR-EPOXY ENCAPSULATED — RECTANGULAR SHAPE — RADIAL OR AXIAL LEADS

- 0.0047 to 0.47µF
- 2 to 20 VDC
- −55°C to +125°C
- 130% Surge Voltage Rating
- ±20%, ±10%, and ±5% Tolerances also Available

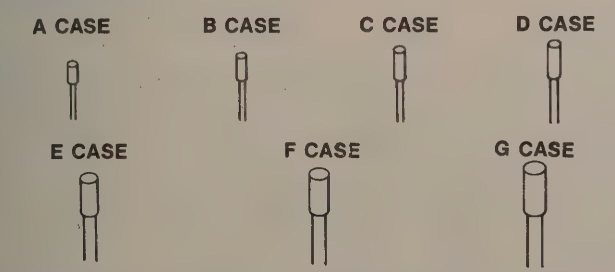
CAPACITOR OUTLINE DRAWINGS


T380 RADIAL LEADS

T382 AXIAL LEADS

.050 (1.27) MAX
.040 MAX (1.02)
3RD. DOT & POLARITY INDICATOR
ACTUAL SIZE
.100 (2.54) MAX
2ND. CAPACITANCE DOT
TOLERANCE DOT (IF REQUIRED)
1ST. CAPACITANCE DOT
LEAD LENGTH: POS.-1.625±.125 (41.28±3.18)
NEG.-1.375±.125 (34.93±3.18)
S
.050 (1.27) MAX
.040 (1.02) MAX
3RD DOT & POLARITY INDICATOR
ACTUAL SIZE
.100 (2.54) MAX
2 ND. CAPACITANCE DOT
TOLERANCE DOT (IF REQUIRED)
1ST CAPACITANCE DOT
REFER TO PAGE 51 FOR CAPACITANCE COLOR CODING
010± 001 (25± 03)

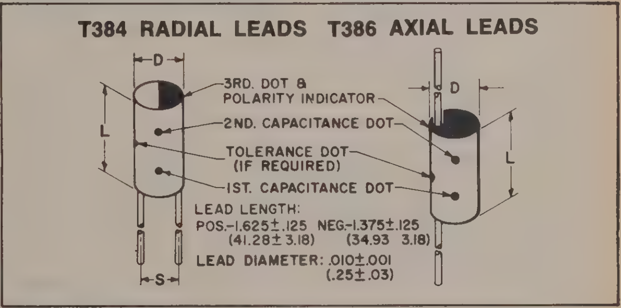
ACTUAL SIZE RADIAL


A CASE
B CASE
C CASE
D CASE
E CASE
F CASE
G CASE

MICRON SERIES
T384, T386
POLAR/EPOXY ENCAPSULATED/HIGH EFFICIENCY/CYLINDRICAL SHAPE

- 0.0010-22 µF
- 2 to 20 VDC
- High Charge (CV) Efficiency
- ±20%, ±10%, and ±5% Tolerances also Available
- −55°C to +125°C
- Solder-Coated Nickel Leads

CAPACITOR OUTLINE DRAWINGS


T384 RADIAL LEADS T386 AXIAL LEADS

D
3RD. DOT & POLARITY INDICATOR
2ND. CAPACITANCE DOT
TOLERANCE DOT (IF REQUIRED)
1ST. CAPACITANCE DOT
L
LEAD LENGTH:
POS.-1.625±.125 NEG.-1.375±.125
(41.28±3.18) (34.93 3.18)
LEAD DIAMETER: .010±.001 (.25±.03)
S
D
L

DIMENSIONS INCHES & (MILLIMETERS)

Case Size	L Case Length Maximum	D Case Diameter Maximum	S Lead Spacing ±0.015 (±0.38)
A	0.110 (2.79)	0.067 (1.70)	0.050 (1.27)
B	0.125 (3.18)	0.067 (1.70)	0.050 (1.27)
C	0.145 (3.68)	0.067 (1.70)	0.050 (1.27)
D	0.160 (4.06)	0.077 (1.96)	0.050 (1.27)
E	0.190 (4.83)	0.077 (1.96)	0.050 (1.27)
F	0.200 (5.08)	0.080 (2.03)	0.050 (1.27)
G	0.215 (5.46)	0.098 (2.49)	0.070 (1.78)

For further details consult Micron Catalog F-2710

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET SOLID TANTALUM CAPACITORS

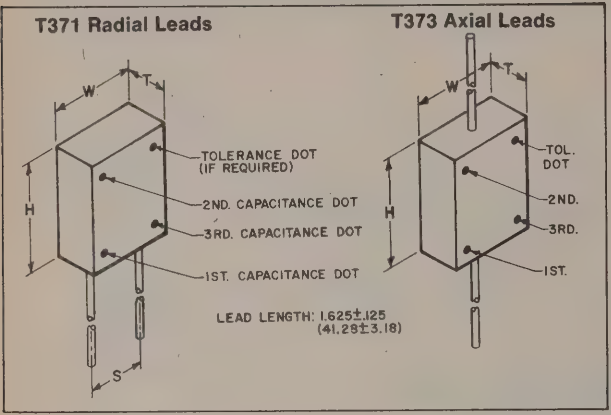
UNION CARBIDE

MICRON SERIES
T371 & T373

THE FOLLOWING ADDITIONAL MICRON SERIES ARE ALSO AVAILABLE: NON-POLAR, AXIAL OR RADIAL LEADS, RECTANGULAR SHAPE, EPOXY ENCAPSULATED

- .001 to 33 μF
- 2 to 50 VDC
- −55°C to +125°C

CAPACITOR OUTLINE DRAWINGS



Case Size	H Case Height Maximum Radial	H Case Height Maximum Axial	W Case Width Maximum	T Thick-ness Maximum	S *Lead Spacing	Lead Diameter ±0.001 (±0.03)
A	0.135 (3.43)	0.175 (4.45)	0.120 (3.05)	0.070 (1.78)	0.100 (2.54)	0.010 (0.25)
B	0.160 (4.06)	0.210 (5.33)	0.120 (3.05)	0.070 (1.78)	0.100 (2.54)	0.010 (0.25)
C	0.200 (5.08)	0.240 (6.10)	0.140 (3.56)	0.080 (2.03)	0.100 (2.54)	0.010 (0.25)
D	0.180 (4.57)	0.220 (5.59)	0.125 (3.18)	0.125 (3.18)	0.100 (2.54)	0.010 (0.25)
E	0.235 (5.97)	0.275 (6.99)	0.190 (4.83)	0.105 (2.67)	0.125 (3.18)	0.010 (0.25)
F	0.240 (6.10)	0.280 (7.11)	0.140 (3.56)	0.180 (4.57)	0.100 (2.54)	0.010 (0.25)
G	0.270 (6.86)	0.310 (7.87)	0.290 (7.37)	0.155 (3.94)	0.200 (5.08)	0.016 (0.41)
H	0.315 (8.00)	0.370 (9.40)	0.180 (4,57)	0.220 (5.59)	0.150 (3.81)	0.016 (0.41)
J	0.335 (8.51)	0.390 (9.91)	0.230 (5.84)	0.230 (5.84)	0.200 (5.08)	0.016 (0.41)

* A, B, C, D, E, F Cases: ±0.020 (±0.51). G, H, J Cases: ±0.025 (±0.64).

For further details consult T370 (Micron) Catalog F-2710

T411, T412 (CWR01), T421 & T422 (CWR02) SERIES — TANTALUM CHIP CAPACITORS

KEMET Tantalum Chip Capacitors present, at an economical price, maximum volumetric efficiency and high temperature capability. They are manufactured using a Union Carbide developed copper coating process that permits assembly temperatures up to 300°C for a short duration and continuous operating temperatures to 175°C when derated linearly to 25% of the 85°C voltage rating. T412 (CWR01) and T422 (CWR02) per MIL-C-55365 are KEMET's military equivalent capacitors of the 411 and 421. They are specially designed for use in hybrid circuit and PC board applications using solder reflow bonding techniques. The anode connection consists of a solder coated nickel tab. Cathode connection is made to the solder coating surrounding the body of the chip. Standard capacitance values are from 0.1 to 100 μF with unlisted values available on special order. Voltage range is 4 to 50 VDC. For information on chips that are suitable for other bonding techniques (including epoxy), contact your KEMET representative.

Capacitance Ranges:
T411: 0.1-68 μF
T412 & T422: 0.1-100 μF
T421: 0.1-100 μF
All types available from 4 to 50 VDC

For further details consult T411, T412, T421 & T422 Catalog F-2715

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET

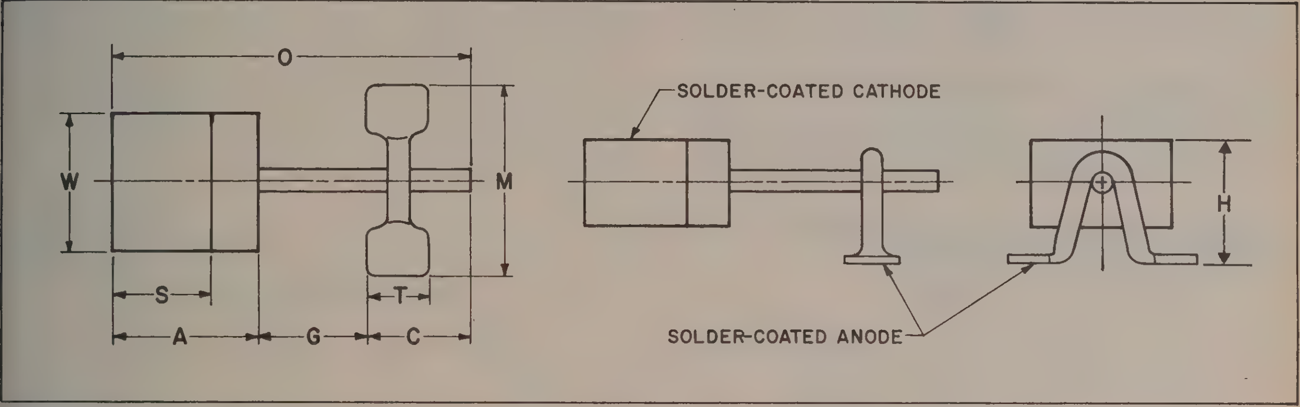
SOLID TANTALUM CAPACITORS

UNION CARBIDE

T411, T412 (CWR01), T421 & T422 (CWR02) SERIES — TANTALUM CHIP CAPACITORS

CAPACITOR OUTLINE DRAWINGS

T411 SERIES — STANDARD RECTANGULAR CHIP CAPACITORS

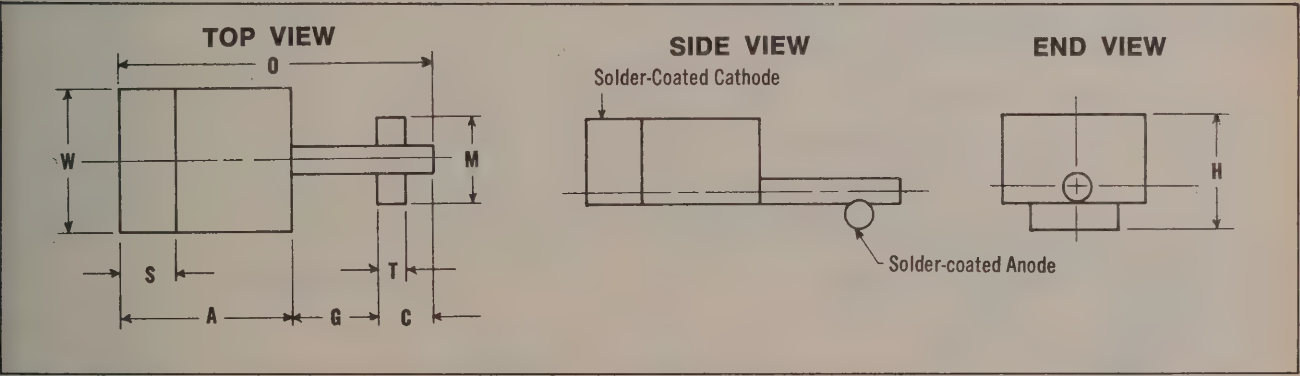


DIMENSIONS
INCHES & (MILLIMETERS)

Case Size	O Max.	W Max.	A Max.	S* Min.	G Min.	T Max.	C Max.	M Max.	H Max.	Wt. Max. Grams
A	0.185 (4.70)	0.100 (2.54)	0.080 (2.03)	30%	0.055 (1.40)	0.045 (1.14)	0.050 (1.27)	0.100 (2.54)	0.070 (1.78)	.06
B	0.230 (5.84)	0.130 (3.30)	0.125 (3.18)	40%	0.040 (1.02)	0.055 (1.40)	0.065 (1.65)	0.150 (3.81)	0.070 (1.78)	.11
C	0.270 (6.86)	0.160 (4.06)	0.165 (4.19)	40%	0.040 (1.02)	0.055 (1.40)	0.065 (1.65)	0.150 (3.81)	0.070 (1.78)	.18
D	0.335 (8.51)	0.170 (4.32)	0.215 (5.46)	40%	0.040 (1.02)	0.065 (1.65)	0.080 (2.03)	0.150 (3.81)	0.100 (2.54)	.28
E	0.340 (8.64)	0.180 (4.57)	0.220 (5.59)	40%	0.040 (1.02)	0.065 (1.65)	0.080 (2.03)	0.150 (3.81)	0.150 (3.81)	.35

* S — Solderable area expressed as percentage of Dimension A.

T421 SERIES MINIATURE RECTANGULAR CHIP CAPACITORS



DIMENSIONS
INCHES & (MILLIMETERS)

Case Size	O Max.	W Max.	A Max.	S* Min.	G Min.	T Max.	C Max.	M Max.	H Max.	Wt. Max. Grams
A	0.190 (4.83)	0.070 (1.78)	0.100 (2.54)	40%	0.025 (0.64)	0.055 (1.40)	0.065 (1.65)	0.070 (1.78)	0.060 (1.52)	.05
B	0.205 (5.21)	0.120 (3.05)	0.120 (3.05)	40%	0.025 (0.64)	0.050 (1.27)	0.060 (1.52)	0.070 (1.78)	0.060 (1.52)	.09
C	0.250 (6.35)	0.160 (4.06)	0.165 (4.19)	40%	0.025 (0.64)	0.050 (1.27)	0.060 (1.52)	0.090 (2.29)	0.080 (2.03)	.18
D	0.305 (7.75)	0.170 (4.32)	0.215 (5.46)	40%	0.025 (0.64)	0.055 (1.40)	0.065 (1.65)	0.090 (2.29)	0.110 (2.79)	.35
E	0.315 (8.00)	0.175 (4.45)	0.220 (5.59)	40%	0.025 (0.64)	0.060 (1.52)	0.070 (1.78)	0.090 (2.29)	0.150 (3.81)	.51

* S — Solderable area expressed as percentage of Dimension A.

For further details consult T411, T412, T421 & T422 Catalog F-2715

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET® MULTILAYER CERAMIC CAPACITORS

UNION CARBIDE

The basic capacitor element is called a chip and consists of formulated ceramic dielectric materials in layers interspersed with metal electrode layers. The entire structure is fired together at high temperature, after which conductive terminations are applied on opposite ends to contact protruding electrode edges. Chips may be terminated with materials suitable for hybrid-circuit substrate assembly. More usually, chips are furnished with protecting encapsulation and leadwires.

KEMET multilayer ceramic capacitors are produced in a plant designed specifically for capacitor manufacture. The process features a high degree of mechanization as well as precise controls over raw materials and process conditions. Manufacturing is supplemented by extensive Technology, Engineering, and Quality Assurance programs. Extensive application in aerospace and military programs attests to the reliability of KEMET capacitors. No capacitors exceed the failure rate qualifications held by KEMET capacitors under military specifications.

KEMET ceramic capacitors are offered in the three most popular temperature characteristics. These are designated by the Electronics Industry Association (EIA) as the ultra-stable C0G (known in the vernacular as NPO), the stable X7R (military BX or BR), and the general purpose Z5U. A wide range of sizes and lead arrangements are available to provide capacitance from 0.1 picofarad through 3.3 microfarads in 50, 100, and 200 volt ratings.

MOLDED CASES WITH RADIAL LEADS CAPACITOR OUTLINE DRAWINGS

10-3,300,000 pF
50, 100 & 200 VOLTS

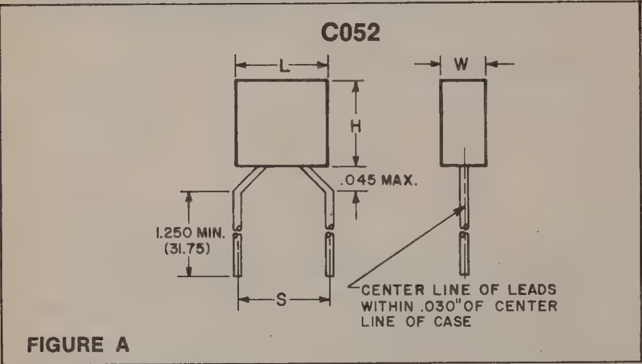


FIGURE A

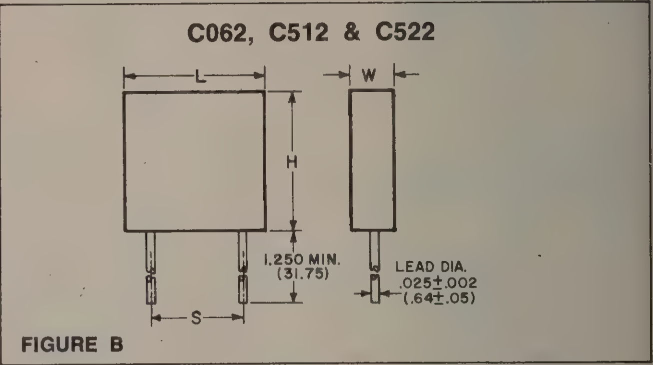


FIGURE B

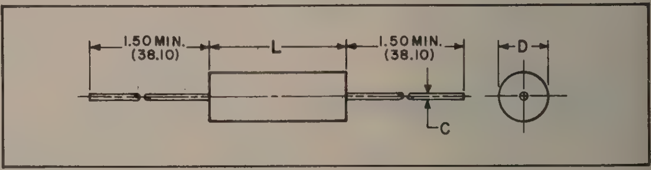
DIMENSIONS INCHES & (MILLIMETERS)

KEMET		Military Styles						
Figure	Case Size	MIL-C-11015*	MIL-C-39014*	MIL-C-20*	H Height	L Length	W Width	S Lead Spacing
A	C052	CK05	CKR05	CCR05/CC05	0.190 ±0.010 (4.83 ±0.25)	0.190 ±0.010 (4.83 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.200 ±0.015 (5.08 ±0.38)
B	C062	CK06	CKR06	CCR06/CC06	0.290 ±0.010 (7.73 ±0.25)	0.290 ±0.010 (7.73 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.200 ±0.015 (5.08 ±0.38)
B	C512	—	—	CCR07/CC07	0.480 ±0.020 (12.19 ±0.51)	0.480 ±0.020 (12.19 ±0.51)	0.140 ±0.010 (3.56 ±0.25)	0.400 ±0.020 (10.16 ±0.51)
B	C522	—	—	CCR08/CC08	0.480 ±0.020 (12.19 ±0.51)	0.480 ±0.020 (12.19 ±0.51)	0.240 ±0.010 (6.10 ±0.25)	0.400 ±0.020 (10.16 ±0.51)

* Note: Per MIL-C-11015 and C-39014, BX/BR only. — Per MIL-C-20, CG/CH only.

MOLDED CASES WITH AXIAL LEADS

C114 to C222



DIMENSIONS INCHES & (MILLIMETERS)

Case Size	Military Styles		L	D	C
	MIL-C-11015	MIL-C-39014			
C114	CK12	CKR11	0.160 ±0.010 (4.06 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.019 ±0.002 (0.48 ±0.05)
C124	CK13	CKR12	0.250 ±0.010 (6.35 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.019 ±0.002 (0.48 ±0.05)
C192	CK14	CKR14	0.390 ±0.010 (9.91 ±0.25)	0.140 ±0.010 (3.56 ±0.25)	0.025 ±0.002 (0.64 ±0.05)
C202	CK15	CKR15	0.500 ±0.020 (12.70 ±0.51)	0.250 ±0.015 (6.35 ±0.38)	0.025 ±0.002 (0.64 ±0.05)
C222	CK16	CKR16	0.690 ±0.030 (17.53 ±0.76)	0.350 ±0.020 (8.89 ±0.51)	0.025 ±0.002 (0.64 ±0.05)

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET MULTILAYER CERAMIC CAPACITORS

UNION CARBIDE

MOLDED RADIAL AND AXIAL CERAMIC CAPACITOR ORDERING INFORMATION

C 052 K 102 K 2 X 5 C A

CERAMIC

***CASE SIZE**
(See table below)

SPECIFICATION
Standard & Military
A — GR900 High Reliability (Chips)
B — GR900 High Reliability (Leaded Devices)
C — Standard
E — KEMET Military Equivalent
T — MIL-C-39014C Slash Sheets 1, 2 & 5
K — MIL-C-11015D
G — MIL-C-20

CAPACITANCE
In picofarad code: First two digits are significant figures and third is number of zeros following (except 9 indicates division by 10). Examples: 0.1 μF = 100,000 pF = 104 and 9.1 pF = 919.

CAPACITANCE TOLERANCE

Standard	Others
M — ±20%	H — ±3%
K — ±10%	G — ±2%
J — ±5%	F — ±1%
Z — +80% −20%	B — ±0.1 pF
	C — ±0.25 pF
P — GMV (Guar. Min. Value)	D — ±0.5 pF
X — Special	

Standard tolerances for each Series are shown in the repetitive parts lists. See catalog F-2644Q

FAILURE RATE
A — Not Applicable (Standard)
L — Obsolete (inactive for new design)
M — 1.0% R — 0.01%
P — 0.1% S — 0.001%

LEAD MATERIAL
C — Standard
Available on special order at additional cost: (Contact your sales representative.)
D — Gold Dumet
G — Gold Plated Nickel
E — Copperweld (Solder Coated)
R — Copper (Solder Coated)

INTERNAL CONSTRUCTION
1 — High Temperature Solder. For Z5U Temperature Characteristic only.
5 — Ultra-High Temperature Solder. For all other Temperature Characteristics.

TEMPERATURE CHARACTERISTIC

WORKING VOLTAGE
1 — 100 5 — 50
2 — 200 0 — Other

***CASE SIZE**

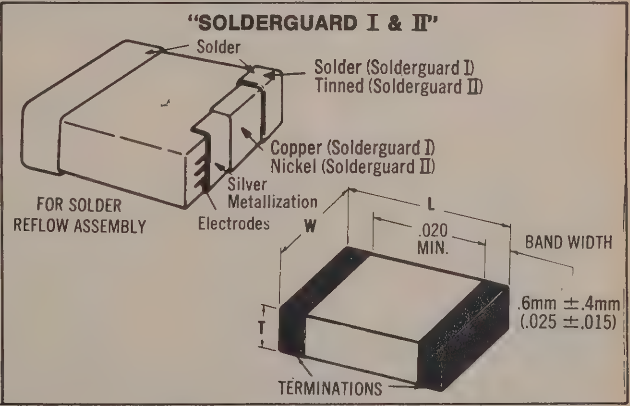
Radial	Axial
C052	C114
C062	C124
C512	C192
C522	C202
	C222

CHIP CAPACITORS FOR HYBRID CIRCUITS

Standard Solderguard (I & II) chips feature a unique barrier layer of copper or nickel in the end metallization that prevents silver leaching or scavenging and subsequent open circuits during assembly. The "Solderguard" chips will withstand solder reflow temperatures with little or no degradation of electrical continuity or performance. Silver palladium end termination is also available as standard. Other terminations available on special order include silver, gold and gold-palladium. KEMET chips are available in C0G, X7R and Z5U temperature characteristics in 50, 100 and 200 volt ratings.

1-1,500,000 pF
50, 100 & 200 VOLTS

CAPACITOR OUTLINE DRAWINGS



DIMENSIONS — MILLIMETERS & (INCHES)

Size Code	L Length	W Width	T Thickness Max.
0805	2.0 ±0.2 (.078 ±.008)	1.25 ±0.2 (.049 ±.008)	1.4 (.055)
1005	2.5 ±0.2 (.098 ±.008)	1.25 ±0.2 (.049 ±.008)	1.5 (.059)
1206	3.2 ±0.2 (.126 ±.008)	1.6 ±0.2 (.063 ±.008)	1.5 (.059)
1210	3.2 ±0.2 (.126 ±.008)	2.5 ±0.2 (.098 ±.008)	1.5 (.059)
1805	4.5 ±0.3 (.177 ±.012)	1.25 ±0.3 (.049 ±.012)	1.5 (.059)
1808	4.5 ±0.3 (.177 ±.012)	2.0 ±0.3 (.078 ±.012)	2.0 (.079)
1812	4.5 ±0.3 (.177 ±.012)	3.2 ±0.3 (.126 ±.012)	2.0 (.079)
1825	4.5 ±0.3 (.177 ±.012)	6.4 ±0.3 (.252 ±.012)	2.0 (.079)
2225	5.6 ±0.4 (.220 ±.016)	6.4 ±0.4 (.252 ±.016)	2.0 (.079)

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET MULTILAYER CERAMIC CAPACITORS

UNION CARBIDE

AXIMAX CONFORMAL AXIAL CAPACITORS

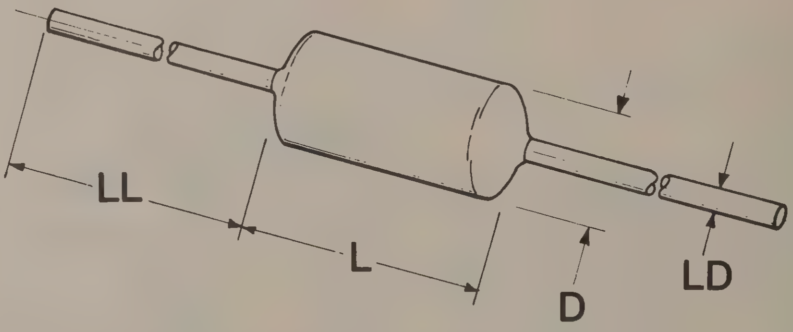
The KEMET AXIMAX product line provides maximum range, conformally-coated capacitors in three dielectrics — COG Ultra-Stable; X7R Stable and Z5U General Purpose. The six case sizes include over 300 CV values in a capacitance range of 10 pF to 1.0 μF in 50 and 100 volts. Their reliable performance is built-in through automated manufacture and precision process control techniques that assure uniform dielectric thickness, excellent electrode integrity, and electrode-to-termination continuity. Internal construction consists of the same superior multilayer body used in KEMET's molded capacitors. Encapsulation consists of a moisture and shock resistant epoxy conformal coating that meets the flame requirements of Underwriters Laboratory Standard 94V-O. The gold color permits Laser markings with outstanding legibility.

KEMET AXIMAX capacitors are available in Lead Tape and Reel configuration.

Additional CV values, sizes, and lead configurations are available on special order.

10 pF-1.0 μF
50 & 100 VOLTS

CAPACITOR OUTLINE DRAWINGS



DIMENSIONS (INCHES & MILLIMETERS)

STYLE	L (MAX - INCHES)	D (MAX - INCHES)	LD (+.001/−.003 INCHES)	LL (MIN - INCHES)
C410	.170 (4.32)	.100 (2.54)	.020 (.51)	1.0 (25.4)
C420	.260 (6.60)	.100 (2.54)	.020 (.51)	1.0 (25.4)
C430	.290 (7.37)	.150 (3.81)	.020 (.51)	1.0 (25.4)
C440	.400 (10.16)	.150 (3.81)	.020 (.51)	1.0 (25.4)

KEMET® MULTILAYER CERAMIC CAPACITORS UNION CARBIDE

GR900 SERIES

CERAMIC HIGH RELIABILITY CAPACITORS

GR900 capacitors are intended for use in any application where the chance of failure must be reduced to the lowest possible level. While any well-made multilayer ceramic capacitor is an inherently reliable device, GR900 capacitors receive special attention in all phases of manufacture including raw materials selection, special designs, Class 100 Clean Room production, individual batch testing (not group sample per mil spec), ultrasonic scanning, and destructive physical analysis. These capacitors are built to the highest known standards in the industry today and exceed new EIA specification RS 469 for Destructive Physical Analyses. These parts are well worth the added investment in comparison to the cost of a device or system failure.

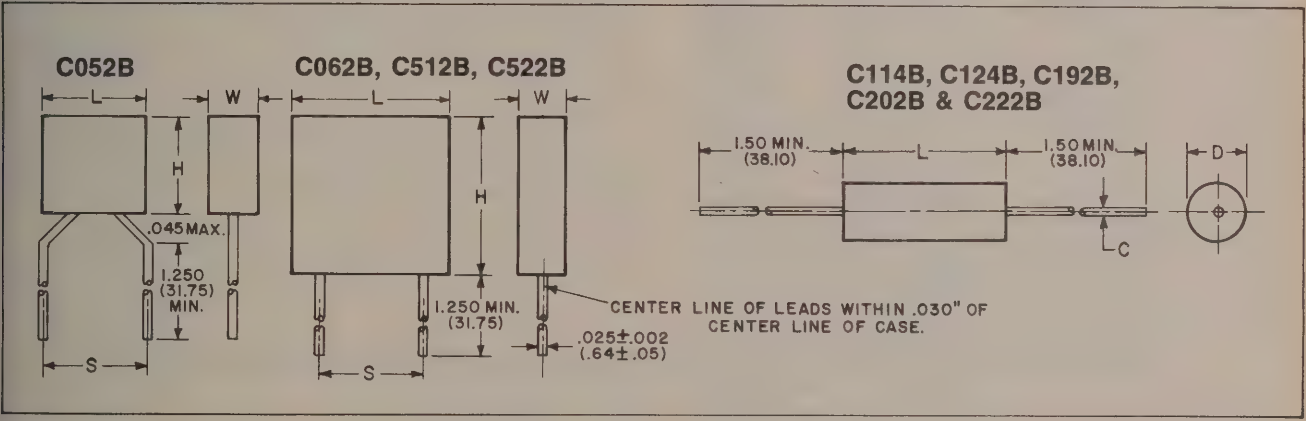
Typical applications include:

1. Medical: heart pacemakers, pain control devices, life signs monitoring, eye sight improvement and electroencephalographic equipment.
2. Aerospace: space exploration (Viking, Apollo, Venus Lander, etc.); Communications Satellites; Space Shuttle/IUS; Sky Lab.
3. Military: F-15 Radar, Trident Submarine, Patriot, Hawk Missile and Captor Programs.
4. Consumer: transportation failsafe (elevators and rail), airline navigation systems, smoke alarms and undersea cable amplifiers.

A data package is sent with each shipment which contains a destructive physical analysis (DPA) photograph representing each batch used in manufacture of the parts. Also, a certificate of compliance is included, stating that the parts meet all applicable requirements of the appropriate military specification to the best failure level to which KEMET is approved.

CAPACITOR OUTLINE DRAWINGS

Molded Axial & Radial Capacitors: 1-3,300,000 pF
Chips: 1-1,000,000 pF / All in 50,100 & 200 Volts



DIMENSIONS INCHES & (MILLIMETERS)

RADIAL LEAD

Case Size	Military Equivalent Styles	H Height	L Length	W Width	S Lead Spacing
C052	CC05, CCR05 CK05, CKR05	0.190 ±0.010 (4.83 ±0.25)	0.190 ±0.010 (4.83 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.200 ±0.015 (5.08 ±0.38)
C062	CC06, CCR06 CK06, CKR06	0.290 ±0.010 (7.37 ±0.25)	0.290 ±0.010 (7.37 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.200 ±0.015 (5.08 ±0.38)
C512	CC07, CCR07	0.480 ±0.020 (12.19 ±0.51)	0.480 ±0.020 (12.19 ±0.51)	0.140 ±0.010 (3.56 ±0.25)	0.400 ±0.020 (10.16 ±0.51)
C522	CC08, CCR08	0.480 ±0.020 (12.19 ±0.51)	0.480 ±0.020 (12.19 ±0.51)	0.240 ±0.010 (6.10 ±0.25)	0.400 ±0.020 (10.16 ±0.51)

AXIAL LEAD

Case Size	L	D	C	Military Styles	
				MIL-C-11015	MIL-C-39014
C114	0.160 ±0.010 (4.06 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.020, +0.000, −0.003 (0.51, +0.00, −0.08)	CK12	CKR11
C124	0.250 ±0.010 (6.35 ±0.25)	0.090 ±0.010 (2.29 ±0.25)	0.020, +0.000, −0.003 (0.51, +0.00, −0.08)	CK13	CKR12
C192	0.390 ±0.010 (9.91 ±0.25)	0.140 ±0.010 (3.56 ±0.25)	0.025, +0.004, −0.002 (0.64, +0.10, −0.05)	CK14	CKR14
C202	0.500 ±0.020 (12.70 ±0.51)	0.250 ±0.015 (6.35 ±0.38)	0.025, +0.004, −0.002 (0.64, +0.10, −0.05)	CK15	CKR15
C222	0.690 ±0.030 (17.35 ±0.76)	0.350 ±0.020 (8.89 ±0.51)	0.025, +0.004, −0.002 (0.64, +0.10, −0.05)	CK16	CKR16

For further information consult GR900 Specification Bulletins F-2872 & F-2873

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

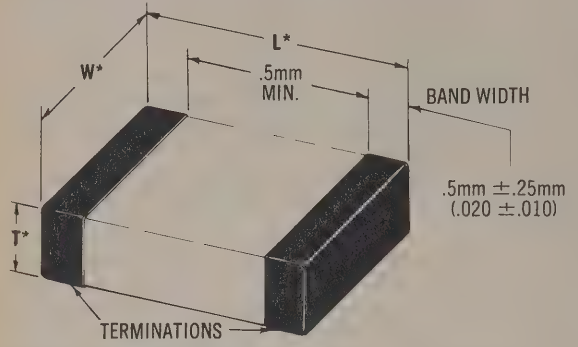
KEMET MULTILAYER CERAMIC CAPACITORS UNION CARBIDE

GR900 SERIES

HYBRID CERAMIC CHIP CAPACITORS

CAPACITOR OUTLINE DRAWING

* On Solderguard I, 'L', 'W' & 'T' dimensions, add .5mm to 'L' & .25mm to 'W' & 'T' dimensions for 'H' type terminations.



DIMENSIONS — MILLIMETERS & (INCHES)

Size Code	L Length	W Width	T Thickness Max.
0805	2.0 ±0.2 (0.78 ±.008)	1.25 ±0.2 (.049 ±.008)	1.4 (.055)
1005	2.5 ±0.2 (.098 ±.008)	1.25 ±0.2 (.049 ±.008)	1.5 (.059)
1210	3.2 ±0.2 (.126 ±.008)	2.5 ±0.2 (.098 ±.008)	1.5 (.059)
1805	4.5 ±0.3 (.177 ±.012)	1.25 ±0.3 (.049 ±.012)	1.5 (.059)
1808	4.5 ±0.3 (.177 ±.012)	2.0 ±0.3 (.078 ±.012)	2.0 (.079)
1812	4.5 ±0.3 (.177 ±.012)	3.2 ±0.3 (.126 ±.012)	2.0 (.079)
1825	4.5 ±0.3 (.177 ±.012)	6.4 ±0.3 (.252 ±.012)	2.0 (.079)
2225	5.6 ±0.4 (.220 ±.016)	.64 ±0.4 (.252 ±.016)	2.0 (.079)

GR900 CERAMIC CHIP ORDERING INFORMATION

C 0805 A 103 K 5 X A H

CERAMIC

SIZE CODE
See table below

SPECIFICATION
A — KEMET GR900 (CHIPS)

CAPACITANCE CODE
Expressed in Picofarads (pF)
First two digits — significant figures.
Third digit — number of zeros.
(Use 9 for 1.0 thru 9.9 pF.
Example: 2.2 pF — 229).

CAPACITANCE TOLERANCE

K — ±10%	F — ±1%
M — ±20%	G — ±2%
P — (GMV)	J — ±5%
C — ±0.25 pF	Z — +80%, −20%
D — ±0.5 pF	X — Other

VOLTAGE
1 — 100 2 — 200 5 — 50 0 — Other

TEMPERATURE CHARACTERISTIC
Designated by Capacitance Change over Temperature Range
G — NPO (±30 ppm/°C)
X — BX (±15%; +15%, −25% with bias)

FAILURE RATE LEVEL (%/1,000 HOURS)
A — Standard — Meets or exceeds MIL-C-55681, level R

END METALLIZATION
H — SolderGuard I (Standard-Tinned)
T — Silver
G — Gold Plated
V — Palladium Silver (Standard-Untinned)
Z — Other

SPECIFIC REQUIREMENTS GR900/R & GR900/A ORDERING INFORMATION

C 124 B 223 K 1 X 5 C A

MULTILAYER CERAMIC CAPACITORS

PHYSICAL DIMENSIONS
(See page 26)

HI REL SPECIFICATIONS APPLY:
B — Leaded devices

CAPACITANCE PICOFARAD CODE
First two digits are significant figures of capacitance value and third digit is the number of zeros to follow in stating capacitance in picofarads. For example, "223" is 22,000 pF. The third-digit number "9" indicates a divisor of 10; for example, "229" is 2.2 pF.

CAPACITANCE TOLERANCE

M — ±20%	J — ±5%	F — ±1%
K — ±10%	G — ±2%	D — ±0.5 pF

RATED VOLTAGE
1 — 100 2 — 200 5 — 50

FAILURE RATE
A — Standard — Meets or exceeds MIL-C-20, level R or MIL-C- 39014, level S

LEAD MATERIAL
C — Standard — Radial: Tinned Copper
Axial: Tinned Copperweld

INTERNAL CONSTRUCTION
5 — Ultra-High Temperature Solder

TEMPERATURE CHARACTERISTICS
(See table below)

TEMPERATURE CHARACTERISTICS CAPACITANCE CHANGE WITH TEMPERATURE −55°C to +125°C

Part Number Letter	Without D.C. Bias	With Rated D.C. Voltage Applied	Other Nomenclature		
			EIA	Military	Common
G	±30 ppm/°C	±30 ppm/°C	COG	CG, BP	NPO
X	±15%	+15%, −25%	X7R	BX	—

For further information consult GR900 Specification Bulletins F-2872 & F2873

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET® MULTILAYER CERAMIC CAPACITORS UNION CARBIDE

GOLDEN MAX

DIPPED CERAMIC CAPACITORS

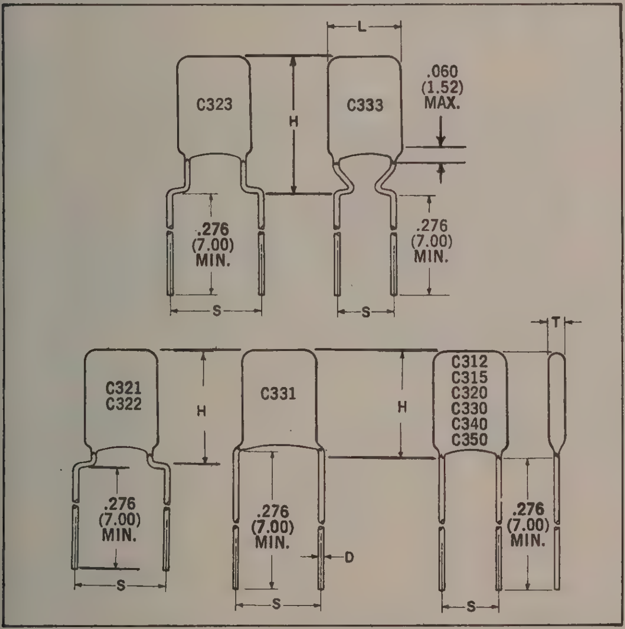
DIPPED CASES WITH RADIAL LEADS

The KEMET "Golden Max" product line provides maximum range conformally-coated capacitors in three dielectrics — COG Ultra-Stable; X7R Stable and Z5U General Purpose. The six case sizes include over 300 CV values in a capacitance range of 1.0 pF to 6.8 μF in 50, 100, and 200 volts. Their reliable performance is built-in through automated manufacture and precision process control techniques that assure uniform dielectric thickness, excellent electrode integrity, and electrode-to-termination continuity. Internal construction consists of the same superior multilayer body used in KEMET's molded capacitors. Encapsulation consists of a multi-layer moisture and shock resistant coating that meets the flame test requirements of Underwriter's Laboratory Standard 94V-O.

This new plastic resin is gold color with easy-to-read laser markings.

Additional CV values, sizes and lead configurations are available on special order.

CAPACITOR OUTLINE DRAWINGS



GOLDEN MAX ORDERING INFORMATION

C 320 C 102 M 1 G 5 C A

CERAMIC — C

CASE SIZE — 320
(See Table Below)

SPECIFICATION — C
C — Standard

CAPACITANCE CODE — 102
Expressed in Picofarads (pF)
First two digits - significant figures
Third digit - number of zeros (use 9 for 1.0 thru 9.9 pF. Example: 2.2 pF - 229)

CAPACITANCE TOLERANCE — M
D — ±0.5 pF
F — ±1%
G — ±2%
J — ±5%
K — ±10%
M — ±20%
P — 0, +100% (GMV)
Z — −20%, +80%

VOLTAGE — 1
2 — 200
1 — 100
5 — 50

DIELECTRIC — G
EIA Designation
G — COG (NPO) — Ultra-stable
R — X7R — Stable
U — Z5U — General Purpose

INTERNAL CONSTRUCTION — 5
1. High Temperature Solder — Standard for Z5U
5. Ultra-High Temperature Solder — Standard for X7R and COG

LEAD MATERIAL — C
C — Standard

FAILURE RATE — A
A — Not Applicable

1.0 pF-6.8 μF
50, 100 & 200 VOLTS

MAXIMUM DIMENSIONS — INCHES & (MILLIMETERS)

Case Size	L Max.	H Max.	T Max.	S** ±.030	D +.004 −.001
C312	0.120 (3.05)	0.160 (4.06)	0.100 (2.54)	0.100 (2.54)	0.016 (0.41)
C315	0.150 (3.81)	0.210 (5.33)	0.100 (2.54)	0.100 (2.54)	0.016 (0.41)
C320*	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.100 (2.54)	0.020 (0.51)
C321*	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.250 (6.35)	0.020 (0.51)
C322*	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.200 (5.08)	0.020 (0.51)
C323*	0.200 (5.08)	0.320 (8.13)	0.125 (3.18)	0.200 (5.08)	0.020 (0.51)
C330*	0.300 (7.62)	0.360 (9.14)	0.150 (3.81)	0.200 (5.08)	0.020 (0.51)
C331*	0.300 (7.62)	0.360 (9.14)	0.150 (3.81)	0.250 (6.35)	0.020 (0.51)
C333*	0.300 (7.62)	0.390 (9.91)	0.150 (3.81)	0.200 (5.08)	0.020 (0.51)
C340	0.400 (10.16)	0.460 (11.68)	0.150 (3.81)	0.200 (5.08)	0.020 (0.51)
C350	0.500 (12.70)	0.560 (14.22)	0.200 (5.08)	0.400 (10.16)	0.025 (.064)

Note: 1 inch = 25.4mm.

Note: * Case Sizes C320/C321/C322/C323, and C330/C331/C333 are identical electrically but differ in lead spacing.
** Measured at seating plane.

For further details on Golden Max Ceramic Capacitors consult Catalog F-2795

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET

FILM CAPACITORS

UNION CARBIDE

FLAT KAP FILM CAPACITORS

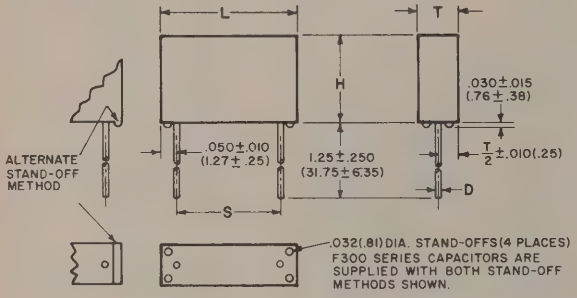
Flat Kaps are small ultra stable film capacitors ideally suited for filters, A/D converters, integrators, multivibrator timing capacitors, and other applications where capacitance stability is essential. This stability is obtained by locking the capacitor body in place with a solid impregnant. Outstanding electrical characteristics and volumetric efficiencies, up to 20 times greater than mica, glass, and porcelain are derived from the unique vacuum deposited dielectric, parylene.

Available in three different temperature coefficient of capacitance characteristics: −200 ±30, 0 ±50, and 0 ±100 ppm/°C over the operating range −55°C to +125°C. Capacitors are tested in accordance with MIL-C-55514 and are stocked in all standard values down to ±1% tolerance. Tighter tolerances and non-standard values are available from 0.001 µF to 1 µF on special order. For additional information refer to KEMET Film Capacitor Catalog.

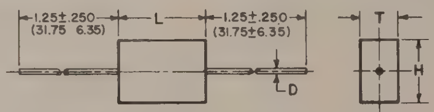
F110, F120 & F130 Hermetically Sealed Radial Lead Flat Kaps also available.

CAPACITOR OUTLINE DRAWINGS

F310 (MILITARY CFR04R), F320 & F330 RADIAL LEADS


L
T
H
.030±.015
(.76±.38)
ALTERNATE STAND-OFF METHOD
.050±.010
(1.27±.25)
1.25±.250
(31.75±6.35)
T/2±.010(.25)
D
S
.032(.81) DIA. STAND-OFFS (4 PLACES)
F300 SERIES CAPACITORS ARE SUPPLIED WITH BOTH STAND-OFF METHODS SHOWN.

F311 (MILITARY CFR04A), F321 & F331 AXIAL LEADS



FLAT KAP ORDERING INFORMATION

F 331 A 1201 G 050 A

FILM

***SERIES**
(Listed Below)

CASE SIZE

PICOFARAD CODE
First three digits represent significant
figures. Fourth digit specifies
number of zeros to follow.

CAPACITANCE TOLERANCE
K — ±10%
J — ±5%
G — ±2%
F — ±1%
D — ±0.5%

VOLTAGE

FAILURE RATE LEVEL
In Percent/1000 hr.
A — Non-Applicable
M — 1.0% P — 0.1%
R — 0.01% S — 0.001%

***SERIES**

300	Plastic Encapsulation, Flat Kaps
310	(CFR04R Per MIL-C-55514/3) A Temp. Coef., (−200 ±30 ppm) Molded, Radial Leads
311	(CFR04A Per MIL-C-5514/3) A Temp. Coef., (−200 ±30 ppm) Molded, Axial Leads
320	†B Temp. Coef., (0 ±100 ppm) Molded, Radial Leads
321	†B Temp. Coef., (0 ±100 ppm) Molded, Axial Leads
330	†C Temp. Coef., (0 ±50 ppm) Molded, Radial Leads
331	†C Temp. Coef., (0 ±50 ppm) Molded, Axial Leads

† A Temperature coefficient available through all ratings. B & C temperature coefficient available all ratings to 0.1 µF and to 0.22 µF on special order.

Flat Kap film capacitors are also available in hermetically sealed cases.

F320, F321, F330 & F331 capacitors are available from 0.001 µF through 0.22 µF only.

DIMENSIONS INCHES & (MILLIMETERS)

Case Size	H ±0.030 (±0.76)	L ±0.015 (±0.38)	T ±0.015 (±0.38)	S ±0.005 (±0.13)	D ±0.001 (±0.03)
A	0.280 (7.11)	0.500 (12.70)	0.125 (3.18)	0.400 (10.16)	0.020 (0.51)
B	0.375 (9.53)	0.500 (12.70)	0.195 (4.95)	0.400 (10.16)	0.025 (0.64)
C	0.375 (9.53)	0.600 (15.24)	0.195 (4.95)	0.500 (12.70)	0.025 (0.64)
D	0.375 (9.53)	0.600 (15.24)	0.295 (7.49)	0.500 (12.70)	0.025 (0.64)
E	0.375 (9.53)	0.750 (19.05)	0.500 (12.70)	0.650 (16.51)	0.025 (0.64)
H	0.550 (13.97)	1.500 (38.10)	0.600 (15.24)	1.400 (35.56)	0.032 (0.81)
J	0.375 (9.53)	0.600 (15.24)	0.225 (5.72)	0.500 (12.70)	0.025 (0.64)

For further details consult Flat Kap Film Capacitors Catalog F-2274

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

KEMET FILM CAPACITORS **UNION CARBIDE**

METALLIZED POLYCARBONATE FILM CAPACITORS

(MIL-C-83421/1A, MIL-C-39022/9 AND MIL-C-39022/10)

KEMET Metallized Polycarbonate Film Capacitors are designed for circuits requiring stable performance characteristics over a wide temperature range, small size, and operational reliability. They meet the same excellent quality standards associated with all other Union Carbide products. Electrical features include high insulation resistance, low dielectric absorption, low dissipation factor, and full voltage rating to 100°C. In addition, they are AC rated and have the self-healing properties that are inherent in a metallized dielectric. Typical applications include filtering, by-pass, timing, SCR commutating, and 400 cycle AC power circuits. Construction consists of high-purity metallized polycarbonate film with sprayed metal end terminations, hermetically sealed in ultra-small solder-coated tubular metal cases. The capacitance range is 0.001 to 22 μF with a DC voltage rating range of 30 to 600 volts. The 400 Hz AC voltage ratings range is 22 to 240 VRMS. The appropriate series are capable of meeting MIL-C-83421 CRH and MIL-C-39022 CHR requirements (see table below). For additional information refer to the KEMET Film Catalog Form F-2871.

F24 __
PART NUMBER IDENTIFICATION

F 241 A 1002 G 100 A

FILM CAPACITOR

SERIES
KEMET Metallized Polycarbonate

***KEMET REFERENCE NUMBER**
(See Table Below)

PICOFARAD CODE
First three digits represent significant figures.
Fourth digit specifies number of zeros to follow.

CAPACITANCE TOLERANCE
K — ±10% G — ±2% D — ±0.5%
J — ±5% F — ±1% C — ±0.25%

Note: C — 0.25% and D — 0.5% tolerances are available upon request.

VOLTAGE
Direct Reading

FAILURE RATE
A — Not Applicable R — 0.01% /1,000 hr.
M — 1.0% /1,000 hr. S — 0.001% /1,000 hr.
P — 0.1% /1,000 hr.

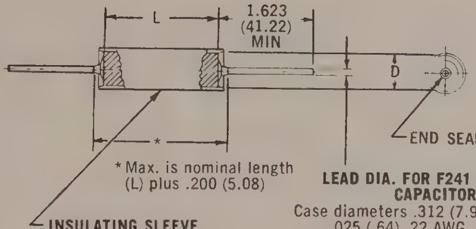
*KEMET REFERENCE NUMBERS

KEMET Series		*	30 VDC	50 VDC	100 VDC	200 VDC	400 VDC
F241	MIL-C-83421/1	1	CRH01	CRH02	CRH03	CRH04	CRH05
F242	MIL-C-83421/1	2	CRH06	CRH07	CRH08	CRH09	CRH00
F245	MIL-C-39022/9	1	CHR01A	CHR01D	CHR01G	CHR01K	CHR01N
F246	MIL-C-39022/9	2	CHR01B	CHR01E	CHR01H	CHR01L	CHR01P
F247	MIL-C-39022/9	3	CHR01C	CHR01F	CHR01J	CHR01M	CHR01R

KEMET Series		50 VDC	100 VDC	200 VDC	300 VDC	400 VDC	600 VDC
F248	MIL-C-39022/10	CHR10	CHR10	CHR10	CHR10	CHR10	CHR10

* Quality Level

CAPACITOR OUTLINE DRAWING



*Max. is nominal length (L) plus .200 (5.08)

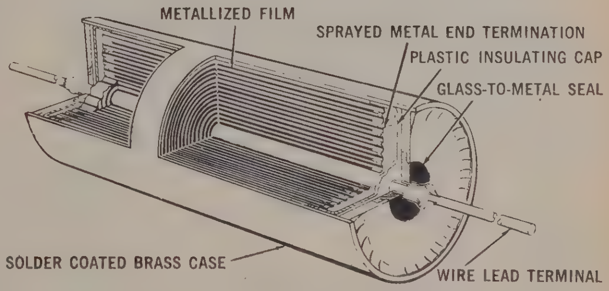
INSULATING SLEEVE
Shall extend beyond the capacitor body. Thickness shall not exceed .005 (.13)

LEAD DIA. FOR F241 THRU F247 CAPACITORS
Case diameters .312 (7.92) and less: .025 (.64), 22 AWG
Case diameters .400 (10.16) and .500 (12.70): .032 (.81) 20 AWG
Case diameters .562 (14.27) and over: .040 (1.02), 18 AWG

LEAD DIA. FOR F248 CAPACITORS
Case diameters of .175 (4.45) and .195 (4.95): .020 (.51) 24 AWG
Case diameters of .235 (5.97) and .312 (7.92): .025 (.64) 22 AWG
Case diameters of .400 (10.16) and over: .032 (.81) 20 AWG

Millimeters are in parenthesis — 1 inch = 25.4mm

TYPICAL HERMETICALLY SEALED METALLIZED CAPACITOR

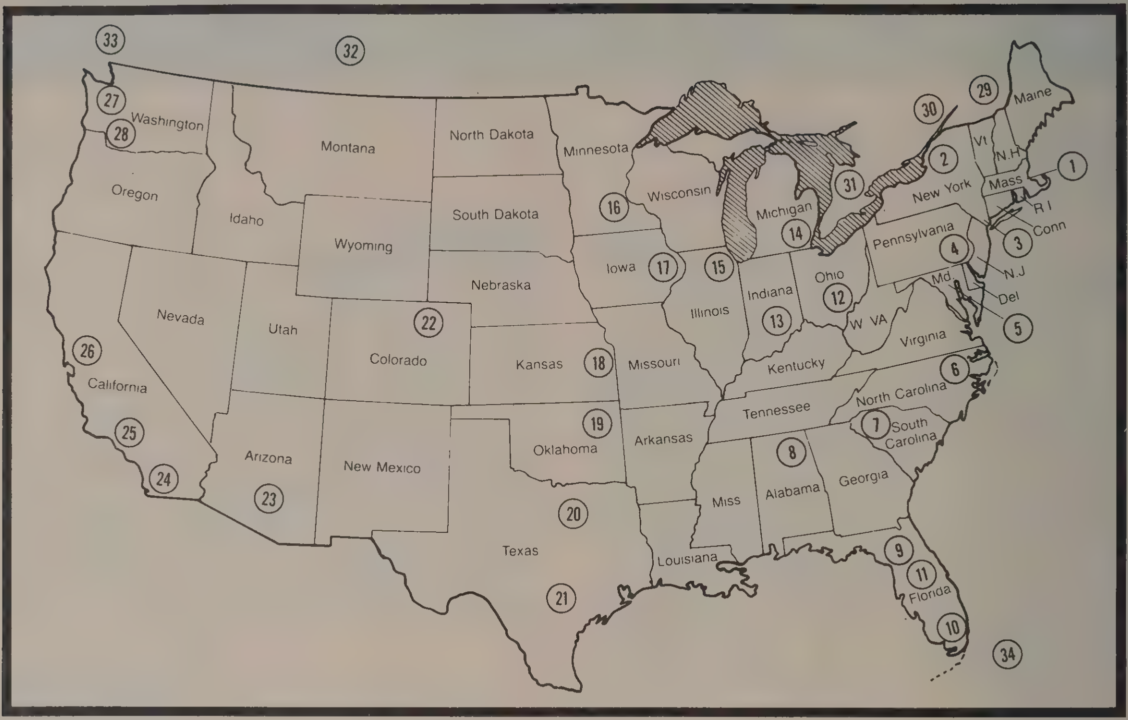


Marking — Capacitors are printed with KEMET Series designation, tolerance, voltage, and date code.

For further details consult Metallized Polycarbonate Film Capacitors Catalog F-2867

Union Carbide Corporation, Electronics Division
P.O. Box 5928, Greenville, SC 29606 / (803) 963-6300

OEM SALES REPRESENTATIVES


33
32
27
Washington
28
Montana
North Dakota
Minnesota
30
29
Maine
Oregon
Idaho
South Dakota
16
Wisconsin
Michigan
31
2
Vt
N.H
New York
Mass
1
R I
Conn
Wyoming
14
Pennsylvania
4
3
Iowa
17
15
Nebraska
Ohio
Indiana
12
Md
N.J
Del
Nevada
Utah
22
Illinois
13
W VA
5
Virginia
26
Colorado
Kansas
18
Missouri
Kentucky
6
California
North Carolina
Tennessee
19
7
South Carolina
25
Oklahoma
Arkansas
8
Arizona
New Mexico
24
Georgia
Alabama
Miss
23
20
Texas
Louisiana
9
11
Florida
21
10
34

1. **UNION CARBIDE - ELECTRONICS DIVISION**
400 Unicorn Park Drive
Woburn, MA 01801
Phone: (617) 938-5400

2. **UNION CARBIDE - ELECTRONICS DIVISION**
300 Tulip Street
Liverpool, NY 13088
Phone: (315) 451-0720

3. **UNION CARBIDE - ELECTRONICS DIVISION**
150 White Plains Road, Room 207
Tarrytown, NY 10591
Phone: (914) 332-4000
TWX: 710-567-1222

4. **UNION CARBIDE - ELECTRONICS DIVISION**
347 North Pottstown Pike
Exton, PA 19341
Phone: (215) 363-8310

5. **UNION CARBIDE - ELECTRONICS DIVISION**
Grosvenor Century Plaza, Suite 126
10630 Little Patuxent Parkway
Columbia, MD 21044
Phone: (301) 992-5600

6. **UNION CARBIDE - ELECTRONICS DIVISION**
3101 Poplarwood Court, Suite 120
Box 95100
Raleigh, NC 27625
Phone: (919) 872-2877

7. **UNION CARBIDE - ELECTRONICS DIVISION**
Piedmont Center, Suite 406
33 Villa Road
Greenville, SC 29615
Phone: (803) 242-5789
TWX: 810-281-2235

8. **UNION CARBIDE - ELECTRONICS DIVISION**
500 Wynn Drive, Suite 301C
Huntsville, AL 35805
Phone: (205) 830-1090

9. **UNION CARBIDE - ELECTRONICS DIVISION**
4950 West Kennedy Blvd., Suite 400
Tampa, FL 33609
Phone: (813) 872-1861

10. **UNION CARBIDE - ELECTRONICS DIVISION**
3441 N.W. 55th St., Bldg. 7
Ft. Lauderdale, FL 33309
Phone: (305) 731-2187

11. **UNION CARBIDE - ELECTRONICS DIVISION**
7600 Southland Blvd., Suite 109
Orlando, FL 32809
Phone: (305) 855-8886

12. **UNION CARBIDE - ELECTRONICS DIVISION**
Suite 102
229 Huber Village Blvd.
Westerville, OH 43081
Phone: (614) 890-8688

13. **UNION CARBIDE - ELECTRONICS DIVISION**
Fidelity Bank Plaza, Suite 260
11550 North Meridian St.
Carmel, IN 46032
Phone: (317) 844-7756

14. **UNION CARBIDE - ELECTRONICS DIVISION**
39201 Seven Mile Road, Suite 300
Livonia, MI 48152
Phone: (313) 591-0555

15. **UNION CARBIDE - ELECTRONICS DIVISION**
Schaumburg Corporate Center, Suite 207W.
1501 Woodfield Rd.
Schaumburg, IL 60195
Phone: (312) 843-1030

16. **UNION CARBIDE - ELECTRONICS DIVISION**
6600 France Avenue, South, Suite 420
Edina, MN 55435
Phone: (612) 929-4642

17. **SELTEC SALES CORPORATION**
1930 St. Andrews Drive, N.E.
P.O. Box 2172
Cedar Rapids, IA 52406
Phone: (319) 393-1114
TWX: 910-525-1329

18. **UNION CARBIDE - ELECTRONICS DIVISION**
Cloverleaf II Bldg., Suite 102
6901 W. 63rd Street
Shawnee Mission, KS 66202
Phone: (913) 362-8004

19. **UNION CARBIDE - ELECTRONICS DIVISION**
Exchange Bank Tower, Suite 914
4500 South Garnett Road
Tulsa, OK 74145
Phone: (918) 664-8592

20. **UNION CARBIDE - ELECTRONICS DIVISION**
Waterway Office Tower, Suite 700
433 East Las Colinas Blvd.
Irving, TX 75039
Phone: (214) 556-0009
TWX: 910-860-5750

21. **UNION CARBIDE - ELECTRONICS DIVISION**
111 West Anderson Lane, Suite 221
Austin, TX 78752
Phone: (512) 458-3181

22. **UNION CARBIDE - ELECTRONICS DIVISION**
10 Inverness Drive, East
Suite 232
Englewood, CO 80112
Phone: (303) 790-0494

23. **UNION CARBIDE - ELECTRONICS DIVISION**
40 West Baseline Road, Suite 201
Tempe, AZ 85283
Phone: (602) 831-2151
TWX: 910-951-0125

24. **UNION CARBIDE - ELECTRONICS DIVISION**
8840 Complex Dr., Suite 125
San Diego, CA 92123
Phone: (619) 560-0768

25. **UNION CARBIDE - ELECTRONICS DIVISION**
4676 Admiralty Way, Suite 302
Marina del Rey, CA 90292
Phone: (213) 821-8824
TWX: 910-343-6244

26. **UNION CARBIDE - ELECTRONICS DIVISION**
4677 Ironsides Drive, Suite 210
Marriott Business Park
Santa Clara, CA 95050
Phone: (408) 986-0424

27. **UNION CARBIDE - ELECTRONICS DIVISION**
401 Parkplace, Suite 219
Kirkland, WA 98033
Phone: (206) 828-4853

28. **UNION CARBIDE - ELECTRONICS DIVISION**
1300 Esther Street
Vancouver, WA 98660
Phone: (206) 695-1500

29. **DESKIN SALES CORPORATION**
290 Banjamin Hudon Street
Ville St. Laurent, Quebec
H4N 1J4
Phone: (514) 331-2860
TWX: 610-421-3793
Telex: 05-827584

30. **DESKIN SALES CORPORATION**
130 Slater Street, Suite 225
Ottawa, Ontario
K1P 5H6
Phone: (613) 238-4542
Telex: 053-4516

31. **DESKIN SALES CORPORATION**
77D Steelcase Road, West
Markham, Ontario
L3R 2M4
Phone: (416) 475-1412
TWX: 610-492-5113

32. **DESKIN SALES CORPORATION**
102-12604 126 Street
Edmonton, Alberta
T5L 0X6
Phone: (403) 451-4805
TWX: 610-831-1660

33. **DESKIN SALES CORPORATION**
105-3930 Jacombs Road
Richmond, B.C.
V6V 1Y6
Phone: (604) 273-4963
TWX: 610-922-5036

34. **CARIBBEAN AREA INQUIRIES—**
ISLA CARIBE ELECTRO SALES
Ponce de Leon No. 1057
Santurce, Puerto Rico 00907
Phone: (809) 722-5140
(809) 724-1572
(809) 724-0917

Union Carbide Corp., Electronics Div., P.O. Box 5928, Greenville, S.C. 29606 (803) 963-6300

KAHGAN
Electronics Corp.

556 Peninsula Boulevard
P.O. Box 459, Hempstead, New York 11550
Phone: (516) 538-2300
TWX: 510-222-4347

MICA CAPACITORS

STANDARD MICA CAPACITORS							
	Maximum Capacitance (pf)						
Style	100V	300V	500V	1000V	1500V	2000V	2500V
DM04	330	200	—	—	—	—	—
DM05	430	330	—	—	—	—	—
DM10	470	360	270	—	—	—	—
DM12	1200	1000	510	—	—	—	—
DM15	1500	1200	750	—	—	—	—
DM19	8200	6200	5100	1000	—	—	—
DM20	18,000	12,300	10,000	5600	3000	—	—
DM30	40,000	30,000	22,000	11,000	8200	3000	2700
DM42	100,000	69,000	51,000	—	—	—	—

DM SERIES — Entire Range, Fully Professional.

KZ SERIES — Low Cost/Replace NPO ceramic CK-06/7.

KZDM SERIES — Low Cost DM10 and DM15 direct, plug-in replacements for high volume applications.

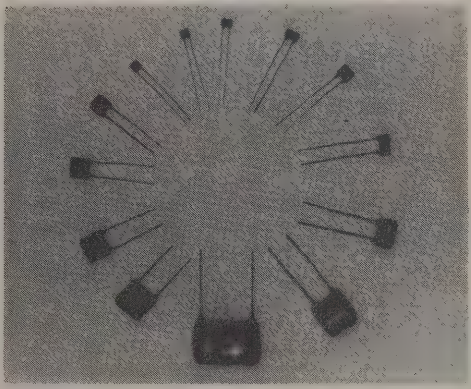
KSAX — Axial Mica — Available to 680pf/100V — Available tape and reel.

Taping and Reeling available on DM12 and DM15 sizes. Radial per Panasert type.

High voltage available to 2500VDC.

Tolerances ±½%, 1%, 2%, and 5% available in any value.

LOW COST SERIES					
Style	Cap (pf)	L	W	T	S
KZ4	1-43	0.195	0.235	0.140	0.100
KZ5	44-82	0.235	0.275	0.140	0.100
KZ8	83-220	0.355	0.395	0.160	0.200
KZ10	221-330	0.435	0.475	0.160	0.236
KZ12	331-510	0.515	0.550	0.180	0.315
KZ15	511-800	0.630	0.670	0.180	0.394
KZDM10	1-100	0.275	0.230	0.140	0.157
KZDM15	1-220	0.420	0.275	0.160	0.236



ELECTROLYTIC CAPACITORS

MINIATURE RADIAL & AXIAL; LARGE CV; SWITCHER TYPES

Style	Capacitance (mfd)	Voltage	Description
KAET/KSET	0.47 to 3300	6.3-100	Axial/Radial for general purpose applications.
KSET-LN	0.1 to 47	6.3-50	Low Leakage Radials. Tantalum Replacements.
KGPF/KGPK	1000 to 22,000	10-100	High Capacity Radials. 3 Lead wires for extra support.
KSMM	0.47 to 10,000	6.3-100	Miniaturized version of KSET radial type.
KTSMB	0.47 to 47	6.3-50	Ultra miniature radial. All units have 0.295″ diameter.
KLC120	100 to 10,000	6.3-100	Axial long life — high reliability.
KLC121	2.2 to 470	160-450	Axial high voltage extension of the KLC120 series.
KLC033	15 to 22,000	6.3-350	Axial −55°C to +85°C. Extra long life and reliability.

FILM CAPACITORS

Style	Capacitance (mfd)	Voltage	Description
KMMR	0.022-2.20	250	Radial Metallized Polyester with epoxy coating.
KMDDE	0.022-1.00	100-250	Radial Metallized Polyester.
KMTBE	0.022-1.00	100-250	Axial Version of KMDDE Metallized Polyester.
KMRA	0.001-0.47	50	Radial Polyester with epoxy coating. Tape and Reel available.
KPXH	0.0001-0.01	50 and 100	Axial Polypropylene. Low Cost. Tape and Reel available.
KPRH	0.0001-0.01	50 and 100	Radial Polypropylene. Low Cost.
KPRA	0.001-0.10	100	Radial Polypropylene with epoxy coating. Tape and Reel available.
KSXA	0.0001-0.01	50	Axial polystyrene. Low Cost. Tape and Reel available.

24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
2800
TRW

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY

"CERAMIC CAPACITOR MANUFACTURERS SINCE 1947"

85,000 square foot manufacturing facilities located in Hampton, Virginia

Maida in America

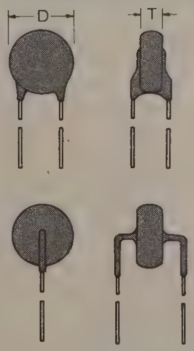
serving the electronics industry for over thirty-five years.

Maida Development Company, domestically owned and operated, has served the electronics industry with a wide variety of ceramic components. We specialize in custom design and manufacturing, from ceramic powder formulation through finished devices, to meet specific requirements of our customers. Typcial capacitor products include (1) high voltage capacitors for power supplies; (2) UL and CSA recognized capacitors for across-the-line, line-by-pass, and antenna coupling uses; (3) reduced titanate capacitors for low-voltage general purpose applications; (4) leadless discs; (5) slot-mounted "trapezoids" for printed circuits; and (6) multilayer capacitors. Our newest product line - zinc oxide varistors (ZOV) is designed for transient voltage suppression and surge energy absorption and many are UL recognized. Our delivery is timely and reliable - with either bulk packaging or tape and reel. We value with pride the repeat business from such customers as GE, Zenith, RCA, IBM, AT&T, Xerox, Sunbeam, GTE, NAP, Kodak, Harris, Allen-Bradley and many others.

HIGH VOLTAGE DISCS - 10, 12, 15, 20 KVDC - X5R/Z5U

MAX. NOM. CAP. ± 20% ρF	10KV "T" MAX. 0.360		12KV "T" MAX. 0.400		15KV "T" MAX. 0.460		20KV "T" MAX. 0.560	
	X5R	Z5U	X5R	Z5U	X5R	Z5U	X5R	Z5U
100	D68	—	D68	—	D689	—	D689	—
200	D68	—	D68	—	D619	—	D619	—
250	D68	—	D61	—	D619	—	D719	—
500	D71	D68	D62	D61	D629	D619	D649	D719
750	D64	D61	D64	D62	D639	D629	D679	D699
1000	D64	D71	D63	D62	D679	D699	D659	D649
1500	D67	D69	D65	D69	D669	D649	—	D679
2200	D65	D64	D66	D63	—	D679	—	D659
2500	D66	D63	D70	D67	D709	D659	—	D669
3000	—	D67	—	D65	—	D659	—	—
4300	—	D65	—	D66	—	—	—	D709
5600	—	D66	—	—	—	D709	—	—
6800	—	—	—	D70	—	—	—	—

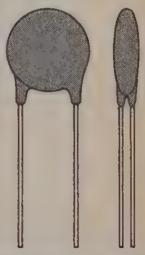
STYLE	MAX. "D"
D68/D689	0.406
D61/D619	0.469
D71/D719	0.513
D62/D629	0.552
D69/D699	0.659
D64/D649	0.719
D63/D639	0.781
D67/D679	0.840
D65/D659	0.969
D66/D669	1.100
D70/D709	1.350



APPLICATIONS:
Voltage Multipliers, High Voltage Power Supplies

UNDERWRITERS LABS & CANADIAN STANDARDS ASSOCIATION APPROVED

Type	Approval	T.C. EIA	Cap. Max.
UU2M	UL	U2M	220pF
US3N	UL	S3N	390pF
AUF	UL	Z5P	2700pF
UW	UL/CSA	Z5U	10000pF
* DP	UL/CSA	Z5U	5000pF

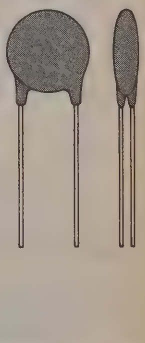


APPLICATIONS:
Line-by-pass, antenna coupling, across-the-line

* "Double Protection" in above uses

250 VOLT & 500 VOLT AC POWER LINE CAPACITORS

STYLE CODE	MAX. "D" INCHES	MAX. CAPACITANCE, pF 250VAC	500VAC
60	0.312	1200	680
68	0.375	2500	1200
61	0.470	3600	2000
71	0.530	4300	2200
62	0.590	6800	3600
64	0.720	10000	6200
63	0.780	13000	6800
67	0.840	15000	8200
65	0.970	22000	12000
66	1.10	30000	15000



APPLICATIONS:
AC line voltage applications where minimum currents - reactive and resistive - are required.

TOLERANCES AVAILABLE:
±20% or ±80 - 20%

20 LIBBY STREET / P.O. BOX 3529 — HAMPTON, VIRGINIA 23663 / (804) 723 - 0785 / TELEX 82 - 3443

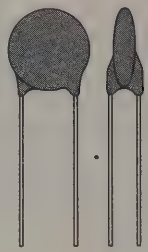
CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

ANTI-CORONA DISCS - 1 thru 6 KV

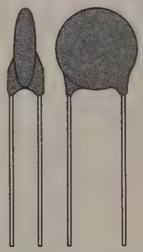
Class	T.C.	Max Capacitance	
		1 KV	6 KV
1	N750 N1500 N2200 N3300	680pF 1100pF 1600pF 2700pF	180pF 300pF 430pF 750pF
2	Z5P X7R Z5U	11000pF 14000pF 27000pF	3000pF 3900pF 5100pF



APPLICATIONS:
High Voltage operation
such as TV deflection
circuits where corona
is a problem

500 VOLT DISCS - CLASS 1 and 2

Class	T.C.	Capacitance Range
1	P100	3pF - 68pF
	NPO	16pF - 470pF
	NO33 thru N470	16pF - 620pF
	N750	27pF - 750pF
	N1500	47pF - 1300pF
	N2200 thru N5600	68pF - 5100pF
2	X5F	380pF - 8900pF
	Z5P/X7R	580pF - 13360pF
	Z5U	1000pF - 24000pF
	ZRV	1700pF - 40000pF

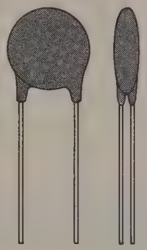


APPLICATIONS:
Hi Q capacitance stability

General purpose, by-pass,
coupling, etc.

LOW VOLTAGE DISCS - CLASS 3 - 16, 25, 50 VOLTS

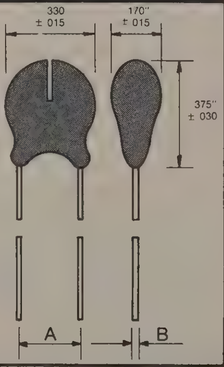
Style Code	EIA T.C. Code	Max Capacitance, μF.		
		16 VDC	25 VDC	50 VDC
60 HYS	Y5S	.02	.02	.01
61 HYS	Y5S	.033	.033	.022
71 HYS	Y5S	.05	.05	.033
62 HYS	Y5S	.10	.10	.05
64 HYS	Y5S	.15	.15	.10



APPLICATIONS:
High capacitance density
where D.F. and T.C.
are not critical.

1500 (±300) VDC SPARK GAPS

STYLE NO.	A	B
100	.200" ±.015	22 ga.
100 - 1	.200" ±.015	20 ga.
100 - 2	.250" ±.015	22 ga.
100 - 3	.250" ±.015	20 ga.

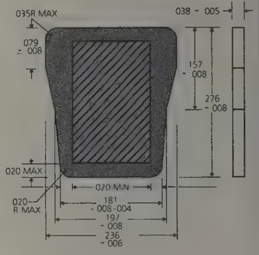


Rugged flame-retardant epoxy coating.

APPLICATIONS:
Protection of low-voltage circuits
from high voltage surges.

500 VOLT TRAPEZOIDS - CLASS 1 and 2

Class	T.C.	Capacitance Range
1	P100	1.5pF - 3.3pF
	NPO	2.4pF - 18pF
	N033thru N470	2.7pF - 24pF
	N750	5.6pF - 30pF
	N1500	22pF - 51pF
	N2200 thru N5600	30pF - 130pF
2	X5F	150pF - 220pF
	Z5P/X7R	150pF - 470pF
	Z5U	150pF - 1000pF
	Z5V	200pF - 1900pF

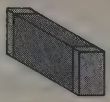


APPLICATIONS:
Solder into slot for
minimum lead inductance.

MULTILAYER CHIP CAPACITORS - NPO, X7R, Z5U

Size, inches L × W × T max.	Maximum Capacitance Value					
	NPO		X7R		Z5U	
	50V	100V	50V	100V	50V	100V
.080 × .050 × .050	240pF	180pF	5600pF	4200pF	.015μF	.01μF
.100 × .050 × .050	300pF	220pF	6800pF	5600pF	.02μF	.012μF
.150 × .050 × .050	560pF	420pF	.012μF	.01μF	.033μF	.024μF
.180 × .080 × .060	1000pF	750pF	.022μF	.018μF	.068μF	.051μF
.120 × .100 × .060	1200pF	910pF	.027μF	.022μF	.075μF	.056μF
.170 × .120 × .060	3300pF	2400pF	.075μF	.056μF	.2μF	.15μF
.250 × .220 × .060	.12μF	9100pF	.27μF	.22μF	.68μF	.5μF

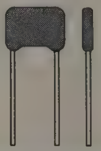
APPLICATIONS:
Hybrid Circuits



MULTILAYER RADIAL - LEAD DIP CHIPS - NPO, X7R, Z5U

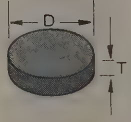
Size, inches L × W × T max.	Maximum Capacitance Value					
	NPO		X7R		Z5U	
	50V	100V	50V	100V	50V	100V
.200 × .200 × .125	3300pF	2400pF	.075μF	.056μF	.2μF	.15μF
.300 × .300 × .125	.012μF	9100pF	.27μF	.22μF	.68μF	.51μF
.400 × .400 × .150	033μF	.022μF	.82μF	.68μF	2.2μF	1.5μF
.500 × .500 × .200	.062μF	.042μF	1.2μF	1.0μF	3.3μF	2.2μF

APPLICATIONS:
High volumetric efficiency
in printed circuit boards.



500 VOLT LEADLESS DISCS - CLASS 1

T.C.	Capacitance	"D" Nom.	"T"
NPO	2.2pF - 3.0pF	.250"	.120" max.
N080	3.3pF - 7.5pF	.250"	.062" max.
N150	1.8pF - 5.4pF	.250"	.120" max.
N220	5pF	.250"	.083" max.
N470	18pF	.250"	.032" min.
N750	24pF	.250"	.032" min.
N1500	39pF	.250"	.032" min.
N080	7.5pF	.312"	.062" min.
N150	10pF	.312"	.083" max.
N220	10pF	.312"	.090" max.



APPLICATIONS:
UHF circuits with very
low inductance

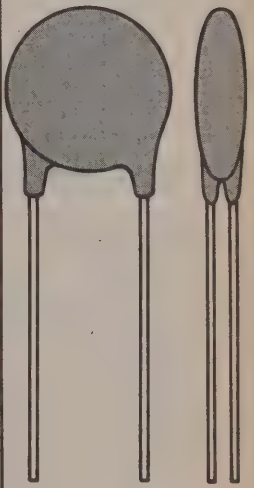
20 LIBBY STREET / P.O. BOX 3529 — HAMPTON, VIRGINIA 23663 / (804) 723 - 0785 / TELEX 82 - 3443

VARISTORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

ZINC OXIDE VARISTORS - TRANSIENT VOLTAGE SURGE SUPPRESSION

MDC - ZOV STYLE	MDC MODEL SIZE	CONTINUOUS RMS VOLTAGE	CONTINUOUS DC VOLTAGE	TRANSIENT ENERGY (10×1000 µs)	VARISTOR VOLTAGE @1mADC ± 10%	MAX. CLAMPING VOLTAGE @ TEST CURRENT (8×20 µs)		CAP @1KHZ ± 30%
	mm	VOLTS	VOLTS	JOULES	VOLTS	VOLTS	AMPS	pF
D73ZOV500RA01	7	50	66	4	82	157	5	620
D69ZOV500RA03	14			15		147	10	3200
D73ZOV600RA01	7	60	81	5	100	190	5	500
D69ZOV600RA03	14			20		175	10	2600
D73ZOV750RA02	7	75	102	6	120	230	10	420
D69ZOV750RA04	14			22		210	50	2200
D73ZOV950RA02	7	95	127	8	150	285	10	340
D69ZOV950RA04	14			30		255	50	1800
• ★ D73ZOV121RA03	7	120	160	10	188	360	10	300
• ★ D69ZOV121RA10	14			35		320	50	1400
• ★ D65ZOV121RA20	20			60		320	100	2500
• ★ D65ZOV121RB20	20			60		300	100	2500
• ★ D73ZOV131RA03	7	130	175	11	204	390	10	250
• ★ D69ZOV131RA10	14			38		340	50	1300
• ★ D65ZOV131RA20	20			70		340	100	2300
• ★ D65ZOV131RB20	20			70		325	100	2300
★ D73ZOV141RA03	7	140	188	12	220	410	10	230
★ D69ZOV141RA10	14			40		370	50	1200
★ D65ZOV141RA20	20			75		370	100	2100
★ D65ZOV141RB20	20			75		340	100	2100
• ★ D73ZOV151RA03	7	150	200	13	235	430	10	220
• ★ D69ZOV151RA10	14			45		395	50	1100
• ★ D65ZOV151RA20	20			80		395	100	2000
• ★ D65ZOV151RB20	20			80		360	100	2000
D73ZOV251RA04	7	250	330	21	393	730	10	130
D69ZOV251RA20	14			72		650	50	700
D65ZOV251RA40	20			130		650	100	1200
D65ZOV251RB40	20			130		620	100	1200
D73ZOV271RA04	7	270	360	23	424	775	10	120
D69ZOV271RA20	14			75		710	50	620
D65ZOV271RA40	20			140		710	100	1100
D65ZOV271RB40	20			140		680	100	1100
D69ZOV321RA15	14	320	420	90	502	850	50	530
D65ZOV321RA40	20			160		850	100	940
D65ZOV321RB40	20			160		810	100	940
D69ZOV421RA15	14	420	560	90	660	1120	50	400
D65ZOV421RA40	20			160		1120	100	710
D65ZOV421RB40	20			160		1060	100	710
D69ZOV461RA20	14	460	615	100	722	1240	50	370
D65ZOV461RA40	20			170		1240	100	650
D65ZOV461RB40	20			170		1160	100	650
D69ZOV481RA40	14	480	640	105	754	1240	50	350
D65ZOV481RA80	20			180		1240	100	620
D65ZOV481RB80	20			180		1160	100	620
D69ZOV511RA40	14	510	675	110	801	1350	50	330
D65ZOV511RA80	20			190		1350	100	590
D65ZOV511RB80	20			190		1280	100	590
D69ZOV551RA40	14	550	700	115	864	1500	50	310
D65ZOV551RA80	20			200		1500	100	550
D65ZOV551RB80	20			200		1410	100	550
D69ZOV581RA40	14	580	735	120	910	1500	50	290
D65ZOV581RA80	20			220		1500	100	520
D65ZOV581RB80	20			220		1410	100	520
D69ZOV102RA80	14	1000	1200	220	1570	2700	50	170
D65ZOV102RA160	20			360		2700	100	300
D65ZOV102RB160	20			360		1420	100	300



★ UL Recognized Components for Surge Supression, File E86730

• UL Recognized for Across-The-Line Applications, File E38785

Protection for Voltage Sensitive Equipment
Transient voltage suppression from sources such as lightning induced transients, switching surges, ground faults and AC power lines.

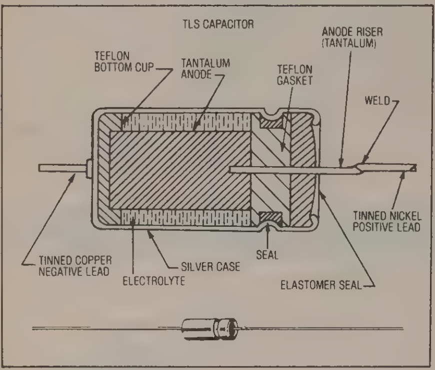
APPLICATIONS:
Ground fault interrupters, CATV systems, IC's and microprocessor protection, power supplies, industrial control systems, RFI filters, etc.

20 LIBBY STREET / P.O. BOX 3529 — HAMPTON, VIRGINIA 23663 / (804) 723-0785 / TELEX 82-3443

MALLORY

TANTALUM WET SLUG CAPACITORS

TLS-TLH EXTENDED CAPACITANCE MINIATURE POLAR HIGH CAPACITANCE – LOW DC LEAKAGE



SPECIFICATIONS

- **CAPACITANCE:**
  To 2200 μF
- **VOLTAGE:**
  6 to 125 VDC @ 85°C
  4 to 85 VDC @ 125°C
- **TOLERANCE:**
  ±20: ±10:
  ±5: on special order
- **CASE SIZES:**
  4 sizes, .188″ x .453″
  to .375″ x 1.062″
- **TEMPERATURE:**
  −55°C to 125°C

KEY FEATURES

- High capacitance per case size
- Extremely low DCL
- Long operating life
- Wide operating temperature range
- Rugged mechanical construction

APPLICATIONS

- Filter, coupling, bypass circuits
- Critical timing circuits
- Low source impedance circuits
- High charging current circuits

STANDARD AND EXTENDED RANGE RATINGS

Mallory TLS wet slug tantalum capacitors are available in 4 miniature case sizes with high capacitance at dual voltage ratings for 85°C and 125°C operation. The TLH is a higher capacitance version of the TLS with the same high performance and reliability. TLS-TLH capacitors exhibit very low DCL, low ESR, with electrical stability over a broad temperature range from −55°C to +125°C.

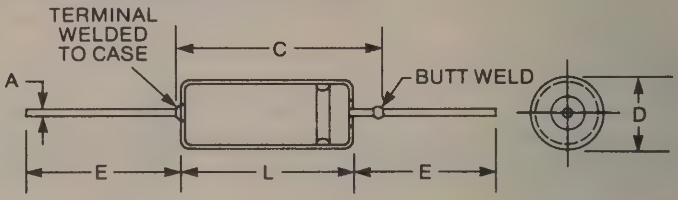
The low DCL characteristic of TLS-TLH capacitors is ideally suited for critical timing circuits. The miniature size and rugged construction of the TLS-TLH is intended for applications where space is a premium and resistance to shock and vibration is a requirement.

High reliability and long life is assured by the rugged mechanical construction of the TLS-TLH. A combination elastomer-teflon seal assembly is firmly seated in a silver case by a precision groove and roll-over crimp that virtually eliminates electrolyte leakage. The tantalum anode is firmly seated in the case by teflon shock pads.

The TLS is in accord with EIA Specifications RS-228 and meets all requirements of MIL-C-3965 and can be used as a replacement for applications where Type CL64, CL65 are used.

As a cost savings Mallory offers the CTL silver-plated, copper-alloy case capacitor in the same ratings, case sizes, end seal construction as the TLS. Refer to CTL TIB 4-610A for complete details. Refer to TIB 4-604 for TLS data.

SIZE AND CONFIGURATIONS



CASE SIZE	UNINSULATED		INSULATED		E LEAD LENGTH ±.25 IN. (±6.35mm)
	DIAMETER D ±.016 IN. (±.40mm)	LENGTH L +.031 −.016 IN. (+.80 −.40mm)	DIAMETER D MAXIMUM IN. (mm)	LENGTH L MAX. IN. (mm)	
A	.188 (4.78)	.453 (11.51)	.219 (5.56)	.608	1.50 (38.10)
B	.281 (7.14)	.641 (16.28)	.312 (7.94)	.796	2.25 (57.15)
C	.375 (9.53)	.766 (19.46)	.406 (10.32)	.921	2.25 (57.15)
F	.375 (9.53)	1.062 (26.99)	.406 (10.32)	1.217	2.25 (57.15)

Note: The case insulation shall extend .016 inch minimum, .062 maximum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.

MAXIMUM CAPACITANCE — VOLTAGE PER CASE SIZE

CASE SIZE	WORKING VOLTAGE (WVDC) MAXIMUM CAPACITANCE IN μF										
	6	8	10	15	25	30	50	60	75	100	125
A	220	180	150	100	68	56	33	27	22	4.7	36
B	820	680	560	390	270	220	120	100	82	22	14
C	1500	1500	1200	820	560	470	270	220	180	43	25
F	2200	1800	1500	1000	680	560	330	270	220	86	56

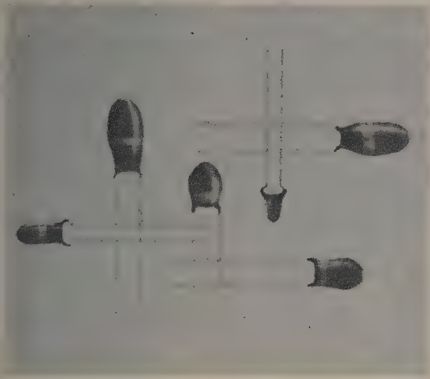
MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

TANTALUM SOLID ELECTROLYTE CAPS

TDC TYPE – LOW COST DIPPED EPOXY



HIGH CAPACITANCE/VOLTAGE PER CASE SIZE

The TDC is a Solid Electrolyte Tantalum Capacitor which features a self insulating, hard, dip coated epoxy protective covering.

This capacitor exhibits an extremely high volumetric efficiency (CV product per unit volume) and is supplied in four (4) case sizes to cover a wide range of ratings.

TDC's are supplied with space saving, solderable, radial leads which are formed to provide a mounting standoff for easy assembly and soldering operations.

The TDC is ideally suited for commercial and industrial applications where low cost and the inherent features of a Solid Electrolyte Tantalum Capacitor are required. These features include excellent stability at high and low temperatures, low DC leakage and equivalent series resistance, wide operating temperature range, long storage and shelf life and excellent impedance verses frequency and temperature characteristics.

For additional information send for 4-810B.

SPECIFICATIONS

- **CAPACITANCE:** .10 to 330 μF
- **VOLTAGE:** 6 to 50 VDC
- **TOLERANCE:** ±20% Standard ±10% Optional
- **Temperature:** −55°C to 85°C, 125°C with voltage derating
- **CASE SIZES:** 4 sizes from .175″ to .350″ to .400″ to .750″

KEY FEATURES

- Low cost
- Flame retardant case
- High capacitance per case size
- Long life

APPLICATIONS

- Bypass, coupling, timing
- Filtering in consumer and industrial equipment

OUTLINE DIMENSIONS

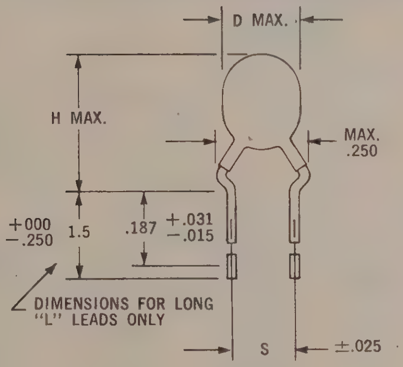


FIG. I
E & F CASE SIZE
.125 LEAD SPACING

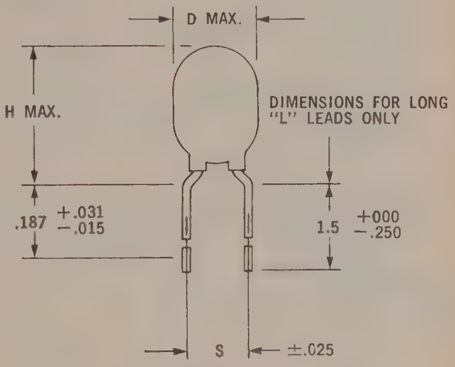


FIG. II
E, F, G & H CASE SIZE
.250 LEAD SPACING

CASE	DIAMETER HEIGHT D In. (mm)	H In. (mm)	LEADS SPACE In. (mm)	CODE	DIA. In. (mm)	AWG
E	.175 (4.45)	.350 (8.89)	.125 (3.17) .250 (6.35)	N W	.020 (.51) .025 (.64)	#24 #22
F	.250 (6.35)	.500 (12.7)	.125 (3.17) .250 (6.35)	N W	.020 (.51) .025 (.64)	#24 #22
G	.350 (8.89)	.650 (16.51)	.250 (6.35)	W	.025 (.64)	#22
H	.400 (10.16)	.750 (19.05)	.250 (6.35)	W	.025 (.64)	#22

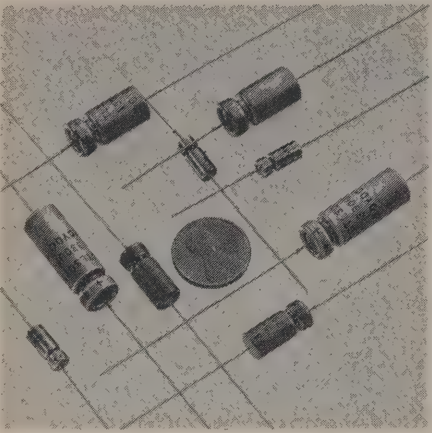
MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

TANTALUM WET SLUG CAPACITORS

CTL TYPE—LOW COST, MINIATURE, HIGH CAPACITANCE, POLAR



LOWER COST — LOW DC LEAKAGE

STANDARD AND EXTENDED RANGE RATINGS

The CTL wet slug tantalum capacitor is now available in a new improved proprietary silver plated copper alloy case. The CTL offers at lower cost the same ratings, case sizes, and electrical performance as silver case wet slug capacitors.

The miniature size and rugged construction of the CTL is identical to the Mallory TLS wet slug capacitor. The sintered tantalum anode is firmly seated in the case on a teflon shock pad. The anode riser extends through a combination elastomer-teflon seal assembly which is seated in the case by a precision groove and roll-over crimp. The double seal construction virtually eliminates electrolyte leakage.

The CTL offers a cost savings as an exact replacement for silver case wet slug tantalum capacitors.

Refer to TIB 4-610A.

HIGHLIGHTS

- **CAPACITANCE:**
  To 2200 μF
- **VOLTAGE:**
  6 to 125 VDC @ 85°C
  4 to 85 VDC @ 125°C
- **TOLERANCE:**
  ±20%, ±10%
  ±5% on special order
- **CASE SIZES:**
  4 sizes, .188″ x .453″ to .375″ x 1.062″
- **TEMPERATURE:**
  −55°C to 125°C

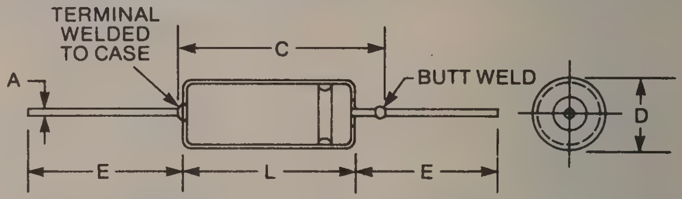
KEY FEATURES

- High capacitance per case size
- Extremely low DCL
- Long operating life
- Wide operating temperature range
- Rugged mechanical construction

APPLICATIONS

- Filter, coupling, bypass circuits
- Critical timing circuits
- Low source impedance circuits
- High charging current circuits

SIZE AND CONFIGURATIONS



CASE SIZE	UNINSULATED DIAMETER D ±.016 IN. (±.40mm)	UNINSULATED LENGTH L +.031 −.016 IN. (+.80 −.40mm)	INSULATED DIAMETER D MAXIMUM IN. (mm)	INSULATED LENGTH L MAX. IN. (mm)	E LEAD LENGTH ±.25 IN. (±6.35mm)
A	.188 (4.78)	.453 (11.51)	.219 (5.56)	.608	1.50 (38.10)
B	.281 (7.14)	.641 (16.28)	.312 (7.94)	.796	2.25 (57.15)
C	.375 (9.53)	.766 (19.46)	.406 (10.32)	.921	2.25 (57.15)
F	.375 (9.53)	1.062 (26.99)	.406 (10.32)	1.217	2.25 (57.15)

Note: The case insulation shall extend .016 inch minimum, .062 maximum beyond each end. However, when a shrink-fitted insulation is used, it shall lap over the ends of the capacitor body.

MAXIMUM CAPACITANCE — VOLTAGE PER CASE SIZE

CASE SIZE	WORKING VOLTAGE (WVDC) MAXIMUM CAPACITANCE IN μF 6	8	10	15	25	30	50	60	75	100	125
A	220	180	150	100	68	56	33	27	22	4.7	3.6
B	820	680	560	390	270	220	120	100	82	22	14
C	1500	1500	1200	820	560	470	270	220	180	43	25
F	2200	1800	1500	1000	680	560	330	270	220	86	56

For high-volume applications any capacitance value from 1.7 ΩF to the maximum capacitance of this table may be ordered.

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

TANTALUM WET SLUG CAPACITORS

CMT TYPE — LOW COST, SUBMINIATURE

LOWER COST, SUBMINIATURE
TUBULAR WET SLUG — POLAR

The CMT copper alloy case wet slug tantalum capacitor offers highest capacitance in subminiature size at lowest cost. The proprietary copper alloy case provides a significant cost savings over similar miniature capacitors in silver cases. The size and rugged construction of the CMT is intended for applications where space is a premium and resistance to shock and vibration is a requirement. The low and stable DCL characteristic of the CMT is ideally suited for application in timing circuits. Excellent high frequency performance and stable operation over a wide temperature range allow use in a variety of applications.

The rugged construction of the CMT includes mounting the tantalum anode on a shock pad positioned in a copper alloy case. A nickel lead wire is welded to the anode. The use of sulphuric acid electrolyte assures good low temperature impedance and capacitance characteristics. Special treatment of the copper alloy case prevents attack by the sulphuric acid. The capacitor is sealed by roll-crimping onto a special elastomer seal. An insulating sleeve covers the case and red epoxy encapsulant that protects the seal and encloses the positive lead wire weld. The CMT is suitable for use in automatic insertion equipment and can be furnished lead-tape and reel packaged.

For additional information send for TIB-4-609A.

HIGHLIGHTS

- **CAPACITANCE:** To 470 µF
- **VOLTAGE:** 6 to 60 VDC
- **TOLERANCE:** ±10%, ±20%
- **CASE SIZES:** 4 sizes .115″ x .300″ to .225″ x .778″
- **TEMPERATURE:** −55°C to +85°C

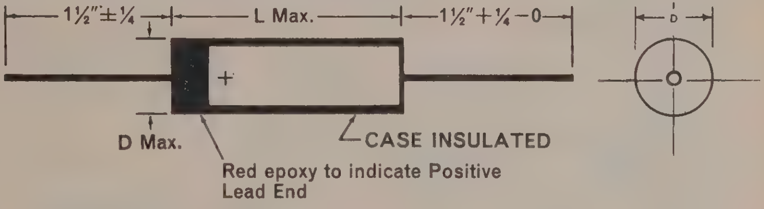
KEY FEATURES

- Highest CV per given volume
- Low, stable DCL
- Excellent shelf and operating life
- Rugged mechanical construction

APPLICATIONS

- Timing circuits, filter coupling, bypass circuits

SIZE AND CONFIGURATIONS



Lead Size: .020″ ±.001 Diameter

Lead Material: Positive, Tinned Nickel; Negative, Tinned Copper

Polarity Marking: Plus Signs Around the Anode End

CASE SIZE	LENGTH	DIAMETER	APPROXIMATE WEIGHT (PER UNIT IN GRAMS)
D	.300	.115	0.40
A	.403	.115	0.50
B	.600	.145	1.00
C	.778	.225	2.60

MAXIMUM CAPACITANCE — VOLTAGE PER CASE SIZE

CASE CODE	WORKING VOLTAGE (WVDC) MAXIMUM CAPACITANCE IN µF						
	6	10	15	20	30	50	60
D	15	10	8	6.8	6	4.0	3.3
A	47	30	20	15	10	6.8	5.6
B	180	120	80	60	45	30	22
C	470	330	220	150	120	78	68

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

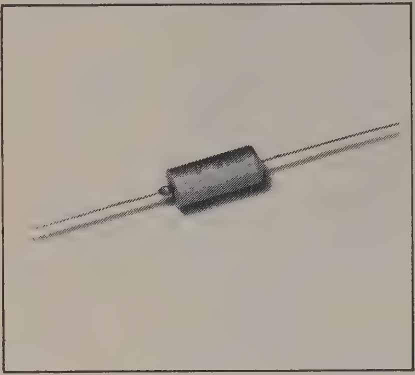
MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

TANTALUM SOLID ELECTROLYTE CAPACITORS

THF TYPE—HIGH RIPPLE PERFORMANCE

FOR SWITCHING REGULATOR POWER SUPPLY APPLICATIONS



ONE THF CAPACITOR CAN REPLACE UP TO FOUR CSR TYPES

The THF is designed to provide stable capacitance, low impedance, and higher ripple current capability at high frequency. A patented special configuration anode offers lower ESR and impedance at frequencies above 1 kHz through 100 kHz. The lower power loss characteristics of the THF makes it suitable for output filtering in switching regulator power supplies.

The inherent electrical stability and lower power loss of the THF allows it to carry the same ripple current that would require up to four conventional solid tantalum capacitors. Savings in cost, space, and weight can be realized by use of the THF in high frequency ripple current applications.

The military version of the THF is approved to meet all the requirements of military specification MIL-C-39003/9 Style CSR21. Refer to Bulletin 4-819 for specifications and MIL part numbers. Refer to TIB 4-805B for complete details.

SPECIFICATIONS

- **Capacitance**
  5.6 to 330 μF
- **Voltage**
  6 to 50 VDC
- **Tolerance**
  Standard ±20%—±10% optional
- **Temperature**
  −80°C to +125°C
- **Case Size**
  2 sizes, .29 x .69 & .35 x .79 inches

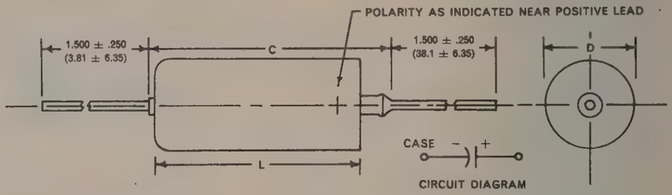
KEY FEATURES

- High Ripple Current
- Low ESR
- Lower Impedance at High Frequencies
- Small Size
- Extremely Stable Capacitance
- Hermetic Seal
- Long Life

APPLICATIONS

- Switching Regulators
- High Frequency Power Supplies
- By-pass Filtering

SIZE AND CONFIGURATIONS



CASE CODE	UNINSULATED CASE DIMENSIONS D +.016 −.010 IN. (+.41 −.25mm)	UNINSULATED CASE DIMENSIONS L ±.031 IN. (±.79mm)	INSULATED CASE DIMENSIONS D +.016 −.010 IN. (+.41 −.25mm)	INSULATED CASE DIMENSIONS L ±.031 IN. (±.79mm)	OVERALL DIMENSIONS C MAX. IN. (mm)	LEAD DIAMETER A +.005 −.001 IN. (+.127 −.025mm)
F	.279 (7.08)	.650 (16.5)	.289 (7.34)	.686 (17.4)	.822 (20.9)	.025 (.635)
G	.341 (8.66)	.750 (19.1)	.351 (8.91)	.786 (19.9)	.622 (23.4)	.025 (.635)

MAXIMUM CAPACITANCE—VOLTAGE PER CASE SIZE

CASE CODE	WORKING VOLTAGE (WVDC) 6	10	15	20	35	50
	MAXIMUM CAPACITANCE IN μF					
F	180	120	68	47	22	18
G	330	220	150	100	47	22

MAXIMUM RIPPLE CURRENT @ 100 kHz PER RATED WORKING VOLTAGE @ 25°C

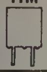
WVDC	6	10	15	20	35	50
MAXIMUM RMS RIPPLE IN mA	4300	3900	3600	3300	2700	2300

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

TANTALUM SOLID ELECTROLYTIC CAPACITORS

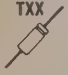
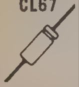
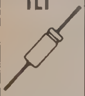
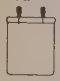
TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	Volt. Range (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB*
TAS TXA 	Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG 24 AWG	−80 to +125	6 to 100	.0047 to 1000	±5 ±10 ±20	.125x.250 .175x.438 .279x.650 .341x.750	Standard Capacitance - TAS Extended Capacitance - TXA Low DC Leakage Temperature Stable High Capacity, Long Shelf Life	4-801A
TFR 	Metal Case, Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG	−55 to +125	6 to 50	22 to 330	±5 ±10 ±20	.289x.686 .351x.786	MIL-C-39003 CSR21 High Frequency, High Ripple Capability, High Reliability	4-819A
TER TXE TXR 	Mylar Sleeved, Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 100	.0047 to 1000	±5 ±10 ±20	.135x.286 .185x.474 .289x.686 .351x.786	MIL-C-39003D CSR13, 23, 33 High Reliability	4-813A
TNR 	Metal Tubular, Axial Lead Non Polar	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 100	.0023 to 160	±5 ±10 ±20	.161x.575 .207x.955 .314x1.35 .376x1.55	MIL-C-39003D CSR 91 High Reliability, Non-Polar Application	4-815A
THF 	Mylar Sleeved, Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG	−80 to +125	6 to 50	5.6 to 330	±10 ±20	.289x.686 .351x.786	4.5 Amps Ripple Capability, Low ESR at High Freq. from 1 kHz-100 kHz	4-805B
TAN TXN 	Metal Case Tubular Hermetic Seal	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 50 VNP	2.8 to 500	±5 ±10 ±20	.161x .575 .207x .955 .314x1.350 .376x1.550	Non-Polar, Standard and Extended Range Capacity	4-817
TIM 	Rectangular, Molded Epoxy Radial Lead	Wire Leads Single Ended 22 AWG 24 AWG	−55 to +125	3 to 50	.082 to 220	±10 ±20	.340x.228x.105 .225x.285x.170 .335x.360x.170 .375x.600x.195	High Density Mounting, Automatic Insertion Capability	4-806B
TAC 	Molded Epoxy, Tubular, Axial Lead	Wire Leads 22 AWG 24 AWG	−55 to +125	3 to 50	.082 to 68	±10 ±20	.105x.300 .148x.350 .180x.350 .200x.540	Automatic Insertion Capability, High Shock & Vibration Capability	4-807D
TDM 	Epoxy Dipped, Rectangular Radial Lead	Wire Leads Single Ended 24 AWG	−55 to +85	6 to 50	.10 to 330	±10 ±20	.27x.27x.18 .33x.32x.21 .37x.40x.22 .40x.40x.25 .46x.48x.32 .56x.58x.32	Low Profile, Low Cost, High Volumetric Efficiency	4-810B
TDC 	Plastic Dipped, Radial Lead	Wire Leads LD Spacing .125 & .250	−55 to +85	6 to 50	.10 to 330	±10 ±20	.17x.35 .25x.50 .35x.65 .40x.75	Low Cost, Extended Capacitance, Temp. Stable, Long Storage Life	4-810B
TDL 	Plastic Dipped, Radial Lead	Wire Leads LD Spacing .10 & .20	−55 to +85	3 to 50	.10 to 330	±10 ±20	.18x.28 .20x.30 .26x.36 .34x.40 .40x.56 .44x.68	Low Cost, Low Profile, Long Storage Life	4-810B
TDR 	Plastic Dipped, Radial Lead	Wire Leads Lead Space .125 & .250	−55 to +85	6 to 50	.10 to 330	±10 ±20	.175x.350 .250x.500 .350x.650 .400x.750	MIL-C-49137/2 CX02 CX12	4-816

* Technical Information Bulletin

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

TANTALUM WET SLUG CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	Volt. Range (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB*
TLX TXX 	Silver Tubular, Axial Lead, Hermetic Seal Mylar Sleeve	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-39006 CLR65 & CLR69 High CV, Long Life, High Reliability	4-612A
CL66 CL67 	Silver Tubular, Axial Lead, Hermetic Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 ±20	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-3965 CL66, CL67 Rugged Construction Long Life	4-613
TLW 	Silver Tubular, Axial Lead, Hermetic Seal Kapton Sleeve	Wire Leads 22 AWG	−55 to +175	6 to 100	2.5 to 1200	±5 ±10 ±2	.219x .608 .312x .796 .406x .921 .406x1.217	High Cap, High Temp. to 175°C	4-611B
TLT 	Tantalum Case, Tubular, Axial Lead Hermetic Seal	Nickel Wire Heads 22 AWG	−55 to +125	6 to 100	2.5 to 1200	±5 ±10 ±20	.312x .796 .406x .921 .406x1.217	MIL-C-39006 CLR79 High CV Reverse Voltage Capability, High Reliability	4-616C
TLS TLH 	Silver Tubular, Axial Lead Elastomer Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-3965 Styles CL64 & CL65, Low DCL, Wide Temp. Range	4-604
CTL 	Copper Alloy Tubular, Axial Lead Elastomer Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	3.6 to 1200	±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	Low Cost, Low DCL, Wide Temp. Range	4-610A
CMT 	Copper Alloy Tubular, Red Plastic, Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	1 to 450	±20	.115x.300 .115x.403 .145x.600 .225x.778	Low Cost, High Cap, Miniature Size	4-609A
MTP 	Silver Tubular, Red Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	3.3 to 470	±20	.115x.300 .115x.403 .145x.600 .225x.778	High Cap, Miniature Size	4-606A
MTPH 	Silver Tubular, Red Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	4.7 to 470	±10 ±20	.115x.403 .145x.600 .225x.778	High Reliability, Miniature Size	4-614
TAP 	Silver Tubular, Black Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 90	2 to 330	−15 +75 −15 +50 −15 +20 −10 +20 ±10	.226x.504 .226x.560 .226x.847	Low ESR, Miniature Size	4-602
TNT 	Silver Tubular, Yellow Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	3 to 50	2 to 80	−15 +75	.163x.347 .163x.472	Low DCL, Miniature Size	4-601
TAH 	Silver Tubular, Green Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +125	4 to 60	2 to 330	−15 +75 ±10 −10 +20 −15 +20 −15 +50	.238x.470 .238x.600 .238x.810	Miniature Size, Wide Temp. Range, Low DCL	4-603
XTM XTK XTH XTL XTV 	Metal Can, Single or Dual Ended, Hermetic Seal	Wire Leads, Screw, Stud, Solder Lug, Turret	−55 to +200	20 to 900	2 to 2200	−15 +75 −15 +50 ±20	.656x.438x1.78 .875x.540x4.06 1.13 x.600x2.81	MIL-C 39006 CLR10, 14 & 17 High Reliability, Rugged Construction Very High Temp., High Cap & Voltage	4-84A
TL 	Metal Case, Rectangular, Glass to Metal Seal	Solder Lugs	−55 to +125	15 to 150	70 to 2400	±20	1.062x1.275x.690 1.375x1.275x.690 1.625x1.275x.690 2.000x1.275x.690 2.500x1.275x.690	MIL-C-3965 Style CL55, Low DCL, Wide Temp. Range	4-79A

* Technical Information Bulletin

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

ALUMINUM ELECTROLYTIC CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLTAGE RANGE (WVDC)	CAP. RANGE (µF)	STANDARD TOLERANCE (% µF)	CASE SIZES DIA.xLGTH. (INCHES) HxWxD (INCHES)	FEATURES	TIB*
TT	Aluminum Tubular, Axial Lead	Wire Leads	−40 to +85	3 to 150	1 to 2400	±20%	.25 x .50 to .68 .312x .687 to .81 .375x .687 to 1.50 .438x1.25 to 1.5 .485x1.25 to 1.75	Miniature, All Welded Construction Low DCL, Low ESR	4-104B
TCW	Aluminum Tubular, Axial Lead	Wire Leads	−20 to +85	3 to 450	2 to 36,000	−10 +75 −10 +50	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.75 .87x1.37 to 3.12 1.00x1.37 to 3.89	All Welded Construction	4-103
TCX	Aluminum Tubular, Axial Lead	Wire Leads	−55 to +105	3 to 150	12 to 26,000	−10 +75 −10 +50	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.62 .87x1.12 to 3.12 1.00x1.12 to 3.62	High Temperature Computer Grade Low DCL, Low ESR All Welded Constructeion	0-311
TCG	Aluminum Tubular, Axial Lead	Wire Leads	−40 to +85	6 to 450	3 to 23,000	−10 +75 −10 +50 −10 +100	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.62 .87x1.12 to 3.12 1.00x1.12 to 3.62	Computer Grade High Cap, Low DCL, Low ESR All Welded Construction	4-307
VPR	Aluminum Can, Vertical Mount Single Ended	Wire Leads, Plug-in	−55 to +105	6 to 150	22 to 20,000	−10 +100 −10 +75 −10 +50	.50x1.00 to 1.62 .75x1.12 to 3.62 .87x1.12 to 3.62 1.00x1.12 to 3.62	Miniature, All Welded Low DCL, Low ESR Low ESL, High Temperature, High Ripple Current	4-106
FP **PFP**	Aluminum Can, Twist-Tab or PC Vertical Mount	Solder Lugs, Wire Wrap, PC Lugs	−30 to +85	6 to 450	22 to 20,000	−10 +150 −10 +100 −10 +50	.75x1.50 to 3.00 1.00x1.50 to 4.00 1.37x1.50x5.00	Single or Multi-Section	4-101
CGS	Aluminum Can, Bracket Mount	Solder Lugs, Screw Inserts	−40 to +85	3 to 450	10 to 920,000	−10 +75 −10 +50	1.00x1.75 to 4.12 1.37x1.75 to 5.62 1.75x2.12 to 5.62 2.00x2.12 to 5.62 2.50x3.12 to 5.62 3.00x3.62 to 8.62	Computer Grade Low DCL, Low ESR High Performance	4-303

*Technical Information Bulletin

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

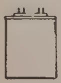
MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

ALUMINUM ELECTROLYTIC CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLTAGE RANGE (WVDC)	CAP. RANGE (µF)	STANDARD TOLERANCE (% µF)	CASE SIZES DIA.xLGTH. (INCHES) HxWxD (INCHES)	FEATURES	TIB*
CGR	Aluminum Can, Bracket Mount	Low or High Post Screw Inserts	−55 to +85	3 to 150	140 to 320,000	−10 +75 −10 +50	1.37x1.75 to 5.62 1.75x2.12 to 5.62 2.00x2.12 to 5.62 2.50x3.12 to 5.62 3.00x3.62 to 5.62	Computer Grade Low DCL, Extremely Low ESR High Ripple Current	4-313
CGO	Aluminum Can Bracket Mount	Low or High Post Screw Inserts	−55° to +85	5 to 55	2800 to 67000	−20 +20	1.37 x 2.12 to 5.62	Low, Controlled ESR ±30% Symmetrical Capacitance Tolerance High Ripple Current	4-314
SFC	Aluminum Can, Bracket or Buss-Bar Mount	Buss-Bar Screw	−40 to +85	6 to 50	6800 to 100,000	−0 +100	3.00x4.12 3.00x5.62	Computer Grade Low DCL, Ultra-Low ESR, Ultra-High Ripple Capability Low ESL	4-310
HC **NP**	Bakelite Case, Single Ended	Screw	−20 to +85	3 to 450 3 to 450NP	65 to 40,000 30 to 32,000	−10 +150 −10 +100 −10 +50 ±25%	1.44x2.75 to 2.06x4.37	**Rugged Hi-Pot Case, Versatile Mounting** **NP—Non-Polar**	4-301

MOTOR START & MOTOR RUN CAPACITORS

P	Bakelite Case, Round Single Ended	Screw, Solder Lugs, Quick Connect	−40 to +65	AC Volts 110 to 330	21 to 1326	−0 +20	1.44x2.75 to 4.37 1.81x3.37 to 4.37 2.06x3.37 to 4.37 2.56x4.37	Motor Start, Intermittent AC Duty EIA Type 1 & 2	4-401
CRN	Terne Plate Steel Can, Round, Oval & Rectangular, Single Ended	Quick Connect, Solder Lugs	−55 to +70 (PCB Free)	AC Volts 170 to 660	1 to 60	±10% ±6%	1.69x2.16x1.31 to 9.50x3.66x1.97	**Motor Run, Continuous AC Duty Non-PCB**	4-403A
MPD **MPF** 	Terne Plate Steel Can, Round & Flat Oval Single Ended	Quick Connect Solder Lugs	−40 to +70 (PCB Free)	AC Volts ≤240V Dry 330V to 440V w/Fluid	3 to 70 µF	±10% ±6%	1¾″ Dia., 2″ Dia. 2½″ Dia. 2⅝″—5¾″ HT. plus Flat Ovals	Motor Run Continuous AC Duty Non-PCB Metallized Film	4-404B

*Technical Information Bulletin

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

AC-METALLIZED POLYPROPYLENE FILM CAPACITORS

NON-PCB TYPE CAPACITORS

SPECIFICATIONS

- **Capacitance**
  2 to 70 μF
- **Voltage**
  180 VAC to 240 VAC-Dry
  330 VAC to 440 VAC-Oil Filled
- **Operating Frequency**
  50 to 60 Hertz
- **Capacitance Tolerance**
  ±10% Standard and ±6% Special
- **Dissipation Factor**
  0.1% Max.
- **Case Temperature**
  −40°C to +70°C (Std.)
  −40°C to +90°C (Optional)
- **Case Styles**
  Round, Flat Ovals
- **Case Sizes**
  Round 1¾″, 2″, 2½″ dia.
  Flat Oval 1¼″, 1½″, 1¾″, 2″ industry types
  Height 2⅝″ up to 5¾″

KEY FEATURES

- Internal Protector
- Environmentally Acceptable with Biodegradable Dielectric Fluid
- Wide Range of Case Styles and Sizes
- Long Life and High Reliability
- Double Rolled Seams
- Steel Cases

SUGGESTED APPLICATIONS

- Air Conditioning
- Business Machines
- Fan Motors
- Power Supplies
- Refrigeration
- Industrial Control
- Phase Shifting
- H.I.D. Lighting

NON-PCB WITH U.L. RECOGNIZED PROTECTOR

Mallory Non-PCB capacitors contain Metallized Polypropylene Dielectric and a biodegradable fluid for environmental compatibility. They also incorporate a U.L. recognized internal protective device to minimize the hazard of case rupture in the event of capacitor failure. These capacitors are useful in a variety of applications where continuous operation is required on the normal AC Power source available in home and industry.

They offer good reliability and long life and are designed to meet the intent of EIA Standard RS-456 — characteristic "E" or "F."

FOR COMPLETE DETAILS
WRITE FOR TECHNICAL INFORMATION BULLETIN 4-404B

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. EM, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

Mepco//Electra
A NORTH AMERICAN PHILIPS COMPANY

Reliability across the board™

TANTALUM SOLID, WET AND CHIP CAPACITORS

5900 Australian Avenue, West Palm Beach, FL 33407 (305) 842-3201 TWX: 510-952-7618

MIL SLASH NO.	DESIGNATION		M/E STYLE	DESCRIPTION	CAPACITANCE RANGE	VOLTAGE RANGE
WET SLUG MIL-C-3965						
/1	CL14	CL16	43XW	Hermetic Seal, Screw Mount, Cylindrical Case	3.5- 200 µf	20-630v
/19	CL17	CL18	43XW	Hermetic Seal, Stud Mount, Cylindrical Case	12-1300 µf	30-630v
/21	CL55		43JW	Hermetic Seal, Rectangular Module	70-2400 µf	15-150v
/4	CL64	CL65	40LW	Elastomer Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
/24	CL66	CL67	40SW	Hermetic Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
MIL-C-39006				Established Reliability		
/18	CLR10		43XW	Extended Range, Axial Lead, Tubular Case	2.0- 140 µf	8-360v
/19	CLR14		43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	3.5- 200 µf	20-630v
/20	CLR17		43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	12-1300 µf	30-630v
/09D	CLR65-	8000	40SW	Glass-to-Tantalum Hermetic Seal, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
/22C	CLR79		40AW	Hermetic Seal, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
SOLID SLUG MIL-C-26665B						
	CS12	CS13	40SS	Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
MIL-C-39003				Established Reliability		
/02	CSR09		40TS	Polar, Miniature, Hermetic Seal, Axial Lead, Tubular Case	.047- 18 µf	6- 75v
/01	CSR13		40SS	Polar, Extended Range, Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
/03	CSR23		40XS	Polar, Hermetic Seal, Axial Lead, Tubular Case	1.2-1000 µf	6- 50v
/06	CSR33		40YS	Polar, Extended Range, Hermetic Seal, for Low Impedance Application	1.2-1000 µf	6- 50v
/04	CSR91		40NS	Non-Polar, Hermetic Seal, Axial Lead, Tubular Case	.0023- 160 µf	6-100v
SOLID CHIP MIL-C-55365/4				Established Reliability		
	CWR06		49BC	Polar Hybrid Tantalum Chip	.1- 100 µf	4- 50v
WET SLUG						
	40AW			Hermetic, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
	40CW			Miniature, Polar, Non-Hermetic, Tubular, Axial Lead	3.3- 450 µf	6- 60v
	40EW			Extended Range, Polar, Non-Hermetic, Tubular, Axial	6.8-1800 µf	6-125v
	43JW			Hermetic, Rectangular Module, Spade Lugs	35-22,000 µf	6-150v
	40LW			Polar, Non-Hermetic, Tubular, Axial Lead	1.7-1100 µf	6-125v
	40PW			Polar, Non-Hermetic, Tubular, Axial Lead	1.7-1100 µf	6-125v
	40SW			Hermetic, Polar, Glass to Tantalum Seal, Tubular, Axial	1.7-1200 µf	6-125v
	40TW			Hermetic, Non-Silver Case, Tubular, Axial, High Temp.	1.7-1200 µf	6-125v
	43XW			Hermetic, Cylindrical Case, Stud or Screw Mount	3.5-1300 µf	20-630v
	40YW			Miniature, Non-Acid Electrolyte, Polar, Tubular, Non-Hermetic	0.1- 320 µf	6- 60v
SOLID CHIP						
	49BC			Polar, Hybrid Chip Tantalum Capacitor	0.1- 100 µf	4- 50v
SOLID MOLDED MIL-C-49137/5						
	CX05		40MS	Polar, Molded, Non-Hermetic, Axial Lead	0.1- 68 µf	2- 50v
SOLID SLUG						
	40CS			Polar, Miniature Non-Hermetic, Tubular Metal Case, Axial Lead	.0047- 68 µf	2- 50v
	41DS			Polar, Dipped, Non-Hermetic, Radial Lead	0.1- 330 µf	6- 50v
	40ES			Polar, Non-Hermetic, Tubular Metal Case, Axial Lead	.0047- 330 µf	6-100v
	47ES			Polar, Hermetic, Feed-Thru, Screw Mount	3.9- 60 µf	6- 75v
	41GS			Polar, Dipped, Non-Hermetic, Miniature, Radial Lead	0.1- 680 µf	3- 50v
	41KS			Polar, Dipped, Low Profile, Non-Hermetic, Radial Lead	0.1- 270 µf	6- 35v
	40MS			Polar, Molded, Non-Hermetic, Axial Lead	0.1- 68 µf	2- 50v
	40NS			Non-Polar, Hermetic, Tubular Case, Axial Lead	.0023- 160 µf	6-100v
	41PS			Polar, Non-Hermetic, Rectangular Plastic Case, Radial Lead	0.1- 220 µf	6- 50v
	40SS			Polar, Standard Hermetic, Tubular Case, Axial Lead	.0047- 330 µf	6-100v
	40TS			Polar, Miniature Hermetic, Tubular Case, Axial Lead	.0047- 39 µf	4-100v
	40XS			Polar, Extended Range, Hermetic Tubular, Axial Lead	0.82-1000 µf	6- 60v
	40YS			Polar, Extended Range, Hermetic, For Low Impedance Applications	1.2-1000 µf	6- 50v

TANTALUM WET FOIL CAPACITORS

6071 St. Andrews Road, Columbia, SC 29210 (803) 772-2500 TWX: 810-666-2622

MIL SLASH NO.	DESIGNATION		M/E STYLE	DESCRIPTION	CAPACITANCE RANGE	VOLTAGE RANGE
WET FOIL MIL-C-3965						
/17	CL20	CL21	40AF	Polar, Etched Foil, Tubular Case, Axial Lead	1- 580 µf	15-150v
/18	CL22	CL23	40BF	Non-Polar, Etched Foil, Tubular Case, Axial Lead	0.5- 350 µf	15-150v
/15	CL30	CL31	40AG	Polar, Plain Foil, Tubular Case, Axial Lead	0.27- 300 µf	3-300v
/16	CL32	CL33	40BG	Non-Polar, Plain Foil, Tubular Case, Axial Lead	0.12- 400 µf	3-300v
/9	CL51		43KG	Polar, Plain Foil, KSR, Hermetic Rectangular Module	40- 960 µf	15-150v
/10	CL52		43JG	Non-Polar, Plain Foil, KSR, Hermetic Rectangular Module	20- 600 µf	15-150v
/11	CL53		43KF	Polar, Etched Foil, KSR, Hermetic Rectangular Module	70-3500 µf	15-150v
/12	CL54		43JF	Non-Polar, Etched Foil, KSR, Hermetic Rectangular Module	35-2100 µf	15-150v
/22	CL70	CL71	40RF	Polar, High Etched Foil, Tubular Case, Axial Lead	16- 920 µf	15-150v
/23	CL72	CL73	40SF	Non-Polar, High Etched Foil, Tubular Case, Axial Lead	0.75- 590 µf	15-150v
MIL-C-39006				Established Reliability		
/01	CLR25		40EF	Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	1.0- 580 µf	15-150v
/02	CLP27		40FF	Non-Polar, Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.5- 350 µf	14-150v
/03	CLR35		40EG	Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.35- 160 µf	15-200v
/04	CLR37		40FG	Non-Polar, Plain Foil, Hermetic and Non-Hermetic, Axial Lead	0.15- 100 µf	15-200v
/16	CLR71		40TF	Polar, High Etched Foil, Hermetic and Non-Hermetic, Axial Lead	1.6- 920 µf	15-150v
/17	CLR73		40VF	Non-Polar, High Etched Foil, Hermetic and Non-Hermetic, Axial Lead	0.75- 590 µf	15-150v

Mepco//Electra
A NORTH AMERICAN PHILIPS COMPANY

Reliability across the board™

ALUMINUM ELECTROLYTIC CAPACITORS

6071 St. Andrews Road, Columbia, SC 29210 (803) 772-2500 TWX: 810-666-2622

Mepco/Electra Series	Operating Temp.	D.C.V. Range	Capacitance Range (µf)	Standard Cap. Tolerance	Min. Case Size In Inches	Max. Case Size In Inches	Min. Case Size In MM	Max. Case Size In MM	Life*
3050 Axial	−40 to +85°C	6V to 450V	3 to 28,000	−10 +50% −10 +75%	.5X 1.125	1.0X 3.625	12.7X 28.57	25.4X 92.07	2000 Hrs.
3052 Axial	−55 to +105°C	5V to 250V	17 to 38,000	−10 +50% −10 +75%	.625X 1.125	1.0X 3.625	15.9X 28.57	25.4X 92.07	2000 Hrs.
3070 Miniature Axial	−40 to +85°C	6.3V to 385V	.33 to 10,000	−10 +50% ±20	.177X .394	.827X 1.575	4.5X 10.0	21.0X 40.0	2000 Hrs.
3120 Computer Grade	−55 to +105°C	6V to 300V	110 to 700,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	2000 Hrs.
3126 Computer Grade	Per Mil-C-39018/04	5V to 150V	220 to 220,000	−10 +50%	1.375X 2.125	3.0X 5.625	34.92X 53.97	76.2X 142.88	Per M39018/04
3186 Computer Grade	−40 to +85°C	5V to 450V	75 to 650,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	1000 Hrs.
3188 Computer Grade	−40 to +85°C	5V to 400V	170 to 590,000	−10 +50% −10 +75%	1.375X 2.125	3.0X 8.625	34.92X 53.97	76.2X 219.07	2000 Hrs.
3189 Computer Grade	−40 to +85°C	5V to 75V	3200 to 760,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	1000 Hrs.
3190 Computer Grade	−40 to +85°C	3V to 75V	2700 to 650,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3191 Computer Grade	−55 to +85°C	5V to 55V	2800 to 200,000	+20%	1.375X 2.125	2.0X 5.625	34.92X 53.97	50.8X 142.87	2000 Hrs.
3194 Computer Grade	−55 to +105°C	150V to 250V	290 to 11,000	−10 +50%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3195 Computer Grade	−40 to +85°C	5V to 100V	2800 to 1,200,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	1000 Hrs.
3196 Computer Grade	−40 to +85°C	3V to 100V	1600 to 1,000,000	−10 +50% −10 +75%	1.375X 3	2.125X 8.625	34.92X 76.20	53.97X 219.07	2000 Hrs.
3427 Radial	−40 to +85°C	6.3V to 450V	12 to 35,000	−10 +50% −10 +75%	.750X 1.125	1.0X 3.625	19.1X 28.6	25.4X 92.1	2000 Hrs.
3428 Radial	−55 to +105°C	6.3V to 250V	19 to 17,000	−10 +50% −10 +75%	.750X 1.125	1.0X 3.625	19.1X 28.6	25.4X 92.1	2000 Hrs.
3475 Miniature Radial	−40 to +85°C	6.3V to 100V	.22 to 4700	±20%	.197X .433	.630 1.221	5.0X 11.0	16.0X 31.07	1000 Hrs.
3476 Miniature Radial	−40 to +85°C for 100V or less −25 to +85°C for 160V or greater	6.3V to 450V	0.47 to 10,000	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3477 Miniature Radial	−40 to +85°C	6.3V to 100V	0.1 to 4,700	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3478 Miniature Radial	−40 to +80°C	6.3V to 50V	0.1 to 100	±20%	.197X .55	.394X .591	5X 14	10x 15	1000 Hrs.
3479 Miniature Radial	−40 to +85°C	10V to 100V	470 to 22,000	±20%	.866X 1.181	1.181X 2.008	22X 30	30X 51	1000 Hrs.
3480 Miniature Radial	−55 to +105°C	6.3V to 100V	0.47 to 10,000	±20%	.197X .433	.709X 1.399	5X 11	18X 40	1000 Hrs.
3481 Miniature Radial	−55 to +105°C	10V to 100V	2.2 to 1000	−10 +100%	.315X .453	.492X 1.673	8X 11.5	12.5X 42.5	2000 Hrs.
3482 Miniature Radial	−55 to +105°C	7.5V to 100V	82 to 16,500	−10 +75%	.752X 1.252	1.000X 3.626	19.1X 31.8	25.4X 92.1	2000 Hrs.
3487 Snap-In	−40 to +85°C	6.3V to 250V	22 to 100,000	±20%	.866X 1.0	1.575X 3.15	22X 25	40X 80	1000 Hrs.
3500 A.C. Motor Start	−20 to +65°C	110V to 330V	21-25 thru 1000-1200	±20%	1.44X 2.75	2.56X 4.38	3.66X 6.99	6.50X 17.75	40K to 75K Starts

* Life: If capacitors are operated properly, life should exceed 10 yrs. Measured at max. temp. with full applied voltage.

Mepco//Electra

A NORTH AMERICAN PHILIPS COMPANY

Reliability across the board™

FILM CAPACITORS

6071 St. Andrews Road, Columbia, SC 29210 (803) 772-2500 TWX: 810-666-2622

MEPCO/ELECTRA SERIES NEW	PREVIOUS	12 NC	CONSTRUCTION	ENCLOSURE	LEAD	VOLTAGE VDC/VAC	CAPACITANCE RANGE (μF)	TOLERANCE ±%
POLYESTER								
708D1	61F & AE	—	FILM/FOIL	WRAP & POT	AXIAL	80-200 VDC AVAILABLE TO 600	.001 THRU 1.0 AVAILABLE TO 2.0	2, 5, 10
708D2	63F (CTM)	—	FILM/FOIL	WRAP & POT	AXIAL	50-300 VDC (125°C)	.001 THRU 1.0	5, 10
711D1	75F	—	FILM/FOIL	MOLDED	RADIAL	50-600 VDC	.001 THRU 1.0	5, 10
713D1	C350	347	FILM/FOIL	CONFORMAL	RADIAL	VDC 100, 250, 400, 630 VAC 50, 80, 125, 200	.001 THRU 1.0	10
719D1	65F	—	FILM/FOIL	POTTED	RADIAL	50 VDC	.001 THRU 1.0	5, 10
701A1	C281A	341	METALIZED	MOLDED	AXIAL	VDC 100, 250, 400 VAC 63, 160, 220	.01 THRU 4.7	5, 10
708A1	BA	—	METALIZED	WRAP & POT	AXIAL	100-200 VDC	.10 THRU 10.0	5, 10
713A1	C280	342/352	METALIZED	CONFORMAL	RADIAL	VDC 100, 250, 400, 630 VAC 63, 160, 220, 220	.001 THRU 6.8	10, 20
712A1	—	365-368	METALIZED	EPOXY	RADIAL	VDC 63, 100, 250, 400 VAC 40, 63, 160, 220	.001 THRU 6.8	5, 10
719A1	C280MA	344	METALIZED	POTTED	RADIAL	VDC 63, 100, 250, 400 VAC 40, 63, 160, 220	.01 THRU 10.0	5, 10
POLYCARBONATE								
708G1	74F51	—	FILM/FOIL	WRAP & POT	AXIAL	100-200 VDC	.001 THRU 1.0	5, 10
701B1	C281C	341	METALIZED	MOLDED	AXIAL	VDC 100, 250, 400, 630, 1000 VAC 63, 160, 220, 220, 250	.01 THRU 4.7	5, 10
708B1	74F01	—	METALIZED	WRAP & POT	AXIAL	100-200 VDC	.10 THRU 10.0	5, 10
719B1	C280MC	344	METALIZED	POTTED	RADIAL	100-630 VDC 63-220 VAC	.01 THRU 6.8	5, 10
POLYSTYRENE								
704C1	POCO	424-431	FILM/FOIL	WRAPPED	AXIAL	VDC 63, 160, 250, 630 VAC 25, 63, 125, 200	51PF THRU .039	1, 2, 5
708C1	—	444-447	FILM/FOIL	WRAP & POT	AXIAL	VDC 63, 160, 250, 630 VAC 25, 63, 125, 250	.0068 THRU .160	1, 2, 5
719C1	—	443	FILM/FOIL	POTTED	RADIAL	VDC 63 VAC 25	100 PF THRU .033	1% ONLY
POLYPROPYLENE								
704E1	—	455-459	FILM/FOIL	WRAPPED	AXIAL	VDC 63 160, 250 VAC 25, 63, 125	47 PF THRU .022	2, 5
719E1	—	357-5	FILM/FOIL	POTTED	RADIAL	VDC 250 VAC 160	.39 THRU .82	5, 10
719H1	—	357-6/9	METALIZED	POTTED	RADIAL	VDC 630, 1000, 1500, 2000 VAC 300, 400, 600, 700	.001 THRU .33	5, 10
711H1	—	—	METALIZED	MOLDED (CAN)	TERMINAL	TO 330 VAC	5 THRU 70 MFD	3, 6, 10
POLYESTER & PAPER — CLASS X VDE APPROVED								
701J1	—	330	METALIZED	MOLDED	AXIAL	250 VAC	.01 THRU .47	10, 20
719J1	—	330	METALIZED	POTTED	RADIAL	250 VAC	.01 THRU 1.0	10, 20

VARIABLE CAPACITORS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437

FILM DIELECTRIC

Mepco/Electra Part Number (Type)	Capacitance Range (pf)	Dielectric Material	Operating Temperature Range
2800C (808/HT 10/C010)	1-5 to 12-120	PTFE Teflon® Polypropylene Polycarbonate Polyethylene	−40°C to +85°C or −40°C to +70°C
2800D (809)	1-3.5 to 7-100	PTFE Teflon® or Polyimide/FEP	−40°C to +125°C

TUBULAR CERAMIC DIELECTRIC

Mepco/Electra Part Number (Type)	Capacitance Range (pf)	Dielectric Material	Operating Temperature Range
2500A (801/802)	0.5-3.0 to 1.7-18	Low Loss Ceramic	−50°C to +100°C

For information on Mepco/Electra's RESISTORS/POTENTIOMETERS/MILITARY COMPONENTS, see pages 1B•1012-1013, 1A•1890-1891 and 1A•2046.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

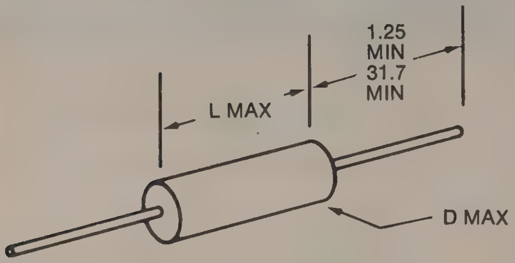
Y

YIG yttrium iron garnet

METUCHEN CAPACITORS INC.

Glass Sealed Axial-Leaded Ceramic Capacitors

RUGGED, RELIABLE, AND IDEAL FOR AUTOMATIC INSERTION



MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Glass to metal seal

LEAD MATERIAL: .020 Dia. — Solderable tinned copper

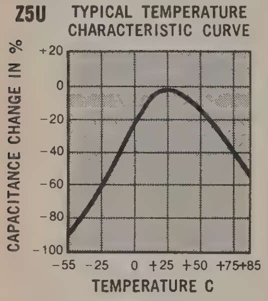
MARKING:

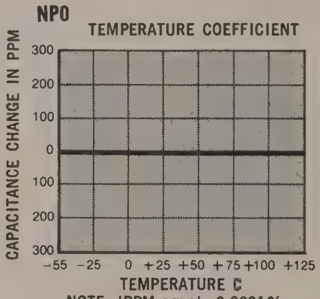
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

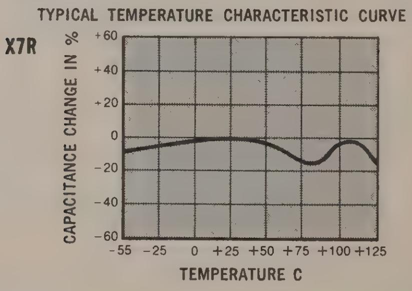
EIA specifications apply regarding Q, TC tol and CAP tol on all units of 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES





NOTE: IPPM equals 0.0001%



HOW TO ORDER

GT07 B CG 101 J

SIZE: GT07

WVDC: (B = 50V)(1) (D = 100V) (F = 200V)

DIELECTRIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:(2)

TOLERANCE:(3)

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC, 200 VDC
2. 101 = 100 pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**

B = ±.1 pF (10 pF and below)	J = ±5% (10 pF and above)
C = ±.25 pF (10 pF and below)	K = 10% (5.6 pF and above)
D = ±.5 pF (10 pF and below)	M = 20% (2.7 pF and above)
F = ±1% (10 pF and above)	Z = +80%, −20% (all values)
G = 2% (10 pF and above)	P = +100%, −0% (GMV — all values)

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55°C to +125°C (EIA Characteristic COG)

DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF

INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%

Meets or exceeds requirements of MIL-C-20

MCI PART NO.	GT07		GT10		GT14		Capacitance Characteristic EIA
L MAX	In. .170	mm 4.32	In. .260	mm 6.60	In. .400	mm 10.16	
D MAX	.100	2.54	.100	2.54	.150	3.81	
Capacitance in pF	WVDC 100	50	WVDC 100	50	WVDC 100	50	
1.0	▨	▨					109
1.2	▨	▨					129
1.5	▨	▨					159
1.8	▨	▨					189
2.2	▨	▨					229
2.7	▨	▨					279
3.3	▨	▨					339
3.9	▨	▨					399
4.7	▨	▨					479
5.6	▨	▨					569
6.8	▨	▨					689
8.2	▨	▨					829
10	▨	▨					100
12	▨	▨					120
15	▨	▨					150
18	▨	▨					180
22	▨	▨					220
27	▨	▨					270
33	▨	▨					330
39	▨	▨					390
47	▨	▨					470
56	▨	▨					560
68	▨	▨	▨	▨			680
82	▨	▨	▨	▨			820
100	▨	▨	▨	▨			101
120	▨	▨	▨	▨			121
150	▨	▨	▨	▨			151
180	▨	▨	▨	▨			181
220	▨	▨	▨	▨			221
270	▨	▨	▨	▨			271
330	▨	▨	▨	▨			331
390	▨	▨	▨	▨	▨	▨	391
470	▨	▨	▨	▨	▨	▨	471
560		▨	▨	▨	▨	▨	561
680		▨	▨	▨	▨	▨	681
820		▨	▨	▨	▨	▨	821
1000			▨	▨	▨	▨	102
1200			▨	▨	▨	▨	122
1500			▨	▨	▨	▨	152
1800			▨	▨	▨	▨	182
2200			▨	▨	▨	▨	222
2700			▨	▨	▨	▨	272
3300				▨	▨	▨	332
3900				▨	▨	▨	392
4700					▨	▨	472
5600					▨	▨	562
6800					▨	▨	682
8200						▨	822
10,000						▨	103

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

METUCHEN CAPACITORS INC.

Glass Sealed Axial-Leaded Ceramic Capacitors

RUGGED, RELIABLE, AND IDEAL FOR AUTOMATIC INSERTION

X7R CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: ±15% from −55°C to +125°C (EIA Characteristic X7R)

DISSIPATION FACTOR: 2.5% maximum at 1 kHz, 25°C

INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarad whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±5%, ±10%, ±20%, +80% −20%, or +100% −0%

Meets or exceeds requirements of MIL-C-39014

MCI PART NO.	GT07		GT10		GT14		Capacitance Characteristic EIA
L MAX	In. .170	mm 4.32	In. .260	mm 6.60	In. .400	mm 10.16	
D MAX	.100	2.54	.100	2.54	.150	3.81	
Capacitance in pF	WVDC 100	50	WVDC 100	50	WVDC 100	50	
10	●	●					100
12	●	●					120
15	●	●					150
18	●	●					180
22	●	●					220
27	●	●					270
33	●	●					330
39	●	●					390
47	●	●					470
56	●	●					560
68	●	●					680
82	●	●					820
100	●	●					101
120	●	●					121
150	●	●					151
180	●	●					181
220	●	●					221
270	●	●					271
330	●	●					331
390	●	●					391
470	●	●					471
560	●	●					561
680	●	●					681
820	●	●					821
1000	●	●					102
1200	●	●	●	●			122
1500	●	●	●	●			152
1800	●	●	●	●			182
2200	●	●	●	●			222
2700	●	●	●	●			272
3300	●	●	●	●	●	●	332
3900	●	●	●	●	●	●	392
4700	●	●	●	●	●	●	472
5600	●	●	●	●	●	●	562
6800	●	●	●	●	●	●	682
8200	●	●	●	●	●	●	822
10,000	●	●	●	●	●	●	103
12,000		●	●	●	●	●	123
15,000		●	●	●	●	●	153
18,000		●	●	●	●	●	183
22,000			●	●	●	●	223
27,000				●	●	●	273
33,000				●	●	●	333
39,000				●	●	●	393
47,000				●	●	●	473
56,000					●	●	563
68,000					●	●	683
82,000					●	●	823
100,000					●	●	104
120,000					●	●	124
150,000					●	●	154
180,000					●	●	184
220,000						●	224
270,000							274
330,000							334

Z5U CHARACTERISTICS

WORKING VOLTAGE: 50/100 VDC

DISSIPATION FACTOR: 3% maximum at 1 kHz, 25°C
Meets or exceeds requirements of MIL-C-11015

TEMPERATURE COEFFICIENT: +22%, −56% from +10°C to +85°C (EIA Characteristic Z5U)

INSULATION RESISTANCE: 100 K megohms or 500 megohm-microfarad, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±20%, +80% −20%, or +100% −0%

Meets or exceeds requirements of MIL-C-11015

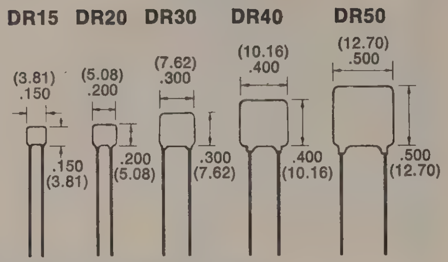
MCI PART NO.	GT07		GT10		GT14		Capacitance Characteristic EIA
L MAX	In. .170	mm 4.32	In. .260	mm 6.60	In. .400	mm 10.16	
D MAX	.100	2.54	.100	2.54	.150	3.81	
Capacitance in pF	WVDC 100	50	WVDC 100	50	WVDC 100	50	
10	●	●					100
12	●	●					120
15	●	●					150
18	●	●					180
22	●	●					220
27	●	●					270
33	●	●					330
39	●	●					390
47	●	●					470
56	●	●					560
68	●	●					680
82	●	●					820
100	●	●					101
120	●	●					121
150	●	●					151
180	●	●					181
220	●	●					221
270	●	●					271
330	●	●					331
390	●	●					391
470	●	●					471
560	●	●					561
680	●	●					681
820	●	●					821
1000	●	●					102
1200	●	●					122
1500	●	●					152
1800	●	●					182
2200	●	●					222
2700	●	●					272
3300	●	●					332
3900	●	●					392
4700	●	●					472
5600	●	●					562
6800	●	●					682
8200	●	●					822
10,000	●	●	●	●			103
12,000	●	●	●	●			123
15,000	●	●	●	●			153
18,000	●	●	●	●			183
22,000		●	●	●			223
27,000		●	●	●	●		273
33,000		●	●	●	●	●	333
39,000		●	●	●	●	●	393
47,000		●	●	●	●	●	473
56,000		●	●	●	●	●	563
68,000			●	●	●	●	683
82,000			●	●	●	●	823
100,000			●	●	●	●	104
120,000				●	●	●	124
150,000				●	●	●	154
180,000				●	●	●	184
220,000				●	●	●	224
270,000				●	●	●	274
330,000					●	●	334
390,000					●	●	394
470,000						●	474
560,000						●	564
680,000						●	684
820,000						●	824
1,000,000						●	105
1,200,000							125
1,500,000							155
1,800,000							185
2,200,000							225

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

METUCHEN CAPACITORS INC.

Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

MCI PART NUMBERS



MAXIMUM PHYSICAL DIMENSIONS

MCI PART NO.	DR15	DR20	DR30	DR40	DR50
S ±.030	.100 (2.54)	.100 (2.54)	.200 (5.08)	.200 (5.08)	.400 (10.16)
D +.004 −.001	.016 (.406)	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)
T MAX	.100 (2.54)	.125 (3.18)	.150 (3.81)	.150 (3.81)	.200 (5.08)
AWG#	26	24	24	24	22

S = Lead spacing D = Lead size T = Body thickness mm are in parentheses

MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Dipped epoxy

LEAD MATERIAL: Solderable tinned copper

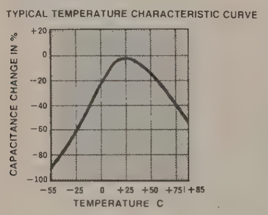
MARKING:
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

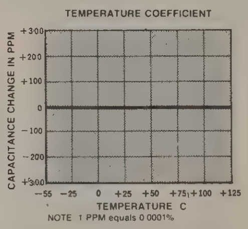
EIA specifications apply regarding Q. TC tol and CAP tol on all units 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

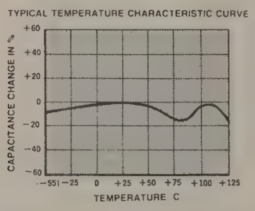
Z5U



NPO



X7R



HOW TO ORDER

DR15 B CG 101 J

SIZE: DR15

WVDC: (B = 50V)(1)
(D = 100V)

DIELECTRIC: (CG = NPO)
(BM = X7R)
(BN = Z5U)

CAPACITANCE CODE:(2)

TOLERANCE:(3)

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC, 200 VDC
2. 101 = 100 pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**
   - B = ±.1 pF (10 pF and below)
   - C = ±.25 pF (10 pF and below)
   - D = ±.5 pF (10 pF and below)
   - F = ±1% (10 pF and above)
   - G = ±2% (10 pF and above)
   - J = ±5% (10 pF and above)
   - K = ±10% (5.6 pF and above)
   - M = ±20% (2.7 pF and above)
   - Z = +80%, −20% (all values)
   - P = +100%, −0% (GMV — all values)

Z5U CHARACTERISTICS

CAPACITANCE RANGE: .001 MFD to 4.7 MFD

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: +22%, −56% from +10°C to +85°C (EIA Characteristic Z5U)

DISSIPATION FACTOR: 3% maximum at 1 kHz, 25°C

INSULATION RESISTANCE: 100 K megohms or 500 megohm-microfarad, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±20%, +80% −20%, or +100% −0%

MCI PART NO.	DR15		DR20		DR30		DR40		DR50		Capacitance Characteristic EIA
Capacitance in pF	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	
1000	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	102
1200	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	122
1500	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	152
1800	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	182
2200	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	222
2700	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	272
3300	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	332
3900	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	392
4700	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	472
5600	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	562
6800	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	682
8200	▨		▨	▨	▨	▨	▨	▨	▨	▨	822
10,000	▨		▨	▨	▨	▨	▨	▨	▨	▨	103
12,000	▨		▨	▨	▨	▨	▨	▨	▨	▨	123
15,000	▨		▨	▨	▨	▨	▨	▨	▨	▨	153
18,000	▨		▨	▨	▨	▨	▨	▨	▨	▨	183
22,000	▨		▨	▨	▨	▨	▨	▨	▨	▨	223
27,000			▨	▨	▨	▨	▨	▨	▨	▨	273
33,000			▨	▨	▨	▨	▨	▨	▨	▨	333
39,000			▨	▨	▨	▨	▨	▨	▨	▨	393
47,000			▨	▨	▨	▨	▨	▨	▨	▨	473
56,000			▨	▨	▨	▨	▨	▨	▨	▨	563
68,000			▨	▨	▨	▨	▨	▨	▨	▨	683
82,000			▨		▨	▨	▨	▨	▨	▨	823
100,000			▨		▨	▨	▨	▨	▨	▨	104
120,000			▨		▨	▨	▨	▨	▨	▨	124
150,000			▨		▨	▨	▨	▨	▨	▨	154
180,000			▨		▨	▨	▨	▨	▨	▨	184
220,000			▨		▨	▨	▨	▨	▨	▨	224
270,000					▨	▨	▨	▨	▨	▨	274
330,000					▨	▨	▨	▨	▨	▨	334
390,000					▨		▨	▨	▨	▨	394
470,000					▨		▨	▨	▨	▨	474
560,000					▨		▨	▨	▨	▨	564
680,000					▨		▨	▨	▨	▨	684
820,000					▨		▨	▨	▨	▨	824
1,000,000					▨		▨	▨	▨	▨	105
1,200,000							▨		▨	▨	125
1,500,000							▨		▨	▨	155
1,800,000							▨		▨		185
2,200,000							▨		▨		225
2,700,000									▨		275
3,300,000									▨		335
3,900,000											395
4,700,000											475

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

METUCHEN CAPACITORS INC.

Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request
TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55° to 125°C (EIA Characteristic COG)
DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF
INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage
DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current
CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%
Meets or exceeds requirements of MIL-C-20

MCI PART NO	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
1.0	▨	▨	▨													109
1.2	▨	▨	▨													129
1.5	▨	▨	▨													159
1.8	▨	▨	▨													189
2.2	▨	▨	▨													229
2.7	▨	▨	▨													279
3.3	▨	▨	▨													339
3.9	▨	▨	▨													399
4.7	▨	▨	▨													479
5.6	▨	▨	▨													569
6.8	▨	▨	▨													689
8.2	▨	▨	▨													829
10	▨	▨	▨	▨	▨	▨										100
12	▨	▨	▨	▨	▨	▨										120
15	▨	▨	▨	▨	▨	▨										150
18	▨	▨	▨	▨	▨	▨										180
22	▨	▨	▨	▨	▨	▨										220
27	▨	▨	▨	▨	▨	▨										270
33	▨	▨	▨	▨	▨	▨										330
39	▨	▨	▨	▨	▨	▨										390
47	▨	▨	▨	▨	▨	▨										470
56	▨	▨	▨	▨	▨	▨										560
68	▨	▨	▨	▨	▨	▨										680
82	▨	▨	▨	▨	▨	▨										820
100	▨	▨	▨	▨	▨	▨										101
120	▨	▨	▨	▨	▨	▨										121
150	▨	▨	▨	▨	▨	▨										151
180	▨	▨	▨	▨	▨	▨										181
220	▨	▨	▨	▨	▨	▨										221
270	▨	▨		▨	▨	▨										271
330	▨	▨		▨	▨	▨										331
390	▨	▨		▨	▨	▨										391
470	▨	▨		▨	▨	▨										471
560	▨	▨		▨	▨	▨										561
680				▨	▨	▨										681
820				▨	▨	▨										821
1000				▨	▨	▨										102
1200				▨	▨	▨	▨	▨	▨							122
1500				▨	▨	▨	▨	▨	▨							152
1800				▨	▨	▨	▨	▨	▨							182
2200				▨	▨	▨	▨	▨	▨							222
2700				▨	▨		▨	▨	▨							272
3300				▨	▨		▨	▨	▨	▨	▨	▨				332
3900				▨	▨		▨	▨	▨	▨	▨	▨				392
4700				▨	▨		▨	▨	▨	▨	▨	▨				472
5600				▨	▨		▨	▨	▨	▨	▨	▨				562
6800							▨	▨	▨	▨	▨	▨				682
8200							▨	▨	▨	▨	▨	▨				822
10,000							▨	▨	▨	▨	▨	▨	▨	▨	▨	103
12,000							▨	▨		▨	▨	▨	▨	▨	▨	123
15,000							▨	▨		▨	▨	▨	▨	▨	▨	153
18,000							▨	▨		▨	▨	▨	▨	▨	▨	183
22,000							▨	▨		▨	▨	▨	▨	▨	▨	223
27,000										▨	▨	▨	▨	▨	▨	273
33,000										▨	▨	▨	▨	▨	▨	333
39,000										▨	▨		▨	▨	▨	393
47,000										▨	▨		▨	▨	▨	473
56,000													▨	▨	▨	563
68,000													▨	▨		683
82,000													▨	▨		823
100,000													▨	▨		104

X7R CHARACTERISTICS

TEMPERATURE COEFFICIENT: ±15% from −55°C to +125°C (EIA Characteristic X7R)
DISSIPATION FACTOR: 2.5% maximum at 1 kHz, 25°C
CAPACITANCE TOLERANCES AVAILABLE: ±5%, ±10%, ±20%, +80% −20%, or +100% −0%
Meets or exceeds requirements of MIL-C-39014
Working Voltage, Insulation Resistance and Dielectric Strength same as NPO Radial

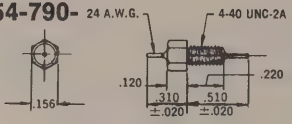
MCI PART NO.	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
10	▨	▨	▨													100
12	▨	▨	▨													120
15	▨	▨	▨													150
18	▨	▨	▨													180
22	▨	▨	▨													220
27	▨	▨	▨													270
33	▨	▨	▨													330
39	▨	▨	▨													390
47	▨	▨	▨													470
56	▨	▨	▨													560
68	▨	▨	▨													680
82	▨	▨	▨													820
100	▨	▨	▨	▨	▨	▨										101
120	▨	▨	▨	▨	▨	▨										121
150	▨	▨	▨	▨	▨	▨										151
180	▨	▨	▨	▨	▨	▨										181
220	▨	▨	▨	▨	▨	▨										221
270	▨	▨	▨	▨	▨	▨										271
330	▨	▨	▨	▨	▨	▨										331
390	▨	▨	▨	▨	▨	▨										391
470	▨	▨	▨	▨	▨	▨										471
560	▨	▨	▨	▨	▨	▨										561
680	▨	▨	▨	▨	▨	▨										681
820	▨	▨	▨	▨	▨	▨										821
1000	▨	▨	▨	▨	▨	▨	▨	▨	▨							102
1200	▨	▨	▨	▨	▨	▨	▨	▨	▨							122
1500	▨	▨	▨	▨	▨	▨	▨	▨	▨							152
1800	▨	▨		▨	▨	▨	▨	▨	▨							182
2200	▨	▨		▨	▨	▨	▨	▨	▨							222
2700	▨	▨		▨	▨	▨	▨	▨	▨							272
3300	▨	▨		▨	▨	▨	▨	▨	▨							332
3900	▨	▨		▨	▨	▨	▨	▨	▨							392
4700	▨	▨		▨	▨	▨	▨	▨	▨							472
5600	▨	▨		▨	▨	▨	▨	▨	▨							562
6800	▨			▨	▨	▨	▨	▨	▨							682
8200	▨			▨	▨	▨	▨	▨	▨							822
10,000	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	103
12,000	▨			▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	123
15,000	▨			▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	153
18,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	183
22,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	223
27,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	273
33,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	333
39,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	393
47,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	473
56,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	563
68,000				▨	▨		▨	▨	▨	▨	▨	▨	▨	▨	▨	683
82,000				▨			▨	▨		▨	▨	▨	▨	▨	▨	823
100,000				▨			▨	▨		▨	▨	▨	▨	▨	▨	104
120,000				▨			▨	▨		▨	▨	▨	▨	▨	▨	124
150,000							▨	▨		▨	▨	▨	▨	▨	▨	154
180,000							▨	▨		▨	▨	▨	▨	▨	▨	184
220,000							▨	▨		▨	▨		▨	▨	▨	224
270,000							▨	▨		▨	▨		▨	▨	▨	274
330,000							▨	▨		▨	▨		▨	▨		334
390,000							▨	▨		▨	▨		▨	▨		394
470,000							▨	▨		▨	▨		▨	▨		474
560,000							▨			▨	▨		▨	▨		564
680,000							▨			▨	▨		▨	▨		684
820,000							▨			▨			▨	▨		824
1,000,000							▨			▨			▨	▨		105
1,200,000							▨						▨	▨		125
1,500,000							▨						▨	▨		155
1,800,000							▨						▨			185
2,200,000							▨						▨			225
2,700,000													▨			275
3,300,000													▨			335
3,900,000																395
4,700,000																475

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

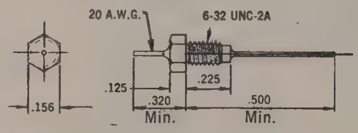
METUCHEN CAPACITORS INC.

Feed-Thru Ceramic Capacitors RESIN SEAL

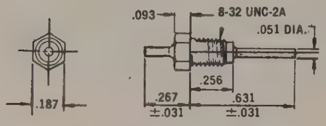
TYPES 54-790-


24 A.W.G.
4-40 UNC-2A
.156
.120
.310 ±.020
.510 ±.020
.220

54-779-


20 A.W.G.
6-32 UNC-2A
.156
.125
.225
.320 Min.
.500 Min.

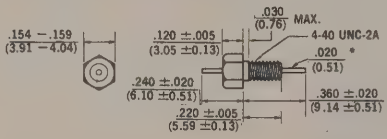
54-713-


.093
8-32 UNC-2A
.051 DIA.
.187
.256
.267 ±.031
.631 ±.031

Working Voltage +85°C	Working Voltage +125°C	Cap. pF	Ordering Number
200	100	10	54-790-001-100M
200	100	100	54-790-001-101M
200	100	500	54-790-001-501Z
200	100	1000	54-790-001-102P
200	100	22,000	54-790-001-223Z
200	100	10	54-779-001-100M
200	100	100	54-779-001-101M
200	100	500	54-779-001-501P
200	100	1000	54-779-001-102P
200	100	22,000	54-779-001-223Z
200	100	10	54-713-001-100M
200	100	100	54-713-001-101M
200	100	1000	54-713-001-102Z
200	100	5000	54-713-001-502P

SERIES SCI 910X/911X/912X

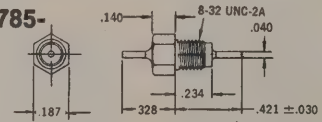
* For 24 gauge tinned copper leads, replace "X" with "0"; for 26 gauge tinned steel leads (.016 Dia.) replace "X" with "2." When steel lead is used, maximum DC current is 5 amps. 24 AWG (.020) leads are available, contact factory for part numbers.


.154 – .159 (3.91 – 4.04)
.120 ±.005 (3.05 ±0.13)
.030 (0.76) MAX.
4-40 UNC-2A
.020 (0.51) *
.240 ±.020 (6.10 ±0.51)
.360 ±.020 (9.14 ±0.51)
.220 ±.005 (5.59 ±0.13)

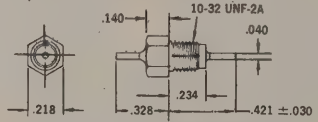
Series	SCI 910X	SCI 911X	SCI 912X
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS. MAX.	10	10	10
CAPACITANCE (GMV)	100 pF 1000 5000	100 pF 1000 5000	100 pF 1000 5000
	.01 μF .027 .05	.01 μF .027 .05	.01 μF

HIGH CAPACITY MULTI-LAYER FEED-THRU CAPACITORS

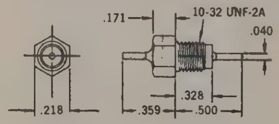
TYPES 54-785-


.140
8-32 UNC-2A
.040
.187
.234
328
.421 ±.030

54-786-013

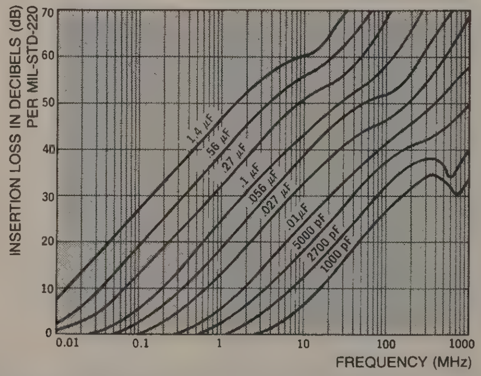

.140
10-32 UNF-2A
.040
.218
.234
.328
.421 ±.030

54-786-021
014


.171
10-32 UNF-2A
.040
.218
.328
.359
.500

Working Voltage @ 125°C	Cap. μF	Ordering Number
100	.05	54-785-005-503P
100	.3	54-786-013-304Z
50	.5	54-786-021-504Z
50	1.0	54-786-014-105Z

FEED-THROUGH CAPACITORS — TYPICAL INSERTION LOSS



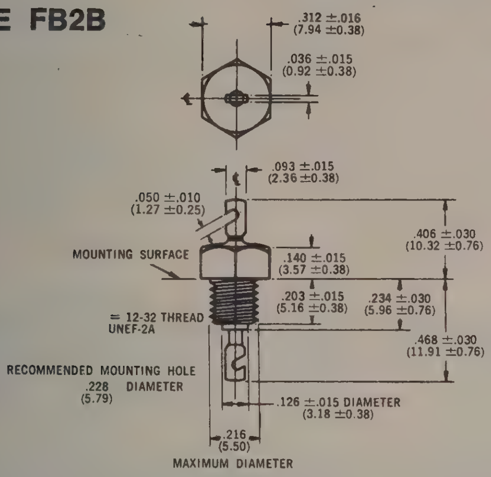
All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control Inc. . .**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

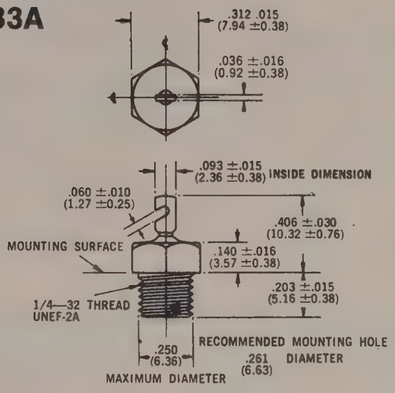
METUCHEN CAPACITORS INC.

Feed-Thru Ceramic Capacitors

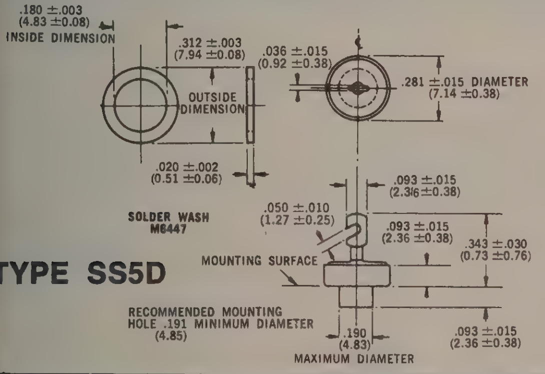
TYPE FB2B


.312 ±.016
(7.94 ±0.38)
.036 ±.015
(0.92 ±0.38)
.093 ±.015
(2.36 ±0.38)
.050 ±.010
(1.27 ±0.25)
MOUNTING SURFACE
.406 ±.030
(10.32 ±0.76)
.140 ±.015
(3.57 ±0.38)
.203 ±.015
(5.16 ±0.38)
.234 ±.030
(5.96 ±0.76)
= 12-32 THREAD
UNEF-2A
.468 ±.030
(11.91 ±0.76)
RECOMMENDED MOUNTING HOLE
.228 DIAMETER
(5.79)
.126 ±.015 DIAMETER
(3.18 ±0.38)
.216
(5.50)
MAXIMUM DIAMETER

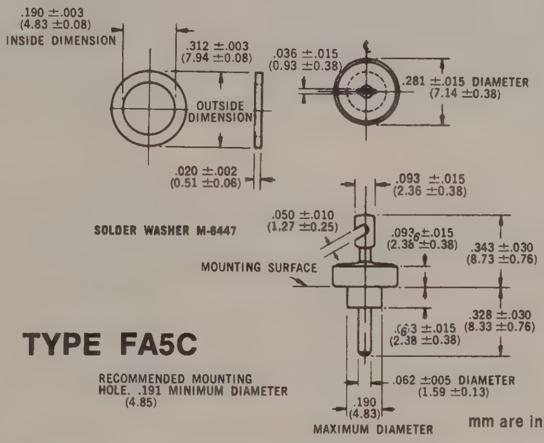
TYPE SB3A


.312 .015
(7.94 ±0.38)
.036 ±.016
(0.92 ±0.38)
.093 ±.015
(2.36 ±0.38) INSIDE DIMENSION
.060 ±.010
(1.27 ±0.25)
.406 ±.030
(10.32 ±0.76)
MOUNTING SURFACE
.140 ±.016
(3.57 ±0.38)
.203 ±.015
(5.16 ±0.38)
1/4—32 THREAD
UNEF-2A
.250
(6.36)
MAXIMUM DIAMETER
RECOMMENDED MOUNTING HOLE
.261 DIAMETER
(6.63)

TYPE SS5D


.180 ±.003
(4.83 ±0.08)
INSIDE DIMENSION
.312 ±.003
(7.94 ±0.08)
.036 ±.015
(0.92 ±0.38)
OUTSIDE DIMENSION
.281 ±.015 DIAMETER
(7.14 ±0.38)
.020 ±.002
(0.51 ±0.06)
SOLDER WASH
M6447
.093 ±.015
(2.316 ±0.38)
.050 ±.010
(1.27 ±0.25)
.093 ±.015
(2.36 ±0.38)
.343 ±.030
(0.73 ±0.76)
MOUNTING SURFACE
RECOMMENDED MOUNTING
HOLE .191 MINIMUM DIAMETER
(4.85)
.190
(4.83)
MAXIMUM DIAMETER
.093 ±.015
(2.36 ±0.38)

TYPE FA5C


.190 ±.003
(4.83 ±0.08)
INSIDE DIMENSION
.312 ±.003
(7.94 ±0.08)
.036 ±.015
(0.93 ±0.38)
.281 ±.015 DIAMETER
(7.14 ±0.38)
OUTSIDE DIMENSION
.020 ±.002
(0.51 ±0.06)
.093 ±.015
(2.36 ±0.38)
SOLDER WASHER M-6447
.050 ±.010
(1.27 ±0.25)
.093 ±.015
(2.36 ±0.38)
.343 ±.030
(8.73 ±0.76)
MOUNTING SURFACE
.328 ±.030
(8.33 ±0.76)
.093 ±.015
(2.38 ±0.38)
RECOMMENDED MOUNTING
HOLE. .191 MINIMUM DIAMETER
(4.85)
.062 ±.005 DIAMETER
(1.59 ±0.13)
.190
(4.83)
MAXIMUM DIAMETER

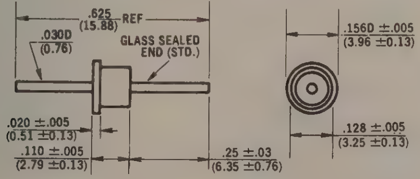
mm are in parentheses

Ordering Number	Type	Tolerance %	Capacitance pF
54-794-002-101M	FA5C-1012	20	100
54-794-002-471M	FA5C-4712	20	470
54-794-002-102P	FA5C-102W	GMV	1000
54-804-002-101M	FB2B-1012	20	100
54-804-002-471M	FB2B-4712	20	470
54-804-002-102P	FB2B-102W	GMV	1000

Ordering Number	Type	Tolerance %	Capacitance pF
54-803-004-101M	SS5D-1012	20	100
54-803-004-471M	SS5D-4712	20	470
54-803-004-102P	SS5D-102W	GMV	1000
54-807-002-101M	SB3A-1012	20	100
54-807-002-471M	SB3A-4712	20	470
54-807-002-102P	SB3A-102W	GMV	1000

SERIES SCI 9900/9910/9920

All units are hermetically sealed (glass to metal) on one end, while the other end is epoxy sealed. These units are also available reversed with the hermetic seal at the opposite end. To order, add "R" to the end of the part number; e.g. 9900-502R. Installation: Series 9900 units are designed to be soldered in place. Maximum soldering temperature is +200°C (400°F).


.625 REF
(15.88)
.030D
(0.76)
GLASS SEALED
END (STD.)
.020 ±.005
(0.51 ±0.13)
.110 ±.005
(2.79 ±0.13)
.25 ±.03
(6.35 ±0.76)
.156D ±.005
(3.96 ±0.13)
.128 ±.005
(3.25 ±0.13)

Series	SCI 9900	SCI 9910	SCI 9920
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS. MAX.	5	5	5
CAPACITANCE (GMV)	100 pF 500 1000 1200 2700 5000 .015 μF	100 pF 500 1000 1200 2700 5000	100 pF 500 1000 1200

All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control Inc. . .**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

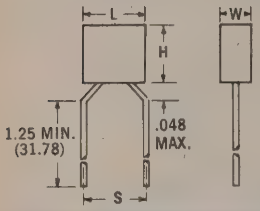
METUCHEN CAPACITORS INC.

NPO Ceramic Capacitors QUALIFIED TO MIL-C-20

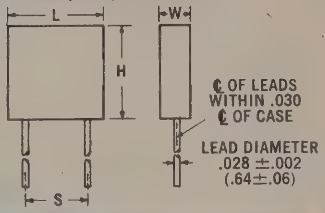
- 0 ±30 ppm/°C Per MIL-C-20
- .1 to 100,000 Pf −55°C +125°C
- Low Dissipation Factor
- Tight Tolerances

RADIAL LEAD CAPACITORS

CCR05



CCR06, 07, 08 & 09



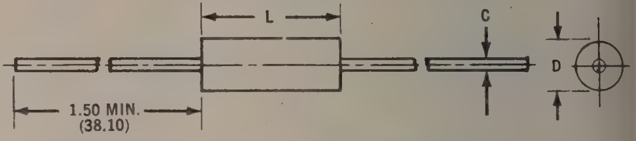
Mil. Equiv.	H & L	W	S
CCR05	.190 ±.010	.090 ±.010	.200 ±.015
CCR09	.190 ±.010	.090 ±.010	.100 ±.015
CCR06	.290 ±.010	.090 ±.010	.200 ±.015
CCR07	.480 ±.020	.140 ±.010	.400 ±.020
CCR08	.480 ±.020	.240 ±.010	.400 ±.020

ER	Slash Sheet	Volt	Cap. Range pF
CCR05 CCR09	35	200 100 50	1-330 360-1800 2200-3300
CCR06	36	200 100 50	360-1800 2000-4700 5100-18,000
CCR07	37	200 100 50	2200-4700 5600-12,000 15,000-100,000
CCR08	38	200 100 50	3900-4700 15,000-18,000 56,000-68,000

All dimensions shown in inches.

AXIAL LEAD CAPACITORS

CCR75, 76, 77, 78 & 79



Mil. Equiv.	L	D	Lead Size
CCR75	.160 ±.010	.090 ±.010	.016
CCR76	.250 ±.010	.090 ±.010	.016
CCR77	.390 ±.010	.140 ±.010	.025
CCR78	.500 ±.020	.250 ±.015	.025
CCR79	.690 ±.020	.350 ±.015	.025

ER	Slash Sheet	Volt	Cap. Range pF
CCR75	27	200 100 50	.1-75 82-240 270-680
CCR76	28	200 100 50	82-130 270-680 750-1000
CCR77	29	200 100 50	150-680 750-2200 2400-5600
CCR78	30	200 100 50	820-3300 3900-12,000 15,000-27,000
CCR79	31	200 100 50	3900-10,000 15,000-39,000 47,000-82,000

Fixed Capacitors, Ceramic Dielectric (Temperature Compensating), Established Reliability

ER CCR05 CG 102 G R

0±30ppm/°C

STYLE

05 = Radial .190x.190
09 = Radial .190x.190
06 = Radial .290x.290
07 = Radial .480x.480
08 = Radial .480x.480
75 = Axial .160x.090
76 = Axial .250x.090
77 = Axial .390x.140
78 = Axial .500x.250
79 = Axial .690x.350

CAPACITANCE

Nominal capacitance expressed in picofarads (uF) by three-digit number, first two digits represent significant figures, last digit specifies number of zeroes to follow. When the nominal value is less than 10 pF, the letter 'R' indicates the decimal point and the succeeding digit(s) represent significant figure(s). For example: IRO indicates 1.0 pF; R75 indicates 0.75 pF and OR5 indicates 0.5 pF.

FAILURE RATE LEVEL

M = 1.0%
P = 0.1%
R = 0.01%
Expressed in % per 1000 hours

CAPACITANCE TOLERANCE

C = ±.25 pF
D = ±.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

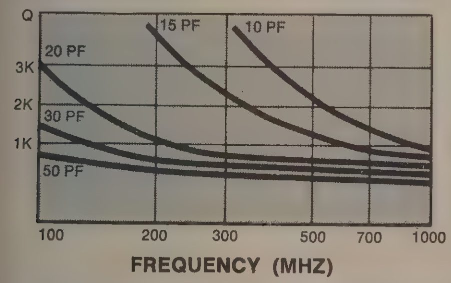
Ultra-Q Miniature Microwave Ceramic Capacitors QUALIFIED TO MIL-C-55681B

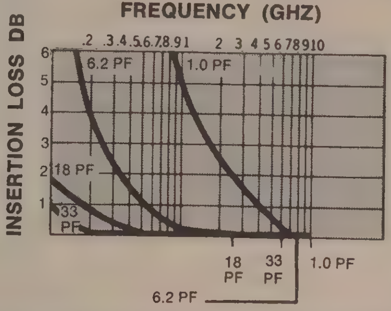
A state of the art ceramic capacitor designed for use at microwave frequencies. The superior dielectric properties of the ceramic material furnish extremely high Q and lowest loss of any type capacitor available. A minimum Q of 10,000 is guaranteed at 1 MHz. Units are available in either chip form or various leaded configurations. Typical applications include low noise FET circuits, high frequency, low noise receiver front ends and UHF microwave hybrids.

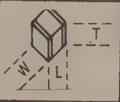
GENERAL SPECIFICATIONS

CAPACITANCE RANGE: .1 pF through 1000 pF
WORKING VOLTAGE: 50 through 500 VDC (see tables)
Q @ 1 MHz: 10,000 minimum
DISSIPATION FACTOR @ 1 MHz: less than .0001
INSULATION RESISTANCE: more than 100,000 megohms @ 25°C, 10,000 meg @ 125°C
TEMPERATURE COEFFICIENT: +90 ±20 ppm/°C
OPERATING TEMPERATURE RANGE: −55°C to +125°C
CAPACITANCE TOLERANCE: B = ±.1 pF, C = ±.25 pF, D = ±.5 pF (values <5 pF), F = ±1%, G = ±2%, J = ±5%, K = ±10% (values ≥5 pF)
CHIP TERMINATION: Palladium silver
DIELECTRIC STRENGTH: 250% of WVDC rating
CAPACITANCE DRIFT: ±.1% or .1 pF, whatever is greater

TYPICAL FREQUENCY CHARACTERISTICS





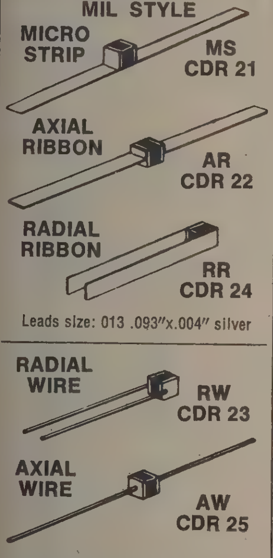


SIZE	MIL STYLE	L + W	T. max.
01	CDR11	.050″ ±.015	.050″
013	CDR13	.110″ ±.015	.100″

MIL-STYLE	WVDC	CAP. RANGE pF
CDR11 & CDR12	50	.1-1000
CDR13 thru CDR25	500 300 200 100 50	.1-100 110-200 220-470 510-620 680-1000

LEAD STYLES AVAILABLE

Add .020″ to "L" dim.
Add following suffix to part number



Leads size: 013 .093″x.004″ silver

Leads: #26 AWG tinned copper

SIZE 01 .050 x .050 x .050 Cap. pF	Part Number	WVDC	SIZE 01 .050 x .050 x .050 Cap. pF	Part Number	WVDC	SIZE 013 .110 x .110 x .100 Cap. pF	Part Number	WVDC	SIZE 013 .110 x .110 x .100 Cap. pF	Part Number	WVDC	SIZE 013 .110 x .110 x .100 Cap. pF	Part Number	WVDC
0.1	01Q108B	50V	6.2	01Q629J	50V	0.1	013Q108B	500V	5.6	013Q569J	500V	110	013Q111J	300V
0.2	01Q208B	50V	6.8	01Q689J	50V	0.2	013Q208B	500V	6.2	013Q629J	500V	120	013Q121J	300V
0.3	01Q308B	50V	7.5	01Q759J	50V	0.3	013Q308B	500V	6.8	013Q689J	500V	130	013Q131J	300V
0.4	01Q408B	50V	8.2	01Q829J	50V	0.4	013Q408B	500V	7.5	013Q759J	500V	150	013Q151J	300V
0.5	01Q508B	50V	9.1	01Q919J	50V	0.5	013Q508B	500V	8.2	013Q829J	500V	160	013Q161J	300V
0.6	01Q608B	50V	10	01Q100J	50V	0.6	013Q608B	500V	9.1	013Q919J	500V	180	013Q181J	300V
0.7	01Q708B	50V	11	01Q110J	50V	0.7	013Q708B	500V	10	013Q100J	500V	200	013Q201J	300V
0.8	01Q808B	50V	12	01Q120J	50V	0.8	013Q808B	500V	11	013Q110J	500V			
0.9	01Q908B	50V	13	01Q130J	50V	0.9	013Q908B	500V	12	013Q120J	500V			
1.0	01Q109C	50V	15	01Q150J	50V	1.0	013Q109C	500V	13	013Q130J	500V			
1.1	01Q119C	50V	16	01Q160J	50V	1.1	013Q119C	500V	15	013Q150J	500V	220	013Q221J	200V
1.2	01Q129C	50V	18	01Q180J	50V	1.2	013Q129C	500V	16	013Q160J	500V	240	013Q241J	200V
1.3	01Q139C	50V	20	01Q200J	50V	1.3	013Q139C	500V	18	013Q180J	500V	270	013Q271J	200V
1.4	01Q149C	50V	22	01Q220J	50V	1.4	013Q149C	500V	20	013Q200J	500V	300	013Q301J	200V
1.5	01Q159C	50V	24	01Q240J	50V	1.5	0130159C	500V	22	013Q220J	500V	330	013Q331J	200V
1.6	01Q169C	50V	27	01Q270J	50V	1.6	013Q169C	500V	24	013Q240J	500V	360	013Q361J	200V
1.7	01Q179C	50V	30	01Q300J	50V	1.7	013Q179C	500V	27	013Q270J	500V	390	013Q391J	200V
1.8	01Q189C	50V	33	01Q330J	50V	1.8	013Q189C	500V	30	013Q300J	500V	430	013Q431J	200V
1.9	01Q199C	50V	36	01Q360J	50V	1.9	013Q199C	500V	33	013Q330J	500V	470	013Q471J	200V
2.0	01Q209C	50V	39	01Q390J	50V	2.0	013Q209C	500V	36	013Q360J	500V			
2.1	01Q219C	50V	43	01Q430J	50V	2.1	013Q219C	500V	39	013Q390J	500V			
2.2	01Q229C	50V	47	01Q470J	50V	2.2	013Q229C	500V	43	013Q430J	500V			
2.7	01Q279C	50V	51	01Q510J	50V	2.7	013Q279C	500V	47	013Q470J	500V	510	013Q511J	100V
3.0	01Q309C	50V	56	01Q560J	50V	3.0	013Q309C	500V	51	013Q510J	500V	560	013Q561J	100V
3.3	01Q339C	50V	62	01Q620J	50V	3.3	013Q339C	500V	56	013Q560J	500V	620	013Q621J	100V
3.6	01Q369C	50V	68	01Q680J	50V	3.6	013Q369C	500V	62	013Q620J	500V	680	013Q681J	100V
3.9	01Q399C	50V	75	01Q750J	50V	3.9	013Q399C	500V	68	013Q680J	500V	750	013Q751J	100V
4.3	01Q439C	50V	82	01Q820J	50V	4.3	013Q439C	500V	75	013Q750J	500V	820	013Q821J	100V
4.7	01Q479C	50V	91	01Q910J	50V	4.7	013Q479C	500V	82	013Q820J	500V	910	013Q911J	100V
5.1	01Q519J	50V	100	01Q101J	50V	5.1	013Q519J	500V	91	013Q910J	500V	1000	013Q102J	100V
5.6	01Q559J	50V							100	013Q101J	500V			

HOW TO ORDER

CDR13 BG 101 E G M M

STYLE

CDR11 – Chip .055″ x .055″
CDR12 – Tinned Chip .055″ x .055″
CDR13 – Chip .110″ x .110″
CDR14 – Tinned Chip .110″ x .110″
CDR21 – Micro Strip .135″ x .110″
CDR22 – Axial Ribbon .135″ x .110″
CDR23 – Radial Wire .135″ x .110″
CDR24 – Radial Ribbon .135″ x .110″
CDR25 – Axial Wire .135″ x .110″

CAPACITANCE

Nominal capacitance expressed in picofarads (pF) by three-digit number, first two digits represent significant figures, last digit specifies number of zeros to follow. When the nominal value is less than 10 pF, the letter 'R' indicates the decimal point and the succeeding digit(s) represent significant figure(s). For example: IRO indicates 1.0 pF; R75 indicates 0.75 pF and OR5 indicates 0.5 pF.

WVDC

A = 50
B = 100
C = 200
D = 300
E = 500

CAPACITANCE TOLERANCE

B = ±.1 pF
C = ±.25 pF
D = ±.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%

FINISH

CDR11 = M
CDR12 = S
CDR13 = M
CDR14 = S
CDR21 = T
CDR22 = T
CDR23 = S
CDR24 = T
CDR25 = S

FAILURE RATE LEVEL

Expressed in % per 1000 hours
M = 1.0%
P = .1%
R = .01%

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

METUCHEN CAPACITORS INC.

Molded Precision Radial-Leaded NPO Capacitors TIGHT TOLERANCES (AS CLOSE AS ±0.5%)

GENERAL SPECIFICATIONS

OPERATING TEMPERATURE RANGE: −55°C to +125°C

DISSIPATION FACTOR: For 30 pF to and including 1000 pF .1% Max. at 1 MHz. Less than 30 pF per MIL-C-20. Above 1000 pF. 15% Max. at 1 kHz. All measurements at 1 VAC

INSULATION RESISTANCE: 1000 megohms — microfarads but need not exceed 100,000 megohms at ±25°C

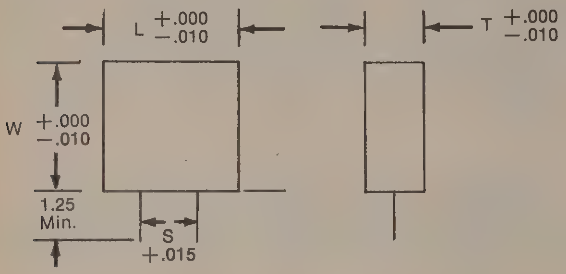
FLASH TEST: 3 times WVDC

LIFE TEST: 2 times WVDC

LEADS: #22 AWG (.025 Dia.) except CR04 #24 AWG (.020 Dia.) Tinned Copper

CAPACITANCE TOLERANCE AVAILABLE: Greater than 10 pF, ±0.5%, ±1%, ±2%, ±5%, ±10% and ±20%; Less than or equal to 10 pF, ±.25 pF and ±.5 pF

Will meet or exceed latest revision of MIL-C-20



DIMENSIONS

Style	CR04	CR05	CR06	CR08	CR20
L	.150 (3.81)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)
W	.150 (3.81)	.200 (5.08)	.300 (7.62)	.300 (7.62)	.500 (12.70)
T	.100 (2.54)	.100 (2.54)	.100 (2.54)	.150 (3.81)	.150 (3.81)
S	.100 (2.54)	.200 (5.08)	.200 (5.08)	.200 (5.08)	.400 (10.16)

mm are in parentheses

HOW TO ORDER

CR04 B CG 101 K

SIZE: CR04

WVDC: B
B = 50, D = 100, F = 200

DIELECTRIC TYPE: CG
CG = NPO ±30 ppm/°C

CAPACITANCE: 101

TOLERANCE: K
C = ±.25 pF, D = ±.5 pF (10 pF and below)
E = 0.5%, F = ±1%, G = ±2% (10 pF and above)
J = ±5%, K = ±10%, M= ±20%

Style	CR04			CR05			CR06			CR08			CR20		Cap. Char. EIA
Cap. value	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	
1.0pF	▨	▨	▨	▨	▨	▨									109
1.2	▨	▨	▨	▨	▨	▨									129
1.5	▨	▨	▨	▨	▨	▨									159
1.8	▨	▨	▨	▨	▨	▨									189
2.2	▨	▨	▨	▨	▨	▨									229
2.7	▨	▨	▨	▨	▨	▨									279
3.3	▨	▨	▨	▨	▨	▨									339
3.9	▨	▨	▨	▨	▨	▨									399
4.7	▨	▨	▨	▨	▨	▨									479
5.6	▨	▨	▨	▨	▨	▨									569
6.8	▨	▨	▨	▨	▨	▨									689
8.2	▨	▨	▨	▨	▨	▨									829
9.1	▨	▨	▨	▨	▨	▨									919
10	▨	▨	▨	▨	▨	▨									100
12	▨	▨	▨	▨	▨	▨									120
15	▨	▨	▨	▨	▨	▨									150
18	▨	▨	▨	▨	▨	▨									180
20	▨	▨	▨	▨	▨	▨									200
22	▨	▨	▨	▨	▨	▨									220
24	▨	▨	▨	▨	▨	▨									240
27	▨	▨	▨	▨	▨	▨									270
30	▨	▨	▨	▨	▨	▨									300
33	▨	▨	▨	▨	▨	▨									330
36	▨	▨	▨	▨	▨	▨									360
39	▨	▨	▨	▨	▨	▨									390
43	▨	▨	▨	▨	▨	▨									430
47	▨	▨	▨	▨	▨	▨									470
51	▨	▨	▨	▨	▨	▨									510
56	▨	▨	▨	▨	▨	▨									560
62	▨	▨	▨	▨	▨	▨									620
68	▨	▨	▨	▨	▨	▨									680
75	▨	▨	▨	▨	▨	▨									750
82	▨	▨	▨	▨	▨	▨									820
91	▨	▨	▨	▨	▨	▨									910
100	▨	▨	▨	▨	▨	▨									101
110	▨	▨		▨	▨	▨									111
120	▨	▨		▨	▨	▨									121
130	▨	▨		▨	▨	▨									131
150	▨	▨		▨	▨	▨									151
160	▨	▨		▨	▨	▨									161
180	▨	▨		▨	▨	▨									181
200	▨	▨		▨	▨	▨									201
220	▨	▨		▨	▨	▨									221
240	▨	▨		▨	▨	▨			▨						241
270	▨	▨		▨	▨	▨			▨						271
300	▨	▨		▨	▨	▨			▨						301
330	▨	▨		▨	▨	▨			▨						331
360	▨			▨	▨				▨						361
390	▨			▨	▨				▨						391
430	▨			▨	▨				▨						431
470	▨			▨	▨				▨						471
510	▨			▨	▨				▨						511
560	▨			▨	▨				▨						561
620	▨			▨	▨				▨						621
680	▨			▨	▨				▨						681
750	▨			▨	▨				▨						751
820	▨			▨	▨				▨						821
910	▨			▨	▨			▨	▨						911
1000	▨			▨	▨			▨	▨						102
1200				▨	▨			▨	▨						122
1500				▨	▨			▨	▨			▨			152
1800				▨	▨			▨	▨			▨			182
2000				▨				▨				▨			202
2200				▨				▨				▨			222
2400				▨			▨	▨							242
2700				▨			▨	▨							272
3000				▨			▨	▨							302
3300				▨			▨	▨							332
3600							▨	▨							362
3900							▨	▨							392
4300							▨	▨							432
4700							▨	▨							472
5100							▨				▨				512
5600							▨				▨				562
6200							▨				▨				622
6800							▨				▨				682
7500							▨				▨				752
8200							▨				▨				822
9100							▨				▨				912
.010uF							▨				▨		▨	▨	103
.012							▨						▨	▨	123
.015							▨						▨	▨	153
.018										▨			▨	▨	183
.020										▨			▨	▨	203
.022										▨			▨	▨	223
.024										▨			▨	▨	243
.027										▨			▨	▨	273
.030										▨			▨	▨	303
.033										▨			▨	▨	333
.036										▨			▨	▨	363
.039										▨			▨	▨	393
.043										▨			▨		433
.047										▨			▨		473
.051													▨		513
.056													▨		563
.062													▨		623
.068													▨		683
.075													▨		753
.082													▨		823
.091													▨		913
.100													▨		104

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

Multi Products International

218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009
(201) 239-8183 · TELEX 130430 · CABLE:MUPRINUSA-CEDG

SPECIALISTS IN CERAMIC CAPACITORS

DISC CERAMIC CAPACITORS

SPECIFICATIONS

Temperature Characteristics: Available in characteristics shown in table (below-right) as standard.

Operating Temperature: −55°C to +85°C.

Test Voltage: 2.5 times working voltage for 1 second.

Insulation Resistance:
7500 Megohms or an RC product of 75-ohms F, whichever is less.
RC product of .04-ohms F for 12 VDCW Y5T.
RC product of .1-ohm F for 16 VDCW Y5T.
10,000 Megohms for NPO.

Q (Ratio of Reactance to Equivalent Series Resistance):
Capacitance ≤ 30 pf Q ≥ 400 + 20 x Cpf
Capacitance > 30 pf Q ≥ 1000

Dissipation Factor:
For Z5F, X5R, Z5U, Z5P (@ 1 KC and 25°C) 2.5%
For Z4V, Z5V 5%
For Y5U 8.0%
For S2L, S3N 0.6%
For NPO, N750, N1500: 0.2%

Encapsulation: Phenolic coated, wax impregnated.

Marking: MP, Value, Tolerance, Voltage.

HOW TO ORDER

Type CF-104Z4

Voltage Rating
Temperature Characteristic
Capacitance
(In picofarads.) The 1st two digits indicate significant digits. The 3rd digit indicates the number of zeroes following. R denotes decimal.
Tolerance
Lead Variation

Note: The digit "4" representing lead variation may be 1, 2, 3 or 6 as shown in the diagrams below. The letter "C" and a blank space may also represent lead variations as shown in the diagrams.

TEMPERATURE CHARACTERISTIC

A =	Y5U	F =	Z5V	M =	P100	S =	N470
B =	Z5F	G =	S2L	N =	NPO	T =	N750
C =	Z5R	H =	S3N	P =	N150	V =	N1500
D =	Z5P	J =	Z4V	Q =	N220	W =	N2200
E =	Z5U	K =	Z5T	R =	N330	X =	N3300

Other temp. char. available.

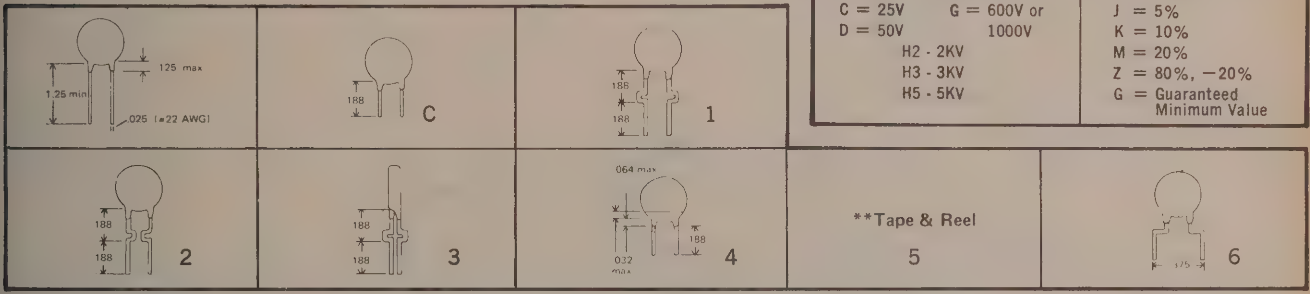
VOLTAGE RATING (WDC)

A = 12V
B = 16V
C = 25V
D = 50V
E = 100V
F = 500V
G = 600V or 1000V
H2 - 2KV
H3 - 3KV
H5 - 5KV

TOLERANCE

C = ±.25 PF
D = ±.50 PF
J = 5%
K = 10%
M = 20%
Z = 80%, −20%
G = Guaranteed Minimum Value

*LEAD VARIATIONS



*For other lead variations, consult factory.
**Disc Ceramic Capacitors can be mounted on continuous tape for automatic board insertion. These may be supplied for use in machines such as Matsushita, "Panasert", TDK "Avisert", or Universal 6341. Check the specifications of the particular capacitor(s) required by your application. To order tape and reel packaging, add numeral "5" to part number. Consult factory for details.

MULTILAYER CHIPS

SPECIFICATIONS

- **Temperaure Characteristics: NPO/COG** — 0 ±30ppm/°C, −55°C to +125°C; **BX/X7R** — △C 0 ± 15% Max. over −55°C to +125°C; **Z5U** — △C +22, −56% Max. over +10°C to +85°C
- **Capacitance: NPO/COG** — Measured at 1 Vrms Max., 1MHz ±50KHz, 25°C, below 100PF — 1 Vrms Max., 1KHz ±50Hz, 25°C, above 100PF; **BX/X7R** — Measured at 1KHz ±50Hz, 1.0 ±0.2V, 25°C; **Z5U** — Measured at 1KHz ±50Hz, 0.5V Max., 25°C
- **Dielectric Withstanding Voltage: NPO/COG, BX/X7R, Z5U** — 200% rated voltage for 5 seconds, 50mA Max. charging current, 25°C
- **Insulation Resistance:** — **NPO/COG** — Greater than 100 G Ω below .01 UF, 25°C, VDCW — Greater than 1000 Ω F above .01 UF, 25°C, VDCW; **BX/X7R** — Greater than 100 G Ω for capacitance below .01 UF, 25°C, VDCW; **Z5U** — Greater than 10,000M Ω for capacitance below .05 UF,25°C, VDCW — Greater than 500 Ω F for capacitance above .05 UF, 25°C, VDCW
- **Dissipation Factor (D.F.): NPO/COG** — 0.1% Max., at 1 Vrms Max., 1KHz, 25°C; **BX/X7R** — .025 (2.5%) Max. at 1KHz ±50Hz, 1.0 ±0.2V, 25°C; **Z5U** — .025 (2.5%) Max., at 1KHz ±50Hz, 0.5V Max., 25°C

ORDERING TERMINOLOGY:

MA R30 CG — 331 J S — 201

SERIES CODE (MA)

SIZE CODE (R30)
see chart

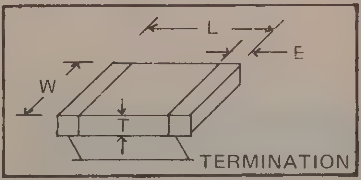
TEMPERATURE COEFFICIENT CODE (CG)
CG = NPO/COG
XR = X7R
ZU = Z5U

CAPACITANCE CODE (331)
For example:
331 = 330 PF
561 = 560 PF
102 = 1000 PF
223 = 22,000 PF = .022 UF
154 = 150,000 PF = .15 UF
8R2 = 8.2 PF
3R3 = 3.3 PF

TOLERANCE CODE (J)
*B = ±0.1 PF
*C = ±0.25 PF
*D = ±0.5 PF
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%
*For Capacitance value below 10 PF only.

TERMINATION CODE (S)
S = Silver
G = Gold
P = Palladium — Silver
T = Palladium — Gold

RATED VOLTAGE (201)
6R0 = 6 VDCW
120 = 12 VDCW
250 = 25 VDCW
500 = 50 VDCW
101 = 100 VDCW
201 = 200 VDCW



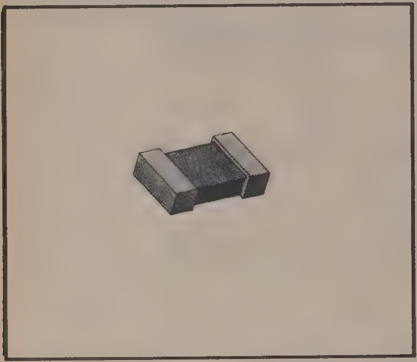
SIZE CODE

SIZE (in.)	R01	R03	R05	R07	R09	R11	R13	L01	S02	L02	L05	S04	L07
*L	.055	.080	.100	.110	.125	.130	.150	.175	.175	.180	.185	.200	.225
*W	.050	.050	.050	.105	.095	.095	.055	.065	.130	.080	.080	.260	.075
**T (max.)	.050	.050	.050	.070	.070	.070	.060	.070	.070	.060	.070	.070	.070
E	.005	.015	.020	.020	.020	.020	.020	.020	.020	.020	.020	.020	.020

*Tolerance ±0.010, ±7%, whichever is greater, +0.030-0.010 for soldered units.
**For soldered units allow +0.020.

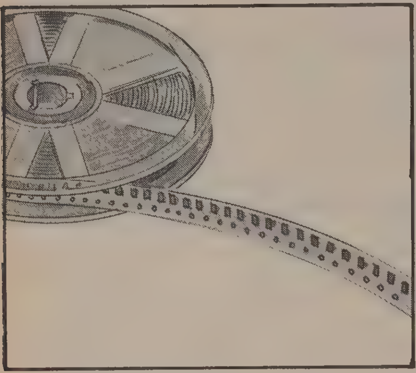
monolithic ceramic capacitors

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.



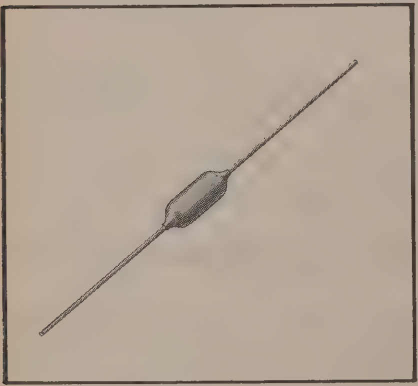
Chips

Capacitance Range:	1pF to .47mF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO, X7F, X7R, Z5U
Dimensions:	.060" x .030" to .220" x .200"



Chips for Tape and Reel

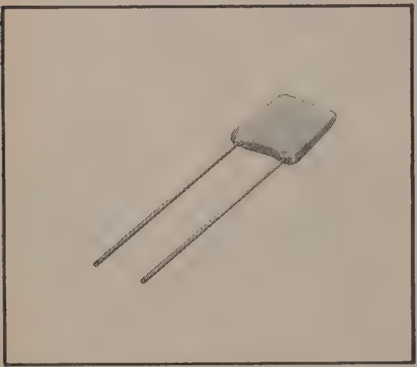
Capacitance Range:	0.5pF to 1.5mF
Voltage Ratings:	25, 50 & 100 VDC
Temperature Characteristics:	NPO, X7R, Y5V, Z5U
Dimensions:	.080" x .050" to .220" x .200"
Carrier Tape:	Standard 8 & 12 MM



Axial Leaded Conformal Epoxy Coated

Capacitance Range:	1pF to 1mF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO, X7R, Z5U
Dimensions:	.170" x .100" to .400" x .150"

Available in standard packaging for auto-insertion



Radial Leaded Conformal Epoxy Coated

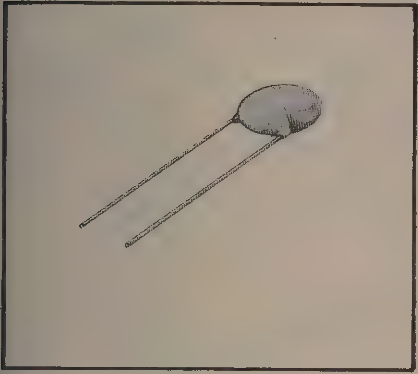
Capacitance Range:	1pF to 4.7mF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO, X7R, Z5U
Dimensions:	.138" x .100" to .500" x .500"

Available taped and reeled for auto-insertion

muRata ERIE
MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

disc ceramic capacitors

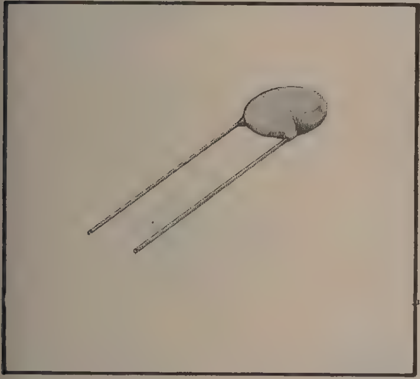
muRata ERIE
MURATA ERIE NORTH AMERICA, INC.



Low Voltage

Capacitance Range:	1pF to .5mF
Voltage Ratings:	12 VDC to 100 VDC
Temperature Characteristics:	Y5R, Y5P, Y5U, Y5V, Z5U NPO thru N750
Dimensions:	.157″ to .690″ Dia.

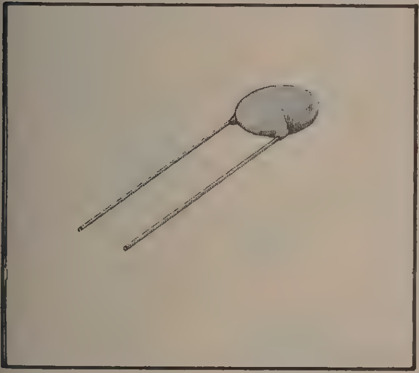
Available in standard packaging for auto-insertion



Medium Voltage

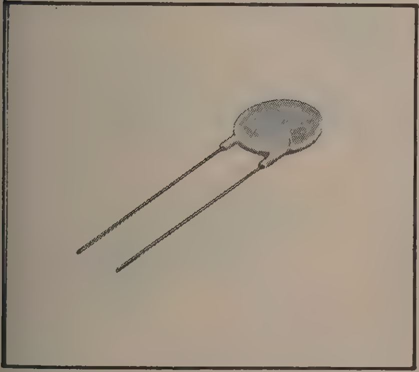
Capacitance Range:	1pF to .02mF
Voltage Ratings:	500; 1,000; 2,000; 3,000, 6,000 VDC
Temperature Characteristics:	Y5F, Y5P, Y5U, Z5U NPO, N220, N750, N1500
Dimensions:	.197″ to .708″ Dia.

Available in standard packaging for auto-insertion



High Voltage

Capacitance Range:	100pF to 2,200pF
Voltage Ratings:	7,500; 10,000; 15,000 VDC
Temperature Characteristics:	Y5P, Z5U, N4700
Dimensions:	.354″ to .788″ Dia.



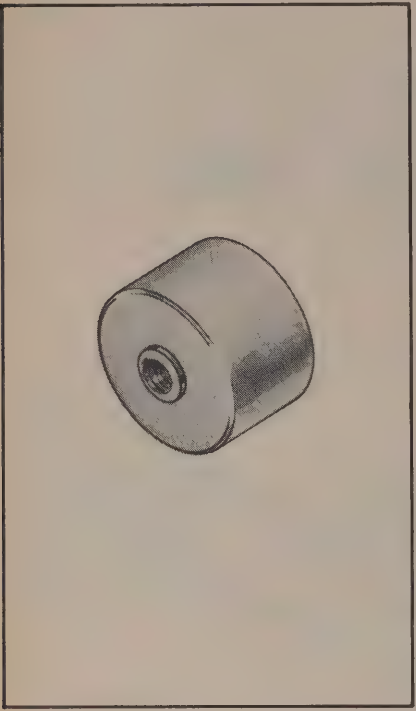
Safety Recognized UL, CSA, etc.

Capacitance Range:	100pF to .01mF
Voltage Ratings:	400 VAC
Temperature Characteristics:	B, F, FZ
Dimensions:	.394″ to .669″ Dia.
Approval Types:	UL, CSA, VDE, SEMKO, BS, SEV

muRata ERIE
MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

high voltage ceramic capacitors

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.



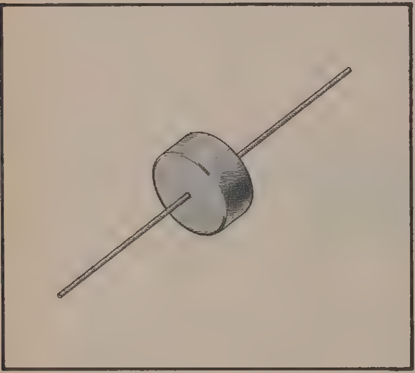
10 to 40 KVDC, DHS Series

For AC and DC Pulse Applications

Capacitance Ranges:	190pF to 8000pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	N4700
Size:	.63″ x .79″ Dia. to 1.42″ x 2.36″ Dia.

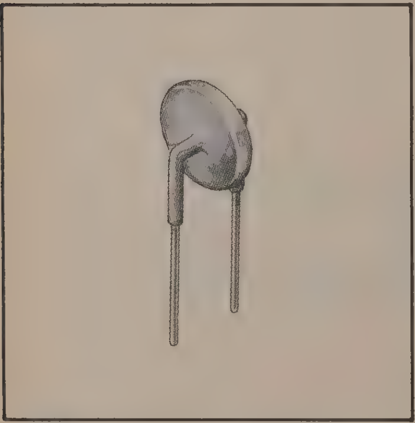
For General Purpose Applications

Capacitance Ranges:	180pF to 9300pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	Z5U
Size:	.75″ x .79″ Dia. to 1.61″ x 2.36″ Dia.



10 and 15 KVDC—DHL Series

Capacitance Ranges:	750pF and 1000pF
Voltage Ratings:	10 and 15 KVDC
Temperature Characteristics:	Y5P
Size:	.39″ x .79″ Dia. to .47″ x .79″ Dia.



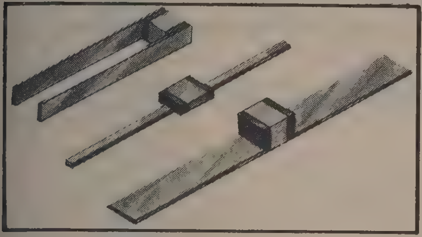
10 and 15 KVDC—DHD Series

Capacitance Ranges:	500pF and 2000pF
Voltage Ratings:	10 and 15 KVDC
Temperature Characteristics:	Y5P
Size:	.295″ x .630″ Dia. to .295″ x .945″ Dia.

muRata ERIE
MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

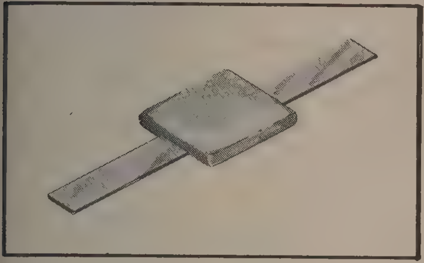
fixed and variable capacitors for microwave applications

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.



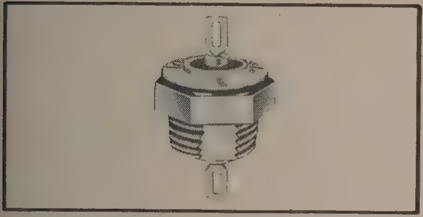
Monolithic Chips — MA Series

Capacitance Ranges:	0.3pF to .1μF
Voltage Ratings:	50, 100, 200, 300, 500 VDC
Tolerances:	B, ±0.1pF thru M, ±20%
Q:	10,000 @ 1 MHz
Temperature Characteristics:	P90, ±20ppm/°C, NPO, X7R
Size:	.055″ x .055″ to .150″ x .110″



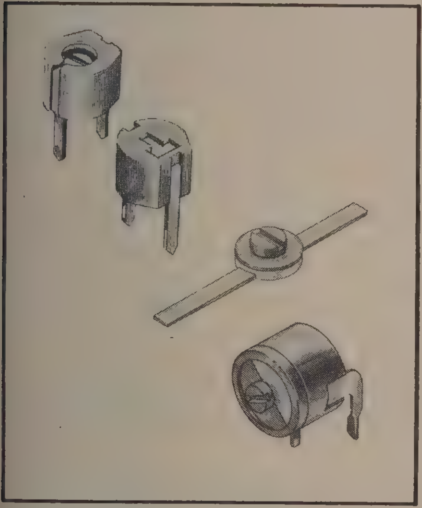
Glass Encapsulated Monolithic RF Power — UFP Series

Capacitance Ranges:	10pF to 3000pF
Voltage Ratings:	300 to 3600 VDC
Q:	5000 @ 1 MHz
RF Current Ratings:	8 Amperes
Temperature Characteristics:	P90, ±20ppm/°C
Size:	37/64″ x 35/64″ to 1 1/16″ x 1 1/16″



Button Mica

Capacitance Ranges:	15pF to 1000pF
Voltage Ratings:	500 VDC
Q:	Per MIL-C-10950
Configurations:	Stand-off and Feed-thru
Size:	.457″ Dia. x .730″ and .515″ Dia x .815″



Ceramic Trimmers

TZ03

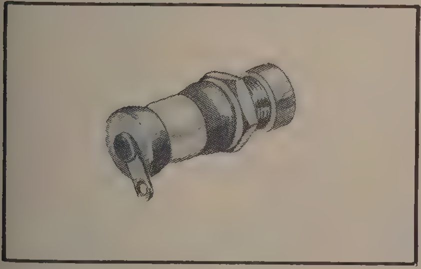
Capacitance Ranges:	1.25pF — 2.3pF to 10pF to 120pF
Voltage Ratings:	50 and 100 VDC
Temperature Characteristics:	NPO thru N1200
Size:	.236 Dia.

DVS3

Capacitance Ranges:	1.5pF — 6pF to 5pF to 35pF
Voltage Ratings:	25 VDC
Temperature Characteristics:	NPO and N750
Size:	.126″ Dia.

DV11

Capacitance Ranges:	2pF — 8pF to 15pF — 60pF
Voltage Ratings:	200 and 350 VDC
Temperature Characteristics:	NPO thru N1500
Size:	3/8″ Dia.



Air Trimmers

MVM

Capacitance Ranges:	0.8pF — 10pF to 1pF — 20pF
Voltage Ratings:	250 VDC
Temperature Characteristics:	0, ±15 and 0, ±25ppm/°C
Size:	.281″ Dia. x .484″ to .281″ Dia. x .900″

muRata ERIE

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

NIC COMPONENTS CORPORATION

NORTH AMERICAN OPERATIONS NIPPON INDUSTRIES COMPANY LTD.

ALUMINUM ELECTROLYTIC CAPACITORS

ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
1	NAE	Axial—General Purpose, Miniature Size	-40 ~ + 85°C	0.47 ~ 15,000 mfd	±20% (M)	6.3 ~ 100WVDC
2	NAE-H	Axial—High Voltage	-40 ~ +85°C	0.47 ~ 1000 mfd	-10+50% ±20% (M)	160 ~ 500WVDC
3	NAE-WT	Axial—Wide Temperature	-40 ~ +105°C	0.47 ~ 15,000 mfd	±20% (M)	6.3 ~ 100WVDC
4	NLE-A	Axial—Low Leakage	-40 ~ +85°C	0.1 ~ 470 mfd	±10% (K) ±20% (M)	6.3 ~ 100WVDC
5	NNA	Axial—Non-Polarized	-40 ~ +85°C	0.47 ~ 1000 mfd	±10% (K) ±20% (M)	6.3 ~ 100WVDC
6	NRE	Radial—General Purpose	-40 ~ +85°C	0.47 ~ 10,000 mfd	±20% (M)	6.3 ~ 100WVDC
7	NRE-H	Radial—High Voltage	-40 ~ +85°C	0.47 ~ 1000 mfd	-10+50% ±20% (M)	160 ~ 450WVDC
8	NRE-WT	Radial—Wide Temperature	-40 ~ +105°C	0.47 ~ 10,000 mfd	±20% (M)	6.3 ~ 100WVDC
9	NLE-L	Radial—Low Leakage	-40 ~ +85°C	0.1 ~ 4700 mfd	±10% (K) ±20% (M)	6.3 ~ 100WVDC
10	NLE-LWT	Radial—Low Leakage, Wide Temperature	-40 ~ +105°C	0.1 ~ 4700 mfd	±10% (K) ±20% (M)	6.3 ~ 100WVDC
11	NLE	Radial—Super Subminiature, Low Leakage, Tantalum Replacement	-40 ~ +85°C	1.0 ~ 100 mfd	±10% (K) ±20% (M)	6.3 ~ 63WVDC
12	NNR	Radial—Non-Polarized	-40 ~ +85°C	0.47 ~ 470 mfd	±10% (K) ±20% (M)	6.3 ~ 100WVDC
13	NRX	Radial—Low ESR for Switching Regulators	-55 ~ +105°C	1.0 ~ 2200 mfd	-10+50% ±20% (M)	10 ~ 100WVDC
14	NRL	Snap-In Terminal	-40 ~ +85°C	47 ~ 22,000 mfd	-10+50% ±20% (M)	10 ~ 450WVDC
15	NRLP	Snap-In Terminal, Low Profile	-40 ~ +85°C	47 ~ 22,000 mfd	-10+50% ±20% (M)	10 ~ 450WVDC
16	NRL-W	Snap-In Terminal, Wide Temperature	-40 ~ +110°C	47 ~ 22,000 mfd	-10+50% ±20% (M)	10 ~ 450WVDC
17	NRLP-W	Snap-In Terminal, Low Profile, Wide Temperature	-40 ~ +110°C	47 ~ 22,000 mdf	-10+50% ±20% (M)	10 ~ 450WVDC

OPTIONS AVAILABLE

EPOXY END SEAL (-E)	RADIAL TAPING (TB)	CUT LEADS (C)
ANTI-SOLVENT END SEAL (-AS)	AXIAL TAPING (TR)	FORMED LEADS (F)

TANTALUM CAPACITORS

ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
18	NDT	Radial—Resin Dipped	-55 ~ +85°C	0.1 ~ 330 mfd	±10% (K)	3.15 ~ 50WVDC
19	NTA	Axial—Solid, Can Type	-55 ~ +125°C	0.1 ~ 470 mfd	±10% (K)	3.15 ~ 50WVDC
20	NTC	Chip Type, Surface Mounted	-55 ~ +125°C	0.1 ~ 47 mfd	±20% (M)	4 ~ 35WVDC

NIC COMPONENTS CORP. 238 Route 109, Farmingdale, New York 11735 • (516) 694-0060 • (800) 645-9333, 9222

NIC COMPONENTS CORPORATION

NORTH AMERICAN OPERATIONS NIPPON INDUSTRIES COMPANY LTD.

FILM CAPACITORS

ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
21	NEM	Radial, Inductive Dipped Polyester	-40 ~ +85°C	.001 ~ 0.47 mfd	±10% (K) ±5% (J)	100 ~ 400WVDC
22	NRP	Radial, Non-Inductive Dipped Polyester	-55 ~ +85°C	.001 ~ 1.0 mfd	±10% (K) ±5% (J) ±2% (G)	50 ~ 630WVDC
23	NAP	Axial, Wrap and Fill Polyester, Non-Inductive	-55 ~ +85°C	.001 ~ 2.0 mfd	±10% (K) ±5% (J) ±2% (G)	50 ~ 630WVDC
24	NRM	Radial, Metalized Polyester, Dipped	-55 ~ +85°C	.01 ~ 6.8 mfd	±10% (K) ±5% (J)	100 ~ 630WVDC
25	NAM	Axial, Metalized Polyester, Wrap and Fill, Flat Oval	-55 ~ +85°C	.01 ~ 10 mfd	±10% (K) ±5% (J)	100 ~ 630WVDC
26	NTM	Axial, Metalized Polyester, Wrap and Fill, Tubular	-55 ~ +85°C	.01 ~ 10 mfd	±10% (K) ±5% (J)	100 ~ 630WVDC
27	NPRM	Radial Metalized Polypropylene, Dipped	-55 ~ +85°C	.01 ~ 3.3 mfd	±10% (K) ±5% (J) ±2% (G)	100 ~ 630WVDC
28	NPAM	Axial Metalized Polypropylene, Wrap and Fill, Flat Oval	-55 ~ +85°C	.01 ~ 10 mfd	±10% (K) ±5% (J) ±2% (G)	100 ~ 630WVDC
29	NPTM	Axial Metalized Polypropylene, Wrap and Fill, Tubular	-55 ~ +85°C	.01 ~ 10 mfd	±10% (K) ±5% (J) ±2% (G)	100 ~ 630WVDC
30	NPST	Axial Polystyrene, Film Foil	-55 ~ +85°C	100 pf ~ 1 mfd	±5% (J) ±2% (G) ±1% (F)	100 ~ 630WVDC

CERAMIC CAPACITORS

ITEM NO.	SERIES	DESCRIPTION	OPERATING TEMPERATURE (°C)	CAPACITANCE RANGE	TOLERANCE	RATED VOLTAGE RANGE
31	NCD	Radial Disc, HI-K Type Y5F, Y5P, Z5U, Z5V	-30 ~ +85°C	100 pfd ~ .22 mfd	±10% (K) ±20% (M) +80-20% (Z)	16 ~ 6000WVDC
32	NCD-TC	Radial Disc, Temperature Compensating Type, NPO, SL, N750, N1500	-30 ~ +85°C	1.0 pfd ~ 1000 pfd	±5% (J) ±10% (K)	16 ~ 1000WVDC
33	NCD-SC	Radial Disc, Semi-Conductive Type Y5S, Y5T, Y5V	-30 ~ +85°C	.01 mfd ~ .47 mfd	±20% (M) +80-20% (Z)	12 ~ 50WVDC
34	NCM	Radial, Multi-Layer, Epoxy Dip NPO, X7R, Z5U	-55 ~ 125°C	10 pfd ~ 2.2 mfd	±5% (J) ±10% (K) ±20% (M)	50 ~ 100WVDC
35	NMC	Chip Type Multi-Layer NPO, X7R, Z5U	-55 ~ 125°C	0.5 pfd ~ 2.2 mfd	±2% (G) ±5% (J) ±10% (K) ±20% (M)	25 ~ 200WVDC

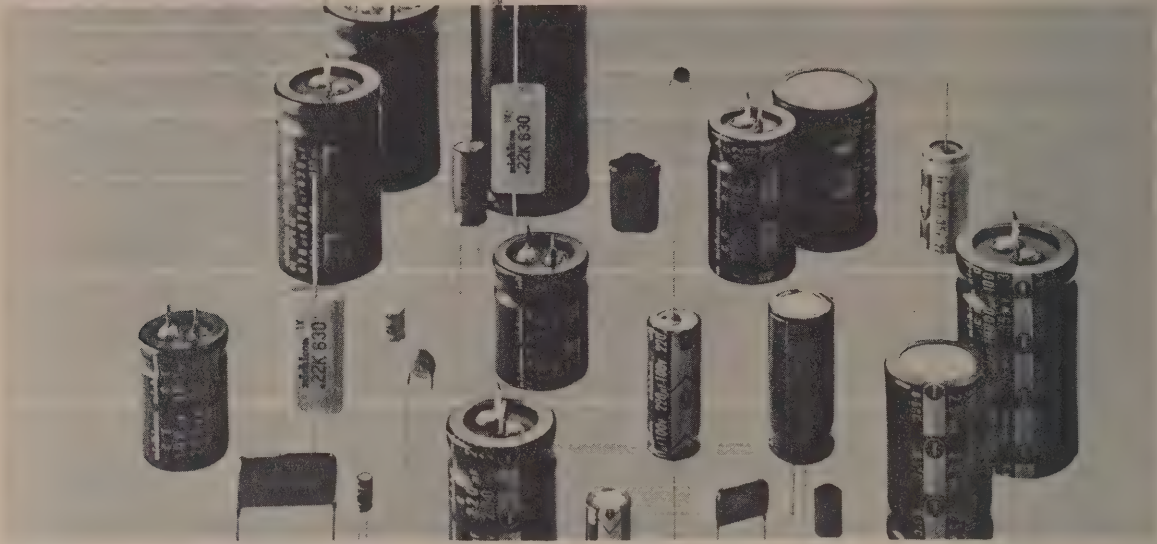
NIC COMPONENTS CORP. 238 Route 109, Farmingdale, New York 11735 • (516) 694-0060 • (800) 645-9333, 9222

ALUMINUM ELECTROLYTIC CAPACITORS
SEMI-CONDUCTIVE CERAMIC CAPACITORS
POLYESTER FILM CAPACITORS

nichicon

CAT. NAC-SF043

SHORT FORM CATALOG



At Nichicon, we're capacitor specialists. So we have to go to extremes for you. To answer your engineering questions. To help you solve design problems. To match the right capacitor to the application...at the right price, when you need them.

Nichicon is one of the world's largest manufacturers of miniature and can type aluminum electrolytic, semi-conductive ceramic disc, polyester film and metallized polyester film capacitors.

For catalogs and pricing contact your local Nichicon representative or distributor. You can also call or write Nichicon (America) Corporation, 927 E. State Parkway, Schaumburg, Illinois 60195. (312) 843-7500.

We're Nichicon. The capacitor choice.

IMPORTANT INFORMATION IN THE APPLICATION OF ALUMINUM ELECTROLYTIC CAPACITORS

1. DC electrolytic capacitors have polarity. The polarity is marked on the body of the capacitors. This type of capacitor must not be used with polarity reversed.
2. Voltage in excess of the rated voltage and/or the rated surge voltage must not be applied.
3. The capacitors should not be used at temperatures exceeding the range of the specified operating temperature.
4. In general, capacitance values decrease as the frequency increases.
5. If the capacitors are stored or left unused for more than three (3) years at normal storage temperature (−40°C ~ +40°C), aging should be conducted at the rated working voltage before application.
6. Soldering irons should not come in contact with the vinyl insulating sleeves of the capacitors.
7. Dip-soldering of the capacitors should not exceed ten (10) seconds at 260°C.
8. The capacitors may be damaged with some cleaning solvents such as Chlorothine, Triclene, Methyl Chloride, etc.

When requesting more information or data sheets, reference the series type number.

nichicon
The capacitor choice.

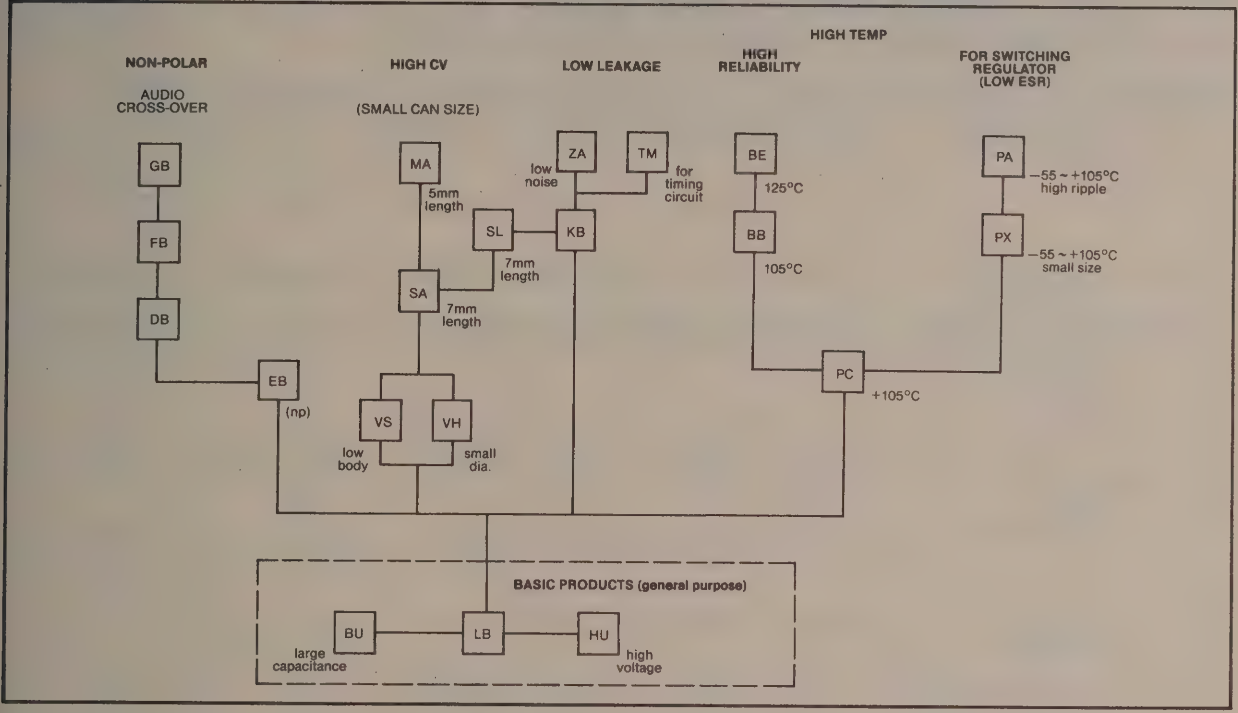
NICHICON (AMERICA) CORPORATION

927 EAST STATE PARKWAY
SCHAUMBURG, ILLINOIS 60195
PHONE • (312) 843-7500 TELEX • 20-6577

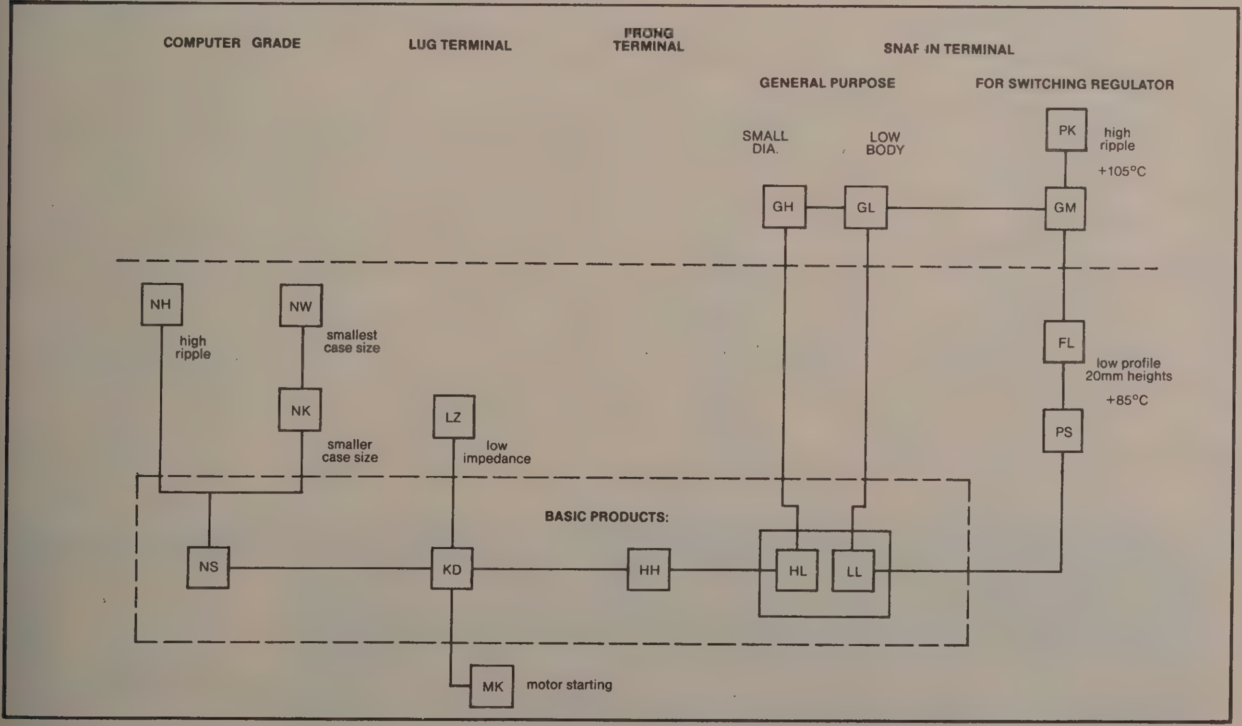
ALUMINUM ELECTROLYTIC CAPACITORS
SEMI-CONDUCTIVE CERAMIC CAPACITORS
POLYESTER FILM CAPACITORS

nichicon

ALUMINUM ELECTROLYTIC CAPACITORS GROUP CHART: MINIATURE, RADIAL–TYPE 'U' AND AXIAL–TYPE 'T'


NON-POLAR
AUDIO CROSS-OVER
HIGH CV
(SMALL CAN SIZE)
LOW LEAKAGE
HIGH TEMP
HIGH RELIABILITY
FOR SWITCHING REGULATOR (LOW ESR)
GB
FB
DB
EB
(np)
MA
5mm length
SL
7mm length
SA
7mm length
VS
low body
VH
small dia.
ZA
low noise
TM
for timing circuit
KB
BE
125°C
BB
105°C
PA
−55 ~ +105°C high ripple
PX
−55 ~ +105°C small size
PC
+105°C
BASIC PRODUCTS (general purpose)
BU
large capacitance
LB
HU
high voltage

GROUP CHART: CAN TYPE–TYPE 'L'


COMPUTER GRADE
LUG TERMINAL
PRONG TERMINAL
SNAP IN TERMINAL
GENERAL PURPOSE
FOR SWITCHING REGULATOR
SMALL DIA.
LOW BODY
PK
high ripple
+105°C
GH
GL
GM
NH
high ripple
NW
smallest case size
NK
smaller case size
LZ
low impedance
FL
low profile 20mm heights
+85°C
PS
BASIC PRODUCTS:
NS
KD
HH
HL
LL
MK
motor starting

ALUMINUM ELECTROLYTIC CAPACITORS SEMI-CONDUCTIVE CERAMIC CAPACITORS POLYESTER FILM CAPACITORS

nichicon

MINIATURE ALUMINUM ELECTROLYTICS— RADIAL LEAD—TYPE 'U' AND AXIAL LEAD—TYPE 'T'

Item No.	Series Type	Features	Operating Temp (°C)	Construction	Rated Voltage Range (V. DC)	Capacitance Range (µF)	Capacitance Tol. (%)	D.C. Leakage Current (µA)
1	LB	• Smaller Standard Size • Greater CV Density	−40 ~ +85	Radial (U)	6.3 ~ 100	0.1 ~ 10,000	±20(M)	0.03 CV (4µA Min.) After 1 Minute
				Axial (T)	6.3 ~ 100	0.47 ~ 33,000	±20(M)	0.03CV (3µA Min.) After 5 Minutes
2	VS/VH	• Low Profile Design (VS) • Small Diameter (VH)	−40 ~ +85	Radial (U)	6.3 ~ 50	0.1 ~ 3,300	±20(M)	0.01CV (2µA Min.) After 2 Minutes
3	BU	• Large Capacitance in Compact Size • 3-Lead Construction or Conventional 2 Lead Type	−40 ~ +85	Radial (U)	6.3 ~ 100	680 ~ 33,000	±20(M)	0.03CV After 5 Minutes
4	HU	• High Voltage	−25 ~ +85	Radial (U)	160 ~ 450	1 ~ 100	−10 ~ +50(T)	0.06CV +10 After 5 Minutes
				Axial (T)	160 ~ 450	1 ~ 470	−10 ~ +50(T)	
5	KB	• Low Leakage • Good for Tantalum Replacement	−40 ~ +85	Radial (U)	6.3 ~ 100	0.1 ~ 4,700	±20(M) ±10(K)	0.002CV (0.4µA Min.) After 2 Minutes
				Axial (T)	6.3 ~ 100	0.47 ~ 3,300	±20(M) ±10(K)	0.002CV (1µA Min.) After 2 Minutes
6	ZA	• Low Noise • Epoxy End Seal	−40 ~ +85	Radial (U)	6.3 ~ 100	0.47 ~ 47	±20(M)	0.004CV (0.2µ A Min.) After 30 Sec.
7	SA	• Super Miniature, Body Height (7mm for full line) • For Tantalum Replacement	−40 ~ +85	Radial (U)	6.3 ~ 63	0.1 ~ 100	±20(M)	0.01CV (3µ A Min.) After 2 Minutes
8	SL	• Super Miniature, Body Height (7mm for full line) • Low Leakage • For Tantalum Replacement	−40 ~ +85	Radial (U)	6.3 ~ 63	0.1 ~ 100	±20(M)	0.002CV (0.4µ A Min.) After 2 Minutes
9	MA	• Ultra Miniature, Body Height (5mm for full line) • For Tantalum Replacement	−40 ~ +85	Radial (U)	4 ~ 50	0.1 ~ 100	±20(M)	0.01CV (3µ A Min.) After 2 Minutes
10	PC	• Similar Case Size as LB Series • Plus Extended Temperature Range	−55 ~ +105	Radial (U)	6.3 ~ 100	0.1 ~ 10,000	±20(M)	0.03CV (4µ A Min.) After 1 Minute
			−40 ~ +105	Axial (T)	6.3 ~ 100	0.47 ~ 4,700	±20(M)	
11	BB	• High Temp. • High Reliability (+105°C, 3,000 hours)	−40 ~ +105	Radial (U)	10 ~ 100	0.47 ~ 1,000	±20(M)	0.002CV (2µ A Min.) After 5 Minutes
				Axial (T)	10 ~ 100	0.47 ~ 1,000	±20(M)	
12	BE	• High Temp. • High Reliability (+125°C, 2,000 hours)	−40 ~ +125	Radial (U)	10 ~ 50	0.47 ~ 470	±20(M)	0.002CV (2µ A Min.) After 5 Minutes
				Axial (T)	10 ~ 50	0.47 ~ 470	±20(M)	
13	TM	• For Timing Circuits • Very Stable at High Temp.	−40 ~ +85	Radial (U)	10 ~ 50	1 ~ 470	±20(M) ±10(K)	0.001CV +1 After 2 Minutes
14	EB	• Non-Polarized	−40 ~ +85	Radial (U)	6.3 ~ 100	0.47 ~ 6,800	±20(M)	0.03CV (3µA Min.) After 5 Minutes
				Axial (T)	6.3 ~ 100	0.47 ~ 10,000	±20(M)	
15	DB	• Bi-Polar For Audio Crossover • Standard of Bi-Polar Series	−40 ~ +85	Radial (U)	50	1 ~ 68	±20(M)	0.03 A (3µ A Min.) After 5 Minutes
				Axial (T)	50	1 ~ 68	±20(M)	
16	FB	• Bi-Polar For Audio Crossover • Small Case and Wider Capacitance Range	−40 ~ +85	Radial (U)	50	1 ~ 100	±20(M)	0.03CV (3µ A Min.) After 5 Minutes
17	GB	• Bi-Polar For Audio Crossover • Highest Performance of Bi-Polar Series	−40 ~ +85	Radial (U)	50	1 ~ 39	±10(K)	0.03CV (3µ A Min.) After 5 Minutes

ALUMINUM ELECTROLYTIC CAPACITORS
SEMI-CONDUCTIVE CERAMIC CAPACITORS
POLYESTER FILM CAPACITORS

nichicon

MINIATURE ALUMINUM ELECTROLYTICS—FOR SWITCHING REGULATORS

Item No.	Series Type	Features	Operating Temp (°C)	Construction	Rated Voltage Range (V. DC)	Capacitance Range (μF)	Capacitance Tol. (%)	D.C. Leakage Current (μA)
18	PA	• Low-ESR For Switching Regulators • High Ripple at High Frequency	−55 ~ +105	Radial (U)	6.3 ~ 200	1 ~ 1,000	±20(M)	0.002CV (3μ A Min.) After 5 Minutes
19	PX	• Low-ESR For Switching Regulators • Compact Case Size	−55 ~ +105	Radial (U)	6.3 ~ 63	22 ~ 2,200	±20(M)	0.03CV After 5 Minutes

CAN-TYPE ELECTROLYTICS—TYPE L

Item No.	Series Type	Features	Operating Temp. (°C)	Rated Voltage Range (V. DC)	Capacitance Range (μF)	Capacitance Tol.(%)	D.C. Leakage Current (μA)
20	KD	• Lug Terminal (LA)	−40 ~ +85 (16 ~ 100V) −25 ~ +85 (160 ~ 500V)	16 ~ 500	22 ~ 68,000	−10 ~ +50(T)	$3\sqrt{CV}$ After 5 Minutes
21	HH	• Prong Terminal (HH) for P.C.B. Mount	−40 ~ +85 (16 ~ 100V) −25 ~ +85 (160 ~ 500V)	16 ~ 500	150 ~ 47,000	−10 ~ +50(T)	$3\sqrt{CV}$ After 5 Minutes
22	HL	• Snap-in Terminal (HS) • for P.C.B Mount	−40 ~ +85 (16 ~ 100V) −25 ~ +85 (160 ~ 500V)	16 ~ 500	22 ~ 22,000	−10 ~ +30(Q)	$3\sqrt{CV}$ After 5 Minutes
23	LL	• Snap-in Terminal (HS) for P.C.B. Mount • Low Profile of HL Series	−40 ~ +85 (16 ~ 100V) −25 ~ +85 (160 ~ 200V)	16 ~ 200	220 ~ 15,000	−10 ~ +30(Q)	$3\sqrt{CV}$ After 5 Minutes
24	GH	• Snap-in Terminal (HS) • Higher Temp. (105°C)	−40 ~ +105	10 ~ 100	470 ~ 15,000	±20(M)	$3\sqrt{CV}$ After 5 Minutes
25	GL	• Snap-in Terminal (HS) • Higher Temp. (105°C) • Low Profile of GH Series	−40 ~ +105	10 ~ 100	1,000 ~ 10,000	±20(M)	$3\sqrt{CV}$ After 5 Minutes
26	LZ	• P.C. Mount Terminal (LM) • Low Impedance • Low Profile	−40 ~ +85	16 ~ 100	2,200 ~ 22,000	−10 ~ +30(Q)	$3\sqrt{CV}$ After 5 Minutes
27	NW	• Computer Grade—Screw Terminal (SM) • Smallest Size of Computer Grade	−25 ~ +85	6.3 ~ 450	120 ~ 1,000,000 (1F)	−10 ~ +50(T)	$3\sqrt{CV}$ After 5 Minutes
28	NK	• Computer Grade—Screw Terminal (SM) • Smaller Case Size Than 'NS' and Higher Ripple than 'NW'	−25 ~ +85	6.3 ~ 450	150 ~ 470,000	−10 ~ +50(T)	$3\sqrt{CV}$ After 5 Minutes
29	NS	• Computer Grade—Screw Terminal (SM) • Standard Size and Ripple	−25 ~ +85	6.3 ~ 450	220 ~ 470,000	−10 ~ +50(T)	$3\sqrt{CV}$ After 5 Minutes
30	NH	• Computer Grade—Screw Terminal (SM) • For High Ripple Current Applications	−25 ~ +85	6.3 ~ 450	220 ~ 220,000	−10 ~ +100(W) (63 ~ 80V) −10 ~ +75(U) (100 ~ 350V) −10 ~ +50(T) (400 ~ 450V)	$3\sqrt{CV}$ After 5 Minutes
31	MK	• For Motor Starting • Lug Terminal (LA)	−25 ~ +65	110 ~ 250 V. AC	20 ~ 400	−0 ~ +20(A)	–

nichicon
The capacitor choice.

The capacitor choice.

NICHICON (AMERICA) CORPORATION

ALUMINUM ELECTROLYTIC CAPACITORS
SEMI-CONDUCTIVE CERAMIC CAPACITORS
POLYESTER FILM CAPACITORS

nichicon

CAN TYPE ELECTROLYTICS—TYPE 'L' FOR SWITCHING REGULATORS

Item No.	Series Type	Features	Operating Temp. (°C)	Rated Voltage Range (V. DC)	Capacitance Range (μF)	Capacitance Tol.(%)	D.C Leakage Current (μA)
32	PS	• Snap-in Terminal (HS) • Provides Several Case Size for Each Rating	−40 ~ +85 (160 ~ 250V) −25 ~ +85 (350 ~ 450V)	160 ~ 450	47 ~ 1,000	±20(M)	$3\sqrt{CV}$ After 5 Minutes
33	FL	• Snap-in Terminal (HS) • Low Profile	−40 ~ +85	160 ~ 250	82 ~ 270	±20(M)	$3\sqrt{CV}$ After 5 Minutes
34	GM	• Snap-in Terminal (HS) • Higher Temp. (105°C) • Provides Several Case Size for Each Rating	−40 ~ +105 (160 ~ 250V) −25 ~ +105 (400V)	160 ~ 400	47 ~ 1,000	±20(M)	$3\sqrt{CV}$ After 5 Minutes
35	PK	• Snap-in Terminal (HS) • Higher Temp (105°C) • Highest Ripple Current Capability	−40 ~ 105	200, 250	150 ~ 1,000	±20(M)	$3\sqrt{CV}$ After 5 Minutes

SEMI-CONDUCTIVE CERAMIC CAPACITOR

Item No.	Series Type	Rated Voltage (V. DC)	T. C.	Capacitance (μF)	Capacitance Tolerance	Insulation Resistance (MΩ)
36	HES	12	Y5S	0.022 ~ 0.47	±20% (M), +80-20% (Z)	0.022-0.1μF—1 Min. at 12V 0.33μF—0.33 Min. at 12 V 0.22μF—0.5 Min. at 12V 0.47μF—0.25 Min. at 12 V
37	HET	25	Y5T	0.01 ~ 0.1	±20% (M), +80-20% (Z)	1,000 Min. at 25V
38	HEV HET	50	Y5V Y5T	0.01 ~ 0.1	Y5V: +80-20% (Z) Y5T ±20% (M), +80-20% (Z)	1,000 Min. at 50V

POLYESTER FILM CAPACITOR

Item No.	Series Type	Rated Voltage (V. DC)	Capacitance (μF)	Capacitance Tolerance	Insulation Resistance	D. F.
39	QYA	100	0.001 ~ 0.47	±5% (J), ±10% (K), ±20% (M)	9,000 MΩ Min.	1.0% Max. at 1kHz

METALLIZED POLYESTER FILM CAPACITOR

Item No.	Series Type	Rated Voltage (V. DC)	Capacitance (μF)	Capacitance Tolerance	Insulation Resistance	D. F.
40	QXM (Radial)	250, 400, 630	0.01 ~ 2.2	±5% (J), ±10% (K), ±20% (M)	≤0.33μF—9,000 MΩ Min.	1.0% Max.
41	QAM (Axial)	250, 400, 630	0.15 ~ 10	±5% (J), ±10% (K), ±20% (M)	>0.33μF—3,000 MΩ Min.	at 1kHz

UL LISTED METALLIZED FILM CAPACITOR—RADIAL— MOLDED RESIN CASE

Item No.	Series Type	Rated Voltage	Capacitance (μF)	Capacitance Tolerance	Insulation Resistance	D. F.
42	AL	125 V. AC	0.0047 ~ 0.22	±10% (K), ±20% (M)	9,000 MΩ Min. at 100 V. DC 1 Min.	1.0% Max. at 1kHz

Note: The following features for ceramic disc and film capacitors are available upon your request:
1. Radial lead taping is available in 11mm diameter and less products for all ceramic series and TDY film capacitors
2. Axial lead taping is available in 11mm diameter and less products for all ceramic series
3. Lead cut and forming are available for all series

Nichicon also manufactures:

Oil filled paper capacitors (without P.C.B.'s)
Paper tublar and metallized paper tublar capacitors
Hybrid I.C.'s
PTC Thermistors "POSI-R"

SPECIAL ORDERING SPECIFICATIONS

nichicon

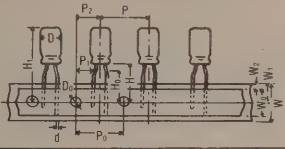
TAPED CAPACITORS FOR AUTOMATIC INSERTION

Taped Nichicon aluminum electrolytic capacitors of Axial Lead type and Radial Lead type designs are available in a choice of two packaging methods: reel packaging and ammunition box.

TAPED RADIAL LEADS

Available for capacitors with diameters of 4 (.157"); 5 (.196"); 6 (.236"); and 8mm (.314"). In conformity with EIAJ-RC1008

Units of up to ϕ10 (ϕ10x16L) can be supplied in taped form on request.



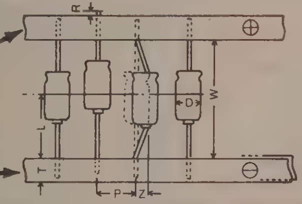
Code	D	d	P	P₀	P₁	P₂	F	H	H₀	H₁	D₀	W	W₀	W₁	W₂
Nominal Value	*	*	12 7	12.7	3 85	6 35	5 0	H+A≤H₁	16 0	MAX 32.25	4.0	18.0	MIN 12.5	9 0	MAX 3 0
Tolerance	MAX +0 5	±0 05	±1 0	±0 2	±0 7	±1.3	+0.8 −0 2	–	±0 5	–	±0 2	±0 5	–	±0.5	–

* For capacitors of ϕ4, units with F dimension of 3.5 are also available.
* "ϕd" depends on capacitor specification.

TAPED AXIAL LEADS

Available for capacitors with diameters of 5 (.196"); 6 (.236"); 8 (.314"); 10 (.394") and 13mm (.511"). In conformity with EIAJ-RC1008 and IEC-Pub 286

White tape for positive polarity



Blue or yellow tape for negative polarity

Code	W	R	P	Z	L	T
Nominal Value	52.4, 63.5, 73	2 MAX.	*	1 2 MAX.	$\frac{W}{2}$	6.0
Tolerance	±1.5	–	±0.5	–	±1 2	±1

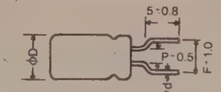
* P = 10 for ϕ5, 6 and 8 capacitors P = 15 for ϕ10 and 13 capacitors

LEAD FORMING (Capacitors with trimmed or formed leads—radial lead type)

Capacitors with their leads formed or trimmed allow for easier insertion of the units into PC boards. Thus, higher mounting efficiency can be gained.

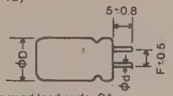
Formed leads and trimmed leads

Shape (1)
(ϕ4, 5, 6, 8)



Formed lead code: FA

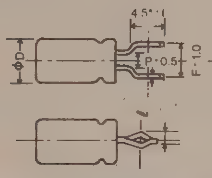
Shape (2)
(ϕ10, 13, 16, 18)



Formed lead code: CA

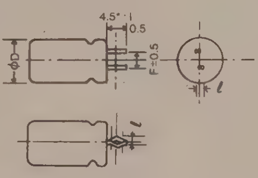
Snap-in type lead

Shape (3)
(ϕ4, 5, 6, 8)



Formed lead code: AA

Shape (4)
(ϕ10, 13, 16, 18)



Formed lead code: AA

Forming method Code	Shape No.	Dimensions			
		ϕD	F	P	L
Forming and cutting FA	①	4	5	1.5	–
		5	5	2.0	–
		6(6 3)	5	2.5	–
		8	5	3.5	–
Cutting CA	②	10	5	–	–
		13	5	–	–
		16	7.5	–	–
		18	7.5	–	–
Snap-in type forming AA	③	4	5	1.5	1 1
		5	5	2.0	1 1
		6(6 3)	5	2.5	1 1
		8	5	3.5	1 3
	④	10	5	–	1 3
		13	5	–	1 3
		16	7.5	–	1 3
		18	7.5	–	1 3

*For ϕ4 capacitors with formed or trimmed leads, they can also be supplied with F dimension of 3.5 mm.
*Lead diameter ϕd depends on capacitor specification.

SAFETY VENT (Miniature Aluminum Electrolytic Capacitors)

Diameters ≥ 10mm	Safety Vent Standard
Diameters ≤ 8mm	Safety Vent Optional (Except SA, SL, and MA Series,)

ANTI-SOLVENT FEATURE

Clean and simple. Nichicon anti-solvent aluminum electrolytic capacitors withstand unfriendly cleaning agents for up to 5 minutes. And even though they perform better than epoxy end-sealed capacitors, their maximum seated height and cost have been reduced.

Series	Cleaning Agent	Cleaning Condition	Cleaning Time
LB† SA SL PC* PX EB VS/VH BU	Freon® TE, TES TMS, TF Daiflon S3-E Daiflon S3-P35	• Ultrasonic (28kHz, 10 W/L Max. output) • Vapor • Immersion	5 minutes

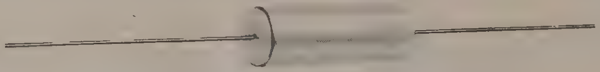
† LB Series capacitors with capacitance ratings ≥ 1μF, except: 100V "T" type axials and 100V/470μF radial types.
*PC Series capacitors with capacitance ratings ≥ 1μF, except: "T" type axials and radial types ≥ 63V.

nichicon
The capacitor choice.
The capacitor choice.
NICHICON (AMERICA) CORPORATION

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 107 POLYESTER FILM CAPACITORS

POLYESTER FILM CAPACITORS EXTENDED FOIL/FILM WRAP/EPOXY END FILL STYLE 107 −55°C TO +125°C



ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

CAPACITANCE MEASUREMENTS

Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz. Capacitors greater than 1.0 μF shall be measured at 60 Hz. The standard capacitance tolerance is 20%. Other tolerances are available upon request.

Reference: MIL-STD-202, Method 305.

TEMPERATURE CHARACTERISTICS

The maximum change in capacitance from the measured value at +25°C shall be −6% at −55°C, and +15% at +125°C.

DISSIPATION FACTOR

When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.6% for values up to 1.0 μF and shall not exceed 1.0% for greater capacitance values.

INSULATION RESISTANCE

When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 50,000 megohm-microfarads, but need not exceed 100,000 megohms. The period of electrification shall not exceed two minutes.

Reference: MIL-STD-202, Method 302.

VOLTAGE DERATING

The capacitors may be operated at full rated voltage from −55°C to +85°C, or with linear derating to 50% of rated voltage above +85°C with a maximum temperature of +125°C.

VOLTAGE TEST

When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:

Terminal to terminal	200% of DC rating
Terminal to case (less than .235 diameter)	200% of DC rating
Terminal to case (greater than .235 diameter)	400% of DC rating or 2,000 VDC, whichever is less

Reference: MIL-STD-202, Method 301.

LIFE TESTING

When tested for 1000 hours at 150% of the appropriate rated voltage for the test temperature, the capacitors shall exhibit no more than one failure in twelve pieces tested. Alternatively, an accelerated +125°C test may be performed at the +85°C voltage rating for a period of 250 hours. A failure is defined as:

a) A capacitance change of more than 10% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than 1/3 that specified in Paragraph 4; or
d) A permanent open or short.

VIBRATION

The capacitors will meet or exceed in the vibration requirements of MIL-STD-202, Method 201.

NYTRONICS CATALOG NUMBERING SYSTEM

107 B 103 M

Nytronics Style — 107

D.C. Voltage Rating — B
B = 100V
C = 200V
E = 400V
F = 600V

Capacitance — 103
In $\mu\mu$f. The first two digits are the significant figures, the third is the number of zeros.

Capacitance Tolerance — M
F = ±1%
P = ±2%
J = ±5%
K = ±10%
M = ±20%

Note: Special capacitance values, voltage ratings and sizes available to customer requirements.

PHYSICAL SIZE TOLERANCES

	100 Volts DC & 200 Volts DC		400 Volts DC	
DIAMETER	Up to .158	+.032 −.000	Up to .218	±.032
	.159 to .200	+.040 −.000	.219 to .500	±.046
	Over .200	+.050 −.000	Over .500	±.062
LENGTH		+1/16 −0		+3/32 −1/16

TINNED COPPERWELD LEADS

No. 22 AWG. (.025) for cases up to .325 Dia.
No. 20 AWG. (.032) for cases .326 thru 1.0 Dia.
No. 18 AWG. (.040) for cases above 1.0 Dia.

Lead Length: 1 5/8″ Min.

Also available are the following styles with characteristics similar to Type 107.

STYLE 103
Flat Press with Axial Leads
Extended Foil Construction
Polyester Film Dielectric
Film Wrap-Epoxy Endfill
−55°C to +125°C Operation

STYLE 118
Round Body with Axial Leads
Extended Foil Construction
Polyester Film Dielectric
Polyethylene Case-Epoxy Endfill
−55°C to +100°C Operation

STANDARD RATINGS

Capacitance μf	Dia. x Length		Cat. No.
100 VOLTS DC WORKING			
.001	.138	3/8	107B102M
.0015	.138	3/8	107B152M
.0022	.138	3/8	107B222M
.0033	.138	3/8	107B332M
.0047	.138	3/8	107B472M
.0068	.138	3/8	107B682M
.0082	.138	3/8	107B822M
.01	.158	3/8	107B103M
.015	.158	21/32	107B153M
.022	.158	21/32	107B223M
.027	.158	21/32	107B273M
.033	.158	21/32	107B333M
.047	.190	21/32	107B473M
.068	.220	21/32	107B683M
.082	.265	21/32	107B823M
.1	.265	11/16	107B104M
.12	.300	3/4	107B124M
.15	.330	3/4	107B154M
.22	.350	15/16	107B224M
.27	.350	1 1/16	107B274M
.33	.385	1 1/16	107B334M
.39	.415	1 1/16	107B394M
.47	.450	1 1/16	107B474M
.56	.490	1 1/16	107B564M
.68	.540	1 1/16	107B684M
.82	.570	1 1/16	107B824M
1.	.590	1 3/16	107B105M
1.5	.670	1 5/16	107B155M
1.8	.730	1 5/16	107B185M
2.0	.700	1 1/2	107B205M
200 VOLTS DC WORKING			
.001	.138	3/8	107C102M
.0015	.138	3/8	107C152M
.0022	.138	3/8	107C222M
.0033	.138	3/8	107C332M
.0047	.138	3/8	107C472M
.0068	.138	3/8	107C682M
.0082	.138	3/8	107C822M
.01	.158	3/8	107C103M
.015	.158	21/32	107C153M
.022	.158	21/32	107C223M
.027	.158	21/32	107C273M
.033	.158	21/32	107C333M
.047	.190	21/32	107C473M
.068	.220	21/32	107C683M
.082	.265	21/32	107C823M
.1	.265	11/16	107C104M
.12	.285	13/16	107C124M
.15	.315	13/16	107C154M
.22	.325	1 1/16	107C224M
.27	.350	1 3/16	107C274M
.33	.390	1 3/16	107C334M
.39	.415	1 3/16	107C394M
.47	.450	1 3/16	107C474M
.56	.490	1 3/16	107C564M
.68	.540	1 3/16	107C684M
.82	.580	1 3/16	107C824M
1.	.590	1 5/16	107C105M
1.5	.680	1 7/16	107C155M
1.8	.740	1 7/16	107C185M
2.0	.750	1 9/16	107C205M
400 VOLTS DC WORKING			
.001	.156	5/8	107E102M
.0015	.156	5/8	107E152M
.0022	.156	5/8	107E222M
.0033	.156	5/8	107E332M
.0047	.187	5/8	107E472M
.0068	.218	5/8	107E682M
.0082	.234	5/8	107E822M
.01	.250	5/8	107E103M
.015	.296	5/8	107E153M
.022	.312	3/4	107E223M
.027	.281	7/8	107E273M
.033	.312	7/8	107E333M
.047	.343	7/8	107E473M
.068	.375	1	107E683M
.082	.406	1	107E823M
.1	.421	1	107E104M
.12	.468	1	107E124M
.15	.468	1 1/4	107E154M
.22	.546	1 3/8	107E224M
.27	.609	1 3/8	107E274M
.33	.593	1 5/8	107E334M
.39	.625	1 5/8	107E394M
.47	.671	1 5/8	107E474M
.56	.718	1 3/4	107E564M
.68	.796	1 3/4	107E684M
.82	.812	1 7/8	107E824M
1.	.812	2	107E105M
1.5	.921	2 1/4	107E155M
1.8	1.015	2 1/4	107E185M
2.0	1.093	2 1/4	107E205M

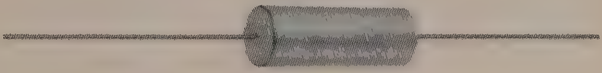
Special capacitance values, tolerances and sizes are available on request.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

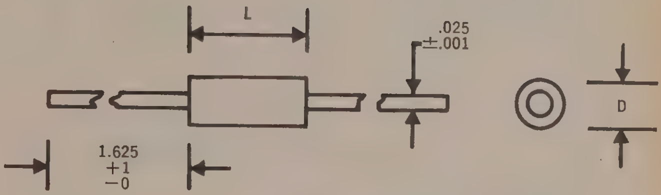
**TYPE 111
MOLDED POLYESTER
CAPACITORS**

TYPE 111 MOLDED MYLAR* CAPACITORS

MOLDED IN RUGGED FLAME-RETARDANT MOLDING COMPOUND



Nytronics Type 111 Capacitors were developed for applications requiring excellent capacitance stability, superior humidity resistance and high insulation resistance. The capacitor element is non-inductively wound with mylar dielectric and extended foil.



Size	D, Max	L, Max
A	.188	.440
B	.188	.697
C	.219	.697
** A-B	.219	.572

ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

CAPACITANCE
Shall be within the specified limits when measured at a frequency of 1 KHz at +25°C.

DISSIPATION FACTOR
Shall not exceed 1% when measured as above.

INSULATION RESISTANCE
When measured at +25°C and with rated voltage applied for 2 minutes, shall be a minimum of 50,000 megohms.

DIELECTRIC STRENGTH
Shall withstand 2.5X rated voltage for one minute.

OPERATING TEMPERATURE
−55°C to +85°C at full rated voltage; derated linearly to 50% of rated voltage at 125°C.

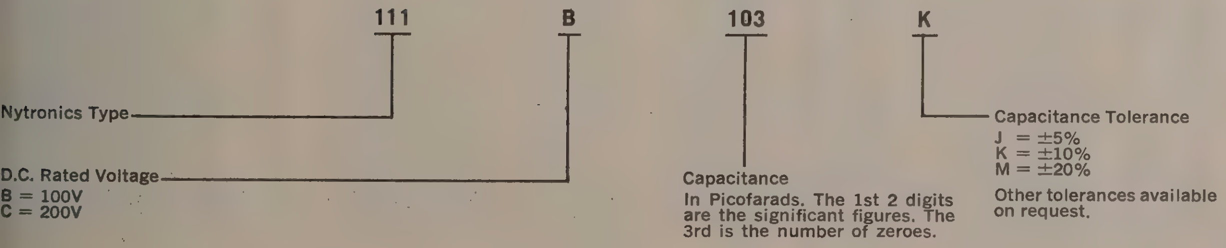
LIFE TEST
250 hours, at +85°C and 150% of rated voltage or, at +125°C with 85°C rated voltage applied. One failure in twelve allowed.

MOISTURE RESISTANCE
Capacitors shall meet the humidity requirements of MIL-STD-202E, Method 106D, 5 cycles.

Capacity MFD	100 VDC	Case Size	200 VDC	Case Size
.001	111B102K	A	111C102K	A
.0012	111B122K	A	111C122K	A
.0015	111B152K	A	111C152K	A
.0018	111B182K	A	111C182K	A
.0022	111B222K	A	111C222K	A
.0027	111B272K	A	111C272K	A
.0033	111B332K	A	111C332K	A
.0039	111B392K	A	111C392K	A
.0047	111B472K	A	111C472K	A
.0056	111B562K	A	111C562K	A
.0068	111B682K	A	111C682K	A
.0082	111B822K	A	111C822K	A
.01	111B103K	A	111C103K	B
.012**	111B123K	B	111C123K	B
.015**	111B153K	B	111C153K	B
.018**	111B183K	B	111C183K	B
.022**	111B223K	B	111C223K	B
.027**	111B273K	C	111C273K	C
.033**	111B333K	C	111C333K	C
.039	111B393K	C		
.047	111B473K	C		

** Available in alternate A-B size. To order prefix number with AB — Example AB111B123, 100 VDC only.

NYTRONICS CATALOG NUMBERING SYSTEM



Nytronics Type

D.C. Rated Voltage
B = 100V
C = 200V

Capacitance
In Picofarads. The 1st 2 digits are the significant figures. The 3rd is the number of zeroes.

Capacitance Tolerance
J = ±5%
K = ±10%
M = ±20%

Other tolerances available on request.

Intermediate capacitance values available
* Dupont Trade Name
† Other values and sizes available soon; inquiries invited

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE 133
POLYSTYRENE
CAPACITORS**

POLYSTYRENE CAPACITORS

EXTENDED FOIL
FILM WRAP/EPOXY END-FILL
STYLE 133
−55°C TO +85°C

ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

CAPACITANCE MEASUREMENTS

Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz.

Capacitors greater than 1.0 μF shall be measured at 60 Hz.

The standard capacitance tolerance is 20%. Other tolerances are available upon request.

Reference: MIL-STD-202. Method 305.

TEMPERATURE CHARACTERISTICS AND STABILITY

When measured over the full operating range, the Temperature Coefficient shall be −120ppm/°C ±30ppm/°C.

There shall be less than 0.1% change per year in capacitance when operated between +20°C and +50°C.

After cycling from −55°C to +75°C, the capacitance shall not vary more than 0.2% from its initial measurement at +25°C.

DISSIPATION FACTOR

When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.1%.

INSULATION RESISTANCE

When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 200.000 megohm-microfarads, but need not exceed 500,000 megohms. The period of electrification shall not exceed two minutes.

Reference: MIL-STD-202, Method 302.

VOLTAGE DERATING

The capacitors may be operated at full rated voltage from −55°C to +65°C, or with linear derating to 60% of rated voltage above +65°C to the maximum operating temperature of +85°C.

VOLTAGE TEST

When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:

Terminal to terminal	200% of DC rating
Terminal to case (less than .235 diameter)	200% of DC rating
Terminal to case (greater than .235 diameter)	400% of DC rating or 2.000 VDC, whichever is less

Reference: MIL-STD-202, Method 301.

LIFE TESTING

When tested at 85°C for 250 hours at full 65°C rated voltage, the capacitors shall exhibit no more than one failure in twelve pieces tested. A failure is defined as:

a) A capacitance change of more than 6% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than 60% that specified in Paragraph 4; or
d) A permanent open or short.

VIBRATION

The capacitors will meet or exceed the vibration requirements of MIL-STD-202, Method 201.

NYTRONICS CATALOG NUMBERING SYSTEM

133 B 103 M

133 — Nytronics Style

B — DC Rated Voltage
A = 50V
B = 100V
C = 200V
E = 400V
F = 600V

103 — Capacitance
In μμf. The first two digits are the significant figures, the third is the number of zeroes.

M — Capacitance Tolerance
F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

Note: Special capacitance values, voltage ratings and sizes available to customer requirement.

Intermediate value available.

STANDARD RATINGS AT 85°C

50 VOLTS DC WORKING

Capacitance MFD	Diameter	Length	Cat. No.
.001	.218	.625	133A102M
.0015	.218	.625	133A152M
.0022	.218	.625	133A222M
.0033	.218	.625	133A332M
.0039	.218	.625	133A392M
.0047	.218	.625	133A472M
.0068	.218	.625	133A682M
.0082	.218	.625	133A822M
.01	.218	.625	133A103M
.015	.260	.625	133A153M
.022	.260	.750	133A223M
.027	.290	.750	133A273M
.033	.325	.750	133A333M
.039	.350	.812	133A393M
.047	.375	.812	133A473M
.068	.390	.937	133A683M
.082	.420	.937	133A823M
.1	.420	.937	133A104M
.12	.460	1.000	133A124M
.15	.460	1.125	133A154M
.18	.500	1.125	133A184M
.22	.600	1.125	133A224M
.27	.655	1.437	133A274M
.39	.703	1.437	133A394M
.47	.734	1.562	133A474M

100 VOLTS DC WORKING

Capacitance μf	Diameter	Length	Cat. No.
.001	.218	.750	133B102M
.0015	.218	.750	133B152M
.0022	.218	.750	133B222M
.0033	.218	.750	133B332M
.0039	.218	.750	133B392M
.0047	.218	.750	133B472M
.0068	.234	.750	133B682M
.0082	.234	.750	133B822M
.01	.296	.750	133B103M
.012	.296	.750	133B123M
.015	.296	.750	133B153M
.022	.318	.875	133B223M
.027	.328	.875	133B273M
.033	.343	.875	133B333M
.039	.359	.875	133B393M
.047	.375	.875	133B473M
.068	.406	1.000	133B683M
.082	.460	1.000	133B823M
.1	.460	1.000	133B104M
.15	.460	1.125	133B154M
.18	.500	1.125	133B184M
.22	.600	1.125	133B224M
.27	.655	1.437	133B274M
.39	.703	1.437	133B394M
.47	.734	1.562	133B474M

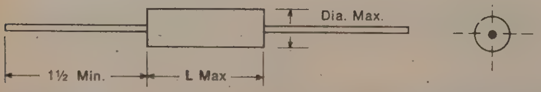
200 VOLTS DC WORKING

Capacitance μf	Diameter	Length	Cat. No.
.001	.218	.750	133C102M
.0015	.218	.750	133C152M
.0022	.218	.750	133C222M
.0033	.218	.750	133C332M
.0039	.218	.750	133C392M
.0047	.218	.750	133C472M
.0068	.234	.750	133C682M
.0082	.234	.750	133C822M
.01	.296	1.000	133C103M
.012	.296	1.000	133C123M
.015	.296	1.000	133C153M
.022	.318	1.000	133C223M
.027	.375	1.000	133C273M
.033	.375	1.000	133C333M
.039	.437	1.125	133C393M
.047	.437	1.125	133C473M
.068	.500	1.125	133C683M
.082	.462	1.375	133C823M
.1	.500	1.375	133C104M
.15	.625	1.375	133C154M
.18	.687	1.375	133C184M
.22	.687	1.812	133C224M
.27	.687	1.812	133C274M
.39	.875	1.812	133C394M
.47	1.000	1.812	133C474M

400 VOLTS DC WORKING

Capacitance μf	Diameter	Length	Cat. No.
.001	.218	.750	133E102M
.0015	.218	.750	133E152M
.0022	.218	.750	133E222M
.0033	.218	.750	133E332M
.0039	.218	.750	133E392M
.0047	.218	.750	133E472M
.0068	.234	.750	133E682M
.0082	.234	.750	133E822M
.01	.320	1.000	133E103M
.012	.320	1.000	133E123M
.015	.400	1.000	133E153M
.022	.400	1.000	133E223M
.027	.450	1.125	133E273M
.033	.450	1.125	133E333M
.039	.515	1.125	133E393M
.047	.515	1.125	133E473M
.068	.562	1.125	133E683M
.082	.562	1.375	133E823M
.1	.640	1.375	133E104M
.15	.640	1.812	133E154M
.18	.700	1.812	133E184M
.22	.750	1.812	133E224M
.27	.750	1.812	133E274M
.39	1.000	1.812	133E474M
.47	1.000	1.812	133E474M

CONFIGURATIONS



LEAD WIRE SIZE

No. 22 AWG. (.025) for cases up to .325 Dia.
No. 20 AWG. (.032) for cases .326 thru 1.0 Dia.
No. 18 AWG. (.040) for cases above 1.0 Dia.

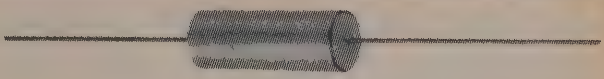
Nytronics Components Group, Inc.

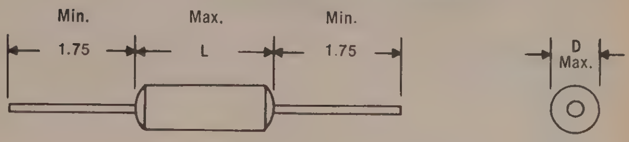
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE 187
POLYPROPYLENE
CAPACITORS**

TYPE 187 POLYPROPYLENE CAPACITORS

EXTENDED FOIL/FILM WRAP/ EPOXY ENDFILL





ELECTRICAL SPECIFICATIONS

CAPACITANCE
Shall be within the specified limits when measured at 1 kHz at +25°C.

DISSIPATION FACTOR
Shall not exceed .1% when measured as above.

INSULATION RESISTANCE
When measured at +25°C and with rated voltage applied for 2 minutes, shall be a minimum 250,000 megohms/mfd; need not exceed 500,000 megohms.

DIELECTRIC STRENGTH
Shall withstand 200% of rated voltage for 1 minute.

OPERATING TEMPERATURE
−55°C to +105°C at full rated voltage.

LIFE TEST
250 hours, at 105°C with 140% of rated voltage applied. One failure in twelve shall be permitted.

HUMIDITY RESISTANCE
Meets the requirements of MIL-STD-202, Method 103B, Test Condition B. After test the I.R. will be equal to or greater than 1/3 of the initial requirement.

LEAD PULL & BEND TEST
Capacitors will withstand a 5 pound pull test and bend test as described in RS-164.

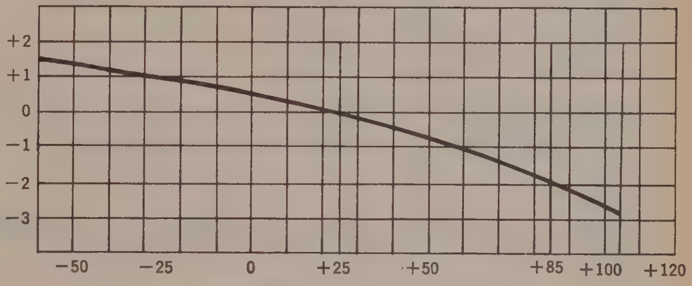
LEAD WIRE SIZE

AWG	DIAMETER MAX.
#22	.40 & Under
#20	.401 Thru 1.0
#18	Above 1.0

CAPACITY TOLERANCE SUFFIX

F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

TYPICAL CAPACITANCE CHANGE WITH TEMPERATURE IN PERCENT



TEMPERATURE IN DEGREES CENTIGRADE

Other capacitance values and voltage ratings available upon request.

CAPACITY MFD.	100 VDC CATALOG NO.	D MAX.	L MAX.	200 VDC CATALOG NO.	D MAX.	L MAX.	400 VDC CATALOG NO.	D MAX.	L MAX.
.001	187B102____	.218	.625	187C102____	.218	.625	187E102____	.218	.625
.0012	187B122____	.218	.625	187C122____	.218	.625	187E122____	.218	.625
.0015	187B152____	.218	.625	187C152____	.218	.625	187E152____	.218	.625
.0018	187B182____	.218	.625	187C182____	.218	.625	187E182____	.218	.625
.0022	187B222____	.218	.625	187C222____	.218	.625	187E222____	.218	.625
.0027	187B272____	.218	.625	187C272____	.218	.625	187E272____	.218	.625
.0033	187B332____	.218	.625	187C332____	.218	.625	187E332____	.218	.625
.0039	187B392____	.218	.625	187C392____	.218	.625	187E392____	.218	.625
.0047	187B472____	.218	.625	187C472____	.218	.625	187E472____	.218	.625
.0056	187B562____	.218	.625	187C562____	.218	.625	187E562____	.240	.625
.0068	187B682____	.218	.625	187C682____	.218	.625	187E682____	.255	.625
.0082	187B822____	.218	.625	187C822____	.218	.625	187E822____	.235	.687
.01	187B103____	.218	.625	187C103____	.232	.625	187E103____	.255	.687
.012	187B123____	.218	.625	187C123____	.245	.625	187E123____	.280	.687
.015	187B153____	.235	.625	187C153____	.242	.687	187E153____	.310	.687
.018	187B183____	.250	.625	187C183____	.255	.687	187E183____	.340	.687
.022	187B223____	.265	.625	187C223____	.265	.687	187E223____	.360	.687
.027	187B273____	.285	.625	187C273____	.316	.687	187E273____	.395	.687
.033	187B333____	.320	.625	187C333____	.320	.687	187E333____	.370	.812
.039	187B393____	.345	.625	187C393____	.358	.687	187E393____	.395	.812
.047	187B473____	.300	.750	187C473____	.330	.812	187E473____	.435	.812
.056	187B563____	.325	.750	187C563____	.354	.812	187E563____	.465	.812
.068	187B683____	.345	.812	187C683____	.385	.812	187E683____	.450	.937
.082	187B823____	.345	.812	187C823____	.415	.812	187E823____	.480	.937
.1	187B104____	.410	.812	187C104____	.415	.937	187E104____	.530	.937
.12	187B124____	.425	.812	187C124____	.450	.937	187E124____	.495	1.250
.15	187B154____	.425	.937	187C154____	.495	.937	187E154____	.545	1.250
.18	187B184____	.425	.937	187C184____	.530	.937	187E184 ____	.605	1.250
.22	187B224____	.450	.937	187C224____	.520	1.125	187E224____	.655	1.250
.27	187B274____	.460	1.125	187C274____	.575	1.125	187E274____	.630	1.500
.33	187B334____	.490	1.125	187C334____	.635	1.125	187E334____	.690	1.500
.39	187B394____	.490	1.250	187C394____	.635	1.250	187E394____	.740	1.500
.47	187B474____	.540	1.250	187C474____	.690	1.250	187E474____	.810	1.500
.56	187B564____	.585	1.250	187C564____	.660	1.500	187E564____	.870	1.500
.68	187B684____	.635	1.250	187C684____	.720	1.500	187E684____	.860	1.750
.82	187B824____	.685	1.250	187C824____	.720	1.750	187E824____	.950	1.750
1.	187B105____	.760	1.250	187C105____	.770	1.750	187E105____	1.040	1.750

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 192 METALLIZED POLYPROPYLENE CAPACITORS

POLYESTER TAPE WRAP CASE/EPOXY ENDFILL

Type 192 Capacitors feature small size, excellent stability, high insulation resistance, low dissipation factor and good humidity resistance. These properties make them ideal for use in timing and integrating circuitry.

CAPACITANCE

Shall be within specified tolerance when measured at 1 KHz for values thru 1 MFD and at 60 Hz for values above 1 MFD.

DISSIPATION FACTOR

Less than .1% when measured as above at 25°C.

DIELECTRIC STRENGTH

1.5 X rated voltage for one minute through a limiting resistance of 100 ohms/volt.

INSULATION RESISTANCE

Minimum values.

Temperature	+25°C	+85°C	+105°C
Megohms X Microfarads	100,000	5,000	500
Need Not Exceed (Megohms)	200,000	10,000	1000

Measured After Two Minutes Electrification
At Rated Voltage

TEMPERATURE RANGE

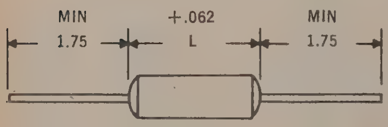
−55°C to +85°C at rated voltage to 105°C with 50% voltage derating.

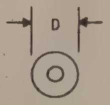
HUMIDITY

Will meet the test requirements of MIL-STD-202, Method 103B, Test Condition B. After testing the I.R. will be equal to or greater than ⅓ of the initial requirements. One failure in 12 permitted.

LIFE TEST

250 hours at 85°C with 140% of rated voltage applied. A resistance of one ohm per volt shall be inserted in series with each capacitor. One failure in 12 shall be permitted.





D TOLERANCE	
.249 and Under	+.032
.250 thru .500	+.046
.501 thru 1.000	+.062

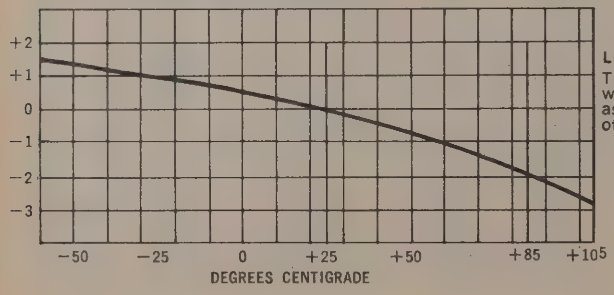
LEAD GAUGE

Body Length	AWG
.530 and Less	24
.650 thru 1.062	22
1.187 thru 2.00	20
Greater Than 2.00	18

CAPACITY TOLERANCE SUFFIX

F = ± 1%
P = ± 2%
J = ± 5%
K = ±10%
M = ±20%

TYPICAL CAPACITANCE CHANGE WITH TEMPERATURE IN PERCENT



LEAD MATERIAL:
Tinned copperweld wire shall withstand mechanical test as specified in Paragraph 3.4 of EIA Standard RS-164A

CAP MFD	CAT. No.	DIA.	LENGTH
150 VOLTS DC WORKING			
.010	192V103	.160	.400
.012	192V123	.170	.400
.015	192V153	.190	.400
.018	192V183	.165	.470
.022	192V223	.180	.470
.027	192V273	.188	.470
.033	192V333	.178	.470
.039	192V393	.188	.470
.047	192V473	.203	.470
.056	192V563	.190	.530
.068	192V683	.205	.530
.082	192V823	.225	.530
.10	192V104	.245	.530
.12	192V124	.265	.530
.15	192V154	.240	.650
.18	192V184	.260	.650
.22	192V224	.285	.650
.27	192V274	.315	.650
.33	192V334	.315	.780
.39	192V394	.325	.780
.47	192V474	.355	.780
.56	192V564	.385	.780
.68	192V684	.380	.900
.82	192V824	.380	1.062
1.0	192V105	.415	1.062
1.2	192V125	.450	1.062
1.5	192V155	.500	1.062
2.0	192V205	.535	1.187
3.0	192V305	.575	1.437
4.0	192V405	.660	1.437
5.0	192V505	.665	1.750
6.0	192V605	.725	1.750
8.0	192V805	.770	2.000
10.0	192V106	.860	2.000
200 VOLTS DC WORKING			
.010	192C103	.160	.400
.012	192C123	.170	.400
.015	192C153	.190	.400
.018	192C183	.165	.470
.022	192C223	.180	.470
.027	192C273	.195	.470
.033	192C333	.210	.470
.039	192C393	.195	.530
.047	192C473	.215	.530
.056	192C563	.230	.530
.068	192C683	.250	.530
.082	192C823	.225	.650
.10	192C104	.245	.650
.12	192C124	.265	.650
.15	192C154	.295	.650
.18	192C184	.285	.780
.22	192C224	.310	.780
.27	192C274	.340	.780
.33	192C334	.370	.780
.39	192C394	.360	.900
.47	192C474	.395	.900
.56	192C564	.425	.900
.68	192C684	.465	.900
.82	192C824	.440	1.187
1.0	192C105	.480	1.187
1.2	192C125	.525	1.187
1.5	192C155	.580	1.187
2.0	192C205	.670	1.187
3.0	192C305	.720	1.500
4.0	192C405	.825	1.500
5.0	192C505	.830	1.750
6.0	192C605	1.000	1.750
8.0	192C805	.960	2.000
10.0	192C106	1.070	2.000
400 VOLTS DC WORKING			
.010	192E103	.205	.400
.012	192E123	.220	.400
.015	192E153	.195	.470
.018	192E183	.210	.470
.022	192E223	.230	.470
.027	192E273	.220	.530
.033	192E333	.240	.530
.039	192E393	.255	.530
.047	192E473	.230	.650
.056	192E563	.245	.650
.068	192E683	.270	.650
.082	192E823	.290	.650
.10	192E104	.285	.780
.12	192E124	.305	.780
.15	192E154	.340	.780
.18	192E184	.370	.780
.22	192E224	.365	.900
.27	192E274	.400	.900
.33	192E334	.440	.900
.39	192E394	.475	.900
.47	192E474	.440	1.187
.56	192E564	.475	1.187
.68	192E684	.525	1.187
.82	192E824	.570	1.187
1.0	192E105	.560	1.500
1.2	192E125	.610	1.500
1.5	192E155	.680	1.500
2.0	192E205	.710	1.750
3.0	192E305	.860	1.750
4.0	192E405	.860	2.250
5.0	192E505	.950	2.250

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 188 POLYESTER CAPACITORS

METALLIZED POLYESTER CAPACITORS TYPE 188 FILM WRAP / EPOXY END FILL −55°C TO +125°C

Type 188 Capacitors features extremely small size, light weight and self clearing metallized construction which virtually eliminates catastrophic failures. Well suited for Voltage Multiplier Circuits in TV power supplies and Electrostatic copiers. Also ideal for Potting or encapsulating in Electronic Sub assemblies, Power supplies, etc.

CAPACITANCE

Measurements shall be made at 1000 cycles per second for capacitance values thru 1. MFD and at 60 cycles per second for values over 1. MFD.

CAPACITANCE TOLERANCE

Standard capacitance tolerance is ±20% (M). Closer tolerances available upon request.

DISSIPATION FACTOR

The dissipation factor shall not exceed 1% when measured at 25°C. Measurements shall be made at 1000 Hz for capacitance values thru 1. MF and at 60 Hz for higher values.

TEST VOLTAGE

Capacitors shall withstand 200% of rated DC voltage for one minute at 25°, with the charging and discharge current limited to a maximum of 1. Ampere.

OPERATING TEMPERATURES

−55°C to +125°C.

LIFE TEST

Capacitors shall withstand a life test of 250 hours at 125°C, with 140% of the 125°C rated DC voltage applied. A resistance of one ohm per volt of applied voltage shall be inserted in series with the capacitor.

VOLTAGE DERATING

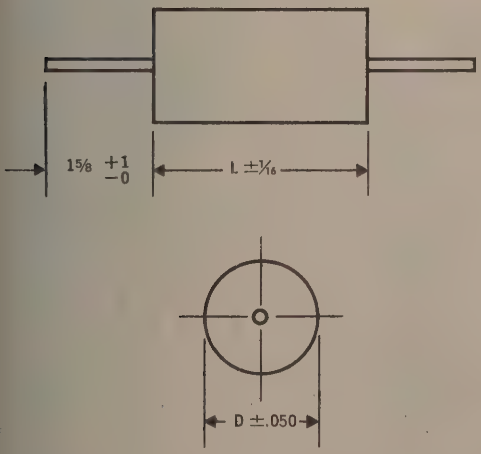
These capacitors will operate as full DC voltage ratings at 85°C. For operation at temperatures above 85°C, see Figure 4.

VIBRATION

Capacitors shall withstand a vibration test per Method 204, Test condition B of MIL-STD-202B as modified by MIL-C-27287. After test, the I.R. will be equal to or greater than 1/3 of the initial requirement.

HUMIDITY TEST

These capacitors shall meet the humidity test requirements of MIL-STD-202 Method 103B, test condition B. After testing the I.R. will be equal to or greater than 1/3 of the initial requirement.



Lead Sizes
.160 dia. — .250 = .020
.251 dia. — .500 = .025
.501 dia. & over = .032

100 VOLTS DC WORKING

Capacitance	Diameter	Length	Cat. No.
.010	.16	.40	188B103M
.012	.16	.40	188B123M
.015	.16	.40	188B153M
.018	.16	.40	188B183M
.022	.16	.40	188B223M
.027	.16	.40	188B273M
.033	.16	.40	188B333M
.039	.18	.40	188B393M
.047	.20	.40	188B473M
.056	.16	.53	188B563M
.068	.16	.53	188B683M
.082	.17	.53	188B823M
.10	.19	.53	188B104M
.12	.20	.53	188B124M
.15	.19	.65	188B154M
.18	.21	.65	188B184M
.22	.23	.65	188B224M
.27	.25	.65	188B274M
.33	.27	.65	188B334M
.39	.29	.65	188B394M
.47	.26	.78	188B474M
.56	.28	.78	188B564M
.68	.30	.78	188B684M
.82	.33	.78	188B824M
1.0	.36	.78	188B105M
1.2	.34	.97	188B125M
1.5	.37	.97	188B155M
2.0	.42	.97	188B205M
2.5	.42	1.17	188B255M
3.0	.45	1.17	188B305M
3.5	.49	1.17	188B355M
4.0	.52	1.17	188B405M
4.5	.49	1.45	188B455M
5.0	.52	1.45	188B505M

200 VOLTS DC WORKING

Capacitance	Diameter	Length	Cat. No.
.010	.16	.40	188C103M
.012	.17	.40	188B123M
.015	.19	.40	188C153M
.018	.21	.40	188C183M
.022	.16	.53	188C223M
.027	.17	.53	188C273M
.033	.19	.53	188C333M
.039	.20	.53	188C393M
.047	.18	.65	188C473M
.056	.20	.65	188C563M
.068	.21	.65	188C683M
.082	.23	.65	188C823M
.10	.25	.65	188C104M
.12	.27	.65	188C124M
.15	.30	.65	188C154M
.18	.27	.78	188C184M
.22	.30	.78	188C224M
.27	.32	.78	188C274M
.33	.35	.78	188C334M
.39	.33	.97	188C394M
.47	.35	.97	188C474M
.56	.38	.97	188C564M
.68	.42	.97	188C684M
.82	.46	.97	188C824M
1.0	.45	1.17	188C105M
1.2	.49	1.17	188C125M
1.5	.54	1.17	188C155M
2.0	.56	1.45	188C205M
2.5	.61	1.45	188C255M
3.0	.67	1.45	188C305M
3.5	.65	1.68	188C355M
4.0	.69	1.68	188C405M
4.5	.73	1.68	188C455M
5.0	.77	1.68	188C505M

400 VOLTS DC WORKING

Capacitance	Diameter	Length	Cat. No.
.010	.20	.40	188E103M
.012	.16	.53	188E123M
.015	.17	.53	188E153M
.018	.19	.53	188E183M
.022	.20	.53	188E223M
.027	.18	.65	188E273M
.033	.20	.65	188E333M
.039	.21	.65	188E393M
.047	.23	.65	188E473M
.056	.25	.65	188E563M
.068	.27	.65	188E683M
.082	.25	.78	188E823M
.10	.27	.78	188E104M
.12	.29	.78	188E124M
.15	.32	.78	188E154M
.18	.35	.78	188E184M
.22	.33	.97	188E224M
.27	.36	.97	188E274M
.33	.39	.97	188E334M
.39	.42	.97	188E394M
.47	.46	.97	188E474M
.56	.44	1.17	188E564M
.68	.48	1.17	188E684M
.82	.54	1.17	188E824M
1.0	.53	1.45	188E105M
1.2	.57	1.45	188E125M
1.5	.63	1.45	188E155M
2.0	.65	1.68	188E205M
2.5	.73	1.68	188E255M
3.0	.79	1.68	188E305M
3.5	.85	1.68	188E355M
4.0	.78	2.25	188E405M
4.5	.83	2.25	188E455M
5.0	.87	2.25	188E505M

600 VOLTS DC WORKING

Capacitance	Diameter	Length	Cat. No.
.010	.20	.53	188F103M
.012	.18	.65	188F123M
.015	.20	.65	188F153M
.018	.22	.65	188F183M
.022	.23	.65	188F223M
.027	.25	.65	188F273M
.033	.28	.65	188F333M
.039	.26	.78	188F393M
.047	.28	.78	188F473M
.056	.30	.78	188F563M
.068	.32	.78	188F683M
.082	.35	.78	188F823M
.10	.33	.97	188F104M
.12	.35	.97	188F124M
.15	.39	.97	188F154M
.18	.44	.97	188F184M
.22	.42	1.17	188F224M
.27	.45	1.17	188F274M
.33	.50	1.17	188F334M
.39	.55	1.17	188F394M
.47	.54	1.45	188F474M
.56	.58	1.45	188F564M
.68	.63	1.45	188F684M
.82	.63	1.68	188F824M
1.0	.69	1.68	188F105M
1.2	.75	1.68	188F125M
1.5	.84	1.68	188F155M
2.0	.83	2.25	188F205M
2.5	.92	2.25	188F255M
3.0	1.00	2.25	188F305M

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 189 POLYESTER CAPACITORS

METALLIZED POLYESTER CAPACITORS TYPE 189 FILM WRAP / EPOXY END FILL −55°C TO +125°C

Type 189 Capacitors features extremely small size, light weight and self clearing metallized construction which virtually eliminates catastrophic failures. Well suited for Voltage Multiplier Circuits in TV power supplies and Electrostatic copiers. Also ideal for Potting or encapsulating in Electronic Sub assemblies, Power supplies, etc.

CAPACITANCE

Measurements shall be made at 1000 cycles per second for capacitance values thru 1. MFD and at 60 cycles per second for values over 1. MFD.

CAPACITANCE TOLERANCE

Standard capacitance tolerance is ±20% (M). Closer tolerances available upon request.

DISSIPATION FACTOR

The dissipation factor shall not exceed 1% when measured at 25°C. Measurements shall be made at 1000 Hz for capacitance values thru 1. MF and at 60 Hz for higher values.

TEST VOLTAGE

Capacitors shall withstand 200% of rated DC voltage for one minute at 25°, with the charging and discharge current limited to a maximum of 1. Ampere.

OPERATING TEMPERATURES

−55°C to +125°C.

LIFE TEST

Capacitors shall withstand a life test of 250 hours at 125°C, with 140% of the 125°C rated DC voltage applied. A resistance of one ohm per volt of applied voltage shall be inserted in series with the capacitor.

VOLTAGE DERATING

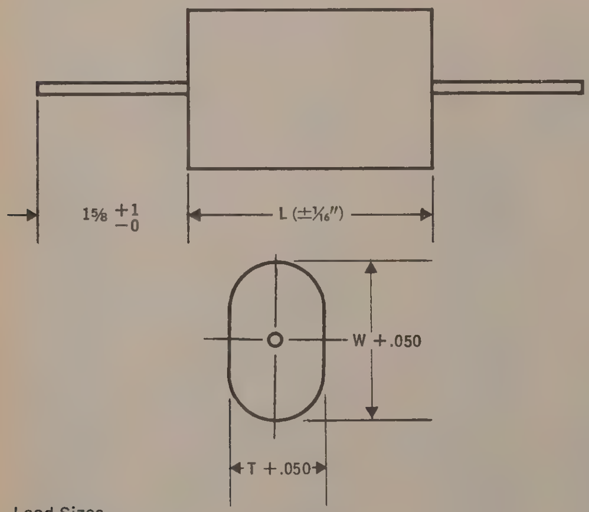
These capacitors will operate as full DC voltage ratings at 85°C. For operation at temperatures above 85°C, see Figure 4.

VIBRATION

Capacitors shall withstand a vibration test per Method 204, Test condition B of MIL-STD-202B as modified by MIL-C-27287.

HUMIDITY TEST

These capacitors shall meet the humidity test requirements of MIL-STD-202 Method 103B, test condition B. After testing the I.R. will be equal to or greater than ⅓ of the initial requirement.



Lead Sizes **Nom. Body Length**	**Lead Dia.**
Thru .530	.020
.650 thru .970	.025
Above .970	.032

Capacitance	Thickness	Width	Length	Cat. No.
100 VOLTS DC WORKING				
.010	.10	.20	.40	189B103M
.012	.10	.20	.40	189B123M
.015	.10	.20	.40	189B153M
.018	.10	.20	.40	189B183M
.022	.10	.20	.40	189B223M
.027	.10	.20	.40	189B273M
.033	.10	.20	.40	189B333M
.039	.10	.20	.40	189B393M
.047	.10	.22	.40	189B473M
.056	.11	.24	.40	189B563M
.068	.10	.20	.53	189B683M
.082	.10	.20	.53	189B823M
.10	.10	.20	.53	189B104M
.12	.10	.23	.53	189B124M
.15	.12	.25	.53	189B154M
.18	.14	.27	.53	189B184M
.22	.17	.30	.53	189B224M
.27	.19	.32	.53	189B274M
.33	.21	.34	.53	189B334M
.39	.24	.37	.53	189B394M
.47	.21	.34	.65	189B474M
.56	.23	.36	.65	189B564M
.68	.27	.40	.65	189B684M
.82	.24	.37	.78	189B824M
1.0	.26	.42	.78	189B105M
1.2	.29	.45	.78	189B125M
1.5	.33	.49	.78	189B155M
2.0	.32	.48	.97	189B205M
2.5	.36	.52	.97	189B255M
3.0	.35	.51	1.17	189B305M
3.5	.38	.54	1.17	189B355M
4.0	.41	.57	1.17	189B405M
4.5	.44	.60	1.17	189B455M
5.0	.47	.63	1.17	189B505M
6.0	.52	.68	1.17	189B605M
8.0	.46	.62	1.68	189B805M
10.0	.53	.69	1.68	189B106M
200 VOLTS DC WORKING				
.010	.10	.20	.40	189C103M
.012	.10	.20	.40	189C123M
.015	.10	.20	.40	189C153M
.018	.13	.23	.40	189C183M
.022	.13	.26	.40	189C223M
.027	.10	.20	.53	189C273M
.033	.12	.22	.53	189C333M
.039	.12	.25	.53	189C393M
.047	.13	.26	.53	189C473M
.056	.14	.27	.53	189C563M
.068	.16	.29	.53	189C683M
.082	.18	.31	.53	189C823M
.10	.20	.33	.53	189C104M
.12	.22	.35	.53	189C124M
.15	.26	.39	.53	189C154M
.18	.24	.37	.65	189C184M
.22	.26	.39	.65	189C224M
.27	.24	.37	.78	189C274M
.33	.27	.40	.78	189C334M
.39	.30	.43	.78	189C394M
.47	.33	.46	.78	189C474M
.56	.37	.50	.78	189C564M
.68	.32	.48	.97	189C684M
.82	.35	.51	.97	189C824M
1.0	.35	.51	1.17	189C105M
1.2	.38	.54	1.17	189C125M
1.5	.43	.59	1.17	189C155M
2.0	.52	.68	1.17	189C205M
2.5	.46	.62	1.68	189C255M
3.0	.49	.65	1.68	189C305M
3.5	.54	.70	1.68	189C355M
4.0	.58	.74	1.68	189C405M
4.5	.62	.78	1.68	189C455M
5.0	.64	.84	1.68	189C505M
6.0	.70	.90	1.68	189C605M
8.0	.84	1.04	1.68	189C805M
10.0	.75	.95	2.25	189C106M
400 VOLTS DC WORKING				
.010	.14	.24	.40	189E103M
.012	.10	.23	.53	189E123M
.015	.11	.21	.53	189E153M
.018	.12	.22	.53	189E183M
.022	.12	.25	.53	189E223M
.027	.13	.26	.53	189E273M
.033	.15	.28	.53	189E333M
.039	.17	.30	.53	189E393M
.047	.19	.32	.53	189E473M
.056	.21	.34	.53	189E563M
.068	.23	.36	.53	189E683M
.082	.26	.39	.53	189E823M
.10	.23	.36	.65	189E104M
.12	.25	.38	.65	189E124M
.15	.24	.37	.78	189E154M
.18	.26	.39	.78	189E184M
.22	.30	.43	.78	189E224M
.27	.33	.46	.78	189E274M
.33	.36	.52	.78	189E334M
.39	.33	.49	.97	189E394M
.47	.37	.53	.97	189E474M
.56	.34	.50	1.17	189E564M
.68	.38	.54	1.17	189E684M
.82	.43	.59	1.17	189E824M
1.0	.48	.64	1.17	189E105M
1.2	.54	.70	1.17	189E125M
1.5	.46	.62	1.68	189E155M
2.0	.54	.70	1.68	189E205M
2.5	.60	.80	1.68	189E255M
3.0	.67	.87	1.68	189E305M
3.5	.73	.93	1.68	189E355M
4.0	.78	.98	1.68	189E405M
4.5	.69	.89	2.25	189E455M
5.0	.75	.95	2.25	189E505M

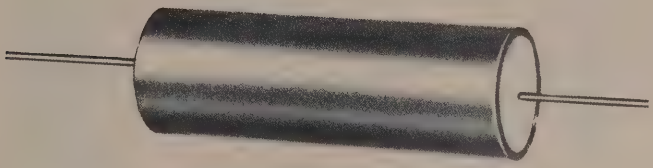
Capacitance	Thickness	Width	Length	Cat. No.
600 VOLTS DC WORKING				
.010	.12	.25	.53	189F103M
.012	.13	.26	.53	189F123M
.015	.15	.28	.53	189F153M
.018	.17	.30	.53	189F183M
.022	.19	.32	.53	189F223M
.027	.21	.34	.53	189F273M
.033	.24	.37	.53	189F333M
.039	.21	.34	.65	189F393M
.047	.24	.37	.65	189F473M
.056	.22	.35	.78	189F563M
.068	.25	.38	.78	189F683M
.082	.27	.40	.78	189F823M
.10	.30	.43	.78	189F104M
.12	.32	.48	.78	189F124M
.15	.36	.52	.78	189F154M
.18	.33	.49	.97	189F184M
.22	.37	.53	.97	189F224M
.27	.36	.52	1.17	189F274M
.33	.40	.56	1.17	189F334M
.39	.44	.60	1.17	189F394M
.47	.49	.65	1.17	189F474M
.56	.41	.57	1.68	189F564M
.68	.45	.61	1.68	189F684M
.82	.51	.67	1.68	189F824M
1.0	.58	.74	1.68	189F105M
1.2	.64	.80	1.68	189F125M
1.5	.73	.89	1.68	189F155M
2.0	.69	.89	2.25	189F205M
2.5	.80	1.00	2.25	189F225M
3.0	.87	1.07	2.25	189F305M

INTERMEDIATE VALUES AVAILABLE.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE 161
TUBULAR
CAPACITORS**

HIGH VOLTAGE TUBULAR CAPACITORS DUAL DIELECTRIC/OIL IMPREGNATED PHENOLIC CASED/EPOXY END FILL/TYPE 161



RECOMMENDED APPLICATIONS

Nytronics Type 161 Capacitors are well-suited for use in Oscilloscopes, Electronic Air Cleaners, Power Supplies of industrial devices, and related equipment. The design of these capacitors employs a Paper/Polyester Film Section, oil impregnated, incased in a phenolic tube designed specifically for high voltage application. A unique epoxy endfill process precludes oil seepage which occasionally occurs in similar designs.

TYPICAL RATINGS

CAP/MFD	3000 VDC	5000 VDC	8000 VDC	10,000 VDC
.005	½ x 1½	9⁄16 x 1⅞	¾ x 2	¾ x 2½
.01	9⁄16 x 1⅞	¾ x 1⅞	¾ x 2¼	⅞ x 2½
.05	¾ x 2 1⁄16	1 x 2½	1 x 4¼	1½ x 3⅛

NOTE: Other Ratings can be designed to your specifications.

OPERATING TEMPERATURE

−55°C to +85°C at full rated voltage.

DISSIPATION FACTOR

Will not exceed 1% at 25°C.

MEASUREMENTS

Capacitance up to 1 microfarad are measured at a frequency of 1000 cycles per second and capacitances over 1 microfarad at 60 cps.

DIELECTRIC STRENGTH TEST

Units will withstand a potential of 150% of rated voltage applied for one minute at 25°C.

STANDARD TOLERANCE

±20%. Other tolerances available on request.

STANDARD MARKING

Nytronics, Part No., Capacitance, Voltage, and Date Code.

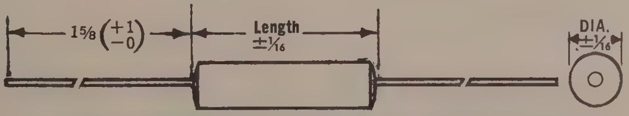
INSULATION RESISTANCE

When measured at the applicable test temperature with an electrification time of two minutes at 500 volts shall be equal to or greater than the values listed below:

Test Temperature	25°C	85°C
Megohms X Microfarads	2000	10
except that the insulation resistance in megohms need not exceed	25000	250

MOISTURE RESISTANCE

These capacitors will meet the moisture resistance requirements of EIA Specification RS-164, which requires units to withstand a 95% Relative Humidity at 40°C, except time of exposure may be increased to 500 hours. After exposure and subsequent drying periods, the insulation resistance will not be less than ⅓ of the initial requirement.



Tinned Copperweld Leads #20 AWG (.032) for sizes to ⅝″ Dia.
#18 AWG (.040) for sizes ⅝″ Dia. and over.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 231 POLYSTYRENE FILM CAPACITORS

POLYSTYRENE FILM CAPACITORS HERMETICALLY SEALED TYPE 231 −65°C to +85°C

ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

1. CAPACITANCE MEASUREMENTS

Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz. Capacitors greater than 1.0 μF measured at 60 Hz.
Tolerances of ±20%, ±10%, ±5%, ±2%, ±1% are standard. Tolerances closer than ±1% are available upon request.
Reference: MIL-STD-202, Method 305.

2. TEMPERATURE/CHARACTERISTICS AND STABILITY

When measured over the full operating range, the Temperature Coefficient shall be −120 ppm/°C ±30 ppm/°C.
There shall be less than 0.1% change per year in capacitance when operated between +20°C and +50°C.
When cycled from −55°C to +75°C, the capacitance shall not vary more than 0.2% from its initial measurement.

3. DISSIPATION FACTOR

When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.1%.

4. INSULATION RESISTANCE

When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 200,000 megohm-microfarads, but need not exceed 500,000 megohms. The period of electrification shall not exceed two minutes.
Reference: MIL-STD-202, Method 302.

5. VOLTAGE DERATING

The capacitors may be operated at full rated voltage from −55°C to +85°C.

6. VOLTAGE TEST

When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:

Terminal to terminal	200% of DC rating
Terminal to case	200% of DC rating

Reference: MIL-STD-202, Method 301.

7. LIFE TESTING

When tested at 85°C for 250 hours at 140% of the rated voltage, the capacitors shall exhibit no more than one failure in twelve pieces tested. A failure is defined as:

a) A capacitance change of more than 6% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than 60% that specified in Paragraph 4; or
d) A permanent open or short.

8. VIBRATION

The capacitors will meet or exceed the vibration requirements of MIL-STD-202, METHOD 201.

NYTRONICS CATALOG NUMBERING SYSTEM

231 A 3 E 104 M 2

NYTRONICS TYPE
231 Polystyrene

TERMINALS
Wire Leads
No. 22 AWG. (.025)
for case Dia. .312 and under
No. 20 AWG. (.032)
for case Dia. over .312

CIRCUIT
Circuit 1 Circuit 3

DC RATED VOLTAGE
B = 100
C = 200
E = 400
F = 600

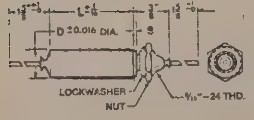
CAPACITANCE
In uuf. The first two digits are the significant figures, the third is the number of zeroes.

CAPACITANCE TOLERANCE
M = ±20%
K = ±10%
J = ±5%
G = ±2%
F = ±1%

STYLE

CONFIGURATIONS

Circuit 1



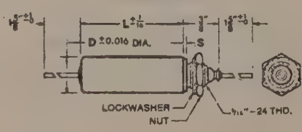
STYLE 3

D	S
.400	.020
.562 and up	.031

Minimum D=.400″

Circuit 3

Deduct 1/16 from L



STANDARD RATINGS

Nytronics Part No.	Capacitance μf	Dia. ±.016	Length ±1/16
100 VOLTS DC WORKING			
231A1B822K	.0082	.235	15/16
231A1B103K	.01	.235	15/16
231A1B123K	.012	.235	15/16
231A1B153K	.015	.235	15/16
231A1B183K	.018	.312	15/16
231A1B223K	.022	.312	15/16
231A1B273K	.027	.312	15/16
231A1B333K	.033	.312	15/16
231A1B393K	.039	.312	15/16
231A1B473K	.047	.400	15/16
231A1B563K	.056	.400	15/16
231A1B683K	.068	.400	15/16
231A1B823K	.082	.562	15/16
231A1B104K	.10	.562	15/16
231A1B124K	.12	.562	15/16
231A1B154K	.15	.562	15/16
231A1B184K	.18	.562	1 5/16
231A1B224K	.22	.562	1 5/16
231A1B274K	.27	.670	1 5/16
231A1B334K	.33	.670	1 5/16
231A1B394K	.39	.670	1 11/16
231A1B474K	.47	.670	1 11/16
231A1B564K	.56	.670	1 11/16
231A1B684K	.68	.750	1 11/16
231A1B824K	.82	1.000	1 11/16
231A1B105K	1.0	1.000	1 11/16
231A1B125K	1.2	1.000	1 11/16
200 VOLTS DC WORKING			
231A1C472K	.0047	.235	15/16
231A1C562K	.0056	.235	15/16
231A1C682K	.0068	.235	15/16
231A1C822K	.0082	.312	15/16
231A1C103K	.01	.312	15/16
231A1C123K	.012	.312	15/16
231A1C153K	.015	.312	15/16
231A1C183K	.018	.312	15/16
231A1C223K	.022	.400	15/16
231A1C273K	.027	.400	15/16
231A1C333K	.033	.400	15/16
231A1C393K	.039	.400	15/16
231A1C473K	.047	.562	15/16
231A1C563K	.056	.562	15/16
231A1C683K	.068	.562	15/16
231A1C823K	.082	.562	15/16
231A1C104K	.10	.562	1 5/16
231A1C124K	.12	.562	1 5/16
231A1C154K	.15	.670	1 5/16
231A1C184K	.18	.670	1 5/16
231A1C224K	.22	.670	1 11/16
231A1C274K	.27	.670	1 11/16
231A1C334K	.33	.750	1 11/16
231A1C394K	.39	1.000	1 11/16
231A1C474K	.47	1.000	1 11/16
231A1C564K	.56	1.000	1 11/16
400 VOLTS DC WORKING			
231A1E222K	.0022	.235	15/16
231A1E272K	.0027	.235	15/16
231A1E332K	.0033	.235	15/16
231A1E392K	.0039	.235	15/16
231A1E472K	.0047	.312	15/16
231A1E562K	.0056	.312	15/16
231A1E682K	.0068	.312	15/16
231A1E822K	.0082	.312	15/16
231A1E103K	.01	.312	15/16
231A1E123K	.012	.312	15/16
231A1E153K	.015	.400	15/16
231A1E183K	.018	.400	15/16
231A1E223K	.022	.400	15/16
231A1E273K	.027	.562	15/16
231A1E333K	.033	.562	15/16
231A1E393K	.039	.562	15/16
231A1E473K	.047	.562	15/16
231A1E563K	.056	.562	15/16
231A1E683K	.068	.562	1 5/16
231A1E823K	.082	.670	1 5/16
231A1E104K	.10	.670	1 5/16
231A1E124K	.12	.562	1 11/16
231A1E154K	.15	.670	1 11/16
231A1E184K	.18	.670	1 11/16
231A1E224K	.22	.750	1 11/16
231A1E274K	.27	.750	1 11/16
231A1E334K	.33	1.000	1 11/16
231A1E394K	.39	1.000	1 11/16
231A1E474K	.47	1.000	1 11/16
600 VOLTS DC WORKING			
231A1F102K	.001	.235	15/16
231A1F122K	.0012	.235	15/16
231A1F152K	.0015	.235	15/16
231A1F182K	.0018	.235	15/16
231A1F222K	.0022	.312	15/16
231A1F272K	.0027	.312	15/16
231A1F332K	.0033	.312	15/16
231A1F392K	.0039	.312	15/16
231A1F472K	.0047	.312	15/16
231A1F562K	.0056	.312	15/16
231A1F682K	.0068	.312	15/16
231A1F822K	.0082	.312	15/16
231A1F103K	.01	.400	15/16
231A1F123K	.012	.400	15/16
231A1F153K	.015	.562	15/16
231A1F183K	.018	.562	15/16
231A1F223K	.022	.562	15/16
231A1F273K	.027	.562	15/16
231A1F333K	.033	.562	1 5/16
231A1F393K	.039	.562	1 5/16
231A1F473K	.047	.670	1 5/16
231A1F563K	.056	.670	1 5/16
231A1F683K	.068	.562	1 11/16
231A1F823K	.082	.670	1 11/16
231A1F104K	.10	.670	1 11/16
231A1F124K	.12	.750	1 11/16
231A1F154K	.15	1.000	1 11/16
231A1F184K	.18	1.000	1 11/16
231A1F224K	.22	1.000	1 11/16

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**MIL TYPE CP04 - CP08
MIL-C-25
HERMETICALLY SEALED
CAPACITORS**

HERMETICALLY SEALED CAPACITORS CP04 THRU CP09 TO MIL-C-25

μF	WVDC	CP04A1 — CP05A1 (Uninsulated) (Insulated) Char. K −55°C to +125°C	Size* D. x L.
.001	600	CP04A1KF102K3	.235 x ¾
.0015	600	CP04A1KF152K3	.235 x ¾
.0022	600	CP04A1KF222K3	.235 x ¾
.0033	600	CP04A1KF332K3	.235 x ¾
.0047	600	CP04A1KF472K3	.235 x ¾
.0068	600	CP04A1KF682K3	.235 x ¾
.01	400	CP04A1KE103K3	.235 x ¾
	600	CP04A1KF103K3	.312 x ⅞
.015	200	CP04A1KC153K3	.235 x ¾
	600	CP04A1KF153K3	.312 x ⅞
.022	200	CP04A1KF223K3	.235 x ¾
	600	CP04A1KF223K3	.312 x ⅞
.033	100	CP04A1KB333K3	.235 x ¾
	400	CP04A1KE333K3	.312 x ⅞
	600	CP04A1KF333K3	.400 x ⅞
.047	200	CP04A1KC473K3	.312 x ⅞
	400	CP04A1KE473K3	.400 x ⅞
	600	CP04A1KF473K3	.400 x 1⅛
.068	200	CP04A1KC683K3	.312 x ⅞
	400	CP04A1KE683K3	.400 x 1⅛
	600	CP04A1KF683K3	.400 x 1⅜
.1	100	CP04A1KB104K3	.312 x ⅞
	200	CP04A1KC104K3	.400 x ⅞
	400	CP04A1KE104K3	.400 x 1⅜
	600	CP04A1KF104K3	.562 x 1⅛
.15	100	CP04A1KB154K3	.400 x ⅞
	200	CP04A1KC154K3	.400 x 1⅛
	400	CP04A1KE154K3	.562 x 1⅛
	600	CP04A1KF154K3	.562 x 1⅜
.22	100	CP04A1KB224K3	.400 x 1⅜
	200	CP04A1KC224K3	.400 x 1⅜
	400	CP04A1KE224K3	.562 x 1⅜
	600	CP04A1KF224K3	.562 x 1⅞
.33	100	CP04A1KB334K3	.400 x 1⅜
	200	CP04A1KC334K3	.562 x 1⅛
	400	CP04A1KE334K3	.562 x 1⅞
	600	CP04A1KF334K3	.670 x 1⅞
.47	100	CP04A1KB474K3	.562 x 1⅛
	200	CP04A1KC474K3	.562 x 1⅜
	400	CP04A1KE474K3	.670 x 1⅞
	600	CP04A1KF474K3	.750 x 2⅛
.68	100	CP04A1KB684K3	.562 x 1⅜
	200	CP04A1KC684K3	.562 x 1⅞
	400	CP04A1KE684K3	.750 x 2⅛
	600	CP04A1KF684K3	1.0 x 1⅞
1.0	100	CP04A1KB105K3	.562 x 1⅞
	200	CP04A1KC105K3	.670 x 1⅞
	400	CP04A1KE105K3	1.0 x 1⅞

μF	WVDC	CP08A1 — CP09A1 (Uninsulated) (Insulated) Char. K −55°C to +125°C	Size* D. x L.
.001	600	CP08A1KF102K3	.235 x ¾
.0015	600	CP08A1KF152K3	.235 x ¾
.0022	600	CP08A1KF222K3	.235 x ¾
.0033	400	CP08A1KE332K3	.235 x ¾
	600	CP08A1KF332K3	.312 x ⅞
.0047	200	CP08A1KC472K3	.235 x ¾
	600	CP08A1KF472K3	.312 x ⅞
.0068	200	CP08A1KC682K3	.235 x ¾
	600	CP08A1KF682K3	.312 x ⅞
.01	100	CP08A1KB103K3	.235 x ¾
	600	CP08A1KF103K3	.312 x ⅞
.015	100	CP08A1KB153K3	.235 x ¾
	400	CP08A1KE153K3	.312 x ⅞
	600	CP08A1KF153K3	.400 x ⅞
.022	200	CP08A1KC223K3	.312 x ⅞
	600	CP08A1KF223K3	.400 x ⅞
.033	200	CP08A1KC333K3	.312 x ⅞
	400	CP08A1KE333K3	.400 x ⅞
	600	CP08A1KF333K3	.400 x 1⅛
.047	100	CP08A1KB473K3	.312 x ⅞
	200	CP08A1KC473K3	.400 x ⅞
	400	CP08A1KE473K3	.400 x 1⅛
	600	CP08A1KF473K3	.400 x 1⅜
.068	200	CP08A1KC683K3	.400 x ⅞
	400	CP08A1KE683K3	.400 x 1⅜
	600	CP08A1KF683K3	.562 x ⅛
.1	100	CP08A7KB104K3	.400 x ⅞
	200	CP08A1KC104K3	.400 x 1⅛
	400	CP08A1KE104K3	.562 x 1⅛
	600	CP08A1KF104K3	.562 x 1⅜
.15	100	CP08A1KB154K3	.400 x 1⅛
	200	CP08A1KC154K3	.400 x 1⅜
	400	CP08A1KE154K3	.562 x 1⅜
	600	CP08A1KF154K3	.562 x 1⅝
.22	100	CP08A1KB224K3	.400 x 1⅜
	200	CP08A1KC224K3	.562 x 1⅛
	400	CP08A1KE224K3	.562 x 1⅝
	600	CP08A1KF224K3	.670 x 1⅝
.33	100	CP08A1KB334K3	.562 x 1⅛
	200	CP08A1KC334K3	.562 x 1⅜
	400	CP08A1KE334K3	.670 x 1⅝
	600	CP08A1KF334K3	.750 x 2⅛
.47	100	CP08A1KB474K3	.562 x 1⅜
	200	CP08A1KC474K3	.562 x 1⅝
	400	CP08A1KE474K3	.750 x 2⅛
	600	CP08A1KF474K3	.750 x 2⅜
.68	100	CP08A1KB684K3	.562 x 1⅝
	200	CP08A1KC684K3	.670 x 1⅝
1.0	100	CP08A1KB105K3	.670 x 1⅝
	200	CP08A1KC105K3	.750 x 2⅛

NOTE: The capacitors listed in this table have a capacitance tolerance of ±10%.
* For case grounded reduce L dimension by 1⁄16″. Above listing are ratings listed in Mil-C-25C. Other values are available in Nytronics Commercial Equivalents.
** For CP05 and CP09 add .0625 to Diameter and 1⁄16″ to Length.

NYTRONICS CATALOG NUMBERING SYSTEM

CP 04 A 1 K B 273 K 1

MILITARY TYPE
CAPACITORS
Fixed,
Paper dielectric,
Direct current,
Hermetically sealed in
metallic cases

SUBMINIATURE
CAPACITORS
CP05 CP09
CP10 CP12
CP11 CP13

TERMINALS
A = axial leads

CIRCUIT
1 =
3 =

CHARACTERISTIC
K = −55°C to +125°C

DC VOLTAGE RATING

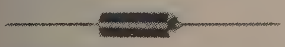
CAPACITANCE
In uuf. The first two digits are the significant figures, the third is the number of zeros.

CAPACITANCE TOLERANCE
K = ±10%

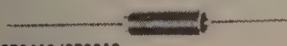
VIBRATION GRADE
1 = 10 to 55 cps
3 = 10 to 2000 cps

RATED VOLTAGE DESIGNATIONS
(DC working at 40°C, except for characteristic K which is 85°C)
B = 100 C = 200 E = 400 F = 600 G = 1000

BASIC STYLE

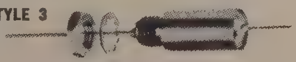


CP04A1/CP08A1
CIRCUIT 1 — Case Floating

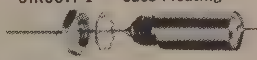


CP04A3/CP08A3
CIRCUIT 3 — Case Grounded

STYLE 3

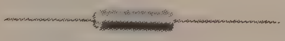


CP11A1/CP13A1
CIRCUIT 1 — Case Floating

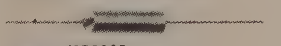


CP11A3/CP13A3
CIRCUIT 3 — Case Grounded

STYLE V (Insulated)

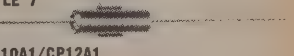


CP05A1/CP09A1
CIRCUIT 1 — Case Floating

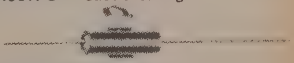


CP05A3/CP09A3
CIRCUIT 3 — Case Grounded

STYLE 7



CP10A1/CP12A1
CIRCUIT 1 — Case Floating



CP10A3/CP12A3
CIRCUIT 3 — Case Grounded

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

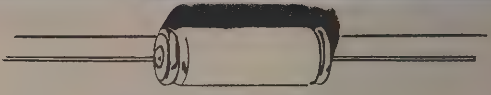
MIL TYPE CP25 - CP29
MIL-C-25
CAPACITORS

MIL-C-25 (LATEST REVISION) CP25 TO CP29

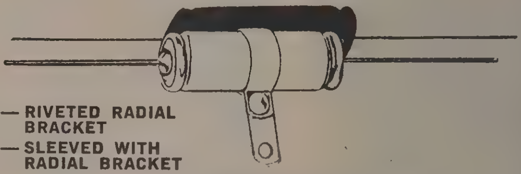
Available in capacitances from .003 thru 0.1 mf and voltages of 1500 VDC.

Type Designation[1]	Rated Voltage	Capacitance µf
CP2-A-EC104-	200	.1
CP2-A-EC254-	200	.25
CP2-A-EC504-	200	.5
CP2-A-EF302-	600	.003
CP2-A-EF602-	600	.006
CP2-A-EF103-	600	.01
CP2-A-EF203-	600	.02
CP2-A-EF503-	600	.05
CP2-A-EF104-	600	.1
CP2-A-EF254-	600	.25
CP2-A-EF504-	600	.5
CP2-A-EG302-	1,000	.003
CP2-A-EG602-	1,000	.006
CP2-A-EG103-	1,000	.01
CP2-A-EG203-	1,000	.02
CP2-A-EG503-	1,000	.05
CP2-A-EG104-	1,000	.1
CP2-A-EG254-	1,000	.25
CP2-A-EH302-	1,500	.003
CP2-A-EH602-	1,500	.006
CP2-A-EH103-	1,500	.01
CP2-A-EH203-	1,500	.02
CP2-A-EH503-	1,500	.05
CP2-A-EH104-	1,500	.1

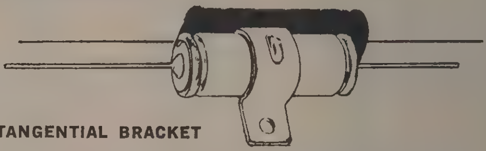
[1] Complete type designation will include additional symbols to complete style designation and to indicate circuit and capacitance tolerance.



CP25 — UNINSULATED BODY
CP26 — INSULATED BODY

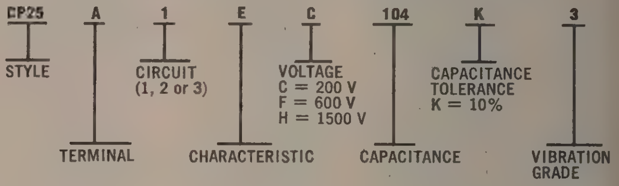


CP27 — RIVETED RADIAL BRACKET
CP28 — SLEEVED WITH RADIAL BRACKET



CP29 — TANGENTIAL BRACKET

TYPE - DESIGNATION EXAMPLE (CP25A1EC104K)

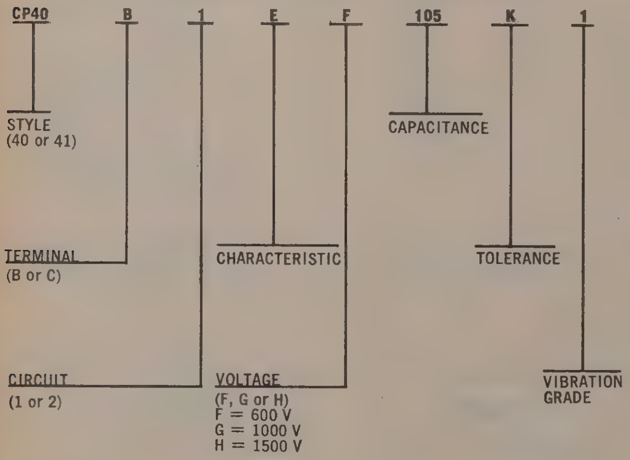

CP25
A
1
E
C
104
K
3
STYLE
CIRCUIT (1, 2 or 3)
VOLTAGE C = 200 V F = 600 V H = 1500 V
CAPACITANCE TOLERANCE K = 10%
TERMINAL
CHARACTERISTIC
CAPACITANCE
VIBRATION GRADE

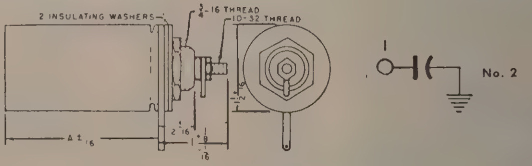
CP40, CP41 (TYPES PCM, PCIM)

Available in capacitances from .25 mf thru 4.0 mf and voltages of 600 VDC thru 1500 VDC.

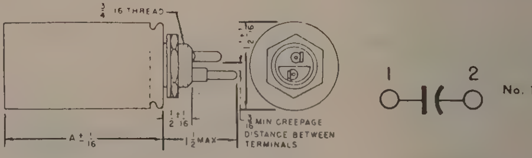
Type Designation 1/	DC Voltage Rating (see fig. 2) Volts	Capacitance µf
CP4 - - - - F105K1	600	1
CP4 - - - - F205K1	600	2
CP4 - - - - F405K1	600	4
CP4 - - - - G105K1	1,000	1
CP4 - - - - G205K1	1,000	2
CP4 - - - - H254K1	1,500 3/	0.25
CP4 - - - - H504K1	1,500	0.5
CP4 - - - - H105K1	1,500	1

TYPE - DESIGNATION EXAMPLE (CP40B1EF105K)


CP40
B
1
E
F
105
K
1
STYLE (40 or 41)
CAPACITANCE
TERMINAL (B or C)
CHARACTERISTIC
TOLERANCE
CIRCUIT (1 or 2)
VOLTAGE (F, G or H) F = 600 V G = 1000 V H = 1500 V
VIBRATION GRADE


2 INSULATING WASHERS
3/4-16 THREAD
10-32 THREAD
A ± 1/16
2 1/16
1 1/8
1/16
1/2
1
No. 2

CIRCUIT DIAGRAM — CP40
Available with (C) or (B) Terminals


3/4 16 THREAD
1/16
1/2
1/2 ± 1/16
3/16 MIN CREEPAGE DISTANCE BETWEEN TERMINALS
A ± 1/16
1 1/2 MAX
1
2
No. 1

CIRCUIT DIAGRAM — CP41
Available only with (B) Terminal

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**MIL TYPE CP53 - CP55
MIL-C-25
CAPACITORS**

CAPACITORS MIL TYPE CP53, CP54, CP55

CP53

Section assembled in hermetically sealed tin-coated drawn-shell container. Mineral-oil impregnated and filled. Lug-type terminal seals. Meets requirements of MIL-C-25.

Temperature Rating: −55°C to +85°C.

Standard Tolerance: −10% to +20%.

PDM VARIATIONS

MIL Type CP53, with terminals on side.

PDMT (CP54) With terminals on top.

PDMB (CP55) With terminals on the bottom.

CP53 — Side Terminals
CP54 — Top Terminals
CP55 — Bottom Terminals

Type Designation	DC Voltage Rating Volts	Capacitance µf
CP5-B- - B105K1	100	1
CP5-B-EB205K1	100	2
CP5-B- - B405K1	100	4
CP5-B-FC504K1	200	0.5
CP5-B-EC105K1	200	1
CP5-B-EC205K1	200	2
CP5-B-EF254K1	600	0.25
CP5-B- - F504K1	600	0.5
CP5-B- - F105K1	600	1
CP5-B-EF205K1	600	2
CP5-B-EG503K1	1,000	0.05
CP5-B-EG104K1	1,000	0.1
CP5-B- - G254K1	1,000	0.25
CP5-B-EG504K1	1,000	0.5
CP5-B-EG105K1	1,000	1
CP5-B-EF503V1	600	0.05-0.05
CP5-B-EF104V1	600	0.1 -0.1
CP5-B- - F254V1	600	0.25-0.25
CP5-B- - F504V1	600	0.5 -0.5
CP5-B-EF105V1	600	1 -1
CP5-B-EG503V1	1,000	0.05-0.05
CP5-B- - G104V1	1,000	0.1 -0.1
CP5-B-EG254V1	1,000	0.25-0.25
CP5-B-EG504V1	1,000	0.5 -0.5
CP5-B5-E504V1	400	0.5 -0.5 -0.5
CP5-B5-F104V1	600	0.1 -0.1 -0.1
CP5-B5EF254V1	600	0.25-0.25-0.25
CP5-B5EF504V1	600	0.5 -0.5 -0.5
CP5-B5EG503V1	1,000	0.05-0.05-0.05
CP5-B5EG104V1	1,000	0.1 -0.1 -0.1
CP5-B5EG254V1	1,000	0.25-0.25-0.25

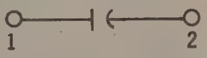
Vibration grade: 1 (10 to 55 Hz. incl.)

Terminal:

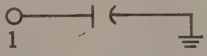
Symbol B ---------- Solder lug (nonremovable).

Circuit diagram:

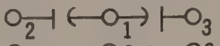
Symbol 1 ----------



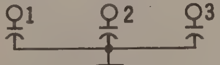
Symbol 2 ----------



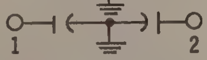
Symbol 4 ----------



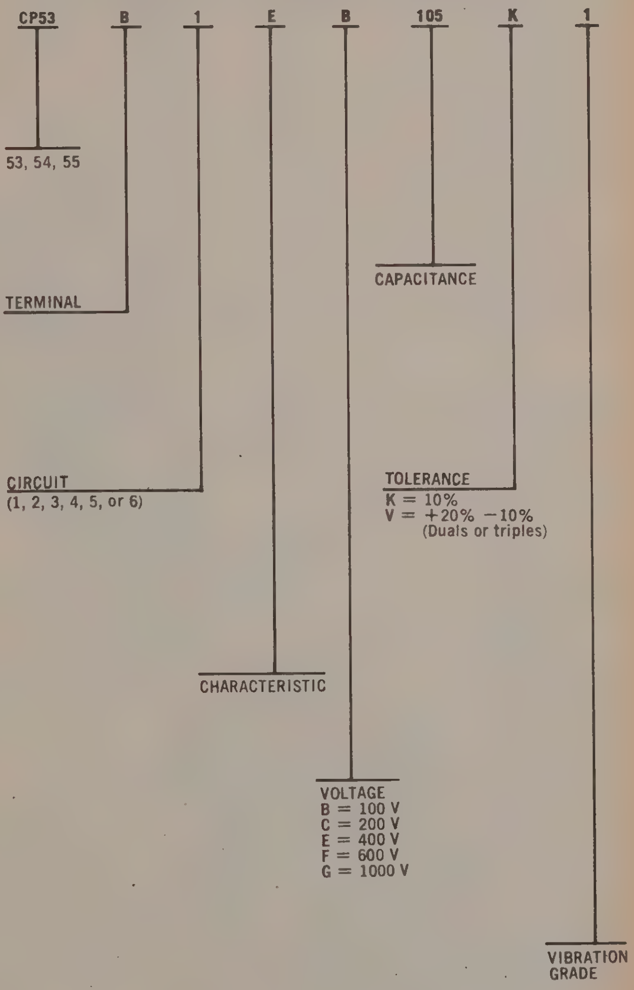
Symbol 5 ----------



Symbol 6 ----------



TYPE - DESIGNATION EXAMPLE (CP53B1EB105K)


CP53
B
1
E
B
105
K
1
53, 54, 55
TERMINAL
CAPACITANCE
CIRCUIT
(1, 2, 3, 4, 5, or 6)
TOLERANCE
K = 10%
V = +20% −10%
(Duals or triples)
CHARACTERISTIC
VOLTAGE
B = 100 V
C = 200 V
E = 400 V
F = 600 V
G = 1000 V
VIBRATION GRADE

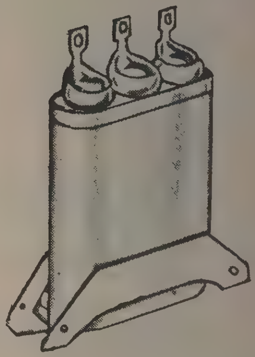
Nytronics Components Group, Inc.

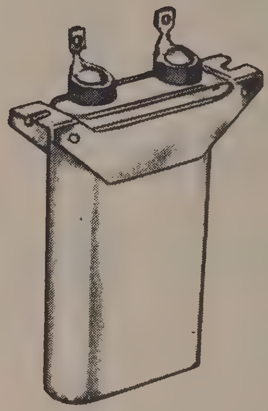
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

MIL TYPE CP69, CP67, CP91
MIL-C-25

CAPACITORS MIL TYPE CP67, CP69

Type Designation	DC Voltage Rating Volts	Capacitance µf
CP6-B-EF503K1	600	0.05
CP6-B-EF104K1	600	0.1
CP6-B-EF254K1	600	0.25
CP6-B-EF504K1	600	0.5
CP6-B- - F105K1	600	1
CP6-B-EG103K1	1,000	0.01
CP6-B-EG203K1	1,000	0.02
CP6-B-EG503K1	1,000	0.05
CP6-B- - G104K1	1,000	0.1
CP6-B-EG254K1	1,000	0.25
CP6-B- - G504K1	1,000	0.5
CP6-B-EF503V1	600	0.05-0.05
CP6-B-EF104V1	600	0.1 -0.1
CP6-B-EF254V1	600	0.25-0.25
CP6-B- - F504K1	600	0.5 -0.5
CP6-B-EG103V1	1,000	0.01-0.01
CP6-B-EG203V1	1,000	0.02-0.02
CP6-B- - G503V1	1,000	0.05-0.05
CP6-B- - G104V1	1,000	0.1 -0.1
CP6-B- - G254V1	1,000	0.25-0.25
CP6-B-5-F503V1	600	0.05-0.05-0.05
CP6-B5EFP04V1	600	0.1 -0.1 -0.1
CP6-B5-F254V1	600	0.25-0.25-0.25
CP6-B5EG103V1	1,000	0.01-0.01-0.01
CP6-B5EG203V1	1,000	0.02-0.02-0.02
CP6-B5F.G503V1	1,000	0.05-0.05-0.05
CP6-B5EG104V1	1,000	0.1 -0.1 -0.1

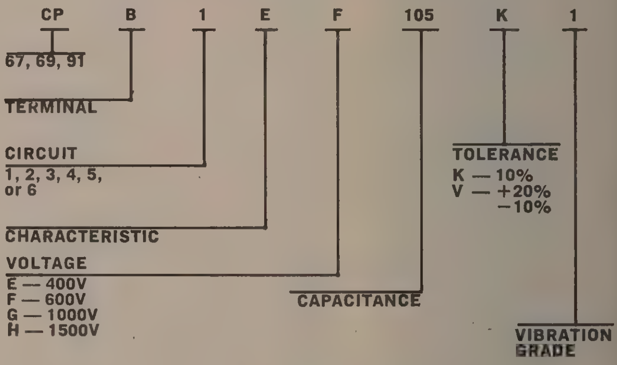

CP67


CP69

CAPACITORS MIL TYPE CP91 SERIES

Type Designation	DC Voltage Rating Volts	Capacitance µf	Capacitance Tolerance
CP91B-E105K1	400	1	K
CP91B-EF503K1	600	0.05	K
CP91B-EF254K1	600	0.25	K
CP91B-EF504K1	600	0.5	K
CP91B-F105K1	600	1	K
CP91B-EG103K1	1,000	0.01	K
CP91B-EG203K1	1,000	0.02	K
CP91B-EG503K1	1,000	0.05	K
CP91B-EG104K1	1,000	0.1	K
CP91B-EG254K1	1,000	0.25	K
CP91B-G504K1	1,000	0.5	K
CP91B6EE503V1	400	0.05-0.05	V
CP91B6EE104V1	400	0.1 -0.1	V
CP91B6EE504V1	400	0.5 -0.5	V
CP91B6EF503V1	600	0.05-0.05	V
CP91B6-F104V1	600	0.1 -01	V
CP91B6EF254V1	600	0.25-0.25	V
CP91B6-F504V1	600	0.5 -0.5	V
CP91B6EG103V1	1,000	0.01-0.01	V
CP91B6EG203V1	1,000	0.02-0.02	V
CP91B6EG503V1	1,000	0.05-0.05	V
CP91B6-G104V1	1,000	0.1 -0.1	V
CP91B6-G254V1	1,000	0.25-0.25	V
CP91B6EH103V1	1,500	0.01-0.01	V
CP91B6EH503V1	1,500	0.05-0.05	V

TYPE DESIGNATION EXAMPLE

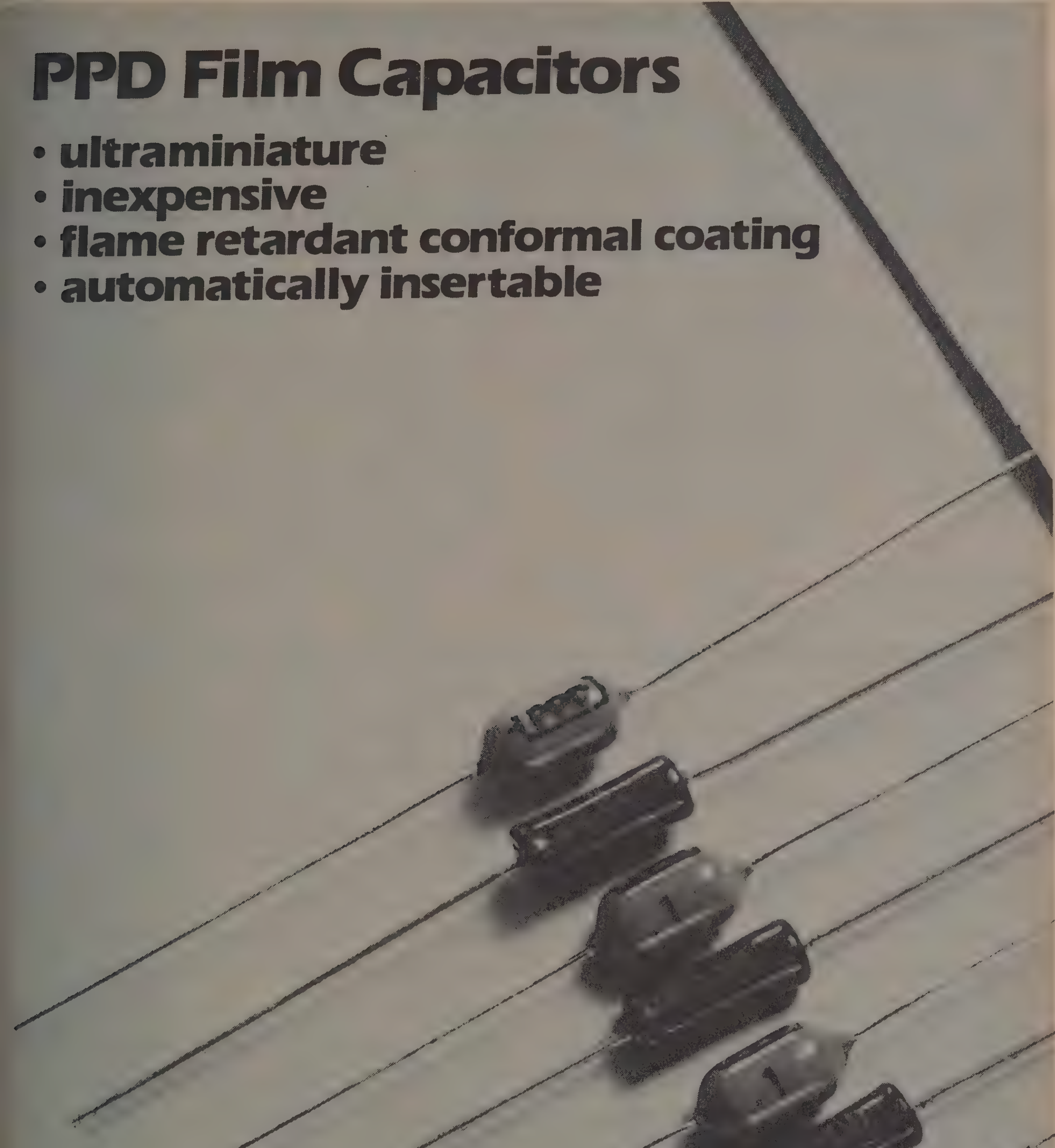


CP91

NOTE: AVAILABLE WITH SPADE-LUG OR FOOTED BRACKET

PPD Film Capacitors

- ultraminiature
- inexpensive
- flame retardant conformal coating
- automatically insertable



PEC 831 Metallized Polyester Film

General Characteristics

The PEC 831 is manufactured using a unique packaging process which allows the production of a compact body size for a given capacitance. This allows the designer to specify an automatically insertable, axial lead capacitor allowing higher circuit board densities than were previously possible. The general characteristics of the PEC 831 make it an ideal choice for general coupling, decoupling and filtering applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics.

Capacitance range	1000 pF to 6.8 μF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	40VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125° C. Over 85°C the voltage is derated linearly to 50% at 125°C.
Moisture resistance	After 72 hours at 75°C and 95%RH, the IR shall exceed 30% of the initial requirement.
Dielectric and electrodes	Polyester film vacuum metallized with aluminum.
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0.
Leads	Solder coated copper clad steel wire.
Temperature coefficient	See capacitance vs. temperature curve
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds.
Life test	140% rated DC voltage at 85°C for 250 hours.

Insulation resistance	C≤.33μF and V>100VDC: 30,000MΩ Min.
2 Min. Electrification, 25°C	C>.33μF and V≥100VDC: 10,000 MΩ×μF Min.
10 VDC for V<100 VDC	C≤.1μF and V≤100VDC: 10,000 MΩ Min.
100VDC for V≥100VDC	C>.1μF and V<100VDC: 1,000 MΩ×μF Min.
Dissipation Factor	C≤1μF 0.8% max. (0.5% average) at 1KHz C>1μF 1.0% max. (0.6% average) at 1KHz
Self Inductance	10nH/cm along length of body and leads

MAXIMUM PULSE RISE TIME

	V/μs					
	CASE					
VDC	A	B	C	D	E	F
40V	6.2	3.6	1.9	1.5	1.1	0.84
63V	7.3	4.6	2.3	1.8	1.4	1.0
100V	12.1	7.3	3.8	2.9	2.3	1.7
200V	16.2	9.7	5.1	3.9	3.0	2.2
400V	51.0	25.0	11.6	8.6	6.5	4.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP.	CASE					
μF	A	B	C	D	E	F
.001	400					
.0012	400					
.0015	400					
.0018	400					
.0022	400					
.0027	400					
.0033	400					
.0039	400					
.0047	400					
.0056	200	400				
.0068	200	400				
.0082	200	400				
.01	200	400				
.012	200	—	400			
.015	200	—	400			
.018	200	—	400			
.022	200	—	—	400		
.027	200	—	—	400		
.033	100	200	—	400		
.039	100	200	—	400		
.047	100	200	—	400		
.056	63	200	—	400		
.068	63	100	200	—	400	
.082	63	100	200	—	400	
.1	63	100	200	—	400	
.12	40	100	—	200	400	
.15	40	63	100	200	400	
.18	40	63	100	200	400	
.22	40	63	—	200	—	400
.27		63	—	200	—	400
.33			63	100	200	400
.39			63	100	200	—
.47				100	200	—
.56				100	200	—
.68				63	200	—
.82				63	200	—
1.0				63	100	200
1.5					100	200
2.2					63	100
3.3					63	—
4.7						63
6.8			VOLTS			63

CASE SIZE

	A	B	C	D	E	F
	D×L	D×L	D×L	D×L	D×L	D×L
IN	.177×.250	.177×.355	.195×.497	.247×.610	.345×745	.347×.970
MM.	4.5×6.4	4.5×90	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP.	VOLTAGE (DC)				
μF	40V	63V	100V	200V	400V
.001					A
.0012					A
.0015					A
.0018					A
.0022					A
.0027					A
.0033					A
.0039					A
.0047					A
.0056				A	B
.0068				A	B
.0082				A	B
.01				A	B
.012				A	C
.015				A	C
.018				A	C
.022				A	D
.027				A	D
.033			A	B	D
.039			A	B	D
.047			A	B	D
.056		A	B	B	D
.068		A	B	C	E
.082		A	B	C	E
.1		A	B	C	E
.12	A	B	B	D	E
.15	A	B	C	D	E
.18	A	B	C	D	E
.22	A	B	D	D	F
.27	B	B	D	D	F
.33	C	C	D	E	F
.39	C	C	D	E	
.47	D	D	D	E	
.56	D	D	D	E	
.68	D	D	E	E	
.82	D	D	E	E	
1.0	D	D	E	F	
1.5	E	E	E	F	
2.2	E	E	F		
3.3	E	E			
4.7	F	F			
6.8	F	F			

PPD

FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

Specifications subject to change without notice.

PPC 830 Polypropylene Film/Foil

General Characteristics.

The PPC 830 is an axial lead, polypropylene film capacitor that features small size, low price and flame retardant coating. The electrical stability of polypropylene and its characteristic high resistance to moisture allow these units to retain their original capacitance over long periods of time without degradation due to changing environmental conditions. The PPC 830 has the excellent characteristics previously found only in polystyrene capacitors but offers a higher temperature rating and, of course, flame resistance. The low negative TC and very low dissipation factor of the PPC 830 provide for a stable frequency response curve and high Q in resonant and filtering circuit applications. Since the PPC 830 also exhibits high insulation resistance (I.R.) and low dielectric absorption (D.A.), it is a good choice for storage and timing circuit applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics

Capacitance range	150pF to .56μF
Capacitance tolerance	±1% thru ±10%
Voltage ratings AC ratings are at 60Hz (higher voltages available upon request)	160VDC/90VAC, 400VDC/160VAC, 630VDC/200VAC
Temperature range	−55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Humidity range	95% RH max., 85% yearly average
Dielectric	Polypropylene film
Electrodes	Aluminum foil
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0

Leads	Solder coated copper clad steel wire.
Temperature coefficient of capacitance	−150 ± 100 ppm/°C
Capacitance stability	<± 0.5% drift over period of 2 years
Test voltage/Dielectric strength	2.5 x rated voltage for 2 seconds
Insulation resistance	> 100,000 MΩ after 2 mins. at 100V, 25°C
Life test	140% rated voltage at 105°C for 250 hrs.
Dissipation factor	≤ .07% at 10KHz
Dielectric absorption	< .05%
Self inductance	10nH/cm along length of body and leads
Max pulse rise time	500V/μ sec

	160VDC/90VAC				400VDC/160VAC				630VDC/200VAC			
	mm		in		mm		in		mm		in	
PF	D	L	D	L	D	L	D	L	D	L	D	L
150	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
220	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
330	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
470	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
680	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
735	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
820	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1000	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1500	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
2200	4.8	10	.188	.394	4.8	10	.188	.394	5.2	10	.205	.394
3300	4.8	10	.188	.394	4.8	10	.188	.394	6.1	10	.240	.394
4100	4.8	10	.188	.394	5.2	10	.205	.394	6.5	10	.255	.394
4300	4.8	10	.188	.394	5.2	10	.205	.394	6.6	10	.260	.394
4700	4.8	10	.188	.394	5.3	10	.210	.394	5.8	12	.230	.475
4900	5	10	.195	.394	5.5	10	.215	.394	6	12	.235	.475
5600	5	10	.195	.394	5.6	10	.220	.394	6.2	12	.245	.475
6800	5	10	.195	.394	6	10	.235	.394	6.7	12	.265	.475
8200A	6	10	.235	.394	—	—	—	—	—	—	—	—
8200B	5	12	.195	.475	5.6	12	.220	.475	7.1	12	.280	.475
MFD												
.01A	6.2	10	.245	.394	—	—	—	—	—	—	—	—
.01B	5	12	.195	.475	6.4	12	.250	.475	7.7	12	.305	.475
.013	5.5	12	.215	.475	6.9	12	.270	.475	8.5	12	.335	.475
.015	5.7	12	.225	.475	7.1	12	.280	.475	7.9	14.7	.310	.580
.018	6	12	.235	.475	7.5	12	.295	.475	8.3	14.7	.325	.580
.022	6.5	12	.255	.475	8	12	.315	.475	8.8	14.7	.345	.580
.025	6.9	12	.270	.475	7.9	14.7	.310	.580	9.5	14.7	.375	.580
.027	7.1	12	.280	.475	8.1	14.7	.320	.580	9.9	14.7	.390	.580
.033	7.6	12	.300	.475	8.9	14.7	.350	.580	9	18.3	.355	.720
.047	7.9	14.7	.310	.580	10.3	14.7	.405	.580	9.9	18.3	.390	.720
.056	8.8	14.7	.345	.580	11.	14.7	.435	.580	10.4	18.3	.410	.720
.060	9	14.7	.355	.580	9.1	18.3	.360	.720	10.8	22	.425	.865
.068	9.4	14.7	.370	.580	10.3	18.3	.405	.720	11.4	22	.450	.865
.082	8.4	18.3	.330	.720	11.4	18.3	.450	.720	12.4	22	.490	.865
.1A	9.1	18.3	.360	.720	11.9	18.3	.470	.720	—	—	—	—
.1B	8.1	22	.320	.865	10.3	22	.405	.865	13.5	22	.530	.865
.15	9.5	22	.375	.865	11.8	22	.465	.865	13.9	25.1	.548	.990
.22	11.4	22	.450	.865	13	22	.510	.865				
.27	12.4	22	.490	.865								
.33	11.9	22	.470	.865								
.47	12.7	25.1	.500	.990								
.56	14	25.1	.550	.990								

PPD

FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

Specifications subject to change without notice.

PPC 831 Metallized Polypropylene Film

General Characteristics

The PPC 831 is an axial lead, metallized polypropylene film capacitor featuring small size, high performance, low price and conformal encapsulation with a flame retardant coating.

The physical and electrical characteristics of polypropylene as a dielectric are commendable. Polypropylene is relatively impervious to moisture. It is also extremely stable. The PPC 831 will, therefore, retain its original properties over extended periods of time in a fluctuating environment.

Other noteworthy attributes of the PPC 831 are high insulation resistance (IR) and a low dielectric absorption (DA) factor. Both of these parameters are of critical importance in the selection of a sample-and-hold capacitor in data acquisition applications. The DA of polypropylene is about 10 times less than that of polyester and is significantly less than that of polycarbonate or polystyrene.

Also to be considered are the gently sloping curves for temperature coefficient (TC), dissipation factor (DF) and capacitance variation with frequency. The relatively flat response of the PPC 831 assures dependable, stable performance when incorporated into critical resonant and filtering circuit applications.

Physical and electrical characteristics:

Capacitance	Measured at 1,000 Hz
Capacitance range	1000 pF to 1.0 μF
Capacitance tolerance	1%, 2.5%, 5%, 10%, 20%
Voltage ratings **AC ratings at 60 Hz**	160 VDC/ 90 VAC, 250 VDC/ 220 VAC, 400 VDC/ 250 VAC, 630 VDC/ 300 VAC
Temperature range	−55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Dielectric	Aluminum metallized polypropylene film
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0
Leads	Solder coated copper clad steel wire
Dissipation factor **Measured at 25°C, 1 KHz**	Less than .1%, Figures I & II
Dielectric absorption **Per MIL-C-19978**	Less than .05%, Figure III

Insulation resistance **Rated voltage, 2 min. electrification**		+25°C	+85°C	+105°C
	MΩ × μF	100,000	5,000	500
	≤MΩ	200,000	10,000	1,000

Life test **1Ω/ Volt in series**	1000 hours, 85°C, 140% voltage
Humidity	72 hours, 75°C, 95% R.H. (Ref. EIA RS377, IR shall exceed 30% of minimum)
Dielectric strength **100Ω/ Volt in series**	200% rated voltage, 1 min.
Capacitance drift	± .5% over 2 years 20°C to 40°C, 40% to 60% R.H.
Temperature coefficient	Figure IV
Self inductance	10nH/cm along leads and body

MAXIMUM PULSE RISE TIME

VDC	V/μs CASE B	C	D	E	F
160V	8.3	4.6	3.5	2.7	2
250V	15.7	8	5.8	4.3	3.1
400V	21	10.7	7.8	5.8	4.2
630V	43	18.5	13	9.6	6.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP. μF	CASE B	C	D	E	F
.001	630				
.0012	630				
.0015	630				
.0018	630				
.0022	630				
.0027	400	630			
.0033	400	630			
.0039	400	630			
.0047	400	630			
.0056	400	630			
.0068	400	630			
.0082	400	—	630		
.01	250	400	630		
.012	250	400	630		
.015	250	400	630		
.018	160	250	630		
.022	160	250	630		
.027	160	250	400	630	
.033	160	—	400	630	
.039	160	—	400	630	
.047	160	—	400	630	
.056		160	250	630	
.068		160	250	400	630
.082		160	250	400	630
.1		160	250	400	630
.12			160	400	630
.15			160	400	630
.18			160	250	400
.22			160	250	400
.27				250	400
.33				160	250
.39				160	250
.47				160	250
.56				160	250
.68				160	—
.82			VOLTS		160
1.0					160

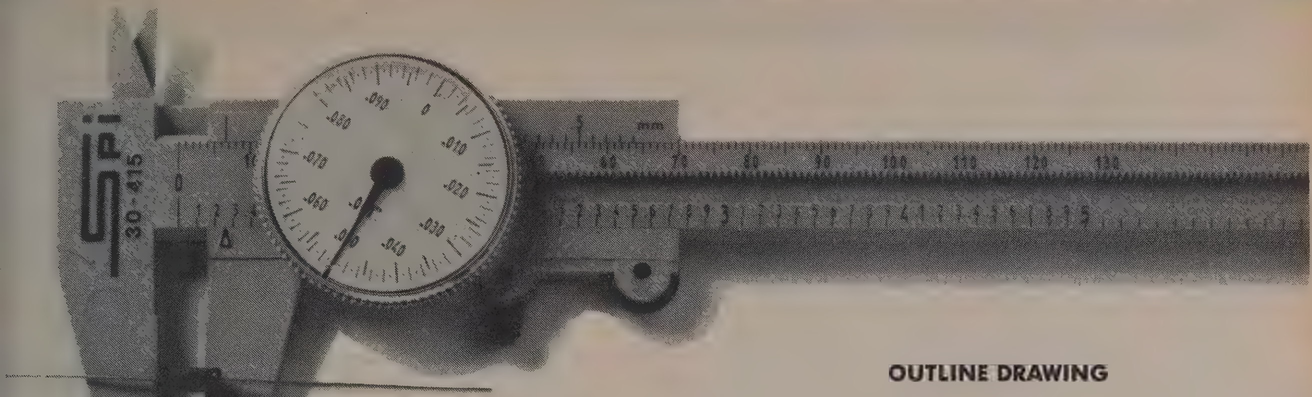
CASE SIZE

	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L
IN	.177 × .355	.195× 497	.247 × .610	.345× 745	.347 × .970
MM.	4.5 × 9.0	5.0 × 12.6	6.3 × 15.5	8.8 × 18.9	8.8 × 24.6

CAP. μF	VOLTAGE (DC) 160V	250V	400V	630V
.001				B
.0012				B
.0015				B
.0018				B
.0022				B
.0027			B	C
.0033			B	C
.0039			B	C
.0047			B	C
.0056			B	C
.0068			B	C
.0082			B	D
.01		B	C	D
.012		B	C	D
.015		B	C	D
.018	B	C	D	D
.022	B	C	D	D
.027	B	C	D	E
.033	B	D	D	E
.039	B	D	D	E
.047	B	D	D	E
.056	C	D	E	E
.068	C	D	E	F
.082	C	D	E	F
.1	C	D	E	F
.12	D	E	E	F
.15	D	E	E	F
.18	D	E	F	
.22	D	E	F	
.27	E	E	F	
.33	E	F		
.39	E	F		
.47	E	F		
.56	E	F		
.68	E			
.82	F			
1.0	F			

PPD
FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

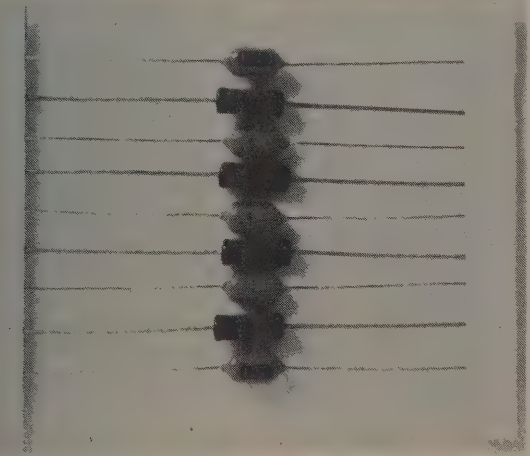
Specifications subject to change without notice.



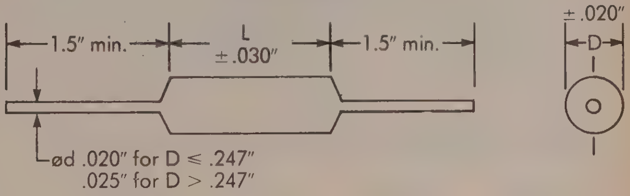
The "A" and "B" case sizes of the PPC 831 and PEC 831 style capacitors are computer designed with today's manufacturing and design criteria firmly in mind — namely, automation.

Until now, the most useful configuration for automated assembly, with respect to general bypassing, filtering and timing requirements, has been the box style capacitor. This is because the corresponding axial style devices are of physical proportions incompatible with automatic insertion equipment. Unfortunately, the box capacitor presents the modern factory with its own unique problems. An expensive radial insertion machine must be obtained. Box insertion requires an additional step in the assembly process which adds both direct and indirect production costs. In comparison, axials insert 3 times faster than radials.

PPD has been studying this situation for some time now. The culmination of this work has been the development of the "A" and "B" case film capacitors. The designer is now presented with the capability of specifying axial lead, automatically insertable, metallized film capacitors in the range of .001 μF to .27 μF. Examination of the dimensions of the "A" and "B" cases will reveal that, in length, they closely approximate the dimensions of RN55 and RN60 style resistors. Both "A" and "B" cases have a .177" ± .020" diameter. They can, therefore, be taped on 0.2" centers. Ultimately, these devices can be sequenced on standard axial lead insertion machinery to provide high volume, low cost production.



OUTLINE DRAWING

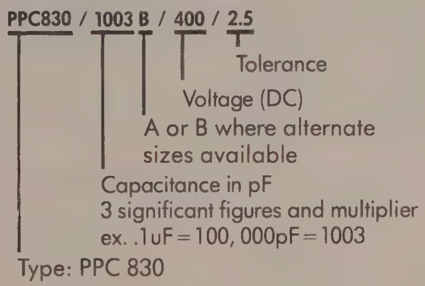

1.5" min.
L
± .030"
1.5" min.
± .020"
D
ød .020" for D ≤ .247"
.025" for D > .247"

CASE SIZE

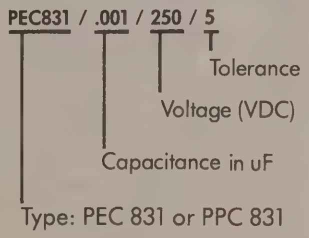
	A	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L	D x L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.50×6.35	4.50×9.02	4.95×12.62	6.27×15.49	8.76×18.92	8.81×24.64

PART NUMBERING INFORMATION

PPC 830


PPC830 / 1003 B / 400 / 2.5
Tolerance
Voltage (DC)
A or B where alternate sizes available
Capacitance in pF
3 significant figures and multiplier
ex. .1uF = 100, 000pF = 1003
Type: PPC 830

PPC831 and PEC 831


PEC831 / .001 / 250 / 5
Tolerance
Voltage (VDC)
Capacitance in uF
Type: PEC 831 or PPC 831

PPD

FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

Specifications subject to change without notice.

Typical Performance Characteristics

— — — Polypropylene ——— Polyester

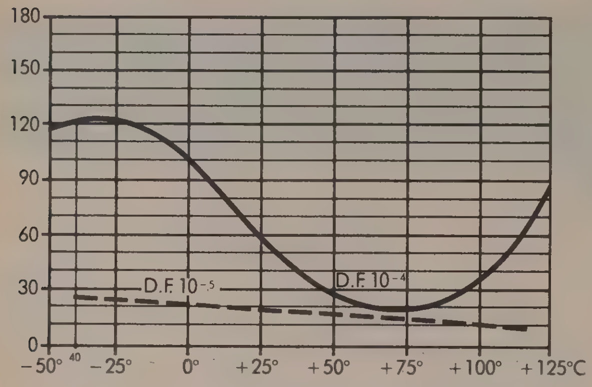


Fig. I *Dissipation factor variation with temperature*

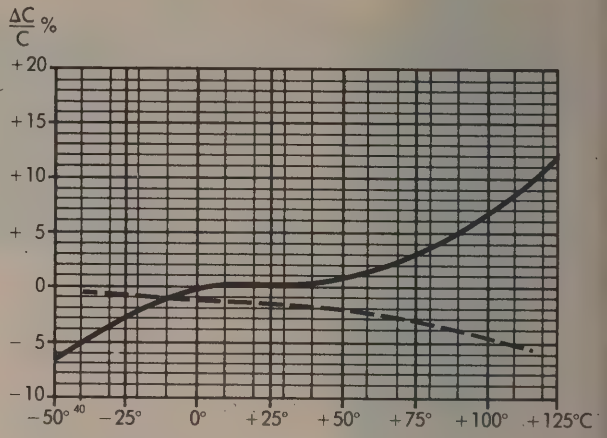


Fig. IV *Capacitance variation with temperature*

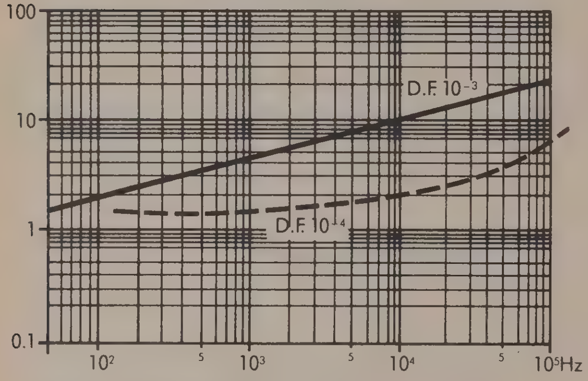


Fig. II *Dissipation factor variation with frequency*

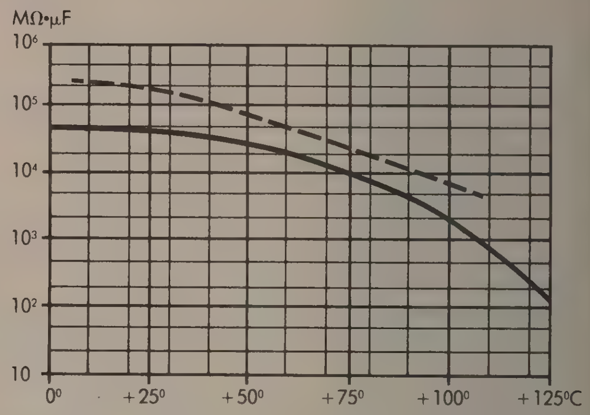


Fig. V *Insulation resistance variation with temperature*

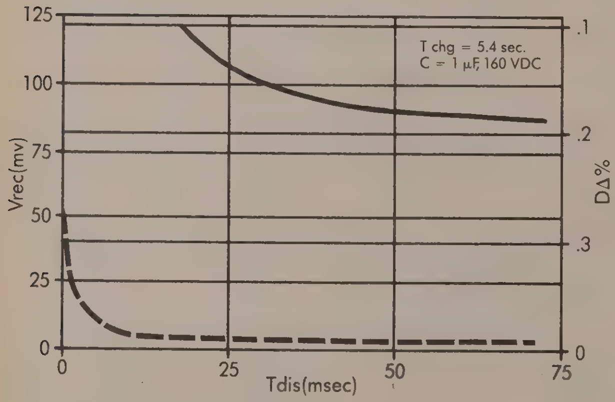


Fig. III *Dielectric absorption*

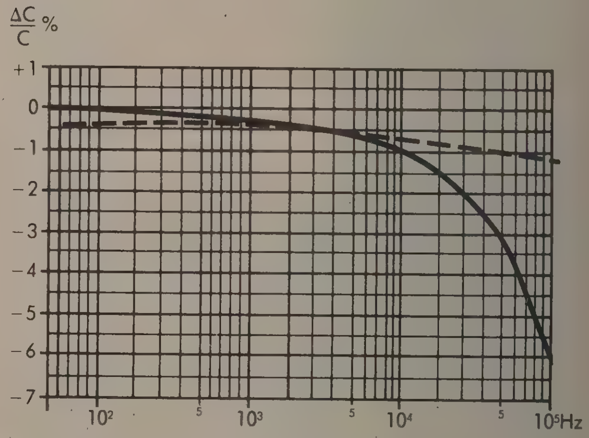


Fig. VI *Capacitance variation with frequency*

PPD

FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

Printed in U.S.A.

Specifications subject to change without notice.

PEB 731 Metallized Polyester "Box" Capacitors

Physical and Electrical Characteristics*

Capacitance range	1000 pF to 1.0 μF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	50VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125°C. Over 85°C the voltage is derated linearly to 50% at 125°C
Moisture resistance	After 72 hours at 75°C and 95% RH, the IR shall exceed 30% of the initial requirement
Dielectric and electrodes	Polyester film vacuum metallized with aluminum
Leads	Solder coated copper clad steel wire
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds
Life test	140% rated DC voltage at 85°C for 250 hours
Dissipation Factor	C≤1 uF 0.8% max. (0.5% average) at 1kHz C>1 uF 1.0% max. (0.6% average) at 1kHz

*Additional Information Available on Request

MAXIMUM PULSE RISE TIME (V/μs)

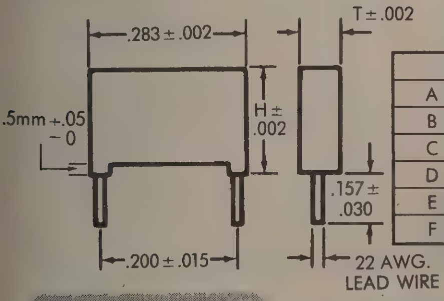
Voltage VDC	Lead Spacing .200″	.400″
50	4	—
63	8	3
100	10	6
250	—	11
400	—	20
630	—	30

Pulse current = Cap. (μf) × Rise Time (V/μs)

CAP μf	.400″ (10 mm) Lead Spacing 63V D.C./ 40V A.C. Case code	100V D.C./ 63V A.C. Case code	250V D.C./ 160V A.C. Case code	400V D.C./ 200V A.C. Case code	630V D.C./ 220V A.C. Case code	.200″ (5 mm) Lead Spacing 50V D.C. Case code	63V D.C. Case code	100V D.C. Case code
.001								A
.0012								A
.0015								A
.0018								A
.0022								A
.0027								A
.0033								A
.0039					A			A
.0047					A			A
.0056					A			A
.0068					A			A
.0082					A			A
.01					A			A
.012				A	*B			A
.015				A	*B			A
.018				A	*B			A
.022				A	*C			A
.027				A				A
.033			A	*B			A	
.039			A	*B			A	
.047			A	*C			A	
.056			A				A	
.068			A				A	
.082			A				A	
.1		A	*B/C			A	B	
.12		A	*C			A	B	
.15		A	*C			B	C	
.18		A	*C			B	C	
.22	A	*B				C	*D	
.27	A	*B				C	*D	
.33	A	*C				*D	*E	
.39	A					*D	*E	
.47	*B					*E	*F	
.68						*E	*F	
1.0						*F	*F	

*Additional sizes also available

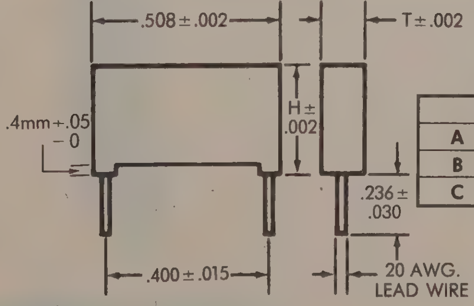
.200″ (5 MM) C.T.S. CASE



CASE SIZE

	H	T
A	.256	.098
B	.256	.118
C	.295	.138
D	.335	.177
E	.394	.197
F	.433	.236

.400″ (10 MM) C.T.S. CASE



CASE SIZE

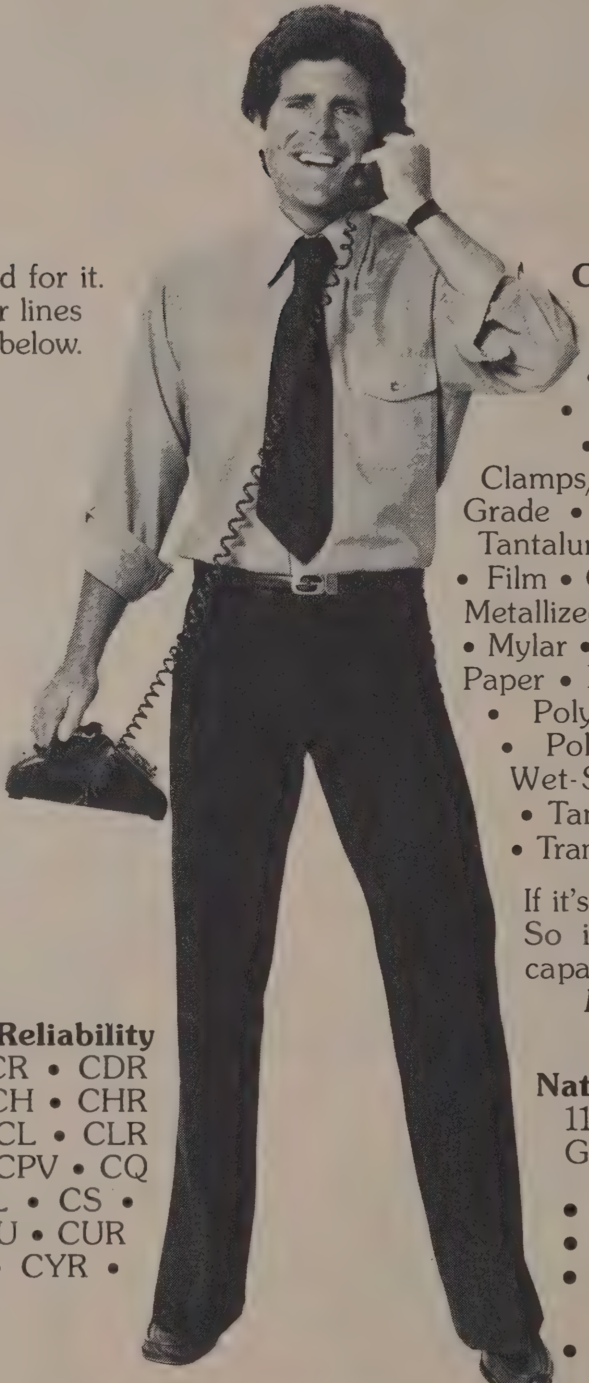
	H	T
A	.354	.157
B	.433	.197
C	.472	.236

PPD

FILM CAPACITORS
Rt. 8, Box 116B, Raleigh, N.C. 27612
(919) 781-3955

Specifications subject to change without notice.

“National Capacitor carries every type capacitor with the largest inventory in the USA”



But don’t take our word for it. Just check the capacitor lines and types we carry listed below.

CAPACITOR LINES

- ACUSHNET
- ARCO
- CAPACITOR TECH
- CORNELL-DUBILIER
- MALLORY
- MATSUO
- MURATA-ERIE
- SAN FERNANDO
- SEACOR
- SPRAGUE-GOODMAN
- TANSITOR
- THOMSON-CSF
- UNITED CHEMICON
- WEST-CAP

CAPACITOR TYPES

Military/Established Reliability

CA • CB • CC • CCR • CDR • CE • CFR • CG • CH • CHR • CJ • CK • CKR • CL • CLR • CM • CMR • CP • CPV • CQ • CQR • CRH • CRL • CS • CSR • CT • CTM • CU • CUR • CV • CWR • CY • CYR • CZ • CZR • PC

Commercial/Industrial

AC Motor Start/Run • Aluminum Electrolytic • Bathtub • Button Mica • Chip • Ceramic Disc • Ceramic Monolithic • Clamps/Brackets • Computer Grade • Dipped Mica • Dipped Tantalum • Feed-Thru/Filters • Film • Glass • High Voltage • Metallized Film • Mica Trimmers • Mylar • Nonpolar • Oil Filled • Paper • Piston • Polycarbonate • Polyester • Polypropylene • Polysulfone • Tantalum Wet-Slug • Tantalum-Solid • Tantalum-Foil • Trimmers • Transmitting Mica • Variables

If it’s a capacitor, we stock it! So if you are looking for capacitors, call “*The Buyer’s Best Friend.*”

National Capacitor
11731 Markon Drive,
Garden Grove, CA 92641.

- **(714) 892-7749**
- **(213) 598-9611**
- Outside California **(800) 854-2451**
- TWX International **(910) 596-1316**

NATIONAL CAPACITOR®

SERVING HIGH TECHNOLOGY

PRESIDIO COMPONENTS INC.

7185 Construction Court, San Diego, California 92121 Telephone:(619) 578-9390
Post Office Box 81576 San Diego, CA 92138 TWX 910-335-1254 ANS-GRT TWN SDG

CHIP KIT

Each Kit holds 300 chips
Consisting of 10 each of 30 standard
RETMA Values.

SAMPLE CHIP KIT
0504 NPO 1.0 - 270 PF
PRESIDIO COMPONENTS, INC.

Tolerance NPO ±5%, X7R-BX ±10%, Z5U +80%-20%

PRESIDIO COMPONENTS INCORPORATED is a manufacturer of high quality multilayer ceramic chip capacitors for the sophisticated commercial, military and medical electronics market. We manufacture standard chip capacitors as well as a variety of high frequency, high voltage and high temperature devices.

CHIP KIT ELEMENTS

NO.	SIZE	CAP RANGE	DIEL.	PRICE
1	0504	1.0pF — 270pF	NPO	$ 75
2	0504	1.8pF — 470pF	NPO	$ 75
3	0805	1.0pF — 270pF	NPO	$ 75
4	0805	4.7pF —1200pF	NPO	$ 75
5	VAR	39pF — .01μF	NPO	$ 75
6	0504	180pF — .047μF	X7R/Z5U	$100
7	0805	390pF — .1μF	X7R/Z5U	$100
8	VAR	3900pF — 1.0μF	X7R/Z5U	$125
9	0403	10pF — .01μF	NPO/X7R/Z5U	$125
KIT RACK holds 5 elements + Tray				$ 18

UNIVERSAL CROSS REFERENCE OF CAPACITANCE & SIZES NOW IN PRODUCTION Includes Low Profile Capacitors for Height-Critical Applications

SIZE	LENGTH	WIDTH	THICKNESS MAX	NPO		BX		X7R		Z5U	
				50V	25V	50V	25V	50V	25V	50V	25V
0403	.040	.030	.020	68pF	100pF	1200pF	2700pF	2200pF	3300pF	3900pF	5600pF
			.030	150pF	220pF	2700pF	4700pF	4700pF	5600pF	6800pF	.01μF
0504	.050	.040	.020	150pF	180pF	2700pF	4700pF	4700pF	8200pF	8200pF	.012μF
			.030	270pF	330pF	4700pF	8200pF	8200pF	.012μF	.018μF	.022μF
			.040	470pF	680pF	6800pF	.010μF	.012μF	.018μF	.033μF	.039μF
0603	.060	.030	.030	220pF	270pF	2700pF	4700pF	6800pF	.010μF	.012μF	.015μF
0704	.070	.040	.040	680pF	820pF	6800pF	.012μF	.018μF	.022μF	.027μF	.039μF
0805	.080	.050	.020	330pF	390pF	3900pF	8200pF	.010μF	.015μF	.033μF	.039μF
			.030	560pF	680pF	8200pF	.012μF	.015μF	.022μF	.068μF	.082μF
			.040	820pF	1000pF	.010μF	.018μF	.027μF	.033μF	.082μF	.12μF
			.050	1000pF	1500pF	.012μF	.022μF	.033μF	.047μF	.10μF	.15μF
0905	.100	.050	.050	1800pF	2200pF	.018μF	.033μF	.047μF	.068μF	.12μF	.18μF
0907	.090	.070	.050	3900pF	4700pF	.068μF	.10μF	.10μF	.12μF	.22μF	.27μF
1206	.125	.065	.065	3900pF	4700pF	6800pF	8200pF	.10μF	.12μF	.33μF	.39μF
1209	.125	.095	.065	.010μF	.012μF	.10μF	.15μF	.22μF	.27μF	.47μF	.68μF
1505	.150	.050	.050	3300pF	3900pF	.047μF	.082μF	.10μF	.12μF	.22μF	.27μF
1706	.170	.065	.065	4700pF	8200pF	.10μF	.15μF	.18μF	.22μF	.47μF	.68μF
1712	.170	.125	.065	.018μF	.022μF	.27μF	.33μF	.47μF	.56μF	1.0μF	1.2μF
1808	.180	.080	.065	.010μF	.012μF	.15μF	.22μF	.33μF	.39μF	1.0μF	1.2μF
2018	.197	.180	.080	.027μF	.033μF	.47μF	.56μF	.56μF	.68μF	2.2μF	2.7μF
2225	.220	.250	.080	.047μF	.056μF	.82μF	1.0μF	1.0μF	1.2μF	3.3μF	3.9μF
2321	.225	.210	.070	.047μF	.056μF	.68μF	.82μF	.82μF	1.0μF	2.7μF	3.3μF
2708	.270	.080	.070	.010μF	.012μF	.22μF	.27μF	.39μF	.47μF	1.2μF	1.5μF
3943	.395	.430	.080	.15μF	.18μF	.22μF	.27μF	.33μF	.39μF	10μF	12μF
4015	.395	.145	.070	.047μF	.056μF	.82μF	1.0μF	1.0μF	1.2μF	2.7μF	3.9μF
5930	.585	.298	.070	.10μF	.12μF	2.7μF	3.3μF	3.3μF	3.9μF	10μF	12μF
	tol. ±0.010 or 7%										

QPL

MIL-C-55681B

(M-LEVEL)
ESTABLISHED RELIABILITY
CDR11 thru CDR14
CDR21 thru CDR25

MIL-C-11272C

CY81 thru CY89

QPL

MIL-C-20G

(R-LEVEL)
ESTABLISHED
RELIABILITY
CCR05 thru CCR09
CCR75 thru CCR79
CC05 thru CC09 CC75 thru CC79

ULTRA-STABLE

NPO MU-CAPS®

MOST STABLE MINIATURE
CAPACITOR AVAILABLE
T.C.--ZERO ±30 PPM/°C

AXIAL RADIAL

SQUARE ... from 1 PF. to .22 MF.

TUBULAR ... from 1 PF. to .22 MF.

REPUBLIC

SUBMINIATURE CERAMIC CAPACITORS

ULTRA-Q MICROWAVE FREQUENCIES

Pd. SILVER or TINNED

MS MICRO STRIP

AR AXIAL RIBBON

RR RADIAL RIBBON

RW RADIAL WIRE

AW AXIAL WIRE

SPECIFICATIONS

Capac. Range: .1 Pf thru 1000 Pf
WVDC: 50 thru 500 VDC
Q @ 1 MHZ: 10,000 minimum
Temp. Coeff.: +90 ±20ppm/°C

CHIPS SINGLE LAYER

Sizes: .030" Sq. and up

Capacitance:		
SUPER-K Ceramic	150 PF. to 10,000 PF.
HIGH-K	"	100 PF. to 5,000 PF.
STABLE-K	"	50 PF. to 2,700 PF.
LOW-VAR	"	20 PF. to 1,000 PF.
TEMP. COMP.	"	1 PF. to 330 PF.

Electrodes: Normally silver. Other precious metals on request
Voltage: 50 WVDC

CHIPS MONOLITHIC MULTILAYER

Sizes: From .050" x .050" x .050" to .610" x .310" x .080"
Capacitance: STABLE-K Ceramic 10 PF. to 2 MF.
NPO " 1 PF. to .027 MF.
Electrodes: Normally silver. Other precious metals on request
Voltage: 50 WVDC

TEMPERATURE COMPENSATING NPO thru N5600 AND GENERAL PURPOSE

M-CAPS NPO ULTRA-STABLE

are monolithic capacitors with maximum capacitance/volume ratio in a choice of 3 dielectrics to cover all requirements. From .100" square to .300" square.

NPO	STABLE-K	HIGH-K
2.2-33,000 PF.	120 PF.-1MF.	470 PF. -1MF.

RIBBON LEADS

Style RLA

Size and specifications same as "Thinline" capacitors shown above, except radial and axial tinned copper ribbon leads, approximately .006" thick x 3/32" wide for units with max. size of .150" and up; .045" wide for smaller units.

SEND FOR FREE CATALOG

REPUBLIC ELECTRONICS CORP.
176 E. 7th St., PATERSON, N.J. 07524
201-279-0300 TWX 710-988-5908

SEACOR CAPACITORS

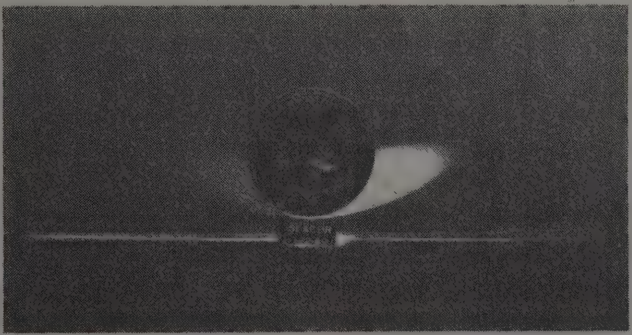
*High Performance—Unvarying Quality—Complete Reliability—Certain Deliveries—**AT THE RIGHT PRICES***

Seacor: Technical excellence—Self-healing, extended foil, non-inductive construction. Very low dissipation factors. Many types available taped and reeled for autoassembly. Lead length options. "Flat" temp. coeffs. Wide op. temp. ranges. High insulation resistances.

Type	Construction	Capacitance Range, MFD	Std. Tolerances, %	WVDC
AXIAL LEAD—WRAP AND FILL				
MMWA	Metallized Polyester	.01-10.0 Mfd	5, 10, 20	100/250/400/630
MFWA	Polyester Foil	.001-1.0 Mfd	5, 10, 20	100/200/400/630
PMWA	Metallized Polypropylene	.01-10.0 Mfd	1, 2, 5, 10, 20	250/400/630/1000
PFWA	Polypropylene Foil	.01-.12 Mfd	1, 2, 5, 10, 20	63/100/250
CMWA	Metallized Polycarbonate	.01-10.0 Mfd	1, 2, 5, 10, 20	100/250/400/630
SFWA	Polystyrene Foil	100-603,000 Pfd	1, 2, 5, 10, 20	63/100/250/400 630/1000
OVAL AXIAL—LEAD WRAP AND FILL				
CMWF	Metallized Polycarbonate	.001-22.0 Mfd	5, 10, 20	100/200/400/630
RADIAL LEAD—MOLDED CASE				
MMKR	Metallized Polyester	.01-6.8 Mfd	5, 10, 20	100/250/400/630
CMKR	Metallized Polycarbonate	.001-.33 Mfd	1, 2, 5, 10, 20	100/250/400
RADIAL LEAD—EPOXY-DIPPED				
MMDR	Metallized Polyester	.01-2.2 Mfd	5, 10, 20	250/400/630
MFDR	Polyester Foil	.001-.47 Mfd	5, 10, 20	100/200/400/630
MVDS	Polyester Foil-Inductive	.001-.47 Mfd	5, 10, 20	100
PFDR-S	Polypropylene Foil	.001-.18 Mfd	1, 2, 5, 10, 20	160/200/400/630
AXIAL LEAD—HEAT SEALED				
SVVO	Polystyrene Foil	22-100,000 Pfd	1, 2, 5, 10, 20	33/63/160/630
SVVA	Polystyrene Foil	140-150,000 Pfd	1, 2, 5, 10, 20	33/63/160
X&Y SUPPRESSOR CAPACITORS (VDE, SEV, DEMKO, NEKO Approvals)				
PNKR	Metallized Polypropylene	.01-1.0 Mfd	10, 20	250 Vac
PNKS	Metallized Polypropylene	.015-2.2 Mfd	10, 20	250 Vac
MNKR	Metallized Polyester	.001-1.5 Mfd	10, 20	250 Vac
PNKT	Metallized Polypropylene	.001-.022 Mfd	10, 20	250 Vac
MOTOR RUN CAPACITORS				
PNP	Metallized Polypropylene	1.0-65.0 Mfd	5, 10	115/250/400/450 Vac

The New Seacor Special Products Division

If you can't meet your much needed requirements in a standard capacitor, contact Seacor's Special Products Division. Non-standard capacitances, tolerances, and voltages, are just a few of our capabilities. Special lead configurations, sub-miniature sizes, special designs, as well as unique marking requirements are also features of our newly developed department. Our capabilities also include special capacitance sorting and matching abilities and MANY, MANY OTHERS. A good place to start or before giving up, check Seacor's Special Products Division!



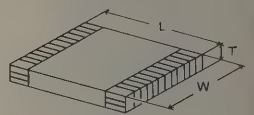
TM

SEACOR INC. 123 Woodland Avenue, P.O. Box 541, Westwood, NJ 07675 ■ (201) 666-5600 ■ TLX 135354

SOSHIN ELECTRONIC COMPONENTS

CHIP MICA CAPACITOR

- Extremely high Q — your No.1 capacitor choice for high-frequency applications.
- Minimum capacitance tolerance of ±0.25% or ±0.25pF, whichever is greater.
- Excellent crack-free performance after being subjected to thermal shock. Plus — no need for pre-heating or solder containing silver.



Capacitance, Rated Voltage and Dimensions

Type	Capacitance Range (PF)		Size (mm)		
	100WV	500WV	L	W	Tmax
UC12	1 — 43	—	2.0	1.25	1.4
UC23	43.5 — 240	1 — 91	3.2	2.5	1.5
UC34	241 — 820	91.5 — 470	4.5	3.2	2.0
UC55	821 — 2000	471 — 1200	5.6	5.0	2.0

Applicable Capacitance Range

Capacitance Range	Capacitance Step
1PF≤C≤100PF	0.5PF Step
100PF<C≤1000PF	1PF Step
1000PF<C≤2000PF	10PF Step

DIPPED MICA CAPACITOR

Temperature tests prove superiority: These dipped mica capacitors withstand 2000 hrs at 40°C, 90% to 95% humidity. Usable temperature range −55°C to +150°C.
Miniature type, DM05, also available.
Approved in accordance with MIL-C-5 specification.

Style	Maximum allowable capacitance (pF)			tolerance	Sizes (mm)																		Leads (mm)		
					ONE COAT type									STANDARD type									ONE COAT STANDARD		
	100 WV	300 WV	500 WV		500WV			300WV			100WV			500WV			300WV			100WV					
					W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	W MAX	H MAX	T MAX	A ±0.04	D	C MIN
DM05	200	120	—	D.F.G.J.K	—	—	—	6.3	5.3	4.3	6.3	5.3	4.3	—	—	—	6.8	6.3	4.8	6.8	6.3	4.8	3.0	0.4	32.0
DM10	470	360	250	D.F.G.J.K	7.8	5.8	3.5	7.8	6.0	3.8	7.8	6.0	3.8	9.9	9.6	5.5	10.1	9.9	5.8	10.1	9.9	5.8	3.5	0.4	32.0
DM15	1,600	1,200	750	D.F.G.J.K	10.6	7.6	4.5	10.6	7.6	4.5	10.6	7.6	4.5	12.7	10.9	6.3	12.7	10.9	6.3	12.7	10.9	6.3	5.9	0.64	32.0
DM19	8,200	6,800	5,100	D.F.G.J.K	16.7	12.7	8.1	16.2	12.4	6.9	16.5	12.4	7.6	18.0	14.9	9.3	17.5	14.4	8.3	17.7	14.7	8.8	8.7	0.8	32.0
DM20	18,000	12,300	10,000	D.F.G.J.K	19.3	13.4	10.1	19.0	12.9	9.1	19.3	13.2	9.3	20.8	16.0	11.4	20.5	15.2	10.1	20.8	15.7	11.1	11.0	0.8	32.0
DM30	40,000	30,000	22,000	D.F.G.J.K	—	—	—	—	—	—	—	—	—	21.3	23.6	12.1	21.0	23.3	11.6	21.3	23.3	11.9	11.0	1.0	32.0
DM40	25,000	20,000	15,000	D.F.G.J.K	—	—	—	—	—	—	—	—	—	25.6	19.0	9.9	25.8	19.2	10.4	26.0	19.0	9.9	15.0	1.0	32.0
DM42	100,000	69,000	51,000	D.F.G.J.K	—	—	—	—	—	—	—	—	—	37.5	23.3	11.9	37.5	23.6	12.1	38.1	23.9	12 7	26.9	1.0	32.0

PRINTED FILTER

- The use of mica as dielectric material for the substrate assures high temperature stability, stable cut off frequency and low ripple within pass band.
- This unit with a thin configuration is more suitable for conservation of space comparing with hybrids and discrete parts.
- A small number of external connections assures high reliability of connections and contributes a decrease in cost.

Filter for Satellite TV

Type	Pass Band (MHz)	IL (dB MAX)	Stop Band	
			(dB MIN)	(MHz)
BP1450B1	950 — 1450	1.5	40 35	0 — 500 1750 — 2250
BP70B1	57 — 83	2	20	5 — 40 100 — 200
SEP 770/1035B1	0 — 770 1035 — 1335	1	25	1035 — 1335 0 — 770

Filter for Mobile Radio

Type	Pass Band (MHz)	IL (dB MAX)	Stop Band	
			(dB MIN)	(MHz)
LP174A 1	0 — 174	0.7	35 25	296 — 522 522 — 1300
LP470A1	0 — 470	0.7	35 25	780 — 1100 1100 — 1300
BP465A 1	460 — 470	3	20	0 — 400 550 — 800

Filter for PRCS

Type	Pass Band (MHz)	IL (dB MAX)	Stop Band	
			(dB MIN)	(MHz)
BP992A 2	991.5 — 993.5	4	30	933.5 — 935.5
LP950A 1	0 — 950	0.5	40	1867 — 1871

Separator for Cordless Telephone

Type	Pass Band (MHz)	IL (dB MAX)	Stop Band	
			(dB MIN)	(MHz)
DPX 915/960A 1	915 960	3	15	960 915

SOSHIN
SOSHIN ELECTRIC CO., LTD.
1-18-18 Nakamagome, Ohta-ku, Tokyo, Japan. TELEX: 246-6377

Distributor
Arco Electronics, Inc.
400 MORELAND ROAD COMMACK, NEW YORK 11725
EAST TEL: (516) 864-7000
9822 INDEPENDENCE AVE., CHATSWORTH, CALIF. 91311
WEST TEL: (818) 882-8707

CAPAR COMPONENTS CORPORATION
25 Dubon Court
Farmingdale, New York 11735
(516) 454-6390

1701 East Edinger Avenue
Santa Ana, California 92705
(714) 547-7034

Sprague-Goodman. Nobody Offers a Broader Selection of Trimmer Capacitors.

When it comes to high-quality trimmer capacitors, nobody comes close to Sprague-Goodman.

We have the world's largest selection of models, styles and dielectrics: sub-miniature glass, quartz and sapphire Pistoncaps®, plastic Filmtrims® or Ceramic single turn, Mica compression, Airtrim® air dielectric, multi-turn plastic and miniature LC tuners and Stab-L® metalized inductors.

So whether you need standard or custom products, you can count on Sprague-Goodman. The first and last name in trimmer capacitors.

Sprague-Goodman
Electronics, Inc.
(An affiliate of the Sprague Electric Company)
134 Fulton Avenue,
Garden City Park, NY 11040
516-746-1385
TLX: 14-4533

GMA2030
GMD 40 60

MICROCAP

MICROCAP, 11120 Roselle St., San Diego, CA 92121 **(619) 452-9812**

HIGH-REL • HIGH-Q • HIGH-VOLTAGE CERAMIC CHIP CAPACITORS

It's official. We've changed our name from Statnetics to Microcap and are expanding our manufacturing operation. But our customers know that what won't change is the quality and depth of service they've come to depend on. Or the fast delivery we're famous for.

Microcap is now the premier name in high reliability MLC chip capacitors — perfect for hybrid circuitry or wherever surface mounted components are required. Microcap produces high-voltage, high-Q, and standard MLC chip capacitors in both Class I dielectrics (NPO) and Class II dielectrics (X7R, BX). What's more, Microcap provides components certified under performance tests outlined by MIL-C-55681, high reliability Group A, B, and C inspection.

DIELECTRIC CHARACTERISTICS

BX — CERAMIC CHIP CAPACITORS

Operating Temperature Range: −55°C to +125°C
Temperature Coefficient: ±15%, maximum
Voltage-Temperature Coefficient: +15, −25% with Rated DC Voltage bias applied
Dissipation Factor: 2.5%, maximum
Insulation Resistance: (25°C, Rated DC Voltage): Exceeds 100 GΩ or 1000 Ω-F, whichever is less
(125°C, Rated DC Voltage) 10% of 25° requirement
Dielectric Strength: 2.5 times Rated DC Voltage
Test Conditions (Capacitance & d.f.): 1 kHz, 1.0 Vrms, 25°C
Quality Specs: Meets or exceeds applicable portions of MIL-C-55681B and EIA-198B

HIGH-Q CERAMIC CHIP CAPACITORS

Capacitance Values: 0504 size: 0.1 to 100.0 pf, 1209 size: 0.1 to 1000.0 pf
Tolerances: B,C,D (C<10 pf), F,G,J,K,M (C≥10 pf)
Quality Factor: Q>10,000 at 1 MHz
Insulation Resistance (25°C): 10^6 Megohms minimum (C≤470 pf), 10^5 Megohms minimum (C>470 pf)
Temperature Coefficient: 90 ±20 ppm/°C (MIL characteristic BG)
Working Voltage: 100 VDC (size 0504), 1000 VDC (size 1210)
Aging Rate: None

NPO CERAMIC CHIP CAPACITORS

MIL-Specs: Meets or exceeds applicable portions of MIL-C-55681B and EIA–198B
Insulation Resistance: 100,000 megohms or 1,000 megohm microfarads minimum, whichever is less, with rated voltage applied, at 25°C (see curve for other temperatures)
Flash Test: 2.5 Times WVDC below 0.5 mfd; 2.0 times WVDC at 0.5 mfd and above
Life Test: 2.0 times WVDC at +125°C, 1,000 hours
Temperature Range: −55°C to +125°C
Temperature Coefficient: 0 ±30 ppm/°C
Dissipation Factor: 0.1% maximum at 1 MHz

X7R — CERAMIC CHIP CAPACITORS

Operating Temperature Range: −55°C to +125°C
Temperature Coefficient: ±15%, maximum
Dissipation Factor: 2.5%, maximum
Insulation Resistance: (25°C, Rated DC Voltage): Exceeds 100 GΩ or 1000 Ω-F, whichever is less
(125°C, Rated DC Voltage) 10% of 25° requirement
Dielectric Strength: 2.5 times Rated DC Voltage
Test Conditions (Capacitance & d.f.): 1 kHz, 1.0 Vrms, 25°C
Quality Specs: Meets or exceeds applicable portions of MIL-C-55681B and EIA-198B

HIGH VOLTAGE NPO DIELECTRIC

Dielectric Type (K): NPO (COG)
Temperature Coefficient (T.C.): Less than 30 ppm/°C; −55°C to +125°C
Dissipation Factor (D.F.): Less than .0015 (.15%) @ 1 kHz, 1 Vrms 25°C
Insulation Resistance (I.R.): 100K megΩ or 1000 megΩ-microfarads, whichever is less (25°C, 500 VDC)
Aging: 0
Dielectric Withstanding Voltage: 1.2 Times Rated Voltage @ 25°C*
Dimensional Tolerance: ±.010 or ±5%, whichever is greater

HIGH VOLTAGE X7R DIELECTRIC

Dielectric Type (K): XR7
Temperature Coefficient (T.C.): ±15%, −55 to +125°C
Dissipation Factor (D.F.): 1.5% max. 1 kHz, 1 Vrms, 25°C
Insulation Resistance (I.R.): 100K megΩ or 1000 megΩ-microfarads, whichever is less (25°C, 500 VDC)
Aging: 0.6% per decade
Dielectric Withstanding Voltage: 1.2 Times Rated Voltage @ 25°C*
Voltage Coefficient (V.C.): See Graph
Dimensional Tolerance: ±.010 or ±5%, whichever is greater

* Dielectric Withstanding Voltage Test on Monolithic Chips and Radials is conducted with charging current limited to 10 mA and the discharge current limited to 5A.

PART NUMBER

0805 ND 102 KP

CHIP SIZE

In the case of bare chips, this number describes approximate dimensions. In the case of leaded devices, this characteristic describes dimensions of chips which would be installed in the package.

DIELECTRIC TYPE

H = High Q 90 ±20 ppm/°C
N = NPO 0 ±30 ppm/°C
X = X7R ±15%
B = BX ±15% (OVDC), +15-25% (rated VDC)
Z = Z5U +22, −56%
Y = Y5V +22, −82%

VOLTAGE RATING

A = 12 VDC
C = 25 VDC
D = 50 VDC
E = 100 VDC
H = 200 VDC
I = 300 VDC
J = 400 VDC
L = 500 VDC
1K = 1,000 VDC
2K = 2,000 VDC
3K = 3,000 VDC
4K = 4,000 VDC
5K = 5,000 VDC

NOMINAL CAPACITANCE

Describes EIA coded nominal cap, in picofarads, first two digits are significant figures; third is number of zeros to follow.

CAP TOLERANCE

B = ±0.1 pF
C = ±0.25 pF
D = ±0.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%
Y = +100, −0%
Z = +80, −20%

TERMINATION STYLE

P = Pd/Ag (Palladium/Silver)
R = Pt/Ag (Platinum/Silver)
S = Ag (Silver)
T = Solder (604 Ag, 60% Tin, 36% Lead, 4% Silver)
U = Solder (95/5, 95% Tin, 5% Silver)
V = Solder (60/40, 60% Tin, 40% Lead)
W = Solder (Au/Sn)
X = Solder (Sn62, 62% Tin, 36% Lead, 2% Silver, most common for capacitor termination).
E = Radial Leaded

MICROCAP

MICROCAP, 11120 Roselle St., San Diego, CA 92121 **(619) 452-9812**

HIGH-Q CERAMIC CHIP CAPACITORS

SPECIFICATIONS

Capacitance values:	0504:0.1 to 100.0 pf
	1209:0.1 to 1000.0 pf

	MODEL 0504	MODEL 1209	DIMENSIONS
L	.050	.115	(±.010)
T	.040	.100	(max)
W	.040	.105	(±.010)
BW	.005-.015	.010-.030	

Termination bond strength exceeds 8 pounds in an axial pull test.

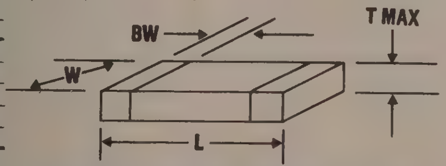
● X7R ■ BX ▲ NPO

NPO, X7R, BX CHIP CAPACITORS

STYLE	0504				0805				1005				1505				EIA CAP. CODE
L.	.050				.080				.100				.150				
W.	.040				.050				.050				.050				
T. MAX	.040				.050				.050				.050				
BW	.010				.020				.020				.020				
CAPACI-TANCE (PF)	VOLTS 25	50	100	200	VOLTS 25	50	100	200	VOLTS 25	50	100	200	VOLTS 25	50	100	200	
10/100		▲	▲	▲		▲	▲	▲		▲	▲	▲					100
12		▲	▲	▲		▲	▲	▲		▲	▲	▲					120
15		▲	▲	▲		▲	▲	▲		▲	▲	▲					150
18		▲	▲	▲		▲	▲	▲		▲	▲	▲					180
22		▲	▲	▲		▲	▲	▲		▲	▲	▲					220
27		▲	▲	▲		▲	▲	▲		▲	▲	▲					270
33		▲	▲	▲		▲	▲	▲		▲	▲	▲					330
39		▲	▲	▲		▲	▲	▲		▲	▲	▲					390
47		▲	▲	▲		▲	▲	▲		▲	▲	▲					470
56		▲	▲	▲		▲	▲	▲		▲	▲	▲					560
68		▲	▲	▲		▲	▲	▲		▲	▲	▲					680
82		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	820
100	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲	101
120	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲	121
150	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲	151
180	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲	181
220	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲	221
270	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲	271
330	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲	331
390	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲	391
470	●■	●■▲	●■▲		●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲	471
560	●■	●■▲	●■▲		●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲	561
680	●■	●■▲	●■▲		●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲		▲	▲	▲	681
820	●■	●■▲	●■		●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲	821
1000	●■	●■	●■		●■	●■▲	●■▲		●■	●■▲	●■▲	▲	●■	●■▲	●■▲	▲	102
1200	●■	●■	●■		●■	●■▲	●■▲		●■	●■▲	●■▲		●■	●■▲	●■▲	▲	122
1500	●■	●■	●■		●■	●■▲	●■▲		●■	●■▲	●■▲		●■	●■▲	●■▲	▲	152
1800	●■	●■	●■		●■	●■▲	●■		●■	●■▲	●■▲		●■	●■▲	●■▲	▲	182
2200	●■	●■	●■		●■	●■▲	●■		●■	●■▲	●■		●■	●■▲	●■▲	▲	222
2700	●■	●■	●■		●■	●■	●■		●■	●■▲	●■		●■	●■▲	●■▲		272
3300	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■▲	●■▲		332
3900	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■▲	●■		392
4700	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■▲	●■		472
5600	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		562
6800	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		682
8200	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		822
.0100µf	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		103
.0120	●■	●■			●■	●■	●■		●■	●■	●■		●■	●■	●■		123
.0150	●■	●■			●■	●■	●■		●■	●■	●■		●■	●■	●■		153
.0180	●■	●			●■	●■	●■		●■	●■	●■		●■	●■	●■		183
.0220	●■	●			●■	●■	●■		●■	●■	●■		●■	●■	●■		223
.0270					●■	●■	●■		●■	●■	●■		●■	●■	●■		273
.0330					●■	●■	●		●■	●■	●■		●■	●■	●■		333
.0390					●■	●■	●		●■	●■	●■		●■	●■	●■		393
.0470					●■	●			●■	●■	●		●■	●■	●■		473
.0560					●■	●			●■	●■			●■	●■	●■		563
.0680									●■	●			●■	●■	●		683
.0820													●■	●■			823
.1000													●■	●			104
.1200													●■	●			124
.1500																	154
.1800																	184
.2200																	224
.2700																	274
.3300																	334
.3900																	394
.4700																	474
.5600																	564
.6800																	684
.8200																	824
1.000																	105
1.200																	125
1.500																	155

STYLE	1706				1808				1209				1812				EIA CAP. CODE
L.	.170				.180				.125				.175				
W.	.060				.080				.095				.125				
T. MAX	.050				.060				.060				.060				
BW	.020				.020				.020				.020				
CAPACI-TANCE (PF)	VOLTS 25	50	100	200	VOLTS 25	50	100	200	VOLTS 25	50	100	200	VOLTS 25	50	100	200	
10/100																	100
12																	120
15																	150
18																	180
22																	220
27																	270
33																	330
39																	390
47																	470
56																	560
68																	680
82																	820
100																	101
120		▲	▲	▲													121
150		▲	▲	▲													151
180		▲	▲	▲													181
220		▲	▲	▲													221
270		▲	▲	▲		▲	▲	▲		▲	▲	▲					271
330		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	331
390		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	391
470		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	471
560		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	561
680		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	681
820		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	821
1000		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	102
1200		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	122
1500		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	152
1800		▲	▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	182
2200	●■	●■▲	●■▲	▲		▲	▲	▲		▲	▲	▲		▲	▲	▲	222
2700	●■	●■▲	●■▲			▲	▲	▲		▲	▲	▲		▲	▲	▲	272
3300	●■	●■▲	●■▲			▲	▲	▲		▲	▲	▲		▲	▲	▲	332
3900	●■	●■▲	●■▲			▲	▲	▲		▲	▲	▲		▲	▲	▲	392
4700	●■	●■▲	●■			▲	▲	▲		▲	▲	▲		▲	▲	▲	472
5600	●■	●■▲	●■			▲	▲			▲	▲			▲	▲	▲	562
6800	●■	●■	●■		●■	●■▲	●■▲		●■	●■▲	●■▲			▲	▲	▲	682
8200	●■	●■	●■		●■	●■▲	●■▲		●■	●■▲	●■▲			▲	▲	▲	822
.0100µf	●■	●■	●■		●■	●■▲	●■		●■	●■▲	●■		●■	●■▲	●■▲		103
.0120	●■	●■	●■		●■	●■▲	●■		●■	●■▲	●■		●■	●■▲	●■▲		123
.0150	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■▲	●■▲		153
.0180	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■▲	●■		183
.0220	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■▲	●■		223
.0270	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		273
.0330	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		333
.0390	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		393
.0470	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		473
.0560	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		563
.0680	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		683
.0820	●■	●■	●■		●■	●■	●■		●■	●■	●■		●■	●■	●■		823
.1000	●■	●■	●		●■	●■	●■		●■	●■	●■		●■	●■	●■		104
.1200	●■	●■	●		●■	●■	●■		●■	●■	●■		●■	●■	●■		124
.1500	●■	●			●■	●■	●■		●■	●■	●■		●■	●■	●■		154
.1800	●■	●			●■	●■	●■		●■	●■	●		●■	●■	●■		184
.2200					●■	●■	●■		●■	●			●■	●■	●■		224
.2700					●■	●■							●■	●■	●■		274
.3300					●■	●■							●■	●■	●		334
.3900					●■	●							●■	●■			394
.4700													●■	●			474
.5600																	564
.6800																	684
.8200																	824
1.000																	105
1.200																	125
1.500																	155

STYLE	2218				2522				4015				EIA CAP. CODE
L.	.220				.250				.395				
W.	.180				.230				.150				
T. MAX	.060				.060				.060				
BW	.020				.030				.030				
CAPACI-TANCE (PF)	VOLTS 25	50	100	200	VOLTS 25	50	100	200	VOLTS 25	50	100	200	
10/100													100
12													120
15													150
18													180
22													220
27													270
33													330
39													390
47													470
56													560
68													680
82													820
100													101
120													121
150													151
180													181
220													221
270													271
330													331
390													391
470													471
560													561
680													681
820		▲	▲	▲		▲	▲	▲					821
1000		▲	▲	▲		▲	▲	▲		▲	▲	▲	102
1200		▲	▲	▲		▲	▲	▲		▲	▲	▲	122
1500		▲	▲	▲		▲	▲	▲		▲	▲	▲	152
1800		▲	▲	▲		▲	▲	▲		▲	▲	▲	182
2200		▲	▲	▲		▲	▲	▲		▲	▲	▲	222
2700		▲	▲	▲		▲	▲	▲		▲	▲	▲	272
3300		▲	▲	▲		▲	▲	▲		▲	▲	▲	332
3900		▲	▲	▲		▲	▲	▲		▲	▲	▲	392
4700		▲	▲	▲		▲	▲	▲		▲	▲	▲	472
5600		▲	▲	▲		▲	▲	▲		▲	▲	▲	562
6800		▲	▲	▲		▲	▲	▲		▲	▲	▲	682
8200		▲	▲	▲		▲	▲	▲		▲	▲	▲	822
.0100µf		▲	▲	▲		▲	▲	▲		▲	▲	▲	103
.0120		▲	▲	▲		▲	▲	▲		▲	▲	▲	123
.0150		▲	▲	▲		▲	▲	▲		▲	▲	▲	153
.0180		▲	▲			▲	▲	▲		▲	▲	▲	183
.0220	●■	●■▲	●■▲		●■	●■▲	●■▲	▲		▲	▲	▲	223
.0270	●■	●■▲	●■▲		●■	●■▲	●■▲			▲	▲		273
.0330	●■	●■▲	●■		●■	●■▲	●■▲		●■	●■▲	●■▲		333
.0390	●■	●■▲	●■		●■	●■▲	●■▲		●■	●■▲	●■▲		393
.0470	●■	●■	●■		●■	●■▲	●■		●■	●■▲	●■		473
.0560	●■	●■	●■		●■	●■▲	●■		●■	●■▲	●■		563
.0680	●■	●■	●■		●■	●■	●■		●■	●■	●■		683
.0820	●■	●■	●■		●■	●■	●■		●■	●■	●■		823
.1000	●■	●■	●■		●■	●■	●■		●■	●■	●■		104
.1200	●■	●■	●■		●■	●■	●■		●■	●■	●■		124
.1500	●■	●■	●■		●■	●■	●■		●■	●■	●■		154
.1800	●■	●■	●■		●■	●■	●■		●■	●■	●■		184
.2200	●■	●■	●■		●■	●■	●■		●■	●■	●■		224
.2700	●■	●■	●■		●■	●■	●■		●■	●■	●■		274
.3300	●■	●■	●■		●■	●■	●■		●■	●■	●■		334
.3900	●■	●■	●■		●■	●■	●■		●■	●■	●■		394
.4700	●■	●■	●■		●■	●■	●■		●■	●■	●■		474
.5600	●■	●■	●		●■	●■	●■		●■	●■	●■		564
.6800	●■	●■	●		●■	●■	●■		●■	●■	●■		684
.8200	●■	●			●■	●■	●■		●■	●■	●		824
1.000	●■	●			●■	●■	●		●■	●■	●		105
1.200					●■	●■			●■	●■			125
1.500					●■	●■							155



All BW values ±.010 except .010 values which is ±.005
All L and W values ±.010 or 7%, whichever is greater

MICROCAP

MICROCAP, 11120 Roselle St., San Diego, CA 92121 **(619) 452-9812**

HIGH VOLTAGE CERAMIC CHIP CAPACITORS

● X7R ▲ NPO

	1 kV					2 kV					3 kV					4 kV					5 kV					
SIZE	2520	3530	4540	5550	6560	2520	3530	4540	5550	6560	2520	3530	4540	5550	6560	2520	3530	4540	5550	6560	2520	3530	4540	5550	6560	
L	.25″	.35″	.45″	.55″	.65″	.25″	.35″	.45″	.55″	.65″	.25″	.35″	.45″	.55″	.65″	.25″	.35″	.45″	.55″	.65″	.25″	.35″	.45″	.55″	.65″	
W	.20″	.30″	.40″	.50″	.60″	.20″	.30″	.40″	.50″	.60″	.20″	.30″	.40″	.50″	.60″	.20″	.30″	.40″	.50″	.60″	.20″	.30″	.40″	.50″	.60″	
T (MAX.)	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.15″	.20″	.20″	.20″	.20″	.20″	.25″	.25″	.25″	.25″	.25″	
MB (MAX.)	.030″	.040″	.040″	.040″	.040″	.030″	.040″	.040″	.040″	.040″	.030″	.040″	.040″	.040″	.040″	.030″	.040″	.040″	.040″	.040″	.030″	.040″	.040″	.040″	.040″	
CAPACITANCE																										EIA CODE
10 pF																										100
12 pF																										120
15 pF																										150
18 pF																					▲					180
22 pF											▲					▲					▲					220
27 pF						▲					▲					▲					▲					270
33 pF	▲					▲					▲					▲					▲					330
39 pF	▲					▲					▲					▲					▲					390
47 pF	▲					▲					▲					▲					▲					470
56 pF	▲					▲					▲					▲					▲					560
68 pF	▲					▲					▲					▲					▲					680
82 pF	▲					▲					▲					▲					▲					820
100 pF	▲					▲					▲					▲					▲					101
120 pF	▲					▲					▲					▲					▲					121
150 pF	▲					▲					▲					▲					▲	▲				151
180 pF	▲					▲					▲					● ▲	▲				● ▲	▲				181
220 pF	▲					▲					▲	▲				● ▲	▲				● ▲	▲				221
270 pF	▲					▲					● ▲	▲				● ▲	▲				●	▲				271
330 pF	▲					▲					● ▲	▲				●	▲				●	▲	▲			331
390 pF	▲					● ▲					●	▲				●	▲	▲			●	▲	▲			391
470 pF	▲					● ▲					●	▲				●	▲	▲			●	▲	▲			471
560 pF	▲					● ▲					●	▲	▲			●	▲	▲			●		▲			561
680 pF	● ▲					● ▲	▲				●	▲	▲			●		▲			●	●	▲	▲		681
820 pF	● ▲					●	▲				●	▲	▲			●		▲	▲		●	●	▲	▲		821
1000 pF	● ▲					●	▲				●		▲	▲		●		▲	▲	▲	●	●	▲	▲		102
1200 pF	● ▲					●	▲	▲			●		▲	▲		●	●	▲	▲	▲		●		▲	▲	122
1500 pF	● ▲					●	▲	▲			●		▲	▲		●	●		▲	▲		●	●	▲	▲	152
1800 pF	● ▲	▲				●	▲	▲			●	●		▲	▲	●	●		▲	▲		●	●	▲	▲	182
2200 pF	● ▲	▲				●		▲	▲	● ▲	●	●		▲	▲		●			▲		●	●		▲	222
2700 pF	● ▲	▲				●		▲	▲	● ▲	●	●		▲	▲		●			▲			●		▲	272
3300 pF	●	▲				●		▲	▲	● ▲		●			▲		●	●		▲			●	●		332
3900 pF	●	▲				●			▲	▲		●			▲		●	●					●	●		392
4700 pF	●	▲	▲			●	●		▲	▲		●	●				●	●					●	●		472
5600 pF	●	▲	▲			●	●		▲	▲		●	●					●	●					●	●	562
6800 pF	●	▲	▲			●	●			▲		●	●					●	●					●	●	682
8200 pF	●		▲	▲			●			▲			●					●	●	●				●	●	822
.010 µFd	●		▲	▲			●						●	●					●	●					●	103
.012 µFd	●		▲	▲			●	●					●	●					●	●					●	123
.015 µFd	●			▲	▲		●	●					●	●						●						153
.018 µFd	●	●		▲	▲		●	●	●					●	●					●						183
.022 µFd	●	●		▲	▲			●	●					●	●					●						223
.027 µFd	●	●			▲			●	●					●	●											273
.033 µFd		●			▲			●	●						●											333
.039 µFd		●			▲				●						●											393
.047 µFd		●	●						●	●																473
.056 µFd		●	●						●	●																563
.068 µFd		●	●						●	●																683
.082 µFd			●							●																823
.100 µFd			●	●						●																104
.120 µFd			●	●																						124
.150 µFd			●	●	●																					154
.180 µFd				●	●																					184
.220 µFd				●	●																					224
.270 µFd					●																					274
.330 µFd					●																					334
.390 µFd					●																					394

For more information on any of these products, contact
MICROCAP, 11120 Roselle St., San Diego, CA 92121 **(619) 452-9812**

TDK

CERAMIC CAPACITORS

MULTILAYER CERAMIC CAPACITORS

DK multilayer ceramic capacitors are supplied five basic styles to fit any application. Each f the styles is available in a wide range of alues ranging from as low as 0.5 pF to as high s 4.7 μF. Several choices of temperature coefficients are available in all styles to match the apacitors to the circuit needs. Tolerances are etailed in the table below.

number of styles are particularly suited to utomatic insertion and assembly techniques. he C3216 and C2012 (chips) series are available on tape and reel as well as in magazines for se in hybrid circuits or direct mounting to P/C oards. One style of dipped capacitors (FK20 & K22) is especially designed for automatic insertion. All of the axial styles (MA12, MA13 & A14) are available taped and on reels.

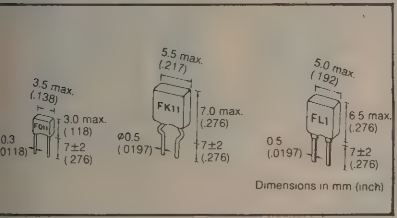
here are special types for use in high frequency up to 1 GHz) in three styles as shown at the ottom of this page.

or complete details on TDK capacitors, ask for atalog BMCE.

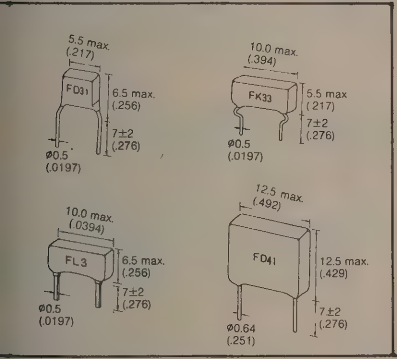
TOLERANCES & CODES

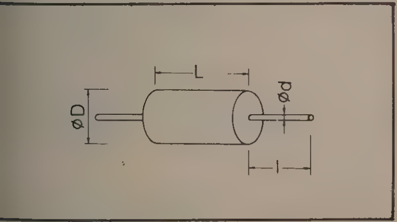
Code	Tolerance	Up to 5 pF	Up to 10 pF	Above 10 pF
C	+0.25 pF	OK	OK	NO
D	+0.50 pF	OK	OK	NO
F	+1.00 pF	OK	OK	NO
J	+5%	NO	NO	OK
K	+10%	NO	NO	OK
M	+20%	NO	NO	OK
Z	+80%-20%	NO	NO	OK

OTE: Not all tolerances are available in styles and TCs. ee tables.



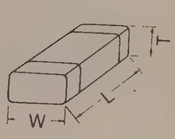
Dimensions in mm (inch)





CHIP CAPACITORS

Type	wVdc	Dimensions Nom. (mm) L x W x T			COG (pF) Min	COG (pF) Max	SL (pF) Min	SL (pF) Max	X7R (pF) Min	X7R (pF) Max	Y5V (μF) Min	Y5V (μF) Max
C1508	50	1.5	0.8	1.0	0.5	180	0.5	470	47	5600	.0022	.022
	100	1.5	0.8	1.0	0.5	120	0.5	330	47	3900	.0022	.010
C2012	50	2.0	1.25	1.25	0.5	560	0.5	1800	47	18k	.0022	.100
	100	2.0	1.25	1.25	0.5	390	0.5	1200	47	12k	.0022	.047
C3225	50	3.2	2.5	1.9	10	3300	100	8200	1k	150k	.010	.470
	100	3.2	2.5	1.9	10	2200	100	5600	1k	82k	.010	.220
C4532	50	4.5	3.2	1.9	1000	5600	1k	18k	10k	220k	.022	1.000
	100	4.5	3.2	1.9	1000	3900	1k	12k	10k	150k	.022	.470
C5650	50	5.6	5.0	1.9	1000	10k	1k	33k	100k	470k	.470	1.500
	100	5.6	5.0	1.9	1000	6800	1k	22k	100k	330k	.470	1.000
Cap. Tolerance:					F,D,C,K,J		F,D,C,K,J		K,M		Z (+80-20%)	



CHIP CAPACITORS FOR AUTOMATIC MOUNTING

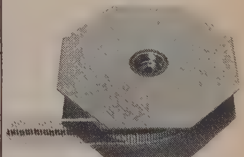
Class I Type 50 wVdc	TC	T = 0.5 Min	T = 0.5 Max	T = 0.85 Min	T = 0.85 Max	T = 1.1 Min	T = 1.1 Max	Class II Type	TC	wVdc	T = 0.6 Min	T = 0.6 Max	T = 0.85 Min	T = 0.85 Max	T = 1.1 Min	T = 1.1 Max
		Cap. Range (pF) for thickness:									Cap. Range (pF) for thickness:					
C3216CHIH	CH	0.5	330	390	470	650	680	C3216BIH	B	50	1k	15k	—	18k	22k	27k
C3216PHIH	PH	0.5	330	390	560	680	820	C3216BIE	B	25	12k	27k	33k	39k	—	47k
C3216RHIH	RH	0.5	390	470	680	820	1000	C3216DIH	D	50	1k	22k	—	33k	—	47k
C3216SHIH	SH	0.5	470	560	680	820	1200	C3216DIE	D	25	33k	47k	—	68k	—	100k
C3216THIH	TH	0.5	560	680	820	1000	1200	C3216FIH	F	50	4.7k	47k	—	68k	—	100k
C3216UJIH	UJ	0.5	560	680	1000	1200	1500	C3216FIE	F	25	47k	100k	—	150k	—	220k
C3216SLIH	SL	0.5	1200	1500	1800	2200	2700									
C2012CHIH	CH	0.5	180	200	330	360	430	C2012BIH	B	50	470	5.6k	6.8k	10k	12k	15k
C2012PHIH	PH	0.5	220	240	390	430	560	C2012BIE	B	25	6.8k	10k	12k	18k	22k	27k
C2012RHIH	RH	0.5	240	270	510	560	680	C2012DIH	D	50	1k	6.8k	8.2k	15k	18k	22k
C2012SHIH	SH	0.5	270	300	560	620	750	C2012DIE	D	25	10k	15k	22k	27k	33k	39k
C2012THIH	TH	0.5	330	360	680	750	820	C2012FIH	F	50	3.3k	15k	22k	33k	—	47k
C2012UJIH	UJ	0.5	390	430	750	820	1000	C2012FIE	F	25	22k	33k	—	47k	—	100k
C2012SLIH	SL	0.5	820	1000	1300	1500	1800									
Cap. Tolerance:		D,C,F,K,J						TC B = K & M; TC D: M; TC F:Z.								

DIPPED WITH RADIAL LEADS

Type	TC: COG, Cap.: pF 50V (1H) Min	50V (1H) Max	100V (2A) Min	100V (2A) Max	TC: SL, Cap.: pF TC: 50V (1H) Min	50V (1H) Max	100V (2A) Min	100V (2A) Max	TC: X7R, Cap.: pF 50V (1H) Min	50V (1H) Max	100V (2A) Min	100V (2A) Max	TC: Y5V, Cap.: pF 50V (1H) Min	50V (1H) Max	100V (2A) Min	100V (2A) Max
FD11	0.5	560	0.5	390	0.5	1800	0.5	1000	1000	18k	1000	12k	10k	100k	10k	47k
FK11	10	3300	10	2200	10	8200	100	4700	1000	150k	1000	82k	10k	470k	10k	220k
FL-1	10	2700	10	1800	10	6800	100	3900	1000	100k	1000	68k	10k	220k	10k	100k
FK20	10	3300	10	2200	100	8200	100	4700	1000	150k	1000	82k	10k	470k	10k	220k
FK22	1000	5600	1000	3900	1000	18k	1000	10k	10k	220k	10k	150k	22k	1000k	22k	470k
FD23	6800	27k	4700	15k	22k	68k	12k	39k	270k	680k	180k	470k	1500k	4700k	1000k	2200k
FL-2	1000	3900	1000	2700	1000	10k	1000	5600	10k	180k	10k	100k	22k	470k	22k	220k
									TC: Y5R, Cap: pF							
FD31	330	3900	330	2200	33	8200	33	4700	2200	120k	2200	68k	10k	470k	100k	220k
FK33	1000	5600	1000	3900	1000	22k	1000	12k	10k	330k	10k	180k	22k	1000k	22k	470k
FL-3	1000	12k	1000	6800	1000	4700	1000	3300	10k	220k	10k	120k	22k	470k	22k	220k
FD41	1000	33k	1000	15k	10k	82k	10k	47k	100k	1000k	100k	680k	1000k	6800k	1000k	4700k
FK20	10	3300	10	2200	100	8200	100	4700	1000	150k	1000	82k	10k	470k	10k	220k
FK22	1000	5600	1000	3900	1000	18k	1000	10k	10k	220k	10k	150k	22k	1000k	22k	470k
Cap. Tol.	D,C,K,J				D,C,K,J				M,K				Z			

MOLDED WITH AXIAL LEADS

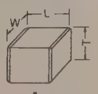
Type	wVdc	Nom. Dimen. (mm) L x D x d			Capacitance (pF) TC: COG Min	TC: COG Max	TC: SL Min	TC: SL Max	TC: X7R Min	TC: X7R Max	TC: Y5V Min	TC: Y5V Max
MA12	50	4.06	2.29	0.50	0.5	560	0.5	1800	100	18k	10k	100k
	100	4.06	2.29	0.50	0.5	390	0.5	1200	100	12k	10k	47k
MA13	50	6.35	2.29	0.50	100	1500	100	5600	1000	56k	10k	220k
	100	6.35	2.29	0.50	100	1000	100	3900	1000	39k	10k	100k
MA14	50	9.91	3.56	0.64	1000	4700	1000	12k	10k	220k	100k	470k
	100	9.91	3.56	0.64	1000	3300	1000	8200	10k	150k	100k	220k
Cap. Tolerance:					D,C,K,J				K,M		Z	



LOW LOSS CAPACITORS FOR HIGH FREQUENCY

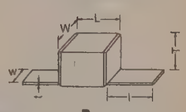
Type	Fig	wVdc (Code)	Nom. Dimen. (mm) L x W x T			Capacitance (pF) TC: COG Min	TC: COG Max	TC: X7R Min	TC: X7R Max
FC1414	A	50 (1H)	1.40	1.40	1.60	0.5	100	150	3300
FR1414	B	50 (IH)	1.40	1.40	1.60	0.5	100	150	3300
FC2828/	A	500 (2H)	2.80	2.80	3.00	0.5	100	—	—
FR2828	B	300 (2F)	2.80	2.80	3.00	120	180	—	—
		200 (2D)				220	470	—	—
		100 (2A)				—	560	—	—
		50 (1H)				680	1000	470	22k
HR3225	C	220 (2D)	3.50	2.80	2.00	0.5	82	—	—
HR3225	C	100 (2A)	3.50	2.80	2.00	100	220	—	—
HR3225	C	50 (1H)	3.50	2.80	2.00	270	1000	680	22k
Cap. Tolerance:						D,C,K,J		K,M	

FC1414
FR2828



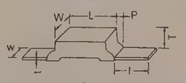
A

FR1414
FC2828



B

HR3225



C

TDK CORPORATION OF AMERICA • 4711 W. GOLF ROAD, SKOKIE, IL 60076 • (312) 679-8200

EEM PRODUCT SELECTION GUIDES

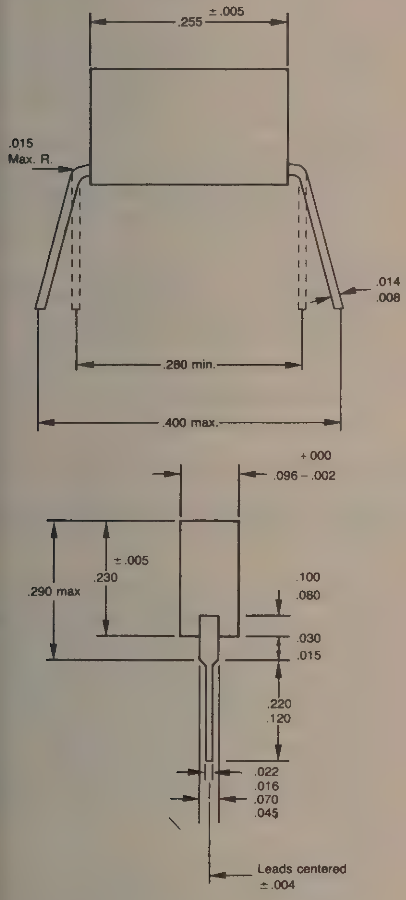
There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

Metallized Polyester DIP

TRW

Type TRW-81

- **High IR**
- **Low DF**
- **Self-Healing**
- **Low ESR**
- **Flame Retardant Molded Epoxy Case**
- **2-pin DIP Leads**



The TRW-80 series embodies the latest in thin gauge technology. The use of ultra-thin gauge metallized polyester packaged in a small molded case with short 2 pin-dip leads provides near-ideal performance. The reliability of self-healing gives long catastrophic failure-free operation while the small package affords the low-inductance and low ESR so vital in future designs. The consistant size, low weight, precise lead placement and radial lead packaging make the TRW-80 series ideal for low cost high speed manufacturing.

SPECIFICATIONS

Insulation Resistance: Measured after 60 seconds at 25°C and rated voltage. See Table below.

Dissipation Factor: Shall be less than 1.0% when measured at 1000 ±20 Hz and at 25°C for values up to and including .12 MFD.

Dielectric Strength: Shall withstand a test of 1.6 times rated voltage for two seconds at 25°C without catastrophic failure.

Capacitance: Shall be within specified tolerance when measured at 1000 ±20 Hz at 25°C for values up to and including .12 MFD.

Equivalent Series Resistance (ESR): Less than the value shown in ESR graph when measured at 100 KHz using a Clark Hess Model 273A ESR bridge or equivalent.

Noise Factor: The pulsed ESR shall be measured with a pulse having a rise time of 5 nanoseconds to a steady state current of 100 milliamps. Typical values are shown in ESR graph. The measurement is taken after the inductive spike.

Construction: Non inductive metallized polyester winding.

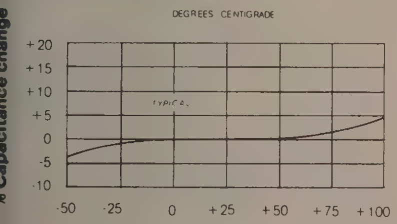
Encasement: Red molded epoxy.

Lead Material: .010 Copper-Olin C194, ¾ to full hard with 50/150 microinches 60/40 of tin. 2 pin DIP configuration.

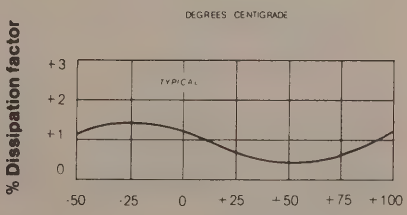
Standard Capacitance Values 50 VDC
Capacitance in MFD

.001	.01	.1
.0012	.012	.12
.0015	.015	—
.0018	.018	—
.0022	.022	—
.0027	.027	—
.0033	.033	—
.0039	.039	—
.0047	.047	—
.0056	.056	—
.0068	.068	—
.0082	.082	—

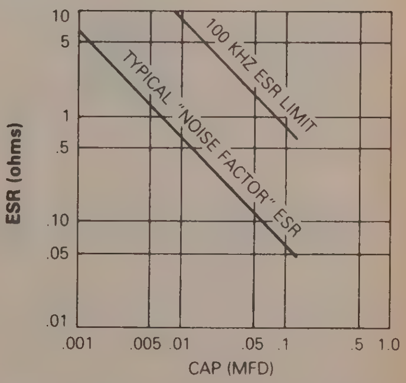
Capacitance change vs. temp.



Dissipation factor vs. temp.



ESR vs. Capacitance



CAPACITOR DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 301 WEST O STREET, OGALLALA, NE 69153 • PHONE (308) 284-3611 • TWX 910-620-0321

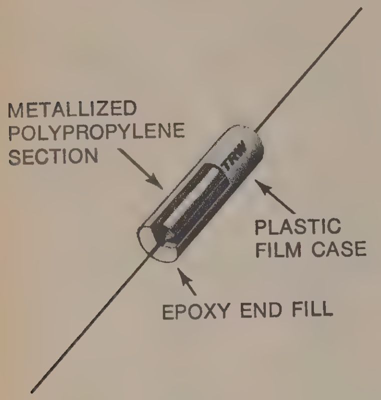
Metallized Polypropylene Dielectric

Type X363UW

Subminiature . . . Instrument Grade

- Long stable life
- Very high insulation resistance
- Lowest dissipation factor
- Humidity resistant
- Saves on size and weight
- Capacitance tolerance to 1%

CUT-AWAY SHOWS CONSTRUCTION



Used for a number of years in the non-precision power capacitor field, polypropylene has now been developed by TRW Capacitors as a dielectric for miniaturized precision capacitors exhibiting unique and outstanding electrical and environmental characteristics. Particularly worthy of note is its stability. The X363UW exhibits negligible shift in capacitance under long term exposure to humidity, operating life, and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all the equivalent of or superior to those of polystyrene.

SPECIFICATIONS

Insulation Resistance: Minimum values.

Temperature	+25°C	+85°C	+105°C
Megohms X Microfarads	300,000	30,000	3,000
Need Not Exceed (Megohms)	500,000	50,000	5,000

Measured after two minutes electrification at 200 volts.

Capacitance Range: 0.010 thru 15.0 mfd.

Voltage Range: 100, 200, 400 VDC.

Dielectric Strength: Twice rated voltage for one minute through a limiting resistance of 100 ohms/volt.

Dissipation Factor: Less than 0.1% at 25°C when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 10.0 mfd.

Dielectric Absorption: When tested per MIL-C-19978 the dielectric absorption shall not exceed 0.05%. Shorter test methods produce lower results. For further information, consult TRW Engineering.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz for values up to and including 15.0 mfd at 25° ±5°C.

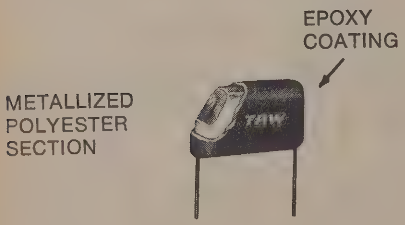
Temperature Range: −55°C to +105°C with no voltage derating.

Metallized Polyester

Type X601PE-X601CPE

Dipped Epoxy Coating

- Ultra miniature, lightweight
- Tough, Rugged Case
- Styled for maximum packaging efficiency
- Capacitance values to 10 mfd
- Tolerances to ±5%



CUT-AWAY SHOWS CONSTRUCTION

The X601PE was designed for quality capacitor applications utilizing the advance technology of TRW. It is ideally designed for "Space Age" applications requiring the best the industry has to offer in minimum size and weight, consistent with maximum reliability. The X601PE line is now available in a full range of value from 0.01 to 10.0 mfd in 100 and 200 VDC. The unit is excellent in electrical and environmental performance throughout this range.

SPECIFICATIONS

Insulation Resistance: Table 1, minimum values.

Temperature	+25°C	+85°C	+125°C
Megohms X Microfarads	20,000	2,000	20
Need Not Exceed (Megohms)	30,000	5,000	50

Measured after 2 minutes electrification at rated voltage

Dissipation Factor: Less than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25°C ±5°C. Capacitance values greater than 1.0 mfd measured at 60 ±6 Hz.

Dielectric Strength: Twice rated voltage for 1 minute through 100 ohms per volt limiting resistance.

Humidity Resistance: Tested as outlined in MIL-STD-202, Method 103, Condition B, no voltage applied. After final conditioning, IR no less than ⅓ minimum values listed in Table 1.

Life Test: 500 hours at +100°C and 125% of rated volts.

Temperature Range: −55°C to +100°C to 125°C with 50% derating.

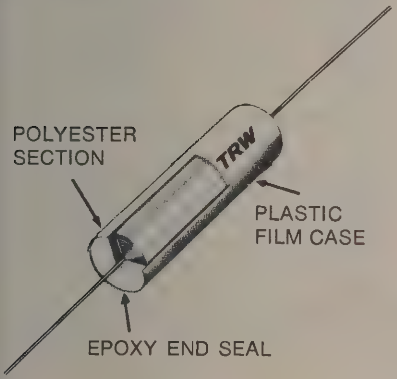
Construction: Metallized Polyester, non-inductive winding.

Polyester Dielectric

Type 663UW

- **For maximum space saving**
- **"Instrument" quality**
- **Tough, moisture resisting case**
- **Conservatively rated**
- **Tolerances to ±1%**
- **Capacitance Range 0.001 thru 2.0 mfd**

CUT-AWAY SHOWS CONSTRUCTION



Type 663UW capacitors are compatible in size with other subminiature transistor components. In addition, they are conservatively designed and rated for long life and reliable service in high quality equipment and instrument applications. The Polyester winding is covered with a thin, tough plastic case adding less than 1/64" to the body diameter. The dense thermosetting epoxy endfill bonds securely to the lead and case. This line is designed and rated for long life and reliable service.

SPECIFICATIONS

Insulation Resistance: Greater than 70,000 megohms-microfarads at 25°C, but the IR need not exceed 140,000 megohms.

Dissipation Factor: Less than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25°C ±5°C. Capacitance values greater than 1.0 mfd measured at 60 ±6 Hz.

Life Test: 250 hours at 85°C and 125% of Rated Voltage. No more than one failure allowed of 18 units tested.

Dielectric Strength: 2 times rated voltage for one minute through a limiting resistance of 100 ohms/volt.

Lead Pull Test: Steady force of 4 lbs. applied axially for 60 sec. on diameters up to 0.359 — 8 lbs. on diameters over 0.359.

Humidity Resistance: Will meet or exceed requirements of MIL-C-27287, Paragraph 3.12, when tested in accordance with MIL-STD-202, Method 103, Condition B. One failure allowed of 18 units tested.

Temperature Range: May be operated at rated voltage from −55°C to +85°C and to +125°C with 50% derating.

Voltage Range: 100 thru 1000 VDC.

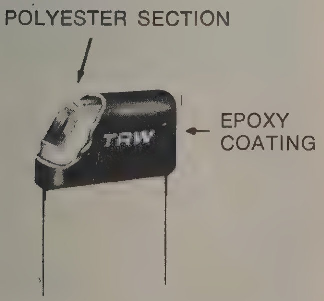
Winding Design: Extended foil construction.

Polyester Dielectric

Type 601PE-601CPE

Dipped Epoxy Coating

- **Styled for "High Density" packaging**
- **Extremely stable**
- **Ideal replacement for ceramic discs**
- **High insulation resistance**
- **Full range of values**
- **Tolerances to ±5%**



Now available in the full range from 35V to 600V and 0.001 to 1.0 mfd, the "slim" 601 series is even more valuable in high density applications. Thin, modular packaging provides maximum capacitance for minimum chassis area. It is engineered to replace ceramic discs where stability with temperature change is important.

SPECIFICATIONS

Insulation Resistance: Minimum values according to Table 1. (Refer to graph for IR at other temperatures.)

Temperature	+25°C	+85°C	+125°C
Megohms X Microfarads	50,000	2,000	20
Need Not Exceed (Megohms)	100,000	5,000	100

Measured after 2 minutes electrification at 100 VDC or rated voltage, whichever is greater.

Dissipation Factor: Less than 1.0% when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25°C ±5°C. Capacitance values greater than 1.0 mfd measured at 60 ±6 Hz.

Dielectric Strength: Twice rated voltage for 1 minute through 100 ohms per volt limiting resistance.

Humidity Resistance: These designs comply with test requirements per MIL-STD-202, Method 103, Condition B, no voltage applied. Minimum resistance after test, 15,000 megohms.

Life Test: 1000 hrs. @ +85°C and 125% of rated voltage. No more than one failure allowed of 24 units tested.

Temperature Cycling: MIL-STD-202, Method 102, Condition D, no voltage applied. Minimum insulation resistance after test 25,000 megohms. Less than 1% change in capacitance.

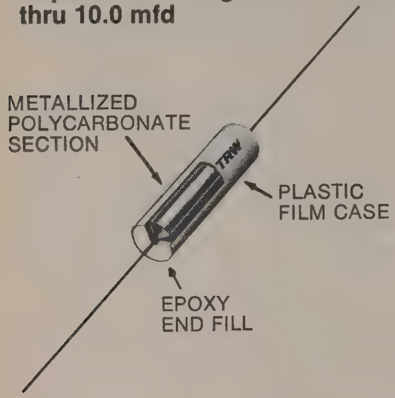
Capacitance Tolerance: Within specified tolerance when measured at 1000 ±20 Hz, 25°C ±5°C (standard is 20%).

Temperature Range: May be operated at rated voltage from −55°C to +85°C. Derate to 50% when operating at 125°C.

Metallized Polycarbonate

Type X463UW

- **Small size — Lightweight**
- **Very low temperature coefficient**
- **Fully rated from −55°C to +125°C**
- **High insulation resistance**
- **Excellent retrace**
- **Tolerances to ±1%**
- **Capacitance range from 0.001 thru 10.0 mfd**



The increasing demand for reduction in size and weight coupled with requirements for enhanced circuit performance, requires capacitors which incorporate the latest developments in component technology. TRW has now introduced a capacitor which combines the improved electrical performance of polycarbonate and the size and weight reductions associated with a metallized dielectric.

SPECIFICATIONS

Insulation Resistance: Table 1, minimum values.

Temperature	+25°C	+85°C	+125°C
Megohms X Microfarads	60,000	6,000	600
Need Not Exceed (Megohms)	200,000	50,000	5,000

Measured after 2 minutes electrification at rated voltage

Dissipation Factor: Less than 0.3% at 25°C when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 10 mfd.

Dielectric Strength: Twice rated voltage for one minute through a limiting resistance of 100 ohms/volt.

Life Test: 250 hours at 125°C and 140% rated voltage with no more than one failure out of 12 units tested.

Temperature Range: −55°C to +125°C with no voltage derating.

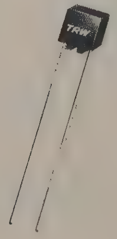
Humidity Resistance: No more than one failure allowed of 12 units tested when tested as outlined in MIL-STD-202, Method 103, Condition B, with 100 volts or rated voltage applied, whichever is less.

Voltage Ranges: 50, 100, 200, 400 VDC.

Metallized Dielectric

Type X440

- **Minimum possible size — Lightweight**
- **Very low temperature coefficient**
- **Fully rated from −55°C to +125°C**
- **High insulation resistance**
- **Tolerances to ±1%**
- **Capacitance Range 0.001 thru 0.10 mfd**



The X440 has been specifically designed to be a real help in the ever increasing problem of fitting components in today's miniaturized designs. Its absolute minimum size, precision dimensions, and the close tolerance lead spacing permit space savings impossible before. Additionally, the highly impressive electrical properties of polycarbonate are of immense value in modern high performance circuitry.

Standoffs on the bottom of the premolded case provide for rigid, secure mounting and facilitate cleaning of the printed circuit boards. Leads are uniformly and accurately spaced on 0.0200″ centers.

SPECIFICATIONS

Voltage Rating: 50 VDC from −55°C to +125°C.

Insulation Resistance: Greater than 500,000 megohms @ 25°C.

Dissipation Factor: Less than 0.3% at 1K Hz @ 25°C.

Capacitance Change with Temperature:
a. Between 0°C and 125°C, as referenced to 25°C, capacitance change will not exceed +½ −1½%.
b. TC of capacitance characteristic is 0 +50 −150 PPM/°C between 0°C and 125°C.

Dielectric Strength: 200% of rated voltage applied for 2 minutes through limiting resistance of 100 ohm/volt.

Life Test: Tested in accordance with MIL-C-27287, 250 hrs., 125°C @ 1.4 RV. IR greater than 70% of original requirement, DF less than 0.3%, cap. change less than 1%.

Humidity Resistance: Tested in accordance with MIL-C-27287, 40°C, 95% RH, 240 hours. IR greater than 10 gigaohms @ 25°C. DF less than 0.3%.

Lead Pull Test: 5 lbs. in any direction.

Construction: Metallized polycarbonate dielectric, non-inductive winding. Epoxy case with standoffs.

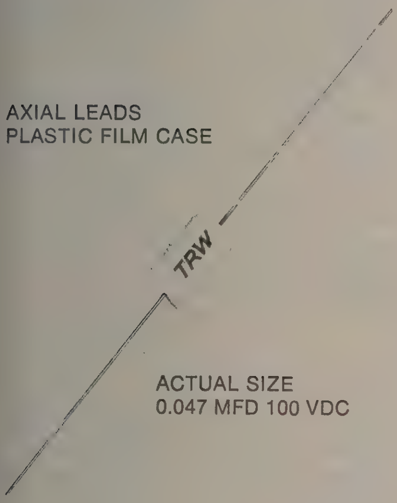
Leads: 24 gauge tinned solid wire on 0.2″ centers.

Metallized Polyester Flattened

TRW

Type X659F

- **Smallest possible size**
- **High insulation resistance**
- **Self-healing — Long stable life**
- **Full voltage range — 50 thru 400W VDC**
- **Capacitance values to 20.0 mfd**



AXIAL LEADS
PLASTIC FILM CASE

ACTUAL SIZE
0.047 MFD 100 VDC

TRW Type X659F adds a complete new dimension to circuit board layout by providing a metallized polyester, wound flattened capacitor, in sizes never before available. This advance design which utilizes the very thin gauges of metallized polyester, coupled with TRW's advanced manufacturing technology and in-house metallizing capability and control, offers the same rugged durability and reliability as all TRW Capacitors.

This basic reliability and the proven performance record of metallized polyester makes the X659F the ideal choice where freedom in equipment design and durability is required.

SPECIFICATIONS

Insulation Resistance: Minimum values.

Temperature	+25°C	+85°C	+125°C
Megohms X Microfarads	30,000	3,000	50
Need Not Exceed (Megohms)	30,000	3,000	50

Measured after 2 minutes electrification at rated voltage.

Dissipation Factor: Less than 1.0% when measured at or referred to 1000 ±20 cps for capacitance values up to and including 1.0 mfd at 25°C ±5°C except for units having a thickness dimension of 0.170 or less, the DF shall not exceed 1.5%. Capacitance values greater than 1.0 mfd measured at 60 ±6 cps.

Temperature Range: −55°C to 100°C; to +125°C with 50% derating.

Humidity Resistance: Tested as outlined in MIL-STD-202C, Method 103B, Condition A. After final conditioning IR, no less than ⅓ minimum values listed in Table 1. Dielectric strength to withstand test as outlined in Para. 3.4. One failure allowed of 18 units tested.

Dielectric Strength: 200% rated voltage for one minute through a limiting resistance of 100 ohms/volts.

Metallized Polyester Dielectric

Types TRW-40, -41 and -42

- **AC voltage ratings from 330 to 460 volts, 50/60 Hz**
- **Capacitance values to 2.0 mfd**
- **Flame-retardant tape wrap case**

PERFORMANCE

Type TRW-40, -41 and -42 capacitors are constructed from metallized polyester film and offer small size, less weight and long reliable life without the use of impregnants. The flame retardant tape wrap and end fill provides both physical and environmental protection.

The full range of capacitance values available gives these capacitors broad usage in the electrical and electronic fields.

APPLICATIONS

Type TRW-40, -41 and -42 capacitors can be utilized for applications such as motor run, motor speed control, and noise filtering, as found in computer peripherals such as terminals, printers and disc drives; in large and small cooling fans and small motors of all types. Special terminals such as stranded insulated leads or quick disconnects are available on a customized basis. Consult the factory for details.

SPECIFICATIONS

Type	TRW-40	TRW-41	TRW-42
Capacitance Range	0.047 to 2.0 mfd	0.047 to 2.0 mfd	0.01 to 2.0 mfd
Dielectric Strength*	900 VDC	1500 VDC	2100 VDC
AC Voltage Rating	330 Vrms, 50/60 Hz	370 Vrms, 50/60 Hz	460 Vrms, 50/60 Hz
Corona Onset (min.)	480 Vrms, 60 Hz	460 Vrms, 60 Hz	600 Vrms, 60 Hz

* For one minute through a limiting resistance of 100 ohms/volt

Insulation Resistance:

Temperature	+25°C	+85°C
Megohms x Micorfarads	30,000	3,000
Need Not Exceed (Megohms)	30,000	3,000

Measured after two minutes electrification at 400 VDC

Dissipation Factor: Less than 1.0% when measured or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd at 25 ±5°C. Capacitance values larger than 1.0 mfd shall be measured at 60 ±6 Hz.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz for capacitance values up to and including 1.0 mfd. Capacitance values larger than 1.0 mfd shall be measured at 60 ±6 Hz.

Humidity Resistance: When tested as in MIL-STD-202E, Method 103B, Condition B no more than one failure allowed of eighteen units tested.

Life Test: 1000 hours at +85°C and 125% of rated AC voltage (50-60 cps).

Temperature Range: −55°C to +85°C.

Construction: Metallized construction.

Case: Flame retardant polyester tape wrap with flame retardant epoxy endfill.

Lead Material: Tinned copperweld wire.

Lead Pull Test: Will withstand for one minute a steady force of the following magnitude:

4 lbs. — Diameters up to and including 0.465 dia.

8 lbs. — Diameters over 0.466

CAPACITOR DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 301 WEST O STREET, OGALLALA, NE 69153 • PHONE (308) 284-3611 • TWX 910-620-0321

Metallized Polypropylene Dielectric

Type TRW-35

- **Designed for switching power supply applications**
- **Rated for 20 KHz usage**
- **High current — up to 9A rms**
- **Capacitance to 30 mfd**
- **Special high current termination**
- **Very low ESR values**

PERFORMANCE

The TRW-35 is designed specifically for switching power supply applications where high current, high capacitance range and low ESR values are important.

The Metallized polypropylene TRW-35 shows negligible shift in capacitance under long term exposure to humidity, operating life and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all superior to those of electrolytic capacitors presently used by switching power supply manufacturers. Added to these features are size and weight savings.

APPLICATIONS

The TRW-35 is used for input filtering, hi-frequency transformer D.C. blocking, and output filtering. As an input filter it provides EMI protection back into the line (generated by the switch) and serves as a quasi-constant current source (turn on for the switch). As a D.C. blocking capacitor it prevents D.C. saturation of the hi-frequency transformer caused by switch unbalance while passing the AC square wave with little loss. As an output filter it provides a low impedance path for high frequency ripple filtering.

Unlike the electrolytic capacitor often used for such applications, the TRW-35 exhibits little or no capacitance roll-off with increasing frequency. The TRW-35 features ESR typically an order of magnitude or more under the ESR of equivalent electrolytic capacitance values.

In filter designs where capacitance values of 30 mfd or smaller are adequate for system performance, the TRW-35 offers impedance characteristics that can significantly enhance the overall system design.

SPECIFICATIONS

Dissipation Factor: Shall be less than 0.1% when measured at or referred to 1000 Hz ±20 Hz. Typical value is 0.05%.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 Hz ±20 Hz.

Insulation Resistance: Shall be greater than 100,000 megohms — Micro Farads but need not exceed 500,000 megohms when tested at 25°C and electrified at 100 VDC for 2 minutes.

ESR: The 100 KHz ESR values shall not exceed the values shown.

Construction: Non-inductive winding, polypropylene dielectric, metallized electrodes with special high current termination.

Case: Polyester tape wrap with epoxy endseals.

Lead Material: Tinned copper wire.

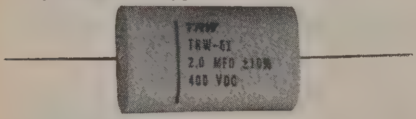
Temperature Rating: 55°C to 105°C with no voltage derating.

Voltage: 100 thru 400 VDC.

Metallized Polyester

Type TRW-61

- **Rated for 60 KHz usage**
- **High current — up to 4A rms**
- **Capacitance to 4.7 mfd**
- **White polyester tape wrap case**
- **Special high current termination**
- **Low ESR values**



PERFORMANCE

The TRW-61 is designed specifically for switching power supply applications where current and low ESR Values are important. The metallized polyester TRW-61 shows negligible shift in capacitance under long exposure to humidity, operating life and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all superior to those of electrolytic capacitors presently used by switching power supply manufacturers.

These features, plus size and weight savings in SPS designs, make the TRW-61 the logical capacitor for performance and design of switching power supplies requiring medium current ratings.

SPECIFICATIONS

Insulation Resistance: Table 1, minimum values.

Insulation Resistance	+25°C	+85°C
Megohms & Microfarads	30,000	3,000
Need not Exceed (Megohms)	30,000	3,000

Measured after 2 minutes electrification at rated voltage.

Dissipation Factor: Less than 1.0% when measured at or referred to 1000 ±20 Hz at 25°C.

Temperature Range: −55°C to +100°C.

Humidity Resistance: Tested as outlined in MIL-STD-202C, Method 103B, Condition A. After final conditioning IR, no less than ⅓ minimum values listed in Table 1. Dielectric strength to withstand test as outlined in Para. 3.4. One failure allowed of 18 units tested.

Capacitance: Shall be within specified tolerance when measured at or referred to 1000 ±20 Hz at 25°C.

Capacitor Tolerance: Standard Tolerance ±20%; also available in ±10% and ±5%.

Equivalent Series Resistance (ESR): Shall be less than shown when measured at 100 KHz.

Case: Polyester tape wrap with epoxy end seals.

Lead Material: Tinned solid copper wire.

DIMENSIONS

Capacitance In Mfds.	250 VDC			Lead Gauge	I RMS	I Peak amps	100 KHz ESR Max Milliohms
	T Max	W Max	L Max				
1	0.360	0.560	1.125	20	2	7	41
1.5	0.450	0.650	1.125	20	2	11	34
2.2	0.500	0.800	1.125	20	3	16	28
3.3	0.550	0.840	1.250	20	4	19	23
4.7	0.620	1.010	1.250	18	4	26	19
400 VDC							
1	0.550	0.850	1.200	20	2	10	41
1.5	0.690	0.990	1.200	18	3	14	34
2.2	0.630	1.020	1.560	18	4	16	28
3.3	0.790	1.180	1.560	18	4	23	23
4.7	0.960	1.350	1.560	18	4	33	19

RC Snubber Network

Type TRW-39A

- **Resistor: 3.9 ohm ½ watt ±10% carbon composition**
- **Capacitor: 0.1 mfd ±20%, 50 VDC**
- **White polyester tape wrap case**
- **Low inductance, extended foil construction**
- **Rugged polyester-foil design**
- **RC = 0.39 micro second nominal**

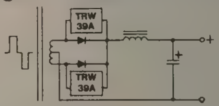
PERFORMANCE

This rugged RC network is designed for snubber applications across Schottky diodes operating in 20 KHz switching power supplies and provides critical damping of the ringing encountered in many circuits.

APPLICATIONS

Specifically designed for applications in 20 KHz switching power supplies, the TRW-39A provides critical damping and reverse voltage protection for the Schottky diode. The leakage inductance of the high frequency power transformer causes ringing of the reverse voltage when diode conduction abruptly ceases. This can cause Schottky diode failure. Figure 1 shows the snubber used across each diode. For other RC values contact TRW Capacitors, Application Engineering.

Figure 1: Snubber Circuit



SPECIFICATIONS

Insulation Resistance: Greater than 140K megohms when measured at 25°C after 2 minute electrification at 50 VDC.

Dissipation Factor: Less than 1.8% at 1000 Hz.

Dielectric Strength: Greater than 150 VDC.

Leads: Tin plated solid wire. 0.025/0.035 dia.

Wound Film-Foil Capacitors

TRW

GENERAL-PURPOSE, WELDED TAB CONSTRUCTION

Polystyrene Film-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Rated Voltage (VDC)	Temperature Range (°C)	Lead Configuration	Case Style
Type 611	20-100,000 pF	1 through 20	33-630	−40 to +70	Axial Offset Leads	Tubular, Heat Shrunk
Type 616	20-100,000 pF	1 through 20	33-630	−40 to +70	Axial Centered Leads	Tubular, Heat Shrunk
Type 619	20-30,000 pF	1 through 20	33-630	−40 to +70	Preformed	Tubular, Heat Shrunk

Polypropylene Film-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Rated Voltage (VDC)	Temperature Range (°C)	Lead Configuration	Case Style
Type 636	220-27,000 pF	1 through 20	160 and 630	−40 to +85	Axial Centered Leads	Tubular, Heat Shrunk
Type 639	220-27,000 pF	1 through 20	160 and 630	−40 to +85	Preformed	Tubular, Heat Shrunk

Polyester Film-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Rated Voltage (VDC)	Temperature Range (°C)	Lead Configuration	Case Style
Type 641	0.001-0.1 µF	10, 20	160, 400 and 630	−40 to +85	Axial Offset Leads	Tubular, Heat Shrunk

---

PROFESSIONAL STYLE, EXTENDED FOIL CONSTRUCTION

Polystyrene Film-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Rated Voltage (VDC)	Temperature Range (°C)	Lead Configuration	Case Style
Type 602	100 pF to 600 nF	0.625 through 5.0	63-1000	−40 to +70	Radial	Epoxy-filled Tubular Plastic
Type 604	47 to 250,000 pF	1.0, 2.5, 5.0	100, 200, 500	−40 to +85	Radial	Epoxy-filled Rect. Plastic
Type 605	100 pF to 30 nF	0.625 through 5.0	63	−40 to +70	Radial	Epoxy-filled Square Plastic
Type 607	100 pF to 680 nF	0.625 through 5.0	63-750	−40 to +70	Radial	Tubular Tape Wrap

CAPACITOR DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 301 WEST O STREET, OGALLALA, NE 69153 • PHONE (308) 284-3611 • TWX 910-620-0321

Wound Capacitors

TRW

Metallized Polycarbonate

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Voltage Range (V dc)	Temperature Range (°C)	Lead Configuration	Case Style
Series H	.01-15.0 µF	5, 10, 20	50-600	−55 to +125	axial	oval tape wrap
Series HE	.01- 5.0 µF	5, 10, 20	100-600	−55 to +125	axial	rect. epoxy case
Series H2E	.01- 5.0 µF	5, 10, 20	100-600	−55 to +125	radial	rect. epoxy case
Series HL	.01-15.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed tubular metal case
Series HG	.01-10.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed rect. metal case

Metallized Polyester

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Voltage Range (V dc)	Temperature Range (°C)	Lead Configuration	Case Style
Series D	.01-15.0 µF	5, 10, 20	50-600	−55 to +125	axial	oval tape wrap
Series DE	.01-10.0 µF	5, 10, 20	100-600	−55 to +125	axial	rect. epoxy case
Series D2E	.01- 8.0 µF	5, 10, 20	100-600	−55 to +125	radial	rect. epoxy case
Series DL	.01-15.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed tubular metal case
Series DG	.01-15.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed rect. metal case

Polyester-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Voltage Range (V dc)	Temperature Range (°C)	Lead Configuration	Case Style
Series E	.001-5.0 µF	5, 10, 20	100-600	−55 to +125	axial	oval tape wrap
Series EE	.001-2.0 µF	5, 10, 20	100-600	−55 to +125	axial	rect. epoxy case
Series EL	.001-5.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed tubular metal case
Series EG	.001-3.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed rect. metal case
Series EBC	.001-1.0 µF	5, 10, 20	100-600	−55 to +125	axial	tubular tape wrap meets MIL-C-27287

Polystyrene-Foil

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Voltage Range (V dc)	Temperature Range (°C)	Lead Configuration	Case Style
Type 602	100 pF-.60 µF	0.625-5.0	63-1000	−40 to +70	radial	tubular epoxy case
Type 605	100 pF-.03 µF	0.625-5.0	63	−40 to +70	radial	rect. epoxy case
Type 607	100 pF-.68 µF	0.625-5.0	63-750	−40 to +70	axial	tubular tape wrap
Series X	.001-2.0 µF	5, 10, 20	50-400	−55 to +85	axial	oval tape wrap
Series XL	.001-2.0 µF	5, 10, 20	50-400	−55 to +85	axial	hermetically sealed tubular metal case
Series XG	.001-.82 µF	5, 10, 20	50-400	−55 to +85	axial	hermetically sealed rect. metal case

Metallized Polypropylene

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Voltage Range (V dc)	Temperature Range (°C)	Lead Configuration	Case Style
Style EPYC4	.01-15.0 µF	1.0-20	100-400	−55 to +105	axial	tubular tape wrap

Paper/Polyester Dielectric

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Voltage Range (V dc)	Temperature Range (°C)	Lead Configuration	Case Style
Series BW	.001-.20 µF	5, 10, 20	2000-30,000	−55 to +125	axial	oval tape wrap
Series BWE	.001-.20 µF	5, 10, 20	2000-30,000	−55 to +125	axial	rect. epoxy case

Metallized Paper, Epoxy Impregnated

TRW Designation	Capacitance Range	Standard Tolerances (±%)	Voltage Range (V dc)	Temperature Range (°C)	Lead Configuration	Case Style
Series M	.01-10.0 µF	5, 10, 20	100-600	−55 to +125	axial	oval tape wrap
Series ME	.01- 8.0 µF	5, 10, 20	100-600	−55 to +125	axial	rect. epoxy case
Series M2E	.01- 8.0 µF	5, 10, 20	100-600	−55 to +125	radial	rect. epoxy case
Series ML	.01-15.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed tubular metal case
Series MG	.01-15.0 µF	5, 10, 20	100-600	−55 to +125	axial	hermetically sealed rect. metal case

Note: These metallized paper capacitors are also available with wax impregnation instead of epoxy. Specifications are similar, but maximum operating temperature is limited to +85°C. To order, substitute "W" for "M" in series number (e.g., Series WL).

CAPACITOR DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 301 WEST O STREET, OGALLALA, NE 69153 • PHONE (308) 284-3611 • TWX 910-620-0321

Ceramic Disc Capacitors

TRW

Type 501 Class 1

Medium Voltage

- Suitable for use in high-frequency, high-Q, and temperature-compensated circuits
- Recommended for both UHF and VHF applications
- High capacitance stability coupled with long life
- Capacitance range of .82 to 470 pF
- Voltage ratings of 250 and 500 VDC
- Temperature characteristics of NPO to N5250

Type 502 Class 1

High Voltage

- Ideal for temperature compensation in high-power circuits
- Controlled temperature coefficient, low dissipation factor, high dielectric strength and large dissipation area
- Capacitance range of 2.2 to 620 pF
- Voltage ratings of 1000 to 6000 VDC
- Temperature characteristics of NP0 to N5250

Type 506 Class 2

Medium Voltage

- Suitable for radio frequency coupling circuits and other printed circuit board applications
- Extended frequency range of 100 MHz, extreme temperature stability, long life and small size
- Capacitance range of 100 to 4700 pF
- Voltage ratings of 250 and 500 volts
- Temperature characteristics of X5D to X5S

Type 507 Class 2

High Voltage

- Recommended for high-power circuits in TV applications
- Stable at high frequency, extremely resistant to high humidity conditions
- Capacitance range of 56 to 6200 pF
- Voltage ratings of 1000 to 6000 VDC
- Temperature characteristics of X5D to X5T

Type 509 Class 2

Medium Voltage

- Designed for coupling and bypass circuits where supply voltage is 500 VDC or less
- Offers small size in a medium voltage rating
- Capacitance range of 250 to 10,000 pF
- Voltage ratings of 250 and 500 VDC
- Temperature characteristics of X5U, Y5U

Type 511 Class 2

Medium Voltage

- Exhibits excellent electrical characteristics in transistorized circuits in bypass networks
- Ideal where space is at a premium and high capacitance value is required
- Capacitance range of 470 to 15,000 pF
- Voltage ratings of 250 and 500 VDC
- Temperature characteristics of X5V and Z5U

Type 512 Class 2

High Voltage

- Well-suited for TV and computer deflection systems
- Used also in bypass and decoupling circuits where high voltage capacitors are required
- Features high voltage performance, small size, high K, and excellent resistance to humidity
- Capacitance range of 470 to 10,000 pF
- Voltage ratings of 1000 and 2000 VDC
- Temperature characteristics of Y5V and Z5U

Type 516 Class 2

Low Voltage

- Designed for radio frequency bypass circuits in auto and home radios, TVs and computers
- Combines small size with superior performance characteristics
- Capacitance range of .0033 to .047 mfd
- Voltage ratings of 50 and 100 VDC
- Temperature characteristic of Z5U

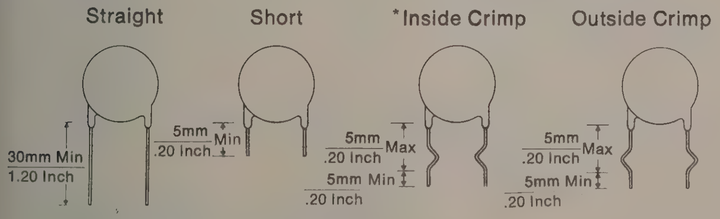
NOTE: The listed ceramic disc capacitors are standard catalog devices. However, variations in electrical characteristics are available in most cases. Please contact TRW Universal Capacitors for assistance in your design applications.

Electrical Specifications

TRW Part No.	Dissipation Factor	Min. Insulation Resistance	Dielectric Strength
Type 501	0.1% max. for C=50 pF and above, 0.8% max. for others; at 5 V_{rms}	10×10^9 ohms at 100 VDC	250% of rated voltage, max. I=50 mA
Type 502	0.2% max. for C=50 pF and above, 0.8% max. for others; at 5 V_{rms}	10×10^9 ohms at 100 VDC	170% of rated voltage, max. I=50 mA
Type 506	2.5% max. at 1 V_{rms}	10×10^9 ohms at 100 VDC	250% of rated voltage, max. I=50 mA
Type 507	2.5% max. at 1 V_{rms}	10×10^9 ohms at 100 VDC	170% of rated voltage, max. I=50 mA
Type 509	2.5% max. at 1 V_{rms}	10×10^9 ohms at 100 VDC	250% of rated voltage, max. I=50 mA
Type 511	3.0% max. at 1 V_{rms}	10×10^9 ohms at 100 VDC	250% of rated voltage, max. I=50 mA
Type 512	3.0% max. at 1 V_{rms}	10×10^9 ohms at 100 VDC	200% of rated voltage, max. I=50 mA
Type 516	3.0% max. at 0.1 V_{rms}	5×10^9 ohms at 10 VDC	250% of rated voltage, max. I=50 mA

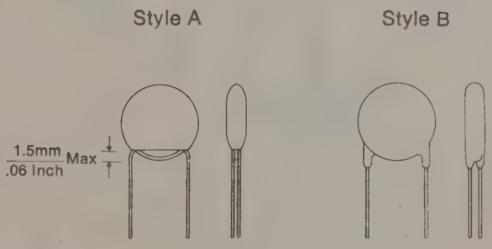
Reference Conditions: T=25° ± 1°C, F=1.0 ± 0.2 kHz, RH=63 to 67%.

Lead Configurations:



* Not available on .250 spacing

Phenolic Dipped Encapsulation:



CAPACITOR DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 301 WEST O STREET, OGALLALA, NE 69153 • PHONE (308) 284-3611 • TWX 910-620-0321

NEED MORE INFORMATION?

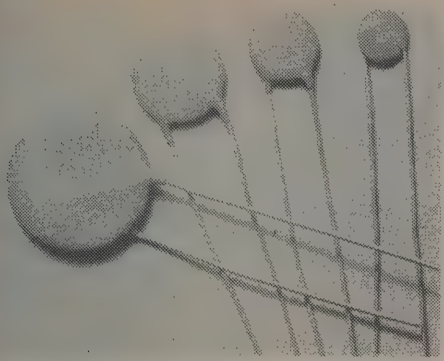
USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?



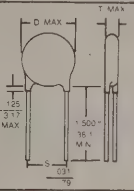
TUSONIX SLC™*

Ceramic Capacitors—Disc

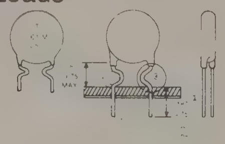
Applications and Features

TUSONIX Ceramic Disc Capacitors offer high performance in a complete range of ratings, values, and sizes. The complete line of voltage ratings offers the designer the convenience of selecting the exact capacitor rating required for his application. TUSONIX Discs are available in 100-200-500 VDC; 1-2-3-4-5 and 6 KV. Capacity increases per size for voltages less than 500 volts and decreases per size for voltages greater than 500 volts. Where voltage rating is not critical, we recommend our standard 500 volt line. (For complete details, consult our Ceramic Disc Capacitor catalog.)

Standard Leads



Kink Type Leads



TUSONIX STYLE NUMBER	831	801	851	871	811	841	821	3841	3851	3871	3881
MAXIMUM DIAMETER (D)	290/7 37	360/9 14	437/11 10	490/12 45	593/15 06	675/17 15	750/19 05	.800/20 32	875/22 23	937/23 80	1 100/27 94
LEAD SPACING (S)	250/6 35	250/6 35	250/6 35	.250/6 35	375/9 52	375/9 52	.375/9 52	375/9 52	375/9 52	375/9 52	375/9 52
WIRE GAUGE (AWG)	22	22	22	22	22	22	22	22	22	22	22

General Electrical Specifications

Ceramic Disc Capacitors are available in a broad range of dielectric constants. This allows a wide selection of capacitance values.

Temperature Compensating

Ceramic Capacitors (NPO thru N750) are ideal for applications requiring very precisely controlled capacitance change with temperature, high Q and very small capacitance tolerance.

Extended Temperature Compensating

Disc Capacitors (1500 thru N5600) are capacity sensitive to temperature in varying degrees, and are useful as temperature compensating elements for stabilization over a wide temperature range.

General Purpose or Hi-K

Specials

Special disc products are available from TUSONIX upon request, including details on TUSONIX's approval for U.L. line by-pass capacitors and approval to Mil-C-20 and Mil-C-11015.

Physical Characteristics

Leads—All values up to and including 2 KV are available with 20, 22 and 24 AWG leads, except body sizes. 655″ max. and larger available with 20 or 22 AWG only. All values up to and including 6 kV are available with 20 or 22 AWG leads.

Body insulation—conformal coating.

Standard max. coating on leads is .125″; closer control is optional at extra cost.

Marking—Trademark, Cap, Tol., T.C., and Voltage (Voltage omitted on 500V).

TUSONIX also offers inside kink leads, outside kink leads and short pin leads to the electronic industry for use in printed wiring board applications.

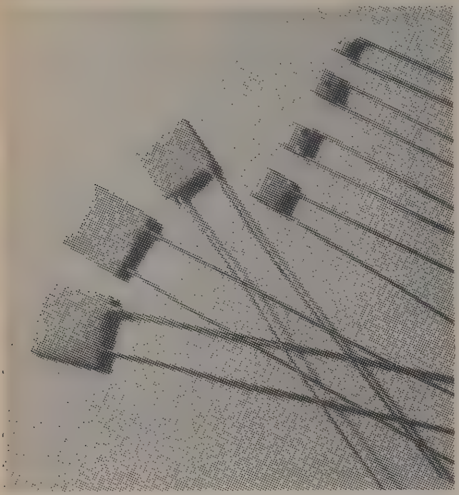
Special physical requirements are also available. Special lead spacing requirements are optional upon request, in addition to standard nominal lead spacings.

	TEMP. CHAR. CODE			MIN CAP TOL (%)	MIN TC TOL	MAX DF (%)	MIN Q	500 V MAXIMUM NOMINAL CAPACITANCE (pF)										
								THICKNESS .156″ MAX.										
								831	801	851	871	811	841	821	3841	3851	3871	3881
GENERAL PURPOSE (Hi-K)	Z5D Y5E X5F X7F			±5		2		200	350	500	720	1000	1300	1400	1450	1500	1600	1700
	Z5D Y5E X5F X7F			±5		2		680	1100	1800	2400	3400	4600	4700	4800	5300	5400	5600
	Z5F Y5F X5F X7R			±10		2		900	1500	2500	3500	5000	6500	7000	7400	8000	8200	8500
	Z5F Y5F X5R X7S			±10		2		1300	2300	3500	4700	7000	9000	10000	10300	11000	11500	12000
	Z5U Y5U X5U X7V			±20		2		2000	3500	5400	7300	12000	16000	18000	19000	20000	21000	22000
	Z5U Y5V X5W X7W			±20		3		3300	5600	8600	11000	20000	22000	25000	30000	32000	34000	35000
	GP7			±20		3		4400	7500	11000	15000	25000	35000	43000	52000	55000	58000	60000
TEMPERATURE COMPENSATING EXTENDED TEMPERATURE COMPENSATING	NP0	C0G		±1	±30		1000	1-30	60	90	120	150	210	240	250	270	280	290
	N030	S1G		±1	±30		1000	1.6-18	31	48	64	80	110	120	130	135	140	150
	N080	U1G		±1	±30		1000	1.8-21	36	55	75	95	120	135	150	155	160	180
	N150	P2G		±1	±30		1000	1.9-24	40	60	85	100	140	155	170	175	180	200
	N220	R2G		±1	±30		1000	2-26	45	65	90	110	160	175	190	195	200	220
	N330	S2H		±1	±60		1000	2.2-29	50	75	100	130	170	185	200	220	230	240
	N470	T2H		±1	±60		1000	2.6-35	60	90	125	150	210	230	250	260	270	290
	N750	U2J		±2	±120		1000	3.5-60	110	170	230	340	450	470	480	520	540	560
	N1500	P3K		±2	±250		1000	6-82	140	210	290	360	490	550	580	600	640	690
	N2200	R3A		±2	±400		500	7-90	160	240	330	410	560	630	670	700	730	790
	N3300	S3B		±5	±650		500	12-160	280	430	580	720	990	1050	1100	1200	1300	1400
	N4200	G3C		±5	±850		500	23-170	300	460	620	1000	1400	1600	2000	2200	2300	2500
	N4700	T3D		±5	±900		200	25-210	360	550	750	1200	1600	2000	2500	2700	2800	3000
	N5600	H3M		±5	±1000		200	40-310	540	830	1100	1800	2500	3000	3700	3900	4100	4500

TUSONIX

For complete ordering information, write or call
TUSONIX, Inc., P.O. Box 37144, Tucson,
Arizona 85740-7144. (602) 744-0400. TX 299-640 (RCA)

*SLC stands for Single-layer Ceramic Capacitors.



TUSONIX SLC™*

Ceramic Capacitors—WEECON® Plate

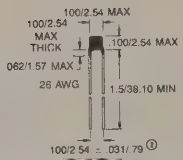
Applications and Features

TUSONIX WEECON Plate Ceramic Capacitors offer the broadest selection of ceramic formulations and package sizes available. Capacitance values range from 1 pF through .082 uF; a variety of TC materials and tolerances is available. The range of temperature characteristics adapts these capacitors from the ultra stable requirements of tuned circuits to the general purpose needs for coupling and by-pass applications. Voltages are from 25V to 500V. (For complete details, consult our WEECON® Ceramic Capacitor catalog.)

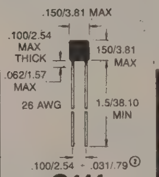
Physical Characteristics

Weecon **Temperature Compensating** Ceramic Capacitors are ideal for applications demanding precisely controlled capacitance changes with temperature variation. They are well suited for high Q circuits requiring optimum frequency stability and have excellent retrace characteristics. **Extended Temperature Compensating** Weecons are indicated where large controlled capacitance change with temperature variation is a factor. For applications where volumetric efficiency is of prime importance, **Stable** Weecons will provide higher capacitance values, in smaller packages with better reliability. TUSONIX **General Purpose** Weecons are ideal for circuits requiring the utmost in volumetric efficiency at rated temperatures.

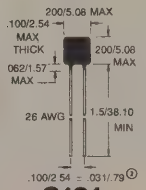
inches / mm	inches/mm


100/2.54 MAX
100/2.54 MAX THICK
.100/2.54 MAX
062/1.57 MAX
26 AWG
1.5/38.10 MIN
100/2 54 ± .031/.79 ②

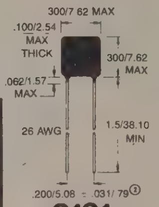
8101


.150/3.81 MAX
.100/2.54 MAX THICK
150/3.81 MAX
.062/1.57 MAX
26 AWG
1.5/38.10 MIN
.100/2.54 ± .031/.79 ②

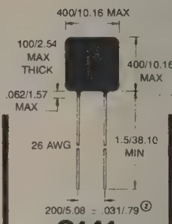
8111


200/5.08 MAX
.100/2.54 MAX THICK
200/5.08 MAX
062/1.57 MAX
26 AWG
1.5/38.10 MIN
.100/2 54 ± .031/.79 ②

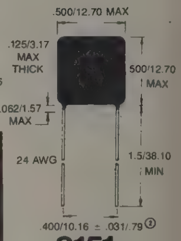
8121


300/7 62 MAX
.100/2.54 MAX THICK
300/7.62 MAX
.062/1.57 MAX
26 AWG
1.5/38.10 MIN
.200/5.08 ± .031/ 79 ②

8131


400/10.16 MAX
100/2.54 MAX THICK
400/10.16 MAX
.062/1.57 MAX
26 AWG
1.5/38.10 MIN
200/5.08 ± .031/.79 ②

8141


.500/12.70 MAX
.125/3.17 MAX THICK
500/12.70 MAX
.062/1.57 MAX
24 AWG
1.5/38.10 MIN
.400/10.16 ± .031/.79 ②

8151

MAXIMUM CAPACITANCE

					8101			8111			8121			8131			8141			8151		
	EIA Code	Dielec-tric	Min.* Tol.	Min. Cap.	50/100V	200V	500V ①	50/100V	200V	500V ①	50/100V	200V	500V ①	50/100V	200V	500V ①	50/100V	200V	500V ①	50/100V	200V	500V ①
TEMP COMP TYPES	COG	NPO	1%	1.0	20	10	N/A	51	24	11	100	51	20	240	120	47	430	220	91	680	360	130
	BIG	N0030	1%	1 6	10	5.1	N/A	27	13	5.6	51	24	11	130	62	24	220	110	47	360	180	75
	UIG	N0080	1%	1.8	12	6.2	N/A	30	15	6.2	56	27	12	130	68	27	240	130	51	390	200	82
	P2G	N0150	1%	2.2	13	6.2	N/A	33	16	6.8	62	30	13	160	75	30	270	130	56	430	220	91
	R2G	N0220	1%	2.4	13	6.8	N/A	36	18	7.5	68	36	13	160	82	33	300	150	62	510	240	100
	S2H	N0330	1%	2.7	16	8.2	N/A	43	20	8.2	82	39	16	200	100	39	360	180	68	560	270	110
	T2H	N0470	1%	3.3	18	9.1	N/A	51	24	10	91	47	18	220	110	43	390	200	82	620	330	130
	U2J	N0750	2%	4.7	24	13	N/A	68	36	13	130	68	27	300	150	62	560	300	110	910	470	180
	P3K	N1500	2%	10	47	24	N/A	130	68	27	240	120	51	560	300	110	1000	510	220	1600	820	330
EXTEND TEMP COMP TYPES	R3A	N2200	2%	13	62	30	N/A	160	82	33	300	150	62	750	360	150	1300	680	270	2000	1000	430
	S3B	N3300	5%	22	100	51	N/A	270	130	56	560	270	110	1200	680	270	2200	1100	510	3600	1800	750
	G3C	N4200	5%	33	160	82	N/A	430	200	91	820	390	160	1800	910	390	3300	1600	750	5600	2700	1200
	T3D	N4700	5%	39	180	91	N/A	510	240	100	910	470	200	2200	1100	430	3900	2000	820	6200	3000	1300
	H3M	N5600	5%	56	270	130	N/A	750	360	150	1300	680	270	3300	1600	680	5600	2700	1200	9100	4700	1800
STABLE TYPES	Z5D Y5F X5F X7F	—	5%	20	100	51	N/A	270	130	51	510	270	100	1200	620	240	2200	1100	470	3600	1800	750
	Z5D Y5D X5E X7R	—	5%	51	270	130	N/A	680	360	130	1300	620	270	3000	1500	620	5600	2700	1100	9100	4700	1800
	Z5E Y5F X5R X7R	—	5%	62	300	160	N/A	820	390	160	1600	820	300	3600	1800	750	6800	3300	1300	10,000	5100	2200
	Z5F Y5F X5F X7R	—	5%	68	360	180	N/A	910	470	180	1800	910	360	4300	2000	820	7500	3900	1500	12,000	6200	2400
	Z5P Y5P X5P X7R	—	10%	130	680	330	N/A	1800	910	360	3300	1600	680	7500	3900	1500	15,000	7500	3000	24,000	12,000	4700
	Z5F Y5T X5T X7T	—	10%	150	750	390	N/A	2000	1000	390	3900	1800	750	9100	4300	1800	16,000	8200	3300	27,000	13,000	5100
GENERAL PURPOSE TYPES	Z5U Y5U X5U X7V	—	20%	240	1300	620	N/A	3300	1600	680	6800	3300	1300	15,000	7500	3000	27,000	13,000	5600	47,000	22,000	9100
	Z5U Y5V X5V 651	—	20%	300	1600	820	N/A	3900	2000	820	10,000	3900	1600	18,000	9100	3600	36,000	18,000	6800	56,000	27,000	10,000

*Tolerances shown in table are minimum for 10 pF and above.
± 0.1 pF is closest tolerance available for 10 pF and less.

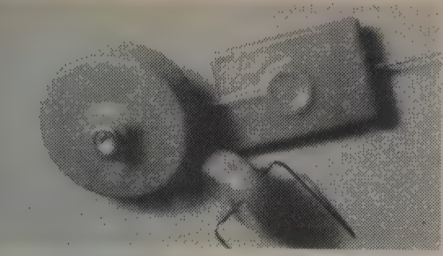
NOTES: ① When ordering 500 Volt parts, allow additional .050" thickness.
② Other lead spacings and wire diameter available upon request.

TO ORDER — **Specify Tusonix Style, Voltage, T.C. Code, Capacitance and Tolerance. Example: 8101-200-Z5U-620, ± 20%* For more data, call 602-624-8231.**

TUSONIX

For complete ordering information, write or call
TUSONIX, Inc., P.O. Box 37144, Tucson,
Arizona 85740-7144. (602) 744-0400. TX 299-640 (RCA)

*SLC stands for Single-layer Ceramic Capacitors.



TUSONIX SLC™ *

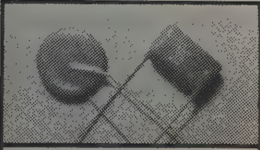
Ceramic Capacitors—High Voltage

Applications and Features

High Voltage Ceramic Capacitors have been one of TUSONIX outstanding component capabilities for many years. These high quality components are used in a broad variety of applications: electric utility transformers, power supplies and voltage multipliers for CRT displays, navigation equipment, electro-optic equipment, and image intensifiers for night vision apparatus.

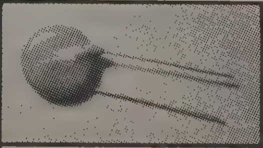
This page details only a few of our high voltage capabilities. The styles shown can be adapted to specific mechanical and electrical requirements of our customers . . . certainly one of the inherent advantages of ceramic capacitors. Custom designs are our specialty.

Disc, Cylindrical, Rectangular Ceramic Capacitors

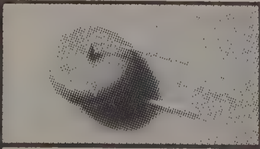


Radial wire leads, 20 ga., 1.25" (31.75) min. length

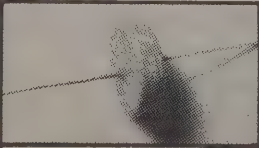
Available in:
3, 5, 10kV
in both disc and rectangular



Offset wire leads, 20 ga., 1.25" (31.75) min. length
Available in:
3, 5, 10KV



Radial formed leads attached axially, 20 ga., 2.0" (50.80) min. length
Available in:
3, 5, 10, 15kV
1" min. lead spacing required for 15kV

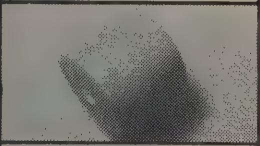


Axial wire leads, 20 ga., 2.0" (50.80) min. length

Available in:
3, 5, 10, 15, 20, 25, 30kV
1.250" max. dia. for over 10kV

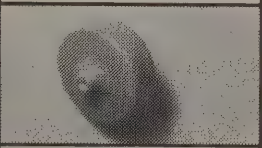
Opposed radial wire leads, 20 ga., 2.0" (50.80) min. length

Available in:
3, 5, 10kV
In both disc and rectangular



Potted female threaded stud terminals, 8-32 threads

Available in:
3, 5, 10, 15 20, 25, 30kV

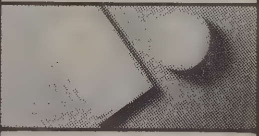


Female threaded stud terminals, 8-32 threads

Available in:
3, 5, 10, 15, 20, 25, 30kV

Male stud terminals, no threads, varnish coating standard.

Available in:
3, 5, 10, 15, 20, 25, 30kV



Electrode with no terminals (single pattern), or specify if tinning is required.
Available in:
Rectangular: **3,5, 10kV** and limited capacitance values for **15, 20, 25, 30kV**
Disc: **3, 5, 10, 15, 20, 25, 30kV**

SPECIALS

Nonstandard or special design part
Available in:
3, 5, 10, 15, 20, 25, 30kV
Note: Can be manufactured with virtually any special terminal to meet specific needs.

Feed-thru Ceramic Capacitors

STANDARD SPECIFICATIONS

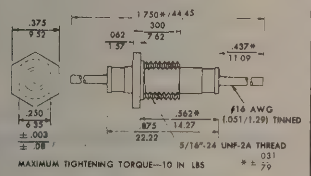
Finish — Silver Plated except 2416 (tinned)
Marking — EIA Color Code except 320
(Capacitance Value-Stamped)

Dimension tolerance ±.015" unless otherwise specified

$\frac{\text{inches}}{\text{mm}}$	inches/mm

TUSONIX PART NO. 2432-002

(Includes Nut and Lockwasher)

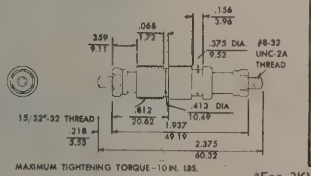

.375 / 9.52
1.750* / 44.45
.300 / 7.62
.062 / 1.57
.437* / 11.09
.250 / 6.35
± .003 / ± .08
.562* / 14.27
.875 / 22.22
#16 AWG (.051/1.29) TINNED
5/16"-24 UNF-2A THREAD
* ± .031 / .79

MAXIMUM TIGHTENING TORQUE—10 IN LBS

EIA Code	Voltage (WVdc)	Max. Cap. (pF)	Tol. %	Min. IR G Ω	Max. DF %
S2L	2KV	90	± 10	50	.1
U2M	2KV	160	± 10	50	.1
X5U	2KV	5000	± 20	10	3
X5W	2KV	7500	+ 80—20	10	3
X7R	1KV	1100	± 20	10	3

TUSONIX PART NO. 320-005

(320-002 is rated at 3 KV*)

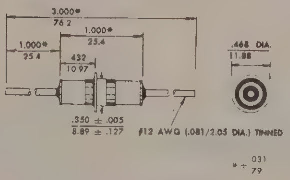

.156 / 3.96
.068 / 1.72
.359 / 9.11
.375 DIA. / 9.52
#8-32 UNC-2A THREAD
.812 / 20.62
.413 DIA / 10.49
15/32"-32 THREAD
.218 / 5.53
1.937 / 49.19
2.375 / 60.32

MAXIMUM TIGHTENING TORQUE–10 IN. LBS.

EIA Code	Voltage (WVdc)	Max. Cap. (pF)	Tol. %	Min. IR G Ω	Max. DF %
S2L	2KV & 3KV*	234	± 20	50	.1
U2M	2KV & 3KV*	332	± 20	50	.1
X5U	2KV & 3KV*	10000	+ 80—20	10	3
X5W	2KV & 3KV*	15000	+ 80—20	10	3
X7R	1KV & 2KV*	2800	+ 80—20	10	3

*For 3KV (and X7R, 2KV) rating, overall length is increased to 2.625/66.67.

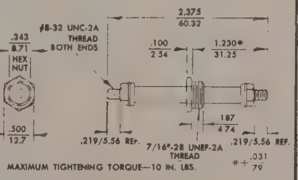
TUSONIX PART NO. 2416-000


3.000* / 76.2
1.000* / 25.4
1.000* / 25.4
.432 / 10.97
.468 DIA. / 11.88
.350 ± .005 / 8.89 ± .127
#12 AWG (.081/2.05 DIA.) TINNED
* ± .031 / .79

EIA Code	Voltage (WVdc)	Max. Cap. (pF)	Tol. %	Min. IR G Ω	Max. DF %
S2L	3KV	96	± 20	50	.1
U2M	3KV	136	± 20	50	.1
X5U	3KV	5000	± 20	10	3
X5W	3KV	8000	+ 80 -20	10	3
X7R	1.5KV	1000	+ 80—20	10	3

TUSONIX PART NO. 2498-000

(2498-001 with Nut and Lockwasher)


#8-32 UNC-2A THREAD BOTH ENDS
.343 / 8.71
HEX NUT
2.375 / 60.32
.100 / 2.54
1.230* / 31.25
.187 / 4.74
.500 / 12.7
.219/5.56 REF.
7/16"-28 UNEF-2A THREAD
.219/5.56 REF.
* ± .031 / .79

MAXIMUM TIGHTENING TORQUE—10 IN. LBS.

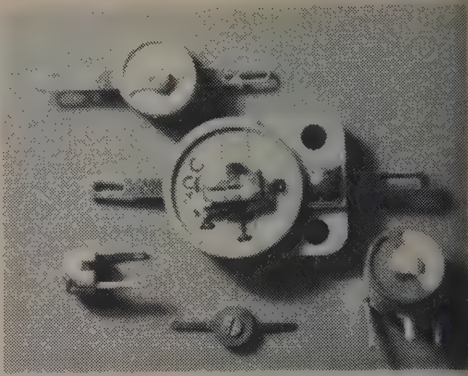
EIA Code	Voltage		MAX. Cap. (pF)	Tol. %	MIN. IR G	Max. DF %
	WVDC	Flash				
S2L	4KV	6KV	156	± 20	50	.1
U2M	4KV	6KV	222	± 20	50	.1
X5R	4KV	6KV	4000	± 20	50	3
X5U	3KV	4.5KV	7000	± 20	10	3
X5W	3KV	4.5KV	10000	+80 -20	10	3
X7R	3KV	4.5KV	1800	+80 -20	10	3

TUSONIX

For complete ordering information, write or call
TUSONIX, Inc., P.O. Box 37144, Tucson,
Arizona 85740-7144. (602) 744-0400. TX 299-640 (RCA)

TUSONIX SLC™*

Ceramic Capacitors – Trimmers

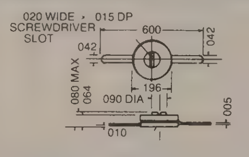


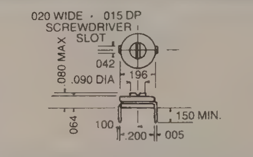
Series 513 –

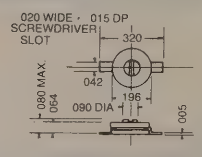
First True Ultraminiature Quality Trimmer

Working Voltage .... A: 100 WVdc to 85°C.
G: 25 WVdc to 85°C.
Dielectric Strength .... 2 times WVDC for 1 to 5 seconds
Operating Temperature Range .... −55°C. to +85°C.
Q Factor @ 1MHz .... 500 Min. (Dielectric Code A)
200 Min. (Dielectric Code G)

Torque .... 0.3 to 2.0 oz. in.
Qualification Specification .... TUSONIX Spec. 513
Dimensions in inches .... For dimensions <.125" tol. is ±.005
For dimensions >.126" tol. is ±.015


020 WIDE · 015 DP
SCREWDRIVER SLOT
600
042
042
080 MAX
064
196
090 DIA
005
010


020 WIDE · 015 DP
SCREWDRIVER SLOT
080 MAX
042
.090 DIA
196
150 MIN.
064
100
200
005


020 WIDE · 015 DP
SCREWDRIVER SLOT
320
080 MAX
064
042
196
090 DIA
005

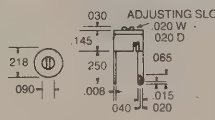
TUSONIX Part No.	TUSONIX Part No.	TUSONIX Part No.	Working Voltage (Vdc) 85°	CAPACITANCE RANGE IN pF
513-010 A 1-5	513-011 A 1-5	513-012 A 1-5	100	1-5
513-010 A 2-10	513-011 A 2-10	513-012 A 2-10	100	2-10
513-010 A 3.5-20	513-011 A 3.5-20	513-012 A 3.5-20	100	3.5-20
513-010 A 5-30	513-011 A 5-30	513-012 A 5-30	100	5-30
513-010 G 7-40	513 011 G 7-40	513-012 G 7-40	25	7-40

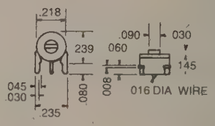
Series 518 –

First Small Size Quality Trimmer

Working Voltage .... A: 100 WVdc to 85° C.; 50 WVdc to 125°C.
G: 25 WVdc to 85°C.
Dielectric Strength .... 2 times WVdc for 1-5 sec.
Operating Temperature Range . ... −55°C to 125°C.

Torque .... .3-3 oz. in.
Q Factor @ 1 MHz .... 500 Minimum (Dielectric Code A)
200 Minimum (Dielectric Code F)


030
ADJUSTING SLOT
.020 W
020 D
.145
218
250
065
090
.008
015
040
020


.218
239
.090
030
060
145
045
.030
080
008
016 DIA WIRE
.235

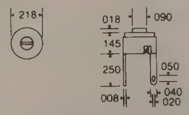
TUSONIX Part No.	MIL-C-81 Desig. 518-016	CAPACITANCE RANGE IN pF	TUSONIX Part No.	MIL-C-81 Desig. 518-017	CAPACITANCE RANGE IN pF
518-000 A 1-3	CV35 A 030	1-3	518-002 A 1.25-3	CV36 A 030	1.25-3
518-000 A 2-5	CV35 A 050	2-5	518-002 A 2-5	CV36 A 050	2-5
518-000 A 2.5-9	CV35 A 090	2.5-9	518-002 A 2.5-9	CV36 A 090	2.5-9
518-000 A 3.5-20	CV35 A 200	3.5-20	518-002 A 3.5-20	CV36 A 200	3.5-20
518-000 A 5-15	CV35 A 150	5-15	518-002 A 5-15	CV36 A 150	5-15
518-000 A 5-25	CV35 A 250	5-25	518-002 A 5-25	CV36 A 250	5-25
518-000 G 7-40	CV35 G 400	7-40	518-002 G 7-40	CV36 G 400	7-40

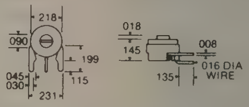
Series 528 –

Quality Low Cost Trimmer

Working Voltage .... A: 100 WVdc to 85°C; 50 WVdc to 125°C.
G: 25 WVdc to 85°C.
Dielectric Strength .... 2 times WVdc for 1-5 secs.

Operating Temperature Range .... −55°C to 125°C.
Torque .... .3-3 oz. in.
Q Factor @ 1MHz .... 500 Minimum (Dielectric Code A)
200 Minimum (Dielectric Code F)


218
018
090
145
250
050
008
040
020


218
090
018
145
008
199
016 DIA WIRE
045
030
115
135
231

TUSONIX Part No.	CAPACITANCE RANGE IN pF	TUSONIX Part No.	CAPACITANCE RANGE IN pF
528-000 A 1-3	1-3	528-002 A 1-3	1-3
528-000 A 3-8	3-8	528-002 A 3-8	3-8
528-000 A 2-5	2-5	528-002 A 2-5	2-5
528-000 A 3.5-10	3.5-10	528-002 A 3.5-10	3.5-10
528-000 A 4-14	4-14	528-002 A 4-14	4-14
528-000 C 3.5-10	3.5-10	528-002 C 3.5-10	3.5-10
528-000 E 4.5-15	4.5-15	528-002 E 4.5-15	4.5-15
528-000 F 6-22	6-22	528-002 F 6-22	6-22
528-000 F 3.5-17	3.5-17	528-002 F 3.5-17	3.5-17

Applications and Features

TUSONIX leads the way in the miniaturization of trimmers, or variable ceramic capacitors. Developments such as those illustrated below have established TUSONIX as a leader in the state of the art. More than 30 years of experience in Trimmer design and technology have enabled TUSONIX to offer engineers the world's most complete line of ceramic trimmer capacitors.

During the past 10 years the ceramic trimmer capacitor has become the most popular trimmer in the electronics industry. The inherent reliability, small size, low cost and wide selection of available electrical characteristics are major factors in the ceramic capacitor's continuing popularity among design engineers.

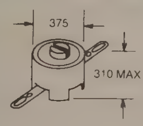
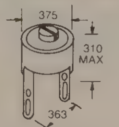
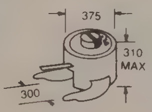
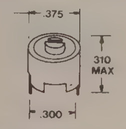
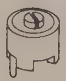
TUSONIX produces a broad range of fixed and variable (trimmer) ceramic capacitors. Complete research, development and manufacturing of the ceramic dielectric itself and the finished capacitor is performed by TUSONIX. Today TUSONIX is recognized as one of the world's leading suppliers of quality ceramic capacitors.

(For complete details consult Trimmer catalog.)

Series 538 –
First 3/8″ Dia. Trimmer in the Industry

Working Voltage...A,B,C: 350 WVdc @ 85°C.; 200 WVdc @ 125°C.
D&F: 200 WVdc @ 85° C.; 100 WVdc @ 125°C.
Dielectric Strength .... 500 Vdc for 1-5 sec.
Operating Temperature Range .... 55°C to +125°C.
Q Factor @ 1 MHz .... 500 Minimum

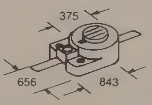
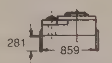
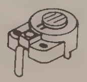
Torque .... 1-6 oz. in.
Qualification Specification .... TUSONIX Spec. 500
For dimensions .... <.125″, tolerance is ±.005
For dimensions .... ≥.126″, tolerance is ±.015
Except where noted.

					CAPACITANCE RANGE IN pF
TUSONIX Part No.	**TUSONIX Part No.**	**TUSONIX Part No.**	**TUSONIX Part No.**	**MIL-C-81 Desig. 538-054**	
538-000 A 2-8	538-002 A 2-8	538-006 A 2-8	538-011 A 2-8	CV31 A 080	2 to 8
538-000 A 5.5-18	538-002 A 5.5-18	538-006 A 5.5-18	538-011 A 5.5-18	CV31 A 180	5.5 to 18
538-000 B 2.5-11	538-002 B 2.5-11	538-006 B 2.5-11	538-011 B 2.5-11	CV31 B 110	2.5 to 11
538-000 B 7-25	538-002 B 7-25	538-006 B 7-25	538-011 B 7-25	CV31 B 250	7 to 25
538-000 C 3-10	538-002 C 3-10	538-006 C 3-10	538-011 C 3-10	CV31 C 100	3 to 10
538-000 C 8-25	538-002 C 8-25	538-006 C 8-25	538-011 C 8-25	CV31 C 250	8 to 25
538-000 D 3-15	538-002 D 3-15	538-006 D 3-15	538-011 D 3-15	CV31 D 150	3 to 15
538-000 D 9-35	538-002 D 9-35	538-006 D 9-35	538-011 D 9-35	CV31 D 350	9 to 35
538-000 F 15-60	538-002 F 15-60	538-006 F 15-60	538-011 F 15-60	CV31 E 600	15 to 60

Series 503 –
First Ceramic Trimmer in the United States

Working Voltage .... A,C: 500 WVdc @ 125°C
...D and F: 500 WVdc @ 85°C.; 250 WVdc @ 125°C.
Dielectric Strength .... 1250 Vdc for 1-5 sec.
Operating Temperature Range .... −55°C. to +125°C.

Q Factor @ 1 MHz .... 500 Minimum; A,C,D
400 Minimum: F
Torque .... 4-20 oz. in.
Qualification Specification .... TUSONIX Spec. 500

	 503-001 Same as 503-000 except terminals bent down		CAPACITANCE RANGE IN pF
TUSONIX Part No.	**TUSONIX Part No.**	**MIL-C-81 Desig. 503-041**	
503-000 A 1.5-7	503-001 A 1.5-7	CV11 C 300	4 to 30
503-000 A 3-12	503-001 A 3-12	CV11 C 450	7 to 45
503-000 A 4.5-25	503-001 A 4.5-25	CV11 D 060	2 to 6
503-000 C 7-45	503-001 C 7-45	CV11 D 300	4 to 30
503-000 D 4-30	503-001 D 4-30	CV11 D 450	7 to 45
503-000 D 7-45	503-001 D 7-45	CV11 A 070	1.5 to 7
503-000 D 5-50	503-001 D 5-50	CV11 A 120	1 to 12
503-000 F 11-110	503-001 F 11-110	CV11 A 250	4.5 to 25

Marking: All units will be marked with TUSONIX trademark, capacitance range and dielectric type code.
Example: T 2-6 D.

*SLC stands for Single-layer Ceramic Capacitors.

TUSONIX

For complete ordering information, write or call
TUSONIX, Inc., P.O. Box 37144, Tucson,
Arizona 85740-7144. (602) 744-0400. TX 299-640 (RCA)

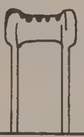
TUSONIX SLC™*

Ceramic Capacitors—Tubular, Feed-thru, Stand-off, Discoidal

Applications and Features

TUSONIX offers a complete line of ceramic tubular, feed-thru, and stand-off capacitors for general purpose, temperature compensation, and high stability applications. All forms feature compact package sizes, many different lead and mounting options, rugged construction, and proven high reliability in a variety of demanding applications such as RF by-passing and filtering. MIL types are also available in each form. (For complete details, consult our Ceramic Tubular, Feed-thru, and Stand-off Capacitor Catalog.)

Tubular Ceramic Capacitors

ENAMEL COATED	Style	Body Dia. Max.	Body Length Max.	Lead Space ±.060	Min. Lead Length	Lead Dia.
	301	.200 5.08	.400 10.16	.250 6.35	1.25 31.75	.025 .64
	302	.200 5.08	.656 16.66	.375 9.52	1.25 31.75	.025 .64
	374	.125 3.17	.320 8.12	.250 6.35	1.25 31.75	.013 .33

MAXIMUM CAPACITANCE (pF)

	TUSONIX STYLE		374		301	302
	VOLTAGE		100 V	200 V	500 V	500 V
	EIA Code	Min. Cap. Tol.	Max.	Max.	Max.	Max.
STABLE TYPES (Hi-K)	Z5D Y5D	± 5%	1000 1000	1000 1000	910 910	1800 1800
	Z5F Y5F X5F X7F (W5F)	± 10%	1600 910 910 240	1600 910 910 —	1600 1300 1300 240	3000 2400 2400 430
	Z5P Y5P X5P X7P (W5P)	± 10%	1600 910 910 240	1600 910 910 —	1600 1300 1300 240	3000 2400 2400 1800
	Z5R Y5R X5R X7R (W5R)	± 10%	1600 1300 1300 240	1600 1300 1300 —	1600 1300 1300 820	3000 2400 2400 1600
	Z5S Y5S X5S X7S (W5S)	± 10%	1600 1300 1300 1000	1600 1300 1300 —	1600 1300 1300 910	3000 2400 2400 1800
	Z5T Y5T X5T X7T (W5T)	± 10%	1600 1600 1600 1600	1600 1600 1600 —	1600 1600 1600 1600	3000 3000 3000 3000
GENERAL PURPOSE TYPES	Z5U Y5U X5U X7U (W5U)	± 20%	3900 3900 3900 1600	3900 3900 3900 —	5100 3600 3600 1600	10000 6800 6800 3000
	Z5V Y5V X5V	± 20%	5600 5600 3900	5600 5600 3900	5100 5100 5100	10000 10000 10000

CAPACITANCE RANGE (pF)

TUSONIX STYLE			301		302		308		374		301		302	
VOLTAGE			500 WVdc @ 85 C		500 WVdc @ 85 C		500 WVdc @ 85 C		200 WVdc @ 85 C		500 WVdc @ 125 C		500 WVdc @ 125 C	
	EIA Code	Temp. Coef. (ppm/C) T.C. Tol.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
TEMPERATURE COMPENSATING TYPES	M7G	P100 ± 30	42	13	14	23	14	26	2 5	12	.42	9.5	10	23
	COG	NPO ± 30	52	49	25	88	25	101	3	49	.52	49	25	88
	B1G	N030 ± 30	63	25	26	47	26	53	5	26	.63	26	19	47
	U1G	N080 ± 30	.63	29	30	53	30	60	5.5	29	.63	29	22	53
	P2G	N150 ± 30	.63	34	35	60	35	68	6.5	33	.63	34	25	60
	R2G	N220 ± 30	.66	37	38	66	38	75	6	36	.66	37	28	66
	S2H	N330 ± 60	66	41	42	73	42	83	7	40	.66	41	31	73
	T2H	N470 ± 60	.66	49	50	88	50	101	9.5	49	.66	36	37	88
	U2J	N750 ± 120	.66	68	69	120	69	137	13.5	67	.66	51	52	120
EXTENDED TEMPERATURE COMPENSATING TYPES	P3K	N1500 ± 250	.89	83	84	147	——		23	122	.89	83	84	147
	R3A	N2200 ± 400	1.5	133	134	235	——		24	131	1.5	52	96	170
	S3B	N3300 ± 650	2.9	208	209	368	——		39	213	2.9	81	101	200
	G3C	N4200 ± 850	3.2	330	323	588	——		61	327	——		——	
	T3D	N4700 ± 900	4.0	450	456	810	——		79	425	4.0	179	180	440
	H3M	N5600 ± 1000	5 4	660	664	1180	——		106	573	——		——	

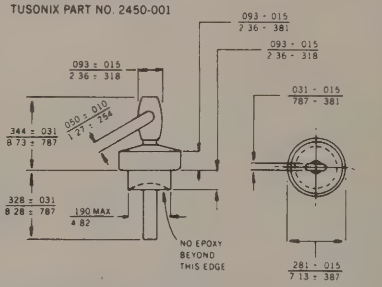
Discoidal Ceramic Capacitors

Dimension tolerance ± .015" unless otherwise specified

inches / mm	inches/mm

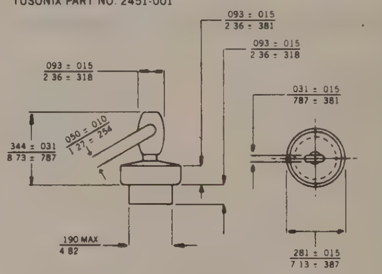
FEED-THRU

TUSONIX PART NO. 2450-001



STAND-OFF

TUSONIX PART NO. 2451-001



EIA Code	Voltage (WVdc)	Cap. (pF)	Tol.%
X5U	500	1000	+100 +0
X5R	500	470	±20
X5R	500	100	±10
X5E	500	6 8	±20
X5S	500	33	±20

RECOMMENDED SOLDERING PROCEDURES FOR INSTALLING DISCOIDAL CAPACITORS.

To insure that the reliability of the part is not destroyed by improper installation, adhere to the following procedure:

1. the part must not be over stressed thermally or mechanically during installation;
2. preheat the part and chassis to 250/275° F and complete the solder joint with a small iron (50 watts). Use 60% tin, 40% lead solder.
3. limit soldering temperature to 500°F;
4. chassis with part mounted should be cooled at a rate similar to that of the pre-heat operation.
5. oven soldering and induction soldering are not recommended

Qualified Products List (QPL) Approved on TUSONIX Tubular Products

MIL Specification	MIL Style	TUSONIX Style	
MIL-C-20 01 /03 04 /06 07 08	 CC20 CC22 CC25 CC27 CC30 CC31	 301-651 331-051 302-651 332-051 308-651 338-051	
MIL-C-39014 /16 .17 18 19	 CKR75 CKR82 CKR76 CKR83	**M** 2499-032 2499-035 2425-049 2425-074	**L** 2449-088 2499-089 2425-088 2425-089

MIL-C-39014

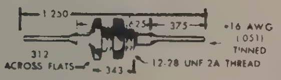
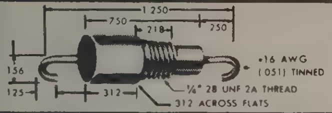
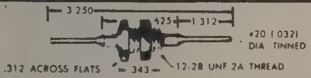
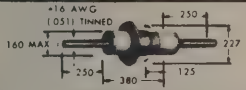
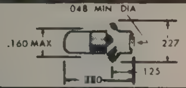
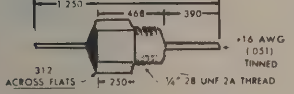
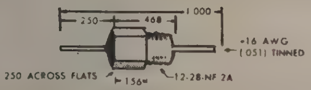
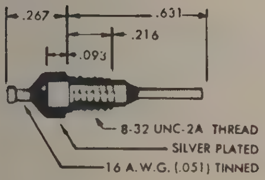
CKR75

CKR76

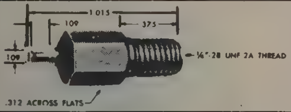
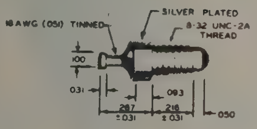
CKR82

CKR83

Feed-thru Ceramic Capacitors

Physical Dimensions	TUSONIX Part No.	Char.	Cap. (pF)	% Tol.
	500 WVdc (Derate 50% at 125° C.)			
 1 250 625 375 •16 AWG (051) TINNED 312 ACROSS FLATS 343 12-28 UNF 2A THREAD	321-000 X5U0 102M (000 Nut Only) (010 Nut and Washer) (Straight Leads)	X5U	1000	±20
	357-000 X5U0 102M	X5U	1000	±20
	357-000 X5U0 152M (000 Nut Only) (001 Nut and Washer) (Curved Leads)	X5U	1500	±20
 1 250 750 218 250 156 125 312 •16 AWG (051) TINNED ¼" 28 UNF 2A THREAD 312 ACROSS FLATS	327-000 X5U0 102M	X5U	1000	±20
	327-000 X5U0 152M (000 No Hardware) (005 Nut Only) (010 Nut and Washer)	X5U	1500	±20
 3 250 625 1 312 •20 (032) DIA TINNED .312 ACROSS FLATS 343 12-28 UNF 2A THREAD	362-000 X5U0 102M	X5U	1000	±20
	362-000 X5U0 152M (000 Nut Only) (013 Nut and Washer)	X5U	1500	±20
 •16 AWG (051) TINNED 250 160 MAX 227 250 380 125	2404-000 U2M0 500M	U2M	50	±20
	2404-000 X5U0 101M	X5U	100	±20
	2404-000 X5U0 102P	X5U	1000	+100 −0
 048 MIN DIA .160 MAX 227 125	2404-014 X5U0 501M	X5U	500	±20
	2404-014 X5U0 102P	X5U	1000	+100 −0
	500 WVdc (Derate 50% at 125° C.)			
 1 250 468 390 •16 AWG (051) TINNED 312 ACROSS FLATS 250 ¼" 28 UNF 2A THREAD	2443-000 X5S0 102M	X5S	1000	±20
	2443-000 X5S0 152M (000 No Hardware) (008 Nut and Washer) (Straight Leads)	X5S	1500	±20
	2443-001 X5S0 102M	X5S	1000	±20
	2443-001 X5S0 152M (001 Nut Only) (007 Nut and Washer) (Curved Leads)	X5S	1500	±20
 1 000 250 468 •16 AWG (051) TINNED 250 ACROSS FLATS 156 12-28-NF 2A	2499-003 X5S0 102M	X5S	1000	±20
	2499-003 X5S0 152M (Nut and Washer)	X5S	1500	±20
	200 WVdc (Derate 50% at 125°C.)			
 .267 .631 .216 .093 8-32 UNC-2A THREAD SILVER PLATED 16 A.W.G. (.051) TINNED	2425-001 X5U0 101AA	X5U	100	GMV
	2425-001 X5U0 102AA	X5U	1000	GMV
	2425-001 X5U0 152AA	X5U	1500	GMV
	2425-001 X5U0 202AA	X5U	2000	GMV
	2425-001 X5U0 501AA	X5U	500	GMV
	2425-001 X5W0 502AA (001 Nut Only)	X5V	5000	GMV
	2425-003 W5U0 101AA	W5U	100	GMV
	2425-003 W5U0 102AA	W5U	1000	GMV
	2425-003 W5U0 152AA	W5U	1500	GMV
	2425-003 W5U0 202AA	W5U	2000	GMV
	2425-003 W5U0 501AA	W5U	500	GMV
	2425-003 W5W0 502AA (003 Nut Only)	W5W	5000	GMV

Stand-Off Ceramic Capacitors

Physical Dimensions	TUSONIX Part No.	Char.	Cap. (pF)	% Tol.
	500 WVdc (Derate 50% at 125° C.)			
 1 015 109 375 109 ¼"-28 UNF 2A THREAD .312 ACROSS FLATS	326-000 X5UO 102M	X5U	1000	± 20
	326-000 X5UO 152M (000 No Hardware) (013 Nut and Washer)	X5U	1500	± 20
	200 WVdc (Derate 50% at 125° C.)			
 SILVER PLATED 8-32 UNC-2A THREAD 16 AWG (051) TINNED 100 031 093 287 ±031 216 ±031 050	2425-061 X5UO 101AA	X5U	100	GMV
	2425-061 X5UO 102AA	X5U	1000	GMV
	2425-061 X5UO 152AA	X5U	1500	GMV
	2425-061 X5UO 202AA	X5U	2000	GMV
	2425-061 X5UO 501AA	X5U	500	GMV
	2425-061 X5UO 502AA (061 Nut Only)	X5V	5000	GMV
	2425-063 W5UO 101AA	W5U	100	GMV
	2425-063 W5UO 102AA	W5U	1000	GMV
	2425-063 W5UO 152AA	W5U	1500	GMV
	2425-063 W5UO 202AA	W5U	2000	GMV
	2425-063 W5UO 501AA	W5U	500	GMV
	2425-063 W5UO 502AA (063 Nut Only)	W5W	5000	GMV

TUSONIX

For complete ordering information, write or call
TUSONIX, Inc., P.O. Box 37144, Tucson,
Arizona 85740-7144. (602) 744-0400. TX 299-640 (RCA)

UNITED CHEMI-CON...

UNITED
CHEMI-CON

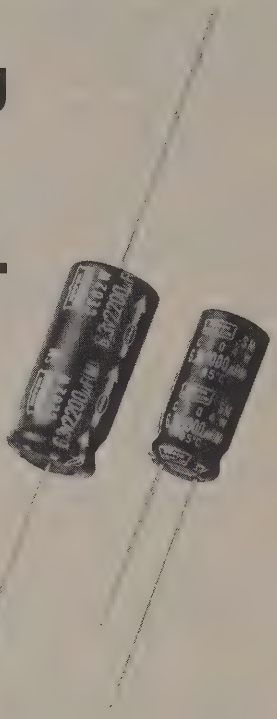
9801 West Higgins Road, Rosemont, Illinois 60018
Phone (312) 696-2000 TWX 910-253-2964 TELEX 28-3557

Your first choice among the world's leading suppliers of aluminum electrolytic capacitors.

Your first choice for...

A wide range of products

☐ Reduced case sizes
☐ Low leakage current
☐ Extended operating temperature range
☐ Extended voltage and capacitance values



SM Series
Very high quality general purpose

KM Series
Low leakage current, extended temperature range, reduced case size

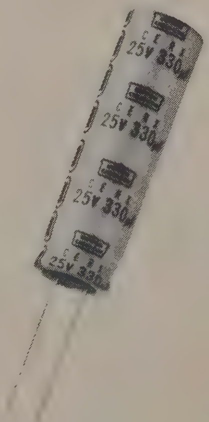
Service

☐ Local representation and inventory
See Directory Section
☐ Large distribution network
See Directory Section
☐ Design engineering support

Quality

☐ All products are 100% tested
☐ All products are date coded
☐ All products are lot traceable

WORLD LEADER OVER 50 YEARS OF CAPACITOR QUALITY



RX Series
Low leakage, high ripple current, ideal for power supply output use

SRA Series
Ultra-miniature case size (4 x 7mm) general purpose

NMHR Series
Long life, reduced case size, high ripple current, ideal for power supply input use

United Chemi-Con Series of Capacitors

United Chemi-Con manufactures capacitors in a wide variety of materials, sizes and termination styles. The table below provides a quick cross reference of the various types and their characteristics. Complete technical data is available. United Chemi-Con . . . since 1931, known the world over for capacitor leadership.

Item	Series	Capacitance Range in μF	Voltage Range in Volts	Temperature Range	Leakage Current in μA	Standard Capacitance Tolerance	Minimum Case Size (mm)	Lead Configuration
Miniature	SMC*	.47 to 10,000	6.3 to 100	−40 to +85°C	.03 CV or 4 .01 CV or 3	±20%	5 x 11 5 x 12.5	Radial Axial
	KMC*	.47 to 10,000	6.3 to 100 160 to 250	−55 to +105°C −40 to +105°C	.002 CV or 2 .03 CV + 15	±20%	5 x 11 5 x 12.5	Radial Axial
	KXC*	.47 to 3300 .47 to 2200	10 to 100	−55 to +110°C	.002 CV or 2	±20%	8 x 11.5 6.3 x 13	Radial Axial
	SXC*	1 to 2200	6.3 to 63	−55 to +105°C	.01 CV	±20%	6.3 x 11	Radial
	RXC*	2.2 to 1000	10 to 100	−55 to +105°C	.002 CV or 2	−10 to +100%	8 x 11.5	Radial
	SRC*	.1 to 3300	6.3 to 50	−55 to +85°C	.01 CV or 3	±20%	5 x 9	Radial
	SL	.47 to 3300 .47 to 10,000	6.3 to 450 6.3 to 500	−40 to +85°C −25 to +85 (70)°C	.03 CV or 4 .03 CV + 100	−10 to +50%	5 x 11 5 x 13	Radial Axial
	SM	.47 to 10,000	6.3 to 100 160 to 450	−40 to +85°C −25 to +85°C	.01 CV or 3 .03 CV + 15	±20%	5 x 11 5 x 12.5	Radial Axial
	SME*	.47 to 15,000 .47 to 22,000	6.3 to 250	−40 to +85°C	.01 CV or 3	±20%	5 x 11 5 x 12.5	Radial Axial
	SRA	.1 to 220	4 to 63	−40 to +85°C	.01 CV or 3	±20%	4 x 7	Radial
	SRE	.1 to 100	4 to 50	−40 to +85°C	.01 CV or 3	±20%	3 x 5	Radial
	LL	.1 to 4700	6.3 to 100	−40 to +85°C	.002 CV or 2	±20%	5 x 11	Radial
	KM	.47 to 10,000	6.3 to 100 160 to 250	−55 to +105°C −40 to +105°C	.002 CV or 2 .03 CV + 15	±20%	5 x 11 5 x 12.5	Radial Axial
	KMA*	.1 to 100	6.3 to 63	−55 to +105°C	.01 CV or 3	±20%	4 x 7	Radial
	SXE*	1.5 to 15,000	6.3 to 100	−55 to +105°C	.01 CV	±20%	4 x 7	Radial
	RX	2.2 to 1000	10 to 100	−55 to +105°C	.002 CV or 2	−10 to +100%	8 x 11.5	Radial
	RZ*	15 to 16,500	7.5 to 100 150 to 250	−55 to +105°C −25 to +105°C	$\sqrt{CV}$ 0.02 CV + 10	−10 to +75%	19.1 x 31.8	Radial
	KX	.47 to 3300 .47 to 2200	10 to 100 160 to 400	−55 to +110°C −25 to +105°C	.002 CV or 2 .02 CV + 10	±20%	8 x 11.5 6.3 x 13	Radial Axial
	GX	.47 to 1000	10 to 63	−40 to +130°C	.002 CV or 2	−10 to +50%	8 x 11.5 6.3 x 13	Radial Axial
Small Can	BK	47 to 22,000	16 to 200 400	−40 to +85°C −25 to +85°C	.03 CV or 3000 .06 CV or 5000	±20%	25.4 x 25	Plug-in
	NM	47 to 22,000	10 to 200 400	−40 to +85°C −25 to +85°C	.03 CV or 3000 .06 CV or 5000	±20%	22 x 26	Plug-in
	NMHR	100 to 1000	160 to 250	−25 to +85°C	.02 CV or 3000	±20%	25.4 x 25	Plug-in
	KM PLUG-IN	10 to 33,000	10 to 100 160 to 400	−40 to +105°C −25 to +105°C	.02 CV or 3000	±20%	22 x 25	Plug-in
	SM-VP	470 to 22,000	10 to 100	−40 to +85°C	.02 CV or 3000	±20%	22 x 30	Radial
Large Can	UW	80 to 390,000	10 to 100 200 to 450	−40 to +85°C −25 to +85°C	.02 CV or 5000	−10 to +75% −10 to +50%	35 x 41	Screw
	MWU	75 to 1,600,000	6 to 100 150 to 450	−40 to +85°C −25 to +85°C	.02 CV or 5000	−10 to 75% −10 to 50%	35 x 41	Screw

*Solvent-proof

Note: These listed values are typical specifications for each series. Please refer to the series catalog for the details.

© 1984 United Chem-Con, Inc.

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms	**1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code	**3**•1103
Batteries, Product Selection Guide	**3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide	**2**•1003
Capacitors, Basic Formulas	**1A**•1093
Capacitors, Miniglossary	**1A**•1069
Capacitors, Product Selection Guide	**1A**•1003
Circuit Boards (Printed), Product Selection Guide	**2**•1089
Coils, Chokes, & Inductors, Product Selection Guide	**1A**•1219
Connectors, Miniglossary	**2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide	**2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**1A**•1309
Delay Lines, Product Selection Guide	**1A**•1445
Discrete Semiconductors, Product Selection Guide	**1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide	**1B**•1021
EBCDIC Code	**3**•1153
Encapsulation, Miniglossary	**2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**2**•1801
Filters, Product Selection Guide	**1A**•1577
Instruments, Graphic Recording, Product Selection Guide	**3**•1381
Instruments, Panel Meters, Product Selection Guide	**3**•1321
Instruments, Test & Measuring, Product Selection Guide	**3**•1182
Interconnection Systems, Product Selection Guide	**2**•1873
Keyboards & Keypads, Product Selection Guide	**1B**•1759
Microwave Components, Product Selection Guide	**1A**•1685
Military Qualified Products Lists	**1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide	**1B**•1121
Opto Semiconductors, Miniglossary	**1B**•1218
Oscilloscopes, Product Selection Guide	**3**•1361
Panel Hardware, Product Selection Guide	**2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**1A**•2017
Power Supplies, Miniglossary	**3**•1455
Power Supplies, AC, Product Selection Guide	**3**•1815
Power Supplies, DC, Product Selection Guide	**3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**1B**•1255
Relay Contact Forms	**1B**•1317
Relays, Electromechanical, Miniglossary	**1**•**B**1292
Relays, Product Selection Guide	**1B**•1289
Resistor Color Codes	**1A**•1791
Resistors, Product Selection Guide	**1A**•1789
Servo Components, Miniglossary	**3**•1935
Solenoids, Product Selection Guide	**1B**•1481
Switches, Product Selection Guide	**1B**•1499
Thyristors/High Power Diodes, Miniglossary	**1A**•1652
Transducers & Encoders, Product Selection Guide	**1B**•1827
Transformers, Product Selection Guide	**1A**•2115
Wire & Cable, Product Selection Guide	**2**•1935

Hi Rel Filters And Capacitors

HI-REL MONOLITHIC CERAMIC COMPONENTS

Capacitors–(Leaded)

Size range: Axial .13L × .07W through .425L × .225W

Radial .20L × .20W through .50L × .50W

Molded and Conformally Coated.

Standard and High Voltage from 25VDC through 5000VDC.

Operating temperature ranges from -55°C through 260°C.

Capacitance ranges from 1pF through 1Mfd.

Low Noise/Low Leakage.

QPL approval to MIL-C-20 and MIL-C-39014.

Capacitors–(Chips)

Size range from .050 × .040 through .870 × .600.

Standard and High Voltage from 25VDC through 5000VDC.

Operating temperature ranges from -55°C through 260°C.

Capacitance ranges from 1pF through 1Mfd.

QPL approval to MIL-C-55681

Filters–(Ft, L, Pi and Multi-Sections)

Size range from .080 Dia. through .670 Dia.

Miniature Solder-In. Screw Body. Hermetically Sealed–Broadband.

Standard and High Voltage from 50VDC through 300VDC/115VAC.

Operating temperature ranges from -55°C through 150°C (300°C installation temperature)

Capacitance ranges from 10pF through 1.4Mfd, QPL approval to MIL-F-28861.

APPLICATIONS:

High Reliability Components for

Military and Aerospace

EW, ECM, ASW, guidance systems, C³, avionics, EMP, missile systems, satellites and other space applications.

Medical Devices & Laboratory Instruments

Heart pacemakers (external and implantable devices), defibrillator, blood analyzer, medication monitoring spectrum analyzer

Well Logging
(Down Hole/Hi Temp)

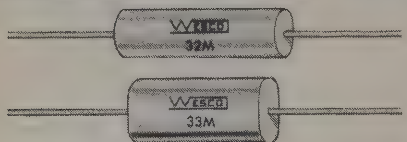
Radiation tools, resistivity/induction tools, sonic/acoustic tools, perforating tools, MWD tools

Custom designs and associated engineering support available on request in all general product categories.

US microtek components

US Microtek Components Corporation • 11144 Penrose Street • Sun Valley, CA 91352 • Tel. 818 767-6770 • TWX 910 498-4988

WESCO® MYLAR* FILM-FOIL CAPACITORS



SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR

Shall not exceed 0.75% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.50% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 80°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287,, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

FEATURES

Wrap and fill construction.
Tubular or oval configuration for optimum space savings.
Extended foil design.
Quality control procedures per Mil-Q-9858.
Will meet or exceed Mil-C-27287.

APPLICATIONS

Computers
Data Processing Equipment
Peripheral Equipment
Aircraft and Missile Systems
Industrial Instrumentation
Navigation and Distance Measuring Equipment
Communications Equipment
Filters

TYPE 32M RATINGS AND DIMENSIONS

Capacity in Mfds.	100 VOLTS			200 VOLTS			400 VOLTS			600 VOLTS		
	D	L	Cat. No. 32M — K-1	D	L	Cat. No. 32M — K-2	D	L	Cat. No. 32M — K-4	D	L	Cat. No. 32M — K-6
.001	.187	.40	1001	.187	.40	1001	.187	.53	1001	.187	.53	1001
.0012	.187	.40	1201	.187	.40	1201	.187	.53	1201	.187	.53	1201
.0015	.187	.40	1501	.187	.40	1501	.187	.53	1501	.187	.53	1501
.0018	.187	.40	1801	.187	.40	1801	.187	.53	1801	.187	.53	1801
.0022	.187	.40	2201	.187	.40	2201	.187	.53	2201	.187	.53	2201
.0027	.187	.40	2701	.187	.40	2701	.187	.53	2701	.203	.53	2701
.0033	.187	.40	3301	.187	.40	3301	.187	.53	3301	.218	.53	3301
.0039	.187	.40	3901	.187	.40	3901	.187	.53	3901	.218	.53	3901
.0047	.187	.40	4701	.187	.40	4701	.187	.53	4701	.187	.65	4701
.0056	.187	.40	5601	.187	.40	5601	.187	.53	5601	.203	.65	5601
.0068	.187	.40	6801	.187	.40	6801	.187	.53	6801	.203	.65	6801
.0082	.187	.40	8201	.187	.40	8201	.203	.53	8201	.218	.65	8201
.01	.187	.40	1002	.203	.40	1002	.218	.53	1002	.234	.65	1002
.012	.187	.40	1202	.234	.40	1202	.234	.53	1202	.265	.65	1202
.015	.203	.40	1502	.250	.40	1502	.265	.53	1502	.281	.65	1502
.018	.218	.40	1802	.203	.53	1802	.218	.65	1802	.265	.78	1802
.022	.234	.40	2202	.218	.53	2202	.250	.65	2202	.281	.78	2202
.027	.265	.40	2702	.234	.53	2702	.234	.78	2702	.312	.78	2702
.033	.218	.53	3302	.218	.65	3302	.265	.78	3302	.296	.90	3302
.039	.187	.65	3902	.234	.65	3902	.281	.78	3902	.328	.90	3902
.047	.203	.65	4702	.250	.65	4702	.312	.78	4702	.359	.90	4702
.056	.218	.65	5602	.281	.65	5602	.296	.90	5602	.375	.90	5602
.068	.250	.65	6802	.312	.65	6802	.328	.90	6802	.421	.90	6802
.082	.265	.65	8202	.296	.78	8202	.343	.90	8202	.375	1.18	8202
.1	.265	.78	1003	.328	.78	1003	.390	.90	1003	.421	1.18	1003
.12	.281	.78	1203	.328	.90	1203	.359	1.18	1203	.453	1.18	1203
.15	.312	.78	1503	.359	.90	1503	.390	1.18	1503	.500	1.18	1503
.18	.312	.90	1803	.359	1.03	1803	.437	1.32	1803	.515	1.32	1803
.22	.343	.90	2203	.390	1.03	2203	.484	1.32	2203	.562	1.32	2203
.27	.343	1.03	2703	.406	1.18	2703	.468	1.56	2703	.562	1.56	2703
.33	.375	1.03	3303	.437	1.18	3303	.515	1.56	3303	.578	1.70	3303
.39	.375	1.18	3903	.468	1.18	3903	.562	1.56	3903	.625	1.70	3903
.47	.406	1.18	4703	.515	1.18	4703	.609	1.56	4703	.687	1.70	4703
.56	.437	1.18	5603	.531	1.32	5603	.640	1.70	5603	.750	1.70	5603
.68	.484	1.18	6803	.515	1.56	6803	.703	1.70	6803	.796	1.82	6803
.82	.531	1.18	8203	.578	1.56	8203	.734	1.82	8203	.828	1.94	8203
1.0	.546	1.32	1004	.593	1.70	1004	.781	1.94	1004	.921	1.94	1004
1.25	.578	1.45	1254	.671	1.70	1254	—	—	—	—	—	—
1.50	.625	1.45	1504	.734	1.70	1504	—	—	—	—	—	—
2.0	.687	1.56	2004	.812	1.82	2004	—	—	—	—	—	—

TYPE 33M RATINGS AND DIMENSIONS

Capacity in Mfds.	100 VOLTS				200 VOLTS				400 VOLTS				600 VOLTS			
	T	W	L	Cat. No. 33M — K1	T	W	L	Cat. No. 33M — K2	T	W	L	Cat. No. 33M — K4	T	W	L	Cat. No. 33M — K6
.001	.125	.234	.40	1001	.125	.234	.40	1001	.109	.203	.53	1001	.109	.203	.53	1001
.0012	.125	.234	.40	1201	.125	.234	.40	1201	.109	.203	.53	1201	.109	.203	.53	1201
.0015	.125	.234	.40	1501	.125	.234	.40	1501	.125	.234	.53	1501	.125	.234	.53	1501
.0018	.125	.234	.40	1801	.125	.234	.40	1801	.125	.234	.53	1801	.125	.234	.53	1801
.0022	.125	.234	.40	2201	.125	.234	.40	2201	.125	.234	.53	2201	.125	.234	.53	2201
.0027	.125	.234	.40	2701	.125	.234	.40	2701	.125	.234	.53	2701	.125	.234	.53	2701
.0033	.125	.234	.40	3301	.125	.234	.40	3301	.125	.234	.53	3301	.140	.281	.53	3301
.0039	.125	.234	.40	3901	.125	.234	.40	3901	.125	.234	.53	3901	.140	.265	.53	3901
.0047	.125	.234	.40	4701	.125	.234	.40	4701	.125	.234	.53	4701	.125	.265	.65	4701
.0056	.125	.234	.40	5601	.125	.234	.40	5601	.125	.234	.53	5601	.125	.250	.65	5601
.0068	.125	.234	.40	6801	.125	.234	.40	6801	.125	.234	.53	6801	.125	.250	.65	6801
.0082	.125	.234	.40	8201	.125	.234	.40	8201	.140	.234	.53	8201	.140	.265	.65	8201
.01	.125	.234	.40	1002	.140	.250	.40	1002	.156	.250	.53	1002	.156	.281	.65	1002
.012	.125	.234	.40	1202	.171	.265	.40	1202	.171	.265	.53	1202	.171	.312	.65	1202
.015	.140	.234	.40	1502	.187	.281	.40	1502	.187	.312	.53	1502	.203	.328	.65	1502
.018	.156	.250	.40	1802	.140	.234	.53	1802	.140	.281	.65	1802	.171	.312	.78	1802
.022	.171	.281	.40	2202	.156	.250	.53	2202	.171	.296	.65	2202	.203	.343	.78	2202
.027	.203	.296	.40	2702	.171	281	.53	2702	.156	.281	.78	2702	.234	.359	.78	2702
.033	.140	.250	.53	3302	.156	.250	.65	3302	.171	.312	.78	3302	.218	.343	.90	3302
.039	.125	.234	.65	3902	.171	.265	.65	3902	.203	.328	.78	3902	.250	.375	.90	3902
.047	.140	.250	.65	4702	.171	.312	.65	4702	.203	.375	.78	4702	.281	.406	.90	4702
.056	.156	.265	.65	5602	.203	.328	.65	5602	.187	.359	.90	5602	.281	.453	.90	5602
.068	.187	.281	.65	6802	.218	.359	.65	6802	.218	.390	.90	6802	.312	.500	.90	6802
.082	.187	.312	.65	8202	.218	.343	.78	8202	.250	.421	.90	8202	.281	.453	1.18	8202
.1	.187	.312	.78	1003	.234	.375	.78	1003	.281	.453	.90	1003	.312	.500	1.18	1003
.12	.203	.328	.78	1203	.218	.390	.90	1203	.250	.421	1.18	1203	.343	.515	1.18	1203
.15	.234	.359	.78	1503	.250	.421	.90	1503	.281	.484	1.18	1503	.390	.578	1.18	1503
.18	.218	.328	.90	1803	.234	.437	1.03	1803	.312	.515	1.32	1803	.406	.578	1.32	1803
.22	.250	.359	.90	2203	.265	.468	1.03	2203	.359	.562	1.32	2203	.468	.640	1.32	2203
.27	.234	.406	1.03	2703	.281	.484	1.18	2703	.343	.546	1.56	2703	.437	.640	1.56	2703
.33	.265	.437	1.03	3303	.328	.515	1.18	3303	.390	.593	1.56	3303	.468	.671	1.70	3309
.39	.265	.453	1.18	3903	.359	.562	1.18	3903	.437	.640	1.56	3903	.500	.703	1.70	3903
.47	.296	.500	1.18	4703	.406	593	1.18	4703	.484	.687	1.56	4703	.562	.765	1.70	4703
.56	.328	.531	1.18	5603	.406	609	1.32	5603	.515	.718	1.70	5603	.625	.828	1.70	5603
.68	.375	.562	1.18	6803	.406	.609	1.56	6803	.578	.781	1.70	6803	.656	.875	1.82	6803
.82	.421	.609	1.18	8203	.453	.656	1.56	8203	.609	.812	1.82	8203	.703	.906	1.94	8203
1.0	.437	.625	1.32	1004	.484	.687	1.70	1004	.656	.859	1.94	1004	.781	.984	1.94	1004
1.25	.453	.656	1.45	1254	.453	.859	1.70	1254	—	—	—	—	—	—	—	—
1.50	.515	.718	1.45	1504	.515	.906	1.70	1504	—	—	—	—	—	—	—	—
2.0	.468	.875	1.56	2004	.578	.984	1.82	2004	—	—	—	—	—	—	—	—

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203" Dia., #22 AWG TCW: from .204" thru .312" Dia., #20 AWG TCW : /313" Dia. and over. **CAPACITY TOLERANCE: STANDARD** . . . ±10% / OTHER . . . from ±20% to ±1%. Other values as well as voltage ratings are available on request.

*DuPONT REGISTERED TRADEMARK

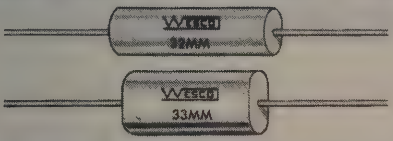
J K ELECTRONICS, INC d/b/a

WESCO® ELECTRICAL COMPANY

201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301

WESCO®

METALIZED POLYESTER CAPACITORS



SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 30,000 megohms-microfarads, but need not exceed 30,000 megohms.

DISSIPATION FACTOR

Shall not exceed 1.0% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

FEATURES

Wrap and fill construction
Tubular and oval configuration for optimum space savings
Extended foil design
Miniature size — lightweight
Low dissipation factor
Excellent stability
Quality control procedures per Mil-Q-9858

APPLICATIONS

Data Processing Equipment
Aircraft and Missile Systems
Industrial Instrumentation
Navigation and Distance Measuring Equipment
Communications Equipment
Tachometers
Filters
Peripheral Equipment

32MM RATINGS AND DIMENSIONS

Capacity in Mfds.	35 VDC		50 VDC		100 VDC		200 VDC		400 VDC		600 VDC	
	D	L	D	L	D	L	D	L	D	L	D	L
.0068	—	—	—	—	—	—	—	—	.218	.53	.312	.53
.0082	—	—	—	—	—	—	—	—	.234	.53	.171	.65
.01	—	—	—	—	—	—	—	—	.265	.53	.250	.65
.012	—	—	—	—	—	—	—	—	.203	.65	.265	.65
.015	—	—	—	—	—	—	—	—	.218	.65	.296	.65
.018	—	—	—	—	—	—	.203	.40	.234	.65	.328	.65
.022	—	—	—	—	—	—	.218	.40	.250	.65	.375	.65
.027	—	—	—	—	.171	.40	.234	.40	.265	.65	.390	.65
.033	—	—	—	—	.187	.40	.265	.40	.296	.65	.437	.65
.039	—	—	—	—	.187	.40	.203	.53	.234	.90	.328	.90
.047	—	—	—	—	.203	.40	.218	.53	.265	.90	.375	.90
.056	—	—	—	—	.218	.40	.234	.53	.265	.90	.390	.90
.068	—	—	—	—	.250	.40	.250	.53	.296	.90	.437	.90
.082	—	—	—	—	.187	.53	.265	.53	.328	.90	.468	.90
.1	—	—	—	—	.203	.53	.281	.53	.343	.90	.515	.90
.12	—	—	—	—	.218	.53	.312	.53	.328	1.18	.453	1.18
.15	—	—	—	—	.234	.53	.343	.53	.343	1.18	.515	1.18
.18	—	—	.187	.40	.250	.53	.296	.65	.375	1.18	.562	1.18
.22	—	—	.203	.40	.234	.65	.328	.65	.406	1.18	.625	1.18
.27	.171	.40	.218	.40	.250	.65	.359	.65	.453	1.18	.687	1.18
.33	.187	.40	.234	.40	.265	.65	.406	.65	.437	1.45	.656	1.45
.39	.203	.40	.250	.40	.281	.65	.437	.65	.468	1.45	.703	1.45
.47	.218	.40	.187	.53	.312	.65	.468	.65	.515	1.45	.781	1.45
.56	.250	.40	.203	.53	.343	.65	.406	.90	.546	1.45	.843	1.45
.68	.171	.53	.218	.53	.375	.65	.437	.90	.609	1.45	.921	1.45
.82	.187	.53	.250	.53	.359	.78	.406	1.18	.593	1.70	.906	1.70
1.00	.203	.53	.218	.65	.390	.78	.437	1.18	.656	1.70	1.000	1.70
1.25	.234	.53	.234	.65	.421	.78	.500	1.18	.734	1.70	1.171	1.70
1.50	.250	.53	.265	.65	.421	.90	.531	1.18	.796	1.70	1.265	1.70
1.80	.218	.65	.281	.65	.453	.90	.593	1.18	.875	1.70	1.375	1.70
2.00	.234	.65	.312	.65	.484	.90	.625	1.18	.921	1.70	1.406	1.70
3.00	.281	.65	.312	.78	.484	1.18	.656	1.45	—	—	—	—
4.00	.343	.65	.375	.78	.562	1.18	.750	1.45	—	—	—	—
5.00	.375	.65	.421	.78	.625	1.18	.765	1.70	—	—	—	—
8.00	.390	.78	.453	.90	.703	1.45	.828	2.06	—	—	—	—
10.00	.390	.90	.453	1.03	.781	1.45	.921	2.06	—	—	—	—
15.00	.468	.90	.546	1.03	—	—	—	—	—	—	—	—
20.00	.546	.90	.593	1.18	—	—	—	—	—	—	—	—
25.00	.500	1.18	.656	1.18	—	—	—	—	—	—	—	—
30.00	.562	1.18	.718	1.18	—	—	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/OTHER . . . from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity Tolerance, VDC Rating and Date Code. (Note: On smaller units, ⑦ trademark will be substituted for WESCO logo.)

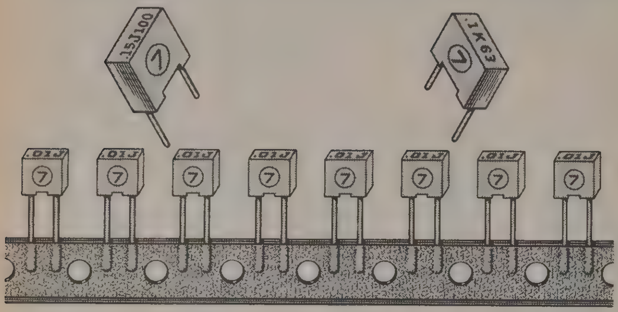
33MM RATINGS AND DIMENSIONS

Capacity in Mfds.	35 VDC			50 VDC			100 VDC			200 VDC			400 VDC			600 VDC		
	T	W	L	T	W	L	T	W	L	T	W	L	T	W	L	T	W	L
.0068	—	—	—	—	—	—	—	—	—	—	—	—	.140	.281	.53	.234	.359	.53
.0082	—	—	—	—	—	—	—	—	—	—	—	—	.156	.296	.53	.078	.218	.65
.01	—	—	—	—	—	—	—	—	—	—	—	—	.187	.312	.53	.171	.296	.65
.012	—	—	—	—	—	—	—	—	—	—	—	—	.125	.250	.65	.140	.281	.65
.015	—	—	—	—	—	—	—	—	—	—	—	—	.140	.265	.65	.203	.343	.65
.018	—	—	—	—	—	—	—	—	—	—	—	—	.156	.281	.65	.218	.421	.65
.022	—	—	—	—	—	—	—	—	—	.140	.281	.40	.171	.312	.65	.250	.437	.65
.027	—	—	—	—	—	—	.109	.203	.40	.156	.296	.40	.203	.328	.65	.281	.484	.65
.033	—	—	—	—	—	—	.125	.218	.40	.187	.312	.40	.218	.359	.65	.312	.531	.65
.039	—	—	—	—	—	—	.125	.234	.40	.125	.250	.53	.156	.296	.90	.218	.421	.90
.047	—	—	—	—	—	—	.140	.250	.40	.140	.265	.53	.171	.312	.90	.250	.437	.90
.056	—	—	—	—	—	—	.156	.265	.40	.156	.281	.53	.187	.328	.90	.265	.468	.90
.068	—	—	—	—	—	—	.187	.281	.40	.171	.296	.53	.218	.343	.90	.312	.515	.90
.082	—	—	—	—	—	—	.109	.234	.53	.187	.312	.53	.218	.390	.90	.343	.562	.90
.1	—	—	—	—	—	—	.125	.250	.53	.203	.343	.53	.250	.421	.90	.390	.593	.90
.12	—	—	—	—	—	—	.140	.265	.53	.234	.359	.53	.218	.390	1.18	.343	.546	1.18
.15	—	—	—	—	—	—	.156	.281	.53	.265	.390	.53	.250	.421	1.18	.390	.596	1.18
.18	—	—	—	.125	.218	.40	.187	.312	.53	.234	.359	.65	.281	.453	1.18	.437	.640	1.18
.22	—	—	—	.140	.234	.40	.156	.281	.65	.250	.390	.65	.296	.500	1.18	.500	.687	1.18
.27	.109	.203	.40	.156	.250	.40	.171	.296	.65	.281	.406	.65	.343	.531	1.18	.562	.765	1.18
.33	.125	.218	.40	.187	.265	.40	.187	.312	.65	.281	.484	.65	.312	.515	1.45	.531	.734	1.45
.39	.140	.234	.40	.218	.296	.40	.218	.343	.65	.312	.515	.65	.343	.546	1.45	.578	.781	1.45
.47	.156	.250	.40	.125	.218	.53	.234	.359	.65	.359	.562	.65	.390	.578	1.45	.640	.843	1.45
.56	.187	.265	.40	.156	.250	.53	.250	.406	.65	.281	.484	.90	.437	.625	1.45	.718	.921	1.45
.68	.218	.296	.53	.187	.265	.53	.281	.437	.65	.328	.515	.90	.484	.687	1.45	.796	1.000	1.45
.82	.140	.234	.53	.187	.296	.53	.250	.421	.78	.296	.484	1.18	.468	.671	1.70	.781	.984	1.70
1.0	.156	.250	.53	.156	.250	.65	.281	.453	.78	.328	.531	1.18	.531	.734	1.70	.875	1.078	1.70
1.25	.187	.265	.53	.187	.281	.65	.312	.515	.78	.375	.578	1.18	.609	.812	1.70	1.062	1.265	1.70
1.50	.187	.281	.53	.203	.296	.65	.296	.500	.90	.421	.625	1.18	.671	.875	1.70	1.156	1.359	1.70
1.80	.187	.250	.65	.218	.312	.65	.328	.515	.90	.406	.687	1.18	.750	.953	1.70	1.265	1.484	1.70
2.0	.187	.265	.65	.234	.343	.65	.359	.562	.90	.421	.718	1.18	.796	1.000	1.70	1.281	1.484	1.70
3.0	.218	.312	.65	.234	.359	.78	.375	.578	1.18	.460	.765	1.45	—	—	—	—	—	—
4.0	.265	.359	.65	.281	.406	.78	.406	.703	1.18	.625	.828	1.45	—	—	—	—	—	—
5.0	.296	.406	.65	.328	.453	.78	.453	.750	1.18	.640	.828	1.70	—	—	—	—	—	—
8.0	.312	.437	.78	.375	.500	.90	.531	.828	1.45	.656	.953	2.06	—	—	—	—	—	—
10.0	.312	.437	.90	.375	.500	1.03	.609	.906	1.45	.750	1.046	2.06	—	—	—	—	—	—
15.0	.390	.515	.90	.468	.593	1.03	—	—	—	—	—	—	—	—	—	—	—	—
20.0	.453	.578	.90	.500	.640	1.18	—	—	—	—	—	—	—	—	—	—	—	—
25.0	.437	.562	1.18	.578	.703	1.18	—	—	—	—	—	—	—	—	—	—	—	—
30.0	.468	.593	1.18	.656	.781	1.18	—	—	—	—	—	—	—	—	—	—	—	—

STANDARD LEAD SIZES: Refer to equivalent rating in type 32MM above. **CAPACITY TOLERANCE:** STANDARD . . . ±10%/OTHER . . . from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** For marking and lead material see type 32MM above.

J K ELECTRONICS, INC d/b/a
WESCO® ELECTRICAL COMPANY
201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301
Telephone: 413-774-4358

WESCO METALIZED POLYESTER CAPACITORS "BOX" CAPACITORS



TYPE 60MM

Capacity in MFD.	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code	250 VDC 160 VAC Case Code	400 VDC 200 VAC Case Code	630 VDC 220 VAC Case Code
.001-.01	—	—	—	—	G
.022	—	—	—	G	O
.047	—	—	G	L	P
.1	—	—	L	P	R
.22	G	K	L	R	W
.47	K	L	R	W	—
1.0	L	U	W	Z	—

TYPE 67MM

Capacity in MFD.	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code	250 VDC 160 VAC Case Code	400 VDC 200 VAC Case Code	630 VDC 250 VAC Case Code
.001-.0033	—	—	—	—	C
.0047	—	—	—	C	F
.01	—	—	C	F	J
.047	—	C	F	—	—
.1	C	F	J	—	—
.22	F	J	—	—	—
.47	J	—	—	—	—
1.0	N	—	—	—	—

TYPE 68MM

Capacity in MFD.	50 VDC 30 VAC Case Code	63 VDC 40 VAC Case Code	100 VDC 63 VAC Case Code
.001-.022	—	—	A
.033-.068	—	A	—
.1	A	B	—
.22	D	E	—
.47	H	I	—
1.0	M	—	—

SPECIFICATIONS

TEMPERATURE RANGE
−55°C to +85°C. To +100°C with 50% voltage derating.

DIELECTRIC WITHSTANDING VOLTAGE
160% of rated voltage for 2 seconds at 25°C.

DISSIPATION FACTOR
Shall not exceed 1.0% when measured at 25°C at 1KHz ±20Hz.

CAPACITANCE TOLERANCE
Standard ±20%. ±10% and ±5% available upon request. Measurements will be made at 25°C and 1KHz ±20Hz.

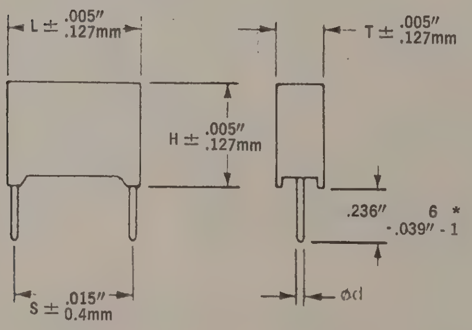
LIFE TEST
Shall withstand 125% of rated voltage at 85°C for 1000 hours.

HUMIDITY RESISTANCE
Meets requirements of MIL-STD-202, Method 103B, condition B.

TERMINALS
Tinned solid copper wire.

MARKING
Capacitance, tolerance, voltage (VDC), WESCO trademark ⑦.
(Exception: Certain values due to size limitation, will display capacitance, tolerance and ⑦ only.)
Tolerance Codings: M = ±20%, K = ±10%, J = ±5%.

RESISTANCE TO SOLDERING HEAT
During soldering operation, maximum heat of +260°C may be applied to leads for no longer than 6 seconds.



* Except for type 68MM which is: 0.157″ ± .04″ 4mm + 1

DIMENSIONS

Case Code	T mm	T in	H mm	H in	L mm	L in	S mm	S in	d mm	d in
A	2.5	.098	6.5	.256	7.2	.284	5	.197	0.6	.025
B	3	.118	6.5	.256	7.2	.284	5	.197	0.6	.025
C	3.5	.138	6.5	.256	10.5	.414	7.5	.295	0.6	.025
D	3.5	.138	7.5	.295	7.2	.284	5	.197	0.6	.025
E	3.5	.138	8.5	.335	7.2	.284	5	.197	0.6	.025
F	4	.158	9	.355	10.5	.414	7.5	.295	0.6	.025
G	4	.158	9	.355	13	.512	10	.394	0.8	.032
H	4.5	.177	9.5	.374	7.2	.284	5	.197	0.6	.025
I	5	.197	10	.394	7.2	.284	5	.197	0.6	.025
J	5	.197	11	.433	10.5	.414	7.5	295	0.8	.032
K	5	.197	11	.433	13	.512	10	.394	0.8	.032
L	5	.197	11	.433	18	.709	15	.591	0.8	.032
M	6	.236	11	.433	7.2	.284	5	.197	0.6	.025
N	6	.236	12	.473	10.5	.414	7.5	.295	0.8	.032
O	6	.236	12	.173	13	.512	10	.394	0.8	.032
P	6	.236	12	.473	18	.709	15	.591	0.8	.032
Q	6	.236	15	.591	26.5	1.044	20	.788	0.8	.032
R	6	.236	15	.591	26.5	1.044	22.5	.886	0.8	.032
S	7	.276	16	.630	26.5	1.044	20	.788	0.8	.032
T	7	.276	16	.630	26.5	1.044	22.5	.886	0.8	.032
U	7.5	.295	13.5	.532	18	.709	15	.591	0.8	.032
V	8.5	.335	14.5	.571	18	.709	15	.591	0.8	.032
W	8.5	.335	17	.670	26.5	1.044	22.5	.886	0.8	.032
X	9	.355	17	.670	32	1.26	27.5	1.083	0.8	.032
Y	10	.394	18.5	.729	26.5	1.044	22.5	.886	0.8	.032
Z	11	.433	20	.788	32	1.26	27.5	1.083	0.8	.032

J K ELECTRONICS, INC d/b/a
WESCO ELECTRICAL COMPANY
201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301

WESCO® POLYSTYRENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 500,000 megohms-microfarads, but need not exceed 500,000 megohms.

DISSIPATION FACTOR

Shall not exceed .05% when measured at 25°C and 1000 Hz, ± Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT

Capacitance shall change linearly over operating temperature range at rate of −105, ±30 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)

Less than .05% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied.

TYPE 32P RATINGS & DIMENSIONS

Capacity in Mfds.	100 VOLTS			200 VOLTS			400 VOLTS		
	D	L	Cat. No. 32P — J-1	D	L	32P Cat. No. — J-2	D	L	Cat. No. 32P — J-4
.001	.187	.53	1001	.187	.53	1001	.187	.53	1001
.0012	.187	.53	1201	.187	.53	1201	.187	.53	1201
.0015	.187	.53	1501	.187	.53	1501	.187	.53	1501
.0018	.187	.65	1801	.187	.65	1801	.187	.65	1801
.0022	.187	.65	2201	.187	.65	2201	.187	.65	2201
.0027	.187	.65	2701	.187	.65	2701	.187	.65	2701
.0033	.187	.65	3301	.187	.65	3301	.187	.65	3301
.0039	.187	.65	3901	.187	.65	3901	.187	.65	3901
.0047	.187	.65	4701	.187	.65	4701	.234	.65	4701
.0056	.187	.65	5601	.187	.65	5601	.250	.65	5601
.0068	.187	.65	6801	.187	.65	6801	.234	.78	6801
.0082	.187	.65	8201	.203	.65	8201	.250	.78	8201
.01	.203	.65	1002	.234	.65	1002	.265	.78	1002
.012	.218	.65	1202	.218	.78	1202	.296	.78	1202
.015	.234	.65	1502	.250	.78	1502	.328	.78	1502
.018	.234	.78	1802	.265	.78	1802	.359	.78	1802
.022	.250	.78	2202	.281	.78	2202	.343	.90	2202
.027	.265	.78	2702	.312	.78	2702	.375	.90	2702
.033	.296	.78	3302	.343	.78	3302	.406	.90	3302
.039	.328	.78	3902	.375	.78	3902	.453	.90	3902
.047	.343	78	4702	.359	.90	4702	437	1.03	4702
.056	.375	.78	5602	.390	.90	5602	.484	1.03	5602
.068	.375	.90	6802	.421	.90	6802	.484	1.18	6802
.082	.406	.90	8202	.421	1.03	8202	.531	1.18	8202
.1	.453	.90	1003	.468	1.03	1003	.578	1.18	1003
.12	.484	.90	1203	.515	1.03	1203	.625	1.18	1203
.15	.500	1.03	1503	.531	1.18	1503	.656	1.32	1503
.18	.531	1.03	1803	.578	1.18	1803	.671	1.45	1803
.22	.546	1.18	2203	.640	1.18	2203	.671	1.70	2203
.27	.609	1.18	2703	.656	1.32	2703	.734	1.70	2703
.33	.625	1.32	3303	.687	1.45	3303	.812	1.70	3303
.39	.671	1.32	3903	.750	1.45	3903	—	—	—
.47	.703	1.45	4703	.734	1.70	4703	—	—	—

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203″ Dia.
#22 AWG TCW: from .204″ thru .312″ Dia.
#20 AWG TCW: .313″ Dia.and over

CAPACITY TOLERANCE: STANDARD . . . ±5% / OTHER . . . from ±20% to ±1%
Other values as well as voltage ratings are available upon request.

METALIZED POLYCARBONATE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 50,000 megohms-microfarads, but need not exceed 50,000 megohms.

DISSIPATION FACTOR

Shall not exceed 0.3% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90 ° in the opposite direction with no evidence of breakage.

TYPE 32MPC RATINGS & DIMENSIONS

WESCO
32MPC

Capacity in Mfds.	50 VOLTS			100 VOLTS			200 VOLTS		
	D	L	Cat. No. 32MPC — K-05	D	L	Cat. No. 32MPC — K-1	D	L	Cat. No. 32MPC — K-2
.012	—	—	—	—	—	—	.171	.40	1202
.015	—	—	—	—	—	—	.187	.40	1502
.018	—	—	—	—	—	—	.203	.40	1802
.022	—	—	—	.156	.40	2202	.218	.40	2202
.027	—	—	—	.171	.40	2702	.234	.40	2702
.033	—	—	—	.171	.40	3302	.250	.40	3302
.039	—	—	—	.187	.40	3902	.187	.53	3902
.047	—	—	—	.203	.40	4702	.203	.53	4702
.056	—	—	—	.218	.40	5602	.218	.53	5602
.068	—	—	—	.234	.40	6802	.234	.53	6802
.082	.156	.40	8202	.187	.53	8202	.265	.53	8202
.1	.171	.40	1003	.203	.53	1003	.234	.65	1003
.12	.187	.40	1203	.218	.53	1203	.250	.65	1203
.15	.203	.40	1503	.234	.53	1503	281	.65	1503
.18	.218	.40	1803	.250	.53	1803	.296	.65	1803
.22	.171	.53	2203	.265	.53	2203	.328	.65	2203
.27	.187	.53	2703	.250	.65	2703	.312	.78	2703
.33	.203	.53	3303	.265	.65	3303	.343	.78	3303
.39	.203	.53	3903	.281	.65	3903	.359	.78	3903
.47	.218	.53	4703	.312	.65	4703	.406	.78	4703
.56	.250	53	5603	.328	.65	5603	.390	.90	5603
.68	.218	.65	6803	.328	.78	6803	.421	.90	6803
.82	.234	.65	8203	.343	.78	8203	.468	.90	8203
1.0	.265	.65	1004	.375	.78	1004	.515	.90	1004
1.25	.296	.65	1254	.421	.78	1254	.484	1.18	1254
1.50	.312	.65	1504	.453	.78	1504	.531	1.18	1504
1.80	.328	.78	1804	.453	.90	1804	.578	1.18	1804
2.0	.343	.78	2004	.468	.90	2004	.609	1.18	2004
3.0	.390	.78	3004	.484	1.18	3004	.656	1.45	3004
4.0	.437	.78	4004	.546	1.18	4004	.750	1.45	4004
5.0	.437	.90	5004	.531	1.45	5004	.734	1.78	5004
8.0	.468	1.18	8004	.593	1.78	8004	.859	2.06	8004
10.0	.515	1.18	1005	.656	1.78	1005	.953	2.06	1005

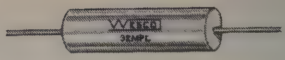
STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203″ Dia.
#22 AWG TCW: from .204″ thru .312″ Dia.
#20 AWG TCW: .313″ Dia.and over

CAPACITY TOLERANCE: STANDARD . . . ±10% / OTHER . . . from ±20% to ±2%
Other values as well as voltage ratings are available upon request.

J K ELECTRONICS, INC d/b/a
WESCO® ELECTRICAL COMPANY
201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301
Telephone: 413-774-4358

WESCO

METALIZED POLYPROPYLENE CAPACITORS



SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR

Shall not exceed 0.1% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 105°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT

Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)

Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in precent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE

−55°C to +105°C with full rated voltage applied.

DIELECTRIC ABSORPTION

Shall not exceed .05% when tested in accordance with Mil-C-19978.

TYPE 32MPL RATINGS AND DIMENSIONS

Capacity In Mfds.	100 VDC			200 VDC			400 VDC		
	D	L	Cat No. 32MPL — K-1	D	L	Cat No. 32MPL — K-2	D	L	Cat No. 32MPL — K-4
.01	.171	.406	1002	.171	.406	1002	.187	.531	1002
.012	.171	.406	1202	.171	.406	1202	.203	.531	1202
.015	.171	.406	1502	.187	.406	1502	.234	.531	1502
.018	.171	.406	1802	.203	.406	1802	.250	.531	1802
.022	.171	.406	2202	.171	.531	2202	.265	.531	2202
.027	.171	.406	2702	.171	.531	2702	.296	.531	2702
.033	.187	.406	3302	.187	.531	3302	.312	.531	3302
.039	.203	.406	3902	.203	.531	3902	.343	.531	3902
.047	.218	.406	4702	.218	.531	4702	.281	.656	4702
.056	.234	.406	5602	.234	.531	5602	.312	.656	5602
.068	.187	.531	6802	.250	.531	6802	.343	.656	6802
.082	.187	.531	8202	.275	.531	8202	.375	.656	8202
.1	.218	.531	1003	.250	.656	1003	.343	.781	1003
.12	.234	.531	1203	.265	.656	1203	.375	.781	1203
.15	.250	.531	1503	.296	.656	1503	.421	.781	1503
.18	.275	.531	1803	.328	.656	1803	.453	.781	1803
.22	.312	.531	2203	.359	.656	2203	.437	.906	2203
.27	.328	.531	2703	.359	.781	2703	.484	.906	2703
.33	.281	.656	3303	.375	.781	3303	.546	.906	3303
.39	.312	.656	3903	.406	.781	3903	.578	.906	3903
.47	.343	.656	4703	.390	.906	4703	.531	1.187	4703
.56	.375	.656	5603	.437	.906	5603	.578	1.187	5603
.68	.375	.781	6803	.484	.906	6803	.625	1.187	6803
.82	.390	.781	8203	.515	.906	8203	.687	1.187	8203
1.0	.421	.781	1004	.484	1.187	1004	.671	1.437	1004
1.25	.421	.906	1254	.531	1.187	1254	.750	1.437	1254
1.50	.453	.906	1504	.578	1.187	1504	.812	1.437	1504
1.80	.500	.906	1804	.640	1.187	1804	.796	1.687	1804
2.00	.515	.906	2004	.671	1.187	2004	.843	1.687	2004
3.00	.531	1.187	3004	.718	1.437	3004	1.03	1.687	3004
4.00	.609	1.187	4004	.828	1.437	4004	—	—	—
5.00	.671	1.187	5004	.828	1.687	5004	—	—	—
8.00	.750	1.437	8004	.937	2.062	8004	—	—	—
10.00	.843	1.437	1005	1.03	2.062	1005	—	—	—
12.00	.828	1.687	1205	—	—	—	—	—	—
15.00	.921	1.687	1505	—	—	—	—	—	—

STANDARD LEAD SIZES: #24 AWG: up to and including .203″ Dia.
#22 AWG: from .204″ thru .312″ Dia.
#20 AWG: .313″ Dia. and over

STANDARD LEAD MATERIAL: SOLID TINNED COPPER WIRE.

CAPACITY STANDARD: STANDARD . . . ±5%/OTHER . . . FROM ±20% TO ±1%.

OTHER VALUES AS WELL AS VOLTAGE RATINGS ARE AVAILABLE UPON REQUEST.

LIMITED WARRANTY

Seller warrants the products sold shall conform to specifications and be free from defects in material and workmanship furnished by Seller, which develop under normal and intended use. The **sole liability** of Seller, whether based upon breach of warranty or contract or negligence, shall be limited to repair or replacement, at Seller's election, of all such defective or nonconforming products, upon return f.o.b. to Seller's factory, provided Buyer has given Seller notice in writing of such defect or nonconformity within ninety days after delivery by Seller of such items to Buyer.

Seller assumes no liability for 1) incidental, collateral or consequential damages; 2) applications in combination with any electrical or electronic components other than as intended by Seller; 3) damages of any kind incurred by Buyer from modifications made to the products without written consent of Seller.

The foregoing constitutes the sole and exclusive remedy of Buyer and the exclusive liability of Seller and IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, DESCRIPTION, QUALITY OR PRODUCTIVENESS.

J K ELECTRONICS, INC d/b/a
WESCO ELECTRICAL COMPANY
201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301
Telephone: 413-774-4358

WESCO®

POLYPROPYLENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 250,000 megohms-microfarads, but need not exceed 250,000 megohms.

DISSIPATION FACTOR

Shall not exceed .05% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 105°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT

Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)

Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para 3.12 when tested in accordance with Mil-STD.-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE

−55°C to +105°C with full rated voltage applied.

TYPE 32PL
RATINGS & DIMENSIONS

Capacity in Mfds.	100 VOLTS			200 VOLTS			400 VOLTS		
	D	L	Cat.No. 32PL — K-1	D	L	Cat.No. 32PL — K-2	D	L	Cat.No. 32PL — K-4
.0010	.187	.406	1001	.187	.406	1001	.187	.406	1001
.0015	.187	.406	1501	.187	.406	1501	.203	.406	1501
.0022	.187	.406	2201	.187	.406	2201	.234	.406	2201
.0033	.187	.406	3301	.187	.406	3301	.187	.531	3301
.0039	.187	.406	3901	.203	.406	3901	.187	.531	3901
.0047	.187	.406	4701	.187	.531	4701	.203	.531	4701
.0056	.187	.406	5601	.187	.531	5601	.218	.531	5601
.0068	.187	.406	6801	.187	.531	6801	.234	.531	6801
.0082	.187	.406	8201	.187	.531	8201	.203	.656	8201
.0100	.203	.406	1002	.203	.531	1002	.218	.656	1002
.015	.219	.531	1502	.203	.656	1502	.265	.656	1502
.022	.250	.531	2202	.234	.656	2202	.312	.656	2202
.027	.265	.531	2702	.265	.656	2702	.328	.656	2702
.033	.234	.656	3302	.281	.656	3302	.328	.781	3302
.039	.250	.656	3902	.312	.656	3902	.359	.781	3902
.047	.281	.656	4702	.296	.781	4702	.390	.781	4702
.056	.281	.656	5602	.312	.781	5602	.421	.781	5602
.068	.296	.656	6802	.343	.781	6802	.406	.906	6802
.082	.312	.781	8202	.375	.781	8202	.437	.906	8202
.10	.344	.781	1003	.375	.906	1003	.484	.906	1003
.12	.375	.781	1203	.406	.906	1203	.453	1.156	1203
.15	.375	.906	1503	.453	.906	1503	.500	1.156	1503
.18	.406	.906	1803	.484	.906	1803	.546	1.156	1803
.22	.437	.906	2203	.484	1.031	2203	.687	1.156	2203
.27	.437	1.031	2703	.531	1.031	2703	.578	1.406	2703
.33	.500	1.031	3303	.593	1.031	3303	.640	1.406	3303
.39	.531	1.031	3903	.593	1.156	3903	.687	1.406	3903
.47	.531	1.156	4703	.656	1.156	4703	.750	1.406	4703
.56	.578	1.156	5603	.625	1.406	5603	.825	1.406	5603
.68	.625	1.156	6803	.687	1.406	6803	.825	1.656	6803
.82	.625	1.406	8203	.687	1.656	8203	.906	1.656	8203
1.0	.687	1.406	1004	.734	1.656	1004	1.000	1.656	1004

STANDARD LEAD SIZES: #24 AWG TCW: up to and including .203″ Dia.
#22 AWG TCW: from .204″ thru .312″ Dia.
#20 AWG TCW: .313″ Dia.and over

CAPACITY TOLERANCE: STANDARD . . . ±10% / OTHER . . . from 20% to ±1%
Other values as well as voltage ratings are available upon request.

FEATURES

32P

- Wrap and fill construction
- Excellent long-term stability
- Superior "Q" for tuned circuits
- High insulation resistance
- Linear temperature coefficient
- Quality control procedures per Mil-Q-9858
- Extended foil design

32MPC

- Wrap and fill construction
- Micro-miniature — lightweight
- Low dissipation factor
- Zero TC ±50 ppm/°C from +25°C to +55°C
- Extended foil design
- Excellent stability
- Quality control procedures per Mil-Q-9858

32PL & 32MPL

- Wrap and fill construction
- Excellent long-term stability
- Superior "Q" for tuned circuits
- High insulation resistance
- Linear temperature coefficient (−55°C to +85°C)
- Quality control procedures per Mil-Q-9858
- Extended foil design

APPLICATIONS

32P, 32PL & 32MPL

- Computers
- Data Processing Equipment
- Aircraft and Missile Systems
- Industrial Instrumentation
- Navigation and Distance Measuring Equipment
- Communications Equipment
- Timing and Retrace Circuits
- Integrating Networks
- High "Q" Low Loss Filters
- Peripheral Equipment

32MPC

- Data Processing Equipment
- Aircraft and Missile Systems
- Industrial Instrumentation
- Navigation and Distance Measuring Equipment
- Communications Equipment
- Tachometers
- Filters
- Peripheral Equipment

EXPLANATION OF CATALOG NUMBER

32 P 1002 K-1

32	Round, Wrap and Fill, with epoxy seals.
P	Polystyrene — Foil, Axial Leads*
1002	In Picofarads — first three digits are significant. Last digit specifies number of zeros, i.e., 1002 = 10,000 pfd. or 0.01 mfd.
K	Capacity Tolerance: K = ±10% H = ±3% F = ±1% M = ±20% J = ±5% G = ±2%
1	DC Voltage Rating: 05 = 50 VDC 2 = 200 VDC 6 = 600 VDC 1 = 100 VDC 4 = 400 VDC etc.
*	For Radial Leads, add letter "R" at end of part number.

J K ELECTRONICS, INC d/b/a

WESCO® ELECTRICAL COMPANY

201 MUNSON STREET • GREENFIELD • MASSACHUSETTS • 01301

Telephone: 413-774-4358

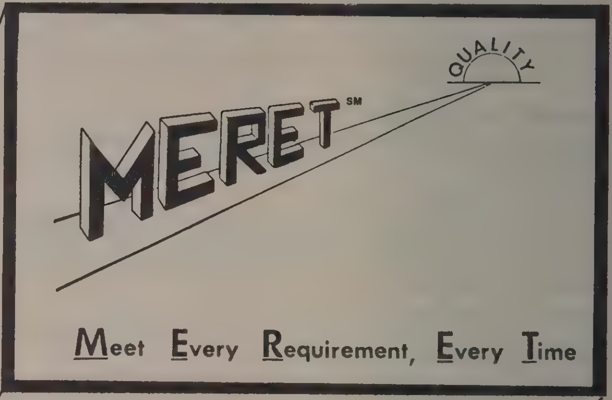
Nytronics Components Group, Inc.

Orange Street, Darlington, S.C. 29532

A SIGN FOR OUR TIMES

THIS BANNER IS PROMINENTLY DISPLAYED OVER OUR EMPLOYEE ENTRANCE . . . AS A DAILY REMINDER OF OUR . . .

MERET is a Nytronics Components Group, Inc. Service Mark for our quality improvement process, aimed at supplying components which Meet Every Requirement, Every Time.


QUALITY
MERET SM
Meet Every Requirement, Every Time

. . . QUALITY ATTITUDE

. . . WE STRIVE TO . . .

MERET.

(MEET EVERY REQUIREMENT EVERY TIME)

. . . ESPECIALLY . . .

YOUR COMPONENT REQUIREMENTS

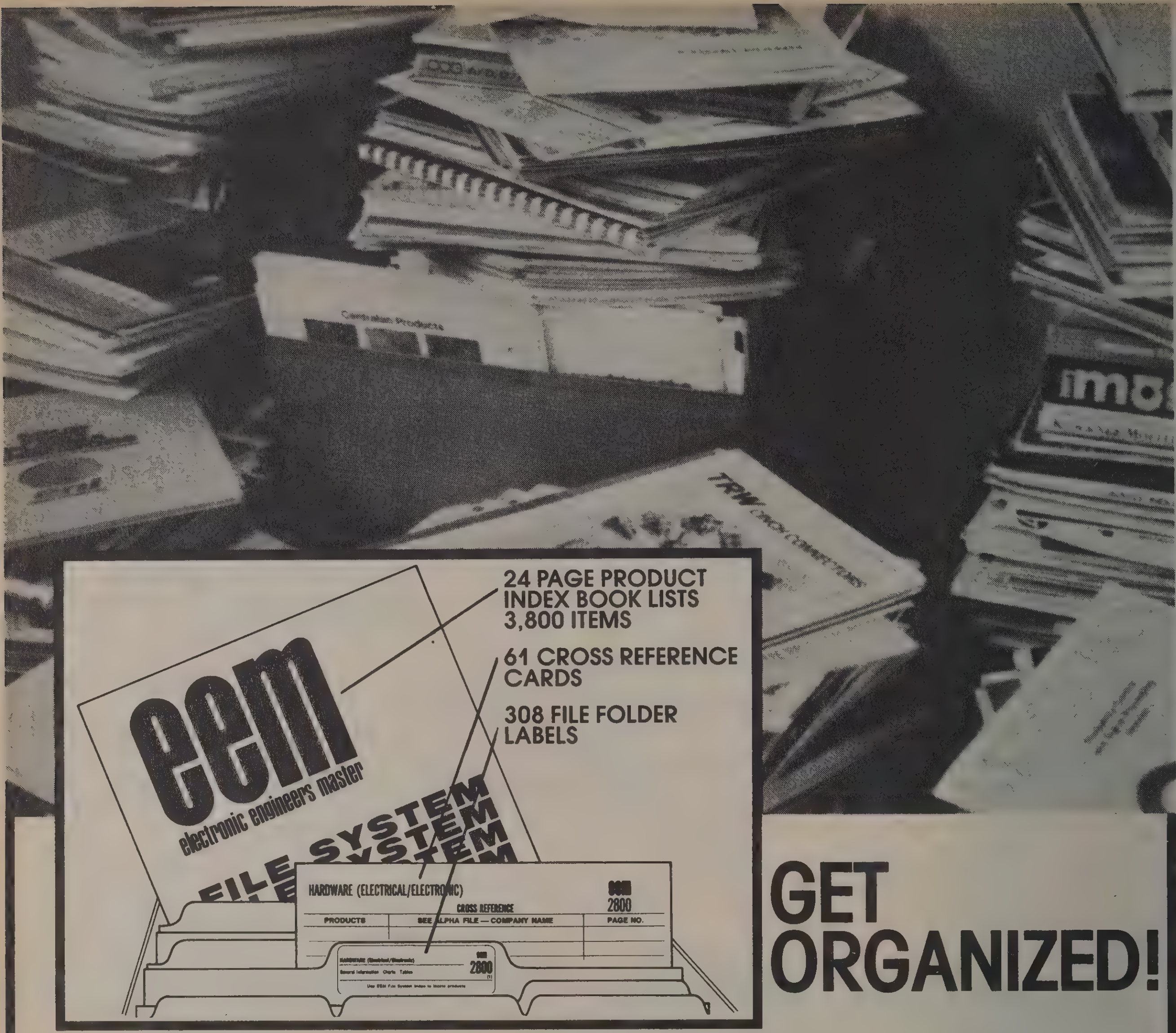
Inductors
page 1A•1248-1267
Capacators
page 1A•1160-1172
Delay Lines
page 1A•1554-1557
Resistors
page 1A•1907-1909

MERET
SHIPPING RECEIVING

COILS & CHOKES

Manufacturer	AF	RF	IF	High Q	Shielded	Variable (Adjustable)	Choke/Filter	Chip	Toroidal Inductors	Other	Type
Automatic Coil		1A•1222* 1A•1223*	1A•1222* 1A•1223*		1A•1222* 1A•1223*						
Bell Industries		1A•1224-1A•1228*		1A•1228	1A•1227*	1A•1227* 1A•1228	1A•1224-1A•1229*		1A•1224*		
Caddell-Burns	1A•1223*	1A•1223*	1A•1223*		1A•1223*	1A•1223*	1A•1223*		1A•1223*		
Coilcraft		1A•1232				1A•1232	1A•1230	1A•1231		1A•1230	Coil Kits
Dale Electronics		1A•1234* 1A•1235		1A•1236-1A•1239*	1A•1234*		1A•1234-1A•1242*		1A•1235-1A•1239*	1A•1235	Bobbins
Delevan		1A•1243			1A•1243	1A•1243			1A•1243	1A•1243	Bobbins
Endicott Coil									1A•1244		
Microtran	1A•1245			1A•1245					1A•1245		
North Hills		1A•1227		1A•1227	1A•1227	1A•1227					
Nytronics		1A•1249-1A•1267*		1A•1252*	1A•1249* 1A•1252* 1A•1254-1A•1259*	1A•1252* 1A•1253*					
OPT Industries	1A•1268* 1A•1269*										
Pico Electronics	1A•1271-1A•1275*			1A•1271-1A•1273*				1A•1274* 1A•1275*			
Piconics		1A•1277*				1A•1277*	1A•1227*	1A•1277*			
Renco Electronics	1A•1278-1A•1280*				1A•1278	1A•1280	1A•1278-1A•1280*		1A•1279 1A•1280		
TDK Corp.						1A•1281	1A•1281				
Toko America	1A•1282	1A•1282	1A•1282				1A•1282	1A•1282			
Torotel Prods.	1A•1284* 1A•1286-1A•1297*	1A•1283* 1A•1285*							1A•1286* 1A•1287* 1A•1290-1A•1297		
TRW Inductive Products	1A•1298* 1A•1300-1A•1305*	1A•1298* 1A•1299*		1A•1298* 1A•1299* 1A•1303*	1A•1298* 1A•1300*	1A•1298*		1A•1298*	1A•1298* 1A•1301-1A•1303*		
Vanguard		1A•1276*		1A•1276*		1A•1276*		1A•1276*	1A•1276*		
Wilco Corp.					1A•1306		1A•1306 1A•1307			1A•1306	Coil Kits

* Mil. Spec.


24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
2800
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
TRW

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

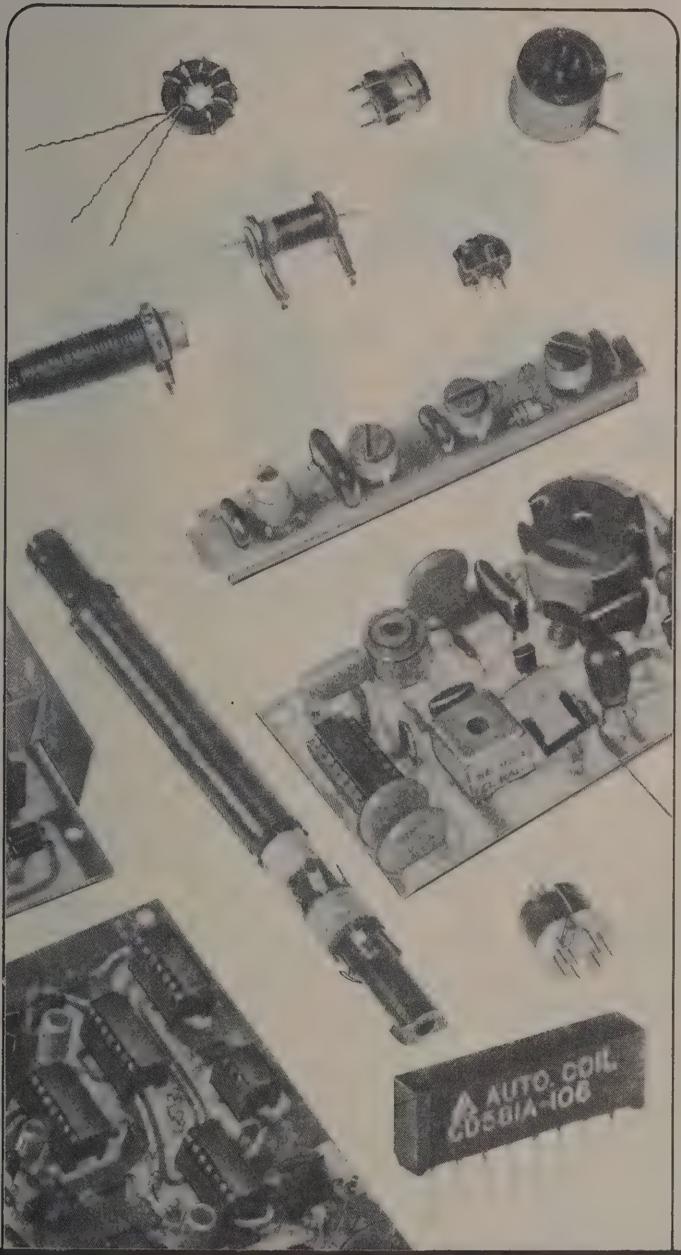
Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

Automatic Coil Corp.

Designers and manufacturers of inductive and electro-magnetic devices

SOLUTIONS TO YOUR SYSTEM DESIGN NEEDS



ASK FOR OUR FREE LITERATURE:

- ☐ COMMERCIAL & MILITARY COILS
- ☐ DELAY LINES
- ☐ ASSEMBLY SERVICES (Electrical/Mechanical)
- ☐ CONTRACT LABOR SERVICES

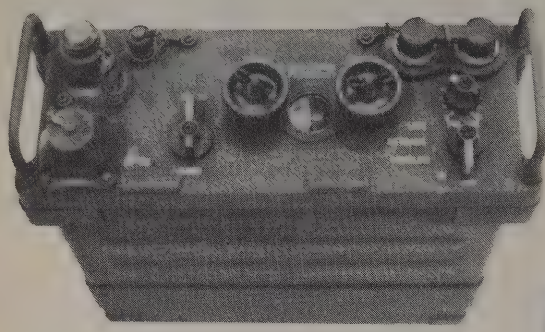
With its reputation for quality and service for over 30 years the Automatic Coil Corporation has firmly established itself as a leading manufacturer of custom designed inductive components. We offer a complete line of IF-RF coils, transformers, toroids, baluns, bobbins, delay lines, and related windings for commercial and military applications.

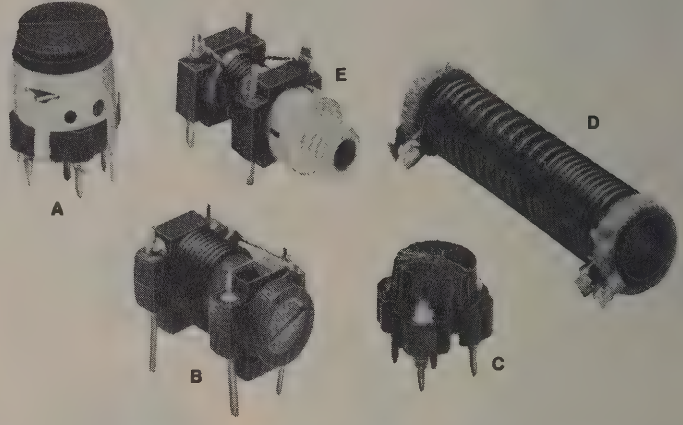
FOR ADDITIONAL INFORMATION ON YOUR CUSTOM REQUIREMENTS

CALL

Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.
Office:
Dept. E 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX 810-848-8097

AN/PRC—77 COILS





Automatic Coil is recognized as the worlds leading manufacturer of coils and transformers for U.S. Military Radios including the AN/PRC77 Manpack. The AN/PRC77 silicon transistorized radio set is a tactical manpack FM transceiver. It is capable of operating in a wideband mode from 30 to 76 MHz. The AN/PRC77 is compatible with FM radio sets operating in the same frequency range.

Module Number	Signal Corps Coil Part Numbers Used
A11A	SMD447522 (2)
A12A	SMD447523 (2), SMD447524 (2)
A17A	SMD447521
A18A	SMD447525, SMD447526 (2), SMD447527
A21A	SMD447518, SMD447519, SMD447520
A28	SMD447801, SMD447802, SMD447803, SMD447804
A31	SMD448919, SMD448921, SMD448923, SMD448925, SMD448927 (2), SMD449053
A32	SMD448942, SMD448944
A33	SMD448931, SMD448933, SMD449009
A34	SMD448932, SMD448933, SMD449009
A35A	SMD448607, SMD447636
A36	SMD449007, SMD449011, SMD449013, SMD449057
A37	SMD449043, SMD449041
A38	SMD449033 (2), SMD449035, SMD449037
A39A	SMD447805, SMD447530
A40A	SMD447531, SMD447532, SMD447538
A43	SMD447533, SMD447534, SMD447535, SMD447536
A44A	SMD621281, SMC621282, SMD621285
A45A	SMD447528, SMD911079

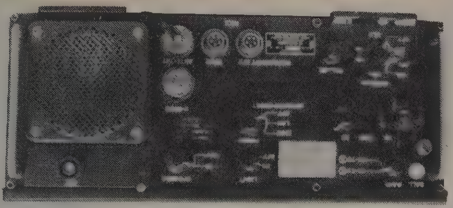
Signal Corps Part Number	Automatic Coil Part Number	AN/PRC-77 Module Used In	Style
SMD447518	CB2CXX-01X	A21A	A
SMD447519	CB2CXX-02X	A21A	A
SMD447520	CB1CXX-01X	A21A	A
SMD447521	CB2CXX-03X	A17A	A
SMD447522	CB2CXX-04X	A11A	A
SMD447523	CB2CXX-05X	A12A	A
SMD447524	CB1CXX-02X	A12A	A
SMD447525	CB2CXX-06X	A18A	A
SMD447526	CB1CXX-03X	A18A	A
SMD447527	CB2CXX-07X	A18A	A
SMD447528	CB2CXX-08X	A45A	A
SMD447530	CB2BXX-03X	A39A	A (w/o cup & shield)
SMD447531	CB2CXX-10X	A40A	A
SMD447532	CB2CXX-11X	A40A	A
SMD447533	CB1NXX-01X	A43	B
SMD447534	CB2NXX-01X	A43	B
SMD447535	CB2NXX-02X	A43	B
SMD447536	CB2NXX-03X	A43	B
SMD447538	CB2NXX-05X	A40A	B
SMD447636	CB2CXX-14X	A35A	A
SMD447801	CB1NXX-02X	A28	B
SMD447802	CB1GXX-01X	A28	D
SMD447803	CB1GXX-02X	A28	D
SMD447804	CB1GXX-03X	A28	D
SMD447805	CB2MXX-01X	A39A	E
SMD448607	CB2BXX-02X	A35A	A (w/o cup & shield)
SMD448919	CB2CXX-17X	A31	A
SMD448921	CB2CXX-18X	A31	A
SMD448923	CB2CXX-19X	A31	A
SMD448925	CB2CXX-20X	A31	A
SMD448927	CB2CXX-21X	A31	A
SMD448931	CB2NXX-08X	A33 & A34	B
SMD448933	CB2NXX-09X	A33 & A34	B
SMD448942	CB2NXX-10X	A32	B
SMD448944	CB2NXX-11X	A32	B
SMD449007	CB2NXX-12X	A36	B
SMD449009	CB2DXX-01X	A33 & A34	C
SMD449011	CB2NXX-13X	A36	B
SMD449013	CB2NXX-14X	A36	B
SMD449033	CB2DXX-02X	A38	Not shown
SMD449035	CB2NXX-15X	A38	B
SMD449037	CB2NXX-16X	A38	B
SMD449041	CB2DXX-03X	A37	C
SMD449043	CB2DXX-04X	A37	C
SMD449053	CB1CXX-05X	A31	A
SMD449057	CB2NXX-17X	A36	B
SMD621281	CB2NXX-18X	A44A	B
SMC621282	CB3AXX-01X	A44A	Encapsulated network
SMD621285	CB2NXX-19X	A44A	B
SMD911079	CB2CXX-24X	A45A	A

Complete technical specifications shown in catalog AC-36, available free upon request.

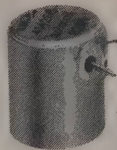
Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.

Dept. E 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX 810-848-8097

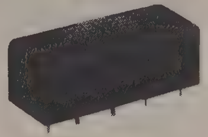
AN/VRC—12 COILS

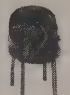


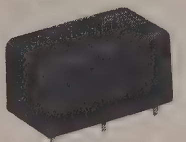
The VRC-12 is a combat-proven vehicle radio. Automatic Coil is currently fulfilling long term contracts for the full complement of VRC-12 coils and transformers for U.S. and free world manufacturers.

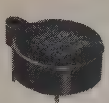

Toroid G

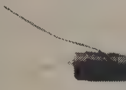
Coil K

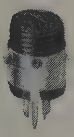

Filter O

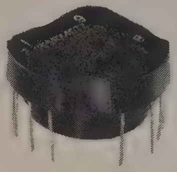

Toroid L

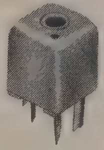

Filter P


Toroid H


Choke C

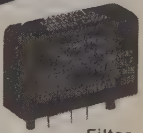

RFXFMR A


Toroid E

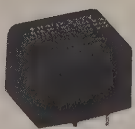

Can I

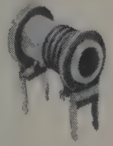
Dogbone M

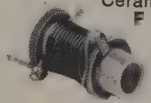
Filter Q

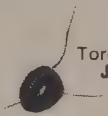

Filter S

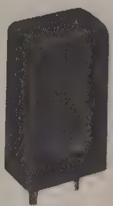
Toroid D


Filter N


Ceramic B


Ceramic F


Toroid J


Filter R

Module Number	Signal Corps Coil Part Numbers Used	Module Number	Signal Corps Coil Part Numbers Used
A1100	SMC416321-1 (2), SMC416327-1	A3700	SMC413577, SMD413712, SMD413714
A1200	SMC416321-1 (2), SMC416327-1	A4100	SMD413735, SMD413740, SMD413742
A1300	SMC416321-1 (2), SMC416327-1	A4200	SMD413735, SMD413740, SMD413768, SMD413770, SMC413779 (2), SMB413782
A1400	SMC416328, SMC416329	A6100	SMC414091 (2), SMC414093, SMC414096
A1500	SMC416321-1, SMC416310, SMC416387, SMC416385	A6300	SMC416332, SMC416321-2, SMC416352-1, SMC416327-2
A1600	SMC416323, SMC416326	A6400	SMC416332, SMC416321-2, SMC416352-2, SMC416327-3, SMC416400
Y2100	SMC413577, SMD414452, SMD414454	A6500	SMC619625, SMC619630, SMC619632, SMC619638
Y2200	SMC413577, SMD414461	A8101	SMC414189
A3100	SMC413577, SMC413582	A8200	SMC413577, SMC414805, SMC414228, SMD414231, SMD414233, SMD414235
A3200	SMC413604, SMC413608, SMC414142	A8300	SMD414208, SMD414210, SMD414212
A3300	SMD413623, SMD413625, SMD413627	A8400	SMC414266
A3400	SMD413645, SMD413647		
A3500	SMC413577, SMD413663, SMD413665, SMD413667		
A3600	SMC413577, SMD413681, SMD413690, SMD413692, SMD413694		

Signal Corps Part Number	Automatic Coil Part Number	VRC-12 Module Used In	Style	Signal Corps Part Number	Automatic Coil Part Number	VRC-12 Module Used In	Style
SMC413577	CF1AXX-01X	Y2100, Y2200, A3100, A3500, A3600, A3700, A8200	C	SMD414233	CF2CXX-24X	A8200	A
SMC413582	CF2CXX-01X	A3100	A	SMD414235	CF2CXX-25X	A8200	A
SMC413604	CF2AXX-01X	A3200	C	SMC414266	CF2EXX-04X	A8400	G
SMC413608	CF2AXX-02X	A3200	C	SMD414452	CF2CXX-26X	Y2100	A
SMD413623	CF2CXX-02X	A3300	A	SMD414454	CF1CXX-01X	Y2100	A
SMD413625	CF2CXX-03X	A3300	A	SMD414461	CF2CXX-27X	Y2200	A
SMD413627	CF2CXX-04X	A3300	A	SMC414805	CF1AXX-04X	A8200	C
SMD413645	CF2CXX-05X	A3400	A	SMC416310	CF1MXX-02X	A1500	B
SMD413647	CF2CXX-06X	A3400	A	SMC416321-1	CF1MXX-03X	A1100 (2), A1200 (2) A1300 (2), A1500	B
SMD413663	CF2CXX-07X	A3500	A	SMC416321-2	CF1MXX-04X	A6300, A6400	B
SMD413665	CF2CXX-08X	A3500	A	SMC416323	CF1EXX-01X	A1600	H
SMD413667	CF2CXX-09X	A3500	A	SMC416326	CF2EXX-05X	A1600	E
SMD413681*	CF2EXX-01X	A3600	D	SMC416327-1	CF1MXX-05X	A1100, A1200, A1300	B
SMD413690	CF2CXX-10X	A3600	A	SMC416327-2	CF1MXX-06X	A6300	B
SMD413692	CF2CXX-11X	A3600	A	SMC416327-3	CF1MXX-07X	A6400	B
SMD413694*	CF2EXX-02X	A3600	D	SMC416327-4	CF1MXX-08X	Silicone Version	B
SMD413712	CF2CXX-12X	A3700	A	SMC416328	CF2MXX-03X	A1400	B
SMD413714	CF2CXX-13X	A3700	A	SMC416329	CF2MXX-02X	A1400	B
SMD413735	CF2CXX-14X	A4100, A4200	A	SMC416332	CF1MXX-09X	A6300, A6400	B
SMD413740	CF2CXX-15X	A4100, A4200	A	SMC416352-1	CF1MXX-10X	A6300	B
SMD413742	CF2CXX-16X	A4100	A	SMC416352-2	CF1MXX-11X	A6400	B
SMD413768	CF2CXX-17X	A4200	A	SMC416385	CF2DXX-01X	A1500	J
SMD413770	CF2CXX-18X	A4200	A	SMC416387	CF2AXX-04X	A1500	C
SMC413779	CF2MXX-01X	A4200 (2)	B	SMC416400	CF2AXX-05X	A6400	C
SMB413782	CF1AXX-02X	A4200	C	SMC619625	CF2DXX-03X	A6500	J
SMC414091	CF1AXX-04X	A6100 (2)	C	SMC619630	CF2DXX-04X	A6500	J
SMC414093	CF1MXX-12X	A6100	F	SMC619632	CF2DXX-05X	A6500	J
SMC414096	CF1MXX-13X	A6100	F	SMC619638	CF2DXX-06X	A6500	J
SMC414142	CF1AXX-03X	A3200	C	SMD921099	CF2DXX-02X	Silicone Version	L
SMC414189*	CF2EXX-03X	A8101	D	SMD921100	CF2AXX-06X	Silicone Version	C
SMC414194	CF1MXX-01X	Silicone Version	B	SMD921128	CF2CXX-34X	Silicone Version	I
SMD414208	CF2CXX-20X	A8300	A	SMD921136	CF2GXX-01X	Silicone Version	K
SMD414210	CF2CXX-21X	A8300	A	SMD921188	CF2NXX-01X	Silicone Version	M
SMD414212	CF2CXX-22X	A8300	A	SMD921203	CF2CXX-29X	Silicone Version	A
SMC414228	CF2AXX-03X	A8200	C	SMD921455	CF2CXX-33X	Silicone Version	A
SMD414231	CF2CXX-23X	A8200	A				

Complete technical specifications shown in catalog AC-36, available free upon request.

Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.

Dept. E 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX 810-848-8097

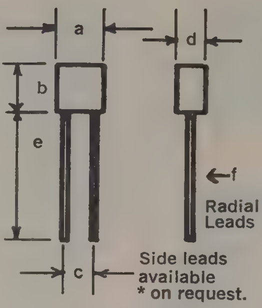
J. W. MILLER DIVISION, BELL INDUSTRIES / DEPT. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200

J.W.MILLER

Since 1924

- RF Coils
- Inductors
- Molded Chokes
- From Stock (or) Your Specs

BELL INDUSTRIES
J. W. Miller Division
19070 REYES AVE. • BOX 5825
RANCHO DOMINGUEZ,
CALIFORNIA 90224



Side leads available
* on request.

Closer inductance tolerances
* available on request.

ENCAPSULATED SUBMINIATURE AND MINIATURE TOROIDAL INDUCTORS

Features

- Applications: printed circuits and modules
- Environmental: designed to meet MIL-C-15305, Grade 1, Class B (—55°C to +125°C)
- Moisture and shock resistant, immersion proof
- Powdered iron toroidal core, low external magnetic field
- Identification: part number and inductance value printed in contrasting color

General Specifications (All Series)

Maximum operating temperature: 125°C
Rated temperature rise (at 90°C): 35°C
Dielectric withstanding voltage: 700 v rms
Terminal pull: 5 pounds
Altitude rating: 70,000 feet
Overload current: 1.4 times the rated current

T1 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100066	0.01	0.02	3000
100067	0.012	0.02	3000
100068	0.015	0.02	3000
100069	0.018	0.02	3000
100070	0.022	0.02	3000
100071	0.027	0.02	3000
100072	0.033	0.02	3000
100073	0.039	0.02	3000
100074	0.047	0.02	3000
100075	0.056	0.02	3000
100076	0.068	0.03	2500
100077	0.082	0.04	2200
100078	0.10	0.04	2200
100079	0.12	0.05	2000
100080	0.15	0.06	1800
100081	0.18	0.07	1600
100082	0.22	0.08	1500
100083	0.27	0.10	1400
100084	0.33	0.12	1300
100085	0.39	0.15	1150
100086	0.47	0.20	1000
100087	0.56	0.25	900
100088	0.68	0.30	800
100089	0.82	0.35	750
100090	1.0	0.40	700

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.01 to 0.082 uH, ±20%; 0.10 to 1.0 uH, ±10%.

T2 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100092	0.10	0.04	2200
100093	0.12	0.05	2000
100094	0.15	0.06	1800
100095	0.18	0.07	1600
100096	0.22	0.08	1500
100097	0.27	0.10	1400
100098	0.33	0.11	1300
100099	0.39	0.14	1200
100100	0.47	0.17	1100
100101	0.56	0.22	1000
100102	0.68	0.27	900
100103	0.82	0.30	800
100104	1.0	0.35	750
100105	1.2	0.40	700
100106	1.5	0.50	630
100107	1.8	0.70	530
100108	2.2	0.90	470
100109	2.7	1.1	420
100110	3.3	1.3	390
100111	3.9	1.5	360
100112	4.7	1.8	330
100113	5.6	2.0	310
100114	6.8	2.2	300
100115	8.2	2.4	290
100116	10	2.6	280

a	b	c	d	e	f
.2	.2	.1	.1	1.0	#24

Inductance Tolerances: 0.10 to 0.82 uH, ±10%; 1.0 to 10 uH, ±5%.

T3 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100117	10	1.1	550
100118	12	1.3	500
100119	15	1.5	450
100120	18	1.9	410
100121	22	2.3	380
100122	27	2.7	350
100123	33	3.3	320
100124	39	3.9	290
100125	47	4.7	260
100126	56	5.6	240
100127	68	6.8	220
100128	82	8.1	200
100129	100	9.7	180
100130	120	12	160
100131	150	14	150
100132	180	17	140
100133	220	20	130
100134	270	24	120
100135	330	19	130
100136	390	22	120
100137	470	27	110
100138	560	32	100
100139	680	19	130
100140	820	23	120
100141	1000	27	110

a	b	c	d	e	f
.27	.27	.2	.15	1.0	#22

Inductance Tolerance: ±5%.

T4 SERIES

Part Number	Apparent Induc., uH	Max. DC Resist., Ohms	Rated DC Current mA
100142	100	6	280
100143	120	7	260
100144	150	8	240
100145	180	10	220
100146	220	12	200
100147	270	14	180
100148	330	17	160
100149	390	20	150
100150	470	24	140
100151	560	28	130
100152	680	33	120
100153	820	39	110
100154	1000	45	100
100155	1200	31	120
100156	1500	37	110
100157	1800	44	100
100158	2200	52	90
100159	2700	61	85
100160	3300	71	80
100161	3900	82	75
100162	4700	93	70
100163	5600	105	65
100164	6800	140	60
100165	8200	160	55

a	b	c	d	e	f
.375	.375	.2	.187	1.0	#22

Inductance Tolerance: ±5%.

SERIES S, M, L MOLDED R.F. CHOKES

Series	Lengths	Diameter	Lead Size	Lead Length
S	.44 max.	.188 max.	#22 AWG	1.3 min.
M	.60 max.	.25 max.	#21 AWG	1.3 min.
L	.90 max.	.31 max.	#21 AWG	1.3 min.

Physical and Environmental Characteristics
Operating temperature —55° to +125°C terminal strength—meets five pound pull test per MIL-C-15305
All Series meet requirements of MIL-C-15305, Grade 1, Class B

Inductance Tolerance: 0.1 to 22 uH, ±10% on Q-meter / 27 uH to 10,000, ±5% 1 kHz bridge

SERIES S

Part Number	-L- Micro-Henries	Max DC Res, Ohms	Max I mA
100170	0.10	0.02	4000
100171	0.12	0.025	3500
100172	0.15	0.03	3000
100173	0.18	0.03	3000
100174	0.22	0.03	3000
100175	0.27	0.04	2700
100176	0.33	0.05	2500
100177	0.39	0.08	2000
100178	0.47	0.08	2000
100179	0.56	0.10	1700
100180	0.68	0.12	1500
100181	0.82	0.18	1300
100182	1.0	0.24	1100
100183	1.2	0.35	1000
100184	1.5	0.43	850
100185	1.8	0.65	720
100186	2.2	0.80	610
100187	2.7	0.12	1600
100188	3.3	0.15	1400
100189	3.9	0.23	1200
100190	4.7	0.30	1000
100191	5.6	0.45	900
100192	6.8	0.55	800
100193	8.2	0.65	720
100194	10.0	0.73	650
100195	12.0	1.1	590
100196	15.0	1.4	500
100197	18.0	1.6	460
100198	22.0	1.8	430
100199	27.0	2.7	360
100200	33.0	3.5	300
100201	39.0	3.8	290
100202	47.0	4.0	275
100203	56.0	4.4	265
100204	68.0	4.7	250
100205	82.0	5.3	235
100206	100.0	6.0	220

SERIES M

Part Number	-L- Micro-Henries	Max DC Res, Ohms	Max I mA
100207	1.0	0.04	2700
100208	1.2	0.04	2700
100209	1.5	0.04	2700
100210	1.8	0.05	2500
100211	2.2	0.05	2500
100212	2.7	0.05	2500
100213	3.3	0.05	2500
100214	3.9	0.07	2100
100215	4.7	0.09	1800
100216	5.6	0.14	1550
100217	6.8	0.17	1300
100218	8.2	0.25	1150
100219	10.0	0.32	1000
100220	12.0	0.47	870
100221	15.0	0.62	730
100222	18.0	0.72	660
100223	22.0	0.8	600
100224	27.0	1.2	520
100225	33.0	1.5	450
100226	39.0	2.3	380
100227	47.0	3.0	300
100228	56.0	4.2	270
100229	68.0	5.2	250
100230	82.0	6.2	220
100231	100.0	7.0	200
100232	120.0	7.5	200
100233	150.0	8.0	190
100234	180.0	9.0	185
100235	220.0	10.0	180
100236	270.0	11.0	172
100237	330.0	12.0	165
100238	390.0	13.0	157
100239	470.0	14.0	150
100240	560.0	16.0	145
100241	680.0	17.0	140
100242	820.0	19.0	132
100243	1000.0	21.0	125

SERIES L

Part Number	-L- Micro-Henries	Max DC Res, Ohms	Max I mA
100244	10.0	0.15	1800
100245	12.0	0.23	1600
100246	15.0	0.3	1300
100247	18.0	0.4	1150
100248	22.0	0.5	1000
100249	27.0	0.6	900
100250	33.0	0.7	850
100251	39.0	1.1	720
100252	47.0	1.3	620
100253	56.0	1.8	540
100254	68.0	2.4	450
100255	82.0	2.8	425
100256	100.0	3.2	400
100257	120.0	4.8	360
100258	150.0	6.4	280
100259	180.0	9.5	240
100260	220.0	12.0	200
100261	270.0	13.0	195
100262	330.0	14.0	190
100263	390.0	15.5	180
100264	470.0	17.0	170
100265	560.0	18.5	165
100266	680.0	20.0	155
100267	820.0	22.0	150
100268	1000.0	24.0	145
100269	1200.0	27.0	137
100270	1500.0	29.0	130
100271	1800.0	32.0	125
100272	2200.0	35.0	120
100273	2700.0	40.0	112
100274	3300.0	45.0	105
100275	3900.0	49.0	100
100276	4700.0	53.0	95
100277	5600.0	60.0	90
100278	6800.0	67.0	85
100279	8200.0	75.0	82
100280	10000.0	80.0	80

J. W. MILLER DIVISION, BELL INDUSTRIES / DEPT. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200

MOLDED SHIELDED MINIATURE RF CHOKES

Part Number	MS Type	Induct. Micro-henries ±10%	D.C. Resist. Max.	Milli-amp Rating Max.
9250-101	75087-1	0.10	.025	1790
9250-121	75087-2	.12	.034	1530
9250-151	75087-3	.15	.037	1470
9250-181	75087-4	.18	.047	1300
9250-221	75087-5	.22	.067	1100
9250-271	75087-6	.27	.11	855
9250-331	75087-7	.33	.13	780
9250-391	75087-8	.39	.18	670
9250-471	75087-9	.47	.25	565
9250-561	75087-10	.56	.33	490
9250-681	75087-11	.68	.45	420
9250-821	75087-12	.82	.59	370
9250-102	75088-1	1.00	.07	1070
9250-122	75088-2	1.20	.10	895
9250-152	75088-3	1.50	.12	815
9250-182	75088-4	1.80	.14	775
9250-222	75088-5	2.20	.19	650
9250-272	75088-6	2.70	.28	535
9250-332	75088-7	3.30	.35	480
9250-392	75088-8	3.90	.40	450
9250-472	75088-9	4.70	.55	380
9250-562	75088-10	5.60	.72	335
9250-682	75088-11	6.80	1.02	280
9250-822	75088-12	8.20	1.32	250
9250-103	75088-13	10.0	1.62	220
9250-123	75088-14	12.0	2.00	200
9250-153	75089-1	15.0	.80	315
9250-183	75089-2	18.0	.89	300
9250-223	75089-3	22.0	.96	290
9250-273	75089-4	27.0	1.19	260
9250-333	75089-5	33.0	1.37	240
9250-393	75089-6	39.0	1.93	205
9250-473	75089-7	47.0	2.11	195
9250-563	75089-8	56.0	2.23	190
9250-683	75089-9	68.0	2.70	170
9250-823	75089-10	82.0	2.44	180
9250-104	75089-11	100.0	3.12	160
9250-124	75089-12	120.0	3.60	150
9250-154	75089-13	150.0	4.10	140
9250-184	75089-14	180.0	4.40	135
9250-224	75089-15	220.0	5.00	125
9250-274	75089-16	270.0	5.80	115
9250-334	75089-17	330.0	6.40	110
9250-394	75089-18	390.0	7.40	105
9250-474	75089-19	470.0	9.50	92
9250-564	75089-20	560.0	10.5	90
9250-684	75089-21	680.0	11.8	80
9250-824	75089-22	820.0	13.0	80
9250-105	75089-23	1,000.0	17.5	70
9250-125	75089-24	1,200.0	22.1	60
9250-155	75089-25	1,500.0	26.5	55
9250-185	75089-26	1,800.0	29.9	50
9250-225	75089-27	2,200.0	33.8	50
9250-275	75089-28	2,700.0	47.3	40
9250-335	75089-29	3,300.0	53.0	40
9250-395	75089-30	3,900.0	73.8	35
9250-475	75089-31	4,700.0	81.6	31
9250-565	75089-32	5,600.0	98.9	28
9250-685	75089-33	6,800.0	111.0	27
9250-825	75089-34	8,200.0	119.0	26
9250-106	75089-35	10,000.0	137.0	24
9250-126	75089-36	12,000.0	143.0	23
9250-156	75089-37	15,000.0	157.0	22
9250-186	75089-38	18,000.0	175.0	21
9250-226	75089-39	22,000.0	274.0	17
9250-276	75089-40	27,000.0	308.0	16
9250-336	75089-41	33,000.0	343.0	15
9250-396	75089-42	39,000.0	376.0	15
9250-476	75089-43	47,000.0	473.0	13
9250-566	75089-44	56,000.0	512.0	13
9250-686	75089-45	68,000.0	580.0	12
9250-826	75089-46	82,000.0	618.0	11
9250-107	75089-47	100,000.0	678.0	11

0.10 thru 0.82 uh — Phenolic Core.
1.00 thru 12 uh — Iron Core.
15 + uh — Ferrite Core.
Mold Size: .162 ±.010 Diameter; .410 ±.020 length.
Leads: AWG #22TCW; 1.438±.188 Length.

See General Catalog for Complete Off The Shelf Coverage

Custom Windings A Specialty — Let Us Quote On Your Requirements

MICRO MITE MOLDED RF CHOKES

Miller Part Number	MS Type	Induct. Micro-henries ±5%	D.C. Resist. Max.	Milli-amp Rating Max.	Mold Size
9210-54	90538-01	36	2.50	180	D
9210-56	90538-02	39	2.60	176	D
9210-58	90538-03	43	2.70	172	D
9210-60	90538-04	47	2.75	170	D
9210-62	90538-05	51	2.85	167	D
9210-64	90538-06	56	3.00	164	D
9210-66	90538-07	62	3.15	160	D
9210-68	90538-08	68	3.30	156	D
9210-70	90538-09	75	3.70	147	D
9210-72	90538-10	82	3.90	143	D
9210-74	90538-11	91	4.30	136	D
9210-76	90538-12	100	4.50	133	D
9210-78	90538-13	110	4.90	128	D
9210-80	90538-14	120	5.20	124	D
9210-82	90538-15	130	5.45	121	D
9210-84	90538-16	150	6.05	114	D
9210-86	90538-17	160	6.40	111	D
9210-88	90538-18	180	6.75	108	D
9210-90	90538-19	200	7.10	106	D
9210-92	90538-20	220	7.45	103	D
9210-94	90538-21	240	7.80	101	D
9220-00	90539-01	270	8.2	110	A
9220-02	90539-02	300	8.7	107	A
9220-04	90539-03	330	9.1	105	A
9220-06	90539-04	360	9.6	102	A
9220-08	90539-05	390	10.0	100	A
9220-10	90539-06	430	10.6	97	A
9220-12	90539-07	470	11.1	95	A
9220-14	—	500	11.6	93	A
9220-15	90539-08	510	11.6	92	A
9220-16	90539-09	560	12.3	91	A
9220-18	90539-10	620	13.0	88	A
9220-20	90539-11	680	13.7	85	A
9220-22	90539-12	750	14.4	83	A
9220-24	90539-13	820	15.1	81	A
9220-26	90539-14	910	15.8	79	A
9220-28	90539-15	1000	16.5	78	A
9220-30	90540-01	1100	21.0	78	B
9220-32	90540-02	1200	22.0	76	B
9220-34	90540-03	1300	23.0	75	B
9220-36	90540-04	1500	25.0	72	B
9220-38	90540-05	1600	26.0	70	B
9220-40	90540-06	1800	28.0	68	B
9220-42	90540-07	2000	29.0	67	B
9220-44	90540-08	2200	30.0	66	B
9220-46	90540-09	2400	31.0	64	B
9220-48	90540-10	2700	33.0	62	B
9220-50	90540-11	3000	35.0	61	B
9220-52	90540-12	3300	38.0	58	B
9220-54	90540-13	3600	40.0	57	B
9220-56	90541-01	3900	44.0	61	C
9220-58	90541-02	4300	46.0	59	C
9220-60	90541-03	4700	48.0	58	C
9220-62	90541-04	5000	50.0	57	C
9220-64	90541-05	5600	53.0	56	C
9220-66	90541-06	6200	56.0	54	C
9220-68	90541-07	6800	59.0	52	C
9220-70	90541-08	7500	62.0	51	C
9220-72	90541-09	8200	65.0	50	C
9220-74	90541-10	9100	68.0	49	C
9220-76	90541-11	10000	72.0	47	C

Mold Size	Mold Diameter	Mold Length	Lead Size	Lead Length
A	.190±.010	.440±.010	AWG #22	1.44±.188
B	.215±.010	.560±.010	AWG #21	1.44±.188
C	.240±.010	.740±.010	AWG #20	1.44±.188
D	.155±.010	.375±.010	AWG #22	1.44±.188

MOLDED RF CHOKES

Part No.	MS Type	L uH	Res. Max.	mA Max.
9360-01	91189-1	1.1±20%	0.09	2800
9360-02	91189-2	2.2±20%	.20	1800
9360-03	91189-3	3.3±10%	.32	1500
9360-04	91189-4	4.7±10%	.60	1100
9360-05	91189-5	6.8±10%	1.10	800
9360-06	91189-6	10.0±10%	1.80	600
9360-07	91189-7	15.0±10%	3.00	500
9360-08	91189-8	22.0±10%	.30	1500
9360-09	91189-9	33.0±10%	.60	1100
9360-10	91189-10	47.0±10%	1.20	700
9360-11	91189-11	82.0±10%	2.20	600
9360-12	91189-12	100.0±10%	2.80	500
9360-13	91189-13	120.0±10%	4.00	400

Mold Size: .281±.031 Diameter; .937±.0625 Length. Leads: 1.500±.125.

MOLDED RF CHOKES

Miller Part Number	MS Type	Induct. Micro-henries*	D.C. Re-sist. Max.	Milli-amp Rating Max.
9310-00	18130-1	.15*	.03	2450
9310-02	18130-2	.22*	.055	1900
9310-04	18130-3	.33*	.09	1400
9310-06	18130-4	.47*	.12	1225
9310-07	18130-5	.56	.135	1220
9310-08	18130-6	.68	.15	1100
9310-10	18130-7	.82	.22	900
9310-12	18130-8	1.00	.29	830
9310-14	18130-9	1.20	.42	650
9310-16	18130-10	1.50	.50	600
9310-18	18130-11	1.80	.65	525
9310-20	18130-12	2.20	.95	435
9310-22	18130-13	2.70	1.20	385
9310-24	18130-14	3.30	2.00	300
9310-26	18130-15	3.90	2.30	280
9310-28	18130-16	4.70	2.60	260
9310-30	18130-17	5.60	.32	750
9310-32	18130-18	6.80	.50	600
9310-34	18130-19	8.20	.60	545
9310-36	18130-20	10.0	.90	445
9310-38	18130-21	12.0	1.10	404
9310-40	18130-22	15.0	1.40	370
9310-42	18130-23	18.0	2.25	280
9310-44	18130-24	22.0	2.50	265
9310-46	—	24.0	2.50	265
9310-48	18130-25	27.0	2.60	260
9310-50	—	30.0	2.80	255
9310-52	18130-26	33.0	3.00	250

Mold Size: .156±.010 Diameter; .375±.010 Lgth. Leads: AWG #22 TCW; 1.437±.188 Lgth.

9320-00	75008-21	.15*	.030	3000
9320-02	75008-22	.22*	.035	2800
9320-04	75008-23	.33*	.065	2000
9320-06	75008-24	.47*	.085	1700
9320-07	75008-25	.56	.125	1450
9320-08	75008-26	.68	.150	1300
9320-09	75008-27	.82	.205	1100
9320-10	75008-28	1.00	.290	930
9320-11	75008-29	1.20	.400	785
9320-12	75008-30	1.50	.485	700
9320-13	75008-31	1.80	.740	580
9320-14	75008-32	2.20	.970	505
9320-16	75008-33	2.70	1.20	460
9320-18	75008-34	3.30	.140	1350
9320-20	75008-35	3.90	.155	1250
9320-22	75008-36	4.70	.210	1100
9320-24	75008-37	5.60	.280	935
9320-26	75008-38	6.80	.375	810
9320-28	75008-39	8.20	.440	750
9320-30	75008-40	10.0	.605	640
9320-32	75008-41	12.0	1.05	490
9320-34	75008-42	15.0	1.20	460
9320-35	75008-43	18.0	1.95	360
9320-36	75008-44	22.0	2.20	335
9320-38	75008-45	27.0	2.75	300

Mold Size: .188±.031 Diameter; 0.437±.031 Lgth. Leads: AWG #22 TCW; 1.437±.188 Lgth.

9330-00	90542-01	.47	.06	1970
9330-01	90542-02	.56	.08	1850
9330-02	90542-03	.68	.08	1700
9330-03	90542-04	.82	.11	1520
9330-04	90542-05	1.00	.14	1290
9330-05	90542-06	1.20	.19	1120
9330-06	90542-07	1.50	.28	925
9330-07	90542-08	1.80	.37	790
9330-08	90542-09	2.20	.50	680
9330-10	90542-10	2.70	.65	600
9330-12	90542-11	3.30	1.00	480
9330-14	90542-12	3.90	1.20	440
9330-16	90542-13	4.70	1.80	360
9330-18	90542-14	5.60	.13	1340
9330-20	90542-15	6.80	.20	1080
9330-22	90542-16	8.20	.22	1030
9330-24	90542-17	10.0	.26	950
9330-26	90542-18	12.0	.45	720
9330-28	90542-19	15.0	.52	670
9330-30	90542-20	18.0	.70	580
9330-32	90542-21	22.0	1.00	480
9330-34	90542-22	27.0	1.30	420
9330-36	90542-23	33.0	1.50	390
9330-38	90542-24	39.0	2.00	340

Mold Size: .22±.03 Diameter; 0.560±.010 Length. Leads: AWG #22 TCW; 1.437±.19 Length.
*Inductance Tolerance: ±20%.
All Others 10%.

R.F. CHOKES J. W. MILLER DIVISION, BELL INDUSTRIES / DEPT. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200

SUB-MINIATURE RF CHOKES

An extremely versatile series of iron core R.F. chokes designed to meet the industries' demand for high reliability, ultra-miniature components. The coils are ideally suited to network and filter design, delay lines and computer applications. The coils are impregnated with a moisture resistant lacquer and on special order they can be fungus-proofed per JAN-T-152 using varnish per MIL-V-173A. They can also be encapsulated in epoxy resin to conform to Grade 1, Class B of MIL-C-15305. Note: L measured on 260A Q Meter except 120 thru 500 mH which are measured on 1 kHz Bridge.

Miller Part No.	Inductance Nominal*	D.C. Resistance Max.	Milliamp Rating Max.	Max. Winding Diam.	Form Length ±1/32
70F107AP	.10 uh★	.013	3922	.156	5/16
70F157AP	.15 uh★	.025	2828	.141	5/16
70F227AP	.22 uh★	.038	2294	.141	5/16
70F337AP	.33 uh★	.070	1690	.125	5/16
70F477AP	.47 uh★	.125	1264	.125	5/16
70F687AP	.68 uh★	.200	1000	.125	5/16
70F757AP	.75 uh★	.264	870	.125	5/16
70F827AP	.82 uh★	.290	830	.125	5/16
70F106AI	1.0 uh	.048	2041	.165	¼
70F126AI	1.2 uh	.072	1666	.160	¼
70F156AI	1.5 uh	.096	1443	.160	¼
70F186AI	1.8 uh	.096	1443	.160	¼
70F226AI	2.2 uh	.156	1132	.160	¼
70F276AI	2.7 uh	.168	1091	.160	¼
70F336AI	3.3 uh	.240	912	.150	¼
70F396AI	3.9 uh	.264	870	.150	¼
70F476AI	4.7 uh	.457	661	.150	¼
70F566AI	5.6 uh	.492	637	.150	¼
70F686AI	6.8 uh	.624	566	.150	¼
70F756AI	7.5 uh	,624	566	.150	¼
70F826AI	8.2 uh	.744	518	.150	¼
70F916AI	9.1 uh	1.44	288	.160	¼
70F105AI	10 uh	1.56	277	.160	¼
70F125AI	12 uh	1.68	267	.160	¼
70F155AI	15 uh	1.92	250	.165	¼
70F185AI	18 uh	2.28	229	.165	¼
70F225AI	22 uh	2.28	229	.165	¼
70F255AI	25 uh	2.64	213	.170	¼
70F275AI	27 uh	2.64	213	.170	¼
70F335AI	33 uh	2.76	208	.170	¼
70F395AI	39 uh	3.36	188	.175	¼
70F475AI	47 uh	3.36	188	.175	¼
70F565AI	56 uh	3.84	176	.180	¼
70F685AI	68 uh	4.20	169	.180	¼
70F755AI	75 uh	4.56	162	.185	¼
70F825AI	82 uh	4.80	158	.185	¼
70F915AI	91 uh	4.92	156	.185	¼
70F104AI	100 uh	7.68	139	.165	¼
70F124AI	120 uh	8.16	135	.165	¼
70F154AI	150 uh	8.16	135	.165	¼
70F184AI	180 uh	8.16	135	.170	¼
70F204AI	200 uh	10.3	120	.170	¼
70F224AI	220 uh	11.5	114	.170	¼
70F254AI	250 uh	12.1	111	.170	¼
70F274AI	270 uh	13.2	106	.175	¼
70F304AI	300 uh	13.2	106	.175	¼
70F334AI	330 uh	13.9	103	.175	¼
70F354AI	350 uh	14.4	102	.180	¼
70F394AI	390 uh	15.8	97	.180	¼
70F474AI	470 uh	16.3	95	.185	¼
70F504AI	500 uh	18.0	91	.195	¼
70F564AI	560 uh	19.2	88	.195	¼
70F684AI	680 uh	19.8	87	.200	¼
70F754AI	750 uh	22.9	80	.210	¼
70F824AI	820 uh	22.9	80	.210	¼
70F914AI	910 uh	24.0	79	.220	¼
70F103AI	1.00 mh	24.0	79	.225	¼
70F123AI	1.20 mh	33.6	66	.220	¼
70F153AI	1.50 mh	37.2	63	.225	¼
70F183AI	1.80 mh	42.0	59	.235	¼
70F223AI	2.20 mh	45.6	57	.240	¼
70F253AI	2.50 mh	45.6	57	.260	⅜
70F273AI	2.70 mh	45.6	57	.260	⅜
70F333AI	3.30 mh	51.6	53	.260	⅜
70F393AI	3.90 mh	57.6	51	.275	⅜
70F473AI	4.70 mh	64.8	48	.285	⅜
70F563AI	5.60 mh	69.6	46	.300	⅜
70F683AI	6.80 mh	78.0	43	.310	⅜
70F753AI	7.50 mh	85.2	41	.310	⅜
70F823AI	8.20 mh	92.4	40	.330	⅜
70F913AI	9.10 mh	98.4	39	.330	⅜
70F102AI	10.0 mh	101	38	.335	⅜
70F122AI	12 mh	100	50	.300	½
70F152AI	15 mh	113	47	.300	½
70F182AI	18 mh	128	44	.325	½
70F222AI	22 mh	144	41	.330	½
70F252AF	25 mh	115	46	.340	⅝
70F272AF	27 mh	120	45	.353	⅝
70F332AF	33 mh	134	43	.353	⅝
70F392AF	39 mh	147	41	.370	⅝
70F472AF	47 mh	168	38	.384	⅝
70F502AF	50 mh	175	37	.400	⅝
70F562AF	56 mh	189	36	.400	⅝
70F682AF	68 mh	215	34	.415	⅝
70F752AF	75 mh	222	33	.430	⅝
70F822AF	82 mh	238	32	.430	⅝
70F912AF	91 mh	250	31	.430	⅝
70F101AF	100 mh	278	29	.446	⅝
70F121AF	120 mh	288	48	.485	⅞
70F151AF	150 mh	328	44	.505	⅞
70F181AF	180 mh	374	41	.525	⅞
70F221AF	220 mh	424	39	.540	⅞
70F251AF	250 mh	468	37	.555	⅞
70F271AF	270 mh	490	36	.570	⅞
70F331AF	330 mh	540	34	.580	⅞
70F391AF	390 mh	617	33	.600	⅞
70F471AF	470 mh	704	30	.615	⅞
70F501AF	500 mh	736	30	.635	⅞

* Tolerance 0.1 to 1.0 uh ±20%, 1.1 to 15 uh ±10%, over 15 uh ±5%. ★ Measured with leads ¼″ long from Q Meter binding posts.

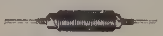
PHENOLIC CORE SINGLE LAYER WINDINGS

Dimensions of core: 3/16″ diameter x ¾″ long. Leads are 1½″ long.

Miller Part Number	Inductance Nominal*	D. C. Resistance Maximum	Milliamp Rating Maximum	Diameter over Winding
4602	1.0 uh	.050	2000	.270
4604	1.5 uh	.093	1800	.270
4606	2.4 uh	.190	1500	.270
4608	3.9 uh	.450	1000	.270
4609	5 5 uh	.670	850	.270
4610	6.2 uh	.830	700	.270
4611	8.2 uh	1.20	600	.270
4612	10.0 uh	1.50	500	.270

*Tolerance 1.0 uh ±20%, 1.1 to 10 uh ±10%

IRON CORE SINGLE LAYER WINDINGS



Dimensions of core: 7/32″ diameter x ⅞″ long. Leads are 1½″ long.

4622	10 uh ±5%	.11	1500	.29
4624	15 uh ±5%	.17	1000	.29
4626	24 uh ±5%	.34	800	.29
4628	39 uh ±5%	.65	600	.29
4629	55 uh ±5%	1.0	500	.29
4630	62 uh ±5%	1.2	475	.29
4631	82 uh ±5%	1.9	450	.29
4632	100 uh ±5%	3.0	400	.29

PHENOLIC CORE 3-SECTION WINDINGS

Dimensions of core: 3/16″ diameter x ¾″ long. Leads are 1½″ long.

4642	.10 mh ±5%	5.4	160	.406
4644	.15 mh ±5%	6.5	160	.406
4646	.24 mh ±5%	8.5	160	.438
4648	.39 mh ±5%	11	160	.500
4649	.55 mh ±5%	13	160	.500
4650	.62 mh ±5%	15	160	.531
4651	.75 mh ±5%	16	160	.531
4652	1.0 mh ±5%	19	160	.563

IRON CORE 3-SECTION WINDINGS

Dimensions of core: 7/32″ diameter x ⅞″ long. Leads are 1½″ long.

Miller Part Number	Inductance @ 1000 Hertz	D. C. Resistance Maximum	Milliamp Rating Maximum	Diameter over Winding
4662	1.0 mh ±5%	8.6	160	.469
4664	1.5 mh ±5%	11	160	.469
4666	2.4 mh ±5%	15	160	.531
4668	3.9 mh ±5%	20	160	.563
4669	5.5 mh ±5%	25	160	.594
4670	6.2 mh ±5%	37	100	.531
4671	8.2 mh ±5%	46	100	.563
4672	10 mh ±5%	50	100	.594

FERRITE CORE 3-SECTION WINDINGS

Dimensions of core: ¼″ diameter x ⅞″ long. Leads are 1½″ long.

6302	2.5 mh ±5%	9.0	160	.469
6304	5.0 mh ±5%	14	160	.531
6306	10 mh ±5%	31	100	.531
6308	25 mh ±5%	82	65	.531
6310	50 mh ±5%	127	65	.625

SINGLE LAYER COLOR CODED RF CHOKES

The following solenoid wound R.F. Chokes are impregnated with a thermosetting varnish and are color coded to EIA standards. Form Dimensions .156 x ½″.

Part No.	L*	R Ohms Max.	I Ma. Max.
74F106AP	1.0 uh	.20	1000
74F126AP	1.2 uh	.22	950
74F156AP	1.5 uh	.25	900
74F186AP	1.8 uh	.28	850
74F226AP	2.2 uh	.30	800
74F276AP	2.7 uh	.50	700
74F336AP	3.3 uh	.70	600
74F396AP	3.9 uh	.80	500
74F476AP	4.7 uh	1.00	400
74F566AP	5.6 uh	1.80	350
74F686AP	6.8 uh	1.85	300
74F826AP	8.2 uh	1.90	275
74F105AP	10 uh	3.00	250
74F125AP	12 uh	3.60	200
74F155AP	15 uh	6.00	150
74F185AP	18 uh	7.50	100
74F225AI	22 uh	2.00	500
74F275AI	27 uh	1.85	450
74F335AI	33 uh	2.00	450
74F395AI	39 uh	2.60	400
74F475AI	47 uh	3.50	350
74F565AI	56 uh	3.75	300
74F685AI	68 uh	4.00	250
74F825AI	82 uh	5.10	200
74F104AI	100 uh	6.00	150

* Tolerance 1.0 to 2.2 uh, ±20%, 2.7 to 100 uh, ±10%

SEE OUR INDUSTRIAL CATALOG FOR COMPLETE COVERAGE

Custom Windings — May We Quote On Your Requirements?

VLS SERIES VARIABLE INDUCTORS (SHIELDED)

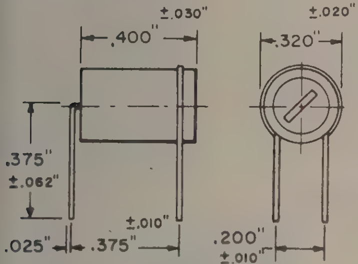
May be mounted either Vertically or Horizontally

Printed Circuit: Mil-C-15305

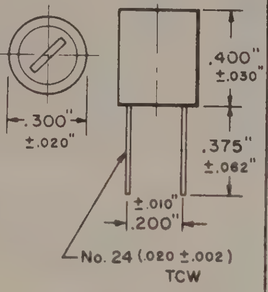
Tunable Range: .10 uH .12 uH ±5% — All others ±10%

Operating Temperature: −55°C to +125°C

Leads: No. 24 TCW



HORIZONTAL STYLE

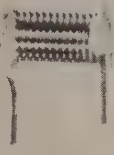


VERTICAL STYLE

Part No.	Nom. L	DCR 25°C, Max. Ohms	Max. I mA	Part No.	Nom. L	DCR 25°C, Max. Ohms	Max. I mA
VLSR10	.10	0.030	2500	VLS121	120.00	2.38	316
VLSR12	.12	0.030	2500	VLS151	150.00	2.52	306
VLSR15	.15	0.030	2500	VLS181	180.00	2.88	288
VLSR18	.18	0.035	2400	VLS221	220.00	3.18	273
VLSR22	.22	0.038	2300	VLS271	270.00	3.50	260
VLSR27	.27	0.040	2200	VLS331	330.00	4.80	222
VLSR33	.33	0.040	2200	VLS391	390.00	5.44	209
VLSR39	.39	0.045	2100	VLS471	470.00	5.90	201
VLSR47	.47	0.045	2100	VLS561	560.00	6.30	194
VLSR56	.56	0.050	2000	VLS681	680.00	7.20	181
VLSR68	.68	0.055	1900	VLS821	820.00	8.00	172
VLSR82	.82	0.060	1800	VLS102	1,000.00	12.00	141
VLS1R0	1.00	0.070	1700	VLS122	1,200.00	13.50	132
VLS1R2	1.20	0.085	1670	VLS152	1,500.00	16.50	119
VLS1R5	1.50	0.100	1540	VLS182	1,800.00	18.00	114
VLS1R8	1.80	0.110	1470	VLS222	2,200.00	20.50	107
VLS2R2	2.20	0.120	1410	VLS272	2,700.00	22.50	102
VLS2R7	2.70	0.125	1380	VLS332	3,300.00	42.00	76
VLS3R3	3.30	0.165	1200	VLS392	3,900.00	47.50	71
VLS3R9	3.90	0.180	1135	VLS472	4.700.00	53.00	67
VLS4R7	4.70	0.245	985	VLS562	5,600.00	62.50	65
VLS5R6	5.60	0.265	950	VLS682	6,800.00	69.50	58
VLS6R8	6.80	0.330	853	VLS822	8,200.00	75.00	56
VLS8R2	8.20	0.460	720	VLS103	10,000.00	100.00	49
VLS100	10.00	0.640	620	VLS123	12,000.00	64.00	60
VLS120	12.00	0.800	545	VLS153	15,000.00	84.00	52
VLS150	15.00	0.865	520	VLS183	18,000.00	93.00	50
VLS180	18.00	0.940	504	VLS223	22,000.00	104.00	45
VLS220	22.00	1.03	460	VLS273	27,000.00	173.00	35
VLS270	27.00	1.18	418	VLS333	33,000.00	187.00	32
VLS330	33.00	1.30	398	VLS393	39,000.00	220.00	30
VLS390	39.00	1.41	385	VLS473	47,000.00	253.00	28
VLS470	47.00	1.61	350	VLS563	56,000.00	285.00	26
VLS560	56.00	2.08	330	VLS683	68,000.00	311.00	24
VLS680	68.00	2.20	320	VLS823	82,000.00	385.00	22
VLS820	82.00	2.42	300	VLS104	100,000.00	420.00	20
VLS101	100.00	2.15	333				

FIXED COILS

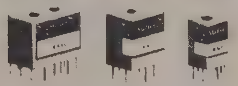
The 75F series are of Polypropylene moulded around an accurately positioned winding. Unsurpassed stability and uniformity is obtained.



Frequency range: 50 MHz to 450 MHz
Lead length: 3/16″ ±1/32″
Maximum length: .38 inches
Maximum width: .23 inches

Miller Part Number	Inductance	Q Minimum	DC Current	Wire Size
75F238MPC	.023 uH	110	1A	22 AWG
75F328MPC	.032 uH	110	1A	22 AWG
75F518MPC	.051 uH	110	1A	22 AWG
75F117MPC	.110 uH	110	1A	22 AWG
75F157MPC	.150 uH	110	1A	22 AWG
75F227MPC	.270 uH	110	.5A	26 AWG
75F397MPC	.390 uH	110	.5A	26 AWG
75F477MPC	.470 uH	110	.5A	26 AWG
75F597MPC	.590 uH	110	.5A	26 AWG

I.F. COMPONENTS SUB MINIATURE



The transformers in this series represents the state of the art, as it relates to a commercial product. In both the 455 kc. and 10.7 Mc. groups there are a complete set of I.F. transformers as well as Ratio Detector and Discriminator transformers.

Dimensions: 8849, 8850, 8851, 8805, 8806, 8807 — 25/32″ x 7/16″ x 1/2″ high • 8852, 8853 & 8854 — 13/32″ sq. x 5/8″ high • 8810, 8811, 8812 & 8813 — 9/32″ sq. x 15/32″ high

Cat. No.	Specs	Description
	10.7 Mc. Transistor Transformers	
8849	500 kc. P P	10.7 Mc. Ratio Detector
8850	300 kc. P P	10.7 Mc. Discriminator
8851-A	6 db 300 kc.	10.7 Mc. Double Tuned IF
8852	100 K-300	10.7 Mc. Single Tuned IF
8853	20 K-500	10.7 Mc. Single Tuned IF
8854	25 K-500	10.7 Mc. Single Tuned IF
	455 Kc. Transistor Transformers	
8805	20 kc. P P	455 kc. Ratio Detector
8806	20 kc. P P	455 kc. Discriminator
8807	6 db 15 kc.	455 kc. Double Tuned IF
8810	50 K-500	455 kc. Single Tuned IF
8811	30 K-500	455 kc. Single Tuned IF
8812	20 K-5 K	455 kc. Single Tuned IF
8813	Oscillator (455 kc. IF). (Tuning Cap. 78 to 110 pf. Max.)	

ADJUSTABLE R.F. COILS 9100 SERIES SHIELDED

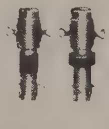
These ultra compact adjustable coils offer a good inductance range with relatively small changes in Q. Tuning is accessible from either top or bottom of the assembly. Magnetic shielding is achieved by the use of cup cores while the copper shield offers effective electro static shielding. Printed circuit terminals on base and shield.

Applications between 10 kHz and 200 MHz
Dimensions: .440″ Sq. x .550″ High.

Part No.	L Min.	L Max.	Max. DC Ohms	Max. Current
9101	.099	.134	0.01	4.85 A
9102	.129	.192	0.01	4.43 A
9103	.165	.258	0.02	3.97 A
9104	.246	.418	0.02	3.83 A
9105	.366	.627	0.02	3.43 A
9106	.588	.950	0.90	516.00 mA
9107	.830	1.54	1.02	485.00 mA
9108	1.44	2.94	1.38	417.00 mA
9109	2.52	5.70	1.76	368.00 mA
9110	5.35	13.49	2.92	286.00 mA
9111	12.50	29.45	4.72	225.00 mA
9112	26.25	71.25	6.97	185.00 mA
9113	64.57	163.00	9.98	155.00 mA
9114	147.00	430.00	16.32	121.00 mA
9115	422.00	1.10	27.84	92.00 mA
9116	1.05	3.74	41.06	76.00 mA
9117	3.36	11.12	78.92	55.00 mA

ECONOMY ADJUSTABLE R.F. CHOKES

Through the use of a recently developed Nylon molding process we are able to offer an inexpensive line of adjustable chokes. These items feature a wide inductance range which has been achieved through the use of a threaded ferrite core. They can be adjusted from either the top or bottom. This lends a degree of flexibility to your design. Mounting is achieved by means of a metal clip in a 5/16″ round hole or a special keyed hole. Instructions supplied with each coil.



Dimensions:
3/8″ x 1 3/8″ long.

Miller Part Number	Inductance Minimum	Inductance Maximum	R Ohms Max.	Max. Current Ma.
4201	.300 uh	.580 uh	.04	636
4201-A	.550 uh	1.10 uh	.05	636
4202	1.00 uh	2.50 uh	.15	400
4203	2.00 uh	5.50 uh	.19	400
4204	5.00 uh	12.0 uh	1.1	126
4205	10.0 uh	25. uh	1.6	100
4206	20.0 uh	55. uh	2.3	100
4207	50.0 uh	140. uh	4.0	100
4208	120. uh	330. uh	6.6	100
4209	310. uh	860. uh	12.	100

J. W. MILLER DIVISION, BELL INDUSTRIES / DEPT. EM, 19070 Reyes Ave., Rancho Dominguez, CA 90221 / (213) 537-5200

VERTICAL MOUNTED PRINTED CIRCUIT VELVETORK ADJUSTABLE RF COILS

Dimensions (form only) Over Collar ⅜″ Dia. x ¾″ long.

The coil form is Polyester impregnated Alpha Cellulose tubing with internally bonded resilient ribs which provide both thread and torque control. Coils may be adjusted from either end of form.

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.	Max. Current Ma.	Dia. over Winding
23A107RPC	.095 uH	.125 uH	.02	4100	.40
23A157RPC	.130 uH	.170 uH	.02	1600	.37
23A227RPC	.185 uH	.265 uH	.02	1600	.37
23A337RPC	.285 uH	.410 uH	.03	1000	.37
23A477RPC	.420 uH	.580 uH	.03	2500	.37
23A687RPC	.540 uH	.850 uH	.03	1600	.37
23A827RPC	.640 uH	1.00 uH	.03	1600	.37
23A106RPC	.760 uH	1.25 uH	.04	1600	.37
23A156RPC	1.20 uH	1.87 uH	.06	1000	.37
23A226RPC	1.65 uH	2.75 uH	.14	400	.37
23A336RPC	2.40 uH	4.10 uH	.17	400	.37
23A476RPC	3.40 uH	5.80 uH	.24	400	.37
23A686RPC	4.60 uH	8.50 uH	.39	250	.37
23A826RPC	5.60 uH	10.00 uH	.64	160	.37
23A105RPC	7.10 uH	12.50 uH	.77	160	.37
23A155RPC	10.00 uH	18.70 uH	1.68	100	.37
23A225RPC	14.80 uH	27.50 uH	1.91	100	.37
23A335RPC	22.00 uH	41.00 uH	2.34	100	.37
23A475RPC	31.00 uH	58.00 uH	2.72	100	.40
23A685RPC	43.50 uH	85.00 uH	3.30	100	.40
23A825RPC	61.00 uH	100.00 uH	3.89	100	.40
23A104RPC	76.00 uH	125.00 uH	4.39	100	.40
23A154RPC	105.00 uH	187.00 uH	5.46	100	.40
23A224RPC	160.00 uH	275.00 uH	6.70	100	.44
23A334RPC	240.00 uH	410.00 uH	8.30	100	.44
23A474RPC	360.00 uH	580.00 uH	10.50	100	.48
23A684RPC	530.00 uH	850.00 uH	12.90	100	.48
23A824RPC	700.00 uH	1.00 mH	14.90	100	.53
23A103RPC	910.00 uH	1.25 mH	17.10	100	.58
23A153RPC	990.00 uH	1.87 mH	28.20	65	.45
23A223RPC	1.60 mH	2.75 mH	34.80	65	.45
23A333RPC	2.40 mH	4.10 mH	42.90	65	.48
23A473RPC	3.40 mH	5.80 mH	51.60	65	.48
23A683RPC	5.15 mH	8.50 mH	63.60	65	.55
23A823RPC	7.40 mH	10.00 mH	75.60	65	.55
23A102RPC	9.80 mH	12.50 mH	87.30	65	.55
23A152RPC	12.00 mH	18.70 mH	111.00	65	.60
23A222RPC	12.10 mH	27.50 mH	197.00	33	.60
23A332RPC	18.20 mH	41.00 mH	244.00	33	.60
23A472RPC	27.50 mH	58.00 mH	302.00	33	.60
23A682RPC	40.00 mH	85.00 mH	378.00	33	.58
23A822RPC	50.00 mH	100.00 mH	423.00	33	.58
23A101RPC	62.00 mH	125.00 mH	468.00	33	.60

SHIELDED SUBMINIATURE ADJUSTABLE RF COILS

Dimensions: ½″ sq., x ⅝″ high.

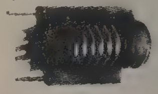
These compact adjustable coils offer a minimum two-to-one inductance range with relatively small changes in Q. The tuning adjustment is accessible from either the top or bottom of the coil assembly. Magnetic shielding is achieved through the use of cup cores while the metal shield offers effective electrostatic shielding. Printed circuit terminals on base and shield.

Miller Part No.	Inductance Min.	Inductance Max.	R Ohms Max.	Max. Current Ma.
9050	1.5 uH	3.0 uH	.66	80
9051	3.0 uH	7.0 uH	.85	125
9052	7.0 uH	14.0 uH	1.38	80
9053	14.0 uH	28.0 uH	2.10	80
9054	28.0 uH	60.0 uH	3.00	100
9055	60.0 uH	120.0 uH	4.00	100
9056	120.0 uH	280.0 uH	5.75	80
9057	280.0 uH	650.0 uH	12.00	80
9058	650.0 uH	1.3 mH	15.00	100
9059	1.3 mH	3.0 mH	23.00	100
9059-1	1.8 mH	2.2 mH	10.00	141
9060	3.0 mH	10.0 mH	76.00	30
9061	8.0 mH	20.0 mH	110.00	30
9062	15.0 mH	40.0 mH	150.00	30
9063	20.0 mH	60.0 mH	175.00	25

HIGH Q MOLDED ADJUSTABLE COILS

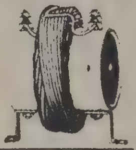
The 48A Series of coils listed below may easily be tapped at ⅛, ¼, ⅜, ⅝, ¾, ⅞ turn if desired.

Frequency Range: 30 MHz to 250 MHz
Wire Size: 20 AWG tinned copper
Form Length: .73 inches
Coil OD: .310 inches
Lead Spacing: .408 inches
Core: 10-32 x ⅜″ Carbonyl J



Miller Part No.	Minimum Inductance	Maximum Inductance	D.C. Current
48A518mpc	.046 uH	.055 uH	2A
48A778mpc	.071 uH	.082 uH	2A
48A117mpc	.099 uH	.122 uH	2A
48A147mpc	.118 uH	.157 uH	2A
48A187mpc	.150 uH	.207 uH	2A
48A227mpc	.181 uH	.278 uH	2A
48A257mpc	.209 uH	.283 uH	2A
48A287mpc	.241 uH	.316 uH	2A
48A317mpc	.270 uH	.351 uH	2A

MEDIUM DUTY DUO-LATERAL LINE FILTER CHOKES



Cat. No.	Amps.	Ohms	Induc.	Dimensions
7826	5	.28	570 uH	2½″ x 4″
7827	10	.15	370 uH	2½″ x 4″
7828	15	.085	200 uH	2½″ x 4″
7829	20	.05	135 uH	2½″ x 4″

LIGHT DUTY DUO-LATERAL LINE FILTER CHOKES

Single Line Filter Chokes
Dimensions: 1⅞″ x 1¾″.

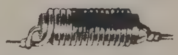
Cat. No.	Amps.	Ohms	uH
7825	2	.7	600
7825-3	3	.25	250
7825-5	5	.1	100
7825-8	8	.05	50

DUAL LINE FILTER CHOKES

Dimensions: 3¼″ x 2⅛″.

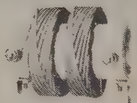
Cat. No.	Amps.	Ohms	uH
D-7825	2	.7	600
D-7825-3	3	.25	250
D-7825-5	5	.1	100
D-7825-8	8	.05	50

HEAVY DUTY HASH CHOKES



Part No.	uH ±20%	Ohms Max.	Amps.	Dimensions
5218	3.35	.010	20	17/32″ x 1 5/16″
5219	4.90	.016	15	½″ x 1¼″
5220	8.80	.021	10	½″ x 1¼″
5230	4.00	.012	8	5/16″ x 29/32″
5240	40.00	.082	3	9/16″ x 1¼″
5248	68.00	.054	5	17/32″ x 1¼″
5250	100.00	.216	2	5/16″ x 1¼″
5252	125.00	.080	3.5	½″ x 1¼″
5254	250.00	.170	2.5	7/16″ x 1¼″
5256	500.00	.260	2.0	9/16″ x 1¼″
5258	1000.00	.550	1.0	½″ x 1¼″
*5300	100.00	.087	2.5	¾″ x 1 1/32″

*Dual Choke:
Electrical measurements per section



DUAL LINE FILTER CHOKES

Miller Dual Duo-Lateral Line Filter Chokes are wound with two coils on one form, giving the advantage of small physical size in cases where space requirements are stringent and two single coils would occupy too much area. Identical in specifications, except for dimensions, to our single type Duo-Lateral chokes. They are wound on white ceramic forms 2″ in diameter by 4½″ long.

Cat. No.	Amps.	Ohms	uH	Dimensions
D-7826	5	.28	570	4½″ x 4″
D-7827	10	.15	370	4½″ x 4″
D-7828	15	.085	200	4½″ x 4″
D-7829	20	.05	135	4½″ x 4″

SINGLE PI FERRITE CORE RF CHOKES

This series of single pi RF Chokes affords maximum Q with minimum resistance through the use of ferrite core material. The coils are impregnated in a fungus resistant lacquer. Form Dimensions .187″ x ⅝″.

Part No.	L ±5%	Max. R Ohms	Max. Ma.
73F104AF	100.0 uH	2.0	250
73F124AF	120.0 uH	2.2	250
73F154AF	150.0 uH	2.5	250
73F184AF	180.0 uH	2.9	250
73F224AF	220.0 uH	3.2	250
73F274AF	270.0 uH	3.6	250
73F334AF	330.0 uH	3.8	250
73F394AF	390.0 uH	4.2	225
73F474AF	470.0 uH	4.8	200
73F564AF	560.0 uH	5.3	200
73F684AF	680.0 uH	6.0	200
73F824AF	820.0 uH	6.8	200
73F103AF	1.0 mH	7.5	150
73F123AF	1.2 mH	7.8	150
73F153AF	1.5 mH	8.8	150
73F183AF	1.8 mH	11.0	150
73F223AF	2.2 mH	12.0	150
73F273AF	2.7 mH	13.5	125
73F333AF	3.3 mH	15.1	125
73F393AF	3.9 mH	18.0	125
73F473AF	4.7 mH	21.5	100
73F563AF	5.6 mH	25.0	80
73F683AF	6.8 mH	29.0	80
73F823AF	8.2 mH	30.0	80
73F102AF	10.0 mH	34.0	80

MICRO-MINIATURE MOLDED RF CHOKES

We are pleased to offer the following series of molded RF chokes. They represent what we believe to be the smallest package for the current rating specified. Color Coding is per MIL-C-15305.

Miller Part No.	MS Type	Inductance Micro-henries ±10%	Max. D.C. Resis-tance	Milli-amp Rating Max.
9230-94	75083-1	.10	.07	1100
9230-96	75083-2	.12	.08	1100
9230-00	75083-3	.15	.10	1100
9230-02	75083-4	.18	.12	1010
9230-04	75083-5	.22	.14	935
9230-06	75083-6	.27	.16	875
9230-08	75083-7	.33	.20	780
9230-10	75083-8	.39	.30	640
9230-12	75083-9	.47	.35	590
9230-14	75083-10	.56	.50	495
9230-16	75083-11	.68	.60	450
9230-18	75083-12	.82	.85	380
9230-20	75083-13	1.00	1.00	350
9230-22	75084-1	1.20	.18	825
9230-24	75084-2	1.50	.22	745
9230-26	75084-3	1.80	.30	640
9230-28	75084-4	2.20	.40	550
9230-30	75084-5	2.70	.50	495
9230-32	75084-6	3.30	.85	380
9230-34	75084-7	3.90	1.00	350
9230-36	75084-8	4.70	1.20	320
9230-38	75084-9	5.60	1.80	260
9230-40	75084-10	6.80	2.00	245
9230-42	75084-11	8.20	2.70	210
9230-44	75084-12	10.00	3.70	180
9230-46	75084-13	12.00	2.70	210
9230-48	75084-14	15.00	2.80	205
9230-50	75084-15	18.00	3.10	195
9230-52	75084-16	22.00	3.30	190
9230-54	75084-17	27.00	3.50	185
9230-56	75085-1	33.00	3.40	187
9230-58	75085-2	39.00	3.60	180
9230-60	75085-3	47.00	4.50	165
9230-62	75085-4	56.00	5.70	145
9230-64	75085-5	68.00	6.70	135
9230-66	75085-6	82.00	7.30	130
9230-68	75085-7	100.00	8.00	125
9230-70	75085-8	120.00	13.00	97
9230-72	75085-9	150.00	15.00	85
9230-74	75085-10	180.00	17.00	79
9230-76	75085-11	220.00	21.00	73
9230-78	75085-12	270.00	25.00	65
9230-80	75085-13	330.00	28.00	62
9230-82	75085-14	390.00	35.00	55
9230-84	75085-15	470.00	42.00	50
9230-86	75085-16	560.00	46.00	48
9230-88	75085-17	680.00	60.00	42
9230-90	75085-18	820.00	65.00	40
9230-92	75085-19	1000.00	72.00	38

Mold Size: .095 ±.010 Diameter; .250 ±.010 Length.
Leads: AWG #24 TCW; 1.500 ±.188 Length.

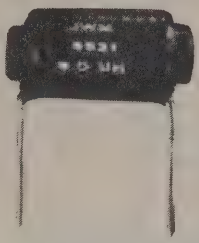
J.W. Miller 5500 & 5600
HIGH CURRENT FILTER CHOKES

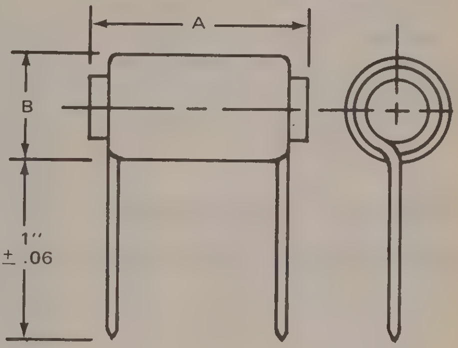
Chokes are ideal for all EMI/RFI filtering applications. They are also suitable for energy storage inductors in switching power supplies.
Covered with shrink tubing and varnish impregnated.
Printed Circuit mounting.

5500 SERIES High saturation flux density ferrite rods.

* Inductance measured @ 1 kHz with 0 Amps D.C. current.
Typical inductance change is less than 5% @ maximum rated current.

Leads: 1" long. Tinned within 1/8" of body.

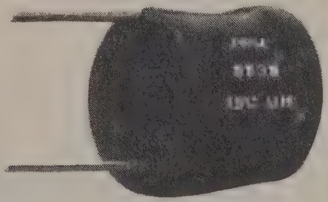


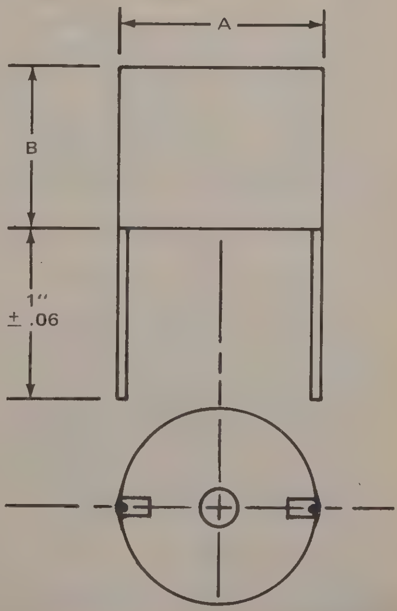


Miller Number	* L uH ± 10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5501	5	.013	10	.88	.63
5502	10	.017	9	1.12	.63
5503	27	.030	7	.88	.81
5504	50	.045	5.6	1.12	.81
5505	100	.061	4.9	1.12	.81
5506	150	.069	4.6	1.38	.81
5507	250	.089	4	1.62	.81
5508	5	.009	14	.88	.64
5509	10	.012	12	1.12	.64
5510	27	.022	9	.88	.88
5511	50	.028	8	1.12	.88
5512	68	.034	7.3	1.12	.88
5513	100	.038	6.8	1.38	.88
5514	150	.046	6.3	1.62	.88
5515	5	.006	19	1.12	.69
5516	10	.008	16	1.38	.69
5517	27	.014	12.5	1.12	.94
5518	50	.020	10.5	1.38	.94
5519	68	.023	10	1.38	.94
5520	100	.027	10	1.62	.94
5521	5	.004	23	1.38	.72
5522	10	.006	20	1.69	.72
5523	27	.010	15	1.38	1
5524	50	.013	15	1.62	1

5600 SERIES High saturation flux density ferrite bobbins.

* Inductance measured @ 1 kHz with 0 Amps D.C. current.
Typical inductance change is less than 5% @ twice rated current.





Miller Number	* L uH ± 10%	R,dc Max. Ohms	I,dc Max. Amps	Dim. A Max.	Dim. B Max.
5601	5	.007	15	.83	.91
5602	10	.008	14	.83	.91
5603	25	.023	8	.83	.91
5604	50	.034	6.6	.83	.91
5605	100	.072	4.5	.83	.91
5606	250	.173	2.9	.83	.91
5607	500	.378	2	.83	.91
5608	1,000	.801	1.3	.83	.91
5609	2,500	2.04	.85	.83	.91
5610	5	.005	20	1.22	1.11
5611	10	.006	17	1.22	1.11
5612	25	.009	14	1.22	1.11
5613	50	.017	10	1.22	1.11
5614	100	.034	7	1.22	1.11
5615	250	.083	4.6	1.22	1.11
5616	500	.129	3.7	1.22	1.11
5617	1,000	.279	2.5	1.22	1.11
5618	2,500	.690	1.6	1.22	1.11
5619	50	.012	14	1.50	1.11
5620	100	.025	9.8	1.50	1.11
5621	250	.059	6.4	1.50	1.11
5622	500	.090	5	1.50	1.11
5623	1,000	.195	3.5	1.50	1.11
5624	2,500	.499	2.2	1.50	1.11
5625	5,000	1.08	1.5	1.50	1.11
5626	100	.018	14	1.50	1.50
5627	250	.040	9	1.50	1.50
5628	500	.085	6.5	1.50	1.50
5629	1,000	.183	4.4	1.50	1.50
5630	2,500	.464	2.8	1.50	1.50
5631	5,000	.714	2.2	1.50	1.50
5632	10,000	1.55	1.5	1.50	1.50

Coilcraft

Cary, Illinois 60013 • (312) 639-6400 • TWX 910-651-2251

Ordering information

To order stock items shown, call 312/639-6400 between 8 AM and 4 PM CST. Or write to Coilcraft, Dept. E, 1102 Silver Lake Rd., Cary, IL 60013.

All orders must specify a purchase order number. There is no minimum quantity. Most orders are filled from stock and shipped via UPS unless otherwise specified.

Custom orders

In addition to the standard parts shown here, Coilcraft can custom-build a wide range of inductive devices to meet your precise requirements. For more information call our Sales Department at 312/639-2361.

Other Coilcraft inductive devices

- Switching power magnetics
  - Chokes
  - Transformers
  - Current sensors
- CRT magnetic components
- Magnetic recording heads
- Surface mount devices
  - Chip toroids
  - Chip transformers

Experimenters kits

"Unicoil" Kit

A 196 piece assortment of tuneable coils covering the inductance range from .0425 uH to 1.5 uH. Includes two shielded and two unshielded samples of each part number.

"Unicoil" Kit — $50.00

"Slot Ten" Kit

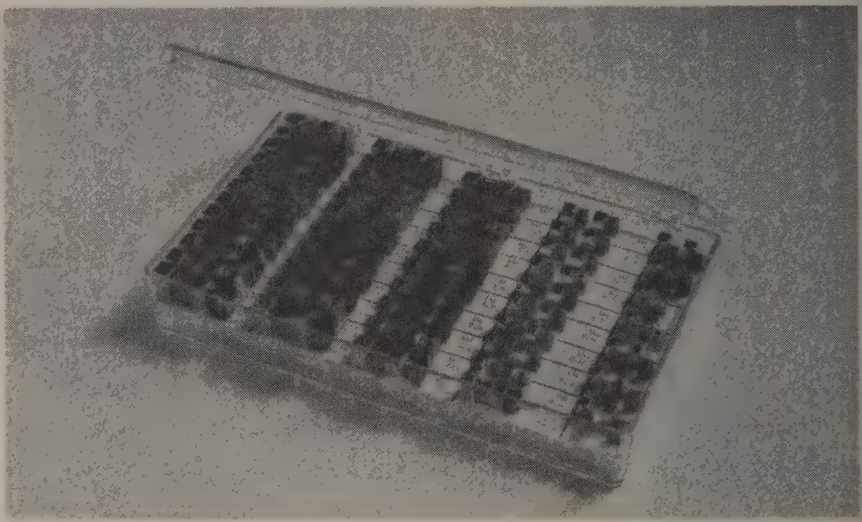
Contains 72 tuneable coils covering the inductance range from .7 uH to 1.143 mH. Two shielded and two unshielded samples of each part number are provided, along with electrostatic shield sleeves and ferrite and iron tuning cores for experimentation.

"Slot Ten" Kit — $50.00

"Bug" Kit

Contains 120 fixed molded inductors covering the range from 31.5 nH to 720 nH. Six samples of each part number.

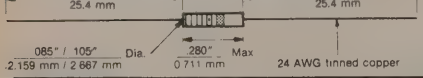
"Bug" Kit — $35.00



CONFORMAL COATED CHOKES

Coilcraft's axial chokes are **close tolerance** coils totally encapsulated in a durable epoxy coating. Their low cost compared to molded type chokes makes them particularly attractive to high volume users. In addition to the standard values shown, custom chokes are available to meet your specific requirements.

- No molding stress to break wire.
- Closer tolerance on inductance.
- Resistance to humidity equal to or greater than that of molded types.
- Low temperature coefficient, compatible with N030-N080 capacitors.
- Available bulk packed, in conventional tape and reel, or "ammo packs."



Part Number	LuH	Q Typical	Test Frequency MHz	R_{DC} Typical Ohms	F_O Minimum MHz
SS-070-1	.10 ± 10%	43	25	.043	680
SS-070-2	.12 "	42	25	.049	640
SS-070-3	.15 "	41	25	.061	600
SS-070-4	.18 "	40	25	.077	550
SS-070-5	.22 "	38	25	.089	510
SS-070-6	.27 "	44	25	.088	460
SS-070-7	.33 "	36	25	.16	410
SS-070-8	.39 "	35	25	.18	365
SS-070-9	.47 "	36	25	.24	330
SS-070-10	.56 "	36	25	.33	310
SS-070-11	.68 "	37	25	.46	280
SS-070-12	.82 "	37	25	.52	260
SS-070-13	1.0 ± 5%	35	25	.78	240
SS-070-14	1.2 "	45	7.9	.14	150
SS-070-15	1.5 "	41	7.9	.16	140
SS-070-16	1.8 "	43	7.9	.25	125
SS-070-17	2.2 "	48	7.9	.37	115
SS-070-18	2.7 "	42	7.9	.39	100
SS-070-19	3.3 "	54	7.9	.67	90
SS-070-20	3.9 "	56	7.9	.75	80
SS-070-21	4.7 "	57	7.9	1.03	75
SS-070-22	5.6 "	63	7.9	1.46	65
SS-070-23	6.8 "	65	7.9	1.64	60
SS-070-24	8.2 "	62	7.9	2.1	55
SS-070-25	10.0 "	66	7.9	2.3	50

NOTES: 1) Temperature rise at rated current and 90°C ambient
.10-1.0 uH: 35°C
1.2-10.0 uH: 15°C
2) Maximum operating temperature
.10-1.0 uH: 125°C
1.2-10.0 uH: 105°C
3) Inductanct measured with TF-A text fixture per MIL-C-15305 using H.P. 4342A Q meter
4) Color coding per MIL-C-15305C
5) Epoxy coating: flame resistant 94 VO
6) Designed to meet requirements of Military Specifications MS75083-MS75084

Coilcraft

Cary, Illinois 60013 • (312) 639-6400 • TWX 910-651-2251

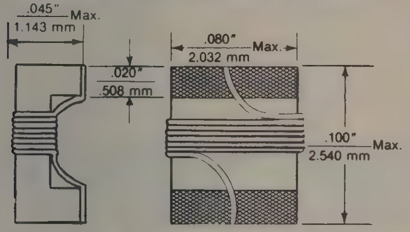
CHIP INDUCTORS

Coilcraft chip inductors eliminate the need to outboard inductance in thick film circuitry. Proprietary production techniques assure close tolerances and low pricing.

- High quality at lowest possible price.
- Reliable one-piece construction.
- Available in 8mm tape and reel for auto insertion.
- Surface mount transformers, toroids, and tuneable inductors also available.

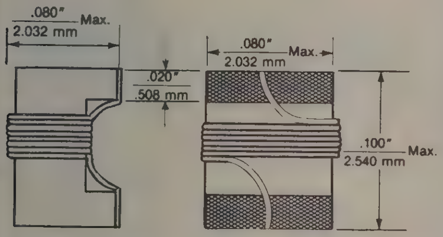
SS 162-CERAMIC

Extra-low inductance, with high Q values. Intended for high frequency applications.



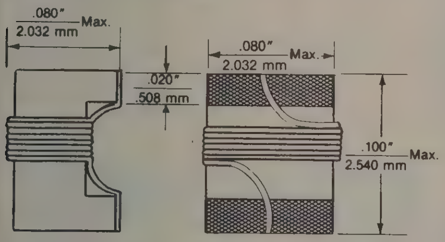
SS 163-CERAMIC

Low inductance, high Q series. Most applicable at higher frequencies.



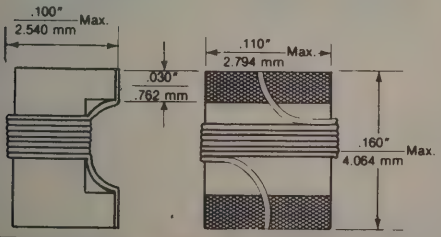
SS 164-FERRITE

Higher inductance in a small size chip. For use over a broad frequency range.



SS 165-FERRITE

Highest inductance values with relatively high Q. Larger size permits wider range of performance characteristics, particularly current handling capability.



Part Number	Inductance	Self Resonance MHz Min.	Test Frequency MHz	Q Min.
SS-162-30	30 nH ± 5%	800	150	35
SS-164-40	40 ''	800	150	35
SS-164-50	50 ''	800	150	35
SS-162-60	60 ''	800	150	40
SS-162-70	70 ''	800	150	35
SS-162-80	80 ''	800	150	40
SS-162-90	90 ''	800	150	35
SS-163-01	100 nH ± 5%	1000	100	46
SS-163-02	110 ''	1000	100	46
SS-163-03	120 ''	950	100	46
SS-163-04	130 ''	900	100	46
SS-163-05	150 ''	870	100	48
SS-163-06	160 ''	850	100	47
SS-163-07	180 ''	810	100	46
SS-163-08	200 ''	770	100	50
SS-163-09	220 ''	740	50	40
SS-163-10	240 ''	710	50	41
SS-163-11	270 ''	680	50	42
SS-163-12	300 ''	630	50	42
SS-163-13	330 ''	590	50	41
SS-163-14	360 ''	560	50	41
SS-163-15	390 ''	530	50	40
SS-163-16	430 ''	500	50	40
SS-163-17	470 ''	480	50	40
SS-163-18	510 ''	465	50	40
SS-163-19	560 ''	450	50	40
SS-163-20	620 ''	435	50	40
SS-163-21	680 ''	420	50	40
SS-163-22	750 ''	400	50	40
SS-163-23	820 ''	385	50	38
SS-163-24	910 ''	370	50	38
SS-163-25	1000 ''	350	50	34
SS-164-01	1.2 uH ± 10%	270	7.9	35
SS-164-02	1.5 ''	150	7.9	25
SS-164-03	1.8 ''	165	7.9	30
SS-164-04	2.2 ''	160	7.9	30
SS-164-05	2.7 ''	150	7.9	30
SS-164-06	3.3 ''	140	7.9	30
SS-164-07	3.9 ''	120	7.9	30
SS-164-08	4.7 ''	120	7.9	30
SS-164-09	5.6 ''	100	7.9	30
SS-164-10	6.8 ''	95	7.9	30
SS-164-11	8.2 ''	80	7.9	28
SS-165-01	1.2 uH ± 10%	260	7.9	33
SS-165-02	1.5 ''	230	7.9	33
SS-165-03	1.8 ''	200	7.9	33
SS-165-04	2.2 ''	190	7.9	34
SS-165-05	2.7 ''	170	7.9	35
SS-165-06	3.3 ''	165	7.9	35
SS-165-07	3.9 ''	150	7.9	35
SS-165-08	4.7 ''	140	7.9	35
SS-165-09	5.6 ''	125	7.9	35
SS-165-10	6.8 ''	105	7.9	35
SS-165-11	8.2 ''	95	7.9	34
SS-165-12	10.0 ''	65	7.9	33
SS-165-13	12.0 ''	45	2.5	32
SS-165-14	15.0 ''	23	2.5	31
SS-165-15	18.0 ''	21	2.5	31
SS-165-16	22.0 ''	19	2.5	31
SS-165-17	27.0 ''	14	2.5	31
SS-165-18	33.0 ''	9	2.5	31
SS-165-19	39.0 ''	8.8	2.5	30
SS-165-20	47.0 ''	8.7	2.5	30
SS-165-21	56.0 ''	8.6	2.5	30
SS-165-22	68.0 ''	8.5	2.5	30
SS-165-23	82.0 ''	7.2	2.5	28
SS-165-24	100.0 ''	6.0	2.5	26
SS-165-25	120.0 ''	5.6	.790	25
SS-165-26	150.0 ''	5.2	.790	25
SS-165-27	180.0 ''	4.7	.790	24
SS-165-28	220.0 ''	4.3	.790	24
SS-165-29	270.0 ''	4.1	.790	24
SS-165-30	330.0 ''	3.8	.790	24
SS-165-31	390.0 ''	3.6	.790	24
SS-165-32	470.0 ''	3.4	.790	24
SS-165-33	560.0 ''	2.6	.790	23
SS-165-34	680.0 ''	2.4	.790	22
SS-165-35	820.0 ''	2.2	.790	21
SS-165-36	1000.0 ''	2.0	.790	20

Coilcraft

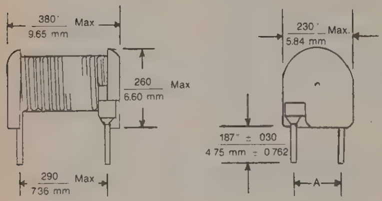
Cary, Illinois 60013 • (312) 639-6400 • TWX 910-651-2251

TUNEABLE RF COILS

These Coilcraft variable inductors are precision molded in plastic to assure constant winding pitch and a consistent relationship to the printed circuit board. They're ideal for applications requiring low inductance and are more economical than any similar coil. Typical applications include RF coils, IF coils, oscillators, chokes, and helical resonators.

- Reliable one-piece construction
- Compact 10mm or 7mm size
- Molded-in windings assure tight tolerances
- Highly resistant to humidity, temperature, shock and vibration
- Threaded cores allow precise tuning
- Custom values available

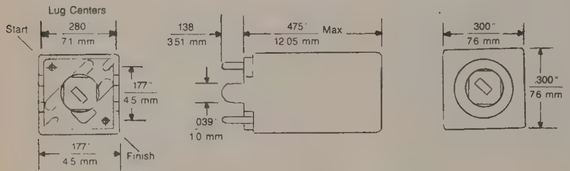
132 "BUG" (FIXED)


380″ Max
9.65 mm
260 Max
6.60 mm
290 Max
736 mm
230″ Max.
5.84 mm
187″ ± 030
4 75 mm ± 0 762
A

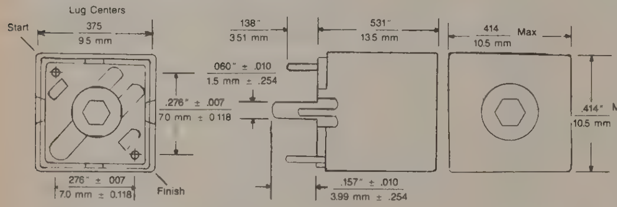
WIRE	A
#22 AWG	.148″/3.76 mm
#23 AWG	.148″/3.76 mm
#24 AWG	.153″/3.89 mm
#25 AWG	.154″/3.91 mm
#26 AWG	.156″/3.96 mm
#27 AWG	.156″/3.96 mm
#28 AWG	.160″/4.06 mm

Part Number	Color	Turns	L nH ± 5%	Min Q @ L nom
132-01	Brown	1½	31.5	60 @ 50 MHz
132-02	Red	2½	36.5	64 "
132-03	Orange	3½	44.0	68 "
132-04	Yellow	4½	53.5	72 "
132-05	Green	5½	64.0	75 "
132-06	Blue	6½	79.0	80 "
132-07	Violet	7½	99.0	66 @ 25 MHz
132-08	Gray	8½	117	68 "
132-09	White	9½	138	68 "
132-10	Black	10½	158	68 "
132-11	Brown	11½	197	66 "
132-12	Red	12½	235	72 "
132-13	Orange	13½	260	70 "
132-14	Yellow	14½	290	70 "
132-15	Green	15½	345	72 "
132-16	Blue	16½	410	72 "
132-17	Violet	17½	475	66 "
132-18	Gray	18½	550	66 "
132-19	White	19½	600	68 "
132-20	Black	20½	720	66 "

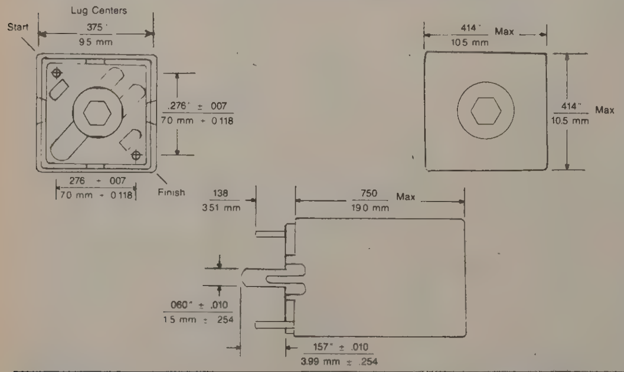
146/150 "UNICOIL"


Lug Centers
Start
280″
71 mm
177″
45 mm
177″
45 mm
Finish
138
351 mm
475″ Max
12 05 mm
039″
10 mm
300″
76 mm
.300″
76 mm

142 "UNICOIL"


Lug Centers
Start
375
95 mm
276″ ± 007
7.0 mm ± 0.118
Finish
.276″ ± .007
70 mm ± 0 118
060″ ± .010
1.5 mm ± .254
138″
351 mm
531″
13.5 mm
.157″ ± .010
3.99 mm ± .254
414 Max
10.5 mm
.414″ Max.
10.5 mm

143/144 "UNICOIL"


Lug Centers
Start
375″
95 mm
.276″ ± 007
70 mm + 0 118
276 + 007
70 mm + 0 118
Finish
414″ Max
105 mm
414″ Max
10.5 mm
138
351 mm
750 Max
190 mm
060″ ± .010
15 mm ± 254
157″ ± .010
3.99 mm ± .254

Part Number	Color	Turns	No Core uH	L Min uH	L Nom uH	L Max uH	Min Q @ L nom
150-01J08S	Brown	1½	.0425	.0435	.0445	.0455	72 @ 50 MHz
150-02J08S	Red	2½	.054	.056	.060	.064	80 "
150-03J08S	Orn.	3½	.068	.071	.076	.081	84 "
150-04J08S	Yel.	4½	.0825	.086	.095	.104	85 "
150-05J08S	Green	5½	.0955	.107	.115	.123	84 "
150-06J08S	Blue	6½	.109	.125	.134	.143	82 "
150-07J08S	Vio.	7½	.123	.150	.156	.162	80 "
146-01J08S	Brown	1½	.044	.045	.046	.047	76 @ 50 MHz
146-02J08S	Red	2½	.059	.062	.065	.068	78 "
146-03J08S	Orn.	3½	.075	.080	.085	.090	78 "
146-04J08S	Yel.	4½	.095	.100	.110	.120	78 "
146-05J08S	Green	5½	.115	.120	.135	.150	76 "
146-06J08S	Blue	6½	.136	.142	.163	.184	72 "
146-07J08S	Vio.	7½	.155	.172	.194	.216	68 "
146-08J08S	Gray	8½	.176	.200	.224	.248	66 "
146-09J08S	White	9½	.202	.234	.260	.284	60 "
146-10J08S	Black	10½	.224	.260	.288	.315	56 "
144-01J08S	Brown	1½	.050	.052	.053	.054	—
144-02J12S	Red	2½	.067	.070	.074	.078	—
144-03J12S	Orn.	3½	.088	.092	.099	.106	—
144-04J12S	Yel.	4½	.106	.111	.122	.133	—
144-05J12S	Green	5½	.126	.132	.149	.165	—
144-06J12S	Blue	6½	.147	.154	.175	.196	106 @ 40 MHz
144-07J12S	Vio.	7½	.168	.176	.200	.223	104 "
144-08J12S	Gray	8½	.190	.202	.226	.250	108 "
144-09J12S	White	9½	.210	.239	.256	.274	108 "
144-10J12S	Black	10½	.232	.270	.282	.295	106 "
142-01J08S	Brown	1½	.058	.058	.0595	.061	—
142-02J08S	Red	2½	.081	.084	.086	.089	—
142-03J08S	Orn.	3½	.110	.115	.120	.121	—
142-04J08S	Yel.	4½	.140	.147	.156	.160	88 @ 40 MHz
142-05J08S	Green	5½	.174	.182	.197	.205	94 "
142-06J08S	Blue	6½	.210	.220	.240	.248	92 "
142-07J08S	Vio.	7½	.247	.259	.280	.290	90 "
142-08J08S	Gray	8½	.284	.299	.322	.337	86 "
142-09J08S	White	9½	.319	.338	.363	.377	88 "
142-10J08S	Black	10½	.357	.382	.410	.422	82 "
143-09J12S	White	9½	.300	.315	.369	.423	80 @ 40 MHz
143-10J12S	Black	10½	.338	.355	.416	.477	82 "
143-11J12S	Brown	11½	.377	.396	.468	.540	78 "
143-12J12S	Red	12½	.412	.433	.509	.585	80 "
143-13J12S	Orn.	13½	.452	.475	.556	.637	80 "
143-14J12S	Yel.	14½	.490	.515	.604	.693	78 "
143-15J12S	Green	15½	.522	.583	.660	.738	80 "
143-16J12S	Blue	16½	.575	.638	.720	.801	76 "
143-17J12S	Vio.	17½	.612	.693	.770	.846	76 "
143-18J12S	Gray	18½	.650	.754	.814	.874	82 "
143-19J12S	White	19½	.675	.792	.846	.900	80 "
143-20J12S	Black	20½	.715	.847	.896	.945	74 "

QUALITY COILS SINCE 1946

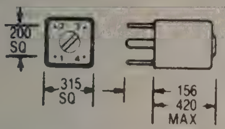
CADDELL-BURNS

40G East Second Street
Mineola, New York 11501-3597

Area Code 516 746-2310

SUBMINIATURE SHIELDED VARIABLE INDUCTORS

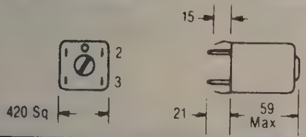
.08 µH — 12 mH **TYPE 6740**



200 SQ
315 SQ
156
420 MAX

MINIATURE SHIELDED VARIABLE INDUCTORS

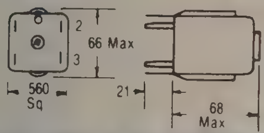
.25 µH — 70 µH **TYPE 435**



15
2
3
420 Sq
21
59 Max

MINIATURE SHIELDED VARIABLE INDUCTORS

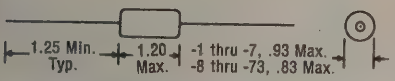
.55 µH — 64 µH **TYPE 434**



2
66 Max
3
560 Sq
21
68 Max

HIGH CURRENT CHOKES

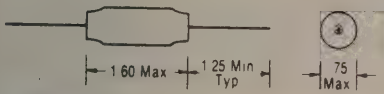
10 µH — 10H **TYPE 6950**



1.25 Min. Typ.
1.20 Max.
-1 thru -7, .93 Max.
-8 thru -73, .83 Max.

HIGH CURRENT CHOKES

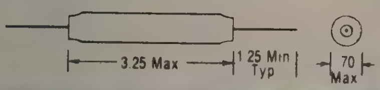
10 µH — 1.0 mH **TYPE 6490**



1 60 Max
1 25 Min Typ
75 Max

HIGH CURRENT/ HIGH VOLTAGE CHOKES

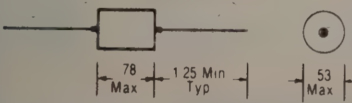
80 µH — 2.0 mH **TYPE 6400**



3.25 Max
1 25 Min Typ
70 Max

SHIELDED CHOKES

5.0 mH — 1.0 H **TYPE 1662**



78 Max
1 25 Min Typ
53 Max

OVER 38 YEARS OF DEPENDABILITY

in the design and manufacture of coils and transformers for industry and defense. We specialize in the manufacture of coils and electronic assemblies to the most rigid military specifications

FERRITE POT CORE ASSEMBLIES
I.F. TRANSFORMERS
EPOXY ENCAPSULATED COIL ASSEMBLIES
BROADBAND MATCHING TRANSFORMERS
ANTENNA COILS AND TRANSFORMERS
OSCILLATOR COILS
BFO TRANSFORMERS
INVERTER CONVERTER TRANSFORMERS
DELAY LINES
DIFFERENTIAL TRANSFORMERS
FILTER (HIGH LOW BAND PASS TRAPS)
PHOTO FLASH TRIGGER TRANSFORMERS
PULSE TRANSFORMERS
Toroidal Power Inductors
D.C. to D.C. Converter Transformers
Saturable Reactors

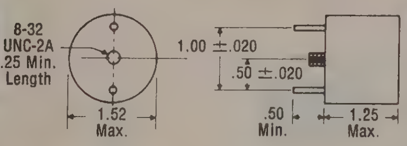
PARTS
COIL FORMS AND BUSHINGS
SHIELD CANS
SPADE BOLTS AND MOUNTING HARDWARE
TUNING CORES
CUP CORES POT CORES TOROIDS
TERMINALS AND TERMINAL BOARDS
R.F. VARNISH AND OTHER PARTS

FOR MORE INFORMATION, WRITE OR PHONE FOR COMPLETE CATALOG.

CADDELL-BURNS DOES NOT SELL THRU DISTRIBUTORS. ALL SALES ARE DIRECT.

HIGH CURRENT CHOKES

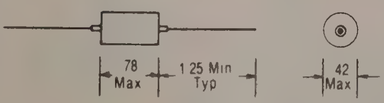
10 µH — 10 mH **TYPE 7000**



8-32 UNC-2A .25 Min. Length
1.00 ±.020
.50 ±.020
1.52 Max.
.50 Min.
1.25 Max.

HIGH CURRENT CHOKES

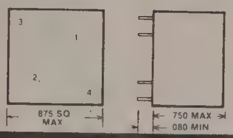
10µH — 1.0H **TYPE 6860**



78 Max
1 25 Min Typ
42 Max

SHIELDED HIGH CURRENT CHOKES

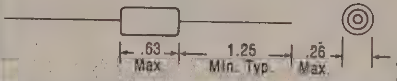
10 µH — 1.0 H **TYPE 6900**



3
1
2
4
875 SQ MAX
750 MAX
080 MIN

MINIATURE HIGH CURRENT CHOKES

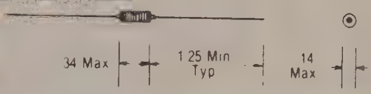
1.0 µH — 100 mH **TYPE 7070**



.63 Max
1.25 Min. Typ.
.26 Max.

MINIATURE CHOKES

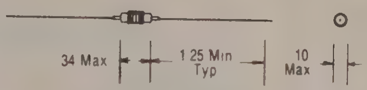
250 µH — 10.0 mH **TYPE 659**



34 Max
1 25 Min Typ
14 Max

MINIATURE CHOKES

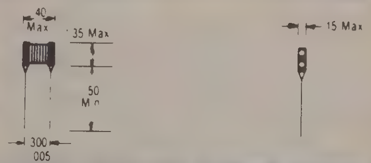
1.0 µH — 100 µH **TYPE 620**



34 Max
1 25 Min Typ
10 Max

PRINTED CIRCUIT CHOKES

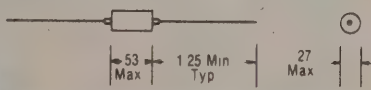
1 µH — 10 mH **TYPE 6550**



40 Max
35 Max
50 Min
300 005
15 Max

SHIELDED CHOKES

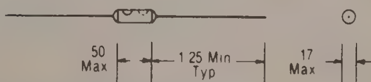
250 µH — 100 mH **TYPE 1670**



53 Max
1 25 Min Typ
27 Max

MINIATURE SHIELDED CHOKES

1.0 µH — 5.0 mH **TYPES 6375/6376**

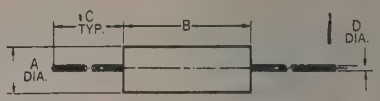


50 Max
1 25 Min Typ
17 Max

DALE®

RF CHOKES, MIL-C-15305

Epoxy Molded, Flame Retardant, Standard and Shielded Types



INDUCTANCE RANGE & MIL STANDARD

Model No.	INDUCTANCE RANGE Mil. Range shown in bold face From	To	CLASSIFICATION Grade	Class	Military Standard
IM-2	**.10 µH**	**1.00 µH**	1	B	MS75083
	1.2 µH	**27 µH**	1	A	MS75084
	33 µH	**1000 µH**	1	A	MS75085
IM-4	**.15 µH**	**4.7 µH**	1	B	MS18130
	5.6 µH	**33 µH**	1	A	MS14046
	36 µH	**240 µH**	1	A	MS90538
	270 µH	1800 µH	—	—	—
IM-6	**.10 µH**	**2.7 µH**	1	B	MS75008
	3.3 µH	**27 µH**	1	A	MS75101
	33 µH	220 µH	—	—	—
	270 µH	**1000 µH**	1	A	MS90539
IM-8	**1100 µH**	**3600 µH**	1	A	MS90540
IM-10	**3900 µH**	**10,000 µH**	1	A	MS90541
IMS-5	**.1 µH**	**100,000 µH**	1	A	MS75088

DIMENSIONS

Model No.		A	B	C	D
IM-2	Max.	.105 [2.67]	.260 [6.60]	1.626 [41.30]	.0215 [.546]
	Min.	.085 [2.16]	.240 [6.10]	1.250 [31.75]	.0185 [.470]
IM-4	Max.	.165 [4.19]	.385 [9.78]	1.625 [41.28]	.027 [.686]
	Min.	.145 [3.68]	.365 [9.27]	1.250 [31.75]	.023 [.584]
IM-6	Max.	.200 [5.08]	.450 [11.43]	1.625 [41.28]	.027 [.686]
	Min.	.180 [4.57]	.430 [10.92]	1.250 [31.75]	.023 [.584]
IM-8	Max.	.225 [5.72]	.570 [14.48]	1.625 [41.28]	.030 [.762]
	Min.	.205 [5.21]	.550 [13.97]	1.250 [31.75]	.026 [.660]
IM-10	Max.	.250 [6.35]	.750 [19.05]	1.625 [41.28]	.034 [.864]
	Min.	.230 [5.84]	.730 [18.54]	1.250 [31.75]	.030 [.762]
IMS-5	Max.	.172 [4.37]	.430 [10.92]	1.625 [41.28]	.027 [.686]
	Min.	.152 [3.86]	.390 [9.91]	1.250 [31.75]	.023 [.584]

MODEL NO. IM-2

Ind. & Tol. (µH)	Q Min.	Test Freq. L & Q (Mhz)
.10±10%	40	25.0
.12±10%	40	25.0
.15±10%	38	25.0
.18±10%	35	25.0
.22±10%	33	25.0
.27±10%	33	25.0
.33±10%	30	25.0
.39±10%	30	25.0
.47±10%	30	25.0
.56±10%	30	25.0
.68±10%	28	25.0
.82±10%	28	25.0
1.00±10%	25	25.0
1.20±10%	25	7.9
1.50±10%	28	7.9
1.80±10%	30	7.9
2.20±10%	30	7.9
2.70±10%	37	7.9
3.30±10%	45	7.9
3.90±10%	45	7.9
4.70±10%	45	7.9
5.60±10%	50	7.9
6.80±10%	50	7.9
8.20±10%	55	7.9
10.0 ±10%	55	7.9
12.0 ±10%	45	2.5
15.0 ±10%	40	2.5
18.0 ±10%	50	2.5
22.0 ±10%	50	2.5
27.0 ±10%	50	2.5
33.0 ±10%	45	2.5
39.0 ±10%	45	2.5
47.0 ±10%	45	2.5
56.0 ±10%	45	2.5
68.0 ±10%	50	2.5
82.0 ±10%	50	2.5
100. ±10%	50	2.5
120. ±10%	30	.79
150. ±10%	30	.79
180. ±10%	30	.79
220. ±10%	30	.79
270. ±10%	30	.79
330. ±10%	30	.79
390. ±10%	30	.79
470. ±10%	30	.79
560. ±10%	30	.79
680. ±10%	30	.79
820. ±10%	30	.79
1000. ±10%	30	.79

MODEL NO. IM-4

Ind. & Tol. (µH)	Q Min.	Test Freq. L & Q (Mhz)
.15±20%	50	25.0
.22±20%	50	25.0
.33±20%	45	25.0
.47±20%	45	25.0
.56±10%	50	25.0
.68±10%	50	25.0
.82±10%	50	25.0
1.00±10%	50	25.0
1.20±10%	33	7.9
1.50±10%	33	7.9
1.80±10%	33	7.9
2.20±10%	33	7.9
2.70±10%	33	7.9
3.30±10%	33	7.9
3.90±10%	33	7.9
4.70±10%	33	7.9
5.60±10%	45	7.9
6.80±10%	50	7.9
8.20±10%	50	7.9
10 ±10%	55	7.9
12 ±10%	65	2.5
15 ±10%	65	2.5
18 ±10%	75	2.5
22 ±10%	75	2.5
27 ±10%	60	2.5
33 ±10%	65	2.5
36 ± 5%	60	2.5
39 ± 5%	60	2.5
43 ± 5%	60	2.5
47 ± 5%	55	2.5
51 ± 5%	55	2.5
56 ± 5%	55	2.5
62 ± 5%	55	2.5
68 ± 5%	55	2.5
75 ± 5%	55	2.5
82 ± 5%	50	2.5
91 ± 5%	50	2.5
100 ± 5%	50	2.5
110 ± 5%	60	.79
120 ± 5%	65	.79
130 ± 5%	65	.79
150 ± 5%	65	.79
160 ± 5%	65	.79
180 ± 5%	65	.79
200 ± 5%	65	.79
220 ± 5%	65	.79
240 ± 5%	65	.79
270 ± 5%	65	.79
300 ± 5%	65	.79
330 ± 5%	65	.79
360 ± 5%	65	.79
390 ± 5%	65	.79
430 ± 5%	65	.79
470 ± 5%	65	.79
510 ± 5%	65	.79
560 ± 5%	65	.79
620 ± 5%	65	.79
680 ± 5%	55	.79
750 ± 5%	55	.79
820 ± 5%	55	.79
910 ± 5%	55	.79
1000 ± 5%	55	.79
1100 ± 5%	30	.25
1200 ± 5%	30	.25
1300 ± 5%	30	.25
1500 ± 5%	30	.25
1600 ± 5%	30	.25
1800 ± 5%	30	.25

MODEL NO. IM-6

Ind. & Tol. (µH)	Q Min.	Test Freq. L & Q (Mhz)
.10±10%	55	25.0
.12±10%	55	25.0
.15±10%	55	25.0
.18±10%	55	25.0
.22±10%	50	25.0
.27±10%	50	25.0
.33±10%	50	25.0
.39±10%	50	25.0
.47±10%	50	25.0
.56±10%	50	25.0
.68±10%	45	25.0
.82±10%	40	25.0
1.00±10%	40	25.0
1.20±10%	30	7.9
1.50±10%	30	7.9
1.80±10%	30	7.9
2.20±10%	30	7.9
2.70±10%	30	7.9
3.30±10%	30	7.9
3.90±10%	30	7.9
4.70±10%	30	7.9
5.60±10%	30	7.9
6.80±10%	30	7.9
8.20±10%	30	7.9
10.0 ±10%	30	7.9
12.0 ±10%	50	2.5
15.0 ±10%	55	2.5
18.0 ±10%	60	2.5
22.0 ±10%	60	2.5
27.0 ±10%	65	2.5
33.0 ±10%	75	2.5
39.0 ±10%	75	2.5
47.0 ±10%	75	2.5
56.0 ±10%	75	2.5
68.0 ±10%	75	2.5
82.0 ±10%	75	2.5
100 ±10%	65	2.5
120 ±10%	65	.79
150 ±10%	65	.79
180 ±10%	65	.79
220 ±10%	65	.79
270 ± 5%	65	.79
300 ± 5%	65	.79
330 ± 5%	65	.79
360 ± 5%	65	.79
390 ± 5%	65	.79
430 ± 5%	65	.79
470 ± 5%	65	.79
510 ± 5%	65	.79
560 ± 5%	65	.79
620 ± 5%	60	.79
680 ± 5%	60	.79
750 ± 5%	60	.79
820 ± 5%	60	.79
910 ± 5%	60	.79
1000 ± 5%	60	.79

MODEL NO. IM-8

Ind. & Tol. (µH)	Q Min.	Test Freq. L & Q (Mhz)
1100 ± 5%	60	.25
1200 ± 5%	60	.25
1300 ± 5%	60	.25
1500 ± 5%	65	.25
1600 ± 5%	65	.25
1800 ± 5%	65	.25
2000 ± 5%	65	.25
2200 ± 5%	70	.25
2400 ± 5%	70	.25
2700 ± 5%	70	.25
3000 ± 5%	70	.25
3300 ± 5%	70	.25
3600 ± 5%	70	.25

MODEL NO. IM-10

Ind. & Tol. (µH)	Q Min.	Test Freq. L & Q (Mhz)
3900 ± 5%	80	.25
4300 ± 5%	80	.25
4700 ± 5%	80	.25
5000 ± 5%	80	.25
5600 ± 5%	80	.25
6200 ± 5%	80	.25
6800 ± 5%	80	.25
7500 ± 5%	80	.25
8200 ± 5%	80	.25
9100 ± 5%	80	.25
10,000 ± 5%	80	.25

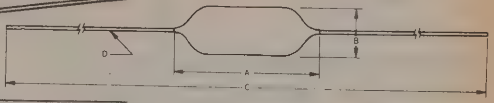
MODEL NO. IMS-5 Shielded Inductor

Ind. ±10% (µH)	Q. Min.	Test Freq. (Mhz)
.10	50	25
.12	51	25
.15	51	25
.18	50	25
.22	49	25
.27	47	25
.33	46	25
.39	44	25
.47	44	25
.56	43	25
.68	42	25
.82	40	25
1.00	44	25
1.20	44	7.9
1.50	44	7.9
1.80	44	7.9
2.20	44	7.9
2.70	44	7.9
3.30	44	7.9
3.90	44	7.9
4.70	44	7.9
5.60	44	7.9
6.80	50	7.9
8.20	50	7.9
10.0	50	7.9
12.0	55	2.5
15.0	45	2.5
18.0	45	2.5
22.0	45	2.5
27.0	45	2.5
33.0	45	2.5
39.0	50	2.5
47.0	50	2.5
56.0	50	2.5
68.0	50	2.5
82.0	50	2.5
100.0	50	2.5
120.0	55	.79
150.0	55	.79
180.0	55	.79
220.0	55	.79
270.0	55	.79
330.0	55	.79
390.0	60	.79
470.0	60	.79
560.0	60	.79
680.0	60	.79
820.0	60	.79
1,000.0	60	.79
1,200.0	45	.25
1,500.0	45	.25
1,800.0	45	.25
2,200.0	45	.25
2,700.0	45	.25
3,300.0	45	.25
3,900.0	45	.25
4,700.0	45	.25
5,600.0	44	.25
6,800.0	40	.25
8,200.0	40	.25
10,000.0	40	.25
12,000.0	30	.079
15,000.0	30	.079
18,000.0	30	.079
22,000.0	27	.079
27,000.0	27	.079
33,000.0	27	.079
39,000.0	27	.079
47,000.0	23	.079
56,000.0	23	.079
68,000.0	23	.079
82,000.0	21	.079
100,000.0	18	.079

For complete information, write or phone

DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®



RF CHOKES

Epoxy Conformal Coated Inductors

FEATURES

- Equivalent in quality to molded chokes—at a lower price.
- Excellent for automatic insertion.

Model No.		A	B	C	D
IR-2	MAX.	.300 [7.62]	.120 [3:05]	—	.0215 [.534]
	MIN.	.270 [6.86]	.100 [2.54]	2.9202 [74.17]	.0185 [.458]
IR-4	MAX.	.440 [11.18]	.180 [4.57]	—	.027 [.686]
	MIN.	.410 [10.41]	.150 [3.81]	2.985 [75.82]	.023 [.584]

MODEL NO. IR-2

Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.10	±10%	40	25.0
.12	±10%	40	25.0
.15	±10%	38	25.0
.18	±10%	35	25.0
.22	±10%	33	25.0
.27	±10%	33	25.0
.33	±10%	30	25.0
.39	±10%	30	25.0
.47	±10%	30	25.0
.56	±10%	30	25.0
.68	±10%	28	25.0
.82	±10%	28	25.0
1.00	±10%	25	25.0
1.20	±10%	25	7.9
1.50	±10%	28	7.9
1.80	±10%	30	7.9
2.20	±10%	30	7.9
2.70	±10%	37	7.9
3.30	±10%	45	7.9
3.90	±10%	45	7.9
4.70	±10%	45	7.9
5.60	±10%	50	7.9
6.80	±10%	50	7.9
8.20	±10%	55	7.9
10.0	±10%	55	7.9
12.0	±10%	45	2.5
15.0	±10%	40	2.5
18.0	±10%	50	2.5
22.0	±10%	50	2.5
27.0	±10%	50	2.5
33.0	±10%	45	2.5
39.0	±10%	45	2.5
47.0	±10%	45	2.5
56.0	±10%	45	2.5
68.0	±10%	50	2.5
82.0	±10%	50	2.5
100.	±10%	50	2.5
120.	±10%	30	.79
150.	±10%	30	.79
180.	±10%	30	.79
220.	±10%	30	.79
270.	±10%	30	.79
330.	±10%	30	.79
390.	±10%	30	.79
470.	±10%	30	.79
560.	±10%	30	.79
680.	±10%	30	.79
820.	±10%	30	.79
1000.	±10%	30	.79

MODEL NO. IR-4

Ind. (μh)	Tol.	Q. Min.	Test Freq. L & Q (Mhz)
.15	±20%	50	25.0
.22	±20%	50	25.0
.33	±20%	45	25.0
.47	±20%	45	25.0
.56	±10%	50	25.0
.68	±10%	50	25.0
.82	±10%	50	25.0
1.00	±10%	50	25.0
1.20	±10%	33	7.9
1.50	±10%	33	7.9
1.80	±10%	33	7.9
2.20	±10%	33	7.9
2.70	±10%	33	7.9
3.30	±10%	33	7.9
3.90	±10%	33	7.9
4.70	±10%	33	7.9
5.60	±10%	45	7.9
6.80	±10%	50	7.9
8.20	±10%	50	7.9
10.0	±10%	55	7.9
12.0	±10%	65	2.5
15.0	±10%	65	2.5
18.0	±10%	75	2.5
22.0	±10%	75	2.5
27.0	±10%	60	2.5
33.0	±10%	65	2.5
36.0	± 5%	60	2.5
39.0	± 5%	60	2.5
43.0	± 5%	60	2.5
47.0	± 5%	55	2.5
51.0	± 5%	55	2.5
56.0	± 5%	55	2.5
62.0	± 5%	55	2.5
68.0	± 5%	55	2.5
75.0	± 5%	55	2.5
82.0	± 5%	50	2.5
91.0	± 5%	50	2.5
100.0	± 5%	50	2.5
110.0	± 5%	60	.79
120.0	± 5%	65	.79
130.0	± 5%	65	.79
150.0	± 5%	65	.79
160.0	± 5%	65	.79
180.0	± 5%	65	.79
200.0	± 5%	65	.79
220.0	± 5%	65	.79
240.0	± 5%	65	.79

CUSTOM INDUCTIVE PRODUCTS

TOROIDS

• Potted with case sizes to fit your specific designs • Open wound using Dale-formulated coatings for extra protection • Inverters, RF Inductors and Transformers with or without terminal boards. Unusual shapes and sizes a specialty.

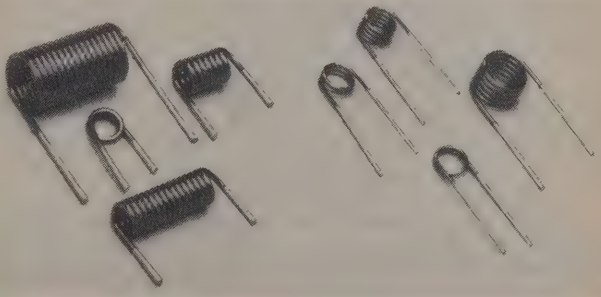
BOBBINS

• Statistical control on high volume production items • Low initial tooling cost.

TOUGH COIL JOBS

Whether you need a hundred pieces or a million, we offer: • Complete facilities to design, engineer and produce prototype quantities • Faster turn-around on custom samples and short run production quantities • Close production coordination including cost-saving statistical control on high volume items.

AIR CORE CHOKES, INDUCTORS



Produced to your specifications for a wide range of high frequency applications including: • Television • Radio (2-way, scanners, AM/FM) • Cable TV Systems • Satellite Communication • Microwave • Test Equipment

SPECIFICATIONS

ELECTRICAL

Frequency: To 500 MHz
Current: 1 amp. max.
Temperature: To 130°C

MECHANICAL

Winding: 1 to 32 turns, clockwise or counter-clockwise with variable pitch.
Wire Gauge: #18 to #32.

Leads: Automatically tinned. Various configurations available.
Coil Inside Diameter: .079″ to .354″.
Coil Length: Up to 1.26″.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

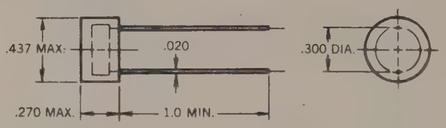
DALE®

DALE TYPE TE-2 & TD-2 FILTER INDUCTORS (Toroidal)

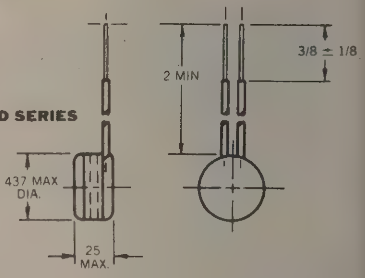
FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TE style designed to meet the requirements of MIL-T-27, Type TF5SX20ZZ. TD style combines low cost with excellent performance in commercial applications.
- High Q and wide selection of Q vs frequency ranges in one small package. Large number of standard inductance values.

TE SERIES



TD SERIES



SPECIFICATIONS

ELECTRICAL

Tolerance: ±1% standard>2 mH. ±2% standard 0.05 mH to 2.0 mH.

Insulation Resistance: 1000 Megohms minimum.

Dielectric Strength: 1000 Volts minimum (TE)
500 Volts minimum (TD)

MECHANICAL

Terminal Strength: 2 lb. pull test (TE)

Vibration: Per MIL-T-27 (TE)

Shock: Per MIL-T-27 (TE)

Weight: 2 grams (TE) • 1.6 grams typical (TD)

MATERIAL

Encapsulant: Epoxy (TE)

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: 24 AWG Tinned Copper (TE); 30 AWG Stranded Copper, tinned, Teflon-insulated (TD)

INDUCTANCE RANGES

TYPE TE & TD	INDUCTANCE MILLIHENRIES
Q0	.050 to 10.0
Q3	.470 to 120
Q4	1.00 to 250

TEMPERATURE COEFFICIENT CODE*

T.C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE
TA	0 ± 1%	−55°C to +125°C
TD	0 ±0.1%	0°C to + 55°C
TM	0 ±0.25%	−65°C to +125°C
TW	0 ±0.25%	−55°C to + 85°C
TR	50 PPM/°C TYP.	−65°C to +125°C

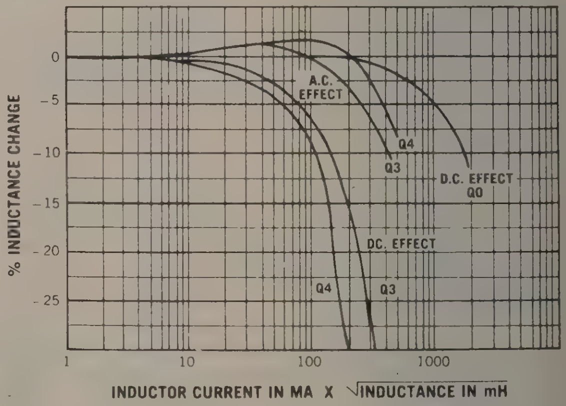
*Applies to core only. TR does not apply to Q3 and Q4 – nor do other codes apply to Q0.

DC RESISTANCE & SELF RESONANT FREQUENCIES
(Typical Values*)

INDUCTANCE (mH)	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
0.050	1.9	–	–	10	–	–
0.100	2.7	–	–	7	–	–
0.330	7.7	–	–	3.1	–	–
0.470	9.3	2.3	–	2.5	2.4	–
1.00	26	4.2	2.3	1.4	1.2	2.0
3.30	79	9.7	5.4	.70	.79	.95
10.0	251	31	18	.34	.40	.43
33.0	–	118	54	–	.18	.21
100	–	408	227	–	.06	.10
250	–	–	450	–	–	.05

*For test limits of specific values, contact factory.

INDUCTANCE VS D.C. BIAS INDUCTANCE VS A.C. EXCITATION



SAMPLE PART NUMBER

TE-2 TD-2	Q0	TR	5mH	2.0
DALE SIZE	Q TYPE	T.C. CODE	INDUCTANCE	% TOLERANCE

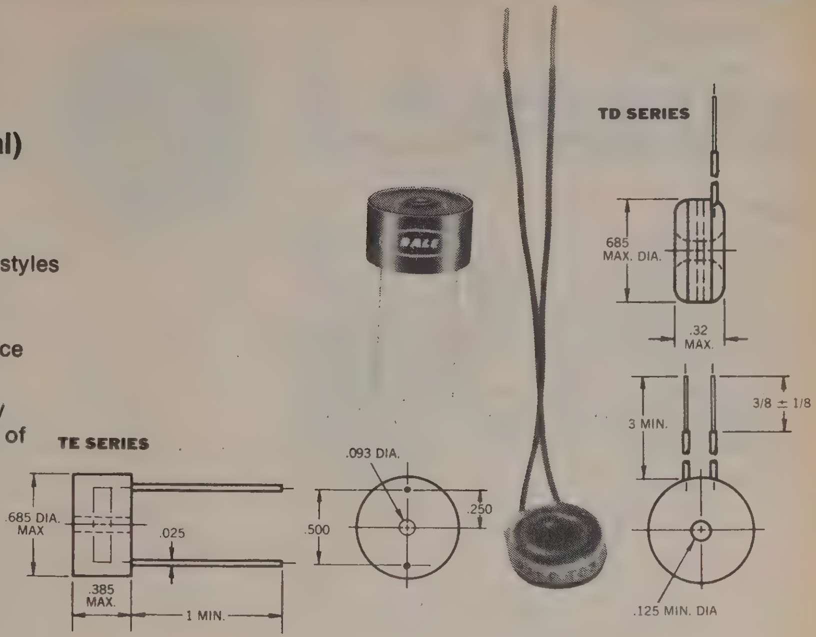
For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

DALE TYPE TE-3 & TD-3 FILTER INDUCTORS (Toroidal)

FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TE style designed to meet the requirements of MIL-T-27, Type TF5SX20ZZ. TD style combines low cost with excellent performance in commercial applications.
- High Q and wide selection of Q vs frequency ranges in one small package. Large number of standard inductance values.



SPECIFICATIONS

ELECTRICAL

Tolerance: ±1% standard >2 mH, ±2% standard 154 μH to 2.0 mH. ±5% standard <150 μH

Insulation Resistance: 1000 Megohms minimum

Dielectric Strength: 1000 Volts minimum (TE)
500 Volts minimum (TD)

MECHANICAL

Terminal Strength: 2 lb. pull test (TE)

Vibration: Per MIL-T-27 (TE)

Shock: Per MIL-T-27 (TE)

Weight: 5.1 grams (TE) • 4.9 grams typical (TD)

MATERIAL

Encapsulant: Epoxy (TE)

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: 22 AWG Tinned Copper (TE); 26 AWG Stranded Copper, tinned, Teflon-insulated (TD)

INDUCTANCE RANGES

TYPE TE & TD	INDUCTANCE
Q0	50 μH to 15 mH
Q3	500 μH to 1 H
Q4	1 mH to 4 H

TEMPERATURE COEFFICIENT CODE*

T.C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE
TA	0 ± 1%	-55° C to +125° C
TD	0 ± 0.1%	0° C to +55° C
TL**	+40 to +110 PPM/° C	-55° C to +25° C
	+85 to +185 PPM/° C	+25° C to +85° C
TM	0 ± 0.25%	-65°C to +125° C
TR	50 PPM/° C TYP.	-65°C to +125° C
TW	0 ± 0.25%	-55°C to +85° C

*Applies to core only. TR does not apply to Q3 and Q4 – nor do other codes apply to Q0.

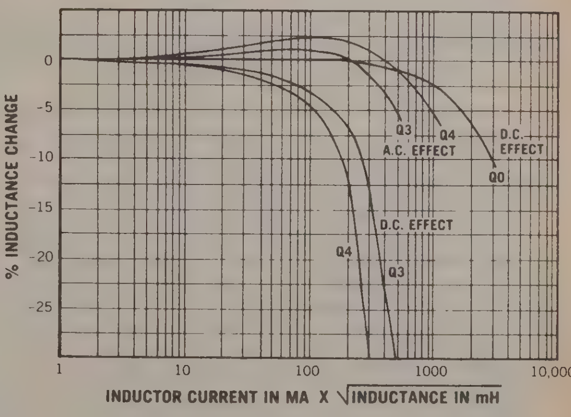
**Inverse of typical temperature coefficient of polystyrene capacitor. (Applies to Q4 only.)

DC RESISTANCE & SELF RESONANT FREQUENCIES
(Typical Values*)

INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
50.0 μH	.68	–	–	7.6	–	–
100. μH	1.0	–	–	5.1	–	–
330. μH	3.3	–	–	2.9	–	–
1.00 mH	6.9	1.5	.82	1.4	1.1	1.0
3.30 mH	24	4.1	2.3	.79	.57	.55
10.0 mH	84	14	5.9	.40	.29	.25
15.0 mH	106	17	9.1	.34	.24	.21
33.0 mH	–	40	18	–	.14	.12
100. mH	–	138	58	–	.080	.077
330. mH	–	555	220	–	.040	.038
1.0 H	–	1500	670	–	.021	.019
4.00 H	–	–	2700	–	–	.009

*For test limits of specific values, contact factory.

INDUCTANCE VS D.C. BIAS INDUCTANCE VS A.C. EXCITATION



SAMPLE PART NUMBER

TE-3 TD-3	Q0	TR	5mH	2.0
DALE SIZE	Q TYPE	T.C. CODE	INDUCTANCE in μH, mH or H	% TOLERANCE

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

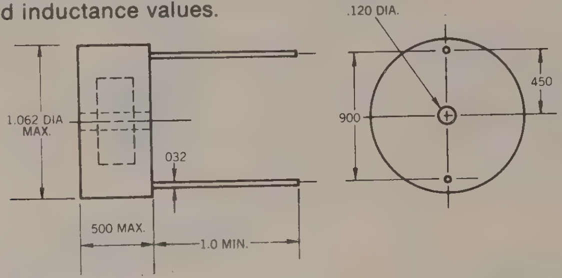
DALE®

DALE TYPE TE-4 & TD-4 FILTER INDUCTORS (Toroidal)

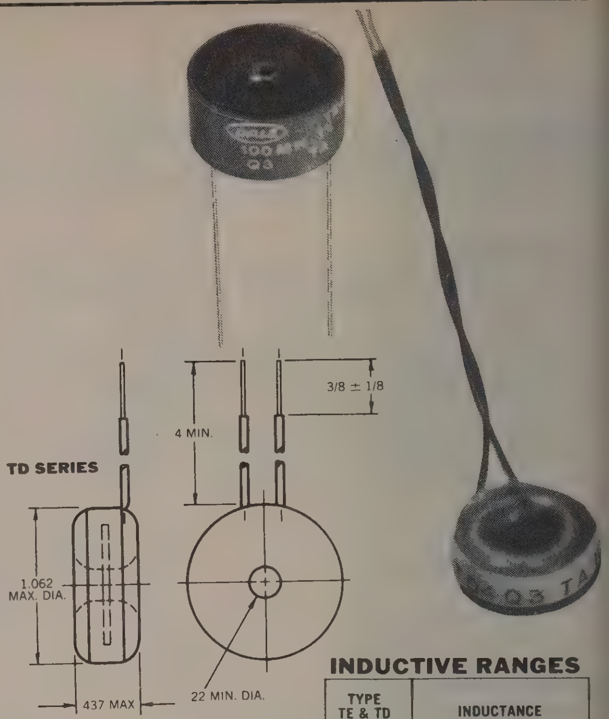
FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TE style designed to meet the requirements of MIL-T-27, Type TF5SX20ZZ. TD style combines low cost with excellent performance in commercial applications.
- High Q and wide selection of Q vs frequency ranges in one small package. Large number of standard inductance values.

TE SERIES



TD SERIES



INDUCTIVE RANGES

TYPE TE & TD	INDUCTANCE
Q0	150 µH to 20 mH
Q3	1 mH to 2 H
Q4	2 mH to 7.5 H

SPECIFICATIONS

ELECTRICAL

Tolerance: ±1% standard>2 mH,
±2% standard<2 mH

Insulation Resistance: 1000 Megohms minimum

Dielectric Strength: 1000 Volts minimum (TE)
500 Volts minimum (TD)

MECHANICAL

Terminal Strength: 2 lb. pull test (TE)

Vibration: Per MIL-T-27 (TE)

Shock: Per MIL-T-27 (TE)

Weight: 20 grams typical (TE) • 17 grams typical (TD)

MATERIAL

Encapsulant: Epoxy (TE)

Coating: Vinyl (TD). non-flammable. abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: 20 AWG Tinned Copper (TE); 24 AWG Stranded Copper, tinned, Teflon-insulated (TD)

TEMPERATURE COEFFICIENT CODE (APPLIES TO CORE ONLY)

T. C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	T. C. AVAILABILITY Q0	Q3	Q4
TA	0 ± 1%	−55° C to +125°C		X	X
TB	0 ± 0.1%	+13° C to +35° C		X	X
TD	0 ± 0.1%	0° C to +55° C		X	X
TE	0 ± 0.15%	0° C to +55° C			X
TL*	+40 to +110 PPM/° C	−55° C to +25° C			X
	+85 to +185 PPM/° C	+25° C to +85° C			
TM	0 ± 0.25%	−65° C to +125° C		X	X
TR	50 PPM/° C (TYPICAL)	−65° C to +125° C	X		
TW	0 ± 0.25%	−55° C to +85° C		X	X

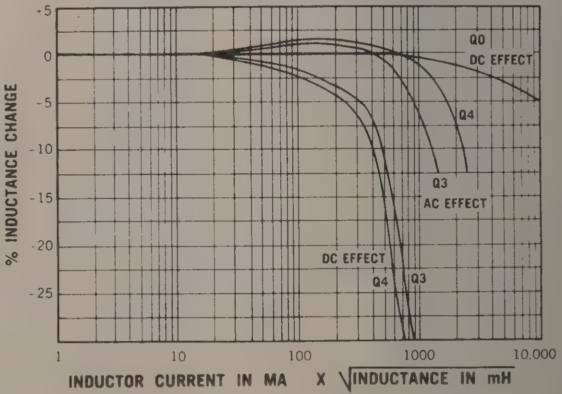
Inverse of typical Temperature Coefficient of polystyrene capacitor.

DC RESISTANCE & SELF RESONANT FREQUENCIES
(Typical Values*)

	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
INDUCTANCE	Q0	Q3	Q4	Q0	Q3	Q4
150. µH	.54	–	–	2.6	–	–
1.00 mH	2.8	.70	–	1.0	.75	–
2.00 mH	5.5	1.4	.78	.64	.54	.45
10.0 mH	27	4.9	2.5	.24	.21	.18
20.0 mH	54	9.6	5.0	.18	.15	.13
100. mH	–	56	23	–	.059	.051
1.00 H	–	570	260	–	.016	.014
2.00 H	–	1200	520	–	.013	.011
7.5 H	–	–	2000	–	–	.004

*For test limits on specific values, contact factory.

INDUCTANCE VS D. C. BIAS
INDUCTANCE VS A.C. EXCITATION



SAMPLE PART NUMBER

TE-4 TD-4	Q0	TR	5mH	1.0
DALE SIZE	Q TYPE	T.C. CODE	INDUCTANCE in µH, mH or H	% TOLERANCE

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

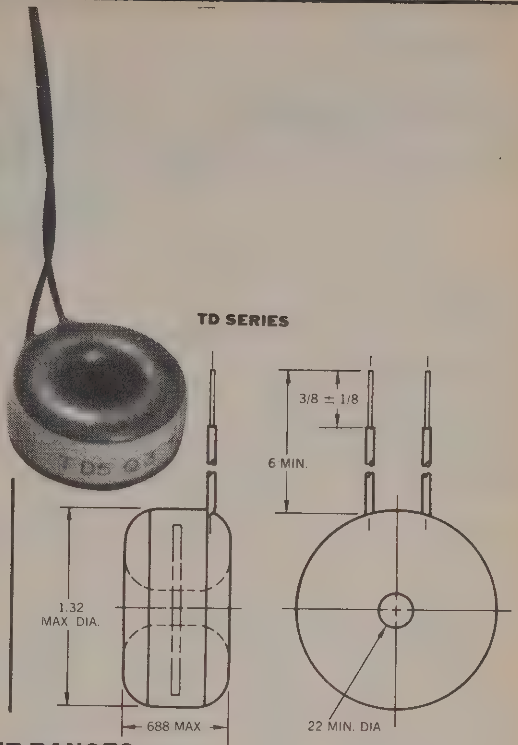
DALE®

DALE TYPE TE-5 & TD-5 FILTER INDUCTORS (Toroidal)

FEATURES

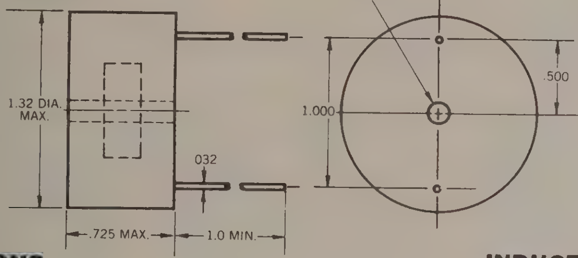
- Choice of encapsulated (TE) or dipped (TD) styles
- TE style designed to meet the requirements of MIL-T-27, Type TF5SX20ZZ. TD style combines low cost with excellent performance in commercial applications.
- High Q and wide selection of Q vs frequency ranges in one small package. Large number of standard inductance values.

TD SERIES



TE SERIES

TE SERIES



SPECIFICATIONS

ELECTRICAL

Tolerance: ±1% standard >2 mH.
±2% standard <2 mH

Insulation Resistance: 1000 Megohms minimum

Dielectric Strength: 1000 Volts minimum (TE)
500 Volts minimum (TD)

MECHANICAL

Terminal Strength: 2 lb. pull test (TE)

Vibration: Per MIL-T-27 (TE)

Shock: Per MIL-T-27 (TE)

Weight: 53 grams typical (TE) • 52 grams typical (TD)

MATERIAL

Encapsulant: Epoxy (TE)

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: 20 AWG Tinned Copper (TE); 24 AWG Stranded Copper, tinned. Teflon-insulated (TD)

INDUCTIVE RANGES

TYPE TE & TD	INDUCTANCE
Q0	1 mH to 100 mH
Q3	5 mH to 2 H
Q4	10 mH to 20 H

TEMPERATURE COEFFICIENT CODE (APPLIES TO CORE ONLY)

T. C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	T. C. AVAILABILITY		
			Q0	Q3	Q4
TA	0 ± 1%	−55° C to +125°C		X	X
TB	0 ± 0.1%	+13° C to +35° C		X	X
TD	0 ± 0.1%	0° C to +55° C		X	X
TE	0 ± 0.15%	0° C to +55° C			X
TL*	+40 to +110 PPM/° C +85 to +185 PPM/° C	−55° C to +25° C +25° C to +85° C			X
TM	0 ± 0.25%	−65° C to +125° C		X	X
TR	50 PPM/° C (TYPICAL)	−65° C to +125° C	X		
TW	0 ± 0.25%	−55° C to +85° C		X	X

Inverse of typical Temperature Coefficient of polystyrene capacitor.

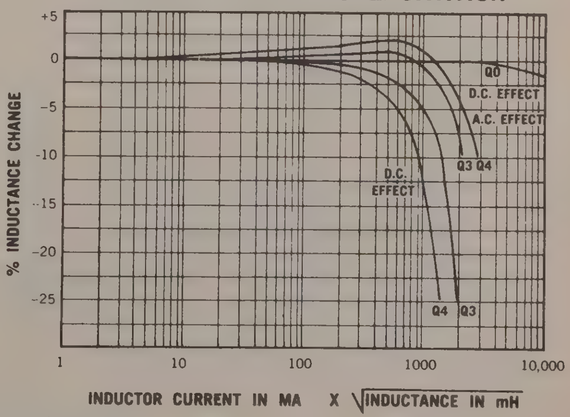
DC RESISTANCE & SELF RESONANT FREQUENCIES

(Typical Values*)

INDUCTANCE	DC RESISTANCE (Ohms)			SELF-RESONANT FREQUENCIES (MHz)		
	Q0	Q3	Q4	Q0	Q3	Q4
1.00 mH	1.8	–	–	.80	–	–
3.30 mH	5.2	–	–	.44	–	–
5.00 mH	6.5	1.8	–	.33	.32	–
10.00 mH	13	2.4	1.7	.21	.20	.15
33.00 mH	49	8.8	3.9	.12	.11	.086
100.00 mH	133	27	11	.061	.057	.044
330.00 mH	–	80	44	–	.032	.024
1.00 H	–	222	121	–	.016	.012
2.00 H	–	475	217	–	.012	.008
10.00 H	–	–	1300	–	–	.003
20.00 H	–	–	2400	–	–	.002

*For test limits of specific values, contact factory.

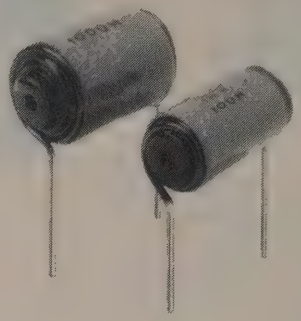
INDUCTANCE VS D.C. BIAS
INDUCTANCE VS A.C. EXCITATION



For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

TYPE IH SERIES
High Current Filter Chokes



FEATURES

- Printed circuit mounting
- Pre-tinned leads

TYPICAL APPLICATIONS

Noise filtering for switching regulators, power amplifiers, power supplies and SCR or Triac control circuits.

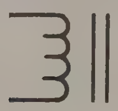
ELECTRICAL SPECIFICATIONS / DIMENSIONS

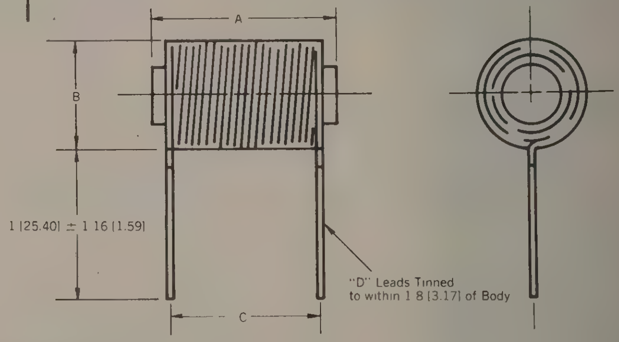
Dimension in Inches
[Dimensions in Millimeters]

MODEL	IND. @ 1 KHz * ± 10%	RATED CURRENT (Max.)	DC RESISTANCE (Max.)	SELF-RESONANT FREQUENCY (Min.)	INCREMENTAL CURRENT**	A (Max.)	B (Max.)	C ±.062 [1.59]	D ±.005 [0.13]
IH-3	5 μh	3 amps	.015 Ω	40 MHz	19 amps	0.875 [22.23]	0.625 [15.88]	0.500 [12.70]	.042 [1.067]
IH-3	10 μh	3 amps	.018 Ω	25 MHz	17 amps	1.125 [28.58]	0.625 [15.88]	0.687 [17.45]	.042 [1.067]
IH-3	27 μh	3 amps	.035 Ω	8 MHz	15 amps	0.875 [22.23]	0.812 [20.62]	0.437 [11.10]	.042 [1.067]
IH-3	50 μh	3 amps	.050 Ω	5 MHz	12 amps	1.125 [28.58]	0.812 [20.62]	0.750 [19.05]	.042 [1.067]
IH-3	100 μh	3 amps	.065 Ω	2.5 MHz	8 amps	1.125 [28.58]	0.812 [20.62]	0.937 [23.80]	.042 [1.067]
IH-3	150 μh	3 amps	.075 Ω	2.0 MHz	5 amps	1.375 [34.93]	0.812 [20.62]	1.062 [26.97]	.042 [1.067]
IH-3	250 μh	3 amps	.090 Ω	1.0 MHz	3 amps	1.625 [41.28]	0.812 [20.62]	1.312 [33.32]	.042 [1.067]
IH-5	5 μh	5 amps	.012 Ω	30 MHz	20 amps	0.875 [22.23]	0.640 [16.26]	0.750 [19.05]	.053 [1.35]
IH-5	10 μh	5 amps	.015 Ω	20 MHz	18 amps	1.125 [28.53]	0.640 [16.26]	1.000 [25.40]	.053 [1.35]
IH-5	27 μh	5 amps	.025 Ω	7 MHz	15 amps	0.875 [22.23]	0.875 [22.23]	0.562 [14.27]	.053 [1.35]
IH-5	50 μh	5 amps	.030 Ω	4 MHz	10 amps	1.125 [28.53]	0.875 [22.23]	0.750 [19.05]	.053 [1.35]
IH-5	68 μh	5 amps	.035 Ω	3.5 MHz	9 amps	1.125 [28.53]	0.875 [22.23]	0.875 [22.23]	.053 [1.35]
IH-5	100 μh	5 amps	.050 Ω	2.5 MHz	7 amps	1.375 [34.93]	0.875 [22.23]	1.000 [25.40]	.053 [1.35]
IH-5	150 μh	5 amps	.060 Ω	2.0 MHz	5 amps	1.625 [41.28]	0.875 [22.23]	1.250 [31.75]	.053 [1.35]
IH-10	5 μh	10 amps	.010 Ω	30 MHz	19 amps	1.125 [28.53]	0.687 [17.45]	0.812 [20.62]	.065 [1.65]
IH-10	10 μh	10 amps	.012 Ω	20 MHz	17 amps	1.375 [34.93]	0.687 [17.45]	1.218 [30.94]	.065 [1.65]
IH-10	27 μh	10 amps	.018 Ω	7 MHz	15 amps	1.125 [28.53]	0.937 [23.80]	0.687 [17.45]	.065 [1.65]
IH-10	50 μh	10 amps	.025 Ω	4 MHz	9 amps	1.375 [34.93]	0.937 [23.80]	0.937 [23.80]	.065 [1.65]
IH-10	68 μh	10 amps	.027 Ω	3.5 MHz	8 amps	1.375 [34.93]	0.937 [23.80]	1.125 [28.53]	.065 [1.65]
IH-10	100 μh	10 amps	.030 Ω	2.5 MHz	6 amps	1.625 [41.28]	0.937 [23.80]	1.312 [33.32]	.065 [1.65]
IH-15	5 μh	15 amps	.008 Ω	30 MHz	20 amps	1.375 [34.93]	0.725 [18.42]	0.937 [23.80]	.082 [2.08]
IH-15	10 μh	15 amps	.010 Ω	20 MHz	17 amps	1.687 [42.85]	0.725 [18.42]	1.500 [38.10]	.082 [2.08]
IH-15	27 μh	15 amps	.015 Ω	7 MHz	14 amps	1.375 [34.93]	1.000 [25.40]	0.937 [23.80]	.082 [2.08]
IH-15	50 μh	15 amps	.020 Ω	4 MHz	9 amps	1.625 [41.28]	1.000 [25.40]	1.125 [28.53]	.082 [2.08]

*Inductance measured with zero D.C. current.
**Incremental current reduces inductance by 10% or less.
Average current must not exceed specified rated current.

SCHEMATIC





ORDERING INFORMATION

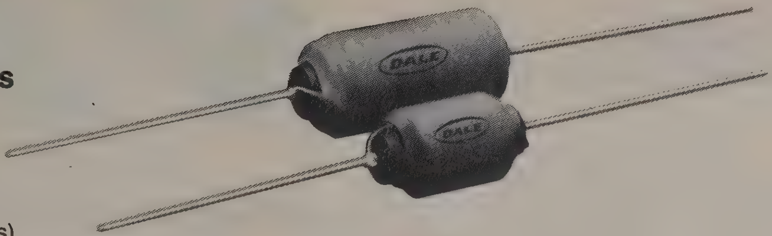
IH	–5	10 μh ±10%
1.	2.	3.

1. Basic model high current choke
2. Current rating maximum (amperes)
3. Inductance (μh)

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

TYPE IHA SERIES
High Current Filter Chokes



FEATURES

- Printed circuit mounting (axial leads)
- Pre-tinned leads
- Low cost construction
- Designed for use with switching power supplies
- Protected by polyolefin sleeve

SPECIFICATIONS
ELECTRICAL

Inductance: Measured at 1 KHz with no D.C. current. Rated current will reduce inductance by 10% or less.

Current Rating: Maximum continuous operating current (DC or RMS) at room temperature ambient.

Dielectric Rating: 2,500 V RMS, 60 Hz, applied for one minute between winding and outer circumference to within .25″ of the insulation sleeve edge.

Temperature Rating: Continuous operation at temperature between −55°C and 105°C.

MECHANICAL

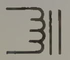
Winding: Layered solenoid type with magnetic core

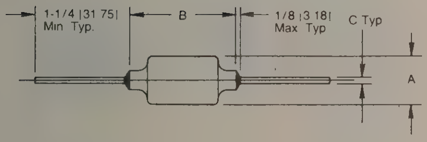
Wire: Solid soft copper

Terminals: Tinned copper leads

Coating: Polyolefin tubing

SCHEMATIC





ORDERING INFORMATION

IHA	−101
1.	2.

1. Basic model high current choke
2. Dash number for current and inductance value desired.

ELECTRICAL SPECIFICATIONS

MODEL	INDUCTANCE @ 1 KHz ±10%	CURRENT (Max.)	DC RESISTANCE (Max.)	SELF-RESONANT FREQUENCY (Min.)
IHA-101	50 μh	1 amp.	.12Ω	4.0 MHz
IHA-102	100 μh	1 amp.	.18Ω	2.0 MHz
IHA-103	250 μh	1 amp.	.30Ω	1.0 MHz
IHA-104	500 μh	1 amp.	.50Ω	.8 MHz
IHA-105	1000 μh	1 amp.	.60Ω	.5 MHz
IHA-201	27 μh	2 amp.	.085Ω	5.5 MHz
IHA-202	50 μh	2 amp.	.10Ω	4.0 MHz
IHA-203	100 μh	2 amp.	.15Ω	2.0 MHz
IHA-204	250 μh	2 amp.	.25Ω	1.0 MHz
IHA-205	500 μh	2 amp.	.45Ω	.5 MHz
IHA-301	5 μh	3 amp.	.025Ω	25.0 MHz
IHA-302	10 μh	3 amp.	.035Ω	20.0 MHz
IHA-303	27 μh	3 amp.	.05Ω	6.0 MHz
IHA-304	50 μh	3 amp.	.065Ω	4.0 MHz
IHA-305	100 μh	3 amp.	.075Ω	2.0 MHz
IHA-501	5 μh	5 amp.	.015Ω	50.0 MHz
IHA-502	10 μh	5 amp.	.025Ω	40.0 MHz
IHA-503	27 μh	5 amp.	.035Ω	7.0 MHz
IHA-504	50 μh	5 amp.	.05Ω	2.0 MHz
IHA-505	100 μh	5 amp.	.065Ω	1.0 MHz

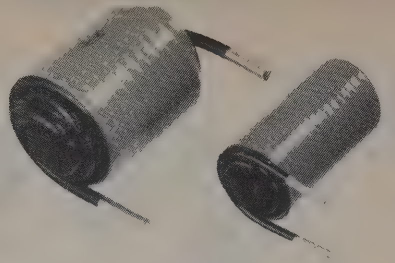
MECHANICAL SPECIFICATIONS

MODEL	A (Max.)	B (Max.)	C ±.002 [0.05]
IHA-101	.475 [12.06]	.800 [20.32]	.032 [0.81]
IHA-102	.475 [12.06]	.800 [20.32]	.032 [0.81]
IHA-103	.475 [12.06]	1.050 [26.67]	.032 [0.81]
IHA-104	.550 [13.97]	1.050 [26.67]	.032 [0.81]
IHA-105	.550 [13.97]	1.175 [29.84]	.032 [0.81]
IHA-201	.500 [12.70]	.800 [20.32]	.032 [0.81]
IHA-202	.500 [12.70]	.800 [20.32]	.032 [0.81]
IHA-203	.500 [12.70]	.920 [23.37]	.032 [0.81]
IHA-204	.600 [15.24]	.920 [23.37]	.032 [0.81]
IHA-205	.750 [19.05]	1.050 [26.67]	.032 [0.81]
IHA-301	.475 [12.06]	.800 [20.32]	.032 [0.81]
IHA-302	.475 [12.06]	.920 [23.37]	.032 [0.81]
IHA-303	.550 [13.97]	.800 [20.32]	.032 [0.81]
IHA-304	.550 [13.97]	.920 [23.37]	.032 [0.81]
IHA-305	.550 [13.97]	1.175 [29.84]	.032 [0.81]
IHA-501	.475 [12.06]	1.050 [26.67]	.040 [1.02]
IHA-502	.475 [12.06]	1.050 [26.67]	.040 [1.02]
IHA-503	.700 [17.78]	1.050 [26.67]	.040 [1.02]
IHA-504	.700 [17.78]	1.050 [26.67]	.040 [1.02]
IHA-505	.700 [17.78]	1.300 [33.02]	.040 [1.02]

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

TYPE IHV SERIES
High Current Filter Chokes



FEATURES

- Printed circuit mounting
- Low cost construction
- Designed for use with switching power supplies
- Pre-tinned leads
- Epoxy coated for durability and reliability

SPECIFICATIONS
ELECTRICAL

Inductance: Measured at 1 KHz with no D.C. current

Dielectric: 2500 Volts RMS between winding and outer circumference to within 0.25 inches of the insulation sleeve edge.

Temperature: Operating: −55°C to +105°C
Storage: −55°C to +130°C

Current Rating: Based on continuous operation at room temperature ambient. Derating is required at elevated ambient temperatures in accordance with the derating curve.

MECHANICAL

Terminals: Extensions of winding wire, solder coated

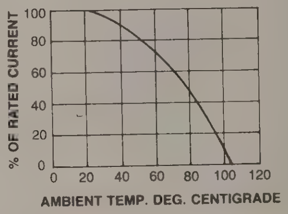
Coating: Epoxy conformal coated

ELECTRICAL SPECIFICATIONS

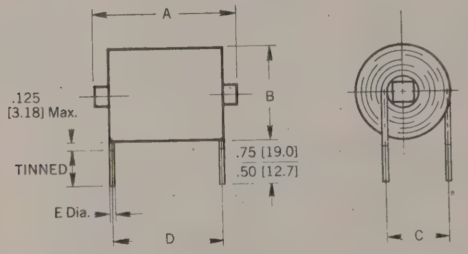
MODEL	INDUCTANCE* ±10%	CURRENT (Max.)	DC RESISTANCE (Max.)	SELF-RESONANT FREQUENCY (Min.)
IHV-15-500	500 μh	15 amps	.050Ω	0.8 MHz
IHV-20-200	200 μh	20 amps	.021Ω	1.2 MHz
IHV-28-60	60 μh	28 amps	.0085Ω	1.9 MHz
IHV-30-150	150 μh	30 amps	.013Ω	2.1 MHz
IHV-40-39	39 μh	40 amps	.0048Ω	2.5 MHz
IHV-45-92	92 μh	45 amps	.0075Ω	2.9 MHz
IHV-50-50	50 μh	50 amps	.0045Ω	3.1 MHz
IHV-60-24	24 μh	60 amps	.0025Ω	5.7 MHz

*Will not decrease more than 10% at rated current.

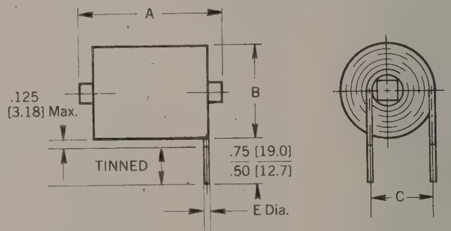
DERATING CHART



STYLE 1



STYLE 2



MECHANICAL SPECIFICATIONS

MODEL	STYLE	A (Max.)	B ±.050 [1.27]	C ±.062 [1.57]	D ±.062 [1.57]	E (Dia.)	TYPICAL WEIGHT (Grams)
IHV-15-500	1	2.45 [62.2]	1.45 [36.8]	.98 [24.9]	1.95 [49.6]	.082 [2.08]	305
IHV-20-200	2	2.45 [62.2]	1.45 [36.8]	.98 [24.9]	—	.102 [2.59]	310
IHV-28-60	2	2.45 [62.2]	1.02 [25.9]	.77 [19.6]	—	.102 [2.59]	160
IHV-30-150	2	2.45 [62.2]	1.65 [41.9]	1.08 [27.4]	—	.129 [3.28]	470
IHV-40-39	2	2.45 [62.2]	1.15 [29.2]	.82 [20.8]	—	.129 [3.28]	210
IHV-45-92	2	2.55 [64.8]	1.92 [48.8]	1.21 [30.7]	—	.162 [4.11]	650
IHV-50-50	1	2.55 [64.8]	1.57 [39.9]	1.05 [26.7]	2.10 [53.3]	.162 [4.11]	420
IHV-60-24	2	2.45 [62.2]	1.27 [32.3]	.89 [22.6]	—	.162 [4.11]	270

ORDERING INFORMATION

IHV	−15	500 ±10%
1.	2.	3.

1. Basic model high current choke
2. Current rating maximum (amperes)
3. Inductance (μh)

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

Delevan

COILS & INDUCTIVE COMPONENTS

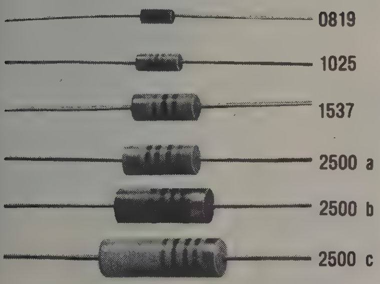
SETTING THE STANDARDS FOR OVER 30 YEARS

For over three decades, Delevan has manufactured a wide variety of inductive devices to Military and Aerospace standards of quality. This brief overview describes the basic lineup of many standard catalog items meeting rigid military or other commercial standards.

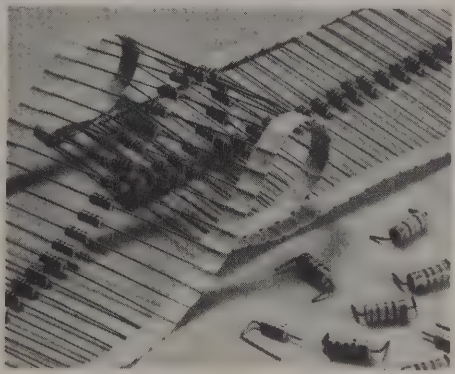
In addition to our over 800 catalog designs, Delevan manufactures a wide variety of custom magnetic components to customer specifications. Send us your requirements for a prompt quotation.

For further information call your Delevan Representative or contact the factory direct.

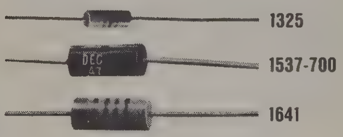
MOLDED RF COILS



Series	Inductance Range Microhenries	Dia.		Length
0819	.10- 1,000	.078"	x	.200"
1025	.10- 1,000	.095"	x	.250"
1537	.15- 240	.156"	x	.375"
2500	270-10,000	a .190"	x	.440"
		b .215"	x	.560"
		c .240"	x	.740"



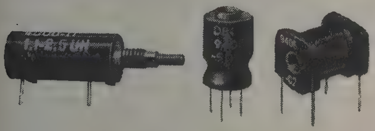
MOLDED SHIELDED RF COILS



Series	Inductance Range Microhenries	Dia.		Length
1325	.10- 560	.125"	x	.250"
1537-700	.10-10,000	.156"	x	.375"
1641	.10-10,000	.162"	x	.410"

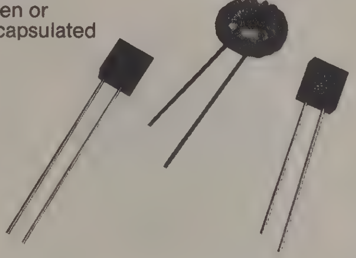
VARIABLE RF COILS

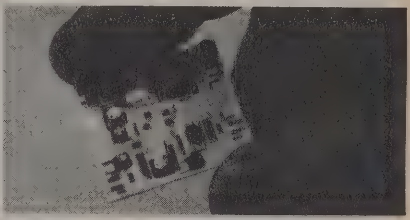
Inductance values to 70,000 μH



TOROIDS

Open or
encapsulated



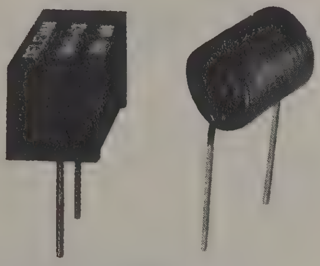


MICRO-i® CHIP INDUCTORS

- Low profile
- Ribbon leads or chip
- Gold plated or Solder coated
- Wire bondable versions
- from .010 μH to 1,000 μH

POT CORES

Coils & transformers
in a wide range of sizes



POWER CHOKES

- for high current applications
- standard values—
  1.0 μH to 15,000 μH

ALSO

CUSTOM MOLDED

OPEN BOBBIN

POTTED COILS

for a wide range of special inductive applications

SPECIAL SERVICES

- Reel Taping
- Cut or Formed Leads
- Color Coding or Custom Marking
- Q Meter Repair or Calibration
- Environmental Testing

Write or call for application assistance.

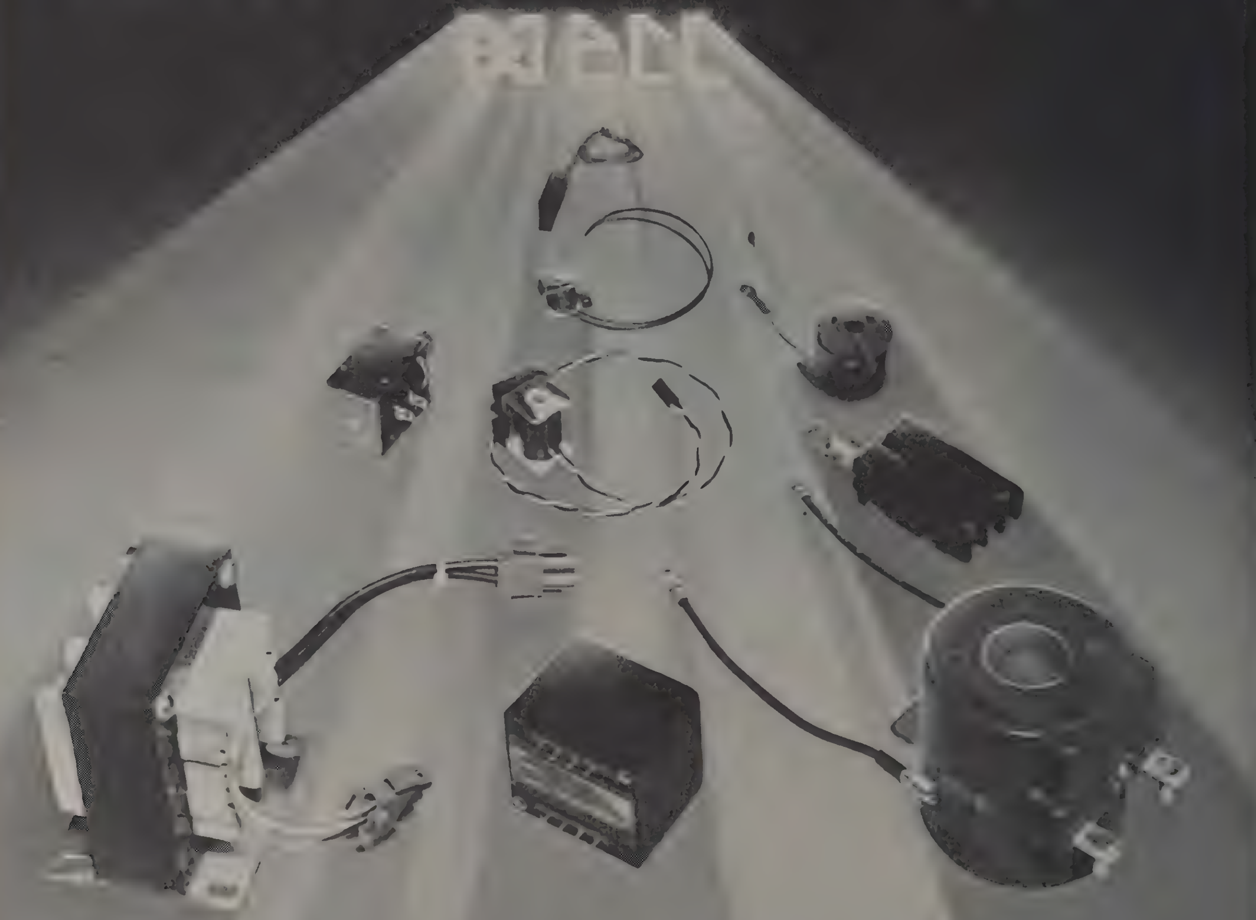
Delevan
Division

AMERICAN
PRECISION
INDUSTRIES INC.

270 QUAKER RD./EAST AURORA, N.Y. 14052
TELEPHONE 716/652-3600 TELEX 91-293

Other Divisions and Subsidiaries include:
Basco, Deltran, A.P.I. of Florida,
American Precision Industries (U.K.) Ltd.

From A Single Source



Magnetic Components To Your Specs.

When you need transformers, solenoids, coils, torroids or similar magnetic components, ECC has the experience, personnel and facilities to design, build and deliver your parts . . . on time.

Whatever techniques your magnetic components require:
HIGH SPEED WINDING • HAND WINDING • ASSEMBLY
MOLDING • POTTING • VACUUM IMPREGNATION

We are ready to put our facility to work for you.
For a complete capabilities brochure, call us at:

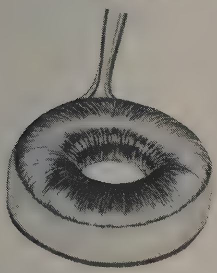
ECC
Endicott Coil Co., Inc.

24 Charlotte Street • P.O. Box 67 • Binghamton, NY 13905
607-797-1263

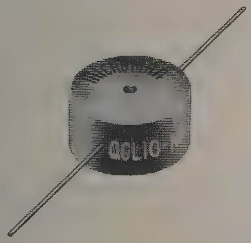
TOROIDAL INDUCTORS

MICROTRAN
company, inc.

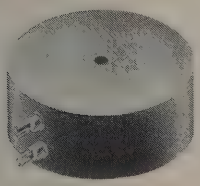
QE-M Molded



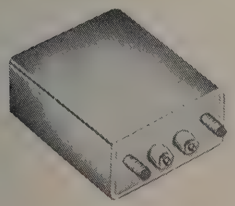
QG-F, QI-F, QK-F, QPL-F, QTL-F
Open Frame



QG-M Molded



QI-M, QK-M, QPL-M, QTL-M Molded



QI-H, QK-H 2 studs, QPL-H, QTL-H
4 studs Hermetic

QE SERIES

Ultra miniaturized with low height design. Exceptionally high "Q" and wide frequency range. Frequency range of QEL Series 1 to 300 kHz; QEM, 3 to 500 kHz. Accuracy, ±2%. Molded in epoxy resin with .020″ x 2″ gold-plated nickel alloy leads. Size, .450″ dia. x .285″.

QEL-M SERIES				QEM-M SERIES			
Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF	Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF
QEL1-M	1 mH	2.1	25	QEM05-M	0.5 mH	2.1	20
QEL2-M	2	3.6	30	QEM1-M	1	3.8	30
QEL5-M	5	7.3	35	QEM2-M	2	6.2	35
QEL10-M	10	15.8	45	QEM5-M	5	15.9	45
QEL15-M	15	20	45	QEM10-M	10	19	50
QEL25-M	25	32	50	QEM15-M	15	42	55
QEL50-M	50	69	50	QEM25-M	25	88	60
QEL100-M	100	185	70	QEM50-M	50	193	70

QG SERIES

Frequency range of QGL Series, to 20 kHz; QGM Series, 2 to 100 kHz. Accuracy, ±2%. **QG-F:** Open frame, microcrystalline wax dipped with 4″ #28 plastic leads. Size, 5/8″ dia. x 9/32″. **QG-M:** Molded in high temperature epoxy resin with .020″ x 2″ gold plated nickel alloy leads. Leads may be bent downward for plug-in printed circuit use. Size, 7/8″ dia. x 3/8″.

QGL SERIES				QGM SERIES			
QGL5-	5 mH	2.5	30	QGM1-	1 mH	1.4	22
QGL10-	10	5	33	QGM2-	2	2.5	25
QGL15-	15	8	34	QGM5-	5	6	28
QGL30-	30	17	37	QGM10-	10	12	31
QGL50-	50	28	40	QGM15-	15	18	32
QGL100-	100	50	42	QGM25-	25	30	35
QGL250-	250	130	46	QGM50-	50	52	37
QGL500-	500	290	48	QGM100-	100	115	39
QGL1000-	1.0 H	530	51				
QGL1500-	1.5	825	53				

QI SERIES

Frequency range to 20 kHz; accuracy, ±2%. **QIL-M:** Molded in high temperature epoxy with silver plated turret lugs. Size, 1 3/16″ dia. x 1/2″. **QIL-H:** Hermetically sealed in metal case with Teflon terminals. Size, 1 1/16″ x 1/2″ x 1 7/32″. **QIL-F:** Open frame. Microcrystalline wax dipped with 4″ #28 plastic leads. Size, 1″ dia. x 13/32″.

QIL SERIES							
QIL3-	3 mH	.73	36	QIL150-	150 mH	34	50
QIL5-	5	1.1	38	QIL250-	250	55	53
QIL10-	10	2.1	40	QIL500-	500	95	55
QIL15-	15	3.3	42	QIL1000-	1.0 H	210	57
QIL25-	25	5.3	45	QIL1500-	1.5	335	59
QIL50-	50	11	47	QIL2500-	2.5	550	61
QIL100-	100	22	49				

QK SERIES

Frequency range of QKL Series, to 10 kHz; QKM Series, 5 to 50 kHz. Accuracy, ±2%. **QK-F:** Open frame, microcrystalline wax dipped; 4″ #28 plastic leads. Size, 1 1/4″ dia. x 5/8″. **QK-H:** Hermetically sealed with Teflon terminals. Size, 1 15/32″ x 25/32″ x 1 47/64″. **QK-M:** Molded in high temperature epoxy resin, silver plated turret lugs. Size, 1 3/8″ dia. x 3/4″; #8 clearance hole.

QKL SERIES							
QKL5-	5 mH	.62	60	QKL250-	250 mH	28	87
QKL10-	10	1.1	66	QKL500-	500	63	91
QKL15-	15	1.7	68	QKL1000-	1.0 H	110	96
QKL25-	25	2.8	72	QKL1500-	1.5	175	98
QKL50-	50	6	76	QKL2500-	2.5	275	103
QKL100-	100	11	81	QKL5000-	5	645	106
QKL150-	150	17	83	QKL10,000-	10	1175	112
QKM SERIES							
QKM2-	2 mH	.45	52	QKM100-	100 mH	25	79
QKM5-	5	1.1	58	QKM250-	250	65	87
QKM10-	10	2.5	62	QKM500-	500	115	92
QKM25-	25	6.5	70	QKM1000-	1.0 H	250	97
QKM50-	50	11	74				

QP SERIES

Frequency range to 10 kHz; accuracy, ±2%. **QPL-F:** Open frame, microcrystalline wax dipped; 4″ #24 leads. Size, 1 15/16″ x 7/8″. **QPL-H:** Hermetically sealed with Teflon terminals. Size, 1 15/16″ x 1 1/16″ x 2 9/32″. **QPL-M:** Molded in high temperature epoxy resin; silver plated turret lugs. Size, 2″ dia. x 1″.

QPL SERIES							
QPL25-	25 mH	1.5	100	QPL2500-	2.5 H	150	133
QPL50-	50	2.5	105	QPL5000-	5.0	350	138
QPL100-	100	6	110	QPL7500-	7.5	525	140
QPL250-	250	15	115	QPL10,000-	10	600	142
QPL500-	500	25	120	QPL15,000-	15	900	146
QPL1000-	1.0 H	60	125	QPL25,000-	25	1500	150
QPL1500-	1.5	90	130				

QT SERIES

Frequency range to 15 kHz; accuracy, ±2%. **QTL-F:** Open frame, microcrystalline wax dipped; 4″ #24 leads. Size, 2 7/16″ dia. x 1″. **QTL-H:** Hermetically sealed with Teflon terminals. Size, 2 9/16″ x 1 5/16″ x 2 13/16″. **QTL-M:** Molded in epoxy resin. Size, 2 7/8″ x 1 3/8″.

QTL SERIES							
QTL25-	25 mH	0.85	127	QTL1500-	1.5 H	40	177
QTL50-	50	1.5	136	QTL2500-	2.5	70	184
QTL100-	100	2.8	144	QTL5000-	5	140	192
QTL150-	150	3.9	149	QTL10,000-	10	270	200
QTL250-	250	7	156	QTL15,000-	15	430	205
QTL500-	500	15	164	QTL25,000-	25	850	212
QTL1000-	1.0 H	27	173	QTL50,000-	50	1500	221

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

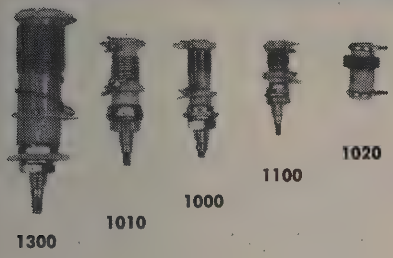
Y

YIG yttrium iron garnet

NORTH HILLS • HIGH-PERFORMANCE COILS, ADJUSTABLE & FIXED

TO COVER ALL FREQUENCY RANGES FROM AUDIO TO 200 MHZ

COILS ON CERAMIC FORMS PER MIL-I-10

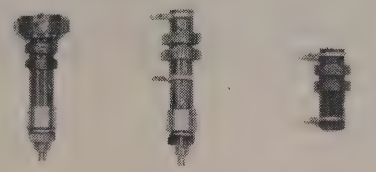


Series No.	Dimensions (Inches) Dia.	Dimensions (Inches) Length	Mtg. Hole Dia. (Inches)
1000	.50	.88	.196
1020	.50	.63	.050, .500 Apart
1100	.33	.63	.166
1300	.70	1.80	.252
1010	.43	.88	.196

Miniature 1000 Series

Part No.	Range Microhenries	Average Q
1000-A	1.0- 1.6	70 @ 7.9 MHz
1000-B	1.6- 2.7	80 @ 7.9 MHz
1000-C	2.7- 4.5	85 @ 7.9 MHz
1000-D	4.5- 8.5	85 @ 7.9 MHz
1000-E	8.5-14.5	75 @ 2.5 MHz
1000-F	14.5-22	65 @ 2.5 MHz
1000-G	22-29	65 @ 2.5 MHz
1000-H	29-55	85 @ 2.5 MHz
1000-I	55-110	80 @ 2.5 MHz
1000-J	110-185	85 @ .79 MHz
1000-K	185-305	85 @ .79 MHz
1000-L	305-515	85 @ .79 MHz
1000-M	515-820	85 @ .79 MHz
1000-N	820-1100	75 @ .79 MHz
RF Printed Circuit Coils		
1020-A	0.41- 0.53	75 @ 25 MHz
1020-B	0.85- 1.15	65 @ 7.9 MHz
1020-C	1.87- 2.50	65 @ 7.9 MHz
1020-D	4.0 - 5.4	70 @ 7.9 MHz
1020-E	7.5 -12.5	70 @ 2.5 MHz
1020-F	20 -29	80 @ 2.5 MHz
1020-G	33 -61	80 @ 2.5 MHz
1020-H	80 -120	60 @ 0.79 MHz
1020-I	170 -260	70 @ 0.79 MHz
Subminiature 1100 Series		
1100-A	0.9- 1.4	60 @ 7.9 MHz
1100-B	1.4- 1.9	70 @ 7.9 MHz
1100-C	1.9- 2.6	65 @ 7.9 MHz
1100-D	2.6- 3.7	65 @ 7.9 MHz
1100-E	3.7- 5.5	65 @ 7.9 MHz
1100-F	5.5- 7.4	60 @ 7.9 MHz
1100-G	7.4-12.5	70 @ 7.9 MHz
1100-H	12.5-18.0	65 @ 2.5 MHz
1100-I	18.0-28.0	70 @ 2.5 MHz
1100-J	28.0-38.0	70 @ 2.5 MHz
1100-K	38.0-55.0	70 @ 2.5 MHz
Transmitter 1300 Series		
1300-A	For use from 90-200 MHz	
1300-B	For use from 40-90 MHz	
1300-C	For use from 20-40 MHz	
1300-D	0.7- 1.0	170 @ 25 MHz
1300-E	1.1- 1.6	130 @ 7.9 MHz
1300-F	1.7- 2.5	140 @ 7.9 MHz
1300-G	2.7- 4.1	140 @ 7.9 MHz
1300-H	4.4- 6.5	140 @ 7.9 MHz
1300-I	6.8-10.0	140 @ 7.9 MHz
1300-J	11.5-17.0	110 @ 2.5 MHz
1300-K	19.0-29.0	95 @ 2.5 MHz
1300-L	31.0-45.0	100 @ 2.5 MHz
1300-M	49.0-75.0	100 @ 2.5 MHz
HF Coils, Variable Approx. ±15%		
1010-A	0.118	115 @ 50 MHz
1010-B	0.225	125 @ 25 MHz
1010-C	0.315	130 @ 25 MHz

WIDE ADJUSTMENT RANGE 120 SERIES



120 Series
Mica-filled form

PCS-120 Series
Phenolic form

.75″ O.D. x 1.3″ H.
.196″ dia. mtg. hole

PC-120 Series
Phenolic form
.5″ O.D. x 1.25″ L.
.05″ Pins,
.70″ Apart

Part No.	Range Microhenries	Average Q
120-A	2-3	70 @ 7.9 MHz
120-B	3-5	80 @ 7.9 MHz
120-C	5-9	85 @ 7.9 MHz
120-D	9-18	65 @ 2.5 MHz
120-E	18-36	70 @ 2.5 MHz
120-F	36-64	65 @ 2.5 MHz
120-G	64-105	85 @ 2.5 MHz
120-H	105-200	80 @ .79 MHz
120-I	200-500	75 @ .79 MHz
120-J	500-1000	85 @ .79 MHz
120-K	1000-2000	50 @ .25 MHz

Subminiature 600 Series

- Variable ±10%
- Shielded
- 0.3″ O.D. x 0.4″ H
- .020″ Leads .20″ Apart

Part No.	Nominal Microhenries	Average Q
600U1X0	1.0	120 @ 7.9 MHz
600U1X5	1.5	120 @ 7.9 MHz
600U2X2	2.2	120 @ 7.9 MHz
600U3X3	3.3	130 @ 7.9 MHz
600U4X7	4.7	125 @ 7.9 MHz
600U6X8	6.8	140 @ 7.9 MHz
600U10X	10	135 @ 7.9 MHz
600U15X	15	130 @ 2.5 MHz
600U22X	22	135 @ 2.5 MHz
600U33X	33	130 @ 2.5 MHz
600U47X	47	130 @ 2.5 MHz
600U68X	68	120 @ 2.5 MHz
600MX10	100	100 @ 2.5 MHz
600MX15	150	125 @ .79 MHz
600MX22	220	130 @ .79 MHz
600MX33	330	125 @ .79 MHz
600MX47	470	120 @ .79 MHz
600MX68	680	100 @ .79 MHz
600M1X0	1000	100 @ .79 MHz

High Q RF Coils, Fixed

- .75″ O.D. x .63″ H
- Hermetically sealed
- Complete shielding
- For printed circuitry
- For standard circuitry

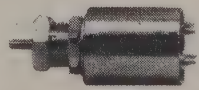
Part No.	Nominal Microhenries	Average Q
1219-A	0.47± 5%	90 @ 20 MHz
1219-B	1.0 ± 5%	100 @ 10 MHz
1219-C	2.2 ± 5%	130 @ 8 MHz
1219-D	4.7 ± 5%	130 @ 5 MHz
1219-E	10 ± 5%	130 @ 3 MHz
1219-F	22 ± 3%	185 @ 1.7 MHz
1219-G	47 ±3%	185 @ 1 MHz
1219-H	100 ±3%	200 @ 0.8 MHz
1219-I	220 ±3%	225 @ 0.7 MHz
1219-J	470 ±3%	250 @ 0.6 MHz
1219-K	1000 ±3%	300 @ 0.5 MHz
1219-L	2200 ±3%	300 @ 0.25 MHz

Hi Q 801, 802 Series, Adjustable ±10%

801, 802 Series
1.18″ O.D. x .93″ H

Part No.	Nominal Millihenries	Peak Q
801M1X0	1.0	100 @ 10 kHz
801M1X5	1.5	100 @ 10 kHz
801M2X2	2.2	100 @ 10 kHz
801M3X3	3.3	100 @ 10 kHz
801M4X7	4.7	100 @ 10 kHz
801M6X8	6.8	100 @ 10 kHz
801M10X	10	200 @ 20 kHz
801M15X	15	200 @ 20 kHz
801M22X	22	200 @ 20 kHz
801M33X	33	200 @ 20 kHz
801M47X	47	200 @ 20 kHz
801M68X	68	200 @ 20 kHz
801HX10	100	300 @ 30 kHz
801HX15	150	300 @ 30 kHz
801HX22	220	300 @ 30 kHz
801HX33	330	250 @ 20 kHz
801HX47	470	250 @ 20 kHz
801HX68	680	250 @ 20 kHz
801H1X0	1000	150 @ 15 kHz
802M1X0	1.0	400 @ 100 kHz
802M1X5	1.5	400 @ 100 kHz
802M2X2	2.2	400 @ 100 kHz
802M3X3	3.3	400 @ 100 kHz
802M4X7	4.7	400 @ 100 kHz
802M6X8	6.8	400 @ 100 kHz
802M10X	10	400 @ 70 kHz
802M15X	15	400 @ 70 kHz
802M22X	22	400 @ 70 kHz
802M33X	33	400 @ 70 kHz
802M47X	47	400 @ 40 kHz

SHIELDED COILS



- Shielded
- Encapsulated

- .44″ Diameter **900 Series**

Part No.	Range Microhenries	Average Q
900-A	0.5- 0.8	80 @ 25 MHz
900-B	0.8- 1.3	70 @ 18 MHz
900-C	1.3- 2.0	60 @ 15 MHz
900-D	2.0- 4.0	70 @ 8 MHz
900-E	4.0- 7.0	70 @ 5 MHz
900-F	7.0-12.0	70 @ 4 MHz
900-G	12.0-20.0	70 @ 3 MHz
900-H	20.0-35.0	70 @ 2.5 MHz
900-I	35.0-60.0	70 @ 2.0 MHz
900-J	60.0-100.0	70 @ 1.0 MHz

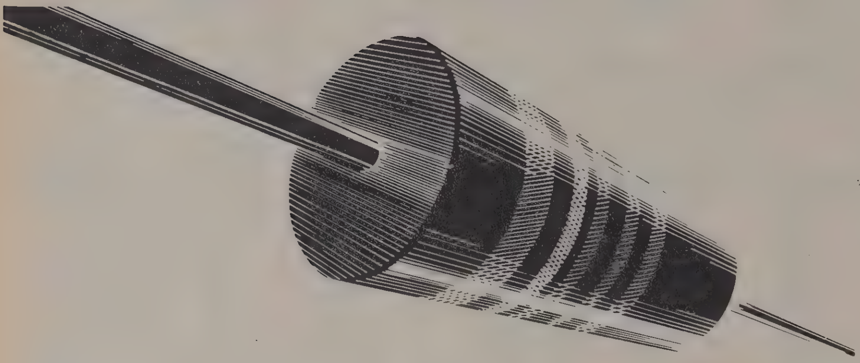
- .63″ Diameter **1500 Series**

Part No.	Range Millihenries	Average Q
1500-A	.100- .175	80 @ 790 kHz
1500-B	.175- .300	80 @ 790 kHz
1500-C	.300- .500	80 @ 790 kHz
1500-D	.500- .800	75 @ 790 kHz
1500-E	.800-1.15	55 @ 500 kHz
1500-F	1.15-1.50	55 @ 250 kHz
1500-G	1.50-2.30	55 @ 250 kHz
1500-H	2.30-3.50	50 @ 250 kHz
1500-I	3.50-7.50	40 @ 250 kHz

For North Hills Wideband Transformers See Section 5600.

North Hills Electronics, INC. | *GLEN COVE, N.Y. 11542 • 516-671-5700*

Nytronics Inductors



HI-REL . . .

Nytronics Inductors are fully qualified to the established reliability spec MIL-C-39010 in styles /1 through /10. But, Nytronics Inductors also meet the requirements of a **higher authority!** They are widely used in heart pacers to provide RF protection. . . . It's a life or death matter. . . . Literally.

AVAILABILITY . . .

Off-the-shelf from a distributor near you.

***UPDATE**

UNITS HOURS: 352,016,640

Date: 3:1:84

NCG part number. The military part number shall consist of the letter "M", the basic document number, and an assigned dash number as shown in the following:

M	39010/01	A	1R0	K	M
Military designator	Document sheet number	Class	Inductance	Inductance tolerance	Failure rate level

Class. The classes of coils denoting the maximum operating temperatures are identified by a single letter in accordance with MIL-C-39010 slash sheets.

Maximum operating temperature

Class	Temperature
A ------	105°C
B ------	125°C

New High Reliability Qualification	
MIL-C-39010-1	MIL-C-39010-6
MIL-C-39010-2	MIL-C-39010-7
MIL-C-39010-3	MIL-C-39010-8
MIL-C-39010-4	MIL-C-39010-9
MIL-C-39010-5	MIL-C-39010-10

BROAD LINE . . .

There's a Nytronics Inductor to meet every need from 0.10uH to 180kuH.

With sizes ranging from the world's smallest shielded inductor to the most complex variable inductor . . . shielded, unshielded and variable, in hundreds of off-the-shelf values . . . it makes good sense to check first with Nytronics or your local distributor.

FIXED SHIELDED INDUCTORS

Super Wee Ductor
MS75087, MS75088, MS75089
MS90537

Super Wee Wee Ductor MS21399-21401
Wee Ductor
Wee Wee Ductor
Pee Wee Ductor
Pee Cee Ductor

FIXED NON-SHIELDED INDUCTORS

Deci Ductor
Mili Ductor
MS75083, MS75084, MS75085
RFC-SS MS18130, 14046, 90538
RFC-S MS21389, 21390
MS75008, MS75101, M90539
RFC-M MS21388
RFC-L MS21380
Pee Dee Ductor

VARIABLE INDUCTORS

Wee V-L (Shielded) MS21381, MS21402
H Wee V-L (Shielded) MS21381, MS21402
VIV (Non-Shielded)
VIH (Non-Shielded)

Nytronics Components Group, Inc.

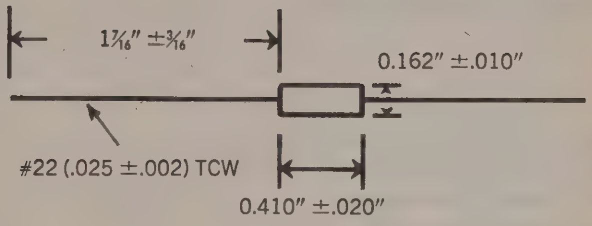
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

M39010/1, /2, /3 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010
(LATEST REVISION)



Magnetically Shielded
MIL-C-39010-1 (Phenolic Core - Iron Sleeve)
MIL-C-39010-2 (Iron Core - Iron Sleeve)
MIL-C-39010-3 (Ferrite Core - Ferrite Sleeve)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.

Dielectric Strength: 1500 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Q: Measured on a Q-Meter.

Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches. **Weight:** 1.0 grams maximum.

Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:
EXAMPLE: M39010
/01
A1ROKR } - Military part number.
83125 - Manufacturer's source code.
J 8411A - "JAN" marking, date code, and lot symbol.

M39010	Dash Number	L µH	Q min		Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
				MHz				
/1	AR10K*	0.10	50	25	250	0.025	1790	
	AR12K*	0.12	51	25	250	0.034	1530	
	AR15K*	0.15	51	25	250	0.037	1470	
	AR18K*	0.18	50	25	250	0.047	1300	
	AR22K*	0.22	49	25	250	0.067	1100	
	AR27K*	0.27	47	25	250	0.11	855	
	AR33K*	0.33	46	25	250	0.13	780	
	AR39K*	0.39	44	25	250	0.18	670	
	AR47K*	0.47	44	25	235	0.25	565	
	AR56K*	0.56	43	25	210	0.33	490	
	AR68K*	0.68	42	25	190	0.45	420	
	AR82K*	0.82	40	25	180	0.59	370	
/2	A1R0K*	1.0	44	25	140	0.070	1070	
	A1R2K*	1.2	44	7.9	130	0.093	895	
	A1R5K*	1.5	44	7.9	115	0.12	815	
	A1R8K*	1.8	44	7.9	105	0.14	775	
	A2R2K*	2.2	44	7.9	100	0.19	650	
	A2R7K*	2.7	44	7.9	92	0.28	535	
	A3R3K*	3.3	44	7.9	85	0.35	480	
	A3R9K*	3.9	44	7.9	75	0.40	450	
	A4R7K*	4.7	44	7.9	70	0.55	380	
	A5R6K*	5.6	44	7.9	65	0.72	335	
	A6R8K*	6.8	50	7.9	55	1.02	280	
	A8R2K*	8.2	50	7.9	50	1.32	250	
	A100K*	10	50	7.9	46	1.62	220	
	A120K*	12	55	2.5	44	2.00	200	
/3	A150K*	15	44	2.5	49	0.80	315	250
	A180K*	18	45	2.5	45	0.89	300	235
	A220K*	22	46	2.5	41	0.96	290	220
	A270K*	27	49	2.5	38	1.19	260	200
	A330K*	33	45	2.5	34	1.37	240	190
	A390K*	39	53	2.5	29	1.93	205	180
	A470K*	47	52	2.5	27	2.11	195	175
	A560K*	56	49	2.5	25	2.23	190	160
	A680K*	68	51	2.5	21	2.70	170	150
	A820K*	82	45	2.5	10.5	2.44	180	140

M39010	Dash Number	L µH	Q min		Min. SRF MHz	Max. DCR Ω	Max. I mA	Incr.† I mA
				MHz				
/3	A101K*	100	52	2.5	10.0	3.12	160	120
	A121K*	120	57	0.79	9.7	3.60	150	95
	A151K*	150	56	0.79	8.5	4.10	140	90
	A181K*	180	60	0.79	8.0	4.40	135	85
	A221K*	220	58	0.79	7.5	5.00	125	80
	A271K*	270	60	0.79	7.0	5.80	115	70
	A331K*	330	54	0.79	6.5	6.40	110	65
	A391K*	390	67	0.79	6.2	7.40	105	60
	A471K*	470	60	0.79	5.7	9.50	92	58
	A561K*	560	60	0.79	4.7	10.5	90	55
	A681K*	680	60	0.79	4.5	11.8	80	50
	A821K*	820	57	0.79	4.2	13.0	80	45
	A102K*	1000	60	0.79	3.8	17.5	70	40
	A122K*	1200	45	0.25	1.5	22.1	60	35
	A152K*	1500	49	0.25	1.2	26.5	55	33
	A182K*	1800	47	0.25	1.0	29.9	50	30
	A222K*	2200	50	0.25	0.97	33.8	50	27
	A272K*	2700	47	0.25	0.92	47.3	40	25
	A332K*	3300	43	0.25	0.84	53.0	40	22
	A392K*	3900	43	0.25	0.80	73.8	35	20
	A472K*	4700	44	0.25	0.74	81.6	31	19
	A562K*	5600	45	0.25	0.73	98.9	28	17
	A682K*	6800	43	0.25	0.66	111.0	27	16
	A822K*	8200	42	0.25	0.54	119.0	26	15
	A103K*	10,000	39	0.25	0.47	137.0	24	14
	A123K*	12,000	31	0.079	0.33	143.0	23	13
	A153K*	15,000	31	0.079	0.29	157.0	22	12
	A183K*	18,000	31	0.079	0.28	175.0	21	10
	A223K*	22,000	27	0.079	0.25	274.0	17	9
	A273K*	27,000	27	0.079	0.21	308.0	16	8
	A333K*	33,000	27	0.079	0.19	343.0	15	7.5
	A393K*	39,000	27	0.079	0.17	376.0	15	6.0
	A473K*	47,000	23	0.079	0.16	473.0	13	5.5
	A563K*	56,000	23	0.079	0.14	512.0	13	5.0
	A683K*	68,000	23	0.079	0.13	580.0	12	4.0
	A823K*	82,000	21	0.079	0.12	618.0	11	3.5
	A104K*	100.000	18	0.079	0.11	678.0	11	3.0

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/1 - /2 - /3 FAILURE RATE "R" .01%/1000 HRS.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**M39010/4, /5, /6, /7
INDUCTORS**

ESTABLISHED RELIABILITY

MIL-C-39010
(LATEST REVISION)

MIL-C-39010-4 (Phenolic Core)
MIL-C-39010-5 (Iron Core)
MIL-C-39010-6 (Phenolic Core)
MIL-C-39010-7 (Iron Core)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47 uhy ±20%; 0.56 and up ±10%.

Dielectric Strength: 1500 Volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

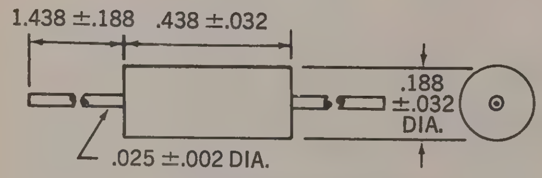
Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-39010.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

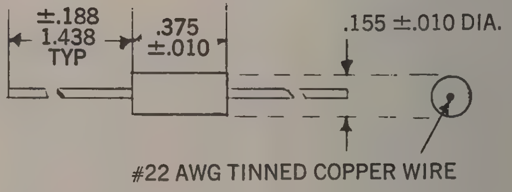
EXAMPLE:	M39010 /04 A1ROKR	- Military part number.
	83125	- Manufacturer's source code.
	J 8411 A	- "JAN" marking, date code, and lot symbol.



ALL DIMENSIONS IN INCHES

Weight: 0.950 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/4	BR15L*	0.15 ±20%	55	25.0	510	0.030	2,900
	BR22L*	0.22 ±20%	50	25.0	415	0.035	2,700
	BR33L*	0.33 ±20%	50	25.0	350	0.065	2,000
	BR47L*	0.47 ±20%	50	25.0	300	0.085	1,700
	BR56K*	0.56 ±10%	50	25.0	270	0.125	1,450
	BR68K*	0.68 ±10%	45	25.0	250	0.150	1,300
	BR82K*	0.82 ±10%	40	25.0	210	0.205	1,100
	B1R0K*	1.00 ±10%	40	25.0	200	0.290	930
	B1R2K*	1.20 ±10%	30	7.9	180	0.400	785
	B1R5K*	1.50 ±10%	30	7.9	170	0.485	720
	B1R8K*	1.80 ±10%	30	7.9	150	0.740	580
	B2R2K*	2.20 ±10%	30	7.9	140	0.970	505
	B2R7K*	2.70 ±10%	30	7.9	120	1.20	460
/5	A3R3K*	3.30	30	7.9	70	0.140	945
	A3R9K*	3.90	30	7.9	65	0.155	370
	A4R7K*	4.70	30	7.9	60	0.210	745
	A5R6K*	5.60	30	7.9	50	0.280	645
	A6R8K*	6.80	30	7.9	50	0.375	560
	A8R2K*	8.20	30	7.9	48	0.440	520
	A100K*	10.0	30	7.9	42	0.605	440
	A120K*	12.0	50	2.5	36	1.05	335
	A150K*	15.0	55	2.5	30	1.20	310
	A180K*	18.0	60	2.5	30	1.95	245
	A220K*	22.0	60	2.5	24	2.20	230
	A270K*	27.0	65	2.5	22	2.75	205



Weight: 0.90 gram maximum.

M39010	Dash Number	Inductance µH	Q min	Test frequency MHz	Self-resonant frequency Min. MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/6	BR15L*	0.15 ±20%	50	25.0	525	0.030	2,450
	BR22L*	0.22 ±20%	50	25.0	450	0.055	1,810
	BR33L*	0.33 ±20%	45	25.0	360	0.090	1,400
	BR47L*	0.47 ±20%	45	25.0	310	0.12	1,225
	BR56K*	0.56 ±10%	50	25.0	280	0.135	1,150
	BR68K*	0.68 ±10%	50	25.0	250	0.150	1,100
	BR82K*	0.82 ±10%	50	25.0	220	0.220	900
	B1R0K*	1.00 ±10%	50	25.0	200	0.290	785
	B1R2K*	1.20 ±10%	33	7.9	180	0.420	650
	B1R5K*	1.50 ±10%	33	7.9	160	0.500	600
	B1R8K*	1.80 ±10%	33	7.9	150	0.650	525
	B2R2K*	2.20 ±10%	33	7.9	135	0.950	435
	B2R7K*	2.70 ±10%	33	7.9	120	1.20	385
	B3R3K*	3.30 ±10%	33	7.9	110	2.00	300
	B3R9K*	3.90 ±10%	33	7.9	100	2.30	280
	B4R7K*	4.70 ±10%	33	7.9	90	2.60	260
/7	A5R6K*	5.6	45	7.9	60	0.32	495
	A6R8K*	6.8	50	7.9	55	0.50	395
	A8R2K*	8.2	50	7.9	50	0.60	360
	A100K*	10	55	7.9	45	0.90	290
	A120K*	12	65	2.5	42	1.10	265
	A150K*	15	65	2.5	40	1.40	240
	A180K*	18	75	2.5	34	2.25	185
	A220K*	22	75	2.5	30	2.50	175
	A270K*	27	60	2.5	25	2.60	170
	A330K*	33	65	2.5	19	3.00	165

* Complete dash number will include an additional letter symbol to indicate failure rate level.

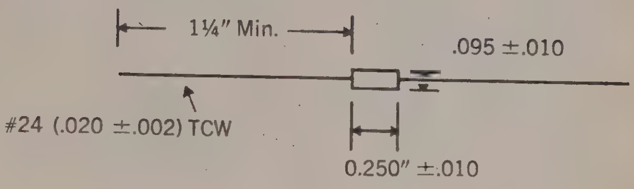
MIL-C-39010/4 - /5 - /6 - /7 FAILURE RATE "R" .01%/1000 HRS.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

M39010/8, /9, /10 INDUCTORS

ESTABLISHED RELIABILITY

MIL-C-39010 (LATEST REVISION)



MIL-C-39010-8 (Phenolic Core)
MIL-C-39010-9 (Iron Core)
MIL-C-39010-10 (Ferrite Core)

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.

Dielectric Strength: 1000 volts RMS at sea level.

Self-Resonant Frequency: Measured per MIL-C-39010.

Rating: Maximum current based on: 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron, and for ferrite core inductors.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +125°C phenolic core, −55°C to +105°C iron and ferrite core.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate direction.

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-39010 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking:

EXAMPLE:	M39010 /08 A1ROKR	- Military part number.
	83125	- Manufacturer's source code.
	J 8411 A	- "JAN" marking, date code, and lot symbol.

M39010	Dash Number	Inductance (±10%) µH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/8	BR10K*	.10	40	25.0	680	.08	1350
	BR12K*	.12	40	25.0	640	.09	1270
	BR15K*	.15	38	25.0	600	.10	1200
	BR18K*	.18	35	25.0	550	.12	1105
	BR22K*	.22	33	25.0	510	.14	1025
	BR27K*	.27	33	25.0	430	.16	960
	BR33K*	.33	30	25.0	410	.22	815
	BR39K*	.39	30	25.0	365	.30	700
	BR47K*	.47	30	25.0	330	.35	650
	BR56K*	.56	30	25.0	300	.50	545
	BR68K*	.68	28	25.0	275	.60	495
	BR82K*	.82	28	25.0	250	.85	415
	B1R0K*	1.00	25	25.0	230	1.00	385
/9	A1R2K*	1.2	25	7.9	150	.18	590
	A1R5K*	1.5	28	7.9	140	.22	535
	A1R8K*	1.8	30	7.9	125	.30	455
	A2R2K*	2.2	30	7.9	115	.40	395
	A2R7K*	2.7	37	7.9	100	.55	335
	A3R3K*	3.3	45	7.9	90	.85	270
	A3R9K*	3.9	45	7.9	80	1.00	250
	A4R7K*	4.7	45	7.9	75	1.20	230
	A5R6K*	5.6	50	7.9	65	1.80	185
	A6R8K*	6.8	50	7.9	60	2.00	175
	A8R2K*	8.2	55	7.9	55	2.70	155
	A100K*	10	55	7.9	50	3.70	130
	A120K*	12	45	2.5	40	2.70	155
	A150K*	15	40	2.5	35	2.80	150
	A180K*	18	50	2.5	30	3.10	145
	A220K*	22	50	2.5	25	3.30	140
	A270K*	27	50	2.5	20	3.50	135

M39010	Dash Number	Inductance (±10%) µH	Q min	Test frequency MHz	Self-resonant frequency Min MHz	DC resistance Max. (25°C) ohms	Rated dc current mA
/10	A330K*	33	45	2.5	24	3.4	130
	A390K*	39	45	2.5	22	3.6	125
	A470K*	47	45	2.5	20	4.5	110
	A560K*	56	45	2.5	18	5.7	100
	A680K*	68	50	2.5	15	6.7	92
	A820K*	82	50	2.5	14	7.3	88
	A101K*	100	50	2.5	13	8	84
	A121K*	120	30	.79	12	13	66
	A151K*	150	30	.79	11	15	61
	A181K*	180	30	.79	10	17	57
	A221K*	220	30	.79	9	21	52
	A271K*	270	30	.79	8	25	47
	A331K*	330	30	.79	7	28	45
	A391K*	390	30	.79	6.5	35	40
	A471K*	470	30	.79	6	42	36
	A561K*	560	30	.79	5	46	35
	A681K*	680	30	.79	4	60	30
	A821K*	820	30	.79	3.8	65	29
	A102K*	1000	30	.79	3.4	72	28

* Complete dash number will include an additional letter symbol to indicate failure rate level.

MIL-C-39010/8 - /9 - /10 FAILURE RATE "R" .01%/1000 HRS.

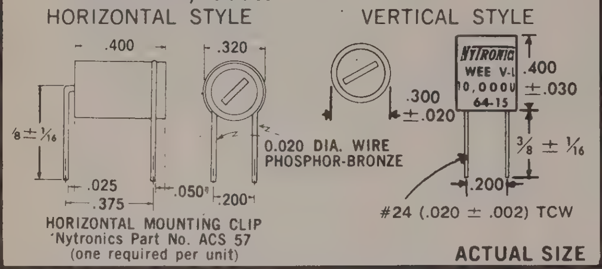
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE WEE-VL MS21381 & 21402 VARIABLE INDUCTORS

WEE V-L

NOW MIL APPROVED MIL-C-15305 (latest revision) — MS21381 & MS21402

Subminiature Shielded Adjustable Inductor
High Q Values
Vertical or Horizontal* Mounting
Unitized Epoxy-Molded Construction
0.400″ by 0.300″
0.10 to 100,000uH



The **WEE V-L** is designed to accommodate close inductance adjustments in high-density circuits that demand exceptional stability and high "Q" in the smallest size available.
The **WEE V-L** is qualified MIL-C-15305 (latest revision). Printed board mounting is facilitated by 0.200 grid spacing and unit has shield construction to allow maximum density packaging. Standardized in 73 stock values.

ELECTRICAL CHARACTERISTICS

Adjustable Inductance Range:	±10%† over entire range as measured per MIL-C-15305 (latest revision).
Q and f₀ Values:	Minimum not less than 80% of specified value at L nominal.
Dielectric Strength:	840 Volts R.M.S. at sea level.
Working Voltage:	300 Volts D.C.
Maximum Current:	Based on temperature rise not to exceed 15°C at 90°C ambient.
Incremental Current:	Defined as the DC current required to cause a five percent reduction in the nominal inductance value.

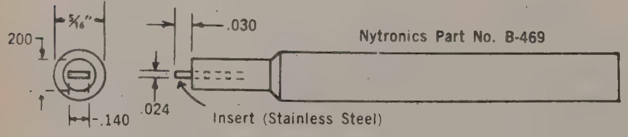
DENSITY CHARACTERISTICS

Weight:	1.5 grams maximum
Volume:	.0346 cubic inches
Shielding:	3% coupling maximum when two units are tested side by side.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Use Nytronics Tuning Tool No. B-469 or equal.

Torque:	0.75 to 6.0 inch-oz.
Operating Temperature:	−55°C to +105°C.
Moisture, Vibration, and Shock Resistance:	Meet requirements of MIL-C-15305 (latest revision).
Marking:	Manufacturer data printed.
Terminal Pull:	Three pounds.



MS GRADE 1 CLASS A
WVL GRADE 3 CLASS A

MS No.	NCG Part No.**	L nom. uH	f MHz	Q nom.	SRF Nom. MHz	Max. BCR ohms	Max. I m.a.	Incr. I m.a.
*MS21381-1	WEE V-L† 0.10	.10	25	70	>250	0.030	1510	NA
*MS21381-2	WEE V-L† 0.12	.12	25	70	>250	0.030	1450	NA
*MS21381-3	WEE V-L 0.15	.15	25	70	>250	0.030	1400	NA
*MS21381-4	WEE V-L 0.18	.18	25	70	>250	0.035	1370	NA
*MS21381-5	WEE V-L 0.22	.22	25	70	>250	0.038	1340	NA
*MS21381-6	WEE V-L 0.27	.27	25	80	>250	0.040	1300	NA
*MS21381-7	WEE V-L 0.33	.33	25	80	>250	0.040	1260	NA
*MS21381-8	WEE V-L 0.39	.39	25	80	250	0.045	1240	NA
*MS21381-9	WEE V-L 0.47	.47	25	80	230	0.045	1200	NA
*MS21381-10	WEE V-L 0.56	.56	25	80	220	0.050	1160	NA
*MS21381-11	WEE V-L 0.68	.68	25	80	190	0.055	1100	NA
*MS21381-12	WEE V-L 0.82	.82	25	85	180	0.060	1040	NA
*MS21381-13	WEE V-L 1.00	1.00	25	85	160	0.070	986	NA
MS21381-14	WEE V-L 1.2	1.2	7.9	90	170	0.085	968	NA
MS21381-15	WEE V-L 1.5	1.5	7.9	100	155	0.100	893	NA
MS21381-16	WEE V-L 1.8	1.8	7.9	115	135	0.110	853	NA
MS21381-17	WEE V-L 2.2	2.2	7.9	110	120	0.120	817	NA
MS21381-18	WEE V-L 2.7	2.7	7.9	110	104	0.125	800	NA
MS21381-19	WEE V-L 3.3	3.3	7.9	90	93.0	0.165	696	NA
MS21381-20	WEE V-L 3.9	3.9	7.9	90	87.0	0.180	659	NA
MS21381-21	WEE V-L 4.7	4.7	7.9	95	79.0	0.245	571	NA
MS21381-22	WEE V-L 5.6	5.6	7.9	95	72.0	0.265	550	NA
MS21381-23	WEE V-L 6.8	6.8	7.9	85	63.0	0.330	493	NA
MS21381-24	WEE V-L 8.2	8.2	7.9	95	60.0	0.460	417	NA
MS21381-25	WEE V-L 10	10	7.9	90	54.0	0.640	359	NA
MS21381-26	WEE V-L 12	12	2.5	120	37.0	0.800	316	NA
MS21381-27	WEE V-L 15	15	2.5	120	28.8	0.865	301	NA
MS21381-28	WEE V-L 18	18	2.5	115	23.8	0.940	292	NA
MS21381-29	WEE V-L 22	22	2.5	125	21.3	1.03	267	NA
MS21381-30	WEE V-L 27	27	2.5	115	20.6	1.18	243	NA
MS21381-31	WEE V-L 33	33	2.5	120	18.6	1.30	231	NA
MS21381-32	WEE V-L 39	39	2.5	120	17.7	1.41	223	NA
MS21381-33	WEE V-L 47	47	2.5	110	14.9	1.61	203	NA
MS21381-34	WEE V-L 56	56	2.5	115	13.9	2.08	191	NA
MS21381-35	WEE V-L 68	68	2.5	105	12.9	2.20	185	NA
MS21381-36	WEE V-L 82	82	2.5	105	11.7	2.42	174	NA
MS21402-1	WEE V-L 100	100	2.5	95	10.5	2.15	333	333
MS21402-2	WEE V-L 120	120	0.790	95	5.60	2.38	316	190
MS21402-3	WEE V-L 150	150	0.790	90	5.20	2.52	306	175
MS21402-4	WEE V-L 180	180	0.790	95	4.90	2.88	288	150
MS21402-5	WEE V-L 220	220	0.790	95	4.60	3.18	273	125
MS21402-6	WEE V-L 270	270	0.790	100	4.20	3.50	260	120
MS21402-7	WEE V-L 330	330	0.790	100	3.55	4.80	222	110
MS21402-8	WEE V-L 390	390	0.790	100	3.45	5.44	209	105
MS21402-9	WEE V-L 470	470	0.790	100	3.20	5.90	201	100
MS21402 10	WEE V-L 560	560	0.790	95	2.90	6.30	194	90
MS21402-11	WEE V-L 680	680	0.790	100	2.70	7.20	181	80
MS21402-12	WEE V-L 820	820	0.790	90	2.50	8.00	172	70
MS21402-13	WEE V-L 1,000	1,000	0.790	100	2.35	12.0	141	65
MS21402-14	WEE V-L 1,200	1,200	0.250	95	2.20	13.5	132	60
MS21402-15	WEE V-L 1,500	1,500	0.250	90	1.90	16.5	119	55
MS21402-16	WEE V-L 1,800	1,800	0.250	100	1.80	18.0	114	47
MS21402-17	WEE V-L 2,200	2,200	0.250	100	1.70	20.5	107	43
MS21402-18	WEE V-L 2,700	2,700	0.250	95	1.50	22.5	102	39
MS21402-19	WEE V-L 3,300	3,300	0.250	90	1.40	42.0	76	36
MS21402-20	WEE V-L 3,900	3,900	0.250	85	1.27	47.5	71	35
MS21402-21	WEE V-L 4,700	4,700	0.250	85	1.24	53.0	67	34
MS21402-22	WEE V-L 5,600	5,600	0.250	85	0.93	62.5	65	31
MS21402-23	WEE V-L 6,800	6,800	0.250	75	0.79	69.5	58	27
MS21402-24	WEE V-L 8,200	8,200	0.250	80	0.75	75.0	56	26
MS21402-25	WEE V-L 10,000	10,000	0.250	70	0.70	100.0	49	24
MS21402-26	WEE V-L 12,000	12,000	0.079	70	0.50	64	60	40
MS21402-27	WEE V-L 15,000	15,000	0.079	70	0.38	84	52	34
MS21402-28	WEE V-L 18,000	18,000	0.079	70	0.36	93	50	30
MS21402-29	WEE V-L 22,000	22,000	0.079	70	0.32	104	45	28
MS21402-30	WEE V-L 27,000	27,000	0.079	70	0.30	173	35	26
MS21402-31	WEE V-L 33,000	33,000	0.079	70	0.27	187	32	24
MS21402-32	WEE V-L 39,000	39,000	0.079	70	0.26	220	30	22
MS21402-33	WEE V-L 47,000	47,000	0.079	70	0.25	253	28	20
MS21402-34	WEE V-L 56,000	56,000	0.079	70	0.24	285	26	19
MS21402-35	WEE V-L 68,000	68,000	0.079	60	0.20	311	24	18
MS21402-36	WEE V-L 82,000	82,000	0.079	60	0.19	385	22	16
MS21402-37	WEE V-L 100,000	100,000	0.079	60	0.17	420	20	15

*Turntable range on MS2138-1 thru -13 and -74 thru -85 is ±5%.

*For horizontal mounting use Nytronics mounting clip No. ACS-57 or order with prefix H (i.e. H WEE V-L 0.10).

†Tunable range ±5.0% on 0.10uH thru 1.0uH.

**NCG Part No. cannot be used as the MS number.

NOTE: Min. Q on MIL version not less than 80% of Q min. of commercial version.
NOTE: MS 21381 -74 thru -85 are available.

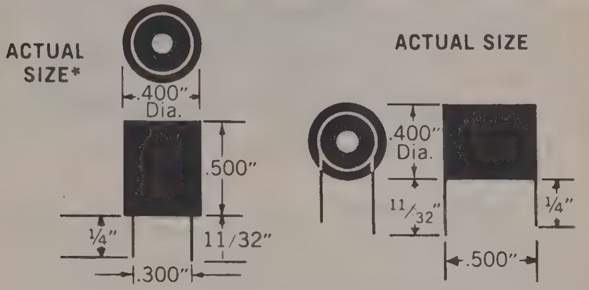
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE VIV - VIH VARIABLE INDUCTORS

VIV-VIH

Miniature with inductance range of 0.10 to 4700uH in 29 values.
Encapsulated in epoxy resin for reliability.
Designed to meet MIL-C-15305B

ALL DIMENSIONS ARE ±1/32 INCH



Terminal Leads #22 (.025 ± .002) VCW

VERTICAL STYLE HORIZONTAL STYLE

The **VARIABLE INDUCTOR** offers high reliability and exceptional stability over extreme temperature variations. This small lightweight unit is furnished in vertical and horizontal styles to facilitate mounting on printed circuit boards. The unit is designed to meet the requirements of MIL-C-15305B.

GRADE 2 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Range:	0.33 to 4700uH Tunable Range ±20% 0.15 to 0.22uH Tunable Range ±15% 0.1 Tunable Range ±10% All measurements at 25°C on Q-Meter using miniature alligator clips mounted 1/32" from body. Q values min. not less than 80% of specified value.
Self-Resonant Frequency:	Minimum f_o to be not less than 80% of published data as measured with Grid-Dip Meter.

DENSITY CHARACTERISTICS

Volume:	0.063 cubic inches
Weight:	2.6 grams

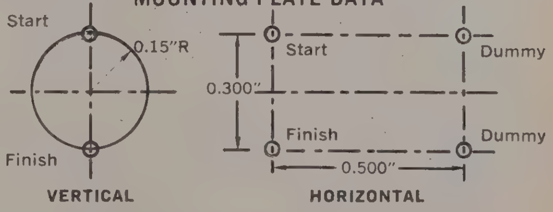
PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Torque:	0.75 to 5.0 inch-ounces Use Nytronics Tuning Tool No. B-305 or equal.
Operating Temperature:	−55°C to +125°C
Terminal Strength:	Meets five pound pull tests.
Core Material:	Iron
Marking:	Manufactured data printed.

NCG PART NOS.		L nom.	Q at L Nom.		Approx. SRF, L nom.	Max. DCR	Max. I
VIV	VIH	μH		MHz	MHz	Ω	mA
VIV-0.10	VIH-0.10	0.10	85	25.	>500.	0.02	3500
VIV-0.15	VIH-0.15	0.15	100	25.	>500.	0.035	2600
VIV-0.22	VIH-0.22	0.22	100	25.	>500.	0.04	2500
VIV-0.33	VIH-0.33	0.33	100	25.	334.	0.04	2500
VIV-0.47	VIH-0.47	0.47	100	25.	285.	0.05	2200
VIV-0.68	VIH-0.68	0.68	100	25.	237.	0.07	1850
VIV-1.00	VIH-1.00	1.00	90	25.	205.	0.13	1350
VIV-1.50	VIH-1.50	1.50	70	7.9	168.	0.24	1000
VIV-2.20	VIH-2.20	2.20	73	7.9	135.	0.30	890
VIV-3.30	VIH-3.30	3.30	80	7.9	112.	0.45	730
VIV-4.70	VIH-4.70	4.70	75	7.9	100.0	0.80	550
VIV-6.80	VIH-6.80	6.80	80	7.9	80.0	1.1	460
VIV-10.0	VIH-10.0	10.0	82	7.9	67.0	1.9	355
VIV-15.0	VIH-15.0	15.0	65	2.5	54.2	3.2	270
VIV-22.0	VIH-22.0	22.0	55	2.5	17.5	3.4	265
VIV-33.0	VIH-33.0	33.0	54	2.5	15.0	3.6	255
VIV-47.0	VIH-47.0	47.0	51	2.5	13.2	4.5	230
VIV-68.0	VIH-68.0	68.0	55	2.5	12.0	5.5	210
VIV-100	VIH-100	100.0	50	2.5	10.5	6.7	190
VIV-150	VIH-150	150.	50	.79	3.0	11.0	150
VIV-220	VIH-220	220.	50	.79	2.70	13.0	135
VIV-330	VIH-330	330.	48	.79	2.24	16.0	120
VIV-470	VIH-470	470.	45	.79	1.90	18.0	115
VIV-680	VIH-680	680.	42	.79	1.70	21.0	105
VIV-1000	VIH-1000	1000.	40	.79	1.40	38.0	80
VIV-1500	VIH-1500	1500.	40	.25	1.14	54.0	65
VIV-2200	VIH-2200	2200.	44	.25	0.96	66.0	60
VIV-3300	VIH-3300	3300.	46	.25	0.86	85.0	54
VIV-4700	VIH-4700	4700.	48	.25	0.76	99.0	49

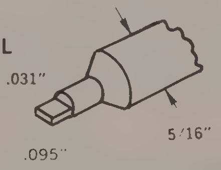
* All dimensions ±1/32 inch.

MOUNTING PLATE DATA



TYPICAL ALIGNING TOOL

B-305



Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

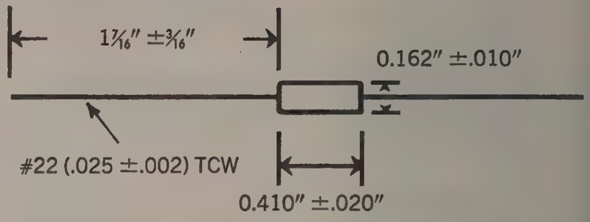
TYPE SWD
MS75087, 75088 & 75089
INDUCTORS

MS-INDUCTOR SERIES
75087, 75088, 75089
MOLDED SHIELDED INDUCTOR

GRADE 1 CLASS A

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on a Q-Meter.
Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS No.	NCG P/N	L	Q min		Min. SRF	Max. DCR	Max. I	Incr.† I
			uH		MHz	MHz	Ω	mA	mA
PHENOLIC	MS75087-1	SWD	0.10	50	25	250	0.025	1790	>2900
	MS75087-2	SWD	0.12	51	25	250	0.034	1530	>2800
	MS75087-3	SWD	0.15	51	25	250	0.037	1470	>2750
	MS75087-4	SWD	0.18	50	25	250	0.047	1300	>2200
	MS75087-5	SWD	0.22	49	25	250	0.067	1100	>1700
	MS75087-6	SWD	0.27	47	25	250	0.11	855	>1500
	MS75087-7	SWD	0.33	46	25	250	0.13	780	>1300
	MS75087-8	SWD	0.39	44	25	250	0.18	670	>1100
	MS75087-9	SWD	0.47	44	25	235	0.25	565	>1000
	MS75087-10	SWD	0.56	43	25	210	0.33	490	> 900
	MS75087-11	SWD	0.68	42	25	190	0.45	420	> 750
	MS75087-12	SWD	0.82	40	25	180	0.59	370	> 600
IRON	MS75088-1	SWD	1.0	44	25	140	0.070	1070	>1900
	MS75088-2	SWD	1.2	44	7.9	130	0.093	895	>1600
	MS75088-3	SWD	1.5	44	7.9	115	0.12	815	>1300
	MS75088-4	SWD	1.8	44	7.9	105	0.14	775	>1200
	MS75088-5	SWD	2.2	44	7.9	100	0.19	650	>1100
	MS75088-6	SWD	2.7	44	7.9	92	0.28	535	> 950
	MS75088-7	SWD	3.3	44	7.9	85	0.35	480	> 800
	MS75088-8	SWD	3.9	44	7.9	75	0.40	450	> 750
	MS75088-9	SWD	4.7	44	7.9	70	0.55	380	> 650
	MS75088-10	SWD	5.6	44	7.9	65	0.72	335	> 550
	MS75088-11	SWD	6.8	50	7.9	55	1.02	280	> 500
	MS75088-12	SWD	8.2	50	7.9	50	1.32	250	> 475
	MS75088-13	SWD	10	50	7.9	46	1.62	220	> 450
	MS75088-14	SWD	12	55	2.5	44	2.00	200	> 400
FERRITE	MS75089-1	SWD	15	45	2.5	49	0.80	315	250
	MS75089-2	SWD	18	45	2.5	45	0.89	300	235
	MS75089-3	SWD	22	45	2.5	41	0.96	290	220
	MS75089-4	SWD	27	45	2.5	38	1.19	260	200
	MS75089-5	SWD	33	50	2.5	34	1.37	240	190
	MS75089-6	SWD	39	50	2.5	29	1.93	205	180
	MS75089-7	SWD	47	50	2.5	27	2.11	195	175
	MS75089-8	SWD	56	50	2.5	25	2.23	190	160
	MS75089-9	SWD	68	50	2.5	21	2.70	170	150
	MS75089-10	SWD	82	50	2.5	10.5	2.44	180	140
FERRITE	MS75089-11	SWD	100	50	2.5	10.0	3.12	160	120
	MS75089-12	SWD	120	55	0.79	9.7	3.60	150	95
	MS75089-13	SWD	150	55	0.79	8.5	4.10	140	90
	MS75089-14	SWD	180	55	0.79	8.0	4.40	135	85
	MS75089-15	SWD	220	55	0.79	7.5	5.00	125	80
	MS75089-16	SWD	270	55	0.79	7.0	5.80	115	70
	MS75089-17	SWD	330	55	0.79	6.5	6.40	110	65
	MS75089-18	SWD	390	60	0.79	6.2	7.40	105	60
	MS75089-19	SWD	470	60	0.79	5.7	9.50	92	58
	MS75089-20	SWD	560	60	0.79	4.7	10.5	90	55
	MS75089-21	SWD	680	60	0.79	4.5	11.8	80	50
	MS75089-22	SWD	820	60	0.79	4.2	13.0	80	45
	MS75089-23	SWD	1000	60	0.79	3.8	17.5	70	40
	MS75089-24	SWD	1200	40	0.25	1.5	22.1	60	35
	MS75089-25	SWD	1500	45	0.25	1.2	26.5	55	33
	MS75089-26	SWD	1800	45	0.25	1.0	29.9	50	30
	MS75089-27	SWD	2200	45	0.25	0.97	33.8	50	27
	MS75089-28	SWD	2700	45	0.25	0.92	47.3	40	25
	MS75089-29	SWD	3300	45	0.25	0.84	53.0	40	22
	MS75089-30	SWD	3900	45	0.25	0.80	73.8	35	20
	MS75089-31	SWD	4700	45	0.25	0.74	81.6	31	19
	MS75089-32	SWD	5600	44	0.25	0.73	98.9	28	17
	MS75089-33	SWD	6800	40	0.25	0.66	111.0	27	16
	MS75089-34	SWD	8200	40	0.25	0.54	119.0	26	15
	MS75089-35	SWD	10,000	40	0.25	0.47	137.0	24	14
	MS75089-36	SWD	12,000	30	0.079	0.33	143.0	23	13
	MS75089-37	SWD	15,000	30	0.079	0.29	157.0	22	12
	MS75089-38	SWD	18,000	30	0.079	0.28	175.0	21	10
	MS75089-39	SWD	22,000	27	0.079	0.25	274.0	17	9
	MS75089-40	SWD	27,000	27	0.079	0.21	308.0	16	8
	MS75089-41	SWD	33,000	27	0.079	0.19	343.0	15	7.5
	MS75089-42	SWD	39,000	27	0.079	0.17	376.0	15	6.0
	MS75089-43	SWD	47,000	23	0.079	0.16	473.0	13	5.5
	MS75089-44	SWD	56,000	23	0.079	0.14	512.0	13	5.0
	MS75089-45	SWD	68,000	23	0.079	0.13	580.0	12	4.0
	MS75089-46	SWD	82,000	21	0.079	0.12	618.0	11	3.5
	MS75089-47	SWD	100,000	18	0.079	0.11	678.0	11	3.0

† INCREMENTAL CURRENT: The D.C. current required to cause a 5% reduction in the nominal inductance value.
MS No. Electricals as shown.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**TYPE SWD
MS90537
INDUCTORS**

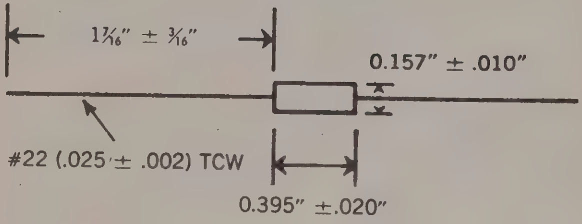
MS-INDUCTOR SERIES
90537
MOLDED SHIELDED INDUCTOR

(Manufactured per MS-90537)

**Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.**

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.

GRADE 1 CLASS B



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on Q-Meter.

Maximum Current: Based on temperature rise not to exceed 35°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305D, Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

Material	MS Catalog No.	NCG P/N	L	Q Min.		Min. SRF	Max. DCR	Max. I	Incr.** I
			µH		MHz	MHz	Ω	mA	mA
PHENOLIC	90537-1	SWD	0.10	50	25	250	0.025	2900	>2900
	90537-2	SWD	0.12	51	25	250	0.034	2800	>2800
	90537-3	SWD	0.15	51	25	250	0.037	2750	>2750
	90537-4	SWD	0.18	50	25	250	0.047	2200	>2200
	90537-5	SWD	0.22	49	25	250	0.067	1700	>1700
	90537-6	SWD	0.27	47	25	250	0.11	1500	>1500
	90537-7	SWD	0.33	46	25	250	0.13	1300	>1300
	90537-8	SWD	0.39	44	25	250	0.18	1100	>1100
	90537-9	SWD	0.47	44	25	235	0.25	1000	>1000
	90537-10	SWD	0.56	43	25	210	0.33	900	>900
	90537-11	SWD	0.68	42	25	190	0.45	750	>750
	90537-12	SWD	0.82	40	25	180	0.59	600	>600
IRON	90537-13	SWD	1.0	47	25	140	0.070	1900	>1900
	90537-14	SWD	1.2	46	7.9	130	0.093	1600	>1600
	90537-15	SWD	1.5	45	7.9	115	0.12	1300	>1300
	90537-16	SWD	1.8	43	7.9	105	0.14	1200	>1200
	90537-17	SWD	2.2	45	7.9	100	0.19	1100	>1100
	90537-18	SWD	2.7	46	7.9	92	0.28	950	>950
	90537-19	SWD	3.3	44	7.9	85	0.35	800	>800
	90537-20	SWD	3.9	44	7.9	75	0.40	750	>750
	90537-21	SWD	4.7	44	7.9	70	0.55	650	>650
	90537-22	SWD	5.6	47	7.9	65	0.72	550	>550
	90537-23	SWD	6.8	50	7.9	55	1.02	500	>500
	90537-24	SWD	8.2	50	7.9	50	1.32	475	>475
	90537-25	SWD	10	49	7.9	46	1.62	450	>450
	90537-26	SWD	12	55	2.5	44	2.00	400	>400
FERRITE	90537-27	SWD	15	44	2.5	49	0.80	620	250
	90537-28	SWD	18	45	2.5	45	0.89	610	235
	90537-29	SWD	22	46	2.5	41	0.96	600	220
	90537-30	SWD	27	49	2.5	38	1.19	500	200
	90537-31	SWD	33	45	2.5	34	1.37	490	190
	90537-32	SWD	39	53	2.5	29	1.93	410	180
	90537-33	SWD	47	52	2.5	27	2.11	400	175
	90537-34	SWD	56	49	2.5	25	2.23	380	160
	90537-35	SWD	68	51	2.5	21	2.70	370	150
	90537-36	SWD	82	45	2.5	10.5	2.44	360	140

Material	MS Catalog No.	NCG P/N	L	Q Min.		Min. SRF	Max. DCR	Max. I	Incr.** I
			µH		MHz	MHz	Ω	mA	mA
FERRITE	90537-37	SWD	100	52	2.5	10.0	3.12	325	120
	90537-38	SWD	120	57	.79	9.7	3.60	290	95
	90537-39	SWD	150	56	.79	8.5	4.10	275	90
	90537-40	SWD	180	60	.70	8.0	4.40	260	85
	90537-41	SWD	220	58	.79	7.5	5.00	250	80
	90537-42	SWD	270	60	.79	7.0	5.80	240	70
	90537-43	SWD	330	54	.79	6.5	6.40	225	65
	90537-44	SWD	390	67	.79	6.2	7.40	200	60
	90537-45	SWD	470	60	.79	5.7	9.50	180	58
	90537-46	SWD	560	60	.79	4.7	10.5	174	55
	90537-47	SWD	680	60	.79	4.5	11.8	168	50
	90537-48	SWD	820	57	.79	4.2	13.0	152	45
	90537-49	SWD	1000	65	.79	3.8	17.5	135	40
	90537-50	SWD	1200	45	.25	1.5	22.1	115	35
	90537-51	SWD	1500	49	.25	1.2	26.5	110	33
	90537-52	SWD	1800	47	.25	1.0	29.9	105	30
	90537-53	SWD	2200	50	.25	0.97	33.8	99	27
	90537-54	SWD	2700	47	.25	0.92	47.3	83	25
	90537-55	SWD	3300	43	.25	0.84	53.0	80	22
	90537-56	SWD	3900	43	.25	0.80	73.8	67	20
	90537-57	SWD	4700	44	.25	0.74	81.6	63	19
	90537-58	SWD	5600	45	.25	0.73	98.9	56	17
	90537-59	SWD	6800	43	.25	0.66	111.0	54	16
	90537-60	SWD	8200	42	.25	0.54	119.0	52	15
	90537-61	SWD	10,000	39	.25	0.47	137.0	49	14
	90537-62	SWD	12,000	31	.079	0.33	143.0	46	13
	90537-63	SWD	15,000	31	.079	0.29	157.0	45	12
	90537-64	SWD	18,000	31	.079	0.28	175.0	41	10
	90537-65	SWD	22,000	27	.079	0.25	274.0	33	9
	90537-66	SWD	27,000	27	.079	0.21	308.0	31	8
	90537-67	SWD	33,000	27	.079	0.19	343.0	30	7.5
	90537-68	SWD	39,000	27	.079	0.17	376.0	27	6.0
	90537-69	SWD	47,000	23	.079	0.16	473.0	26	5.5
	90537-70	SWD	56,000	23	.079	0.14	512.0	25	5.0
	90537-71	SWD	68,000	23	.079	0.13	580.0	24	4.0
	90537-72	SWD	82,000	21	.079	0.12	618.0	23	3.5
	90537-73	SWD	100,000	18	.079	0.11	678.0	22	3.0

**INCREMENTAL CURRENT — The D.C. current required to cause a 5% reduction in the nominal inductance value.
NCG and MS Part No. electricals as shown.

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE SWWD
MS21399, 21400 & 21401
INDUCTORS

SUPER WEE-WEE-DUCTOR

The **SUPER WEE-WEE-DUCTOR**, a shielded miniaturized inductor, provides a greater inductance-to-size ratio in a molded epoxy envelope. Use of unique "T" lead construction on all values from 15 uH to 10,000 uH assures exceptional reliability in ranges where fine wire sizes are used. This MS inductor series is designed to meet the stringent requirements of MIL-C-15305 (latest revision). This provides the design engineer with utmost reliability, electrical performance, and minimum coupling in high density packaging.

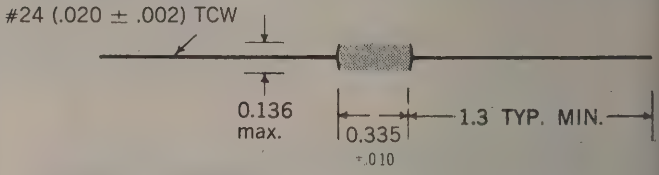
ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% (Q-Meter).
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured with full length leads on Q-Meter.
Q: Measured on Q-Meter.
Rating: maximum based on 1/3 watt dissipation.

DENSITY CHARACTERISTICS

Volume: 0.0041 cubic inches.
Weight: 0.50 grams maximum.
Shielding: Less than 3% coupling with two units mounted side by side at 1000 cycles.

An Ultra-Reliable molded shielded inductor. Subminiature size for high density circuits. Great Inductance-to-size ratio. .10 uH to 10,000 uH. 0.136″ diameter x 0.335″ length. 61 stock values.



GRADE 1 CLASS A

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.
Terminal Strength: Meets five pounds pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High Frequency: 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.
Marking: Color coded per MIL-C-15305 (latest revision).

SUPER WEE-WEE-DUCTOR STANDARD VALUES

Material	MS No.	NCG Part No.	L	Q min.		min. Fo	approx. Cd	Max. DCR	Max. I	Incr.* I
			µH		MHz	MHz	Pf	Ω	mA	mA
PHENOLIC	MS21399-1	SW-W- 0.10	0.10	42	25	480	.70	.087	1650	>1650
	MS21399-2	SW-W- 0.12	0.12	42	25	460	.63	.090	1630	>1630
	MS21399-3	SW-W- 0.15	0.15	42	25	400	.66	.098	1550	>1550
	MS21399-4	SW-W- 0.18	0.18	42	25	360	.62	.117	1420	>1420
	MS21399-5	SW-W- 0.22	0.22	42	25	340	.63	.141	1330	>1330
	MS21399-6	SW-W- 0.27	0.27	42	25	320	.59	.157	1230	>1230
	MS21399-7	SW-W- 0.33	0.33	42	25	295	.55	.178	1140	>1140
	MS21399-8	SW-W- 0.39	0.39	42	25	275	.55	.208	1060	>1060
	MS21399-9	SW-W- 0.47	0.47	41	25	250	.56	.257	960	> 960
	MS21399-10	SW-W- 0.56	0.56	39	25	238	.52	.283	915	> 915
	MS21399-11	SW-W- 0.68	0.68	36	25	224	.50	.337	840	> 840
	MS21399-12	SW-W- 0.82	0.82	35	25	205	.50	.470	720	> 720
IRON	MS21400-1	SW-W- 1.0	1.0	38	25	135	.87	.170	1180	>1180
	MS21400-2	SW-W- 1.2	1.2	38	7.9	124	.87	.190	1150	>1150
	MS21400-3	SW-W- 1.5	1.5	38	7.9	114	.87	.212	1050	>1050
	MS21400-4	SW-W- 1.8	1.8	38	7.9	105	.89	.242	990	> 990
	MS21400-5	SW-W- 2.2	2.2	38	7.9	95	.88	.263	950	> 950
	MS21400-6	SW-W- 2.7	2.7	38	7.9	85	.83	.320	880	> 880
	MS21400-7	SW-W- 3.3	3.3	38	7.9	78	.81	.345	820	> 820
	MS21400-8	SW-W- 3.9	3.9	42	7.9	74	.76	.411	755	> 755
	MS21400-9	SW-W- 4.7	4.7	42	7.9	68	.75	.562	650	> 650
	MS21400-10	SW-W- 5.6	5.6	42	7.9	62	.77	.742	565	> 565
	MS21400-11	SW-W- 6.8	6.8	45	7.9	55	.80	1.00	485	> 485
	MS21400-12	SW-W- 8.2	8.2	47	7.9	51	.78	1.20	440	> 440
	MS21400-13	SW-W- 10	10	51	7.9	45	.78	1.84	355	> 335
	MS21400-14	SW-W- 12	12	51	2.5	41	.85	2.60	300	> 300
FERRITE "T" LEAD	MS21401-1	SW-W- 15	15	45	2.5	48	.55	.635	610	200
	MS21401-2	SW-W- 18	18	45	2.5	44	.55	.728	570	175
	MS21401-3	SW-W- 22	22	45	2.5	37	.60	.825	530	160
	MS21401-4	SW-W- 27	27	45	2.5	32	.65	.950	500	155
	MS21401-5	SW-W- 33	33	46	2.5	30	.65	1.26	430	150
	MS21401-6	SW-W- 39	39	46	2.5	27	.66	1.42	405	145
	MS21401-7	SW-W- 47	47	46	2.5	23	.66	1.72	370	140
	MS21401-8	SW-W- 56	56	48	2.5	21	.75	2.03	340	130
	MS21401-9	SW-W- 68	68	48	2.5	18.5	.75	2.29	320	120
	MS21401-10	SW-W- 82	82	46	2.5	17.0	.75	2.55	305	115
	MS21401-11	SW-W- 100	100	46	2.5	15.5	.78	2.92	280	100
	MS21401-12	SW-W- 120	120	53	0.79	14.5	.72	3.30	235	80
	MS21401-13	SW-W- 150	150	53	0.79	13.0	.70	4.30	215	68
	MS21401-14	SW-W- 180	180	53	0.79	11.5	.70	5.40	200	64
	MS21401-15	SW-W- 220	220	55	0.79	10.0	.84	6.65	150	60
	MS21401-16	SW-W- 270	270	57	0.79	9.50	.74	7.60	140	58
	MS21401-17	SW-W- 330	330	57	0.79	8.50	.75	8.50	130	56
	MS21401-18	SW-W- 390	390	57	0.79	8.00	.74	10.0	120	54
	MS21401-19	SW-W- 470	470	57	0.79	7.20	.70	13.5	100	52
	MS21401-20	SW-W- 560	560	61	0.79	6.40	.70	14.5	95	50
	MS21401-21	SW-W- 680	680	61	0.79	5.80	.78	16.0	90	48
	MS21401-22	SW-W- 820	820	58	0.79	5.30	.78	19.0	85	47
	MS21401-23	SW-W- 1000	1000	58	0.79	4.80	.78	21.5	80	45
	MS21401-24	SW-W- 1200	1200	55	0.25	2.90	1.9	23	100	40
	MS21401-25	SW-W- 1500	1500	55	0.25	2.80	1.6	30	90	35
	MS21401-26	SW-W- 1800	1800	55	0.25	2.60	1.5	33	86	32
	MS21401-27	SW-W- 2200	2200	55	0.25	2.55	1.3	40	78	30
	MS21401-28	SW-W- 2700	2700	55	0.25	2.40	1.2	43	74	28
	MS21401-29	SW-W- 3300	3300	55	0.25	2.00	1.1	58	65	26
	MS21401-30	SW-W- 3900	3900	55	0.25	1.95	1.1	76	56	23
	MS21401-31	SW-W- 4700	4700	55	0.25	1.85	1.1	85	53	20
	MS21401-32	SW-W- 5600	5600	55	0.25	1.75	1.0	100	48	18
	MS21401-33	SW-W- 6800	6800	50	0.25	1.58	1.0	127	43	15
	MS21401-34	SW-W- 8200	8200	50	0.25	1.55	1.0	150	40	12
	MS21401-35	SW-W- 10,000	10,000	50	0.25	1.45	1.0	190	37	10

*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

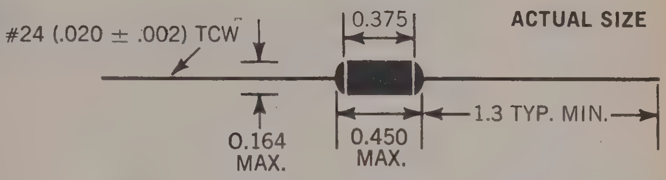
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE WD INDUCTORS

WEE-DUCTOR

Miniature Shielded Inductor with high inductance-to-size ratio.
0.10uH to 180,000uH in 76 values
Designed to meet MIL-C-15305B.

The **WEE-DUCTOR** was the first miniature shielded inductor that Nytronics standardized for stock delivery. This encapsulated non-flammable shielded unit in a 0.164″ diameter by 0.450″ long envelope offers the design engineer extremely high inductance for density packaging. The WEE-DUCTOR is designed to meet the environmental requirements of MIL-C-15305 Rev. B. **GRADE 2 CLASS B**



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.1 to 22uH ±10% (Q-Meter); 27uH to 1,000 ±5% (1KC Bridge); 1,200uH to 56,000uH ±10% (1KC Bridge) 68,000uH to 180,000uH ±20% (1KC Bridge) measured at point on leads ¼ inch from body.

Dielectric Strength: 700 volts RMS at sea level.

Self-Resonant Frequency: Minimum f_0 to be not less than 80% of published data, and measured with full length leads on Q-Meter.

Q: Measured on Q-Meter.

Maximum Current: Based on temperature rise not to exceed 40°C at 85°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0087 cubic inches **Weight:** 0.75 grams maximum
Shielding: Less than 3% coupling with two units measured side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305B.
Marking: Printed with pertinent data.

Note: L & Q are not always tested at the same frequency.

MATERIAL	NCG PART NO.	L	Q min		Approx. SRF	approx. Cd	Max. DCR	Max. I	Incr* I
		µH		MHz	MHz	µµF	Ω	mA	mA
PHENOLIC	WEE- 0.10	0.10	63	25	>500	0.67	0.020	4000	4000
	WEE- 0.12	0.12	61	25	>500	0.67	0.029	3350	3350
	WEE- 0.15	0.15	59	25	>500	0.67	0.032	3000	3000
	WEE- 0.18	0.18	57	25	458	0.67	0.040	2850	2850
	WEE- 0.22	0.22	56	25	414	0.67	0.045	2700	2700
	WEE- 0.27	0.27	50	25	373	0.67	0.08	2000	2000
	WEE- 0.33	0.33	48	25	337	0.67	0.09	1900	1900
	WEE- 0.39	0.39	48	25	310	0.67	0.16	1420	1420
	WEE- 0.47	0.47	48	25	283	0.67	0.17	1400	1400
	WEE- 0.56	0.56	45	25	258	0.67	0.36	960	960
	WEE- 0.68	0.68	45	25	235	0.67	0.37	940	940
	WEE- 0.82	0.82	41	25	214	0.67	0.46	870	870
IRON	WEE- 1.0	1.0	42	7.9	164	0.92	0.062	2300	2300
	WEE- 1.2	1.2	43	7.9	150	0.92	0.067	2200	2200
	WEE- 1.5	1.5	41	7.9	135	0 92	0.16	1420	1420
	WEE- 1.8	1.8	42	7.9	124	0.92	0.17	1370	1370
	WEE- 2.2	2.2	42	7.9	112	0.92	0.19	1300	1300
	WEE- 2.7	2.7	41	7.9	107	0.92	0.20	1270	1270
	WEE- 3.3	3.3	40	7.9	91.5	0.92	0.31	1030	1030
	WEE- 3.9	3.9	40	7.9	84.5	0.92	0.33	1000	1000
	WEE- 4.7	4.7	40	7.9	76.5	0.92	0.58	750	750
	WEE- 5.6	5.6	40	7.9	69.5	0.92	0.64	710	710
	WEE- 6.8	6.8	40	7.9	63.5	0.92	0.68	680	680
	WEE- 8.2	8 2	45	7.9	57.5	0.92	1.3	500	500
	WEE- 10	10	46	2.5	52.5	0.92	1.4	480	480
	WEE- 12	12	47	2.5	47.5	0.92	1.5	460	460
	WEE- 15	15	47	2.5	42.5	0.92	1.7	440	440
FERRITE	WEE- 18	18	45	2.5	53.5	0.49	0.88	610	235
	WEE- 22	22	47	2.5	47.0	0.50	0.95	590	220
	WEE- 27	27	42	2.5	44.0	0.48	1.15	530	200
	WEE- 33	33	43	2.5	40.0	0.48	1.2	520	193
	WEE- 39	39	45	2.5	36.5	0.48	1.6	450	183
	WEE- 47	47	46	2.5	33.0	0.49	1.8	420	177
	WEE- 56	56	40	2.5	30.0	0.49	2.2	390	170
	WEE- 68	68	40	2 5	27.0	0.50	2.3	375	165
	WEE- 82	82	42	2.5	17.5	1.0	2.4	360	160
	WEE- 100	100	63	.79	15.0	1.0	2.6	345	157
	WEE- 120	120	62	.79	14.0	1 0	2.9	330	145

MATERIAL	NCG PART NO.	L	Q min		Approx SRF	approx. Cd	Max. DCR	Max. I	Incr* I
		µH		MHz	MHz	µµF	Ω	mA	mA
FERRITE	WEE- 150	150	63	.79	12.5	1.0	3.3	315	126
	WEE- 180	180	60	.79	11.5	1.0	3.6	300	110
	WEE- 220	220	57	.79	11.0	0.94	4.1	280	105
	WEE- 270	270	52	.79	10.0	0.92	4.8	260	91
	WEE- 330	330	50	.79	9.0	0.92	5.6	240	87
	WEE- 390	390	43	.79	8.5	0.87	6.2	230	72
	WEE- 470	470	66	.79	8.0	0.83	10.0	180	67
	WEE- 560	560	64	.79	7.5	0.82	11.5	170	65
	WEE- 680	680	71	.79	6.5	0.87	12.0	160	60
	WEE- 820	820	67	.79	6.0	0.87	13.8	150	55
	WEE- 1000	1000	62	.79	5.6	0.87	16.0	140	52
	WEE- 1200	1200	52	.250	1.490	9.0	18.2	135	50
	WEE- 1500	1500	51	.250	1.460	8.0	23.7	118	48
	WEE- 1800	1800	51	.250	1 420	6.5	30.2	105	42
	WEE- 2200	2200	50	.250	1.300	6.8	33.7	99	37
	WEE- 2700	2700	51	.250	1.180	6.8	43.1	87	33
	WEE- 3300	3300	52	250	1.050	7.0	48.7	82	30
	WEE- 3900	3900	48	.250	.960	7.0	62.7	72	29
	WEE- 4700	4700	48	.250	.840	7.4	70.5	68	28
	WEE- 5600	5600	48	.250	.810	6.8	104	56	24
	WEE- 6800	6800	45	.250	.740	6.8	118	53	20
	WEE- 8200	8200	38	.250	.580	9.2	146	47	18
	WEE- 10,000	10,000	36	.079	.470	11.5	76.6	66	15
	WEE- 12,000	12,000	36	.079	.370	15.0	109	55	14
	WEE- 15.000	15.000	38	.079	.330	15.0	119	52	13
	WEE- 18,000	18,000	38	.079	305	15.0	138	49	13
	WEF- 22,000	22.000	32	.079	.295	13.0	219	39	12
	WEE- 27,000	27,000	32	.079	.270	13.0	259	35	12
	WEE- 33,000	33.000	32	.079	.250	12.5	296	33	11
	WEE- 39,000	39,000	30	.079	.215	14.0	395	29	10
	WEE- 47,000	47,000	25	.079	.210	12 5	452	27	9
	WEE- 56.000	56.000	25	.079	.195	12.0	499	26	8
	WEE- 68.000	68,000	20	.079	.130	18.4	395	29	1 1
	WEE- 82,000	82.000	20	.079	.125	16 5	452	27	1.1
	WEE-100,000	100,000	20	.079	.115	16.2	499	26	1.1
	WEE-120,000	120,000	20	.070	105	16.8	540	23	1.1
	WEE-150,000	150,000	20	.060	.098	13.4	750	20	1.0
	WEE-180,000	180,000	20	.050	.094	13.4	880	18	0.8

*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE WWD INDUCTORS

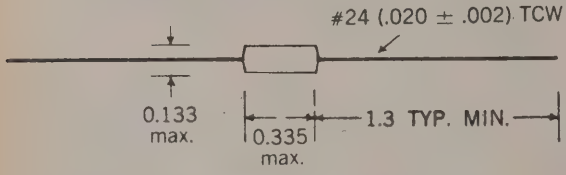
WEE-WEE-DUCTOR SERIES

The smallest shielded inductor for high density circuits 0.10 to 1,000 uh 0.133" diameter x 0.335" length. We have 49 stock values.

GRADE 2 CLASS B

The **WEE-WEE-DUCTOR** offers the Design Engineer a subminiature shielded inductor to solve special problems in density circuit application. This shielded inductor has great inductance-to-size ratio and is designed to meet the stringent requirements of MIL-C-15305 Rev. B.

0.10 to 10,000uH
0.133" diameter x 0.335" length
49 stock values



ELECTRICAL CHARACTERISTICS

Inductance Tolerance:	±10% (Q-Meter).
Dielectric Strength:	700 volts RMS at sea level.
Self-Resonant Frequency:	Minimum f_o to be not less than 80% of published data, and measured with full length leads on Q-Meter.
Rating:	I maximum based on ⅓ watt dissipation.

DENSITY CHARACTERISTICS

Volume:	0.0041 cubic inches.
Weight:	0.50 grams maximum.
Shielding:	Less than 3% coupling with two units mounted side by side at 1000 cycles.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature:	−55°C to +125°C.
Terminal Strength:	Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Marking:	Color coded per MIL-C-15305 (latest revision).

WEE-WEE-DUCTOR STANDARD VALUES

NCG PART NO.	L	Q min.		approx. SRF	Max. DCR	Max. I	Incr.* I	
	µH		MHz	MHz	Ω	mA	mA	
WEE-WEE- 0.10	0.10	42	25	500	.112	1720	>1720	PHENOLIC
WEE-WEE- 0.12	0.12	42	25	500	.126	1630	>1630	
WEE-WEE- 0.15	0.15	42	25	500	.138	1550	>1550	
WEE-WEE- 0.18	0.18	42	25	458	.165	1420	>1420	
WEE-WEE- 0.22	0.22	42	25	414	.198	1330	>1330	
WEE-WEE- 0.27	0.27	42	25	373	.220	1230	>1230	
WEE-WEE- 0.33	0.33	42	25	360	.258	1140	>1140	
WEE-WEE- 0.39	0.39	42	25	339	.292	1060	>1060	
WEE-WEE- 0.47	0.47	41	25	309	.360	960	> 960	
WEE-WEE- 0.56	0.56	39	25	295	.397	915	> 915	
WEE-WEE- 0.68	0.68	36	25	270	.472	840	> 840	
WEE-WEE- 0.82	0.82	35	25	250	.638	720	> 720	
WEE-WEE- 1.0	1.0	42	25	170	.208	1260	>1260	IRON
WEE-WEE- 1.2	1.2	38	7.9	150	.225	1210	>1210	
WEE-WEE- 1.5	1.5	38	7.9	139	.265	1120	>1120	
WEE-WEE- 1.8	1.8	38	7.9	129	.285	1080	>1080	
WEE-WEE- 2.2	2.2	36	7.9	118	.330	1000	>1000	
WEE-WEE- 2.7	2.7	38	7.9	106	.381	935	> 935	
WEE-WEE- 3.3	3.3	38	7.9	98	.432	875	> 875	
WEE-WEE- 3.9	3.9	40	7.9	91	.576	755	> 755	
WEE-WEE- 4.7	4.7	42	7.9	83	.787	650	> 650	
WEE-WEE- 5.6	5.6	42	7.9	77	1.04	565	> 565	
WEE-WEE- 6.8	6.8	45	7.9	67	1.40	485	> 485	
WEE-WEE- 8.2	8.2	47	7.9	62	1.68	440	> 440	
WEE-WEE- 10	10	51	7.9	55	2.58	355	> 355	
WEE-WEE- 12	12	51	2.5	49	3.65	300	> 300	
WEE-WEE- 15	15	45	2.5	55	.862	620	200	FERRITE
WEE-WEE- 18	18	43	2.5	50	1.02	570	175	
WEE-WEE- 22	22	42	2.5	45	1.12	545	160	
WEE-WEE- 27	27	37	2.5	41	1.28	510	155	
WEE-WEE- 33	33	46	2.5	37	1.70	440	150	
WEE-WEE- 39	39	38	2.5	33	1.99	405	145	
WEE-WEE- 47	47	42	2.5	29	2.41	370	140	
WEE-WEE- 56	56	41	2.5	27	2.85	340	130	
WEE-WEE- 68	68	46	2.5	23	3.21	320	120	
WEE-WEE- 82	82	46	2.5	21	3.57	305	115	
WEE-WEE- 100	100	43	2.5	19	4.10	280	100	
WEE-WEE- 120	120	50	0.79	16	5.97	235	80	
WEE-WEE- 150	150	49	0.79	15	7.05	215	68	
WEE-WEE- 180	180	56	0.79	14	8.12	200	64	
WEE-WEE- 220	220	53	0.79	12	14.8	150	60	
WEE-WEE- 270	270	57	0.79	11.5	16.8	140	58	
WEE-WEE- 330	330	57	0.79	10.5	18.6	130	56	
WEE-WEE- 390	390	57	0.79	10.0	21.1	120	54	
WEE-WEE- 470	470	50	0.79	8.5	32.2	100	52	
WEE-WEE- 560	560	50	0.79	7.5	36.4	95	50	
WEE-WEE- 680	680	56	0.79	7.0	41.1	90	48	
WEE-WEE- 820	820	49	0.79	6.5	45.0	85	47	
WEE-WEE-1000	1000	49	0.79	6.0	52.0	80	45	

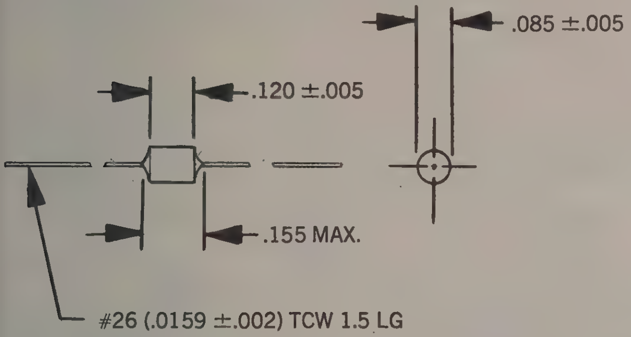
*INCREMENTAL CURRENT — The D.C. current to cause a 5% reduction in the nominal inductance value.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE PW INDUCTORS

PEE-WEE SERIES

The amazing **PEE-WEE DUCTOR** represents a 66% size reduction from the smallest magnetically shielded axial leaded inductor series heretofore available anywhere. Furthermore, this size reduction was obtained with negligible loss of electrical performance by employing several unique concepts in RF coil design.



ALL DIMENSIONS IN INCHES

ELECTRICAL CHARACTERISTICS:

Inductance Tolerance:	± 10% (Std).
L,Q,F, values:	Measurements per MIL-C-15305. (latest revision).
Incremental Current:	Incremental current in table is for 5% reduction in inductance value.
Dielectric Strength:	300 Volts RMS @ Sea Level.

*SRF minimum not less than 80% of specified values.

DENSITY CHARACTERISTICS:

Volume:	.0007 Cubic Inches
Weight:	0.12 Grams
Shielding:	5% maximum coupling for two units side by side.
Marking:	EIA color coded

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS:

Terminal pull:	3 lbs. minimum.
Environmental:	Grade 2 Class A

PEE-WEE DUCTOR STANDARD VALUES

NCG PART NO.	L µH	Q min. @	MHz	*SRF MHz	Max. DCR Ω	Max. I mA	Incr. I mA
PW- 0.10	.10	40	25	500	.060	1500	*
PW- 0.12	.12	40	25	480	.070	1400	*
PW- 0.15	.15	40	25	450	.080	1300	*
PW- 0.18	.18	40	25	430	.090	1200	*
PW- 0.22	.22	40	25	390	.11	1100	*
PW- 0.27	.27	40	25	340	.12	1000	*
PW- 0.33	.33	40	25	310	.14	950	*
PW- 0.39	.39	40	25	280	.16	900	*
PW- 0.47	.47	40	25	250	.20	800	*
PW- 0.56	.56	40	25	220	.25	750	*
PW- 0.68	.68	35	25	200	.27	700	*
PW- 0.82	.82	35	25	180	.36	600	*
PW- 1.0	1.0	35	25	165	.40	525	*
PW- 1.2	1.2	35	7.9	150	.70	425	*
PW- 1.5	1.5	35	7.9	130	.80	400	*
PW- 1.8	1.8	35	7.9	120	.90	350	*
PW- 2.2	2.2	35	7.9	110	1.3	320	*
PW- 2.7	2.7	35	7.9	100	1.8	275	*
PW- 3.3	3.3	35	7.9	70	1.7	290	*
PW- 3.9	3.9	35	7.9	65	1.8	275	*
PW- 4.7	4.7	35	7.9	58	2.6	225	*
PW- 5.6	5.6	35	7.9	54	2.9	210	*
PW- 6.8	6.8	35	7.9	50	3.3	200	*
PW- 8.2	8.2	35	7.9	48	4.5	170	*
PW- 10	10	35	7.9	45	4.8	165	*
PW- 12	12	35	2.5	40	2.0	250	230
PW- 15	15	35	2.5	36	2.5	230	180
PW- 18	18	35	2.5	31	3.5	195	150
PW- 22	22	35	2.5	28	4.5	170	135
PW- 27	27	35	2.5	25	5.0	160	115
PW- 33	33	35	2.5	23	5.5	150	105
PW- 39	39	35	2.5	22	7.0	140	100
PW- 47	47	35	2.5	21	7.5	135	95
PW- 56	56	35	2.5	19	8.0	130	90
PW- 68	68	35	2.5	18	9.0	120	83
PW- 82	82	35	2.5	16	14	95	65
PW- 100	100	35	2.5	14	16	90	70
PW- 120	120	35	.79	9.5	10	115	40
PW- 150	150	35	.79	8.8	12	105	35
PW- 180	180	35	.79	8.1	15	90	32
PW- 220	220	35	.79	7.8	20	80	30
PW- 270	270	35	.79	7.3	23	75	27
PW- 330	330	35	.79	6.8	26	70	25
PW- 390	390	35	.79	6.0	35	65	23
PW- 470	470	35	.79	5.6	37	60	21
PW- 560	560	35	.79	5.0	40	58	20
PW- 680	680	35	.79	4.3	48	54	18
PW- 820	820	35	.79	3.8	54	47	17
PW-1000	1000	35	.79	3.5	65	43	15

* GREATER THAN MAX I

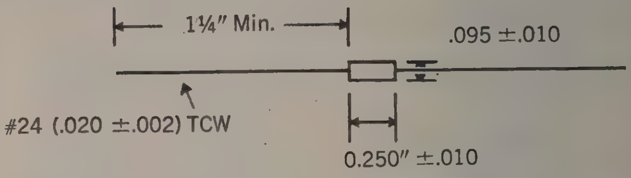
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE DD INDUCTORS

DECI-DUCTOR

New Subminiature Inductor 0.10uH to 1000uH Range
0.100″ diameter by 0.250″ length 49 STANDARD VALUES

The **DECI-DUCTOR** offers the design engineer epoxy-molded reliability and uniformity in a subminiature R.F. Inductor. This Nytronics R.F. Inductor line is designed to meet all the environmental specifications of MIL-C-15305 (latest revision).



GRADE 2 CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum Current based on 35°C rise in 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches **Weight:** 0.35 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C

Terminal Strength: Meets three pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 15 G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 50G, 11 MS.

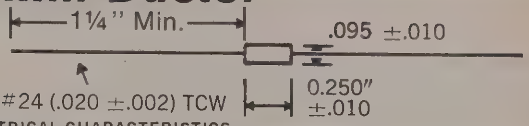
Marking: Color coded per MIL-C-15305 (latest revision).

	NCG Part No.	L	Q Min.		Min. SRF	Max. DCR	Max I.
		uH		MHz	MHz	Ohms	mA
PHENOLIC	DD-0.10	0.10	40	25	690	0.07	2000
	DD-0.12	0.12	40	25	650	0.08	1900
	DD-0.15	0.15	38	25	600	0.09	1750
	DD-0.18	0.18	38	25	550	0.10	1600
	DD-0.22	0.22	35	25	510	0.11	1550
	DD-0.27	0.27	35	25	470	0.15	1350
	DD-0.33	0.33	32	25	410	0.21	1150
	DD-0.39	0.39	32	25	370	0.29	970
	DD-0.47	0.47	32	25	340	0.35	820
	DD-0.56	0.56	32	25	310	0.48	700
	DD-0.68	0.68	33	25	280	0.65	600
	DD-0.82	0.82	30	25	255	0.82	500
	DD-1.00	1.00	30	25	240	1.10	475
IRON	DD-1.20	1.20	30	7.9	155	0.16	1200
	DD-1.50	1.50	32	7.9	140	0.20	1100
	DD-1.80	1.80	35	7.9	130	0.32	900
	DD-2.20	2.20	35	7.9	120	0.37	760
	DD-2.70	2.70	37	7.9	105	0.49	700
	DD-3.30	3.30	45	7.9	95	0.67	575
	DD-3.90	3.90	45	7.9	87	0.95	500
	DD-4.70	4.70	45	7.9	80	1.10	475
	DD-5.60	5.60	52	7.9	75	1.60	380
	DD-6.80	6.80	52	7.9	65	1.80	350
	DD-8.20	8.20	60	7.9	62	2.40	300
	DD-10.0	10.0	60	7.9	52	3.40	265
	DD-12.0	12.0	45	2.5	42	2.40	300
	DD-15.0	15.0	47	2.5	36	2.70	275
	DD-18.0	18.0	50	2.5	32	3.00	260
	DD-22.0	22.0	50	2.5	28	3.30	250
	DD-27.0	27.0	50	2.5	25	3.80	240
FERRITE	DD-33.0	33.0	50	2.5	30	3.80	260
	DD-39.0	39.0	50	2.5	26	4.10	240
	DD-47.0	47.0	50	2.5	24	4.40	210
	DD-56.0	56.0	50	2.5	22	5.70	205
	DD-68.0	68.0	52	2.5	19	6.50	180
	DD-82.0	82.0	52	2.5	17	7.30	175
	DD-100	100	50	2.5	15	8.20	165
	DD-120	120	28	0.79	14	14	110
	DD-150	150	28	0.79	13	16	105
	DD-180	180	28	0.79	12	18	100
	DD-220	220	26	0.79	11	25	90
	DD-270	270	26	0.79	10	33	75
	DD-330	330	26	0.79	9.0	37	70
	DD-390	390	25	0.79	8.0	51	60
	DD-470	470	27	0.79	7.0	56	58
	DD-560	560	27	0.79	6.5	61	55
	DD-680	680	28	0.79	6.0	70	50
	DD-820	820	28	0.79	5.5	91	45
	DD-1000	1000	28	0.79	5.2	102	40

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE MD INDUCTORS

Mili-Ductor



—MS INDUCTOR SERIES 75083, 75084, 75085 MOLDED INDUCTOR/0.100 uh to 1000 uh

Markings: Color coded per MIL-C-15305 (Latest Rev.)

The MS Inductor Series are RF Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). This MS Series is Epoxy Molded enveloped features reliability and uniformity in a Subminiature Inductor.

ELECTRICAL CHARACTERISTICS
Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum current based on; 35°C rise in 90° ambient for phenolic, 15°C rise in 90° ambient for iron, 35°C rise in 70° ambient for ferrite core inductors.

DENSITY CHARACTERISTICS
Volume: 0.002 cubic inches; **Weight:** 0.30 grams.

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS
Operating Temperature: —55°C to +125°C phenolic core, —55°C to +105°C iron and ferrite core.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

MS No.	NCG Part No.	±10% Inductance uh	Q Min.	Test Frequency (L & Q) MHz	Self-resonant Frequency, Min. MHz	DC Resistance Max. Ohms	Rated DC Current MA	Material
MS75083-01	MD	.10	40	25.0	680	.08	1350	PHENOLIC
MS75083-02	MD	.12	40	25.0	640	.09	1270	
MS75083-03	MD	.15	38	25.0	600	.10	1200	
MS75083-04	MD	.18	35	25.0	550	.12	1105	
MS75083-05	MD	.22	33	25.0	510	.14	1025	
MS75083-06	MD	.27	33	25.0	430	.16	960	
MS75083-07	MD	.33	30	25.0	410	.22	815	
MS75083-08	MD	.39	30	25.0	365	.30	700	
MS75083-09	MD	.47	30	25.0	330	.35	650	
MS75083-10	MD	.56	30	25.0	300	.50	545	
MS75083-11	MD	.68	28	25.0	275	.60	495	
MS75083-12	MD	.82	28	25.0	250	.85	415	
MS75083-13	MD	1.00	25	25.0	230	1.00	385	
MS75084-01	MD	1.2	25	7.9	150	.18	590	IRON
MS75084-02	MD	1.5	28	7.9	140	.22	535	
MS75084-03	MD	1.8	30	7.9	125	.30	455	
MS75084-04	MD	2.2	30	7.9	115	.40	395	
MS75084-05	MD	2.7	37	7.9	100	.55	355	
MS75084-06	MD	3.3	45	7.9	90	.85	270	
MS75084-07	MD	3.9	45	7.9	80	1.00	250	
MS75084-08	MD	4.7	45	7.9	75	1.20	230	
MS75084-09	MD	5.6	50	7.9	65	1.80	185	
MS75084-10	MD	6.8	50	7.9	60	2.00	175	
MS75084-11	MD	8.2	55	7.9	55	2.70	155	
MS75084-12	MD	10	55	7.9	50	3.70	130	
MS75084-13	MD	12	45	2.5	40	2.70	155	
MS75084-14	MD	15	40	2.5	35	2.80	150	
MS75084-15	MD	18	50	2.5	30	3.10	145	
MS75084-16	MD	22	50	2.5	25	3.30	140	
MS75084-17	MD	27	50	2.5	20	3.50	135	
MS75085-01	MD	33	45	2.5	24	3.4	130	FERRITE
MS75085-02	MD	39	45	2.5	22	3.6	125	
MS75085-03	MD	47	45	2.5	20	4.5	110	
MS75085-04	MD	56	45	2.5	18	5.7	100	
MS75085-05	MD	68	50	2.5	15	6.7	92	
MS75085-06	MD	82	50	2.5	14	7.3	88	
MS75085-07	MD	100	50	2.5	13	8	84	
MS75085-08	MD	120	30	.79	12	13	66	
MS75085-09	MD	150	30	.79	11	15	61	
MS75085-10	MD	180	30	.79	10	17	57	
MS75085-11	MD	220	30	.79	9	21	52	
MS75085-12	MD	270	30	.79	8	25	47	
MS75085-13	MD	330	30	.79	7	28	45	
MS75085-14	MD	390	30	.79	6.5	35	40	
MS75085-15	MD	470	30	.79	6	42	36	
MS75085-16	MD	560	30	.79	5	46	35	
MS75085-17	MD	680	30	.79	4	60	30	
MS75085-18	MD	820	30	.79	3.8	65	29	
MS75085-19	MD	1000	30	.79	3.4	72	28	

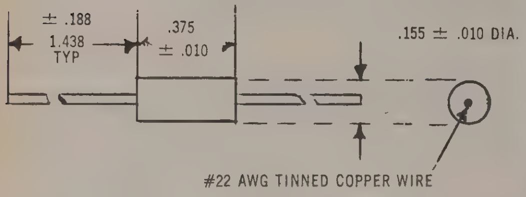
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE RFC-SS
MS18130, 14046 & 90538
INDUCTORS

RFC-SS SERIES

Molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance from 0.15 to 240uH.

GRADE 1 CLASS A (0.15-4.7)
CLASS B (5.6-240)



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 33 uH ±10%
36 to 240 uH ±5%
Measured on Q meter per MIL-C-15305 (latest revision).

Dielectric Strength: 1000 volts RMS @ sea level

Rated Current: Based on max. temp. rise of 35°C (ambient 90°C) for RFC-SS-0.15 to 4.7
15°C (ambient 90°C) for RFC-SS-5.6 to -240

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: Max. 125°C for RFC-SS-0.15 to -4.7
Max. 105°C for RFC-SS-5.6 to -240

Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), high frequency 10 cps

Marking: Color banded.

MS NO.	NCG* PART NO.	L	Q Min.	@	Min. SRF	Max. DCR	Rated DC Cur.	Material
		uH		MHz	MHz	Ω	mA	
MS18130-1	RFC-SS- .15	0.15	50	25	525	0.03	2450	PHENOLIC
MS18130-2	RFC-SS- .22	0.22	50	25	450	0.05	1900	
MS18130-3	RFC-SS- .33	0.33	45	25	360	0.09	1400	
MS18130-4	RFC-SS- .47	0.47	45	25	310	0.12	1225	
MS18130-5	RFC-SS- .56	0.56	50	25	280	0.13	1220	
MS18130-6	RFC-SS- .68	0.68	50	25	250	0.15	1100	
MS18130-7	RFC-SS- .82	0.82	50	25	220	0.22	900	
MS18130-8	RFC-SS- 1.00	1.00	50	25	200	0.29	830	
MS18130-9	RFC-SS- 1.20	1.20	33	7.9	180	0.42	650	
MS18130-10	RFC-SS- 1.50	1.5	33	7.9	160	0.50	600	
MS18130-11	RFC-SS- 1.80	1.8	33	7.9	150	0.65	525	
MS18130-12	RFC-SS- 2.2	2.2	33	7.9	135	0.95	435	
MS18130-13	RFC-SS- 2.7	2.7	33	7.9	120	1.20	385	
MS18130-14	RFC-SS- 3.3	3.3	33	7.9	110	2.00	300	
MS18130-15	RFC-SS- 3.9	3.9	33	7.9	100	2.30	280	
MS18130-16	RFC-SS- 4.7	4.7	33	7.9	90	2.60	260	
MS14046-1	RFC-SS- 5.6	5.6	45	7.9	60	0.32	750	IRON
MS14046-2	RFC-SS- 6.8	6.8	50	7.9	55	0.50	600	
MS14046-3	RFC-SS- 8.2	8.2	50	7.9	50	0.60	545	
MS14046-4	RFC-SS- 10	10.0	55	7.9	45	0.90	445	
MS14046-5	RFC-SS- 12	12	65	2.5	42	1.10	404	
MS14046-6	RFC-SS- 15	15	65	2.5	40	1.40	370	
MS14046-7	RFC-SS- 18	18	75	2.5	34	2.25	280	
MS14046-8	RFC-SS- 22	22	75	2.5	30	2.50	265	
MS14046-9	RFC-SS- 27	27	60	2.5	25	2.60	260	
MS14046-10	RFC-SS- 33	33	65	2.5	19	3.00	250	
MS90538-1	RFC-SS- 36	36	60	2.5	15.5	2.50	180	
MS90538-2	RFC-SS- 39	39	60	2.5	14.5	2.60	176	
MS90538-3	RFC-SS- 43	43	60	2.5	13.7	2.70	172	
MS90538-4	RFC-SS- 47	47	55	2.5	13.0	2.75	170	
MS90538-5	RFC-SS- 51	51	55	2.5	12.7	2.85	167	
MS90538-6	RFC-SS- 56	56	55	2.5	12.0	3.00	164	
MS90538-7	RFC-SS- 62	62	55	2.5	11.5	3.15	160	
MS90538-8	RFC-SS- 68	68	55	2.5	11.0	3.30	156	
MS90538-9	RFC-SS- 75	75	55	2.5	10.5	3.70	147	
MS90538-10	RFC-SS- 82	82	50	2.5	10.3	3.9	143	
MS90538-11	RFC-SS- 91	91	50	2.5	10.0	4.3	136	
MS90538-12	RFC-SS-100	100	50	2.5	9.5	4.5	133	
MS90538-13	RFC-SS-110	110	60	0.79	8.9	4.9	128	
MS90538-14	RFC-SS-120	120	65	0.79	8.7	5.2	124	
MS90538-15	RFC-SS-130	130	65	0.79	8.5	5.45	121	
MS90538-16	RFC-SS-150	150	65	0.79	8.0	6.05	114	
MS90538-17	RFS-SS-160	160	65	0.79	7.5	6.40	111	
MS90538-18	RFC-SS-180	180	65	0.79	7.0	6.75	108	
MS90538-19	RFC-SS-200	200	65	0.79	6.5	7.10	106	
MS90538-20	RFC-SS-220	220	65	0.79	6.2	7.45	103	
MS90538-21	RFC-SS-240	240	65	0.79	5.9	7.8	101	

* NCG Part No. electricals and tolerances as shown,
MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.

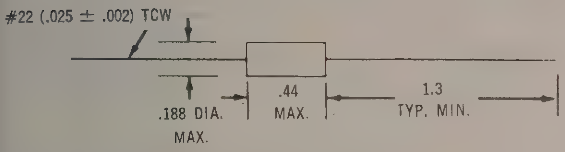
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE RFC-S MS21389 & 21390 INDUCTORS

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 0.1 to 1000uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance:	0.1 to 22uH ±10% on Q-Meter 27uH to 100 ±5% 1,000 cps bridge 120uH to 1000uH ±5% on Q-Meter
Dielectric Strength:	700 volts RMS at sea level.
Self-Resonant Frequency:	Minimum f₀ to be not less than 80% of published data and measured with full length leads on Grid-Dip Meter.
Q:	Measured on Q-Meter.
Rating:	⅓ watt dissipation for series S
	Note: L & Q are not always tested at the same frequency.

DENSITY CHARACTERISTICS

Volume:	0.012 cu. in.
Weight:	0.90 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature:	−55°C to +125°C.
Terminal Strength:	Meets five pound pull test per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance:	Meets requirements of MIL-C-15305 Grade 1, Class B. High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

RFC-S SERIES

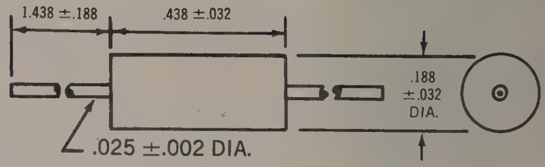
MS NO.	NCG PART NO.*	L	Q min		approx SRF	Max. DCR	max. I	MATERIAL
		uH		MHz	MHz	Ω	mA	
MS21389-1	RFC-S- 0.10	0.10	85	50	500	.02	4000	PHENOLIC
MS21389-2	RFC-S- 0.12	0.12	85	50	500	0.25	3500	
MS21389-3	RFC-S- 0.15	0.15	85	50	500	.03	3000	
MS21389-4	RFC-S- 0.18	0.18	75	50	500	.03	3000	
MS21389-5	RFC-S- 0.22	0.22	75	50	500	.03	3000	
MS21389-6	RFC-S- 0.27	0.27	70	45	470	.04	2700	
MS21389-7	RFC-S- 0.33	0.33	70	40	440	.05	2500	
MS21389-8	RFC-S- 0.39	0.39	65	40	400	.08	2000	
MS21389-9	RFC-S- 0.47	0.47	60	25	360	.08	2000	
MS21389-10	RFC-S- 0.56	0.56	55	25	330	.10	1700	
MS21389-11	RFC-S- 0.68	0.68	55	25	300	.12	1500	
MS21389-12	RFC-S- 0.82	0.82	50	25	275	.18	1300	
MS21389-13	RFC-S- 1.0	1.0	50	20	250	.24	1100	
MS21389-14	RFC-S- 1.2	1.2	45	20	220	.35	1000	
MS21389-15	RFC-S- 1.5	1.5	45	15	200	.43	850	
MS21389-16	RFC-S- 1.8	1.8	45	15	180	.65	720	
MS21389-17	RFC-S- 2.2	2.2	45	15	165	.80	610	
MS21390-1	RFC-S- 2.7	2.7	55	10	110	.12	1600	IRON
MS21390-2	RFC-S- 3.3	3.3	55	10	100	.15	1400	
MS21390-3	RFC-S- 3.9	3.9	60	10	95	.23	1200	
MS21390-4	RFC-S- 4.7	4.7	70	7.9	90	.30	1000	
MS21390-5	RFC-S- 5.6	5.6	65	7.9	80	.45	900	
MS21390-6	RFC-S- 6.8	6.8	65	7.9	70	.55	800	
MS21390-7	RFC-S- 8.2	8.2	60	7.9	65	.65	720	
MS21390-8	RFC-S- 10	10	60	5	60	.73	650	
MS21390-9	RFC-S- 12	12	65	5	53	1.1	590	
MS21390-10	RFC-S- 15	15	80	2.5	47	1.4	500	
MS21390-11	RFC-S- 18	18	75	2.5	43	1.6	460	
MS21390-12	RFC-S- 22	22	75	2.5	40	1.8	430	
MS21390-13	RFC-S- 27	27	75	2.5	36	2.7	360	
MS21390-14	RFC-S- 33	33	85	2.5	32	3.5	300	
MS21390-15	RFC-S- 39	39	80	2.5	26	3.8	290	
MS21390-16	RFC-S- 47	47	80	2.5	22	4.0	275	
MS21390-17	RFC-S- 56	56	75	2.5	19	4.4	265	
MS21390-18	RFC-S- 68	68	75	2.5	16	4.7	250	
MS21390-19	RFC-S- 82	82	75	2.5	13	5.3	235	
MS21390-20	RFC-S- 100	100	75	1.5	10	6.0	220	
MS21390-21	RFC-S- 120	120	65	0.79	7.2	5.0	170	
MS21390-22	RFC-S- 150	150	65	0.79	6.7	5.8	164	
MS21390-23	RFC-S- 180	180	65	0.79	6.3	6.6	158	
MS21390-24	RFC-S- 220	220	65	0.79	5.9	7.4	155	
MS21390-25	RFC-S- 270	270	65	0.79	5.6	8.0	150	
MS21390-26	RFC-S- 300	300	65	0.79	5.3	8.6	145	
MS21390-27	RFC-S- 330	330	65	0.79	5.0	8.9	142	
MS21390-28	RFC-S- 360	360	65	0.79	4.7	9.6	137	
MS21390-29	RFC-S- 390	390	65	0.79	4.5	9.9	135	
MS21390-30	RFC-S- 430	430	65	0.79	4.3	10.4	131	
MS21390-31	RFC-S- 470	470	65	0.79	4.0	10.9	128	
MS21390-32	RFC-S- 510	510	65	0.79	3.8	11.6	124	
MS21390-33	RFC-S- 560	560	65	0.79	3.6	11.8	123	
MS21390-34	RFC-S- 620	620	60	0.79	3.5	12.5	120	
MS21390-35	RFC-S- 680	680	60	0.79	3.4	13.5	115	
MS21390-36	RFC-S- 750	750	60	0.79	3.3	14.0	113	
MS21390-37	RFC-S- 820	820	60	0.79	3.1	15.0	110	
MS21390-38	RFC-S- 910	910	60	0.79	3.0	15.5	107	
MS21390-39	RFC-S-1000	1000	60	0.79	2.8	16.5	104	

* NCG Part No. electricals and tolerances as shown,
MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE RFC-S MS75008, 75101 & 90539 INDUCTORS

MS-INDUCTOR SERIES
75008-75101-90539
MOLDED INDUCTOR



ALL DIMENSIONS IN INCHES

Proven reliability molded inductors designed to meet MIL-C-15305 (latest revision).
Inductance 0.15 to 1000 uh.

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: 0.15 to 0.47 uh ±20%; 0.56-27 uh ±10%; 270-1000 uH ±5%.
Dielectric Strength: 1000 Volts RMS at sea level
Max. Temp. Rise: 35°C

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.
Terminal Strength: Meets five pound pull test per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.
Volume: S Type — 0.012 cu. in.
Weight: S Type — 0.90 grams
Marking: Color banded per MIL-C-15305 (latest revision).

	MS No.	NCG Part No.*	Inductance ±5% uh	Q Min.	Test Frequency MHz	Self-Resonant Frequency, Min. MHz	DC Resistance Maximum Ohms	Rated DC Current mA	Material
GRADE 1, CLASS B	MS75008-21	RFC-S	0.15 ±20%	55	25.0	510	0.030	3,000	PHENOLIC
	MS75008-22	RFC-S	0.22 ±20%	50	25.0	415	0.035	2,800	
	MS75008-23	RFC-S	0.33 ±20%	50	25.0	350	0.065	2,000	
	MS75008-24	RFC-S	0.47 ±20%	50	25.0	300	0.085	1,700	
	MS75008-25	RFC-S	0.56 ±10%	50	25.0	270	0.125	1,450	
	MS75008-26	RFC-S	0.68 ±10%	45	25.0	250	0.150	1,300	
	MS75008-27	RFC-S	0.82 ±10%	40	25.0	210	0.205	1,100	
	MS75008-28	RFC-S	1.00 ±10%	40	25.0	200	0.290	930	
	MS75008-29	RFC-S	1.20 ±10%	30	7.9	180	0.400	785	
	MS75008-30	RFC-S	1.50 ±10%	30	7.9	170	0.485	700	
	MS75008-31	RFC-S	1.80 ±10%	30	7.9	150	0.740	580	
	MS75008-32	RFC-S	2.20 ±10%	30	7.9	140	0.970	505	
	MS75008-33	RFC-S	2.70 ±10%	30	7.9	120	1.20	460	
	MS75101-1	RFC-S	3.30 ±10%	30	7.9	70	0.140	1,350	IRON
	MS75101-2	RFC-S	3.90 ±10%	30	7.9	65	0.155	1,250	
	MS75101-3	RFC-S	4.70 ±10%	30	7.9	60	0.210	1,100	
	MS75101-4	RFC-S	5.60 ±10%	30	7.9	50	0.280	935	
	MS75101-5	RFC-S	6.80 ±10%	30	7.9	50	0.375	810	
	MS75101-6	RFC-S	8.20 ±10%	30	7.9	48	0.440	750	
	MS75101-7	RFC-S	10.00 ±10%	30	7.9	42	0.605	640	
	MS75101-8	RFC-S	12.00 ±10%	50	2.5	36	1.05	490	
	MS75101-9	RFC-S	15.00 ±10%	55	2.5	30	1.20	460	
	MS75101-10	RFC-S	18.00 ±10%	60	2.5	30	1.95	360	
	MS75101-11	RFC-S	22.00 ±10%	60	2.5	24	2.20	335	
	MS75101-12	RFC-S	27.00 ±10%	65	2.5	22	2.75	300	
GRADE 1, CLASS A	MS90539-01	RFC-S	270 ±5%	65	.79	5.6	8.2	110	IRON
	MS90539-02	RFC-S	300 ±5%	65	.79	5.3	8.7	107	
	MS90539-03	RFC-S	330 ±5%	65	.79	5.0	9.1	105	
	MS90539-04	RFC-S	360 ±5%	65	.79	4.7	9.6	102	
	MS90539-05	RFC-S	390 ±5%	65	.79	4.5	10.0	100	
	MS90539-06	RFC-S	430 ±5%	65	.79	4.3	10.6	97	
	MS90539-07	RFC-S	470 ±5%	65	.79	4.0	11.1	95	
	MS90539-08	RFC-S	510 ±5%	65	.79	3.8	11.6	93	
	MS90539-09	RFC-S	560 ±5%	65	.79	3.6	12.3	91	
	MS90539-10	RFC-S	620 ±5%	60	.79	3.5	13.0	88	
	MS90539-11	RFC-S	680 ±5%	60	.79	3.4	13.7	85	
	MS90539-12	RFC-S	750 ±5%	60	.79	3.3	14.4	83	
	MS90539-13	RFC-S	820 ±5%	60	.79	3.1	15.1	81	
	MS90539-14	RFC-S	910 ±5%	60	.79	2.9	15.8	79	
	MS90539-15	RFC-S	1000 ±5%	60	.79	2.8	16.5	78	

MS No. electricals as shown,
NCG Part No. is reference only, see page 16 for RFC--S electricals.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

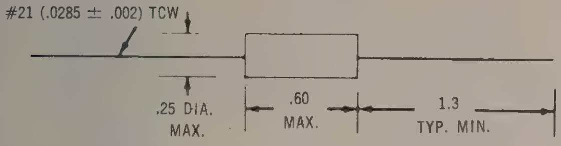
TYPE RFC-M
MS21388
INDUCTORS

RFC-M SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 2200uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance:	1.0 to 22uH ± 10% on Q-Meter 27uH to 2200 ± 5% 1,000 cps bridge
Dielectric Strength:	700 volts RMS at sea level.
Self-Resonant Frequency:	Minimum f_0 to be not less than 80% of published data and measured with full length leads on Grid-Dip Meter.
Q:	Measured on Q-Meter.
Rating:	⅓ watt dissipation for series M

Note: L & Q are not always tested at the same frequency.

DENSITY CHARACTERISTICS

Volume:	0.029 cu. in.
Weight:	2.00 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature:	−55°C to +125°C.
Terminal Strength:	Meets five pound pull test per MIL-C-15305.
Moisture, Vibration, and Shock Resistance:	Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q Min.		approx. SRF	Max. DCR	Max. I	MATERIAL
		uH		MHz	MHz	Ω	mA	
MS21388-1	RFC-M- 1.0	1.0	100	15	170	.04	2700	IRON
MS21388-2	RFC-M- 1.2	1.2	100	15	155	.04	2700	
MS21388-3	RFC-M- 1.5	1.5	100	10	140	.04	2700	
MS21388-4	RFC-M- 1.8	1.8	95	10	125	.05	2500	
MS21388-5	RFC-M- 2.2	2.2	95	10	110	.05	2500	
MS21388-6	RFC-M- 2.7	2.7	68	7.9	95	.05	2500	
MS21388-7	RFC-M- 3.3	3.3	60	7.9	90	.05	2500	
MS21388-8	RFC-M- 3.9	3.9	60	7.9	87	.07	2100	
MS21388-9	RFC-M- 4.7	4.7	60	7.9	75	.09	1800	
MS21388-10	RFC-M- 5.6	5.6	65	7.9	70	.14	1550	
MS21388-11	RFC-M- 6.8	6.8	70	7.9	65	.17	1300	
MS21388-12	RFC-M- 8.2	8.2	65	7.9	57	.25	1150	
MS21388-13	RFC-M- 10	10	65	5	50	.32	1000	
MS21388-14	RFC-M- 12	12	65	5	45	.47	870	
MS21388-15	RFC-M- 15	15	75	4	40	.62	730	
MS21388-16	RFC-M- 18	18	65	4	37	.72	660	
MS21388-17	RFC-M- 22	22	65	2.5	35	.8	600	
MS21388-18	RFC-M- 27	27	65	2.5	31	1.2	520	
MS21388-19	RFC-M- 33	33	80	2.5	27	1.5	450	
MS21388-20	RFC-M- 39	39	80	2.5	25	2.3	380	
MS21388-21	RFC-M- 47	47	100	2.5	24	3.0	300	
MS21388-22	RFC-M- 56	56	100	2.5	22	4.2	270	
MS21388-23	RFC-M- 68	68	100	2.5	20	5.2	250	
MS21388-24	RFC-M- 82	82	100	2.5	18	6.2	220	
MS21388-25	RFC-M- 100	100	100	1.5	17	7	200	
MS21388-26	RFC-M- 120	120	95	1.5	14	7.5	200	
MS21388-27	RFC-M- 150	150	90	1.0	11	8	190	
MS21388-28	RFC-M- 180	180	85	1.0	9	9	185	
MS21388-29	RFC-M- 220	220	85	1.0	7	10	180	
MS21388-30	RFC-M- 270	270	80	1.0	5.5	11	172	
MS21388-31	RFC-M- 330	330	80	.8	4.5	12	165	
MS21388-32	RFC-M- 390	390	75	.8	4.0	13	157	
MS21388-33	RFC-M- 470	470	75	.8	3.5	14	150	
MS21388-34	RFC-M- 560	560	65	.8	3.1	16	145	
MS21388-35	RFC-M- 680	680	65	.8	2.7	17	140	
MS21388-36	RFC-M- 820	820	65	.8	2.5	19	132	
MS21388-37	RFC-M-1000	1000	70	.5	2.3	21	125	
MS21388-38	RFC-M-1200	1200	60	.25	2.7	22	120	
MS21388-39	RFC-M-2200	2200	70	.25	2.0	30	100	

* NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

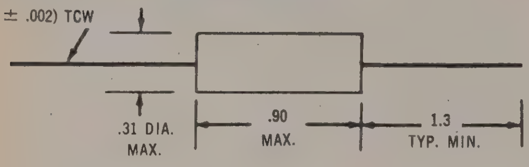
TYPE RFC-L
MS21380
INDUCTORS

RFC-L SERIES

Proven reliability molded inductors specifically designed to meet MIL-C-15305 (latest revision). Inductance 1.0 to 10,000uH.

GRADE 1 CLASS B

ACTUAL SIZE



ELECTRICAL CHARACTERISTICS

Inductance Tolerance:	0.1 to 22uH ±10% on Q-Meter 27uH to 10,000 ±5% 1,000 cps bridge
Dielectric Strength:	700 volts RMS at sea level.
Self-Resonant Frequency:	Minimum f_0 to be not less than 80% of published data and measured with full length leads on Grid-Dip Meter.
Q:	Measured on Q-Meter.
Rating:	½ watt dissipation for L series.

Note: L & Q are not always tested at the same frequency.

DENSITY CHARACTERISTICS

Volume:	0.068 cu. in.
Weight:	4.10 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature:	−55°C to +125°C.
Terminal Strength:	Meets five pound pull test per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance:	Meets requirements of MIL-C-15305 (latest revision). High frequency 10 cps to 2000 cps @ 30G ±10% maximum for 12 logarithmic swings, each of 20 minute duration repeated for each of three mutually perpendicular planes.

MS NO.	NCG PART NO.*	L	Q min		approx. SRF	Max. DCR	max. I	MAT.
		μH		MHz	MHz	Ω	mA	
MS21380-1	RFC-L- 1.0	1.0	130	15	170	.03	4000	IRON
MS21380-2	RFC-L- 1.2	1.2	130	15	155	.03	4000	
MS21380-3	RFC-L- 1.5	1.5	130	10	140	.03	4000	
MS21380-4	RFC-L- 1.8	1.8	130	10	125	.03	4000	
MS21380-5	RFC-L- 2.2	2.2	130	10	115	.04	3500	
MS21380-6	RFC-L- 2.7	2.7	100	10	102	.04	3500	
MS21380-7	RFC-L- 3.3	3.3	100	7.9	90	.04	3500	
MS21380-8	RFC-L- 3.9	3.9	80	7.9	85	.05	3100	
MS21380-9	RFC-L- 4.7	4.7	75	7.9	80	.05	3100	
MS21380-10	RFC-L- 5.6	5.6	65	7.9	72	.06	3000	
MS21380-11	RFC-L- 6.8	6.8	65	7.9	65	.06	3000	
MS21380-12	RFC-L- 8.2	8.2	65	7.9	57	.11	2400	
MS21380-13	RFC-L- 10	10	75	5	50	.15	1800	
MS21380-14	RFC-L- 12	12	75	5	45	.23	1600	
MS21380-15	RFC-L- 15	15	75	5	40	.3	1300	
MS21380-16	RFC-L- 18	18	75	5	36	.4	1150	
MS21380-17	RFC-L- 22	22	75	2.5	32	.5	1000	
MS21380-18	RFC-L- 27	27	70	2.5	30	.6	900	
MS21380-19	RFC-L- 33	33	70	2.5	28	.7	850	
MS21380-20	RFC-L- 39	39	70	2.5	26	1.1	720	
MS21380-21	RFC-L- 47	47	75	2.5	25	1.3	620	
MS21380-22	RFC-L- 56	56	80	2.5	22	1.8	540	
MS21380-23	RFC-L- 68	68	100	2.5	20	2.4	450	
MS21380-24	RFC-L- 82	82	100	2.5	18	2.8	425	
MS21380-25	RFC-L- 100	100	100	1.5	17	3.2	400	
MS21380-26	RFC-L- 120	120	100	1.5	15	4.8	360	
MS21380-27	RFC-L- 150	150	100	1.0	14	6.4	280	
MS21380-28	RFC-L- 180	180	95	1.0	12	9.5	240	
MS21380-29	RFC-L- 220	220	95	1.0	11	12	200	
MS21380-30	RFC-L- 270	270	70	1.0	9	13	195	
MS21380-31	RFC-L- 330	330	65	.79	7.5	14	190	
MS21380-32	RFC-L- 390	390	65	.79	6.5	15.5	180	
MS21380-33	RFC-L- 470	470	60	.79	5.5	17	170	
MS21380-34	RFC-L- 560	560	75	.5	4	18.5	165	
MS21380-35	RFC-L- 680	680	75	.5	3.2	20	155	
MS21380-36	RFC-L- 820	820	75	.5	2.8	22	150	
MS21380-37	RFC-L- 1000	1000	75	.5	2.4	24	145	
MS21380-38	RFC-L- 1200	1200	75	.5	2.1	27	137	
MS21380-39	RFC-L- 1500	1500	75	.4	1.9	29	130	
MS21380-40	RFC-L- 1800	1800	65	.4	1.7	32	125	
MS21380-41	RFC-L- 2200	2200	65	.25	1.5	35	120	
MS21380-42	RFC-L- 2700	2700	65	.25	1.3	40	112	
MS21380-43	RFC-L- 3300	3300	65	.25	1.2	45	105	
MS21380-44	RFC-L- 3900	3900	65	.25	1.05	49	100	
MS21380-45	RFC-L- 4700	4700	65	.25	.95	53	95	
MS21380-46	RFC-L- 5600	5600	65	.25	.85	60	90	
MS21380-47	RFC-L- 6800	6800	65	.25	.75	67	85	
MS21380-48	RFC-L- 8200	8200	65	.25	.65	75	82	
MS21380-49	RFC-L-10000	10000	65	.15	.58	80	80	

MS91189-14 THRU -28, VALUES 1.2 THRU 18uH (ON PHENOLIC CORES) ARE AVAILABLE.

MS75103-1 THRU -10, VALUES 22 THRU 120uH ARE ALSO AVAILABLE.

* NCG Part No. electricals and tolerances as shown.
MS No. electricals and tolerances per actual MS sheet.

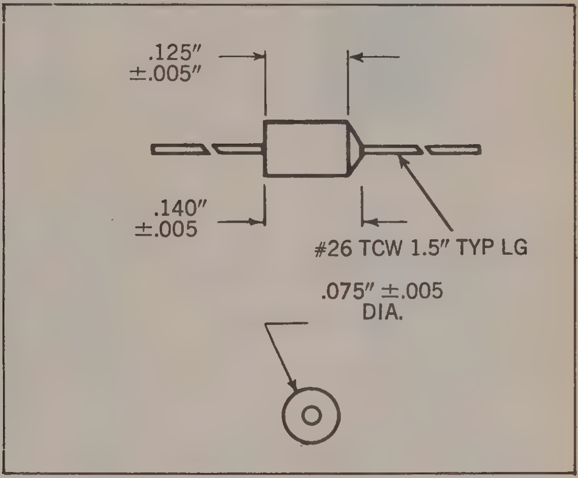
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE PD INDUCTORS

Pee Dee Ductor Series

Marking: EIA color coded

The Pee Dee Ductor is a new, microminiature, axial-leaded RF inductor for hybrid circuit applications. It is significantly smaller than any unshielded inductor available anywhere. Designed to meet the requirements of MIL-C-15305 B, this reliable, high performance inductor has a standard inductance tolerance of ±10%.



GRADE 2 CLASS A

ELECTRICAL CHARACTERISTICS:

Inductance Tolerance:	±10% (Std).
L,Q,F, values:	Measurements per MIL-C-15305. (latest revision).
Dielectric Strength:	300 Volts RMS @ Sea Level.

* SRF minimum not less than 80% of specified values.

DENSITY CHARACTERISTICS:

Volume:	.0007 Cubic Inches
Weight:	0.12 Grams
Marking:	EIA color coded

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS:

Terminal pull:	3 lbs. minimum.
Environmental:	Grade 2 Class A

ALL DIMENSIONS IN INCHES

ELECTRICAL DATA

NCG Part No.	L uH	Q (Min.)	Test Freq. MHz	$^*F_o$ MHz	DCR Max. Ohms	Rated Current mA
PD-0.10	0.10	40	25	500	0.2	600
PD-0.12	0.12	40	25	450	0.2	600
PD-0.15	0.15	40	25	400	0.25	575
PD-0.18	0.18	40	25	380	0.25	575
PD-0.22	0.22	40	25	360	0.30	565
PD-0.27	0.27	40	25	300	0.30	565
PD-0.33	0.33	40	25	280	0.35	560
PD-0.39	0.39	40	25	260	0.37	550
PD-0.47	0.47	40	25	250	0.39	535
PD-0.56	0.56	40	25	240	0.40	525
PD-0.68	0.68	35	25	220	0.45	500
PD-0.82	0.82	35	25	180	0.50	480
PD-1.0	1.0	35	25	170	0.60	450
PD-1.2	1.2	35	7.9	150	0.70	425
PD-1.5	1.5	35	7.9	130	0.80	400
PD-1.8	1.8	35	7.9	120	0.90	350
PD-2.2	2.2	35	7.9	110	1.3	320
PD-2.7	2.7	35	7.9	105	1.8	275
PD-3.3	3.3	35	7.9	100	1.1	340
PD-3.9	3.9	35	7.9	90	1.4	310
PD-4.7	4.7	35	7.9	85	1.6	290
PD-5.6	5.6	35	7.9	70	1.8	275
PD-6.8	6.8	35	7.9	65	2.0	250
PD-8.2	8.2	35	7.9	62	2.2	245
PD-10	10	35	7.9	60	3.0	210
PD-12	12	35	2.5	35	2.0	250
PD-15	15	35	2.5	30	2.2	245
PD-18	18	35	2.5	25	2.5	230
PD-22	22	35	2.5	23	2.7	220
PD-27	27	35	2.5	21	3.8	195
PD-33	33	35	2.5	20	4.5	170
PD-39	39	35	2.5	16	6.0	150
PD-47	47	35	2.5	14	6.5	145
PD-56	56	35	2.5	12	7.8	135
PD-68	68	35	2.5	10	8.6	130
PD-82	82	35	2.5	9.0	9.8	120
PD-100	100	35	2.5	8.0	11.5	110
PD-120	120	28	.79	7.0	15.0	90
PD-150	150	28	.79	6.0	16.5	88
PD-180	180	25	.79	5.5	22	75
PD-220	220	24	.79	5.2	31	62
PD-270	270	24	.79	5.0	38	56
PD-330	330	24	.79	4.8	42	53
PD-390	390	24	.79	3.6	58	47
PD-470	470	24	.79	3.4	60	45
PD-560	560	24	.79	3.2	65	43
PD-680	680	22	.79	3.0	90	36
PD-820	820	23	.79	2.5	95	34
PD-1000	1000	21	.79	2.0	130	30

* F_o (self resonant frequency) minimum not less than 80% of specified value.

opt
INDUSTRIES INC.

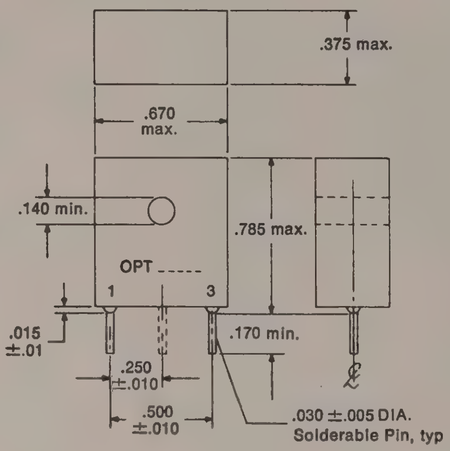
300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

INDUCTORS

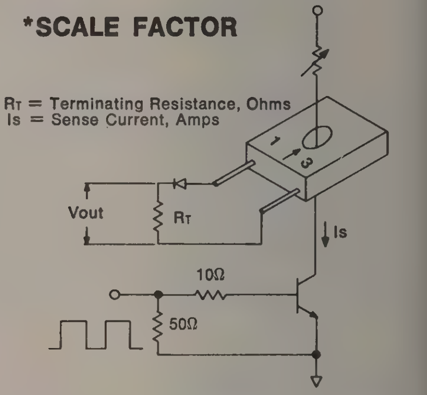
CURRENT SENSE

- DESIGNED FOR SWITCHING POWER SUPPLY APPLICATIONS
- MOLDED CONSTRUCTION
- LOW COST
- FREQUENCY RANGE 20 KHz AND ABOVE
- 0.02 IN. MINIMUM MATERIAL THICKNESS FROM HOLE I.D. TO COIL

CASE DIMENSIONS



*SCALE FACTOR



The scale factor is proportional to terminating resistance as shown in the following table.

Terminating Resistance	Scale Factor Vout, Volts per Amp
½ Rated	.5
Rated	1.0
Twice Rated	2.0

ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Schematic Figure	Turns ±5%	Inductance (Term 1-3) mH Min.	Inductance Test Volts 15.75 KHz	DC Resistance (1-3) Ohms Max.	Rated* Terminating Resistance, (Ω)
SM8200	1	50	5.0	0.50	0.70	50
SM8201	1	100	20.0	1.00	1.40	100
SM8202	1	200	80.0	2.00	4.50	200
SM8203	2	50 C.T.	5.0	0.50	0.70	50
SM8204	2	100 C.T.	20.0	1.00	1.40	100
SM8205	2	200 C.T.	80.0	2.00	4.50	200

SCHEMATICS

FIG. 1

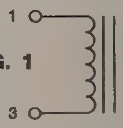
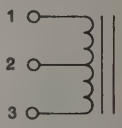
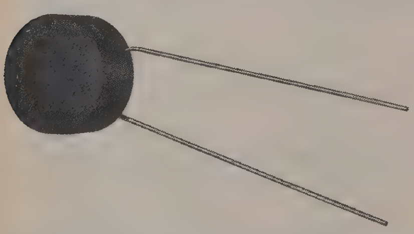


FIG. 2

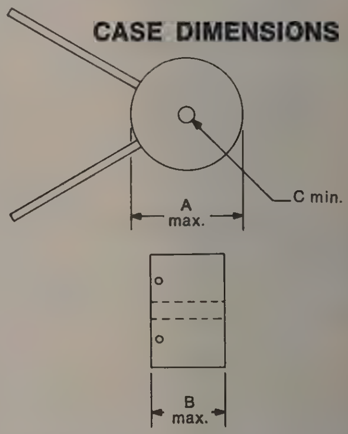


ENCAPSULATED POWER



- ENCAPSULATED CONSTRUCTION
- AMBIENT TEMPERATURE RANGE −55° TO +85°C
- STABLE INDUCTANCE WITH TEMPERATURE
- DESIGNED TO MEET MIL-T-27 SPECS

CASE DIMENSIONS

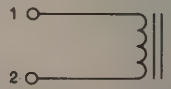


Case Style	A Dia.	B Ht.	C Dia.
A	1.39	.75	.140
B	1.05	.55	.12
C	.70	.36	.09

ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Max. DC Current	Min. Inductance @ Max. DC Current	Inductance @ 50% Current Typical	Inductance @ Zero DC Current Typical	DC Resistance Typical (Ω)	Size
SM8250	5 A	320 uh	400 uh	450 uh	0.10	A
SM8251	5 A	80 uh	110 uh	120 uh	0.06	B
SM8252	5 A	9 uh	9.5 uh	10 uh	0.012	C
SM8253	2 A	2.0 Mh	2.5 Mh	2.8 Mh	0.66	A
SM8254	2 A	525 uh	675 uh	750 uh	0.34	B
SM8255	2 A	55 uh	60 uh	62 uh	0.076	C
SM8256	1 A	8.0 Mh	10 Mh	11 Mh	2.60	A
SM8257	1 A	2.0 Mh	2.7 Mh	3.0 Mh	1.39	B
SM8258	1 A	220 uh	240 uh	250 uh	0.31	C
SM8259	0.5 A	32 Mh	40 Mh	45 Mh	10.6	A
SM8260	0.5 A	8 Mh	10 Mh	11.5 Mh	5.4	B
SM8261	0.5 A	.9 Mh	.95 Mh	1.0 Mh	1.22	C
SM8262	0.25 A	125 Mh	160 Mh	180 Mh	43	A
SM8263	0.25 A	30 Mh	38 Mh	42 Mh	19.8	B
SM8264	0.25 A	3.5 Mh	3.8 Mh	4.0 Mh	4.9	C
SM8265	0.125A	12.3 Mh	13.3 Mh	14.0 Mh	18.4	C

SCHEMATIC



opt INDUSTRIES INC.

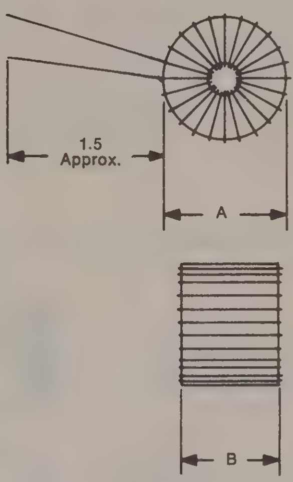
300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

INDUCTORS

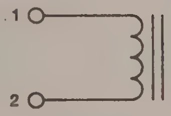
POWER INDUCTORS

- OPEN STYLE CONSTRUCTION
- HIGH ENERGY STORAGE CAPACITY
- VARNISH COATED
- MAXIMUM OPERATING TEMP. AMBIENT + RISE = 150°C

CASE DIMENSION



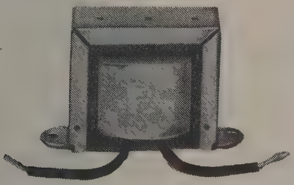
SCHEMATIC



ELECTRICAL SPECIFICATIONS AT 25°C

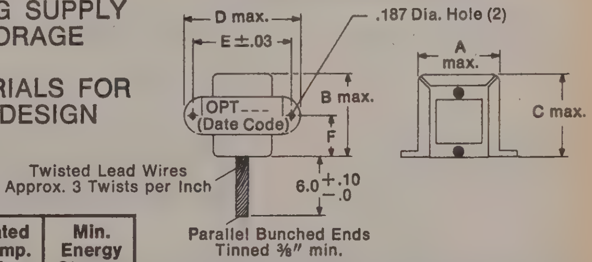
Part Number	Max. DC Current	Min. Inductance	Typical DC Resistance (Ω)	"A" Dia.	"B" Dia.	Lead Dia.
SM8100	40A	38 uh	.006	1.875	1.625	.100
SM8101	40A	19 uh	.004	1.875	.95	.100
SM8102	40A	11 uh	.0024	1.375	1.875	.100
SM8103	40A	5.5 uh	.0017	1.375	.88	.100
SM8104	40A	3.8 uh	.0014	1.125	1.45	.100
SM8105	40A	1.9 uh	.001	1.125	.63	.100
SM8106	25A	75 uh	.012	1.875	1.625	.080
SM8107	25A	37 uh	.008	1.875	.95	.080
SM8108	25A	22 uh	.005	1.375	1.875	.080
SM8109	25A	11 uh	.0034	1.375	.88	.080
SM8110	25A	8 uh	.0034	1.125	1.45	.080
SM8111	25A	4 uh	.0025	1.125	.63	.080
SM8112	15A	150 uh	.027	1.875	1.625	.064
SM8113	15A	75 uh	.018	1.875	.95	.064
SM8114	15A	54 uh	.011	1.375	1.875	.064
SM8115	15A	27 uh	.008	1.375	.88	.064
SM8116	15A	18 uh	.007	1.125	1.45	.064
SM8117	15A	9 uh	.005	1.125	.63	.064
SM8118	10A	300 uh	.06	1.875	1.625	.050
SM8119	10A	150 uh	.04	1.875	.95	.050
SM8120	10A	90 uh	.025	1.375	1.875	.050
SM8121	10A	45 uh	.016	1.375	.88	.050
SM8122	10A	34 uh	.014	1.125	1.45	.050
SM8123	10A	17 uh	.01	1.125	.63	.050
SM8124	5A	630 uh	.15	1.875	1.625	.035
SM8125	5A	315 uh	.10	1.875	.95	.035
SM8126	5A	220 uh	.063	1.375	1.875	.035
SM8127	5A	110 uh	.045	1.375	.88	.035
SM8128	5A	75 uh	.038	1.125	1.45	.035
SM8129	5A	37 uh	.028	1.125	.63	.035

LAMINATED OUTPUT



- PERFORMANCE TESTED IN 20 KHz SWITCHING SUPPLY
- HIGH ENERGY STORAGE CAPABILITY
- STANDARD MATERIALS FOR COST EFFECTIVE DESIGN

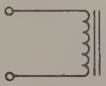
OUTLINE DIMENSIONS



Size	A	B	C	D	E	F
1	1.50	1.12	1.25	2.13	1.76	0.65
2	1.72	1.37	1.47	2.42	2.00	0.81
3	2.00	1.56	1.69	2.88	2.38	0.85
4	2.37	1.81	2.03	3.31	2.83	1.10

Tolerance. ±.010
Supplied without sleeving or terminals. Both items available as options.

SCHEMATIC



ELECTRICAL SPECIFICATIONS AT 25°C

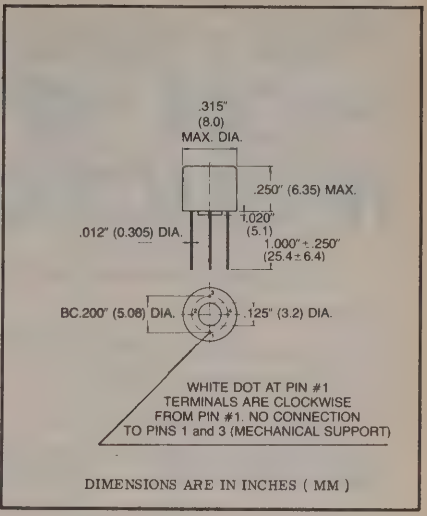
Part Number	Effective Inductance (μH +20% −10%)	Rated DC Current (Amps)	DCR (Ohms Max)	Size	Lead Size	Max. ET (Volt μSec.)	Rated Temp. Rise (Deg. Cent.)	Min. Energy Storage (μJ or LI ²/₂)
SM8300	65	12.5	0.0130	1	2 x 16 AWG	85	40	4550
SM8301	32	25.0	0.0050	2	4 x 16 AWG	85	40	9000
SM8302	19	50.0	0.0025	3	10 x 18 AWG	85	60	21375
SM8303	8	100.0	0.0009	4	15 x 16 AWG	85	60	36000
SM8304	590	4.0	0.100	1	18 AWG	255	40	4240
SM8305	275	8.0	0.035	2	2 x 18 AWG	255	40	7900
SM8306	155	15.0	0.015	3	6 x 20 AWG	255	50	15650
SM8307	80	27.0	0.0056	4	5 x 16 AWG	255	50	26225
SM8308	2350	2.0	0.400	1	21 AWG	510	40	4225
SM8309	1100	4.0	0.135	2	18 AWG	510	40	7900
SM8310	590	7.5	0.052	3	2 x 18 AWG	510	50	14900
SM8311	310	14.0	0.020	4	2 x 15 AWG	510	50	27300

EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

PICO's ultra-miniature HIGH "Q" INDUCTORS

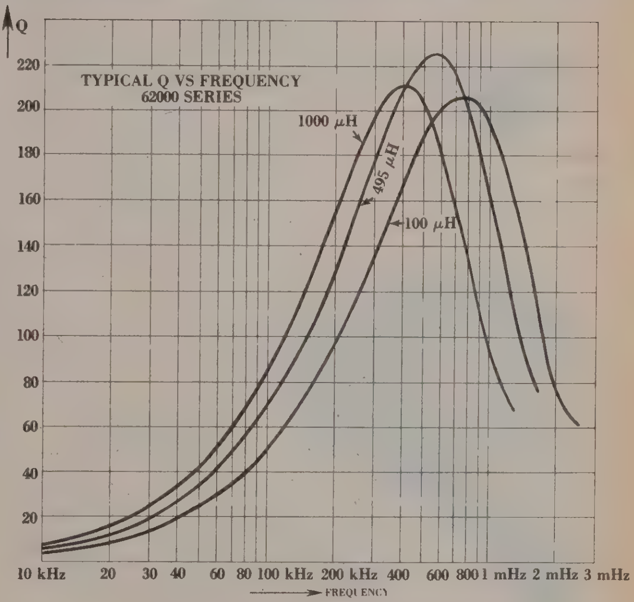
- ± 2% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units are magnetically shielded
- Non-standard inductance values available at 10% higher cost than nearest standard inductor.



Delivery— stock to one week

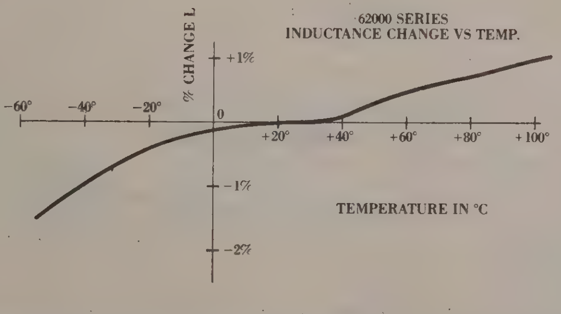
"62000" SERIES

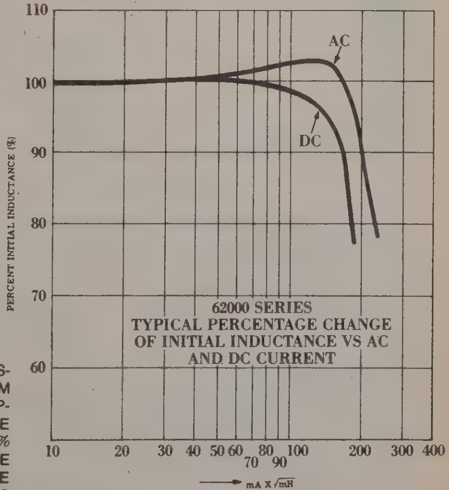
PART NUMBER	INDUCTANCE (MICRO-HENRYS)	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (MHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	PRICE (1-9)
62112	2500	18	1.15	80	180 at (400 kHz)	14.25
62132	1500	10	1.5	100	180 at (400 kHz)	14.25
62152	992	7	1.8	125	200 at (400 kHz)	14.25
62172	900	6.5	1.9	130	200 at (400 kHz)	14.25
62192	800	6.0	2.1	140	200 at (400 kHz)	14.25
62212	742	5.7	2.3	150	200 at (500 kHz)	14.25
62232	702	5.5	2.5	155	200 at (500 kHz)	14.25
62252	600	5.0	2.7	160	200 at (500 kHz)	14.25
62272	495	4.5	3	170	200 at (500 kHz)	14.25
62292	400	3.7	3.3	185	180 at (500 kHz)	14.25
62312	298	2.8	3.8	215	170 at (500 kHz)	14.25
62332	248	2.3	4.2	235	170 at (500 kHz)	14.25
62352	196	1.8	4.75	265	160 at (500 kHz)	14.25
62372	150	1.4	5.5	300	160 at (500 kHz)	14.25
62392	100	1.2	6.8	330	150 at (500 kHz)	14.25



SPECIFICATIONS:

- INDUCTANCE TOLERANCE
  ±3% AT 0.1V-100KHZ
- INDUCTANCE STABILITY VS TEMPERATURE
  ±2% -55°C TO 105°C
- MEETS MIL-T-27D TF5R20ZZ
- WEIGHT 1 GRAM
- THERMAL SHOCK
  100 CYCLES, METHOD 107D
  MIL-STD 202E
  TEST CONDITION A3
- UNIT HAS MAGNETIC SHIELD





62000 SERIES
TYPICAL PERCENTAGE CHANGE
OF INITIAL INDUCTANCE VS AC
AND DC CURRENT

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.
453 North MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
Telephone 914-699-5514

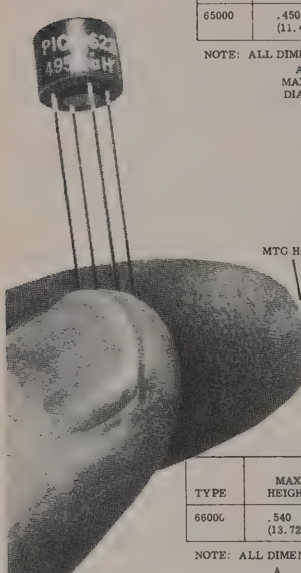
ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 30°C HEAT RISE AND APPROXIMATELY 2% DROP IN INDUCTANCE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES. THE EXCITATION IS PLOTTED IN mA $\times\sqrt{\text{mHy}}$. FOR EXAMPLE THE 0.495 mH INDUCTOR (62272) WITH 170 mA DC FLOWING WILL HAVE AN EXCITATION OF mA $\times\sqrt{\text{mHy}}$ = 120, AND THE INDUCTANCE WILL DROP FROM 495 uH to 485 uH. IF THE 170 mA WAS AC, THE INDUCTANCE WOULD BE 510 uH.

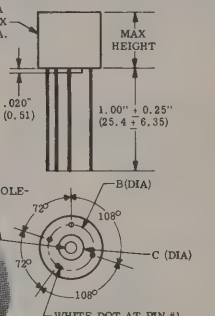
PICO's miniature HIGH "Q" INDUCTORS

- ± 1% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units are magnetically shielded
- Non-standard inductance values available at 10% higher cost than nearest standard inductor.

TYPE	MAX HEIGHT	A MAX DIA.	B BOLT CIRCLE	C STAND-OFF
63000	.290 (7.37)	.410 (10.41)	.260 (6.6)	.160 (4.06)
64000	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
65000	.450 (11.43)	.630 (16.0)	.440 (11.17)	.340 (8.64)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM

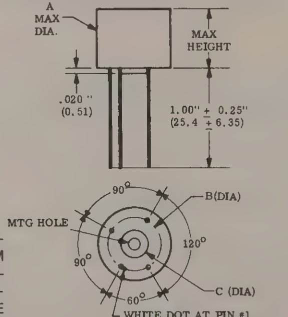




WHITE DOT AT PIN #1
TERMINALS ARE CLOCKWISE FROM PIN #1.
NO CONNECTION TO PIN #1 AND #3 (MECHANICAL SUPPORT)

TYPE	MAX HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF
66000	.540 (13.72)	.800 (20.32)	.560 (14.22)	.460 (11.68)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM



WHITE DOT AT PIN #1
TERMINALS ARE CLOCKWISE FROM PIN #1.
NO CONNECTION TO PIN #2 AND #4 (MECHANICAL SUPPORT)

ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 5% DROP IN INDUCTANCE AND NEGLIGIBLE HEAT RISE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES SHOWN FOR EACH INDUCTOR TYPE. THE EXCITATION IS PLOTTED IN mA X $\sqrt{mHy}$. FOR EXAMPLE THE 10 mH INDUCTOR (64314) WITH 79 mA DC FLOWING WILL HAVE AN EXCITATION OF mA X $\sqrt{mH}$ = 79 X $\sqrt{10}$ = 250 AND THE INDUCTANCE WILL DROP FROM 10 mH TO 9mH. IF THE 79 mA WAS AC THE INDUCTANCE WOULD BE 9.65 mH.

For immediate engineering assistance or to order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

"63000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
63120	1 Hy	1840	47	5.7	30 at (10 kHz)	14.99
63140	750 mH	1380	54	6.6	30 at (10 kHz)	14.46
63160	500 mH	920	66	8	30 at (10 kHz)	13.62
63180	200 mH	368	105	12.5	60 at (20 kHz)	13.62
63200	100 mH	185	148	18	60 at (20 kHz)	13.62
63220	75 mH	140	172	20.8	100 at (40 kHz)	13.62
63240	50 mH	90	210	25.5	100 at (40 kHz)	13.62
63260	30 mH	55	270	33	100 at (40 kHz)	13.62
63280	20 mH	37	332	40	100 at (40 kHz)	13.62
63300	15 mH	28	383	46	100 at (40 kHz)	13.62
63320	10 mH	18.5	470	57	100 at (40 kHz)	13.62
63340	5 mH	10	665	80	100 at (40 kHz)	13.62
63360	1 mH	2	1480	180	100 at (40 kHz)	14.99

"64000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
64114	5 Hy	3000	17	2.8	15 at (2 kHz)	16.30
64134	3 Hy	1800	22	3.6	30 at (4 kHz)	15.72
64154	2 Hy	1200	27	4.4	30 at (4 kHz)	14.99
64174	1 Hy	600	38	6.3	30 at (4 kHz)	13.62
64194	750 mH	450	44	7.3	30 at (4 kHz)	13.62
64214	500 mH	300	54	9	30 at (4 kHz)	13.62
64234	250 mH	150	76	13	65 at (10 kHz)	13.62
64254	100 mH	60	120	20	65 at (10 kHz)	13.62
64274	75 mH	45	139	23	120 at (20 kHz)	13.62
64294	50 mH	30	170	28	120 at (20 kHz)	13.62
64314	10 mH	6	380	63	200 at (40 kHz)	13.62
64334	5 mH	3	537	89	200 at (40 kHz)	13.62
64354	1 mH	.6	1200	200	200 at (40 kHz)	14.99

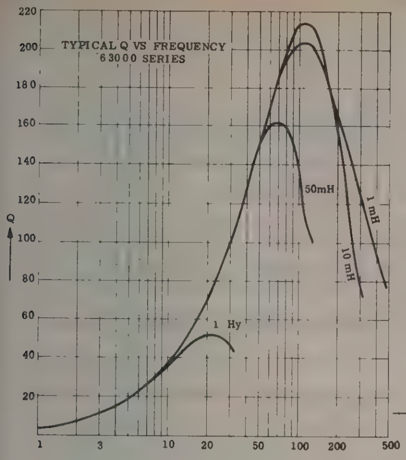
"65000" SERIES

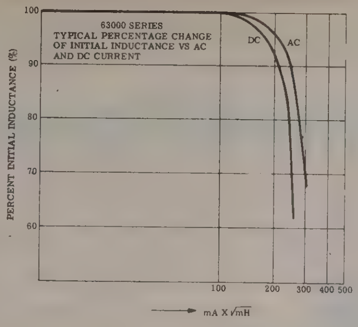
PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
65413	10 Hy	3800	11.7	2.8	28 at (2 kHz)	16.30
65433	5 Hy	1900	16.5	3.9	28 at (2 kHz)	15.72
65453	3 Hy	1140	21	5.1	28 at (2 kHz)	14.99
65473	2 Hy	760	26	6.3	56 at (4 kHz)	14.99
65493	1 Hy	380	37	8.8	56 at (4 kHz)	13.62
65513	500 mH	190	52	12.5	56 at (4 kHz)	13.62
65533	250 mH	95	74	17.7	140 at (10 kHz)	13.62
65553	100 mH	38	117	28	140 at (10 kHz)	13.62
65573	50 mH	19	165	39.6	240 at (20 kHz)	13.62
65593	10 mH	3.8	370	88.5	240 at (20 kHz)	13.62

"66000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
66218	10 Hy	2200	11	4.2	50 at (2 kHz)	16.30
66238	5 Hy	1100	15.7	6	50 at (2 kHz)	15.72
66258	3 Hy	660	20	7.7	100 at (4 kHz)	15.72
66278	2 Hy	440	25	9.4	100 at (4 kHz)	13.62
66298	1 Hy	220	35	13	100 at (4 kHz)	13.62
66318	500 mH	110	49	18.8	100 at (4 kHz)	13.62
66338	250 mH	55	70	26.6	200 at (10 kHz)	13.62
66358	100 mH	22	110	42	200 at (10 kHz)	13.62
66378	50 mH	11	156	59	200 at (10 kHz)	13.62
66398	10 mH	2.2	350	133	200 at (10 kHz)	13.62

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

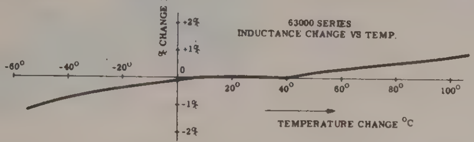


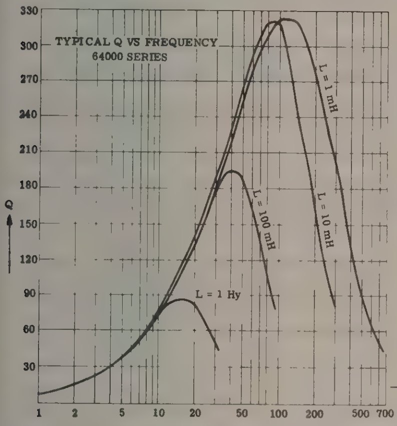


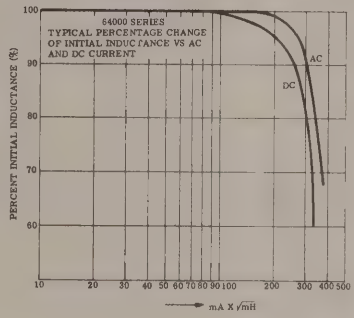
"63000" SERIES

SPECIFICATIONS:

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 4 kHz.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1% - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 2.2 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



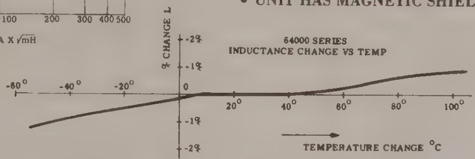


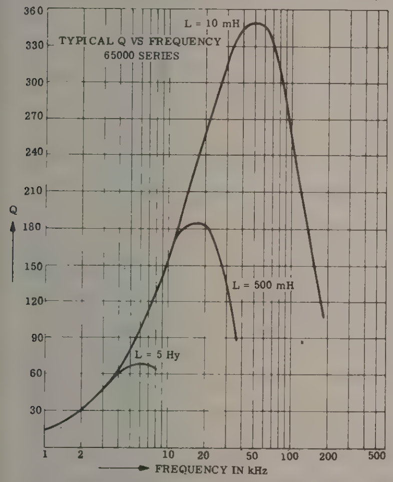


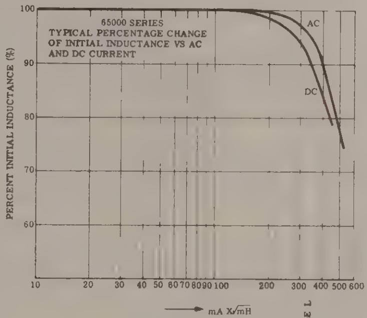
"64000" SERIES

SPECIFICATIONS:

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 2 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1% - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 3 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



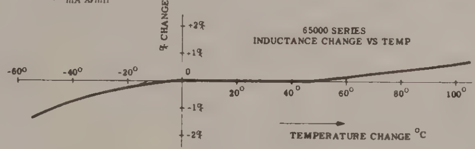


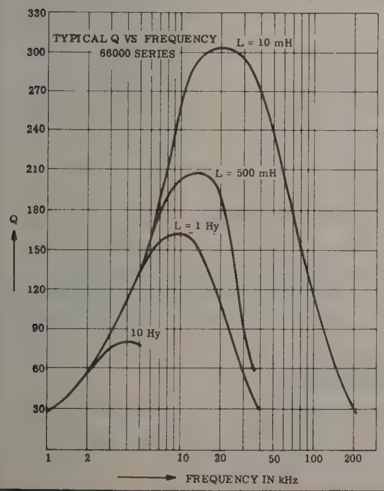


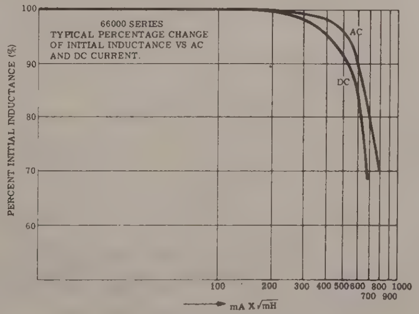
"65000" SERIES

SPECIFICATIONS:

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1% - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 6 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



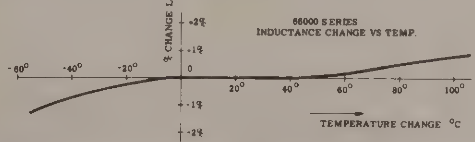




"66000" SERIES

SPECIFICATIONS:

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1% - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 13 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

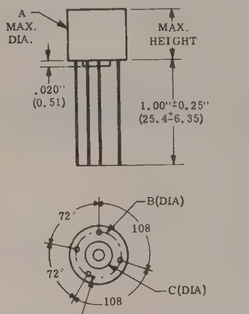


PICO's Miniaturized Power Inductors

These Inductors are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

SIZE	MAX. HEIGHT	A MAX. DIA.	B BOLT CIRCLE	C STAND-OFF
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

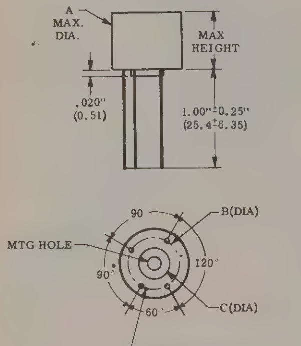
NOTE: ALL DIMENSIONS ARE IN INCHES, ( ) = MM



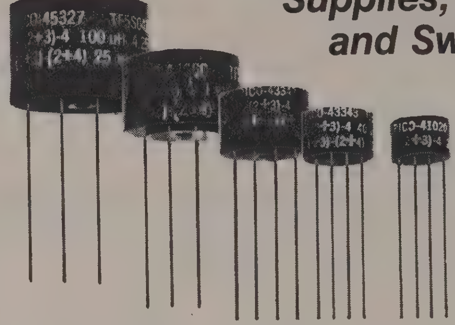
WHITE DOT AT PIN # 1
TERMINALS ARE CLOCKWISE FROM PIN # 1.

SIZE	MAX. HEIGHT	A MAX. DIA.	B BOLT CIRCLE	C STAND-OFF	MTG. HOLE
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	-
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	.140 (3.55)

NOTE: ALL DIMENSIONS ARE IN INCHES, ( ) = MM



WHITE DOT AT PIN #1
TERMINALS ARE CLOCKWISE FROM PIN # 1.



- **Minimum possible size**
- **Meets MIL-T-27D (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **All units have split windings**
- **Large selection of sizes available**
- **All units are magnetically shielded**

All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41020 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

INDUCTANCE	I_{DC} (AMPS)	R_{DC} (OHMS)	SIZE	MODEL NUMBER	*** PRICE 1-9
20 MILLI-HENRY	.06	54	1	41020	11.24
	.10	29	2	42105	11.24
	.14	20	3	43103	11.24
	.22	12.4	4	44500	13.45
	.29	10.2	5	45107	13.45
15 MILLI-HENRY	.07	40.5	1	41040	11.24
	.12	22	2	42125	11.24
	.16	15	3	43123	11.24
	.25	9.3	4	44520	13.45
	.33	7.7	5	45127	13.45
10 MILLI-HENRY	.08	27	1	41060	11.24
	.14	14.6	2	42145	11.24
	.20	10	3	43143	11.24
	.31	6.2	4	44560	13.45
	.40	5.1	5	45147	13.45
7.5 MILLI-HENRY	.10	20.3	1	41080	11.24
	.17	11	2	42165	11.24
	.24	7.5	3	43163	11.24
	.38	4.7	4	44580	13.45
	.49	3.8	5	45167	13.45
5 MILLI-HENRY	.12	13.5	1	41100	11.24
	.21	7.3	2	42185	11.24
	.30	5	3	43183	11.24
	.47	3.1	4	44600	13.45
	.6	2.6	5	45187	13.45
3 MILLI-HENRY	.16	8.1	1	41120	11.24
	.27	4.4	2	42205	11.24
	.38	3	3	43203	11.24
	.6	1.9	4	44620	13.45
	.78	1.5	5	45207	13.45

INDUCTANCE	I_{DC} (AMPS)	R_{DC} (OHMS)	SIZE	MODEL NUMBER	*** PRICE 1-9
2 MILLI-HENRY	.19	5.4	1	41140	11.24
	.33	2.9	2	42225	11.24
	.47	2	3	43223	11.24
	.74	1.3	4	44640	13.45
	.95	1	5	45227	13.45
1 MILLI-HENRY	.27	2.7	1	41160	11.24
	.47	1.5	2	42245	11.24
	.66	1	3	43243	11.24
	1	.62	4	44660	13.45
	1.3	.5	5	45247	13.45
750 MICRO-HENRY	.31	2	1	41180	11.24
	.54	1	2	42265	11.24
	.76	.75	3	43263	11.24
	1.2	.47	4	44680	13.45
	1.6	.38	5	45267	13.45
500 MICRO-HENRY	.38	1.3	1	41200	11.24
	.66	.66	2	42285	11.24
	.93	.5	3	43283	11.24
	1.47	.31	4	44700	13.45
	1.9	.25	5	45287	13.45
250 MICRO-HENRY	.53	.66	1	41220	11.24
	.93	.33	2	42305	11.24
	1.3	.25	3	43303	11.24
	2.08	.16	4	44720	13.45
	2.7	.13	5	45307	13.45
100 MICRO-HENRY	.84	.26	1	41240	11.24
	1.47	.13	2	42325	11.24
	2.07	.1	3	43323	11.24
	3.28	.062	4	44740	13.45
	4.25	.05	5	45327	13.45
40 MICRO-HENRY	1.33	.11	1	41260	11.24
	2.33	.053	2	42345	11.24
	3.28	.04	3	43343	11.24

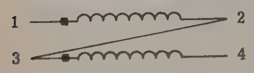
*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

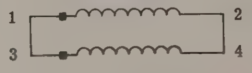
SPECIFICATIONS:

- All units meet MIL-T-27D and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C
- Unit has magnetic shield

TERMINAL ARRANGEMENT SERIES CONNECTION



PARALLEL CONNECTION



For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

Delivery— stock to one week

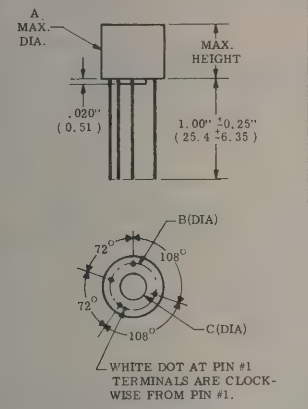
PICO's EMI Common Mode Suppression Inductors

- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength . . . . 1500 Volts RMS**
- **All units are magnetically shielded**

These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

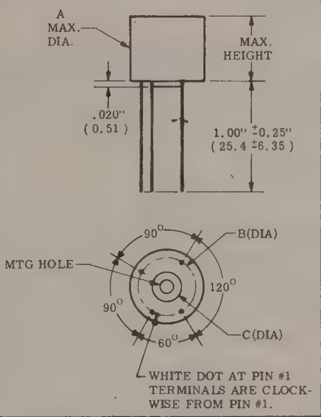
SIZE	MAX. HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

NOTE: ALL DIMENSIONS ARE IN INCHES ( )= MM



SIZE	MAX. HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF	MTG HOLE
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	.140 (3.55)
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	.170 (4.31)

NOTE: ALL DIMENSIONS ARE IN INCHES ( )= MM

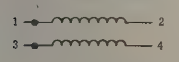


INDUCTANCE	Irms (AMPS) TEMP. RISE 60°C	Irms (AMPS) TEMP. RISE 40°C	Irms (AMPS) TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1-9
100 MICRO-HENRY	2.22	1.78	1.47	.041	3.5	1	46282	12.57
	2.92	2.50	2.16	.026	3.5	2	47290	12.57
	5.03	4.31	3.67	.012	4	3	48380	12.57
250 MICRO-HENRY	1.42	1.14	1.09	.10	5	1	46262	12.57
	1.83	1.57	1.35	.066	5	2	47270	12.57
	3.18	2.72	2.32	.03	4.5	3	48360	12.57
	5.20	4.35	3.48	.015	4.5	4	49460	15.09
500 MICRO-HENRY	.980	.785	.650	.21	9	1	46242	12.57
	1.30	1.12	.967	.13	8	2	47250	12.57
	2.25	1.93	1.64	.06	8	3	48340	12.57
	3.67	3.07	2.46	.03	7.5	4	49440	15.09
	5.34	4.75	3.45	.017	6.5	5	50240	15.09
750 MICRO-HENRY	.808	.646	.536	.31	10.3	1	46222	12.57
	1.05	.900	.779	.20	8.9	2	47230	12.57
	1.84	1.57	1.34	.09	8.4	3	48320	12.57
	3.00	2.50	2.01	.045	7.7	4	49420	15.09
	4.32	3.85	2.79	.026	7.5	5	50220	15.09
1 MILLI-HENRY	.703	.562	.466	.41	13.8	1	46202	12.57
	.925	.789	.683	.26	11.9	2	47210	12.57
	1.59	1.36	1.16	.12	11.3	3	48300	12.57
	2.60	2.17	1.74	.06	10.3	4	49400	15.09
	3.78	3.36	2.44	.034	10.0	5	50200	15.09
	5.80	4.81	4.29	.022	9.4	6	51302	16.56
2 MILLI-HENRY	.497	.397	.330	.82	27.5	1	46182	12.57
	.654	.558	.483	.52	23.8	2	47190	12.57
	1.12	.963	.821	.24	22.5	3	48280	12.57
	1.83	1.54	1.23	.12	20.6	4	49380	15.09
	2.63	2.34	1.70	.07	20	5	50180	15.09
	4.30	3.57	3.18	.04	18.8	6	51282	16.56
4 MILLI-HENRY	.350	.280	.232	1.65	55	1	46162	12.57
	.460	.392	.340	1.05	47.5	2	47170	12.57
	.804	.688	.587	.47	45.0	3	48260	12.57
	1.30	1.09	.871	.24	41.3	4	49360	15.09
	1.86	1.65	1.20	.14	40.0	5	50160	15.09
	2.87	2.38	2.12	.09	37.5	6	51262	16.56
9 MILLI-HENRY	.233	.187	.154	3.71	123.8	1	46142	12.57
	.307	.262	.227	2.36	106.9	2	47150	12.57
	.532	.456	.389	1.07	101.3	3	48240	12.57
	.874	.731	.586	.53	92.8	4	49340	15.09
	1.25	1.11	.808	.31	90.0	5	50140	15.09
	1.92	1.60	1.42	.20	84.4	6	51242	16.56
16 MILLI-HENRY	.175	.140	.115	6.6	220	1	46122	12.57
	.230	.195	.170	4.2	190	2	47130	12.57
	.40	.340	.290	1.9	180	3	48220	12.57
	.650	.546	.430	.95	165	4	49320	15.09
	.940	.830	.600	.55	160	5	50120	15.09
	1.45	1.20	1.07	.35	150	6	51222	16.56

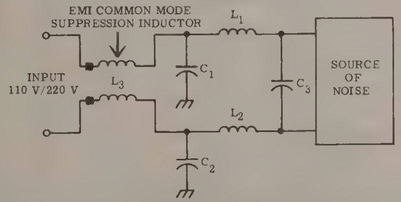
SPECIFICATIONS

- **All units meet MIL-T-27D and are type TF5S04ZZ**
- **Inductance measured at 0.1VRMS-10kHz**
- **Unit has magnetic shield**
- **Dielectric Strength . . . . 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C** **(ie maximum ambient of part no. 46282 would be 105°C if Irms is 1.47 AMPS)**

TERMINAL ARRANGEMENT



TYPICAL APPLICATION CIRCUIT



A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

Delivery— stock to one week

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.
453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

VANGUARD ELECTRONICS COMPANY, INC.

1480 W. 178th Street, Gardena, California 90248
Phone: (213) 323-4100 / TWX 910-346-7067

MIL-T-27 CUSTOM TRANSFORMERS

Vanguard Electronics has over 30 years experience in designing and manufacturing high reliability magnetic components. We have over 45,000 sq. ft. of internationally based laboratory and manufacturing facilities. Our quality assurance system complies with MIL-I-45208A. Transformers are manufactured and tested in accordance with MIL-T-27 procedures. We have prototype thru volume manufacturing capability and are QPL listed.

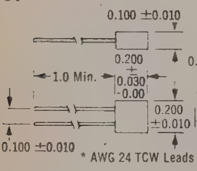
ENCAPSULATED SUBMINIATURE AND MINIATURE TOROIDAL INDUCTORS — MS 21423

For application in printed circuits and modules.

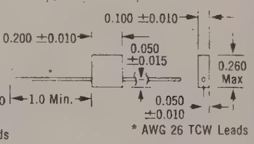
- Moisture and shock resistant, immersion proof.
- Designed to meet MIL-C-15305, Grade 1, Class B, toroids will operate at any temperature from −55°C to +125°C.
- The low external magnetic field of the toroid permits tighter packaging of units than with other inductive devices.

Frequency range: 25 to 150 MHz
Inductance tolerances: 0.01 to 0.082 µh, ±20%; 0.10 to 1.0 µh, ±10%; closer tolerances on request
Maximum dissipation: ⅕-watt
Inductance TC: +150 ppm/°C nominal; +200 ppm/°C max.
TC of Q: −0.1%/°C nominal; −0.15%/°C max.

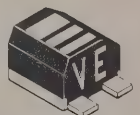
91



91S



FIXED CHIP INDUCTORS MIL SPEC M83446/8

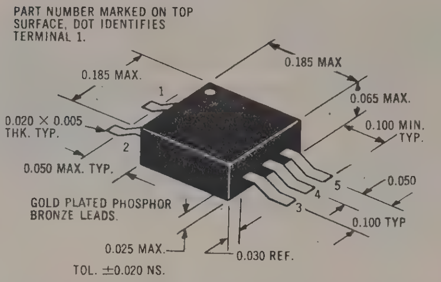


M 83446/8- SPECIFICATIONS

MIL Spec Part No.	Part No.	Inductance µH *Tol	Min Q	Typ Q	Test Freq MHz	SRF MHz Min	DCR Ohms Max	Current mA Max
1	30000	0.010	60	70	150	2000	0.025	750
2	30001	0.012	60	70	150	2000	0.025	750
3	30002	0.015	60	70	150	1800	0.040	750
4	30003	0.018	60	70	150	1500	0.040	750
5	30004	0.022	51	60	100	1400	0.040	750
6	30005	0.027	51	60	100	1200	0.040	750
7	30006	0.033	47	55	100	1100	0.050	640
8	30007	0.039	47	55	100	1000	0.07	600
9	30008	0.047	47	55	100	900	0.08	550
10	30009	0.056	47	55	100	850	0.09	520
11	30010	0.068	47	55	100	840	0.10	480
12	30011	0.082	47	55	100	750	0.11	470
13	30012	0.10	47	55	50	580	0.11	470
14	30013	0.12	47	55	50	240	0.11	470
15	30014	0.15	47	55	50	230	0.12	450

Standard terminations: Tab terminals, phosphor bronze with tin-lead coating, welded internal connection.
Gold plated terminations on request.
When ordering, specify part number.
Add suffix "NT" for no tab terminations.
Add suffix "G" for gold plated terminations.
* Inductance tolerance: ±10%. Closer tolerances and other inductance values on request.
** Temperature coefficient of inductance and Q measured @ −55°C, and +125°C with an external capacitance of 100 pf min.
Part Nos. 30000 thru 30011 TCL +125 PPM/°C Max. TCQ −0.20%/°C Max.
Part Nos. 30012 thru 30033 TCL + 80 PPM/°C Max. TCQ −0.20%/°C Max.
Part Nos. 30034 thru 30048 TCL + 80 PPM/°C Max. TCQ −0.35%/°C Max.

SUB-MINIATURE R.F. WIDEBAND TRANSFORMERS



Transfer-molded as tiny as 0.185 ins. square and 0.065 ins. high, these transformers operate in the frequency range from 500 KHz to 500 MHz. Insertion loss is typically 0.5 dB. Power rating is 100 milliwatts.

The series features DC isolated or non-isolated primary and secondary windings, at impedances from 50 Ohms to 800 Ohms. The secondary winding is either balanced (center-tapped), or unbalanced (no tap).

Designed to exceed the most stringent military and space requirements specified in MIL-T-55631, these transformers will operate over the temperature range −55°C to +125°C. (Maximum temperature rise: +35°C @ +90°C ambient.) Flat gold plated terminations are suitable for gold bonding in hybrid enclosures and for conventional P.C. mounting. The transfer-molded construction meets shock, moisture and vibration tests specified in MIL-T-55631.

Vanguard will also make custom designs to suit your specific frequency ranges, impedance levels and insertion loss requirements.

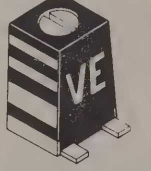
- All Welded Construction
- Transfer Molded
- Moisture Resistant
- Operating Temperature Range −55°C to +125°C
- Compatible with Reflow Soldering Techniques
- Suitable for Automatic Chip Insertion Equipment

STANDARD SPECIFICATIONS
FREQUENCY RESPONSE & V.S.W.R.

			BALANCED SECONDARY				UNBALANCED SECONDARY			
DC ISOLATED	PRI. & SEC. Impedance		50Ω-50Ω	50Ω-100Ω	50Ω-200Ω	50Ω-800Ω	50Ω-50Ω	50Ω-100Ω	50Ω-200Ω	50Ω-800Ω
	Min. Frequency Range (MHz) for insertion loss of	1 dB	5.0-165	10.8-105	5.1-195	11.3-45	6.5-225	8.3-125	4.5-235	9.0-30
		2 dB	1.1-300	2.6-235	1.3-335	4.0-105	1.5-305	2.2-290	1.3-305	4.2-85
		3 dB	0.7-400	1.0-315	0.7-390	1.9-155	0.8-420	1.0-350	0.7-335	1.8-145
	Typ. VSWR @ 100 MHz		1.14	1.21	1.13	1.91	1.11	1.23	1.12	1.63
	Max. VSWR @ 100 MHz		1.19	1.27	1.18	1.96	1.16	1.30	1.17	1.85

			BALANCED SECONDARY				UNBALANCED SECONDARY			
NON DC ISOLATED	PRI. & SEC. Impedance		50Ω-50Ω	50Ω-100Ω	50Ω-200Ω	50Ω-800Ω	50Ω-50Ω	50Ω-100Ω	50Ω-200Ω	50Ω-800Ω
	Min. Frequency Range (MHz) for insertion loss of	1 dB	6.2-195	8.7-120	4.5-210	12.0-45	.5 6-320	8.7-150	2.8-440	12.0-35
		2 dB	1.5-375	2.0-280	1.5-370	4.6-105	1.2-475	2.4-475	2.4-300	5.8-75
		3 dB	0.9-450	0.9-380	0.8-460	1.9-165	0.7-525	1.0-360	0.4-710	2.0-150
	Typ. VSWR @ 100 MHz		1.16	1.19	1.18	1.67	1.10	1.20	1.12	1.63
	Max. VSWR @ 100 MHz		1.21	1.24	1.23	1.91	1.15	1.26	1.17	1.85

TOP TUNED VARIABLE CHIP INDUCTORS MIL SPEC M83446/9



Nominal Inductance Range:
0.018 thru 120 µH
Other inductance values on request.
Inductance TC:
0.018 µH to 12 µH — +140 PPM/°C
15 µH to 120 µH — +300 PPM/°C
QTC:
0.018 µH to 12 µH — −0.13/°C
15 µH to 120 µH — −0.35%/°C
Temperature coefficient of inductance and Q measured @ −55°C, and +125°C with an external capacitance of 100 pF min.
Standard terminations:
Tab terminals, phosphor bronze with tin-lead coating, welded internal connection.
Gold plated terminations on request.
When ordering, specify part number.
Add su1x "NT" for no tab terminations.
Add suffix "G" for gold plated terminations.

Mil Spec Part Number	VE Part Number	Nom. "L" µH	Minimum Inductance Range µH	Test Freq MHz	Q Min Over Ind Range	SRF MHz	DCR Ohms Max	Current mA Max
M 83446/9- 1	31000	0.018	0.015- 0.021	150	50	1200	0.03	750
M 83446/9- 2	31001	0.022	0.018- 0.026	150	55	1100	0.03	750
M 83446/9- 3	31002	0.027	0.022- 0.032	150	55	1000	0.03	750
M 83446/9- 4	31003	0.033	0.027- 0.039	150	55	900	0.04	750
M 83446/9- 5	31004	0.039	0.033- 0 047	150	55	750	0.04	750
M 83446/9- 6	31005	0.047	0.039- 0.056	100	55	660	0.04	750
M 83446/9- 7	31006	0.056	0.047- 0.068	100	55	610	0.05	700
M 83446/9- 8	31007	0.068	0.055- 0.083	100	55	550	0.05	700
M 83446/9- 9	31008	0.082	0.067- 0.099	100	55	520	0.06	645
M 83446/9-10	31009	0.10	0.080- 0.120	100	55	490	0.06	645
M 83446/9-11	31010	0.12	0.096- 0.144	50	50	460	0.07	600
M 83446/9-12	31011	0.15	0.12 - 0.18	50	50	430	0.08	560
M 83446/9-13	31012	0.18	0.14 - 0.22	50	50	385	0.09	525
M 83446/9-14	31013	0.22	0.17 - 0.27	50	50	330	0.10	500
M 83446/9-15	31014	0.27	0.21 - 0.33	50	50	300	0.15	400
M 83446/9-16	31015	0.33	0.26 - 0.40	50	50	275	0.19	360
M 83446/9-17	31016	0.39	0.32 - 0.47	50	40	240	0.25	300
M 83446/9-18	31017	0.47	0.37 - 0.57	25	40	210	0.30	280
M 83446/9-19	31018	0.56	0.46 - 0.68	25	40	190	0.40	250
M 83446/9-20	31019	0.68	0.54 - 0.82	25	40	165	0.60	200
M 83446/9-21	31020	0.82	0.68 - 1.00	25	40	155	0.70	180
M 83446/9-22	31021	1.0	0.75 - 1.25	25	40	140	0.90	160
M 83446/9-23	31022	1.2	0.90 - 1.50	25	40	125	1.1	150
M 83446/9-24	31023	1.5	1.13 - 1.87	7.9	35	115	1.3	135
M 83446/9-25	31024	1.8	1.35 - 2.25	7.9	35	105	1.7	120
M 83446/9-26	31025	2.2	1.65 - 2.75	7.9	35	100	2.3	100
M 83446/9-27	31026	2.7	2.02 - 3.37	7.9	25	85	3.0	90
M 83446/9-28	31027	3.3	2.48 - 4.12	7.9	25	75	3.9	80
M 83446/9-29	31028	3.9	2.92 - 4.87	7.9	25	47	3.9	80
M 83446/9-30	31029	4.7	3.52 - 5.88	7.9	25	30	3.9	80
M 83446/9-31	31030	5.6	4.2 - 7.0	7.9	22	24	4.0	75
M 83446/9-32	31031	6.8	5.1 - 8.5	7.9	22	23	4.0	75
M 83446/9-33	31032	8.2	6.1 - 10.2	7.9	22	22	4.5	72
M 83446/9-34	31033	10	7.5 - 12.5	7.9	22	21	4.5	72
M 83446/9-35	31034	12	9.0 - 15.0	7.9	22	17	5.0	70
M 83446/9-36	31035	15	11.2 - 18.7	2.5	22	15	6.0	65
M 83446/9-37	31036	18	13.5 - 22.5	2.5	22	14	8.0	55
M 83446/9-38	31037	22	16.5 - 27.5	2.5	22	13	10	50
M 83446/9-39	31038	27	20.2 - 31.3	2.5	22	11	11	45
M 83446/9-40	31039	33	24.7 - 41.2	2.5	22	10	13	43
M 83446/9-41	31040	39	29.2 - 48.8	2.5	22	9	14	42
M 83446/9-42	31041	47	35.2 - 58.8	2.5	22	8	15	40
M 83446/9-43	31042	56	42.0 - 70.0	2.5	22	7	19	36
M 83446/9-44	31043	68	51.0 - 85.0	2.5	22	6	24	32
M 83446/9-45	31044	82	62.0 -102.0	2.5	25	5	31	28
M 83446/9-46	31045	100	75.0 -125.0	2.5	25	4	40	25
M 83446/9-47	31046	120	90.0 -150.0	2.5	25	3	50	22

PICONICS®

INDUCTIVE COMPONENTS
FOR MICROELECTRONIC CIRCUITS

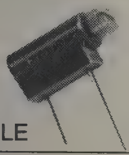
LEADED/CHIP
TUNABLE/FIXED

PICONICS components feature excellent stability, high Q and controlled characteristics

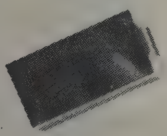
PICONICS offers custom design capability

Call or write for complete catalog and for design/application engineering support.

LEADED INDUCTOR SELECTION TABLE MIL-C-15305

	TYPE	LENGTH	WIDTH	HEIGHT	INDUCTANCE	CASE	ADJUSTMENT	QPL
 TUNABLE	B	.260	.100	.400	.020uH to 1MH	Molded	Screw (side)	Yes
	G	.165	.075	.125	.018uH to 1MH	Conformal coating	Slide	In Process
	ST	.200	.100	.275	.020uH to 1MH	Molded	Screw (top)	Yes
	TT	.280	.097	.475	.020uH to 1MH	Molded	Screw (top)	Yes
FIXED	C	.185	.085	.135	.01uH to 1MH	NOTES Conformal coating		In Process
	D	.190	.075 or .090	.075 or .090	.01uH to 1MH	Molded case		In Process
	JA	.100 .170 .250 .500	.060 .075 .125 .300	.060 .075 .125 .300	6nH to 1MH	Open frame case, self-leaded		In Process
	JC	.186	.085	.085	7nH to 1MH	Self-leaded		In Process
	M	.004 .170	.027	.027	10nH to 1uH	Air core high frequency choke Self-leaded		In Process
	S	.200	.100	.100	5nH to 270nH	Air core, high frequency, tinned and encapsulated choke		In Process

CHIP INDUCTOR SELECTION TABLE MIL-C-83446

	TYPE	LENGTH	WIDTH	HEIGHT	INDUCTANCE	NOTES	QPL
 TUNABLE	PGV	.160	.125	.330	Range .010 to 1000uH	Top adjustable Headless self-locking tuning screw	Yes
	PSV	.320	.165	.130	Range .010 to 1000uH	Side adjustable Headless self-locking tuning screw	Yes
	PV	.180	.140	.095	Range .010 to 1000uH	Slide adjustable	Yes
	PVW	.180	.140	.095	Range .010 to 1000uH	Bonding pad completes connection Slide adjustable	Yes
FIXED	P	.180	.140	.095	.010 to 1000uH	Minimum height profile	Yes
	PA	.100	.100	.100	.010 to 1000uH	Epoxy molded cube; minimum area profile	In Process
	PG	.160	.125	.125	.010 to 1000uH	Easily handled by automatic insertion equipment	In Process
	PK	.160	.125	.125	.010 to 1000uH	Molded case with special reflow solder pads	In Process
	PW	.180	.140	.095	.010 to 1000uH	Bonding pad completes connection	Yes

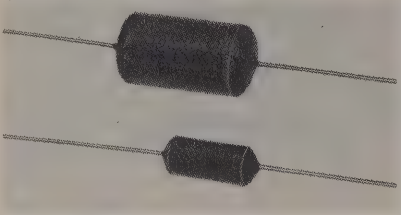
See section 2700 pg 1A•1611 for FILTERS
and section 3130 pg 1A•1680 for your HYBRID requirements.

PICONICS INC. P.O. BOX 387, TYNGSBORO, MA 01879 • TEL: (617) 649-7501 • TELEX: 754759

RENCO ELECTRONICS, INC.

Available in 406 standard values. High saturation flux density material makes these coils ideal wherever high current choke values in a small physical size are needed.

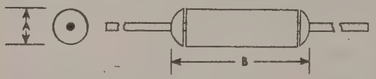
Shielded Inductors RL1123/RL1124



Low cost, miniature shielded coils, extremely useful in compact audio filters, tone control circuits, amplifiers, and wherever high inductance coils are needed. Excellent, low cost alternatives to fixed pot cores.

Series RL1123: (96 values)
Inductance: 1.0 μH to 47.0 H
Max DCR: 0.0066 to 5170.0 Ohms
Suggested rated current: 1.5 to 0.0054 AC Amps

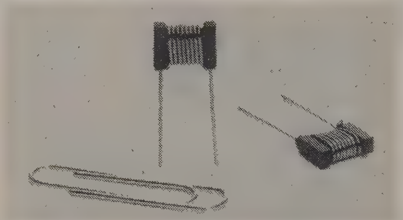
Series RL1124: (80 values)
Inductance: 1.0 μH to 4.7 H
Max DCR: 0.011 to 1700.0 Ohms
Suggested rated current: 0.707 to 0.0054 AC Amps



DIM. (IN)		RL1123	RL1124
	A	.500 max.	.260 max.
	B	.950 max.	.700 max.

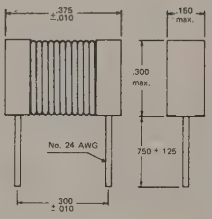
WEIGHT: RL1123 . . . 15 gm max, approx.
RL1124 . . . 5 gm max, approx.
LEADS: No. 20 tinned copper 1-1/4' long min.

Flat Coils RL1160 (45 values)

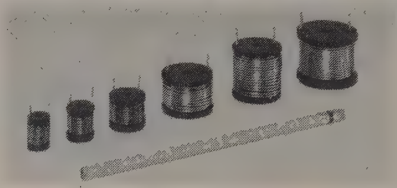


Unique flat coil configuration ideally suited to high density PCBs. Twice the inductance and Q values than axial lead inductors occupying the same space. Wide range of inductance and Q values for use at radio as well as audio frequencies.

Inductance:
1.0 to 4700.0 μH
Frequency:
7.9 MHz to 250.0 KHz
Min Q: 37.0 to 63.0
Max DCR:
0.010 to 29.9 Ohms
Saturation current:
7.0 to 0.11 DC Amps
Suggested rated current: 2.25 to 0.027 AC Amps



Power Line Chokes RL1256/1283/1284



Series RL1256-1: (34 values)
Inductance: 1.0 to 560.0 μH
Max DCR: 0.003 to 0.696 Ohms
Saturation current: 87.0 to 2.9 DC Amps
Suggested Rated current: 9.0 to 0.8 AC Amps
Dimension "E": 0.406 to 0.550

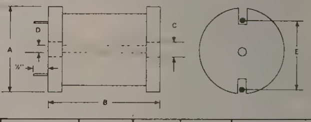
Series RL1256-2: (41 values)
Inductance: 1.0 to 2200.0 μH
Max DCR: 0.003 to 1.54 Ohms
Saturation current: 108.0 to 2.90 DC Amps
Suggested rated current: 11.4 to 0.8 AC Amps
Dimension "E": 0.590 to 0.671

Series RL1256-3: (45 values)
Inductance: 1.0 to 4700.0 μH
Max DCR: 0.003 to 1.86 Ohms
Saturation current: 116.0 to 1.7 DC Amps
Suggested rated current: 21.0 to 1.0 AC Amps
Dimension "E": 0.750 to 0.800

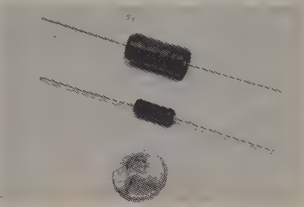
Series RL1256-4: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 3.39 Ohms
Saturation current: 150.0 to 1.5 DC Amps
Suggested rated current: 27.0 to 1.3 AC Amps
Dimension "E": 1.11 to 1.187

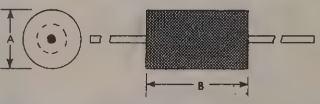
Series RL1256-5: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 2.17 Ohms
Saturation current: 155.0 to 1.5 DC Amps
Suggested rated current: 35.0 to 2.0 AC Amps
Dimension "E": 1.11 to 1.28

Series RL1256-6: (49 values)
Inductance: 4.7 to 47000.0 μH
Max DCR: 0.002 to 6.19 Ohms
Saturation current: 149.9 to 1.2 DC Amps
Suggested rated current: 35.0 to 1.4 AC Amps
Dimension "E": 1.31 to 1.53



DIM. (IN)	A	B	C	D
RL1256-1	0.660	0.84	0.195	Clearance Hole For 4/40 Screw
RL1256-2	0.825	0.84	0.195	
RL1256-3	1.1	0.84	0.195	
RL1256-4	1.6	1.03	0.290	Clearance Hole For 8/32 Screw
RL1256-5	1.6	1.45	0.290	
RL1256-6	2.0	1.50	0.320	



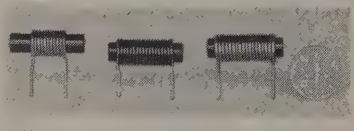


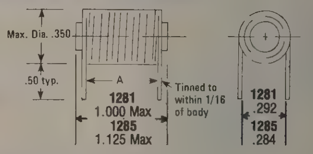
Series RL1283: (54 values)
Inductance: 3.9 to 100000.0 μH
Max DCR: 0.007 to 89.7 Ohms
Saturation current: 15.5 to 0.081 DC Amps
Suggested rated current: 4.0 to 0.065 AC Amps

Series RL1284: (45 values)
Inductance: 3.9 to 18000.0 μH
Max DCR: 0.008 to 48.3 Ohms
Saturation current: 7.3 to 0.091 DC Amps
Suggested rated current: 1.28 to 0.039 AC Amps

DIM. **RL-1283** **(A)** 0.453 max. **(B)** 0.900 max.
(IN) **RL-1284** **(A)** 0.260 max. **(B)** 0.650 max.

Low Cost Chokes RL1281/1285





Heavy duty, general purpose inductors use ferrite cores and offer a wide range of inductance values. Their compact size and pretinned leads make them easy to use in printed circuit boards.

Series RL1281: (23 values)
Max current: 4 Amps
Inductance (±15%)*: 0.22 to 12.50 μH
Max DCR: 0.003 to 0.025 Ohms
Dimension "A": 0.187 to 0.875

Series RL1285: (19 values)
Max current: 6 Amps
Inductance (±15%)*: 0.22 to 10.20 μH
Max DCR: 0.002 to 0.015 Ohms
Dimension "A": 0.125 to 0.883

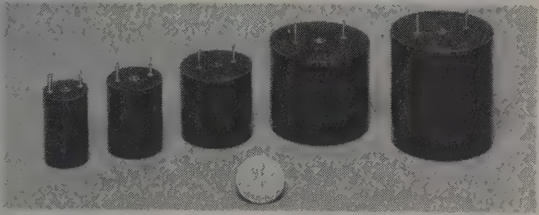
*Measured at 1 KHz

TOLL-FREE ENGINEERING HOTLINE 800-645-5828 • RENCO ELECTRONICS, INC. • 60 Jefryn Blvd., East • Deer Park, NY 11729 • (516) 586-5566 • RCA Telex No. 220-883

Copyright © Renco Electronics, Inc. 1984, Printed in USA

RENCO ELECTRONICS, INC.

Mil Spec Inductors RL1324/1325/1326



Encapsulated power line chokes, designed to meet MIL-T-27D. The use of high saturation flux density material makes these coils ideal for a wide variety of circuit applications that require compact power inductors. A threaded bushing is an integral part of the RL1324 Series, permitting secure fastening to a printed circuit board or chassis. The terminal pins are plated to ensure ease of soldering.

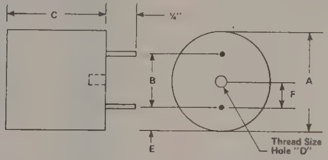
Series RL1324-1: (34 values)
Inductance: 1.0 to 560.0 μH
Max DCR: 0.003 to 0.696 Ohms
Saturation current: 87.0 to 2.9 DC Amps
Suggested rated current: 8.1 to 0.7 AC Amps

Series RL1324-2: (41 values)
Inductance: 1.0 to 2200.0 μH
Max DCR: 0.003 to 1.54 Ohms
Saturation current: 108.0 to 2.0 DC Amps
Suggested rated current: 10.2 to 0.7 AC Amps

Series RL1324-3: (45 values)
Inductance: 1.0 to 4700.0 μH
Max DCR: 0.003 to 1.86 Ohms
Saturation current: 116.0 to 1.7 DC Amps
Suggested rated current: 18.9 to 0.9 AC Amps

Series RL1324-4: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 3.39 Ohms
Saturation current: 150.0 to 1.5 DC Amps
Suggested rated current: 24.3 to 1.1 AC Amps

Series RL1324-5: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 2.17 Ohms
Saturation current: 155.0 to 1.5 DC Amps
Suggested rated current: 31.5 to 1.8 AC Amps

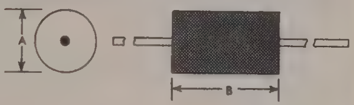


DIM. (IN)	A	B	C	D	E	F
RL1324-1	0.641	0.450	1.031	4-40	0.096	0.225
RL1324-2	0.812	0.500	1.031	4-40	0.156	0.250
RL1324-3	1.075	0.537	1.031	4-40	0.269	0.268
RL1324-4	1.500	0.750	1.312	6-32	0.375	0.375
RL1324-5	1.500	0.750	1.782	6-32	0.375	0.375

Tolerance: ±.010"

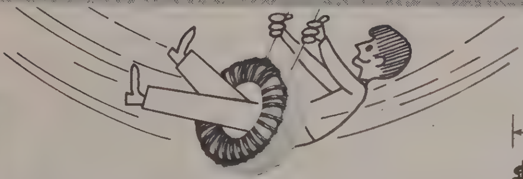
Series RL1325: (54 values)
Inductance: 3.9 to 100000.0 μH
Max DCR: 0.008 to 98.7 Ohms
Saturation current: 14.7 to 0.077 DC Amps
Suggested rated current: 3.6 to 0.077 AC Amps

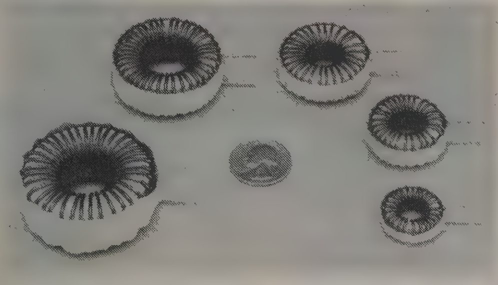
Series RL1326: (45 values)
Inductance: 3.9 to 18000.0 μH
Max DCR: 0.009 to 53.1 Ohms
Saturation current: 6.9 to 0.087 DC Amps
Suggested rated current: 1.15 to 0.035 AC Amps



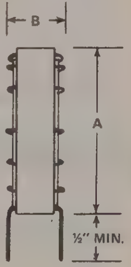
DIM. (IN)	RL 1325	RL 1326
A	0.500 ± 0.015	0.250 ± 0.015
B	1.000 ± 0.030	0.625 ± 0.030

Swingductors™ RL1386





Designed for applications requiring a known inductance change with changing current loads (as in power supplies). Although similar in appearance to conventional toroids, the special core material allows a "controlled saturation," so that a specific inductance value is repeatable at a specific current. The core material is effective up to 1 MHz. As a result of toroidal design, the Swingductor™ produces a closed magnetic field, resulting in low EMI. All are supplied with pretinned leads for easy PC board installation.



Series RL1386-1: (35 values)
Inductance at 0 Amps: 1.1 to 1500.0 μH
Current causing inductance drop of —
- **10%:** 13.0 to 0.30 Amps;
- **20%:** 9.4 to 0.44 Amps;
- **30%:** 26.8 to 0.61 Amps;
- **40%:** 35.1 to 0.81 Amps;
- **50%:** 46.1 to 1.1 Amps

Max DCR: 0.003 to 0.469 Ohms
Suggested rated current: 5.0 to 1.2 AC Amps

Series RL1386-2: (36 values)
Inductance at 0 Amps: 1.2 to 2700.0 μH
Current causing inductance drop of —
- **10%:** 21.7 to 0.93 Amps;
- **20%:** 32.7 to 0.58 Amps;
- **30%:** 45.0 to 0.78 Amps;
- **40%:** 59.1 to 1.11 Amps;
- **50%:** 77.7 to 1.4 Amps

Max DCR: 0.003 to 0.520 Ohms
Suggested rated current: 5.0 to 2.0 Amps

Series RL1386-3: (36 values)
Inductance at 0 Amps: 1.50 to 3900.0 μH
Current causing inductance drop of —
- **10%:** 23.7 to 0.38 Amps;
- **20%:** 39.2 to 0.63 Amps;
- **30%:** 54.9 to 0.78 Amps;
- **40%:** 73.2 to 1.2 Amps;
- **50%:** 96.3 to 1.5 Amps

Max DCR: 0.003 to 0.541
Suggested rated current: 9.0 to 2.0 Amps

Series RL1386-4: (40 values)
Inductance at 0 Amps: 1.2 to 5600.0 μH
Current causing inductance drop of —
- **10%:** 33.3 to 0.42 Amps;
- **20%:** 50.4 to 0.63 Amps;
- **30%:** 69.3 to 0.87 Amps;
- **40%:** 90.9 to 1.1 Amps;
- **50%:** 119.7 to 1.4 Amps

Max DCR: 0.002 to 0.348 Ohms
Suggested rated current: 14.0 to 4.5 Amps

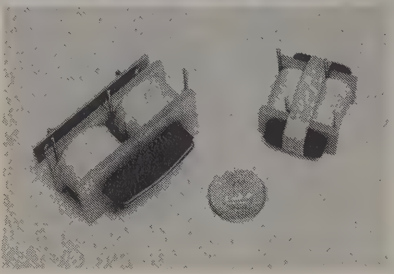
DIM. (IN)	"A" (MAX. DIA.)	"B" (MAX. WIDTH)
RL1386-1	1.10	0.500
RL1386-2	1.45	0.874
RL1386-3	1.80	0.900
RL1386-4	2.00	1.100
RL1386-5	2.60	1.500

Series RL1386-5: (38 values)
Inductance at 0 Amps: 1.0 to 5600.0 μH
Current causing inductance drop of —
- **10%:** 55.8 to 0.59 Amps;
- **20%:** 83.7 to 0.9 Amps;
- **30%:** 115.2 to 1.2 Amps;
- **40%:** 151.2 to 2.1 Amps

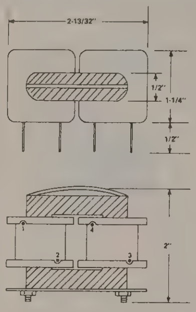
Max DCR: 0.001 to .264 Ohms
Suggested rated current: 22.0 to 5.0 Amps

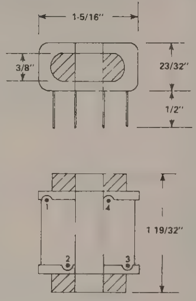
TOLL-FREE ENGINEERING HOTLINE 800-645-5828 • RENCO ELECTRONICS, INC. • 60 Jefryn Blvd., East • Deer Park, NY 11729 • (516) 586-5566 • RCA Telex No. 220-883

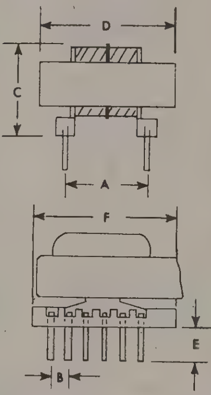
Common Mode Chokes RL1328/1329/1361



Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. These low priced Common Mode Chokes are available in a wide range of standard inductances, with current ratings to 35 Amps.







Series RL1328:
(120 values)
Inductance:
47.0 to 39000.0 μH
Max DCR: 0.002 to 0.555 Ohms
Max leakage inductance:
4.0 to 3080.0 μH
Max interwinding capacitance: 2.0 to 9.4 pF
Hipot winding to winding and winding to core:
5000 VAC
Suggested rated current:
3 to 35 AC Amps

Series RL1329:
(86 values)
Inductance:
6.8 to 22000.0 μH
Max DCR: 0.0028 to 0.555 Ohms
Max leakage inductance:
1.5 to 1430.0 μH
Max interwinding capacitance: 1.0 to 10.7 pF
Hipot winding to winding and winding to core:
5000 VAC
Suggested rated current:
2 to 22 AC Amps

Series RL1361-1:
(81 values)
Inductance:
47.0 to 150000.0 μH
Max DCR: 0.013 to 16.0 Ohms
Max leakage inductance:
3.5 to 3800.0 μH
Max interwinding capacitance: 6 to 36.0 pF
Hipot winding to winding and winding to core:
2500 VAC
Suggested rated current:
3.5 to 0.10 AC Amps

RENCO ELECTRONICS, INC.

. . . Want a **FREE** sample of any of the products shown on these pages?
Call 800-645-5828 or
TURN TO PAGE 1A•2261

. . . Would you like a **FREE** sample of a choke NOT shown on these pages — that is, a sample specially made to your specs?
Call 800-645-5828 or
TURN TO PAGE 1A•2261

. . . Have you got a problem in magnetics you'd like to discuss with an expert?
Call 800-645-5828 or
TURN TO PAGE 1A•2261

. . . Are you hesitating about placing an order with us because you need just a few chokes, and are afraid you'll have to pay a premium?
Call 800-645-5828 or
TURN TO PAGE 1A•2261

. . . Would you like to get custom-designed transformers for your switching power supplies — at standard prices?
Call 800-645-5828 or
TURN TO PAGE 1A•2260

Custom Coils, Toroids and Pot Core Assemblies

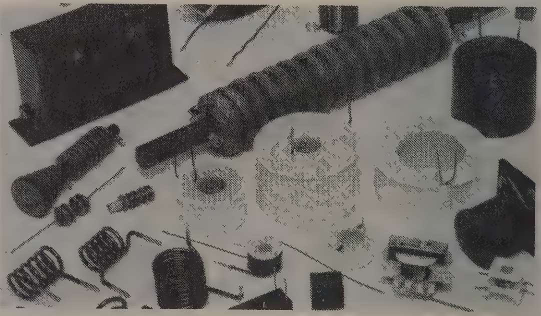
Making custom coils is not just an accommodation for an occasional customer. Custom coils have always been a major part of Renco's business. We have over 29 years experience in making custom designed inductors and transformers.

As for pot core assemblies, we've manufactured millions since 1955, and are thoroughly experienced with all standard cores and hardware, including Ferroxcube, Siemens, TDK, Magnetics Inc., Indiana General, etc. We stock all the popular bobbins, including printed circuit types.

Let us assist you in your upcoming designs. Our fully independent sample and prototype department can usually ship a prototype within 10 days.

Send us your specifications and designs for your pot cores, coils, inductors, or transformers, and we'll respond promptly with very competitive prices. We have a reputation for keeping our delivery promises.

Try us!



MADE IN USA
SHIPPED WORLDWIDE

RENCO ELECTRONICS, INC.

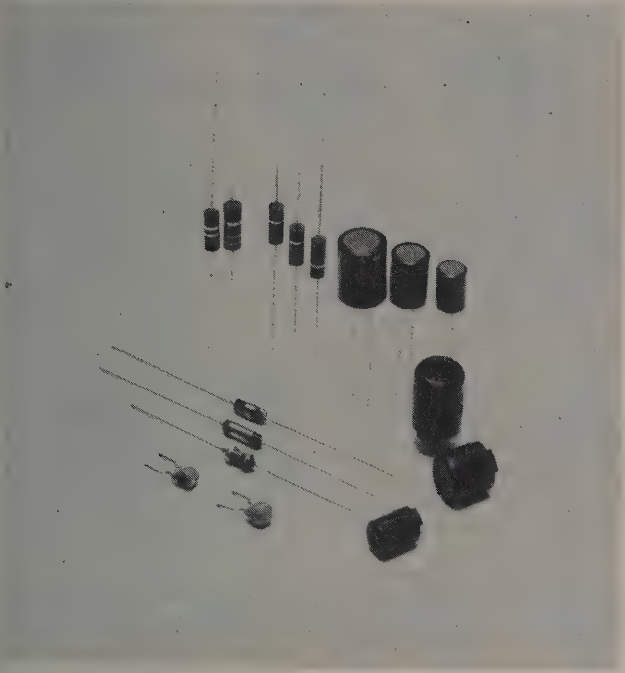
TOLL-FREE ENGINEERING HOTLINE 800-645-5828 • 60 Jefryn Blvd., East • Deer Park, NY 11729 • (516) 586-5566 • RCA Telex No. 220-883

SINCE 1955

TDK

INDUCTORS

FIXED INDUCTORS



Fixed inductors have a wide range of applications such as VCRs, color TVs, stereo car radios, radio transceivers, and industrial electronic products. They are also used in the power-driven tools for EMI filters.

Features

1) EL type
The radial lead type inductor is commonly found in consumer products where most of the EL inductors are used. TDK's original structure and Automated mass-production lines ensures the reliability of these products. EL0405 is available on tape for automatic insertion.

2) SP type
The axial lead type inductor is commonly found in consumer products. SP0408, 0410 and 0412 have the smallest distributed capacity. They are designed for automatic insertion.

3) TP type
This type has high reliability and stability characteristics based on transfer molding and strict quality control. TP0206 type is especially small for application in high density PCBs for measuring instruments and control devices.

4) FS type
This small ferrite shield inductor has a high performance ferrite cap shape with a molded inductor. FS0810 and FS1012 are most suitable for magnetic shield applications.

5) TPF0410 type
This high reliability inductor complies with Defense Agency standards (MIL) and for industrial applications requiring a magnetic shield.

6) NL, NLF type
The electrodes are metal terminals and the inductor has resin coating for heat resistance.

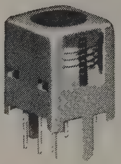
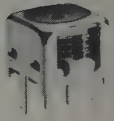
NL, NLF type

1) Metal frame terminal suitable for flow or reflow soldering.
2) Dimensional accuracy is high so the inductors are well suited to automatic PC board mounting machine.
3) High terminal strength gives resistance to pulling and bending after mounting on PCB.
4) Extremely durable against mechanical impact and pressure or shock due to dropping.
5) Extremely stable against temperature and moisture.

		Type	Taping	Lead space (mm)	No. of L-values	Inductance range (μH)	Q range (min.)	Dimension (mm)
Non shielded type	Radial lead	EL0405	EL0405RA-	2.5	45	0.22 to 1,000	25 to 50	4 x 5
		EL0606	EL0606RA-	5.0	49	0.22 to 2,200	30 to 50	6 x 6
		EL0607	EL0607RA-	5.0	37	10 to 10,000	15 to 45	6 x 7
		EL0909	FL0909R-	5.0	34	100 to 56,000	35 to 65	9 x 9
	Axial lead	SP0305	SPT0305-	–	45	0.22 to 1,000	40 to 60	2.8 x 7
		SP0406	SPT0406-	–	45	0.22 to 1,000	25 to 85	4 x 9.5
		SP0408	SPT0408-	–	25	0.15 to 27	50 to 70	4.5 x 8
		SP0410	——	–	4	33 to 56	60 to 65	4.5 x 10
		SP0412	——	–	2	68 to 82	60 to 70	4.5 x 12
		SP0412	——	–	8	1 to 15 (1.0 to 4.5A)	20	4 x 12
		SP0615	——	–	10	1 to 33 (up to 6A)	20	6 x 15
		SP0720	——	–	12	1 to 68 (up to 7A)	20	7 x 20
		SP0830	——	–	15	1 to 220 (up to 10A)	20	8 x 30
	Axial lead	TP0206	TPT0206-	–	37	0.1 to 100	25 to 55	2 x 6
		TP0410	TPT0410-	–	62	0.15 to 1,000	33 to 90	4 x 10
		TP0511	——	–	15	270 to 1,000	100	5 x 11
		TP0514	——	–	13	1,100 to 3,600	90	5 x 14
		TP0619	——	–	11	3,900 to 10,000	110	6 x 19
	Leadless	NL453232	NL453232-	–	37	1.0 to 1,000	30 to 50	4.5 x 3.2 x 3.2
Magnetic shielded type	Radial lead	FS0712	——	5.0	61	1.0 to 100 mH	10 to 40	7 x 12
		FS0810	——	2.5	24	12 to 1,000 μH	55 to 95	8 x 10
		FS1012	——	2.5	24	1.2 to 100 mH	6 to 112	10 x 12
	Axial lead	TPF0410	TPFT0410	–	57	0.1 to 4,700	40 to 67	4 x 10
	Leadless	NLF453532	——	–	19	1.0 to 1,000	40 to 50	4.5 x 3.5 x 3.2

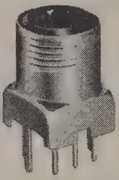
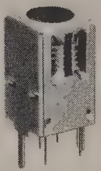
TOKO AMERICA COILS

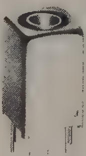
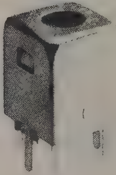
SUBMINIATURE COILS

Type	5 S	5 A	5 K	7 ES	7 PLA	7 TS
Freq. Range	100 KHz - 10 MHz	50 MHz - 200 MHz	30 MHz - 200 MHz	100 KHz - 10 MHz	10 KHz - 200 KHz	10 KHz - 200 KHz
L Values	1 μH ~ 680 μH	.03 μH ~ .3 μH	.08 μH ~ 1 μH	1 μH ~ 500 μH	1 mH ~ 15 mH	200 μH ~ 7 mH
Q Value	70	50 ~ 70	70	60 ~ 100	50	50
Int. Cap. Values	18 pF ~ 47 pF, 180 pF, 1500 pF	None	None	18 pF ~ 47 pF, 180 pF, 1500 pF	10 pF ~ 6800 pF	None

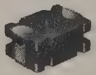
ADJUSTABLE COILS

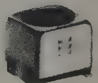



Type	7 P	7 KP	7 KL	7 KM	10 EZ	10 PA	10 K
Freq. Range	100 KHz - 10 MHz	2 MHz - 150 MHz	50 MHz - 200 MHz	25 MHz - 200 MHz	100 KHz - 10 MHz	10 KHz - 200 KHz	1 MHz - 150 MHz
L Values	1 μH ~ 1.1 mH	1 μH ~ 18 μH	.1 μH ~ 50 μH	.1 μH ~ 80 μH	2 μH ~ 2 mH	1 mH ~ 55 mH	.08 μH ~ 50 μH
Q Values	70 ~ 110	70 @ 10.7 MHZ, 100 @ 60 MHZ, 100 @ 100 MHZ	80	80	70 ~ 140	50	80 ~ 100
Int. Cap. Values	5 pF ~ 100 pF, 180 pF, 430 pF	5 pF ~ 100 pF	5 pF ~ 100 pF	5 pF ~ 100 pF	5 pF ~ 100 pF, 100 pF, 430 pF	None	5 pF ~ 100 pF

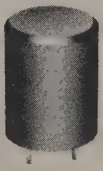
CHIP COILS





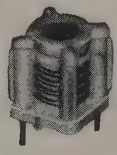
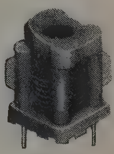
Type	43 CS	43 FS	CIR-01	5 CD
Freq. Range	200 KHz - 150 MHz	200 KHz - 150 MHz	200 KHz - 150 MHz	200 KHz - 15 MHz
L Values	1 μH ~ 470 μH	1 μH ~ 470 μH	1 μH ~ 470 μH	1 μH ~ 500 μH
Q Value	50	50	50	70
Int. Cap. Values	None	None	None	5 pF ~ 330 pF
Mounting	dip soldering	reflow soldering	reflow soldering	reflow soldering

FIXED COILS



Type	8 RBS (RADIAL)	10 RB
Freq. Range	10 KHz - 200 KHz	10 KHz - 200 KHz
L Values	56 μH ~ 15 mH	1 mH ~ 120 mH
Q Values	60	70 ~ 100
Int. Cap. Values	None	None

MOLDED COILS

Type	MC 120	MC 122
Freq. Range	30 MHz - 150 MHz	30 MHz - 150 MHz
L Values	.03 μH ~ .35 μH	.03 μH ~ .44 μH
Q Value	120	110
Winding	Single	

~ Denotes: Numerous variations available between values listed

Toko manufactures a large variety of high grade miniature and subminiature coils. These coils are designed for use in electronics equipment such as video tape recorders and cameras, TV receivers and in AM and FM radios. We have coils available over a wide range of inductances and structures in addition to those shown above. Toko can help you meet all your coil needs. If you don't find the right coil shown here please contact us, we are interested in custom designs.

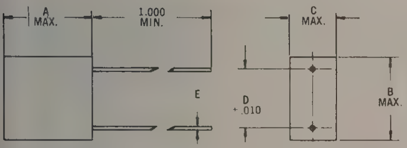
TOKO AMERICA INC. / 5520 WEST TOUHY AVENUE / SKOKIE, ILLINOIS 60077
TEL. 312-677-3640 / TELEX 230-724372 (203-724372 TOKO AM SKO) / FACSIMILE-1-312-674-2910 (G III)
CALIF. OFFICE: 10050 N. WOLFE RD. / SWI-297 / CUPERTINO CA 95014 /TEL. 408-996-7575

TOROTEL PRODUCTS INC.

INDUCTORS

13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

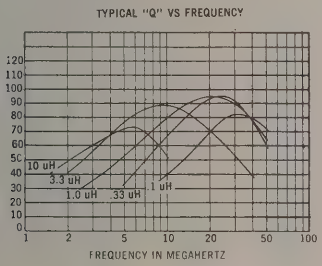
MINI-L
ENCAPSULATED RF INDUCTORS



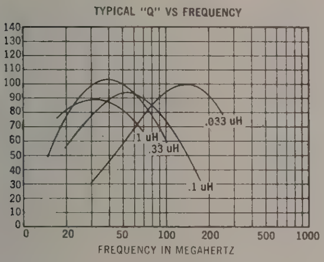
Type	A	B	C	D	E	Wt.
TA-TF	.225	.210	.110	.100	.020	.01 oz.
TB	.300	.280	.160	.200	.025	.02 oz.
TD	.390	.390	.197	.200	.025	.04 oz.

Designed to meet the requirements of MIL-C-15305, Grade 1, Class B (−55°C to +125°C). The rated temperature rise is 35°C above an ambient of 90°C. Overload current should not exceed 1.4 times the rated current. Dielectric withstanding voltage is 700 volts rms. The powdered iron cores used in these items possess excellent temperature stability and result in an inductor with low external magnetic field. This allows mounting in close proximity to each other and to other circuit components without ill effects.

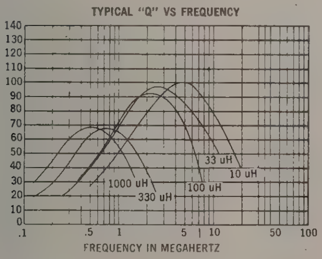
TA



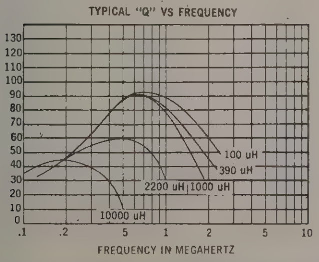
TF



TB



TD



TA SERIES

Frequency Range: 1 to 50 MHz.

Inductance Tolerances: Less than 1.0 uH, ±10%. Greater than or equal to 1.0 uH, ±5%. Closer tolerances available by special request.

Inductance TC: +50 PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

MIL-C-15305, Grade 1, Class B.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TA-1	0.10	60	25	450	0.04	2230
TA-2	0.12	60	25	410	0.05	2000
TA-3	0.15	65	25	350	0.06	1825
TA-4	0.18	65	25	325	0.07	1675
TA-5	0.22	65	25	300	0.08	1550
TA-6	0.27	65	25	280	0.09	1475
TA-7	0.33	65	25	260	0.10	1400
TA-8	0.39	70	25	240	0.11	1325
TA-9	0.47	70	25	220	0.15	1125
TA-10	0.56	70	25	200	0.20	1000
TA-11	0.68	70	25	180	0.25	900
TA-12	0.82	70	25	165	0.30	810
TA-13	1.0	70	25	150	0.35	750
TA-14	1.2	65	7.9	130	0.25	875
TA-15	1.5	65	7.9	120	0.30	800
TA-16	1.8	65	7.9	110	0.50	600
TA-17	2.2	65	7.9	100	0.75	500
TA-18	2.7	65	7.9	90	0.90	450
TA-19	3.3	65	7.9	70	1.0	425
TA-20	3.9	65	7.9	60	1.2	400
TA-21	4.7	60	7.9	50	1.5	350
TA-22	5.6	60	7.9	45	1.7	325
TA-23	6.8	60	7.9	40	2.0	300
TA-24	8.2	60	7.9	37	2.4	290
TA-25	10.0	60	7.9	35	2.6	280

TB SERIES

Recommended Frequency Range: 50 KHz to 35 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .33 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.01 uH should be subtracted from reading.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TB-1	10	75	2.5	35	1.1	550
TB-2	12	75	2.5	31	1.3	500
TB-3	15	75	2.5	27	1.5	460
TB-4	18	80	2.5	25	1.9	410
TB-5	22	80	2.5	22	2.2	380
TB-6	27	80	2.5	20	2.6	350
TB-7	33	80	2.5	18	3.3	320
TB-8	39	80	2.5	16	3.8	290
TB-9	47	80	2.5	14	4.6	260
TB-10	56	80	2.5	12	5.6	240
TB-11	68	80	2.5	11	6.7	220
TB-12	82	80	2.5	10	8.1	200
TB-13	100	80	2.5	9.1	9.6	180
TB-14	120	50	0.79	8.2	10.0	175
TB-15	150	50	0.79	7.5	11.0	160
TB-16	180	50	0.79	6.5	12.0	155
TB-17	220	50	0.79	5.6	13.0	150
TB-18	270	55	0.79	5.0	17.0	125
TB-19	330	55	0.79	4.5	19.0	130
TB-20	390	55	0.79	4.0	21.0	120
TB-21	470	55	0.79	3.5	22.0	115
TB-22	560	55	0.79	3.0	24.0	110
TB-23	680	55	0.79	2.8	19.0	130
TB-24	820	50	0.79	2.5	23.0	120
TB-25	1000	50	0.79	2.2	26.0	110

TF SERIES

Frequency Range: 15 to 300 MHz.

Inductance Tolerances: Less than 0.1 uH, ±20%. Greater than or equal to 0.1 uH, ±10%. Closer tolerances available by special request.

Inductance TC: +200 PPM/°C maximum.

Maximum Power Dissipation: 0.2 watt.

Leads: 1 inch minimum AWG 24 tinned copper wire. Weldable gold plated Dumet leads are available.

Method of Measurement: Apparent inductance measured on Boonton 190-A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals. Residual "Q" meter inductance of 0.0026 uH should be subtracted from value calculated from C and F readings.

MIL-C-15305, Grade 1, Class B.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (MHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TF-1	0.01	60	150	1000	0.02	3100
TF-2	0.012	60	150	1000	0.02	3100
TF-3	0.015	60	150	1000	0.02	3100
TF-4	0.018	60	150	1000	0.02	3100
TF-5	0.022	60	100	900	0.02	3100
TF-6	0.027	60	100	800	0.02	3100
TF-7	0.033	60	100	750	0.02	3100
TF-8	0.039	60	100	700	0.02	3100
TF-9	0.047	60	100	650	0.02	3100
TF-10	0.056	60	100	600	0.02	3100
TF-11	0.068	60	100	550	0.03	2500
TF-12	0.082	60	100	500	0.03	2500
TF-13	0.10	70	50	450	0.04	2200
TF-14	0.12	70	50	400	0.05	2000
TF-15	0.15	70	50	350	0.06	1800
TF-16	0.18	70	50	320	0.07	1650
TF-17	0.22	70	50	300	0.08	1500
TF-18	0.27	70	50	280	0.10	1400
TF-19	0.33	70	50	260	0.12	1300
TF-20	0.39	60	50	240	0.15	1150
TF-21	0.47	60	50	220	0.20	1000
TF-22	0.56	60	50	200	0.25	900
TF-23	0.68	60	50	180	0.30	800
TF-24	0.82	60	50	160	0.35	750
TF-25	1.0	60	50	150	0.40	700

TD SERIES

Recommended Frequency Range: 50 KHz to 10 MHz.

Inductance Tolerance: ±5%. Closer tolerances available by special request.

Inductance TC: From +60 PPM/°C maximum to +300 PPM/°C maximum, depending upon inductance value.

Maximum Power Dissipation: .50 watt.

Leads: 1 inch minimum AWG 22 tinned copper wire. Weldable gold plated Dumet leads are available.

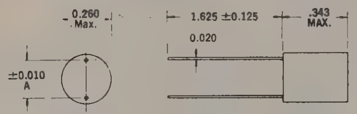
Method of Measurement: Apparent inductance measured on HP4342A "Q" meter with leads connected ¼ inch from inductor body directly to "Q" meter terminals.

Part No.	Apparent Inductance (uH)	Minimum "Q"	Test Frequency (KHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TD-1	100	75	790	8.4	6	280
TD-2	120	75	790	7.5	7	260
TD-3	150	75	790	6.8	8	240
TD-4	180	75	790	6.1	10	220
TD-5	220	80	790	5.4	12	200
TD-6	270	80	790	4.7	14	180
TD-7	330	80	790	4.2	17	165
TD-8	390	80	790	3.8	20	150
TD-9	470	75	790	3.4	24	140
TD-10	560	75	790	3.1	28	130
TD-11	680	75	790	2.8	33	120
TD-12	820	75	790	2.5	40	110
TD-13	1000	75	790	2.2	46	100
TD-14	1200	45	250	1.9	30	120
TD-15	1500	45	250	1.6	35	110
TD-16	1800	50	250	1.4	40	105
TD-17	2200	50	250	1.3	50	95
TD-18	2700	50	250	1.2	60	85
TD-19	3300	50	250	1.1	70	80
TD-20	3900	50	250	1.0	80	75
TD-21	4700	50	250	0.9	90	70
TD-22	5600	45	250	0.8	100	65
TD-23	6800	40	250	0.7	140	60
TD-24	8200	40	250	0.6	160	55
TD-25	10,000	40	250	0.6	175	50

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

MINI-L ENCAPSULATED INDUCTORS
TE/TJ SERIES



Series	A	WT.
TE	.200	.03 oz.
TJ	.100	.03 oz.

Recommended Frequency Range: 25 KHz to 2.5 MHz.

Inductance Tolerances: ±10% @ 1 KHz.

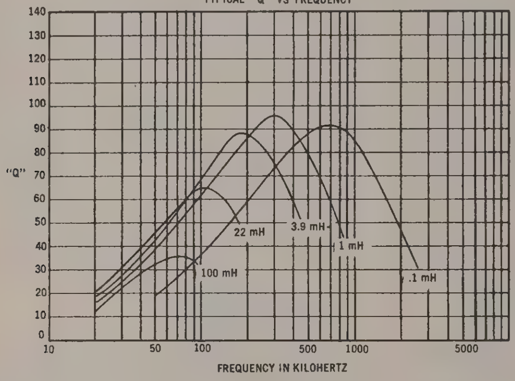
Maximum Power Dissipation: .33 watt.

Leads: 1.625 ±.125 AWG #24 tinned copper leads. Add suffix "D" to Part Number for Weldable Gold Plated Dumet leads.

Method of Measurement: Inductance at 1 KHz measured on General Radio inductance bridge Type 1632A with leads connected directly to bridge. "Q" at test frequency, measured on HP4342A "Q" meter with leads connected directly to meter terminals.

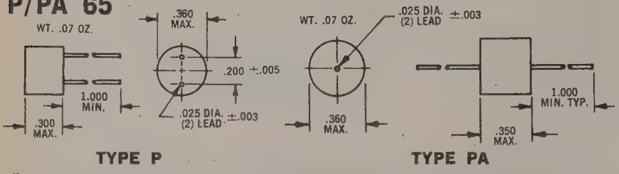
MIL-C-15305, Grade 1, Class B.

TYPICAL "Q" VS FREQUENCY



Part Number		Inductance Ref. @ 1 KHz (mH)	Minimum "Q"	"Q" Test Frequency (KHz)	Minimum SRF (MHz)	Maximum DCR (ohms)	DC Current (mA)
TJ-1	TE-1	0.10	80	790	4.5	1.8	450
TJ-2	TE-2	0.12	80	790	3.9	2.1	425
TJ-3	TE-3	0.15	75	790	3.6	2.3	400
TJ-4	TE-4	0.18	75	790	3.3	2.7	380
TJ-5	TE-5	0.22	75	790	3.0	2.9	360
TJ-6	TE-6	0.27	75	790	2.7	3.2	320
TJ-7	TE-7	0.33	70	790	2.5	3.6	300
TJ-8	TE-8	0.39	70	790	2.3	4.0	275
TJ-9	TE-9	0.47	65	790	2.1	4.4	265
TJ-10	TE-10	0.56	60	790	2.0	4.7	250
TJ-11	TE-11	0.68	55	790	1.8	5.4	240
TJ-12	TE-12	0.82	50	790	1.6	5.8	225
TJ-13	TE-13	1.00	80	250	1.5	8.7	190
TJ-14	TE-14	1.20	75	250	1.4	9.5	180
TJ-15	TE-15	1.50	75	250	1.2	11.6	160
TJ-16	TE-16	1.80	75	250	1.1	15.8	140
TJ-17	TE-17	2.20	75	250	0.95	17.3	130
TJ-18	TE-18	2.70	70	250	0.87	18.9	125
TJ-19	TE-19	3.30	70	250	0.80	25.2	110
TJ-20	TE-20	3.90	70	250	0.75	27.2	105
TJ-21	TE-21	4.70	65	250	0.70	31.5	100
TJ-22	TE-22	5.60	65	250	0.60	42.0	85
TJ-23	TE-23	6.80	60	250	0.55	52.5	75
TJ-24	TE-24	8.20	55	250	0.50	63.0	65
TJ-25	TE-25	10.0	45	250	0.45	89.2	55
TJ-26	TE-26	12.0	40	79	0.40	105.0	50
TJ-27	TE-27	15.0	40	79	0.35	121.0	45
TJ-28	TE-28	18.0	40	79	0.33	136.0	40
TJ-29	TE-29	22.0	40	79	0.30	147.0	35
TJ-30	TE-30	27.0	40	79	0.26	241.0	30
TJ-31	TE-31	33.0	35	79	0.24	325.0	28
TJ-32	TE-32	39.0	35	79	0.22	367.0	25
TJ-33	TE-33	47.0	35	79	0.20	420.0	23
TJ-34	TE-34	56.0	30	79	0.18	483.0	20
TJ-35	TE-35	68.0	25	79	0.16	630.0	18
TJ-36	TE-36	82.0	20	79	0.14	893.0	16
TJ-37	TE-37	100.0	20	79	0.12	1100	15
TJ-38	TE-38	120.0	10	50	0.10	1200	14
TJ-39	TE-39	150.0	10	50	0.095	1360	13
TJ-40	TE-40	180.0	10	40	0.080	1520	11
TJ-41	TE-41	220.0	10	40	0.070	1890	10

P/PA 65



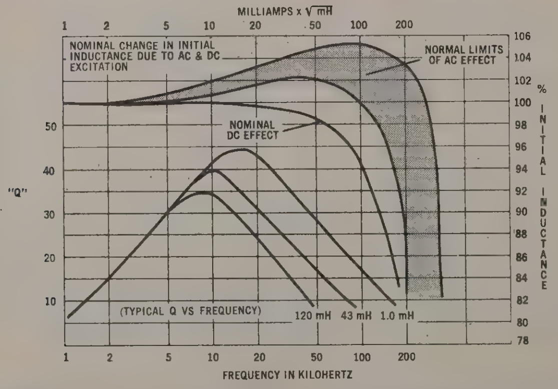
Frequency Range: 1 to 50 KHz **MIL-T-27 Grade 5, Class S.**

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.

EXAMPLE: PA65 — XX

CASE TYPE: PA65

PART NUMBER: XX



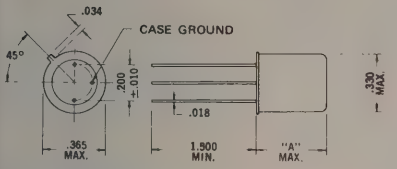
CORE NO. 65

Inductance ±2% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
1.00	65-1	.934	12
1.25	65-2	1.310	12
1.50	65-3	1.430	12
1.75	65-4	1.550	14
2.00	65-5	2.020	14
2.40	65-6	2.200	14
2.50	65-7	2.250	14
3.00	65-8	3.010	16
3.60	65-9	3.300	16
4.30	65-10	3.600	16
5.00	65-11	4.260	18
6.00	65-12	4.680	18
7.20	65-13	5.120	18
7.50	65-14	7.000	20
8.00	65-15	7.700	22
8.60	65-16	8.000	22
10.00	65-17	10.300	24
12.00	65-18	11.300	24
12.50	65-19	11.600	24
15.00	65-20	16.500	26
17.50	65-21	17.800	26
20.00	65-22	19.000	28
24.00	65-23	28.500	28
25.00	65-24	29.100	30
30.00	65-25	31.900	30
36.00	65-26	34.900	32
43.00	65-27	42.100	32
50.00	65-28	48.000	34
60.00	65-29	52.600	34
72.00	65-30	61.500	36
75.00	65-31	78.700	36
86.00	65-32	84.200	36
100.00	65-33	90.800	38
120.00	65-34	115.000	40

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

MINI-L HERMETICALLY SEALED RF INDUCTORS
TG, TH SERIES



Series	A max.	Weight
TG	.390	.06 oz.
TH	.350	.07 oz.

TG SERIES

Recommended Frequency Range: 10 KHz to 500 KHz.

Inductance Tolerance: ±5%.

Inductance Stability: Less than ±2% from −20°C to +130°C.

Method of Test: Inductance is measured on a General Radio inductance bridge, Type 1632A with leads connected directly to bridge. "Q" is measured on HP4342A "Q" meter with leads connected directly to the "Q" meter terminals.

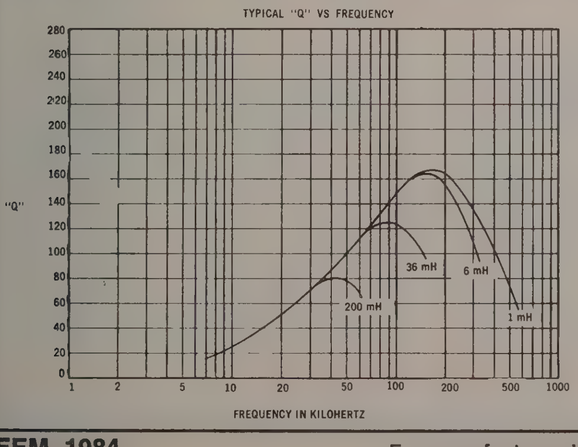
MIL-T-27, Grade 4, Class S.

Temperature Range: −55°C to +130°C.

Insulation Resistance: 10,000 Megohms minimum at 100 volts DC.

Dielectric Withstanding Voltage: 100 volts rms.

Part Number	Inductance (mH)	Inductance Test Frequency (KHz)	"Q" Minimum	"Q" Test Frequency (KHz)	Maximum DCR* (ohms)	Minimum SRF (KHz)	DC Current (mA)
TG-1	1.0	10	120	200	3.3	1500	123
TG-2	1.2	10	120	200	3.6	1300	118
TG-3	1.5	10	120	200	4.8	1160	102
TG-4	1.75	10	120	200	5.2	1080	98
TG-5	2.0	10	120	200	5.7	1000	94
TG-6	2.4	10	120	200	7.9	920	80
TG-7	3.0	10	120	150	8.9	820	75
TG-8	3.6	10	120	150	9.8	730	71
TG-9	4.3	10	120	150	13.7	660	60
TG-10	5.0	10	120	150	14.7	600	58
TG-11	6.0	10	120	150	20.0	540	50
TG-12	7.2	10	120	100	21.8	480	48
TG-13	8.6	10	100	100	24.0	430	45
TG-14	10.0	10	100	100	32.4	400	39
TG-15	12.0	10	100	100	34.8	360	38
TG-16	15.0	10	100	100	39.1	320	36
TG-17	17.5	10	85	70	55.0	300	30
TG-18	20.0	10	85	70	60.0	280	29
TG-19	24.0	10	85	70	64.7	250	28
TG-20	30.0	10	85	70	86.3	220	24
TG-21	36.0	10	85	70	95.8	195	23
TG-22	43.0	10	85	70	132	185	19
TG-23	50.0	10	85	70	143	165	18
TG-24	60.0	10	75	50	155	145	18
TG-25	72.0	10	75	50	172	130	17
TG-26	86.0	10	75	50	233	125	15
TG-27	100	10	75	50	252	115	14
TG-28	120	5	75	50	290	105	13
TG-29	150	5	50	40	323	95	13
TG-30	175	5	50	40	350	85	12
TG-31	200	5	50	40	477	80	10
TG-32	240	5	50	40	693	71	10
TG-33	300	5	50	40	735	63	8
TG-34	360	5	30	30	1005	57	7
TG-35	430	5	30	30	1100	51	6.5
TG-36	500	5	30	20	1200	48	6.5



The TG and TH series offer high "Q" inductors in a TO-5 transistor can configuration. High density packaging can be accomplished with little regard to coupling between adjacent circuitry since construction of these units results in a low external magnetic and electrostatic field.

TH SERIES

Recommended Frequency Range: 100 KHz to 10 MHz.

Inductance Tolerances: 10 uH through 33 uH, ±10%, 39 uH through 130 uH, ±5%, greater than and including 150 uH, ±3%.

Inductance Stability: Less than or equal to ±2% from −20°C to +85°C.

Method of Test: Inductance and "Q" are measured on HP4342A "Q" meter with leads connected directly to the "Q" meter terminals.

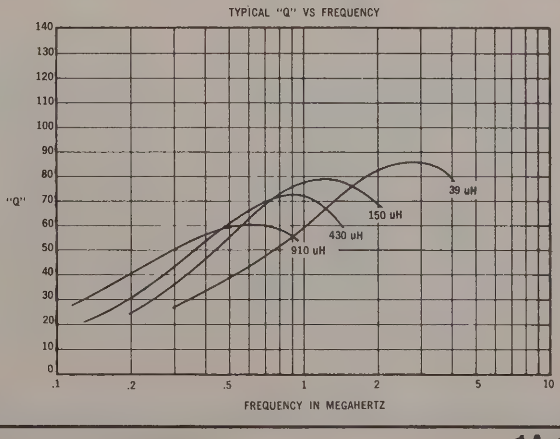
MIL-C-15305, Grade 1, Class C.

Temperature Range: −55°C to +130°C.

Insulation Resistance: 10,000 Megohms minimum at 100 volts DC.

Dielectric Withstanding Voltage: 100 volts rms.

Part Number	Inductance (uH)	Inductance Test Frequency (KHz)	"Q" Minimum	"Q" Test Frequency (KHz)	Maximum DCR* (ohms)	Minimum SRF (MHz)	DC Current (mA)
TH-7	10	1000	75	2500	2.4	35.0	102
TH-8	12	1000	75	2500	2.5	30.0	100
TH-9	15	1000	75	2500	2.6	25.0	98
TH-10	18	1000	75	2500	2.7	23.0	96
TH-11	22	1000	75	2500	2.8	20.0	94
TH-12	27	1000	75	2500	2.9	17.0	93
TH-13	33	1000	75	2500	3.0	14.0	91
TH-14	39	500	70	2500	3.1	11.0	90
TH-15	47	500	70	2500	3.2	10.0	88
TH-16	56	500	70	2500	3.3	9.5	87
TH-17	68	500	70	2500	3.4	9.0	85
TH-18	82	500	70	2500	4.5	8.0	74
TH-19	100	500	70	1500	5.1	7.5	70
TH-20	110	500	70	1500	6.0	7.0	64
TH-21	120	500	70	1500	6.2	6.5	63
TH-22	130	500	70	1500	6.4	6.0	62
TH-23	150	500	70	1500	6.6	5.5	61
TH-24	160	500	60	790	8.6	5.3	54
TH-25	180	500	60	790	9.0	5.0	52
TH-26	200	500	60	790	9.5	4.5	51
TH-27	220	250	60	790	10.0	4.0	50
TH-28	240	250	60	790	10.6	3.8	48
TH-29	270	250	60	790	11.2	3.6	48
TH-30	300	250	60	790	14.2	3.4	42
TH-31	330	250	60	790	14.6	3.2	41
TH-32	360	250	60	790	15.0	3.0	41
TH-33	390	250	60	790	15.6	2.9	40
TH-34	430	250	60	790	16.4	2.8	39
TH-35	470	250	60	790	20.4	2.7	35
TH-36	510	250	60	790	21.8	2.6	34
TH-37	560	250	60	790	23.6	2.5	32
TH-38	620	250	60	790	24.6	2.3	32
TH-39	680	250	50	790	25.8	2.1	31
TH-40	750	250	50	790	26.8	1.9	31
TH-41	820	250	50	790	38.4	1.7	25
TH-42	910	250	50	790	40.8	1.5	24
TH-43	1000	250	50	790	42.6	1.4	24



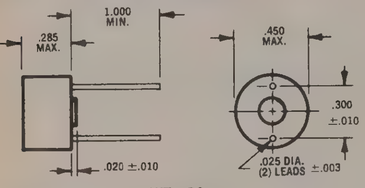
TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

MINIATURE TOROIDS

TYPE P/PF

Epoxy Encapsulated
MIL-T-27 Grade 5, Glass S



WT. .08 oz.

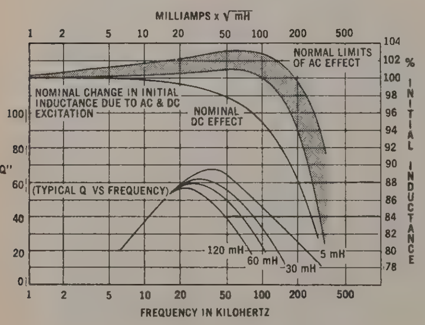
P	PF
NO FOOT	WITH FOOT

CORE NO. 03

Recommended Frequency: Up to 100 KHz.
Maximum Inductance: 250 mH.
Special Core Stabilization Available: D, W, M, L.

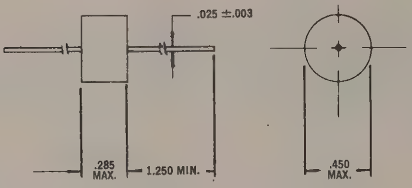
When ordering add the prefix P, PA, PF, or M to the Part Number for the case type desired.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
1.00	03-1	1.5	14
1.25	03-2	1.7	14
1.50	03-3	2.4	18
1.75	03-4	2.6	20
2.00	03-5	2.7	20
2.40	03-6	3.7	22
2.50	03-7	3.8	22
3.00	03-8	4.0	24
3.60	03-9	5.7	24
4.30	03-10	6.2	24
5.00	03-11	6.7	26
6.00	03-12	9.3	26
7.20	03-13	10.0	26
7.50	03-14	10.5	28
8.00	03-15	11.0	28
8.60	03-16	14.0	28
10.00	03-17	15.0	30
12.00	03-18	15.5	32
12.50	03-19	16.0	34
15.00	03-20	23.0	36
17.50	03-21	25.0	38
20.00	03-22	26.0	40
24.00	03-23	35.0	42
30.00	03-24	39.0	44
36.00	03-25	58.0	46
43.00	03-26	64.0	48
50.00	03-27	69.0	50
60.00	03-28	78.0	52
72.00	03-29	106.0	54
75.00	03-30	108.0	56
86.00	03-31	140.0	58
100.00	03-32	150.0	60
120.00	03-33	155.0	62
150.00	03-34	228.0	64
175.00	03-35	246.0	66
178.00	03-36	248.0	66
200.00	03-37	333.0	68
250.00	03-38	373.0	70



TYPICAL TYPE PA

Axial Lead Epoxy Encapsulated

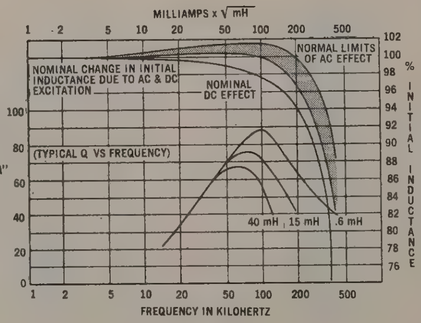


WT. .08 oz.

CORE NO. 13

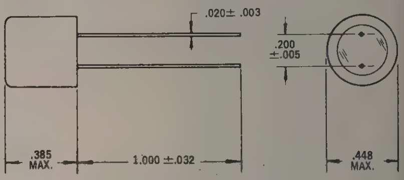
Recommended Frequency: 10 KHz to 200 KHz.
Maximum Inductance: 100 mH.
Special Core Stabilization Available: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
.50	13-1	1.5	14
.60	13-2	1.6	14
.72	13-3	2.4	14
.86	13-4	2.6	14
1.00	13-5	2.8	16
1.25	13-6	3.9	16
1.50	13-7	4.1	18
1.75	13-8	5.7	18
2.00	13-9	6.1	20
2.40	13-10	6.7	22
2.50	13-11	6.8	24
3.00	13-12	9.5	24
3.60	13-13	10.5	26
4.30	13-14	14.7	28
5.00	13-15	15.5	30
6.00	13-16	16.0	30
7.20	13-17	24.0	32
8.60	13-18	26.0	34
10.00	13-19	27.0	36
12.00	13-20	39.0	38
15.00	13-21	41.0	40
17.50	13-22	59.0	40
20.00	13-23	63.0	42
24.00	13-24	67.0	42
25.00	13-25	68.0	44
30.00	13-26	100.0	44
36.00	13-27	103.0	46
40.00	13-28	108.0	46
43.00	13-29	142.0	48
50.00	13-30	154.0	48
60.00	13-31	168.0	50
72.00	13-32	228.0	50
86.00	13-33	250.0	52
100.00	13-34	340.0	52



TYPE M

Metal Cased
MIL-T-27 Grade 4, Class R

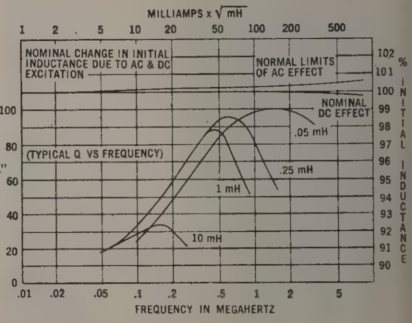


WT. .15 oz.

CORE NO. 29

Recommended Frequency: 50 KHz to 5 MHz.
Maximum Inductance: 15 mH.
Only Core Stabilization Available: ±90 PPM/°C

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
.050	29-1	1.2	10
.060	29-2	1.6	10
.072	29-3	1.8	10
.075	29-4	1.8	12
.086	29-5	1.9	12
.100	29-6	2.1	12
.120	29-7	2.3	12
.125	29-8	3.0	12
.150	29-9	3.3	12
.175	29-10	3.5	14
.200	29-11	4.5	14
.240	29-12	4.9	14
.250	29-13	5.0	14
.300	29-14	7.0	14
.360	29-15	7.7	14
.400	29-16	8.1	16
.430	29-17	10.5	16
.500	29-18	12.3	16
.600	29-19	13.5	16
.720	29-20	16.2	16
.750	29-21	16.5	18
.860	29-22	17.7	18
1.000	29-23	19.1	18
1.200	29-24	25.9	20
1.250	29-25	26.4	20
1.500	29-26	29.0	22
1.750	29-27	37.6	22
2.000	29-28	40.3	24
2.400	29-29	44.0	24
2.500	29-30	45.0	26
3.000	29-31	64.0	28
3.600	29-32	69.0	28
4.000	29-33	73.0	30
4.300	29-34	76.0	32
5.000	29-35	102.0	34
6.000	29-36	112.0	34
7.200	29-37	122.0	36
7.500	29-38	125.0	38
8.600	29-39	162.0	40
10.000	29-40	175.0	42



INDUCTORS

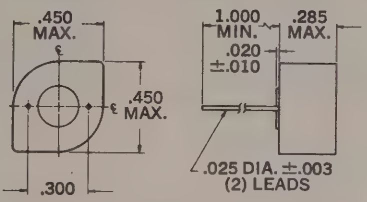
TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

MINIATURE TOROIDS

NEW CASE TYPE AVAILABLE FOR CORES 03, 13, 29, 82, 72, 52

TYPE PE/PEF
Epoxy Encapsulated
MIL-T-27 Grade 5, Class S

PE	PEF
NO FOOT	WITH FOOT



WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.

EXAMPLE P 03-1

CASE TYPE — P
PART NUMBER — 03-1

CORE NO. 82

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 250 mH.
Special Core Stabilization: D, W, M, L.

When ordering add the prefix P, PA, PF, or M, to the part number for the case type desired.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	82-1	1.23	12
1.25	82-2	1.38	14
1.50	82-3	1.85	14
1.75	82-4	2.00	16
2.00	82-5	2.34	16
2.40	82-6	2.56	18
2.50	82-7	2.62	18
3.00	82-8	3.87	18
3.60	82-9	4.25	20
4.30	82-10	4.63	22
5.00	82-11	6.29	22
6.00	82-12	6.91	24
7.20	82-13	7.55	24
7.50	82-14	9.27	26
8.00	82-15	9.57	26
8.60	82-16	9.93	28
10.00	82-17	10.70	28
12.00	82-18	14.20	30
15.00	82-19	15.90	30
17.50	82-20	22.10	32
20.00	82-21	23.60	34
24.00	82-22	25.90	36
30.00	82-23	36.50	36
36.00	82-24	40.00	38
43.00	82-25	43.70	38
50.00	82-26	56.70	40
60.00	82-27	62.10	40
72.00	82-28	68.10	42
86.00	82-29	96.80	44
100.00	82-30	104.00	44
120.00	82-31	149.00	46
150.00	82-32	206.00	48
175.00	82-33	223.00	48
200.00	82-34	305.00	50
250.00	82-35	341.00	50

CORE NO. 72

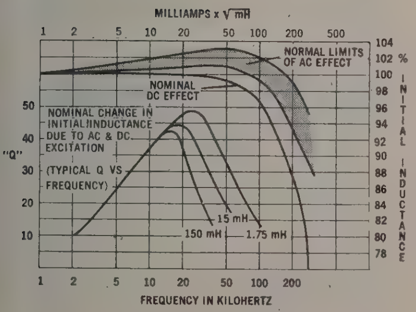
Recommended Frequency: Up to 30 KHz.
Maximum Inductance: 360 mH.
Special Core Stabilization: D, W, M, L.

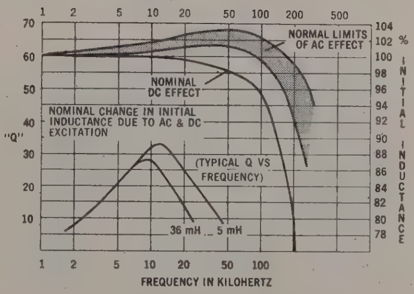
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.25	72-1	1.23	12
1.50	72-2	1.34	14
1.75	72-3	1.78	14
2.00	72-4	1.90	16
2.40	72-5	2.28	16
2.50	72-6	2.34	18
3.00	72-7	2.55	18
3.60	72-8	3.78	18
4.30	72-9	4.14	20
5.00	72-10	4.45	22
6.00	72-11	6.15	22
7.20	72-12	6.75	24
7.50	72-13	6.88	24
8.00	72-14	7.09	26
8.60	72-15	8.86	26
10.00	72-16	9.54	28
12.00	72-17	10.50	28
15.00	72-18	14.20	30
17.50	72-19	15.30	30
20.00	72-20	16.40	32
24.00	72-21	23.10	34
30.00	72-22	25.80	36
36.00	72-23	35.70	36
43.00	72-24	39.00	38
50.00	72-25	42.00	38
60.00	72-26	55.40	40
72.00	72-27	60.70	40
86.00	72-28	66.40	42
100.00	72-29	71.60	44
120.00	72-30	102.00	44
150.00	72-31	148.00	46
175.00	72-32	160.00	48
200.00	72-33	213.00	48
250.00	72-34	304.00	50
300.00	72-35	333.00	52
360.00	72-36	365.00	54

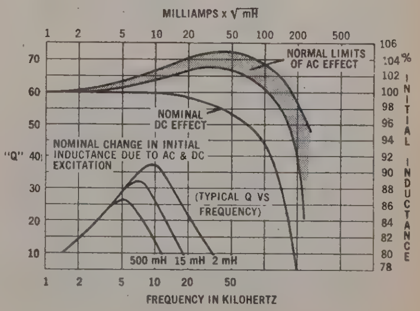
CORE NO. 52

Recommended Frequency: Up to 15 KHz.
Maximum Inductance: 500 mH.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
2.0	52-1	1.27	12
2.4	52-2	1.39	14
2.5	52-3	1.74	14
3.0	52-4	1.91	16
3.6	52-5	2.28	16
4.3	52-6	2.49	18
5.0	52-7	2.70	18
6.0	52-8	4.00	18
7.2	52-9	4.38	20
7.5	52-10	4.47	22
8.0	52-11	4.61	22
8.6	52-12	6.02	24
10.0	52-13	6.50	24
12.0	52-14	7.11	26
15.0	52-15	9.57	26
17.5	52-16	10.30	28
20.0	52-17	11.10	28
24.0	52-18	14.70	30
30.0	52-19	16.40	30
36.0	52-20	23.20	32
43.0	52-21	25.30	34
50.0	52-22	27.30	36
60.0	52-23	37.70	36
72.0	52-24	41.30	38
86.0	52-25	54.30	38
100.0	52-26	58.60	40
120.0	52-27	64.20	40
150.0	52-28	71.70	42
175.0	52-29	101.00	44
200.0	52-30	140.00	44
250.0	52-31	156.00	46
300.0	52-32	213.00	48
360.0	52-33	233.00	48
400.0	52-34	315.00	50
430.0	52-35	326.00	52
500.0	52-36	352.00	54







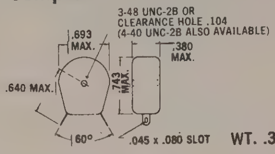
TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

MINIATURE INDUCTORS

Mechanical Tolerance: ±.015 unless otherwise indicated.

TYPE P — Compression Molded



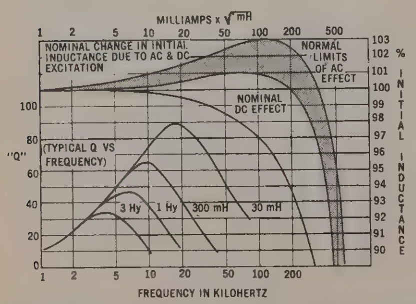
3-48 UNC-2B OR CLEARANCE HOLE .104 (4-40 UNC-2B ALSO AVAILABLE)
.693 MAX.
.380 MAX.
.640 MAX.
.743 MAX.
60°
.045 x .080 SLOT

WT. .35 oz.

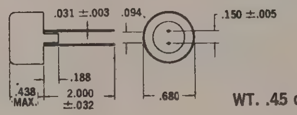
CORE NO. 50

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 4.5 H.
Special Core Stabilization Available: D, L, M, W.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.0	50-1	.6	30
2.5	50-2	1.4	31
5.0	50-3	2.8	31
6.0	50-40	3.3	32
7.2	50-41	3.9	32
7.5	50-4	4.1	32
8.6	50-42	4.7	33
10.0	50-5	5.4	33
12.0	50-43	6.5	33
12.5	50-6	6.6	33
15.0	50-7	7.5	34
17.5	50-44	9.4	34
20.0	50-8	10.7	34
24.0	50-45	12.9	34
25.0	50-9	13.5	34
30.0	50-10	16.1	35
36.0	50-46	19.4	35
40.0	50-11	21.5	35
43.0	50-47	23.1	36
50.0	50-12	27.3	36
60.0	50-48	32.6	36
72.0	50-49	38.9	37
75.0	50-13	41.0	37
86.0	50-50	47.0	38
100.0	50-14	54.0	38
120.0	50-51	66.0	38
125.0	50-15	68.0	39
150.0	50-16	81.0	39
175.0	50-53	95.0	40
200.0	50-17	108.0	40
240.0	50-54	130.0	41
250.0	50-52	135.0	41
300.0	50-18	161.0	42
360.0	50-55	194.0	42
400.0	50-19	215.0	43
430.0	50-56	231.0	43
500.0	50-20	268.0	44
600.0	50-57	321.0	44
720.0	50-58	387.0	45
750.0	50-21	403.0	45
860.0	50-59	461.0	46
1.00 H	50-22	536.0	46
1.20 H	50-60	643.0	47
1.25 H	50-61	672.0	47
1.50 H	50-62	804.0	48
1.75 H	50-63	938.0	48
2.00 H	50-64	1103.0	49
2.40 H	50-67	1286.0	50
2.50 H	50-66	1339.0	50
3.00 H	50-65	1607.0	51

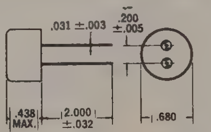


TYPE M — Metal Cased



WT. .45 oz.

TYPE MG — Metal Cased - Grid Spacing

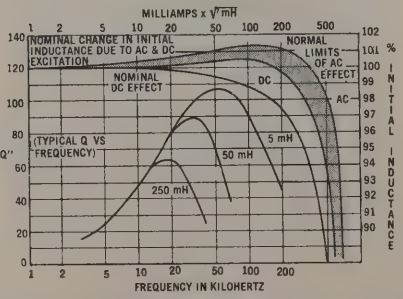


WT. .45 oz.

CORE NO. 51

Recommended Frequency: 10 KHz to 200 KHz.
Maximum Inductance: 1 H.
Special Core Stabilization Available: D, M, W, L.

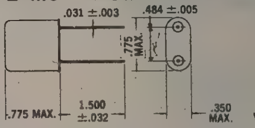
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
1.00	51-1	1.2	25
1.20	51-2	1.3	25
1.50	51-3	1.7	26
1.75	51-4	1.9	26
2.00	51-5	2.5	26
2.40	51-6	2.7	26
3.00	51-7	3.3	27
3.60	51-8	4.4	27
4.30	51-9	4.7	27
5.00	51-10	5.5	28
6.00	51-11	6.6	28
7.20	51-12	7.8	28
8.60	51-13	9.4	28
10.00	51-14	10.9	28
12.00	51-15	13.1	28
15.00	51-16	16.3	29
17.50	51-17	18.9	29
20.00	51-18	21.7	29
24.00	51-19	26.0	29
30.00	51-20	33.0	29
36.00	51-21	39.0	29
43.00	51-22	47.0	29
50.00	51-23	55.0	30
60.00	51-24	66.0	30
72.00	51-25	78.0	30
86.00	51-26	94.0	30
100.00	51-27	109.0	31
120.00	51-28	130.0	31
150.00	51-29	162.0	31
175.00	51-30	189.0	31
200.00	51-31	217.0	32
240.00	51-32	260.0	32
300.00	51-33	325.0	33
360.00	51-34	389.0	33
430.00	51-35	466.0	34
500.00	51-36	546.0	35



WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†
EXAMPLE: U 55-1
CASE TYPE — U; 55-1 — PART NUMBER

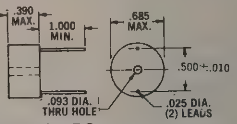
† Add "C" to part number of molded inductor if clearance hole is desired.

TYPE MC — Metal Cased



WT. .45 oz.

TYPE PT — Printed Circuit

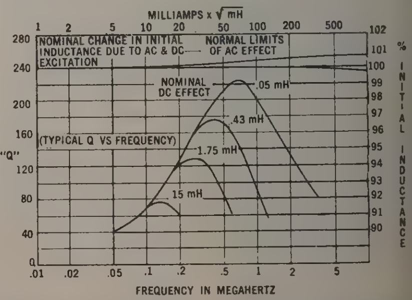


WT. .35 OZ.

CORE NO. 53

Recommended Frequency: 50 KHz to 2 MHz.
Maximum Inductance: 20 mH.
Only Core Stabilization Available: ±90 PPM/°C

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
0.050	53-1	.42	6
0.060	53-2	.50	6
0.072	53-3	.60	6
0.075	53-4	.61	6
0.086	53-5	.72	6
0.100	53-6	.78	6
0.120	53-7	.89	6
0.125	53-8	.94	6
0.150	53-9	1.17	7
0.175	53-10	1.26	7
0.200	53-11	1.72	7
0.240	53-12	2.02	7
0.250	53-13	2.08	8
0.300	53-14	2.28	8
0.360	53-15	2.44	8
0.400	53-16	3.20	8
0.430	53-17	3.30	8
0.500	53-18	4.80	8
0.600	53-19	5.60	8
0.720	53-20	5.90	8
0.750	53-21	7.40	8
0.860	53-22	7.50	8
1.000	53-23	10.10	8
1.200	53-24	11.30	8
1.250	53-25	11.40	8
1.500	53-26	12.50	8
1.750	53-27	13.50	9
2.000	53-28	18.20	9
2.400	53-29	19.90	9
2.500	53-30	20.80	9
3.000	53-31	23.10	9
3.600	53-32	23.20	9
4.000	53-33	25.90	9
4.300	53-34	27.10	9
5.000	53-35	36.00	9
6.000	53-36	39.00	9
7.200	53-37	51.00	9
7.500	53-38	52.00	9
8.600	53-39	57.00	9
10.000	53-40	64.00	9
12.000	53-41	86.00	9
12.500	53-42	94.00	9
15.000	53-43	104.00	9

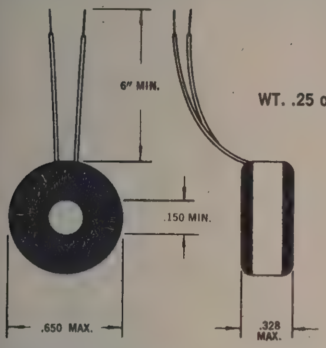


INDUCTORS

TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

MINIATURE INDUCTORS

TYPE U — Uncased

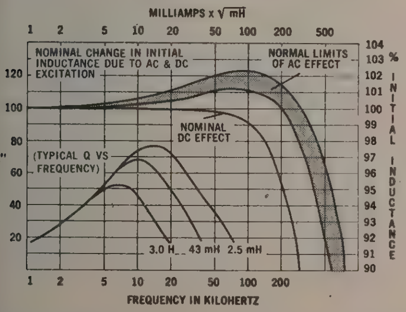


WT. .25 oz.

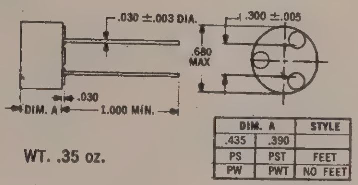
CORE NO. 55

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 5 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
1.20	55-1	0.50	30
1.50	55-2	0.71	30
1.75	55-3	0.77	32
2.00	55-4	0.82	32
2.40	55-5	1.13	32
3.00	55-6	1.26	34
3.60	55-7	1.38	34
4.30	55-8	1.51	34
5.00	55-9	1.63	34
6.00	55-10	2.32	34
7.20	55-11	3.20	36
8.60	55-12	3.51	36
10.00	55-13	4.68	36
12.00	55-14	5.11	36
15.00	55-15	5.72	36
17.50	55-16	7.60	38
20.00	55-17	8.12	38
24.00	55-18	8.89	38
30.00	55-19	12.30	38
36.00	55-20	13.40	40
43.00	55-21	18.20	40
50.00	55-22	19.60	40
60.00	55-23	27.00	42
72.00	55-24	29.60	42
86.00	55-25	40.70	42
100.00	55-26	43.90	42
120.00	55-27	48.10	44
150.00	55-28	71.50	44
175.00	55-29	77.30	44
200.00	55-30	82.60	46
240.00	55-31	117.00	46
300.00	55-32	131.00	46
360.00	55-33	143.00	48
430.00	55-34	196.00	48
500.00	55-35	211.00	48
600.00	55-36	292.00	50
720.00	55-37	320.00	50
860.00	55-38	350.00	52
1.00 H	55-39	475.00	52
1.20 H	55-40	520.00	54
1.50 H	55-41	735.00	54
1.75 H	55-42	794.00	54
2.00 H	55-43	1080.00	56
2.40 H	55-44	1180.00	56
3.00 H	55-45	1320.00	56



TYPE PS/PST/PW/PWT — Printed Circuit

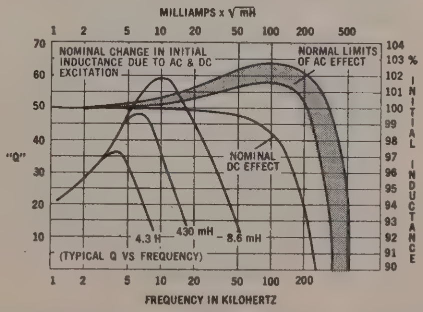


WT. .35 oz.

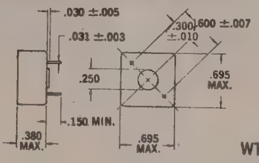
CORE NO. 56

Recommended Frequency: Up to 40 KHz.
Maximum Inductance: 7 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
1.50	56-1	0.50	36
1.75	56-2	0.54	36
2.00	56-3	0.58	36
2.40	56-4	0.80	36
3.00	56-5	0.90	38
3.60	56-6	1.23	38
4.30	56-7	1.35	38
5.00	56-8	1.46	38
6.00	56-9	1.60	38
7.20	56-10	2.27	40
8.60	56-11	3.13	40
10.00	56-12	3.38	40
12.00	56-13	3.70	42
15.00	56-14	5.11	42
17.50	56-15	5.53	42
20.00	56-16	5.90	44
24.00	56-17	7.95	44
30.00	56-18	8.89	44
36.00	56-19	12.00	46
43.00	56-20	13.10	46
50.00	56-21	14.10	46
60.00	56-22	19.20	46
72.00	56-23	26.40	48
86.00	56-24	28.90	48
100.00	56-25	31.20	48
120.00	56-26	43.00	50
150.00	56-27	48.10	50
175.00	56-28	51.90	52
200.00	56-29	73.90	52
240.00	56-30	80.90	54
300.00	56-31	117.00	54
360.00	56-32	128.00	54
430.00	56-33	140.00	56
500.00	56-34	189.00	56
600.00	56-35	207.00	58
720.00	56-36	286.00	58
860.00	56-37	313.00	60
1.00 H	56-38	337.00	60
1.20 H	56-39	369.00	62
1.50 H	56-40	520.00	62
1.75 H	56-41	710.00	64
2.00 H	56-42	759.00	64
2.40 H	56-43	832.00	66
3.00 H	56-44	1180.00	66
3.60 H	56-45	1290.00	66

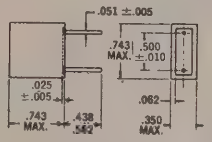


TYPE S — Printed Circuit



WT. .35 oz.

TYPE PC — Printed Circuit

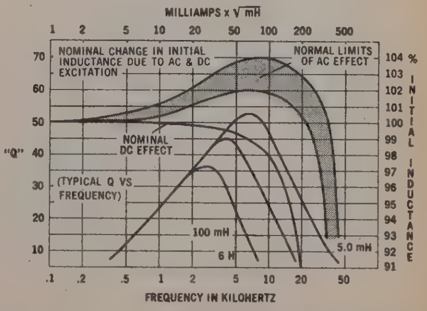


WT. .35 oz.

CORE NO. 57

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 10 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
2.0	57-1	0.48	40
2.4	57-2	0.52	40
3.0	57-3	0.74	42
3.6	57-4	0.81	42
4.3	57-5	1.11	42
5.0	57-6	1.19	44
6.0	57-7	1.31	44
7.2	57-8	1.43	44
8.6	57-9	1.56	46
10.0	57-10	2.19	46
12.0	57-11	2.40	46
15.0	57-12	3.40	46
17.5	57-13	3.66	48
20.0	57-14	4.84	48
24.0	57-15	5.30	50
30.0	57-16	7.29	50
36.0	57-17	7.99	52
43.0	57-18	8.73	52
50.0	57-19	11.60	54
60.0	57-20	12.70	54
72.0	57-21	13.90	56
86.0	57-22	18.80	56
100.0	57-23	20.30	56
120.0	57-24	28.00	58
150.0	57-25	31.30	58
175.0	57-26	42.60	60
200.0	57-27	45.50	62
240.0	57-28	49.80	62
300.0	57-29	74.10	64
360.0	57-30	81.20	64
430.0	57-31	115.00	64
500.0	57-32	124.00	66
600.0	57-33	136.00	66
720.0	57-34	186.00	66
860.0	57-35	203.00	68
1.00 H	57-36	219.00	68
1.20 H	57-37	303.00	70
1.50 H	57-38	338.00	72
1.75 H	57-39	366.00	72
2.00 H	57-40	492.00	74
2.40 H	57-41	682.00	74
3.00 H	57-42	762.00	74
3.60 H	57-43	835.00	76
4.30 H	57-44	1160.00	76
5.00 H	57-45	1250.00	76



TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

TOROIDAL INDUCTORS

Studs are available on the "M" Series on special request.

Mechanical Tolerance: ±.015 unless otherwise indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.
EXAMPLE: PS 90-1
CASE TYPE — PS; PART NUMBER — 90-1

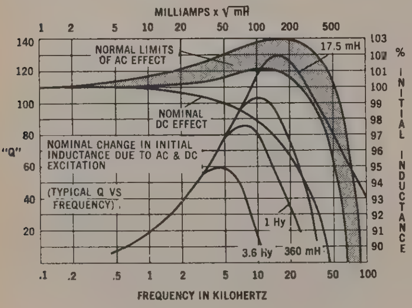
CORE NO. 90

Recommended Frequency: Up to 50 KHz.

Maximum Inductance: 9 H.

Special Core Stabilization: D, L, M, W.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
3.0	90-1	1.10	34
3.6	90-2	1.20	35
4.0	90-3	1.61	35
4.3	90-4	1.67	36
5.0	90-5	1.80	36
6.0	90-6	1.97	36
7.2	90-7	2.70	37
7.5	90-8	2.75	37
8.6	90-9	2.95	37
10.0	90-10	3.82	38
12.0	90-11	4.19	38
12.5	90-12	4.28	38
15.0	90-13	4.68	38
17.5	90-14	6.15	39
20.0	90-15	6.57	39
24.0	90-16	9.18	39
25.0	90-17	9.36	39
30.0	90-18	10.30	40
36.0	90-19	11.30	40
40.0	90-20	15.10	40
43.0	90-21	15.70	41
50.0	90-22	16.90	41
60.0	90-23	18.50	42
72.0	90-24	25.40	42
75.0	90-25	25.90	43
86.0	90-26	27.70	43
100.0	90-27	29.90	44
120.0	90-28	42.30	45
125.0	90-29	43.10	45
150.0	90-30	47.20	46
175.0	90-31	63.00	46
200.0	90-32	67.50	47
240.0	90-33	74.00	47
250.0	90-34	75.50	48
300.0	90-35	104.00	48
360.0	90-36	114.00	49
400.0	90-37	120.00	49
430.0	90-38	165.00	50
500.0	90-39	178.00	50
600.0	90-40	195.00	50
720.0	90-41	264.00	51
750.0	90-42	270.00	51
860.0	90-43	288.00	52
1.00 H	90-44	312.00	52
1.20 H	90-45	480.00	53
1.25 H	90-46	490.00	53
1.50 H	90-47	610.00	54
1.75 H	90-48	659.00	54
2.00 H	90-49	705.00	55
2.40 H	90-50	772.00	55
2.50 H	90-51	788.00	56
3.00 H	90-52	1090.00	56
3.60 H	90-53	1190.00	57
4.00 H	90-54	1522.00	57
5.00 H	90-55	1705.00	58
6.00 H	90-56	2420.00	58



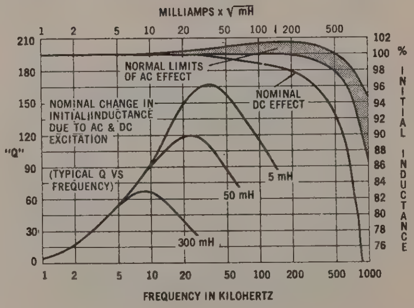
CORE NO. 89

Recommended Frequency: Up to 200 KHz.

Maximum Inductance: 1.5 H.

Special Core Stabilization: D, L, M, W

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
1.50	89-1	1.12	27
1:75	89-2	1.20	27
2.00	89-3	1.63	28
2.40	89-4	1.89	28
3.00	89-5	2.00	29
3.60	89-6	2.74	29
4.30	89-7	2.98	30
5.00	89-8	3.87	31
6.00	89-9	4.24	31
7.20	89-10	4.65	32
8.60	89-11	6.18	32
10.00	89-12	6.67	33
12.00	89-13	9.30	33
15.00	89-14	10.40	34
17.50	89-15	11.20	34
20.00	89-16	15.20	35
24.00	89-17	16.70	35
30.00	89-18	18.70	36
36.00	89-19	25.80	36
43.00	89-20	28.20	37
50.00	89-21	30.40	37
60.00	89-22	42.80	38
72.00	89-23	46.80	38
86.00	89-24	62.50	39
100.00	89-25	68.50	39
120.00	89-26	74.90	40
150.00	89-27	105.00	41
175.00	89-28	114.00	42
200.00	89-29	122.00	43
240.00	89-30	177.00	44
300.00	89-31	197.00	45
360.00	89-32	268.00	46
430.00	89-33	292.00	47
500.00	89-34	315.00	48
600.00	89-35	422.00	49



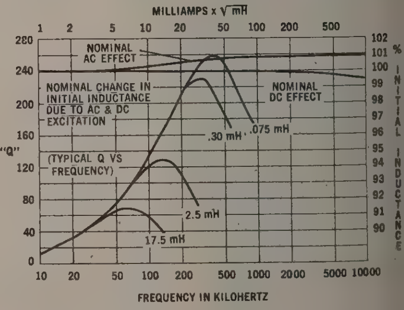
CORE NO. 68

Recommended Frequency: 50 KHz to 2 MHz.

Maximum Inductance: 30 mH.

Only Core Stabilization Available: ±90 PPM/°C.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
0.075	68-1	0.40	9
0.086	68-2	0.54	9
0.100	68-3	0.59	9
0.120	68-4	0.64	9
0.125	68-5	0.65	10
0.150	68-6	0.83	10
0.175	68-7	0.90	10
0.200	68-8	0.96	10
0.240	68-9	1.31	10
0.250	68-10	1.34	10
0.300	68-11	1.47	10
0.360	68-12	1.95	10
0.400	68-13	2.06	10
0.430	68-14	2.14	10
0.500	68-15	2.30	10
0.600	68-16	3.25	11
0.720	68-17	3.56	11
0.750	68-18	3.64	11
0.860	68-19	3.90	11
1.000	68-20	5.02	11
1.200	68-21	5.50	11
1.250	68-22	5.62	11
1.500	68-23	6.15	11
1.750	68-24	8.53	11
2.000	68-25	9.10	11
2.400	68-26	9.98	12
2.500	68-27	10.20	12
3.000	68-28	14.10	12
3.600	68-29	15.50	12
4.000	68-30	16.30	12
4.300	68-31	16.90	12
5.000	68-32	23.40	12
6.000	68-33	25.60	13
7.200	68-34	33.40	13
7.500	68-35	34.00	13
8.600	68-36	36.40	13
10.000	68-37	39.30	13
12.000	68-38	55.50	14
12.500	68-39	56.70	14
15.000	68-40	75.80	15
17.500	68-41	81.80	15



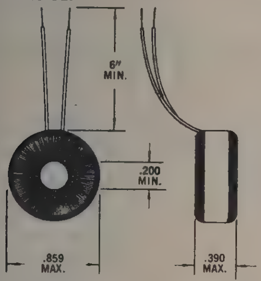
INDUCTORS

TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TOROIDAL INDUCTORS

TYPE U — Uncased

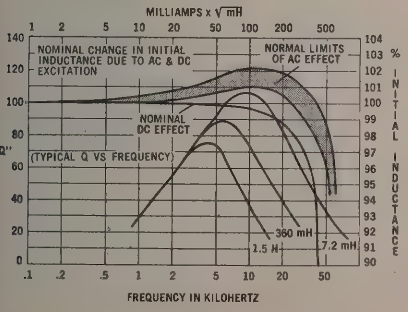
WT. .45 OZ.



CORE NO. 91

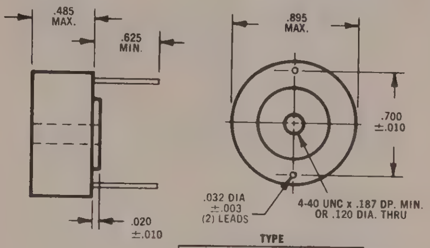
Recommended Frequency: Up to 30 KHz.
Maximum Inductance: 11 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
3.0	91-1	0.96	36
3.6	91-2	1.05	36
4.3	91-3	1.14	36
5.0	91-4	1.23	36
6.0	91-5	1.73	38
7.2	91-6	1.90	38
8.6	91-7	2.60	38
10.0	91-8	2.80	38
12.0	91-9	3.07	38
15.0	91-10	4.02	40
17.5	91-11	4.34	40
20.0	91-12	4.64	40
24.0	91-13	6.50	42
30.0	91-14	7.26	42
36.0	91-15	10.00	42
43.0	91-16	10.90	44
50.0	91-17	11.80	44
60.0	91-18	16.30	46
72.0	91-19	17.90	46
86.0	91-20	19.50	46
100.0	91-21	26.60	46
120.0	91-22	29.10	48
150.0	91-23	41.30	48
175.0	91-24	44.60	48
200.0	91-25	47.70	50
240.0	91-26	52.20	50
300.0	91-27	73.10	52
360.0	91-28	80.10	52
430.0	91-29	110.00	54
500.0	91-30	119.00	54
600.0	91-31	170.00	54
720.0	91-32	186.00	56
860.0	91-33	204.00	56
1.00 H	91-34	278.00	58
1.20 H	91-35	305.00	58
1.50 H	91-36	423.00	58
1.75 H	91-37	457.00	60
2.00 H	91-38	489.00	60
2.40 H	91-39	680.00	62
3.00 H	91-40	760.00	62
3.60 H	91-41	833.00	62
4.30 H	91-42	1130.00	64
5.00 H	91-43	1570.00	64
6.00 H	91-44	1720.00	66



TYPE PS/PF/PFC/PSC — Printed Circuit

WT. .8 OZ.



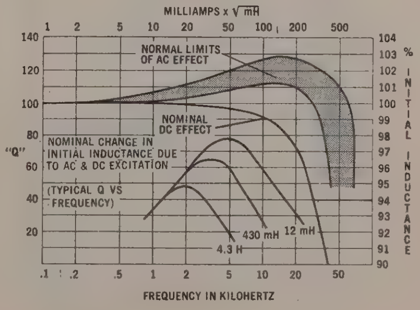
TYPE PREFIX TABLE

4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

CORE NO. 92

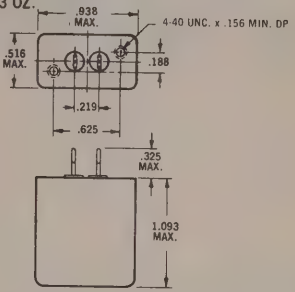
Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 14 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
3.6	92-1	0.93	40
4.3	92-2	1.02	42
5.0	92-3	1.10	42
6.0	92-4	1.20	44
7.2	92-5	1.70	44
8.6	92-6	1.85	44
10.0	92-7	2.51	46
12.0	92-8	2.74	46
15.0	92-9	3.07	46
17.5	92-10	3.88	48
20.0	92-11	4.15	48
24.0	92-12	4.55	50
30.0	92-13	6.50	50
36.0	92-14	7.12	52
43.0	92-15	9.76	52
50.0	92-16	10.50	54
60.0	92-17	11.50	54
72.0	92-18	16.00	54
86.0	92-19	17.50	56
100.0	92-20	18.80	56
120.0	92-21	26.10	56
150.0	92-22	29.10	58
175.0	92-23	39.90	58
200.0	92-24	42.70	60
240.0	92-25	46.70	60
300.0	92-26	52.20	62
360.0	92-27	71.60	62
430.0	92-28	78.30	64
500.0	92-29	106.00	64
600.0	92-30	116.00	64
720.0	92-31	167.00	66
860.0	92-32	182.00	66
1.00 H	92-33	196.00	68
1.20 H	92-34	273.00	68
1.50 H	92-35	305.00	70
1.75 H	92-36	409.00	72
2.00 H	92-37	437.00	72
2.40 H	92-38	479.00	74
3.00 H	92-39	680.00	74
3.60 H	92-40	745.00	74
4.30 H	92-41	814.00	76
5.00 H	92-42	1090.00	76
6.00 H	92-43	1540.00	78
7.20 H	92-44	1690.00	80



TYPE M — Metal Cased

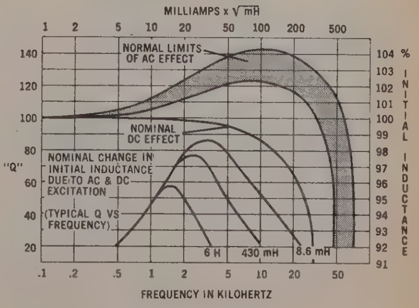
WT. 1.3 OZ.



CORE NO. 93

Recommended Frequency: Up to 10 KHz.
Maximum Inductance: 20 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
5.0	93-1	0.90	46
6.0	93-2	0.98	46
7.2	93-3	1.08	46
8.6	93-4	1.18	48
10.0	93-5	1.63	48
12.0	93-6	1.78	50
15.0	93-7	2.50	52
17.5	93-8	2.70	52
20.0	93-9	2.89	54
24.0	93-10	3.70	54
30.0	93-11	4.14	54
36.0	93-12	4.54	56
43.0	93-13	6.35	56
50.0	93-14	6.84	58
60.0	93-15	9.41	58
72.0	93-16	10.30	60
86.0	93-17	11.30	62
100.0	93-18	15.40	62
120.0	93-19	16.80	62
150.0	93-20	18.80	64
175.0	93-21	25.70	64
200.0	93-22	27.40	66
240.0	93-23	30.00	66
300.0	93-24	42.60	68
360.0	93-25	46.70	68
430.0	93-26	51.00	68
500.0	93-27	68.80	70
600.0	93-28	75.40	70
720.0	93-29	104.00	72
860.0	93-30	114.00	72
1.00 H	93-31	160.00	74
1.20 H	93-32	175.00	74
1.50 H	93-33	196.00	76
1.75 H	93-34	269.00	76
2.00 H	93-35	287.00	76
2.40 H	93-36	315.00	78
3.00 H	93-37	436.00	80
3.60 H	93-38	478.00	82
4.30 H	93-39	664.00	82
5.00 H	93-40	716.00	84
6.00 H	93-41	784.00	86
7.20 H	93-42	1070.00	86
8.60 H	93-43	1170.00	88
10.00 H	93-44	1620.00	90



TOROTEL PRODUCTS INC.
13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

TOROIDAL INDUCTORS

Studs are available on the "M" Series on special request.

Mechanical Tolerance: ±.015 unless otherwise indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†
EXAMPLE: U 24-1
CASE TYPE — U
PART NUMBER — 24-1

† Add "C" to Part Number of molded inductor if clearance hole is desired.

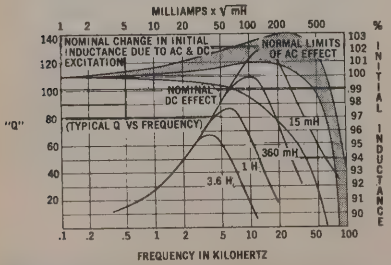
CORE NO. 06

Recommended Frequency: Up to 30 KHz

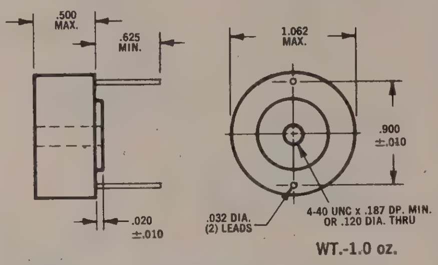
Maximum Inductance: 7.2 H.

Special Core Stabilization Available: B, D, L, M, W.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
5.0	06-1	1.05	40
6.0	06-40	1.26	42
7.2	06-41	1.51	43
7.5	06-2	1.58	43
8.6	06-42	1.80	43
10.0	06-3	2.10	44
12.0	06-43	2.52	44
12.5	06-4	2.63	44
15.0	06-5	3.15	44
17.5	06-44	3.67	45
20.0	06-6	4.20	45
24.0	06-45	5.04	45
25.0	06-7	5.25	46
30.0	06-8	6.30	46
36.0	06-46	7.56	47
40.0	06-9	8.40	48
43.0	06-47	9.03	48
50.0	06-10	10.50	48
60.0	06-48	12.60	49
72.0	06-49	15.10	49
75.0	06-11	15.80	49
86.0	06-50	18.00	49
100.0	06-12	21.00	50
120.0	06-51	25.20	50
125.0	06-13	26.30	51
150.0	06-14	31.50	51
175.0	06-53	36.80	51
200.0	06-15	42.00	52
240.0	06-54	50.40	52
250.0	06-52	52.50	52
300.0	06-16	63.00	53
360.0	06-55	75.60	53
400.0	06-17	84.00	54
430.0	06-56	90.30	54
500.0	06-18	105.00	55
600.0	06-57	126.00	55
720.0	06-58	151.00	55
750.0	06-19	158.00	56
860.0	06-59	180.00	56
1.00 H	06-20	210.00	57
1.20 H	06-60	252.00	57
1.25 H	06-21	263.00	57
1.50 H	06-22	315.00	58
1.75 H	06-61	368.00	58
2.00 H	06-23	420.00	58
2.40 H	06-62	504.00	59
2.50 H	06-69	525.00	59
3.00 H	06-24	630.00	59
3.60 H	06-70	756.00	60
4.30 H	06-71	840.00	60
5.00 H	06-72	903.00	61
6.00 H	06-73	1260.00	62
7.20 H	06-74	1512.00	62



TYPE PS/PF/PFC/PSC — P.C. Mount



TYPE

PREFIX TABLE		
4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

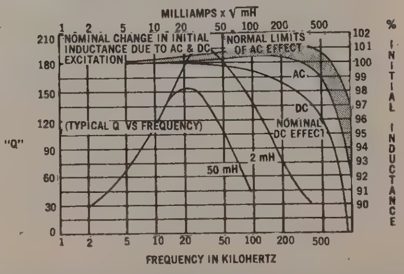
CORE NO. 48

Recommended Frequency: Up to 100 KHz.

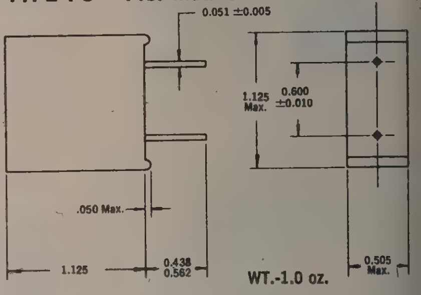
Maximum Inductance: 1 H.

Special Core Stabilization Available: B, D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
2.0	48-1	0.84	30
2.4	48-2	1.01	31
3.0	48-3	1.26	31
3.6	48-4	1.51	32
4.3	48-5	1.80	32
5.0	48-6	2.10	33
6.0	48-7	2.50	33
7.2	48-8	3.02	34
8.6	48-9	3.61	34
10.0	48-10	4.20	35
12.0	48-11	5.05	35
15.0	48-12	6.30	36
17.5	48-13	7.35	36
20.0	48-14	8.40	37
24.0	48-15	10.10	37
30.0	48-16	12.60	38
36.0	48-17	15.10	39
43.0	48-18	18.00	39
50.0	48-19	21.00	40
60.0	48-20	25.20	41
72.0	48-21	30.20	42
86.0	48-22	36.10	43
100.0	48-23	42.00	44
120.0	48-24	50.40	45
150.0	48-25	63.00	46
175.0	48-26	73.50	47
200.0	48-27	84.00	48
240.0	48-28	101.00	49
300.0	48-29	126.00	50
360.0	48-30	151.00	51
430.0	48-31	180.00	52
500.0	48-32	210.00	53
600.0	48-33	252.00	54



TYPE PC — P.C. Mount



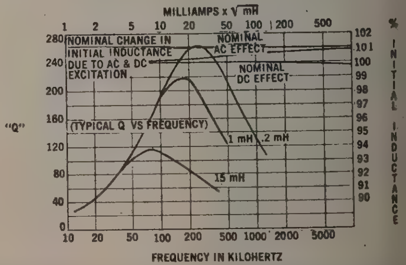
CORE NO. 74

Recommended Frequency: 25 KHz to 1 MHz.

Maximum Inductance: 30 mH.

Only Core Stabilization Available: H.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
0.100	74-1	0.31	18
0.120	74-2	0.36	18
0.125	74-3	0.39	19
0.150	74-4	0.46	19
0.175	74-5	0.55	20
0.200	74-6	0.62	20
0.240	74-7	0.74	20
0.250	74-8	0.77	21
0.300	74-9	0.92	21
0.360	74-10	1.11	21
0.400	74-11	1.23	21
0.430	74-12	1.33	22
0.500	74-13	1.54	22
0.600	74-14	1.85	22
0.720	74-15	2.21	23
0.750	74-16	2.31	23
0.860	74-17	2.65	23
1.000	74-18	3.08	23
1.200	74-19	3.60	24
1.250	74-20	3.80	24
1.500	74-21	4.60	24
1.750	74-22	5.50	25
2.000	74-23	6.20	25
2.400	74-24	7.40	25
2.500	74-25	7.70	26
3.000	74-26	9.20	26
3.600	74-27	11.10	27
4.000	74-28	12.30	27
4.300	74-29	13.30	28
5.000	74-30	15.40	28
6.000	74-31	18.50	29
7.200	74-32	22.10	29
7.500	74-33	23.10	30
8.600	74-34	26.50	30
10.000	74-35	30.80	31
12.000	74-36	36.90	32
12.250	74-37	38.50	33
15.000	74-38	46.20	33
17.500	74-39	53.90	34
20.000	74-40	61.60	35

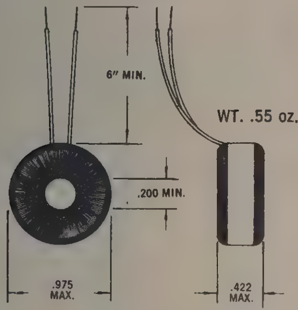


INDUCTORS

TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

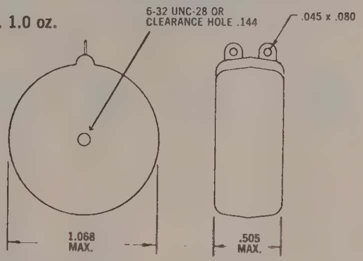
TOROIDAL INDUCTORS

TYPE U — Uncased

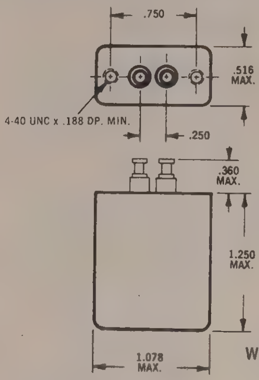


TYPE P — Compression Molded

WT. 1.0 oz.



TYPE M — Metal Cased

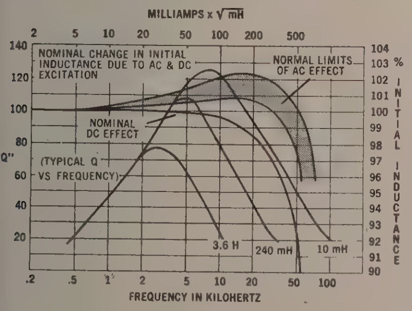


WT. 1.5 oz.

CORE NO. 24

Recommended Frequency: Up to 20 KHz
Maximum Inductance: 12 H.
Special Core Stabilization: D, W, M, L.

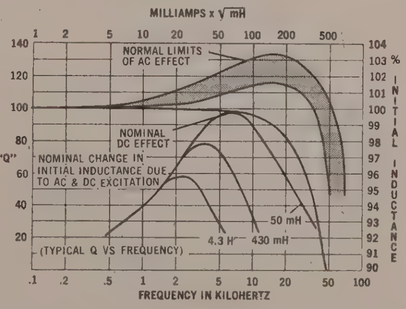
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
6.0	24-1	0.88	40
7.2	24-2	0.97	40
8.6	24-3	1.33	42
10.0	24-4	1.44	42
12.0	24-5	1.80	42
15.0	24-6	2.01	44
17.5	24-7	2.74	44
20.0	24-8	2.93	44
24.0	24-9	3.21	44
30.0	24-10	5.20	46
36.0	24-11	5.70	46
43.0	24-12	6.23	46
50.0	24-13	8.31	46
60.0	24-14	9.10	48
72.0	24-15	9.97	48
86.0	24-16	13.50	48
100.0	24-17	14.50	50
120.0	24-18	20.00	50
150.0	24-19	22.40	50
175.0	24-20	30.80	52
200.0	24-21	32.90	52
240.0	24-22	36.10	52
300.0	24-23	52.50	54
360.0	24-24	57.50	54
430.0	24-25	62.90	56
500.0	24-26	87.00	56
600.0	24-27	95.30	56
720.0	24-28	104.00	58
860.0	24-29	142.00	58
1.00 H	24-30	153.00	58
1.20 H	24-31	212.00	60
1.50 H	24-32	237.00	62
1.75 H	24-33	256.00	62
2.00 H	24-34	345.00	64
2.40 H	24-35	376.00	64
3.00 H	24-36	522.00	64
3.60 H	24-37	572.00	66
4.30 H	24-38	768.00	66
5.00 H	24-39	861.00	68
6.00 H	24-40	1150.00	68
7.20 H	24-41	1260.00	68
8.60 H	24-42	1740.00	70



CORE NO. 23

Recommended Frequency Up to 15 KHz.
Maximum Inductance: 15 H.
Special Core Stabilization: D, W, M, L.

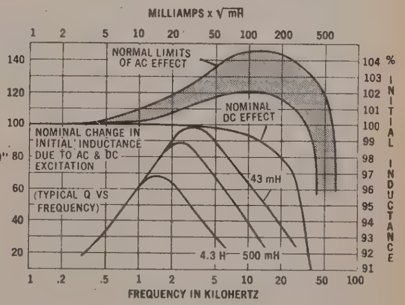
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	23-1	0.86	44
8.6	23-2	0.94	44
10.0	22-3	1.29	44
12.0	23-4	1.41	46
15.0	23-5	1.80	46
17.5	23-6	1.95	46
20.0	23-7	2.08	46
24.0	23-8	2.87	48
30.0	23-9	3.21	48
36.0	23-10	5.09	48
43.0	23-11	5.56	48
50.0	23-12	6.00	48
60.0	23-13	8.13	50
72.0	23-14	8.91	50
86.0	23-15	9.73	50
100.0	23-16	13.00	52
120.0	23-17	14.20	52
150.0	23-18	20.00	54
175.0	23-19	21.60	54
200.0	23-20	23.10	54
240.0	23-21	32.20	56
300.0	23-22	36.00	56
360.0	23-23	51.40	58
430.0	23-24	56.20	58
500.0	23-25	60.60	60
600.0	23-26	85.20	60
720.0	23-27	93.30	62
860.0	23-28	102.00	64
1.00 H	23-29	137.00	64
1.20 H	23-30	150.00	66
1.50 H	23-31	211.00	66
1.75 H	23-32	228.00	68
2.00 H	23-33	244.00	68
2.40 H	23-34	336.00	68
3.00 H	23-35	376.00	70
3.60 H	23-36	511.00	72
4.30 H	23-37	559.00	74
5.00 H	23-38	602.00	74
6.00 H	23-39	842.00	76
7.20 H	23-40	1130.00	78
8.60 H	23-41	1230.00	80
10.00 H	23-42	1680.00	82



CORE NO. 21

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 20 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
10.0	21-1	0.83	50
12.0	21-2	0.91	52
15.0	21-3	1.29	52
17.5	21-4	1.39	54
20.0	21-5	1.70	54
24.0	21-6	1.86	54
30.0	21-7	2.08	56
36.0	21-8	2.87	56
43.0	21-9	3.14	58
50.0	21-10	4.91	58
60.0	21-11	5.38	60
72.0	21-12	5.89	60
86.0	21-13	7.96	62
100.0	21-14	8.58	62
120.0	21-15	9.40	64
150.0	21-16	13.00	64
175.0	21-17	14.00	64
200.0	21-18	15.00	66
240.0	21-19	20.70	66
300.0	21-20	23.20	66
360.0	21-21	32.30	68
430.0	21-22	35.20	68
500.0	21-23	38.00	70
600.0	21-24	54.30	70
720.0	21-25	59.40	72
860.0	21-26	83.40	74
1.00 H	21-27	90.00	74
1.20 H	21-28	98.50	76
1.50 H	21-29	137.00	76
1.75 H	21-30	148.00	76
2.00 H	21-31	199.00	78
2.40 H	21-32	219.00	78
3.00 H	21-33	244.00	80
3.60 H	21-34	337.00	80
4.30 H	21-35	368.00	82
5.00 H	21-36	492.00	84
6.00 H	21-37	540.00	84
7.20 H	21-38	591.00	86
8.60 H	21-39	825.00	86
10.00 H	21-40	1090.00	88
12.00 H	21-41	1190.00	88
15.00 H	21-42	1680.00	90

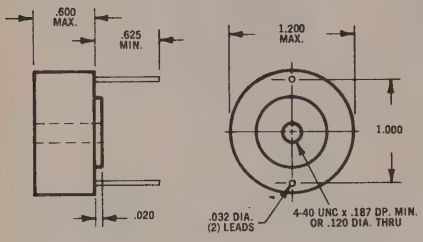


TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

TOROIDAL INDUCTORS

TYPE PS/PF/PFC/PSC

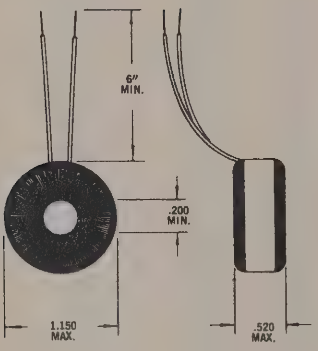


WT. 1.5 oz

TYPE PREFIX TABLE

4-40 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

TYPE U



WT. .82 oz.

Mech. Tol. = ±.010 unless indicated.

WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.

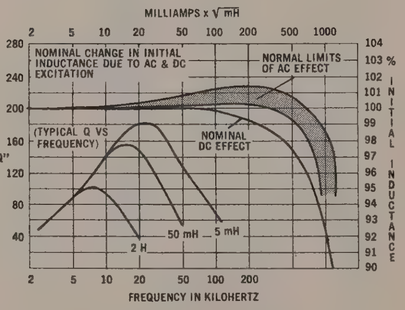
EXAMPLE: U 59-1

CASE TYPE — PART NUMBER

CORE NO. 59

Recommended Frequency: Up to 50 KHz.
Maximum Inductance: 5 H.
Special Core Stabilization: D, W, M, L.

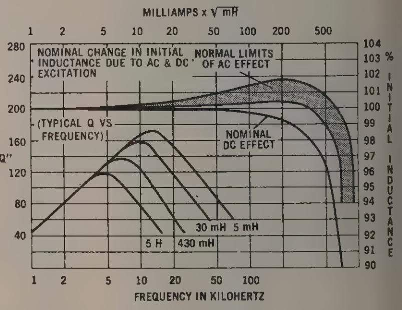
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
3.0	59-1	0.85	50
3.6	59-2	1.17	54
4.3	59-3	1.27	56
5.0	59-4	1.67	60
6.0	59-5	1.83	64
7.2	59-6	2.00	66
8.6	59-7	2.75	68
10.0	59-8	2.97	70
12.0	59-9	3.25	74
15.0	59-10	4.45	76
17.5	59-11	4.80	78
20.0	59-12	6.64	80
24.0	59-13	7.27	82
30.0	59-14	8.13	84
36.0	59-15	11.30	84
43.0	59-16	12.30	86
50.0	59-17	13.30	88
60.0	59-18	18.50	90
72.0	59-19	20.30	92
86.0	59-20	22.20	94
100.0	59-21	30.70	96
120.0	59-22	33.60	98
150.0	59-23	48.30	100
175.0	59-24	52.10	102
200.0	59-25	55.70	104
240.0	59-26	76.90	104
300.0	59-27	86.00	106
360.0	59-28	119.00	106
430.0	59-29	130.00	108
500.0	59-30	140.00	110
600.0	59-31	188.00	112
720.0	59-32	205.00	114
860.0	59-33	225.00	116
1.00 H	59-34	306.00	118
1.20 H	59-35	335.00	120
1.50 H	59-36	472.00	124
1.75 H	59-37	510.00	126
2.00 H	59-38	709.00	130
2.40 H	59-39	777.00	136
3.00 H	59-40	868.00	140
3.60 H	59-41	1200.00	150



CORE NO. 10

Recommended Frequency: Up to 25 KHz.
Maximum Inductance: 12 H.
Special Core Stabilization: D, W, M, L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	10-1	0.76	50
6.0	10-2	0.83	54
7.2	10-3	1.14	56
8.6	10-4	1.25	60
10.0	10-5	1.34	64
12.0	10-6	1.79	66
15.0	10-7	2.00	68
17.5	10-8	2.71	70
20.0	10-9	2.90	74
24.0	10-10	3.17	76
30.0	10-11	4.34	78
36.0	10-12	4.75	80
43.0	10-13	6.72	82
50.0	10-14	7.25	84
60.0	10-15	7.94	84
72.0	10-16	11.00	86
86.0	10-17	12.00	88
100.0	10-18	13.00	90
120.0	10-19	18.10	92
150.0	10-20	20.20	94
175.0	10-21	21.80	96
200.0	10-22	30.00	98
240.0	10-23	32.90	100
300.0	10-24	47.20	102
360.0	10-25	51.70	104
430.0	10-26	56.50	104
500.0	10-27	76.70	106
600.0	10-28	84.10	106
720.0	10-29	116.00	108
860.0	10-30	127.00	110
1.00 H	10-31	137.00	112
1.20 H	10-32	183.00	114
1.50 H	10-33	205.00	116
1.75 H	10-34	221.00	118
2.00 H	10-35	299.00	120
2.40 H	10-36	328.00	124
3.00 H	10-37	366.00	126
3.60 H	10-38	506.00	130
4.30 H	10-39	719.00	136
5.00 H	10-40	775.00	140
6.00 H	10-41	849.00	150
7.20 H	10-42	1170.00	156
8.60 H	10-43	1610.00	160



INDUCTORS

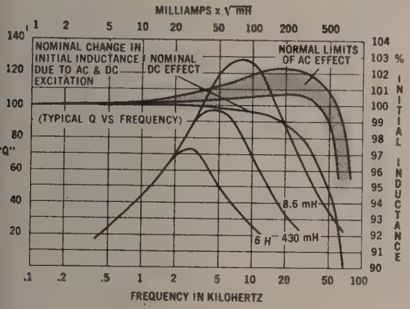
TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TOROIDAL INDUCTORS

CORE NO. 08

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 16 H.
Special Core Stabilization: D, W, M, L.

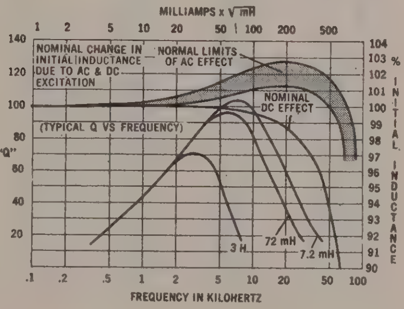
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
7.2	08-1	0.80	60
8.6	08-2	0.88	64
10.0	08-3	1.19	66
12.0	08-4	1.30	68
15.0	08-5	1.77	70
17.5	08-6	1.91	74
20.0	08-7	2.04	76
24.0	08-8	2.81	80
30.0	08-9	3.14	84
36.0	08-10	4.21	86
43.0	08-11	4.60	88
50.0	08-12	4.96	90
60.0	08-13	7.03	94
72.0	08-14	7.70	96
86.0	08-15	8.42	96
100.0	08-16	11.50	98
120.0	08-17	12.60	100
150.0	08-18	14.00	104
175.0	08-19	19.30	106
200.0	08-20	20.70	106
240.0	08-21	29.10	108
300.0	08-22	32.50	110
360.0	08-23	45.70	112
430.0	08-24	50.00	114
500.0	08-25	53.90	116
600.0	08-26	74.40	118
720.0	08-27	81.50	120
860.0	08-28	89.00	124
1.00 H	08-29	121.00	126
1.20 H	08-30	133.00	128
1.50 H	08-31	148.00	130
1.75 H	08-32	196.00	134
2.00 H	08-33	209.00	136
2.40 H	08-34	229.00	140
3.00 H	08-35	324.00	144
3.60 H	08-36	355.00	146
4.30 H	08-37	489.00	150
5.00 H	08-38	527.00	154
6.00 H	08-39	751.00	160
7.20 H	08-40	823.00	166
8.60 H	08-41	938.00	168
10.00 H	08-42	1220.00	170



CORE NO. 07

Recommended Frequency: Up to 15 KHz.
Maximum Inductance: 18 H.
Special Core Stabilization: D, W, M, L.

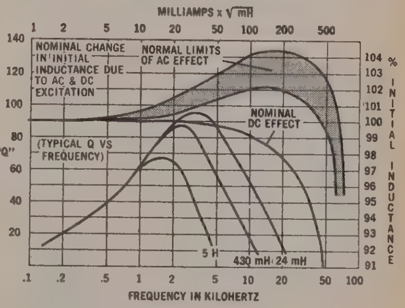
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
10.0	07-1	0.85	60
12.0	07-2	1.17	64
15.0	07-3	1.30	66
17.5	07-4	1.71	68
20.0	07-5	1.83	70
24.0	07-6	2.00	74
30.0	07-7	2.81	76
36.0	07-8	3.08	80
43.0	07-9	3.36	84
50.0	07-10	4.43	86
60.0	07-11	4.85	88
72.0	07-12	6.88	90
86.0	07-13	7.52	94
100.0	07-14	8.11	96
120.0	07-15	11.20	96
150.0	07-16	12.60	98
175.0	07-17	13.60	100
200.0	07-18	18.50	104
240.0	07-19	20.20	106
300.0	07-20	29.00	106
360.0	07-21	31.80	108
430.0	07-22	44.70	110
500.0	07-23	48.10	112
600.0	07-24	52.70	114
720.0	07-25	57.80	116
860.0	07-26	79.60	118
1.00 H	07-27	85.80	120
1.20 H	07-28	119.00	124
1.50 H	07-29	132.00	126
1.75 H	07-30	143.00	128
2.00 H	07-31	187.00	130
2.40 H	07-32	205.00	134
3.00 H	07-33	229.00	136
3.60 H	07-34	317.00	140
4.30 H	07-35	347.00	144
5.00 H	07-36	471.00	146
6.00 H	07-37	516.00	150
7.20 H	07-38	735.00	154
8.60 H	07-39	803.00	160
10.00 H	07-40	866.00	166
12.00 H	07-41	1200.00	170



CORE NO. 05

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 25 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
15.0	05-1	0.85	70
17.5	05-2	1.15	74
20.0	05-3	1.23	76
24.0	05-4	1.34	80
30.0	05-5	1.83	84
36.0	05-6	2.00	86
43.0	05-7	2.74	88
50.0	05-8	2.96	90
60.0	05-9	3.24	92
72.0	05-10	4.34	94
86.0	05-11	4.74	96
100.0	05-12	6.62	100
120.0	05-13	7.25	104
150.0	05-14	8.11	106
175.0	05-15	11.10	108
200.0	05-16	11.80	110
240.0	05-17	13.00	112
300.0	05-18	18.50	114
360.0	05-19	20.20	116
430.0	05-20	22.10	118
500.0	05-21	30.60	120
600.0	05-22	33.50	124
720.0	05-23	47.20	126
860.0	05-24	51.60	130
1.00 H	05-25	55.60	134
1.20 H	05-26	76.70	136
1.50 H	05-27	85.80	138
1.75 H	05-28	117.00	140
2.00 H	05-29	125.00	144
2.40 H	05-30	137.00	146
3.00 H	05-31	187.00	150
3.60 H	05-32	205.00	154
4.30 H	05-33	224.00	156
5.00 H	05-34	305.00	160
6.00 H	05-35	334.00	164
7.20 H	05-36	366.00	166
8.60 H	05-37	504.00	168
10.00 H	05-38	707.00	170
12.00 H	05-39	775.00	174
15.00 H	05-40	866.00	180
17.50 H	05-41	1180.00	186
20.00 H	05-42	1590.00	190

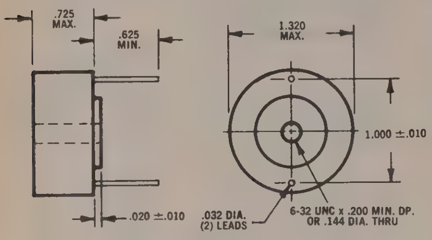


TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

INDUCTORS

TOROIDAL INDUCTORS

TYPE PS/PF/PSC/PFC—Printed Circuit

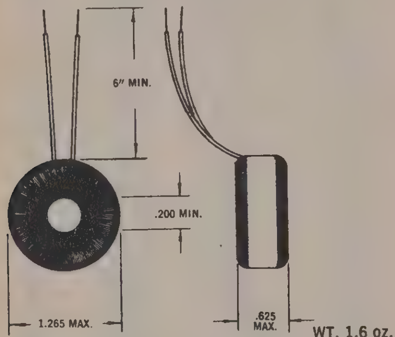


WT. 2.5 oz.

TYPE PREFIX TABLE

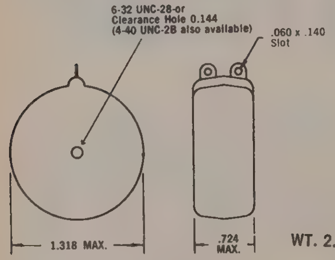
6-32 UNC	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

TYPE U—Uncased



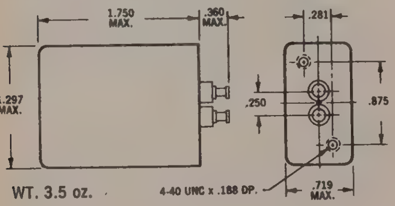
WT. 1.6 oz.

TYPE P—Compression Molded


6-32 UNC-28-or Clearance Hole 0.144 (4-40 UNC-2B also available)
.060 x .140 Slot
1.318 MAX.
.724 MAX.

WT. 2.5 oz.

TYPE M—Metal Cased



WT. 3.5 oz.

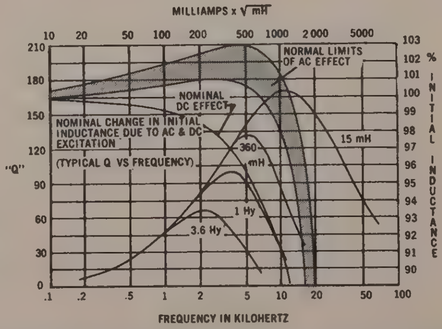
Mechanical Tolerance: ±.015 unless otherwise Indicated.

Studs are available on the "M" Series on special request.

CORE NO. 30

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 17.5 H.
Special Core Stabilization Available: B, D, L, M, W.

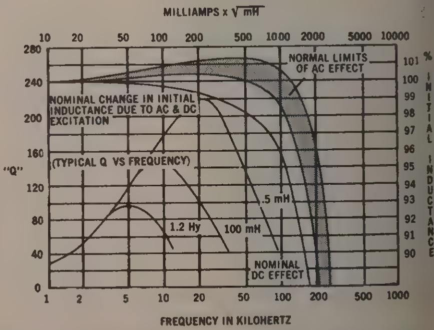
Inductance ±1% (mH)	Part Number	Typical DCR (ohms)	Typical Distributed Capacity (pf)
5.0	30-1	0.53	63
6.0	30-40	0.63	64
7.2	30-41	0.76	65
7.5	30-2	0.79	66
8.6	30-42	0.90	67
10.0	30-3	1.05	68
12.0	30-43	1.26	69
12.5	30-4	1.31	69
15.0	30-5	1.58	70
17.5	30-44	1.84	71
20.0	30-6	2.10	72
24.0	30-45	2.52	73
25.0	30-7	2.63	73
30.0	30-8	3.15	75
36.0	30-46	3.78	76
40.0	30-9	4.20	77
43.0	30-47	4.52	78
50.0	30-10	5.25	79
60.0	30-48	6.30	80
72.0	30-49	7.56	81
75.0	30-11	7.86	81
86.0	30-50	9.03	82
100.0	30-12	10.50	83
120.0	30-51	12.60	84
125.0	30-13	13.10	84
150.0	30-14	15.80	85
175.0	30-53	18.40	86
200.0	30-15	21.00	87
240.0	30-54	25.20	88
250.0	30-52	26.30	88
300.0	30-16	31.50	89
360.0	30-55	37.80	90
400.0	30-17	42.00	91
430.0	30-56	45.20	91
500.0	30-18	52.50	92
600.0	30-57	63.00	93
720.0	30-58	75.60	94
750.0	30-19	78.70	96
860.0	30-59	90.30	97
1.00 H	30-20	105.00	98
1.20 H	30-60	126.00	99
1.25 H	30-21	131.30	99
1.50 H	30-22	157.50	100
1.75 H	30-61	183.80	101
2.00 H	30-23	210.00	102
2.40 H	30 62	252.00	103
2.50 H	30-69	262.50	103
3.00 H	30-24	315.00	104
3.60 H	30-63	378.00	106
4.00 H	30-25	420.00	107
4.30 H	30-64	451.50	108
5.00 H	30-26	525.00	109
6.00 H	30-65	630.00	110
7.20 H	30-66	756.00	111
7.50 H	30-27	787.50	112
8.60 H	30-67	903.00	113
10.00 H	30-28	1050.00	114
12.00 H	30-68	1260.00	115
12.50 H	30-29	1312.50	116
15.00 H	30-30	1575.00	117
17.50 H	30-31	1837.50	118



CORE NO. 94

Recommended Frequency: Up to 75 KHz.
Maximum Inductance: 1 H.
Special Core Stabilization Available: B, D, M, W, L.

Inductance ±1% (mH)	Part Number	Typical DCR* (ohms)	Typical Distributed Capacity (pf)
5.0	94-1	1.05	32
6.0	94-2	1.26	32
7.2	94-3	1.51	33
7.5	94-4	1.58	34
8.6	94-5	1.80	35
10.0	94-6	2.10	35
12.0	94-7	2.52	36
12.5	94-8	2.63	37
15.0	94-9	3.15	38
17.5	94-10	3.67	39
20.0	94-11	4.20	40
24.0	94-12	5.04	41
25.0	94-13	5.25	41
30.0	94-14	6.30	42
36.0	94-15	7.56	43
40.0	94-16	8.40	44
43.0	94-17	9.03	44
50.0	94-18	10.50	45
60.0	94-19	12.60	46
72.0	94-20	15.10	46
75.0	94-21	15.80	47
86.0	94-22	18.00	47
100.0	94-23	21.00	48
120.0	94-24	25.20	49
125.0	94-25	26.30	49
150.0	94-26	31.50	50
175.0	94-27	36.80	51
200.0	94-28	42.00	52
240.0	94-29	50.40	53
250.0	94-30	52.50	54
300.0	94-31	63.00	54
360.0	94-32	75.60	56
400.0	94-33	84.00	57
430.0	94-34	90.00	57
500.0	94-35	105.00	57
600.0	94-36	126.00	58
720.0	94-37	151.00	58
750.0	94-38	158.00	59
860.0	94-39	181.00	59



INDUCTORS

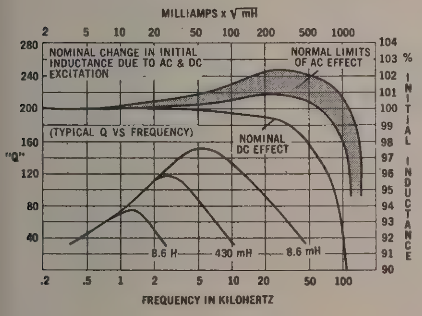
TOROTEL PRODUCTS INC./13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TOROIDAL INDUCTORS

CORE NO. 28

Recommended Frequency: Up to 35 KHz.
Maximum Inductance: 25 H.
Special Core Stabilization: D, W, M, L.

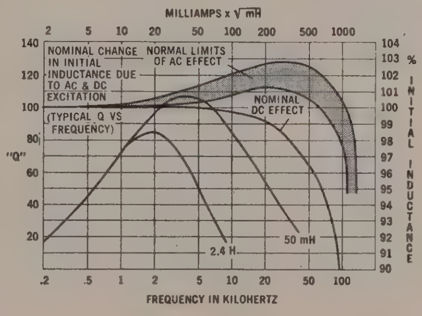
Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
7.2	28-1	0.64	60
8.6	28-2	0.70	64
10.0	28-3	0.97	66
12.0	28-4	1.06	68
15.0	28-5	1.19	70
17.5	28-6	1.66	74
20.0	28-7	1.78	76
24.0	28-8	1.95	78
30.0	28-9	2.57	80
36.0	28-10	2.82	84
43.0	28-11	3.86	86
50.0	28-12	4.16	88
60.0	28-13	4.55	90
72.0	28-14	6.33	94
86.0	28-15	6.91	96
100.0	28-16	9.36	98
120.0	28-17	10.30	100
150.0	28-18	11.50	102
175.0	28-19	16.20	104
200.0	28-20	17.30	106
240.0	28-21	18.90	108
300.0	28-22	26.50	110
360.0	28-23	29.00	114
430.0	28-24	31.70	116
500.0	28-25	42.10	118
600.0	28-26	46.20	120
720.0	28-27	64.50	124
860.0	28-28	70.50	126
1.00 H	28-29	93.90	128
1.20 H	28-30	103.00	130
1.50 H	28-31	115.00	134
1.75 H	28-32	154.00	136
2.00 H	28-33	164.00	140
2.40 H	28-34	229.00	144
3.00 H	28-35	256.00	146
3.60 H	28-36	281.00	148
4.30 H	28-37	388.00	150
5.00 H	28-38	419.00	152
6.00 H	28-39	510.00	154
7.20 H	28-40	624.00	156
8.60 H	28-41	682.00	158
10.00 H	28-42	930.00	160
12.00 H	28-43	1020.00	164
15.00 H	28-44	1440.00	166
17.50 H	28-45	1550.00	168
20.00 H	28-46	1660.00	170



CORE NO. 27

Recommended Frequency: Up to 20 KHz.
Maximum Inductance: 30 H.
Special Core Stabilization: D, W, M, L.

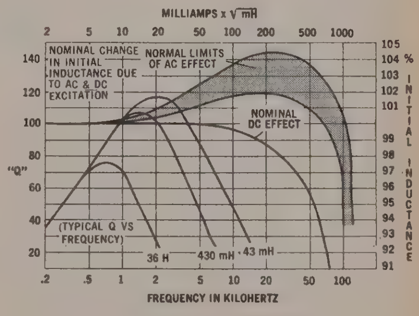
Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
8.6	27-1	0.63	60
10.0	27-2	0.68	64
12.0	27-3	0.95	66
15.0	27-4	1.06	68
17.5	27-5	1.15	70
20.0	27-6	1.59	74
24.0	27-7	1.74	76
30.0	27-8	1.95	78
36.0	27-9	2.52	80
43.0	27-10	2.76	84
50.0	27-11	2.97	86
60.0	27-12	4.07	88
72.0	27-13	4.46	90
86.0	27-14	6.18	94
100.0	27-15	6.67	96
120.0	27-16	7.30	98
150.0	27-17	10.30	100
175.0	27-18	11.10	102
200.0	27-19	15.50	104
240.0	27-20	16.90	106
300.0	27-21	18.90	108
360.0	27-22	26.00	110
430.0	27-23	28.40	114
500.0	27-24	37.70	116
600.0	27-25	41.30	118
720.0	27-26	45.30	120
860.0	27-27	63.10	124
1.00 H	27-28	68.00	126
1.20 H	27-29	74.50	128
1.50 H	27-30	103.00	130
1.75 H	27-31	111.00	134
2.00 H	27-32	147.00	136
2.40 H	27-33	161.00	140
3.00 H	27-34	229.00	144
3.60 H	27-35	251.00	146
4.30 H	27-36	274.00	148
5.00 H	27-37	374.00	150
6.00 H	27-38	410.00	152
7.20 H	27-39	559.00	154
8.60 H	27-40	611.00	156
10.00 H	27-41	659.00	158
12.00 H	27-42	912.00	160
15.00 H	27-43	1020.00	164
17.50 H	27-44	1390.00	166
20.00 H	27-45	1490.00	168
24.00 H	27-46	1630.00	170



CORE NO. 25

Recommended Frequency: Up to 5 KHz.
Maximum Inductance: 40 H.
Special Core Stabilization: L.

Inductance ±1% (mH)	Part Number	Typical	
		DCR (ohms)	Distributed Capacity (pf)
12.0	25-1	0.60	80
15.0	25-2	0.67	84
17.5	25-3	0.94	86
20.0	25-4	1.00	88
24.0	25-5	1.10	90
30.0	25-6	1.59	94
36.0	25-7	1.74	96
43.0	25-8	1.91	98
50.0	25-9	2.42	100
60.0	25-10	2.66	104
72.0	25-11	2.91	106
86.0	25-12	3.98	108
100.0	25-13	4.29	110
120.0	25-14	5.96	112
150.0	25-15	6.67	114
175.0	25-16	7.20	116
200.0	25-17	9.67	118
240.0	25-18	10.60	120
300.0	25-19	15.50	124
360.0	25-20	16.90	126
430.0	25-21	18.50	128
500.0	25-22	25.00	130
600.0	25-23	27.40	132
720.0	25-24	30.00	134
860.0	25-25	40.40	136
1.00 H	25-26	43.50	138
1.20 H	25-27	60.80	140
1.50 H	25-28	68.00	144
1.75 H	25-29	73.40	146
2.00 H	25-30	97.00	150
2.40 H	25-31	106.00	154
3.00 H	25-32	147.00	156
3.60 H	25-33	161.00	158
4.30 H	25-34	224.00	160
5.00 H	25-35	241.00	166
6.00 H	25-36	264.00	168
7.20 H	25-37	367.00	170
8.60 H	25-38	401.00	174
10.00 H	25-39	432.00	176
12.00 H	25-40	589.00	178
15.00 H	25-41	658.00	180
17.50 H	25-42	900.00	184
20.00 H	25-43	970.00	186
24.00 H	25-44	1060.00	190
30.00 H	25-45	1490.00	196
36.00 H	25-46	1630.00	200



WHEN ORDERING, ADD CASE PREFIX (TYPE) TO PART NUMBER.†
EXAMPLE: U 30-1
CASE TYPE — U
30-1 — PART NUMBER

† Add "C" to part number of molded inductor if clearance hole is desired.

Selection Guide for TRW High Q Coils and Chokes

HIGH Q

Over 40 years of specialization in High Q Inductors are reflected in the superior Q and temperature stability of the molybdenum permalloy dust toroid, ferrites, and laminated structures produced by TRW Inductive Products today. Range of application is from DC to 30 MHz.

This catalog lists many different types of stock inductors, but special custom designs produced to customers' specifications are available on special order. Characteristics such as taps, additional windings, special adjustments such as in a resonant circuit, higher voltage capability, inductance adjusted with DC, special mechanical configurations, and even better temperature stability than our stock items are available to customers' requirements.

WHILE THE TOROIDAL COIL is superior for frequencies above 1 kHz, the laminated structure is superior for lower frequencies. The ML, MO, and MQM uses a hum-reducing lamination structure and, in addition, the ML, and MQM are in hipermalloy shield cases.

The toroidal coils MS, MP, MM, MH, MW, FE, MQE have extremely low hum pickup due to the symmetrical winding on the toroidal core.

ALL STOCK INDUCTORS are measured at 0 DC. The maximum DC listings are for approximately 5% drop in inductance, and negligible heat rise. The typical curves of inductance variation with AC or DC currents, illustrated on the following pages, best show the range of operation for a particular inductor. The excitation is plotted in milliamperes × $\sqrt{\text{mHy}}$. For example, the 100 mHy MS toroid (MS-100) with 10 ma of DC flowing has an excitation factor of 10 ma × $\sqrt{100\text{ mHy}}$ = 100, and the curve shows that approximately 90 mHy will be measured with 10 ma DC.

Since these high Q coils will saturate before any appreciable temperature rises occur, heating is usually not a problem. A general rule would be that four times the DC listings may be applied without any detrimental heating due to copper loss.

FOR VARIABLE INDUCTORS such as HVC, TVC and VIC, the DC values listed apply at the mean to minimum inductance settings only. The maximum inductance cannot be obtained with that amount of DC current flowing.

Temperature stability of all TRW inductors is excellent. Guaranteed limits and typical curves of inductance variation with temperature are shown for most types.

Engineering, laboratory, and production facilities are available for full engineering discussion, sampling, and large quantity production to meet special requirements.

Intermediate inductance values in an existing stock toroidal series are available, priced as the next higher inductance unit.

HIGH Q INDUCTORS — FIXED

Type No.	Stock Line Inductance Range	Approx. DCR Ohm/Hy	Approximate		Inductance Tolerance Adjustment	Temp. Stability	MIL Gr.
			Peak Q	@ Freq.			
CH-100 thru CH-200	100 μHy-200 μHy	51,000	85	1500 kHz	±5% @ 1V, 500 kHz	±2%	4
CH-300 thru CH-1000	300 μHy-1000 μHy	42,000	85	790 kHz	±5% @ 1V, 250 kHz	±2%	4
CM	0.25 MHy-50 MHy	3300	120	200 kHz	±5% @ 1V, 10 kHz	±3%	4
FE	.01 Hy-2 Hy	200	125	8 kHz	±1% @ 1V, 1 kHz	±1.5%	5
LL	30 μHy-5000 μHy	1000	—	—	min.	—	5
MH	.6 MHy-40 MHy	2700	80	100 kHz	±2% @ .1V, 1 kHz	±1%	5
ML-0 thru ML-4	.15 Hy-1.4 Hy	150	22	1.5 kHz	±3% @ 1V, 1 kHz	within 2%	5
ML-5 thru ML-10	2.5 Hy-60 Hy	85	22	800 Hz	±3% @ 1V, 400 Hz	±2%	5
MM	3 MHy-120 MHy	1300	60	30 kHz	±2% @ .1V, 1 kHz	±2%	5
MO-.1 thru MO-1	.1 Hy-1 Hy	130	27	1.5 kHz	±2% @ 1V, 1 kHz	+1% −2%	5
MO-2 thru MO-100	2 Hy-100 Hy	65	25	600 Hz	±2% @ 1V, 400 Hz	+1% −3%	5
MP	100 MHy-750 MHy	600	45	10 kHz	±2% @ .1V, 1 kHz	±2%	5
MQE	4 MHy-2 Hy	170	140	8 kHz	±1% @ 1V, 1 kHz	±1%	4
MQL	.25 Hy-2500 Hy	5	45	100 Hz	±2% series @ 1V, 60 Hz parallel @ .5V, 60 Hz	<3%	4
MQM	.5 Hy-600 Hy	10	40	200 Hz	±2% series @ 1V, 60 Hz parallel @ .5V, 60 Hz	±2%	4
MS	1 MHy-100 MHy	1300	40	20 kHz	±2% @ .1V, 1 kHz	±2%	5
MW	.05 Hy-5 Hy	500	80	10 kHz	±1% @ 1V, 1 kHz	±1%	5

HIGH Q INDUCTORS — VARIABLE

Type No.	Mean Inductance Range	Variable Inductance Range	Temp. Stability	MIL Gr
HVC	.006 Hy-150 Hy	+200% −70% (10 to 1)	±1.5%	4
TVC*	.006 Hy-150 Hy	+200% −70% (10 to 1)	±1.5%	4
VIC	.0085 Hy-130 Hy	+85% −45% (3 to 1)	±3%	comml.

* Same as HVC but with taps @ 30, +50%

SR INDUCTORS — FIXED

Type No	Stock Line Inductance Range	DC Current Range	Approx. DCR Ohm/Hy	Inductance Tolerance Adjustment	MIL Gr
SRA	8 μHy-1250 μHy	up to 15A	510	+15%, −5% @ 1V, 10 kHz	5
SRB	20 μHy-3000 μHy	up to 15A	360	+15%, −5% @ 1V, 10 kHz	5
SRC	60 μHy-10,000 μHy	up to 13.6A	190	+15%, −5% @ 1V, 10 kHz	5
SRD	500 μHy-5.6 Hy	Up to 13A	63	+15%, −5% @ 1V, 10 kHz	5

High-Frequency High-Q Inductors

TRW

HIGH Q

PACKAGING Temperature stable inductors in a TO-5 metal case.

MIL SPECS CM to complete MIL-T-27D Specs. Type number TF4S20YY. CH to complete MIL-C-15305E Specs. Type: LT10K.

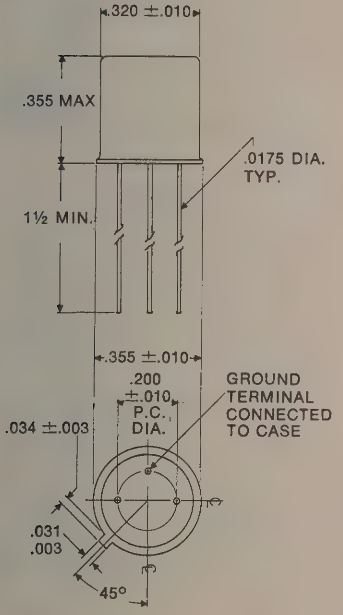
APPLICATION CM Series shielded inductors have Qs over 120, and cover a frequency range from 10 to 800 kHz. Peak Q is centered at approximately 150 kHz.

CH Series shielded inductors have Qs over 100, and cover a frequency range from 0.2 to 3.0 MHz. Peak Q is centered at approximately 1.5 MHz.

CURRENT RATINGS CM Series DC rating is for approximately 10% drop in inductance, with negligible heat rise. CH Series DC rating is for a 40°C maximum heat rise, with negligible drop in inductance.

Type No.	Inductance Tolerance at 25°C	Test Frequency, kHz	Test Level, RMS V	Max. L Variation, −55°C to +105°C
CM	±5%	10	1.0	±3%
CH-100 thru CH-200	±5%	500	1.0	±2%
CH-300 thru CH-1000	±5%	250	1.0	±2%

CM and CH Series

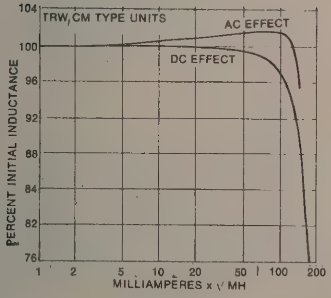


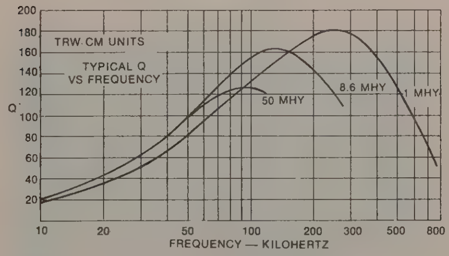
CM SERIES

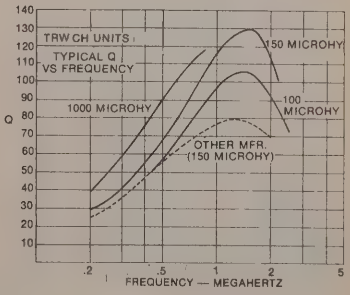
Type No.	Inductance at 0 DC, mHy	Max. DC Resistance, Ohms	Min. Q	Min. SRF, kHz	Max. DC Current, mA
CM-.25	0.25	0.9	120 @ 200 kHz	3000	260
CM-.50	0.50	1.8	120 @ 200 kHz	2100	180
CM-1.0	1.0	3.3	120 @ 200 kHz	1500	130
CM-1.5	1.5	4.8	120 @ 200 kHz	1160	105
CM-2.5	2.5	8.2	120 @ 150 kHz	900	83
CM-3.6	3.6	10	120 @ 150 kHz	730	70
CM-5.0	5.0	15	120 @ 150 kHz	600	59
CM-7.5	7.5	22	120 @ 100 kHz	470	48
CM-8.6	8.6	24	120 @ 100 kHz	430	45
CM-10	10	33	100 @ 100 kHz	400	41
CM-15	15	40	100 @ 100 kHz	320	34
CM-20	20	60	85 @ 70 kHz	280	29
CM-30	30	90	85 @ 70 kHz	220	24
CM-50	50	150	85 @ 70 kHz	165	18

CH SERIES

Type No.	MIL Part No.	Inductance at 0 DC, μHy	Max. DC Resistance, Ohms	Min. Q	Min. SRF, MHz	Max. DC Current, mA
CH-100	MS21358-44	100	5.1	85 @ 1500 kHz	7.5	191
CH-150	MS21358-45	150	6.6	85 @ 1500 kHz	5.5	168
CH-200	MS21358-46	200	9.5	85 @ 790 kHz	4.5	140
CH-300	MS21358-47	300	14	85 @ 790 kHz	3.4	115
CH-390	MS21358-48	390	16	85 @ 790 kHz	2.9	108
CH-500	MS21358-49	500	21	85 @ 790 kHz	2.6	94
CH-560	MS21358-50	560	23	85 @ 790 kHz	2.5	88
CH-680	MS21358-51	680	26	85 @ 790 kHz	2.1	85
CH-1000	MS21358-52	1000	43	60 @ 790 kHz	1.6	65







INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

Miniductor™ Series

PULSE

PACKAGING Hermetically sealed, MS, MM, MH, MP, MW, epoxy molded symmetrical toroids. ML hipermalloy shield cased, hum reducing laminated inductor. MO, epoxy molded hum reducing laminated inductor. All have straight pin terminals for printed circuit applications.

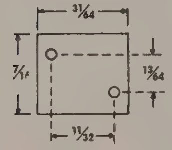
TERMINALS Per MIL-STD-1276.

MIL SPECS To complete MIL-T-27D Specs. MIL Type No. TF5R20ZZ.

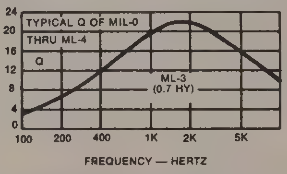
Type No.	Inductance Tolerance at 25°C	Test Frequency	Test Level RMS V	Max L Variation −55°C to +105°C
ML-0 thru 4	±3%	1 kHz	1.0	Within 2%
ML-5 thru 10	±3%	400 Hz	1.0	±2%
MO-.1 thru 1	±2%	1 kHz	1.0	+1% −2%
MO-2 thru 100	±2%	400 Hz	1.0	+1% −3%
MS	±2%	1 kHz	0.1	±2%
MP	±2%	1 kHz	0.1	±2%
MM	±2%	1 kHz	0.1	±2%
MH	±2%	1 kHz	0.1	±1%
MW	±1%	1 kHz	1.0	±1%

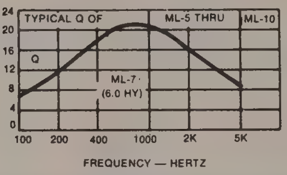
Laminated Types ML Series

TERMINAL LAYOUT

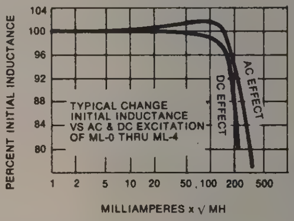


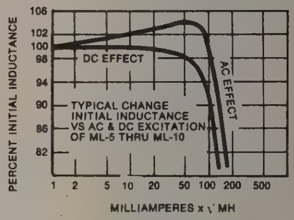
ML CASE
7/16" x 31/64" x 9/16" high
Weight: .2 oz.
TERMINALS: Type D — Tinned Dumet .025" Dia. x 1" long

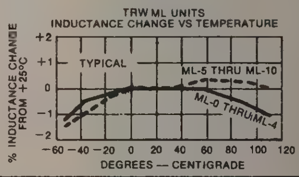




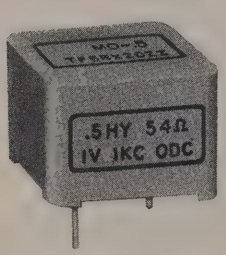
Type No.	MIL Part No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%
ML-0	M27/164-01	.15	12	33
ML-1	M27/164-02	.25	9	55
ML-2	M27/164-03	.4	7	90
ML-3	M27/164-04	.7	5	135
ML-4	M27/164-05	1.4	3	210
ML-5	M27/164-06	2.5	1	210
ML-6	M27/164-07	4.0	.7	340
ML-7	M27/164-08	6.0	.6	530
ML-8	M27/164-09	10	.5	850
ML-9	M27/164-10	25	.3	2300
ML-10	M27/164-11	60	.2	5160



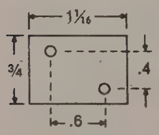




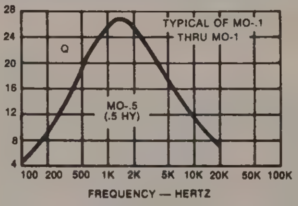
MO Series

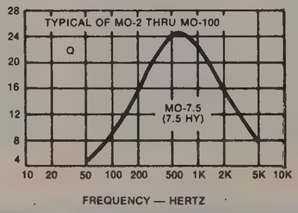


TERMINAL LAYOUT

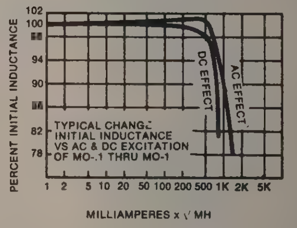


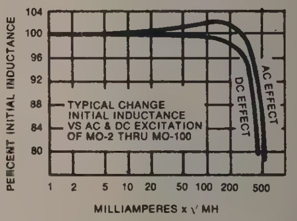
MO CASE
3/4" x 1 1/16" x 13/16" high
Weight: 1 oz.
TERMINALS: Tinned Dumet .040" Dia. x 9/32" long

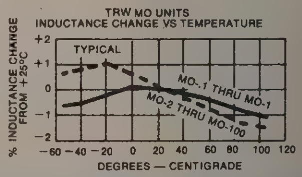




Type No.	MIL Part No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%
MO-.1	M27/168-01	.1	55	14
MO-.15	M27/168-02	.15	45	22
MO-.3	M27/168-03	.3	28	34
MO-.5	M27/168-04	.5	23	54
MO-1	M27/168-05	1	16	130
MO-2	M27/168-06	2	8	130
MO-5	M27/168-07	5	5	340
MO-7.5	M27/168-08	7.5	4.5	517
MO-20	M27/168-09	20	2.7	1310
MO-50	M27/168-10	50	1.4	3180
MO-100	M27/168-11	100	1.1	8550





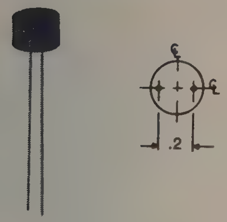


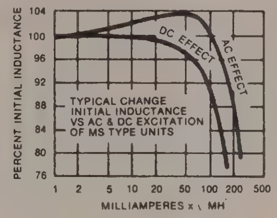
INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

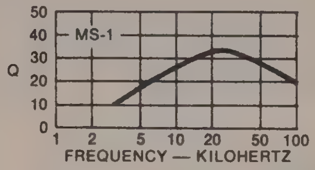
Miniductor™ Series

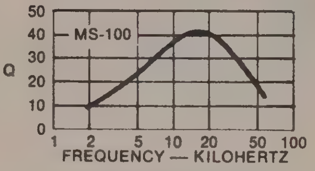
PULSE

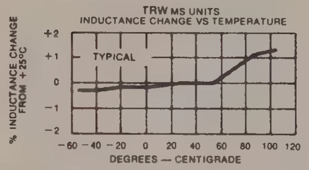
Toroidal Types MS Series







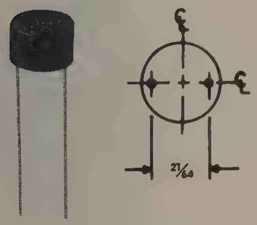


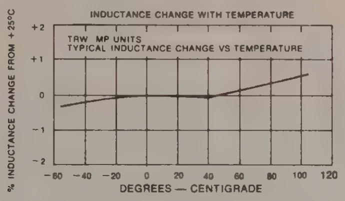


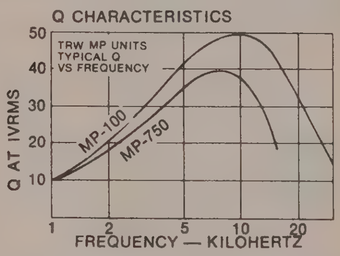
Type No.	MIL Part No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MS-1	M27/146-01	1	60	1.4
MS-5	M27/146-02	5	28	7
MS-10	M27/146-03	10	20	11
MS-25	M27/146-04	25	13	38
MS-50	M27/146-05	50	9	75
MS-100	M27/146-06	100	6	132

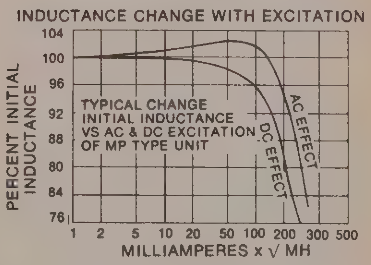
MS CASE
.35″ Dia. x .23″ high
Weight: 1.3 Gm.
TERMINALS: Type D — Tinned Dumet
.025″ Dia x 1¼″ long
MIL Type No. TF5R20ZZ

MP Series





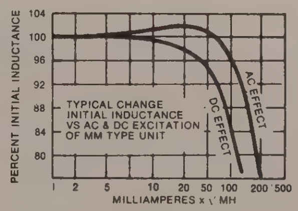


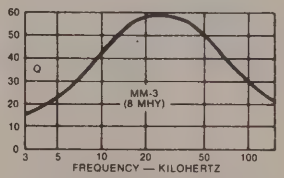


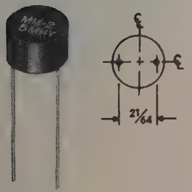
Type No.	MIL Part No.	Ind. mHy (0 DC)	ma DC Max.*	DCRΩ Max.
MP-100	M27/285-01	100	7.0	70
MP-150	M27/285-02	150	6.0	100
MP-250	M27/285-03	250	4.5	180
MP-350	M27/285-04	350	3.7	265
MP-500	M27/285-05	500	3.0	360
MP-750	M27/285-06	750	2.5	540

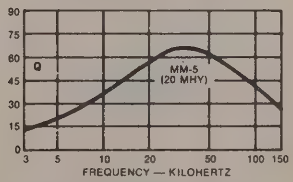
MP CASE
7/16″ Dia. x ¼″ high
Weight: .07 oz.
TERMINALS: Type D — Tinned Dumet
.025″ Dia. x 1¼″ long
MIL Type No. TF5R20ZZ

MM Series

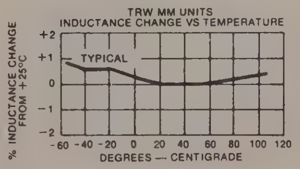








Type No.	MIL Part No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MM-1	M27/240-01	3	50	4.8
MM-2	M27/240-02	5	40	8.0
MM-3	M27/240-03	8	30	13
MM-4	M27/240-04	12.5	25	19
MM-5	M27/240-05	20	20	31
MM-6	M27/240-06	30	16	47
MM-7	M27/240-07	60	11	94
MM-8	M27/240-08	120	8	186



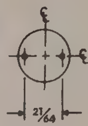
MM CASE
7/16″ Dia. x ¼″ high
Weight: .07 oz.
TERMINALS: Type D — Tinned Dumet
.025″ Dia. x 1¼″ long
MIL Type No. TF5R20ZZ

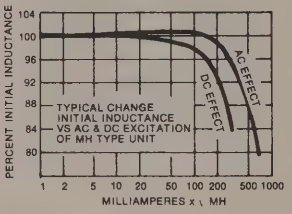
TRW

HIGH Q

Miniductor™ Series

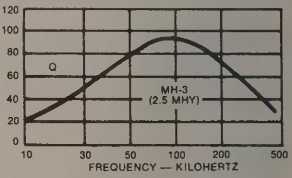
Toroidal Types MH Series

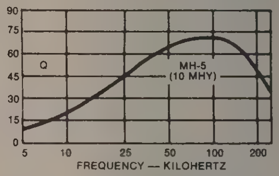


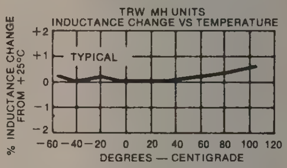


Type No.	MIL Part No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MH-1	M27/241-01	.6	90	1.9
MH-2	M27/241-02	1.5	57	4.9
MH-3	M27/241-03	2.5	44	8.2
MH-4	M27/241-04	6	28	19
MH-5	M27/241-05	10	22	32
MH-6	M27/241-06	15	18	49
MH-7	M27/241-07	25	14	82
MH-8	M27/241-08	40	11	130

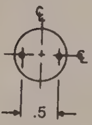
MH CASE
7/16″ Dia. x 1/4″ high
Weight: .07 oz.
TERMINALS: Type D — Tinned Dumet
.025″ Dia. x 1 1/4″ long
MIL Type No. TF5R20ZZ

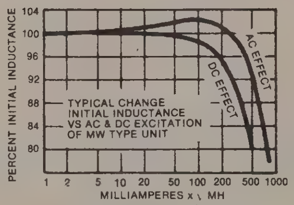






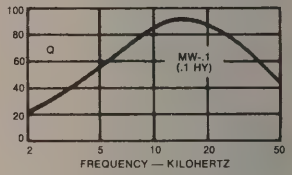
MW Series

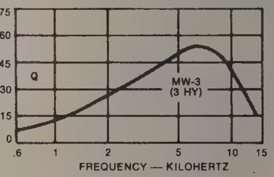


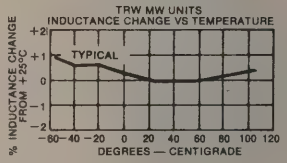


Type No.	MIL Part No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%
MW-.05	M27/161-01	.05	25	27
MW-.10	M27/161-02	.10	18	51
MW-.25	M27/161-03	.25	11	136
MW-.5	M27/161-04	.5	8	243
MW-.75	M27/161-05	.75	7	355
MW-1	M27/161-06	1.0	6	500
MW-1.2	M27/161-07	1.2	5	560
MW-2	M27/161-08	2	4	870
MW-3	M27/161-09	3	3.5	1340
MW-5	M27/161-10	5	3	2500

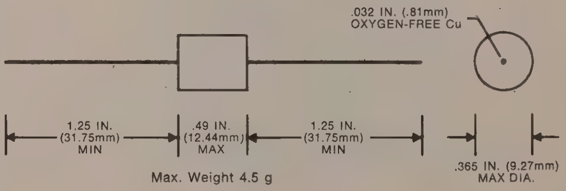
MW CASE
23/32″ Dia. x 13/32″ high
Weight: .25 oz.
TERMINALS: Type N-2 — Tinned Nickel
.040″ Dia. x 3/8″ long
MIL Type No. TF5R20ZZ



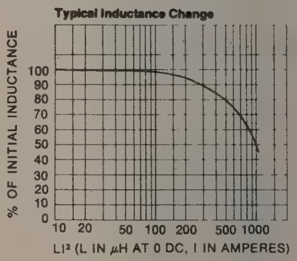




LL Series Power Inductor

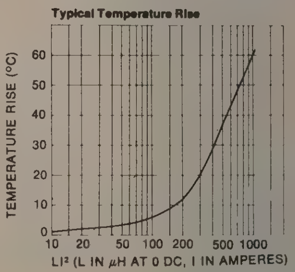


Max. Weight 4.5 g



Type	Inductance at 1 V, 20 kHz (µH)	Max. DCR (ohms)	Rated Current (amps)	MIL Part No.
LL-30	30	.035	3.0	M27/286-07
LL-50	50	.056	2.5	M27/286-08
LL-120	120	0.14	1.6	M27/286-01
LL-300	300	0.35	1.0	M27/286-02
LL-500	500	0.56	0.75	M27/286-03
LL-1200	1200	1.40	0.50	M27/286-04
LL-3000	3000	3.50	0.30	M27/286-05
LL-5000	5000	5.60	0.25	M27/286-06

- Mountable through PC board or to posts
- Inductance from 30 to 5000 µH
- Rated current range: 3.0 to 0.25 A
- Low inductance drop at rated current
- Less than 3/8 inch in diameter
- Suitable for reel-mounted assembly
- Manufactured to meet MIL-T-27
- MIL Type No. TF5R04ZZ



INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

HIGH Q

Hermetically Sealed High Q Coils

Low Frequency Laminated Inductors MQM Series

MQM CASE
1⁵⁄₁₆″ Dia. x 1⅝″ high
Weight: 5 oz.
Mounting Holes: 1⅛″ x 1⅛″
Screws: 4-40
Cutout: 1″ Dia.
MIL Type No. TF4R20YY

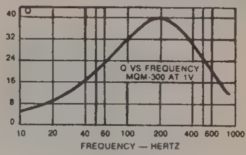
CONNECTIONS Two identical windings brought out to four terminals permit series, parallel, center tapped, or transformer type connections.

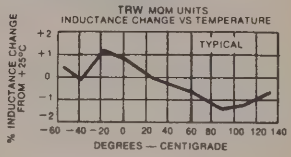
TOLERANCE ±2% @ 60 Hz, 1 V series, 0.5 V parallel.

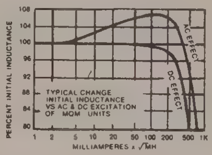
MIL SPECS To complete MIL-T-27D Specs.

TEMPERATURE STABILITY MQM, −55° to +130°C, ±2%.

Type No.	MIL Part No.	Series Henries (0 DC)	Parallel Henries (0 DC)	Series DCRΩ ±20%
MQM-2	M27/162-01	2	.5	21
MQM-16	M27/162-02	16	4	143
MQM-40	M27/162-03	40	10	368
MQM-300	M27/162-04	300	75	3700
MQM-600	M27/162-05	600	150	5720







Toroidal Inductors MQE Series

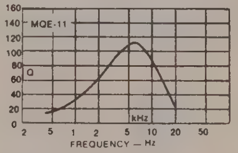
MQE CASE
1¹⁄₁₆″ long x ½″ wide x 1⁷⁄₃₂″ high
Unit Weight: 1.5 oz.
Mounting Holes: ¾″
Screws: 4-40
Cutout: ⁵⁄₁₆″ x ½″

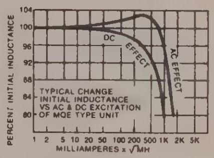
Type No.	MIL Type	Inductance (0 DC)	ma DC Max.	DCRΩ ±20%
MQE-0	TF4R20YY	4 mHy	160	.7
MQE-1	TF4R20YY	7 mHy	135	1.2
MQE-2	TF4R20YY	12 mHy	100	2.0
MQE-3	TF4R20YY	20 mHy	80	3.1
MQE-4	TF4R20YY	30 mHy	65	4.8
MQE-5	TF4R20YY	50 mHy	50	8.0
MQE-6	TF4R20YY	70 mHy	40	12
MQE-7	TF4R20YY	100 mHy	35	17
MQE-8	TF4R20YY	150 mHy	30	27
MQE-9	TF4R20YY	.25 Hy	22	43
MQE-10	TF4R20YY	.4 Hy	17	69
MQE-11	TF4R20YY	.6 Hy	14	102
MQE-12	TF4R20YY	.9 Hy	12	160
MQE-13	TF4R20YY	1.5 Hy	9	266
MQE-14	TF4R20YY	2 Hy	8	385

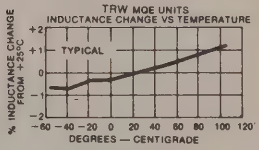
ADJUSTMENT MQE, ±1% @ 1 V, 1 kHz.

MIL SPECS To complete MIL-T-27D Specs.

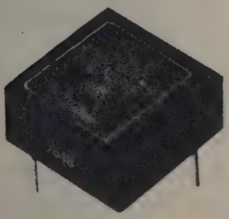
TEMPERATURE STABILITY From −55°C to +105°C. MQE, ±1%.

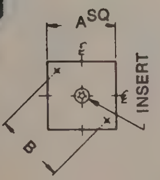






Toroidal Inductors FE Series





PACKAGING Hermetically sealed. Molded flat construction, symmetrical toroids.

TOLERANCE ±1% @ 1 V, 1 kHz.

TERMINALS Per MIL-STD-1276, tinned nickel, type N-2, .040″ dia. x ⅜″ long.

MIL SPECS To complete MIL-T-27D Specs.

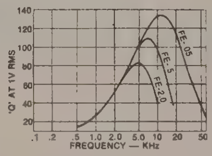
TEMPERATURE STABILITY −55°C to +105°C, ±1.5%.

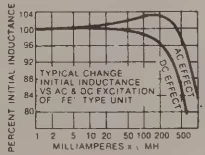
Type No.	MIL Part No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ Max.
FE-.01	M27/142-01	.0100	70	2.5
FE-.02	M27/142-02	.0200	50	5.1
FE-.05	M27/142-03	.0500	30	12
FE-.1	M27/142-04	.100	22	22
FE-.5	M27/142-05	.500	10	122
FE-1	M27/142-06	1.00	7	250
FE-2	M27/142-07	2.00	5	500

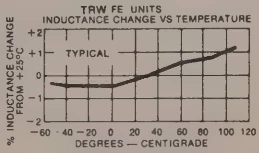
Type	A	B	HT	INSERT	WT
FE	¹⁵⁄₁₆ MX	.968	½ MX	4-40	.7 oz

MIL TYPE NO. TF5R20ZZ

FE







INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

Power Inductors Switching Regulator Type

TRW POWER

SR Series

PACKAGING Hermetically sealed, molded case.

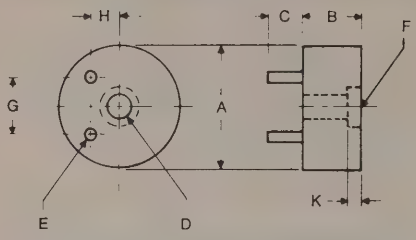
MIL SPECS To complete MIL-T-27D specs. Type number TF5S04ZZ.

APPLICATION These inductors have low losses in the 3 to 100 kHz frequency range, making them ideal for switching regulator and AC filter choke applications.

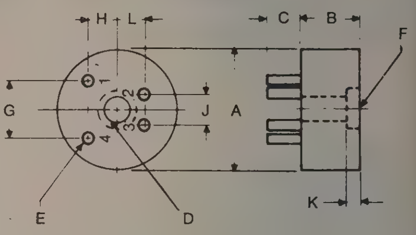
INDUCTANCE Type numbers correspond to inductance values in microhenries, which are measured at 1 V, 10 kHz, 0 DC with an inductance tolerance of +15%, −5%. Values of inductance other than listed in an existing size are available. Part Number would be: SR(A, B or C) — (inductance in microhy at 0 DC).

CURRENT RATINGS Listing I_1 is for approximately 10% drop in inductance with a typical 20°C temperature rise, and Listing I_2 is for approximately 20% drop in inductance with a typical 40°C temperature rise.

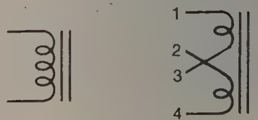
SINGLE WINDING



DOUBLE WINDING

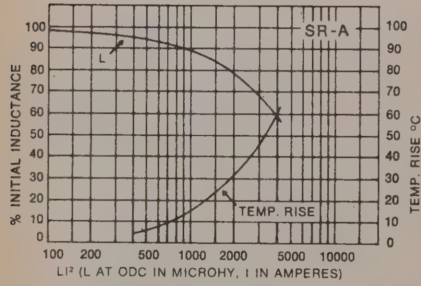


SCHEMS.



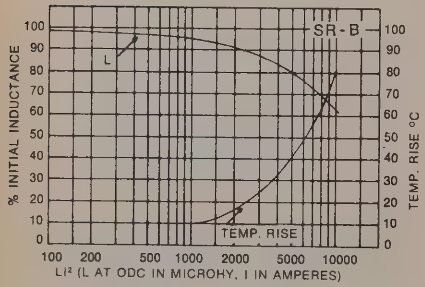
DIMENSIONS IN INCHES

Type	Winding	A dia. ±.030	B ±.063	C ±.030	D dia. ±.010	E dia. ±.005	F dia. ±.015	G ±.010	H ±.010	J ±.010	K C'bore ±.015	L ±.010	Wt. Oz.
SRA	Single	.875	.438	.250	.156	.073	.281	.400	.200	—	.082	—	.6
	Double		.563							.200		.200	
SRB	Single	1.188	.563	.250	.156	.073	.281	.600	.300	—	.082	—	1.5
	Double		.688							.400		.300	
SRC	Single	1.375	.750	.250	.156	.073	.281	.800	.300	—	.082	—	3
	Double		.813							.400		.500	



SRA

Type	No. of Windings	Inductance at 0 DC (μH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Part No.
SRA-1250	1	1250	.8	1.2	.7	M27/287-01
SRA-800	1	800	1	1.5	.45	M27/287-02
SRA-500	1	500	1.2	1.8	.3	M27/287-03
SRA-350	1	350	1.5	2.2	.2	M27/287-04
SRA-200*	2	200 (SER) 50 (PAR)	2 4	3 6	.12 .03	M27/287-05
SRA-88*	2	88 (SER) 22 (PAR)	3 6	4.5 9	.052 .013	M27/287-06
SRA-32*	2	32 (SER) 8 (PAR)	5 10	7.5 15	.02 .005	M27/287-07



SRB

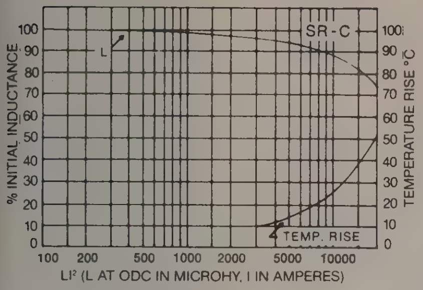
Type	No. of Windings	Inductance at 0 DC (μH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Part No.
SRB-3000	1	3000	.8	1.2	1.2	M27/288-01
SRB-2000	1	2000	1	1.5	.8	M27/288-02
SRB-1200	1	1200	1.25	1.88	.5	M27/288-03
SRB-780	1	780	1.6	2.4	.3	M27/288-04
SRB-520	1	520	2	3	.2	M27/288-05
SRB-320	1	320	2.5	3.75	.13	M27/288-06
SRB-220*	2	220 (SER) 55 (PAR)	3 6	4.5 9	.08 .02	M27/288-07
SRB-120*	2	120 (SER) 30 (PAR)	4 8	6 12	.05 .013	M27/288-08
SRB-80*	2	80 (SER) 20 (PAR)	5 10	7.5 15	.032 .008	M27/288-09

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

Power Inductors Switching Regular Type

TRW POWER

SR Series cont'd

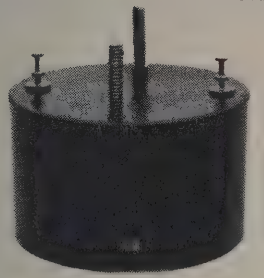


SRC

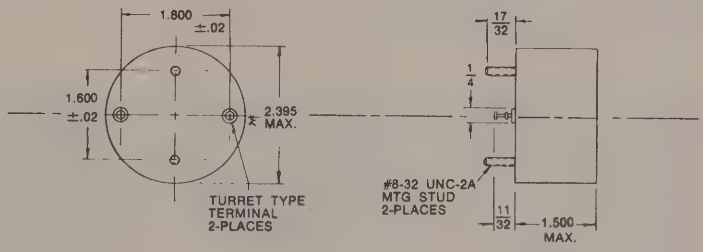
Type	No. of Windings	Inductance at 0 DC (μH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Part No.
SRC-10000	1	10,000	.84	1.1	2.1	M27/289-01
SRC-6400	1	6400	1	1.35	1.4	M27/289-02
SRC-2500	1	2500	1.6	2.2	.55	M27/289-03
SRC-1600	1	1600	2.1	2.8	.34	M27/289-04
SRC-1000	1	1000	2.6	3.5	.21	M27/289-05
SRC-640*	2	640 (SER) 160 (PAR)	3.3 6.6	4.5 9	.13 .033	M27/289-06
SRC-400*	2	400 (SER) 100 (PAR)	4 8	5.4 10.8	.088 .022	M27/289-07
SRC-240*	2	240 (SER) 60 (PAR)	5 10	6.8 13.6	.056 .014	M27/289-08

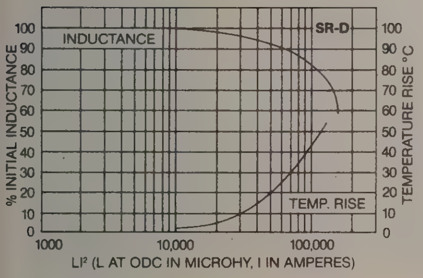
* Two identical windings brought out to four terminals permit series, parallel, center tapped or transformer connections.

NEW



INCREASED POWER HANDLING CAPABILITY





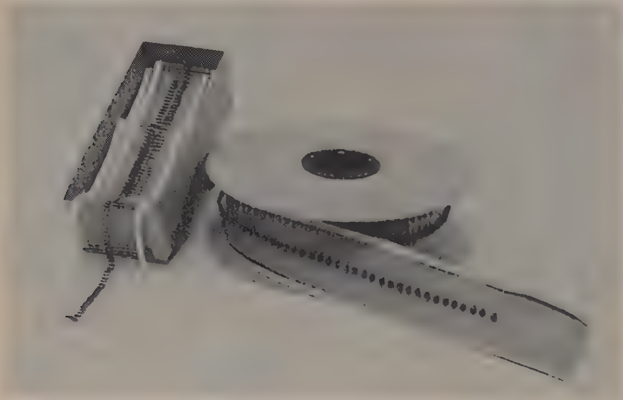
WT. 14 oz.
MIL Type TF5SO4ZZ

SRD

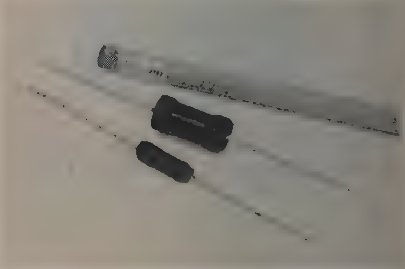
Type	No. of Windings	Inductance at 0 DC (μH)	I_1, at 10% drop in L (amps)	I_2, at 20% drop in L (amps)	Max. DCR (ohms)	MIL Type No.
SRD-500	1	500	9.5	13	.033	TF5S04ZZ
SRD-900	1	900	7.3	10	.057	TF5S04ZZ
SRD-2500	1	2500	4.4	6	.15	TF5S04ZZ
SRD-5000	1	5000	3.1	4.2	.33	TF5S04ZZ
SRD-10000	1	10,000	2.2	3	.60	TF5S04ZZ
SRD-22000	1	22,000	1.4	2	1.4	TF5S04ZZ
SRD-40000	1	40,000	1.1	1.5	2.4	TF5S04ZZ
SRD-90000	1	90,000	.73	1	5.4	TF5S04ZZ
SRD-360000	1	360,000	.36	.50	22	TF5S04ZZ
SRD-1.4	1	1.4 Hy	.18	.25	88	TF5S04ZZ
SRD-5.6	1	5.6 Hy	.09	.125	352	TF5S04ZZ

THE WILCO

When Wilco promises to deliver, we do. It's been that way for over 30 years of electronic component manufacturing.



Special services include reel taping, cut & formed leads, custom prototypes, and engineering sample kits.



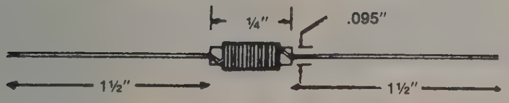
Custom inductive products include: high current filter chokes, hash chokes, shielded inductors and 3-section pi type windings.

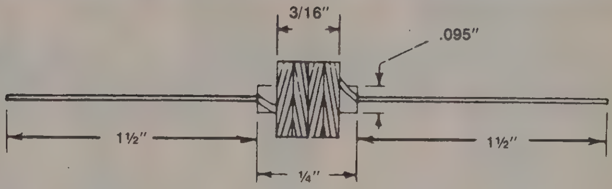
For additional information on custom requirements at competitive pricing, contact Wilco Corporation.

WILCO CORPORATION

4030 W. TENTH STREET
INDIANAPOLIS, IN 46222
(317) 241-2516

COMMITMENT





"ML" SERIES

WILCO PART # ML SERIES	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
ML 10S	.10	45	750+	.06	1489	.107
ML 15S	.15	45	712	.08	1290	.107
ML 22S	.22	47	541	.09	1216	.109
ML 33S	.33	44	428	.13	1012	.107
ML 47S	.47	45	387	.21	796	.105
ML 68S	.68	44	308	.23	760	.107
ML 10G	1.0	30.3	253	.33	635	.106
ML 15G	1.5	31.3	208	.58	479	.104
ML 22G	2.2	32.1	169	1.17	337	.102
ML 33G	3.3	33.3	137	2.68	223	.100
ML 47G	4.7	33.5	114	3.44	197	"
ML 68G	6.8	42.7	54.0	.43	557	.104
ML 100	10	39.1	48.6	.72	430	"
ML 150	15	64.5	36.5	1.43	300	.102
ML 270	27	64.8	27.0	3.54	194	.100

Intermediate Values Available

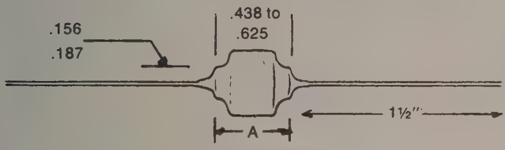
All choke coils in this series are the same size as the unit illustrated. Leads are of No. 21 tinned wire. Tolerances are ± 15% for ML10S through ML82S: ± 10% from ML10G through ML270. All units are impregnated with thermosetting varnish. Color coding available.

"MU" SERIES

WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
MU 390	39	20.0	11.2	5.8	185	.156
MU 470	47	18.2	10.9	6.5	175	"
MU 560	56	17.7	10.6	7.1	162	"
MU 680	68	17.0	10.5	7.8	165	"
MU 820	82	16.0	10.4	8.6	163	.187
MU 101	100	15.5	10.3	9.3	159	"
MU 121	120	22.4	9.6	10.8	150	"
MU 151	150	22.8	9.0	12.2	143	"
MU 181	180	23.4	7.6	13.7	140	"
MU 271	270	23.9	5.7	16.9	130	.218
MU 331	330	24.4	5.2	18.9	126	"
MU 471	470	23.1	4.3	22.6	117	"
MU 681	680	49.0	2.9	12.7	141	.187
MU 102	1000	43.6	2.1	15.5	131	"
MU 152	1500	56.7	1.9	23.9	117	.218

Intermediate Values Available

All choke coils in this series are the same size as the unit illustrated. Leads are of No. 21 tinned wire. Tolerances are ± 10%. All units are impregnated with thermosetting varnish. Color coding available.

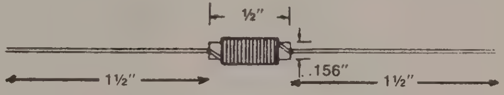


"U" SERIES

WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
U 150	15	24.9	20.00	1.7	480	.218
U 350	35	20.5	14.00	2.6	420	.250
U 550	55	18.1	11.40	3.4	380	.281
U 101	100	15.6	8.80	4.4	350	.312
U 141	140	24.7	7.21	5.5	330	.343
U 181	180	24.4	6.52	6.3	320	.375
U 301	300	24.2	5.11	8.5	290	.437
U 501	500	23.6	4.02	11.0	270	.500
U 701	700	38.4	3.33	27.0	160	.562
U 901	900	36.4	2.87	31.0	150	.562
U 252	2.5 MH	70.8	1.02	32.0	150	.500
U 752	7.5 MH	64.6	.62	65.0	130	.500
U 153	15.0 MH	72	.44	64.8	110	.418
U 253	25.0 MH	70	.34	88	95	.512

Intermediate Values Available

All choke coils in this series are Durez covered and EIA color coded. They have an inductance tolerance of ± 10% and leads are No. 20 AWG tinned copper 1½″ long. Parts U150 through U501 are wound on .156″ dia. phenolic forms with "A" dimensions 7/16″. Parts U601 through U102 are wound on the same form with "A" dimensions ½″. Parts U252 through U752 use .156″ dia. powdered iron forms, "A" dimension ½″. Parts U103 through U253 use .187″ dia. iron forms, "A" dimension ⅝″. Diameters of coils vary from ¼″ to ⅝″ depending on inductance value.



"W" SERIES

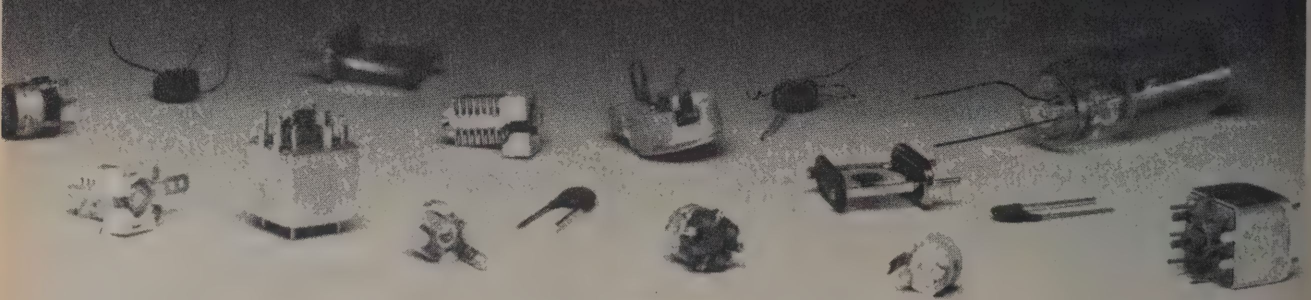
WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX	DIA. NOM.
W 10 G	1.0	45	238	.11	1965	.179
W 12 G	1.2	45	218	.12	1882	.179
W 15 G	1.5	45	200	.14	1742	.179
W 22 G	2.2	45	165	.26	1278	.175
W 27 G	2.7	45	149	.34	1118	.175
W 39 G	3.9	45	127	.61	835	.172
W 47 G	4.7	50	114	.80	729	.170
W 68 G	6.8	50	94.8	1.35	561	.169
W 100	10	50	78.5	2.50	412	.167
W 150	15	30	63.9	5.10	288	.165
W 220	22	85	36.1	1.10	622	.170
W 330	33	80	30.6	1.38	555	.169
W 470	47	90	24.9	2.32	428	.167
W 680	68	90	21.6	3.00	376	.166
W 101	100	100	17.8	5.40	280	.165

Intermediate Values Available

All choke coils in this series are the same size as the unit illustrated. Leads are of No. 20 tinned wire. Tolerances are ± 20% for W10G through W22G: ± 10% from W27G through W101. All units are impregnated with thermosetting varnish and are EIA color coded.

Our more popular, cataloged stock units are available in quantity for immediate delivery.

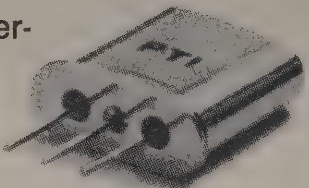
We gave up a lot to improve crystal filter reliability, size and cost.



A lot of components and interconnections, that is. The basic PTI monolithic filter consists of two electrode pairs deposited on the faces of a quartz wafer to form a two-resonator structure. Acoustical coupling between electrode pairs creates a two-pole response.

Simply by designing two-pole filters in cascade, using modern network theory, we can develop four to ten-pole tandem monolithic crystal filters offering maximum reliability, economy, mode suppression, attenuation and minimum size.

There's nothing else. It's that simple. Piezo Technology is the USA's leading supplier of monolithic and tandem monolithic filters, designed specifically for use in communications equipment requiring filtering from 5 to 300 MHz.



Choose from over 100 standard models from 10.7 to 200 MHz in a wide range of miniature, ultraminiature, upright, flat-pack and tandem configurations. Custom designs from below 5 MHz to 300 MHz are available with guaranteed IM, phase noise, linear phase or controlled group delay specifications.

For more information contact:
Piezo Technology, Inc., P.O. Box 7859, Orlando, Florida 32854. (305) 298-2000. TWX: 810-850-4136.

PTI
Piezo Technology, Inc.

CRYSTAL FILTERS

Manufacturer	Active	AF	IF	UHF/VHF	RF	Microwave	LC	Comb.	Single Sideband	Vestigial Sideband	Bandpass	Low Pass	High Pass	Notch (Band Elim.)	Linear Phase	Equalizer	Hybrid	Other	Type
Comstron	1A•1327	1A•1327	1A•1327	1A•1327	1A•1327	1A•1327				1A•1327	1A•1327			1A•1327					
Damon	1A•1347		1A•1347	1A•1347	1A•1347						1A•1347	1A•1347	1A•1347	1A•1347					
Fox Electronics			1A•1354	1A•1354							1A•1354		1A•1354	1A•1354			1A•1354		
Frequency Electronics				1A•1359*	1A•1359*				1A•1359*		1A•1359*			1A•1359*					
Frequency Selective Networks	1A•1361*						1A•1361*		1A•1361*		1A•1361*	1A•1361*	1A•1361*	1A•1361*	1A•1361*	1A•1361*	1A•1361*		
Hughes Solid State		1A•1363*									1A•1363*			1A•1363*					
McCoy Electronics		1A•1377	1A•1378	1A•1378	1A•1378 1A•1379	1A•1378			1A•1379		1A•1377 1A•1378						1A•1379	1A•1379	Filters, Bandpass, SAW Discriminators, Crystal
Microsonics							1A•1383	1A•1383			1A•1383			1A•1383	1A•1383				
Motorola Components			1A•1390		1A•1390									1A•1390					
Murata Erie			1A•1394*		1A•1394*													1A•1395	Ceramic Filters
NTK Technical Ceramics																		1A•1397	Piezoceramic Filters
OPT Industries		1A•1398*	1A•1398*	1A•1398*	1A•1398*		1A•1398*				1A•1398*	1A•1398*	1A•1398*	1A•1398*	1A•1398*				
Piezo Technology			1A•1308 1A•1405	1A•1308 1A•1404 1A•1407	1A•1308 1A•1405	1A•1404	1A•1308				1A•1404			1A•1404 1A•1405	1A•1308 1A•1404 1A•1406			1A•1406	Discriminators,Frequency
Reeves-Hoffman	1A•1415*								1A•1415*		1A•1415*	1A•1415*	1A•1415*	1A•1415*		1A•1415*		1A•1415*	Discriminators;Frequency
Sawtek			1A•1420		1A•1420													1A•1420	Filters, SAW Resonator
Sokol Crystal Prods.	1A•1422- 1A•1425*			1A•1422- 1A•1425*			1A•1424*										1A•1425	1A•1424	Filters, Time Delay Discriminators,Frequency
Vernitron	1A•1432										1A•1432								

* Mil. Spec.

CRYSTALS

Manufacturer	Crystal Blanks	Micro-processor	Quartz	Quartz (watches)	Crystal Holders
Anderson Electronics			1A•1313		
Bliley Electric		1A•1320*	1A•1316-1A•1320*		1A•1321*
Colorado Crystal			1A•1324		
Croven Crystals	1A•1346*		1A•1346*		
CTS Knights		1A•1337-1A•1339	1A•1333-1A•1339*		
Fox Electronics			1A•1352	1A•1352	
Frequency Control Prods.		1A•1356*	1A•1356*		
International Crystal	1A•1367		1A•1367		1A•1367
ITT Components		1A•1371	1A•1371		
McCoy Electronics			1A•1374-1A•1376*		
Monitor Products		1A•1387	1A•1387-1A•1389*		
Motorola Components			1A•1390		
M-tron		1A•1393*	1A•1393*		1A•1393
Murata Erie		1A•1394*	1A•1394*		
Reeves-Hoffman			1A•1413-1A•1414*		
SaRonix		1A•1418	1A•1418		1A•1418
Seiko Instruments		1A•1421-1A•1422	1A•1421-1A•1422	1A•1421-1A•1422	
Sokol Crystal Prods.		1A•1422*, 1A•1425*	1A•1422*, 1A•1425*		
Spectrum Technology			1A•1426*		
Statek			1A•1429-1A•1430		
Valpey-Fisher		1A•1434	1A•1435* 1A•1436		1A•1435

* Mil. Spec.

OSCILLATORS

Manufacturer	AF	LF	RF	Ultra-sonic	Micro-wave	Sinu-soidal	Square Wave	Pulse	UHF/VHF	Crystal Controlled (Module)	Tuning Fork Controlled	Ovenized	Voltage Controlled (VCXO)	Temp. Compnstd. (TCXO)	Volt. Con-trolled/ Temp. Compnstd.	Clock	LC	RC	Other	Type
Anderson		1A•1313	1A•1313			1A•1313			1A•1313	1A•1313						1A•1313				
Austron			1A•1314*				1A•1314*	1A•1314*	1A•1315*	1A•1314*		1A•1314*							1A•1314	Standards, Frequency Time Code Instrumentation
Bliley Electric		1A•1322	1A•1322 1A•1323			1A•1322 1A•1323	1A•1322 1A•1323		1A•1322	1A•1322 1A•1323			1A•1323	1A•1323		1A•1322				
Comclok							1A•1328			1A•1328						1A•1328				
Comstron		1A•1325 1A•1326	1A•1325 1A•1326		1A•1325 1A•1326	1A•1326			1A•1325 1A•1326	1A•1325 1A•1326		1A•1325 1A•1326		1A•1325 1A•1326						
Connor-Winfield		1A•1329- 1A•1332	1A•1329- 1A•1332			1A•1329- 1A•1332	1A•1329- 1A•1332	1A•1329- 1A•1332	1A•1329- 1A•1332	1A•1329- 1A•1332		1A•1332	1A•1330 1A•1331	1A•1331			1A•1329- 1A•1332	1A•1332		
CTS Knights		1A•1341- 1A•1345*	1A•1341 1A•1342			1A•1340- 1A•1343*	1A•1340- 1A•1342	1A•1340- 1A•1345*	1A•1344* 1A•1345*	1A•1340- 1A•1343*		1A•1342* 1A•1343	1A•1340- 1A•1342	1A•1340 1A•1341	1A•1341	1A•1344* 1A•1345*				
Dale Electronics			1A•1348				1A•1348 1A•1349			1A•1348 1A•1349				1A•1349		1A•1348				
Damon			1A•1347			1A•1347		1A•1347	1A•1347	1A•1347			1A•1347							
Efratom																			1A•1350	Standards, Time
Electronic Research			1A•1351			1A•1351				1A•1351		1A•1351								
Fox Electronics			1A•1353				1A•1353	1A•1353	1A•1353	1A•1353						1A•1353			1A•1355	Resonators
Frequency Control		1A•1357				1A•1357				1A•1356* 1A•1357	1A•1357	1A•1357		1A•1357			1A•1356*			
Frequency Electronics		1A•1359*	1A•1359*		1A•1359*					1A•1359*		1A•1359*	1A•1359*	1A•1359*	1A•1359					
Hughes Solid State	1A•1362* 1A•1363*	1A•1362* 1A•1363*	1A•1362* 1A•1363*			1A•1362* 1A•1363*	1A•1362* 1A•1363*	1A•1362* 1A•1363*	1A•1362* 1A•1363*	1A•1362* 1A•1363*			1A•1363*	1A•1362*		1A•1362* 1A•1363*				
Isotemp Research			1A•1368 1A•1369			1A•1368 1A•1369	1A•1368 1A•1369	1A•1368 1A•1369	1A•1368 1A•1369	1A•1368 1A•1369		1A•1368 1A•1369		1A•1368 1A•1369						
ITT Components										1A•1371	1A•1371					1A•1371				
Leach Corp.		1A•1372	1A•1372			1A•1372	1A•1372		1A•1372	1A•1372						1A•1372			1A•1372	Baud Rate Generator
McCoy Electronics	1A•1380- 1A•1382*	1A•1380- 1A•1382*	1A•1380- 1A•1382*			1A•1380- 1A•1382*	1A•1380*	1A•1380*	1A•1380- 1A•1382*	1A•1380- 1A•1382*		1A•1380*	1A•1382	1A•1380 1A•1382	1A•1382*	1A•1380- 1A•1382*				

* Mil. Spec.

OSCILLATORS

Manufacturer	AF	LF	RF	Ultra-sonic	Micro-wave	Sinu-soidal	Square Wave	Pulse	UHF/VHF	Crystal Controlled (Module)	Tuning Fork Controlled	Ovenized	Voltage Controlled (VCXO)	Temp. Compnstd. (TCXO)	Volt. Controlled/ Temp. Compnstd.	Clock	LC	RC	Other	Type
MF Electronics			1A•1384- 1A•1386*				1A•1384- 1A•1386*	1A•1384- 1A•1386*	1A•1384- 1A•1386*	1A•1384- 1A•1386*							1A•1384- 1A•1386*			
Microsonics			1A•1383*			1A•1383*	1A•1383*	1A•1383*		1A•1383*		1A•1383*		1A•1383*	1A•1383*	1A•1383*				
Monitor Products						1A•1388 1A•1389*	1A•1387	1A•1387		1A•1387- 1A•1389*				1A•1387 1A•1388		1A•1387- 1A•1389*				
Motorola Components						1A•1390	1A•1391	1A•1391	1A•1391	1A•1390				1A•1390		1A•1391			1A•1391	Generators, Baud Rate Resonator Crystals
M-tron		1A•1393	1A•1393	1A•1393			1A•1393			1A•1393										
Murata Erie		1A•1394	1A•1394			1A•1394	1A•1394		1A•1394	1A•1394		1A•1394	1A•1394	1A•1394		1A•1394			1A•1394	Ceramic Resonators
NTK Technical																			1A•1396	Ceramic Resonators
Oscillatek	1A•1399*	1A•1399*	1A•1399*			1A•1399*	1A•1399*	1A•1399*		1A•1399*			1A•1399*	1A•1399*		1A•1399*			1A•1399	Generators, Baud Rate
Ovenaire-Audio-Carpenter	1A•1401 1A•1402	1A•1400- 1A•1402	1A•1400- 1A•1402			1A•1400- 1A•1402	1A•1400- 1A•1402	1A•1400- 1A•1402	1A•1400- 1A•1402	1A•1400- 1A•1402		1A•1400	1A•1402	1A•1400			1A•1402	1A•1402	1A•1403	Ovens
Piezo Technology			1A•1404						1A•1404	1A•1404 1A•1408		1A•1404 1A•1408	1A•1408	1A•1404						
Q-Tech Corp.			1A•1411		1A•1411		1A•1410* 1A•1411*	1A•1410* 1A•1411*	1A•1410* 1A•1411*				1A•1410* 1A•1411*			1A•1410* 1A•1411*			1A•1410	Generators, Baud Rate
Reeves-Hoffman			1A•1416 1A•1417				1A•1417	1A•1417	1A•1416 1A•1417	1A•1416 1A•1417		1A•1416 1A•1417	1A•1416 1A•1417	1A•1416 1A•1417		1A•1416 1A•1417				
SaRonix		1A•1419	1A•1419			1A•1419	1A•1419	1A•1419		1A•1419						1A•1419			1A•1418 1A•1419	Tuning Forks Generators, Baud Rate
Sawtek					1A•1420		1A•1421	1A•1421	1A•1421	1A•1421						1A•1421			1A•1420 1A•1420	Oscillators, SAW Resonators, SAW
Spectrum Technology							1A•1426* 1A•1427*	1A•1426* 1A•1427*	1A•1426* 1A•1427*	1A•1426* 1A•1427*				1A•1427*		1A•1426* 1A•1427*				
Statek		1A•1429 1A•1431				1A•1429 1A•1431	1A•1429 1A•1431	1A•1429 1A•1431		1A•1429 1A•1431	1A•1429 1A•1431									
Techtrol			1A•1432 1A•1433		1A•1432 1A•1433	1A•1432 1A•1433			1A•1432 1A•1433	1A•1432 1A•1433									1A•1433	Frequency Multipliers
Valpey-Fisher										1A•1434						1A•1434				
Vectron Labs.			1A•1438 1A•1439*			1A•1439- 1A•1442*	1A•1438 1A•1440 1A•1442*	1A•1438 1A•1440 1A•1442*	1A•1438- 1A•1441*	1A•1438- 1A•1442*		1A•1441* 1A•1442*	1A•1442	1A•1440		1A•1438 1A•1440				
Xsis						1A•1443*	1A•1443*			1A•1443*						1A•1443*				

* Mil. Spec.

For manufacturers' sales offices, see yellow pages

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms ..... **1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code ..... **3**•1103
Batteries, Product Selection Guide ..... **3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **2**•1003
Capacitors, Basic Formulas ..... **1A**•1093
Capacitors, Miniglossary ..... **1A**•1069
Capacitors, Product Selection Guide ..... **1A**•1003
Circuit Boards (Printed), Product Selection Guide ..... **2**•1089
Coils, Chokes, & Inductors, Product Selection Guide ..... **1A**•1219
Connectors, Miniglossary ..... **2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide ..... **2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **1A**•1309
Delay Lines, Product Selection Guide ..... **1A**•1445
Discrete Semiconductors, Product Selection Guide ..... **1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **1B**•1021
EBCDIC Code ..... **3**•1153
Encapsulation, Miniglossary ..... **2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **2**•1801
Filters, Product Selection Guide ..... **1A**•1577
Instruments, Graphic Recording, Product Selection Guide ..... **3**•1381
Instruments, Panel Meters, Product Selection Guide ..... **3**•1321
Instruments, Test & Measuring, Product Selection Guide ..... **3**•1182
Interconnection Systems, Product Selection Guide ..... **2**•1873
Keyboards & Keypads, Product Selection Guide ..... **1B**•1759
Microwave Components, Product Selection Guide ..... **1A**•1685
Military Qualified Products Lists ..... **1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **1B**•1121
Opto Semiconductors, Miniglossary ..... **1B**•1218
Oscilloscopes, Product Selection Guide ..... **3**•1361
Panel Hardware, Product Selection Guide ..... **2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **1A**•2017
Power Supplies, Miniglossary ..... **3**•1455
Power Supplies, AC, Product Selection Guide ..... **3**•1815
Power Supplies, DC, Product Selection Guide ..... **3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **1B**•1255
Relay Contact Forms ..... **1B**•1317
Relays, Electromechanical, Miniglossary ..... **1**•**B**1292
Relays, Product Selection Guide ..... **1B**•1289
Resistor Color Codes ..... **1A**•1791
Resistors, Product Selection Guide ..... **1A**•1789
Servo Components, Miniglossary ..... **3**•1935
Solenoids, Product Selection Guide ..... **1B**•1481
Switches, Product Selection Guide ..... **1B**•1499
Thyristors/High Power Diodes, Miniglossary ..... **1A**•1652
Transducers & Encoders, Product Selection Guide ..... **1B**•1827
Transformers, Product Selection Guide ..... **1A**•2115
Wire & Cable, Product Selection Guide ..... **2**•1935

Anderson Electronics

MICROPROCESSOR CRYSTALS

FREQ. (MHz)	PART NO.	HOLDER	FREQ. (MHz)	PART NO.	HOLDER
1.0000	MAE10	HC 33/U	6.144	MAE61	HC 18/U
1.8432	MAE18	HC 33/U	6.400	MAE64	HC 18/U
2.0000	MAE20	HC 33/U	6.5536	MAE65	HC 18/U
2.097152	MAE21	HC 33/U	7.680	MAE76	HC 18/U
2.4576	MAE24	HC 33/U	8.000	MAE80	HC 18/U
3.2768	MAE32	HC 33/U or HC 18/U	10.000	MAE100	HC 18/U
3.579545	MAE35	HC 33/U or HC 18/U	12.000	MAE120	HC 18/U
4.0000	MAE40	HC 18/U	14.31818	MAE143	HC 18/U
4.0960	MAE41	HC 18/U	15.000	MAE150	HC 18/U
4.194304	MAE42	HC 18/U	16.000	MAE160	HC 18/U
4.9152	MAE49	HC 18/U	18.000	MAE180	HC 18/U
5.0000	MAE50	HC 18/U	18.432	MAE184	HC 18/U
5.0688	MAE51	HC 18/U	20.000	MAE200	HC 18/U
5.185	MAE52	HC 18/U	22.1184	MAE221	HC 18/U
5.9904	MAE59	HC 18/U	32.000	MAE320	HC 18/U
6.0000	MAE60	HC 18/U			
			36.000	MAE360	HC 18/U
			48.000	MAE480	HC 18/U

AE 404 QUARTZ CRYSTAL CLOCK OSCILLATORS

Model AE 404 is a low-profile resistance welded quartz crystal oscillator designed and manufactured to insure reliability.

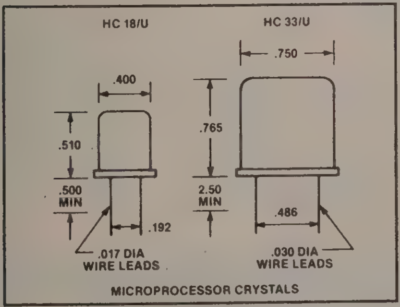
Output	Frequency Range	Frequency Stability	Temperature Range	Input Voltage	Input Current	Waveform Symmetry
TTL	1 Hz to 50 MHz	±.01%	0°C to +70°C	+5 VDL ±10%	25 mA to 125 mA	60/40 max.
LSTTL	1 Hz to 50 MHz	±.01%	0°C to +70°C	+5 VDL ±10%	20 mA to 70 mA	60/40 max.
CMOS	1 Hz to 8 MHz	±.01%	0°C to +70°C	+5 to +15 VDC	5 mA to 20 mA	60/40 max.

- Tighter Frequency Stability and Temperature Range available.
- 14 pin + Dual-in-line package also available.
- Dual outputs available.
- Higher frequencies available.

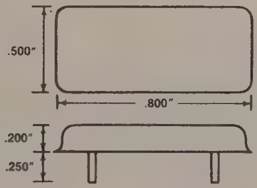
AE 808 MICROPROCESSOR CRYSTAL OSCILLATORS*

FREQUENCY	Pulse Width High (Min)	Pulse Width High (Max)	Pulse Width Low (Min)	Pulse Width Low (Max)	Rise Time (Max)	Fall Time (Max)	High Level (Min)	Low Level (Max)
2.5000 MHz	180ns	250ns	180ns	250ns	20ns	20ns	Vcc - .4V	0.4V
4.0000 MHz	105ns	200ns	105ns	200ns	20ns	20ns	Vcc - .4V	0.4V
6.0000 MHz	65ns	90ns	65ns	90ns	20ns	20ns	Vcc - .4V	0.4V

NOTE: All parameters measured under 150 pf. load over 0° to +70° C temperature range.
*For Zilog or Equivalent (Zilog is the trademark of Zilog, Inc.)



MICROPROCESSOR CRYSTALS

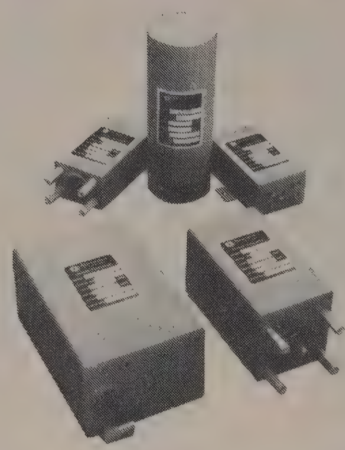


PIN	CONNECTION
1	No Connection
7	Ground
8	Output
14	Input

ANDERSON ELECTRONICS, INC.
310 Penn Street
Hollidaysburg, Pennsylvania 16648
Phone: 814-695-4428 TWX 510-691-2516
Serving Since 1959

AUSTRON INC.

P.O. BOX 14766, EXIT 248, N. IH35, AUSTIN, TEXAS 78761 • (512) 251-2313



AUSTRON OFFERS A COMPLETE LINE OF HIGH PRECISION OVENIZED CRYSTAL OSCILLATORS

- Up to 5 × 10^{-11}/24 hours aging
- Frequencies from 1 to 120 MHz
- MIL-SPEC, JANTX, Radiation hardened
- Custom engineering

SMALL LIGHT WEIGHT

The Austron Model 1100 Crystal Oscillator combines high stability with low power drain in a small, lightweight, plug-in package. This hermetically sealed crystal oscillator finds application whenever space is at a premium and performance cannot be compromised.

OUTPUT FREQUENCY:	5 MHz Standard
AGING RATE:	5, 2 OR 1 × 10^{-9}/24 Hrs. after 72 hours continuous operation.
AMBIENT TEMPERATURE STABILITY:	Less than 2.5 × 10^{-8} from −20° to +65°C
MECHANICAL:	Size: 1.25 × 1.75 × 3.25 inches

DIGITAL APPLICATIONS

The Austron Model 1105 is a low profile solid-state crystal oscillator designed to provide a highly stable 1 MHz logic output for IC applications. The Model 1105 operates from a 5 volt power supply. The size, weight, and stability performance have been packaged in a configuration for the IC instrument designer.

OUTPUT FREQUENCY:	1 MHz; TTL Logic
AGING RATE:	10, 5, 2 or 1 × 10^{-9}/24 hours after 72 hours operation
AMBIENT TEMPERATURE STABILITY:	Less than 5 × 10^{-9} from 0°C to 55°C
MECHANICAL:	Size 1.25 × 1.75 × 3.25 inches

EXTREMELY LOW POWER

The Austron Model 1115 5 MHz Oscillator was specifically designed for undersea applications where high stability and minimal power drain are of prime importance.

OUTPUT FREQUENCY:	5 MHz
AGING:	3 × 10^{-9}/24 hrs after 72 hours operation 1 × 10^{-9}/24 hrs after 30 days operation
AMBIENT TEMPERATURE STABILITY:	Less than 5 × 10^{-9} from −2°C to 25°C NOTE: Higher temperature models available
MECHANICAL:	Size: Cylinder 2″ diameter, 5.5″ long.

VERSATILITY

The Austron Model 1120 is a compact, rugged crystal oscillator designed for a wide range of applications. This unit is available at many different frequencies, input voltages, and mechanical configurations.

OUTPUT FREQUENCY:	1 MHZ THRU 10 MHZ
AGING RATE:	5, 2 or 1 × 10^{-9}/24 Hrs. after 72 hours continuous operation.
AMBIENT TEMPERATURE STABILITY:	Less than 2 × 10^{-9} from −20° to + 65°
MECHANICAL:	Size: 2.27 × 2.14 × 4 inches

LOW PHASE NOISE

The Austron 1120L features extremely low phase noise performance.

OUTPUT FREQUENCY:	5MHz OR 10 MHz
PHASE NOISE: (1 Hz BW)	135 dB, Ten Hz 155 dB, One Hundred Hz 160 dB, One kHz

ULTRA HIGH STABILITY

The Austron Model 1150 is a very rugged, high precision crystal oscillator which was specifically developed for use in satellite navigation systems. The Model 1150 has application whenever system requirements demand a precise time base or frequency reference. Technical features include an ultimate aging of 5 × 10^{-11}/day, low phase noise, and a standard frequency of 5 MHz.

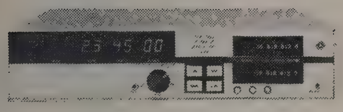
OUTPUT FREQUENCY:	5 MHz Standard
AGING RATE:	5 × 10^{-10}/24 hrs after operation. 1 × 10^{-10}/24 hrs after 30 days operation. Ultimate drift is typically 5 × 10^{-11} after 90 days operation.
AMBIENT TEMPERATURE STABILITY:	Less than 2 × 10^{-9} from −55°C to +60°C Less than 5 × 10^{-10} from 0°C to 50°C.
MECHANICAL:	Size: 2.37 × 3.18 × 5.0 inches.

HIGHER FREQUENCY

Austron's latest addition to the Austron family of oscillators, the Austron Model 1170 Series VHF Oscillator, includes several units in the range of 35 MHz to 120 MHz.

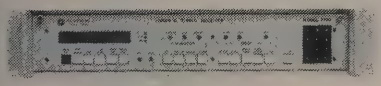
CALL FOR DETAILS

Time/frequency instruments



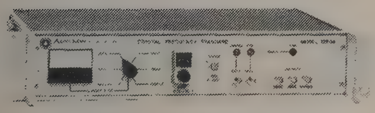
AUSTRON 8154

The Austron Time Code Instrumentation — a complete line of instruments from basic generators and readers to full complement tape search and control units. Available for bench, panel, rack, or portable; all standard IRIG, XR3, and NASA codes are available to give these instruments the flexibility to meet any system requirement.



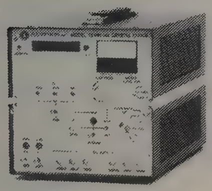
AUSTRON 2100

The Austron Loran-C receivers are microprocessor based automatic acquisition and tracking receivers that utilize the Loran-C groundwave to provide a traceable reference for time epoch determination, frequency management, calibration, and control. These receivers provide time accuracy to one microsecond and frequency accuracy to parts in 10^{-12}.



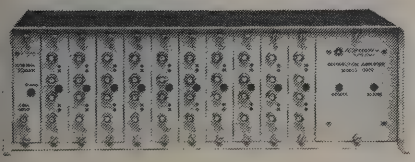
AUSTRON 1250A

The Austron Model 1250A Crystal Frequency Standard generates highly stable output frequencies at 5 MHz, 1 MHz, and 100 kHz. Each of these outputs has excellent waveform and spectral purity. Containing its own internal battery back-up, it also may be used with an external standby power supply such as the Austron Model 1290A Standby Power Supply.



AUSTRON 1210D

The Austron Model 1210D series of Portable Crystal Clocks are compact, self-contained, self-powered time references providing stable time outputs at several pulse and sinusoidal frequencies, as well as a digital time-of-day display.



AUSTRON 1295C

The Austron Model 1295C Distribution Amplifier provides the necessary noise immunity and drive capability to interface a localized frequency standard to other equipment at distances up to 1,000 feet. Four standard frequencies, 10 MHz, 5 MHz, 1 MHz and 0.1 MHz can be accommodated (for other frequencies consult factory). Input frequencies and number of outputs for each frequency are customer specified to provide a more cost effective system. Single frequency units can have up to 40 individual outputs, while units with 2 to 4 frequency inputs will have four or more outputs for each input.

SYSTEMS—complete systems for generation, management, and distribution of precise time and frequency. Austron's engineering has led to such sophistication as the secure communications frequency control sets AN/GSQ-174 and AN/GSQ-183. Time and Frequency Receivers, Disciplined Frequency Standards, Distribution Amplifiers, Time Code Generators and Readers, and all ancillary equipment along with Austron Engineering . . . put it to work, for you!

AUSTRON *INC.*

P.O. BOX 14766, EXIT 248, N. IH35, AUSTIN, TEXAS 78761 • (512) 251-2313

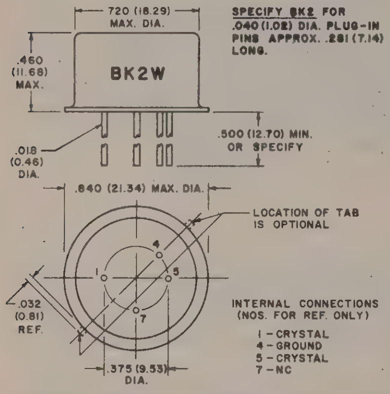
For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE / PENNSYLVANIA 16508

CRYSTALS

Coldweld Vacuum Sealed Transistor Case Styles

Bliley
first name in frequency control

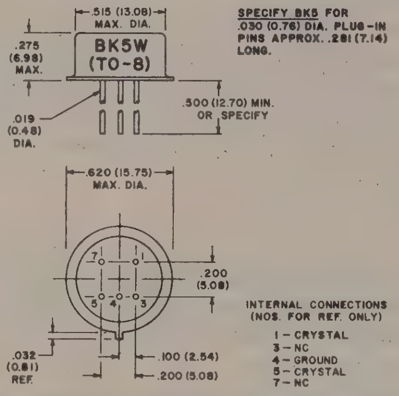
UNMATCHED PERFORMANCE DURING EXTREME SHOCK AND VIBRATION COMBINED WITH SUPERIOR AGING AND HIGH RELIABILITY HAVE FIRMLY ESTABLISHED THIS STYLE AS FIRST CHOICE IN ADVANCED MILITARY AND SPACE SYSTEMS. EASE OF MOUNTING, FORM COMPATIBILITY AND MODERATE COST ALSO ATTRACT QUALITY COMMERCIAL USAGE.


720 (18.29) MAX. DIA.
.460 (11.68) MAX.
BK2W
.018 (0.46) DIA.
.500 (12.70) MIN. OR SPECIFY
.840 (21.34) MAX. DIA.
LOCATION OF TAB IS OPTIONAL
4
1
5
7
.032 (0.81) REF.
.375 (9.53) DIA.

SPECIFY BK2 FOR .040 (1.02) DIA. PLUG-IN PINS APPROX. .281 (7.14) LONG.

INTERNAL CONNECTIONS
(NOS. FOR REF. ONLY)

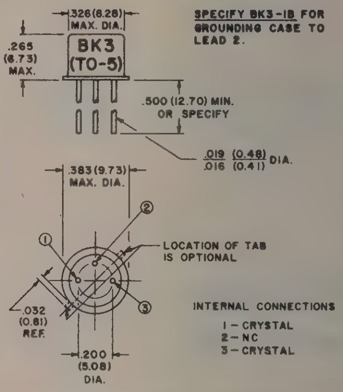
1 – CRYSTAL
4 – GROUND
5 – CRYSTAL
7 – NC


.515 (13.08) MAX. DIA.
.275 (6.98) MAX.
BK5W (TO-8)
.019 (0.48) DIA.
.500 (12.70) MIN. OR SPECIFY
.620 (15.75) MAX. DIA.
7
1
5
4
3
.200 (5.08)
.032 (0.81) REF.
.100 (2.54)
.200 (5.08)

SPECIFY BK5 FOR .030 (0.76) DIA. PLUG-IN PINS APPROX. .281 (7.14) LONG.

INTERNAL CONNECTIONS
(NOS. FOR REF. ONLY)

1 – CRYSTAL
3 – NC
4 – GROUND
5 – CRYSTAL
7 – NC


.326 (8.28) MAX. DIA.
.265 (6.73) MAX.
BK3 (TO-5)
.500 (12.70) MIN. OR SPECIFY
.019 (0.48) / .016 (0.41) DIA.
.383 (9.73) MAX. DIA.
②
①
③
LOCATION OF TAB IS OPTIONAL
.032 (0.81) REF.
.200 (5.08) DIA.

SPECIFY BK3-1B FOR GROUNDING CASE TO LEAD 2.

INTERNAL CONNECTIONS

1 – CRYSTAL
2 – NC
3 – CRYSTAL

BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT-AT (MODE)	TYPICAL DRIVE LEVEL (mW)
		0 TO 50	0 TO 70	−40 TO +70	−55 TO +105			
BK2W	.86 – .99	±.0015	±.002	±.0025	±.003	300	FUNDAMENTAL	1.0
	1 – 1.9					150		
	2 – 2.9					40		
	3 – 6.0					25		
BK5W	2 – 2.9					250		
	3 – 3.9					120		
	4 – 4.9					60		
	5 – 5.9					30		
	6 – 7.9					22		
	8 – 15					15		
BK3	7 – 9.9					40		0.5
	10 – 25					25		
	25 – 75					40	3RD	
	75 – 125					60	5TH	
	125 – 150					100	7TH	

BLILEY TYPE	BK2W	BK3-1B	BK5W
MIL-H-10056 HOLDER DESIGNATION	HC-40/U	HC-35/U	HC-37/U
AGING GUIDELINES: 1ST MONTH FOLLOWING YEAR	 2 PPM 1.5 PPM	 2 PPM 3 PPM	 2 PPM 2 PPM
VIBRATION	20G FROM 10 - 2000 Hz		
SHOCK	150G FOR 7 ms		

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P. O. BOX 3428
ERIE/PENNSYLVANIA 16508

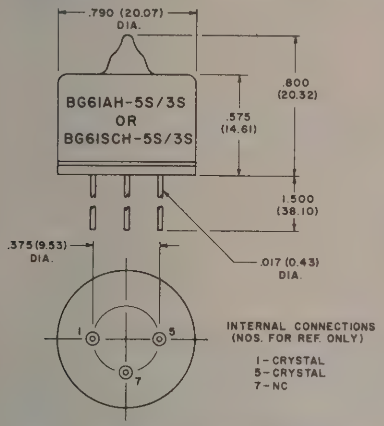
CRYSTALS

Bliley
first name in frequency control

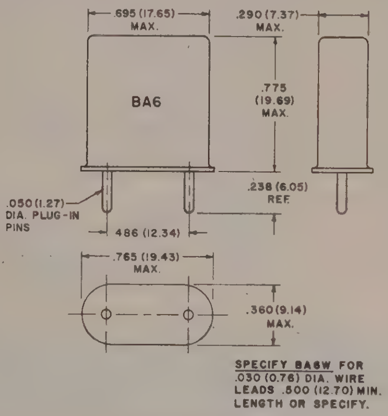
Vacuum Sealed Ultra High Stability

DESIGNED FOR OPTIMUM PERFORMANCE WITH TEMPERATURE CONTROL

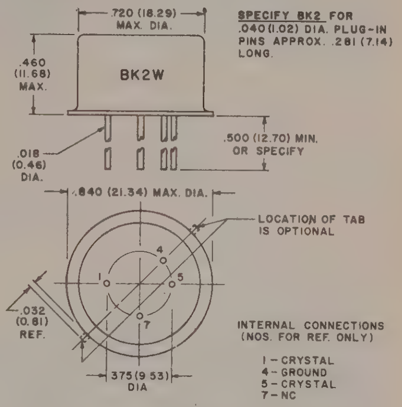
THIS OUTSTANDING GROUP INCORPORATES THE TECHNOLOGY AND CRAFTSMANSHIP THAT HAS MADE BLILEY FAMOUS FOR QUALITY WITHOUT COMPROMISE. EXCEPTIONALLY LOW AGING AND HIGH Q CHARACTERISTICS PROVIDE PRECISION REFERENCE FOR FREQUENCY STANDARDS, SYNTHESIZERS AND ULTRA STABLE SYSTEM CLOCKS.


.790 (20.07) DIA.
BG6IAH-5S/3S OR BG6ISCH-5S/3S
.575 (14.61)
.800 (20.32)
1.500 (38.10)
.375 (9.53) DIA.
.017 (0.43) DIA.
1
5
7
INTERNAL CONNECTIONS (NOS. FOR REF. ONLY)
1 - CRYSTAL
5 - CRYSTAL
7 - NC

BG6IAH-5S/3S OR BG6ISCH-5S/3S
(GLASS ENCLOSURES)


.695 (17.65) MAX.
.290 (7.37) MAX.
BA6
.775 (19.69) MAX.
.238 (6.05) REF.
.050 (1.27) DIA. PLUG-IN PINS
486 (12.34)
.765 (19.43) MAX.
.360 (9.14) MAX.
SPECIFY BA6W FOR .030 (0.76) DIA. WIRE LEADS .500 (12.70) MIN. LENGTH OR SPECIFY.

BA6/BA6W


.720 (18.29) MAX. DIA.
SPECIFY BK2 FOR .040 (1.02) DIA. PLUG-IN PINS APPROX. .281 (7.14) LONG.
.460 (11.68) MAX.
BK2W
.500 (12.70) MIN. OR SPECIFY
.018 (0.46) DIA.
.840 (21.34) MAX. DIA.
LOCATION OF TAB IS OPTIONAL
4
1
5
7
.032 (0.81) REF.
.375 (9.53) DIA
INTERNAL CONNECTIONS (NOS. FOR REF. ONLY)
1 - CRYSTAL
4 - GROUND
5 - CRYSTAL
7 - NC

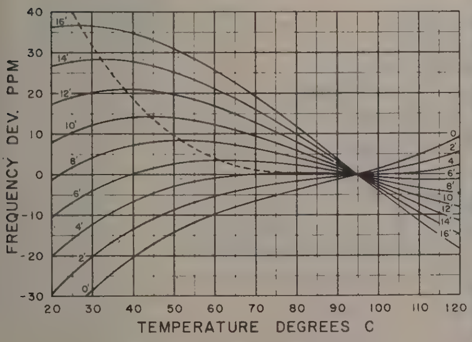
BK2/BK2W

(COLDWELD SEALED METAL ENCLOSURES)

	5TH OVERTONE (AT CUT)	3RD OVERTONE (AT CUT)					
BLILEY TYPE	BG61AH-5S	BG61AH-3S	BA6/BA6W		BK2/BK2W		
FREQ.MHz	5	3.8 – 6.0	3.8 – 7.9	8 – 12	3.8 – 6.0	6.1 – 10.9	11 – 15
AVERAGE Q (10^6)	2.5	1.5		0.6	1.0	0.6	0.4
MAX SERIES RESISTANCE (Ω)	140	50		35	50	40	35
FREQ. TOL. AT TURNING POINT	± 1 PPM	± 4 PPM	± 5 PPM				
TURNING POINT	AVAILABLE AT ANY TEMPERATURE (± 5°C) FROM +45° TO +90°C (TOLERANCE OF ± 3° OR ±4° AVAILABLE UPON REQUEST)						
TEMPERATURE COEFFICIENT	$< 1 \times 10^{-7}$/°C FOR 1° EACH SIDE OF TURNING POINT						
AGING AT +75°C	5×10^{-10}/DAY AFTER 3 DAYS 7×10^{-10}/WEEK AFTER 1 MONTH	2×10^{-9}/DAY AFTER 3 DAYS 2×10^{-9}/WEEK AFTER 1 MONTH	2×10^{-8}/WEEK AFTER 1 WEEK				
DRIVE LEVEL	70µA ± 20%	15µW MAX.	25µW MAX.				
FREQ. CHANGE 50G SHOCK OR 10G VIBRATION	$< \pm 1 \times 10^{-8}$	$< \pm 2 \times 10^{-8}$					
	10 – 200 Hz		10 – 1500 Hz		10 – 2000 Hz		

SC CUT

GENERALIZED TEMPERATURE/FREQUENCY CHARACTERISTICS



	STRESS COMPENSATED – DOUBLE ANGLE ROTATION				
	5TH OVERTONE (SC CUT)	3RD OVERTONE (SC CUT)			
BLILEY TYPE	BG61SCH-5S	BG61SCH-3S		BA6/BA6W AND BK2/BK2W	
FREQ. (MHz)	5	5	10	5	10
AVERAGE Q (x 10^6)	2.5	2.2	1.2	2.0	1.0
MAX SERIES RESISTANCE (Ω)	350	110	65	120	70
FREQ.TOL. (PPM) AT TURNING POINT	±0.5	±1.5	± 1.5	± 1.5	± 1.5
TURNING POINT	WITHIN ±5°C OF ANY TEMP. IN THE RANGE OF 50°C TO 75°C			WITHIN ±5°C OF ANY TEMP. IN THE RANGE OF 30°C TO 75°C	
AGING AT +75°C	7×10^{-10}/WEEK AFTER 1 MO.	2×10^{-9}/WEEK AFTER 1 MO.		2×10^{-8}/WEEK AFTER 1 WEEK	

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE/PENNSYLVANIA 16508

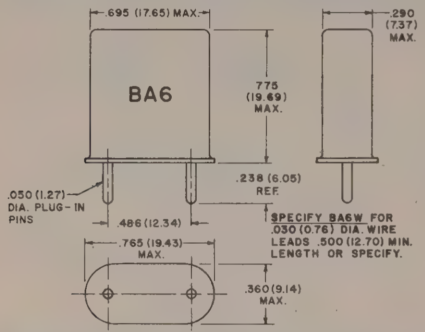
CRYSTALS

Bliley

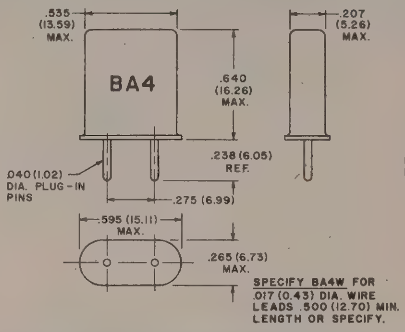
Coldweld Vacuum Sealed

first name in frequency control

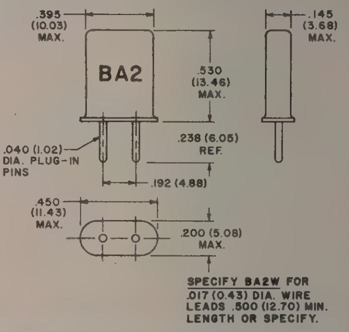
ALTHOUGH SIMILAR IN APPEARANCE AND CONFIGURATION TO A COMMONLY USED SOLDER-SEALED COUNTERPART, BLILEY'S **BA** SERIES FEATURES UNEXCELLED PROCESS CLEANLINESS AND FLUX-FREE SEALING IN VACUUM TO MINIMIZE CONTAMINATION. IMPROVED AGING AND RELIABILITY RESULT AT A MODEST COST PREMIUM. THE DATA FOLLOWING IS SUGGESTED FOR GENERAL GUIDANCE. SUPERIOR PERFORMANCE IN TEMPERATURE STABILITY AND AGING CAN BE PROVIDED IF REQUIRED.


.695 (17.65) MAX.
BA6
.775 (19.69) MAX.
.290 (7.37) MAX.
.050 (1.27) DIA. PLUG-IN PINS
.238 (6.05) REF.
.486 (12.34)
.765 (19.43) MAX.
.360 (9.14) MAX.

SPECIFY BA6W FOR .030 (0.76) DIA. WIRE LEADS .500 (12.70) MIN. LENGTH OR SPECIFY.


.535 (13.59) MAX.
BA4
.640 (16.26) MAX.
.207 (5.26) MAX.
.040 (1.02) DIA. PLUG-IN PINS
.238 (6.05) REF.
.275 (6.99)
.595 (15.11) MAX.
.265 (6.73) MAX.

SPECIFY BA4W FOR .017 (0.43) DIA. WIRE LEADS .500 (12.70) MIN. LENGTH OR SPECIFY.


.395 (10.03) MAX.
BA2
.530 (13.46) MAX.
.145 (3.68) MAX.
.040 (1.02) DIA. PLUG-IN PINS
.238 (6.05) REF.
.192 (4.88)
.450 (11.43) MAX.
.200 (5.08) MAX.

SPECIFY BA2W FOR .017 (0.43) DIA. WIRE LEADS .500 (12.70) MIN. LENGTH OR SPECIFY.

BLILEY TYPE	FREQUENCY RANGE	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM)		MAX. DRIVE LEVEL (mW)
		0 TO 50	0 TO 75	−40 TO +70	−55 TO +90			1ST MONTH	NEXT 12 MONTHS	
BA6	200–299 kHz	±.007	±.008	±.01	±.015	3000	DT	20	40	2
	300–399 kHz					4000				
	400–500 kHz					5000				
	325–499 kHz	±.0025	±.003	±.005	±.007	1500	GT			
	500–600 kHz					2000				
	300–500 kHz	±.003	±.004	±.007	± 011	1000	SL			
BA6 & BA2	500–599 kHz					1500				
	600–800 kHz					2000				
BA6	1–2 MHz	±.0015	±.002	±.0025	–55 to+105	350	A_f	3	2	5
BA6 & BA4	2–3 MHz				±.004	175			3	
	3–4 MHz					75				
BA6, BA4, & BA2	4–7 MHz					50				
	7–10 MHz					30				
	10–20 MHz					25				
	20–60 MHz					40	A_3			2
BA2	60–87 MHz					50	A_5			1
	87–100 MHz					60				
	100–150 MHz					90	A_7			

AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.
A_f, A_3, A_5, A_7 DENOTE AT CUT-FUNDAMENTAL MODE, 3RD OVERTONE MODE, ETC.

BLILEY TYPE	BA6	BA6W	BA4	BA4W	BA2	BA2W
MIL-H-10056 HOLDER DESIGNATION	HC-36/U	HC-47/U	HC-46/U	—	HC-42/U	HC-43/U
VIBRATION	10G FROM 10–2000 Hz					
SHOCK	100G FOR 11 ms					

INTERNALLY RUGGEDIZED DESIGNS ARE AVAILABLE FOR HIGHER LEVEL SHOCK AND VIBRATION.

QUARTZ CRYSTALS • CRYSTAL OSCILLATORS

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P. O. BOX 3428
ERIE/PENNSYLVANIA 16508

CRYSTALS

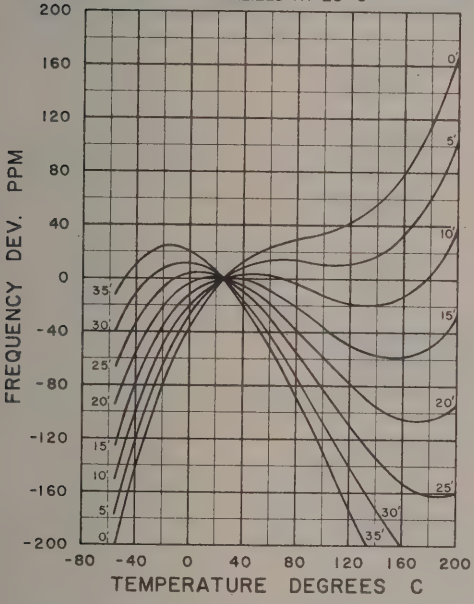
Bliley
first name in frequency control

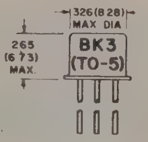
Stress Compensated Double Angle Rotation • SC Cut

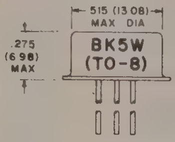
- IMPROVED FREQUENCY STABILITY DURING ACCELERATION AND VIBRATION
- HIGH DRIVE CAPABILITY — SEVERAL TIMES TYPICAL AT CUT LEVELS
- LOW PHASE NOISE
- LOW AGING RATE
- FAST WARM-UP

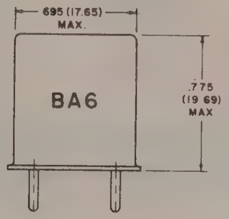
SC CUT

GENERALIZED TEMP./FREQ. CHARACTERISTICS
NORMALIZED AT 25° C




326 (8 28)
MAX DIA
265
(6 73)
MAX.
BK3
(TO-5)


515 (13 08)
MAX DIA
.275
(6 98)
MAX
BK5W
(TO-8)

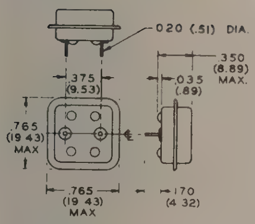

695 (17.65)
MAX.
BA6
.775
(19 69)
MAX

BLILEY TYPE	FREQUENCY RANGE (MHz)	MODE
BK5/BK5W	5–15	FUND.
BK3/BK3-1B	15–33	
BA6/BA6W	5–45	3RD
BK5/BK5W	33–45	
BK3/BK3-1B	45–100	
	75–140	5TH

TEMPERATURE RANGE (°C)	FREQUENCY TOLERANCE*
0 TO +50	±.0018%
−10 TO +60	±.0023%
−40 TO +85	±.0048%
−55 TO +85	±.006%
−55 TO +105	±.007%
−55 TO +125	±.0075%
−55 TO +200	±.01%
+20 TO +85	±.0023%
+60 TO +90	±.001%

*INCLUDES STABILITY OVER TEMP. RANGE & CALIBRATION TOLERANCE.

For PC Board Mount • Coldweld Sealed • DT-SL-AT Cuts


.020 (.51) DIA.
.350
(8.89)
MAX.
.375
(9.53)
.035
(.89)
.765
(19 43)
MAX
.765
(19 43)
MAX
.170
(4 32)

HB2
(HC-39/U)

BLILEY TYPE	FREQUENCY RANGE (kHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C)				MAX. SERIES RES. (Ω)	CUT
		0 TO 50	0 TO 75	−40 TO +70	−55 TO +90		
HB2	200 - 299	±.007	±.008	±.01	±.015	4000	DT
	300 - 399					5500	
	400 - 450					6000	
	450 - 599	±.003	±.004	±.007	±.011	2000	SL
	600 - 800					2500	
	1 - 2 MHz	±.002	±.0025	±.003	±.004	400	A_f
	2 - 3 MHz					200	
	3 - 4 MHz					100	
	4 - 7 MHz					60	
	7 - 10 MHz					30	
	10 - 20 MHz					25	
	20 - 50 MHz					40	A_3

ALL FREQUENCY TOLERANCES INCLUDE INITIAL CALIBRATION AT +25°C.

A_f AND A_3 DENOTE AT CUT-FUNDAMENTAL MODE AND 3RD OVERTONE MODE.

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE/PENNSYLVANIA 16508

CRYSTALS

Bliley
first name in frequency control

General Purpose and Mil-Spec.

Good performance and reliability plus versatility in mounting and economy pinpoint this group as the logical choice for most computer, data processing and general purpose applications. A variety of holder styles is available with the familiar Mil-Spec solder seal or our "Resistance-Weld" seal, a newer process ideally adapted to volume production at lowest cost with a reduced possibility of contamination.

BLILEY TYPE	FREQUENCY RANGE (kHz)	TEMPERATURE RANGE (°C) 0 TO 50 FREQ. TOL. (%)	0 TO 50 MAX. SERIES RES. (Ω)	0 TO 75 FREQ. TOL. (%)	0 TO 75 MAX. SERIES RES. (Ω)	−40 TO +70 FREQ. TOL. (%)	−40 TO +70 MAX. SERIES RES. (Ω)	−55 TO +90 FREQ. TOL. (%)	−55 TO +90 MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM) 1ST MONTH	AGING (PPM) NEXT 12 MOS.	MAX. DRIVE LEVEL (mW)
BH9	2.5-5	±.01	75k	±.015	85k	±.02	85k	±.025	100k	JT	40	100	0.1
	5-8		60k		75k		75k		90k				
	8-13.5		50k		60k		60k		75k				
	13.5-30	±.005	75k	±.009	100k	±.012	100k	±.02	125k	NT	20	50	
	30-50		65k		90k		90k		110k				
	50-100		55k		75k		75k		90k				
	90-175	±.015	3.5k	±.017	3.5k	±.02	4k	±.03	5k	+5°X	25	70	2
	175-250		4k		4k		4.5k		6k				
BH6	200-300		4k		4k		4.5k		6k				

BLILEY TYPE	FREQUENCY RANGE (kHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) 0 TO 50	0 TO 75	−40 TO +70	−55 TO +90	MAX. SERIES RES. (Ω)	CRYSTAL CUT	AGING (PPM) 1ST MONTH	AGING (PPM) NEXT 12 MOS.	MAX. DRIVE LEVEL (mW)
BH6/BR6	200	±.007	±.008	±.01	±.015	4000	DT	20	40	2
	300-399					5000				
	400-500					6000				
BH6/BR6 & BX/BR2	300-500	±.003	±.004	±.007	±.011	1500	SL			
	500-599					2000				
	600-800					2500				
BH6/BR6	325-499	±.0025	±.003	±.005	±.007	2000	GT			
	500-600					2500				
	450-599	±.007	±.009	±.01	±.02	2500	P			
	600-750					3000				
	1-2 MHz	±.002	±.0025	±.003	−55 to +105	400	A_f	4	3	5
BH6/BR6 & BH4/BR4	2-3 MHz				±.005	200				
	3-4 MHz					100				
BH6/BR6 BH4/BR4 & BX/BR2	4-7 MHz					60				
	7-10 MHz					30				
	10-20 MHz					25				
	20-60 MHz					40	A_3			2
BX/BR2	60-87 MHz					60	A_5	4	4	
	87-100 MHz					75				
	100-150 MHz					90	A_7			

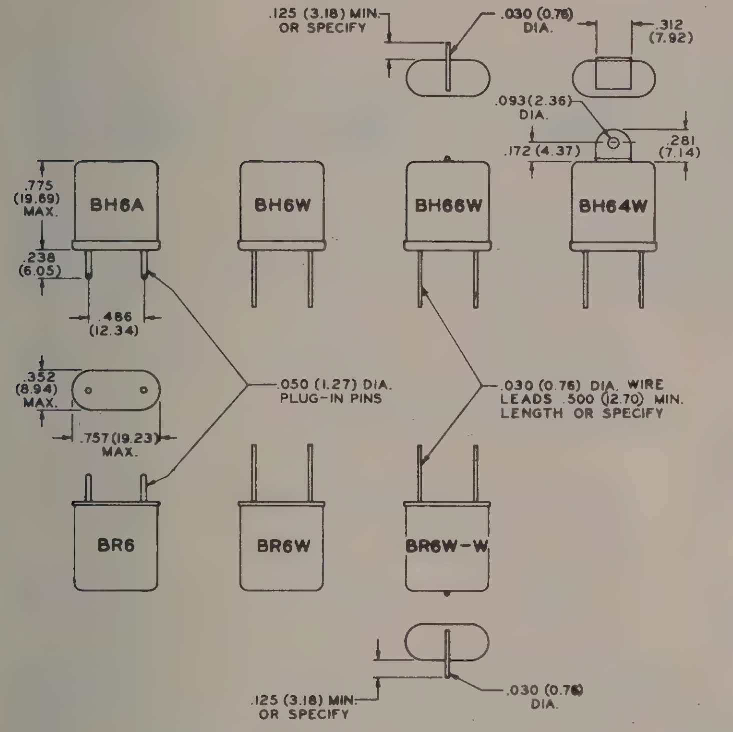
ALL FREQUENCY TOLERANCES INCLUDE INITIAL CALIBRATION AT +25°C.
AGING VALUES ARE BASED UPON CONTINUOUS OPERATION AT +85°C AND DRIVE LEVELS AS INDICATED.
A_f, A_3, A_5, A_7 DENOTE AT CUT-FUNDAMENTAL MODE, 3RD OVERTONE MODE, ETC.

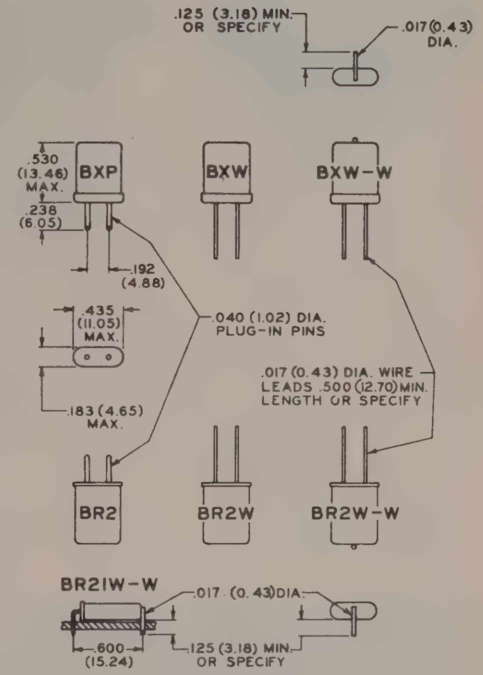
For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE/PENNSYLVANIA 16508

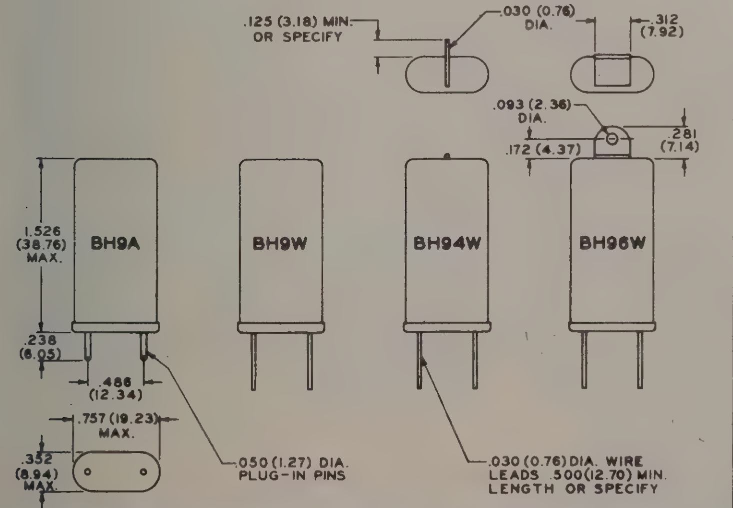
CRYSTAL HOLDERS

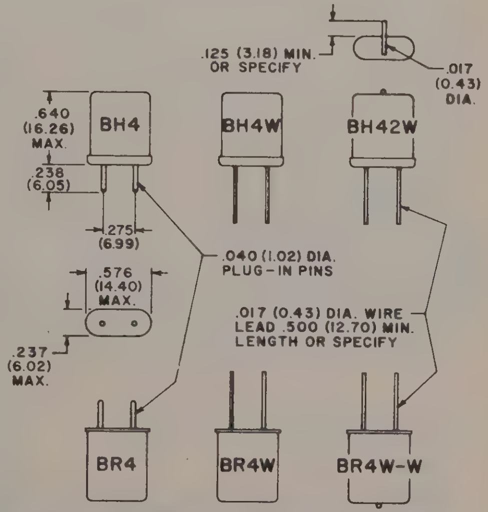
BH & BX Series • solder sealed
BR Series • resistance-weld sealed

Bliley
first name in frequency control


.125 (3.18) MIN. OR SPECIFY
.030 (0.76) DIA.
.312 (7.92)
.093 (2.36) DIA.
.172 (4.37)
.281 (7.14)
.775 (19.69) MAX.
BH6A
BH6W
BH66W
BH64W
.238 (6.05)
.486 (12.34)
.352 (8.94) MAX.
.757 (19.23) MAX.
.050 (1.27) DIA. PLUG-IN PINS
.030 (0.76) DIA. WIRE LEADS .500 (12.70) MIN. LENGTH OR SPECIFY
BR6
BR6W
BR6W-W
.125 (3.18) MIN. OR SPECIFY
.030 (0.76) DIA.


.125 (3.18) MIN. OR SPECIFY
.017 (0.43) DIA.
.530 (13.46) MAX.
BXP
BXW
BXW-W
.238 (6.05)
.192 (4.88)
.435 (11.05) MAX.
.040 (1.02) DIA. PLUG-IN PINS
.017 (0.43) DIA. WIRE LEADS .500 (12.70) MIN. LENGTH OR SPECIFY
.183 (4.65) MAX.
BR2
BR2W
BR2W-W
BR21W-W
.017 (0.43) DIA.
.600 (15.24)
.125 (3.18) MIN. OR SPECIFY


.125 (3.18) MIN. OR SPECIFY
.030 (0.76) DIA.
.312 (7.92)
.093 (2.36) DIA.
.172 (4.37)
.281 (7.14)
1.526 (38.76) MAX.
BH9A
BH9W
BH94W
BH96W
.238 (6.05)
.486 (12.34)
.757 (19.23) MAX.
.352 (8.94) MAX.
.050 (1.27) DIA. PLUG-IN PINS
.030 (0.76) DIA. WIRE LEADS .500 (12.70) MIN. LENGTH OR SPECIFY


.125 (3.18) MIN. OR SPECIFY
.017 (0.43) DIA.
.640 (16.26) MAX.
BH4
BH4W
BH42W
.238 (6.05)
.275 (6.99)
.040 (1.02) DIA. PLUG-IN PINS
.576 (14.40) MAX.
.017 (0.43) DIA. WIRE LEAD .500 (12.70) MIN. LENGTH OR SPECIFY
.237 (6.02) MAX.
BR4
BR4W
BR4W-W

BLILEY TYPE	BH6A	BH6W	BR6	BR6W	BXP	BXW	BR2	BR2W	BH9A	BH9W	BH4
MIL-H-10056 HOLDER DESIGNATION	HC-6/U	HC-33/U	HC-48/U	HC-51/U	HC-25/U	HC-18/U	HC-50/U	HC-49/U	HC-13/U	HC-34/U	HC-32/U
VIBRATION	10 G FROM 10 TO 500 Hz										
SHOCK	100 G FOR 11 ms										

INTERNALLY RUGGEDIZED DESIGNS ARE AVAILABLE FOR HIGHER LEVEL SHOCK AND VIBRATION.

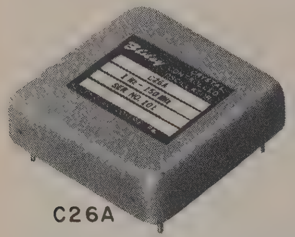
For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE / PENNSYLVANIA 16508

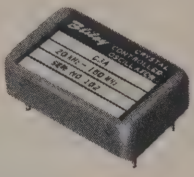
CRYSTAL OSCILLATORS

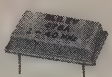
General Purpose-Clock Oscillators

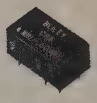
Bliley
first name in frequency control

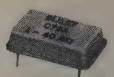
Designed with primary emphasis on Quality — Backed up by Top Technology

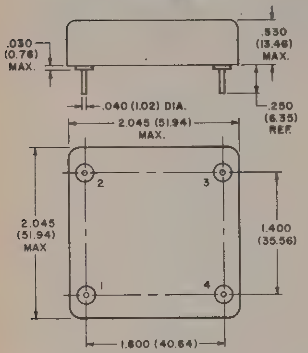

C26A


C3A

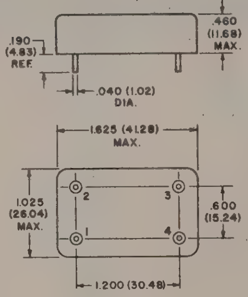

C76A


C8A

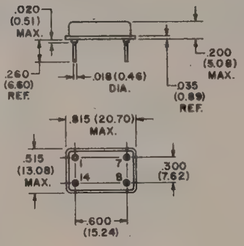

C79A


.030 (0.76) MAX.
.530 (13.46) MAX.
.040 (1.02) DIA.
.250 (6.35) REF.
2.045 (51.94) MAX.
2
3
2.045 (51.94) MAX
1.400 (35.56)
1
4
1.600 (40.64)

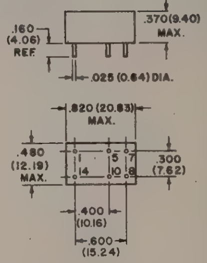
1 — NEG. OSC. & RF GND.
2 — VOLTAGE CONTROL OR N.C.
3 — +5 VDC
4 — OUTPUT


.190 (4.83) REF.
.460 (11.68) MAX.
.040 (1.02) DIA.
1.625 (41.28) MAX.
1.025 (26.04) MAX.
2
3
1
4
.600 (15.24)
1.200 (30.48)

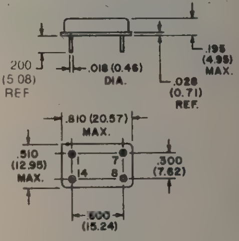
1 — NEG. OSC. & RF GND.
2 — N.C.
3 — +5 VDC
4 — OUTPUT


.020 (0.51) MAX.
.260 (6.60) REF.
.018 (0.46) DIA.
.035 (0.89) REF.
.200 (5.08) MAX.
.815 (20.70) MAX.
.515 (13.08) MAX.
1
7
14
8
.300 (7.62)
.600 (15.24)

1 — N.C.
7 — GROUND
8 — OUTPUT
14 — +5 VDC
(14 PIN DIP COMPATABLE)


.160 (4.06) REF.
.370 (9.40) MAX.
.025 (0.64) DIA.
.820 (20.83) MAX.
.480 (12.19) MAX.
1
5
7
14
10
8
.300 (7.62)
.400 (10.16)
.600 (15.24)

1,5,10 — N.C.
7 — GROUND
8 — OUTPUT
14 — +5 VDC
(14 PIN DIP COMPATABLE)


200 (5.08) REF
.018 (0.46) DIA.
.028 (0.71) REF.
.195 (4.95) MAX.
.810 (20.57) MAX.
.510 (12.95) MAX.
1
7
14
8
.300 (7.62)
.600 (15.24)

1 — N.C.
7 — GROUND
8 — OUTPUT
14 — +5 VDC
(14 PIN DIP COMPATABLE)

BLILEY TYPE	FREQUENCY RANGE	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				OUTPUT
		0 TO 50	0 TO 70	−20 TO +70	−40 TO +70	
C26A	1 Hz — 2 MHz	± .001	± .0015	± .002	± .0025	TTL LOGIC
	50 kHz — 100 MHz	± .001	± .0012	± .0015	± .002	
	800 kHz — 150 MHz					SINE WAVE
C3A	20 kHz — 25 MHz	± .001	± .0012	± .0015	± .002	TTL LOGIC
	25 MHz — 50 MHz	± .001	± .0012	± .002	—	
	3 MHz — 100 MHz	± .001	± .0012	± .0015	± .002	SINE WAVE
C76A	1 MHz — 25 MHz	—	± .01	—	—	TTL LOGIC
	25 MHz — 40 MHz	—	± .02	—	—	
C8A	4 MHz — 60 MHz	± .004	± .005	± .01	—	
C79A*	1 MHz — 25 MHz	—	± .01	—	—	
	25 MHz — 40 MHz	—	± .02	—	—	

*(CASE DESIGN INCORPORATES AN ALL METAL RESISTANCE — WELD HERMETIC SEAL ENCLOSURE.)

GENERAL SPECIFICATIONS

SUPPLY: +5 VDC
OUTPUT: TTL LOGIC "1" +2.4 V MIN., LOGIC "0" +0.4 V MAX.
SYMMETRY: 60/40 DUTY CYCLE WORST CASE
LOAD: 10 TTL GATES
SINE WAVE: 0.7 VRMS (1000 Ω LOAD), 800 kHz — 25 MHz
0.2 VRMS (50 Ω LOAD), 1 — 150 MHz
CUSTOM OPTIONS AVAILABLE: CMOS LOGIC, COMPLEMENTARY OUTPUTS, DUAL-FREQUENCY OUTPUTS
FREQUENCY ADJUSTMENT: ELECTRICAL OR MECHANICAL AVAILABLE ON C26A AS A CUSTOM OPTION
HERMETIC ENCLOSURES: C26A, C3A AND C79A

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P. O. BOX 3428
ERIE/PENNSYLVANIA 16508

CRYSTAL OSCILLATORS

Bliley
first name in frequency control

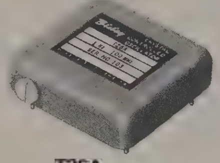
Temperature Compensated (TCXO) Crystal Oscillators

BLILEY TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS ARE DESIGNED TO INTEGRATE THE CHARACTERISTICS OF HIGH QUALITY COLDWELD SEALED CRYSTALS WITH TEMPERATURE COMPENSATED CIRCUITRY TO ACHIEVE IMPROVED FREQUENCY STABILITY WITHOUT TEMPERATURE CONTROL AND LOW AGING TO ASSURE LONG TERM RELIABILITY.

STOCK OSCILLATORS – FAST DELIVERY

BLILEY TYPE NO.	FREQ. (MHz)	FREQ. STABILITY	SUPPLY (DC) VOLTS	SUPPLY (DC) REG.	SUPPLY (DC) mA	TTL LOGIC OUTPUT
T26A411	1	±1 x 10^{-6} OVER 0–50°C	+ 5	± 1%	35	"0": +0.4V MAX.
T26A412			+12	±10%	30	"1": +2.4V MIN.
T26A413/440*	5/10*		+ 5	± 1%	25	T_r & T_f: 12 NS MAX.
T26A414/441*			+12	±10%	35	SYMMETRY: 60/40 LOAD: 10 TTL GATES

FREQ. ADJUST. RANGE: ±5 X 10^{-6} MIN. AGING RATE: 1 X 10^{-6}/YR.


T26A

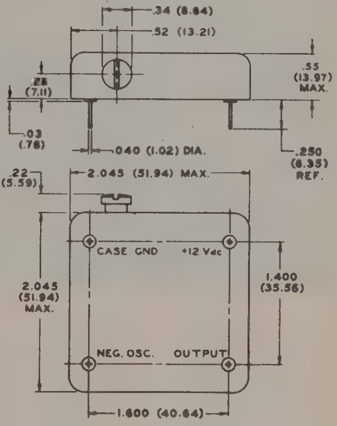
CUSTOM OSCILLATORS / BLILEY TYPE T26A SERIES

FREQUENCY RANGE / OUTPUT WAVEFORM	FREQUENCY STABILITY vs TEMPERATURE RANGE	
1 MHz – 20 MHz SINEWAVE OR 50 kHz – 20 MHz TTL LOGIC	±1 x 10^{-6}	0 to +60°C
	±5 x 10^{-7}	
	±1 x 10^{-6}	–20 to +70°C
	±5 x 10^{-7}	
	±1 x 10^{-6}	–40 to +70°C
	±2 x 10^{-6}	–55 to +70°C
	±1 x 10^{-7}	+20 to +40°C

SUPPLY REQUIREMENTS:
+12 VDC ±10% REG. AGING RATE: 1 X 10^{-6}/YR.

Options available:

- CMOS logic output from 1 Hz – 20 MHz
- Sine Wave & TTL logic output from 20 MHz – 100 MHz
- Other Supply Voltages


.34 (8.64)
.52 (13.21)
.55 (13.97) MAX.
.28 (7.11)
.03 (.76)
.040 (1.02) DIA.
.250 (6.35) REF.
.22 (5.59)
2.045 (51.94) MAX.
CASE GND
+12 Vdc
2.045 (51.94) MAX.
1.400 (35.56)
NEG. OSC.
OUTPUT
1.600 (40.64)

Voltage Controlled (VCXO) Crystal Oscillators

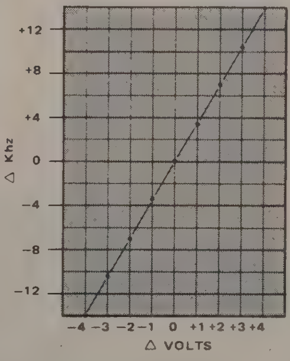
BLILEY VOLTAGE CONTROLLED CRYSTAL OSCILLATORS COMBINE INHERENT CRYSTAL STABILITY AND VOLTAGE CONTROLLED FREQUENCY DEVIATION IN A SINGLE SOLID STATE DEVICE. CENTER FREQUENCY RANGE FROM 1–100 MHz WITH PERFORMANCE CHARACTERISTICS TABULATED BELOW:

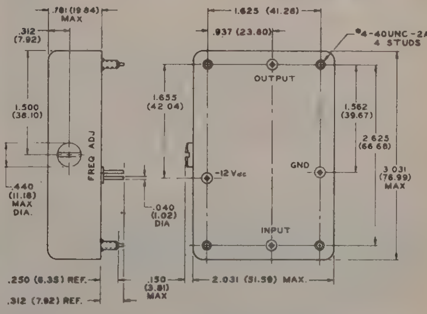
V9A

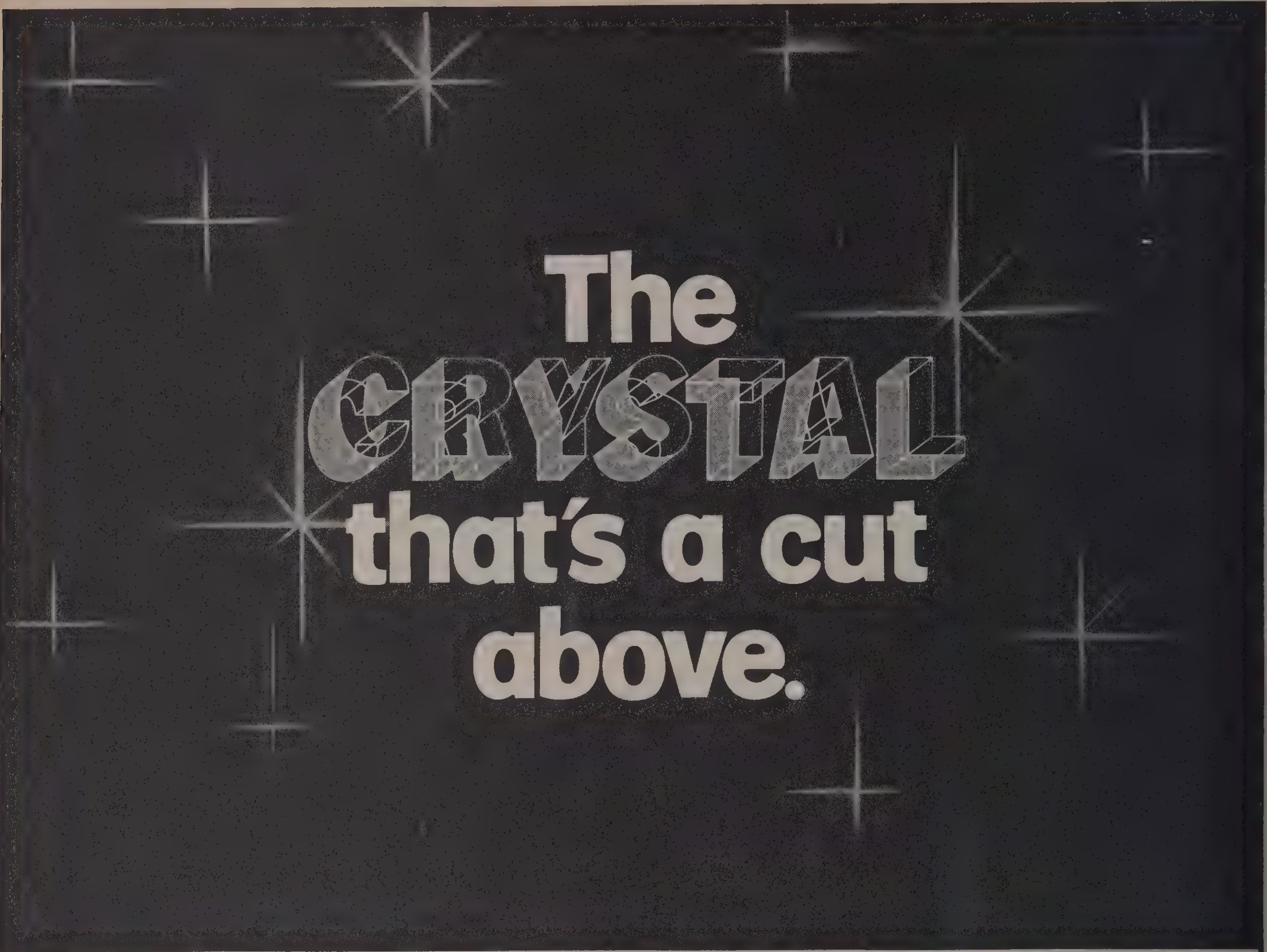
FREQUENCY DEVIATION	FREQUENCY STABILITY	TEMPERATURE RANGE
± .01%	± .001% ± .002%	0 to 50°C -20 to +70°C
± .05%	± .002% ± .005%	0 to 50°C -20 to +70°C
± .1%	± .004% ± .008%	0 to 50°C -20 to +70°C
± .2%	± .005% ± .01%	0 to 50°C -20 to +70°C

- Standard design parameters are based on operation with –12 Vdc; 25 mA supply. Other voltages may be specified as a custom option.
- Standard output is sine wave, typical 1V rms into 1000 ohms or .25V rms into 50 ohms.
- Mechanical trim is provided for center frequency adjustment.
- Typical modulation voltage is ±5V with a modulating input impedance of 10K ohms and modulation rate from DC to 20 kHz

TYPICAL LINEARTY CHART
(C.F. 45 MHz &
± 14 kHz DEVIATION)

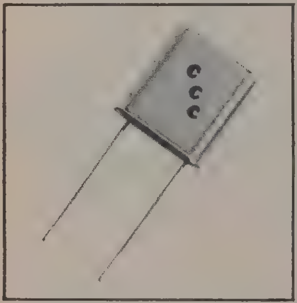



.781 (19.84) MAX
.312 (7.92)
1.500 (38.10)
FREQ ADJ
.440 (11.18) MAX DIA.
.040 (1.02) DIA
.250 (6.35) REF.
.312 (7.92) REF.
.150 (3.81) MAX
1.625 (41.28)
.937 (23.80)
*4-40UNC-2A 4 STUDS
OUTPUT
1.655 (42.04)
1.562 (39.67)
2.625 (66.68)
3.031 (76.99) MAX
GND
-12 Vdc
INPUT
2.031 (51.58) MAX.

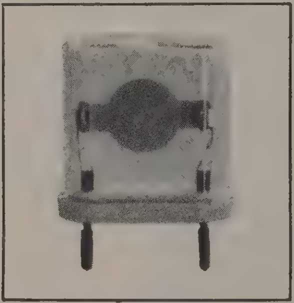


Colorado Crystal Corp., a leader in precision crystals, offers AT, SC, and AC cuts in a variety of holders ranging from the HC27/W glass to the HC40/W coldweld. Our innovative production methods give us a decisive edge in supplying high quality crystals in the 1 to 250 MHz range. We can meet your specifications. Call today and find out how better crystals mean better products.

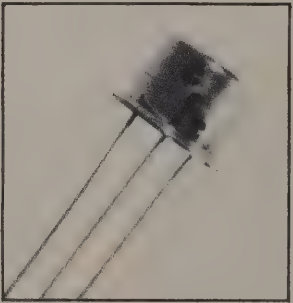
NEW in 1984—Ultra Q Crystals for your most demanding applications. Better resolution, improved stability and greater performance all the way round are available with this new generation of 10 MHz, 5th overtone quartz resonators. Manufactured in Colorado Crystal's new precision clean room, these crystals can make a difference in your product.



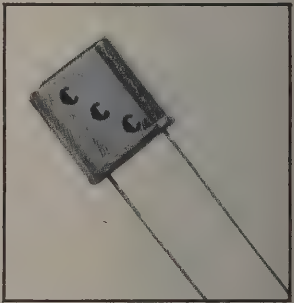
Resistance Weld Holders



Glass Holders



Coldweld Holders



Solder Seal Holders

Whatever your crystal needs, go with the leader and place your confidence in Colorado Crystal Technology.

COLORADO
CRYSTAL
CORP.

(303) 667-9248
2303 West 8th St. / Loveland, Colo. 80537

comstron corporation
TECHNOLOGY " + " FILTERS
The Extra Edge in Systems Performance DC to 1 GHz

Comstron has developed optimum frequency or time domain filters to produce near theoretical system performance. These technology + filters are available as catalog items or custom tailored to your needs.

Design

Comstron has implemented modern network synthesis and physical realization techniques to the point where highly reliable, compact, LC and crystal filters are available – quickly and economically. Proprietary computer analysis, modeling, and optimization programs efficiently arrive at near-optium solutions to spectral, time domain, and stochastic problems. The Company's Enhanced Synthesis Program (ESP), Filter Optimization Program (FOP) and Parameter Optimization Program (POP) provide design parameters for systems oriented functions. Requirements for group delay equalization, wide band arithmetic symmetry, x/sin x amplitude correction, corrected Nyquist filters, phase compensation, and time domain response designs are routinely and efficiently handled.

Test

The Company's commitment to excellence is evident in its extensive test facilities. Automatic computer based network analyzers cover the frequency range from dc to 1.3 GHz with full plotting and printer output capability. Parameters which are automatically measured include amplitude response, phase response, group delay, and return loss. Time domain testing can also be performed to verify impulse response or response to complex waveforms.

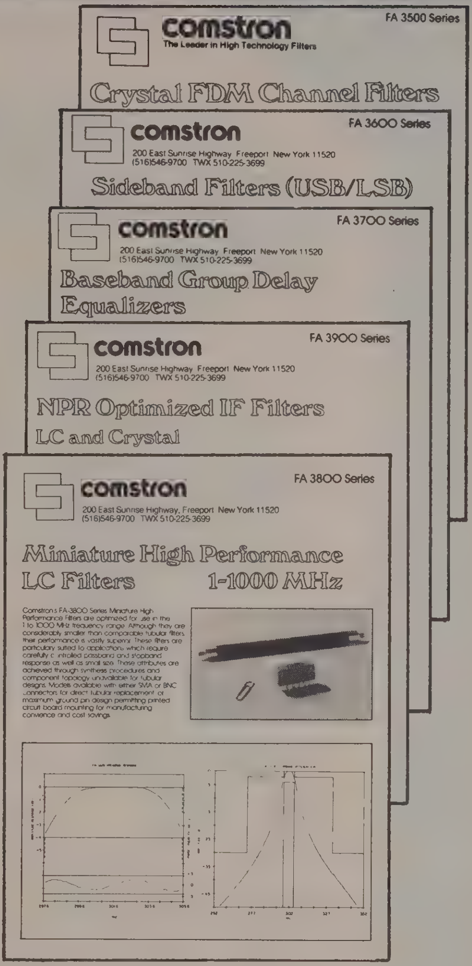
Computer directed environmental testing allows unattended measurements of performance over temperature on a production basis. Comstron's proprietary Automatic Filter Test (AFT) programs permits rapid and accurate generation of acceptance test procedures as well as full documentation and data files when required.

Quality Control

Comstron maintains a Quality Control Department that ensures compliance with MIL-I-45208A and MIL-Q-9858A when applicable. Microscopic inspection, controlled environment, material control and traceability, solder training programs, and strict configuration management all contribute to producing an exceptionally reliable product.

The quality control program is continuously monitored. Over the years since its inception, Comstron has assembled a dedicated, conscientious staff whose pride of workmanship and customer loyalty is the keynote of the Company.

Send for our complete Data Sheets.



comstron
The Leader in High Technology Filters
FA 3500 Series
Crystal FDM Channel Filters

comstron
200 East Sunrise Highway Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3600 Series
Sideband Filters (USB/LSB)

comstron
200 East Sunrise Highway Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3700 Series
Baseband Group Delay Equalizers

comstron
200 East Sunrise Highway Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3900 Series
NPR Optimized IF Filters
LC and Crystal

comstron
200 East Sunrise Highway, Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3800 Series
Miniature High Performance LC Filters 1-1000 MHz

Comstron's FA-3800 Series Miniature High Performance Filters are optimized for use in the 1 to 1000 MHz frequency range. Although they are considerably smaller than comparable tubular filters their performance is vastly superior. These filters are particulary suited to applications which require carefully controlled passband and stopband response as well as small size. These attributes are achieved through synthesis procedures and component topology unavailable for tubular designs. Models available with either SMA or BNC connectors for direct tubular replacement or maximum ground pin design permitting printed circuit board mounting for manufacturing convience and cost savings.

Standard Filter Catagories

- FDM Channel
- Quad Phase Matched
- Miniature LC.
- USB/LSB
- Fiber Optic Repeater
- Group Delay Equalizer
- NPR Optimized
- Pulse Response Optimized
- Nyquist
- Video
- Speech Plus
- Group/Super Group/Master Group/Pilot Notch
- 70/140 MHz Satellite IF Filters
- 70 MHz Switchable Equalizer (Delay or Amplitude)

Call Comstron for applications assistance for your LC and Crystal Filter requirements.

comstron corporation

200 East Sunrise Highway, Freeport, New York 11520
(516)546-9700 TWX 510-225-3699

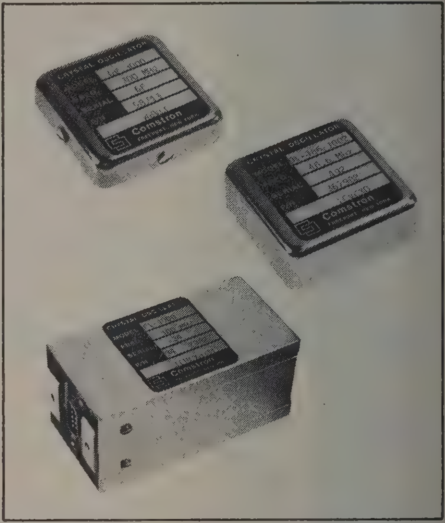
CRYSTAL OSCILLATORS

VCXO's To 1 GHz
TCXO's To 1 GHz

Comstron, the technology leader in oscillators for military, commercial, and deep-space applications, welcomes the opportunity to assist you with your crystal oscillator requirements. Through proprietary computer-generated design, testing and production techniques, Comstron delivers state-of-the-art low noise performance on VCXO's, TCXO's, Oven Controlled Crystal Oscillators and phase locked sources to 1 GHz. The Company's Design for Optimum Performance (DOP) programs provide optimization of performance attributes as well as sensitivity analysis. Our design and high reliability resources can make the difference in your system. Listed are typical standard designs from our Oscillator product library. However, modifications to suit your specific needs are easily accommodated.

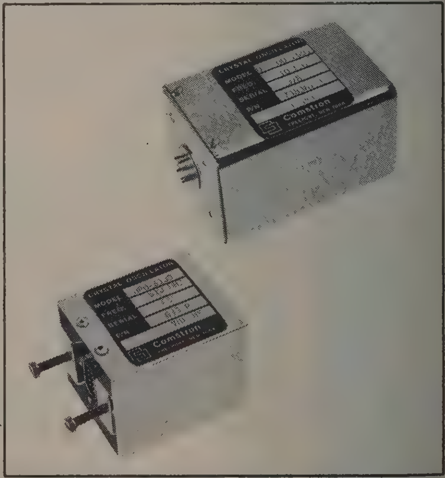
Voltage Controlled Crystal Oscillators

Frequency	1 - 25 MHz	25 - 150 MHz	150 MHz to 1 GHz
Mod Range	± .1%	± .01%	± .01%
	Wider or Narrower Mod Range Available		
Output	Sine OdBm/ 50 ohm	OdBm/50 ohm	OdBm/50 ohm
	ECL	ECL	N/A
	CMOS to 10 MHz	N/A	N/A
	TTL	STTL to 100 MHz	N/A
Mod Voltage	± 5V	± 5V	± 5V
	Variation in Sensitivity Available		
Linearity	± 1%	± 2%	± 5%
Temperature Range	0 - 55°C	0 - 55°C	0 - 55°C
	Wider Temperature Range Available		
Stability	1 ppm	1 ppm	2 ppm
Size	2 × 2 × .75″	2 × 2 × .75″	3 × 1.5 × .75″
Connector	PC Mount	PC Mount	PC Mount
	Special Connectors Available		



Ovenized Crystal Oscillators

Frequency	.1 to 25 MHz	25 MHz to 500 MHz
Aging Rate	1×10^{-9}/day	1×10^{-8}/day
	Improved Stability Available	
Output	Sine OdBm/50 ohm	OdBm/50 ohm
Temperature Range	− 20 to + 60°C	− 20 to + 60°C
Temperature Stability	3×10^{-8}	5×10^{-8}
Supply Voltage	28 V	28 V
Adjustment Range	± 1 ppm min.	± 1 ppm min.
Size	2″ × 2″ × 4″	2″ × 2″ × 4″



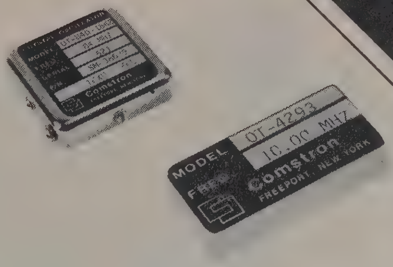
See our ads in Sections 2700 & 2900

comstron corporation

200 East Sunrise Highway, Freeport, New York 11520
(516) 546-9700 TWX 510-225-3699

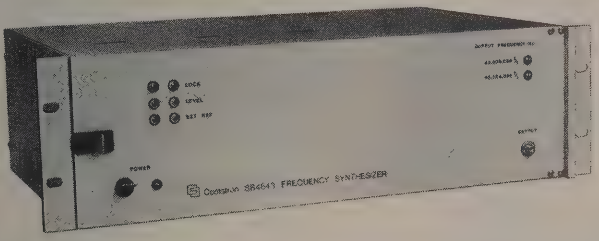
Temperature Compensated Crystal Oscillators

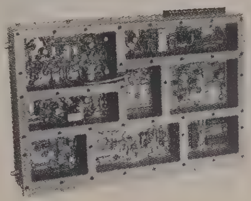
Frequency	.1 to 25 MHz	25 MHz 150 MHz	150 MHz to 1 GHz
Temperature Range	0°C - 60°C	0°C - 60°C	0°C - 60°C
		Wider Temperature Ranges Available	
Stability	5×10^{-7}	5×10^{-7}	1×10^{-8}
Output	Sine OdBm/ 50 ohm ECL CMOS to 10 MHz TTL	OdBm/50 ohm ECL N/A STTL to 100 MHz	OdBm/50 ohm N/A N/A N/A
Aging Rate	1×10^{-6}/year	2×10^{-6}/year	2×10^{-6}/year
Supply Voltage	12 V	12 V	12 V
Current	10 ma	10 ma	10 ma
Size	2″ x 2″ x .75″	2″ x 2″ x .75″	3″ x 1.5″ x .75″
Connectors	PC Mount	PC Mount	PC Mount
		Special Connectors Available	

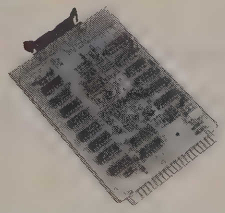


Phase Locked Crystal Oscillators

Comstron's preeminant technology in frequency synthesizers and locked sources can be put to use in your system. Modular building blocks are configurable to cover frequencies from low audio to 1 GHz. When system requirements dictate superior short term stability (phase noise), long term stability and reliability, Comstron's OEM line fills the need.







Ordering Information

How to Specify Part Number:

O for Oscillator;

plus one letter for type.

P = Oven controlled Crystal Oscillator
V = VCXO
T = TCXO

plus one letter for output

S = Sine
E = ECL
C = CMOS
T = TTL

plus four digits for frequency

XXXX in .1 MHz

Example:

OVS-0214

Oscillator VCXO Sine 21.4 MHz

Where requirements differ from listed models, choose the closest model and provide details regarding your specific needs.

See our ads in Sections 2700 & 2900.

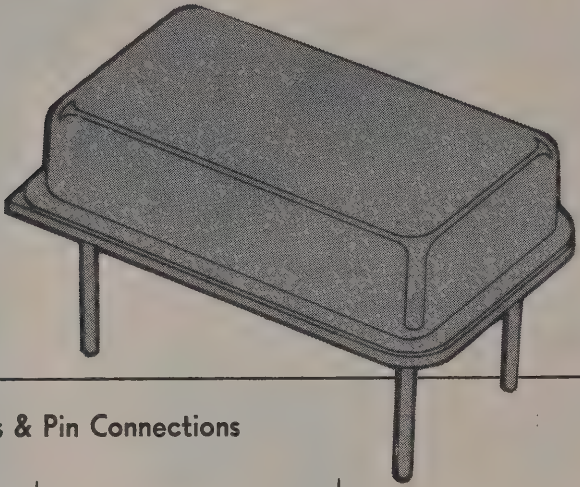
comstron corporation

200 East Sunrise Highway, Freeport, New York 11520
(516) 546-9700 TWX 510-225-3699

COMCLOK

1142 No. Gilbert St., Anaheim, CA 92801 • Technical Assistance (213) 820-7261
Order Placement (800) 854-XTAL — In Calif. (714) 991-1580 • TWX 9105911892

TTL Clock Oscillators



Models:

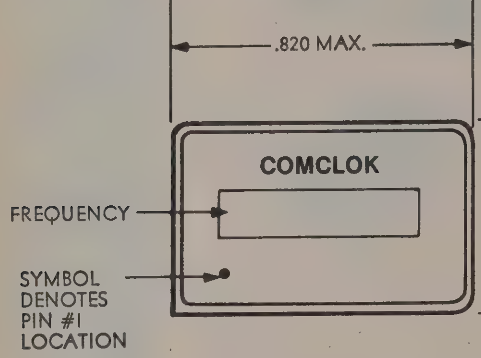
- ☐ CCO 100A (100 ppm)
- ☐ CCO 50A (50 ppm)
- ☐ CCO 25A (25 ppm)

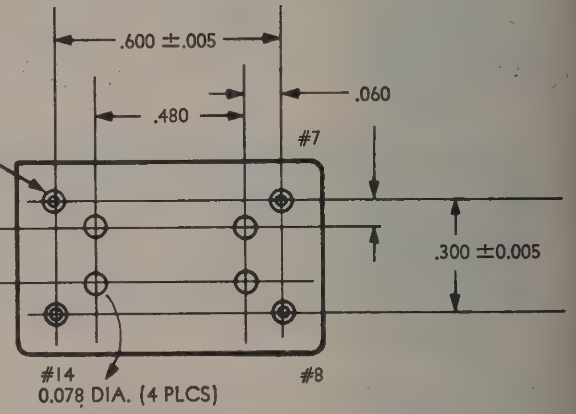
Features:

- ☐ 0.820"(L) x 0.520"(W) x 0.240"(H)*
- ☐ Dual In Line Spacing
- ☐ TTL Compatible Output
- ☐ High Reliability
- ☐ Resistance Welded

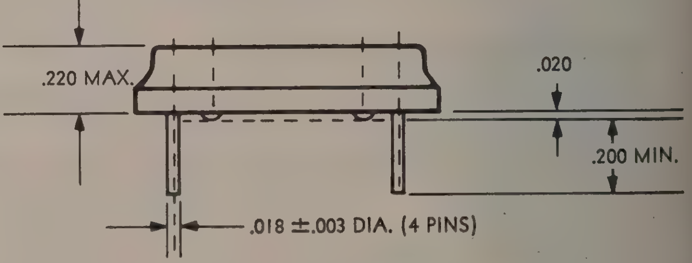
* INCLUDES INSULATED STAND OFF.

Dimensions & Pin Connections


.820 MAX.
COMCLOK
FREQUENCY
SYMBOL DENOTES PIN #1 LOCATION
.520 MAX.


.600 ±.005
.060
.480
PIN #1
#7
.180
.300 ±0.005
#14
#8
0.078 DIA. (4 PLCS)

PIN	CONNECTION
1	N.C.
7	GND
8	OUTPUT
14	+V dc


.220 MAX.
.020
.200 MIN.
.018 ±.003 DIA. (4 PINS)

Specifications

Frequency Range .... 250 KHz - 70 MHz

Frequency Stability .... ±0.01%, ±0.005%, ±0.0025%

Temperature Range
  Operating .... 0° —70°C
  Storage .... −55° - +125°C

Input Current .. 80 mA Max. 250 KHz - 3.9 MHz
  50 mA Max. 4.0 MHz - 31.9 MHz
  60 mA Max. 32.0 MHz - 70.0 MHz

Input Voltage .... +5 V DC ±10%

TTL Output
  Symmetry .... 60/40% @ 1.4 V DC level

Rise and Fall Time
  10 ns Max. 250 KHz - 23.0 MHz
  4 ns Typ, 10 ns Max. 23.0 MHz - 70.0 MHz

"0" Level .... +0.5 V Max.

"1" Level .... +2.4 V Min.

Output .... 1 to 10 TTL Gates

THE **CONNOR–WINFIELD CORPORATION**

West Chicago, IL 60185
CABLE: CONWINWCGO

PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

For over twenty years, the CONNOR-WINFIELD Corporation has been producing high quality frequency control products for both military and commercial applications. CONNOR-WINFIELD has built an excellent reputation as a source of custom designed oscillators. We are also able to provide attractive discounts on large volume orders, but if you are in a hurry, our low volume lead times are consistently short on all standard models.

What follows is only a partial listing of the extensive oscillator capabilities we have available. We invite you to write or call us with your special oscillator requirements.

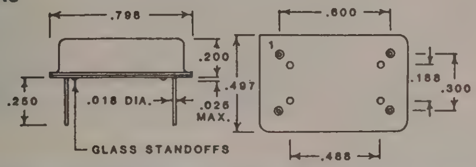
CONNOR-WINFIELD spotlights these new models:

★ECL-A,B	:	ECL logic in an all metal DIP-up to 180MHz (pg.1)
★S15R8	:	Low cost, fast delivery of TTL DIP oscillators—stock frequencies only. (pg. 2)
★C14R5L	:	Low current CMOS logic– <2mA. (pg. 1)
★SW44-1,2	:	Hi frequency Sine wave in an epoxy encapsulated DIP package- up to 200MHz. (pg. 2)
★C13R1,2,3,	:	Rugged non-xtal oscillator in a .2" high, all metal DIP package. (pg. 1)

DIP CRYSTAL OSCILLATORS

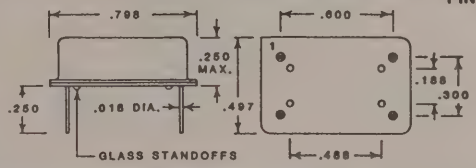
Package Outline 1

PIN CONNECTIONS
1 N/C
7 GROUND
8 OUTPUT
14 Vcc



Package Outline 2

PIN CONNECTIONS
1 OUTPUT
7 GROUND
8 OSC. MON.
14 Vcc



TTL SERIES

Output Load 1 – 10 TTL
Duty Cycle 50/50 ± 10%
Supply Voltage +5Vdc ±10%
Supply Current 85mA Max.

Available Options:

Gating Pin 1 Logic 0 enables Logic 1 disables.

Other Temperature Ranges and Frequency Tolerances Available.

Low Cost on Large Volume Orders.

LSTTL SERIES

Output Load 1 – 10 LSTTL 1 – 3 TTL
Duty Cycle 50/50 ± 10%
Supply Voltage +5Vdc ±10% Supply Current 50mA Max.

CMOS SERIES

Output Load CMOS
Duty Cycle 50/50 ±10%
Supply Voltage +5Vdc to +15Vdc
Supply Current 3 – 20mA (C14R5L) ≤2mA at 5Vdc ≤15mA at 15Vdc

NON–CRYSTAL SOLID STATE

Output Load CMOS Supply Voltage 3 – 15Vdc ±10%
Duty Cycle 50/50 ±10% Supply Current 25mA Max.

100K ECL SERIES

Output Load 100K ECL
Duty Cycle 50/50 ±5%
Supply Voltage – 4.5 or – 5.2Vdc Current 50mA

SINEWAVE SERIES

DPS1 & DPS3 – Supply Voltage +5Vdc ±10%
Output Voltage 1Vrms 10K Load

DPS2 & DPS4 – Supply Voltage +8Vdc to +15Vdc
Output Voltage 1.5Vrms – 3Vrms 10K Load

Model	Package	Freq. Range	Freq. Toler.	Temp. Range
S14R6	1	255KHz to 60MHz	±.005%	−25°C to +75°C
S15R6	1		±.01%	0°C to +70°C
S14R7	1	1Hz to 255KHz	±.005%	−25°C to +75°C
S15R7	1		±.01%	0°C to +70°C
S16R6	1	255KHz to 60MHz	±.01%	−40°C to +85°C
S17R6	1			−55°C to +125°C
SR721	1	25MHz to 80MHz	±.01%	0°C to +70°C
SR722	1		±.005%	
SR723	1		±.01%	−40°C to +85°C
SR724	1		±.005%	
SR725	1		±.01%	−55°C to +125°C
S14P5	2	<1Hz to 10MHz	±.005%	−25°C to +75°C
S15P5	2		±.01%	0°C to +70°C
S14P6	1	20KHz to 20MHz	±.005%	−25°C to +75°C
S15P6	1		±.01%	0°C to +70°C
C14R5	1	200Hz to 8MHz	±.005%	−25°C to +75°C
C15R5	1		±.01%	0°C to +70°C
C14R5L	1	200Hz to 2MHz	±.005%	−25°C to +75°C
C15R5L	1		±.01%	0°C to +70°C
C14C5	2	<1Hz to 200Hz	±.005%	−25°C to +75°C
C15C5	2		±.01%	0°C to +70°C
C13R1	1	150Hz to 4MHz	±1.0%	0°C to +50°C
C13R2	1		±0.1%	
C13R3	1		±1.0%	
ECLA	1 for pin connections 2 for Height	8MHz to 150MHz	±.005%	0°C to +70°C
ECLB	1 for pin connections 2 for Height	8MHz to 180MHz	±.01%	0°C to +70°C
DPS1	2	1KHz to 75KHz	±.01%	−25°C to +75°C
DPS3	2		±.005%	
DPS2	2	100Hz to 100KHz	±.01%	
DPS4	2		±.005%	

All dimensions in inches. Specifications subject to change without notice.

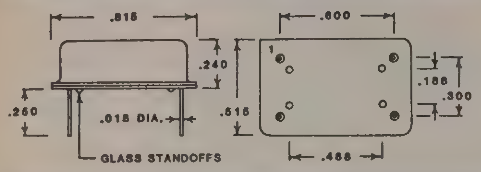
THE CONNOR–WINFIELD CORPORATION

West Chicago, IL 60185
CABLE: CONWINWCGO

PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

FAST DELIVERY/LOW COST TTL DIP CRYSTAL CLOCKS



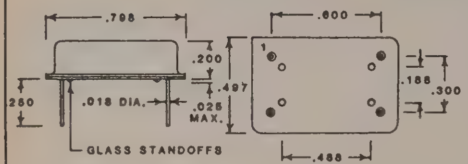
Stock Frequencies

1MHz 2MHz 2.048MHz
4MHz 5MHz 6MHz
8MHz 10MHz 12MHz
16MHz 20MHz 24MHz
40MHz 70MHz

Model	S14R8	S15R8
Freq. Tolerance	±.005%	±.01%
Temp. Range	0°C to +70°C	
Supply Voltage	+5Vdc ± 10%	
Supply Current	60 mA Maximum	
Load	1 to 10 TTL	

PIN CONNECTIONS 1 N/C 8 OUTPUT
7 GROUND 14 Vcc

EPOXY ENCAPSULATED DIP CRYSTAL CLOCKS



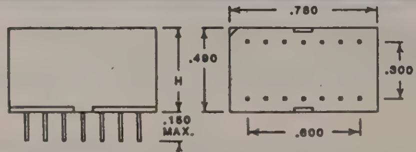
PIN CONNECTIONS
14 Vcc
7 GROUND
OUTPUT:
S13, D13, Pin 8 Output
S14, D14, Pin 1 Output

S13 & S14 C, D & E
All metal package
version of
D13 & D14 C, D & E

Model Number	S13R1 S14R1	S13R1A S14R1A	S13R1B S14R1B	D13C D14C S13C S14C	D13D D14D S13D S14D	D13E D14E S13E S14E
Freq. Range	3MHz to 25MHz			15KHz to 20MHz		
Frequency Tolerance & Temp. Range	±.01% −25°C to +75°C	±.005% 0°C to +70°C	±.01% −40°C to +85°C	±.005% 0°C to +50°C	±.0075% 0°C to +65°C	±.01% −25°C to +75°C
Output	TTL			1 to 10 TTL		
Symmetry	50 / 50 ± 10%					
Supply Voltage	+5Vdc ± 10% <20mA			+5Vdc 20 to 75mA		

TIGHT TOLERANCE TTL/SINEWAVE DIP

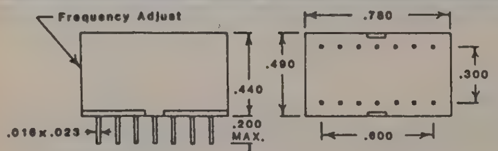
Pin Conn.
7 Ground
14 +
Output:
Per chart



TTL or Sinewave Series
Tight Tolerance Crystal Oscillators
L11 through L14 Series-Discrete Oscillators
F11 through F14 Series-Thick Film Oscillators

Model	L12	F12	L14	F14	L11	F11	L13	F13
Freq. Range	<1Hz to 70MHz							
Output Logic	TTL-Suffix C,D,E				Sinewave-Suffix F,G,I			
Freq. Tolerance add suffix to model number	C–F ±.001% 0°C to +50°C							
	D–G ±.0025% 0°C to +65°C							
	E–I ±.005% −25°C to +75°C							
Output Pins	8	8	12	12	8	8	12	12
Pin Sizes	Flat Pins .016 × .023				Square Pins .017 × .017			
Output Load	1–10 TTL 50/50 ±10%				3Vrms ±1Vrms 10K Ω			
Supply Voltage	+5Vdc ±5%				20mA to 100mA			
H: Height	.44				.57			

HIGH FREQUENCY ECL/SINEWAVE EPOXY ENCAPSULATED DIP



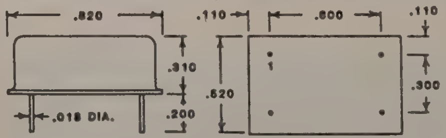
PIN CONN.

E 14C
1 Comp. Output
7 Vee
8 Output
14 Vcc

SW44's
7 Ground
8 Output
14 (+) Supply

Model	E14C	SW44-1	SW44-2
Freq. Range	30MHz to 200MHz	30MHz to 200MHz	
Freq. Tolerance	±.01%	±.01%	
Temp. Range	0°C to +70°C	0°C to +70°C	
Output (please specify)	10K ECL or 100K ECL Duty Cycle 50/50 ±10% Rise/Fall Times 1.5ns	Sinewave 0 dBm into a 50 Ω Load	Sinewave 10 dBm into a 50 Ω Load
Supply Voltage (please specify)	10K ECL −5.2Vdc ±5% 100K ECL −4.5Vdc ±5%	+5Vdc ±5%	+12Vdc ±5%
Supply Current	50mA Maximum	20mA Maximum	

TTL VCO DIP OSCILLATORS



PIN CONN.
1 Con. Volt.
7 Ground
8 Output
14 (+) Supply

Model	PL14R1	PL14R2	PL14R3
Freq. Range	20MHz to 80MHz		
Freq. Tolerance	±1%		±2%
Temp. Range	0°C to +70°C		
Supply Voltage	+5Vdc ±5°C		
Control Voltage	0V to 5V F (nominal) at 2 – 3V		
Deviation	±1% to ±1.5%	±5% to ±10%	±10% to ±15%

All dimensions in inches.

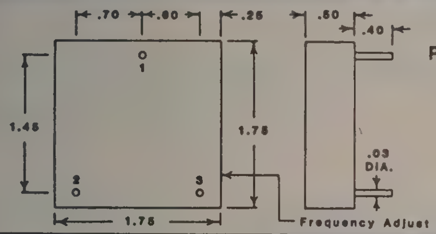
Specifications subject to change without notice.

THE CONNOR–WINFIELD CORPORATION

West Chicago, IL 60185
CABLE: CONWINWCGO
PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

TCXO SERIES

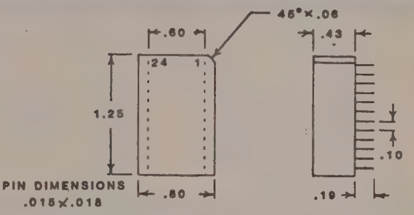

.70
.60
.25
.50
.40
1
1.45
1.75
2
3
.03 DIA.
1.75
Frequency Adjust

C12's PIN CONNECTIONS

1 OUTPUT
2 (+) SUPPLY
3 GROUND

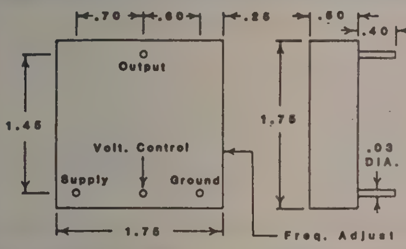
C24's PIN CONNECTIONS

5 OUTPUT
12 GROUND
24 (+) SUPPLY


45°×.06
.60
.43
24
1
1.25
.10
PIN DIMENSIONS .015×.018
.80
.19

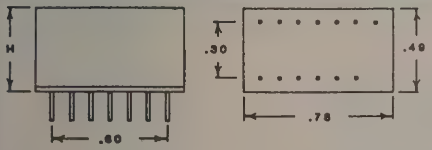
Outputs	TTL	CMOS		SINE	ECL
Frequency Range	C12's 1Hz to 30MHz C24's 15KHz to 30MHz	1Hz to 8MHz	1Hz to 12MHz	(C12 only) 1Hz to 30MHz	C12's 1Hz to 30MHz C24's 4MHz to 30MHz
Output Load	1 to 10 TTL	CMOS		50Ω or 10KΩ	100K ECL
Supply Voltage	+5Vdc ±1%	+5 to +8Vdc ±1%	+8 to +15Vdc ±1%	+5Vdc to +30Vdc ±1%	−4.5Vdc or −5.2Vdc ±1%
Supply Current	<60mA	<25mA		<60mA	<150mA
Frequency Tolerance add suffix to model number	A	±.00005%	+20°C to +40°C		
	B	±.00015%	0°C to +50°C		
	C	±.00025%	−25°C to +65°C		

VCXO SERIES


.70
.60
.25
.50
.40
Output
1.45
Volt. Control
Supply
Ground
1.75
.03 DIA.
1.75
Freq. Adjust

Model	V175A	V175B	V175C	V175D
Freq. Tolerance	±.001%	±.0025%	±.005%	±.0075%
Temp. Range	+20°C to +40°C	0°C to +50°C	0°C to +65°C	+25°C to +65°C
Freq. Range	<1Hz to 30MHz			
Output	TTL	CMOS	SINE	
Supply	+5Vdc ±1% 10 to 75mA	+5Vdc to +15Vdc ±1% 25 to 50mA	+5Vdc to +30Vdc ±1% 25 to 50mA	
Load	1 to 10 TTL	CMOS	50Ω or 10K Ω	
Voltage Control	5Vdc supply: 0 to +4V or ±2V 12Vdc supply: 0 to +10V or ±5V		20ppm/V ± 1ppm/V Wider deviations available	

SOLID STATE EPOXY ENCAPSULATED DIPS



PIN CONNECTIONS

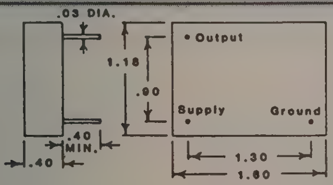
7 GROUND
12 OUTPUT
14 Vcc

L13–Square Pins
.017 × .017

L14–Flat Pins
.016 × .023

Model	L13LT L14LT	L13LC L14LC	L13SW L14SW	L13Q L14Q	L13QC L14QC	L13B L14B
Freq. Tolerance	<1Hz to 4MHz	<1Hz to 4MHz	500KHz to 4MHz	<1Hz to 4MHz	<1Hz to 4MHz	1KHz to 4MHz
Output	TTL 10 TTL	CMOS	Sinewave 3Vrms 10K 0dBm 50Ω	TTL 10TTL	CMOS	Sinewave 3Vrms 10K 0dBM 50 Ω
Supply Voltage	+5Vdc	+5 to +15Vdc	+5 to +15Vdc	+5Vdc	+5 to+15Vdc	+5Vdc
Freq. Stability	±0.1%			±1.0%		
Temp. Range	0°C to +50°C					
Freq. Trimmer	Internal ±2% minimum			External resistor ±2% minimum		
Height	.17 to .57 (depending on frequency)					

TTL/CMOS PC BOARD MOUNT OSCILLATORS


.03 DIA.
Output
1.18
.90
Supply
Ground
.40 MIN.
.40
1.30
1.60

Model	IC5 TTL Series		C123MS CMOS Series
Freq. Range	50Hz to 500KHz		1Hz to 8MHz
Freq. Tolerance (please specify)	K	±.001%	+20°C to +40°C
	R	±.0025%	+0°C to +50°C
	M	±.005%	−40°C to +85°C
	V	±.01%	−55°C to +125°C
Supply Voltage	+5Vdc ±10%		+5Vdc to +15Vdc
Supply Current	5mA to 50mA		depends on frequency

All dimensions in inches.

Specifications subject to change without notice.

THE CONNOR–WINFIELD CORPORATION

West Chicago, IL 60185
CABLE: CONWINWCGO

PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

SERIES 76

Fill in Blanks to Construct your Model Number

Example: XF3

When ordering Please Specify: Series No., Model No., Frequency & Supply Voltage

X	F	3
FREQ. STAB. W, X or Z	OUTPUT A, B, D, E, F or G	PACKAGE 1, 2, 3, 4 or 5

Frequency Stability

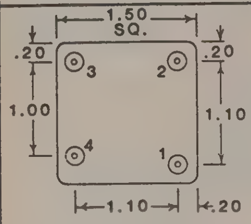
Parameter	Ordering Guide		
	W	X	Z
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C
Frequency Stability	±.005%	±.001%	±.0005%

Output Specifications

Parameter	Ordering Guide																	
	A			B			D			E			F			G		
Frequency Range	1Hz to 5MHz			100Hz to 100MHz			10MHz to 300MHz			60Hz to 1MHz			1MHz to 400MHz			30MHz to 300MHz		
Supply Voltage	+5 to +15Vdc			+5Vdc ±5%			−5.2Vdc ±5%			+12Vdc ±5%			+12Vdc ±5%			−4.5Vdc ±5%		
Supply Current	3 to 20mA			70mA			100mA			25mA			70mA			100mA @ No Load		
Output	CMOS			TTL			10K ECL Compatible			Sine 1Vrms ±10%			Sine +10dBm ±3dBm			100K ECL		
Rise/Fall Time	<100nS			<100nS			≤1.5nS			----			----			≤1ns		
Symmetry/Distortion	50/50 ±10%			50/50 ±10%			----			<5%			−25 dBm			50/50 ±10%		
Load	CMOS			1-10 TTL			ECL			10K Ω			50Ω			ECL		
Termination	1	4	5	1	4	5	1	2	3	1	4	5	1	2	3	1	2	3
Height	.62	1.50	1.50	.62	1.50	1.50	.62	2.00	2.50	1.50	2.00	2.00	1.50	2.00	2.50	.62	2.00	2.50

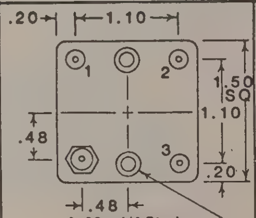
Terminations

1



1 (+) Supply 2 Common
3 Common 4 Output

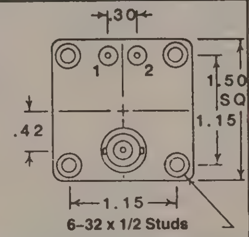
2



6–32 x 1/4 Studs

1 (+) Supply 2 Common
3 Common OSM Output

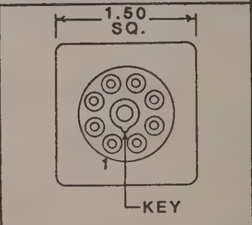
3



6–32 x 1/2 Studs

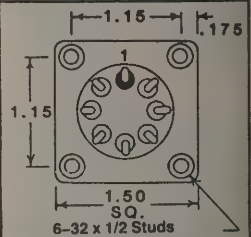
1 Common 2 (+) Supply
BNC Output

4



1 Common 2 (+) Supply
8 Output

5

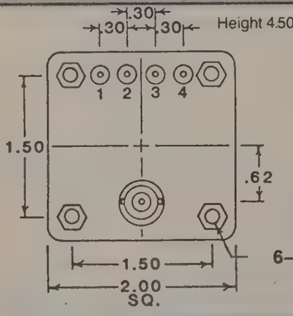


6–32 x 1/2 Studs

1 Common 2 (+) Supply
8 Output

SERIES 79 OVENIZED

Frequency Stability



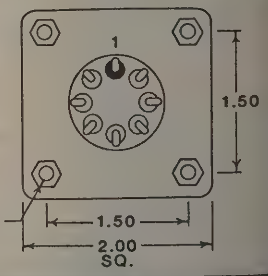
Height 4.50

1 Osc. Supply 2 Osc. Common
3 Ovn. Common 4 Ovn. Supply
BNC Output

6–32 x 1/2 Studs

Parameter	Ordering Guide		
	A	B	C
Frequency Range	1MHz to 20MHz	20MHz to 60MHz	60MHz to 150MHz
Temperature Range	0°C to +60°C	0°C to +60°C	0°C to +60°C
Frequency Stability	$\pm 5 \times 10^{-8}$	$\pm 1 \times 10^{-7}$	$\pm .5 \times 10^{-7}$

Height 4.50



1 Osc. Common 2 Osc. Supply
5 Ovn. Supply 6 Ovn. Common
8 Output

6–32 x 1/2 Studs

Output Specifications

Parameter	Ordering Guide					
	S	T	V	W	X	Y
Frequency Range	1MHz to 20MHz	20MHz to 60MHz	60MHz to 100MHz	100MHz to 150MHz	1MHz to 20MHz	20MHz to 60MHz
Osc. Supply	+12Vdc, 35mA	+12Vdc, 50mA	+12Vdc, 50mA	+12Vdc, 50mA	+12Vdc, 30mA	+12Vdc, 50mA
Ovn Supply	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.
Output, Load	Sine, 50Ω	Sine, 50Ω	Sine, 50Ω	Sine, 50Ω	TTL, 1-10 TTL	TTL, 1-10 TTL
Output Voltage	0dBm ±1.5dBm	0dBm ±1.5dBm	0dBm ±1.5dBm	0dBm ±1.5dBm	TTL	TTL
Harmonic Content	−30dBm	−30dBm	−30dBm	−30dBm	----	----

All Dimensions in Inches.

Specifications subject to change without notice.

CTS® CORPORATION*
KNIGHTS DIVISION

1.0-175.0 MHz CRYSTALS

STANDARD DESIGNS

CTS Knights offers standard crystals, available in **Resistance Weld, Solder Seal** and **Coldweld** packages. All three are available in the two basic holder sizes (HC-18 and HC-6), with pin or wire lead terminations.

CHART A shows standard part numbers which can be purchased by specifying only part number and frequency. The type of seal is indicated by the part number prefix.

R = Resistance Weld
S = Solder Seal
K = Coldweld

In chart A all part numbers have the R prefix. If you wish **Solder Seal** or **Coldweld,** change the prefix letter. When ordering standard crystals by part number, you will receive the following electrical specifications:

CALIBRATION TOLERANCE:

Solder Seal	±.003% @ 25°C
Resistance Weld	±.002% @ 25°C
Coldweld	±.002% @ 25°C

LOAD CAPACITY: Last letter specifies load:
A = 20 PF
B = 32 PF
C = series resonance

RESISTANCE: Specified on chart A

SHUNT CAPACITY: 7 PF Max.

STABILITY: ±.003% of 25°C frequency from −40 to +70°C

AGING:

Solder Seal —	< 10 PPM/YR
Resistance Weld —	< 5 PPM/YR
Coldweld —	< 3 PPM/YR

To order standard crystals, specify P/N and frequency. EXAMPLE: To order the basic HC-49 package size with wire leads, **Resistance Weld,** at 4.00 MHz, 20 PF load capacity, specify: "R1335-2-BA @ 4.00 MHz."

CRYSTAL PERFORMANCE CURVES

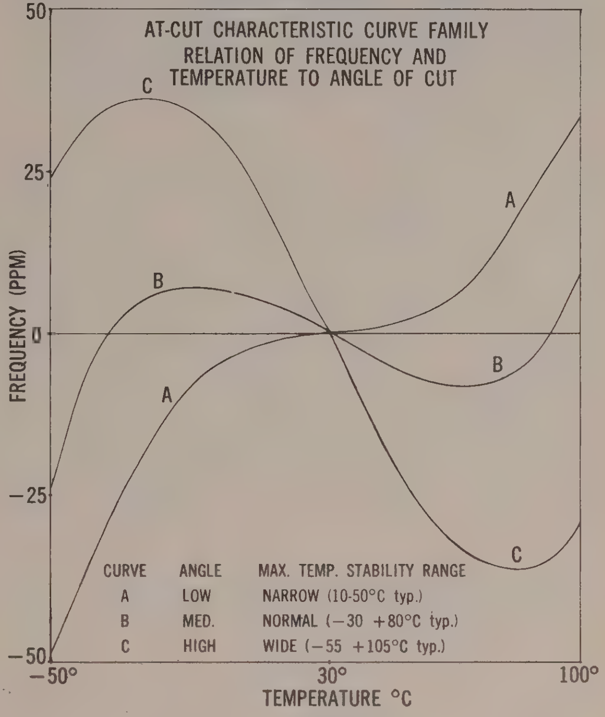


FIG. 1

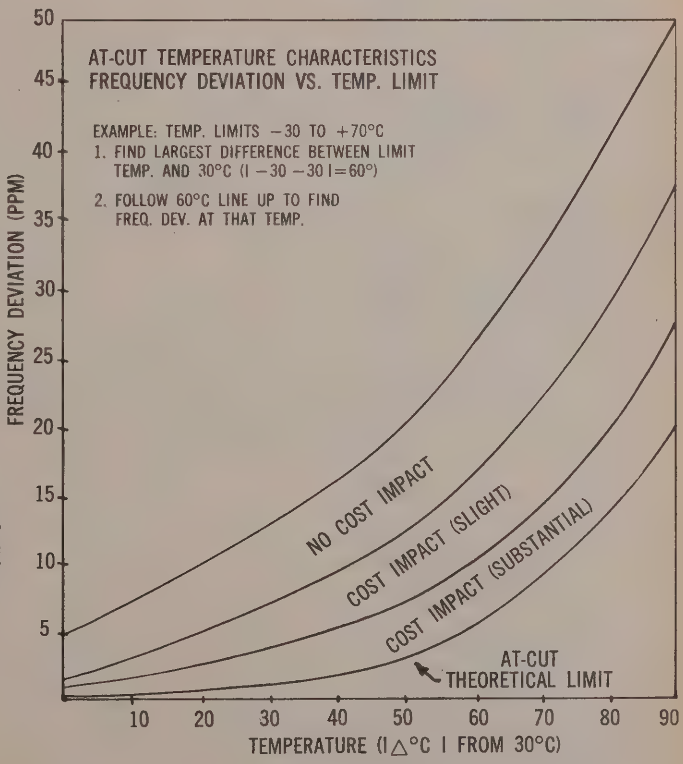


FIG. 2

*In ILLINOIS dba CTS Electronics Corporation

1.0-175.0 MHz CRYSTALS

CTS® CORPORATION*
KNIGHTS DIVISION

CRYSTAL PERFORMANCE CURVES

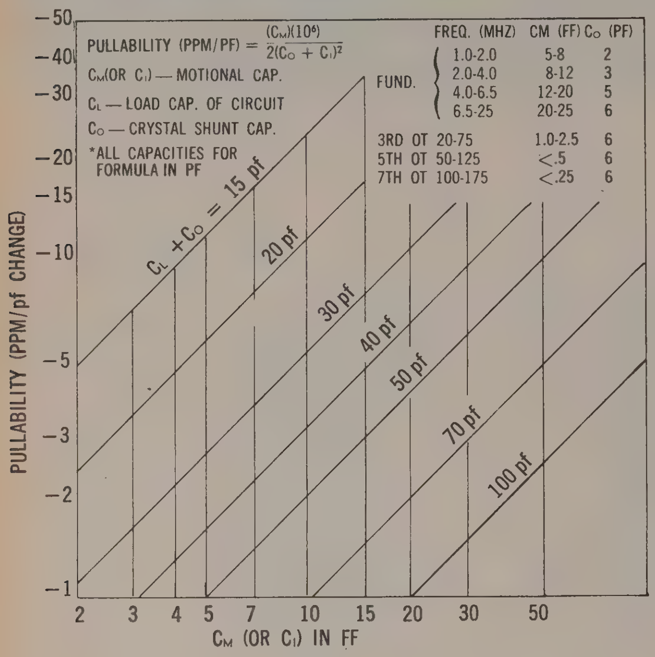


FIG. 3

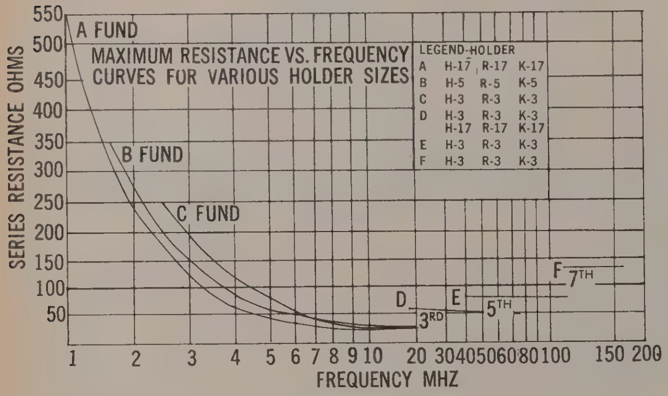


FIG. 4

CUSTOM DESIGNS

Custom crystals include any which cannot be ordered by Specific CTS Knights part number. It does not automatically mean increased cost. Tighter specifications, detailed parameter testing, etc., involve additional cost factors.

Design limits are stated below. Your own specification can be written within these limits. This is intended as a practical window and does not exclude other designs. Query us first on State-of-the-Art needs.

HOLDER: **Resistance Weld, Solder Seal** and **Coldweld** holders are available. See outline drawings section. Note availability of hold-down top wires.

FREQUENCY RANGE: 1 MHz to 175 MHz (see chart A for holder vs frequency).

CALIBRATION: ±.0005 to ±0.1% @ 25°C

TEMP. STABILITY: ±.0002% to ±.01% of 25°C Frequency depending on temperature range.

TEMPERATURE RANGE: Common ranges are:
0 to 70°C
−30 to + 85°C
−55 to +105°C

PULLABILITY: If required (see Fig. 3)

LOAD CAPACITY: When designing your circuit, keep in mind that 20 PF, 32 PF and series resonance are common load capacities. Spec the load of your circuit. Loads between 15 PF and series can be specified without cost impact.

SERIES RESISTANCE (Rs): See performance curve

DRIVE LEVEL: 1-10 MHz 0.1 to 5.0 MW
Above 10 MHz 0.1 to 2.0 MW

SPURIOUS FREQUENCY: 6 db min. separation (2:1 for Resistance) is practical for any crystal frequency. Better attenuation is available in many areas.

To order custom crystals, describe the crystal in full, using the parameter format shown. Consult the factory if necessary.

*In ILLINOIS dba CTS Electronics Corporation

CTS® CORPORATION* KNIGHTS DIVISION

PRECISION CRYSTALS

HIGH STABILITY PRECISION CRYSTALS 1 MHz - 40 MHz

Precision crystals are used in applications where long term aging of better than 2 PPM/YR is required. Two groups are available; those calibrated at room temperature and those calibrated at an elevated temperature, usually between 70° - 100°C, for ovenized oscillator use.

Frequency stability over temperature is tailored to customer's specific need. Frequency deviation over temperature may be held within $\pm5 \text{ x } 10^{-7}$ of the characteristic AT curve.

CRYSTAL TYPE	CTS HOLDER‡	FREQUENCY RANGE	MODE	CALIBRATION TOLERANCE	AGING	DRIVE	Q
For Room Temperature Oscillator use	K3/K3W	8-25 MHz	Fund.	$\pm10\text{x}10^{-6}$ @ 25°C	$1\text{x}10^{-8}$/day	.1 MW	100K-400K
	K3/K3W	25-40 MHz	3rd	$\pm10\text{x}10^{-6}$ @ 25°C	$1\text{x}10^{-8}$/day	.1 MW	100K-400K
	K5/K5W	3-10 MHz	Fund.	$\pm10\text{x}10^{-6}$ @ 25°C	$1\text{x}10^{-8}$/day	.1 MW	100K-400K
	K17/K17W	1- 5 MHz	Fund.	$\pm10\text{x}10^{-6}$ @ 25°C	$1\text{x}10^{-8}$/day	.1 MW	100K-400K
For Ovenized Oscillator use	K17/K17W	1- 5 MHz	Fund.	$\pm5\text{x}10^{-6}$ @ Temp.	$1\text{x}10^{-9}$/day	.1 MW	100K-500K
	K17/K17W	4- 7 MHz	3rd	$\pm5\text{x}10^{-6}$ @ Temp.	$1\text{x}10^{-9}$/day*	.1 MW	800K-1.5KK
	K17/K17W	7-30 MHz	3rd	$\pm5\text{x}10^{-6}$ @ Temp.	$1\text{x}10^{-9}$/day	.1 MW	800K-1.5KK

* $5\text{x}10^{-10}$/day available.

‡ TO5 and TO8 holders are available at many frequencies, consult factory for details.

PERFORMANCE CURVES

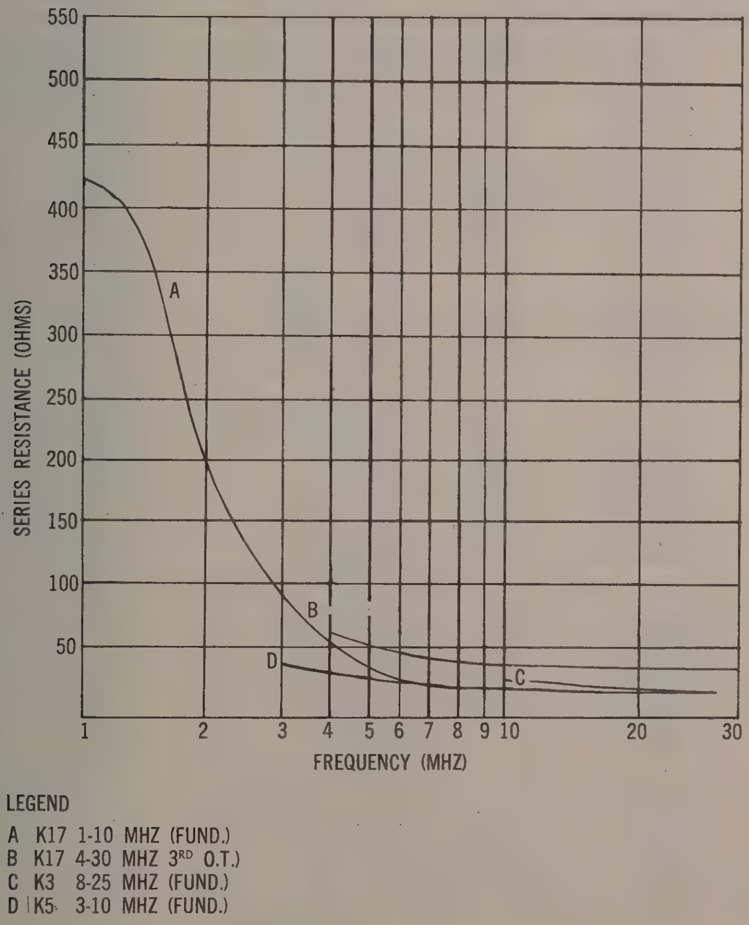
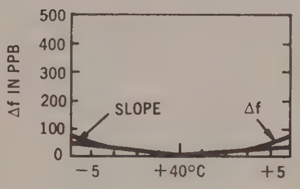


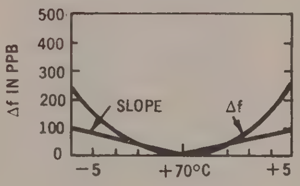
FIG. 5

STABILITY VS. TEMPERATURE



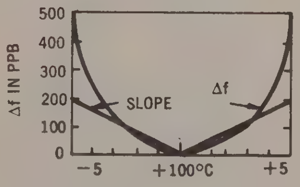
$\frac{\Delta f}{f} = (3\text{ppb}/°\text{C}^2)\text{x}\Delta T^2$

Slope = (6ppb/°C)xΔT



$\frac{\Delta f}{f} = (10\text{ppb}/°\text{C}^2)\text{x}\Delta T^2$

Slope = (20ppb/°C)xΔT



$\frac{\Delta f}{f} = (20\text{ppb}/°\text{C}^2)\text{x}\Delta T^2$

Slope = (40ppb/°C)xΔT

NOTE: Curves assume no thermal shock due to oven cycling.

FIG. 6

KNIGHTS DIVISION • 400E Reimann Ave., Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS

*In ILLINOIS dba CTS Electronics Corporation

MILITARY CRYSTALS

CTS® CORPORATION*
KNIGHTS DIVISION

MILITARY CRYSTALS

CTS KNIGHT'S test lab is government approved for qualification testing to military specification MIL-C-3098G, and includes equipment for environmental testing such as humidity, shock, vibration and aging.

Production test equipment conforms to maintenance and periodic re-calibration required by US Government calibration system requirements in MIL-C-45662A.

CTS KNIGHTS is QPL Approved On The Following Military Types:

- CR-18A/U (1-5, 10-20 MHz)
- CR-19A/U (1-5, 10-20 MHz)
- CR-52A/U (19-61 MHz)
- CR-54A/U (50-110 MHz)
- CR-55A/U
- CR-56A/U (50-110 MHz)
- CR-58A/U (1-20 MHz)
- CR-60A/U
- CR-64/U (4.2-20 MHz)
- CR-67A/U
- CR-72/U
- CR-75/U (50-110 MHz)
- CR76A/U (17-61 MHz)
- CR-78A/U (4.2-20 MHz)
- CR-79/U (4.2-20 MHz)
- CR-81/U (17-62 MHz)
- CR-82/U (50-110 MHz)
- CR-83/U (50-110 MHz)
- CR-89/U
- CR-97/U
- CR-106/U
- CR-111/U
- CR-114/U
- CR-117/U (30-62 MHz)
- CR-124/U
- CR-128/U
- CR-139/U (20 MHz)
- CR-140/U
- CR-141/U (50-90 MHz)
- CR-157/U (1-20 MHz)

MIL-EQUIVALENT CRYSTALS

MIL-C-3098G requires special testing to ensure compliance with the entire specification. Any crystal marked with the "CR" number must receive this testing.

If your required crystal details match those of a mil spec in general parameters, but your commercial application does not demand the exhaustive testing, you can order a mil equivalent crystal. The design will be the same. The crystal **will not** receive the detailed testing. Marking will be standard commercial marking. The "CR" number will not appear on the crystal.

A mil vs commercial cross reference is shown below:

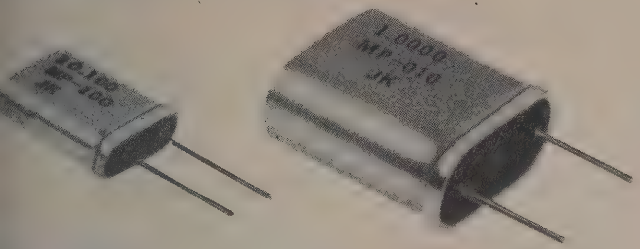
SPEC SHEET MIL-C-3098	MIL TYPE	MIL HOLDER	CTS HOLDER	FREQUENCY RANGE - MHz	VIBRATION MODE	OPERATING TEMPERATURE RANGE (°C)	FREQ. TOL. VS. TEMP. (%)	LOAD CAP. OR SERIES
/3	CR-18A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/4	CR-19A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	Series
/30	CR-52A/U	HC-6/U	R17	20.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/32	CR-54A/U	HC-6/U	R17	50.0-100.0	5th O.T.	−55 to +105	±.005	Series
/33	CR-55A/U	HC-18/U	R3W	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/34	CR-56A/U	HC-18/U	R3W	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/36	CR-58A/U	HC-17/U	R17 Mod.	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/38	CR-60A/U	HC-18/U	R3W	5.0-20.0	Fund.	−55 to +105	±.005	Series
/42	CR-64/U	HC-18/U	R3W	4.2-20.0	Fund.	−55 to +105	±.005	30 pf
/45	CR-67A/U	HC-18/U	R3W	20.0-61.0	3rd O.T.	−55 to +105	±.0025	Series
/50	CR-72/U	HC-25/U Mod.	R3 Mod.	20.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/53	CR-76A/U	HC-18/U	R3W	20.0-61.0	3rd O.T.	−40 to +90	±.002	Series
/55	CR-77/U	HC-25/U	R3	17.0-62.0	3rd O.T.	−(55 to 40) & +(90 to 105)	±.003	Series
/62	CR-78A/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	30 pf
/63	CR-79/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	Series
/58	CR-81/U	HC-25/U	R3	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/59	CR-82/U	HC-25/U	R3	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/60	CR-83/U	HC-25/U	R3	50.0-110.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/67	CR-89/U	HC-32/U	R5	2.12-6.2	Fund.	−55 to +90	±.005	30 pf
/72	CR-97/U	HC-18/U	R3W	8.0-10.0	Fund.	−40 to +85	±.005	32 pf
/82	CR-106/U	HC-18/U	R3W	10.5-11.5	Fund.	−55 to +105	±.005	32 pf
/87	CR-111/U	HC-18/U	R3W	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/90	CR-114/U	HC-25/U Mod.	R3 Mod.	2.9-3.85	Fund.	−55 to +105	±.005	32 pf
/93	CR-117/U	HC-25/U	R3	30.0-63.0	3rd O.T.	Ref. 25°C −40 to +65	±.001 ±.0015	Series
/101	CR-124/U	HC-18/U	R3W	2.9-3.8	Fund.	−55 to +100	±.005	32 pf
/108	CR-128/U	HC-18/U	R3W	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/118	CR-139/U	HC-18/U	R3W	20.0-22.0	Fund.	−55 to +105	±.005	30 pf
/119	CR-140/U	HC-6/U	R17	9.5-12.5	Fund.	−55 to +90	±.005	60 pf
/122	CR-141/U	HC-18/U Mod.	R3W Mod.	50.0-90.0	5th O.T.	−30 to +55 −(55 to 30) & +(55 to 65)	±.0025 ±.0045	Series
/137	CR-157/U	HC-33/U	R17W	1.0-20.0	Fund.	−55 to +105	±.005	Series

KNIGHTS DIVISION • 400E Reimann Ave., Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS

*In ILLINOIS dba CTS Electronics Corporation

CTS® CORPORATION*
KNIGHTS DIVISION

MICROPROCESSOR CRYSTALS



CTS Knights microprocessor crystals offer a low cost crystal for microprocessor clock applications. Reliability is assured by the use of a mil-approved quality control process. These are solder seal and resistance weld crystals with 0.5" min. lead length.

Microprocessor crystals are available as "off the shelf" items from CTS authorized distributors.

Frequency MHz	CTS P/N	Microprocessor or Clock ICN	Specifications	Load Capacity
1.0	MP010	6800 Series, 6500 Series, INS8060 SCMPII, MC14500, 6809, 6860, 2150(AMI), 2650	±.020% 0-70°C H17W	13pf
1.8432	MP018	MC14411 Baud Rate Generator	±.020% 0-70°C H17W	13pf
2.0	MP020	6800 Series, 6500 Series, INS8060 SCMPII, 2650, INS8090, F8(3850CPU), IM6102, 68B09	±.015% 0-70°C H17W	20pf
2.097152	MP021	MM5378, MM5379 — NSC Auto Clock	±.015% 0-70°C H17W	20pf
2.4576	MP024	34702 Baud Rate Generator	±.015% 0-70°C H17W	32pf
3.0	MP030	MCS-48, 8021, 8022, 8035, 8041, 8048, 8741, 8748, IM8048, IM8748	±.015% 0-70°C H17W	18pf
3.2768	MP032	IM6100C, ICM7205	±.015% 0-70°C H17W	15pf
3.579545	MP036	IM5369, Color tv burst, IM6102, PPS-8, 6801, 6803	±.015% 0-70°C H17W	18pf
3.579545	MP036S	IM5369, Color tv burst, IM6102, PPS-8, 6801, 6803	±.015% 0-70°C H3W	18pf
4.0	MP040	MCS-40, 4004, 4040, 4201, 6802, 6808, MK3870, 3872, 3873, 3876, INS8060 SCMPII	±.015% 0-70°C H3W	20pf
4.0	MP04A	PACE-NSC, MC6875, Z80, Z80A	±.015% 0-70°C H3W	Series
4.194304	MP041	ICM7038, 7213, 7049	±.007% 0-50°C H3W	12pf
4.91520	MP042	Standard Clock Frequency	±.015% 0-70°C H3W	20pf
5.0	MP05A	Special Frequency	±.015% 0-70°C H3W	20pf
5.00	MP05B	CDP1802, 1803, TMS9985, TMS9940, IM6100A	±.015% 0-70°C H3W	Series
5.0688	MP050	COM5016, 5016T, Dual BRG	±.015% 0-70°C H3W	Series
5.185	MP051	MCS-40, 4004, 4040, 4201	±.015% 0-70°C H3W	20pf
5.7143	MP057	PACE-NSC	±.015% 0-70°C H3W	Series
5.7143	MP057A	IM6100A	±.015% 0-70°C H3W	20pf
6.0	MP060	MCS-48, 8035, 8041, 8048, 8741, 8748, IM8048, IM8748	±.015% 0-70°C H3W	20pf
6.144	MP061	MCS-85, 8085	±.015% 0-70°C H3W	20pf
6.250	MP062	MCS-85, 8085	±.015% 0-70°C H3W	30pf
6.5536	MP065	ICM7045, Timer Crystal	±.015% 0-70°C H3W	20pf
8.0	MP080	8X30, MC6875	±.015% 0-70°C H3W	Series
8.00	MP080A	IM6100A, MC68000, Z8000, Z8, CDP1804 9940-8-Fair	±.015% 0-70°C H3W	20pf
10.0	MP100	Special Frequency	±.015% 0-70°C H3W	Series
10.0	MP101	MCS-85, 8085A-2, 9940-10-Fair	±.015% 0-70°C H3W	30pf
11.0	MP110	MCS-48, 8039, 8049	±.015% 0-70°C H3W	18pf
12.00	MP120	MCS-86, 8086/8284, 9940-12-Fair, 8202 Ram Controller	±.015% 0-70°C H3W	Series
15.00	MP150	MCS-86, 8086/8284, 8202 Ram Controller	±.015% 0-70°C H3W	Series
18.00	MP180	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
18.432	MP184	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
20.0	MP200	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
22.1184	MP221	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
24.0	MP240	MCS-86, 8086/8284	±.015% 0-70°C H3W	Series
25.0	MP250	8202 Ram Controller	±.015% 0-70°C H3W	Series
27.0	MP270	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
36.0	MP360	9080A/8224-2AMD	±.015% 0-70°C H3W	Series
48.0	MP480	TMS9900 Series/TIM9904(LS362)-TI	±.015% 0-70°C H3W	Series

OUTLINE DRAWINGS CRYSTALS

CTS® CORPORATION*
KNIGHTS DIVISION

OUTLINE DRAWINGS

CTS Knights supplies crystals in four package sizes, (groups) of holders. Physical size and configuration distinguish each group. These are:

HC-18 GROUP

- H3 (HC-25/U)
- H3W (HC-18/U)
- R3 (HC-50/U)
- R3W (HC-49/U)
- K3 (HC-42/U)
- K3W (HC-43/U)

HC-32 GROUP

- H5 (HC-32/U)
- H5W
- R5
- R5W
- K5
- K5W (HC-46/U)

HC-6 GROUP

- H17 (HC-6/U)
- H17W (HC-33/U)
- R17 (HC-48/U)
- R17W (HC-51/U)
- K17 (HC-36/U)
- K17W (HC-47/U)

SPECIAL GROUP

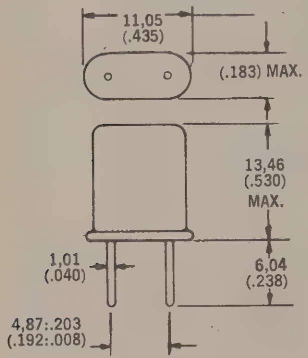
- TO5 (HC-35/U)
- TO8 (HC-37/U)
- R2W (Similar to HC44/U)
- HC-40/U

Three sealing methods are used. "H" holders are solder sealed. "R" holders are resistance welded. "K" and "T" holders are coldwelded. These sealing techniques ensure long term isolation from external environments. Solder sealing, resistance welding and coldwelding are designed to meet the military leak rate specification. Pin-type leads are normally used in sockets; wire-type leads are common for circuit board use. Resistance and coldweld are intrinsically cleaner packages and thus have better reliability.

HC-18 GROUP

mm
(IN.)

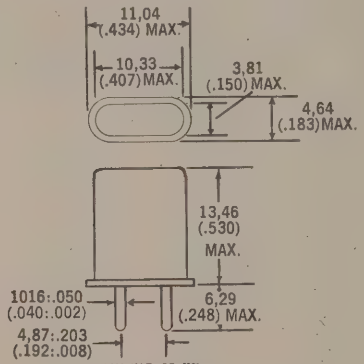
SOLDER SEAL
H3 (HC-25/U)


11,05
(.435)
(.183) MAX.
13,46
(.530)
MAX.
1,01
(.040)
6,04
(.238)
4,87:.203
(.192:.008)

H3W (HC 18/U)
12,70 (.500) LEADS
0,48 (.019) DIA.

FIG. 7

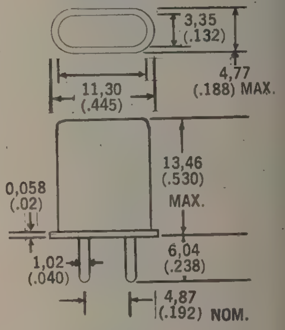
RESISTANCE WELD
R3 (HC-50/U)


11,04
(.434) MAX.
10,33
(.407) MAX.
3,81
(.150) MAX.
4,64
(.183) MAX.
13,46
(.530)
MAX.
1016:.050
(.040:.002)
6,29
(.248) MAX.
4,87:.203
(.192:.008)

R3W (HC-49/U)
12,70 (.500) LEADS
0,48 (.019) DIA.

FIG. 8

COLDWELD
K3 (HC-42/U)


3,35
(.132)
4,77
(.188) MAX.
11,30
(.445)
13,46
(.530)
MAX.
0,058
(.02)
6,04
(.238)
1,02
(.040)
4,87
(.192) NOM.

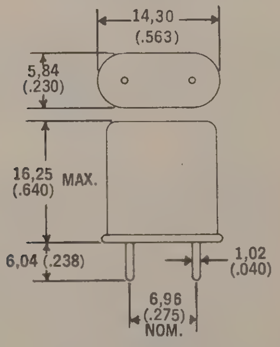
K3W (HC-43/U)
12,7 (.500) LEAD LENGTH
0,48 (.019) MAX. DIA.

FIG. 9

HC-32 GROUP

mm
(IN.)

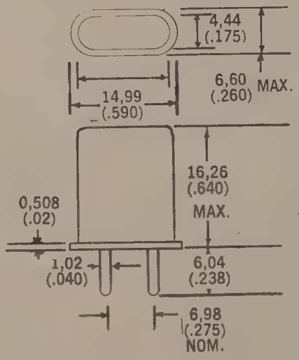
SOLDER SEAL
H5 (HC-32/U)


14,30
(.563)
5,84
(.230)
16,25
(.640) MAX.
6,04 (.238)
1,02
(.040)
6,96
(.275)
NOM.

H5W
12,70 (.500) LEADS
0,51 (.020) DIA.

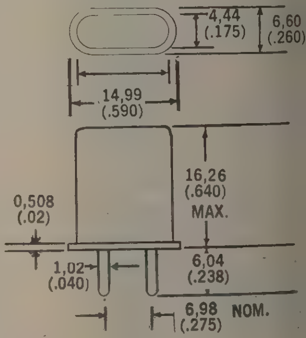
FIG. 10

RESISTANCE WELD
R5


4,44
(.175)
6,60
(.260) MAX.
14,99
(.590)
16,26
(.640)
MAX.
0,508
(.02)
1,02
(.040)
6,04
(.238)
6,98
(.275)
NOM.

H5W R5W
12,7 (.500) LEADS
0,51 (.020) DIA.

COLDWELD
K5


4,44
(.175)
6,60
(.260)
14,99
(.590)
16,26
(.640)
MAX.
0,508
(.02)
1,02
(.040)
6,04
(.238)
6,98 NOM.
(.275)

K5W (HC-46/U)
25,4 (1.0) LEADS
0,51 (.020) DIA.

FIG. 11

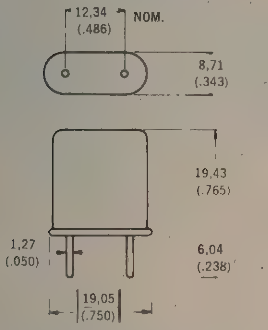
*In ILLINOIS dba CTS Electronics Corporation

CTS® CORPORATION* KNIGHTS DIVISION

OUTLINE DRAWINGS CRYSTALS

HC-6 GROUP

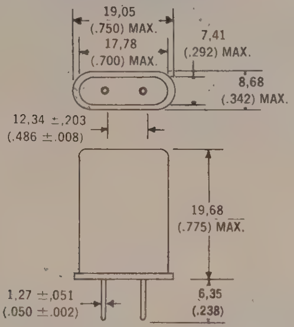
SOLDER SEAL H17 (HC-6/U)


12,34 (.486) NOM.
8,71 (.343)
19,43 (.765)
1,27 (.050)
6,04 (.238)
19,05 (.750)

H17W (HC-33/U)
38,1 LEADS (1.5) LEADS 0,762 DIA. (.030) DIA.

FIG. 12

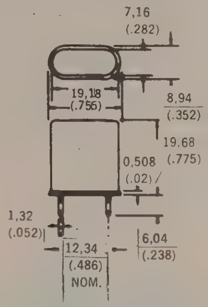
RESISTANCE WELD R17 (HC-48/U)


19,05 (.750) MAX.
17,78 (.700) MAX.
7,41 (.292) MAX.
8,68 (.342) MAX.
12,34 ±,203 (.486 ±.008)
19,68 (.775) MAX.
1,27 ±,051 (.050 ±.002)
6,35 (.238)

R17W (HC-51/U)
LEADS 19,15 .750 LEAD LENGTH ,762 ±,051 (.030 ±.002) DIA.

FIG. 13

COLDWELD K17 (HC-36/U)


7,16 (.282)
19,18 (.755)
8,94 (.352)
19,68 (.775)
0,508 (.02)
1,32 (.052)
12,34 (.486) NOM.
6,04 (.238)

K17W (HC-47/U)
19,15 .750 MIN. LEAD LENGTH 0.76 (.030) DIA.

FIG. 14

SPECIAL GROUP

COLDWELD or RESISTANCE WELD TO5 (HC-35/U)

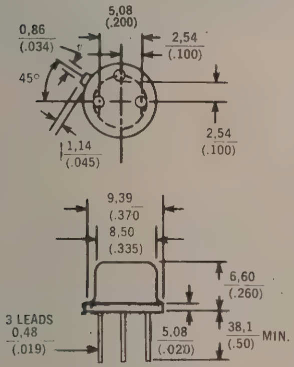

5,08 (.200)
0,86 (.034)
2,54 (.100)
45°
2,54 (.100)
1,14 (.045)
9,39 (.370
8,50 (.335)
6,60 (.260)
3 LEADS 0,48 (.019)
5,08 (.020)
38,1 (.50) MIN.

FIG. 15

R-2W (Similar to HC-44/U) RESISTANCE WELD R-2W

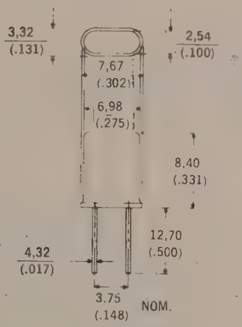

3,32 (.131)
2,54 (.100)
7,67 (.302)
6,98 (.275)
8,40 (.331)
12,70 (.500)
4,32 (.017)
3.75 (.148) NOM.

FIG. 16

TO-8 (HC-37/U) COLDWELD TO-8

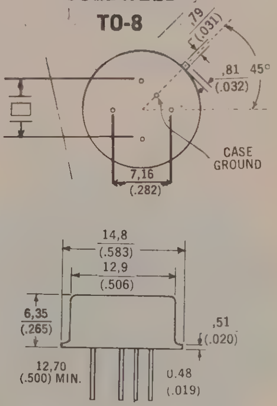

.79 (.031)
,81 45° (.032)
CASE GROUND
7,16 (.282)
14,8 (.583)
12,9 (.506)
6,35 (.265)
,51 (.020)
12,70 (.500) MIN.
0.48 (.019)

FIG. 17

Wire lead versions of Solder Seal, Resistance Weld and Coldweld Holders are available with a hold-down wire for circuit board mounting.

HC-18 GROUP

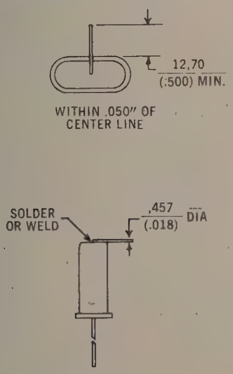

12,70 (.500) MIN.
WITHIN .050″ OF CENTER LINE
SOLDER OR WELD
.457 (.018) DIA

FIG. 18

HC-32 GROUP

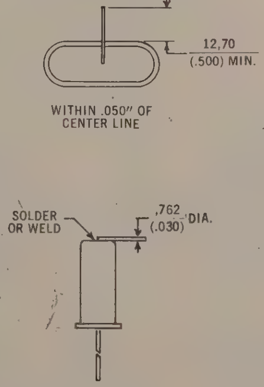

12,70 (.500) MIN.
WITHIN .050″ OF CENTER LINE
SOLDER OR WELD
,762 (.030) DIA.

FIG. 19

HC-6 GROUP

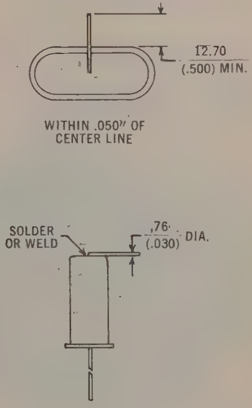

12.70 (.500) MIN.
WITHIN .050″ OF CENTER LINE
SOLDER OR WELD
,76 (.030) DIA.

FIG. 20

TCXO-TCVCXO CRYSTAL OSCILLATORS

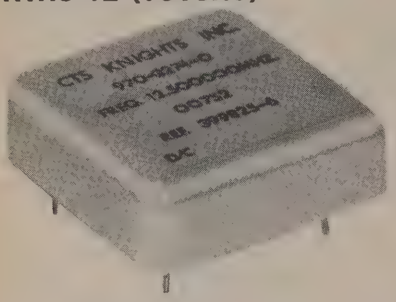
CTS® CORPORATION*
KNIGHTS DIVISION

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO's) VOLTAGE CONTROLLED - TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCVCXO's)

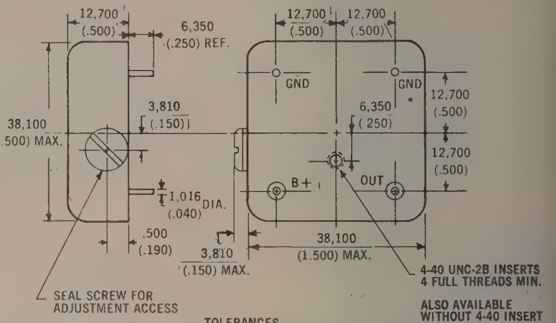
Low power consumption, high stability over wide temperature extremes, and small physical size characterize CTS Knights' TCXO and TCVCXO crystal oscillators. Add excellent environmental characteristics including immunity to humidity, vibration and shock, satisfying the requirements of the instruments and communications industries.

High reliability and stringent long term qualities common in military applications are available in a variety of designs. Note the options and modifications, the flexibility of design which offers the user choices to fulfill specific needs.

JKXO-12 (TCXO)
JKVXO-12 (TCVCXO)


CTS KNIGHTS INC.
970-4274-0
FREQ. 12.800000MHZ
OC752
REF. 399825-6
DC

FEATURES:
Low profile
Solder seal
Vibration 15G's, 10-2000 Hz


12,700 (.500)
6,350 (.250) REF.
12,700 (.500)
12,700 (.500)
GND
GND
12,700 (.500)
12,700 (.500)
3,810 (.150)
6,350 (.250)
38,100 (1.500) MAX.
1,016 DIA. (.040)
B+
OUT
.500 (.190)
3,810 (.150) MAX.
38,100 (1.500) MAX.
4-40 UNC-2B INSERTS 4 FULL THREADS MIN.
SEAL SCREW FOR ADJUSTMENT ACCESS
ALSO AVAILABLE WITHOUT 4-40 INSERT

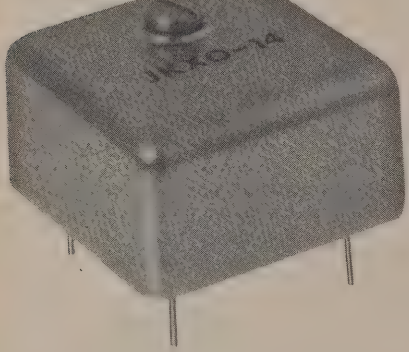
TOLERANCES
.XXX ±.010
.XX ±.020

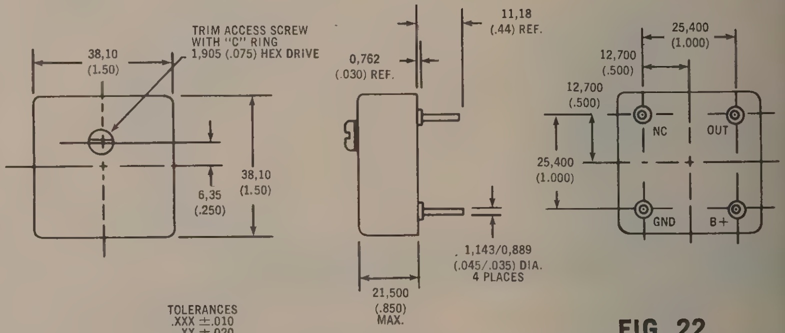
* VCO INPUT ON TCVCXO MODELS

FIG. 21

JKXO-14 (TCXO)

FEATURES:
Top access hex drive trim adjustment
Sine or TTL output

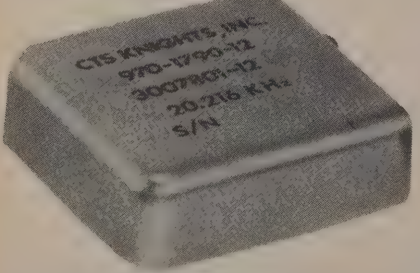



TRIM ACCESS SCREW WITH "C" RING 1,905 (.075) HEX DRIVE
38,10 (1.50)
38,10 (1.50)
6,35 (.250)
0,762 (.030) REF.
11,18 (.44) REF.
1,143/0,889 (.045/.035) DIA. 4 PLACES
21,500 (.850) MAX.
25,400 (1.000)
12,700 (.500)
12,700 (.500)
25,400 (1.000)
NC
OUT
GND
B+

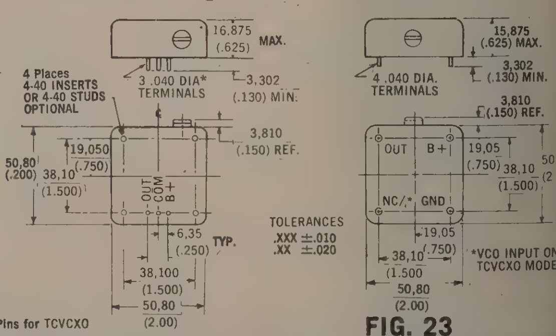
TOLERANCES
.XXX ±.010
.XX ±.020

FIG. 22

JKXO-16 (TCXO)
JKVXO-16 (TCVCXO)


CTS KNIGHTS, INC.
970-1790-12
300701-12
20.216 KHz
S/N

FEATURES:
Solder seal
Wide frequency range
Specialized outputs available


Standard Pkg.

Optional Pkg.
16,875 (.625) MAX.
4 Places 4-40 INSERTS OR 4-40 STUDS OPTIONAL
3 .040 DIA* TERMINALS
3,302 (.130) MIN.
3,810 (.150) REF.
19,050 (.750)
50,80 (.200)
38,10 (1.500)
OUT COM B+
6,35 (.250) TYP.
38,100 (1.500)
50,80 (2.00)
15,875 (.625) MAX.
4 .040 DIA. TERMINALS
3,302 (.130) MIN.
3,810 (.150) REF.
OUT
B+
19,05 (.750)
38,10 (1.500)
50.80 (2.00)
NC/*
GND
19,05 (.750)
38,10 (1.500)
50,80 (2.00)

TOLERANCES
.XXX ±.010
.XX ±.020

* 4 Pins for TCVCXO

*VCO INPUT ON TCVCXO MODELS

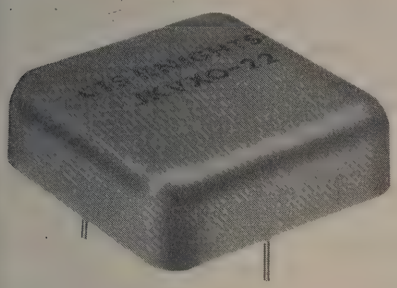
FIG. 23

KNIGHTS DIVISION • 400E Reimann Ave., Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS
In ILLINOIS dba CTS Electronics Corporation

TCXO-TCVCXO CRYSTAL OSCILLATORS

CTS® CORPORATION*
KNIGHTS DIVISION

JKVXO-22



FEATURES:

Available as VCXO or TCVCXO. Temperature stability and deviation are customized per application. 5 volt supply, Mod voltage range 0 to +5 VDC.

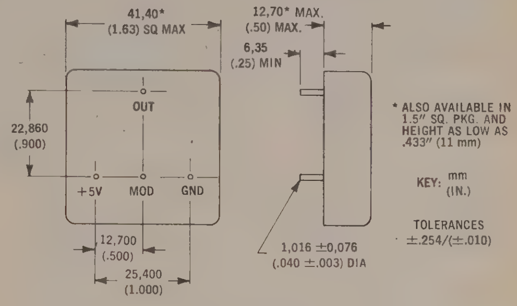

41,40*
(1.63) SQ MAX
12,70* MAX.
(.50) MAX.
6,35
(.25) MIN
OUT
22,860
(.900)
+5V
MOD
GND
12,700
(.500)
25,400
(1.000)
1,016 ±0,076
(.040 ±.003) DIA
* ALSO AVAILABLE IN 1.5" SQ. PKG. AND HEIGHT AS LOW AS .433" (11 mm)
KEY: mm (IN.)
TOLERANCES
±.254/(±.010)

FIG. 24

JKXO-24 (TCXO)

FEATURES:

Compact size with hermetic seal. Frequency adjustment is via an externally applied voltage or a 10K pot. Also available with internal mechanical adjust trimmer with seal screw.

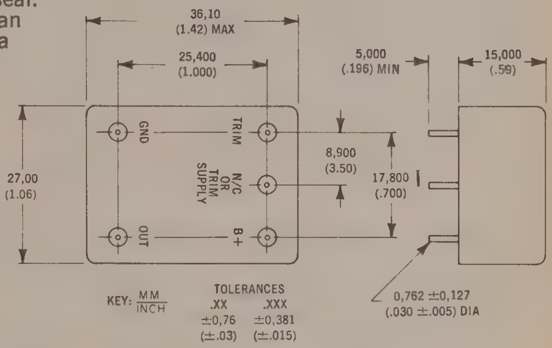

36,10
(1.42) MAX
25,400
(1.000)
5,000
(.196) MIN
15,000
(.59)
GND
TRIM
N/C OR TRIM SUPPLY
OUT
B+
27,00
(1.06)
8,900
(3.50)
17,800
(.700)
KEY: MM/INCH
TOLERANCES
.XX .XXX
±0,76 ±0,381
(±.03) (±.015)
0,762 ±0,127
(.030 ±.005) DIA

FIG. 25

FIG.	MODEL	FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	TYPICAL AGING PER YEAR	OUTPUT OPTIONS
21	JKXO-12A	3-50 MHz	9-20	±2 PPM, −55 to +85°C	NONE	1 PPM	Sine Wave, TTL CMOS (Below 10 MHz) ECL (−5V Supply Req.)
	JKXO-12B	3-30 MHz	9-20	±1 PPM, −40 to +75°C	NONE	1 PPM	
	JKXO-12C	3-50 MHz	9-20	±.5 PPM, 0 to +70°C	NONE	1 PPM	
22	JKXO-14A	3-30 MHz	9-28	±.5 PPM, 0 to +50°C	NONE	1 PPM	TTL or Sine
	JKXO-14B	3-30 MHz	9-28	±1 PPM, 0 to +70°C	NONE	1 PPM	
23	JKXO-16A	1 Hz to 30 MHz	9-28	±1 PPM, −40 to +75°C	NONE	1 PPM	Sine (Above 500 KHz) ECL, TTL CMOS (Below 10 MHz)
	JKXO-16B	1 Hz to 30 MHz	9-28	±1 PPM, −55 to +85°C	NONE	1 PPM	
	JKXO-16C	1 Hz to 30 MHz	9-28	±2 PPM, −40 to +75°C	NONE	1 PPM	
	JKXO-16D	30 to 100 MHz	9-28	±2 PPM, −20 to +70°C	NONE	1 PPM	
	JKXO-16E	1 KHz to 30 MHz	5	±2 PPM, −20 to +70°C	NONE	1 PPM	
25	JKXO-24A	3-30 MHz	8-20	±2 PPM, −20 to +80°C	NONE	1 PPM	TTL or 1.0 VP-P into 1 KΩ
	JKXO-24B	3-30 MHz	9-20	±1 PPM, 0 to +70°C	NONE	1 PPM	
21	JKVXO-12A	3-30 MHz	9-20	±10 PPM, 0 to +70°C	±150 PPM, ±5V Input	1 PPM	TTL
	JKVXO-12B	30 to 50 MHz	9-20	±2 PPM, 0 to +70°C	±15 PPM, ±3V Input	1 PPM	Sine Wave
	JKVXO-12C	8 to 35 MHz	9-20	±2 PPM, 0 to +70°C	±40 PPM, ±3V Input	1 PPM	Sine, TTL, ECL
	JKVXO-12D	1 MHz to 30 MHz	5	±30 PPM, −55 to +85°C	±100 PPM, ±5 VDC or 0 to 5V	1 PPM	TTL, ECL, CMOS, Sine
23	JKVXO-16A	1 KHz to 30 MHz	9-20	±10 PPM, 0 to +65°C	±40 PPM, 1 to 4 VDC	1 PPM	TTL, ECL CMOS (Below 10 MHz) Sine (Above 500 KHz)
	JKVXO-16B	1 KHz to 30 MHz	9-20	±20 PPM, −20 to +70°C	±150 PPM, ±5V Input	1 PPM	
	JKVXO-16C	1 MHz to 30 MHz	5	±30 PPM, −55 to +85°C	±100 PPM, ±5V Input	1 PPM	
	JKVXO-16D	30 MHz to 150 MHz	12-20	±5 PPM, 0 to +50°C	±15 PPM, ±5V Input	1 PPM	Sine, ECL
24	JKVXO-22A	1 KHz to 30 MHz	5	±10 PPM, 0 to +50°C	±40 PPM, 0 to +5 VDC	2 PPM	TTL, CMOS
	JKVXO-22B	30 MHz to 50 MHz	5	±5 PPM, 0 to +50°C	±15 PPM, 0 to +5 VDC	2 PPM	TTL ECL (−5V Supply Req.)
	JKVXO-22C	1 MHz to 30 MHz	5	±15 PPM, −20 to +70°C	±150 PPM, 0 to +5 VDC	2 PPM	

KNIGHTS DIVISION • 400E Reimann Ave., Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS

---

*In ILLINOIS dba CTS Electronics Corporation

CRYSTAL OSCILLATORS

CTS® CORPORATION*
KNIGHTS DIVISION

HIGH STABILITY OVENIZED CRYSTAL OSCILLATORS

CTS Knights ovenized oscillators are available in thermostatically controlled models as well as proportional control models. A variety of design options are available to the user, including very high stability, low power, small size and sine wave or square wave (TTS or CMOS) output. Contact CTS Knights for your special requirements.

MODEL	FREQUENCY RANGE	DIMENSIONS INCHES	DIMENSIONS mm	OSCILLATOR INPUT*	OVEN INPUT*	TEMPERATURE CONTROL	STABILITY VS. TIME	STABILITY VS. TEMPERATURE
JKXO-23	60 Hz- 4 MHz	1.578x1.875 x4.442 HT	40,081x47,625 x112,32	+12 VDC	+28 VDC/AC 115 VAC 11 W.	Thermostat	±2.5x10^{-7}/day ±1x10^{-6}/yr	−40 to +70°C ±7.5x10^{-7}
JKXO-30	1-4 MHz	2.0x2.0x4.0	50,8x50,8 x101,6	+28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	±1x10^{-8}/day ±1x10^{-6}/yr	−10 to +55°C ±5x10^{-8}
JKXO-30	4-10 MHz	2.0x2.0x4.0	50,8x50,8 x101,6	+12 to +28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	±1x10^{-8}/day ±1x10^{-6}/yr	−10 to +55°C ±5x10^{-8}
JKXO-41	1-10 MHz	2.0x2.0x4.25	50,8x50,8 x107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	±1x10^{-9}/day ±1x10^{-7}/yr	−40 to +70°C ±3x10^{-8}
JKXO-41	10-100 MHz	2.0x2.0x4.25	50,8x50,8 x107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	±5x10^{-8}/day ±1x10^{-6}/yr	−25 to +65°C ±5x10^{-8}
JKXO-51	1-2 MHz	1.844x2.0 x3.436	46,838x50,8 x87,274	+28 VDC	+28 VDC 10 W. Max.	Proportional	±1x10^{-8}/day ±3x10^{-7}/yr	−55 to +75°C ±5x10^{-8}
JKXO-88-1	1-10 MHz	2.0x2.25 x.800	50,8x57,15 x20,32	5 & 12 VDC	+28 VDC 10 W. Max.	Proportional	±5x10^{-9}/day ±3x10^{-7}/yr	−25 to +65°C ±1x10^{-7}
JKSC-127	10 MHz	4.5x2.5x2.5	114,3x63,5 x63,5	±15 VDC	+28 VDC 32 W. Max.	Double Oven Proportional	±5x10^{-10}/day ±3x10^{-8}/yr	−55 to +71°C ±5x10^{-9}
JKXO-130	256 KHz- 10 MHz	4.5x1.6x2.11	114,3x40,6 x53,6	+15 VDC	+15 VDC 10 W. Max.	Proportional	±5x10^{-10}/day ±3x10^{-8}/yr	0 to +60°C ±1x10^{-8}

* Other voltages available

VOLTAGE CONTROLLED CRYSTAL OSCILLATORS

Voltage controlled oscillators can be supplied by CTS Knights for various stability versus temperature requirements by adding oven control or temperature compensating circuitry. Contact CTS Knights for special requirements.

MODEL	FREQUENCY RANGE	DIMENSIONS INCHES	DIMENSIONS mm	OSCILLATOR INPUT	OVEN INPUT	MODULATION INPUT	MODULATION DEVIATION	MODULATION LINEARITY	STABILITY VS. TEMPERATURE	DIMEN. OUTLINE
JKVXO-86	5-30 MHz	2.0x 2.00x.750	50,8x 50,8x19,05	12 VDC ±1	None	±3 VP.P., DC to 20 KHz	±1000 PPM	±10%	0 to +50°C ±100x10^{-6}	Fig. 26
JKVXO-87	10-27 MHz	2.0x 2.25x.800	50,8x 57,2x20,32	+12 & +5 VDC	+28 VDC	±3 VP.P., DC to 20 KHz	±1000 PPM	±5%	−40 to +70°C ±10x10^{-6}	Fig. 27
JKVXO-87	10-27 MHz	Vibration and shock, satisfying the requirements of the instrument and communications industries.							0 to +55°C ±5x10^{-6}	Fig. 27
JKVXO-100 Hybrid Design	10-25 MHz	.860x .830x.350	21,844x 21,082x8,89	+12 & +5 VDC	None	±5 VP.P., DC to 10 KHz	±200 PPM	±10%	0 to +60°C ±4x10^{-5}	Fig. 28

All dimensions are maximum unless otherwise noted.

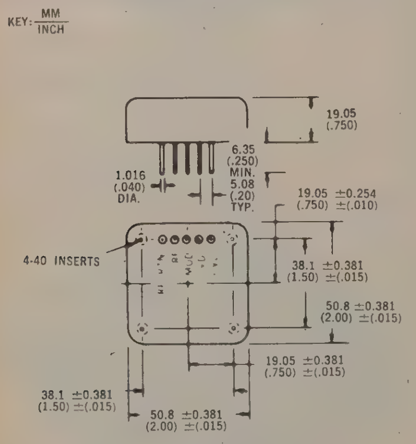

KEY: MM / INCH
19.05 (.750)
6.35 (.250) MIN.
1.016 (.040) DIA.
5.08 (.20) TYP.
19.05 ±0.254 (.750) ±(.010)
4-40 INSERTS
38.1 ±0.381 (1.50) ±(.015)
50.8 ±0.381 (2.00) ±(.015)
19.05 ±0.381 (.750) ±(.015)
38.1 ±0.381 (1.50) ±(.015)
50.8 ±0.381 (2.00) ±(.015)

FIG. 26
JKVXO-86

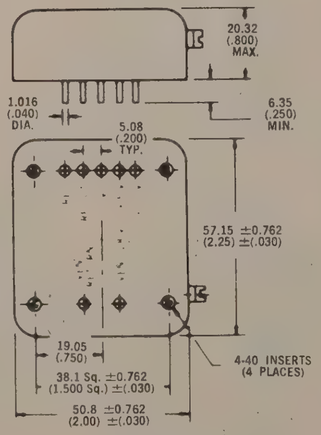

20.32 (.800) MAX.
1.016 (.040) DIA.
6.35 (.250) MIN.
5.08 (.200) TYP.
57.15 ±0.762 (2.25) ±(.030)
4-40 INSERTS (4 PLACES)
19.05 (.750)
38.1 Sq. ±0.762 (1.500 Sq.) ±(.030)
50.8 ±0.762 (2.00) ±(.030)

FIG. 27
JKVXO-87

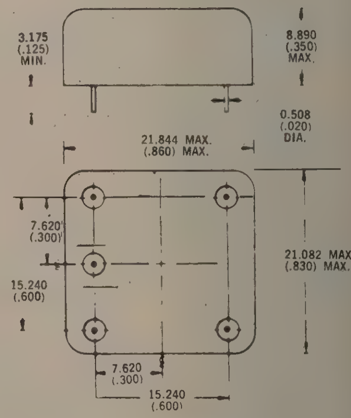

3.175 (.125) MIN.
8.890 (.350) MAX.
0.508 (.020) DIA.
21.844 MAX. (.860) MAX.
7.620 (.300)
15.240 (.600)
21.082 MAX (.830) MAX.
7.620 (.300)
15.240 (.600)

FIG. 28
JKVXO-100
HYBRID DESIGN

KNIGHTS DIVISION • 400E Reimann Ave., Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS

*In ILLINOIS dba CTS Electronics Corporation

CTS® CORPORATION* KNIGHTS DIVISION

JKSC-127 FAST WARM-UP SC CUT OCXO

The JKSC-127 offers ultra fast warm-up with excellent long term, short term and phase noise characteristics. The design utilizes a 10 MHz Coldweld Sealed SC cut overtone crystal along with a uniquely designed proportionally controlled double oven which minimizes stabilized power consumption. The JKSC-127 is available fully militarized with an MTBF of greater than 100,000 hours in ground mobile and airborne environments.

GENERAL SPECIFICATIONS

FREQUENCY: 10.0 MHz or 10.230 MHz

INPUT VOLTAGE: Oven +28 VDC ±5%
Oscillator +15 VDC ±5%

INPUT CURRENT: Oven @ turn-on 1.2 Amps Maximum
Oven @ 25°C 125 mA Typical
Oven @ −55°C 240 mA Typical
Oscillator 20 mA Maximum

FREQUENCY STABILITY VS. TEMPERATURE: $\pm 2 \times 10^{-9}$ from −55°C to +71°C

FREQUENCY STABILITY VS. TIME:
$\pm 5 \times 10^{-12}$ RMS/SEC
$\pm 5 \times 10^{-10}$/DAY **AT SHIPMENT**
$\pm 3 \times 10^{-8}$/YEAR

FREQUENCY STABILITY VS. VOLTAGE: $\pm 5 \times 10^{-10}$ for ±5% Change

WARM-UP: Referenced to 30 minutes
@ −55°C $< 5 \times 10^{-9}$ in 7 minutes
@ −32°C $< 5 \times 10^{-9}$ in 5 minutes
@ +25°C $< 5 \times 10^{-9}$ in 3 minutes

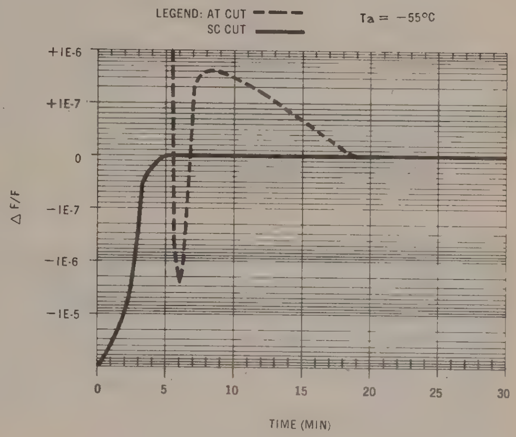
RETRACE: 48 hours off Ta = +25°C $< 5 \times 10^{-9}$ in 15 minutes referenced to the turn off frequency.

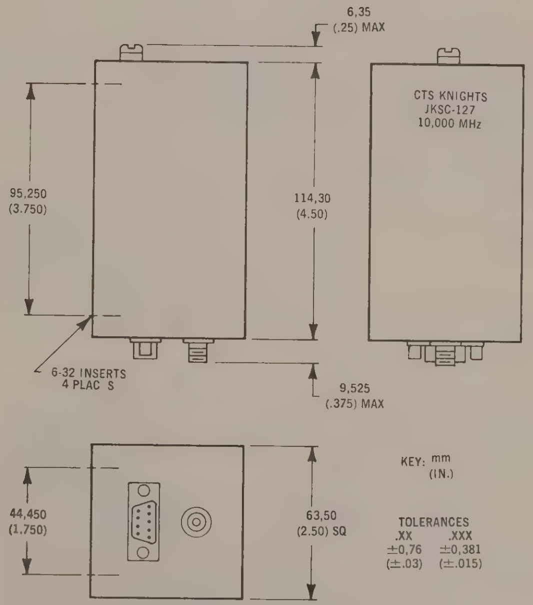
PHASE NOISE (1 HzBW): @ 10 Hz offset −120 dbc
@ 100 Hz offset −140 dbc
@ 1 KHz offset −150 dbc
@ 100 KHz offset −150 dbc

RF OUTPUT: +5 dbm Minimum into 50 Ohms

HARMONICS: −25 dbc

FREQUENCY ADJUSTMENT:
Coarse (Mechanical) $\pm 5 \times 10^{-7}$ Minimum
Fine (Electrical) $\pm 5 \times 10^{-8}$ Minimum for ±5 VDC





MODIFICATIONS OF THE JKSC-127 AVAILABLE — CONSULT FACTORY

DATA SUBJECT TO CHANGE WITHOUT NOTICE.

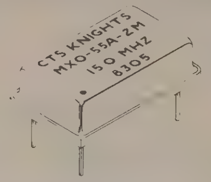
HYBRID CLOCK OSCILLATORS

CTS® CORPORATION*

KNIGHTS DIVISION

MXO-55 SERIES

Fully Hermetic Resistance Weld Package
TTL Compatible
Available with MIL-STD-883B Screening



FREQUENCY STABILITY

±.0025% to ±.1%, inclusive of calibration tolerance @ 25°C, oper. temperature range, environmental conditions, input voltage, aging and load change (See Ordering Table).

PIN CONNECTIONS

Pin 1 N/C, Enable or Output
Pin 7 Ground and/or Case Ground
Pin 8 Output
Pin 14 +5 VDC

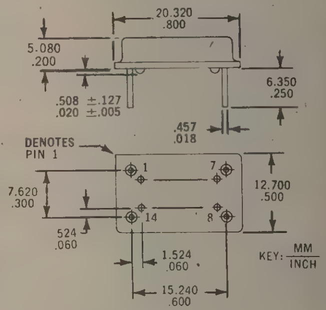
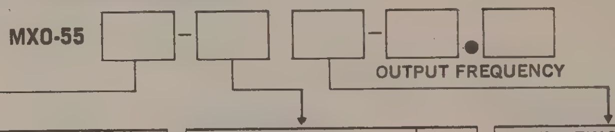


FIG. 29

ORDERING INFORMATION



FREQUENCY & MODEL and OPTION	CODE
4.9152 MHz to 100 MHz Basic Oscillator with No Enable	A
4.9152 MHz to 70 MHz Basic Oscillator with Enable Option	AE
19.2 KHz to 4.9152 MHz Basic Oscillator with Dividers	B
2.4576 MHz to 24 MHz with Complementary Outputs	C
Any of the above with case connected to pin 7	GA GAE GB GC

FREQUENCY TOLERANCE (NOTE 1)	CODE
±.1% (1000 PPM)	1
±.01% (100 PPM)	2
±.005% (50 PPM)	3
±.05% (500 PPM)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

(MXO-50 SERIES: Same as above except .285 max. seated height)

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B, C	20 KHz to 110 MHz	−55°C to +125°C	Vcc	4.75	5.00	5.25	V
			−40°C to +85°C		4.50	5.00	5.50	
Maximum Supply Voltage			−55°C to +125°C	Vcc Max.			7.00	
Input Current	A	4.9152 to 25 MHz	−55°C to +125°C	Icc		20	30	mA
		>25 to 110 MHz				33	55	
	B	2.4576 to <4.9152 MHz				30	50	
		310 KHz to <2.4576 MHz				45	75	
		20 KHz to <310 KHz				70	125	
	C	>12 to 24 MHz				22	30	
		2.4576 to 12 MHz				30	50	
Output Voltage - High	A, B, C	20 KHz to 110 MHz	−55°C to +125°C	Voh	2.40	3.80		V
Output Voltage - Low				Vol		30	40	
Rise & Fall Time (Measured Between 0.5V and 2.4V)	A	4.9152 to 25 MHz	−55°C to +125°C	t_R & t_F		3	5	nS
		>25 to 110 MHz				2	4	
	B	2.4576 to <4.9152 MHz				3	5	
		20 KHz to <2.4576 MHz				8	15	
	C	2.4576 to 24 MHz				3	5	
Start-Up Time	A, B, C	20 KHz to 25 MHz	−55°C to +125°C			2	5	mS
	A	>25 to 110 MHz				5	15	
Duty Cycle (Uptime) (Measured @ 1.5V)	A	4.9152 to 25 MHz	0°C to +70°C		45	50	55	%
			−55°C to +125°C		40	50	60	
		>25 to 110 MHz	−55°C to +125°C		40	50	60	
	B	20 KHz to <4.9152 MHz			45	50	55	
	C	2.4576 to 12 MHz			45	50	55	
		>12 to 24 MHz	0°C to +70°C		45	50	55	
			−55°C to +125°C		40	50	60	
Phase Delay (Measured @ 1.5V)	C	>12 to 24 MHz	0°C to +70°C	$t_{\delta1}$ & $t_{\delta2}$		6	10	nS
		2.4576 to 12 MHz				3	5	
		>12 to 24 MHz	−55°C to +125°C			6	12	
		2.4576 to 12 MHz				3	8	
Enable Input Load Factor	A	4.9152 to 70 MHz	−55°C to +125°C	F_I			1	S-TTL Gates
Fanout (per output)	A, B, C	2.4576 to 110 MHz		F_O			10	
	A	20 KHz to <2.4576 MHz					10	TTL Gates

MIL-0-55310 PRODUCTS
A wide variety of clock oscillators manufactured per MIL-O-55310 are now available in TO-5, TO-8 and Dual-In-Line packages. (See MIL-O-55310).

KNIGHTS DIVISION • 400E Reimann Ave., Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS

---

*In ILLINOIS dba CTS Electronics Corporation

HYBRID CLOCK OSCILLATORS

CTS® CORPORATION*
KNIGHTS DIVISION

MXO-65 SERIES

Microprocessor Driver
MOS Levels
High Capacitance Load
Capability (Up to 500 pf)
Compatible with Motorola K1160 Series*
Frequency Range:
2.45 MHz to 12 MHz
Supply Voltage:
5.0V ±10%

CXO-55 SERIES

CMOS Compatible
Low Supply Current
Pin Connections:
Pin 1 Internal Connection
Pin 7 Ground
Pin 8 Output
Pin 14 + Supply Voltage
Frequency Range:
200 Hz to 12 MHz
Supply Voltage:
4.5 VDC to 15 VDC

EXO-55 SERIES

10K ECL Compatible
Pin Connections:
Pin 1 N/C
Pin 7 B—
Pin 8 Output
Pin 14 Ground
Frequency Range:
8 MHz to 115 MHz
Supply Voltage:
−5.2V ±10% or
−5.0V ±10%

MXO-35 SERIES

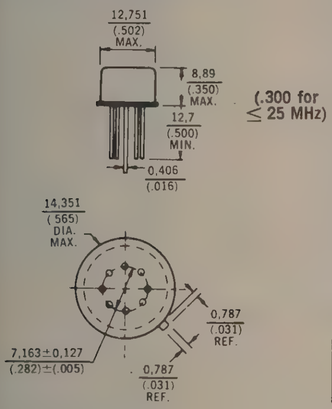
Programmable Baud Rate Generator
Resistance Weld Package
Compatible With Motorola K1135 Series*
Military Screening Available

* Motorola, K1160, K1135 are trademarks of Motorola, Inc.

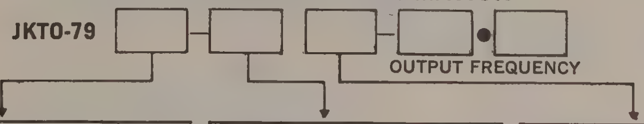
JKTO-79 SERIES

Electrically Similar to MXO-55
Fully Hermetic Welded TO-8 Style Package
Sine Wave Output Option

OUTLINE DIMENSIONS & PIN ASSIGNMENTS



ORDERING INFORMATION



FREQUENCY & MODEL and OPTION	CODE
8.0 MHz to 60.0 MHz Basic Oscillator No Enable	A
4.0 MHz to 8.0 MHz Oscillator with Divider No Enable	B
4.0 MHz to 12.0 MHz Oscillator with Complementary Output No Enable	C
Any of the Above with Enable Option (Note 4)	AE BE CE
1.0 MHz to 12.0 MHz Oscillator with Dual Divider Outputs & Enable Output A = ÷2 Output B = ÷8	D28E
1.0 MHz to 6.0 MHz Oscillator with Dual Divider Outputs & Enable Output A = ÷4 Output B = ÷8	D48E

FREQUENCY TOLERANCE (NOTE 1)	CODE
±.1% (1000 PPM)	1
±.01% (100 PPM)	2
±.005% (50 PPM)	3
±.05% (500 PPM)	4

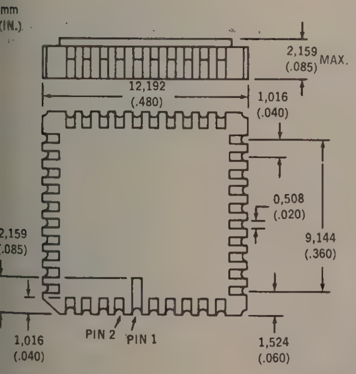
OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

PIN	CONNECTION
1	Enable/Disable Option (Otherwise NC)
2	Internal Connection
3	Output A (Q_A) (Otherwise NC)
4	Ground
5	Output B (Q_B)
6	Internal Connection
7	NC (Model A) Internal Connection (Model B, C, D) Crystal Frequency (Model C, D)
8	Vcc

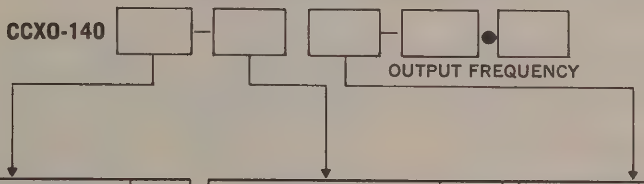
CCXO-140 SERIES

TTL oscillators in surface mount, hermetic chip carrier package
Frequency Range: 1.0 MHz to 30.0 MHz (CMOS and High Frequency TTL under development)

OUTLINE DIMENSIONS & PIN ASSIGNMENTS



ORDERING INFORMATION



FREQUENCY & MODEL	CODE
14.0 MHz to 30.0 MHz Basic Oscillator	A
1.0 MHz to <14.0 MHz Oscillator with Divider	B

FREQUENCY TOLERANCE (NOTE 1)	CODE
±.1% (1000 PPM)	1
±.01% (100 PPM)	2
±.005% (50 PPM)	3
±.05% (500 PPM)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTES:
1. NC — internally connected. No external electrical connections.
2. All other pins may have external electrical connections. These pins may also be used as optional connections. Consult factory for possible pin connection options.

All part types are available with MIL-STD-883 screening. Consult factory or sales representatives for detailed data sheets and custom requirements.

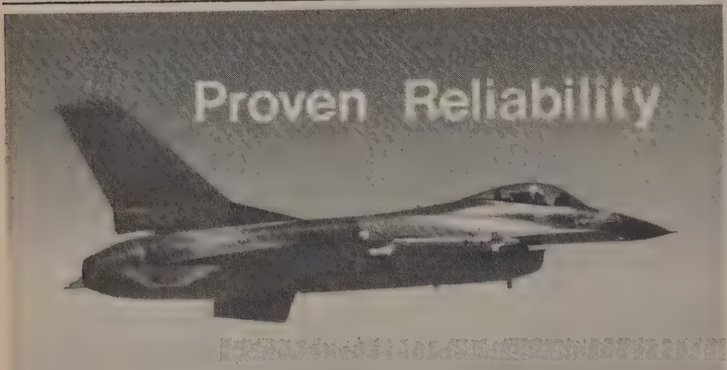
STANDARD PIN CONNECTIONS

	FUNCTION FOR FREQUENCY		
PIN	1-7 MHz	7-14 MHz	14-30 MHz
1			OUTPUT
4	+5 VDC	+5 VDC	+5 VDC
5	NC	NC	NC
10	+5 VDC	+5 VDC	+5 VDC
15	NC	NC	NC
25	NC	NC	NC
31	GND	GND	GND
35	NC	NC	NC
37	GND	GND	GND
39	OUTPUT	NC	NC
40		OUTPUT	NC

KNIGHTS DIVISION • 400E Reimann Ave., Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS
*In ILLINOIS dba CTS Electronics Corporation

CROVEN CRYSTALS

500 Beech Street
Whitby, Ontario
Canada L1N 5S5
416 668-3324
TWX: 610-384-2750



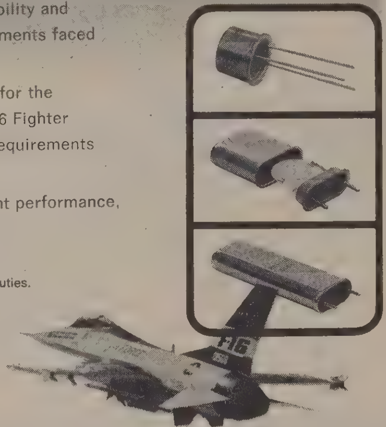
Croven Crystals perform with proven reliability and frequency stability in the toughest environments faced by men and machines.

Croven Crystals were the ultimate choice for the sophisticated radar system used in the F-16 Fighter Aircraft, as well as other high reliability requirements around the world.

If your system requires superior component performance, call us or write for our free catalogue.

All U.S. shipments are quoted in U.S. dollars f.o.b. BUFFALO, N.Y. We clear customs and pay all duties.

CROVEN
500 Beech Street, Whitby, Ontario, Canada
Telephone (416) 668-3324 TWX 610-384-2750



MILITARY CRYSTAL UNITS

We are on the Qualified Products List (QPL) for the types below.

MILITARY CR-TYPE	MILITARY SPEC. NO.	FREQUENCY RANGE IN MHZ	CROVEN CODE
CR-5A/U*	3098/77	2.000- 10.000	A170 FWM-25
CR-6A/U*	3098/78	2.000- 10.000	A170 FWJ-13
CR-8A/U*	3098/111	1.000- 10.000	A170 FWJ-00
CR-18A/U*	3098/3	0.800- 20.000	A061 FWM-32
CR-19A/U*	3098/4	0.800- 20.000	A061 FWM-00
CR-52A/U*	3098/30	10.000- 61.000	B061 FWM-00
CR-55A/U*	3098/33	17.000- 62.000	B180 FWM-00
CR-56A/U*	3098/34	50.000-125.000	C180 FWM-00
CR-58A/U*	3098/36	0.800- 20.000	A170 FWM-32
CR-59A/U*	3098/37	50.000-125.000	C180 EBS-00
CR-6OA/U*	3098/38	5.000- 20.000	A180 FWM-00
CR-61/U*	3098/39	17.000- 61.000	B180 EBS-00
CR-64/U*	3098/42	2.900- 20.000	A180 FWM-30
CR-65/U*	3098/43	10.000- 61.000	B061 CXP-00
CR-67A/U*	3098/45	17.000- 62.000	B180 CUM-00
CR-69A/U*	3098/47	2.900- 25.000	A180 CSM-30
CR-72/U*	3098/50	17.000- 61.000	B259 FWM-00
CR-76A/U*	3098/53	16.000- 61.000	B180 CSM-00
CR-77/U*	3098/55	17.000- 62.000	B251 CSM-00
CR-78A/U*	3098/62	2.200- 20.000	A251 FWM-30
CR-79/U*	3098/63	2.200- 20.000	A251 FWM-00
CR-80/U*	3098/57	50.000-125.000	C180 CSM-00
CR-81/U*	3098/58	17.000- 61.000	B251 FWM-00
CR-82/U*	3098/59	50.000-125.000	C251 FWM-00
CR-83/U*	3098/60	50.000-125.000	C251 CSM-00
CR-84/U*	3098/61	17.000- 61.000	B251 EBS-00
CR-89/U*	3098/67	2.120- 6.200	A321 FWM-30
CR-97/U*	3098/72	8.000- 10.000	A180 FWJ-32
CR-106A/U*	3098/82	10.500- 11.500	A180 FWM-32
CR-117/U*	3098/93	30.000- 63.000	B251 DEJ-00
CR-139/U*	3098/118	20.000- 22.000	A180 FWM-30
CR-140/U*	3098/119	3.500- 12.500	A061 FWM-60
CR-157/U*	3098/137	0.800- 20.000	A330 FWM-00

HOW TO SPECIFY A QUARTZ CRYSTAL

If the parameters for the crystal in question are not already covered by a MIL-SPECIFICATION or by a formal SPECIFICATION CONTROL DRAWING, then Items 1 through 6 are essential.

(1) **MODE OF OPERATION** i.e. fundamental, third, fifth, seventh, ninth or eleventh overtone.
(2) **HOLDER STYLE** i.e. HC-6/u, HC-18/u, HC-35/u, etc, depending on your individual application and the frequency.
(3) **CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE** i.e. ± 20 ppm @ + 25°C, ± 5 ppm @ + 75°C, etc.
(4) **TEMPERATURE STABILITY** the allowable frequency deviation over a specified temperature range, with reference to the actual frequency measured at the calibration temperature. (i.e. ± 15 ppm, ± 2.0 ppm, etc.)
OR TOTAL TOLERANCE the total allowable deviation over a specified temperature range, with reference to the nominal frequency (i.e. calibration tolerance and temperature stability combined). (i.e. ± 50 ppm, ± 30 ppm, etc.)
(5) **OPERATING TEMPERATURE RANGE** the temperature range over which the temperature stability or the total tolerance is to be effective.
(6) **CIRCUIT CONDITION** will be either PARALLEL or SERIES resonance. If PARALLEL resonance, please state the load capacitance.

SPECIFICATION CODING

We use a system whereby we code the major parameters of a crystal specification using a combination of 9 digits. A typical code would be **A251DFE-32** and would be interpreted as follows. **A** = fundamental mode, **25** = HC-25/U holder, **1** = undercut pins per MIL-H-10056, **D** = calibration tolerance of ± 10 ppm @ + 25°C, **F** = temperature stability of ± 20 ppm with reference to the actual frequency measured @ + 25°C, **E** = temperature range of — 15°C to + 65 C over which the temperature stability is effective, **-32** = a circuit condition of parallel resonance and with a load capacitance of 32 pF.

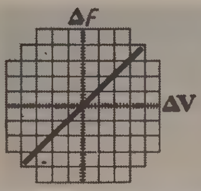
MODE		HOLDER				CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE		TEMPERATURE STABILITY OR TOTAL TOLERANCE		OPERATING, TEMPERATURE RANGE (C)		CIRCUIT CONDITION	
CODE	DESC.	CODE	DESCRIPTION	CODE	DESCRIPTION ***	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
A	Fund	06	HC- 6 standard **	0	Standard			X	± 2PPM stability	X	+ 15 to + 35	00	Series resonance
B	3rd ot.	13	HC-13 standard	1	Undercut pins			Y	± 3PPM stability	Y	+ 10 to + 40		
C *	5th ot.	17	HC-17 standard	2	Modified can height			Z	± 4PPM stability	Z	+ 5 to + 45		
D *	7th ot.	18	HC-18 standard							A	+ 0 to + 50		
E *	9th ot.	25	HC-25 standard	3	Slimline	B	± 5 PPM	B	± 5PPM stability	B	— 5 to + 55		
		32	HC-32 standard	4	3rd wire	C	± 7 PPM	C	± 7PPM stability				
		33	HC-33 (HC-6 wires)	5	Modified can height	D	± 10PPM	D	± 10PPM stability	D	— 10 to + 60	01	Parallel resonance load capacity 100pf or more.
		34	HC-34 (HC-13 wires)			E	± 15PPM	E	± 15PPM stability	E	— 15 to + 65		
		35	HC-35 (TO 5 - type)	6	Modified can height	F	± 20PPM	F	± 20PPM stability	F	— 20 to + 70		
		37	HC-37 (TO 8 - type)			G	± 25PPM	G	± 25PPM stability	G	— 25 to + 75		
		39	HC-39 (Flat-Pack)	7	Coldweld	H	± 30PPM	H	± 30PPM stability	H	— 30 to + 80		
		80	HC-45 (micro-min.)					J	± 40PPM stability	J	— 40 to + 90		
				9	Resistance Weld	M	± 50PPM	M	± 50PPM stability	M	— 55 to + 105		
								L	± 75PPM stability	L	+ 55/+ 65 Oven		
								K	±100PPM stability	T	+ 60/+ 70 Oven	10 to 90	Parallel resonance load capacity in pf as indicated by code.****
								N	±150PPM stability	N	+ 65/+ 75 Oven		
								S	Specific curve	P	+ 70/+ 80 Oven		
								T	± 20PPM‡ (B)†	R	+ 75/+ 85 Oven		
								U	± 25PPM‡ (C)†	S	+ 80/+ 90 Oven		
								V	± 30PPM‡ (D)†		Reference or Calibration temperature is the mid-point of the above ranges		
								W	± 50PPM‡ (F)†			99	Calibration at reference temperature in customer's oscillator.
								P	±100PPM‡ (H)†				
								R	±200PPM‡ (M)†				
								O	Not Specified	O	Not Specified		
									† We use these calibration codes with corresponding total tolerances				

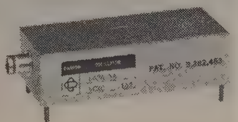
* Available at series resonance only
** Standard types for all codes as per MIL-H-10056
*** Not all holders available with modifications
**** When using a Croven code only to describe your requirement, you must choose from one of the following standard load capacitance values, 10, 12, 14, 16, 18, 20, 24, 27, 30, 32, 35, 40, 45, 50, 55, 60, 70, 80, 90, 100 pf.
‡ Total tolerance (measured from nominal frequency)

DAMON *THE FORM FACTOR SPECIALISTS*

VCXOs — 1 KHz to 500 MHz

Damon VCXOs provide high stability over a broad range of center frequencies. An optional square wave or pulse output signal compatible with I. C. logic circuits is available.



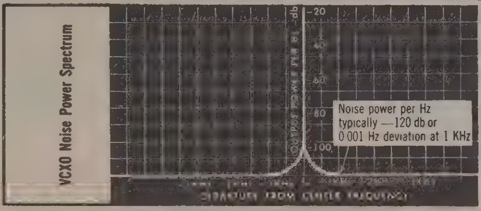


VCXO CHARACTERISTICS:

Center Frequency	1 KHz to 500 MHz
Deviation	.01% to 0.5% of Center Frequency
Linearity	1% to 5% of Peak Deviation
Frequency Stability	Determined by Peak Deviation and Operating Temp.
Modulation Rates	DC to 2 MHz

Low Noise VCXOs

Damon low noise miniaturized VCXOs are all solid state quartz crystal stable oscillators whose frequencies can be varied linearly by an external DC or AC modulating signal. Only a source of power and control signal are required . . . no auxiliary compensating circuitry.



TYPICAL CHARACTERISTICS:

Center Frequency	10.000 MHz ±1 KHz
Deviation	±10 KHz
Linearity	±1%
Modulation Rate	Flat to 4 KHz
Output Power	>1 MW

Gaussian Crystal Filters

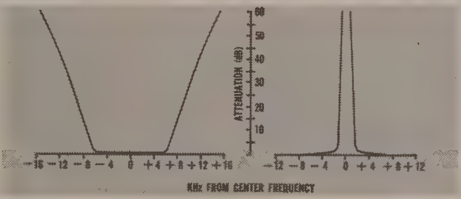
Gaussian Crystal Filters of either conventional or monolithic design. Useful in FM communications or radar systems where flat time delay is required. In a coherent pulsed radar, it can minimize return-pulse overshoot. Eliminates ringing problems in swept spectrum analysis. Available in 2 to 8 pole designs.

DAMON
CRYSTAL FILTER

Center Frequency	
Conventional	10 KHz - 35 MHz
Monolithic	3 - 30 MHz
3 dB Bandwidth	100 Hz - 30 KHz
Shape Factor, 30 dB to 3 dB	3:1 to 7:1
Ringing, Pulse or Impulse	25 - 50 dB down
Phase Linearity	±2%
No. of Poles	
Conventional	2 - 8
Monolithic	2 - 4
Volume	
Conventional	1 - 6 cu. in.
Monolithic	0.016 - 0.4 cu. in.

Band-Pass/Reject Crystal Filters

A wide variety of conventional crystal filters are produced at Damon. Standards designs such as Butterworth, Chebyshev, Gaussian, Bessel, and Legendre, as well as custom tailored designs are available.



RANGE OF PARAMETERS:

Center Frequency	10 KHz - 75 MHz
Bandwidth	.01% - 3% of C.F.
Shape Factor	Down to 1.2:1
Differential Phase Shift	±2°
Group Delay Uniformity	±5%

Surface-Wave Delay Lines

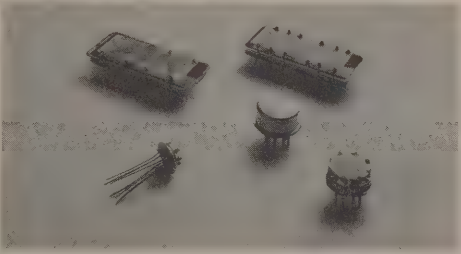
With signal transfer **across** the surface instead of through the body (a state-of-the-art development), the new Surface-Wave concept results in substantially smaller packages, lower cost in production quantities and superior performance over a 20 MHz to 300 MHz range.

RANGE OF PARAMETERS:

Frequency Range	20 MHz - 300 MHz
Time Delay Range	0.5 - 20 Microsecs.
Bandwidth at −3 dB	3% - 30% of Center Frequency
Insertion Loss	10 - 20 dB
Spurious Responses	25 - 30 dB below Desired Response
Environment	Full Military Temp., Shock, Vibration Available
Typical Size	< 1 cu. in.

Monolithic Crystal Filters

Damon Monolithic Filters utilize a single quartz plate for multiple resonators and the coupling medium between them. Advantages over conventional crystal filters include smaller size, superior stability, and lower cost. Available in a wide variety of computer-assisted designs from Chebyshev to Gaussian characteristics and from 2 to 8 poles.



MONOLITHIC CHARACTERISTICS:

Center Frequency	2.5 - 30 MHz
3 dB Bandwidth	0.3 - 30 KHz
No. of Coupled Resonators	2 - 6
Insertion Loss	1 - 6 dB
Ripple	0.5 dB Max.
Terminations	50 Ohms to 20 Kohms
Size	TO-5, TO-8, or Flat-Pack

Write for technical bulletins.

DAMON/ELECTRONICS DIVISION

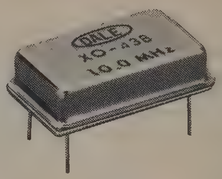
DEPT. EM, 80 WILSON WAY, WESTWOOD, MASS. 02090, TEL: (617) 449-0800, TWX (710) 348-6222

DALE® CLOCK OSCILLATORS

XO-33

250 KHz to 60 MHz

Hybrid, low profile. Standard frequencies: 1.0, 1.2288, 2.0, 2.4576, 4.0, 4.9152, 5.0, 5.0688, 6.0, 8.0, 10.0, 12.0, 16.0, 16.384, 18.432, 19.6608, 20.0, 24.0, 25.0, 30.0, 32.0, 40.0, 50.0 MHz.


DALE
XO-43B
10.0 MHz

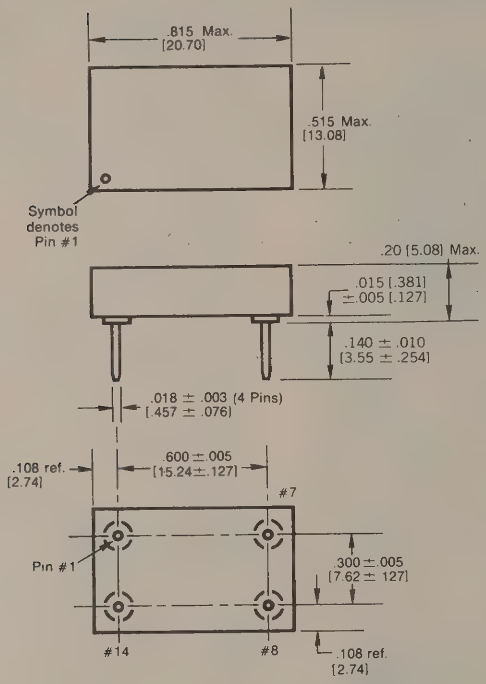
XO-43

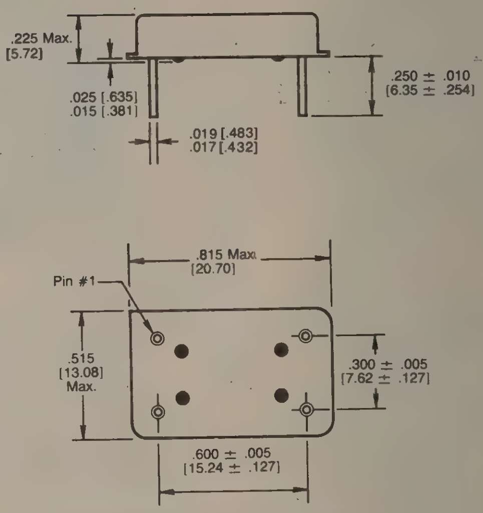
250 KHz to 60 MHz

RESISTANCE WELDED METAL PACKAGE

Hybrid, low profile. Standard frequencies: 1.0, 1.2288, 2.0, 2.4576, 4.0, 4.9152, 5.0, 5.0688, 6.0, 8.0, 10.0, 12.0, 16.0, 16.384, 18.432, 19.6608, 20.0, 24.0, 25.0, 30.0, 32.0, 40.0, 50.0 MHz.

DIMENSIONS


.815 Max.
[20.70]
.515 Max.
[13.08]
Symbol denotes Pin #1
.20 [5.08] Max.
.015 [.381]
±.005 [.127]
.140 ± .010
[3.55 ± .254]
.018 ± .003 (4 Pins)
[.457 ± .076]
.108 ref.
[2.74]
.600 ± .005
[15.24 ± .127]
#7
Pin #1
.300 ± .005
[7.62 ± .127]
#14
#8
.108 ref.
[2.74]


.225 Max.
[5.72]
.025 [.635]
.015 [.381]
.019 [.483]
.017 [.432]
.250 ± .010
[6.35 ± .254]
.815 Max.
[20.70]
Pin #1
.515
[13.08]
Max.
.300 ± .005
[7.62 ± .127]
.600 ± .005
[15.24 ± .127]

Pin #1 is identified by square corner

SPECIFICATIONS	**Model XO-33**	**Model XO-43**
Output Freq. as Specified	From 250 KHz to 60 MHz	From 250 KHz to 60 MHz
Frequency Accuracy and Stability all Conditions	XO-33A ±.005% XO-33B ±.01% XO-33C ±.05% XO-33D ±.1% XO-33H ± 1%	XO-43A ±.005% XO-43B ±.01% XO-43C ±.05% XO-43D ±.1% XO-43H ± 1%
Operating Temperature	0°C to +70°C	0°C to +70°C
Supply Voltage	+5Vdc ± 0.5V	+5Vdc ± 0.5V
Input Current	Below 4.0 MHz: 65 mA max. 4.0 MHz to 15.9 MHz: 40 mA max. 16 MHz to 25.0 MHz: 70 mA max. 25.1 MHz to 60.0 MHz: 50 mA max.	Below 4.0 MHz: 65 mA max. 4.0 MHz to 24.99 MHz: 40 mA max. 25.0 MHz to 60.0 MHz: 50 mA max.
Symmetry at 1.4 VDC Level	60/40 or better	**1
Rise and Fall Time	Below 16 MHz: 15 nS max. 16 MHz and above: 10 nS max.	Below 4.0 MHz: 15 nS max. 4.0 MHz to 24.99 MHz: 10 nS max. 25.0 MHz to 60.0 MHz: 6 nS max.
"Zero" Level Sinking 16 mA	Below 16 MHz: 0.4V max. 16 MHz and above: 0.5V max.	0.4V max.
"One" Level Sourcing 0.4 mA	2.4V min.	2.4V min.

*Outputs are complementary within ±10 nSec phase difference at +1.4V level

**1 250 KHz to 3.99 MHz: 55/45 or better, 4.0 MHz to 60.0 MHz: 60/40 or better

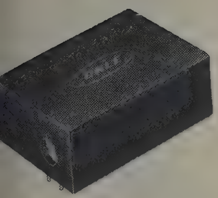
For additional information, contact

DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

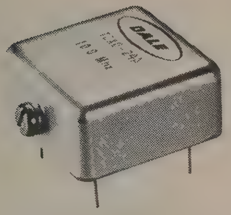
DALE®

TEMPERATURE COMPENSATED, CRYSTAL OSCILLATORS

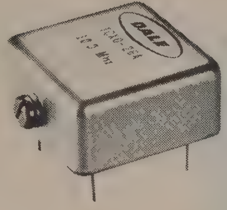
Stock frequencies include: 4.0, 5.0 and 10.0 MHz



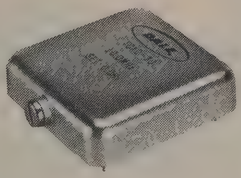
TCXO-22



TCXO-24



TCXO-26

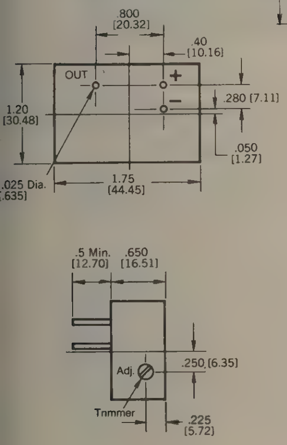


TCXO-30

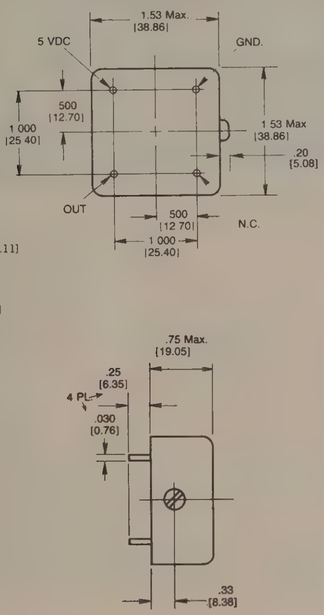
TCXO-32

IMENSIONS

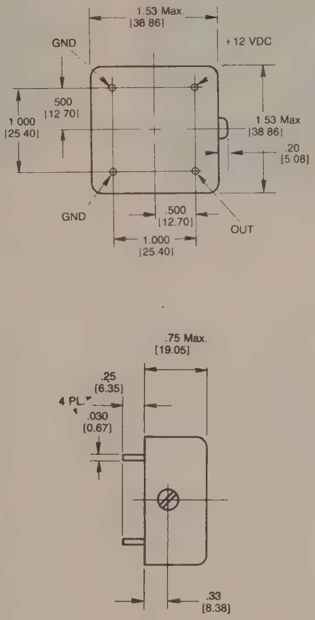
Model TCXO-22


.800 [20.32]
.40 [10.16]
OUT
+
−
.280 [7.11]
1.20 [30.48]
.050 [1.27]
.025 Dia. [.635]
1.75 [44.45]
.5 Min. [12.70]
.650 [16.51]
Adj.
.250 [6.35]
Trimmer
.225 [5.72]

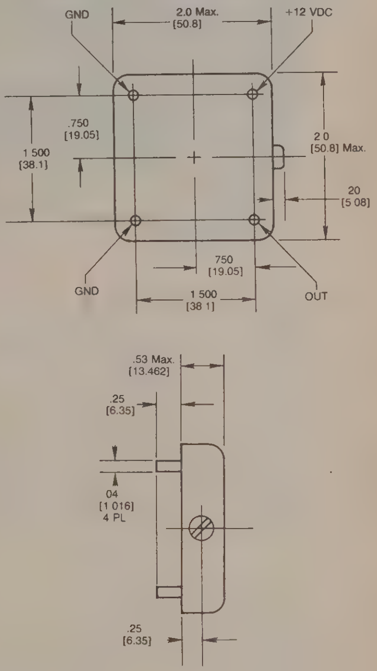
Model TCXO-24


1.53 Max. [38.86]
5 VDC
GND.
500 [12.70]
1 000 [25 40]
1 53 Max [38.86]
.20 [5.08]
OUT
500 [12 70]
N.C.
1 000 [25.40]
.75 Max. [19.05]
.25 [6.35]
4 PL
.030 [0.76]
.33 [8.38]

Model TCXO-26


1.53 Max. [38 86]
GND
+12 VDC
500 [12 70]
1 000 [25 40]
1 53 Max [38 86]
.20 [5 08]
GND
.500 [12.70]
OUT
1.000 [25.40]
.75 Max. [19.05]
.25 [6.35]
4 PL.
.030 [0.67]
.33 [8.38]

Model TCXO-30 and Model TCXO-32


GND
2.0 Max. [50.8]
+12 VDC
.750 [19.05]
1 500 [38.1]
2 0 [50.8] Max.
.20 [5 08]
750 [19.05]
GND
1 500 [38 1]
OUT
.53 Max. [13.462]
.25 [6.35]
04 [1 016] 4 PL
.25 [6.35]

SPECIFICATIONS	**Model TCXO-22 and Model TCXO-24 (A, B or C)**	**Model TCXO-26**	**Model TCXO-30 and Model TCXO-32**
Frequency Range	4 to 15.0 MHz	4 to 15.0 MHz	3 to 15.0 MHz
Accuracy at +25°C	±1 PPM (Adjustable)	±1 PPM Adjustable with Trimmer	±1 PPM Adjustable with Trimmer
Stability vs. Input Voltage	±0.2 PPM for ±10% Volt. Change	±0.25 PPM for ±5% Volt. Change	±0.10 PPM for ±5% Volt. Change
Stability vs. Temp.	TCXO-22A, TCXO-24A ±1 PPM 0 to +55°C TCXO-22B, TCXO-24B ±1 PPM +15 to +50°C TCXO-22C, TCXO-24C ±5 PPM 0 to +55°C	±1 PPM 0 to 70°C	±1 PPM −40°C to +85°C for TCXO-32 ±3 PPM −40°C to +85°C for TCXO-30
Stability vs. Time	1 PPM/Year Max.	1 PPM/Year Max.	1 PPM/Year Max.
Stability vs. Loading	±0.1 PPM for ±20% Load Change	±0.1 PPM for ±20% Load Change	±0.1 PPM for ±20% Load Change
Input Power	V = 5VDC ±10%/Current 16 mA Max.	12VDC ±5%/Current 26 mA Max.	12VDC ±5%/Current 15 mA Typ.
Output Signal	TTL Compatible, Drives 10 Loads	TTL Compatible, Drives 10 Loads	TTL Compatible, Drives 10 Loads
Rise and Fall Time	20 nS Max.	20 nS Max.	20 nS Max.
Symmetry	60/40 or Better at 1.4V Level	60/40 or Better at 1.4V Level	60/40 or Better at 1.4V Level

For additional information, contact
DALE ELECTRONICS, INC., 1155 West 23rd Street, Tempe, AZ 85282 • Phone 602-967-7874

time and frequency systems

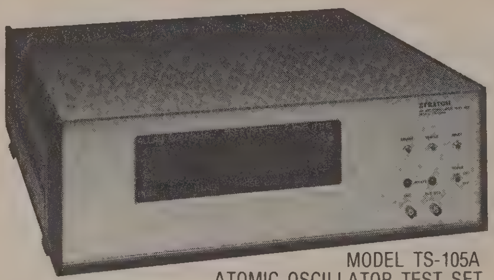
EFRATOM

A DIVISION OF Ball CORP.

RUBIDIUM OSCILLATORS

FRK M-1000 M-100

MODEL FRT
RUBIDIUM FREQUENCY STANDARD



MODEL TS-105A
ATOMIC OSCILLATOR TEST SET

MODEL PNT-1000
PHASE NOISE TEST SET

EFRATOM is the recognized world leader in precision time and frequency systems for military/aerospace and commercial applications. Utilizing state-of-the-art atomic oscillator technology, EFRATOM has conceived and developed a family of time and frequency references that find valuable application in navigation, communications and laboratory environments. The ever increasing demands for precision time base hardware to perform in the harsh environments of space, military theatres and mobile communication platforms, have provided the impetus for the development of EFRATOM's range of atomic oscillators and time base generators.

EFRATOM's Model M-1000 is the world's smallest military atomic oscillator measuring just 3.25 in x 3.25 in x 4.5 in (83 mm x 83 mm x 114 mm), yet this instrument has excellent long term stability and fast warm-up performance. Developed specifically for military use, the Model M-100 and M-1000 rubidium oscillators are radiation hardened and offer unparalled performance in the toughest of airborne and ground environments.

Complimentary to its range of precision oscillators, EFRATOM offers the Model FRT ultra-stable atomic frequency standard for laboratory and field calibration. More recently, EFRATOM introduced its Atomic Oscillator Test Set, Model TS-105A, for frequency stability (Allan Variance) measurements, and a Phase noise Test Set, Model PNT-1000.

EFRATOM's scientists, in conjunction with NBS, have developed a Compact Passive Hydrogen Maser for commercial production (not pictured above, but specified below).

MODEL	FRK-L	FRK-H	FRT-L	FRT-H	M-100	M-1000	CPHM
Output Frequency	10 MHz		2 ea 10; 5; 1; 0.1 MHz		10 MHz	10 MHz	5 MHz
Long Term Drift/mo	$4x10^{-11}$	$1x10^{-11}$	$4x10^{-11}$	$1x10^{-11}$	$6x10^{-11}$ $1x10^{-11}$	$3x10^{-11}$	$<1x10^{-15}$/day
Short Term (100s)	$3x10^{-12}$	$1x10^{-12}$	$3x10^{-12}$	$1x10^{-12}$	$3x10^{-12}$	$4x10^{-12}$	$1x10^{-13}$
Phase Noise (1 Hz BW) SSB	>120 dB (100 Hz) >145 dB (1 KHz) from carrier				>120 dB @ 100 Hz >135 dB @ 1 KHz	>140 dB @ 100 Hz >150 dB @ 1 KHz	−113 dB (1 Hz) −155 dB (>100 Hz)
	Low Noise Option 155 dB (100 Hz)						
Warm-Up	<10 minutes for $2x10^{-10}$				*<10 min to $2x10^{-10}$	<2.5 min to $5x10^{-10}$	~24 Hrs
Operations Temperature	−25°C to +65°C Base Plate		−10°C to +50°C Ambient		−55°C to +55°C Ambient (+68°C Base Plate)	−55°C to +71°C Ambient (+80°C Base Plate)	10°C to 35°C
Power at 25°C	22 VDC to 32 VDC/13W		110/220 VAC/50W		22.5 to 32 VDC/18W	22 to 32 VDC/15W	<70W
Dimensions	~4x4x4.5 inches		6x9x16 inches		~4x4x4.8 inches	3.25x3.25x4.5 in.	19x14x24 inches
Weight	2.9 lbs		27 lbs		4 lbs	<2.3 lbs	~70 lbs

*5 min warm-up available

EFRATOM *USA/18851 Bardeen Ave./Irvine, CA 92715/Telephone (714) 752-2891/Telex 685-635*
Europe & W. Germany/AM Perlacher Forst-186/D-8000 Muenchen 90/Phone (089) 648059/Telex 529701

erc
electronic research company
7618 Wedd, Overland Park, Kansas 66204
TWX: (910) 749-6477
Telephone: (913) 631-6700

GENERAL

Electronic Research Company Model ER8001 is a Precision Ovenized Crystal Oscillator utilizing a 5MHz third overtone crystal manufactured by E.R.C. Model ER8002 uses the same crystal except the output frequency is multiplied to 10MHz. These oscillators are ideal for applications where a precision time base is to be multiplied or synthesized requiring a low phase noise source.

SPECIFICATIONS

Output Frequency: Model ER8001, 5MHz; Model ER8002, 10MHz
Output Level: 1Vrms Minimum into a 50 ohm load
Waveform: Sine-Wave
Harmonic Distortion: 40dB below rated output
Frequency Adjustment: ±2.5PPM Min. course mechanical; ±2.0 x 10^{-7} Min. fine mechanical; ±1.0PPM Min. electrical option 3 only; By D.C. Voltage (−10 to +10V)
Input Voltage: +12VDC ±10%, Current at Turn-on 340MA Max. Note input terminals No. 2 & 4 may be connected together externally.
Frequency Stability vs. Input: ±3 x 10^{-9} for a ±10% change in input
Frequency Stability vs. Load: ±1 x 10^{-9} for a ±10% change in load
Frequency Stability vs. Temperature: ±5 x 10^{-9} from −20°C to +65°C ambient
Warm-up Time: 1 x 10^{-7} in 15 Min.; ±1 x 10^{-8} in 20 Min.
Aging Rate: 1 x 10^{-9}/24 hours, after 72 hours on time
Short Term: 3 x 10^{-11} RMS for one second averaging time
Retrace: ±1 x 10^{-8} after 60 Min. warm-up following a 24 hour off time
Input Power: At turn-on 340MA — After warm-up operating at +25°C 135MA, After warm-up operating at −20°C 225MA
Frequency Stability vs. Orientation: 1.5 x 10^{-9} worst case
Size: Model ER8001 and Model ER8003 2″ x 2″ x 4″ H
Model ER8005 2.25″ x 2.25″ x 4.25″ H

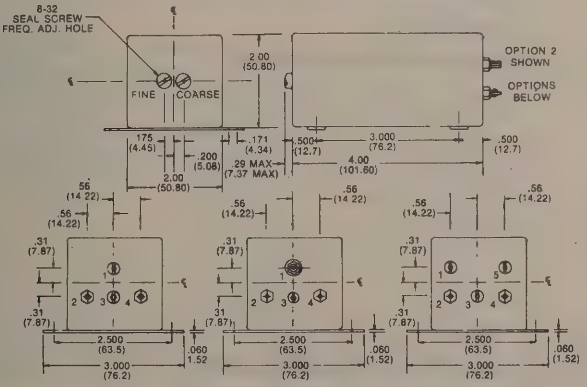
PHASE NOISE S.S.B. 1Hz BW

Offset From Carrier	S/N
10Hz	124dB
100Hz	135dB
1000Hz	145dB
5000Hz	150dB

OPTIONS AVAILABLE

Output Voltage: T.T.L.
Input Voltage: ±12VDC, +15VDC, +24VDC, +30VDC
Mechanical: Various please specify
Long Term Stability: 5 x 10^{-10}/24 hours
Output Frequencies: 1MHz to 15MHz
Tuning: Electrical fine tune options

Technical specifications are subject to change without notice.



OPTION 1
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT

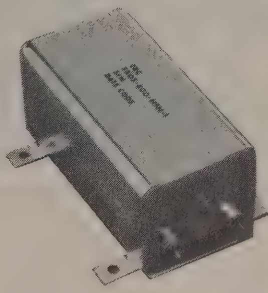
PINS 2 and 4
ERIE# 2499-008-502Z
PINS 1 and 3
104 - LOOP

OPTION 2
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT

PINS 2 and 4
ERIE# 2499-008-502Z
PIN 1
SELECTRO
P/N 51-043-4300
PIN 3
104 - LOOP

OPTION 3
PIN CONNECTIONS
1. OUTPUT RF
2. OSC. INPUT
3. GROUND + CASE
4. OVEN INPUT
5. VCO INPUT

PINS 2 and 4
ERIE# 2499-008-502Z
PINS 1, 3 and 5
104 - LOOP



PRECISION CRYSTAL OSCILLATORS

SERIES 8000

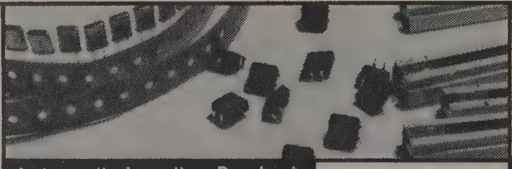
Standard Frequency: 5.0MHz
Aging Rate: Model ER8001 1 x 10^{-9}/day
Model ER8003 1 x 10^{-10}/day
Model ER8005 5 x 10^{-11}/day
Phase Noise: SSB 1Hz BW at 10Hz offset
Model ER8001, 124dB
Model ER8003, 135dB
Input Voltage: 12VDC ±10% standard
Output: Sine-wave 1VRMS into 50 ohm load
Size: Model ER8001 and Model ER8003
2″ x 2″ x 4″ H
Model ER8005
2.25″ x 2.25″ x 4.25″ H
Options: Many options are available to interface with your requirements

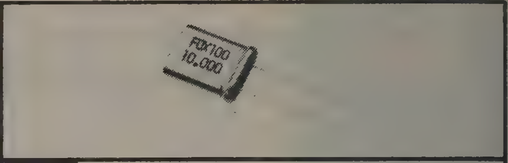
Electronic Research Company Series 8000 precision ovenized crystal oscillators are the ultimate choice where proven reliability and frequency stability is required. These oscillators are ideal for applications where a precision time base is to be multiplied or synthesized requiring a low phase noise source. All Electronic Research Company's oscillators utilize quartz crystals manufactured by ERC for maximum control on all parameters to insure performance specifications. If your application requires superior oscillator performance call us or write for our complimentary catalogue.

For information and prices,
send your specifications to:

electronic research company erc
7618 Wedd, Overland Park,
Kansas 66204
TWX: (910) 749-6477
Telephone: (913) 631-6700

FOX ELECTRONICS


Automatic Insertion Products



HC-18

Quartz Crystals

Fox offers the broadest line of crystal products in the industry: from standard products to volume automatic insertion to miniature crystals.

We carry a large stock of standard and special frequencies and feature fast delivery for large or small quantity orders. Our Distributors in your area also carry stock.

Fox also offers standard and custom holders in solder seal, resistance weld and cold weld. Send your drawings/specifications or call our Customer Service Department for assistance.

We are committed to give our customers a quality product at a competitive price, backed by excellent service.

WITH FOX, YOU GET THE BEST IN QUARTZ.

Standard Microprocessor

(Available from stock)

Frequency Mhz	Holder Type	Fox P/N	Circuit Calibration Condition
1.0000	HC-43	FOX010S	series
1.0000	HC-33	FOX010	13pF
1.8432	HC-33	FOX018	13pF
1.8432	HC-18	FOX018S	13pF
2.0000	HC-33	FOX020	20pF
2.0000	HC-18	FOX020S	20pF
2.097152	HC-33	FOX021	20pF
2.097152	HC-18	FOX021S	20pF
2.4576	HC-33	FOX024	32pF
2.4576	HC-18	FOX024S	32pF
3.0000	HC-33	FOX030	32pF
3.0000	HC-18	FOX030S	32pF
3.2768	HC-33	FOX032	18pF
3.2768	HC-18	FOX032S	18pF
3.579545	HC-33	FOX036	18pF
3.579545	HC-18	FOX036S	18pF
3.6864	HC-18	FOX0368S	series
4.0000	HC-18	FOX040A	series
4.0000	HC-18	FOX040	20pF
4.0320	HC-18	FOX0432	22pF
4.194304	HC-18	FOX041	12pF
4.433619	HC-18	FOX0443	20pF
4.91520	HC-18	FOX049	series
4.9562	HC-18	FOX0495	series
5.0000	HC-18	FOX05A	20pF
5.0688	HC-18	FOX050	series
5.1850	HC-18	FOX051	20pF
6.0000	HC-18	FOX060	series
6.1440	HC-18	FOX061	30pF
6.4000	HC-18	FOX064	20pF
6.5536	HC-18	FOX065	20pF
7.3728	HC-18	FOX073	series
8.0000	HC-18	FOX080	series
10.0000	HC-18	FOX100	series
10.738635	HC-18	FOX107	series
11.0000	HC-18	FOX111	series
12.0000	HC-18	FOX120	series
13.5168	HC-18	FOX135	series
14.31818	HC-18	FOX143	series
15.0000	HC-18	FOX150	series
16.0000	HC-18	FOX160	series
18.0000	HC-18	FOX180	series
18.4320	HC-18	FOX184	series
19.6608	HC-18	FOX196	series
20.0000	HC-18	FOX200	series
22.1184	HC-18	FOX221	series
24.0000	HC-18	FOX240	series
27.0000	HC-18	FOX270	series
32.0000	HC-18	FOX320	series
36.0000	HC-18	FOX360	series
48.0000	HC-18	FOX480	series
100.0000	HC-18	FOX1000	series

Automatic Insertion

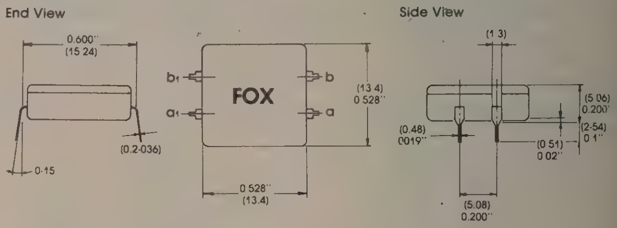
Flat Pack

The FX-1 series line of low cost crystals feature a molded plastic package with dual in-line pin spacing for automatic insertion. The FX-1 utilizes a special crystal technology in crystal packaging while maintaining the FOX quality.

The standard plastic tube houses 25 crystals ready for insertion.

Frequency range ± 3.5 MHz to 15 MHz
Frequency tolerance ± 700ppm @ 25°C
Standard load capacitance 16pf
Operating temperature range – 10 to +60@C

Package Dimensions



Tape and Reel

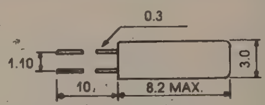
The Fox Tape and Reel crystals are the industry's First line of automatically insertable HC18 crystals for large volume applications.

Available in standard 12 inch reels with .200" pin spacing and up to 1500 crystals per reel of frequencies from 1MHz to 175MHz.

Miniatures

The Fox line of miniature crystals provides the designer with the ultimate in size, performance and economic trade offs. Featured are tuning fork and "AT" cut crystals packaged in a tubular cold weld metal design that features low power, long term stability, tight tolerances and low resistance.

Dimensions



Dimensions in mm

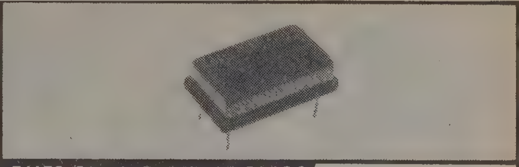
Electrical Specifications

	Part No.	Frequency
Low Frequency tuning forks	NC 38S —	16 KHz-163 KHz
Frequency stability		± 30 PPM
Watch crystal	NC 38 —	32.768 KHz
Frequency stability		± 20 PPM
High Frequency "AT" Cut	FX-3	4.19 MHz-18.0 MHz
Frequency stability		± 30 PPM

FOX ELECTRONICS ■ Sales Department ■ P.O. Box 1078 ■ Cape Coral, Florida 33910 ■ 813/482-7212 ■ TWX 510-951-7386

FOX ELECTRONICS

F-1100 Clock Oscillator TTL



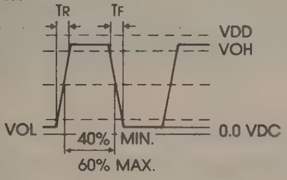
F1152 Clock Oscillator CMOS

Crystal Clock Oscillators

Fox Oscillators feature a high quality metal welded package that offers a hermetic seal to provide excellent resistance to extremes of heat/humidity. With pin 7 case ground, the metal package also includes shielding to minimize RF radiation, helping to meet FCC emit EMI specifications. The Fox Oscillators can be soldered in standard wave line operations without damage. High insulated stand-offs permit good de-fluxing.

The Fox Oscillators include state of the art thick film hybrid devices for generating TTL, CMOS and special output characteristics.

Output Wave Form



(TTL) F1100 Series

Fox TTL Oscillators use standard +5V dc input and drives up to 10 TTL loads. Fox offers a product line of stabilities, tailored for your specific needs and designed to be cost effective.

The F1100 series is interchangeable with Motorola K1100 AM and similar models.

Electrical Specifications

Freq. Range:	250 KHz -80 MHz
Freq. Stability:	±0.001- 1.00% over optg. temp. & voltage
Optg. Temp. Range:	0 to +70°C
Input Voltage:	+5 VDC ± 0.5 V
TTL Output:	
Symmetry:	60/40 to 40/60 @ 1.4 VDC Level
Rise & Fall Times:	15 ns Max. for 250 kHz to 25 MHz, 7 ns Max. for 25 MHz to 60 MHz
"O" Level:	+0.4 Volts
"I" Level:	+2.4 Volts
Output Load:	1 to 10 TTL gates

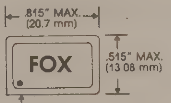
Standard Product Line

Model	Stability	Frequency	Remarks
F1100	± .01%	.250-80 MHz	TTL Clock
F1114	± .05%	.250-80 MHz	TTL Clock
F1115	± .10%	.250-80 MHz	TTL Clock
F1116	±1.0 %	.250-80 MHz	Economy Clock
F1142	± .001%	.250-80 MHz	Precision Clock
F1144	± .0025%	.250-80 MHz	Precision Clock
F1145	± .005%	.250-80 MHz	Precision Clock
F1158	± .01%	.250-80 MHz	Extended Temp.

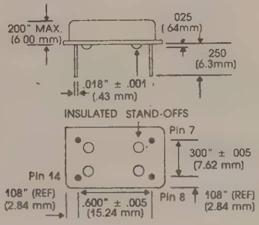
Standard TTL Frequencies (Available from stock)

Freq. (MHz)	Freq. (MHz)
1.0000	10.0000
1.8432	12.0000
2.0000	16.0000
2.4576	18.4320
4.0000	19.6608
5.0000	20.0000
5.0688	22.1184
6.0000	24.0000
6.1440	32.0000
8.0000	40.0000

Package Dimensions



Dot or Logo denotes Pin 1 location.



(CMOS) F1152 Series

Fox CMOS Oscillators generate a compatible output at any frequency specified from 25KHz to 12 MHz. The extremely low power consumption makes it perfect for driving CMOS MPU's or where battery backup is required. As with all CMOS circuits, power consumption and frequency range are dependent upon the selected input voltage.

The CMOS compatible output uses +5Vdc to +15Vdc.

Specifications

Frequency Range: 25 KHz -12.000 MHz

Frequency Stability: +0.01% (Inclusive of calibration tolerance at 25°C, operating temperature range, input voltage change, load change, aging, shock, and vibration.)

Temperature Range: Operating: 0°C to 70°C
Storage: −55°C to +125°C

Input Voltage: +5V to +15V dc

Input Current:	+5V	+10V	+15V
25kHz—3.199 MHz	2.5 mA	6 mA	14 mA
3.200—6.499 MHz	2 mA	6 mA	14 mA
6.500—8.999 MHz		9 mA	17 mA
9.000—12.000 MHz			18 mA

Output:

Symmetry:	40/60% to 60/40% (CL = 15 pF @ VO = ½ Vdd)
"1" Source Current:	120 mA
"0" Sink Current:	360 mA

	+5V	+10V	+15V
VOH (Logic "1") min.	4.5	9.0	13.5
VOL (Logic "0") max.	.5	1.0	1.5
RISE & FALL TIMES (10% to 90% VOD CL = 15 pF)	100 ns	55 ns	35 ns

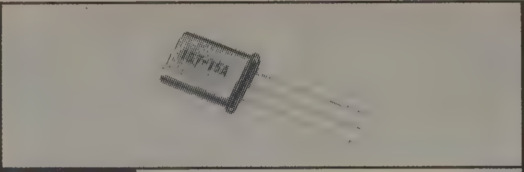
Mil Equivalent F-5500 Series

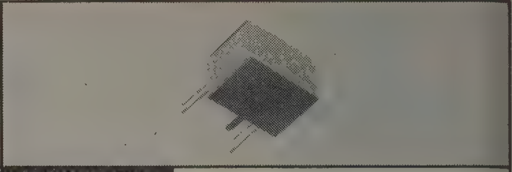
Fox offers a commercial equivalent to mil. 0-55310. If your oscillator needs match those of a mil spec in general parameters, but your application does not demand the exhaustive testing and administration, you can order a mil equivalent Fox oscillator. The Fox mil equivalent oscillator is designed to meet the mil spec. Marking will be standard commercial marking.

Contact the Fox Customer Service Department for assistance.

FOX ELECTRONICS ■ A Division of Fox Enterprises, Inc. ■ P.O. Box 1078 ■ Cape Coral, FL 33910 ■ 813/482-7212 ■ TWX 510-951-7386

FOX ELECTRONICS


HC-18 Filter


Multi-Pole Filter

Monolithic Crystal Filters

Fox filters offer excellent features such as sharp cut off characteristic, low loss and high stability over wide temperature range which are superior to LC filters and ceramic filters.

The basic building block for all custom built Fox filters is the two-pole monolithic filter available in standard package as shown. (See Figure 12.)

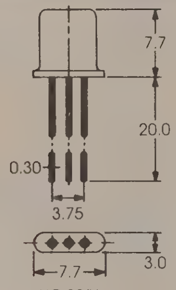
Two-pole monolithic filters can be cascaded to produce four, six and eight or more pole filter responses with addition of coupling capacitors between two-pole sections.

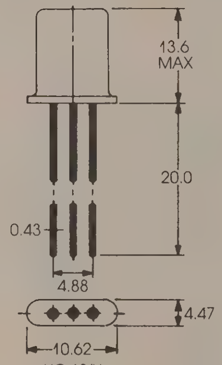
Standard Fox filters are available with center frequencies at 10.7 MHz, 16.9 MHz and 21.7 MHz. Bandwidths from ±7 KHz to ±10 KHz and from two to eight poles.

For custom made filters please specify the following:

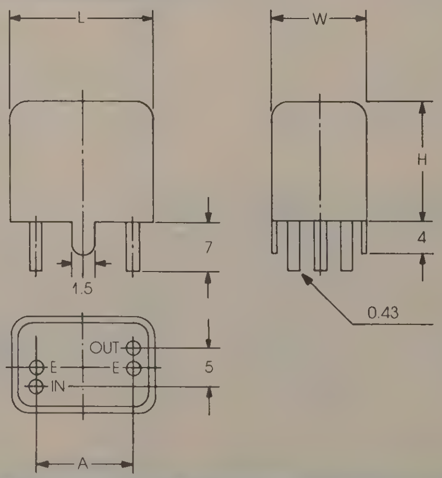
Holder Size/Nominal Frequency/Pass Bandwidth/Insertion Loss/Attenuation/Bandwidth/Spurious Response/Impedance/Operating Temperature Range

Two Pole Packages


7.7
20.0
0.30
3.75
7.7
3.0
HC-80/U


13.6 MAX
20.0
0.43
4.88
4.47
10.62
HC-18/U

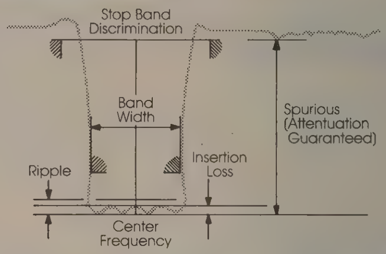
Multi-Pole Packages


L
W
H
7
4
1.5
0.43
OUT
E
E
IN
5
A

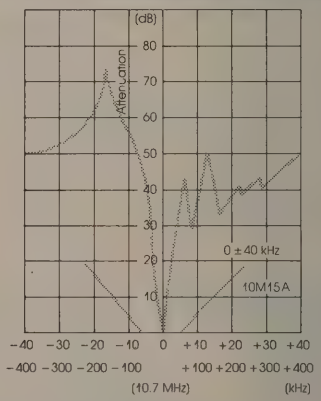
Multi-Pole Package Dimensions (mm)

Case Type	L	W	H	A
B	15	12	15	9
C	18.5	12	15	13.9
D	23	12	15	17.8
BN	12	11	12	7.5
CN	16	11	12	11.5
DN	21	11	12	16.5

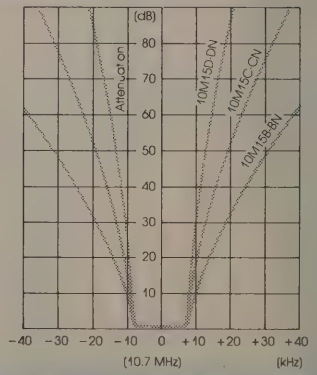
Filter Parameters


Stop Band Discrimination
Band Width
Spurious (Attentuation Guaranteed)
Ripple
Insertion Loss
Center Frequency

10.7 MHz Two Pole Characteristics

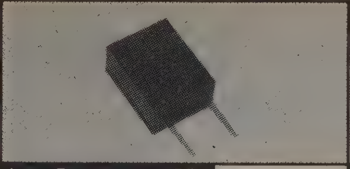


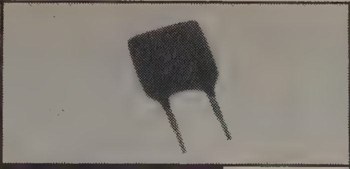
Multi-Pole Characteristics



FOX ELECTRONICS ■ A Division of Fox Enterprises, Inc. ■ P.O. Box 1078 ■ Cape Coral, FL 33910 ■ 813/482-7212 ■ TWX 510-951-7386

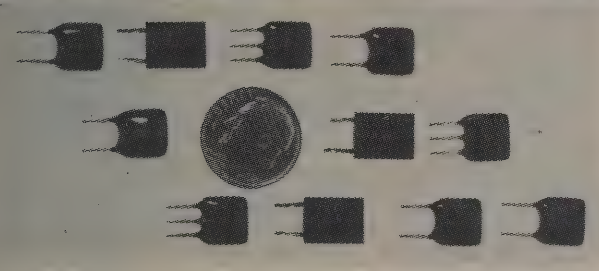
FOX ELECTRONICS


Low Frequency FSB


High Frequency FSA

High Frequency w/caps FSC

Ceramic Resonators


Ceramic Resonator

Fox Ceramic Resonators are frequency stable devices that offer a low cost option for use in oscillator circuits. The Fox resonator stability lies between quartz crystal and LC or RC oscillators. The Fox line includes a low frequency group and high frequency group which includes standard resonators and resonators with built in loading capacitors, a first in the industry.

Features

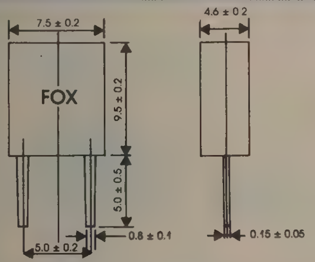
- ■ Low Cost
- ■ Compact & Lightweight
- ■ Stable oscillator
- ■ Built-in capacitors

Applications

- ■ Timing functions
- ■ Microprocessor Clocks
- ■ Square and sine wave oscillators
- ■ Communications & TV consumer products
- ■ Data transmission

Specifications

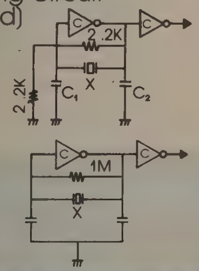
Type	FSA Type	FSB Type	FCA Type
Frequency Range	3.58 to 11 MHz	400 to 800 KHz	4.0 to 10 MHz
Frequency Tolerance	±0.5%	±0.5%	±0.5%
Temperature Stability (−20°C to +80°C)	±0.3%	±0.3%	±0.3%
Time Stability (10 years)	±0.5%	±0.5%	±0.5%
Equivalent Resistance	20 ohms max.	40 ohms max.	40 ohms max



◄ 1

FREQ. RANGE
400-800 KHz

Measuring Circuit
(Standard)



TTL clock circuit

IC : 1/6 74LS04X2
Vcc : 5V (Supply voltage)
X : Resonator
C_1C_2; Loading capacitors

CMOS clock circuit

IC : 1/6 CD4069BEX2
VDD : 12V (Supply voltage)
X : Resonator

Standard Products

Specifications subject to change without notice.

Low Frequency

Frequency	Package Type	Part Number	Max ESR ohms
400 KHz	1	FSB400	20
455 KHz	1	FSB455	20
480 KHz	1	FSB480	20
500 KHz	1	FSB500	20
600 KHz	1	FSB600	20
800 KHz	1	FSB800	20

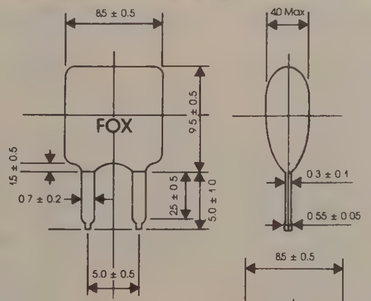
Typical Q value 1500

High Frequency

Frequency	Package Type	Part Number	Max ESR ohms
3.58 MHz	2	FSA3.58	40
4.00 MHz	2	FSA4.00	40
4.19 MHz	2	FSA4.19	40
5.00 MHz	2	FSA5.00	40
6.00 MHz	2	FSA6.00	40
8.00 MHz	2	FSA8.00	40
10.00 MHz	2	FSA10.00	40
11.00 MHz	2	FSA11.00	40

High Frequency with Built-In Capacitors

Frequency	Package Type	Part Number	Max ESR ohms
4.00 MHz	3	FSC4.00	40
6.00 MHz	3	FSC6.00	40
8.00 MHz	3	FSC8.00	40
10.00 MHz	3	FSC10.00	40

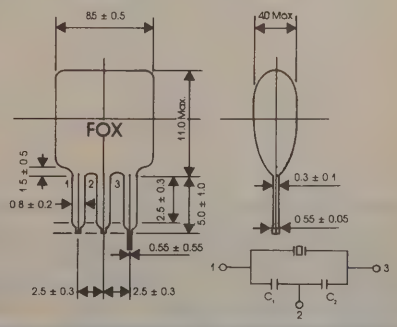


◄ 2

FREQ. RANGE
3.58 to 11 MHz

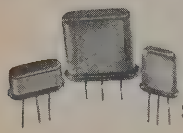
3 ►

FREQ. RANGE
4 to 10 MHz



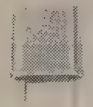
Ceramic Resonator with loading capacitors included in package

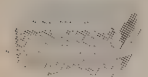
FREQUENCY CONTROL PRODUCTS, INC. Crystals / 1 kHz to 185 MHz

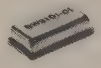

Resistance Welded Subminiature

TO Cans

Coldweld


Solder Sealed


Flatpacks


Clock Oscillators

SOME **FCP** SPECIALS

Microprocessor Crystals. Over 50 standard models for the frequencies from 1 to 48 MHz cover the most widely used microprocessors, clocks and ICs. All available in Coldweld HC-18 cans, some also in HC-33.

Crystals for Filters and Oscillators. Matched sets and high stability.

High Qs. Better than 1x10⁶ in some ranges, also spurious mode suppressions from 20 to 65dB.

Special Environments. High shock and radiation hardened.

Small Packages. 10 MHz in TO-5 (HC-35/U) can, .700 to 1.5 MHz in .215″ high HC-18 coldweld.

Clock Oscillators. Feature crystal stability, printed circuit board on dual in-line mounting and outputs directly compatible with DTL or TTL loads. Full line—Military and Industrial Clock Oscillators.

For more than 25 years **FCP** has been a major supplier of crystals for MIL Spec, general industrial and special applications. A wide variety of packages are available in coldweld and solder seal. Strong on engineering as well as production, Frequency Control Products can often be of assistance to the circuit designer.

1 kHz to 1.5 MHz

Cuts: JT • H (+5° Flexural) • NT
E (+5° Extensional) D • DT Bar

THERMAL COMPRESSION BONDED LEADS

Model 110 H .700 to 1.5 MHz
(mini only 0.215″ high)

Model 128 250 to 700 kHz
(high Q mini, superior temp. tracking)

Model 200 .900 to 1.5 MHz
(submin. resistance welded
only 0.039 in.²)

Typical Performance

		E	DT	DT Bar	JT	H	NT
Temp. Range	–40° +85° C (MIL)	±.015%	±.01%	±.01%	±.02%	±.1%	±.01%
	–10 +60 C (Com.)	±.008%	±.005%	±.005%	±.01%	±.05%	±.005%
Drive Level	in Milliwatts	1	1	1	.1	.1	.1
Freq. Stability	P.P.M./mo.						
Coldweld		0.5	0.1	0.1	0.5	0.5	0.1
Solder Seal		2.0	1.0	1.0	2.0	1.0	1.0

STANDARD HOLDERS

Cuts	Frequency Range, kHz	Bulova No.	Mil No.	Seal²
JT	1-15	71	HC-13/U	S
	3-15	73	HC-13/U	S
	4-15	124	HC-37/U(1.5″)	C
	4-15	118	HC-35/U(1.5″)	C
	4-15	131	HC-41/U	C
	10-15	122	HC-37/U(.6″)	C
	10-15	117	HC-35/U(.6″)	C
H +5° Flexure Mode	10-90	71	HC-13/U(1″)	S
	15-90	73	HC-13/U	S
	15-90	124	HC-37/U(1.5″)	C
	15-90	118	HC-35/U(1.5″)	C
	15-90	131	HC-41/U	C
	45-90	117	HC-35/U(1″)	C
	45-90	122	HC-37/U(.6″)	C
NT	8-200	71	HC-13/U	S
	15-200	73	HC-13/U	S
	20-200	124	HC-37/U(1½″)	C
	20-200	118	HC-35/U(1½″)	C
	20-200	131	HC-41/U	C
	45-200	117	HC-35/U(1″)	C
	45-200	122	HC-37/U(.6″)	C
	85-200	70	HC-6/U	S
	85-200	78	HC-33/U	S
	85-200	113	HC-36/U	C

Cuts	Frequency Range, kHz	Bulova No.	Mil No.	Seal²
E +5° Extensional Mode	50-300	71	HC-13/U (1.75 to 3.50)	S
	85-300	73	HC-13/U	S
	100-300	118	HC-35/U(1½)	C
	100-300	131	HC-41/U	C
	162-300	117	HC-35(1″)	C
	185-300	70	HC-6/U	S
	185-300	78	HC-33/U	S
	235-300	113	HC-36/U	C
	240-300	130	HC-39/U	C
DT	80-400	90	HC-21/U	S
	150-400	70	HC-6/U	S
	150-400	78	HC-33/U	S
	200-400	113	HC-36/U	C
	200-400	130	HC-39/U	C
	325-400	116	HC-35/U(.6″)	C
DT Bar	150-1000	73	HC-13/U	S
	180-1000	131	HC-41/U	C
	250-1000	122	HC-37/U(.6″)	C
	285-1000	70	HC-6/U	S
	285-1000	78	HC-33/U	S
	300-1000	113	HC-36/U	C
	300-1000	130	HC-39/U	C
	440-1000	75	HC-32/U	S
	450-1000	116	HC-35/U(.6″)	C
	800-1050	115	HC-35/U	C
	700-1300	110	HC-18(.215″)	C

1 MHz to 185 MHz

AT Cuts

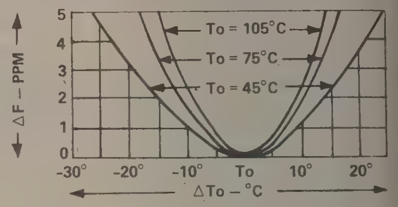
TYPICAL PERFORMANCE

Frequency tolerance: as tight as ± .002% from –55°C to +105°C, .0003% from –10°C to +60°C with reference to +25°C

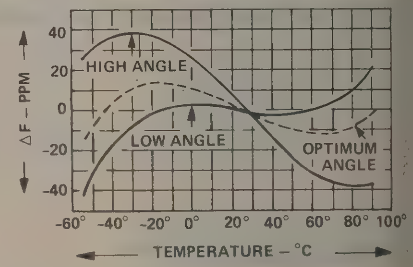
Frequency Stability: Aging, 5 parts in 10^6/30 days to 4 parts 10^8/30 depending upon package, frequency and temperature

Drive Level: 0.01mW to 10mW

AT CUT, ΔF vs. To FOR OVEN UNITS
To = Zero Temperature Coefficient Point



AT CUT, ΔF IN PPM vs. Δ°C
Coefficients, Non-ovenized Applications



STANDARD HOLDERS

FCP No.	Mil No.	Seal²
70	HC-6/U	S
75	HC-32/U	S
78	HC-33/U	S
79	HC-17/U	S
80	HC-18/U	S
83	HC-25/U	S
91	HC-11A/U	S
92	—	S
95	—	S
110	HC-43/U	C
111	HC-24/U	C
112	HC-47/U	C
113	HC-36/U	C
115	HC-35/U	C
120	HC-37/U	C
121	—	C
130	HC-39/U	C
77	HC-27/U	G

Notes 1. *Numbers in parentheses after MIL type number indicates height or height range of modified can. For configuration and dimensions see illustrations.*

2. *Seals. "S" = solder sealed, "C" = coldweld.*

FREQUENCY CONTROL PRODUCTS, INC.
61-20 Woodside Avenue, Woodside, New York 11377
Tel: (212) 458-5811 TWX 710-5822637
(Formerly Bulova Electronics Division)

NEED MORE INFO?
Call or Write
for Full Spec Bulletin

FREQUENCY CONTROL PRODUCTS, INC.

Oscillators / CRYSTAL and FORK

FCP is unique among oscillator suppliers in that it has complete in-house capability for the production of all types of oscillator packages, TCXOs, PCOXOs and XOs. We make our own crystals and tuning forks. We have a large foundation of standard models to draw on and can respond speedily with custom units to fit precise specifications. NOTE! FOR CLOCK OSCILLATORS, SEE OUR AD UNDER CRYSTALS.

XOs—Crystal and Fork Oscillators,
not Temperature Compensated

Overall Stability Percent	Temperature Range, °C	Frequency Range	Supply Voltage d.c.^{2}	Model No. (Letter suffix indicates physsical configuration)
±0.0005	+25	50 Hz to 1 kHz	5 to 40	FS32-25-005-H
±0.001	+25	50 Hz to 1 kHz	5 to 40	FS32-25-010-H
±0.002	+15 to +35	1 Hz to 1 MHz	5 to 40	FS32-1535-020-H
		4 kHz to 20 kHz	5 to 28	FS11-1535-020-I
		360 Hz to 1200 Hz	10 to 28	FS27-1535-020-J
		4 kHz to 1 MHz	5 to 28	FS11-1-1535-020-I
		50 Hz to 1 MHz	5 to 28	FS11-2-1535-020-I
		50 Hz to 1 MHz	5 to 40	FSOA-1535-020-L
		4 kHz to 20 kHz	5 to 28	FS23-1535-020-K
±0.005	0 to +50	1 Hz to 1 MHz	5 to 40	FS32-050-050-H
		4 kHz to 20 kHz	5 to 28	FS11-050-050-I
		4 kHz to 1 MHz	5 to 28	FS11-1-050-050-I
		50 Hz to 1 MHz	5 to 28	FS11-2-050-050-I
		360 Hz to 1200 Hz	10 to 28	FS27-050-050-J
		50 Hz to 1 MHz	5 to 40	FSOA-050-050-L
		4 kHz to 20 kHz	5 to 28	FS23-050-050-K
±0.01	0 to +60	1 Hz to 1 MHz	5 to 40	FS32-060-100-H
		400 to 20 kHz	5 to 28	FS11-060-100-I
		400 to 1 MHz	5 to 28	FS11-1-060-100-I
		1 Hz to 1 MHz	5 to 28	FS11-2-060-100-I
		360 Hz to 1200 Hz	10 to 28	FS27-060-100-J
		50 Hz to 1 MHz	5 to 40	FSOA-060-100-L
		400 Hz to 1 MHz	5 to 28	FS23-060-100-K
+0.02	−55 to +85	1 Hz to 1 MHz	5 to 40	FS32-5585-200-H
		4 kHz to 20 kHz	5 to 28	FS11-5585-200-I
		4 kHz to 1 MHz	5 to 28	FS11-1-5585-200-I
		50 Hz to 1 MHz	5 to 28	FS11-2-5585-200-I
		360 Hz to 1200 Hz	10 to 28	FS27-5585-200-I
		50 Hz to 1 MHz	5 to 40	FSOA-5585-200-L
		4 kHz to 1 MHz	5 to 28	FS23-5585-200-K
±0.05	−55 to +85	1 Hz to 1 MHz	5 to 40	FS32-5585-500-H
		400 Hz to 20 kHz	5 to 28	FS11-5585-500-I
		400 Hz to 1 MHz	5 to 28	FS11-1-5585-500-I
		50 Hz to 1 MHz	5 to 28	FS11-2-5585-500-I
		360 Hz to 1200 Hz	10 to 28	FS27-5585-500-J
		50 Hz to 1 MHz	5 to 40	FSOA-5585-500-L
		4 kHz to 1 MHz	5 to 28	FS23-5585-500-K
±0.1	−55 to +85	400 Hz to 1 MHz	5 to 28	FS23-5585-1000-K
	−55 to +125	1 Hz to 1 MHz	5 to 40	FS32-55125-1000-K
		4 kHz to 1 MHz	5 to 28	FS11-55125-1000-K
		4 kHz to 1 MHz	5 to 28	FS11-1-55125-1000-K
		50 Hz to 1 MHz	5 to 28	FS11-2-55125-1000-K
		360 Hz to 1200 Hz	10 to 28	FS27-55125-1000-K
		50 Hz to 1 MHz	5 to 40	FSOA-55125-1000-K
		4 kHz to 1 MHz	5 to 28	FS23-55125-1000-K

TCXOs—Temperature Compensated Crystal Oscillators

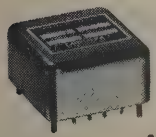
Stability vs. Temperature	Temperature Range, °C	Frequency	Supply Volt. d.c.^{2}	Model No. (Letter suffix indicates physical configuration)
±0.2 pp 10^6	−40 to +75	3 to 5 MHz	12	TCXO-2-475-020-A
±0.25 pp 10^6	0 to +70	10 MHz	12	TCXO-70-070-025-E or F
±0.5 pp 10^6	−40 to +70	3 to 12 MHz	18	TCXO-1A-470-050-B
	−40 to +70	3 to 12 MHz	12	TCXO-1B-470-050-B
	−40 to +75	3 to 5 MHz	12	TCXO-5-475-050-A
	−40 to +70	3 to 5 MHz	18	TCXO-6-470-050-A
	−40 to +75	3 to 5 MHz	12	TCXO-54-475-050-D
	0 to +70	10 MHz	12	TCXO-70-070-050-E or F
±1.0 pp 10^6	−55 to +105	3 to 5 MHz	18	TCXO-18-505-100-A
	−55 to +85	3 to 5 MHz	12	TCXO-7-585-100-A
	−55 to +85	3 to 5 MHz	18	TCXO-8-585-100-A
	−40 to +70	3 to 12 MHz	18	TCXO-1-470-100-B
	−40 to +75	3 to 5 MHz	12	TCXO-1B-475-100-B
	−40 to +75	3 to 10 MHz	12	TCXO-4-475-100-A
	−40 to +75	3 to 10 MHz	18	TCXO-4-475-100-A
	−40 to +75	3 to 13 MHz	12	TCXO-54-475-100-D
	0 to +70	10 MHz	12	TCXO-70-070-100-E or F
±2.0 pp 10^6	−55 to +105	3 to 5 MHz	18	TCXO-18-505-200-A
	−55 to +85	3 to 5 MHz	12	TCXO-7-585-200-A
	−55 to +85	3 to 5 MHz	18	TCXO-8-585-200-A
	−40 to +75	3 to 12 MHz	18	TCXO-1-475-200-B
	−40 to +75	3 to 12 MHz	12	TCXO-1B-475-200-B
	−40 to +75	3 to 10 MHz	12	TCXO-3-475-200-A
	−40 to +75	3 to 10 MHz	18	TCXO-4-475-200-A
	−40 to +75	3 to 13 MHz	12	TCXO-54-475-200-D
	0 to +70	10 MHz	12	TCXO-70-070-200-E or F

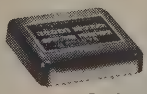
1. Other frequencies available as special units
2. Other voltages available as special units

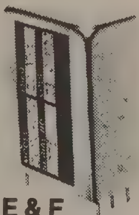
PCOXOs—Highly Accurate Ovenized Units

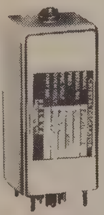
±1 pp 10^8 Temp Range ±3 × 10^9/day Aging	−55 to +70	1 to 10 MHz	+28	PCOXO-102-G
±2.5 pp 10^8 Temp Range ±5ppm10^9/day Aging	−55 to +70	1 to 10 MHz	+28	PCOXO-103-G
±4pp10^{10}/°C Temp Range ±5pp10^9/day Aging	0 to +60	1 to 10 MHz	+28	PCOXO-3-G
±4pp10^{10}/°C Temp Range ±10pp10^9/day Aging	0 to +60	1 to 10 MHz	+28	PCOXO-4-G

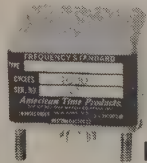
Representative Physical Configurations

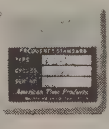

A


B & D


E & F


G


H


I & L

J

K

Package Dimensions

A. 2″ × 2″ × 1″	**E.** 1.8″ × 1.35″ × 0.75″	**H.** 1.5″ × 1.5″ × 1.2″	**K.** 1.875″ × 1.5″ dia.
B. 2″ × 2″ × 0.5″	**F.** (Horizontal version of E)	**I.** 1.5″ × 1.5″ × n*	**L.** 1.5″ × 1.5″ × n*
D. 1.5″ × 1.5″ × 0.5″	**G.** 2″ × 2″ × 4″	**J.** 3″ × 0.72″ dia.	*n = 0.375″ × the number of pc boards required, 0.375″ minimum.

FREQUENCY CONTROL PRODUCTS, INC.
61-20 Woodside Avenue, Woodside, New York 11377
Tel: (212) 458-5811 TWX 710-5822637
(Formerly Bulova Electronics Division)

NEED MORE INFO?
Call or Write
for Full Spec Bulletin

Frequency Electronics' capability is from the basic quartz crystal to complete time and frequency systems.

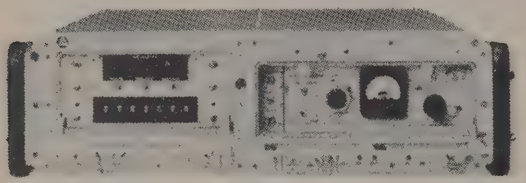
Timekeeper for Outer Space... Ask anyone who knows anything about this nation's deep space probe and satellite programs to mention any 10. Our instruments or equipment are aboard at least 8.

Cesium Beam

Primary Frequency Standards.

Models FE-5450A (TD-1335/V)
FE-5440A (TD-1251/U)

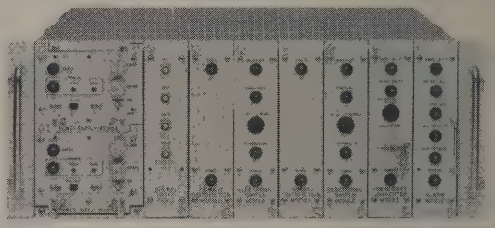
High Reliability, Militarized Cesium Beam Frequency Standards for aerospace, shipboard, laboratory and mobile applications.



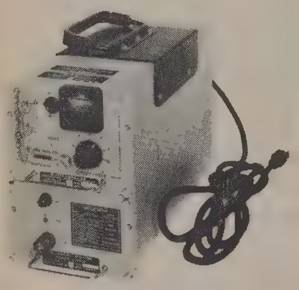
Frequency Distribution Systems

Models FE-798A/FE-799A

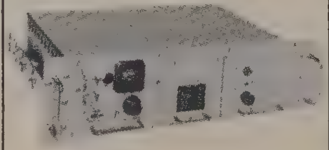
A militarized, high reliability RF distribution system for satellite ground stations and shipboard, mobile, and laboratory applications.



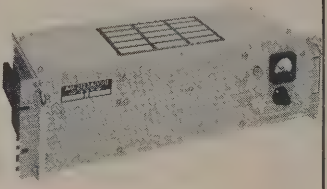
INSTRUMENTS



Model FE-1000Q
(AN/URQ-10A)
High Stability
Frequency Standards



Model FE-1100A
High Stability
Frequency Standards

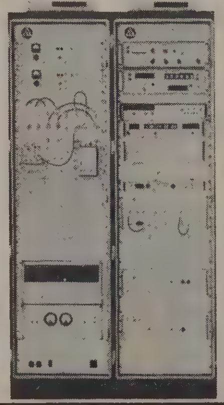


Model FE-70Q
(AM-2123A(V)/U)
Distribution
Amplifier

Model FE-1050A
(AN/URQ-23)
Disciplined Time
Frequency Standard

SYSTEM CAPABILITY

Model FE-5054A
(CTFS)
Communication
Time and Frequency
Standards



Model AN/FRQ-16
Frequency - Time
Standard Set

INSTRUMENTS
- Disciplined Time Frequency Standards
- High Stability Frequency Standards
- Frequency Standard Carrying Cases
- Digital Phase Comparators
- Frequency Error Analyzers
- Distribution Amplifiers
- RF Switchovers
- Passive Combiners
- Digital Clocks
- Microwave Frequency Multipliers
- High Frequency Amplifiers
- UHF Down-Converters
- UHF Up-Converters

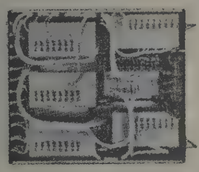
SYSTEMS
- Time & Frequency Control Systems
- UHF Synthesizers
- Frequency Generators
- Coherent Microwave Synthesizers
- RF Switching Systems

FREQUENCY ELECTRONICS, INC.

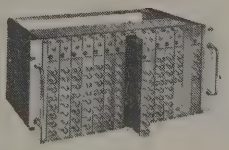
55 Charles Lindbergh Blvd.,
Mitchel Field, N.Y. 11553
TEL: (516) 794-4500
TWX: 510-223-0418

BROAD BAND MODULAR SWITCHING SYSTEMS

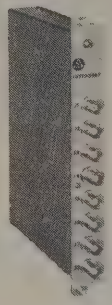
Complete systems with power supplies, digital interface converters, I/O equipment, control panels, and various other functions are available.



Solid-State Matrices
FE-7650A
8 × 50 Matrix



Solid-State Switches
FE-7642D
4 × 92 Switch

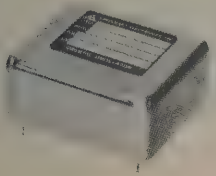


Reed Switches
FE-7735A
1×8 Switch

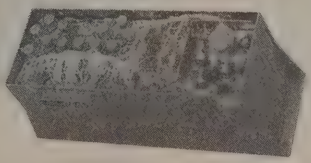
SATELLITE FREQUENCY GENERATION AND DISTRIBUTION EQUIPMENT

State-of-the-art techniques pioneered by FEI for frequency synthesis, processing, and distribution of low noise reference signals have been applied to the development of high reliability hardware for satellite applications. FEI systems consisting of precision oscillators and distribution equipment configured as redundant assemblies are presently being used on a wide variety of space programs resulting in performance capabilities previously unrealizable. The equipment incorporates FEI's high reliability hybrid techniques and results in light weight and low power consumption; considerations of primary importance in satellite applications.

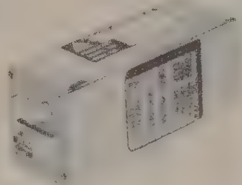
OSCILLATORS



(TCXO and TCVCXO)
Temperature Compensated/
Voltage Controlled
Crystal Oscillators

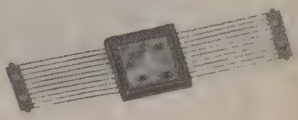


Space Application
High Stability
Remotely Settable
Crystal Oscillator.



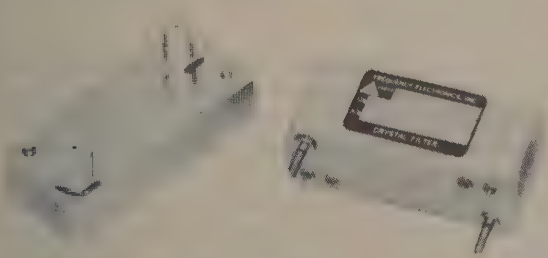
Proportionately
Controlled Ovenized
Oscillator

Miniature Hybridized Oscillator



MIL-M-38510
MIL-STD-883B
Level "S" or Level "B"

CRYSTAL FILTERS AND DISCRIMINATORS



HIGH RELIABILITY PRODUCTS

FREQUENCY ELECTRONICS, INC.

55 Charles Lindbergh Blvd.,
Mitchel Field, N.Y. 11553
TEL: (516) 794-4500
TWX: 510-223-0418

CRYSTAL FILTERS AND DISCRIMINATORS
Narrow Band Crystal Filters
Intermediate Wide Band Crystal Filters
Band Reject Crystal Filters
Single Side Band Crystal Filters
Discriminators

OSCILLATORS
Ovenized Crystal Oscillators
Ovenized Voltage Controlled Crystal Oscillators
Temperature Compensated Voltage Controlled Crystal Oscillators
Temperature Compensated Crystal Oscillators
Non-Ovenized Crystal Oscillators
LC Voltage Controlled Oscillators
Precision Low Power Oscillators
High Stability Proportional Ovens
Custom Engineered Oscillators

Low Phase-Noise Frequency Sources To 10 GHz

24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
2800
TRW

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

EEM FILE SYSTEM,

645 stewart ave., garden city, ny 11530

Filters and Networks

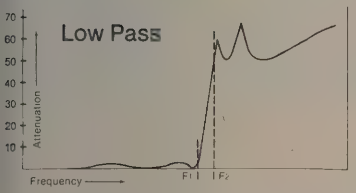
LC Filters • Crystal Filters
Delay Lines • Discriminators

from **FSN** **FREQUENCY SELECTIVE NETWORKS, INC.**

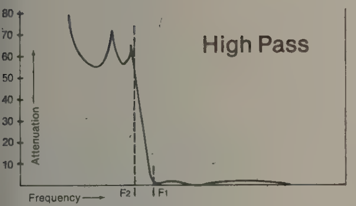
FSN is a filter and network house. We are strong in engineering. We are able and willing to work with system designers to apply state-of-the-art filter technology to optimize not just the filter but the application of filters to help our customers optimize their systems.

Use us as your filter specialist. We are knowledgeable in and have experience with all classes of filters, whether crystal or LC. We can select the proper type for best performance while optimizing the cost-vs-performance trade-off. We design and manufacture **all** the families such as: Butterworth, Chebyshev, Legendre, Cauer (elliptical), General Parameter, Gaussian, Bessel, Transitional Butterworth-Thompson (TBT), Bode, Lerner and others.

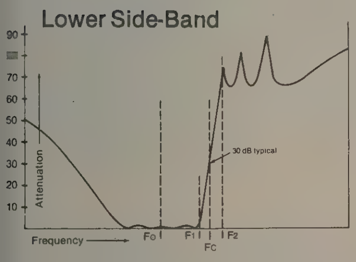
We also design and manufacture such other networks as delay lines, attenuators, phase and delay equalizers, discriminators, matching networks, etc.



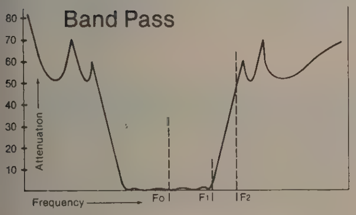
Shape Factor = $\frac{F_2}{F_1}$ As Low as 1.03



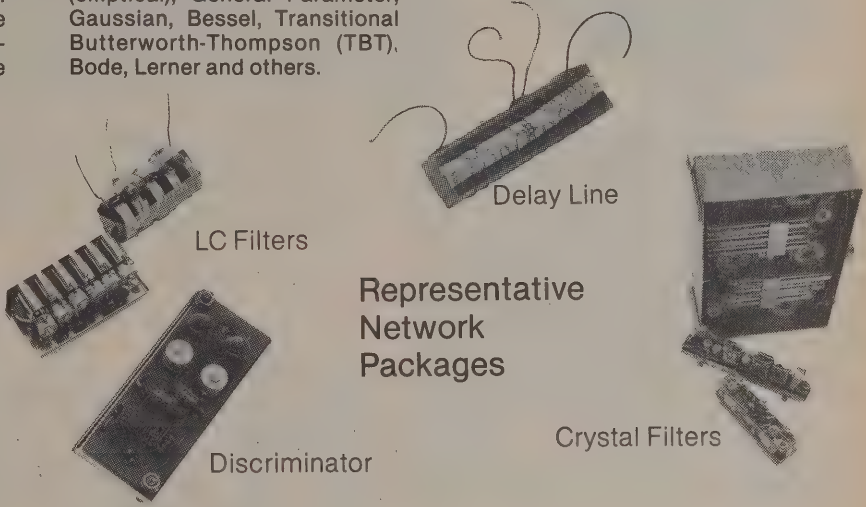
Shape Factor = $\frac{F_1}{F_2}$ As Low as 1.03

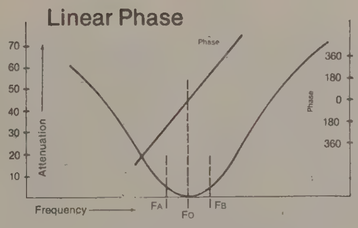


Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05

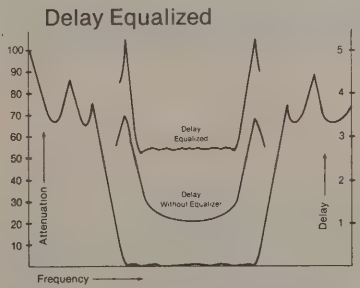


Shape Factor = $\frac{F_2 - F_0}{F_1 - F_0}$ As Low as 1.05

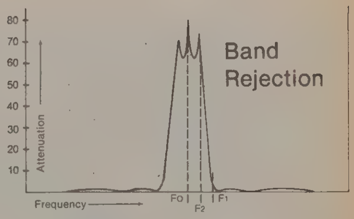




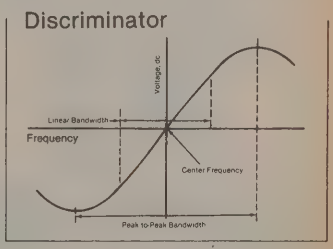
Phase Linearity better than 1°



Shape Factors better than 1.10
Delay Variation better than 2%



Shape Factor = $\frac{F_1 - F_0}{F_2 - F_0}$ As Low as 1.20



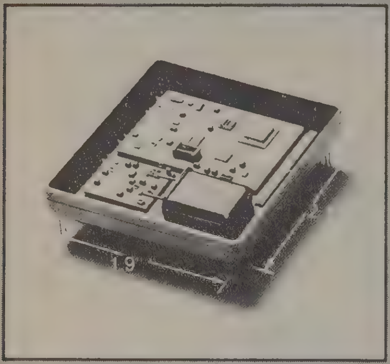
Wide and Narrow Band Linearity ± 1%

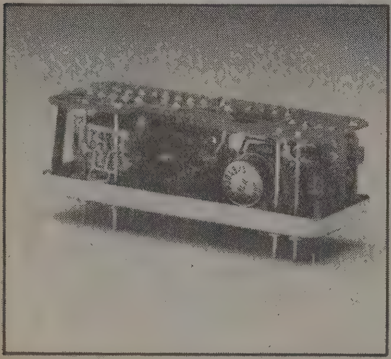
69-20 Garfield Avenue
Woodside, N.Y. 11377
(212) 424-7500

FSN
FREQUENCY SELECTIVE NETWORKS, INC.

LC Filters • Crystal Filters • Delay Lines • Discriminators

Hughes Oscillators



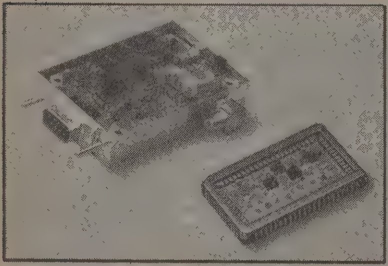


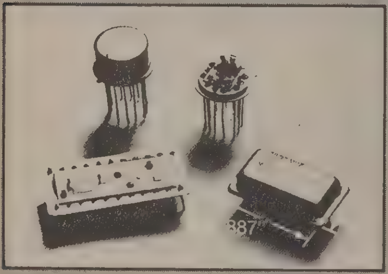
Temperature Compensated Crystal Oscillators

For portable or remote equipment requiring low power and high stability, Hughes offers both TCXO's and DCXO's. The TCXO's utilize analog compensation networks designed with computer aided techniques to achieve frequency stability over wide temperature ranges. Performance is ensured with automated component selection and test and fully automated testing of the finished product. DCXO's achieve even greater frequency stability through digital compensation techniques. Compensation data is stored in an Electrically Erasable Programmable Read Only Memory (EEPROM) which allows the DCXO to be recompensated or programmed a number of times.

Typical Specifications

Frequency Range:	0.1 Hz to 60 MHz
TCXO Frequency Stability:	
over −40°C to +85°C	±0.5 ppm
over −55°C to +85°C	±1.0 ppm
over −55°C to +125°C	±5.0 ppm
DCXO Frequency Stability:	
over 0°C to +70°C	±0.1 ppm
over −40°C to +85°C	±0.2 ppm
Short Term Stability:	±1 x 10^{-8}/sec
Long Term Stability:	±1 ppm/year
Supply Voltage:	5 to 27 VDC available
Size:	as small as 1 x 1 x 0.5 inch Hybrid versions available
Outputs available:	Sinewave, CMOS, TTL, ECL





Custom Clock Oscillators

Hughes Custom Clock Oscillators are manufactured in both hybrid and discrete form. Packaging options include: TO-8, DIP, Flatpack, Leadless Chip carrier as well as larger formats for special mounting requirements. Hughes oscillators meet the general requirements of MIL-0-55310 and MIL-STD-883 Class B. Class S screening is available.

Typical Specifications

Frequency Range:	0.1 Hz to 160 MHz
Frequency Accuracy:	±0.01% to ±0.001% at +25°C
Frequency Stability:	±0.01% to ±0.005% over temperature
Temperature Range:	−55°C to +125°C
Outputs Available:	CMOS, TTL, ECL, Sinewave

HUGHES SOLID STATE PRODUCTS

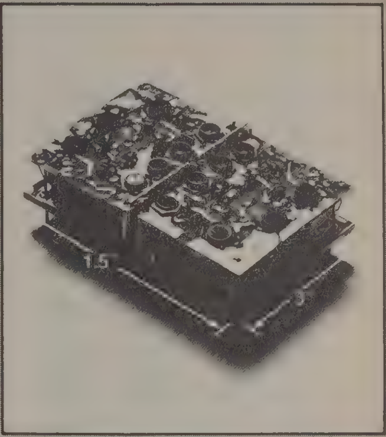
HUGHES AIRCRAFT COMPANY

Contact:
HUGHES SOLID STATE PRODUCTS
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2430 Telex: 910-596-1374

Hughes Custom Filters and Oscillators

Crystal Filters

Hughes has over 20 years of experience with all standard types of bandpass filters, including Butterworth, Chebychev, Elliptical, Gaussian and Bessel types, as well as band reject filters and crystal discriminators.



Characteristics

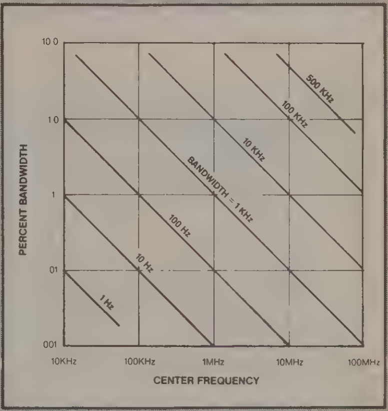
Hughes filters are designed using advanced computer-aided network synthesis and analysis techniques resulting in filters with sharp selectivity, controlled group delay or phase response, non-ringing pulse response and low insertion loss over broad temperature ranges. Hughes has also developed proprietary designs which permit tight control of phase and group delay characteristics or time domain response characteristics such as peak overshoot and ringing in response to pulsed RF signals. Hughes Frequency Control Devices meet the most stringent military standards, when required.

Applications

Hughes Frequency Control Devices are in use in satellites, radar systems, missiles, military and commercial communications and avionics systems.

Typical Specifications

Fractional Bandwidth:	See Graph at right
Shape Factor:	As low as 1.15 to 1 (60 dB/3 dB ratio)
Passband Ripple:	Down to 0.2 dB
Phase or Delay Compensation:	To within ± 1%



How to Determine the Feasibility of Your Filter

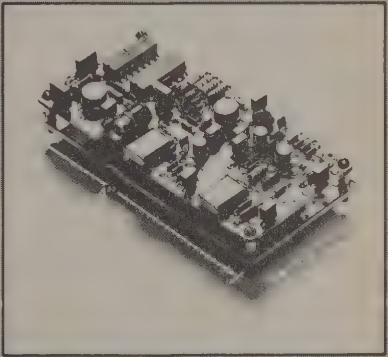
The graph at right shows the general operating region of Hughes filters as determined by center frequency, bandwidth and/or percent of bandwidth. If your filter falls within the white area, Hughes can readily design and produce such a filter. If your filter falls outside the white area but near the boundaries of this chart, you should discuss your requirements with the Hughes design engineering staff, since your filter may still be practical to produce.

Voltage Controlled Crystal Oscillator

Hughes VCXOs offer wide frequency deviations, up to ±0.3% of the nominal oscillator frequency. For extended temperature ranges TCVCXOs are temperature compensated to provide exceptionally low frequency drift characteristics.

Typical Specifications

Frequency Range:	100 Hz to 120 MHz
VCXO Temperature Range:	−40°C to +70°C
TCVCXO Temperature Range:	−55°C to +85°C
Deviation:	±0.3%
Linearity:	± 1%
Spurious:	80 dBc
Supply Voltage:	8 to 27 V_{DC} available
Outputs available:	Sine, TTL, ECL
Size:	As small as 2 x 2 x 0.5 inches Hybrid versions available



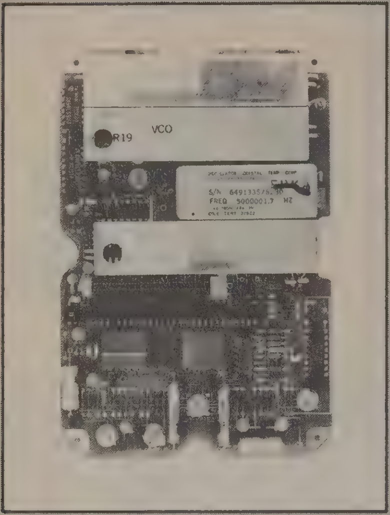
Crystal Processing

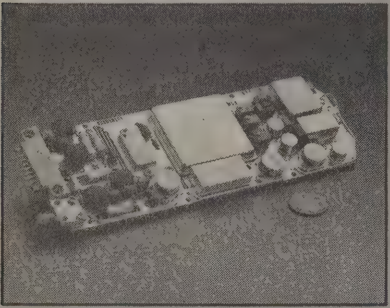
Hughes designs and processes our own crystals for use in our filters and oscillators. These crystals are either open construction (mounted to a substrate and hermetically sealed) or individually packaged. Computerized testing of crystal parameters over temperature range is utilized extensively for phase and gain matched filters.

HUGHES **SOLID STATE PRODUCTS**
HUGHES AIRCRAFT COMPANY

Contact:
HUGHES SOLID STATE PRODUCTS
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2430 Telex: 910-596-1374

Hughes Custom Frequency Synthesizers

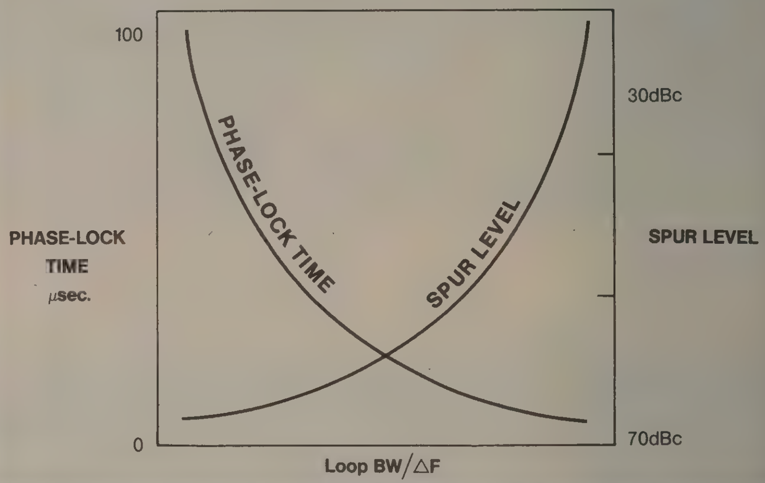




Frequency Synthesizers

Hughes offers a family of high performance Frequency Synthesizers for hi-reliability and military applications. Spanning a frequency range of 1 to 1800MHz and temperature range of −55°C to +85°C, Hughes Synthesizers feature single and multi-loop designs for extremely fast phase-lock and negligible post-tuning drift. Also available are special packaging and complete environmental testing.

FIGURE 1



Typical Specifications

Characteristics	Frequency	Phase Noise	Phase Lock Time	Spurs
Single Frequency Sources:	1 to 1800 MHz	*	50 samples x ref. point	760 dBc
Medium Speed Synthesizers:	1 to 1800 MHz	*	75 Channel spacing	> 60 dBc
Fast Frequency Synthesizers:	500 to 1500 MHz	90 dBc/Hz	< 2.9µsec	55 dBc
Direct Digital Synthesizers:	1.5 to 3.5 MHz	150 dBc/Hz	Instantaneous	> 60 dBc
Fractional N Synthesizers:	1 to 1800 MHz	> 50 dBc	See Figure 1	

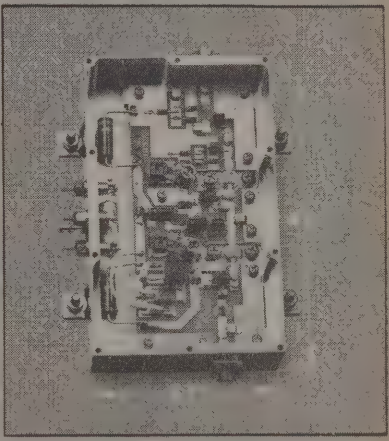
*−157 +20 log N dBc/Hz.

HUGHES **SOLID STATE PRODUCTS**
HUGHES AIRCRAFT COMPANY

Contact:
HUGHES SOLID STATE PRODUCTS
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2430 Telex: 910-596-1374

Hughes RF Modules

RF Amplifiers



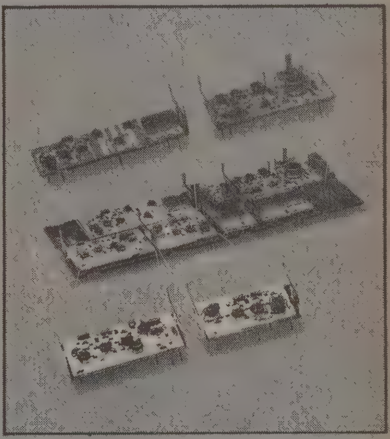
Hughes' RF Amplifiers are custom designed for applications in telecommunications, radar, telemetry and instrumentation systems. Using proprietary designs and modular construction techniques, Hughes' RF Amplifiers are available to meet a wide range of customer specified characteristics including up to 40 watts output power at 1GHz. Other options include pulse modulation or CW, AGC, custom packaging, output protection and full military screening.

Typical Specifications

Frequency Range:	100 MHz to 1 GHz
Temperature Range:	−55°C to +105°C*
P_{OUT}:	40 w maximum
P_{IN}:	+10 dBm
V_{IN}:	26V_{DC} @ 2.2A maximum
Harmonic Rejection:	≤ 30 dBc
Out of Band Spurious:	≤ 80 dBc
Input VSWR:	9.5 return loss 2.0:1 maximum

*Alternate temperature ranges also available.

RF Integrated Subassemblies



Hughes features complete design and manufacturing capabilities for a wide range of RF assemblies and integrated subsystems. Engineered for high reliability, Hughes RF products have been field-proven in many military and space applications.

A typical example is this 420-450 MHz Frequency Hopping Phase Locked, Time Ordered Receiver/Exciter. Using thick film circuitry and surface mount technology, this modular assembly contains an up/down converter, VCO, modulator, three stages each of RF and IF amplification, and an AGC.

Whether your requirements are for a complete subsystem or a single stage amplifier, let Hughes be your source.

Typical Specifications

Frequency Range:	1 MHz to 500 MHz
Temperature Range:	−55°C to +85°C
Power Requirements:	5 V to 25 V
Spurious Response:	≤ −30 dBc (1 MHz −1.2 GHz)
Flatness:	± ≤ 2.0 dB
Gain:	Up to 120 dB
Noise Figure:	≤ 5 dB
Dynamic Range:	−30 to +20 dBm

HUGHES **SOLID STATE PRODUCTS**
HUGHES AIRCRAFT COMPANY

Contact:
HUGHES SOLID STATE PRODUCTS
FREQUENCY CONTROL DEVICES
500 Superior Avenue
Newport Beach, California 92658-1420
Telephone (714) 759-2430 Telex: 910-596-1374

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

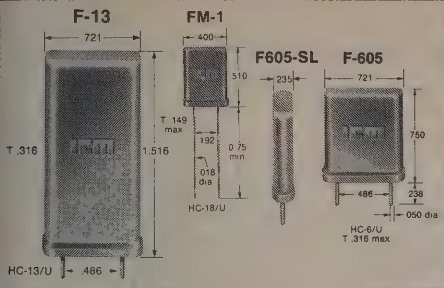
VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

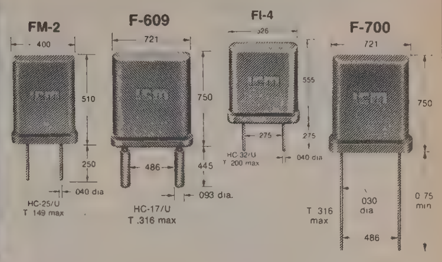
WPS word processing software

Y

YIG yttrium iron garnet



International CUSTOM CRYSTALS



LOW FREQUENCY CRYSTALS 70 KHz - 999.9 KHz

Frequency Range/Mode of Vibration
70-200 KHz Length Shear Fund.
200-599 KHz Edge Shear Fund.
600-999 KHz Shear Fund. AT Cut

Shunt Capacitance (Co) 7 pf Max.

Resistance (Measured at Series Resonance)

70-200 KHz	10,000 to 7,000 Ohms Max.
200-500 KHz	7,000 to 1,100 Ohms Max.
500-999 KHz	1,100 to 550 Ohms Max.

Drive Level

70-499 KHz	2 Milliwatts Max.
500-999 KHz	10 Milliwatts Max.

Holders
F-605, F-609, F-700 specify lead length. F-13 fq. below 150 KHz in F-13 holder only. Note: Solder Seal or Cold Weld Sealing Method. Crystals can be supplied for oven or nonoven use.

FREQUENCY	General Purpose	Commercial Standard
	Calibration Tolerance	Calibration Tolerance
70-99.9 KHz	within ± .02%	*within ± .01%
100-499.9 KHz	within ± .02%	within ± .01%
500-599.9 KHz	within ± .02%	within ± .01%
600-849.9 KHz	within ± .02%	**within ± .0025%
850-999.9 KHz	within ± .02%	within ± .0025%

*Below 600 KHz within ± .01% ** Above 600 KHz within ± .0025%

MEDIUM FREQUENCY CRYSTALS 1 MHz - 30 MHz

Frequency Range/Mode of Vibration
1-30.0 MHz Shear Fundamental AT Cut

Resistance (Measured at Series Resonance)

1.0-1.49 MHz	490 Ohms Max.
1.5-1.99 MHz	375 Ohms Max.
2.0-2.99 MHz	270 Ohms Max.
3.0-3.99 MHz	150 Ohms Max.
4.0-5.09 MHz	75 to 33 Ohms Max.
5.1-30.0 MHz	22 to 16 Ohms Max.

Drive Level

1.0- 9.99 MHz	10 Milliwatts Max.
10.0-22.00 MHz	5 Milliwatts Max.
22.0-30.00 MHz	1 Milliwatt Max.

Shunt Capacitance (Co) 9 pf Max.

Holders
F-605, F-605-SL available 2.0 MHz and above only. F-609, F-700 specify lead length. FI-4 available 4.0 MHz and above only. FM-1, FM-2 supplied standard above 6.0 MHz. 4.0 to 6.0 MHz can be supplied at additional cost. HA available 2.0 MHz and above only. Ground leads can be supplied at additional cost. Note: Solder Seal or Cold Weld Sealing Method. Crystals can be supplied for oven or nonoven use.

FREQUENCY	General Purpose	Commercial Standard		High Accuracy	
	Calibration Tolerance	Calibration Tolerance		Calibration Tolerance	
		CS	CS-1	HA	HA-5*
1.0-1.49 MHz Fund.	within ±.01%	within ±.0025%	within ±.001%	NA	NA
1.5-2.99 MHz Fund.	within ±.01%	within ±.0025%	within ±.001%	within ±.001%	NA
3.0-10.99 MHz Fund.	within ±.01%	within ±.0025%	within ±.001%	within ±.001%	within ±.001%
11.0-19.9 MHz Fund.	within ±.01%	within ±.0025%	within ±.001%	within ±.001%	within ±.001%
20.0-24.9 MHz Fund.	within ±.01%	within ±.0025%	within ±.001%	within ±.001%	within ±.001%
25.0-30.0 MHz Fund.	within ±.01%	within ±.0025%	within ±.001%	within ±.001%	within ±.001%

* HA-5 will maintain within .0005% of 25°C measured frequency, from −10°C to +60°C

HIGH FREQUENCY CRYSTALS 15 MHz - 200 MHz

Frequency Range/Mode of Vibration
15-75 MHz Shear 3rd Mechanical Overtone AT
50-119 MHz Shear 5th Mechanical Overtone AT
111-139 MHz Shear 7th Mechanical Overtone AT
140-200 MHz Shear 9th Mechanical Overtone AT

Shunt Capacitance (Co) 9 pf Max.

Resistance (Measured at Series Resonance)

15- 75.0 MHz	3rd O/T	40 Ohms Max.
50-119.9 MHz	5th O/T	60 Ohms Max.
111-139.9 MHz	7th O/T	80 Ohms Max.
140-200.0 MHz	9th O/T	100 Ohms Max.

Drive Level

15-65 MHz	2 Milliwatt Max.
65-200 MHz	1 Milliwatt Max.

Holders
F-605, F-605,SL, F-609, F-700 (specify lead length), FI-4, FM-1 (specify lead length), FM-2. Note: Solder Seal or Cold Weld Sealing Method. Crystals can be supplied for oven or nonoven use.

FREQUENCY MHz		General Purpose	Commercial Standard		High Accuracy *
		Calibration Tolerance	Calibration Tolerance		Calibration Tolerance
			CS	CS-1	
15-64.9	(3rd)	within ± .01%	within ±.0025%	within ±.001%	within ±.001%
65-75	(3rd)	within ± .01%	within ±.0025%	within ±.001%	within ±.001%
50-79.9	(3rd)	within ± .01%	within ±.0025%	within ±.001%	within ±.001%
80-119.9	(5th)	within ± .01%	within ±.0025%	within ±.001%	within ±.001%
111-139.9	(7th)	within ± .01%	within ±.0025%	within ±.001%	NA
140-159.9	(9th)	within ± .01%	within ±.0025%	within ±.001%	NA
160-200	(9th)	within ± .01%	within ±.0025%	within ±.001%	NA

* HA-5 will maintain within .0005% of 25°C measured frequency, from −10°C to +60°C

WHEN ORDERING — Specify the Following for Each Crystal

A. Crystal frequency
B. Type — GP, CS, or HA
C. Calibration tolerance — .0025% or .001% as specified for (CS) and (CS-1). Not required for GP as this type is supplied only in .01%
D. Calibration temperature — Calibration temperature to be specified by customer.
E. Holder (see above)
F. Circuit load and correlation data — Customer to give oscillator load and correlation data. Do not specify equipment types for GP crystals.

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee, P.O. Box 26330, Oklahoma City, OK 73126

GENERAL
Contact ICM Sales Department for copy of custom crystal catalog and pricing information. All International crystals are made to order and are not stock items. If crystals are needed for commercially manufactured equipment, land mobile, amateur, marine, etc., ICM may have specific catalog numbers already assigned. All International crystals are guaranteed against defective materials and workmanship for an unlimited time when used in correct equipment or oscillator load.

Mail: International Crystal Mfg. Co., Inc., 10 N. Lee, P.O. Box 26330, Oklahoma City, Ok. 73126, Phone (405) 236-3741, TELEX 747-147, Cable Incrystal, Bell System TWX: 910-831-3177

ISOTEMP RESEARCH, INC.

Telephone (804) 295-3101
P. O. Box 3389 Charlottesville, Virginia 22901

Isotemp specializes in custom design crystal oscillators for all applications. High stability, low power ovenized oscillators are our specialty. Wide temperature range, tight tolerance TCXOs are standard fare. Sinusoid and square wave (TTL and/or C/MOS) are available in most models. Call us for help in determining your oscillator needs.

– PRODUCT DIRECTORY –

TCXO'S	Frequency Range	Major Feature	Stability Class	Supply Voltage	Output	Typical Current	Figure No.
TCXO30 Series	2 to 12 MHz	Low Cost	1 ppm	+5 VDC	TTL	15 ma	1
TCXO39 Series	.125 to 20 MHz	Precision Parts, High Performance	5 x 10^{-7} to 2 ppm	+12 VDC	TTL	20 ma	2
TCXO40 Series	2 to 10 MHz	Precision Parts, High Performance	1 ppm to 5 ppm	+15 VDC	Sine	20 ma	2
TCXO41 Series	10 to 30 MHz	3rd Overtone TCXO	1 ppm to 5 ppm	+15 VDC	Sine	20 ma	2
NCXO'S							
NCXO37 Series	2 to 60 MHz	Low Cost, High Performance	5 ppm to 30 ppm	+5 VDC	TTL	10 to 30 ma	Sim. to 1
NCXO46 Series	5 to 20 MHz	Lowest Cost	.01% to .05%	+5 VDC	TTL	15 to 30 ma	3
OCXO'S							
OCXO31 Series	10 MHz	Low Power	1 x 10^{-7} to 5 x 10^{-7}	+5 VDC	TTL	<1 watt	4
OCXO33 Series	10 MHz	Low Power	1 x 10^{-7} to 5 x 10^{-7}	+5 VDC	TTL	<1 watt	Sim. to 2
OCXO36 Series	8 to 15 MHz	High Stability	1 x 10^{-7} to 5 x 10^{-7}/year	+20 & +5 VDC	TTL	2 watts	5

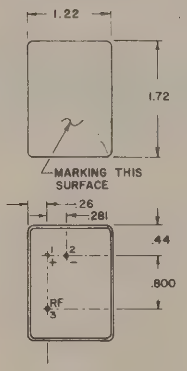

1.22
1.72
MARKING THIS SURFACE
.26
.281
.44
.800
1
2
+
−
RF
3

Figure 1

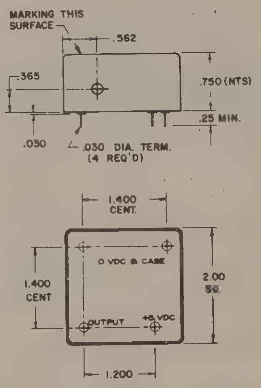

MARKING THIS SURFACE
.562
.365
.750 (NTS)
.25 MIN.
.030
.030 DIA. TERM. (4 REQ'D)
1.400 CENT.
0 VDC @ CASE
1.400 CENT
2.00 SQ
OUTPUT
+5 VDC
1.200

Figure 2

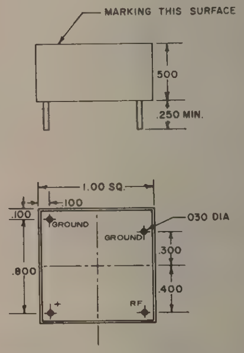

MARKING THIS SURFACE
500
.250 MIN.
1.00 SQ.
.100
.100
030 DIA
GROUND
GROUND
.300
.800
.400
+
RF

Figure 3

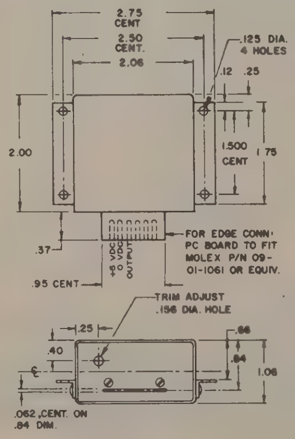

2.75 CENT
2.50 CENT.
2.06
.125 DIA. 4 HOLES
.12
.25
2.00
1.500 CENT
1.75
.37
+5 VDC
0 VDC
OUTPUT
FOR EDGE CONN PC BOARD TO FIT MOLEX P/N 09-01-1061 OR EQUIV.
.95 CENT
TRIM ADJUST .156 DIA. HOLE
.25
.40
.66
.84
1.06
.062 CENT. ON .84 DIM.

Figure 4

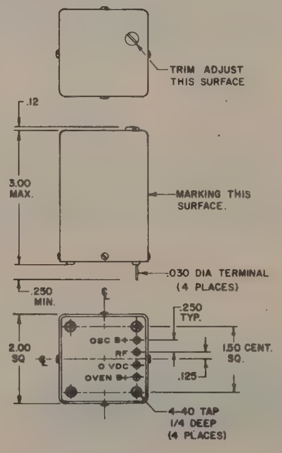

TRIM ADJUST THIS SURFACE
.12
3.00 MAX.
MARKING THIS SURFACE.
.030 DIA TERMINAL (4 PLACES)
.250 MIN.
.250 TYP.
2.00 SQ
OSC B+
RF
0 VDC
OVEN B+
1.50 CENT. SQ.
.125
4-40 TAP 1/4 DEEP (4 PLACES)

Figure 5

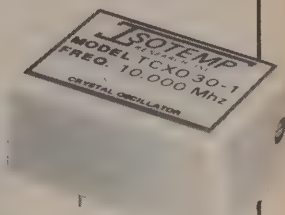
Note: Measurements are in inches.

inches	mm	inches	mm
.025	.635	.660	16.764
.030	.762	.750	19.050
.040	1.016	.800	20.320
.062	1.587	.840	21.336
.100	2.540	.950	24.130
.120	3.048	1.000	25.400
.125	3.175	1.060	26.924
.156	3.962	1.200	30.480
.250	6.350	1.220	30.988
.260	6.604	1.400	35.560
.281	7.143	1.720	43.688
.300	7.620	1.750	44.450
.315	8.001	2.000	50.800
.370	9.398	2.060	52.324
.400	10.160	2.500	63.500
.440	11.176	2.750	69.850
.500	12.700	3.000	76.200

Oscillators

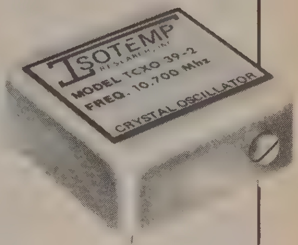
TCXO30 SERIES

Frequency (MHz)		10	10	2 to 12	2 to 12
Temperature range		0° to 50°C	0° to 55°C	0° to +50°C	0° to 55°C
Voltage stability (±5% change)		$\pm 2 \times 10^{-7}$	$\pm 2 \times 10^{-7}$	$\pm 2.5 \times 10^{-7}$	$\pm 2.5 \times 10^{-7}$
		MODEL NUMBERS			
Ambient stability	±1 ppm	TCXO30T-1	TCXO30T-3	TCXO30T-5	TCXO30T-7
Reference to +25°C	±2 ppm	TCXO30T-2	TCXO30T-4	TCXO30T-6	TCXO30T-8


ISOTEMP
MODEL TCXO 30-1
FREQ. 10.000 Mhz
CRYSTAL OSCILLATOR

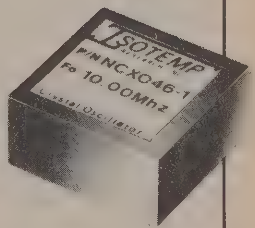
TCXO39 SERIES

Frequency range (MHz)		.125 to 2	2 to 12	12 to 20	2 to 6
Aging (after 60 days operation)		±1 ppm/year	±1 ppm/year	±1 ppm/year	$\pm 5 \times 10^{-7}$/year
Short term stability (10 sec rms)		2×10^{-9}	2×10^{-9}	3×10^{-9}	1×10^{-9}
Voltage stability (per 5% change)		3×10^{-7} typical	2×10^{-7} typical	3×10^{-7} typical	1.5×10^{-7} typical
Trim range		±4 ppm min.	±4 ppm min.	±6 ppm min.	±3.5 ppm min.
Typical current drain		30 ma	20 ma	20 ma	20 ma
		MODEL NUMBERS			
Ambient stability	$\pm 5 \times 10^{-7}$	TCXO39-1	TCXO39-2	N.A.	TCXO39-3
0°C to +55°C	±1 ppm	TCXO39-4	TCXO39-5	N.A.	TCXO39-6
Reference to +25°C	±2 ppm	TCXO39-7	TCXO39-8	TCXO39-9	TCXO39-10


ISOTEMP
RESEARCH INC
MODEL TCXO 39-2
FREQ. 10.700 Mhz
CRYSTAL OSCILLATOR

NCXO46 SERIES

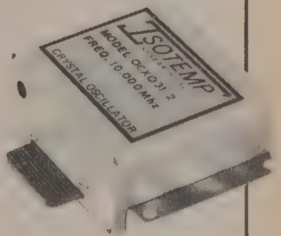
Frequency range (MHz)		10 MHz	5 to 8	8 to 12	12 to 17	17 to 25
Current drain (typical)		17 ma	15 ma	17 ma	20 ma	30 ma
		Model Numbers				
Stability	±0.01%	NCXO46-1	NCXO46-2	NCXO46-3	NCXO46-4	NCXO46-5
All effects	±0.05%	NCXO46-6	NCXO46-7	NCXO46-8	NCXO46-9	NCXO46-10


ISOTEMP
P/N NCXO46-1
Fo 10.00Mhz
Crystal Oscillator

OCXO31 SERIES

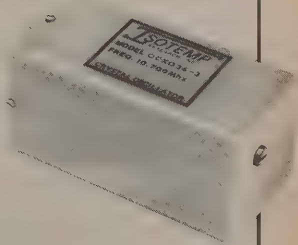
Model number	OCXO31-1	OCXO31-2	OCXO31-3	OCXO31-4
Temperature stability (0°C to 65°C) *	$\pm 5 \times 10^{-8}$	$\pm 1 \times 10^{-7}$	$\pm 2 \times 10^{-7}$	$\pm 3 \times 10^{-7}$
Aging (per year after 60 days)	$\pm 5 \times 10^{-7}$	± 1 ppm	±1.5 ppm	±2 ppm
Short term stability (per 10 second count)	2×10^{10} rms	5×10^{-10} rms	1×10^{-9} rms	2×10^{-9} rms
Voltage stability (+5 VDC ±10 %)	$\pm 3 \times 10^{-8}$	$\pm 5 \times 10^{-8}$	$\pm 1 \times 10^{-7}$	$\pm 1.5 \times 10^{-7}$
Trim range (at time of shipping)	±3 ppm	±4 ppm	±5 ppm	±6 ppm

*Reference to +25°C


ISOTEMP
MODEL OCXO31-2
FREQ. 10.000Mhz
CRYSTAL OSCILLATOR

OCXO36 SERIES

Model number	OCXO36-1	OCXO36-2	OCXO36-3	OCXO36-4
Frequency (MHz)	10	10	8 to 15	8 to 15
Aging (per week at time of shipping)	$\pm 3 \times 10^{-9}$	$\pm 5 \times 10^{-9}$	$\pm 1 \times 10^{-8}$	$\pm 1.5 \times 10^{-8}$
Aging (per year after 21 days)	$\pm 1 \times 10^{-7}$	$\pm 2 \times 10^{-7}$	$\pm 3 \times 10^{-7}$	$\pm 5 \times 10^{-7}$
Retrace (4 hours on after 24 hours off)	2×10^{-9} typ.	5×10^{-9} typ.	1×10^{-8} typ.	1.5×10^{-8} typ.
Ambient stability (0°C to +65°C)	1×10^{-10}/°C	2×10^{-10}/°C	5×10^{-10}/°C	1×10^{-9}/°C
Voltage stability (per 5% change)	7×10^{-10}	2×10^{-9}	2×10^{-9}	4×10^{-9}
Phase noise (100 Hz offset 1 Hz BW)	-143 db min.	-140 db min.	-130 db min.	-125 db min.
Short term (10 second counts)	2×10^{-11} rms	3×10^{-11} rms	1×10^{-10} rms	5×10^{-10} rms
Trim range (minimum)	$\pm 6 \times 10^{-7}$	±1.5 ppm	±2.5 ppm	±3 ppm


ISOTEMP
MODEL OCXO36-2
FREQ. 10.700Mhz
CRYSTAL OSCILLATOR

To order: Specify model number and frequency or contact factory for options.
Phone (804) 295-3101 P. O. Box 3389 Charlottesville, Virginia 22901

ISOTEMP
RESEARCH, INC.

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

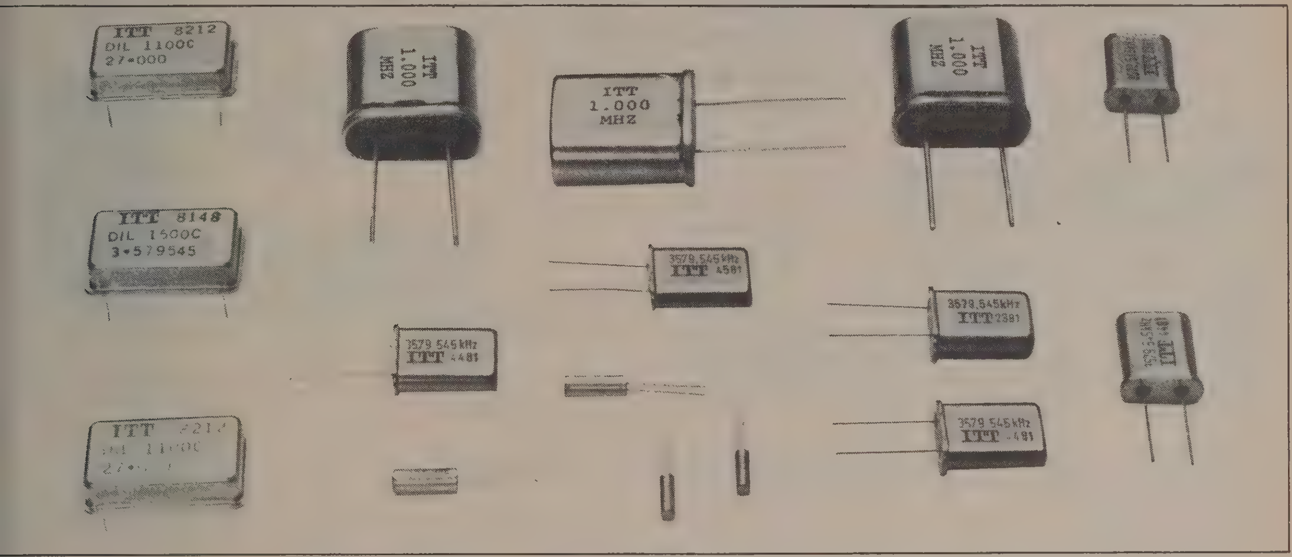
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms	**1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code	**3**•1103
Batteries, Product Selection Guide	**3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide	**2**•1003
Capacitors, Basic Formulas	**1A**•1093
Capacitors, Miniglossary	**1A**•1069
Capacitors, Product Selection Guide	**1A**•1003
Circuit Boards (Printed), Product Selection Guide	**2**•1089
Coils, Chokes, & Inductors, Product Selection Guide	**1A**•1219
Connectors, Miniglossary	**2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide	**2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**1A**•1309
Delay Lines, Product Selection Guide	**1A**•1445
Discrete Semiconductors, Product Selection Guide	**1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide	**1B**•1021
EBCDIC Code	**3**•1153
Encapsulation, Miniglossary	**2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**2**•1801
Filters, Product Selection Guide	**1A**•1577
Instruments, Graphic Recording, Product Selection Guide	**3**•1381
Instruments, Panel Meters, Product Selection Guide	**3**•1321
Instruments, Test & Measuring, Product Selection Guide	**3**•1182
Interconnection Systems, Product Selection Guide	**2**•1873
Keyboards & Keypads, Product Selection Guide	**1B**•1759
Microwave Components, Product Selection Guide	**1A**•1685
Military Qualified Products Lists	**1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide	**1B**•1121
Opto Semiconductors, Miniglossary	**1B**•1218
Oscilloscopes, Product Selection Guide	**3**•1361
Panel Hardware, Product Selection Guide	**2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**1A**•2017
Power Supplies, Miniglossary	**3**•1455
Power Supplies, AC, Product Selection Guide	**3**•1815
Power Supplies, DC, Product Selection Guide	**3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**1B**•1255
Relay Contact Forms	**1B**•1317
Relays, Electromechanical, Miniglossary	**1•B**1292
Relays, Product Selection Guide	**1B**•1289
Resistor Color Codes	**1A**•1791
Resistors, Product Selection Guide	**1A**•1789
Servo Components, Miniglossary	**3**•1935
Solenoids, Product Selection Guide	**1B**•1481
Switches, Product Selection Guide	**1B**•1499
Thyristors/High Power Diodes, Miniglossary	**1A**•1652
Transducers & Encoders, Product Selection Guide	**1B**•1827
Transformers, Product Selection Guide	**1A**•2115
Wire & Cable, Product Selection Guide	**2**•1935

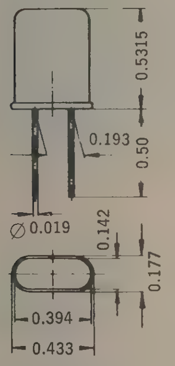
ITT Components
Unit of ITT Corporation

Crystals and Oscillators

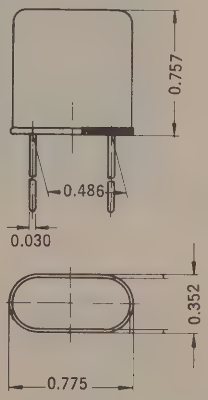

ITT 8212
DIL 1100C
27.000
ITT 1.000 MHZ
ITT 8148
DIL 1500C
3.579545
3579.545kHz ITT 4481
3579.545kHz ITT 2381
ITT 8212
DIL 1100C

Quartz Crystal Units

- Microprocessor clock type crystals covering a frequency spectrum from 1MHz to 200MHz.
- HC18 and HC33 type holders, resistance welded or solder cold weld or solder sealed.
- Frequency tolerance from .002% to .35%.


0.5315
0.193
0.50
∅0.019
0.142
0.177
0.394
0.433

HC-18/U

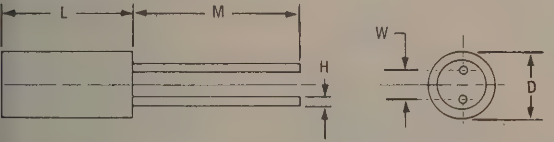

0.757
0.486
0.030
0.352
0.775

HC-33/U

T TF3 AND TF6

uning Fork Crystals

sed for microprocessors and micro computer al-time clock applications.



Type	L	M	H	W	D
TF3	.327 Max. (8.30 Max.)	.354 (9.00)	.012 ±.002 (0.30 ±0.05)	.043 ±.002 (1.10 ±0.05)	.118 ± .008 (3.00 ±0.08)
TF6	.260 ±.002 (6.70 ±0.05)	.295 (7.50)	.010 ±.001 (0.25 ±0.03)	.023 ±.004 (0.70 ±0.10)	.081 ±.002 (2.05 ±0.05)

mensions are in inches (millimeters)

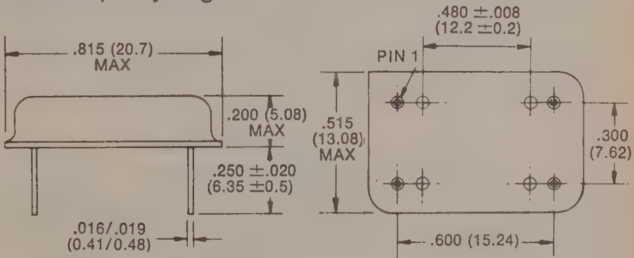
Quartz Crystal Oscillators

The ITT DIL oscillator series are miniature, low-profile, dual-in-line quartz crystal oscillators in a hermetic package. They are designed primarily, to meet the needs of the fast growing minicomputer and microprocessor markets, but are suitable for many other applications where a reliable, accurate clock input is required.

Frequency tolerances ranging from 1000ppm to 25ppm are available.

FEATURES

TTL compatible
Dual-in-Line pin spacing
Low profile — 5.8mm maximum seated height including insulating stand-offs
Hermetic welded metal package
Wide frequency range


.815 (20.7) MAX
.200 (5.08) MAX
.250 ±.020 (6.35 ±0.5)
.016/.019 (0.41/0.48)
.480 ±.008 (12.2 ±0.2)
PIN 1
.515 (13.08) MAX
.300 (7.62)
.600 (15.24)

Pin Connections
1 NC
7 Ground
8 Output
14 +5V

FREQUENCY RANGE: 250KHz — 90MHz

Family	Frequency Tolerance	
ITT 1000C	1000ppm	0.1%
ITT 1500C	500ppm	0.05%
ITT 1100C	100ppm	0.01%
ITT 1050C	50ppm	0.005%
ITT 1025C	25ppm	0.0025%

ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone: (714) 751-3900 • TWX: 910-595-1744 • Telex: 69-1389

LEACH® CORP.

CONTROL PRODUCTS DIVISION
6900 Orangethorpe Avenue, Buena Park, California 90620
Telephone: (714) 739-0770 TWX 910-596-2867

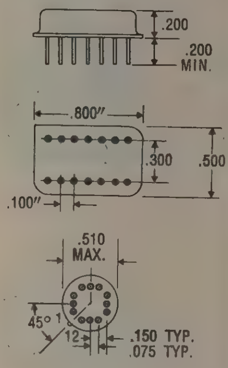
LEACH HYBRID FREQUENCY PRODUCTS

MILITARY • AEROSPACE • CUSTOM

ALL PRODUCTS MANUFACTURED IN THE U.S.A.

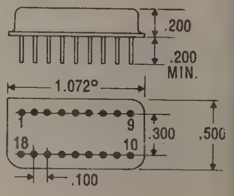
HYBRID OSCILLATORS
MIL-O-55310 PROCESSING

Output Waveform:	C-MOS, TTL/LSTTL, ECL, Sine Wave
Frequency Range:	.1 Hz-300 MHz
Packaging:	14 Pin D.I.P., Flat Packs, Leadless Carriers, TO5 and TO8
Typical Tolerance:	±10 ppm at R.T., ±50 ppm of R.T. from −55°C to +125°C
Typical Symmetry:	50/50% 1-30 MHz, 60/40% 31-300 MHz
Typical Processing:	883B, 38510, Burn In, Lot Traceable
Typical Testing:	Programmable Auto-Test Over Full Temperature Range With Data. All Units Serialized.
Environmental:	Gross/Fine Leak Detection, Centrifuge, Shock, Vibration, Acceleration and Radiation Exposure Available.

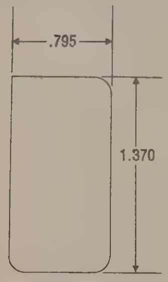


CRYSTAL CONTROLLED DUAL BAUD RATE GENERATOR
C5035 SERIES

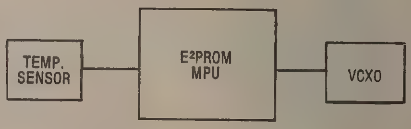
This Device Can Transmit and Receive Simultaneously on 2 Standard Baud Rates Which Are Manually or Soft Ware Selectable From 50 to 19,200 Baud. Fully Processed to MIL-O-55310, 38510 and 883B With Burn In Available. Packaged in 18 Pin D.I.P. or Flat Pack.



DCXO
DIGITALLY COMPENSATED XTAL OSCILLATOR

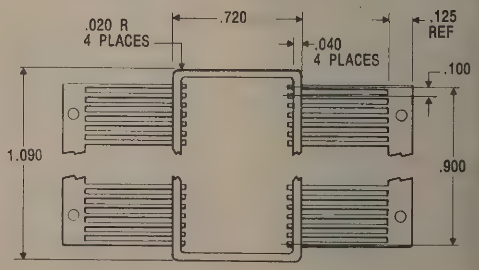


- 1 Hz to 60 MHz
- ±.3 ppm 0 to +70°C
- ±.5 ppm −40°C to +85°C
- ±1 ppm −55° to +125°C
- ±1 ppm/Year Aging
- 5 Volts ±10%
- C-MOS, TTL, LSTTL
- Flat Packs, Leadless Carriers and D.I.P. Packages



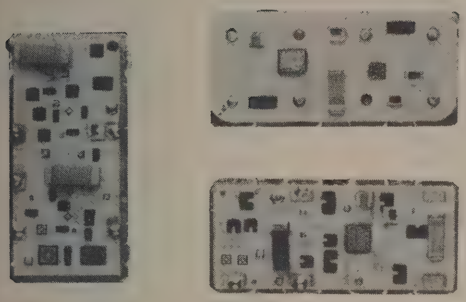
PRECISION TIMERS
CRYSTAL CONTROLLED GATE ARRAY TIMERS

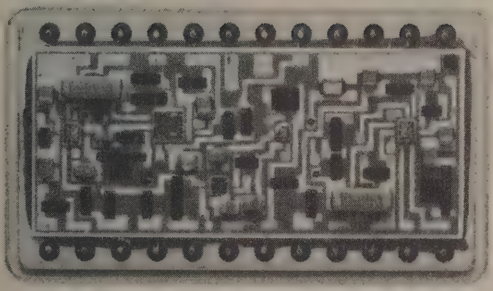
- Custom Gate Array Technology
- Full MIL Temperature Range
- ±.01% to ±1% Accuracy
- Crystal Controlled
- Programmable Outputs
- Hermetically Sealed
- Flat Packs, Leadless Carriers and D.I.P. Packages



LEACH® CORP.

CONTROL PRODUCTS DIVISION
6900 ORANGETHORPE AVENUE
BUENA PARK, CALIFORNIA 90620
TELEPHONE: (714) 739-0770
TWX 910-596-2867





ENVIRONMENTAL TESTING / QUALITY CONTROL

Within a building separate from the manufacturing area, the environmental test lab continuously maintains Leach QPL listings and conducts qualification testing to customer requirements.

Testing in accordance with MIL-STD-202 includes:

- Sine vibration with concurrent temperature testing
- Shock
- Altitude/temperature altitude
- Thermal shock and temperature cycling
- Load and life testing

HISTORY OF HIGH QUALITY ELECTRONICS

The need for high quality thick film hybrid microcircuits for aerospace and military applications lead to Leach Corporation's entry into the field in the early 1970's. The initial 400 square foot engineering lab has evolved into a 22,000 square foot facility housing both engineering and total manufacturing capabilities.

Products include both analog and digital circuitry for interface and switching applications, and consist of both proprietary Leach products and customer designed custom hybrids.

MANAGEMENT PHILOSOPHY

Primarily designed for high reliability applications, products are manufactured to MIL-STD-883 requirements. Military environmental specifications and criteria are standard Leach practice, and products are qualified to MIL-R-83726, MIL-M-38510, and NASA standards.

HYBRID MANUFACTURING FACILITIES

Total facilities for all aspects of thick film hybrid manufacturing as well as hybrid/electromechanical interfacing are contained within the manufacturing area.

- Screen and firing
- Trimming
- Wire bonding
- Eutectic and epoxy die bonding
- Reflow soldering
- Photo processing
- Computerized testing of hardware
- Laminar flow benches
- Inert storage atmosphere

McCOY
ELECTRONICS COMPANY 100 WATTS STREET, PO BOX B,
a subsidiary of **OAK Industries Inc.** MT HOLLY SPRINGS, PA. 17065 717-486-3411 TWX: 510-650-3548

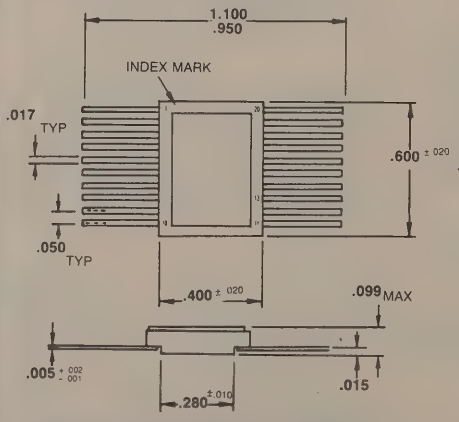
QUALIFIED PRODUCTS LIST MIL-C-3098

TYPE NO.	FREQ. RANGE
CR-5A/U	2 MHz - 10 MHz
CR-6A/U	2 MHz - 10 MHz
CR-8A/U	1.8 MHz - 10 MHz
CR-18A/U	1 MHz - 20 MHz
CR-19A/U	1.8 MHz - 20 MHz
CR-25B/U	200 KHz - 555 KHz
CR-26A/U	200 KHz - 500 KHz
CR-27A/U	3 MHz - 20 MHz
CR-28A/U	3 MHz - 20 MHz
CR-35A/U	3 MHz - 20 MHz
CR-36A/U	3 MHz - 20 MHz
CR-38A/U	16 KHz - 100 KHz
CR-46B/U	200 KHz - 550 KHz
CR-47A/U	190 KHz - 500 KHz
CR-50A/U	16 KHz - 100 KHz
CR-52A/U	10 MHz - 61 MHz
CR-55A/U	17 MHz - 62 MHz
CR-56A/U	75 MHz - 125 MHz
CR-58A/U	3 MHz - 20 MHz
CR-60A/U	5 MHz - 20 MHz
CR-62/U	3 MHz - 20 MHz
CR-63B/U	200 KHz - 555 KHz
CR-64/U	2.9 MHz - 20 MHz
CR-65/U	10 MHz - 61 MHz
CR-67A/U	17 MHz - 62 MHz
CR-69A/U	2.9 MHz - 20 MHz
CR-72/U	17 MHz - 61 MHz
CR-73/U	17 MHz - 61 MHz
CR-74/U	50 MHz - 125 MHz
CR-76A/U	17 MHz - 61 MHz
CR-77/U	17 MHz - 62 MHz
CR-78A/U	2.9 MHz - 20 MHz
CR-79/U	2.9 MHz - 20 MHz
CR-80/U	75 MHz - 125 MHz
CR-81/U	17 MHz - 62 MHz
CR-82/U	75 MHz - 125 MHz
CR-83/U	75 MHz - 125 MHz
CR-85/U	3 MHz - 20 MHz

TYPE NO.	FREQ. RANGE
CR-89/U	2.12 MHz - 6.2 MHz
CR-97/U	8 MHz - 10 MHz
CR-98/U	50 MHz - 134 MHz
CR-102/U	50 MHz - 125 MHz
CR-103/U	17 MHz - 61 MHz
CR-104/U	200 KHz - 580 KHz
CR-105/U	48 MHz - 125 MHz
CR-106/U	10.5 MHz - 11.5 MHz
CR-107/U	50 MHz - 125 MHz
CR-108/U	50 MHz - 93 MHz
CR-110A/U	62.5 MHz - 75 MHz
CR-111/U	17 MHz - 62 MHz
CR-112/U	5 MHz - 20 MHz
CR-113/U	14.5 MHz - 61 MHz
CR-116/U	50 MHz - 125 MHz
CR-117/U	30 MHz - 62 MHz
CR-118/U	7 MHz - 25 MHz
CR-119/U	3 MHz - 20 MHz
CR-122/U	50 MHz - 125 MHz
CR-123/U	50 MHz - 125 MHz
CR-125/U	3 MHz - 3.05 MHz
CR-127/U	10 MHz - 61 MHz
CR-128/U	17 MHz - 61 MHz
CR-129/U	9 MHz - 12 MHz
CR-130/U	3 MHz - 20 MHz
CR-131/U	3 MHz - 20 MHz
CR-134/U	18 MHz - 21 MHz
CR-136/U	8 MHz - 10 MHz
CR-137/U	8.5 MHz - 19 MHz
CR-139/U	20 MHz - 22 MHz
CR-140/U	9.5 MHz - 12.5 MHz
CR-141/U	75 MHz - 90 MHz
CR-142/U	833.333 KHz
CR-147/U	200 KHz - 500 KHz
CR-149/U	46 MHz - 100 MHz
CR-150/U	56 MHz - 100 MHz
CR-151/U	50 MHz - 100 MHz
CR-157/U	1.8 MHz - 20 MHz

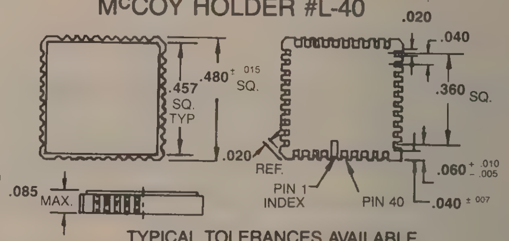
SURFACE MOUNTED CRYSTAL UNITS

LEADED PACKAGE
McCOY HOLDER #L-20



AVAILABLE FROM 10 MHz to 300 MHz
CRYSTAL CONNECTION = PINS 11 & 13
ALL OTHER PINS, NO CONNECTION

LEADLESS PACKAGE
McCOY HOLDER #L-40



TYPICAL TOLERANCES AVAILABLE
Calibration Accuracy @ RT
Choices: ±.001%
±.002% (Standard)
±.005 %

Frequency Tolerances vs Temperature
Choices ±.002% 0° to 70°C
±.005% 0° to 70°C
±.002% −40° to +90°C
±.005% −55° to +105°C (Standard)
±.01% −55° to +105°C

AVAILABLE FROM 10 MHz to 300 MHz
CRYSTAL CONNECTION - PINS 4/10 & 31/37
ALL ELSE, NO CONNECTION

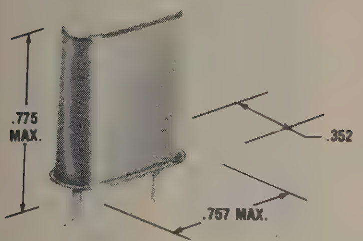
COLDWELD CRYSTALS

HOLDER SERIES
W-1 (HC-36/U)
W-4 (HC-47/U)

Frequency Range:
1 MHz to 250 MHz

W-1 Pins
Dia. = .050
Length = .238

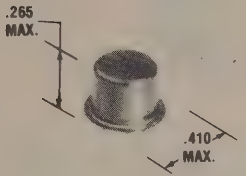
W-4 Wire Leads
Dia. = .030
Length = 1.5


.775
MAX.
.352
.757 MAX.

HOLDER SERIES
W-6 (HC-35/U)

Frequency Range:
10 MHz to 250 MHz

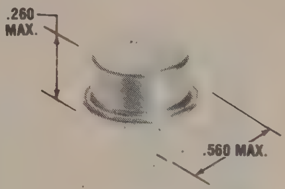
Wire Lead Dia. = .018


.265
MAX.
.410
MAX.

HOLDER SERIES
W-7 (HC-37/U)

Frequency Range:
3 MHz to 250 MHz

Wire Lead Dia. = .018
Note: Pin version also available

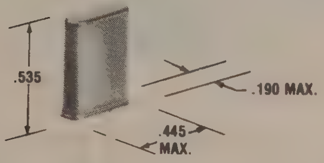

.260
MAX.
.560 MAX.

HOLDER SERIES
W-20 (HC-43/U)
W-21 (HC-42/U)

Frequency Range:
2.9 MHz to 250 MHz

W-20 Wire Leads
Dia. = .017
Length = 1.5

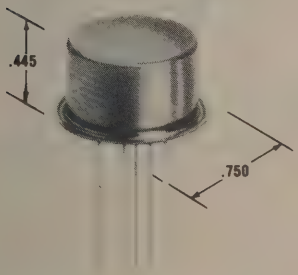
W-21 Pins
Dia. = .040
Length = .238


.535
.190 MAX.
.445
MAX.

HOLDER SERIES
W-8

Frequency Range:
0.8 MHz to 250 MHz

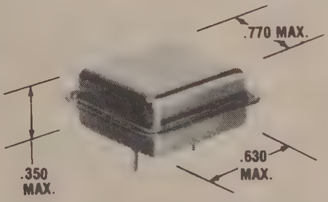
Wire Lead Dia. = .018
Note: Pin version also available



HOLDER SERIES
W-10 (HC-39/U)

Frequency Range:
1 MHz to 250 MHz

Pin Dia. = .020
Pin Length = .170


.770 MAX.
.350
MAX.
.630
MAX.

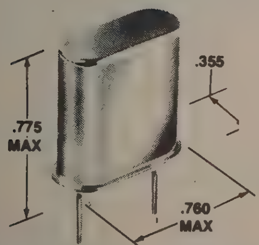
RESISTANCE WELD CRYSTALS

HOLDER SERIES
R-1 (HC-48/U)
R-4 (HC-51/U)

Frequency Range:
2 MHz to 250 MHz

R-1 = Pins
Dia. = .050
Length = .238

R-4 = Wire Leads
Dia. = .030
Length = .500

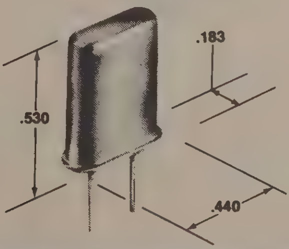

.775
MAX
.355
.760
MAX

HOLDER SERIES
R-20 (HC-49/U)
R-21 (HC-50/U)

Frequency Range:
2.5 MHz to 250 MHz

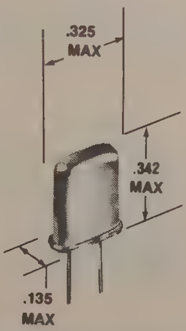
R-20 Wire Leads
Dia. = .017
Length = .500

R-21 Pins
Dia. = .040
Length = .238



HOLDER SERIES
R-60

Frequency Range:
12.5 MHz to 250 MHz


.325
MAX
.342
MAX
.135
MAX

McCOY
ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B,
MT. HOLLY SPRINGS, PA 17065 717-486-3411 • TWX: 510-650-3548
a subsidiary of **OAK Industries Inc.**

McCOY
ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B,
a subsidiary of OAK Industries Inc. MT. HOLLY SPRINGS, PA. 17065 717-486-3411 · TWX: 510-650-3548

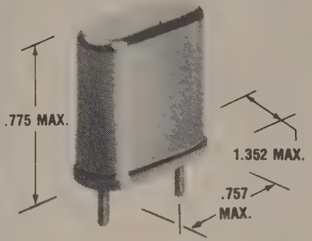
SOLDER SEAL CRYSTALS

HOLDER SERIES
M-1 (HC-6/U)
M-4 (HC-33/U)

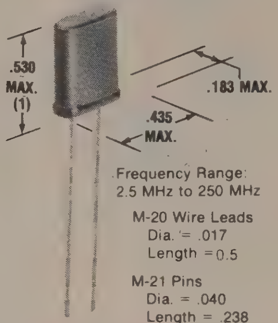
Frequency Range:
0.7 MHz to 250 MHz

M-1 Pins
Dia. = .050
Length = .248

M-4 Wire Leads
Dia. = .030
Length = 1.5



HOLDER SERIES
M-20 (HC-18/U)
M-21 (HC-25/U)



Frequency Range:
2.5 MHz to 250 MHz

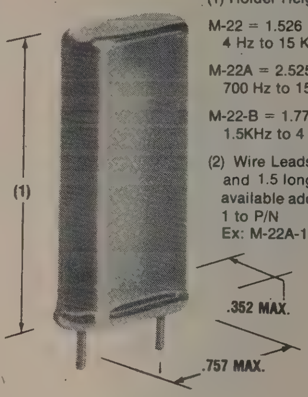
M-20 Wire Leads
Dia. = .017
Length = 0.5

M-21 Pins
Dia. = .040
Length = .238

(1) Also available with short cans
"A" Height = .460 (5 MHz to 250 MHz)
"B" Height = .425 (5 MHz to 250 MHz)
"C" Height = .360 (10 MHz to 250 MHz)
"D" Height = .312 (10 MHz to 250 MHz)
"E" Height = .250 (15 MHz to 250 MHz)
"F" Height = .400 (10 MHz to 250 MHz)

HOLDER SERIES
M-22 (HC-13/U)
M-22A/ M-22B

Frequency Range:
4 Hz to 15 KHz



(1) Holder Height

M-22 = 1.526
4 Hz to 15 KHz

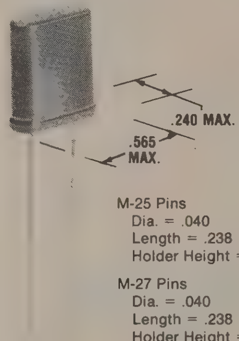
M-22A = 2.525
700 Hz to 15 KHz

M-22-B = 1.775
1.5KHz to 4 KHz

(2) Wire Leads .030 and 1.5 long also available add dash 1 to P/N
Ex: M-22A-1

HOLDER SERIES
M-25 (HC-32/U)
M-27/ M-28

Frequency Range:
2 MHz to 250 MHz

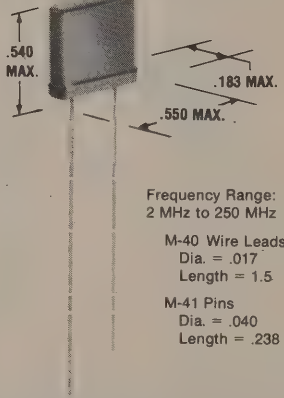


M-25 Pins
Dia. = .040
Length = .238
Holder Height = .650

M-27 Pins
Dia. = .040
Length = .238
Holder Height = .585

M-28 Wire Leads
Dia. = .017
Length = 2.0
Holder Height = .585

HOLDER SERIES
M-40/ M-41

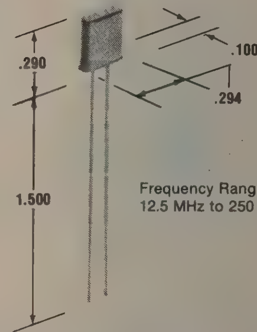


Frequency Range:
2 MHz to 250 MHz

M-40 Wire Leads
Dia. = .017
Length = 1.5

M-41 Pins
Dia. = .040
Length = .238

HOLDER SERIES
M-60 (HC-44/U)



Frequency Range:
12.5 MHz to 250 MHz

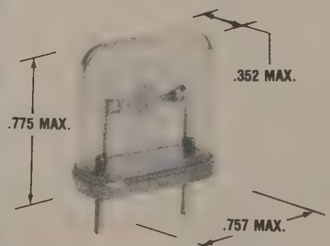
PRECISION GLASS CRYSTALS

HOLDER SERIES
G-1 (HC-27/U)
G-4

Frequency Range:
2 MHz to 100 MHz

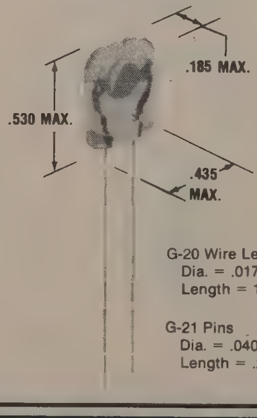
G-1 Pins
Dia. = .050
Length = .248

G-4 Wire Leads
Dia. = .030
Length = 1.5



HOLDER SERIES
G-20 (HC-26/U)
G-21 (HC-29/U)

Frequency Range:
5 MHz to 100 MHz

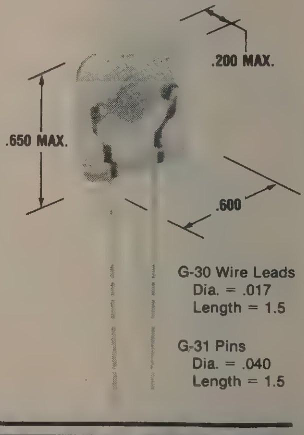


G-20 Wire Leads
Dia. = .017
Length = 1.5

G-21 Pins
Dia. = .040
Length = .238

HOLDER SERIES
G-30/ G-31

Frequency Range:
5 MHz to 100 MHz



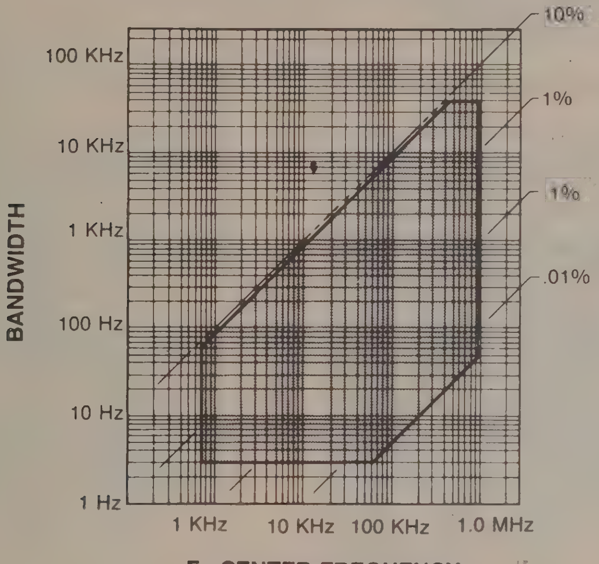
G-30 Wire Leads
Dia. = .017
Length = 1.5

G-31 Pins
Dia. = .040
Length = 1.5

LOW FREQUENCY CRYSTAL FILTERS

Low Frequency crystal filters between 1 KHz and 1 MHz are routinely produced utilizing advanced computer design technology. All filters are custom designed to customer requirements including unique package designs to fit unusual conditions. We invite your challenge. Call our Sales or Engineering Department today with your application.

LOW FREQUENCY BANDWIDTH CHART

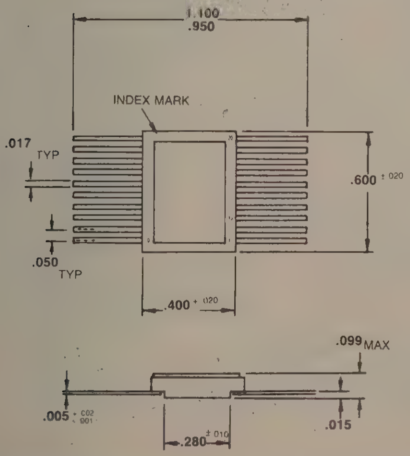


Fc CENTER FREQUENCY

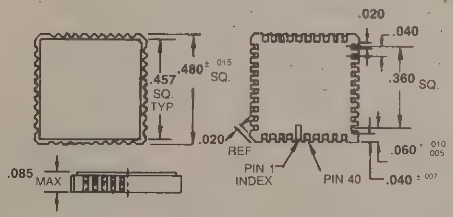
TYPICAL UNITS AVAILABLE

P/N	CENTRAL FREQUENCY	BANDWIDTH	BANDWIDTH	db I.L.	db RIPPLE	Ω IMPED.	SIZE
48B11	12 KHz	1 db 5 Hz Min	40 db 1 KHz	7	1	1 K	3 X 1 56 X 922
48B15	450 KHz	3 db 200 Hz	60 db 1500 Hz	5	3	20 K	2 605 X 595 X 955
48B35	455 KHz	3 db · 1450 Hz	60 db · 1 96 KHz	4 5	0 5	2 K	3 031 X 1 438 X 1

SURFACE MOUNTED CRYSTAL FILTERS



1.100
.950
INDEX MARK
.017
TYP
.600 ± 020
.050
TYP
.400 + 020
.099 MAX
.005 + 002 - 001
.280 ± 010
.015



.020
.040
.480 ± 015 SQ.
.457 SQ. TYP
.360 SQ.
.020
REF
.060 + 010 005
PIN 1 INDEX
PIN 40
.040 ± 007
.085 MAX

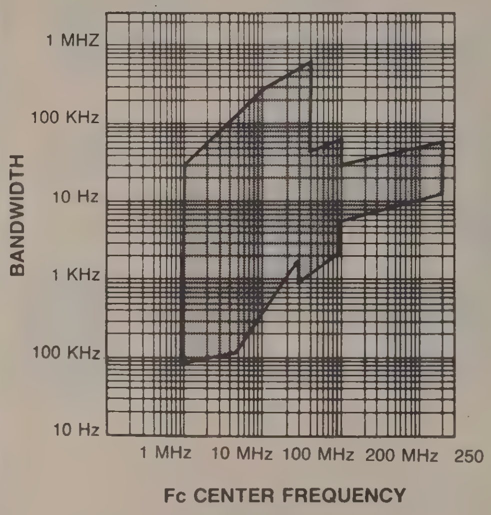
Center Frequency Range Available: 10 MHz to 30 MHz
3 db Bandwidth: .05% to .2%
Shape Factor from 30 to 3db = 7:1 max.
Passband Ripple: 1db max.
Insertion Loss: 2db max.
Source Load impedance: Natural Impedance of Filter

McCOY ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B, MT. HOLLY SPRINGS, PA. 17065 717-486-3411 - TWX: 510-650-3548
a subsidiary of OAK Industries Inc.

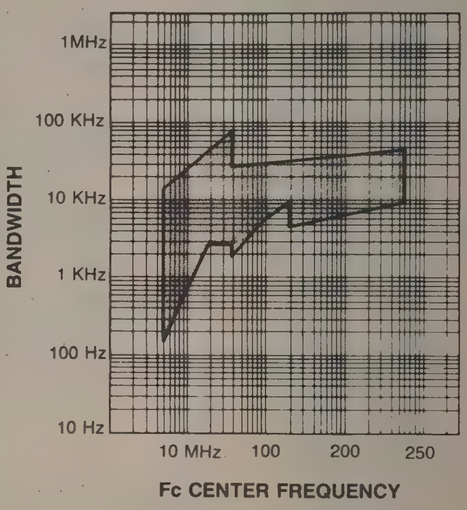
HIGH FREQUENCY CRYSTAL FILTERS

McCoy Electronics manufactures high frequency crystal filters from 1 MHz to over 250 MHz. Both discrete crystal design and monolithic filter designs are utilized to achieve the maximum in bandwidths, selectivity, miniaturization and competitive pricing.

DISCRETE FILTER BANDWIDTH



MONOLITHIC BANDWIDTH CHART



TYPICAL UNITS AVAILABLE

P/N	CENTER FREQUENCY MHz	NO. POLES	BANDWIDTH	BANDWIDTH	db I.L.	db RIPPLE	Ω IMPED.	SIZE
48B52	1.4	14	3 db ± 1.62 KHz	60 db 4.3 KHz	5	1	1K	2.975 × 1.63 × 1.18
48B30	10	6	1 db ± 15 KHz	60 db ± 58 KHz	5	0.5	500	1.87 × .5 × .475
48Q24	21.4	4	6 db 32 KHz	30 db 72 KHz	6	2	2.2K	9 × .215 × .61
48Q19	25.5	6	6 db ± 34.5 KHz	60 db ± 80 KHz	5	1	3K	2.08 × .75 × .635
48Q06	30	8	3 db ± 15 KHz	60 db 60 KHz	4	1	1.5K	.73 × .47 × .59
48B45	50	6	6 db ± 9.5 KHz	55 db ± 25 KHz	8	1	50	2.73 × .64 × 1.085
48B40	70	8	1 db ± 20 KHz	45 db ± 70 KHz	6	1	50	.985 × .719 × .475
48B76	118 to 136	8	6 db ± 12 KHZ	90 db ± 75 KHZ	1	2	50	4.98 × .985 × .985
48Q2	156	2	3 db 15 KHz	30 db 60 KHz	2	1	5K	41 dia. × .265

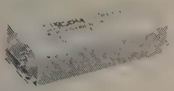
**ONLY A FEW UNITS ARE SHOWN,
WRITE OR CALL FOR COMPLETE CATALOG.**

McCOY
ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B
a subsidiary of **OAK Industries Inc.** MT. HOLLY SPRINGS, PA. 17065 717-486-3411 TWX: 510-650-3548

SWITCHABLE BANDWIDTH FILTERS

MODEL 48B12

Switchable Bandwidth



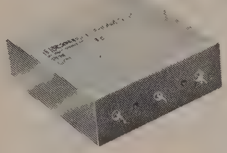
SPECIFICATIONS

Center Frequency: 70.0 MHz
Filter A: 3 db BW: ±35 KHz min.
60 db BW: ±180 KHz max.
Filter B: 6 db BW: ±19 KHz min.
60 db BW: ±90 KHz max.
Ripple: Filter A: 1.5 db max.
Filter B: 1.0 db max.
Insertion Loss: Filter A and B: 8.0 db max.
Ultimate Attenuation: 80 db min. ±200 KHz to ±20 MHz from center frequency
Source/Load Impedance: 50 Ω
Shock: 50G's, MIL-STD-202, method 202
Vibration: MIL-STD-202, method 204, test condition A
Temperature Range: –55° to +95°C
Switching Voltage:
Bias Voltage to Pin 5: 12 VDC
Filter A obtained by applying 0–1 VDC to pin 6
Filter B obtained by applying 24 VDC to pin 6
Filter will sustain no damage with .5 VRMS applied to input

SINGLE SIDEBAND FILTERS

MODEL 48B33

SSB Single Sideband

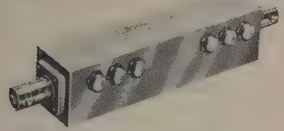


Carrier Frequency: 1.750 MHz
1 db BW: Fc +295 Hz to Fc +3100 Hz min.
60 db BW: Fc –125 Hz to Fc +3975 Hz max.
Carrier Attenuation: Fc 40 db min.
Ripple: 1.0 db max.
Insertion Loss: 5.0 db max.
Ultimate Attenuation: 60 db min.
Source/Load Impedance: 500 Ω
Shock: MIL-STD-202, method 213
Vibration: MIL-STD-202, method 204A, tested condition A
Temperature Range: –40° to +78°C

HIGH FREQUENCY CRYSTAL FILTERS

MODEL 48B76

8 pole



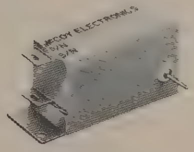
SPECIFICATIONS

Center Frequency: 118.0 MHz to 136 MHz
6 db BW: ±12 KHz min.
60 db BW: ±35 KHz max.
90 db BW: ±75 KHz max.
Ripple: 2.0 db max.
Insertion Loss: 1.0 db max.
Ultimate Attenuation: 90 db min.
Source/Load Impedance: 50 Ω
Shock: Standard Commercial
Vibration: Standard Commercial
Temperature Range: –40° to +70°C
External Supply Required: 10V ±10%
NOTE: Filter designed to eliminate adjacent channel interference and contains amplifier with built in power supply.

HIGH FREQUENCY CRYSTAL FILTERS

MODEL 48B10

8 pole



SPECIFICATIONS

Center Frequency: 30.0 MHz
3 db BW: ±31.8 KHz min.
6 db BW: ±34.5 KHz min.
60 db BW: ±57 KHz max.
Ripple: 1.0 db max. over ±25 KHz
Insertion Loss: 3.0 db max.
Ultimate Attenuation: 60 db min.
Source Impedance: 2K Ω
Load Impedance: 50 Ω
Shock: 15G's, 18 impacts
Vibration: 10–500 Hz, 10G's
Temperature Range: –55° to +105°C

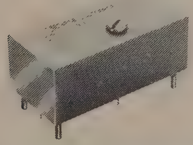
CRYSTAL DISCRIMINATORS

MODEL 48D2

Crystal Discriminators

SPECIFICATIONS

Center Frequency: 498.750 KHz
Positive Slope
Peak-Peak BW: 300 Hz min.
Linear BW: ±100 Hz
Linearity: ±10%
Sensitivity: ±.5V Nominal At ±100 Hz



Driver Source Impedance: 50 Ω, 1 VRMS open circuit
Discriminator Load Impedance: 39K 1 VRMS open circuit
Drive Level: 1 VRMS open circuit
Shock: MIL-STD-202, method 213, condition J
Vibration: MIL-STD-202, method 201
Temperature Range: 0° to +70°C

MCCOY
ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B,
a subsidiary of OAK Industries Inc. MT. HOLLY SPRINGS, PA. 17065 717-486-3411 · TWX: 510-650-3548

McCOY
ELECTRONICS COMPANY 100 WATTS STREET P.O. BOX B.
a subsidiary of **OAK Industries Inc.** MT. HOLLY SPRINGS PA 17065 717-486-3411 TWX: 510-650-3548

CRYSTAL OSCILLATORS

McCoy's line of custom designed Crystal Controlled Oscillators is unexcelled in the industry. From clocks, TCXO's, VCXO's, TCVCXO's thru oven controlled units, we have a unit to meet your requirements. A complete in-house thick film facility coupled with the industries best crystal facility gives you miniaturization capabilities and quality controls unavailable elsewhere. Our QPL approvals on MIL-0-55310 allows the use of military approved unit where the requirement exists.

MIL-0-55310 OSCILLATORS OFFERED BY McCOY ELECTRONICS

MIL-0-55310 SLASH SHEET NO.	CLASS # OF UNIT *	FREQUENCY RANGE COVERED	OUTPUT WAVEFORM	McCOY CORRESPONDING MODEL NUMBER	PACKAGE SIZE AND STYLE
4	3	750 KHz - 10 MHz	C-MOS	MC128A2-( )	1.5" × 1.5" × .5" PC MOUNT
5	3	1 MHz - 10 MHz	TTL	MC180X2-( )	2.0" × 2.0" × .7" PC MOUNT or CHASSIS
6	3	15.7 KHz - 10 MHz	TTL	MC219A1-( )	1.55" × 1.015" × .7" PC MOUNT
7	3	10 MHz - 90 MHz	SINE	MC178X2-( )	2.0" × 2.0" × .7" PC MOUNT
8	1	50 Hz - 50 MHz	TTL	MC765A1-( )	.887" × .54" × .4" 14 PIN DIP
9	1	10 MHz - 60 MHz	TTL	MC717-( )	.410" dia. × .300" TO-5 PACKAGE
10	1	1 KHz - 30 MHz	TTL	MC708A1-( )	.565" dia. × .350" TO-8 PACKAGE
11	1	.05 Hz - 10 MHz	C-MOS	MC751A1-( )	.887" × .54" × .4" 14 PIN DIP
13	1	300 Hz - 10 MHz	C-MOS	MC714-( )	.565" dia. × .350" TO-8 PACKAGE
14	1	.1 Hz - 25 MHz	TTL	MC755A1-( )	.887" × .54" × .2" 14 PIN DIP
15	1	.01 Hz - 10 MHz	C-MOS	MC752A1-( )	.887" × .54" × .2" 14 PIN DIP
16	1	.1 Hz - 50 MHz	TTL	MC741A1-( )	.887" × .54" × .2" 14 PIN DIP
17	1	250 KHz - 25 MHz	TTL	MC726A1-( )	.887" × .54" × .2" 14 PIN DIP
18	1	.01 Hz - 15 MHz	C-MOS	MC745A1-( )	.887" × .54" × .2" 14 PIN DIP
19	1	1 MHz - 60 MHz	TTL	MC070 -( )	.480" SQ. × .085" 40 PAD LEADLESS CHIP CARRIER

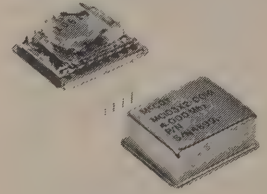
*MIL-0-55310 OSCILLATOR CLASSIFICATIONS

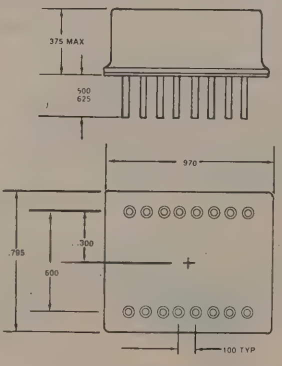
CLASS 1: CRYSTAL OSCILLATOR (XO)
CLASS 3: TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR (TCXO)

ONLY A FEW UNITS ARE SHOWN,
WRITE OR CALL FOR COMPLETE CATALOG.

MINIATURE THICK FILM HYBRID TCXO

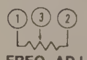
MODEL MC103X2





NOTE: SQUARE CORNER INDICATES PIN #1

PIN LOCATION



FREQ. ADJ.
(10 K POT)

1. GND
2. REG B+
3. ADJ.
4. N/C
5. N/C
6. N/C
7. N/C
8. GND.
9. R.F. OUT
10. N/C
11. N/C
12. N/C
13. N/C
14. N/C
15. N/C
16. +5.0 VDC

SPECIFICATIONS

Frequency Range: 3.2 to 25 MHz
Frequency Stability Options: (Select one)
A) ±1 PPM over 0° to +50°C
B) ±2 PPM over −15° to +70°C
C) ±3 PPM over −30° to +70°C
Input: +5.0 VDC ±2%, 15 ma MAX.

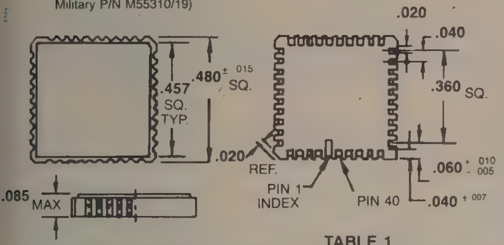
Output: TTL Compatible
Trim: Electrical, ±5 PPM, minimum, trimmed by external 10K pot connected to 3 terminals.
PACKAGE: 16 pin Dip, .375 High

SURFACE MOUNTED OSCILLATORS

MODEL MC070 LEADLESS CHIP CARRIER OSCILLATOR .040" PAD CTRS.

(This model also available as
Military P/N M55310/19)

10 MHz to 100 MHZ



PAD NO.	FUNCTION
4	B+
10	B+
31	GND.
37	GND
39	OUTPUT
1-3	NC
5-9	NC
11-30	NC
32-36	NC
38	NC
40	NC

SPECIFICATIONS

Frequency stability:
Vs temperature: See table I
Vs supply voltage: ± 4 ppm maximum for a .50 V change in input voltage
Aging: ± 10 ppm per year maximum
Seal: Hermetic
Weight. 3 grams, maximum
Temperature:
Operating: Within the specified limits over a temperature range of (see table I)
Storage: −62° to +125°C
Oscillator load: Standard TTL loads (see table I)
Output waveform: Symmetrical square wave
Output voltage:
Logic 1: 2 4 Vdc Minimum at 400 μA source
Logic 0: 0 5 Vdc maximum with 16 mA sink

Vibration, high frequency: In accordance with MIL-0-55310 and MIL-STD-202, method 204
Nonoperating - Test condition G
Operating - Test condition G

Constant acceleration: MIL-STD-883 Method 2001 test condition A (Y1 Plane)

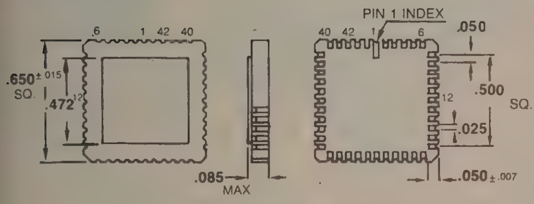
Altitude:
Nonoperating - In accordance with MIL-0-55310
Operating - MIL-STD-202, method 105, test condition C

TABLE 1

OUTPUT FREQUENCY RANGE	INPUT CURRENT MAX MA	PULSE CHARACTERISTICS RISE AND FALL TIME MAX NS	PULSE CHARACTERISTICS SYMMETRY %	PULSE CHARACTERISTICS LOAD MAX	AGING PPM/YR AFTER 30 DAYS	FREQUENCY STABILITY PPM −55°C +125°C A	FREQUENCY STABILITY PPM −55°C +105°C B	FREQUENCY STABILITY PPM −20°C +70°C C
10 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	±100	±75	±50
10 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	±200	±150	±100
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	±100	±75	±50
16 0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	±200	±150	±100
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	±100	±75	±50
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	±200	±150	±100
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	±75	±50
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	±150	±100
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	±50
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	±100

MODEL MC085 LEADLESS CHIP CARRIER OSCILLATOR .050" PAD CTRS.

1 MHz to 100 MHz



PAD NO	FUNCTION
6	B+
12	B+
34	GND
40	GND
42	OUTPUT
1-5	NC
7-11	NC
13-33	NC
35-39	NC
41	NC
43-44	NC

SPECIFICATIONS

Frequency stability:
Vs temperature: See table I
Vs supply voltage: ± 4 ppm maximum for a .50 V change in input voltage
Aging: ± 10 ppm per year maximum
Seal: Hermetic
Weight: 3 grams, maximum
Temperature:
Operating: Within the specified limits over a temperature range of (see table I)
Storage: −62° to +125°C
Oscillator load: Standard TTL loads (see table I)
Output waveform: Symmetrical square wave
Output voltage:
Logic 1: 2 4 Vdc Minimum at 400 μA source
Logic 0: 0 5 Vdc maximum with 16 mA sink

Vibration, high frequency: In accordance with MIL-0-55310 and MIL-STD-202, method 204
Nonoperating - Test condition G
Operating - Test condition G

Constant acceleration: MIL-STD-883 Method 2001 test condition A (Y1 Plane)

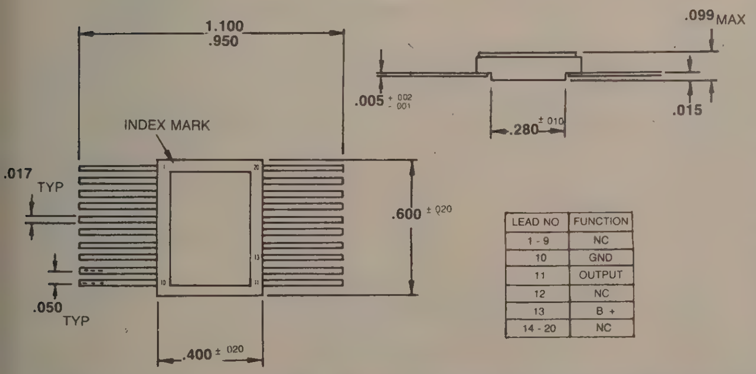
Altitude:
Nonoperating - In accordance with MIL-0-55310
Operating - MIL-STD-202 method 105, test condition C

TABLE 1

OUTPUT FREQUENCY RANGE	INPUT CURRENT MAX MA	PULSE CHARACTERISTICS RISE AND FALL TIME MAX NS	PULSE CHARACTERISTICS SYMMETRY %	PULSE CHARACTERISTICS LOAD MAX	AGING PPM/YR AFTER 30 DAYS	FREQUENCY STABILITY PPM −55°C +125°C A	FREQUENCY STABILITY PPM −55°C +105°C B	FREQUENCY STABILITY PPM −20°C +70°C C
1.0 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	±100	±75	±50
1.0 MHz to 16.0 MHz	75	15	40 to 60	10 TTL	10	±200	±150	±100
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	±100	±75	±50
16.0 MHz to 40 MHz	40	5	40 to 60	10 TTL	10	±200	±150	±100
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	±100	±75	±50
40 MHz to 60 MHz	70	5	40 to 60	10 TTL	10	±200	±150	±100
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	±75	±50
60 MHz to 80 MHz	85	5	40 to 60	10 TTL	10	N/A	±150	±100
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	±50
80 MHz to 100 MHz	85	5	40 to 60	10 TTL	10	N/A	N/A	±100

MODEL MC102A1 FLAT PACK CRYSTAL OSCILLATORS .050" LEAD CTRS.

14 MHZ to 60 MHz



LEAD NO	FUNCTION
1 - 9	NC
10	GND
11	OUTPUT
12	NC
13	B+
14 - 20	NC

SPECIFICATIONS

STABILITY OPTIONS
±50 ppm
±75 ppm
±100 ppm

TEMPERATURE RANGE
−20° to +70°C
−55° to +105°C
−55° to +125°C

INPUT: +5.0 VDC ± .50 volts

CURRENT DRAIN 40 ma maximum 14 MHz to 40 MHz
70 ma maximum 50 MHz to 60 MHz

OUTPUT Capable of driving 10 TTL loads

RISE AND FALL TIME 5ns

SYMMETRY 40/60 percent

ENVIRONMENTAL

Hermetic Seal
Aging 10 ppm/year maximum
Vibration MIL-STD 202, Method 204 test condition G
CONSTANT ACCELERATION MIL-STD 883, method 2001 test condition "A" (Y1 plane)

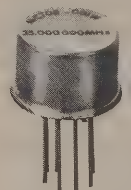
NOTE For Military Applications, units can be screened IAW MIL-O-55310, Level B

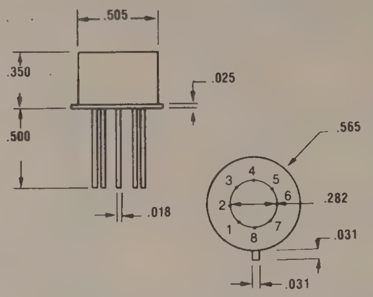
MCCOY
ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B,
a subsidiary of OAK Industries Inc. MT. HOLLY SPRINGS, PA. 17065 717-486-3411 · TWX 510-650-3548

McCOY
ELECTRONICS COMPANY 100 WATTS STREET, P.O. BOX B,
a subsidiary of **OAK Industries Inc.** MT. HOLLY SPRINGS, PA. 17065 717-486-3411 - TWX: 510-650-3548

CRYSTAL OSCILLATORS

MODEL MC708
Standard Oscillator


35.000.000MHz


.505
.350
.025
.500
.565
.018
3
4
5
2
6
1
7
8
.282
.031
.031

Frequency Range: 250 KHz to 50 MHz

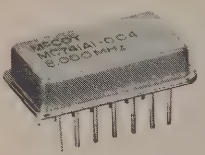
Stability (Options):	**Temperature Range:**
±50 PPM	0°C to +70°C
±50 PPM	-40°C to +85°C
±50 PPM	-55°C to +105°C

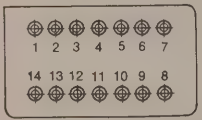
Input: +5V DC ±10%

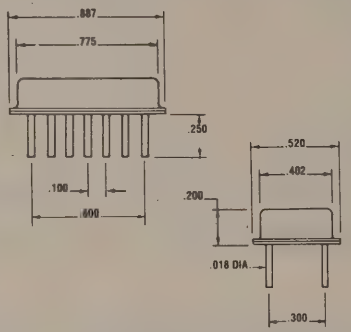
Output: TTL: Fan out 10 TTL Loads (156 KHz to 25 MHz)
TTL: Fan out 6 TTL Loads (25 MHz to 50 MHz)

Pin Connections
1,3,& 7 N/C Internally
2 & 6 Connected Internally
4. Common
5. R.F. Output
8. Oscillator B+

MODEL MC741A1
Standard Oscillator


McCOY
MC741A1-OC4
8.000MHz


1 2 3 4 5 6 7
14 13 12 11 10 9 8


.887
.775
.250
.100
.600
.200
.520
.402
.018 DIA
.300

Frequency Range: 250.0 KHz to 50 MHz

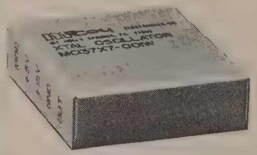
Stability (Options):	**Temperature Range:**
±50 PPM	0°C to +70°C
±50 PPM	-40°C to +85°C
±50 PPM	-55°C to +105°C
± 70 PPM	-55° C to +125° C

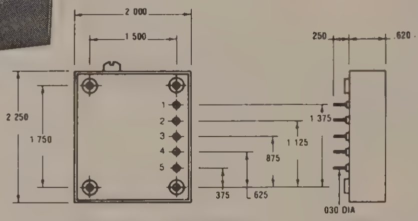
Input: +5V DC ±10%

Output:
TTL: Fan out to 10 TTL Loads (250 KHz to 25 MHz)
TTL: Fan out to 6 TTL Loads (25 MHz to 50 MHz)

Pin Connections
1,2,3,4,5,6,9,10,11,12, & 13 N/C Internally
7. Common
8. R.F. Output
14. Oscillator B+

MODEL MC137X7
TCVCXO


McCOY
XTAL OSCILLATOR
MC137X7-OONN


2 000
1 500
2 250
1 750
1
2
3
4
5
375
625
875
1 125
1 375
250
.620
030 DIA

Frequency Range: 180 KHz to 25 MHz

Stability	**Temperature Range**	**Deviation**
±1 PPM	-10°C to +70°C	±.001%
±5 PPM	-30°C to +70°C	±.0025%
±10 PPM	-40°C to +75°C	±.005%

Linearity: 5%

Output: TTL Compatible

Modulation Input Impedance: 10k Minimum

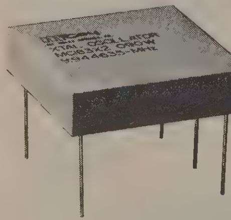
Control Voltage: ±2 Volts to ±10 Volts

Negative Slope:

Input Voltage: +12 to +24V DC

Pin Connections
1. Modulation Input
2. Logic B+
3. Oscillator B+
4. Common and Case
5. R.F. Output

MODEL MC163X2
TCXO


McCOY
XTAL OSCILLATOR
MC163X2-OBOW

Sinewave

Pin Connections
1. Oscillator B+
2. N.C.
3. R.F. Output
4. Common and Case
5. Common and Case

TTL

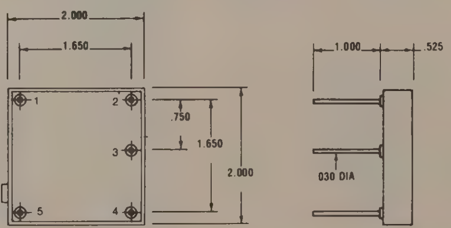
Pin Connections
1. Oscillator B+
2. Common and Case
3. R.F. Output
4. Logic B+
5. Common and Case

CMOS

Pin Connections
1. Oscillator B+
2. N.C.
3. R.F. Output (CMOS)'
4. Common and Case
5. Common and Case

ECL

Pin Connections
1. OSC B+ or B−
2. GND
3. R.F. Output
4. Logic −5.2 VDC
5. GND


2.000
1.650
1
2
3
4
5
.750
1.650
2.000
1.000
.525
030 DIA

Frequency Range: 180 Hz to 150 MHz (depending upon output)

Stability Tr: ±0.5 PPM -20°C to +60°C
±1.0 PPM -40°C to +70°C
±5.0 PPM -55°C to +105°C
(Shown are typical specifications - this is a cost determining requirement and only actual needs should be specified)

Input Voltage Range: +12VDC to +24V DC ±3% and +5V DC ±5% (TTL/DTL units only)

External Trim: 5 PPM Minimum

Aging: 1 PPM/Year Maximum

Output:

Sine Wave	
Freq Range 3-150 MHz Output 1-10 MW 50 ohms Harmonics/ Sub-Harmonics −20 dB Minimum	
TTL/DTL	**CMOS**
187.5 KHz-25 MHz TTL/DTL Compatible	180 Hz-10 MHz CMOS Compatible

Frequency Range: 50 to 100 MHz

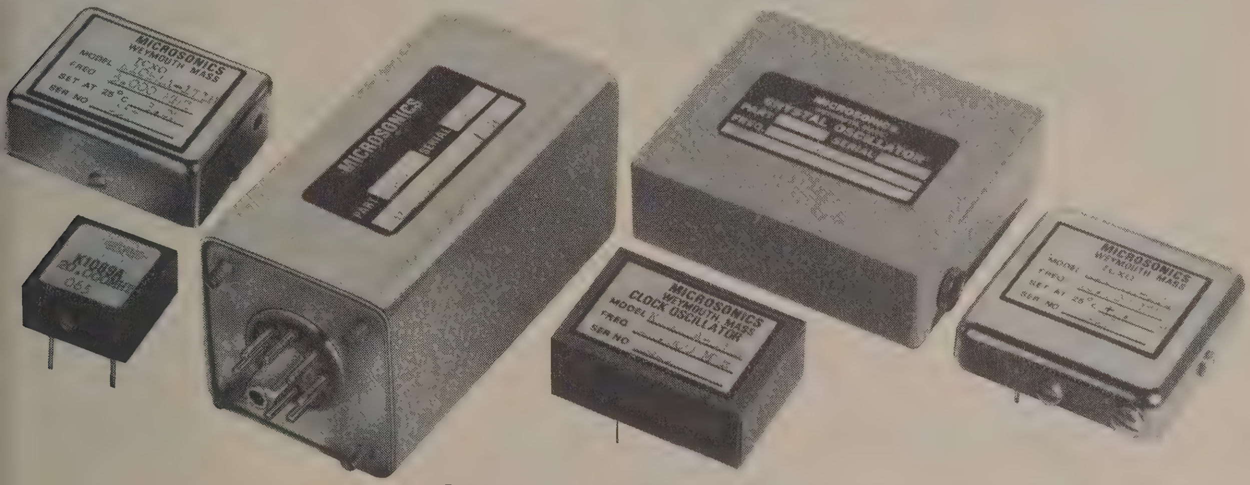
Input Voltage: ±12 to 24 DC ±3% and −5.2VDC ±5%

Output: ECL Compatible

SPECIFY MICROSONICS

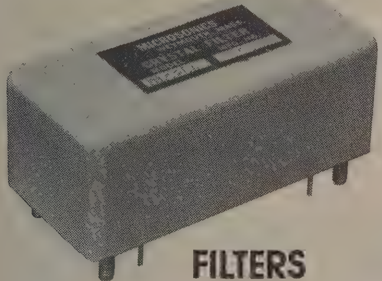
Go with a company that does it all.

In-house crystal manufacturing, producing up to 41 MHz fundamental frequencies. Computer optimized designs. Automatic testing and modern manufacturing facilities. Engineering assistance and liaison. Special packaging. Customized and state-of-the-art devices. Quality assurance to MIL-I-45208A or MIL-Q-9858A if required.



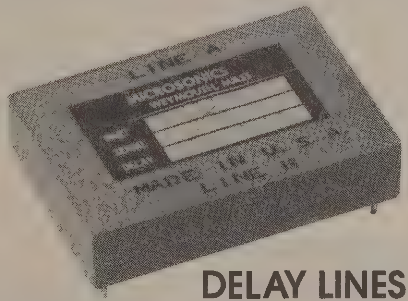
CRYSTAL OSCILLATORS

Ovenized (OC), clock (XO), temperature compensated (TCXO), and temperature compensated voltage controlled (TC/VCXO), crystal oscillators with sine wave, TTL, CMOS, and ECL compatibility. Many standard options available to insure fast delivery of quality oscillators to meet your large or small quantity needs. Plus, our ability to customize military and commercial designs provides you with the flexibility necessary to satisfy all your requirements.



FILTERS

Solving problems in the space, military, commercial and CATV fields. Filters available with center frequencies from 10 KHz to 200 MHz. Featuring wide bandwidths, phase matching, tracking and equalization. Call us for bandpass, band reject, comb, phase tracking and compensated Filters or Discriminators. Designs are available in L.C., or Crystal technologies.



DELAY LINES

We have nearly 25 years experience in delay lines, providing the military and television broadcast equipment markets with quality, high technology delay lines. Delay lines with delays of .5 to 5000 usec with center frequencies from 5 MHz to 200 MHz depending on application. Designs are available utilizing bulkwave in quartz or Zero Temperature Coefficient glass. We can help you solve your delay line problems.

We're available...

Microsonics' Sales and Engineering staff is available to assist you in your Delay Line, Filter and Oscillator requirements, covering the spectrum from high volume commercial production to high reliability space and military. We have the personnel, equipment and commitment to provide our customers with the products they need. Write or call now for bulletins and Engineering or Sales assistance.

MICROSONICS
INCORPORATED

60 WINTER ST., WEYMOUTH, MA 02188
(617) 337-4200 TWX 710-388-6833

MF ELECTRONICS CORP.

CRYSTAL CLOCK OSCILLATORS

PRODUCT SHOWCASE

ECL SINGLE/COMPLEMENTARY OUTPUT:

Models M1400/M2400

Reliable units for commercial or industrial application generating your frequency to 125 MHz and delivering standard 10,000 ECL output. Stability ranges ±.0025% to ±1.0%.

TTL RESISTANCE-WELD ALL METAL COMMERCIAL PACKAGE:

Models M1200-M1245

Reliable crystal clocks from 20 KHz to 100 MHz, in the popular TTL logic, and all metal case. Stability ranges ±.0025% to ±1.0%.

EXTENDED TEMPERATURE RANGE CRYSTAL CLOCKS:

Models M1258/M1256

All metal welded package with standoff insulator design for extended temperature industrial applications. Frequency from 20 KHz to 30 MHz. Stability ranges & temp. range: M1258 ±.01% −40 to +85° C. M1256 ±.0075% −55 to +85°C.

MICROPROCESSOR DRIVER SINGLE/DUAL OUTPUT:

Models M1160/M1159/M1157

Microprocessor driver for Z80A, 2800, MD3880, and MK. 3886 these will drive 200 pf. for long runs on your board. Auxiliary 2X output frequency. Introducing the M1157 with 4X auxiliary output frequency.

TTL CRYSTAL CLOCK FOR COMMERCIAL APPLICATIONS:

Models M1100-M1145

Most popular units from 250 KHz to 50 MHz operate from 5V and generate TTL-dual frequencies available. Stability ranges ±.0025% to ±1.0%.

CMOS CRYSTAL CLOCK IN ALL METAL PACKAGES:

Models M1252/M1251

Low current CMOS units will drive up to 15 pf. Frequency ranges from 825 Hz to 10 MHz. Stability ranges—M1252 ±.01% & M1251 ±.005%.

VERY HIGH/LOW TEMPERATURE RANGE CRYSTAL CLOCKS:

Models M4001-M4008

For use in harsh environments and "Down Hole" applications. 8 temperature and stability options. Frequency ranges from 1 MHz to 30 MHz. TTL and 5 volt CMOS compatible.

MILITARY CRYSTAL OSCILLATORS—FULL RANGE:

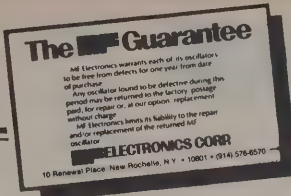
Models M5500/M5516/M5622/M5623

Military DIL oscillators, with full screening. Frequency range: 250 KHz-100 MHz. Temperature range: −55 to +85°C. and −55 to 125°C. Stability range: ±.005% and ±.0075%.

MF ELECTRONICS CORP.

10 Renewal Place, New Rochelle, N.Y. 10801
(914) 576-6570 TWX: 710-563-0643

DIP CRYSTAL OSCILLATORS


The MF Guarantee

MF Electronics warrants each of its oscillators to be free from defects for one year from date of purchase

Any oscillator found to be defective during this period may be returned to the factory postage paid, for repair or, at our option replacement without charge

MF Electronics limits its liability to the repair and/or replacement of the returned MF oscillator

MF ELECTRONICS CORP.
10 Renewal Place New Rochelle, N Y • 10801 • (914) 576-6570

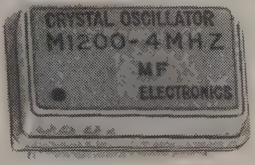
The Broadest line in the industry.

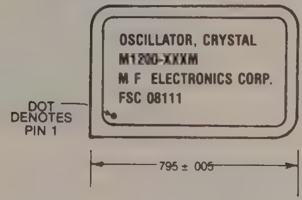
- Units use overtone crystals from 20 MHz to 100 MHz, very stable electrically and more reliable mechanically.
- All units guaranteed for one year to operate within specifications
- Units specified at temperatures exceeding 0 to 70°C are individually recorded 100% for freqency vs temperature insuring compliance.

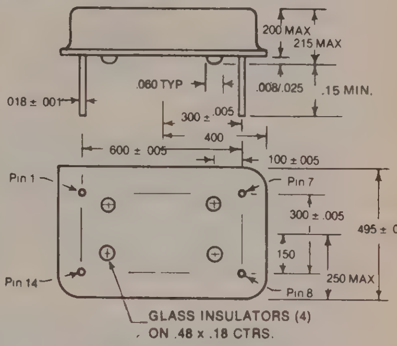
RESISTANCE-WELD CRYSTAL CLOCK OSCILLATORS • 250 KHz TO 100 MHz IN ALL METAL CASE

Series	Stability
M1200	± .01%
M1214	± .05%
M1215	± .10%
M1216	± 1.0%
M1244	± .0025% (25ppm)
M1245	± .0050% (50ppm)

- All metal welded package with standoff insulator
- Area on PC board is one true TTL space-.795 X .495
- Seated height less than 0.215, including insulator
- Frequency from 250 KHz to 100 MHz
- TTL Compatible
- Stability options from 1.0% to .0025%
- Units at 4MHz and higher are simple and reliable using the exclusive MF Clock-chip
- Metal Package-Unit is hermetically sealed by resistance weld, with glass-to-metal seal connector which may be soldered or plugged into socket.


CRYSTAL OSCILLATOR
M1200-4MHZ
MF
ELECTRONICS


OSCILLATOR, CRYSTAL
M1200-XXXM
M F ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
795 ± 005


200 MAX
215 MAX
060 TYP
008/.025
.15 MIN.
018 ± 001
300 ± 005
400
600 ± 005
100 ± 005
Pin 1
Pin 7
300 ± 005
495 ± 005
150
250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON .48 x .18 CTRS.

HYBRID TTL GUARANTEED CRYSTAL CLOCK OSCILLATORS • 250 KHz-50 MHz

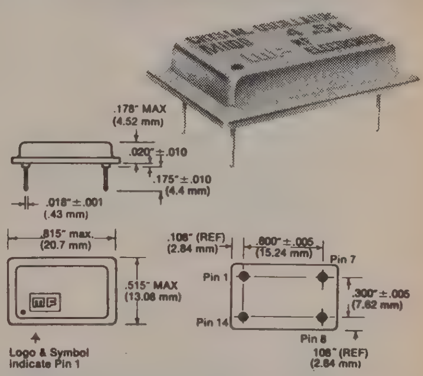
Frequency: any specified frequency from 250 KHz to 50MHz
Frequency Stability: Including calibration at 25°C, operating temperature, change of input voltage, change of load, shock and vibration.

Series	Stability
M1100	± .01%
M1114	± .05%
M1115	± .10%
M1116	± 1.0%
M1144	± .0025% (25 ppm)
M1145	± .0050% (50 ppm)

Temperature: Operating 0 to 70°C
Storage -55 to + 125°C

Input voltage: +5 ±.5VDC
Input current: 60 ma., maximum, under all conditions.
TTL output: All units, 0 to 70°C

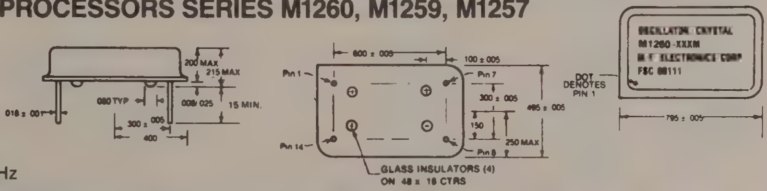
Symmetry	60/40 @ 1.4 VDC
Rise and Fall time	6ns. maximum from 0.5 to 2.4V.
"O" Level	+0.5V, maximum
"I" Level	24V minimum
Loads	10TTL Loads, standard or Shottky


.178" MAX
(4.52 mm)
.020" ±.010
.175" ±.010
(4.4 mm)
.018" ±.001
(.43 mm)
.815" max.
(20.7 mm)
.515" MAX
(13.08 mm)
Logo & Symbol
Indicate Pin 1
.108" (REF)
(2.84 mm)
.600" ±.005
(15.24 mm)
Pin 1
Pin 7
Pin 14
Pin 8
.300" ±.005
(7.62 mm)
108" (REF)
(2.84 mm)

CRYSTAL CLOCK FOR MOS MICROPROCESSORS SERIES M1260, M1259, M1257

Same Dimensions as M1200

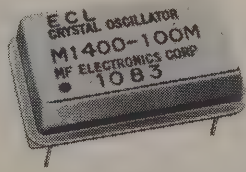
- Drives Z80a AND Z8000, Mostek MK3990-4, Sharp LH0080A, AMD AMz8000, NEC 780C-1
- 2 Times TTL frequency on M1259
- 4 Times TTL frequency on M1257
- MOS output drives 200pf.
- Other frequencies available from 1MHz thru 16MHz

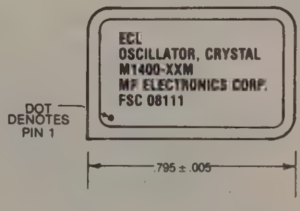

200 MAX
215 MAX
060 TYP
008/025
15 MIN.
018 ± 001
300 ± 005
400
600 ± 005
100 ± 005
Pin 1
Pin 7
300 ± 005
495 ± 005
150
250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON 48 x 18 CTRS
OSCILLATOR, CRYSTAL
M1260-XXXM
M F ELECTRONICS CORP
FSC 08111
DOT DENOTES PIN 1
795 ± 005

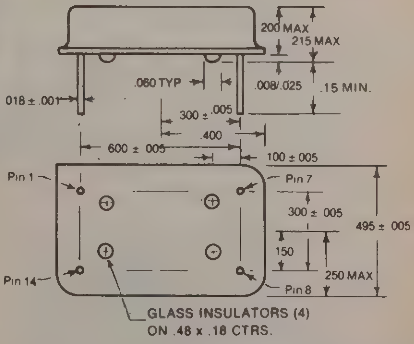
ECL SINGLE/COMPLEMENTARY OUTPUT: 10 MHz TO 125 MHz IN ALL METAL CASE

- Reliable units for Commercial or Industrial application generating your frequency to 125 MHz and delivering standard 10.000 ECL output. Stability ranges ±.0025% to ±1.0%.

Series	Stability
M1400, M2400	±.01%
M1410, M2410	±.02%
M1414, M2414	±.05%
M1415, M2415	±.10%
M1416, M2416	± 1.0%
M1444, M2444	±.0025% (25ppm)
M1445, M2445	±.0050% (50ppm)

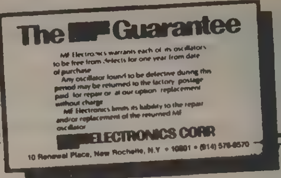

ECL
CRYSTAL OSCILLATOR
M1400-100M
MF ELECTRONICS CORP
1083


ECL
OSCILLATOR, CRYSTAL
M1400-XXM
MF ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
795 ± .005


200 MAX
215 MAX
.060 TYP
.008/.025
.15 MIN.
018 ± .001
300 ± .005
.400
600 ± 005
100 ± 005
Pin 1
Pin 7
300 ± 005
495 ± 005
150
250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON .48 x .18 CTRS.

MF ELECTRONICS CORP.
10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570 • TWX: 710-563-0643

DIP CRYSTAL OSCILLATORS



The MF Guarantee

MF Electronics warrants each of its oscillators to be free from defects for one year from date of purchase.

Any oscillator found to be defective during this period may be returned to the factory postage paid for repair or at our option replacement without charge.

MF Electronics limits its liability to the repair and/or replacement of the returned MF oscillator.

MF ELECTRONICS CORP.
10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570

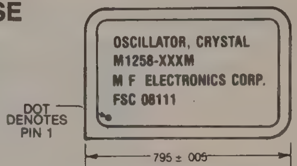
The Broadest line in the industry.

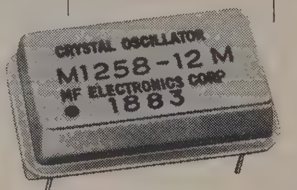
- Units use overtone crystals from 20 MHz to 100 MHz, very stable electrically and more reliable mechanically.
- All units guaranteed for one year to operate within specifications
- Units specified at temperatures exceeding 0 to 70°C are individually recorded 100% for freqency vs temperature insuring compliance.

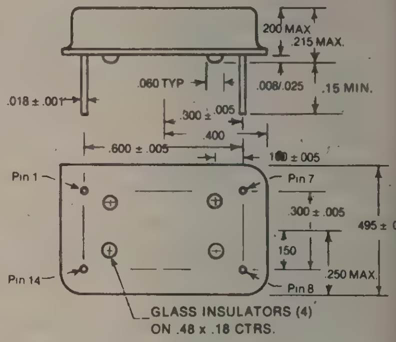
EXTENDED TEMPERATURE RANGE CLOCK OSCILLATOR: 20 KHz TO 30 MHz IN ALL METAL CASE

Series	Stability	Temperature
M1258	± .01%	−40 to +85°C
M1256	± .0075%	−55 to +85°C

- All-Metal welded package with Standoff Insulator design for for Extended Temperature industrial applications.
- Area on PC board is one true TTL space - .495" X .795" max.
- Seated height less than 0.215", including insulator.
- Frequency from 20Khz to 30 MHz.
- Start up time less than 10 ns.
- Stability options from 1.0% to .0025%.
- Units at 8MHz and higher are simple and reliable using the Exclusive MF Clock-Chip.™


OSCILLATOR, CRYSTAL
M1258-XXXM
M F ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
795 ± 005

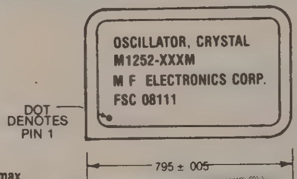

CRYSTAL OSCILLATOR
M1258-12 M
MF ELECTRONICS CORP
1883


200 MAX
.215 MAX.
.060 TYP
.008/.025
.15 MIN.
.018 ± .001
.300 ± .005
.400
.600 ± .005
.100 ± .005
Pin 1
Pin 7
.300 ± .005
.495 ± .005
150
.250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON .48 x .18 CTRS.

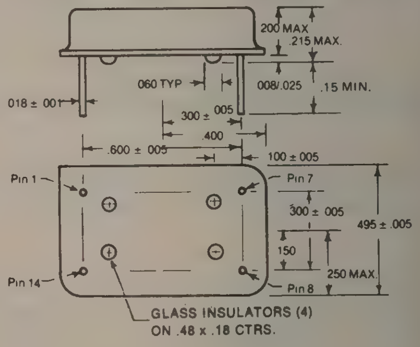
LOW POWER CMOS CRYSTAL CLOCK OSCILLATORS 825 Hz TO 10 MHz

Series	Stability
M1251	± .005%
M1252	± .01%

- All-Metal Welded package with Standoff Insulator.
- CMOS compatibility - will drive up to 15pf.
- Area on PC board is one true TTL space - .495"X.795" max.
- Seated height less than .215", including insulator.
- Frequency from 825 KHz to 10 MHz.
- Low Current.


OSCILLATOR, CRYSTAL
M1252-XXXM
M F ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
795 ± 005

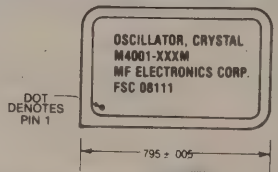
CRYSTAL OSCILLATOR
M1252-2M
MF ELECTRONICS CORP
1483

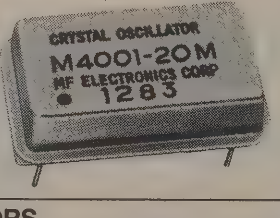

200 MAX
.215 MAX.
060 TYP
008/.025
.15 MIN.
018 ± 001
300 ± 005
.400
.600 ± 005
100 ± 005
Pin 1
Pin 7
300 ± 005
495 ± .005
150
250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON .48 x .18 CTRS.

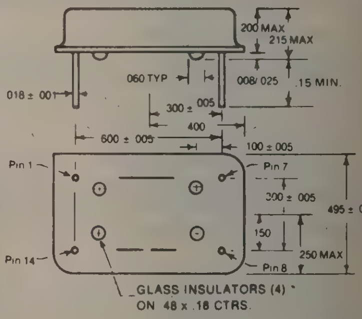
VERY HIGH/LOW TEMPERATURE/CRYSTAL CLOCK OSCILLATORS 1 MHz TO 30 MHz

Series	Stability	Temperature
M4001	±.05%	−55 to 200°C
M4002	±.05%	0 to 200°C
M4003	±.025%	−55 to 200°C
M4004	±.025%	0 to 200°C
M4005	±.025%	−55 to 175°C
M4006	±.025%	0 to 175°C
M4007	±.015%	−55 to 175°C
M4008	±.015%	0 to 175°C

- For use in Harsh Environments and "Downhole" applications.
- 8 Temperatur - Stability options.
- All-Metal welded package with Standoff Insulator.
- Area on PC board is one true DIL space - .495" X .795" max.
- Seated height less than 0.215", including insulator.
- Frequency from 1 MHz to 30 MHz.
- TTL and 5 volt CMOS compatible.
- Low Supply Current.

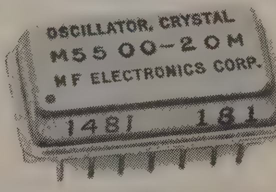

OSCILLATOR, CRYSTAL
M4001-XXXM
MF ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
795 ± 005

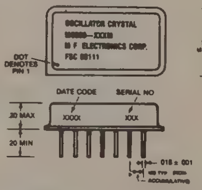

CRYSTAL OSCILLATOR
M4001-20M
MF ELECTRONICS CORP
1283

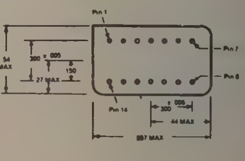

200 MAX
215 MAX
060 TYP
008/025
.15 MIN.
018 ± 001
300 ± 005
400
600 ± 005
100 ± 005
Pin 1
Pin 7
300 ± 005
495 ± 005
150
250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON 48 x .18 CTRS.

HIGH REL MILITARY CRYSTAL OSCILLATORS IN HERMETICALLY SEALED CASE SERIES M5500 • 250 KHz - 100 MHz

- Hermetically sealed resistance welded package
- Crystal specifically manufactured for oscillator with angle of cut controlled within ± 1 minute
- 168 hour Class B burn-in
- Simplified design with proprietary IC
- Capacitors to MIL-C-55681
- Extensive environment testing

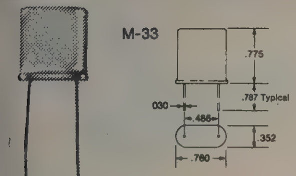

OSCILLATOR, CRYSTAL
M5500-20M
MF ELECTRONICS CORP.
1481
181

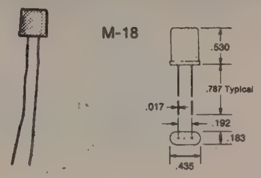

OSCILLATOR CRYSTAL
M5500-XXXM
M F ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
DATE CODE
SERIAL NO
XXXX
XXX
.20 MAX
.20 MIN
.018 ± .001
ACCUMULATIVE

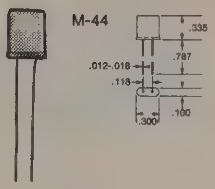

Pin 1
Pin 7
Pin 8
Pin 14
.54 MAX
.300 ± .005
.150
.27 MAX
.300 ± .005
.44 MAX
MAX

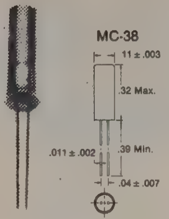
MF ELECTRONICS CORP.
10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570 • TWX: 710-563-0643

MONITOR MICROPROCESSOR CRYSTALS









roduct Type	Frequency (MHz)	Package Style	Effective Series Resistance (ohms)
M-33	1.000000	HC-33/U	1000
	1.843200		440
	2.000000		440
	2.097152		440
	2.457600		250
	3.276800		200
M-18	3.000000	HC-18/U	200
	3.579545		150
	3.686400		100
	4.000000		150
	4.032000		100
	4.194304		120
	4.915200		75
	5.000000		75
	5 068800		75
	5.120000		50
	5.185000		50
	5.714300		50
	5.990400		50
	6.000000		50
	6.144000		50
	6.400000		50
	6.553600		50
	8.000000		50
	10.000000		50
	10.240000		50
	11.000000		50
	12.000000		30
	14.318180		40
	15.000000		25
	16.000000		40

Product Type	Frequency (MHz)	Package Style	Effective Series Resistance (ohms)
MM-18	18.000000		40
	18.432000		40
	20.000000		40
	20.480000		40
	22.118400		40
	24.576000		40
	25.000000		40
	28.356900		40
	48.000000		40
MM-44	*6.000000	HC-44/U	60
	*6.144000		60
	*6.400000		60
	*6.553600		60
	*8.000000		60
	10.000000		60
	10.240000		60
	*11.000000		60
	*14.318180		60
	16.000000		60
	*18.000000		60
	*18.432000		60
	20.000000		60
	*20.480000		60
	*22.118400		60
	*24.576000		60
	*28.356900		60
	*48.000000		60
MC-38	32.768 KHz	NA	40,000

Note: *Not generally stocked

IN STOCK FREQUENCIES AT MONITOR PRODUCTS

ORDERING INFORMATION

Specify: (1) Monitor Package Size
(2) Designator Call out
(3) Frequency
(4) Quantity

DESIGNATOR EXPLANATION

N = 20 pf, parallel resonant
O = 30, 32 pf, parallel resonant
S = series resonant
M = 10-15 pf, parallel resonant
Q = 24 pf

Optional 3rd Lead Available

MONITOR'S ELECTRICAL SPECIFICATIONS

Frequency Calibration Tolerance:	Frequency Stability Tolerance:
MM-33 ± 50 PPM at 25°C	MM-33 ± 50 PPM at − 10°C to + 60°C
MM-18 ± 30 PPM at 25°C	MM-18 ± 30 PPM at − 20°C to + 70°C
MM-44 ± 30 PPM at 25°C	MM-44 ± 30 PPM at − 20°C to + 70°C

Standard stock parallel resonant 20 pf = designator N after package
Call out example MM18N
MM18N standard
± 30 PPM − 20°C to + 70°C, ± 30 PPM @ 25°C
Standard stock parallel resonant 20 pf = designator N after package
Call out example MM33N
MM33N standard
± 50 PPM − 10°C to + 60°C, ± 50 PPM @ 25°C
Standard stock parallel resonant 20 pf/32 pf = designator N or O after package
Call out example MM44N or MM44O
± 30 PPM − 20°C to + 70°C, ± 30 PPM @ 25°C

TL CRYSTAL OSCILLATORS

— 970 Series

INPUT CURRENT

FREQUENCY	MAX @ 25°C	MAX OVERTEMP
200 KHz-3.199 MHz	70 MA	90 MA
3.200 MHz-24.999 MHz	30 MA	40 MA
25.000 MHz-70.000 MHz	50 MA	70 MA

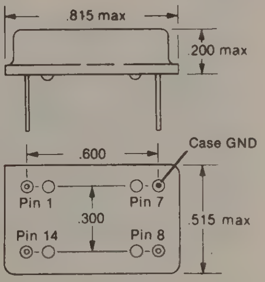
RISE AND FALL TIMES (0.4-2.4 VDC LEVEL)

FREQUENCY	RISE & FALL TIME MAX
200 KHz-8.999 MHz	15 NS
9.000 MHz-31.999 MHz	10 NS
32.000 MHz-70.000 MHz	6 NS

In Stock Microprocessor Crystal Oscillators, TTL

FREQUENCY MHz	MPC/P/N	FREQUENCY MHz	MPC/P/N
1.00 MHz	970	10.00 MHz	970
1.8432 MHz	970	12.00 MHz	970
2.00 MHz	970	14.318180 MHz	970
2.4576 MHz	970	15.00 MHz	970
3.6864 MHz	970	16.00 MHz	970
4.00 MHz	970	18.432 MHz	970
4.9152 MHz	970	19.6608 MHz	970
5.00 MHz	970	20.00 MHz	970
5.0688 MHz	970	25.00 MHz	970
6.00 MHz	970	30.00 MHz	970
6.144 MHz	970	32.00 MHz	970
6.5536 MHz	970	40.0 MHz	970
8.00 MHz	970		

Note: Monitor's 970 oscillator is equivalent to K1100A, K1145A, K1114A, K1116A, 404 CMO-76-5, M1100, MC741A1, MXO-50-2, S15R5



Contact Monitor's CPU/Div. for a CMOS equivalent package.
Tel. 619-433-4510/910-322-1381

CMOS CRYSTAL OSCILLATORS

— 970C Series

970C Series Specifications

Frequency Range	Input Volt. & Min. Current	Max. Over Temp.	Stability
25 KHz-6.144 MHz	+ 5V - 2MA + 12V - 10MA	+ 5V - 5MA + 12V - 15MA	± 0.1%

Temperature Range: Operation, 0°C to 70°C
Storage, − 55°C to 125°C

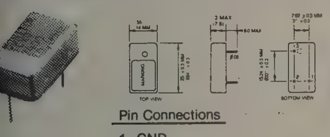
Input Voltage: (V_{DD}) + 4.5 VDC to + 12 VDC

Pin Connections: 1 - N/C; 7 - Case GND
8 - Output, 14 - + 5 VDC

In Stock Microprocessor Crystal Oscillators — CMOS

Frequency (MHz)	MPC P/N
3.6864 MHz	970 'C'
4.0 MHz	970 'C'
4.096 MHz	970 'C'
4.194304 MHz	970 'C'
4.9152 MHz	970 'C'
5.24288 MHz	970 'C'
6.0 MHz	970 'C'

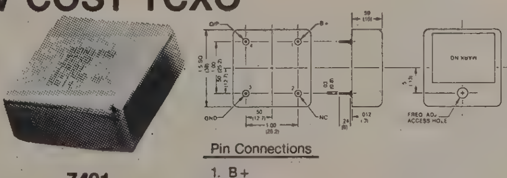
COMMERCIAL/LOW COST TCXO



Pin Connections

1. GND
2. Output
3. Vcc (+5V)

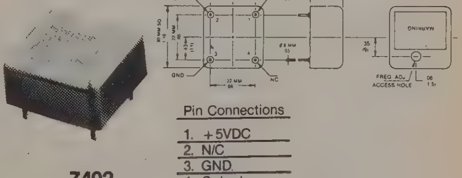
7400



7401

Pin Connections

1. B+
2. N/C
3. GND
4. Output



7402

Pin Connections

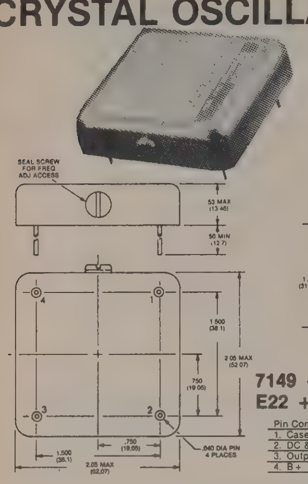
1. +5VDC
2. N/C
3. GND
4. Output

PC P/N	Frequency Range		Freq. TOL. (PPM) vs. Temp. Range Includes Calibration @ 25°C			Output	Optional	Features
		0°C To + 55°C	+ 15°C To + 35°C	− 10 To + 60°C	− 20 To + 70°C			
00	5.0 MHz-20.0 MHz	± 1 PPM	± 0.5 PPM	± 2 PPM		TTL	NA	Low Cost
01	1.0 MHz-20.0 MHz	± 1 PPM	NA	± 1 PPM	± 2 PPM	TTL	CMOS/Sinewave	Low Power Consumption
		− 25°C To + 60°C	− 20°C To + 70°C	− 35°C To + 75°C				
02	1.0 MHz-20.0 MHz	± 1.5 PPM	± 2 PPM	± 3 PPM		TTL	NA	High Long Term Stability

MONITOR PC
MONITOR PRODUCTS
COMPANY, INC.

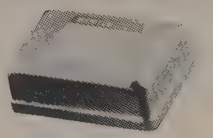
P.O. Box 1966
502 Via Del Monte
Oceanside, CA 92054
Phone: (619) 433-4510
TWX: (910) 322-1381

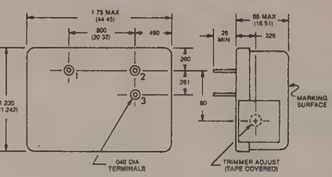
CRYSTAL OSCILLATORS TEMPERATURE COMPENSATED (TCXO)


SEAL SCREW FOR FREQ ADJ ACCESS
53 MAX (13 46)
50 MIN (12 7)
4
1
3
2
1 500 (38 1)
2 05 MAX (52 07)
750 (19 05)
.750 (19.05)
1.500 (38.1)
2.05 MAX (52,07)
.040 DIA PIN 4 PLACES

7149 +5VDC
E22 +12VDC

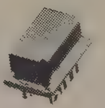
Pin Connections
1. Case Gnd.
2. DC & RF Gnd.
3. Output
4. B+

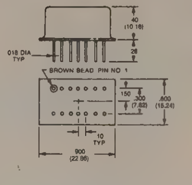



1 75 MAX (44 45)
.800 (20 32)
490
1 230 (31 242)
1
2
3
260
261
80
040 DIA TERMINALS
25 MIN
65 MAX (16 51)
325
MARKING SURFACE
TRIMMER ADJUST (TAPE COVERED)

7093 +5VDC
7153 +12VDC

Pin Connections
1. RF Output
2. B+
3. Case/RF COM

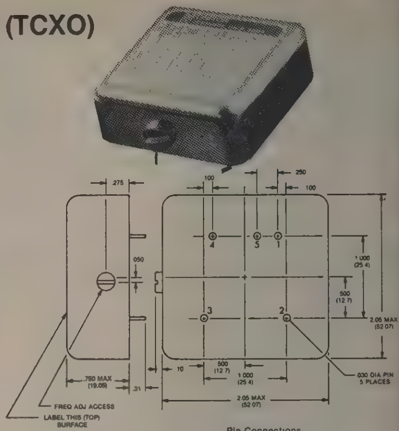



40 (10 16)
26
018 DIA TYP
BROWN BEAD PIN NO 1
150
.300 (7.62)
.600 (15.24)
10 TYP
900 (22.86)

7166 +5VDC

14 PIN DIP COMPATIBLE

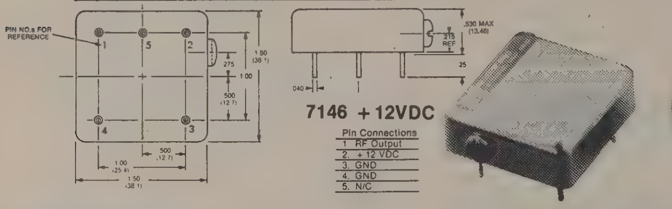
Pin Connections
1. Tuning Cap.
7. COM (Gnd.)
8. Output
14. +5VDC


275
100
250
100
4
5
1
3
2
050
1 000 (25 4)
500 (12 7)
2.05 MAX (52 07)
10
500 (12 7)
1 000 (25 4)
.750 MAX (19.05)
.31
2.05 MAX (52 07)
.030 DIA PIN 5 PLACES
FREQ ADJ ACCESS
LABEL THIS (TOP) SURFACE

7150 +9-12VDC

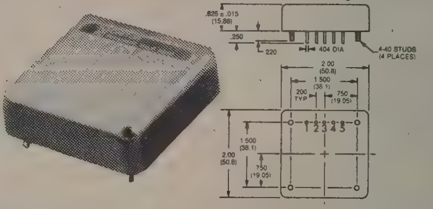
Pin Connections
1. RF Output
2. B+
3. B−
4. Case
5. RF Return

MPC P/N	Frequency Range	Freq. TOL (PPM) vs. Temp. Range (°C) Includes Calibration at +25°C	≥= greater than or equal				Output	*Optional	Features
		0 To 50	0 To 70°C	− 20 To +70°C	− 40 To 70°C	− 55 To + 85			
E22 7149	200 KHz-20.0 MHz	≥± .5 PPM	≥± .5 PPM	≥± .5 PPM	≥± 1 PPM	≥± 1.5 PPM	TTL	Sinewave CMOS	Variety of Options
7153 7093	3.00 MHz-20.0 MHz	≥± .5 PPM	≥± .5 PPM	≥± 2 PPM	—	—	TTL	—	Low Cost
7166	10.0 MHz-16.0 MHz	≥± 5 PPM	—	—	—	—	TTL	—	Outside Trimmer 14 Pin Dip
7150	1.00-10.0 MHz	≥± .5 PPM	≥± .5 PPM	≥± .5 PPM	≥± 1 PPM	≥± 1.5 PPM	CMOS	TTL Sinewave	Low Power Consumption
7146	3.00-20.0 MHz	≥± .5 PPM	≥± 1 PPM	≥± 1 PPM	≥± 1.5 PPM	—	TTL	—	Small Size
7113 (VCXO)	20.0-55.0 MHz	≥± 20 PPM	≥± 20 PPM	—	—	—	TTL	—	Voltage Control Unit
7112 (VCXO)	6.0-20.0 MHz								


PIN NO.s FOR REFERENCE
1
5
2
4
3
275
1 50 (38 1)
1 00
500 (12 7)
500 (12 7)
1 00 (25 4)
1 50 (38 1)
.530 MAX (13.46)
215 REF
25
040

7146 +12VDC

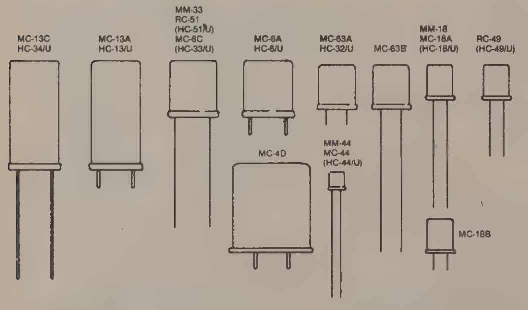
Pin Connections
1. RF Output
2. +12 VDC
3. GND
4. GND
5. N/C


.625 ± .015 (15.88)
.250
220
404 DIA
4-40 STUDS (4 PLACES)
2 00 (50.8)
1 500 (38 1)
200 TYP
750 (19 05)
1 2 3 4 5
1 500 (38.1)
2.00 (50.8)
750 (19 05)

7112 (VCXO)
7113 (VCXO)

Pin Connections
1. +5 VDC
2. Output
3. GND
4. +12 VDC
5. VC

CRYSTALS


MC-13C HC-34/U
MC-13A HC-13/U
MM-33 RC-51 (HC-51/U) MC-6C (HC-33/U)
MC-6A HC-6/U
MC-63A HC-32/U
MC-63B
MM-18 MC-18A (HC-18/U)
RC-49 (HC-49/U)
MC-4D
MM-44 MC-44 (HC-44/U)
MC-18B

STANDARD HIGH FREQUENCY CRYSTALS 1 MHz - 75.0 MHz

Monitor's AT cut crystals provide suitable capabilities for satisfying 80-90% of all crystal requirements. Preferred for high frequency oscillator control wherever wide variation of temperature is encountered. It can be readily mounted to meet stringent environmental applications.

HIGH FREQUENCY CRYSTALS

Cut	Frequency Range	Series Resistance Range in ohms	Typical L_1 in henries	Typical C_0 in pf	Typical C_1 in pf	Average Capacity Ratio	Recommended Drive Level in mw	Delta F in %	Aging Typical X 10^8 per day after			Holder
									1 wk	5 wks	10 wks	
AT_1	1.5 - 2.9 MHz	15-400	.8	3	.008	300	.1	.15	6	2	.7	MC-6 RC 51 MC 33 MM 33
AT_1	3.0 - 24.9 MHz	5- 75	01	4	.015	225	.05	20	7	3	.8	
AT_3	25 - 60 MHz	10- 50	.01	5	.002	2100	.05	.02	7	3	.8	
AT_1	2.0 - 4 9 MHz	10-400	.5	3	.008	325	.1	.15	6	2	.7	MC-63
AT_1	5 0 - 15 MHz	5- 80	.01	4	.012	250	.05	.20	7	3	.8	
AT_3	20 - 45 MHz	10- 50	.015	5	.002	2300	.05	.02	7	3	.8	
AT_1	3.0 - 4 9 MHz	10-150	.1	3	.008	300	.05	.15	6	2	.7	MC 18 RC-49 MM18
AT_1	5 0 - 24 9 MHz	5-100	.008	4	.012	250	.05	.20	7	3	.8	
AT_3	25 75 MHz	10- 50	.007	5	.002	2500	.05	.02	7	3	.8	
AT_1	10 - 25 MHz	15- 60		3	010	275	05	20	10	4	1	MC44 MM44

ENVIRONMENTAL DATA

STANDARD UNITS: Monitor's standard units are built to comply with the requirements as set forth by Table II, Mil-C-3098, per the following:

1. Insulation Resistance: 500 megohms as tested in accordance with Mil-Std-202, Method 302
2. Shock. 100 G's per Method A, Paragraph 4.7.7 1, Mil-C-3098, tested in accordance with Method 202, Mil-Std-202
3. *Vibration: Mil-Std-202, Method 204, Test Condition A, 10 G's to 500 cycles
4. Leakage: 1 × 10^{-8}ccm/sec helium leak rate
5. Immersion. 500 megohms as tested in accordance with Mil-Std-202, Method 104, Test Condition B
6. Salt Spray: Mil-Std-202, Method 101, Test Condition B.
7. Moisture Resistance: Mil-Std-202, Method 106, with exceptions as listed under Paragraph 4.7.14, Mil-C-3098
8. Aging: Paragraph 4.7.15, Mil-C-3098

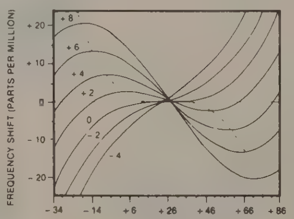
*Only applies to units mounted in Monitor's types MC-6, MC-18, MC-63, RC-51, RC-49

STANDARD FREQUENCY TOLERANCE

±.005%, 0°C to + 60°C
Special closer tolerances available upon request.

TEMPERATURE COEFFICIENT CHART

F in ppm vs angle of cut



STANDARD CRYSTALS DIMENSIONS, MOUNTING AND MECHANICAL DATA

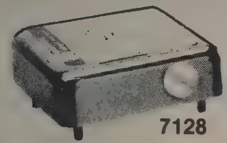
MONITOR TYPE	MILITARY TYPE	DIMENSIONS IN INCHES AND METRIC											
		A Length		B Width		C Pin Length		D Pin Spacing		E Pin Diameter		F Thickness	
MC-4D		1.290	32 77	1 175	29.85	238	6 05	486	12 34	050	1 27	465	11 81
MC-6A	HC-6/U	775	19 69	757	19 23	238	6 05	486	12 34	050	1 27	352	8 94
MC-6C MM-33	HC-33/U	.775	19.69	.757	19.23	1.500	38.10	.486	12.34	.030*	.762	352	8 94
MC-6CBKL		775	19 69	757	19 23	1 500	38.10	.486	12 34	030	762	352	8 94
MC-63A	HC-32/U	640	16 26	567	14 40	238	6 05	275	6 99	040	1 02	237	602
MC-63B		640	16.26	.567	14.40	1.500	38.10	.275	6.99	.018*	.460	237	.602
MC-18A MM-18	HC-18/U	530	13.46	435	11.05	1 500	38.10	.192	4 88	018	460	.183	4 65
MC-18B	HC-25/U	530	13 46	.435	11 05	238	6.05	192	4 88	040	1 02	183	4 65
MC-44 MM-44	HC-44/U	300	762	290	7 37	750	19 05	115	2 92	014	355	100	2 54
MC-13A	HC-13/U	1 526	38.76	757	19 23	238	6 05	486	12 34	050	1 27	352	8 94
MC-13C	HC-34/U	1 526	38 76	757	19 23	1 500	38 10	486	12 34	030*	762	352	8 94
MC-13CBKL		1 526	38 76	757	19 23	1 500	38 10	486	12 34	030	762	352	8 94
RC-49	HC-49/U	530	13 46	435	11 05	750	19 05	192	4 88	017	.430	183	4 65
RC-51	HC-51/U	.775	19.69	.757	19.23	1.500	38.10	.486	12.34	.030	.762	.352	8 94

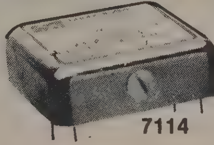
MONITOR
PC
MONITOR
PRODUCTS
COMPANY, INC.

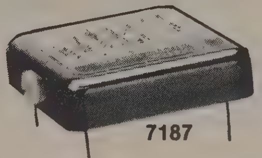
P.O. Box 1966
502 Via Del Monte
Oceanside, CA 92054
Phone: (619) 433-4510
TWX: (910) 322-1381

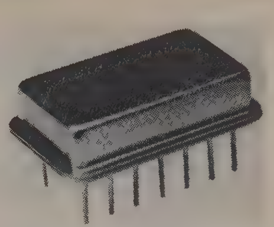
MONITOR PRODUCTS
FIFTY-SEVEN YEARS IN FREQUENCY CONTROL

HI-REL OSCILLATORS — MILITARY

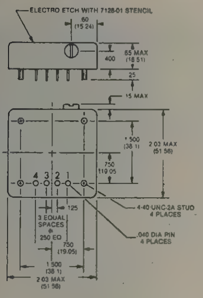


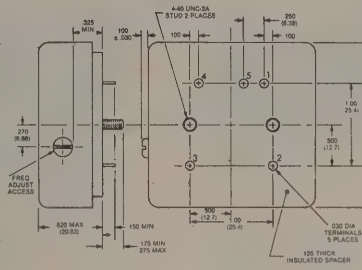


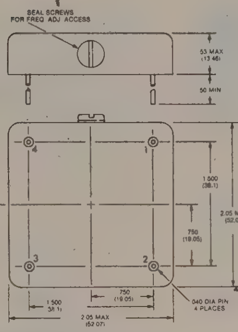


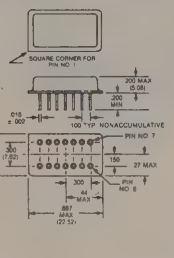


5500-14/16/17
(QPL per MIL-0-55310)


ELECTRO ETCH WITH 7128-01 STENCIL
.60 (15.24)
400
.65 MAX (16.51)
25
.15 MAX
1.500 (38.1)
2.03 MAX (51.56)
750 (19.05)
4 3 2 1
125
3 EQUAL SPACES @ 250 EQ
750 (19.05)
1.500 (38.1)
2.03 MAX (51.56)
4-40 UNC-2A STUD 4 PLACES
.040 DIA PIN 4 PLACES


4-40 UNC-2A STUD 2 PLACES
.325 MIN
100 ±.030
100
250 (6.35)
100
2.00 SQ (50.8)
4 5 1
1.00 (25.4)
270 (6.86)
500 (12.7)
3 2
FREQ ADJUST ACCESS
820 MAX (20.83)
150 MIN
175 MIN 275 MAX
500 (12.7)
1.00 (25.4)
030 DIA TERMINALS 5 PLACES
125 THICK INSULATED SPACER


SEAL SCREWS FOR FREQ ADJ ACCESS
53 MAX (13.46)
50 MIN
4 1
1.500 (38.1)
2.05 MAX (52.07)
750 (19.05)
3 2
1.500 (38.1)
750 (19.05)
2.05 MAX (52.07)
040 DIA PIN 4 PLACES


SQUARE CORNER FOR PIN NO 1
200 MAX (5.08)
.200 MIN
.018 ±.002
100 TYP NONACCUMULATIVE
PIN NO 7
54 MAX (13.72)
300 (7.62)
150
27 MAX
300
PIN NO 8
44 MAX
887 MAX (22.52)

Pin Connections	Pin Connections	Pin Connections	Pin Connections
1. +15VDC	1. RF Output 5. RF Return	1. Case Gnd.	1. thru 6. NC 14. B+
2. Common	2. B+	2. DC & RF Gnd.	7. B– (Case Gnd.)
3. Output	3. B– Common	3. Output	8. Output
4. +5VDC	4. Case	4. +5VDC	9. THRU 13. NC

*Other PIN connections per slash sheet of MIL-0-55310

MPC P/N	Frequency Range	Freq. TOL. (PPM) vs. Temp. Range (°C) Includes Calibration at 25°C			Output	Optional	Features
		-30 To +70°C	–40 To +85°C	–55 To +100°C			
7128	1.0-16.0 MHz	≥± 1.5 PPM	≥± 2 PPM	≥± 5 PPM	CMOS	—	MIL-STD-202, Method 213
7114	1.00 MHz-2.0 MHz	≥± 1 PPM	≥± 2 PPM	≥± 5 PPM	CMOS	Frequencies to 16.0 MHz TTL, Sinewave	Extended Temp Range
7187	200 KHz-20.0 MHz	± 1 PPM	± 2 PPM	≥± 5 PPM	TTL	Sinewave, CMOS	Environmental per MIL-STD 810, Method 514.2
5500	60 Hz-50.00 MHz	± 50 PPM-55°C To +125°C			TTL	—	*QPL per MIL-0-55310 Gold Plated Leads

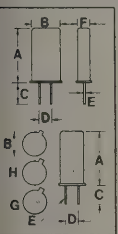
≥= greater than or equal *Other Pin Connections per MIL-0-55310/14 & 17 and stabilities ±30 PPM –20°C to +70°C
Screening per level S, B, or C per MIL-STD 883B.

HI-REL CRYSTALS — MILITARY

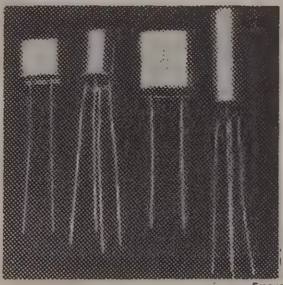
ENVIRONMENTAL DATA

Monitor's Koldweld units meet the following environmental specifications:

1. Leakage: 1 × 10^{-8}CC of Helium
2. Insulation Resistance: 500 Megohm MIL-STD-202, Method 302
3. Moisture Resistance: MIL-STD-202, Method 106 and MIL-C-3098.
4. Salt Spray: MIL-STD-202, Method 104B
5. Immersion: 500 Megohm MIL-STD-202, Method 104B


B
F
A
C
E
D
B
H
A
G
C
E
D

6. Vibration: (Specify one)
   - MIL-C-3098 (10G's 55 cps)
   - MIL-STD-202, Method 204A (10G's 500 cps)
   - MIL-STD-202, Method 204B (15G's, 2,000 cps)
   - MIL-STD-202, Method 204D (20G's, 2,000 cps)
   - Special 30G's to 3,000 cps
   - Normal Handling
7. Shock: (Specify one)
   - MIL-STD-202, Method 202B (100G's, 11 ms)
   - MIL-C-3098 4. 7. 7. 2. Method B
   - Normal Handling
8. Acceleration: (Specify one)
   - MIL-STD-202, Method 212A (100G's)
   - Normal Handling



KOLDWELD CRYSTALS STABILITY RELIABILITY

Monitor's KTO Series Frequency Control Crystals are an extension of Monitor's capability in applying KOLDWELD techniques to crystal packaging. These high reliability, low aging crystals offer precision frequency control in a subminiature package (TO-5 transistor package). The KX type crystals conform to the dimensions and requirements of standard military type HC holders and are ideally suited to extreme environments. The KX type can be used as replacements for standard HC-6, HC-18 and HC-13 mil-spec units.

Monitor also manufactures a complete line of crystals (HC-6/U, HC-18/U, HC-13/U, HC-25/U) to MIL-C-3098 (4 KHz - 200 MHz).

DIMENSIONS IN INCHES AND METRIC

MONITOR TYPE	A Length		B Width		C Pin Length		D Pin Spacing		E Pin Diameter		F Thickness		Weight Nominal (Grams)	Volume Nominal (Cubic Inch)	Seal
KX-6	775	19.685	765	19.431	238	6.045	.486	12.344	.050	1.270	.360	9.144	2.5	.160	Koldweld
KX 18	530	13 46	435	11 05	150	38 10	192	4 88	.018	457	183	4 65	.51	.031	Koldweld
KX 46	640	16 26	575	14 61	150	38 10	275	6.985	018	457	245	6.22	1.5	.080	Koldweld
KTO 2	1 5	38 1	380	9 652	1.5	38.1	.200	5.08	.017	.431	G		3.2	.108	Koldweld
KTO 3	1 0	25 4	380	9 652	1.5	38.1	200	5.08	017	431	G		2.4	.072	Koldweld
KTO 4	5	12 7	380	9.652	1.5	38.1	200	5 08	.017	431	G		1.4	.036	Koldweld
KTO 5	260	6 604	380	9.652	1.5	38.1	.200	5.08	.017	431	H		.8	.018	Koldweld
KTO-6	40	10 16	380	9 652	1 5	38 1	200	5 08	017	431	G		1 3	030	Koldweld
KTO-8	258	6 553	610	15 494	1 0	25 4	282	7 162	018	457	H		1 3	060	Koldweld

HOLDER MATERIAL, KTO-8 . . . . . .NICKEL
ALL OTHERS . . .OFHC
BASE MATERIAL, COPPER CLAD KOVAR
LEAD MATERIAL, KOVAR

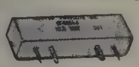
KOLDWELD SPECIFICATIONS

Cut	Frequency Range	Freq. Standard*	Toler. Available	Series Resistance Range in ohms	Typical L₁ in henries	Typical C₀ in pf	Typical C₁ in pf	Average Capacity Ratio	Recomm. Drive Level in mw	Aging Typical X 10⁸ per day after 1 wk	5 wks	10 wks	Holder
NT	90 175 KHz	9	4	5 50K	270	5 0	010	500	05	40	25	7	KX 6
DT	200 400 KHz	7	3, 4	5 5K	30	5 0	010	450	1	30	15	5	
DD	300 700 KHz	6	3, 4	2 5K	15	4 0	009	450	1	30	15	5	
CT	400 900 KHz	10	4	3 5K	10	3 0	006	500	1	35	20	6	
AT	1 5 - 5 0 MHz	5	2, 3, 4	10 - 300	8	3 0	008	300	1	3	1	2	
AT	5 0 25 MHz	5	1, 2, 3, 4	5 50	01	5 0	02	250	05	7	2	5	
AT	25 60 MHz	5	1, 2, 3, 4	10 60	01	5 0	002	2200	05	7	2	.5	
AT	2 0 - 2 499 MHz	6	3, 4, 5	50 300	8	3 0	008	400	1	5	2	2	KX 46 KTO-8
AT	2 5 4 9 MHz	5	1, 2, 3, 4	5 200	5	4 0	012	300	1	5	2	2	
AT	5 0 14 9 MHz	5	1, 2, 3, 4	5 50	01	5 0	02	250	05	7	3	5	
AT	15 30 MHz	5	1, 2, 3, 4	10 40	015	5 0	002	2200	05	7	3	5	
AT	3 0 4 9 MHz	6	3, 4, 5	10 150	1	3 5	012	300	05	7	3	5	KX 18A
AT	5 0 24 9 MHz	5	1, 2, 3, 4	10 75	008	5 0	02	250	05	7	3	5	
AT	25 75 MHz	5	1, 2, 3, 4	10 - 60	007	5 0	002	2200	05	7	3	5	
AT	7 0 - 25 MHz	5	1, 2, 3, 4	5 50	010	4 0	015	250	05	7	3	5	KTO-5
AT	25 75 MHz	5	1, 2, 3, 4	10 60	007	5.0	002	2200	.05	7	3	5	
NT	16 - 100 KHz	9	4	5 - 100K	1000	7 0	008	800	05	40	25	7	KTO-2
5°X	90 120 KHz	10	4	5 3K	30	6 0	010	500	1	40	25	7	
NT	60 - 200 KHz	9	4	5 75K	270	5.0	010	500	05	40	25	7	KTO-3
5°X	120 325 KHz	10	4	.8 - 4K	10	4 0	030	130	.1	35	20	6	
DD	325 600 KHz	6	3, 4	5 5K	20	4 5	010	450	1	30	15	5	
5°X	350 455 KHz	10	4	1 - 6K	16	2 0	015	130	1	35	20	6	KTO-4
DT	450 500 KHz	9	4	1 5 - 6K	12	2 0	005	450	1	30	15	5	
DD	500 700 KHz	9	4	1 - 6K	9	3 0	017	450	.1	30	15	5	
CT	600 900 KHz	10	4	1 - 6K	8	2 0	004	450	1	35	20	6	KTO-6

1. ±.0025% –55°C to +105°C ±.002% oven calibration
2. ±.003% –55°C to +105°C ±.002% oven calibration
3. ±.001% AT SPECIFIC TEMP. ±.002% oven calibration
4. ±.002% AT SPECIFIC TEMP. ±.002% oven calibration
5. ±.005% –55°C to +105°C ±.002% oven calibration
6. ±.008% –40°C to +85°C ±.002% oven calibration
7. ±.01% –40°C to +85°C ±.002% oven calibration
8. ±.01% –55°C to +105°C ±.002% oven calibration
9. ±.012% –40°C to +70°C ±.002% oven calibration
10. ±.02% –40°C to +70°C ±.002% oven calibration

NOTE: UNITS AVAILABLE TO OPERATION TO 150°C
*STANDARD (All values average)

SPECIAL PRODUCTS*



FILTERS
Crystal & LC

FREQUENCY STANDARDS
Stabilities to ± 1 x 10⁹/day

OVENS
Crystal & Component
Several hundred Special Designs

Other Catalogs Available:

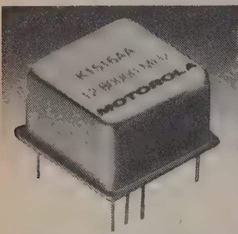
- Crystals
- Microprocessor
- Oscillator
- TCXO
- Filter
- Oven

MPC
MONITOR PRODUCTS COMPANY, INC.
P.O. Box 1966
502 Via Del Monte
Oceanside, CA 92054
Phone: (619) 433-4510
TWX: (910) 322-1381

MONITOR PRODUCTS
FIFTY-SEVEN YEARS IN FREQUENCY CONTROL

MOTOROLA INC.
Components Division
2553 N. Edgington • Franklin Park, Ill. 60131
312/451-1000 TWX: 910-255-4619 Telex: 4990104

TCXOs, Quartz Crystals
Monolithic Filters



MDO-2 Series

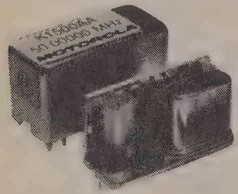
Inclusive ±2 ppm Stability, Full Hermetic Seal

The ±2 ppm frequency stability of the MDO-2 oscillator series is inclusive of voltage and humidity variations while operating over a wide temperature range from −35°C to +85°c. The all-metal welded package offers a full hermetic seal which keeps the oscillator on frequency in environmental extremes of temperature and humidity — high performance with small size (0.8″ x 0.8″ x .480″ high).

MDO-1 Series

±1 ppm Stability Full Hermetic Seal

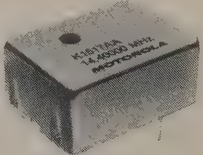
The MDO-1 Series oscillator is an ideal substitute for an ovenized oscillator in many applications while using considerably less space. The ±1 ppm stability is maintained over the full temperature range of −30°C to +90°C. The MDO-1 is contained in an all-metal, welded package for full hermetic seal and for minimized RFI.



MTO-2 Series

Small Size Low Power Consumption

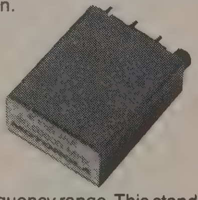
The MTO-2 oscillator series offers optimum performance in a package less than 0.16 cubic inches, making this oscillator ideal for those communication equipment applications in which low power consumption is required.



MTO-1 Series

Inclusive ±5 ppm Stability

The ±5 ppm frequency stability including supply voltage and load variations over the full operating temperature range of −30°C to +85°C makes the MTO-1 oscillator series ideal for those low cost applications in which maximum reliability is needed over an extended temperature range. Optionally available with tighter stability and with frequency modulation.

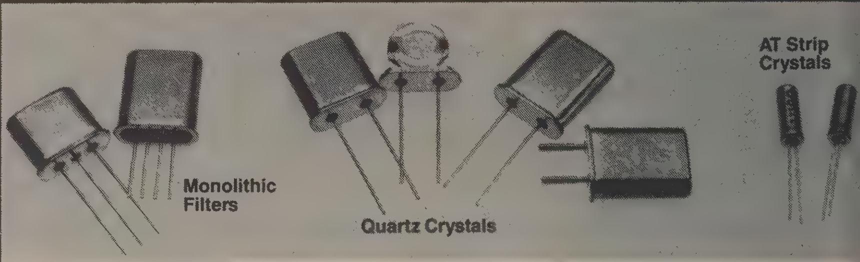


MSO-1 & 2 Series

The MSO oscillator series, specially designed for communications equipment, is available over a wide frequency range. This standup version uses minimal boardspace area. Tight stability and frequency modulation are optionally available.

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Specifications	MDO-1	MDO-2	MTO-1	MTO-2	MSO-1	MSO-2
Frequency (MHz)	10-20	10-20	10-20	45-60	10-20	44-88
Temp. Stability (ppm)	±1.0	±2	±5	±5	±2	±5
Temp. Range (°C)	−30 to +90	−35 to +85	−30 to +85	−30 to +60	−40 to +95	−30 to +70
Supply Voltage (Nom., Vdc)	10	10	10	8	10	5
Current Drain (Max., mA)	10	10	10	11	10	7
Dimensions (Inches) length width height	 1.780 1.170 0.790	 0.800 0.800 0.480	 1.160 0.860 0.560	 0.860 0.370 0.520	 0.755 0.365 0.953	 0.755 0.365 0.953
Freq. Adjust Range	Settable to 1 x 10⁻⁷					
Aging Rate (Typical)	1 x 10⁻⁶					

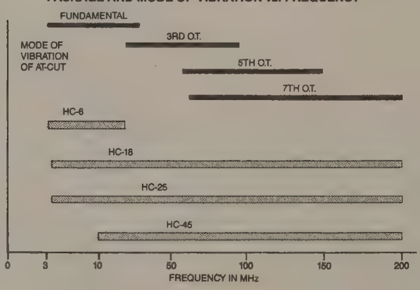


Quartz Crystals

Motorola is an integrated manufacturer of quartz frequency selectivity devices, with complete process control of all the manufacturing processes from growing of cultured quartz through sawing and lapping of the quartz plates to finishing the quartz into high quality crystals. Motorola quartz crystals are ideal for product applications that include FM radio communications equipment, microwave and satellite communications, as well as aerospace and military applications.

Freq. Stability: .0003% to .01%
Load Capacitance: series resonance 20 pF or 32 pF
Aging: ±2 ppm/year @ 25°C
Shock: meets or exceeds MIL C-3058 and MIL STD 883-B method 2002-2

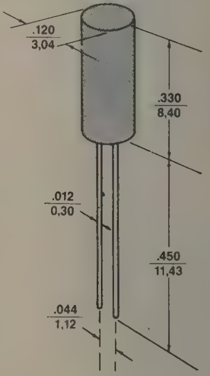
PACKAGE AND MODE OF VIBRATION vs. FREQUENCY



AT-Strip Resonator Crystals

The 3,0 x 8,4 mm AT strip resonator crystal package is volumetrically 75% smaller than the standard HC-45 package and 90% smaller than the HC-18, making the AT strip crystal well-suited for applications which require small size at low cost. It is available in the fundamental frequency range of 10 MHz to 20 MHz. Nominal aging characteristic at 25°C is ±2 ppm/yr.

Freq. Stability: .002% to .01%
Load Capacitance: 20 pF or 32 pF
Aging: ±2 ppm/year nominal
Shock: 5000g @ .3 msec duration



Monolithic Crystal Filters

The disciplines of physics, electrical engineering, and material science are combined with computer-aided Monte Carlo design techniques to create optimum state-of-the-art monolithic crystal filters. Several patented techniques have thus been developed to improve spurious response, stop-band rejection, and intermodulation levels. A broad capability exists to design discrete filters and monolithic filters from two to twelve poles, with frequency capabilities from 5 MHz to 200 MHz.

Motorola offers a complete line of standard filter models designed for use in communications equipment requiring IF filtering. Some of the more popular frequencies at 10.7 MHz, 21.4 MHz, and 45.0 MHz are readily available in a variety of package styles. Contact Motorola Components Division for further information and for specifications.

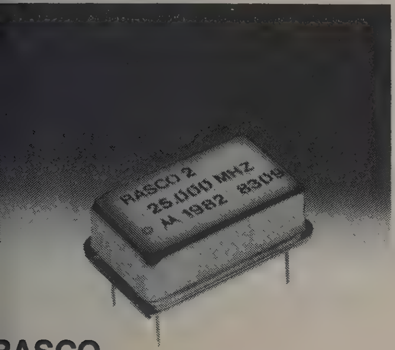
Ⓜ and Motorola are trademarks of Motorola Inc.
© 1984 by Motorola Inc.

MOTOROLA INC.

Components Division

2553 N. Edgington • Franklin Park, Ill. 60131
312/451-1000 TWX: 910-255-4619 Telex: 4990104

DATA CLOCK OSCILLATORS



ASCO Data Clock Oscillator TTL Compatible CMOS Compatible

ASCO oscillators are a new, high quality family f data clocks based on a custom integrated ciruit, making possible a drastic reduction in interal parts count. This reduction in discrete comonents results in greatly improved reliability. The ustom IC also provides several performance adantages: reduced current drain, improved output aveform, and ability to drive both CMOS and TTL gic. At frequencies from 3 to 25 MHz, RASCO locks are available in a variety of output capabilies and tolerances, as shown by the following:

MODEL IDENTIFICATION

RASCO 2 C S E

Stability —— 2
CMOS/TTL —— C
Symmetry —— S
Enable/Disable —— E

Stability — the number in this position signifies e frequency stability specification of the parcular model per the following chart:

MODEL	STABILITY
RASCO 0	±0.005%
RASCO 1	±0.01%
RASCO 2	±0.05%
RASCO 3	±0.1%
RASCO 4	±1.0%

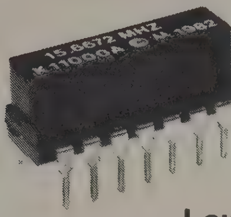
CMOS/TTL — models with TTL compatibility ave no designator here, while CMOS compatible odels are designated by the letter "C." Thus, a ASCO 3C is a CMOS-compatible model with 0.1% stability, and a RASCO 1 is TTL compatie with stability of ±0.01%

Symmetry — tight symmetry (45/55%) models e indicated by an "S" suffix. Models with no S" suffix have the standard 40/60% (worst case) mmetry specification.

Enable/Disable — the enable/disable feature indicated by an "E" suffix.

is possible for a model to require all 3 letter esignators; for example, a ±0.01% CMOSompatible model with tight symmetry and enble/disable would become model RASCO CSE.

Specifications subject to change without notice.
, Motorola, RASCO, K11000, K1144, K1149, and K1135
e trademarks of Motorola Inc. (c) 1984 by Motorola Inc.

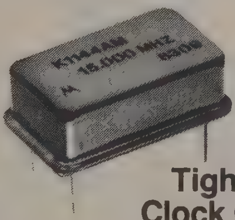


K11000 Low Cost DIP Crystal Clock Oscillator

The K11000 makes use of the proprietary custom integrated circuit developed for the RASCO oscillator. In addition, new, proprietary crystal technology allows the crystal to be miniaturized to a greater degree than previously considered practical. The new crystal also exhibits greater resistance to mechanical shock than contemporary designs. The crystal is contained in its own separate, hermetically-sealed metal enclosure; leads from the crystal are welded to the lead frame to ensure both electrical and mechanical integrity and are tin/lead plated to prevent corrosion.

The K11000 is available only in specific high volume frequencies: 12.0 MHz, 15.6672 MHz, 16.0 MHz, 16.257 MHz, 19.6608 MHz and 20.0 MHz. The availability of other frequencies will be dependent upon volume demand.

Frequency Stability (inclusive): ±0.05%
Operating Temperature Range: 0°C to +60°C
Input voltage: +5V dc ±5%
Voltage Stability: < ±3 ppm Typical
Input Current: Frequency Dependent (see graph, above right)



K1144AM Tight Stability Clock Oscillator

±0.0025% frequency stability over the range of 0°C to +70°C, suitable for most applications in data communications logic timing. This specification is inclusive of calibration tolerance, stability vs. input voltage change, stability vs. load change, aging and stability vs. shock and vibration. It is available in two frequency ranges: from 2.5 MHz to 20 MHz and from 44 MHz to 70 MHz. The K1144AM is available as CMOS compatible in the lower frequency range; it is available as TTL compatible in both frequency ranges.

FREQUENCY RANGE:
2.5 MHz to 20 MHz
44 MHz to 70 MHz

FREQUENCY STABILITY:
±.0025%

OPERATING TEMPERATURE RANGE:
0°C to 70°C

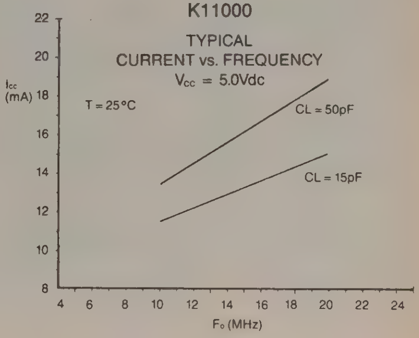
INPUT VOLTAGE:
+5V DC ±10%

RISE AND FALL TIMES:

	T_R and T_F
2.5 MHz to 20.0 MHz	8 ns max.
44.0 MHz to 70.0 MHz	6 ns max.

OUTPUT LOAD:

2.5 MHz to 20.0 MHz	1 to 10 TTL gates
44.0 MHz to 70.0 MHz	1 to 5 TTL gates



K1149AM
90.000 MHZ
8309

K1149AM ECL Compatible Crystal Clock Oscillator

The ECL-compatible K1149AM crystal clock oscillator is designed to drive devices with extremely high speed such as the MECL family. The K1149AM is enclosed in an all-metal, welded package which provides full hermetic seal. With pin 7 as case ground, the metal package also offers improved RF shielding.

Frequency Range: 60.0 MHz to 90.0 MHz
Frequency Stability: ±100 ppm
Operating Temperature Range: 0°C to +70°C
V_{EE} Supply Voltage: −5.2 ±5% typical
Duty Cycle: 50% typical
I_{EE} Supply Current: 28 mA typical, 60 mA max
Output Logic: "0": −1.8V typical
Output Logic "1": −0.9V typical
Rise Time (20%–80%):
1.0 ns typical, 2.0 ns max
Fall Time (20%–80%):
1.0 ns typical, 2.0 ns max

Baud Rate Generators +5V Only

K1135
DUAL BAUD RATE GENERATOR
MOTOROLA

K1135 Series

Enclosed in all-metal, welded packages, these generators need only a single, +5V input to provide the stable reference frequencies needed by serial interface devices such as UARTs, modems, teletypewriters, cassettes, etc. They feature choice of 2x16 output frequencies, direct UART/USRT compatibility, full duplex communications. Version B has an F_o output. Version C has F_o and F_o:4 outputs and has zero error at 19,200 baud.

EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

M·tron—more than just a responsible source for quality clock oscillators and quartz crystals!

In addition to providing you with products produced under superb quality control — with in-house test instrumentation including state-of-the-art TC and analytical equipment — M-tron can offer you additional advantages: (1) provide engineering assistance with specifications to circuit applications . . . (2) make excellent delivery . . . (3) serve you anywhere in the world.

For OEMs, M-tron utilizes computer design for efficient turnaround on prototypes. And, M-tron can custom-produce clocks and AT-Cut crystals to your specifications.

CLOCK OSCILLATORS

We utilize high-quality crystals to provide highly stable TTL and CMOS compatible logic signal sources in true hermetic, all-metal resistance welded packages. Custom-design capability. If you want specials, just ask.

	TTL*	CMOS
Frequency range	250 KHz to 60 MHz	750 Hz to 12 MHz
Frequency stability	± .01%	± .01%
Temperature range	0 to 70°C	0 to 70°C
Input voltage	+ 5V ± 10% VDC	+ 5V to + 15 VDC

Z80/Z8000 compatible and dual phase also available

*Standard frequencies available from stock.

0.815 x 0.515 x 0.20
(20.7 x 13 x 5 mm).
Lead length 0.25 (6.3mm)

HI-LO MICROPROCESSOR CRYSTALS
Hi Volume, Lo Cost

Frequencies listed are standard and available from stock in holders indicated. Any frequency from 1MHz to 100 MHz may be provided. Std. stability specifications are ± .005% @ 25°C and ± .005% of the 25°C reading from 0°C to + 70°C.

Frequencies (MHz)

MP-2 (HC-33U)		MP-1 (HC-18U)					
1.000000	3.276800	3.276800	5.000000	5.714300	6.553600	14.318180	20.480000
1.843200	3.579545	3.579545	5.017600	5.990400	8.000000	16.000000	22.118400
2.000000	4.000000	4.000000	5.068800	6.000000	10.000000	18.000000	24.576000
2.097152	4.194304	4.194304	5.120000	6.144000	10.240000	18.432000	28.356900
2.457600		4.915200	5.185000	6.400000	11.000000	20.000000	48.000000

OEM CRYSTALS

M-tron has the high quality, high volume production capability to produce for annual customer requirements. This can result in cost savings to you. Also, you are assured of delivery consistent with your production requirements. Initial deliveries can begin 6 to 8 weeks after receipt of your order.

Standard units, in quantities up to 200 units, are delivered from stock. Samples for new product applications can be delivered in just 4-5 weeks.

Frequency	1 MHz – 170 MHz
Accuracy	± 20 PPM @ 25°C
Stability	± 25 PPM – 20°C to + 70°C
Load capacity	18pf
Resistance:	500 Ohms @ 1 MHz 25 Ohms @ 15 MHz 120 Ohms @ 170 MHz
Holder type	Standard resistance weld and solder seal

MILITARY CRYSTALS

M-tron has maintained its military qualification and offers many QPL listed products. Write the factory for lists.

M-TRON ADVANTAGES

COMPUTER DESIGN, with programs for both crystals and oscillators, assures consistent, reliable designs. QUALITY CONTROL insures that we meet your specific requirements. ENGINEERING ASSISTANCE – Our engineering department is ready to assist in specifications of circuit analysis. WORLDWIDE DISTRIBUTION adds up to on-time delivery everywhere!

ASK ABOUT OUR SMD AND OTHER NEW PRODUCT LINES

M·tron

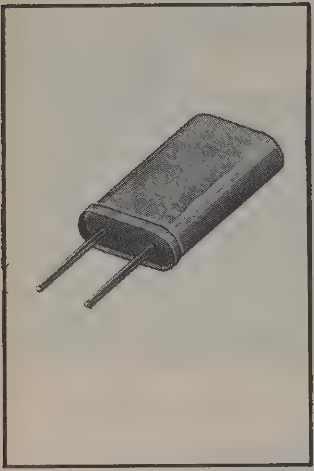
a recognized leader in quality Clock Oscillators and Quartz Crystals.

M-TRON INDUSTRIES, INC., P.O. Box 630, Yankton, SD 57078 • Phone: (605) 665-9321 • TWX: 910-668-3603

MI-14-2

crystals, crystal oscillators, crystal filters & ceramic resonators

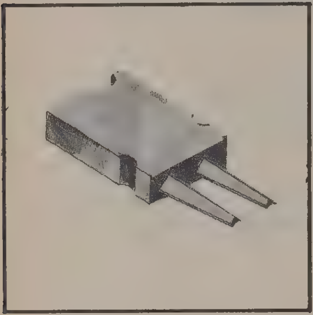
MURATA ERIE NORTH AMERICA, INC.



Crystals

Murata Erie North America, Inc. manufactures crystal cuts capable of handling the entire frequency spectrum from 1 KHz to 150 MHz. Specifications for crystals vary widely with regard to the equipment in which they are being used. Murata Erie manufactures to Military CR types and is qualified on the QPL list for most frequencies. It also manufactures crystals specifically to the customer's own specifications. Murata Erie welcomes the opportunity to quote on any type of crystal in solder seal, cold weld, and resistance weld holders.

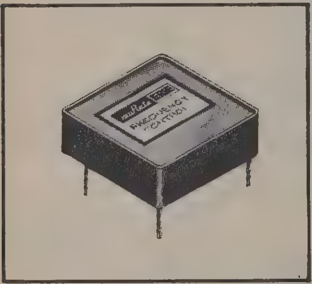
- Frequency Range: 1 KHz to 150 MHz
- Holders: HC-6, HC-13, HC-18, HC-25, HC-32, HC-35 (TO-5), HC-36, HC-39, HC-43, HC-44
- Seal: Cold Weld, Solder, Resistance Weld
- Microprocessor Types: 1 MHz to 100 MHz



Ceramic Resonators

Murata Erie's ceramic resonators derive their frequency selective capability from mechanical vibration resulting from a piezoelectric effect in the ceramic material. They are particularly useful in applications where extremely tight frequency tolerances are not required such as clock oscillators and audio tone generators. They are extremely reliable and low cost.

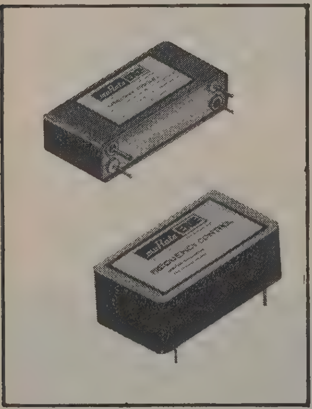
TYPE	CSA TYPE	CSB TYPE
Frequency Range	2.5 to 30 MHz	190 to 800 KHz
Vibration Mode	Thickness Vibration Fundamental	Area Vibration Fundamental
Frequency Tolerance	±0.3%	±0.3%
Temperature Stability (−20°C to +180°C)	±0.3%	±0.3%
Time Stability (10 years)	+0.5%	+0.5%
Equivalent Resistance	20 ohms max.	20 ohms max.



Crystal Oscillators

Murata Erie North America, Inc. manufactures a complete line of oscillators ranging from digital DIP clock oscillators to high stability, high reliability frequency sources. As a majority of our oscillators are custom designed, we welcome your inquiries and specifications. Write for our complete catalog.

- Frequency Range: 200 Hz to 600 MHz
- Size: .5″ x .8″ x .25″ to 2″ x 4″ x 1″
- Types: Clock (TTL, ECL, C/MOS or SINE). Integral Oven, Temperature Compensated, Voltage Controlled (VCO)
- Stability: From ±100ppm to ±3pp 10^8



Crystal Filters

Murata Erie North America, Inc. offers a complete line of sophisticated, discrete crystal filters ranging in frequency from 1 KHz to 100 MHz. In addition, we specialize in handling custom design specifications to fit your demanding applications. These high reliability units are rugged and compact, and can be designed to meet the environmental requirements of Mil-F-18327 in most cases.

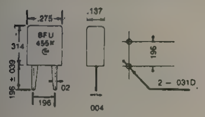
We invite your questions and encourage you to contact Murata Erie for your special design requirements.

- Center Frequency: 1 KHz to 100 MHz
- Bandwidth: .005% to 10% of F_o
- Shape Factor: As low as 1.25 to 1
- Ripple: Generally less than 1 dB
- Insertion Loss: Usually less than 3.0 dB
- Ultimate Attenuation: Up to 100 dB max
- Maximum Operating Temperature: −55°C to +105°C

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

ceramic filters

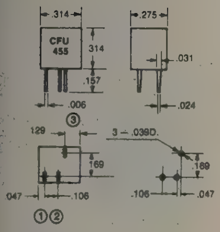
muRata ERiE
MURATA ERIE NORTH AMERICA, INC.


.275
.137
BFU 455K
.314
.196 ± .039
.02
.196
.004
.196
2 - .031D.

455 KHz Emitter Bypass

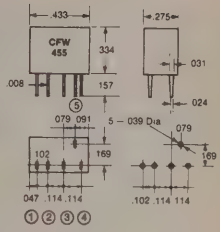
Model	Center Freq. (Fo)	3 dB Band Width	Resistance at Fo	Capacitance	Temperature Characteristics	Aging Stability	Withstanding Voltage
BFU455K	455 KHz ±2 KHz	8 KHz ±2 KHz	30 ohms Max.	550 pF ±20%	±0.4% Max. (−20°C∼+80°C)	Within ±0.5% for 10 years	50 VDC

455 KHz Multielement Filters for Communications


.314
.275
CFU 455
.314
.031
.157
.006
.024
③
.129
3 – .039D.
.169
.169
.047
.106
.106
.047
①②

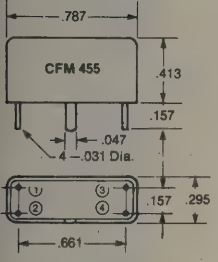
① = Input
② = Ground
③ = Output

Model	Center Frequency (KHz)	6 dB Band Width (KHz) min.	40 dB Band Width (KHz) Max.	50 dB Band Width (KHz) Max.	Attn. within 455 KHz ±100 Hz	Insertion Loss (dB) Max.	In, Output Impedance (Ω)
CFU455B2	455 ±2	±15	±30	—	27	4	1500
CFU455C2	455 ±2	±12.5	±24	—	27	4	1500
CFU455D2	455 ±1.5	±10	±20	—	27	4	1500
CFU455E2	455 ±1.5	± 7.5	±15	—	27	6	1500
CFU455F2	455 ±1.5	± 6	±12.5	—	27	6	2000
CFU455G2	455 ±1	± 4.5	±10	—	27	6	2000
CFU455H2	455 ±1	± 3	± 9	—	27	6	2000
CFU455I2	455 ±1	± 2	± 7.5	—	27	6	2000
CFW455B	455	±15	—	±30	35	4	1500
CFW455C	455	±12.5	—	±24	35	4	1500
CFW455D	455	±10	—	±20	35	4	1500
CFW455E	455	± 7.5	—	±15	35	6	1500
CFW455F	455	± 6	—	±12.5	35	6	2000
CFW455G	455	± 4.5	—	±10	35	6	2000
CFW455H	455	± 3	—	± 9	35	6	2000
CFW455I	455	± 2	—	± 7.5	35	7	2000

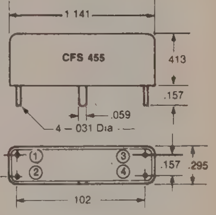

.433
.275
CFW 455
.334
.031
.008
.157
⑤
.024
.079 .091
5 – .039 Dia
.079
.102
.169
.169
.047 .114 .114
.102 .114 .114
①②③④

① = Input
② = Ground
③ = Ground
④ = Ground
⑤ = Output

Model	Center Frequency (KHz)	3 dB Band Width (KHz) Min.	6 dB Band Width (KHz) Min.	Ripple (dB) Max.	50 dB (CFM) 60 dB (CFR) Band Width (KHz) Max.	70 dB Band Width (KHz) Max.	Attn. within 455 KHz ±100 Hz	Insertion Loss. (dB) Max.	In, Output Impedance (Ω)
CFM455A	455	±13	±17.5	*	±30	—	50	3	1000
CFM455B	455	±10	±15	*	±25	—	50	3	1000
CFM455C	455	± 9	±13	*	±23	—	50	3	1000
CFM455D	455	± 7	±10	*	±20	—	50	3	1500
CFM455E	455	± 5.5	± 8	*	±16	—	45	5	1500
CFM455F	455	± 4.2	± 6	*	±12	—	45	5	2000
CFM455G	455	—	± 4	3	±10	—	45	5	2000
CFM455H	455	—	± 3	3	± 7.5	—	45	6	2000
CFR455A	455	±13	±17.5	*	±30	—	60	4	1000
CFR455B	455	±10	±15	*	±25	—	60	4	1000
CFR455C	455	± 9	±13	*	±23	—	60	4	1000
CFR455D	455	± 7	±10	*	±20	—	60	4	1500
CFR455E	455	± 5.5	± 8	*	±16	—	55	6	1500
CFR455F	455	± 4.2	± 6	*	±12	—	55	6	2000
CFR455G	455	—	± 4	3	±10	—	55	6	2000
CFR455H	455	—	± 3	3	± 7.5	—	55	7	2000
CFR455I	455	—	± 2	3	± 5	—	55	8	2000
CFS455A	455	±13	±17.5	*	—	±30	70	4	1500
CFS455B	455	±10	±15	*	—	±25	70	4	1500
CFS455C	455	± 9	±13	*	—	±23	70	4	1500
CFS455D	455	± 7	±10	*	—	±20	70	4	1500
CFS455E	455	± 5.5	± 8	*	—	±15	70	6	1500
CFS455F	455	± 4.2	± 6	*	—	±12	70	6	2000
CFS455G	455	—	± 4	3	—	± 9	70	6	2000
CFS455H	455	—	± 3	3	—	± 7.5	70	7	2000
CFS455I	455	—	± 2	3	—	± 5	70	8	2000
CFS455J	455	—	± 1.5	3	—	± 4.5	60	8	2000


.787
CFM 455
.413
.157
.047
4 – .031 Dia.
①
③
②
④
.157
.295
.661

① = Input ④ = Ground
② = Ground ③ = Output


1.141
CFS 455
.413
.157
.059
4 – .031 Dia.
①
③
②
④
.157
.295
.102

① = Input
② = Ground
③ = Output
④ = Ground

10.7 MHz Ceramic Filters for FM-Stereo

Model Specification	SFE 10.7MA5-Z	SFE 10.7MS2-Z	SFE 10.7MS3-Z	SFE 10.7MJ-Z	SFJ 10.7MA-Z	SFJ 10.7MA2-Z
Center Frequency	A:10.700 MHz ±30 KHz (Red) B:10.670 MHz ±30 KHz (Blue) C:10.730 MHz ±30 KHz (Orange) D:10.640 MHz ±30 KHz (Black) E:10.760 MHz ±30 KHz (White)					
3 dB Band Width KHz	280 ±50	230 ±50	180 ±50	150 ±50	280 ±50	230 ±50
20 dB Band Width KHz Max.	650	570	520	500	—	—
50 dB Band Width KHz Max.	—	—	—	—	750	700
Insertion Loss	6 dB Max.	6 dB Max.	7 dB Max.	10 dB Max.	7 ±2 dB	7 ±3 dB
Spurious Response (8∼12 MHz)	30 dB Min.	40 dB Min.	40 dB Min.	30 dB Min.	55 dB Min.	60 dB Min.
Input/Output Impedance	330 ohms	330 ohms	330 ohms	330 ohms	330 ohms	330 ohms
Temperature Range			−20∼+80°C			
Withstanding Voltage			50 VDC			
Dimensions		< Fig. 1 >			< Fig. 2 >	

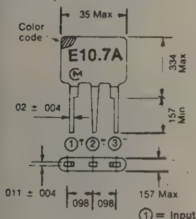

.35 Max
Color code
E10.7A
.334 Max
.02 ± .004
.157 Min
①②③
.011 ± .004
.098 .098
.157 Max

Fig. 3

① = Input
② = Ground
③ = Output

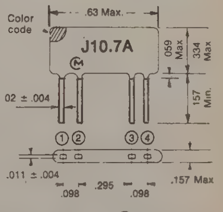

Color code
.63 Max.
J10.7A
.059 Max
.334 Max
.02 ± .004
.157 Min.
①②
③④
.011 ± .004
.295
.098
.098
.157 Max

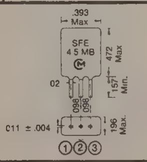
Fig. 4

① = Input
② = Ground
③ = Ground
④ = Ouptut

4.5 MHz Ceramic Filters for TV Sound

Specifications — SFE4.5MB

Nominal Center Frequency: 4.5 MHz. **3 dB Band Width:** ±60 KHz Min. **20 dB Band Width:** 530 KHz Max. **Insertion Loss:** 8.0 dB Max. **Spurious Response:** 20 dB Min. (within ±1 MHz). **Impedance:** 1000 ohms. **Temperature Range:** −20°C∼+80°C. **Withstanding Voltage:** 50 VDC.

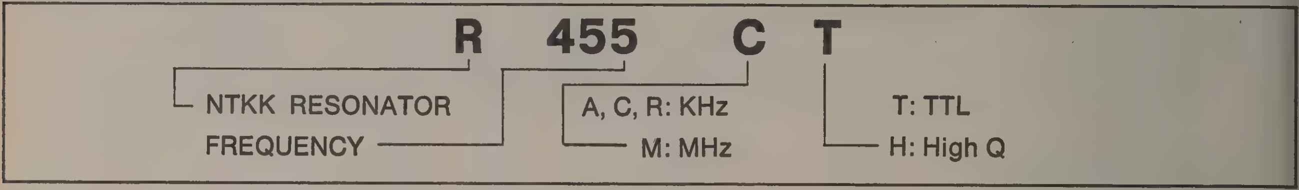

.393 Max
SFE 4.5 MB
.472 Max
.02
.157 Min.
.098 .098
.011 ± .004
.196 Max.
①②③

① = Input
② = Ground
③ = Output

TECHNICAL CERAMICS
NGK SPARK PLUGS (U.S.A.), INC.
1701 North Greenville Ave., #205 Richardson, TX 75081,
Phone: (214) 235-8332. TELEX: 170547UT

NTK CERAMIC RESONATOR

PART NUMBER CODE

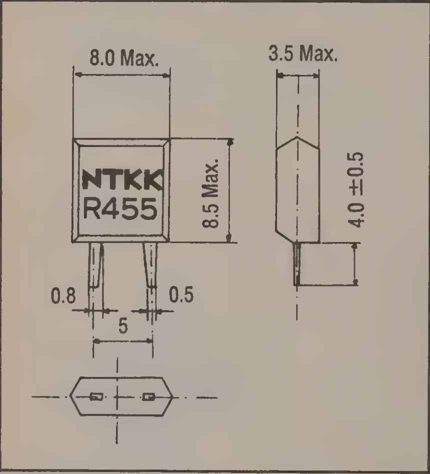

R 455 C T
NTKK RESONATOR
FREQUENCY
A, C, R: KHz
M: MHz
T: TTL
H: High Q

ELECTRICAL SPECIFICATION (Typical)

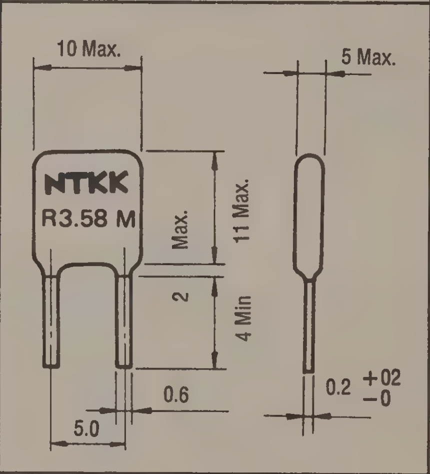
INITIAL FREQUENCY TOLERANCE: ±0.3%
TEMPERATURE STABILITY (−20°C to +80°C): ±0.3%
AGING STABILITY: ±0.3%

DIMENSIONS IN mm.

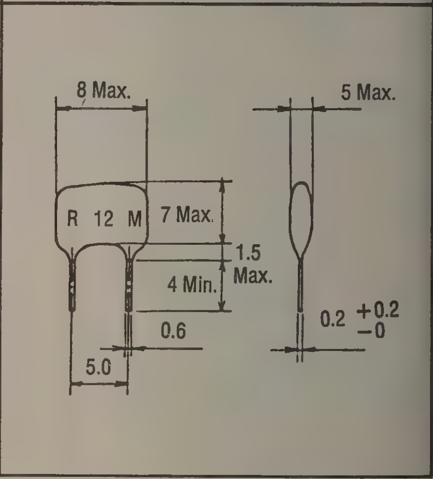
380-800 KHz


8.0 Max.
3.5 Max.
NTKK
R455
8.5 Max.
4.0 ±0.5
0.8
0.5
5

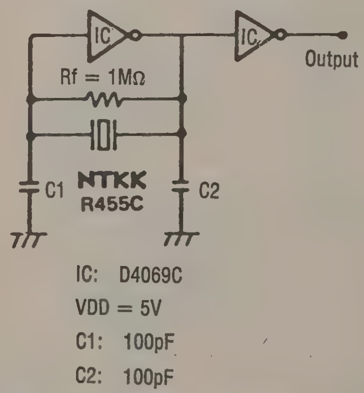
3.5-8 MHz


10 Max.
5 Max.
NTKK
R3.58 M
Max.
11 Max.
2
4 Min
0.6
5.0
0.2 +02 −0

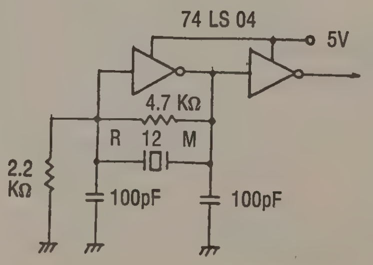
8-12 MHz

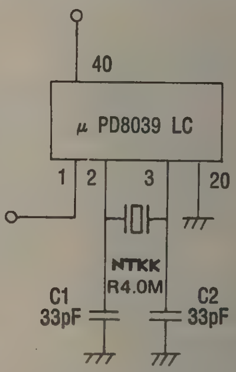

8 Max.
5 Max.
R 12 M
7 Max.
1.5 Max.
4 Min.
0.6
5.0
0.2 +0.2 −0

TYPICAL OSCILLATION CIRCUITS


IC
IC
Output
Rf = 1MΩ
C1
NTKK
R455C
C2

IC: D4069C
VDD = 5V
C1: 100pF
C2: 100pF


74 LS 04
5V
4.7 KΩ
R 12 M
2.2 KΩ
100pF
100pF

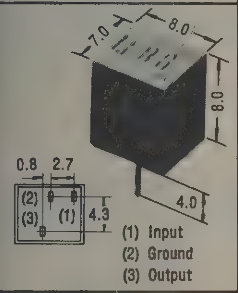

40
μ PD8039 LC
1
2
3
20
NTKK
R4.0M
C1
33pF
C2
33pF

NTK TECHNICAL CERAMIC DIVISION
NGK SPARK PLUGS (U.S.A.), INC.
1701 North Greenville Ave., Suite 205, Richardson, Texas 75081
Phone: (214) 235-8332 Telex: 170547UT

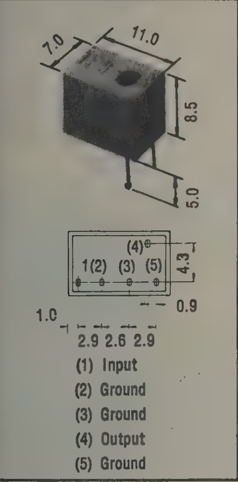
TECHNICAL CERAMICS
NGK SPARK PLUGS (U.S.A.), INC.
1701 North Greenville Ave., #205 Richardson, TX 75081,
Phone: (214) 235-8332. TELEX: 170547UT

NTK PIEZO CERAMIC FILTERS FOR COMMUNICATIONS

PLASTIC CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−40dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-B4	455	4	15	25	9	2
	LF-B6	455	6	18	25	8	2
	LF-B8	455	8	21	25	7	2
	LF-B10	455	10	23	25	6	2
	LF-B12	455	12	26	25	6	2
	LF-B15	455	15	30	25	6	2
	LF-B20	455	20	40	25	5	2
	LF-B25	455	25	50	25	5	2
	LF-B4S	455	4	15	35	7	2
	LF-B6S	455	6	18	35	6	2
	LF-B8S	455	8	21	35	6	2

7.0
8.0
8.0
4.0
0.8
2.7
(2)
(3)
(1)
4.3
(1) Input
(2) Ground
(3) Output

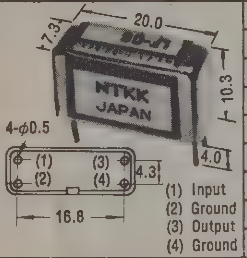
Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-H4	455	4	15	40	8	2
	LF-H6	455	6	18	40	6	2
	LF-H8	455	8	21	40	6	2
	LF-H12	455	12	24	35	6	2
	LF-H15	455	15	30	35	6	1.5
	LF-H18	455	18	36	35	6	1.5
	LF-H4S	455	4	14	45	9	2
	LF-H6S	455	6	16	45	8	2
	LF-H8S	455	8	19	45	7	2
	LF-H12S	455	12	24	40	6	2
	LF-H15S	455	15	30	40	6	1.5
	LF-H18S	455	18	36	40	6	1.5
	LF-K9	400	9	@60dB 18	60	5	1.5
	LF-K12	400	12	@60dB 24	60	5	1.5
	LF-K14A	455	14	@70dB 25	50	6	1.5
	LF-K15	400	15	@60dB 30	60	5	1.5

7.0
11.0
8.5
5.0
(4)
1(2)
(3)
(5)
4.3
0.9
1.0
2.9 2.6 2.9
(1) Input
(2) Ground
(3) Ground
(4) Output
(5) Ground

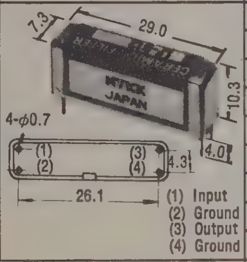
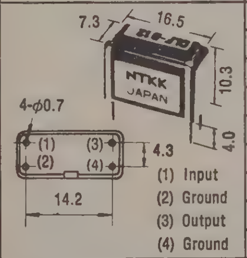
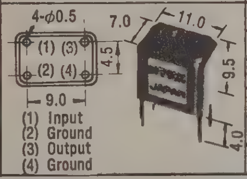
LOW GROUP DELAY FILTERS

Dimension	Item Model	Center Freq.	−3dB BW (KHz)	−60dB BW (KHz)	Attn. (455 ±100) Min. (dB)	G.D. (μsec.) Max.	I.L. Max. (dB)	In. Out. Imp. (KΩ)
Same as CLF-D Type	CLF-G6	455	6	20	60	35	20	1.5
	CLF-G16	455	16	40	60	20	10	1.5
	CLF-G28	455	28	70	60	15	10	1.5
	CLF-G36	455	36	90	60	10	10	1.5

METAL CASE FILTER

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-C4	455	4	12	40	9	2
	LF-C6	455	6	16	45	7	1.5
	LF-C8	455	8	20	45	6	1.5
	LF-C12	455	12	24	45	6	1.5
	LF-C15	455	15	28	45	6	1.5
	LF-C18	455	18	30	45	5	1.5
	LF-C20	455	20	38	50	5	1.5
	LF-C25	455	25	44	50	5	1
	LF-C30	455	30	50	50	5	1

7.3
20.0
NTKK
JAPAN
10.3
4-φ0.5
(1)
(2)
(3)
(4)
4.3
4.0
16.8
(1) Input
(2) Ground
(3) Output
(4) Ground

Dimensions Unit: mm	Item Model	Center Freq.	−6dB BW (KHz)	−70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In. Out. Imp. (KΩ)
	LF-D4	455	4	10	70	12	2
	LF-D6	455	6	15	70	10	1.5
	LF-D8	455	8	18	70	9	1.5
	LF-D12	455	12	22	70	8	1.5
	LF-D15	455	15	28	70	7	1.5
	LF-D18	455	18	34	70	6	1.5
	LF-D20	455	20	36	70	6	1.5
	LF-D25	455	25	44	70	6	1
	LF-D30	455	30	50	70	6	1
	CLF-D2	455	2	8	60	10	2
	CLF-D4	455	4	10	70	9	2
	CLF-D6	455	6	15	70	7	1.5
	CLF-D8	455	8	18	70	7	1.5
	CLF-D10	455	10	20	70	6	1.5
	CLF-D12	455	12	22	70	6	1.5
	CLF-D15	455	15	28	70	6	1.5
	CLF-D18	455	18	34	70	5	1.5
	CLF-D20	455	20	36	70	5	1.5
	SLF-D4	455	4	10	70	9	2
	SLF-D6	455	6	15	70	7	1.5
	SLF-D8	455	8	18	70	7	1.5
	SLF-D10	455	10	20	70	6	1.5
	SLF-D12	455	12	22	70	6	1.5
	SLF-D15	455	28	28	70	6	1.5

7.3
29.0
NTKK
JAPAN
10.3
4-φ0.7
(1)
(2)
(3)
(4)
4.3
4.0
26.1
(1) Input
(2) Ground
(3) Output
(4) Ground

7.3
16.5
NTKK
JAPAN
10.3
4.0
4-φ0.7
(1)
(2)
(3)
(4)
4.3
14.2
(1) Input
(2) Ground
(3) Output
(4) Ground

4-φ0.5
7.0
11.0
(1) (3)
(2) (4)
4.5
9.5
9.0
4.0
(1) Input
(2) Ground
(3) Output
(4) Ground

455 KHz Ceramic Discriminators (P/N D455) and MHz Filters (10.7 MHz, etc.) are also available.

APPLICATIONS

- Cordless Telephones
- Radios
- Transceivers

FEATURES

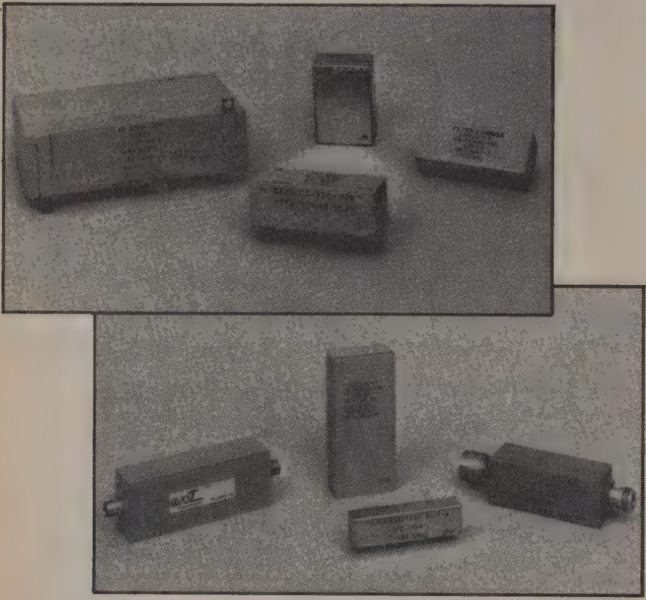
- Compact Size
- High Performance
- Low Insertion Loss

opt
INDUSTRIES INC.

300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

CUSTOM FILTERS
Engineering & Manufacturing

DISCRETE CRYSTAL FILTERS • LC FILTERS AND NETWORKS • MONOLITHIC CRYSTAL FILTERS



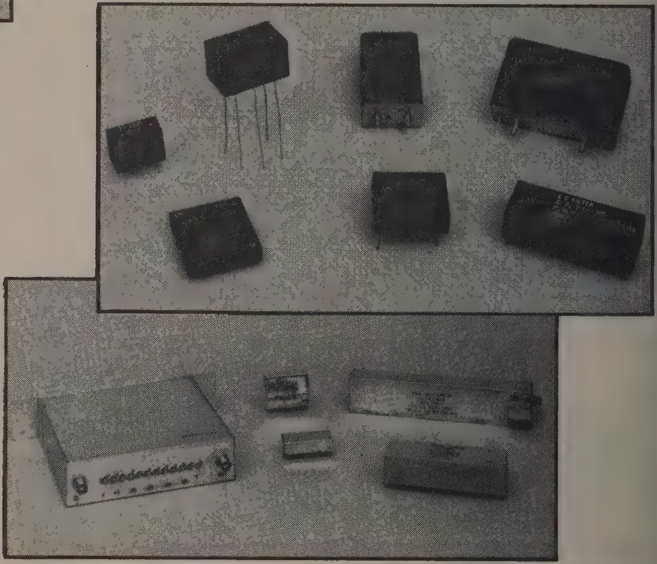
OPT is at the forefront of filter engineering as a result of company sponsored research and development in addition to the technology gained thru the acquisition of all engineering drawings and manufacturing rights from the following companies:

- Bulova Filter Co.
- Burnell & Co.
- Filtech
- Nytronics
- Omnitec
- Ortho Filter

Broad application experience supported by a library of computer synthesis, analysis and optimization programs, assist in supplying the best solution to specific requirements.

OPT is unique in being able to provide in depth engineering support on prototype development as well as quality controlled manufacturing capacity to supply high volume requirements.

Component stabilization procedures permit guaranteeing maximum stability with operating life. Areas of specialization include delay correction, phase matching and time domain synthesis.

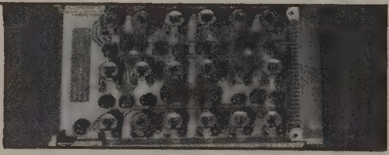


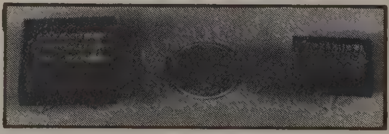
OPT's custom engineering and manufacturing capabilities for monolithic crystal filters range from 4.0 MHz to 30 MHz with relative bandwidths from .04% to .3% of center frequency. Discrete crystal filters range from 1 KHz to 70 MHz with relative bandwidths upwards from .005% of center frequency.

LC Filters and networks include low pass, band pass, high pass, band reject, amplitude and delay correcting, impedance matching in frequencies ranging from DC to 400 MHz with relative bandwidths higher than .2% of center frequency where design permits.

OPT's success in meeting and achieving new goals is reflected in our continued participation in many advanced military programs as well as high quality communication systems.

OPT, in addition to complying with MIL-F-18327 has on certain programs complied with MIL-Q-9858A requirements.





(Above) NASA high reliability bandpass filters for use in space shuttle telemetry system. Built to MIL-STD-810C, method 514.2, proc. 5, part 2, curve AH; shock MIL-STD-202, method 213B, cond. k; temp. −30°C to +75°C.

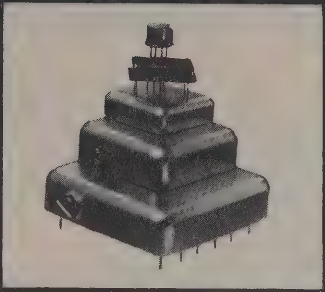
(Top Right) Phase and amplitude matched filters for sonobuoys and phased array sonars. Temp. −20°C to +65°C. Phase is matched over temperature to <3° for any number of channels.

(Bottom Right) Ultraminiature passive low pass filters stable over temperature. Used in codec inputs and secure communications CVDT's.

OSCILLATEK CORPORATION

620 N. LINDENWOOD AVE., OLATHE, KANSAS 66062
TEL: (913) 829-1777 TELEX: 437045

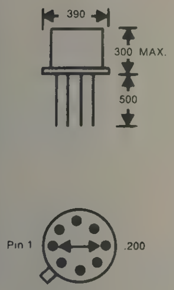
CRYSTAL CLOCK OSCILLATORS



TCXO's

- Crystal controlled thick film hybrid oscillators (XO's).
- Baud rate generators and microprocessor drivers.
- Screening per MIL-0-55310 and MIL-STD-883B is available.
- Temperature compensated crystal oscillators (TCXO's).
- Custom designed oscillators to meet your specifications.
- Standard frequencies are available from stock.

TO5

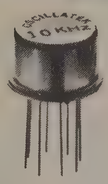


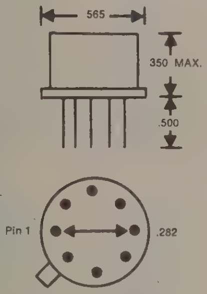
390
300 MAX.
500
Pin 1
.200

PIN 4 = GND
PIN 5 = OUT
PIN 8 = VCC
REST = NC/ITP

NOTE:
QPL'd to MIL-O-55310/09

TO8

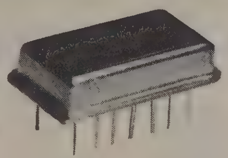




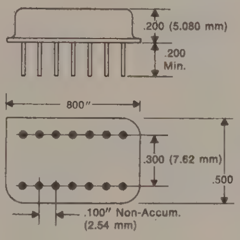
565
350 MAX.
.500
Pin 1
.282

PIN 4 = GND
PIN 5 = OUT
PIN 8 = VCC
REST = NC/ITP

DIP M87/M80/M76



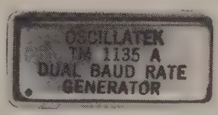
QPL'd to MIL-O-55310/16



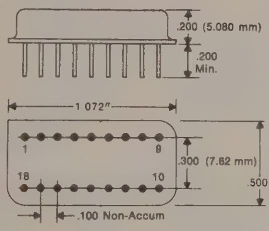
.200 (5.080 mm)
.200 Min.
800"
.300 (7.62 mm)
.500
.100" Non-Accum. (2.54 mm)

PIN 14 = VCC
PIN 8 = OUT
PIN 7 = GND
REST = NC/ITP
Military Pinouts are Available
Note: M87 = .87", M80 = .80", M76 = .76" Length

BAUD RATE GENERATORS



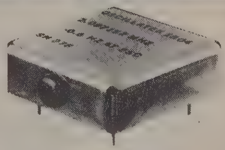
OSCILLATEK
TM 1135 A
DUAL BAUD RATE
GENERATOR

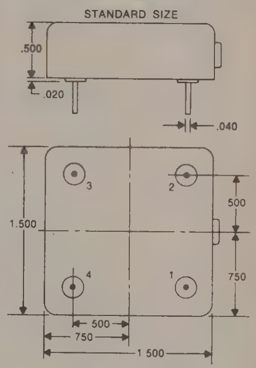


.200 (5.080 mm)
.200 Min.
1 072"
1
9
18
10
.300 (7.62 mm)
.500
.100 Non-Accum

PIN FOR PIN COMPATIBLE TO THE STD. PARTS AVAILABLE IN THE MARKET
Request Brochure for Details

TCXO





STANDARD SIZE
.500
.020
.040
1.500
3
2
4
1
500
750
500
750
1 500

PIN 1 = GND
PIN 2 = VCC
PIN 3 = OUT
PIN 4 = N-C
Non Std. Pinouts and Custom Designing is Available

NOTE:
(1) Very low current CMOS output at low frequency and at high frequency of up to 12 MHz is available specially at 5 Volts.
(2) Non-standard custom designing with multiple outputs, gated outputs, ECL outputs, very low frequency or very high frequency outputs is available. Consult factory.

TCXO's

STABILITY:
1. ±1 x 10^{-7} (0°C to 50°C)
2. ±2 x 10^{-7} (−20°C to 70°C)
3. ±5 x 10^{-7} (−40°C to 85°C)
4. ±1 x 10^{-6} (−55°C to 125°C)

VCXO's

STABILITY: ±.0001% to ±.01%
LINEARITY: ±1% to ±10%
DEVIATION: ±.001% to ±.1%

XO's

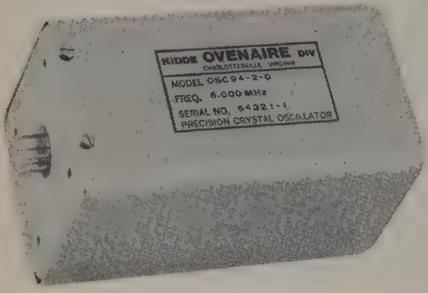
STABILITY:
1. ±5 x 10^{-6} (0°C to 50°C)
2. ±10 x 10^{-6} (−20°C to 70°C)
3. ±20 x 10^{-6} (−40°C to 85°C)
4. ±45 x 10^{-6} (−55°C to 125°C)

FREQUENCY RANGE: TTL = 1 Hz to 100 MHz; CMOS = .01 Hz to 30 MHz
ECL = 1 MHz to 100 MHz; SINEWAVE = 100 KHz to 100 MHz
SUPPLY: 5V to 30V (Current as low as 1.5 mA available)
STANDARD SIZES: 1" x 1" x .26", 1.5" x 1.5" x .5", 2" x 1" x .5", 2" x 2" x .5"
IN ADDITION TO OUR STANDARD PRODUCT LINE WE OFFER CUSTOM DESIGN CAPABILITY.

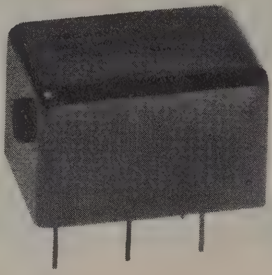
ovenaire oscillators

Ovenaire has the capabilities, experience and production techniques to meet the most exacting crystal oscillator requirements — from State-Of-The-Art Precision Crystal Oscillators to high volume, low cost TCXO's.
The following tables list condensed specifications on regular production models. For additional information on these and other crystal oscillators, call the Ovenaire factory.

PRECISION AND OVENIZED CRYSTAL OSCILLATORS



OSC94 SERIES



OSC85-1 SERIES

OSC49 SERIES

PRECISION CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC46-1A	1	2x10^{-8}/WK	2.2 Watts	+25VDC	Sine	75x75x93	−10°C to +60°C	2x10^{-10}/°C
OSC46-2A	1	2x10^{-8}/WK	2.2 Watts	+30VDC	Sine	75x75x93	−10°C to +60°C	2x10^{-10}/°C
OSC49-3	3 or 10	1x10^{-8}/WK	2.2 Watts	+28VDC	Sine	41x114x53	−15°C to +60°C	±7.5x10^{-9}
OSC49-5	10	4x10^{-9}/WK	2.2 Watts	+20VDC	Optional	(A) 51x51x54 (B) 49x75x54	0°C to +60°C	7x10^{-9}
OSC58-1	8 to 12		2.0 Watts	+13.2VDC ±15%	TTL or C'MOS	69x48x41	−10°C to +60°C	±1x10^{-8}
OSC74	7.5 to 15	1.5x10^{-8}/WK	2.0 Watts	+15VDC	TTL	(A) 64x81x32 (B) 51x51x79	−15°C to +60°C	3x10^{-10}/°C
OSC75	10	1x10^{-8}/WK	2.2 Watts	+28VDC	TTL	37x44x90	−40°C to +70°C	3x10^{-10}/°C
OSC78-12	5	2x10^{-8}/WK	0.6 Watts	+15VDC	TTL	65x75x114	0°C to +50°C	5x10^{-10}/°C
OSC94	5 or 10	7x10^{-9}/WK	1.8 Watts	+12VDC	Optional	54x54x97		±7x10^{-9}

OVENIZED CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage		Max. Size mm	Ambient Range	Ambient Stability
				OSC	Oven			
OSC11-3	1	1.5x10^{-7}/WK	3.5 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	5x10^{-9}/°C
OSC11-5	1	1.5x10^{-7}/WK	1.9 Watts	+12 or +24VDC	+12 or +24VDC	57x57x93	−30°C to +60°C	5x10^{-9}/°C
OSC11-7A	1 thru 20	5x10^{-7}/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	8x10^{-9}/°C
OSC11-7B	3 thru 8	5x10^{-8}/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	5x10^{-9}/°C
OSC29-32	12 to 22	8x10^{-7}/YR	2.5 Watts	+24VDC	+24VDC	37x48x90	−20°C to +60°C	±1x10^{-7}
OSC29-1	10 to 25	2x10^{-7}/WK	2.2 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	5x10^{-9}/°C
OSC29-2	2 to 10	1x10^{-7}/WK	2.7 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	2.5x10^{-9}/°C
OSC32-1	2 to 10	2x10^{-6}/YR	.54 Watts	+12VDC	+24VDC	51x51x70	0°C to +55°C	±2x10^{-8}
OSC44-1	2 to 40	1x10^{-6}/YR	1.6 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC	Choice of 3 Compact Packages, Octal or Solder Pin Mounting	−20°C to +60°C	±4x10^{-7}
OSC44-2	2 to 40	1x10^{-6}/YR	1.6 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−10°C to +60°C	±4x10^{-7}
OSC44-3	2 to 40	1x10^{-6}/YR	1.1 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	±3x10^{-7}
OSC44-4	2 to 40	1x10^{-6}/YR	1.1 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	±3x10^{-7}
OSC45	2 to 12	1x10^{-6}/YR	1.8 Watts	+9 to +28VDC	+9 to +28VDC	(A) 43x64x33 (B) 32x44x70	0°C to +55°C	±1x10^{-7}
OSC55	10 to 55	1x10^{-6}/YR	1.4 Watts	+28VDC	+28VDC	33x67x19	−20°C to +50°C	±1x10^{-6}
OSC70	22 to 120	2x10^{-6}/YR	2.2 Watts	+28VDC	+28VDC	37x48x90	−20°C to +60°C	±5x10^{-8}
OSC73-1	9 to 15	3.5x10^{-7}/YR	2.0 Watts	+15VDC	+15VDC	33x79x54	−30°C to +65°C	±7.5x10^{-8}
OSC73-2	2 to 6	5x10^{-7}/YR	2.0 Watts	+15VDC	+15VDC	47x68x35	−10°C to +65°C	±5x10^{-8}
OSC73-3	12 to 25	1.5x10^{-6}/YR	2.3 Watts	+20VDC	+20VDC	36x75x41	−30°C to +65°C	±1x10^{-7}
OSC83	7.2 to 13.2	1.5x10^{-6}/YR	2.2 Watts	+28VDC	+28VDC	37x48x84	−10°C to +55°C	±2x10^{-7}
OSC85-1-1	1 to 16	1x10^{-6}/YR	1.8 Watts	+5VDC	+24VDC	27x32x45	0°C to +60°C	±1x10^{-7}
OSC85-6-1	10 to 40	8x10^{-7}/YR	1.1 Watts	+12.6VDC	+12.6VDC	37x48x54	0°C to +65°C	±1x10^{-7}

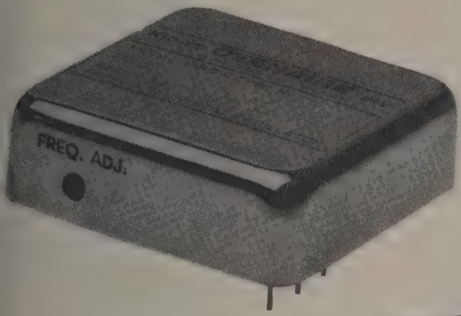
PCB MOUNT CRYSTAL OSOILLATORS

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC51	1 to 60	N/S	300MW	+12VDC	Optional	38x38x13	0°C to +60°C	±1x10^{-5}
OSC52	10 to 150	N/S	300MW	+12VDC	Sine	38x38x25	0°C to +60°C	±1x10^{-5}
OSC69-2	5 to 20	1x10^{-5}/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	±5x10^{-5}
OSC69-3	6 to 22	8x10^{-6}/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	±3.5x10^{-5}

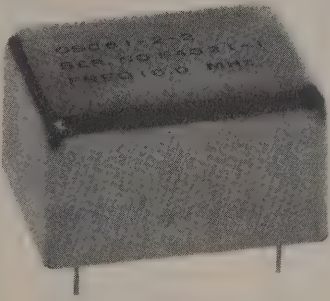
OVENAIRE-AUDIO-CARPENTER
A Division of Electronic Technologies Inc.
706 FORREST STREET – CHARLOTTESVILLE, VIRGINIA 22901
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

ovenaire oscillators

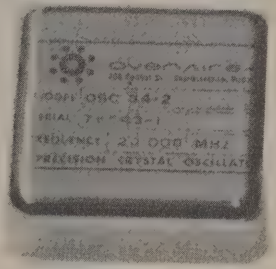
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

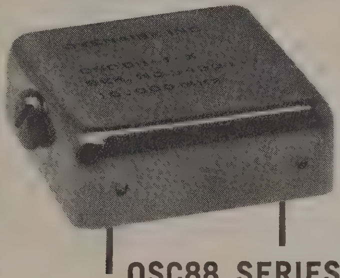


OSC27 SERIES



OSC61 SERIES





OSC88 SERIES

OSC34 SERIES

TCXO'S

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC20-1	10 to 15	3x10^{-6}/YR	135MW	5 or 9VDC	Sine	26x15x54	−30°C to +75°C	±5x10^{-6}
OSC20-2	10 to 15	3x10^{-6}/YR	135MW	5 or 9VDC	Sine	26x15x54	0°C to +50°C	±2x10^{-6}
OSC27-5-1	2 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	±1x10^{-6}
OSC27-5-2	2 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	±5x10^{-7}
OSC27-5-3	2 to 5	5x10^{-6}/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	±3x10^{-7}
OSC27-6-1	2 to 12	1x10^{-6}/YR	360MW	+12VDC	TTL	51x51x15	−40°C to +85°C	±1.5x-10^{-6}
OSC27-6-2	2 to 12	1x10^{-6}/YR	360MW	+12VDC	TTL	51x51x15	−30°C to +75°C	±1x10^{-6}
OSC27-6-3	2 to 6	5x10^{-7}/YR	360MW	+12VDC	TTL	51x51x15	−15°C to +70°C	±5x10^{-7}
OSC34-2	10 to 20	7.5x10^{-7}/YR	240MW	+12VDC	Sine	45x45x15	0°C to +50°C	±1x10^{-6}
OSC35-1-1	2.5 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	±1x10^{-6}
OSC35-1-2	2.5 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	±5x10^{-7}
OSC35-1-3	2.5 to 6	5x10^{-7}/YR	300MW	+12VDC	TTL	51x51x13	0°C to +55°C	±3x10^{-7}
OSC35-2-X	15 to 22	4x10^{-7}/YR	300MW	+12VDC	Sine	58x51x16	−30°C to +60°C	±1x10^{-6}
OSC37-1-1	1 to 5	1x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	±2x10^{-6}
OSC37-2-1	5.01 to 10	2.5x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	±2x10^{-6}
OSC37-3-1	1 to 5	1x10^{-6}/YR	216MW	+12VDC	TTL	44x44x19	−5°C to +60°C	±1x10^{-6}
OSC37-1-2	1 to 5	1x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	±1.5x-10^{-6}
OSC37-2-2	5.01 to 10	2.5x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	±1.5x-10^{-6}
OSC39-1	2.5 to 12	1x10^{-6}/YR	125MW	+5VDC	TTL	48x31x17	0°C to +60°C	±1x10^{-6}
OSC40-1	4KHz to 1MHz	1x10^{-6}/YR	504MW	−18VDC	AC Square	57x51x21	0°C to +55°C	±8x10^{-6}
OSC61-2-2	6 to 16	1x10^{-6}/YR	180MW	+12VDC	Clipped Sine	37x28x19	−20°C to +70°C	±2x10^{-6}
OSC67-1-1	2 to 8	1x10^{-6}/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	±2x10^{-6}
OSC67-1-2	2 to 8	1x10^{-6}/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	±1x10^{-6}
OSC88-1-1	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	±3x10^{-6}
OSC88-1-2	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	±1x10^{-6}
OSC88-1-3	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	0°C to +55°C	±5x10^{-6}
OSC88-1-4	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	±3x10^{-6}
OSC88-1-5	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	±1x10^{-6}
OSC88-1-6	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	−5°C to +70°C	±5x10^{-7}
OSC88-2-1	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	−40°C to +75°C	±2x10^{-6}
OSC88-2-2	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	−40°C to +75°C	±1x10^{-6}
OSC88-2-3	10	.75x10^{-6}/YR	230MW	+12VDC	TTL	38x38x14	−55°C to +105°C	±5x10^{-6}
TCX0101	.0075Hz to 10MHz	±2x10^{-8}/DAY	Freq Dep	+12VDC	12V Square	Pkg B	0°C to +50°C	±1x10^{-6}
TCX0101A	.0075Hz to 10MHz	±2x10^{-8}/DAY	Freq Dep	+12VDC	12V Square	Pkg B	−55°C to +75°C	±5x10^{-6}
TCX034	.0005Hz to 40MHz	±2x10^{-8}/DAY	Freq Dep	+5VDC	4V Square	Pkg B	0°C to +50°C	±1x10^{-6}
TCX056	100KHz to 30MHz	±2x10^{-8}/DAY	Freq Dep	+5VDC	4V Square	Pkg A	0°C to +50°C	±1x10^{-6}
TCX0152	200Hz to 10MHz	±1x10^{-8}/DAY	Freq Dep	+15VDC	10V Square	Pkg OA	0°C to +50°C	±1x10^{-7}
TCX0152A	200Hz to 10MHz	1x10^{-6}/YR	Freq Dep	+15VDC	10V Square	Pkg OA	−40°C to +70°C	±1x10^{-6}

OVENAIRE-AUDIO-CARPENTER

A Division of Electronic Technologies Inc.
706 FORREST STREET – CHARLOTTESVILLE, VIRGINIA 22901
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

ovenaire oscillators

PKG STYLE A
Printed ckt mount
Encapsulated
1.5″ x 2.0″ x .56″
(**AX:** Without mtg. hole)
(**AC:** 7 pin plug-in; stud mt.)

PKG STYLE B
Printed ckt mount
Encapsulated
1.9″ x 2.5″ x .5″
(**BY:** 1.9″ x 2.5″ x 1.0″)
(**BZ:** 1.9″ x 2.5″ x .375″)

PKG STYLE F & Q
Printed ckt mount
Encapsulated
F: 1.0″ x 1.25″ x .5″
Q: 2″ x 2″ x .6″

PKG STYLE G
I.C. plug-in
Encapsulated
.78″ x 1.125″ x .5″
(GX: .75″ x 1.5″ x .5″)

PKG STYLE H
Printed ckt mount
Encapsulated
.875″ x .875″ x .5″

PKG STYLE J
Printed ckt mount
Encapsulated
1.25″ x 1.25″ x .5″
(JX: 1.25″ x 1.25″ x .32″)

PKG STYLE L
Octal plug-in
Stud mount
Metal can
2″ x 2″ x .75″

PKG STYLE P
Special plug-in
Encapsulated metal can
.7″ x 1.3″ x 1.7″

PKG STYLE M, N, & O
Printed ckt mount
Encapsulated metal can
M: 2.5″ x 2.5″ x .625″
N: 2″ x 2″ x .75″
O: 2″ x 2.5″ x .75″
(stud mount)
OA: 2″ x 2.5″ x .65″

Model Series	Frequency Range	Stability	Temperature Range	PK-to-PK Output	Load	Supply Voltage	Pkg. Style
CRYSTAL CONTROLLED OSCILLATORS — NO OVEN REQUIRED							
X0128	7.5KHz to 85KHz	±.02%	0°C to +70°C	6.7V Sine	10K ohms	+15V	Q
X062	4KHz to 16MHz	±.01 to ±.025%[4]	−20°C to +70°C	5V Square	1.5K ohms	+12V	AX
X0110	4MHz to 10MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	F
X0111	250KHz to 3.99MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	J
X0112	63Hz to 249KHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	AX
X0123	7.5KHz to 60KHz	±.01%	0°C to +50°C	1.5V Sine	10K ohms	+5V	A
X0100	.005Hz to 3MHz	±.007%	−40°C to +85°C[2]	12V Square[5]	50 CMOS[5]	+12V	A
X096	5MHz to 16MHz	±.005%	0°C to +70°C	1V Square	3 ECL	−5V	JX
X032	12.5KHz to 5.99MHz	±.003 to ±.01%[4]	0°C to +75°C[2]	4V Square[3]	25 DTL	+5V	A
X032C	6MHz to 40MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 TTL	+5V	A
X033	.001Hz to 30MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 DTL/TTL	+5V	B
X082	190KHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	F
X094	190KHz to 16MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	H
X0181	12Hz to 12.49KHz	±.003%	0°C to +75°C[2]	4V Square	1 TTL	+5V	GX
X081	12.5KHz to 199KHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X071	200KHz to 20MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	G
X081	20.1MHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X045	1MHz to 5MHz	±.001%	+10°C to +50°C	.63V Sine	50 ohms	+15V	AC
LC AND RC OSCILLATORS							
LC035	70KHz to 5MHz	±.5%	0°C to +85°C	2V Sine	10K ohms	+12V	A
LC01028	733KHz to 5MHz	±1%	−50°C to +100°C	2V Sine	1K ohms	+12V	J
PS057	10Hz to 40KHz	±1%/±2%[4]	0°C to +50°C	6V Sine	10K ohms	+12V	A
RC036A	1Hz to 1MHz	±2%	−20°C to +85°C	4V Square[3]	9 DTL/TTL	+5V	A
RC036B	1Hz to 1MHz	±1%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+5V	A
UJ039A	.1Hz to 100Hz	±2%	0°C to +50°C	3V Square	1.5K ohms	+12V	A
RC0109	1Hz to 1MHz	±1%	0°C to +50°C	2.5V Sine	600 ohms	+15V	B
RC0168	1.5Hz to 30KHz	±.5%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+10V	B
SINE WAVE OPTIONS — ADD "S" VERSION TO MODEL NUMBER (MAY REQUIRE LARGER PACKAGE[4])							
S11/12[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	1 mw into 50 ohms		+12V	May be Combined with Oscillator Voltage[4]
S13	5Hz to 100KHz	5% Distortion	−55°C to +75°C	1.75V RMS into 600 ohms		+15V	
S14	10KHz to 1MHz	3% Distortion	−55°C to +125°C	2V pk-to-pk into 10K ohms		None	
S17	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V pk-to-pk into 10K ohms		+5V	
S18	5Hz to 100KHz	3% Distortion	−55°C to +75°C	2.5V pk-to-pk into 600 ohms		+15V	
S19/20[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	2mw into 50 ohms		+15V	
S21	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V RMS into 10K ohms		+15V	
S23	10KHz to 1MHz	1% Distortion	0°C to +75°C	8V pk-to-pk into 10K ohms		+12V	
S24	100KHz to 15MHz	5% Distortion	0°C to +75°C	.5V RMS into 5K ohms		None	

VOLTAGE CONTROLLED OSCILLATORS — CRYSTAL AND NON-CRYSTAL TYPES

Model Series	Center Frequency Range	Minimum Deviation	Input[8]	Linearity	Stability	Temperature Range	PK-to-PK Output	Load	Voltage Supply	Pkg. Style
VC0114	300Hz to 10KHz	±60%	+1.5V to +9V	±10%	±5%	+10°C to +44°C	3V Sine	125 ohms	+6V	B
VC0137	1Hz to 30MHz	±10%	−5V to +5V	±10%	±.5%	0°C to +50°C	4V Square[3]	9 TTL	+5V	B
VC047	1Hz to 75MHz	±10%	0V to −7V	±10%	±3%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B
VC068	5Hz to 15KHz	±10%	0V to −7V	±1%	±.5%	0°C to +75°C	4V Square[3]	9 TTL	+15V	B
VC01019	.5MHz to 5MHz	±2%	+5V to −5V	±5% to ±10%[4]	±.5%	+55°F to +95°F	4V Square	5 TTL	+12V	A
VC01160	100KHz to 30MHz	±1.25%	−5V to +5V	±5%	±.5%	0°C to +50°C	.8V Sine	50 ohms	+12V	BM
VCX01095B	35MHz to 85MHz	±0.03%	−5V to +5V	±5%	±.01%	−40°C to +90°C	1V Square	3 ECL	+5V & −5.2V	BY
VCX0103	1Hz to 20MHz	±.01% to ±10%	±3V or 0V to +6V	±5% to ±10%	±.0001% to ±1%	0°C to +50°C	4V Square[3]	5 TTL	+5V	BY
VCX0255	1Hz to 40MHz	±.005%	0V to +6V	±5%	±.003%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B

[2] For ±.01% over −55°C to +125°C add "A" to Model Number.

[3] Sine wave options listed above. S11/12/19/20 not available for voltage control ranges greater than ±1%.

[4] Depending on frequency.

[5] TTL option available.

OVENAIRE-AUDIO-CARPENTER

A Division of Electronic Technologies Inc.

706 FORREST STREET – CHARLOTTESVILLE, VIRGINIA 22901
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

ovenaire ovens

Ovenaire's Circuit Design Technology is providing State-Of-The-Art Electronic Proportional Control Miniature Crystal and Component Ovens. Space-saving packages for PCB mount, low power consumption, low cost. A representative few of many available designs are shown. Most models are available with temperature setting from +35°C to +95°C, voltage from 5VDC to 36VDC. Ovenaire also offers a complete range of other ovens for commercial and military applications.

MODEL PCL1-43

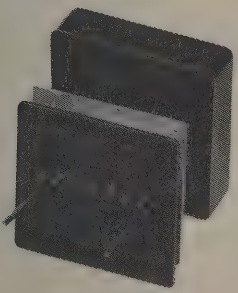
For HC-18/U, HC-25/U, HC-42/U or HC-43/U crystals. 0.750″ dia., 0.562″ high. Temperature stability ±3°C over −30°C to +60°C typical. Also available with temperature adjustability of ±5°C of nominal.

MODEL TO5P

For TO5 crystal, transistor or IC. 0.750″ dia., 0.500″ high. Temperature stability ±3°C over −30°C to +60°C ambient typical. Available with temperature adjustability of ±5°C nominal.

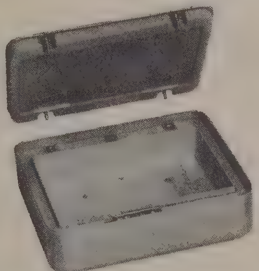
MODEL TO5C

For crystal, transistor or IC with TO5 case. Access to cavity by removing top cover. .750″ dia., .550″ high. Temperature stability ±3.0°C over −30°C to +60°C ambient typical.



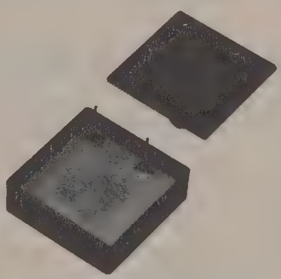
MODEL PC1-25

For 14 pin or 16 pin DIP IC or .375″ x .875″ x .156″ component. Overall size .312″ x 1″ x 1″. Temperature stability ±4°C over −30°C to +60°C ambient typical.



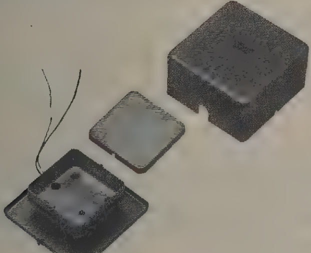
MODEL CO2001

High stability proportional control component oven. Temperature stability ±1°C over 0 to +60°C ambient. Cavity area 2.75″ x 3.93″ x .78″ high. Feed-thru pins for internal connections. O.D. 3.94″ x 4.63″ x 1.25″ high. 24VDC.



MODEL PC1-34

For 1 or 2 DIP's. Component area 1.45″ Sq. x .250″ tall. Overall dimensions 1.5″ Sq. x .50″ tall. Temperature stability is ±3°C over an ambient range of −30°C to within 10°C of the set-point. Various combinations of set-point temperature and DC operating voltage are available.



MODEL CO2106

Component oven with customer-adjustable set-point from 50°C to 90°C. Nominal operating voltage is 19-24 VDC. Heated cavity sizes available from 2″ Sq. x .75″ tall to 6″ Sq. x 1.75″ tall. Control is solid-state, proportional.

MODEL PCL1-21

Slip-on oven for HC-6/U crystal. Size .97″ x .53″ x .83″ high. Temperature stability ±3°C over −30°C to +60°C ambient typical. Models also available for HC-25/U crystal.

MODEL PC2-10

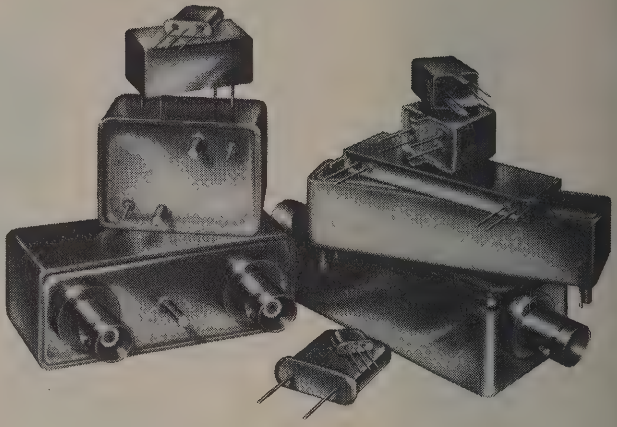
Low cost proportional control oven for 2 HC-6/U crystals. Temperature stability ±2°C over −30°C to +60°C ambient. Size 1.25″ dia. x 1.75″ seated height. Octal plug base.

OVENAIRE-AUDIO-CARPENTER
A Division of Electronic Technologies Inc.
706 FORREST STREET – CHARLOTTESVILLE, VIRGINIA 22901
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

PTi

Piezo Technology, Inc.

The standard in monolithic crystal filters and crystal oscillators



The technology leader in monolithic and discrete crystal filters is now establishing new standards of performance in ovenized and temperature-compensated crystal oscillators.

Since 1965, PTI has set the standard in filter performance. The standard in size. The standard in cost. The standard in quality.

Setting the standard for crystal oscillators was inevitable. From raw quartz processing through automated testing, our unmatched, fully-integrated manufacturing facility gives total control over every process step and assures on-time delivery.

If you have crystal oscillator or filter production requirements, find out why the world's foremost commercial and military equipment producers—those who set the most demanding standards—depend on PTI for leading-edge performance.

Standard Monolithic Filters & TCXO's

PTI's broad range of standard models from 5 to 200 MHz gives you maximum performance per dollar and fast delivery.

Models especially designed for:
- Cellular radio
- Trunked and conventional mobile radio
- Avionics

Custom Crystal Filters

Our standard models are just a sample of what we do—and have done—for commercial and military production applications. Call on PTI for monolithic and discrete crystal filters, from below 5 MHz to over 300 MHz. Test the experts on:
- Controlled group delay
- Low intermodulation
- Low phase noise
- Amplitude linearity
- Phase- and amplitude-matched filter sets
- High reliability

Custom Crystal Oscillators—OCXO's and TCXO's

Our advanced crystal resonator capability gives PTI the advantage in meeting tough production requirements.
- TCXO's—5 to 200 MHz
- VCXO's—5 to 300 MHz
- OCXO's—5 to 200 MHz

For fast and knowledgeable applications assistance, contact Piezo Technology, or your local PTI representative.

Piezo Technology, Inc.
P.O. Box 7859 • Orlando, FL 32854
(305) 298-2000 • TWX 810-850-4136

Piezo Technology, Inc.

The standard in monolithic crystal filters and crystal oscillators

SPECIFICATION SUMMARY: 10.7 MHz FILTERS

MODEL NUMBER/CASE STYLE			No. Poles	Channel Spacing (kHz)	Attenuation Boundaries						Spurious Response (dB Min)	Ultimate Attenuation (dB Min)	Termination Ohms//pF[b]
Unpackaged Tandem Sets[a]	Upright Type	Flatpack Type			dB	kHz	dB	kHz	dB	kHz			
2194/F . . .	. . . .	. . . .	2	20	3	± 6.5	20	±30.0	—	—	15	50	2700//1.0
2195/F . . .	. . . .	. . . .	2	25	3	± 7.5	20	±35.0	—	—	15	50	3000//1.5
2196/F . . .	. . . .	. . . .	2	50	3	±15.0	20	±70.0	—	—	10	35	5000//0
5580/F	1463/UMB	1466/FPA	4	20	3	± 6.5	30	±15.0	—	—	35	75	3100//2.0
5581/F	1464/UMB	1467/FPA	4	25	3	± 7.5	30	±17.5	—	—	35	75	3500//0
5582/F	1465/UMB	1468/FPA	4	50	3	±15.0	30	±35.0	—	—	30	60	5000//0
5583/F	1469/UMB	1472/FPB	6	20	6	± 6.5	60	±19.5	—	—	60	90	3100//1.0
5584/F	1470/UMB	1473/FPB	6	25	6	± 7.5	60	±22.5	—	—	60	90	3500//0
5585/F	1471/UMB	1474/FPB	6	50	6	±15.0	60	±45.0	—	—	60	90	5000//0
5586/F	1475/UMC	1478/FPC	8	20	6	± 6.5	60	±13.0	80	±17.5	80	100	3100//1.0
5587/F	1476/UMC	1479/FPC	8	25	6	± 7.5	60	±15.0	80	±20.0	80	100	3500//0
5588/F	1477/UMC	1480/FPC	8	50	6	±15.0	60	±30.0	80	±40.0	80	100	5000//0
	1433/SCR		8	20	6	± 6.5	60	±12.5	100	±21.0	100	100	850//5.0
	1434/SCR		8	25	6	± 7.5	60	±15.0	100	±25.0	100	100	1000//0
	1435/SCR		8	50	6	±15.0	60	±28.0	100	±50.0	100	100	2000//0

SPECIFICATION SUMMARY: 21.4 MHz HIGH-PERFORMANCE "A" SERIES FILTERS

MODEL NUMBER/CASE STYLE			No. Poles	Channel Spacing (kHz)	Attenuation Boundaries						Spurious Response (dB Min)	Ultimate Attenuation (dB Min)	Termination Ohms//pF
Unpackaged Tandem Sets[a]	Upright Type	Flatpack Type			dB	kHz	dB	kHz	dB	kHz			
6602/A	6600/AMB	6601/APA	4	12.5	3	±3.75	40	±14.0	—	—	40	75	850//5.0
6622/A	6620/AMB	6621/APA	4	20.0	3	±6.0	40	±20.0	—	—	40	75	1200//2.5
6642/A	6640/AMB	6641/APA	4	25.0	3	±7.5	40	±25.0	—	—	40	75	1500//1.0
6605/A	6603/AMB	6604/APB	6	12.5	3	±3.75	45	± 8.75	—	—	70	90	850//5.0
6625/A	6623/AMB	6624/APB	6	20.0	3	±6.0	45	±14.0	—	—	70	90	1200//2.5
6645/A	6643/AMB	6644/APB	6	25.0	3	±7.5	45	±17.5	65	±25.0	70	90	1500//1.0
6608/A	6606/AMC	6607/APC	8	12.5[c]	3	±3.75	65	± 9.0	90	±12.5	90	100	850//5.0
	6610/CSE		8	12.5[c]	3	±3.75	65	± 9.0	90	±12.5	90	100	470//15
6628/A	6626/AMC	6627/APC	8	20.0	3	±6.0	65	±14.0	90	±20.0	90	100	1200//2.5
	6630/CSE		8	20.0	3	±6.0	65	±14.0	90	±20.0	90	100	470//15
6648/A	6646/AMC	6647/APC	8	25.0	3	±7.5	65	±17.5	90	±25.0	90	100	1500//1.5
	6650/CSE		8	25.0	3	±7.5	65	±17.5	90	±25.0	90	100	470//15

SPECIFICATION SUMMARY: 21.4 MHz STANDARD "F" AND "A" SERIES FILTERS

MODEL NUMBER/CASE STYLE						No. Poles	Channel Spacing (kHz)	Attenuation Boundaries						Spurious Response (dB Min)	Ultimate Attenuation (dB Min)	Termination Ohms//pF[b]
Unpackaged Tandem Sets[a]		Upright Type		Flatpack Type												
F Series	A Series	F Series	A Series	F Series	A Series			dB	kHz	dB	kHz	dB	kHz			
	2879/A	. . . .	. . . .	. . . .	. . . .	2	12.5	3	± 3.75	15	±12.5	—	—	15	50	850//6.0
	2880/A	. . . .	. . . .	. . . .	. . . .	2	20.0	3	± 6.5	20	±20.0	—	—	15	50	1200//3.0
2249/F	. . . .	. . . .	. . . .	. . . .	. . . .	2	20.0	3	± 6.5	20	±30.0	—	—	15	45	1400//3.0
	2881/A	. . . .	. . . .	. . . .	. . . .	2	25.0	3	± 7.5	15	± 25.0	—	—	15	50	1500//2.5
2250/F	. . . .	. . . .	. . . .	. . . .	. . . .	2	25.0	3	± 7.5	20	±35.0	—	—	15	45	1600//2.0
	2882/A	. . . .	. . . .	. . . .	. . . .	2	50.0	3	±15.0	15	±50.0	—	—	15	45	3000//0
2251/F	. . . .	. . . .	. . . .	. . . .	. . . .	2	50.0	3	±15.0	20	±90.0	—	—	10	40	3000//0
	6000/A		6012/AMB		6024/APA	4	12.5	3	± 3.75	30	± 12.5	—	—	40	75	850//5.0
5589/F	6001/A	1617/UMB	6013/AMB	1620/FPA	6025/APA	4	20.0	3	± 6.5	30	±22.5	—	—	40	75	1400//1.5
5590/F	6002/A	1618/UMB	6014/AMB	1621/FPA	6026/APA	4	25.0	3	± 7.5	30	±25.0	—	—	40	75	1600//1.0
5591/F	6003/A	1619/UMB	6015/AMB	1622/FPA	6027/APA	4	50.0	3	±15.0	30	±45.0	—	—	25	60	3000//0
	6004/A		6016/AMB		6028/APB	6	12.5	6	± 3.75	60	±12.5	—	—	70	90	850//5.0
5592/F	6005/A	1623/UMB	6017/AMB	1626/FPB	6029/APB	6	20.0	6	± 6.5	60	±22.5	—	—	70	90	1400//1.5
5593/F	6006/A	1624/UMB	6018/AMB	1627/FPB	6030/APB	6	25.0	6	± 7.5	60	±25.0	—	—	70	90	1600//1.0
5594/F	6007/A	1625/UMB	6019/AMB	1628/FPB	6031/APB	6	50.0	6	±15.0	60	±45.0	—	—	50	90	3000//0
	6008/A		6020/AMC		6032/APC	8	12.5[c]	6	± 3.75	60	±10.0	80	±12.5	100[d]	100	850//5.0
5595/F	6009/A	1629/UMC	6021/AMC	1632/FPC	6033/APC	8	20.0	6	± 6.5	60	±17.5	80	±22.5	100[d]	100	1400//1.5
5596/F	6010/A	1630/UMC	6022/AMC	1633/FPC	6034/APC	8	25.0	6	± 7.5	60	±20.0	80	±25.0	100[d]	100	1600//1.0
5597/F	6011/A	1631/UMC	6023/AMC	1634/FPC	6035/APC	8	50.0	6	±15.0	60	±33.0	80	±43.0	80	100	3000//0
—	—	—	6036/CSE	—	—	8	12.5	6	± 3.75	60	±10.0	80	±12.5	90	90	470//15
—	—	—	6037/CSE	—	—	8	20.0	6	± 6.5	60	±17.5	80	±22.5	90	90	470//15
—	—	—	6038/CSE	—	—	8	25.0	6	± 7.5	60	±20.0	80	±25.0	90	90	470//15
—	—	—	6039/CSE	—	—	8	50.0	6	±15.0	60	±33.0	80	±43.0	80	90	470//15

[a] A tandem set consists of two 2-pole units for 4-pole response, three 2-pole units for 6 pole response, and four 2-pole units for 8-pole response.

[b] Parallel termination capacitance is adjusted for optimum filter response (nominal value ±2.0 pF)

[c] Flat loss is 4.5 dB Max.

[d] For "A" holder filters, spurious responses are 90 dB min.

General Specifications

Operating Temperature Range: −30°C to +80°C for "F" Series,
−20°C to +70°C for "A" Series,

Maximum Ripple Over Temperature (dB):
Maximum Insertion Flat Loss Over Temperature (dB):

2 Pole	4 Pole	6 Pole	8 Pole
1	2	2	2
2	2.0	3.0	4.0

All Specifications subject to change without notice.

Piezo Technology, Inc.
P.O. Box 7859 • Orlando, FL 32854
(305) 298-2000 • TWX 810-850-4136

Piezo Technology, Inc.

The standard in monolithic crystal filters and crystal oscillators

Linear Phase Filters

Nominal Center Frequency, f_{on}	10.7 MHz	21.4 MHz
Attenuation Boundaries 3 dB 30 dB 50 dB	 f_{on} ±6.0 kHz Min. f_{on} ±23 kHz Max. f_{on} ±45 kHz Max.	 f_{on} ±6.0 kHz Min. f_{on} ±23 kHz Max. f_{on} ±45 kHz Max.
Ultimate Attenuation (Min.)	60 db	60 dB
Unwanted Response (Min.)	40 dB	40 dB
Flat Loss (Max.)	3 dB	3 dB
Terminations: Resistance Parallel Capacitance	 5000 ohms ±5% −1.3 pF, ±2 pF adjustable	 1900 ohms ±5% −1.3 pF, ±2 pF adjustable
Group Delay: Center Frequency Delay Delay Variation, f_{on} ±6 kHz	 55 μs Nominal 10 μs Maximum	 55 μs Nominal 10 μs Maximum
Operating Temperature Range	−30°C to +80°C	−30°C to +80°C

Model Numbers

Case Style:		
Tandem Set	5182	5446
UMB	5261	6426
FPA	5262	6427

Frequency Discriminators

Models		
F_{on}:	10.7 MHz	21.4 MHz
Case Style F	2283	2378
Case Style A	—	2323

Operating Temperature Range:
−30°C to +70°C

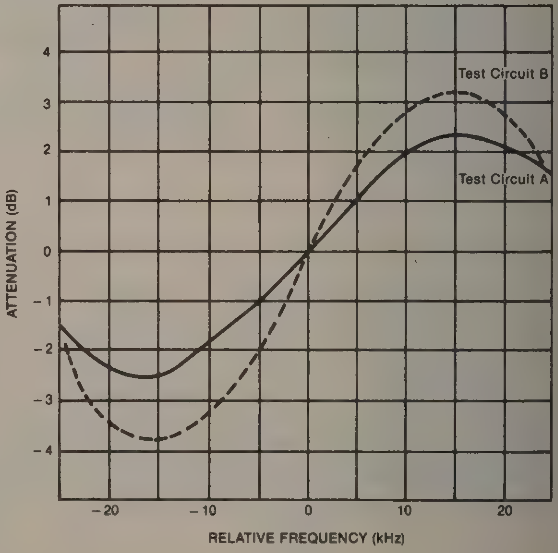
FM Response (Typical)
Test Conditions

Deviation:	±5 kHz
Modulation:	1 kHz
RF Input:	−40 dBm

Test Circuit*:	**A**	**B**
Recovered Audio:	400 mV	800 mV
Total Harmonic Distortion		
Carrier F_{on} +2 kHz	.8%	1.2%
Carrier F_{on} +5 kHz	1.5%	---
Discriminator Peaks	F_{on} ±17 kHz	F_{on} ±14 kHz

** See data sheet*

Typical Discriminator Response



Piezo Technology, Inc.
P.O. Box 7859 • Orlando, FL 32854
(305) 298-2000 • TWX 810-850-4136

Piezo Technology, Inc.

The standard in monolithic crystal filters and crystal oscillators

Special VHF Monolithic Filters

PTI offers the industry's widest selection of VHF monolithic filters. While most VHF four-pole crystal filters require stable, critically-tuned, high-Q, interstage inductors or transformers, the PTI models in the table below do not. Models 2843, 2844, and 3020 are two-pole devices; Model 6437 is a fundamental mode, four-pole tandem monolithic filter; the remaining models are full monolithic (single-wafer) four-pole devices, and are completely self-contained. These are offered both in a single crystal enclosure and packaged with matching to 50 ohms. All packages are hermetically sealed, PC-board mount. Customized packaging and specifications are available for your special production requirements.

Model-Number	Nominal Center Frequency F_{on} (MHz)	Number of Poles	dB	Attenuation Boundaries kHz (Min.)	dB	kHz (Max.)	dB	kHz (Max.)	Spurious Response (dB Min.)	Ultimate Attenuation (dB Min.)	Ripple (dB Max.)	Flat* Loss (dB Max.)	Termination‘ (Ω//pF)	Case Style
4102	30	4	3	±50	60	−400	60	±800	—	60	2.0	4.0	7000//−1	F
6570	30	4	3	±50	—	—	—	—	—	60	2.0	5.0	50	MVB
2843	45	2	3	± 6.5	25	±25	60	±910	15	60	0.5	1.5	2300//0	A
2844	45	2	3	± 7.5	23	±25	60	±910	13	60	0.5	1.5	2600//0	A
4371	45	4	3	± 7.5	35	±25	50	±50	40	60	1.0	3.0	7000//−1	F
3020	45	2	3	±16	15	±60	40/65	±910	—	40	0.5	2.0	860//−1.1	A
6437	45	4	3	±15	35	±50	70	±910	40	75	1.0	4.0	1200//0	A**
4004	70	4	3	±10	30	±30	50	±50	35	65	1.0	3.0	4800//−1.0	F
6762	70	4	3	±10	30	±30	50	±50	35	65	1.0	4.0	50	MVB
4171	75	4	3	±13	—	—	60	±300	30	60	2.0	6.0	4000//−1.0	F
5786	75	4	3	±13	—	−0−	60	±300	30	60	2.0	7.0	50	MVB
4000	90	4	3	±15	—	—	40	±60	35	65	1.0	3.0	4000//−1.0	F
6761	90	4	3	±15	—	—	40	±60	35	65	1.0	4.0	50	MVB

*Power out/power available measured at point of minimum attenuation

**Model 6437 is comprised of 2 A-packages
‘All models—Adjustable ±2.0 pF for best response

VHF Front-End Filters

The models listed below consist of 2-pole monolithic and 4-pole tandem monolithic filters designed for use as front-end filters in low-band and high-band VHF custom applications. They are also suitable for HF up-conversion, first IF filtering and spectrum clean-up in frequency synthesis. Nominal operating frequency is specified by the customer in the 25 MHz to 200 MHz range.

All models operate over a temperature range of −20°C to +70°C. Filters are matched to 50 ohms with a convenient phono-jack, BNC, or a variety of other connectors. See package drawings, VB* series. See table below for detailed specifications.

Electrical Specifications

Model Number	Number of Poles	Center Frequency Range (MHz)	Attenuation Boundaries 20 dB Min. (KHz)	40 dB Min. (KHz)	Ultimate Attenuations (dB Min.)	Flat Loss (dB Max.)	Unwanted Modes (dB Min.)
2133	2	25.0-49.99	± 40	—	30	3	20
2133	2	50.0-89.99	± 40	—	30	4	20
2133	2	90.0-137.99	± 60	—	30	4	20
2133	2	170.0-199.99	± 60	—	30	4.5	20
4133	4	25.0-49.99	± 26	± 50	60	5	40
4133	4	50.0-89.99	± 26	± 50	50	6	40
4133	4	90.0-137.99	± 30	± 50	60	6	40
4133	4	170.0-199.99	± 30	± 50	60	7	40

Attenuation Boundaries:	3dB., F_{on} ±6.75 kHz Min.
Operating Temperature:	−20°C to +70°C
Passband Ripple:	1 dB Max.
Source/Load Termination:	50 ohms

Piezo Technology, Inc.
P.O. Box 7859 • Orlando, FL 32854
(305) 298-2000 • TWX 810-850-4136

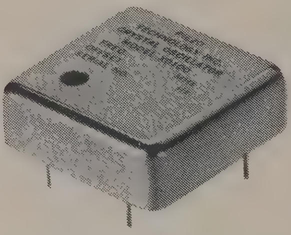
Piezo Technology, Inc.

The standard in monolithic crystal filters and crystal oscillators

Temperature Compensated Crystal Oscillator (TCXO)

SPECIFICATION:

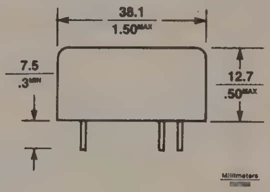
Model XO 1004 is one of a family of TCXO units intended for communications and instrumentation applications. Other frequencies and operating parameters are available upon request.

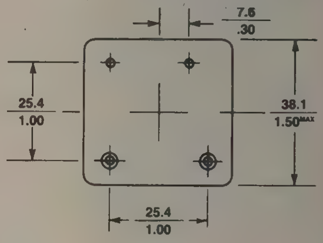


PIN NO.	FUNCTION
1	CASE GROUND
2	OUTPUT
3	+8.2V
4	CASE GROUND

Standard Frequency

Standard Frequency	10 MHz
Available Frequency	8 to 20 MHz
Stability Over Temperature	±1.0 ppm Max.
Operating Temperature	−35°C to +65°C
Aging Adjustment	10 Yrs. Min.
Supply Voltage	+9 V (±.2V)
Output	5 V pk-pk Min.
Load	600 Ohms//0 pF
Shock	5 G's for 6 m Sec.
Size (lxwxh), In. Max.	1.5 × 1.5 × .5 P.C. Board Mount

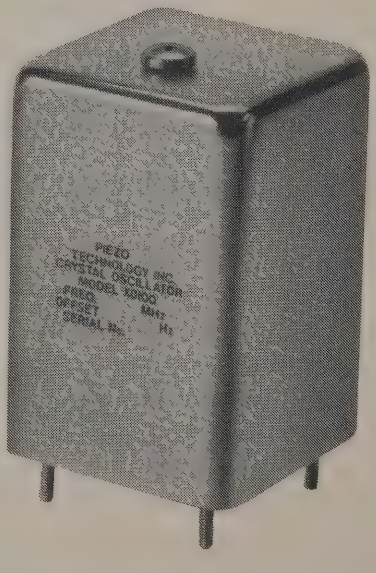

38.1
1.50 MAX
7.5
.3 MIN
12.7
.50 MAX
Millimeters


7.6
.30
25.4
1.00
38.1
1.50 MAX
25.4
1.00

Ovenized Crystal Oscillator (OCXO)

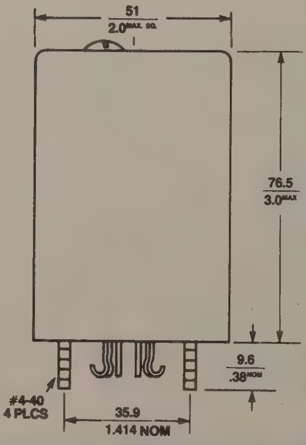
SPECIFICATION:

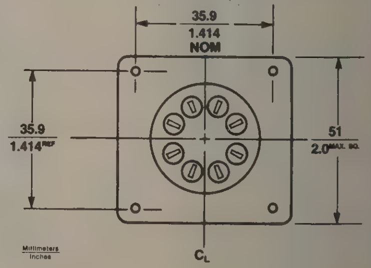
Model XO 1005 is one of a family of OCXO units intended for instrument applications. Other frequencies and operating parameters are available upon request.


PIEZO
TECHNOLOGY INC.
CRYSTAL OSCILLATOR
MODEL XO100
FREQ. MHz
OFFSET Hz
SERIAL No.

Standard Frequency

Standard Frequency	10 MHz
Available Frequency	8 to 20 MHz
Stability Vs:	
Temperature (0 to 50°C)	±1 × 10^{-8} Max.
Supply Voltage (1% Variation)	±1 × 10^{-8} Max.
Load (10% Variation)	±5 × 10^{-9} Max.
Adjustment, Settable to	1 × 10^{-8}
Phase Noise (Optional)	−125 dBc/Hz at 100 Hz Offset −135 dBc/Hz at 1 kHz Offset
d-c Supply	
Voltage	+12V (±.2V)
Power	6W Max. At Turn On 3 W Max. at 25°C After Stabilization
Aging	3 × 10^{-9}/Day Max.
Output (Sinusoidal)	1 V rms
Load	500 Ohms//0 pF
Size (lxwxh) Inches, Max.	2.0 × 2.0 × 3.0
mm., Max.	51 × 51 × 76.5 With mounting studs and 8-pin header


51
2.0 MAX. SQ.
76.5
3.0 MAX
9.6
.38 NOM
#4-40
4 PLCS
35.9
1.414 NOM


35.9
1.414
NOM
35.9
1.414 REF
51
2.0 MAX. SQ.
Millimeters
Inches
C_L

PIN NO.	FUNCTION
1	RF OUTPUT
2	+12VDC OVEN
3	+12VDC OSC
4	GND
5	(RF RETURN) GND
6	N/C
7	N/C
8	N/C

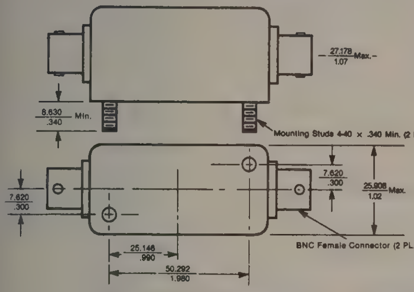
Piezo Technology, Inc.
P.O. Box 7859 • Orlando, FL 32854
(305) 298-2000 • TWX 810-850-4136

Piezo Technology, Inc.

The standard in monolithic crystal filters and crystal oscillators

Packages

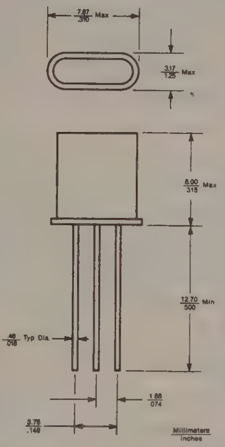
CASE STYLE VBB


27.178 / 1.07 Max.
8.630 / .340 Min.
Mounting Studs 4-40 × .340 Min. (2 PL)
7.620 / .300
25.908 / 1.02 Max.
7.620 / .300
BNC Female Connector (2 PL.)
25.146 / .990
50.292 / 1.980

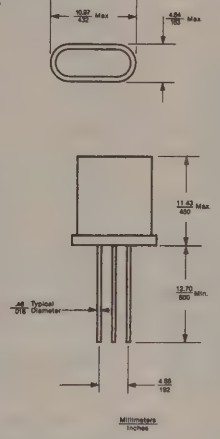
PTI Model	Connector
VBB	BNC
VBC	UHF
VBM	SMA
VBN	N
VBP	Phono Jack
VBF	PC Board Mount

Millimeters / Inches

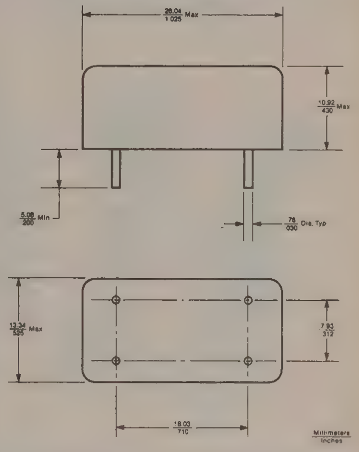
CASE STYLE A


7.87 / .310 Max
3.17 / .125 Max
8.00 / .315 Max
12.70 / .500 Min
.46 / .018 Typ Dia.
1.88 / .074
3.76 / .148
Millimeters / Inches

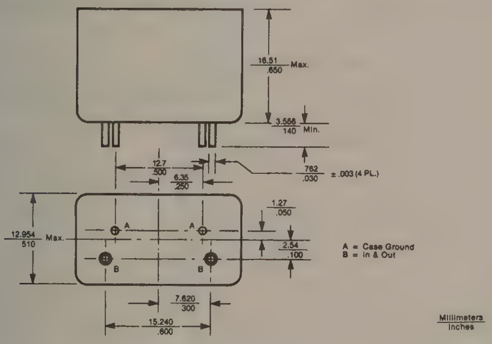
CASE STYLE F


10.97 / .432 Max
4.64 / .183 Max
11.43 / .450 Max.
12.70 / .500 Min.
.46 / .018 Typical Diameter
4.88 / .192
Millimeters / Inches

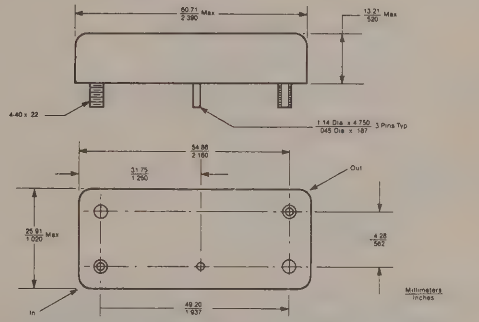
CASE STYLE CSE


26.04 / 1.025 Max
10.92 / .430 Max
5.08 / .200 Min
.76 / .030 Dia. Typ
13.34 / .525 Max
7.93 / .312
18.03 / .710
Millimeters / Inches

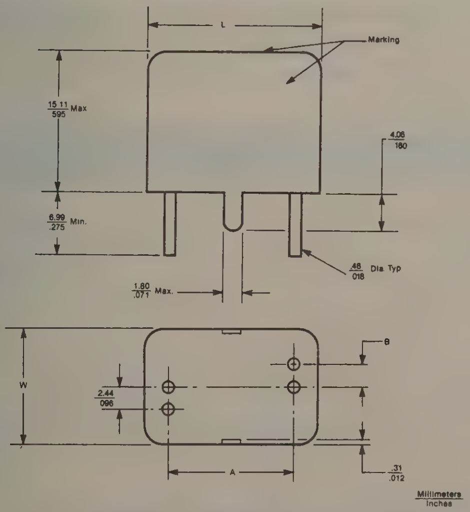
CASE STYLE MVB


16.51 / .650 Max.
3.556 / .140 Min.
12.7 / .500
6.35 / .250
.762 / .030 ± .003 (4 PL.)
1.27 / .050
12.954 / .510 Max.
2.54 / .100
A
B
A = Case Ground
B = In & Out
7.620 / .300
15.240 / .600
Millimeters / Inches

CASE STYLE SCR

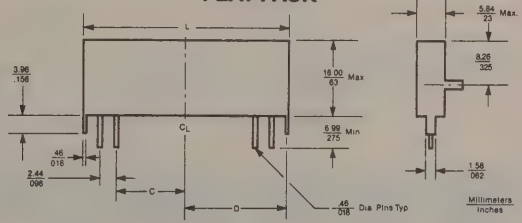

60.71 / 2.390 Max
13.21 / .520 Max
4-40 x .22
1.14 Dia x 4.750 / .045 Dia x .187 3 Pins Typ
54.86 / 2.160
31.75 / 1.250
Out
25.91 / 1.020 Max
4.28 / .562
In
49.20 / 1.937
Millimeters / Inches

UPRIGHT PACKAGE


L
Marking
15.11 / .595 Max
4.06 / .160
6.99 / .275 Min.
.46 / .018 Dia. Typ
1.80 / .071 Max.
W
B
2.44 / .096
A
.31 / .012
Millimeters / Inches

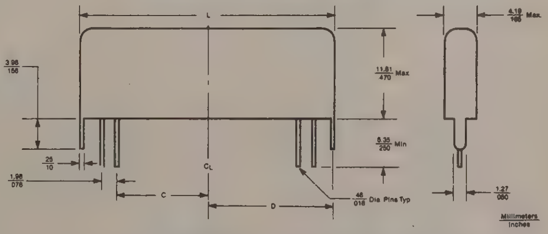
CASE STYLE	L (MAX.)		W (MAX.)		H (MAX.)		A		B	
	in	mm	in	mm	in	mm	in	mm	in	mm
AMB	43	11 00	.335	8.51	.453	11 50	291	7 39	.078	2 00
AMC	.53	13.57	.344	8.74	453	11.50	386	9.80	.078	2 00
UMB	590	14.99	472	11.94	595	15.11	.354	8 99	096	2 44
UMC	.745	18.92	496	12 60	595	15.11	528	13.41	096	2 44

FLAT PACK


L
5.84 / .23 Max.
8.26 / .325
3.96 / .156
16.00 / .63 Max
CL
6.99 / .275 Min
.46 / .018
2.44 / .096
C
D
1.58 / .062
.46 / .018 Dia Pins Typ
Millimeters / Inches

CASE STYLE	L (MAX.)		C		D	
	in	mm	in	mm	in	mm
FPA	0 890	22 61	0 216	5 49	0.435	11 05
FPB	1 320	33 53	0 435	11 05	0 650	16 51
FPC	1 750	44 45	0 654	16 61	0.865	21 97

MINIATURE FLAT PACK


L
4.19 / .165 Max.
3.96 / .156
11.81 / .470 Max
.25 / .10
CL
6.35 / .250 Min
1.98 / .078
C
D
.46 / .018 Dia Pins Typ
1.27 / .050
Millimeters / Inches

CASE STYLE	L (MAX.)		C		D	
	in	mm	in	mm	in	mm
APA	0 665	16 89	0 147	3 73	0 325	8 26
APB	0.985	25.02	0 307	7 80	0 485	12 32
APC	1.305	33 15	0.467	11 86	0 645	16 38

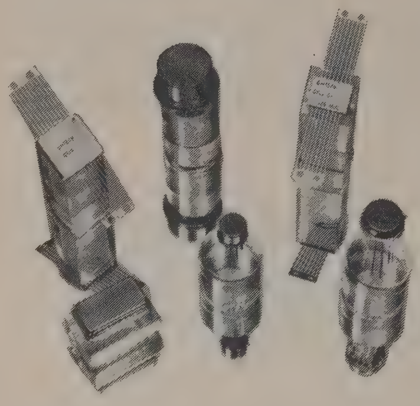
Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

MINIATURE CRYSTAL CLOCK OSCILLATORS QPL-MIL-O-55310

CLOCK OSCILLATORS

Request Bulletin CO-3

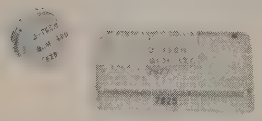


Z80 DRIVERS

Request Bulletin ZD-3

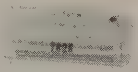
BAUD RATE GENERATORS

Request Bulletin BR-1



6800 CLOCKS

2 PHASE DRIVER



Q-Tech crystal controlled clock oscillators integrate crystal and semiconductor technology to produce a completely hybrid device. This results in a product of the highest reliability at attractive prices. Oscillators produced to MIL-O-55310 requirements, MIL-M-38510 procedures and screened to MIL-STD-883C, Level S or B, meet the highest high reliability requirements of military and space use.

QUALITY CONFORMANCE AND RELIABILITY ASSURANCE

Q-Tech's facilities are qualified to MIL-I-45208 and are well equipped to perform the screening, quality conformance and reliability assurance requirements of MIL-M-38510A and MIL-STD-883. Q-Tech is a QPL source for all hybrid MIL-O-55310 oscillators.

Z80 DRIVERS

Z80 drivers and other microprocessor drivers are available for a variety of other applications and can operate to full MIL specifications.

STANDARD STABILITIES

2 x 10^{-6}	For 10% change of Vcc
1 x 10^{-6}	For 20% change of Load
5 x 10^{-6}	Aging — 30 days
1 x 10^{-5}	Aging — 1 year

TYPICAL TOLERANCES

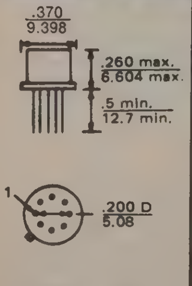
±.005% *±.0005%	0 to 50°C
*External Trimmer Required	
±.005% ±.01%	0 to 70°C
±.0025%	−20 to +70°C
±.005%	−55 to +105°C
±.005% ±.01%	−55 to +125°C

OPTIONS AVAILABLE

• GATED OUTPUT • MULTIPHASE OUTPUTS • MULTIPLE OUTPUTS • PRECISE PROGRAMMED OUTPUTS • VCXO's • FINE FREQUENCY ADJUSTMENT • SPECIAL PACKAGING • ECL OUTPUTS • HIGHER FREQUENCIES WITH MORE OPEN TOLERANCES • UHF OUTPUTS

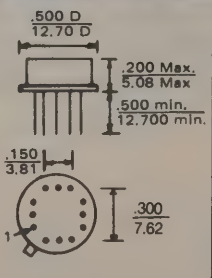
UPPER DIMENSIONS IN INCHES, LOWER DIMENSIONS IN MILLIMETERS.

QT1


.370
9.398
.260 max.
6.604 max.
.5 min.
12.7 min.
1
.200 D
5.08

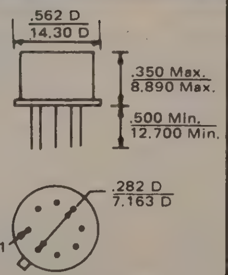
1, 2 & 6	ITP
4	GND
5	OUT
8	VCC/VDD

QT2


.500 D
12.70 D
.200 Max.
5.08 Max
.500 min.
12.700 min.
.150
3.81
.300
7.62
1

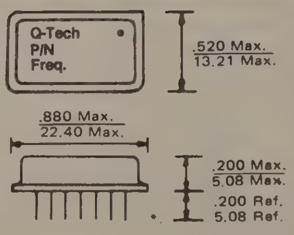
3, 9 & 10	ITP
5	OUT
6	GND
12	VCC/VDD

QT3


.562 D
14.30 D
.350 Max.
8.890 Max.
.500 Min.
12.700 Min.
.282 D
7.163 D
1

2, 6 & 7	ITP
4	GND
5	OUT
8	VCC/VDD

QT4, QT6 & QT10


Q-Tech
P/N
Freq.
.520 Max.
13.21 Max.
.880 Max.
22.40 Max.
.200 Max.
5.08 Max.
.200 Ref.
5.08 Ref.

QT4

3, 11, 12	ITP
4	VCC/VDD
5	OUT
7	GND

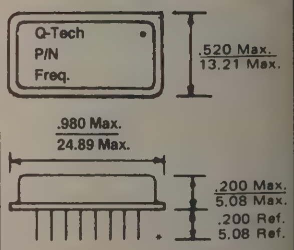
QT6

4, 10, 11	ITP
7	GND
8	OUT
14	VCC/VDD

QT10

1	OUTPUT
2	CASE
8	GND
14	VCC/VDD

QT5 & QT7


Q-Tech
P/N
Freq.
.520 Max.
13.21 Max.
.980 Max.
24.89 Max.
.200 Max.
5.08 Max.
.200 Ref.
5.08 Ref.

QT5

3, 13, 14	ITP
4	VCC/VDD
5	OUT
8	GND

QT7

4	OUT
5, 6, 11	ITP
8	GND
16	VCC/VDD

2201 CARMELINA AVE. • LOS ANGELES, CALIFORNIA 90064 • PHONE (213) 820-4921 • TELEX 69-6140

Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

MINIATURE CRYSTAL CLOCK OSCILLATORS

STANDARD PACKAGES AND FREQUENCIES

Q-TECH can supply oscillators in a wide variety of package types, including TO-5 (8 lead), TO-8 (8 or 12 lead), DIP (14 or 16 lead), FLATPACK (QT21 and QT22), and LCC (QT61 and QT66). These are available over a very wide range of frequencies from fractions of a Hertz to UHF. Please consult us for your custom requirements.

FREQUENCY RANGES AVAILABLE

Package Type	Package Size	C-MOS Frequency Range	TTL Frequency Range
TO-5	QT1	50KHz to 15MHz	20KHz to 30MHz
TO-8	QT2, QT3 or QT8	300Hz to 15MHz	100Hz to 25MHz
14 Pin DIP	QT4 or QT6	.1Hz to 15MHz	.1 Hz to 60MHz
16 Pin DIP	QT5 or QT7	.1Hz to 15MHz	.1 Hz to 60MHz
20 Lead Flat Pack	QT21, QT23	1.0Hz to 15MHz	1Hz to 60MHz
16 Lead Flat Pack	QT22	50KHz to 15MHz	25KHz to 30MHz
Leadless Chip Carrier	QT61 & QT66	30KHz to 15 MHz	20KHz to 60MHz

SPECIAL PACKAGES AND ENCLOSURES

Q-TECH can provide units to unusual package requirements including miniature units withstanding 10,000 PSI and Flat Packs with less than .100 inch thickness. Ultra-thin (.065) ceramic leadless chip carrier packages available with frequencies to 60 MHz.

C-MOS CLOCK OSCILLATORS

Frequencies available in the C-MOS line of oscillators are related to input voltage. It is essential, therefore, when ordering a C-MOS unit to specify the input voltage.

Power requirements of C-MOS units are related to both frequency and input voltage. Most of the power is dissipated within the crystal oscillator portion of the device, and buffering, division, or other logic requirements within the unit contribute little to the total power consumption.

ECL/VHF/UHF CLOCKS AND SOURCES

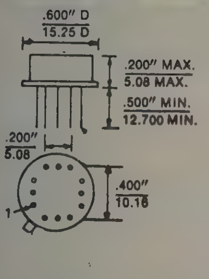
ECL and sine wave clocks and sources are available to 400 MHz.

Q-Tech can work with you to hybridize high stability and synthesized sources up to 3gHz.

Phase noise and G-Sensitivity data are taken when required. Full temperature range, −55°C to +125°C, available for these clocks and sources.

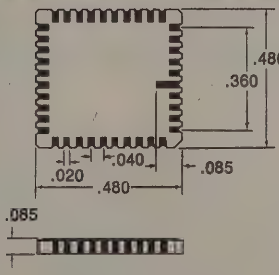
UPPER DIMENSIONS IN INCHES, LOWER DIMENSIONS IN MILLIMETERS.

QT8



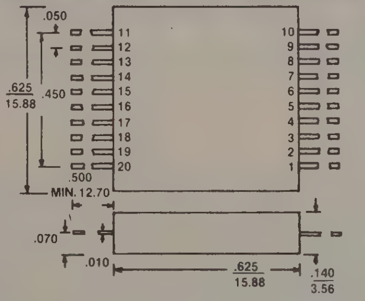
3,9 & 10	ITP
5	OUT
6	GND
12	VCC/VDD

QT66



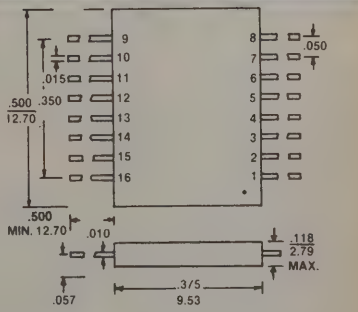
4, 10	Vcc
31, 37	GND
39	OUTPUT

QT21



7 & 16	ITP	10	GND
11	OUT	13	VCC/VDD

QT22



4 & 13	ITP	10	OUT
9	GND	8	VCC/VDD

2201 CARMELINA AVE. • LOS ANGELES, CALIFORNIA 90064 • PHONE (213) 820-4921 • TELEX 69-6140

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

MAY THE FORCE
BE WITH YOU!
THE FORCE IN
QUARTZ CRYSTAL
TECHNOLOGY...

REEVES-HOFFMAN

DIVISION, DYNAMICS CORPORATION OF AMERICA
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

REEVES-HOFFMAN
Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Products

Crystals of proven reliability for military and industrial applications

For 40 years, Reeves-Hoffman has been a leader in the design and manufacture of quartz crystals for government and industry. We are the only company offering the improved stability of coldweld sealing at a lower cost than conventional solder-sealed units.

All Reeves-Hoffman crystals are cut, ground, polished, plated, and mounted at the factory to exacting specifications. Shock, vibration, and hermeticity characteristics all exceed Mil-Spec C-3098. Crystals for oscillator and filter applications are available from 1 kHz to 200 MHz, with varying temperature coefficients, effective resistance, electrical equivalents, and Q values dependent on physical limitations and circuit requirements.

The staff of crystal engineers at Reeves-Hoffman welcomes the opportunity to quote on and discuss your particular application.

Ask for our free booklet, "A Specifier's Guide to Quartz Crystals," written to reduce your design problems.

When specifying crystals, please supply the following:	Crystal Categories
1. Frequency required 2. Holder style 3. Calibration temperature/ tolerance 4. Oscillator load capacitance 5. Temperature range 6. Maximum series resistance 7. Stability over temperature	**Oscillator Crystals** • **Industrial** Aging: 5 to 25 x 10−⁶ per year • **Precision** Aging: Less than 5 x 10−⁶ per year or less than 5 x 10−⁸ per day after first 30 days. • **Military** (per Mil C-3098) **Filter Crystals** See facing page

Low-Frequency Crystals

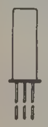
1.0 to 1200 kHz in standard and miniature holders

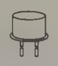
Throughout our long history as a quality supplier of low-frequency crystals, Reeves-Hoffman has dedicated our efforts towards responding to the changing needs of the electronics industry. As miniaturization reduced the size of electronic equipment, the traditionally large low-frequency crystal became one of the largest components in the system. To respond to this, Reeves-Hoffman worked closely with the crystal users. As a result, miniature crystal holders such as the RH135, RH170, RH605, and RH3X8 were developed. This is just one example of Reeves-Hoffman's ingenuity and responsiveness to the needs of our most important asset...our customers.

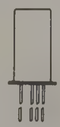
Recommended Element for Frequency Range	
Frequency Range	Element
1-10 kHz	J
10-100 kHz	NT, XY
100-250 kHz	5° X
250-500 kHz	DT
500-1000 kHz	SL

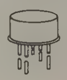
The choice of element will vary. However, Reeves-Hoffman will choose the best element for your specific requirements based on cost and performance considerations.

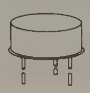
Holder Style vs. Frequency	
Frequency	Holder
1-1.4 kHz	RH13
1.4-1.8 kHz	RH13, E1, E2
1.8-20 kHz	RH13, E1, E2, B2
20-86 kHz	RH13, E1, E2, B2, RH170, RH135, A2, A3
86-150 kHz	RH36, RH47, E1, E2, RH13, B2, A2, A3, RH6, RH33, RH170
150-300 kHz	RH36, RH47, A3, E2, RH13, A2, RH6, RH33, B2, E1, E3
300-450 kHz	RH36, RH47, RH6, RH33, RH512, E3
450-900 kHz	RH42, RH43, RH18, RH25, RH36, RH47, RH512, RH6, RH33, E3
900 kHz-1.2 MHz	RH42, RH43, A5, RH18, RH25, RH36, RH47, RH512, RH6, RH33. E3, RH605

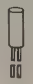

A2
A3

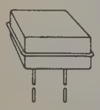

A5

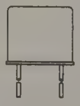

B2

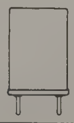

B5

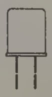

C

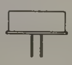

3X8

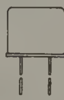

E1
E2
E3


RH6
RH33
RH36
RH47


RH13


RH18
RH25
RH42
RH43
RH605


RH135
RH170


RH512

High-Frequency Crystals

1.0 to 200.0 MHz

The use of high-frequency crystals has grown continually over the years as timing rates, tranmission frequencies, and data-processing speeds increased. Fortunately, Reeves-Hoffman is continually involved in this evolution to the extent that we possess the capabilities to respond to just about any requirement for high-frequency AT-cut crystals. In the past, many challenges have been presented to our engineering and manufacturing personnel. We are extremely proud of their response record, and look forward to working with you to continue this trend.

Frequency	Recommended overtone
1-30 MHz	AT, fundamental
20-60 MHz	AT, third overtone
60-125 MHz	AT, fifth overtone
125-160 MHz	AT, seventh overtone
160-200 MHz	AT. ninth overtone

Holder Style vs. Frequency	
Frequency	Holder
1.0-2.5 MHz	RH36, RH47, E3, RH6, RH33, RH512, C
2.5-10 MHz	RH36, RH47, RH42*, RH43*, RH18*, RH25*, A5*, RH6, RH33, E3, RH512, B5, C
10-100 MHz	RH42, RH43, RH18, RH25, A5, B5, E3, RH512
100-200 MHz	RH42, RH43, RH18, RH25, A5, E3, RH512

*Contact factory for details.

Holder Specifications

Holder Type	Seal*	Max. Height	Max. Length	Max. Width	Pin Dimensions	
					Dia.	Spacing
A-2	CW	1.550		.400 dia.	.0185	.200
A-3	CW	1.000		.400 dia.	.0185	.200
A-5	CW	.260		.400 dia.	.0185	.200
B-2	CW	1.550		.600 dia.	.0185	.282
B-5	CW	.260		.600 dia.	.0185	.282
C	CW	.350		.830 dia.	.0185	.375
RH3X8		.327		.118 dia.	.012	.043
E-1	CW	360	2.100	..730	.020	1.000
E-2	CW	.360	1.595	.730	.020	1.000
E-3	CW	.360	.770	.770	.020	.375
RH-6	SS	.775	.757	.352	.050	.486
RH-13	SS	1.526	.757	.352	.050	.486
RH-18	SS	.530	.435	.183	.0185	.192
RH-25	SS	.530	.435	.183	.040	.192
RH-33	SS	.775	.757	.352	.030	.486
RH-36	CW	.775	.757	.352	.050	.486
RH-42	CW	.530	.435	.183	.040	.192
RH-43	CW	.530	.435	.183	.017	.192
RH-47	CW	.775	.757	.352	.030	.486
RH-135	CW	.135	.500	.135	.010	.080
RH-170	CW	.170	.500	.135	.010	.080
RH-512	SS	650	.564	.234	.030	.275
RH-605	CW	.261	.435	.183	.017	.192

*CW=coldweld
SS=solder seal

Alternate pin configurations and locations are available.

REEVES-HOFFMAN

Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Filters

Reeves-Hoffman custom designs and manufactures passive quartz crystal filters to meet the exacting specifications of companies at the leading edge of technology.

By utilizing computer-aided design and analysis, our staff of professionals can solve your most perplexing problems. Computer controlled frequency synthesis and network analysis provide accurate testing of amplitude, phase, and delay to assure precise filter performance. Image parameter, modern network theory (Butterworth, Chebyshev, Bessel, Gaussian, Cauer) and Lerner synthesis techniques are employed to obtain the desired frequency response.

Because of Reeves-Hoffman's military approved crystal manufacturing capability, we are able to produce quartz crystals which will satisfy the demands of the filter design. The high standards of our Quality Control Department assure that both crystals and filters are manufactured and tested to applicable military specifications.

Contact our sales or engineering department; we welcome the opportunity to review your requirements.

Applications:

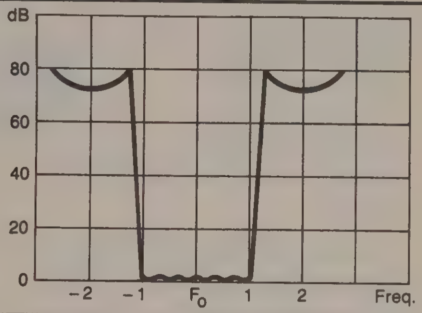
Missile Guidance	Satellite Communication
Fire Control	Telecommunications
Doppler Radar	Military Radios
ECM/ECCM	

To order filters, please specify:

1. Center frequency and tolerance.
2. 3 or 6 dB bandwidth.
3. 40 or 60 dB bandwidth and frequencies at these points if asymmetric.
4. Minimum attenuation in stopband.
5. Passband ripple.
6. Insertion loss.
7. Phase or delay requirements.
8. Input and output impedance (tolerance).
9. Operating temperature range.
10. Packaging details.
11. Additional electrical and environmental specifications as required.

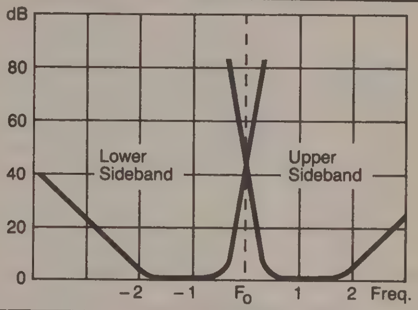
BAND PASS

F_0: 10 KHZ to 200 MHZ
Designs:
Chebyshev Bessel
Butterworth Gaussian



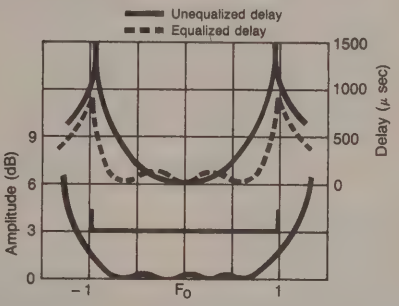
SIDE BAND

F_0: 10 KHZ to 30 MHZ
Carrier Attenuation:
According to specifications



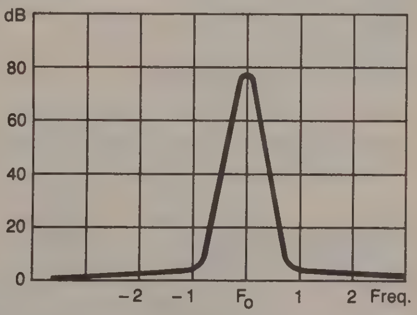
EQUALIZED DELAY FILTERS

F_0: 100 KHZ to 30 MHZ
Delay:
Equalized to specifications



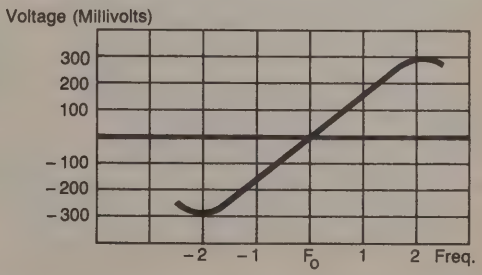
BAND REJECT

F_0: 50 KHZ to 100 MHZ
Rejection Band:
According to specifications



DISCRIMINATOR

F_0: 100 KHZ to 30 MHZ
Discrimination:
According to specifications

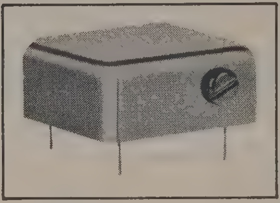


REEVES-HOFFMAN

Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Oscillators Discrete

XO's



FREQUENCY RANGE:
3.00 MHZ thru 200.00 MHZ

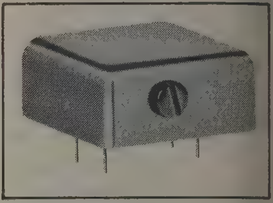
STABILITY:
△F/△Temp: See Below, Seven Std. Options

LOGIC FAMILIES:
T.T.L. CMOS ECL

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	3 MHZ to 100 MHZ	3 MHZ to 20 MHZ	3 MHZ to 200 MHZ
Output	Derived from TTL gate	Derived from CMOS gate	Derived from ECL gate
Symmetry	45/55 thru 55/45	40/60 thru 60/40	45/55 thru 55/45
Stability			
△f/△T Standard	← ±0.01% (0°C to +70°C) →		
Option 1	← ±0.005% (0°C to +70°C) →		
Option 2	← ±0.001% (0°C to +70°C) →		
Option 3	← ±0.01% (−55°C to +125°C) →		
Option 4	← ±0.005% (−55°C to +125°C) →		
Option 5	← ±0.0025% (−55°C to +125°C) →		
Option 6	← ±0.0005% (0°C to +50°C) →		

Notes: Sinewave Output also available, Std. Sinewave Output is Odbm into 50 Ω.
Sinewave Output Frequency can be extended to 600 MHZ.

TCXO's



FREQUENCY RANGE:
3.00 MHZ thru 30.00 MHZ

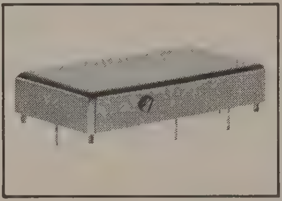
STABILITY:
△F/△Temp: See Below, Six Std. Options

LOGIC FAMILIES:
T.T.L. CMOS ECL

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	3 MHZ to 30 MHZ	3 MHZ to 20 MHZ	3 MHZ to 30 MHZ
Output	Derived from TTL gate	Derived from CMOS gate	Derived from ECL gate
Symmetry	45/55 thru 55/45	40/60 thru 60/40	45/55 thru 55/45
Stability	△F/△Temp.		
Option 1	← ±0.5 ppm (+10°C to +40°C) →		
Option 2	← ±1 ppm (0°C to +50°C) →		
Option 3	← ±2 ppm (−10°C to +60°C) →		
Option 4	← ±3 ppm (−15°C to +65°C) →		
Option 5	← ±4 ppm (−20°C to +70°C) →		
Option 6	← ±5 ppm (−25°C to +75°C) →		

Notes: Sinewave Output also available, Std. Sinewave Output is Odbm into 50 Ω.
Frequency Stability vs. Temp. Options can be extended to ±0.5 ppm over −40°C to +85°C at selected frequencies.
Output Frequencies to 60.00 MHZ, without built-in multipliers, are available.

VCXO's



FREQUENCY RANGE:
3.00 MHZ thru 90.00 MHZ

DEVIATION CAPABILITY:
From ±75 ppm thru ±1500 ppm

LOGIC FAMILIES AND SINEWAVE OUTPUTS

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	3 MHZ to 90 MHZ	3 MHZ to 20 MHZ	3 MHZ to 90 MHZ
Output: Logic	Derived from TTL gate	Derived from CMOS gate	Derived from ECL gate
Output: Sine	Standard Output is O/dbm into a 50Ω Load		
AFC CHARACTERISTICS			
Input Impedance	Models available from 1KΩ to 50KΩ		1KΩ is Std.
Modulation Slope	Both (+) and (−) are available		(+) is Std.
Modulation Response	DC to 100KHZ on special frequencies		DC to 20 KHZ is Std.
Modulation Voltage	Many options available:		
Demodulated Distortion	As low as 1% at ±1000 ppm dev.		3% is Std.

Notes: Output Frequencies, for Sinewave Output, can be extended to 600 MHZ. Output Frequencies above 30.00 MHZ are generated with frequency multipliers.
Complete phase lock loops are available.
Very wideband VCXO's with deviations (up to ±10%) are available.

OCXO's

FREQUENCY RANGE:
1.00 MHZ to 10.00 MHZ

AGING RATES:
As low as $\pm 5 \times 10^{-10}$/day.

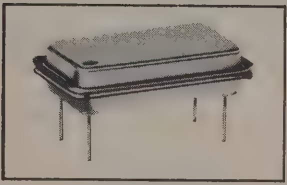
Frequency Range:	1 to 10 MHZ. Range can be extended to 100 MHZ with internal frequency multipliers.	
Output Voltage:	1.0 VRMS ±20% into 50Ω. All forms of logic are also available.	
Aging Rates:	$\pm 5 \times 10^{-9}$/24 hrs	after 72 hrs continuous operation
	$\pm 1 \times 10^{-9}$/24 hrs	after 72 hrs continuous operation
	$\pm 5 \times 10^{-10}$/24 hrs	after 120 hrs continuous operation
	These aging rates are a selectable parameter.	
Stability:	Short Term	3×10^{-11} rms/SEC
	△f/△B+	$\pm 5 \times 10^{-9}$/±10% around B+ and B+ = +20 to +28 VDC
	△f/△RL	$\pm 1 \times 10^{-9}$/±10% around 50Ω
	△f/△Temp.	$\pm 1 \times 10^{-8}$/0°C to +60°C
		$\pm 2 \times 10^{-8}$ −20°C to 65°C
Input Voltage:	Any from +20 V.D.C. to +28 V.D.C. Selectable by P.O.	
Input Power:	5 watts maximum	
Timing:	Mechanical: $\pm 5 \times 10^{-6}$ min.	
	Electrical: $\pm 5 \times 10^{-7}$ min. (+2VDC to +10 VDC)	

REEVES-HOFFMAN

Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Oscillators Hybrid

Hybrid XO's

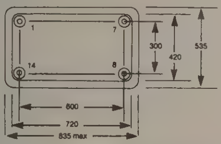


FREQUENCY RANGE:
200.00 HZ thru 200.00 MHZ

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	16 MHZ to 100 MHZ	200 HZ to 20 MHZ	3 MHZ to 200 MHZ
Output	From TTL gate	From CMOS gate	From ECL gate
Symmetry	45/55 thru 55/45	40/60 thru 60/40	45/55 thru 55/45
Stability			
△f/△T Standard	← ±0.01% (0°C to +70°C) →		
Option 1	← ±0.005% (0°C to +70°C) →		
Option 2	← ±0.001% (0°C to +70°C) →		
Option 3	← ±0.01% (−55°C to +125°C) →		
Option 4	← ±0.005% (−55°C to +125°C) →		
Option 5	← ±0.0025% (−55°C to +125°C) →		
Option 6	← ±0.0005% (0°C to +50°C) →		

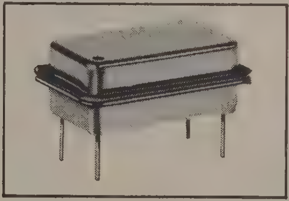
Notes: Initial accuracy on options (1) thru (6) is ±0.001% at room temp.
Models available with external frequency adjust capability. External capacitor between pin (1) and circuit ground.

PACKAGE HEIGHT
MAXIMUM .200



PIN CONNECTIONS
1. CASE & CIRCUIT GND.
7. CASE & CIRCUIT GND.
8. OUTPUT
14. VCC = +5.0 V.D.C.

TTL Hybrid Crystal VCXO's

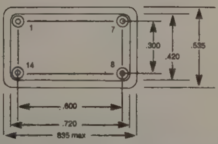


FREQUENCY RANGE:
4.00 MHZ thru 30.00 MHZ

FREQUENCY DEVIATION:
±75ppm min. with ±1.5 VDC

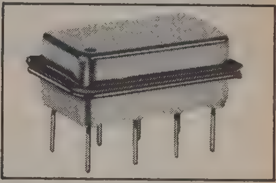
SPECIFICATIONS	
Frequency Range	4.00 MHZ thru 30.00 MHZ
Output (0 to 10 TTL Loads)	Square wave TTL compatible output is from a TTL gate
Symmetry	40/60 to 60/40
Input Voltage	+5.0 V.D.C. ±5%
Input Current	15 to 75 MA
Stability	±25 P.P.M. includes a combined effect of temperature, 1 year aging, initial set accuracy, load variations, and VCC variations.
Temperature Range	0°C to +70°C
AFC CHARACTERISTICS	
Input Voltage	+2.5 V.D.C. ±1.5 V.D.C. (On AFC pin #1)
Frequency Deviation	±75 P.P.M. min. with ±1.5 V.D.C.
Modulation Response	DC to 20KHZ
Linearity	Less than 5% from a straight line
Modulation Slope	(+) As input voltage goes positive, frequency increases
Input Impedance	50KΩ min.

PACKAGE HEIGHT
MAXIMUM .335



PIN CONNECTIONS
1. A.F.C. INPUT
7. CASE AND CIRCUIT GND.
8. OUTPUT
14. VCC = +5.0 V.D.C.

TTL Hybrid Crystal TCXO's

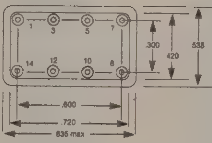


FREQUENCY RANGE:
12.50 MHZ thru 25.00 MHZ

STABILITIES: To ± 5 x 10^{-7}

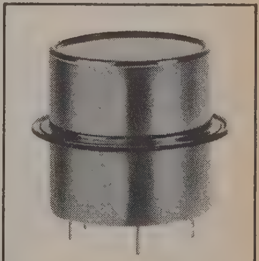
SPECIFICATIONS	
Frequency Range	12.50 MHZ thru 25.00 MHZ
Calibration	External 10K Potentiometer, ±7.0 P.P.M. Min.
Frequency Stability	
Option	△f / △Temp.
1	±2.5 P.P.M./(−35°C to +75°C)
2	±1.5 P.P.M./(−35°C to +75°C)
3	±1.0 P.P.M./(−35°C to +75°C)
4	±1.0 P.P.M./(0°C to +75°C)
5	±1.0 P.P.M./(0°C to +50°C)
6	±0.5 P.P.M./(0°C to +50°C)
△f / △B+	±0.01 P.P.M./(+10.0 ±1.0 V.D.C.)
△f / △Rl	±0.05 P.P.M./(50Ω ± 5Ω any angle)
△f / △Time	±1.0 P.P.M./year @ 40°C average
(ℒ)	−130 dbc @ 25 KHZ
INPUT	+10.0 V.D.C. ±1.0 V.D.C./5 MA max.
OUTPUT	
Wave Shape	A-C coupled negative pulse
Amplitude	1.0 V.P.P. min. → 50Ω 3 V.P.P. max.

PACKAGE HEIGHT
MAXIMUM .335



PIN CONNECTIONS
1. REGULATED D.C.
3. ELECTRONIC FREQ. ADJ.
5. N.C. INTERNAL USE ONLY
7. CASE & CKT GROUND
8. OUTPUT
10. N.C. INTERNAL USE ONLY
12. N.C. INTERNAL USE ONLY
14. +10 V.D.C.

Hybrid OCXO's

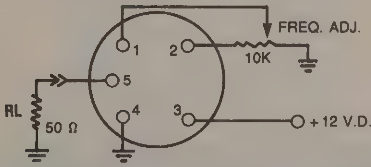


FREQUENCY RANGE:
8.00 MHZ thru 12.00 MHZ

VOLUME:
Less than 0.8 cu. in.

Frequency Range:	8.00 MHZ thru 12 MHZ.
Output Voltage:	0dbm → 50Ω.
Harmonic Distortion:	10% maximum.
Stability:	△f/△Temp: ±1 x 10^{-7}/(0°C to +70°C) △f/△Power: ±1 x 10^{-8}/ ± 10% △f/△RL: ±1 x 10^{-8}/ ± 10% △f/△Time: ±1 x 10^{-6}/year after 30 days, continuous operation
Input Voltage:	+12 V.D.C. ±10%.
Input Power:	.8W maximum at turn on. .5 watts typ at +25C after warm-up.
Warm-Up:	30 min. max. to within ±1 x 10^{-7} of 24 hr. frequency.
External Frequency Adj.:	External 10K potentiometer. A regulated voltage is provided for the external frequency adjustment potentiometer.
Size:	1.00″ dia. x 1.00″ high (dia. at sealing ring 1.2″)

Notes: Fast warm-up units available to 3 min.
Frequency range can be extended to 20 MHZ at relaxed aging specifications.



..SaRonix....

NYMPH™

Quartz Crystal Units
- Microprocessors
- Communications
- Telecommunications
- Toys & games
- Computers & peripherals
- Instruments

Tuning Fork Crystals
- Clocks & watches
- Computer circuits
- Timers
- Pacemakers

Quartz Crystals

SaRonix offers a broad line of crystal products with the best combination of price, quality, delivery, and service available. We carry a large stock of commonly used crystals, and feature rapid turnaround time on special units and large production runs.

In addition to the industry standard holders, many special configurations and a wide range of miniature units are available. We provide back-up stock for all scheduled orders.

Send your drawings and specifications, or call our Customer Service Department for ordering assistance and availability. Toll free (800) 227-8974

Standard Microprocessor

The accompanying selection chart lists NYMPH AT-cut quartz crystals for most common microprocessor applications. Frequencies, configurations, and circuit calibration conditions shown are those in general industry usage or are as recommended by the various microprocessor manufacturers.

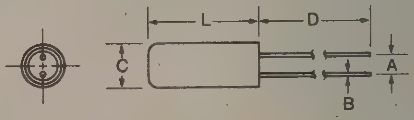
FREQUENCY MHZ	NYMPH PART NUMBER
HC-33/U	
1.000000	NYP010-13
1.000000	NMP010
1.843200	NYP018-13
1.843200	NMP018
2.000000	NYP020-20
2.000000	NMP020
2.097152	NYP021-20
2.457600	NYP024-32
2.457600	NMP024
3.579545	NYP035-18
3.579545	NYP035-18S*
HC-18/U	
1.000000	NMP010A
1.843200	NMP018A
2.000000	NYP020A-20
2.000000	NMP020A
2.097152	NYP021A-20
2.457600	NYP024A-20
2.457600	NMP024A
3.000000	NYP030A-30
3.000000	NMP030A
3.276800	NYP032A-15
3.276800	NMP032A
3.330000	NMP033A
3.579545	NYP035A-18
3.579545	NMP035A
3.600000	NYP036-30
3.600000	NMP036
3.686400	NYP037-20
3.686400	NMP037
3.932160	NYP039-12
3.932160	NMP039
4.000000	NYP040-20
4.000000	NMP040
4.194303	NYP041-12
4.433619	NYP044-20
4.915200	NMP049
5.000000	NYP050-20
5.068800	NMP051
5.185000	NYP052-20
5.714300	NMP057
5.990400	NMP059
6.000000	NMP060
6.144000	NYP061-30
6.400000	NYP064-20
6.553600	NMP065
7.000000	NMP070
7.159090	NYP071-20
7.372800	NMP073
8.000000	NYP080-18
HC-18/U	
8.000000	NMP080
9.216000	NMP092
9.830400	NMP098
10.000000	NMP100
10.738635	NYP107-32
10.738635	NMP107
11.000000	NMP110
11.059200	NMP111
12.000000	NMP120
12.288000	NMP122
13.516800	NMP135
14.318180	NMP143
14.745600	NMP147
15.000000	NMP150
16.000000	NMP160
16.384000	NMP163
17.360000	NMP173
18.000000	NMP180
18.432000	NMP184
19.354000	NMP193
19.660800	NMP196
20.000000	NMP200
22.118400	NMP221
23.400000	NMP234
24.000000	NMP240
24.576000	NYP245-18
25.000000	NMP250
27.000000	NMP270
30.000000	NMP300
32.000000	NMP320
36.000000	NMP360
40.000000	NMP400
48.000000	NMP480
HC-44/U	
6.000000	44N060
8.000000	44N080
10.000000	44N100
12.000000	44N120
12.500000	44N125
14.318180	44N143
14.400000	44N144
15.000000	44N150
16.000000	44N160
18.000000	44N180
18.432000	44N184
19.354000	44N193
19.660800	44N196
20.000000	44N200
22.118400	44N221
24.000000	44N240
25.000000	44N250

*Special .375″ lead spacing

Tuning Forks

The NYMPH tuning fork type quartz crystal provides the circuit designer with the ultimate in size, performance, and economic trade-offs. This highly reliable, stable, and accurate device is available in two micro-miniature sizes for time base applications operating from a 32.768 KHz reference frequency.

Dimensions



	Part Number	
	NTF3238	**NTF3226**
A	1.1±0.2	0.8±0.1
B	0.3±0.07	0.2±0.05
C	3.1 max	2.1 max
L	8.3 max	7.0 max
D	9.0 min	5.0 min

Dimensions in mm

Electrical Specifications

	Part Number	
	NTF3238	**NTF3226**
Freq. @ 25°C	32.768 KHz ± 20 ppm	
Turnover Temp.	25°C±5°C	
Temperature Characteristic-K	-0.038 ppm/°C^2 Typical ($\Delta f/f=K(T_o-T)^2$ where T=pt. of temperature comparison)	
Quality Factor	100,000, Typical	90,000 Typical
Load Cap.	9.5 to 15pF, Typical	
Series Resist.	30 K ohms max.	40 K ohms max.
Drive Level	10 μW Max	
Aging	First 30 Days: 3.0 ppm First Year: 5.0 ppm	
Optg. Temp.	-10 to $+60$°C	

..SaRonix..... 4010 Transport at San Antonio • Palo Alto, California 94303 • (415) 856-6900 • (800) 227-8974

..SaRonix....

NYMPH™

Crystal Clock Oscillators

- TTL
- CMOS
- Baud Rate Generator
- MPU Clock Driver
- Special Output Characteristics
- Selectable Frequency Outputs

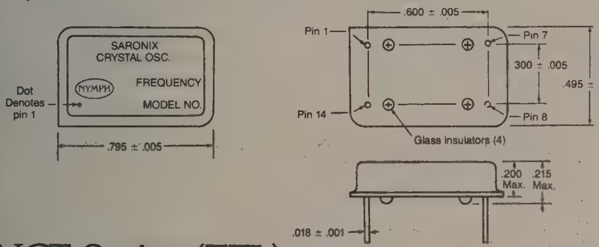
Physically and functionally interchangeable with all major manufacturers' devices.

Crystal Clock Oscillators

Fixed Frequency

The SaRonix NYMPH crystal clock oscillator family includes a wide variety of state-of-the-art thick film hybrid devices for generating TTL, CMOS, Baud Rates, and special output characteristics.

These devices are packaged in a 14 pin DIP compatible, all metal, resistance welded, hermetic unit. They are physically and functionally interchangeable with all major manufacturer's devices.



NCT Series (TTL)

Freq. Range: 250 kHz–60 MHz
Freq. Stability: ±0.0025 to ±1.00% over optg. temp. & voltage
Optg. Temp. Range: 0 to +70°C
Input Voltage: +5 VDC ± 0.5 V
TTL Output:
Symmetry: 60/40 to 40/60 @1.4 VDC Level
Rise & Fall Times: 15 ns Max. for 250 kHz to 25 MHz, 7 ns Max. for 25 MHz to 60 MHz
"O" Level: +0.4 Volts
"I" Level: +2.4 Volts
Output Load: 1 to 10 TTL gates

Standard TTL Frequencies

(Available from stock)

Part No.	Freq. (MHz)	Part No.	Freq. (MHz)
NCT040C	1.0000	NCT050C	10.0000
NCT040C	1.8432	NCT050C	12.0000
NCT040C	2.0000	NCT050C	16.0000
NCT040C	2.4576	NCT050C	18.4320
NCT050C	4.0000	NCT050C	19.6608
NCT050C	5.0000	NCT050C	20.0000
NCT050C	5.0688	NCT070C	22.1184
NCT050C	6.0000	NCT070C	24.0000
NCT050C	6.1440	NCT070C	32.0000
NCT050C	8.0000	NCT070C	40.0000

NCC Series (CMOS)

Freq. Range: 600 Hz–8 MHz
Freq. Stability: ±0.0025 to ±1.00% over optg. temp. & voltage
Optg. Temp. Range: 0 to +70°C
Input Voltage: (V_{DD}) +4.5 VDC to +12 VDC
CMOS Output:
Symmetry: 60/40 to 40/60 @ ½V_{cc}
Fall: 140 ns max. @ V_{DD} = +5 VDC } R_L +200 KΩ
50 ns max. @ V_{DD} = +12 VDC } C_L +50 pf
"O" Level: +0.2 V 50 KΩ load to V_{DD}
"I" Level: (V_{DD}−0.2)V 50 KΩ load to com.

Selectable Frequency

The 8600 Series is a unique family of hybrid oscillators which combines a quartz crystal unit with CMOS circuitry in a 16 pin DIP package. By appropriate selection of six leads, 57 different output frequencies may be generated from the base frequency of the crystal.

8640 Series

Frequency Characteristics

Output Freq. Range: 1 MHz ~ 0.0042 Hz
Freq. Tolerance: ±100 ppm
Aging: ±10 ppm/year
Volt. Coefficient: Typical 10, max. 40 ppm/V
Turnover Temp.: Min. 15, typical 30, max. 45°C
Temp. Coefficient: Typical 0.03, max. 0.05 ppm/°C

Maximum Ratings

Supply Voltage: −0.3 to +10 V
Operating Temp.: −10 to +70°C
Storage Temp.: −30 to +85°C

8650/8651 Series

Frequency Characteristics

Output Freq. Range: 130 KHz ~ 0.00025 Hz
Freq. Tolerance: 8650: ± 50 ppm
8651: ± 5 ppm
Aging: ± 3 ppm/year
Volt. Coefficient: Typical 2 ppm/V
Turnover Temp.: 8650: Typical 25°C
8651: Min. 20, typical 25, max. 30°C
Temp. Coefficient: Min. 0.03, typical 0.035, max. 0.04 ppm/°C²

Maximum Ratings

Supply Voltage: −0.3 to +8 V
Operating Temp.: 8650: −10 to +70°C
8651: −10 to +60°C
Storage Temp.: 8650: −30 to +80°C
8651: −10 to +70°C

Selection Chart

Model	Output Frequency Range	Frequency Tolerance
8640-A	600 KHz—0.005 Hz	± 100 ppm
8640-B	1 MHz—0.0083 Hz	± 100 ppm
8640-C	768 KHz—0.0064 Hz	± 100 ppm
8640-O	Dividing IC Only	
8640-P	50,60 Hz Only	± 100 ppm
8650-A	60 KHz—0.0005 Hz	± 50 ppm
8650-B	100 KHz—0.00083 Hz	± 50 ppm
8651-A	60KHz—0.0005 Hz	± 5 ppm
8651-B	100 KHz—0.00083 Hz	± 5 ppm

..SaRonix.... 4010 Transport at San Antonio • Palo Alto, California 94303 • (415) 856-6900 • (800) 227-8974

SAW Resonator Products

Surface Acoustic Wave Technology provides performance advantages and design flexibility that has proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance resonators, resonator filters, oscillators, and other state-of-the-art signal processing components such as pulse compressors, delay lines, and bandpass filter products. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks comprised of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW resonator products produced by Sawtek and their characteristics are summarized below.

SAW RESONATORS

Sawtek offers SAW resonators at fundamental frequencies from 100 MHz to more than 1000 MHz. These are high Q components which are primarily intended to be used in oscillators and are also used for both bandpass and notch filters. Sawtek resonators are inherently spur free in oscillator applications, exhibit low motional resistance, and have a pulling range comparable to a 3rd overtone bulk wave crystal. Typical values of R_s range from 15 Ω to 150 Ω and capacitance ratios are nominally 2000:1. Incorporation of special metalization improves oscillator noise performance by permitting drive levels up to +20 dBm. These quartz devices can achieve temperature stability of less than 50 PPM from 0°C to 60°C. Both one-port and two-port configurations are available.

Sawtek maintains a large inventory of pre-tooled SAW resonator crystals including many frequencies for CATV convertor applications. New designs can also be tooled rapidly to meet custom requirements. The 668 MHz resonator shown below is representative of Sawtek's low-cost standard products.

SAW OSCILLATORS

SAW resonator-controlled oscillators are currently produced by Sawtek for military and aerospace systems. Because they are able to operate at fundamentals of over 1000 MHz, SAW oscillators simplify design, reduce cost, and improve noise performance through the elimination of multiplier stages. In many applications it is also possible to achieve adequate power in one stage to directly drive a mixer and thereby eliminate the need for a buffer/amplifier stage.

Typical of the company's oscillator products is a fixed frequency, oven stabilized SAW resonator oscillator at 740 MHz. All spurious and harmonics are down 60 dB; the short-term stability is $\pm 2.5 \times 10^{-10}$ for 1.0 to 25 second averaging times and the phase noise is 120 dBc/Hz for a 2.5 kHz offset. The frequency versus temperature stability of this miniature ovenized unit is ±2 PPM from −15° to +60°C. A maximum power consumption of only 1.75 watts at −15°C ambient is achieved. Sawtek also offers assistance in oscillator design for low-cost consumer and commercial applications and is prepared to help evaluate the suitability of SAW oscillators for each new application.

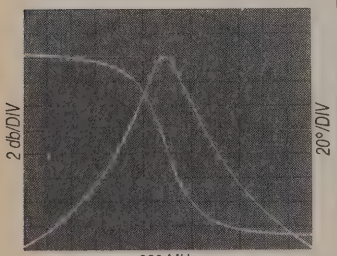
SAW RESONATOR FILTERS

SAW resonator filters provide high rejection and low loss for narrowband applications requiring 0.01% to 0.25% fractional bandwidths. This family of Sawtek's resonator filters is characterized by a "new shape" in narrowband filter technology. The unique shape demonstrated in the performance photographs below arises from the combination of transversal filter and resonator characteristics: the narrowband response produced by the resonant cavity emerges from the broader passband of the input and output transducers.

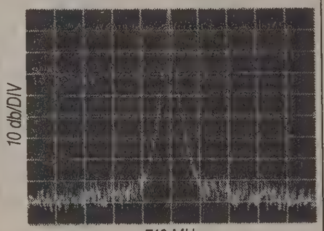
Two pole versions typically exhibit from 2 dB to 5 dB insertion loss with 15 dB to 20 dB near-in rejection and 55 dB to 75 dB ultimate rejection. The two-pole 537 MHz resonator filter shown on the left below has a matched insertion loss of only 4.5 dB, 18 dB close-in rejection, and 60 dB ultimate rejection.

Rejection which is beyond the measurable range of most test instruments can be achieved by cascading these two-pole units into multipole configurations. Depending on the number of poles, this technique provides from 20 dB to 60 dB of near-in rejection, improved shape factor and reduced flyback. Insertion loss generally increases at a rate of less than 1 dB per pole for these filters. The six pole 149.3 MHz filter on the bottom right has an insertion loss of only 5.7 dB and an ultimate rejection of over 100 dB.

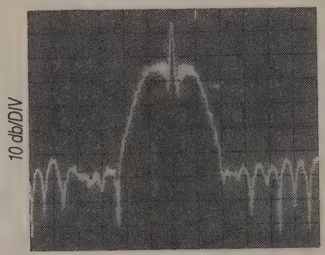
Sawtek's resonator filters are provided in individual two-pole stages in TO-8 and TO-5 packages and in custom modules when several of these 2 pole units are cascaded. Sawtek offers standard resonator filters and also rapid custom design.



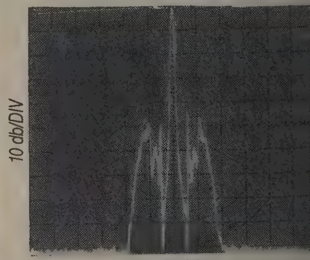
668 MHz
85 KHz/DIV



740 MHz
1 KHz/DIV



537.5 MHz
5 MHz/DIV



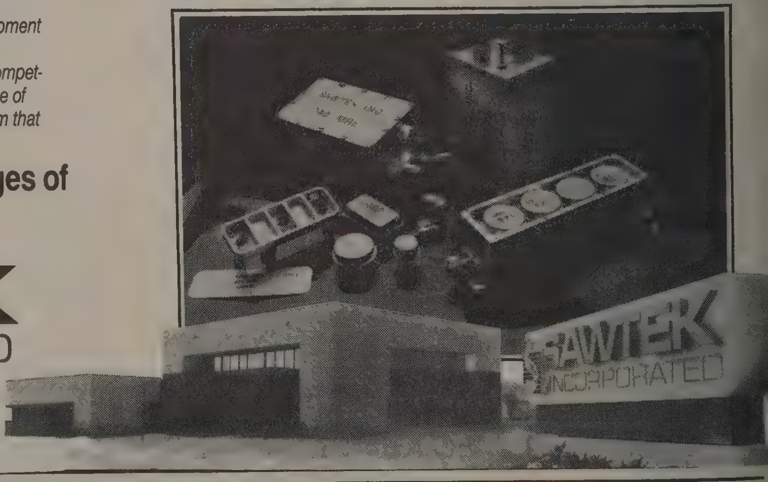
149.3 MHz
1.5 MHz/DIV

Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology . . . Demand Sawtek.

SAWTEK
INCORPORATED

P.O. Box 18000, Dept. EM, Orlando, FL 32860, (305) 886-8860

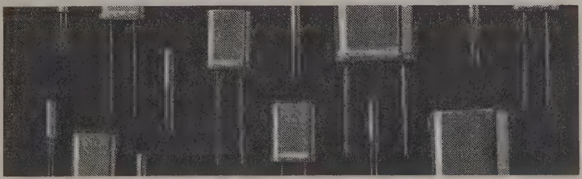


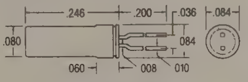
SEIKO INSTRUMENTS

STANDARD CRYSTALS/OSCILLATORS

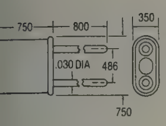
QUARTZ CRYSTALS

Seiko Instruments offers a wide range of high quality, competitively priced quartz crystals. These units are particularly well suited for microprocessors, peripherals, clocks, and other time-based applications where small size, temperature stability, and high reliability are required.

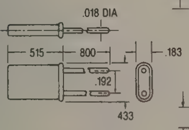




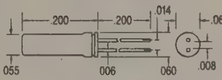
DS-VT-200
32.768 KHz



HC-33U
1.0 ~ 10.0 MHz



HC-18U
1.2 ~ 120.0 MHz



DS-VT-150
32.768 KHz

QUARTZ CRYSTAL SPECIFICATIONS

	HC-33U	HC-18U	DS-VT-150	DS-VT-200
Frequency Range	1—3 MHz	3—120 MHz	32.768 KHz	
Frequency Tolerance	±.002% at 25°C			
Temp. Stability	±.005%			
Temp. Range	0°C to 70°C		−10°C to +60°C	
ES Resistance	1 MHz Range 500Ω 2 MHz Range 300Ω	3 MHz Range 250Ω 4 MHz & above. 100Ω	30KΩ	50KΩ
Drive Level	50μW to 5mW		1.0μW Max.	0.4μW Max.
Shunt-Capacitance	7 pF Max.		0.86 pF Max.	
Storage Temp.	−55°C to 105°C		−30°C to +70°C	

STANDARD FREQUENCY LIST

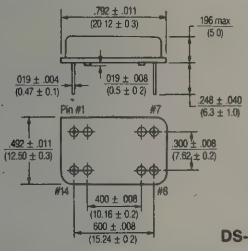
FREQ.	PART #	CASE	LOAD CAP.
1.000 MHz	DS-100	HC-33/U	16 pF
1.73	DS-173	IC-33/U	Series
1.8432	DS-184	HC-33/U	16 pF
2.00	DS-200	HC-33/U	16 pF
2.097152	DS-209	HC-33/U	16 pF
2.4576	DS-245	HC-33/U	32 pF
2.50	DS-250	HC-33/U	Series
3.00	DS-300	HC-18/U	16 pF
3.072	DS-307	HC-18/U	18 pF
3.12	DS-312	HC-18/U	12 pF
3.2768	DS-327	HC-18/U	16 pF
3.330	DS-333	HC-18/U	Series
3.330	DS-333A	HC-18/U	20 pF
3.579545	DS-357	HC-18/U	16 pF
4.00	DS-400	HC-18/U	Series
4.00	DS-400A	HC-18/U	16 pF
4.032*	DS-403	HC-18/U	22 pF
4.194304	DS-419	HC-18/U	16 pF
4.440	DS-444	HC-18/U	20 pF
4.550	DS-455	HC-18/U	20 pF
4.750	DS-475	HC-18/U	20 pF
4.9152	DS-491	HC-18/U	Series
4.9562	DS-495	HC-18/U	Series
5.000	DS-500	HC-18/U	20 pF
5.0688	DS-506	HC-18/U	Series
5.120	DS-512	HC-18/U	Series
5.1850	DS-518	HC-18/U	20 pF
5.5850	DS-558	HC-18/U	Series
5.5870	DS-558A	HC-18/U	20 pF

*Special Spec.

FREQ.	PART #	CASE	LOAD CAP.
6.00 MHz	DS-600	HC-18/U	Series
6.144	DS-614	HC-18/U	30 pF
6.250	DS-625	HC-18/U	16 pF
6.400	DS-640	HC-18/U	16 pF
6.5536	DS-655	HC-18/U	16 pF
8.00	DS-800	HC-18/U	Series
8.00	DS-800A	HC-18/U	18 pF
8.33	DS-833	HC-18/U	Series
10.00	DS-1000	HC-18/U	Series
10.92	DS-1092	HC-18/U	10 pF
11.00	DS-1100	HC-18/U	10 pF
12.00	DS-1200	HC-18/U	10 pF
15.00	DS-1500	HC-18/U	10 pF
16.00	DS-1600	HC-18/U	Series
18.00	DS-1800	HC-18/U	Series
18.432	DS-1843	HC-18/U	Series
20.00	DS-2000	HC-18/U	Series
22.00	DS-2200	HC-18/U	Series
22.1184	DS-2211	HC-18/U	Series
23.40	DS-2340	HC-18/U	Series
24.00	DS-2400	HC-18/U	Series
25.00	DS-2500	HC-18/U	Series
27.00	DS-2700	HC-18/U	Series
32.00	DS-3200	HC-18/U	Series
36.00	DS-3600	HC-18/U	Series
48.00	DS-4800	HC-18/U	Series
32.768 KHz	DS-VT-200	6.2 x 2.0 mm (cylindrical)	6 pF
32.768 KHz	DS-VT-150	5.1 x 1.5 mm (cylindrical)	6 pF

CRYSTAL OSCILLATORS

Seiko Instruments clock oscillators provide all metal, hermetically sealed cases; notably low power consumption; and tight frequency stability for the most demanding applications and reliability. Units are TTL or CMOS compatible.



DS-C304A

SPECIFICATIONS

STANDARD	DS-C304A
Frequency Range	250 KHz to 50 MHz
Frequency Stability	±.007% @ 25°C
Temperature Stability	±.001%
Temperature Range	0°C to 70°C
Storage Temperature	−55°C to +125°C
Input Voltage	+5.0 ±0.5V dc
Input Current	90mA over temp. range
Symmetry	60/40% @ 1.4V dc
Rise and fall time	15 ns maximum (250 KHz–8.999 MHz) 10 ns maximum (9.0 MHz–31.999 MHz) 6 ns maximum (32 MHz–50 MHz)
Output Load	1 to 10 TTL gates

STANDARD FREQUENCY LIST

FREQ.	* STOCK #
1.0	DSC100
1.2288	DSC122
1.8432	DSC184
2.0	DSC200
2.4576	DSC245
4.0	DSC400
4.9152	DSC491
5.000	DSC500
5.0688	DSC506
6.00	DSC600
6.144	DSC614
7.3728	DSC737
8.000	DSC800

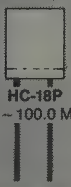
FREQ.	* STOCK #
10.000	DSC1000
12.000	DSC1200
16.000	DSC1600
16.384	DSC1638
18.432	DSC1843
19.6608	DSC1966
20.000	DSC2000
22.1184	DSC2211
24.000	DSC2400
25.000	DSC2500
32.000	DSC3200
40.000	DSC4000

* Part No. DS-C304A.

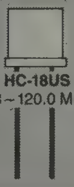
CUSTOM CRYSTALS/OSCILLATORS

QUARTZ CRYSTALS

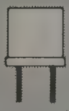
Seiko Instruments also offers the following custom cases for your special quartz crystal engineering needs. Plus, the smallest MHz quartz crystal units in the world…the DS-MGQ series with a frequency range of 1 to 3 MHz, and a temperature stability of ±5 ppm from −30 to +70°C.



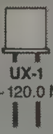
HC-18P
3.2 ~ 100.0 MHz



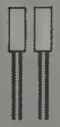
HC-18US
1.8 ~ 120.0 MHz



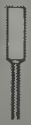
HC-25US
1.8 ~ 120.0 MHz



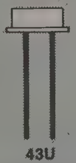
UX-1
1.8 ~ 120.0 MHz



DS-MGQ
1.0 ~ 3.0 MHz



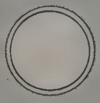
38C/39C
3.2 ~ 10.0 MHz



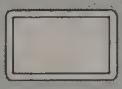
43U
3.0 ~ 20.0 MHz

CRYSTAL OSCILLATORS

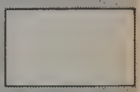
Seiko Instruments also offers tight tolerance oscillators in the cases shown below. Call for complete details.



DS-C308
0.5 ~ 64.0 Hz
3.0 ~ 16.0 MHz



DS-C304
250KHz ~ 50.0 MHz



DS-C303
3.0 ~ 24.0 MHz

SEIKO INSTRUMENTS U.S.A., INC., 2990 W. Lomita Blvd., Torrance, CA 90505 • (213) 530-8777

SMALL WORLD, ISN'T IT?

Modern communication is making the world smaller — and our universe larger. From belt pagers to space relays, communication tightens our human network, and extends our influence to the stars. A key ingredient in communication science is and has been crystals and crystal filters. That's what we make at Sokol.

Our specialties (see graphs) include monoliths, discretes, crystals, and time delays — in a fundamental frequency range of 1-100 MHz, with overtones to 500 MHz. Standards and classics we can ship yesterday. But innovation is what we thrive on. We offer:

MINIATURIZATION. We make the smallest matched set of filters in the industry. Our HC45 package matches or beats performance specs for similar fundamental crystal filters at about 1/3 the size. (And would you believe frequencies above 20 MHz in a package 1/10" diameter by 1/4" high?)

ENGINEERING ASSISTANCE. If what you need exists only as a hole in your schematic, we provide engineering assistance, and the optimum solution in terms of performance, price, and durability. So send us your specs. We'll never say, "This will do." *You* have to say, "This is it!"

QUALITY. We test to any MIL spec, and can handle shock to 2,000 G's, vibration to 3,000 Hz, corrosion, heat, humidity and altitude. Immaculate handling of high quality crystal blanks, and precision testing assure pinpoint performance and maximum working life. As a matter of national pride, we make sure our products surpass imports in all parameters. Including price.

All of which goes to show, you never know who you might run into. Even just leafing through a magazine. We're pleased to let you know that the solutions to your communication engineering needs are only a phone call away.

Small world, isn't it?

NOW!

Sokol Sub-Mini Tubular

Frequency range: 4.3 MHz to 250 MHz

Monolithics as fundamentals to 100 MHz and overtones to 500 MHz

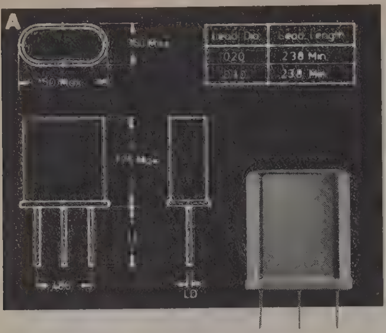
C.F. In MHz	3 dB B.W. In KHz	20 dB B.W. In KHz	Nominal Impedance In Ohms
17.90	15	80	2000
21.40	15	80	1400
25.50	70	400	5000
30.00	30	170	1000
43.50	13	85	3000
45.00	30	130	1200
70.00	30	170	5000
156.00	13	70	3600

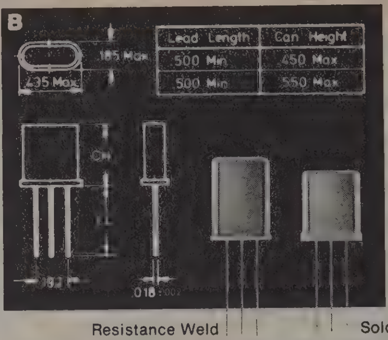
See following pages for our specialties.

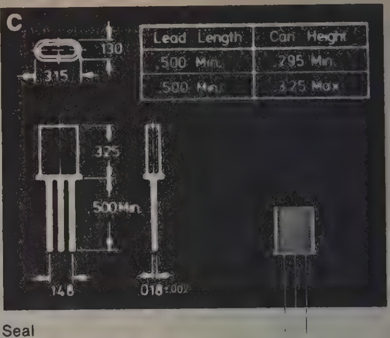
SCP Sokol Crystal Products, Inc.

"Where the Impossible Becomes the Ordinary."

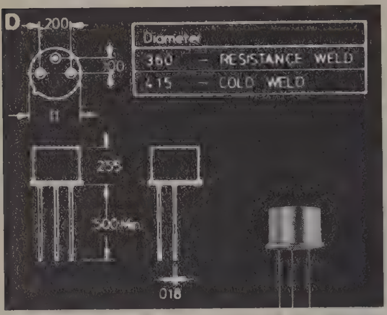
121 Water Street, P.O. Box 249
Mineral Point, WI 53565, Phone 608-987-3363

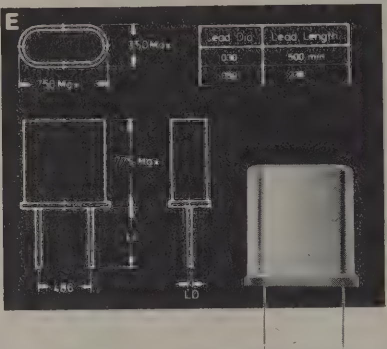

A
Lead Dia
Lead Length
.020
238 Min
238 Min
LD

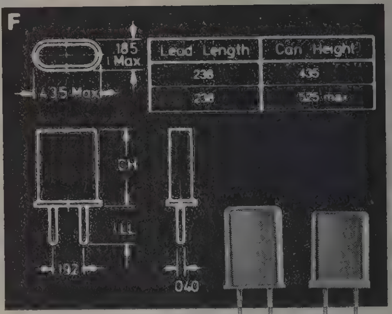

B
185 Max
435 Max
Lead Length
Can Height
500 Min
450 Max
500 Min
550 Max
CH
.018 ±.002


C
130
315
Lead Length
Can Height
.500 Min.
.295 Min.
.500 Min.
.325 Max
325
500 Min.
148
.018 ±.002

Resistance Weld Solder Seal


D
200
Diameter
360 — RESISTANCE WELD
415 — COLD WELD
255
500 Min
018


E
Lead Dia
Lead Length
500 min
LD


F
185 Max
435 Max
Lead Length
Can Height
238
435
238
CH
192
040

Resistance Weld Solder Seal

Two Pole Monolithic Filters

Frequency range: 4.3 MHz to 250 MHz

Monolithics as fundamentals to 100 MHz and overtones to 500 MHz.

C.F. In MHz	3 dB B.W. In KHz	20 dB B.W. In KHz	Nominal Impedance In Ohms	Package Style
5.20	150	900	120	A
5.26	13	70	6000	A
9.00	15	80	4300	B, D
10.70	13	70	1800	B, D
10.70	13	70	3300	B, C, D
10.70	30	165	4300	B, D
10.70	30	165	6500	B, C, D
11.40	10.6	50	2000	B, D
15.1875	36	200	4700	B, C, D
16.90	13	70	390	B, C, D
17.90	15	80	2000	B, C, D
21.40	15	80	1400	B, C, D
25.50	70	400	5000	B, C, D
30.00	30	170	1000	B, C, D
43.50	13	85	3000	B, C, D
45.00	30	130	1200	B, C, D
70.00	30	170	5000	B, C, D
156.00	13	70	3600	B, C, D

Wide Band Crystal and L-C Filter

Frequency range: 100 KHz and 500 MHz

Center Frequency	3 dB B.W.	60 dB B.W.	Insertion Loss	Characteristic Impedance	Package Size
3.0 MHz	3 KHz	3.4 KHz	6 dB	50 ohms	2.9 x 1 x 1
10.607 MHz	186 KHz	260 KHz	8 dB	50 ohms	2.4 x 1 x .9
10.700 MHz	210 KHz	400 KHz	8 dB	50 ohms	2.4 x 1 x .9
10.700 MHz	500 KHz	1000 KHz	8 dB	50 ohms	2.4 x 1 x .9
21.400 MHz	250 KHz	450 KHz	7 dB	50 ohms	2.0 x .9 x .5
21.400 MHz	500 KHz	900 KHz	9 dB	50 ohms	2.4 x 1 .9
21.400 MHz	150 KHz	350 KHz	6 dB	50 ohms	2.0 x .8 x .5
30.000 MHz	500 KHz	1000 KHz	6 dB	50 ohms	2.4 x 1 x .9
21.400 MHz	1000 KHz	4000 KHz	6 dB	50 ohms	1.105 x .496 x .500
21.400 MHz	2000 KHz	8000 KHz	6 dB	50 ohms	1.105 x .496 x .500
21.400 MHz	300 KHz	750 KHz	6 dB	50 ohms	1.105 x .496 x .500
21.400 MHz	500 KHz	2000 KHz	6 dB	50 ohms	1.105 x .496 x .500

Four Pole on One Blank (Miniature Filters)

Frequency range: 15 MHz to 250 MHz Spurious greater than 40 dB below passband response.

C.F. In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Insertion Loss	Characteristic Impedance	Pkg. Style
45.0	15	70	3 dB	4000 ohms	B
72.2	25	120	3 dB	3600 ohms	B
75.0	26	110	3 dB	4000 ohms	B
82.8	30	130	2 dB	3500 ohms	B
99.0	40	180	2 dB	3000 ohms	B
121.0	50	225	2 dB	3000 ohms	B

Packaged Time Delay Filters

Frequency range: 1 MHz to 350 MHz

Time Delay Filters as narrowband monolithics and wideband uniwafers to minimize size and weight.

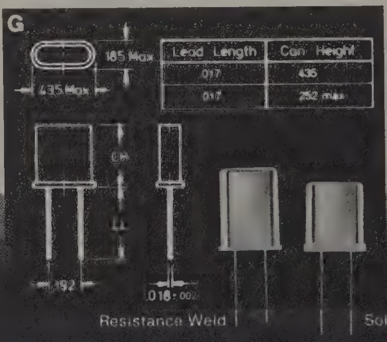
C.F. In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Differential Delay over 3 dB B.W. (In Microseconds)	Package Size
5.120	3.7	10	165	2.375 x 1 x .940
10.700	13.0	55	25	1.75 x .23 x .63
12.500	19.0	125	10	1.280 x .716 x .410
13.500	20.0	95	35	1.880 x .873 x .500
21.400	26.0	130	25	1.105 x .496 x .500
25.000	30.0	140	20	1.105 x .496 x .500
30.000	100.0	700	40	2.375 x 1 x .600
42.900	30.0	60	20	2.375 x 1 x .600

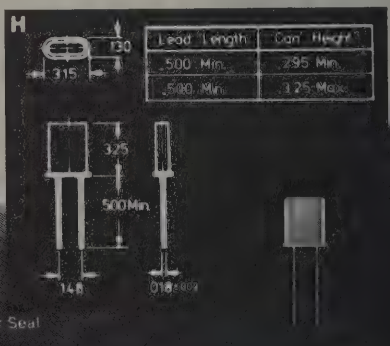
Matched Filter Sets

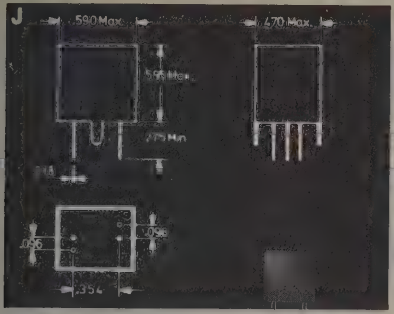
Frequency range: 1 MHz to 500 MHz

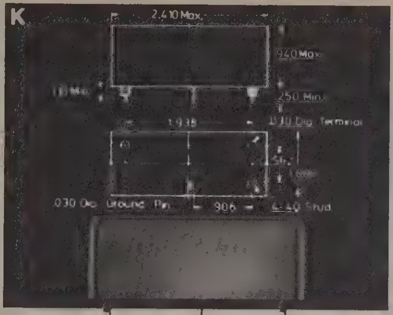
Phase and Amplitude matched sets along with minimized size and weight.

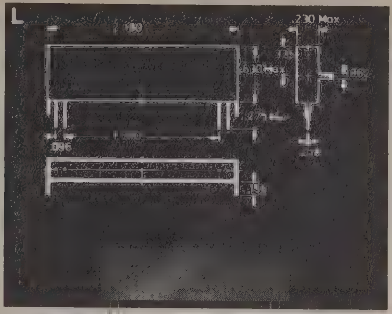
Center Frequency	No. of Filters in matched set	3 dB B.W.	60 dB B.W.	Nominal Impedance	Amplitude Match	Phase Match	Size
5.0 MHz	4	3.0 KHz	10 KHz	1000 ohms	0.2 dB	±1°	2.4 x 1 x .9
5.6 MHz	3	4.5 KHz	13 KHz	50 ohms	0.2 dB	±1°	2.4 x 1 x .9
10.7 MHz	2	25 KHz	100 KHz	50 ohms	0.1 dB	±2°	1.06 x 5 x .6
21.4 MHz	2	10 KHz	20 KHz	1000 ohms	0.2 dB	±2°	1.75 x .6 x .2
21.4 MHz	2	25 KHz	50 KHz	2500 ohms	0.2 dB	±2°	1.75 x .6 x .2
21.4 MHz	2	50 KHz	100 KHz	3000 ohms	0.5 dB	±3°	1.75 x .6 x .2
28.0 MHz	3	5 KHz	15 KHz	50 ohms	0.2 dB	±2°	1.06 x .5 x .5

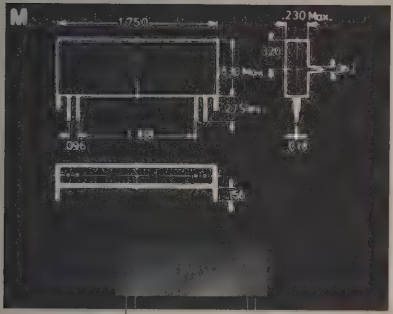

G
185 Max
435 Max
Lead Length
Can Height
.017
435
.017
252 max
CH
192
.018 ±.002
Resistance Weld
Solder Seal

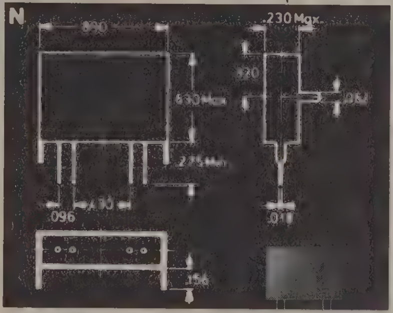

H
130
315
Lead Length
Can Height
.500 Min.
.295 Min.
.500 Min.
.325 Max
325
500 Min.
148
.018 ±.002

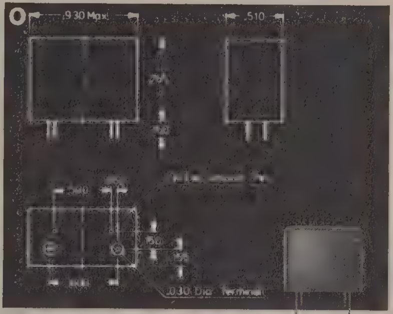
J


K


L


M


N


O


Multipole Monolithic Filters

Frequency range: 4.3 MHz to 350 MHz

Miltipole Monolithics over a wide frequency range with varying frequencies; up to 16 poles.

Center Frequency In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Nominal Impedance In Ohms	Qty.	Package Style
5.200	13.0	25	6000	4	A
5.260	13.0	25	6000	4	A
6.460	13.0	25	5000	4	A
9.000	15.0	40	4300	3	B, D
10.70	13.0	25	3300	4	B, D
10.70	13.0	25	6000	4	B, C, D
10.70	30.0	60	5000	4	B, D
11.40	2.7	6	470	3	B, D
11.40	2.7	6	820	3	B, C, D
12.428	3.0	12	390	2	B, D
12.428	3.0	12	750	2	B, C, D
15.1875	36.0	150	6000	2	B, C, D
16.90	13.0	30	600	3	B, C, D
18.05	46.0	120	6000	3	B, C, D
21.40	15.0	30	1500	4	B, C, D
25.50	22.0	44	1800	4	B, C, D
29.00	30.0	75	1400	3	B, C, D
30.00	50.0	100	2100	4	B, C, D
45.00	15.0	70	2700	2	B, C, D
75.00	13.0	60	3000	2	B, C, D

Packaged Monolithic Filters

Frequency range: 4.3 MHz to 350 MHz

Multipole Monolithics in standard and non-standard packages; 50 and 75 ohms as well as the filter characteristics available. Some standard are as shown below.

C.F. In MHz	3 dB B.W. In KHz	60 dB B.W. In KHz	Nominal Impedance In Ohms	Package Style
5.201	3.4	5.5	1000	2.375 x 1.000 x .940
5.201	3.4	6.0	1500	2.375 x 1.000 x .940
5.26	13.0	25.0	50	2.375 x 1.000 x .750
9.00	2.7	5.2	1000	.745 x .496 x .595
9.00	13.0	25.0	50	2.375 x 1.000 x .750
10.00	30.0	60.0	5000	1.75 x .230 x .630
10.70	22.0	40.0	4300	.745 x .496 x .595
10.70	13.0	25.0	3300	1.75 x .230 x .630
10.70	14.0	20.0	3300	1.105 x .496 x .630
11.10	34.8	70.0	5000	.745 x .496 x .595
11.50	36.0	90.0	50	2.312 x 1.000 x .750
15.1875	36.0	70.0	6000	.745 x .496 x .595
16.025	36.0	70.0	6000	1.750 x .230 x .630
16.90	13.0	25.0	1000	.745 x .496 x .595
21.40	22.0	42.0	2200	1.750 x .230 x .630
25.00	19.0	28.0	1300	2.187 x .230 x .630
30.112	25.0	50.0	50	
70.00	200.0	600.0	50	2.375 x 1.000 x .940
75.00	26.0	90.0	50	.930 x .510 x .765
112.50	25.0	90.0	50	.930 x .510 x .765

Discriminators

Frequency range: 5MHz to 250 MHz

Commercial and Military Discriminators to solve any demodulation problem.

C.F. in MHz	Distortion	B.W. In KHz	Package Style
5.26 MHz	1.0%	28	A, B
10.7 MHz	1.0%	28	B, D
10.7 MHz	0.8%	34	B, D
11.5 MHz	3.5%	50	B, D
16.9 MHz	1.2%	32	B, C, D
21.4 MHz	0.8%	34	B, C, D
25.0 MHz	1.5%	60	B, C, D
30.0 MHz	1.2%	28	B, C, D
34.9 MHz	1.5%	70	B, C, D
45.0 MHz	1.5%	28	B, C, D

Microprocessor and Scanner Crystals

Frequency range: 1MHz to 100 MHz

Some standards are as follows:

Frequency in MHz	Clock IC	Package Style
1.000	2650:6800:56860	E
1.8432	MC14411	E
2.000	F8/CPU3850	E
2.4576	34702	E, F, G
3.5795	TV or Game	E, F, G
4.0000	4040/4201:6800:3870	F, G
4.9152	COM 5026/5046	F, G
5.0688	COM 5016/5036	F, G
6.1440	8085	F, G
8.000	CP 1600: IM 6100	F, G
10.000	TTL Macrologic	D, F, G, H
14.3188	Hughes-Toys	D, F, G, H
18.4320	8080A/8224	D, F, G, H
20.000	AM 2900	D, F, G, H
22.1184	8080A/8224	D, F, G, H
48.0000	Special	D, F, G, H

Military and Aircraft Radio Crystals

Frequency range: 1 MHz to 350 MHz

Rugged versions for high shock and vibration and all other military requirements. Miniatures to meet all size requirements.

Frequency In MHz	Calibration Tolerance	Temp. Range	Stability Over Temp.	Package Style
1.0000	± .002%	-55 to + 105° C	± .005%	E
3.2000	± .002%	-55 to + 85° C	± .0025%	E
4.096	± .002%	-40 to + 100° C	± .003%	F, G
5.600	± .002%	-55 to + 105° C	± .005%	F, G
11.45	± .002%	-55 to + 105° C	± .005%	F, G
20.958	± .003%	-20 to + 55° C	± .002%	F, G
46.850	± .002%	-55 to + 90° C	± .005%	F, G
64.300	± .002%	-40 to + 71° C	± .003%	F, G
64.998	± .002%	-20 to + 55° C	± .003%	F, G
70.000	± .001%	+80 to + 90° C	± .002%	F, G
92.500	± .001%	+80 to + 90° C	± .002%	F, G
121.500	± .002%	-40 to + 71° C	± .003%	F, G
160.500	± .0015%	-55 to + 85° C	± .005%	F, G
161.670	± .0025%	-55 to + 85° C	± .005%	F, G

SCP **Sokol Crystal Products, Inc.**

121 Water Street, P.O. Box 249, Mineral Point, WI 53565 Phone 608-987-3363

Spectrum Technology

P.O. BOX 948
GOLETA, CA 93116
TEL. (805) 964-7791
TWX 910-334-1163

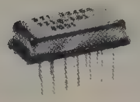
Crystal Oscillators/IC Logic Clocks

14 PIN DIP PACKAGE, Resistance Weld Hermetically Sealed (Mfd. IAW MIL-O-55310) See QPL*
Stabilities to ±.005%, Temperature Range −55 to +125°C

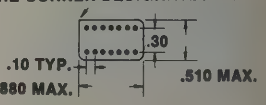
TTL — 7116/7114*/7117† — 1 Hz to 65 MHz, 5 Vdc

CMOS — 4116/4114*/4117† — .015 Hz to 15 MHz (Specify Vdc, +5 to +15)
Package, 14 pin DIP pattern: .87″x.50″x.20″
Std. Pin Conn.: 7, Com; 8, Output; 14, +Supply
MIL-STD-883 Screening available. (Class "B" typical)
* 4-pin package † 7-pin package

Pins: .018″ dia.; .28″ min. length


.20 MAX HT

SQUARE CORNER DESIGNATES PIN 1

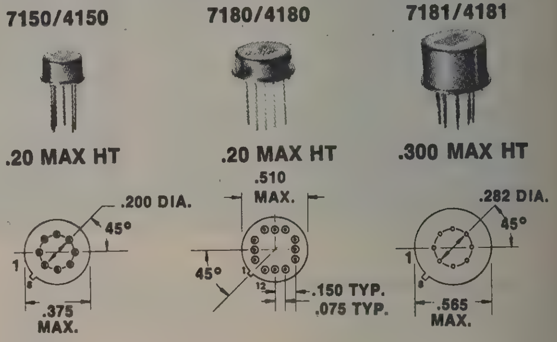

.30
.10 TYP.
.880 MAX.
.510 MAX.
(.810 MAX available)

TO-5/TO-8 PACKAGE, Resistance Weld Hermetically Sealed (Mfd. IAW MIL-O-55310) See QPL*
Stabilities to ±.005%, Temperature Range −55 to +125°C

TTL — 7181/7180(TO-8) — 28 Hz to 65 MHz
7150(TO-5) — 625 KHz to 65 MHz

CMOS — 4181/4180(TO-8) — 3.5 Hz to 15 MHz (Specify Vdc)
4150(TO-5) — 80 KHz to 15 MHz (Specify Vdc)
Std. Pin Conn.:
7150/4150, 7181/4181 — 4, Com; 5, Output; 8, +Supply
7180/4180 — 6, Com; 5, Output; 12, +Supply
MIL-STD-883 Screening available. (Class "B" typical)

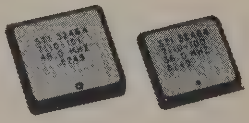
(All pins .018″ dia.; .480 min. length)

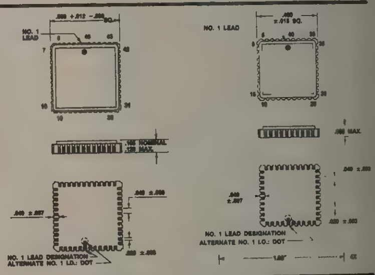

7150/4150
7180/4180
7181/4181
.20 MAX HT
.20 MAX HT
.300 MAX HT
.200 DIA.
45°
1
8
.375 MAX.
.510 MAX.
45°
1
12
.150 TYP.
.075 TYP.
.282 DIA.
45°
1
8
.565 MAX.

LEADLESS CHIP CARRIER (LCC) CRYSTAL OSCILLATOR/LOGIC CLOCK (Mfd. IAW MIL-O-55310) See QPL*
Stabilities to ±.005%, Temperature Range −55 to +125°C

TTL — 7110, 39 Hz to 65 MHz

CMOS — 4110, 600 Hz to 15 MHz (Specify Vdc, +5 to +15)
.480″ sq. — Pin 37 Com; 39 Output; 4 Supply
.560″ sq. — Pin 44 Com; 47 Output; 5 Supply
MIL-STD-883 Screening Available (Class "B" typical)

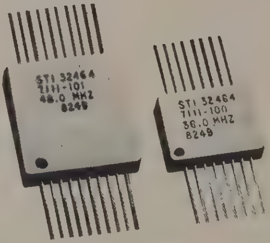

STI 32464
7110-101
48.0 MHZ
8249
STI 32464
7110-100
36.0 MHZ
8249

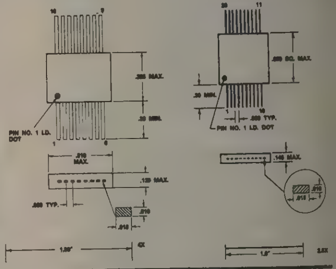

NO. 1 LEAD
NO. 1 LEAD DESIGNATION ALTERNATE NO. 1 I.D.: DOT
NO. 1 LEAD DESIGNATION ALTERNATE NO. 1 I.D.: DOT

FLAT PACK CRYSTAL OSCILLATOR (Mfd. IAW MIL-O-55310) See QPL*
Stabilities to ±.005%, Temperature Range −55 to +125°C

TTL — 7110, 39 Hz to 65 MHz

CMOS — 4111, 3.5 Hz to 15 MHz (Specify Vdc, +5 to +15)
16 Lead — Pin 8 Com; 9 Output; 16 Supply
20 Lead — Pin 10 Com; 11 Output; 20 Supply
MIL-STD-883 Screening Available (Class "B" typical)


STI 32464
7111-101
48.0 MHZ
8249
STI 32464
7111-100
36.0 MHZ
8249


PIN NO. 1 I.D. DOT
PIN NO. 1 I.D. DOT

***QPL to MIL-O-55310:** Spectrum Technology is a Qualified Supplier of crystal oscillators to MIL-O-55310/4 through /17 per QPL-55310. The /4 through /7 are TCXO types; /8 through /19 are hybrid units with general specifications as shown. Hybrid oscillators are available with Class S, Class B, or Class C screening.

M55310/xx	Spectrum Series		Package Type (7)	Frequency Type	Stability, PPM	Output Type	Pin Numbers			
	Generic	QPL					Out	Case	B−	B+
/08	7116-	5008-	14-pin DIP, .2″ H	50 Hz, 50 MHz	(3)	TTL	1	2	8	14
/09	7150-	5009-	TO-5	400 KHz, 30 MHz	(3)	TTL	5	4	4	8
/10	7181-	5010-	TO-8	1 KHz, 30 MHz	(3)	TTL	5	4	4	8
/11	4116/4400	5011-	14-pin DIP, .4″ H.	.05 MHz, 10 MHz	(3)	CMOS	1	2	8	14
/12	4150-	5012-	TO-5	.05 MHz, 10 MHz	(4)	CMOS	5	4	4	8
/13	4181-	5013-	TO-8	300 Hz, 10 MHz	(4)	CMOS	5	4	4	8
/14	7116-	5014-	14-pin DIP, .2″ H.	.1 Hz, 25 MHz	(3)	TTL	5	7	7	4
/15	4116-	5015-	14-pin DIP, .2″ H.	.01 Hz, 10 MHz	(3)	CMOS	1	2	8	14
/16	7116-	5016-	14-pin DIP, .2″ H.	.1 Hz, 50 MHz	(1)	TTL	8	7	7	14
/17 (5)	7116-	5017-	14-pin DIP, .2″ H.	250 KHz, 50 MHz	(1)	TTL	8	7	7	14 (5)
/18 (6)	4116-	5018-	14-pin DIP, .2″ H.	.01 Hz, 15 MHz	(1)	CMOS	8	7	7	14
/19 (6)	7110-	5019-	40-pin LCC, .085″ H.	1.0 MHz, 60 MHz	(2)	TTL	39	—	31/37	4/10

NOTES: STABILITY OPTIONS:	(1)	(2)	(3)	(4)
A: −55 to +125°C;	±50 or 100 ppm	±100 or 200 ppm	±50 ppm	±100 ppm
B: −55 to +105°C;	±40 or 80 ppm	±75 or 150 ppm	±40 ppm	±70 ppm
C: −20 to +70°C;	±25 or 50 ppm	±50 or 100 ppm	±25 ppm	±55 ppm

(5) Gated Oscillator, Gate Input on pin 9.
(6) Pending approval.
(7) All package heights max.

Spectrum Technology

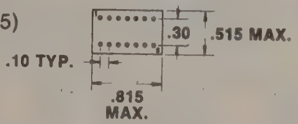
LOW COST DIP PKG. CRYSTAL OSCILLATOR/LOGIC CLOCK

Stabilities to ±.005%, Temperature Range −55 to +105°C
7401/4401 — 14 pin DIP, .8″x.5″x.375″, Epoxy Case
2100/3100 — 4 pin DIP, .8″x.5″x.2″, Resistance Weld Sealed

TL — 2100/7401 — 1 Hz to 65 MHz

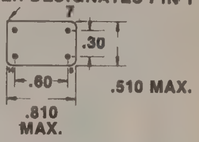
CMOS — 3100/4401 — .015 Hz to 15 MHz (Specify Vdc, +5 to +15)
Std. Pin Conn.: 7, Com; 8, Output; 14, +Supply
Pins: .018 dia.; 7401/4401: .15″ min. length
2100/3100: .23″ min. length

7401/4401


.30
.515 MAX.
.10 TYP.
.815 MAX.

2100/3100

SQUARE CORNER DESIGNATES PIN 1


7
.30
.60
.510 MAX.
.810 MAX.

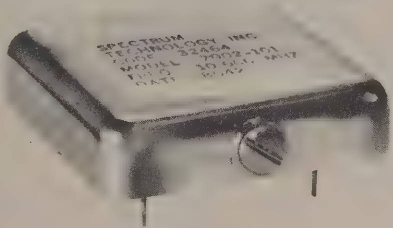
Temperature Compensated Crystal Oscillators

For applications requiring high stability, low power and zero warm-up time. Designed for P.C. Board mounting.

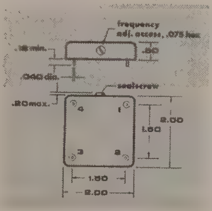
Input Voltage:	+10 to +20 volt range - regulation to ±10%
Output Signal:	TTL standard; CMOS, SINE-WAVE or ECL available
emp Stability:	±2 x 10-7, 0 to +50°C; ±5 x 10-7, −20 to +65°C; ±1 x 10-6, −55 to +85°C; ±5 x 10-6, −55 to +125°C. Other ranges available
req Range:	
7002:	10 KHz to 20 MHz; 1 Hz to 100 MHz available special
7006:	500 KHz to 20 MHz; 10 KHz to 100 MHz available special
rim Adjust:	5 to 10 years aging range

PECIAL PACKAGES: Many special configurations are available including smaller packages, units with mounting studs, rackets, inserts, and special electrical characteristics. Conact Spectrum Technology for further information.

PL TCXO's:
pectrum is an approved QPL Supplier to M55310/4, /5, /6 /7.

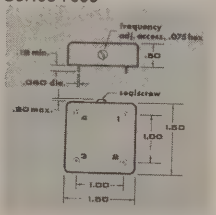


Series 7002


frequency adj. access, .075 hex
.18 min.
.60
.040 dia.
sealscrew
.20 max.
4
1
3
2
2.00
1.50
1.50
2.00

PIN CONNECTIONS
Series 7002
1 — Pos. Supply
2 — Com. and Case
3 — N/C
4 — Output

Series 7006


frequency adj. access, .075 hex
.18 min.
.60
.040 dia.
sealscrew
.20 max.
4
1
3
2
1.50
1.00
1.00
1.50

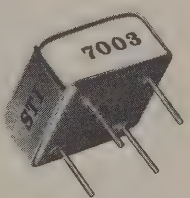
PIN CONNECTIONS
Series 7006
1 — Pos. Supply
2 — Com. and Case
3 — N/C
4 — Output

Standard (Alternate) Package Configurations

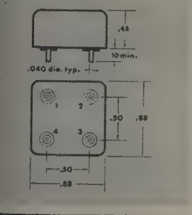
pectrum Technology utilizes conventional P.C. Board or roven reliability Hybrid Circuits as required to supply most of e alternate oscillator packages previously designed into any commercial and military programs. Most packages can rovide CMOS, TTL, Sinewave or ECL outputs from 1 Hz to 00 MHz.

PIN CONNECTIONS
Series 7003, 7042
1—Pos. Supply
2—Com. and Case
3—N/C
4—Output

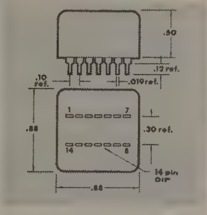
Series 7004, 7600, 7231, 5430
1—N/C
7—Com.
8—Output
14—Pos. Supply



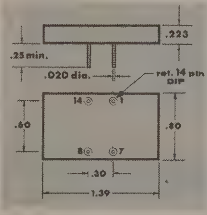
eries 7003


.45
.10 min.
.040 dia. typ.
1
2
4
3
.50
.88
.50
.88

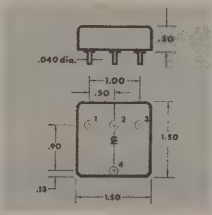
Series 7004


.50
.12 ref.
.10 ref.
.019 ref.
1
7
14
8
.88
.30 ref.
14 pin DIP
.88

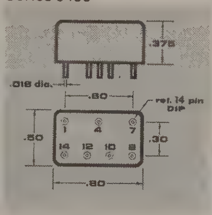
Series 7600


.223
.25 min.
.020 dia.
ref. 14 pin DIP
14
1
8
7
.60
.80
.30
1.39

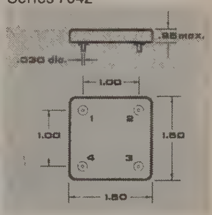
Series 7231


.30
.040 dia.
1.00
.50
1
2
3
4
.90
1.50
.13
1.50

Series 5430


.375
.018 dia.
.80
ref. 14 pin DIP
1
4
7
14
12
10
8
.50
.30
.80

Series 7042


.35 max.
.030 dia.
1.00
1
2
4
3
1.00
1.50
1.50

IGH RELIABILITY oscillators use proven conservative degns and "ER" components. MIL-S-19500 transistors, JTX JTXV; MIL-M-38510 I.C.'s or screened to MIL-STD-883. oldering per N.H.B. 5300.4(3A) as specified.

QUALITY CONTROL exceeds requirements of MIL-I-45208A and MIL-C-45662A. Workmanship and soldering per Requirements 5 and 9 of MIL-STD-454F. Design and testing to MIL-O-55310. MIL-STD-883 or MIL-O-55310 screening.

Spectrum Technology inc

Dept. EM 300 Lopez Road
P. O. Box 948, Goleta, CA 93116
Federal Supplier Code No. 32464

Tel. (805) 964-7791
TWX 910-334-1163

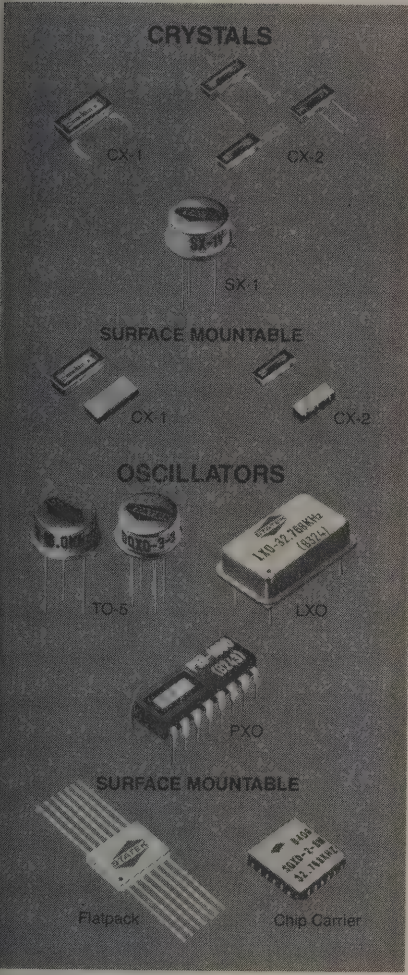
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms	**1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code	**3**•1103
Batteries, Product Selection Guide	**3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide	**2**•1003
Capacitors, Basic Formulas	**1A**•1093
Capacitors, Miniglossary	**1A**•1069
Capacitors, Product Selection Guide	**1A**•1003
Circuit Boards (Printed), Product Selection Guide	**2**•1089
Coils, Chokes, & Inductors, Product Selection Guide	**1A**•1219
Connectors, Miniglossary	**2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide	**2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**1A**•1309
Delay Lines, Product Selection Guide	**1A**•1445
Discrete Semiconductors, Product Selection Guide	**1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide	**1B**•1021
EBCDIC Code	**3**•1153
Encapsulation, Miniglossary	**2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**2**•1801
Filters, Product Selection Guide	**1A**•1577
Instruments, Graphic Recording, Product Selection Guide	**3**•1381
Instruments, Panel Meters, Product Selection Guide	**3**•1321
Instruments, Test & Measuring, Product Selection Guide	**3**•1182
Interconnection Systems, Product Selection Guide	**2**•1873
Keyboards & Keypads, Product Selection Guide	**1B**•1759
Microwave Components, Product Selection Guide	**1A**•1685
Military Qualified Products Lists	**1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide	**1B**•1121
Opto Semiconductors, Miniglossary	**1B**•1218
Oscilloscopes, Product Selection Guide	**3**•1361
Panel Hardware, Product Selection Guide	**2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**1A**•2017
Power Supplies, Miniglossary	**3**•1455
Power Supplies, AC, Product Selection Guide	**3**•1815
Power Supplies, DC, Product Selection Guide	**3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**1B**•1255
Relay Contact Forms	**1B**•1317
Relays, Electromechanical, Miniglossary	**1•B**1292
Relays, Product Selection Guide	**1B**•1289
Resistor Color Codes	**1A**•1791
Resistors, Product Selection Guide	**1A**•1789
Servo Components, Miniglossary	**3**•1935
Solenoids, Product Selection Guide	**1B**•1481
Switches, Product Selection Guide	**1B**•1499
Thyristors/High Power Diodes, Miniglossary	**1A**•1652
Transducers & Encoders, Product Selection Guide	**1B**•1827
Transformers, Product Selection Guide	**1A**•2115
Wire & Cable, Product Selection Guide	**2**•1935

STATEK



Statek has the most complete line of miniature, low-frequency quartz crystals and crystal oscillators in the world!

.0006 Hz to 2 MHz

Quartz Crystals: 10 kHz to 2 MHz • High ccuracy • Produced in volume by photo-thography • Low aging • High Q • Rugged, ermetically sealed ceramic package • esigned for hybrid or PC board packaging.

Quartz Crystal Oscillators: Miniature TO-5) series • Low power series • Program-nable, multi-frequency series • CMOS/TTL ompatible series • Very low frequency eries.

Miniature Quartz Crystals CX Series

SHORT FORM CATALOG

10 kHz to 2 MHz

Statek's CX Series crystals consist of a miniature quartz resonator, hermetically sealed in a rugged, ceramic package.

Types Available (See Table 1)

The CX Series is available in two case sizes: CX-1 and CX-2. The CX-1 is available from 10 kHz to 2 MHz and the CX-2 is available from 16 kHz to 2 MHz.

"H" models are designed for series (two cascaded inverters) oscillators. "V" models are designed for Pierce (single inverter) oscillator applications. See Table 1 for case size and configuration options and other special features.

TABLE 1: Miniature Low-Frequency Crystal Selection Chart: CX Series

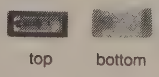
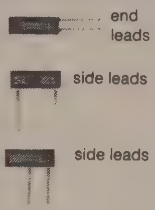
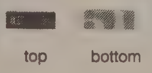
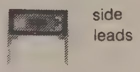
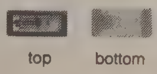
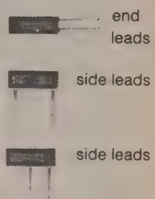
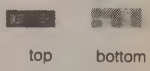
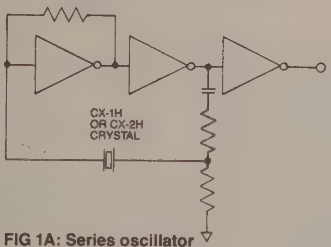
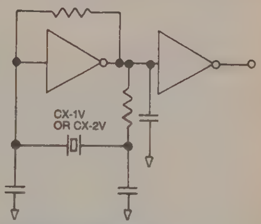
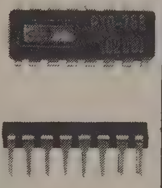
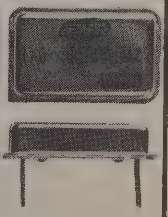
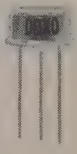
SERIES	CX-1H SERIES	CX-2H SERIES	CX-1V SERIES	CX-2V SERIES
PACKAGE AND LEAD CONFIGURATIONS AVAILABLE. (Photos are actual size.)	 Leadless version for direct surface mounting 	 Leadless version for direct surface mounting 	 Leadless version for direct surface mounting. 	 Leadless verson for direct surface mounting 
FREQUENCY RANGE	10 kHz to 2 MHz	16 kHz to 2 MHz	10 kHz to 2 MHz	16 kHz to 2 MHz
PRINCIPAL FEATURES	Standard IC lead spacing: 0.300 in. (7.62mm)	Smallest possible size for dense PC board or hybrid packaging	Standard IC lead spacing: 0.300 in. (7.62mm)	Smallest possible size for dense PC board or hybrid packaging.
OTHER SPECIAL FEATURES	• H Series designed for long service/storage life • High reliability		• V Series designed for lowest possible power consumption • High stability • Ideal for battery-operated applications	
OSCILLATOR CIRCUIT	 **FIG 1A: Series oscillator with CX-1H or CX-2H**		 **FIG 1B: Pierce oscillator with CX-1V or CX-2V**	

TABLE 2: Low Frequency Crystal Oscillator Selection Chart

SERIES	PXO SERIES	LXO SERIES	SQXO-2 SERIES	LQXO-4 SERIES	DQXO-3 SERIES
PRINCIPAL FEATURES	Generates 57 discrete, programmable frequencies from one crystal	• High accuracy • Low aging • Low power	• TTL and CMOS compatible • TO-5 package	• Low power • CMOS compatible • TO-5 package	• Low frequency oscillator/timer • TO-5 package
PACKAGE STYLE (Photos are actual size.)	 16-pin DIP	 4-pin metal case—pins on 14-pin DIP centers	 TO-5	 TO-5	 TO-5 MORE
FREQUENCY RANGE	0.002 Hz to 2 MHz	10 kHz to 2 MHz	10 kHz to 2 MHz	10 kHz to 2 MHz	0.0006 Hz to 10 kHz

STATEK CORPORATION 512 N. Main, Orange, CA 92668 Telephone (714) 639-7810 Telex 67 8394 TWX 910-593-1355

STATEK

Miniature Low-Frequency Quartz Crystals

TABLE 3: CX Series Specifications 10 kHz to 2 MHz

Specifications are typical at 25°C unless otherwise noted. Specifications subject to change without notice.

Frequency (see Table 4)[1]	10 kHz to 2 MHz*
Calibration Tolerance[2] (see Table 5)	A, B or C Tolerance
Motional Resistance, R_1	Figure 4
Maximum:	
10–169 kHz	2 x typical
170–600 kHz	2.5 x typical
600 kHz–2 MHz	
H Model	5 KΩ maximum
V Model	3 KΩ maximum
Motional Capacitance, C_1	Figure 5
Quality Factor, Q	Figure 6
Shunt Capacitance, C_0	
10–600 kHz	1.4 pf typical
600 kHz–2 MHz	1.0 pf typical
Drive Level	
10–25 kHz	
H Model	1.5 μw maximum
V Model	0.5 μw maximum
25–600 kHz	
H Model	3 μw maximum
V Model	1 μw maximum
600 kHz–2 MHz	
H Model	5 μw maximum
V Model	3 μw maximum
Turning Point, T_0	Figure 7
Temperature Coefficient, K	−0.035 (ppm/°C²)
Aging, first year	
10–600 kHz	5ppm maximum
600 kHz–2 MHz	10ppm maximum
Shock Survival	
10–600 kHz	1000g, 1ms, ½ sine
600 kHz–2 MHz	750g, 1ms, ½ sine
Vibration Survival	
10–600 kHz	20g rms, 10–2000 Hz
600 kHz–2 MHz	10g rms, 10–2000 Hz
Operating Temperature	
Industrial	−40 to +85°C
Military	−55 to +125°C
Storage Temperature	−55 to +125°C
Maximum Temperature[3]	
Lead/Package Junction	175°C
Lid Seal	210°C

[1] Tuning Fork Flexure Mode .... 10–600 kHz
Extentional Mode .... 600 kHz–2 MHz

[2] Frequency specified for Statek standard oscillator circuit. Tighter calibration tolerances available.

[3] Higher temperature capabilities available in surface mountable crystals, see below.

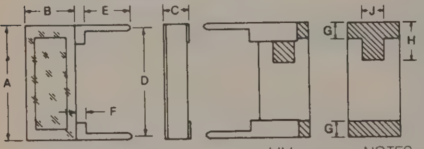
*10–15.9 kHz not available in CX-2 case size.

Surface Mountable Crystals and Oscillators

CX-1 and CX-2 Series crystals are available in higher-temperature leadless versions for surface mounting. SQXO-2 Series oscillators are available in a 24-pin leadless ceramic chip carrier for surface mounting. Surface-mountable crystals are designated CX-1 (H or V)-SM or CX-2 (H or V)-SM, and surface-mountable oscillators are designated SQXO-2-SM.

All Statek surface-mountable devices are designed for use with vapor phase solder reflow processes and wave solder processes up to 260°C. See individual data sheets for specifications.

FIG 2A: Dimensions and case styles—CX-1 Series

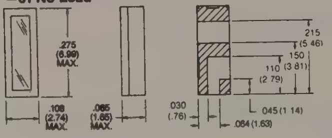


DIM.	IN.	MM	NOTES
A	0.330	8.38	Max
B	0.155	3.94	Max
C	0.080	2.03	Max
D	0.300 ± 0.01	7.62 ± 0.25	
E	0.125	3.23	Min
F	0.040	1.02	Max
G	0.045	1.14	Nom
H	0.105	2.67	Nom
J	0.060	1.52	Nom

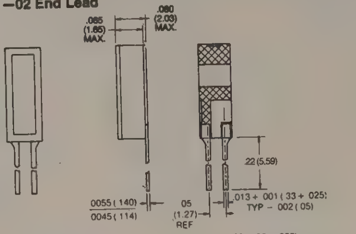
Leads 0.010" x 0.018" (0.25 x 0.46 mm) nom.

FIG 2B: Dimensions and case styles—CX-2 Series

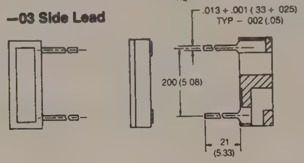
—01 No Lead



—02 End Lead



—03 Side Lead



—04 Side Lead

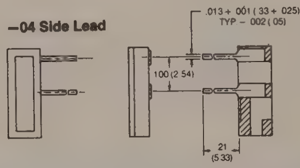


TABLE 4: Standard Frequencies, CX Series

FREQUENCY	COMMON DIVISION	APPLICATION
10* kHz	10	1 kHz audio
12.8* kHz	2^8	50 Hz time base
15.36* kHz	2^8	60 Hz time base
16 kHz	2^4	1 kHz audio
16.384 kHz	2^{14}	1 Hz time base
18.641 kHz	2^{26}	1cycle per hour
19.2 kHz	$2^{6,5,4}$	300, 600, 1200 baud modem
20.48 kHz	2^{12}	5 Hz clock motor
25 kHz	—	Ultrasonic alarm transducer
30.72 kHz	2^9	60 Hz time base
31.5 kHz	—	T.V. raster
32.768 kHz	2^{15}	1 second time base
38.4 kHz	$2^{6,5,4}$	600, 1200, 2400 baud modem
40 kHz	—	Ultrasonic alarm transducer
40.96 kHz	2^{12}	10 Hz clock motor
60 kHz	—	WWVB PLL
76.8 kHz	$2^{6,5,4}$	1200, 2400, 4800 baud modem
100 kHz	—	Calibrator
153.6 kHz	$2^{6,5,4}$	2400, 4800, 9600 baud modem
240 kHz	2^7	Motor control
307.2 kHz	$2^{7,6,5}$	2400, 4800, 9600 baud modem
500 kHz	—	Microprocessor
1 MHz	—	Microprocessor
1.048576 MHz	2^{20}	Microprocessor, real time clock
1.2288 MHz	—	Microprocessor, baud rate generator

*CX-1 only

TABLE 5: Calibration tolerances at 25°, CX Series

CALI-BRATION	10–74.9 kHz	75–169 kHz	170–249 kHz	250–600 kHz	600 kHz–2 MHz
A	±0.003%	±0.005%	±0.01%	±0.02%	±0.05%
B	±0.01%	±0.01%	±0.02%	±0.05%	±0.1%
C	±0.1%	±0.1%	±0.2%	±0.5%	±1.0%

FIG 3: Equivalent circuit, CX Series

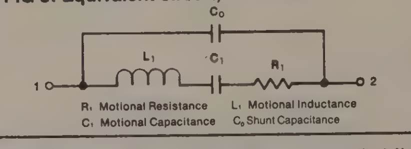

C_0
L_1
C_1
R_1
1
2
R_1 Motional Resistance
L_1 Motional Inductance
C_1 Motional Capacitance
C_0 Shunt Capacitance

FIG. 4: Typical Motional Resistance R₁, CX Series

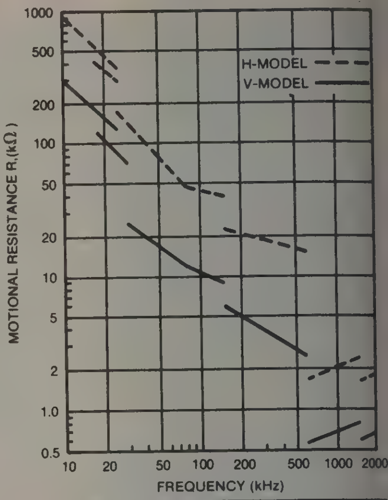


FIG. 5: Typical Motional Capacitance C₁, CX Series

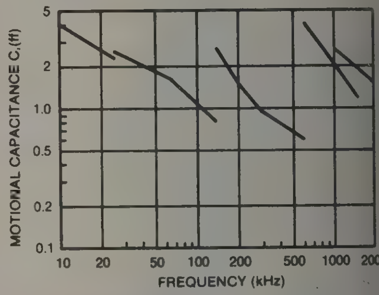


FIG. 6: Typical Quality Factor Q, CX Series

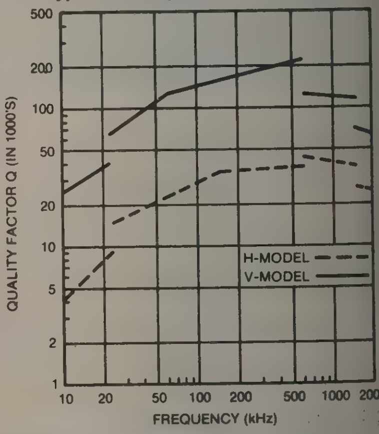
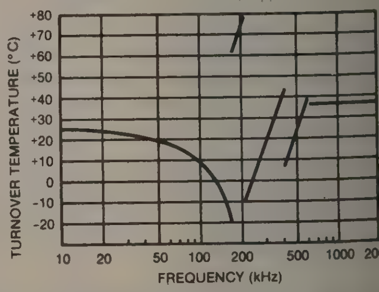


FIG. 7: Typical Turning Point Temperature, CX Series.

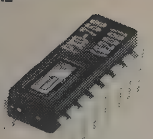


and Quartz Crystal Oscillators

Low-Frequency Quartz Crystal Oscillators

Programmable Crystal Oscillators
PXO Series

0.002 Hz to 2 MHz



PXO-768

Generates 57 discrete, programmable frequencies rom a single crystal • Packaged in standard 16-pin DIP • Low power • Low aging • TTL compatible.
ll frequencies generated are derived from a single uilt-in quartz crystal oscillator and exhibit the same igh levels of accuracy and stability as those of the ase frequency.

tandard calibration tolerance for PXO 32768,A: ±10 ppm. All others ±100 ppm. Tighter olerances available • Frequency stability: ±0.015%*, −10 o +70°C • Supply voltage 4-6V • Supply current 1 mA nax • Rise time: 70 nsec typ • Fall time: 30 nsec typ • ging: 10 ppm max first year.

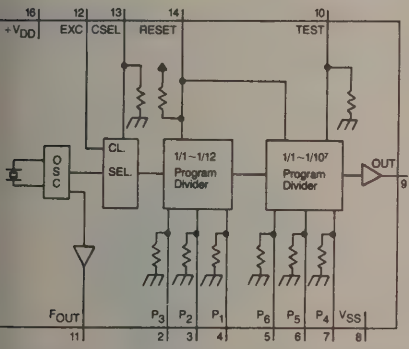
Does not include calibration tolerance

Standard Frequency Ranges, PXO Series*

MODEL	BASE FREQUENCY	OUTPUT FREQUENCY RANGE
PXO-32768	327.68 kHz	0.00273 Hz to 327.68 kHz
PXO-600	600 kHz	0.005 Hz to 600 kHz
PXO-768	768 kHz	0.0064 Hz to 768 kHz
PXO-1000	1 MHz	0.0083 Hz to 1 MHz

Other frequencies available. Consult factory.

Block Diagram, PXO Series



Pin Functions, PXO Series

rog 1 through Prog 6 control divide ratio of base frequency.

P_1	P_2	P_3	DIVIDING RATIO	P_4	P_5	P_6	DIVIDING RATIO
0	0	0	1/1	0	0	0	1/1
0	0	1	1/10	0	0	1	1/10
0	1	0	1/2	0	1	0	$1/10^2$
0	1	1	1/3	0	1	1	$1/10^3$
1	0	0	1/4	1	0	0	$1/10^4$
1	0	1	1/5	1	0	1	$1/10^5$
1	1	0	1/6	1	1	0	$1/10^6$
1	1	1	1/12	1	1	1	$1/10^7$

UT:	Supplies programmed output frequency with rectangular pulse shape (50% duty cycle).
EST:	Setting this terminal Hi multiplies programmed output frequency by 1,000, except when programmed divide ratio is less than 1/1000.
OUT:	Supplies base frequency of internal crystal oscillator.
XC:	Input for counting external clock instead of internal clock.
CSEL:	Clock select. Setting this terminal Hi causes the divider to count the frequency of an external clock instead of the internal clock.
RESET:	Setting this terminal Lo resets all counters and sets output switches to Lo.

(All inputs except EXC and RESET have internal pull-down resistor. RESET has pull-up resistor.)

Output Frequencies, PXO Series

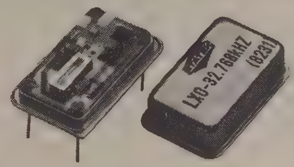
Example—Model PXO-1000
UNIT: Hz

PROGRAM PIN SETTINGS		P4	0	0	0	0	1	1	1	1
		P5	0	0	1	1	0	0	1	1
P1	P2	P3 \ P6	0	1	0	1	0	1	0	1
0	0	0	1M	100K	10K	1K	100	10	1	0.1
0	0	1	100K	10K	1K	100	10	1	0.1	0.01
0	1	0	500K	50K	5K	500	50	5	0.5	0.05
0	1	1	*333.$\dot{3}$K	33.$\dot{3}$K	3.$\dot{3}$K	333.$\dot{3}$	33.$\dot{3}$	3.$\dot{3}$	0.3$\dot{3}$	0.03$\dot{3}$
1	0	0	250K	25K	2.5K	250	25	2.5	0.25	0.025
1	0	1	**200K	20K	2K	200	20	2	0.2	0.02
1	1	0	166.$\dot{6}$K	16.$\dot{6}$K	1.$\dot{6}$K	166.$\dot{6}$	16.$\dot{6}$	1.6$\dot{6}$	0.1$\dot{6}$	0.01$\dot{6}$
1	1	1	83.$\dot{3}$K	8.$\dot{3}$K	833.$\dot{3}$	83.$\dot{3}$	8.$\dot{3}$	0.8$\dot{3}$	0.08$\dot{3}$	0.008$\dot{3}$

*33% duty cycle **40% duty cycle

High Accuracy Crystal Oscillators
LXO Series

10 kHz to 2 MHz



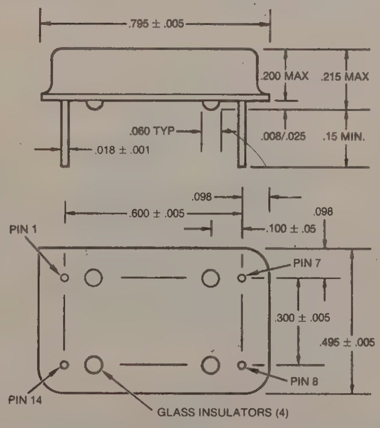
Laser tuned for high accuracy • Low aging • Low power • CMOS compatible • Low profile, hermetically-sealed package.

The LXO Series has the highest accuracy and stability of all Statek oscillators.
Specifications and characteristics of the LXO Series vary with frequency. Characteristics of the LXO-32.768 kHz model are presented below as an example. Contact factory for other frequencies.

Standard calibration tolerances: A: ±10 ppm; B: ±25 ppm; C: ±200 ppm. Tighter tolerances available • Frequency stability: −0.012%, −20 to +70°C* • Supply voltage: 3-6V • Rise time: 1.0 μsec max • Fall time: 1.0 μsec max • Supply current: 50 μA typical at 5V, 20 μA typical at 3V • Aging: 1 ppm/yr typical, 3 ppm max.

*Does not include calibration tolerance.

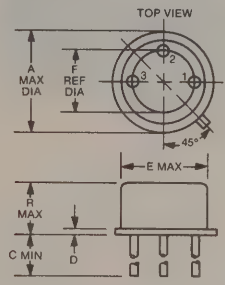
Package Dimensions (inches), LXO Series



Miniature Quartz Crystal Oscillators

Statek manufactures three series of oscillators in TO-5 packages: SQXO-2 Series, LQXO-4 Series and DQXO-3 Series. They all have these features in common:
Laser tuning for high accuracy • hybrid construction • low aging • operating temperature: industrial: −40 to +85°C; military: −55 to +125°C • Shock (survival): 1000g. 1msec., ½ sine • vibration (survival): 10g rms, 10-2000 Hz.

TO-5 Dimensions



PIN	CONNECTION	DIM	INCHES	MILLIMETERS
1	V_{DD}	A	0.362	9.19
2	Output	B	0.185	4.70
3	Gnd.	C	0.500	12.70
		D	0.029	0.74
		E	0.326	8.28
		F	0.200	5.08

1. All metal parts are gold plated.
2. Leads are 0.019″ (0.48mm) dia. max.

Miniature Quartz Crystal Oscillators
SQXO-2 Series

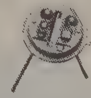
10 kHz to 2 MHz

TTL and CMOS compatible • Standard calibration tolerances: A: ±0.01%, • Frequency stability: ±0.02% typ., −40 to +85°C* • Supply voltage: 4-6V • Supply current: 200μA-3mA • Standard frequencies: same as CX-1 crystal.

*Does not include calibration tolerance
Also available in 24-pin leadless ceramic chip carrier. See SQXO-2-SM Data Sheet

Miniature Quartz Crystal Oscillators:
Low Power
LQXO-4 Series

10 kHz to 2 MHz



Low power • CMOS compatible • Standard calibration tolerance: A: ±0.01%, B: ±0.03%, • Frequency stability: ±0.02% typ., −40 to +85°C* • Supply voltage: 4-6V • Supply current: 25-350 μA • Standard frequencies: same as CX-1 crystal.

*Does not include calibration tolerance

Miniature Quartz Crystal Oscillators/Timers:
Low Frequency
DQXO-3 Series

2 pulses/hr to 10 kHz*

CMOS compatible • Low power • Standard calibration tolerances: A: ±0.01%; B: 0.03% • Frequency stability: ±0.02% typ., −40 to +85°C** • Supply voltage: 4-6V • Supply current: 50 μA-3mA.

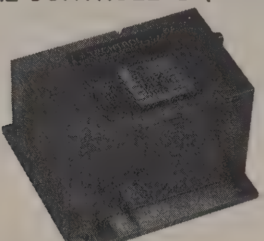
*Lower frequencies available
**Does not include calibration tolerance.
Also available in 24-pin leadless ceramic chip carrier. See DQXO-3-SM Data Sheet.

TECHTROL

815 MARKET STREET
NEW CUMBERLAND, PENNSYLVANIA 17070
(717) 774-2746

MICROWAVE FREQUENCY SOURCE

CRYSTAL CONTROLLED (±.001%) UP TO 8 GHz



SPECIFICATIONS

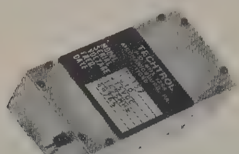
Fixed Frequency Output: Manufactured to your exact requirements.
Stability: ±.001% over temperature range.
Temperature Range: −20°C to +55°C.
Power Output: 100 mW, 20 mW, or, 5 mW min. as specified.
Harmonics and Subharmonics: −40 dBc for all sources with output frequency in range of 1 GHz to 8 GHz.
Harmonics and Subharmonics: −30 dBc for all sources with output frequency in range of .5 GHz to 1 GHz.
DC Input: 12 to 28 VDC Case ground plus or minus (as required).
Output Connectors: SMA.
All units have mechanical frequency adjustment to compensate for aging.
Spurious Levels: −60 dBc.

OPTIONS AVAILABLE

1. **Secondary Standard (Oven Controlled)**
   ±.001% frequency stability over temperature range of −20°C to +60°C.
   Utilizes a small solid state oven enclosing the crystal only.
   Phase noise same as standard unit.
   Additional Requirements:
   +24 VDC to +28 VDC oven power (may be unregulated).
   Add 1.0″ to length.
   Model number becomes MK.
2. **Frequency Standard (Oven Controlled)**
   High Stability
   ±2 x 10^{-8} frequency stability over temperature range of −20°C to +55°C.
   Utilizes a tight tolerance proportional type oven and AGC, crystal is designed for long term aging characteristics.
   Additional Requirements:
   +24 VDC to +28 VDC oven power (maybe unregulated).
   Add 1.5″ to length.
   Model number becomes MH.
3. **Low Phase Noise**
   ±.003% over temperature range of −20°C to +60°C.
   Add 1.0″ to length.
   Model number becomes MN.
4. **Low Phase Noise/High Stability**
   ±2 x 10^{8} over temperature range of −20°C to +55°C.
   Additional Requirements:
   +24 VDC to +28 VDC oven voltage (may be unregulated).
   Add 1.5″ to length.
   Model number becomes MHN.
5. **Voltage Control Crystal Oscillator**
   ÷ 3 options are available.
   Tuning voltage ±3.
   Modulation rate 100 KHz.
   Linearity 5% best straight line.
   Model MVA.
   ±.003% frequency swing.
   ±.002% frequency stability 0° to +50°C.
   Add 1.0″ to length.
   Model MVB.
   ±.01% frequency swing.
   ±.002% frequency stability 0°C to +50°C.
   Add 1.5″ to length.
   Model MVC.
   ±.1% frequency swing.
   ±.005% frequency stability 0°C to +50°C.
   Add 2.0″ to length.
6. **Multi-Channel Crystal Source**
   Up to 7 independent frequencies available.
   TTL compatible frequency selection.
   ±.005% frequency stability.
   Temperature range of −20°C to +50°C.
   Add 2.6″ to length.
   Model number becomes MM.

MODEL NUMBER	FREQUENCY	MIN. POWER OUTPUT	SIZE (IN.) L-W-H
M401	.5-1 GHz	5 mW	2.2-3.4-2
M402	.5-1 GHz	20 mW	2.2-3.4-2
M403	.5-1 GHz	100 mW	2.2-3.4-2
M404	1.01-2 GHz	5 mW	3.2-3.4-2
M405	1.01-2 GHz	20 mW	3.2-3.4-2
406	1.01-2 GHz	100 mW	3.2-3.4-2
407	2.01-4 GHz	5 mW	3.2-3.4-2
M408	2.01-4 GHz	20 mW	3.2-3.4-2
M409	2.01-3 GHz	100 mW	3.2-3.4-2
M410	3.01-4 GHz	100 mW	3.2-3.4-2
M411	4.01-8 GHz	5 mW	3.2-3.4-2
M412	4.01-8 GHz	20 mW	3.2-3.4-2
M413	4.01-8 GHz	100 mW	4.3-3.4-2
M414	8.01-12 GHz	5 mW	3.2-3.4-2
M415	8.01-12 GHz	20 mW	4.3-3.2-2
M416	8.01-12 GHz	50 mW	4.3-3.2-2

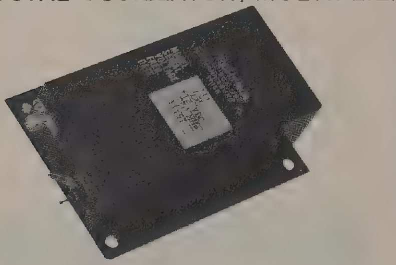
COMPACT MICROWAVE SOURCE/MODEL M4000



SPECIFICATIONS:

Frequency Range: 500 MHz to 3 GHz
±.003% −20°C to +65°C.
+15 VDC supply voltage.
60 dB spurious + harmonic rejection.
Excellent phase noise.
SMA output connector.
Filter-Con for DC supply input.
Design for high shock + vibration.
Size: 1″ x 1.5″ x 3″.

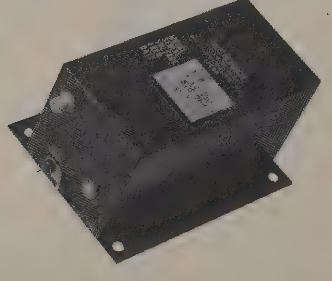
CRYSTAL OSCILLATOR/MULTIPLIER SOURCE/MODEL 111



SPECIFICATIONS

Frequency Range: 300 MHz to 1 GHz.
±.001%, 0°C to +50°C; ±.003%, −20°C to +65°C.
12 VDC to 28 VDC operating voltage range (minus operating voltage available). Specify exact operating voltage.
30 dB spurious rejection.
SMA output connector standard (BNC, TNC, N, UHF connectors available).
Filter-con DC input solder pin).
Over voltage — reverse polarity protected.
Size (Approx): 4″L x 2″W x 1.375″H.

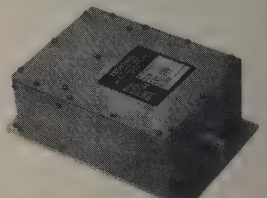
LOW COST CRYSTAL OSCILLATOR/MODEL 107



SPECIFICATIONS

Any discrete frequency between 1 GHz and 2.5 GHz.
±.001%, 0°C to +50°C; ±.003%, −20°C to +65°C.
50 ohms output impedance.
12 VDC to 28 VDC operating voltage range (minus operating voltage available). Specify exact operating voltage.
45 dB spurious rejection.
SMA output connector.
Filter-con DC input (solder pin)
Over voltage — reverse polarity protected.
Size (Approx): 4″L x 2″W x 2″H.
1 year warranty.
20 mW — 1 to 2.5 GHz, 15 mW — 2.5 to 3.5 GHz,

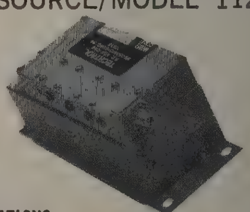
WIDE BAND PHASE LOCK SOURCE/MODEL PLC-140A



SPECIFICATIONS

Frequency Range: 400 MHz to 1500 MHz (Any 200 MHz Band).
Power Output: 20 mW.
Frequency Stability: ±.003%.
Temperature Range: 0°C to +50°C.
Subharmonic Rejection: −50 dBc.
Harmonic Rejection: −26 dBc.
Operating Voltage: +15 VDC.
Connector: SMA.
Size: 4″ x 3.375″ x 2″.

LOW COST MICROWAVE SOURCE/MODEL 112



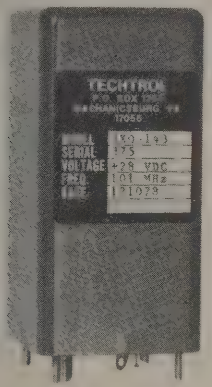
SPECIFICATIONS:

Frequency Range: 3 GHz to 6 GHz.
Frequency Stability: ±.005%.
Temperature Range: 0°C to +50°C.
Power Output: 5 mW min., 10 mW typ.
Operating Voltage: +15 VDC.
Subharmonic Rejection: −35 dBc.
Harmonic Rejection: −50 dBc.
Size: 4″ x 2.1″ x 2″.

TECHTROL

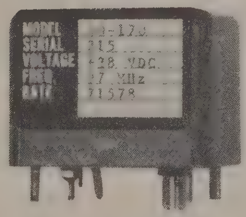
CRYSTAL OSCILLATORS

HIGH STABILITY/HXO-143



SPECIFICATIONS:
Frequency Range: 1 MHz to 600 MHz.
Power Output: +10 dBm, 50 ohms.
Frequency Stability: ±5 x 10^{-8}, 0°C to +55°C.
Aging Rate: ±1 x 10^{-7}/Day.
FM Noise: −105 dB, 100 Hz
−110 dB, 1 KHz
−140 dB, 10 KHz
−140 db, 100 KHz.
Harmonics: Less than 40 dBc.
Voltage: +15 VDC and +28 VDC.
Size: 2″ x 2″ x 4″.
Connector: SMA.

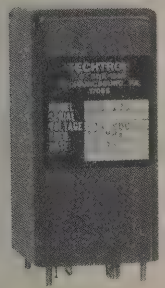
MODEL XO-170



SPECIFICATIONS:
Frequency Range: 1 MHz to 600 MHz.
Power Output: +10 dBm.
Frequency Stability: ±.003%, −20°C to +60°C
±.005%, −40°C to +70°C.
Harmonics: −40 dBc min.
Voltage: +5 VDC to +28 VDC (specify).
Size: 2″W x 2″L x 1.75″H.
Connector: BNC or SMA.

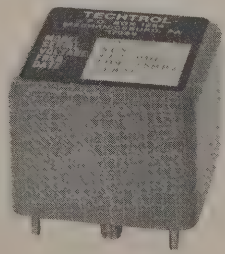
LOW PHASE NOISE

MODEL HXO-178



SPECIFICATIONS:
Frequency Range: 1 MHz to 600 MHz.
Power Output: +10 dBm.
Frequency Stability: ±5 x 10^{-8}, 0°C to +55°C.
Aging Rate: ±1 x 10^{-7}/Day.
FM Noise: −114 dB, 100 Hz
−135 dB, 1 KHz
−160 dB, 10 KHz
−169 dB, 100 KHz.
Harmonics: Less than −40 dBc.
Voltage: +15 VDC and +28 VDC.
Size: 2″ x 2″ x 4″.
Connector: SMA.

MODEL XO-147

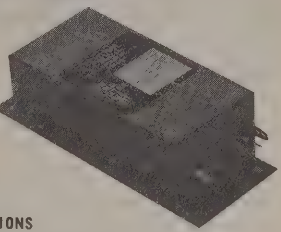


SPECIFICATIONS:
Frequency Range: 1 MHz to 600 MHz.
Power Output: +10 dBm min.
Frequency Stability: ±.003%, −20°C to +60°C
±.005%, −40°C to +70°C.
Harmonics: −20 dBc min.
Voltage: +5 VDC to +28 VDC (specify).
Size: 2″W x 2″L x 1.75″H.
Connector: BNC or SMA.

IF YOU HAVE SPECIAL REQUIREMENTS
CALL US.

MULTIPLIERS

FREQUENCY MULTIPLIER USING DIRECT MULTIPLICATION MODEL FXA-217-1

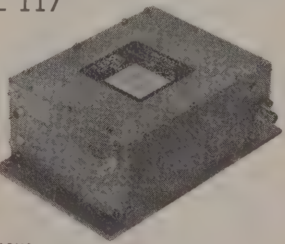


SPECIFICATIONS
Input Frequency: 10 MHz @ 0 dBm.
Output Frequency Range: X2 through X25.
Output Power: +10 dBm.
Power Stability: ±.5 dB, −20°C to +70°C.
Spurious Rejection: 60 dBc or greater.
Operating Voltage: +15 VDC @ 40 mA.
Size: 4″L x 2″W x 1.375″H.

DIGITAL PHASE LOCKED MULTIPLIERS MODEL FXA-151

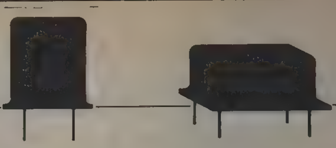
Frequency Range: 10 MHz to 750 MHz.
Input Level: −20 dBc to +10 dBc, 50 ohms, 100 kHz to 10 MHz.
Power Output: +10 dBm min.
Lock Time: Approx. 50 ms.
Operating Temperature Range: 0°C to 50°C (−20°C to +75°C, optional).
Subharmonics: Less than −50 dBc (−70 dBc optional).
Harmonics: Less than −26 dBc (−60 dBc optional).
Output Impedance: 50 ohms.
VSWR: 1.5:1 max.
Output Connector: SMA.
Input Connector: SMA.
Operating Voltage: +15 VDC and +5 VDC.
DC Connector: Filter con.
Size: 4″L x 2″W x 1.375″H.
Mounting: Flange.

FREQUENCY MULTIPLIERS USING DIRECT MULTIPLICATION MODEL 117



SPECIFICATIONS
Frequency Range: 1 MHz to 8.0 GHz.
Band Width: Typically 1%, 1 dB; 3%, 3 dB.
Up to 10% available.
Power Input: 0 dBm ±3 dB. (Inputs from −10 dBm to +20 dBm ranges available).
Power Output: 0 dBm to +20 dBm.
Spurious Rejection: −60 dBc.
Harmonic Rejection: −40 dBc (Higher rejection available).
Subharmonic Rejection: −40 dBc (Higher rejection available).
Operating Voltage: +12 VDC to +28 VDC range (AC option available).
Header: Filter con — SMA.
Size: 4″L x 2″W x 1.375″H. Length depends on requirement.
Mounting: Flange

VALPEY-FISHER
A SUBSIDIARY OF MATEC



MICROPROCESSOR CRYSTALS

Valpey-Fisher quartz crystals are ideally suited for microprocessor applications. They feature low series resistance, precise frequency setting, and a stable frequency tolerance with temperature. Our high reliability production process assures outstanding long-term stability.

Listed are most of the common microprocessor frequencies, a sampling of the microprocessors in which they are used, and the Valpey-Fisher part number for crystals of these frequencies. Other frequencies are available upon request.

All crystals are available in the miniature HC-18/U holder. The small size of this holder makes it ideal for use in densely populated printed circuit boards. To minimize spacing between boards, an engineer may mount the crystal on a plane parallel to the board and support it with the optional third lead or hold-down pin.

Frequency tolerance: ±.005% @ 25°C
Stability tolerance—all types (except VF100):
±.01% from −20°C to +70°C
(VF100): ±.02% from −20°C to +70°C
Static Capacitance, C_0, all types (except VF100):
7.0pf maximum
(VF100): 4.0pf maximum

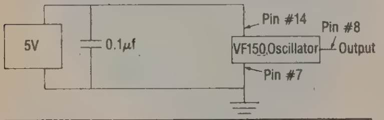
Freq. (MHz)	Microprocessor Applications	Valpey Fisher Type	Calibrated Series/ Parallel @ pf	Max. Eff. Series Res. OHMS	Max. Res.
1.0	SC-MP, COP 402, 420, 421, 440, MN 1500, 1542, 1544, 1562, 1564, 1599, TMS 1000C, T3472, S2000, 2510, 2200, 2400, PIC 1645, 1650, 1655, 6500, 6860	VF100	13	8,000	15,000
1.8432	14411, 6802	VF184* VF184A	13 13	440 825	800 1,000
2.0	F-8, 1610, 2650, 3850, 3851, 3852, 3853, 3856, 3870, 6102, 6500, 6800, 6801, 6802, 6809, 6846, 6875, INS 8060, INS 8900	FV200* or VF200A	20	800	1,100
2.097152	MM 5378, MM 5379, MC 6802, NSC 800	VF210* VF210A	20 20	700 250	950 375
2.4576	2920, IM 4702, 4712, 6100, TMS 9980, 9981 MC 6802, 34702 Baud Rate Generator	VF246	32	250	300
2.5	IM 6100, Z80, 2650, NSC 800	VF250	Series	275	—
3.0	MSC-48, MC 6802, 3870, 8021, 8035, 8041, 8048, 8080, 8085A, 8741, 8742, 8784, 9900	VF300	Series	250	—
3.2768	CP1600, ICM 7205, MC 6802, NSC 800, IM 6100	VF328	15	110	275
3.579545	1372, 3870, 6801, 6802, 6803, 6808, 6809, 68701, 3872, 3873, 3874, 3876, 6102, 8020, 8021, 8022, 8035, 8748, PPS4, PPS8	VF358	18	150	250
4.0	3870, 6801, 6802, 6803, 6805, 6808, 6809, 68000, 68701, 68705, 146805, 8060, 8070, 8072, TMS1000, TMS1200, TMS9940, Z80, Z8000, SC-MP-11, 8X300, PACE, MSC-40	VF400 or VF400A	Series 20	100 100	— 140
4.194304	ICM7038A, 7049, 7213	VF419	12	80	100
4.9152	NSC800, Z80A, COM5026, 5046	VF492	Series	70	—
5.0	Z80, 8085, 8086, 8088, CP1600A, 6801, 6803, 68701, 146805, TMS 9940, TMS 9985, COP 1802, 1803, 1804, IM6100A, IAPX88	VF500	20	50	85
5.0688	8X300, COM5016, 5036	VF507	Series	50	—
5.1850	MSC-40, 4004, 4040, 4201, 8030A	VF519	Series	50	—
6.0	8035, 8041, 8048, 8085, 8741, 8748, 8749, 6801, 6802, 6803, 6808, 6809, 68000, 68701, TMS 9995, MCS-48	VF600 or VF600A	Series 20	50 50	— 70
6.144	8085, 8089, MSC-85	VF614	30	50	65
6.4	1802, 1804, 1805	VF640	20	50	60
6.5536	7208, ICM 7045, ICM 7207	VF655	20	50	60
8.0	6801, 6802, 6803, 6808, 6809, 68000, 68701, 1804, 1805, Z8, Z8000, 8086, 8088, 8X300, CP1600, IM6100	VF800 or VF800A	Series 18	30 30	— 50
8.333	MN602	VF833	Series	30	—
9.8304	Various	VF983	Series	30	—
10.0	AM2901, AM29116, 8086, 8088, MSC 85, 2920, 9400, 9440, NS 16000	VF1000	Series	30	—
10.92	DP8350	VF1092	20	30	50
11.0	8039, 8040, 8049, 8050, MSC 48, 6804	VF1100	Series	30	—
12.0	8031, 8051, 8751, 2920, MSC 86	VF1200	Series	30	—
18.0	8080A, 8224, MSC 80	VF1800	Series	30	—
18.432	8080A, 8224, MSC 80	VF1843	Series	20	—
20.0	F9445, MSC 80, AM2900, 8080A, 8224	VF2000	Series	20	—
22.1184	MSC 80, 8080A, 8224	VF2212	Series	20	—
27.0	MSC 80, 8080A, 8224	VF2700	3rd OT	50	—
36.0	8080A, 8224, 9070A	VF3600	3rd OT	50	—
48.0	TMS 9900, 9940	VF4800	3rd OT	40	—

*Available only in larger HC-33/U holder.

CLOCK OSCILLATORS

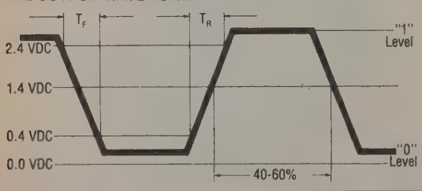
Combine state-of-the-art, thick film hybrid technology with precision quartz crystal resonators to achieve unsurpassed qualities of small size, low cost, high reliability, and frequency accuracy.

In accordance with FCC ruling number 20780 on restricted radiation devices, all Valpey-Fisher oscillators have pin #7 grounded to the metal case unless specified otherwise.



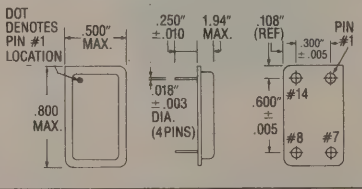
PIN	CONNECTION
1	N.C.
7	GND
8	OUTPUT
14	+5VDC

TTL OUTPUT WAVE FORM:



SPECIFICATIONS

FREQUENCY RANGE: 0.25 to 70.0 MHz
FREQUENCY STABILITY: ±0.0025%, ±0.005%, ±0.01%, ±0.05%, ±0.25%, input voltage variation of ±10%, load changes, and aging.
TEMPERATURE RANGE: Operating: A choice of three standard operating ranges are available: 0°C to +70°C/−40°C to +85°C/−55°C to +125°C
Storage: −55° to +125°C
INPUT VOLTAGE: +5 Volts DC ± 10%
INPUT CURRENT: 250 KHz to 3.999 MHz: 70 mA Max.
4.00 MHz to 25.0 MHz: 30 mA Max.
25.01 MHz to 70.0 MHz: 50 mA Max.
TTL OUTPUT:
Symmetry: 60/40 to 40/60 @ 1.4 VDC level
Rise & Fall Times: 10 ns max. between 0.4 and 2.4 VDC levels (0.25 to 25 MHz)
6 ns max. between 0.5 and 2.7 VDC levels (25.01 and 70 MHz)
"0" Level: +0.4V max., sinking 16 mA min. (0.25 to 25 MHz)
+0.5V max., sinking 20 mA min. (25.01 to 70 MHz)
"1" Level: +2.4V min., sourcing −0.4 mA min. (0.25 to 25 MHz)
+2.7V min. sourcing − 0.5 mA min. (25.01 to 70 MHz)
Output Load: 1 to 10 TTL gates
Short Circuit Output Current: 18 mA min. (0.25 to 25 MHz)
40 mA min. (25.01 to 70 MHz)



The Valpey-Fisher part number is an indicator of frequency, stability, and operating temperature range as detailed further in the table below:

FREQUENCY RANGE (MHz)	STABILITY (%)	OPERATING TEMPERATURE RANGE (°C)		
		0 to +70	−40 to +85	−55 to +125
0.25 to 1.124	0.0025	VF154A	VF154A-1	VF154A-2*
	0.005	VF154B	VF154B-1	VF154B-2
	0.01	VF154	VF154-1	VF154-2
	0.05	VF154C	VF154C-1	VF154C-2
	0.25	VF154D	VF154D-1	VF154D-2
1.125 to 2.249	0.0025	VF153A	VF153A-1	VF153A-2*
	0.005	VF153B	VF153B-1	VF153B-2
	0.01	VF153	VF153-1	VF153-2
	0.05	VF153C	VF153C-1	VF153C-2
	0.25	VF153D	VF153D-1	VF153D-2
2.250 to 3.999	0.0025	VF152A	VF152A-1	VF152A-2*
	0.005	VF152B	VF152B-1	VF152B-2
	0.01	VF152	VF152-1	VF152-2
	0.05	VF152C	VF152C-1	VF152C-2
	0.25	VF152D	VF152D-1	VF152D-2
4.00 to 25.00	0.0025	VF150A	VF150A-1	VF150A-2*
	0.005	VF150B	VF150B-1	VF150B-2
	0.01	VF150	VF150-1	VF150-2
	0.05	VF150C	VF150C-1	VF150C-2
	0.25	VF150D	VF150D-1	VF150D-2
25.01 to 70.00	0.0025	VF155A	VF155A-1	VF155A-2*
	0.005	VF155B	VF155B-1	VF155B-2
	0.01	VF155	VF155-1	VF155-2
	0.05	VF155C	VF155C-1	VF155C-2
	0.25	VF155D	VF155D-1	VF155D-2

*−55°C to +105°C
Valpey-Fisher welcomes inquiries for stability tolerances and temperature ranges that may be specific to your needs.

Valpey-Fisher Corporation • A Subsidiary of MATEC Corp. • 75 South Street • Hopkinton, MA 01748 • Telephone 617-435-6831 • Telex 94-8332

VALPEY-FISHER

A SUBSIDIARY OF MATEC

MIL-C-3098 CRYSTALS

Valpey-Fisher has demonstrated over 50 years of leadership in piezoelectric technology. Since 1931 the performance and reliability of Valpey-Fisher crystals have contributed to the defense of military efforts of our country.

Below are the specific CR types for which the Department of the Air Force and the Defense Electronic Supply Center have added Valpey-Fisher to Qualified Products List (QPL) 3098. The CR number applied to each crystal is a complete specification and defines the frequency range, frequency tolerance, capacitance holder type and environmental conditions. Merely specify the desired frequency.

Mil. Type CR-	Mil. Holder HC-	Freq. Range (MHz)	Mode	Oper. Tol. %	Oper. Temp. (°C)	Load Cap. (pF)	MIL-C-3098/
5A/U	17/U	2 to 10	1	.005	−55 to +90	25 ± .5	77
6A/U	17/U	2 to 10	1	.005	−40 to +70	13 ± .5	78
8A/U	17/U	1 to 10	1	.005	−40 to +70	Series	11
18A/U	6/U	.8 to 20	1	.005	−55 to +105	32 ± .5	3
19A/U	6/U	.8 to 20	1	.005	−55 to +105	Series	4
52A/U	6/U	10 to 61	3	.005	−55 to +105	Series	30
54A/U	6/U	50 to 125	5	.005	−55 to +105	Series	32
55/U	18/U	17 to 61	3	.005	−55 to +105	Series	33
56/U	18/U	50 to 125	5	.005	−55 to +105	Series	34
58A/U	17/U	.8 to 20	1	.005	−55 to +105	32 ± .5	36
60A/U	18/U	5 to 20	1	.005	−55 to +105	Series	38
64/U	18/U	2.9 to 20	1	.005	−55 to +105	30 ± .5	42
65/U	6/U	10 to 61	3	.001 (75°C)	.00025% (70-80)	Series	43
67/U	18/U	17 to 62	3	.0025	−55 to +105	Series	45A
69/U	18/U	2.9 to 25	1	.002(2)	−40 to +90	30 ± .5	47A
72/U	(1)	17 to 61	3	.005	−55 to +105	Series	50 (USAF)
75/U	18/U	17 to 61	3	.0025(2)	−55 to +105	Series	53B
77/U	25/U	17 to 62	3	.002(2)	−40 to +90	Series	55
78A/U	25/U	2.9 to 20	1	.005	−55 to +105	30 ± .5	62 SIG. C
79/U	25/U	2.9 to 20	1	.005	−55 to +105	Series	63 SIG. C
80/U	18/U	50 to 125	5	.002(2)	−40 to +90	Series	57
81/U	25/U	17 to 61	3	.005	−55 to +105	Series	58
82/U	25/U	50 to 125	5	.005	−55 to +105	Series	59
83/U	25/U	50 to 125	5	.002(2)	−40 to +90	Series	60
85/U	6/U	.8 to 20	1	.002(2)	−40 to +90	Series	56 SIG. C
89/U	32/U	2.12 to 6.2	1	.005	−55 to +90	30 ± .5	67
97/U	18/U	8 to 10	1	.005	−40 to +85	32 ± .5	72 (USAF)
98/U	25/U	50 to 134	5	.0015	−30 to +71	Series	73 (USAF)
105/U	18/U	48 to 125	5	.0025	−40 to +90	Series	80 (USAF)
106/U	18/U	10.5 to 11.5	1	.005	−55 to +105	32 ± .5	82 (USAF)
107/U	18/U	50 to 125	5	.005	−55 to +105	Series	83 (USAF)
110A/U	18/U	62.5 to 75	5	.003	−40 to +85	Series	86 (USAF)
112/U	18/U	5 to 20	1	.0025	−55 to +105	Series	88
116/U	18/U	50 to 125	5	.0025	−55 to +105	Series	92 (USAF)
117/U	25/U	30 to 63	3	.0015	−40 to +65	Series	93 (USAF)
118/U	25/U	7 to 25	1	.003	−55 to +85	32 ± .5	94 (USAF)
119/U	6/U	.8 to 20	1	.005	−55 to +105	30	95
122/U	18/U	50 to 125	5	.0005	+80 to +90	Series	99 (USAF)
123/U	18/U	50 to 125	5	.00025	+80 to +90	Series	100 (USAF)
125/U	6/U	1.85 to 3.05	1	.005	−55 to +105	32 ± .5	102 (USAF)
129/U	18/U	9 to 12	1	.0035	−55 to +90	32 ± .5	110 (USAF)
130/U	6/U	.8 to 20	1	.002(2)	−40 to +90	30	109
134/U	18/U	18 to 21	1	.0025(3)	+10 to +80	32 ± .5	113 (USAF)
136/U	18/U	8 to 10	1	.0025(3)	+10 to +80	32 ± .5	115 (USAF)
137/U	18/U	8.5 to 19	1	.0025(4)	+40 ± 2	32 ± .5	116 (USAF)
139/U	18/U	20 to 22	1	.005	−55 to +105	30 ± .5	118 (USAF)
140/U	6/U	9.5 to 12.5	1	.005	−55 to +90	60 ± .5	119 (USAF)
141/U	18/U	48 to 90	5	.0025(5)	−30 to +55	Series	122 (USAF)
148/U	6/U	10 to 61	3	.005	−55 to +105	Series	129 (USAF)
149/U	18/U	46 to 100	5	.0025(6)	+10 to +80	Series	130 (USAF)
151/U	18/U	50 to 100	5	.0035(7)	−30 to +70	Series	132 (USAF)
152/U	18/U	16 to 60	3	.002(8)	−40 to +90	Series	133

1. Same as HC-25 except pin length is .095"
2. Secondary operating temperature is .003% at −55 to −40 and +90 to +105°C
3. Secondary operating temperature range is .005% at −40 to +10 and +80 to +90°C
4. Secondary operating temperature range is .0025% at +20 to +70°C
5. Secondary operating temperature range is .0045% at −55 to −30 and +55 to +65°C
6. Secondary operating temperature range is .005% at −40 to +10 and +80 to +90°C
7. Secondary operating temperature range is .005% at −40 to −30 and +70 to +90°C
8. Secondary operating temperature range is .003% at −55 to −40 and +90 to +105°C

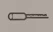
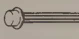
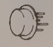
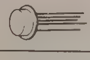
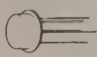
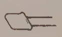
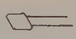
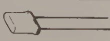
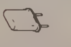
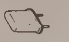
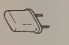
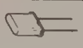
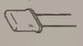
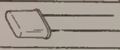
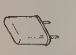
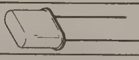
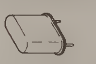
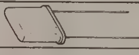
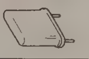
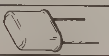
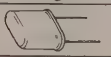
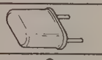
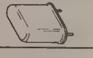
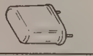
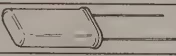
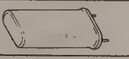
xtending the Military Range of Frequencies

quivalent Valpey-Fisher crystal types cover, but are not limited to, the frequency ranges shown for Military units. For example IL type CR-64/U covers the fundamental mode range of 2.9 to 20.0 MHz in the HC-18/U miniature holder. The Valpey-Fisher ersion, using the same holder, covers from 1.843 to 30.0 MHz.

Please inquire as to the actual range of frequencies available for commercial versions of the MIL types.

CRYSTAL HOLDERS AND ENCLOSURES

The crystal enclosures listed below represent the most commonly used types and are arranged from left to right in descending package size. Special configurations are also available.

	Frequency	Type	Mil Type	Solder Seal	Resis. Weld	Cold Weld	Package Height	Package Width	Package Thick	Pin Length	Pin Diameter	Pin Space*
	32 768 KHz	NC-38	None			•	310	118†	n/a	410	012	043
	3 MHz to 300 MHz	VF-35	HC-35/U			•	265	405	n/a	1 500	018	↑
	↑	VF-37P	HC-37/U			•	↑	↑	n/a	281	030	
	2 MHz to 300 MHz	VF-37	HC-37/U			•	275	620†	n/a	↑	↑	200
	650 MHz to 10 MHz	VF-40	HC-40/U			•	460	840†	n/a	1 500		375
	6 MHz to 300 MHz	VF-45	None		•		↑	305	122	500*	018	↑
	6 MHz to 22 12 MHz	VF-44	None	•			335	295	.094	750	012	148
	↑	VF-43	HC-43/U			•	↑	↑	↑	1 500	017	↑
	2 MHz to 300 MHz	VF-42	HC-42/U			•		450	200	↑	↑	
	↑	VM-6D	HC-50/U		•			↑	↑			
		VM-6D	HC-25/U	•					237	238	040	
		VM-6	HC-49/U		•				↑	↑	↑	
	2 MHz to 200 MHz	VM-6	HC-18/U	•			530	435	183	500*		192
	↑	VR-32E	None	•			↑	↑	↑	1 500	017	↑
	1 50 MHz to 200 MHz	VR-32	HC-32/U	•			.640	567	.237	238	.040	275
	↑	VF-47	HC-47/U			•	↑	↑	↑	1 500	.030	↑
	1 00 MHz to 300 MHz	VR-36	HC-36/U			•		735	335	238	050	
	↑	VR-6SE	None	•				↑	↑	1 500	029	
	1 00 MHz to 200 MHz	VR-6S	None	•					245	238	050	
	↑	VR-6E	HC-51/U		•				↑	↑	↑	
		VR-6E	HC-33/U	•						500*	.029	
		VR-6D	HC-17/U	•	•					437	093	
		VR-6	HC-48/U		•					↑	↑	
	155 KHz to 200 KHz	VR-6	HC-6/U	•			775			.238	.050	
	↑	VR-13E	HC-34/U	•			↑			1 500	029	
	14 KHz to 50 KHz	VR-13	HC-13/U	•			1.526	757	.352	238	.050	486

Nominal Dimensions in Inches

*Center to Center *Minimum †Diameter: Round Package

VALPEY-FISHER
A SUBSIDIARY OF MATEC

HIGH RELIABILITY QUARTZ CRYSTALS

are most appropriate for use in sophisticated communication systems, in advanced military and space applications, and in high performance commercial oscillator, TCXO, VCXO, and OXO applications.

Valpey-Fisher Hi-Rel crystals incorporate the materials, processes, test methods, and workmanship necessary to achieve optimum levels of performance and reliability. A complete in-house environment testing capability is available for those applications which require verification and statistical documentation of product reliability.

FEATURES

- Cold Weld Vacuum Seal with a max leak rate of 5×10⁻⁹ atmos, cc/sec of helium
- Superior Thermal aging
- Shock Resistant
- Seven holder styles
- Frequencies up to 300 MHz
- Setting tolerances as low as 1PPM

The following data is intended for general guidance. Crystals with unique specifications and tolerances can be provided upon request. Also available are low frequency crystals from 14 KHz to 1.0 MHz using NT, 5°, DT, CT, or SL cuts.

Note 1: A suffix number is appended to the Valpey-Fisher type number to denote overtone mode. For example, VF36-5 is a 5th overtone.

Note 2: The VF37 and VF40 are supplied with wire leads. Types VF37P and VF40P contain pin-type leads.

Note 3: The VF35, VF37 and VF40 use a standard 3-point crystal mount. An optional 4-point mount is available for better shock and vibration performance.

FREQUENCY TOLERANCE VS. TEMPERATURE RANGE

	TEMP. RANGE (°C)			
	0 to +50	−20 to +70	−40 to +70	−55 to +105
OPTIMUM	±0.00025%	±0.0005%	±0.001%	±0.0025%
TYPICAL	±0.0005%	±0.001%	±0.002%	±0.005%

Valpey-Fisher Cold Weld Type	Mil Type	Solder Seal Equivalent	Frequency Range (MHz)	Max Series Resistance (OHMS)	Typ. Aging (PPM)		Mode	Typical Drive Level (mW)
					30 days	1 year		
VF40	HC-40/U	—	0.65-.99	300	2	1.5	Fund.	1.0
			1-1.9	150				
			2-2.9	40				
			3-5.9	25				
			6-10	15				
VF37	HC-37/U	TO-8	2-2.9	250	2	2	Fund.	1.0
			3-3.9	120				
			4-4.9	60				
			5-5.9	30				
			6-7.9	22				
			8-25	15				
			25-60	40			3rd	
			60-87	50			5th	
			87-100	60			5th	
			100-150	80			7th	
			150-250	90			9th	
			250-300	100			11th	
V35	HC-35/U	TO-5	3-4.9	120	2	3	Fund.	0.5
			5-6.9	50				
			7-9.9	40				
			10-25	25				
			25-75	40			3rd	
			75-125	60			5th	
			125-150	80			7th	
			150-250	90			9th	
			250-300	100			11th	
VF36 & 4F47	HC-36/U & HC-47/U	HC-6/U & HC-33/U	1-1.9	350		2		
			2-2.9	175				
			3-3.9	75	3	3	Fund.	5.0
VF36, VF47, VF42, & VF43	HC-36/U HC-47/U HC-42/U & HC-43/U	HC-6/U HC-33/U HC-25/U & HC-18/U	4-6.9	50				
			7-10	30				
			10-20	25				
			20-60	40			3rd	2.0
			60-87	50			5th	
			87-100	60			9th	1.0
			100-150	80			7th	
			150-250	90			9th	
			250-300	100			11th	

PRECISION CRYSTALS/3rd & 5th OVERTONES

are ideally used in ovenized oscillators for high stability frequency standards, synthesizers, and clocks.

Valpey-Fisher precision overtone crystals are produced in a climate controlled, clean room environment utilizing state-of-the-art processing equipment. All crystals are thermally aged and then cold weld sealed in an ultrahigh vacuum to ensure exceptionally low aging characteristics.

Product reliability can be documented by complete in-house environmental testing.

FEATURES:

- Low Aging
- Low Resistance
- Cold Weld Vacuum Seal
- High Q
- Ultra High Stability
- AT-Cut

All precision crystals are available in a choice of standard cold welded enclosures:

Valpey-Fisher Type	Mil Type	Solder Seal Equivalent
VF36	HC-36/U	HC-6/U
VF37*	HC-37/U*	TO-8
VF40	HC-40/U	—
VF47	HC-47/U	HC-33/U

*Limited to 3rd overtones in the 9 to 12 MHz range.

The following data is intended for general guidance. Other frequencies, tolerances, and performance parameters can be provided upon request.

Frequency Range (MHz)	**3.8 to 6.0**	**6.1 to 10.9**	**5.0**
Overtone Mode	3rd	3rd	5th
Turning Point	Can be specified at any temperature from +45° to +110°C with ±2° to ±5°C tolerances		
Freq. Tolerance @ Turn Point	±2PPM	±2PPm	±1PPM
Series Resistance (Ohms) Minimum Typical Maximum	 20 30 50	 5 20 40	 90 110 140
Q-Minimum	1.5×10^6	0.6×10^6	2.5×10^6
Aging Rate (after 3 days)	2×10^{-9}/day	2×10^{-9}/day	5×10^{-10}/day
Drive level 50μ W Maximum			
Hermeticity	5×10^{-9} atmos. cc/sec of helium		

Note 1: A suffix number is appended to the Valpey-Fisher type number to denote overtone mode. For example: VF36-3 is a 3rd overtone and VF36-5 is a 5th overtone.

Note 2: The VF37 and VF40 are supplied with wire leads. Types VF37P and VF40P contain pin-type leads.

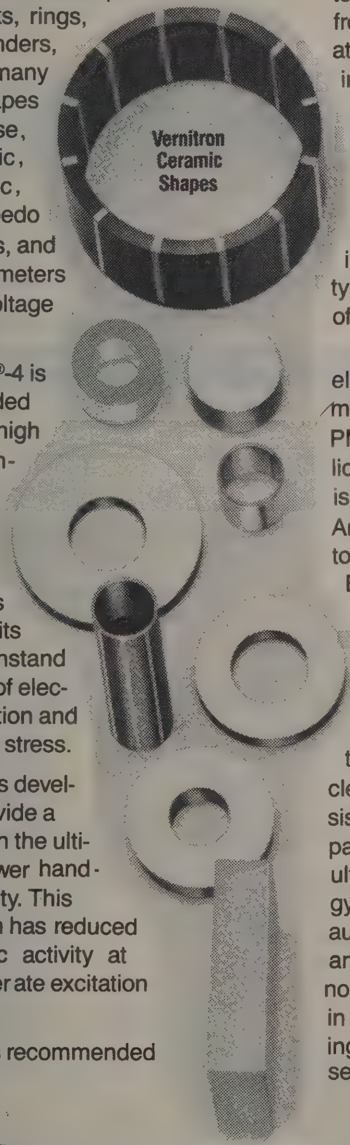
Note 3: The VF37 and VF40 use a standard 3-point crystal mount. An optional 4-point mount is available for better shock and vibration performance.

Valpey-Fisher Corporation • A Subsidiary of MATEC Corp. • 75 South Street • Hopkinton, MA 01748 • Telephone 617-435-6831 • Telex 94-8332

Electronic components and piezo ceramics by Vernitron. 45 years of innovation.

In piezo ceramics of diverse shapes. In Bimorphs and Unimorphs. Also in ceramic bandpass and ladder filters. In ceramic resonators. And in piezo igniters. That's Vernitron Piezoelectric Division.

We've been making innovations in electronic components and piezo ceramics since 1938. And we're still doing it. Take a look at some of our accomplishments in modern ceramic shapes. We've developed discs, blocks, rings, plates, cylinders, tubes and many custom shapes for sonar use, as ultrasonic, hydrophonic, and as torpedo ransducers, and n accelerometers and high voltage generators.



Vernitron Ceramic Shapes

Our PZT®-4 is ecommended or use in high voltage generators and high power acoustic adiating ransducers because of its ability to withstand high levels of elecrical excitation and mechanical stress.

PZT-8 was developed to provide a material with the ultimate in power handling capability. This composition has reduced piezoelectric activity at ow to moderate excitation evels.

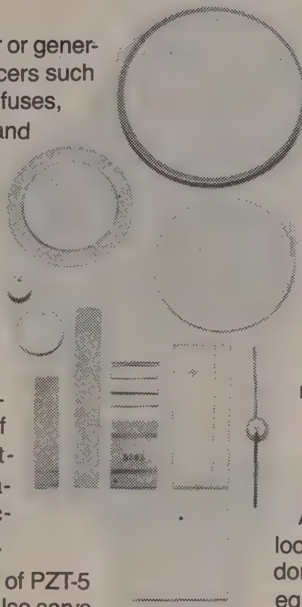
PZT-5A is recommended for use in receiver or generator type transducers such as hydrophones, fuses, accelerometers, and vibration pickups in general etc., because of its high sensitivity, permittivity and time stability.

PZT-5H is better suited to low frequency applications because of increased permittivity, accompanied by a reduced Curie point.

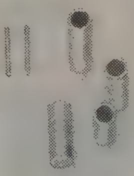
The family of PZT-5 materials may also serve in very low power motor-type transducers because of high motion sensitivity.

Vernitron also has developed lead metaniobate materials, PMN-1 and PMN-2, for diverse applications. Their feature is higher Curie points. And we are the originators of Unimorphs and Bimorphs to serve as compact transducers for audio tones.

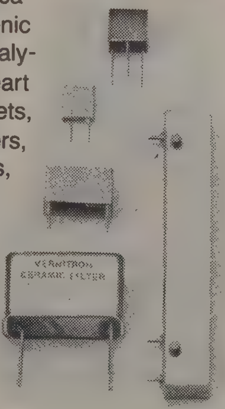
The above compositions are used in such applications as ultrasonic cleaners, kidney dialysis equipment, heart pacemakers, ink jets, ultrasound scanners, gyros, sonobuoys, automatic erasers and a variety of noisemakers. Also in laser positioning and as motion sensors.



Shapes, Unimorphs, Bimorphs



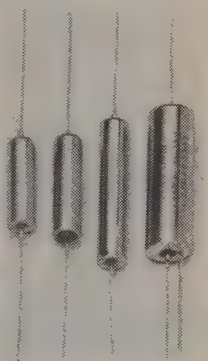
Ink Jet and Ceramic Tubes



Bandpass Filters and Resonators

Innovation is also true of our work in bandpass filters, ladder filters, and ceramic resonators. We offer light weight, stable, fixed tuned, miniature ceramic filters and resonators with varieties for almost any kind of communications equipment:

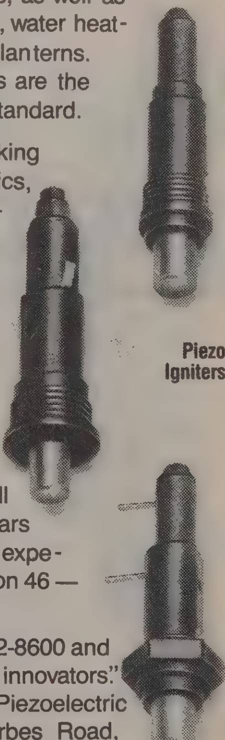
consumer —
commercial —
military.



Ceramic Ladder Filters

And don't overlook what we've done in piezo igniters for gas fired equipment of all types. Vernitron igniters are original equipment in most makes of barbeque grills, as well as in many furnaces, water heaters and camping lanterns. Vernitron igniters are the world industry standard.

So if you're working with piezo ceramics, in alarms, speakers, lasers, sonar, ink jet printing data processing, communications, telephone development, gyros, or hydrophones, pacemakers or gas-fired equipment give us a call and put our 45 years of innovation and experience — going on 46 — to work.



Piezo Igniters

Just call (216) 232-8600 and ask for "one of the innovators." Or write Vernitron Piezoelectric Division, 232 Forbes Road, Bedford, Ohio 44146, for information on any of these products.

Vernitron Piezoelectric Division

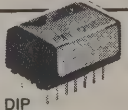
232 Forbes Road. Bedford. Ohio 44146

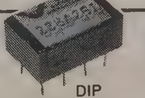
VECTRON TTL Clock Oscillators

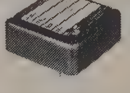
QPL'd to MIL-O-55310/16

	PCB MOUNT	DIP COMPATIBLE	
Series	CO-231 CO-231H	CO-238 CO-234	**CO-401** (4 pins) **CO-402** (14 pins)
Features	*Broadest range of frequencies & options*	*Vectron's lowest price DIP clocks*	*0.2" high, full MIL CO-402 is QPL'd*
Frequency	**CO-231:** 1 Hz-75 MHz **CO-231H:** 75.1-100 MHz	**CO-238:** 16 KHz-100 MHz **CO-234:** 16 KHz-30 MHz	16 KHz-100 MHz
Output	Drives 10 TTL loads (above 50 MHz, drives 2 Schottky loads).		
Supply	5VDC ± 5% at 30-90 ma depending upon frequency.		
Accuracy (at 25°C)	**CO-231:** ± 10 ppm ***CO-231T:** ± 1 ppm **CO-231H:** ± 10 ppm ***CO-231HT:** ± 1 ppm *Tuning settable to ± 1 ppm; available only in CO-238T to 30 MHz, and CO-231T to 100 MHz.	**CO-23☐A:** ± 50 ppm **CO-23☐C:** ± 25 ppm **CO-23☐D:** ± 15 ppm **CO-23☐B:** ± 10 ppm ***CO-23☐T:** ± 1 ppm height: 8 = 0.35" 4 = 0.28"	**CO-40☐A:** ± 50 ppm **CO-40☐C:** ± 25 ppm **CO-40☐D:** ± 15 ppm **CO-40☐B:** ± 10 ppm ****CO-40☐E:** ± 1 ppm 1 = 4 pin base 2 = 14 pin base **Set to ± 1 ppm via external capacitor (< 20 MHz only)
Stability	**STANDARD:** 0°C to + 70°C: ± 25ppm Option **1:** – 55°C to + 85°C: ± 50ppm Option **2:** – 55°C to + 125°C: ± 50ppm (N/A > 70MHz, except for CO-231) Option **3:** 0°C to + 50°C: ± 3ppm (N/A in CO-401 or CO-402) Option **4:** 0°C to + 50°C: ± 1ppm (only for CO-231, 12KHz-20MHz) Option **5:** 0°C to + 50°C: ± 5ppm Option **6:** 0°C to + 50°C: ± 10ppm Option **7:** – 55°C to + 125°C: ± 100ppm (N/A > 70 MHz, except for CO-231) ***Option **8:** 0°C to + 70°C: ± 100ppm (N/A in CO-401 or CO-402) ***Option **9:** – 55°C to + 200°C: ± 300ppm (only for CO-401/402 in 4-20MHz range) Option **Y:** Aging improved from 5 to 1 ppm/yr typical (CO-231/CO-238 only). ***Includes initial accuracy; do not specify A, B, C, D, E or T accuracy.		
Size	1½" x 1½" x ½"	**CO-238:** 0.5" x 0.8" x 0.35" **CO-234:** 0.5" x 0.8" x 0.28"	0.5" x 0.8" x 0.2"
Package	metal can, epoxy base Option **C:** solder sealed case, ⅝" high	epoxy case Option **C:** solder sealed case	resistance welded metal case
Environment	See chart on next page		

CO-400 SERIES


DIP epoxy case


DIP solder sealed case "C"


PCB MOUNT

VECTRON ECL Clock Oscillators

	PCB MOUNT		DIP COMPATIBLE	
Series	CO-233ME CO-233MEH	CO-533KE CO-533ME	CO-633	**CO-431** (4 pins) **CO-432** (14 pins)
Features	*Wide range of options*	*Sub-nanosecond 100K ECL*	*DIP to 200 MHz*	*Lowest profile (0.2") MIL design*
Frequency	**ME:** 5-149.9 MHz **MEH:** 150-200 MHz	150-500 MHz	5-200 MHz	5-150 MHz
Output	ECL	100K ECL	ECL	ECL
Supply	– 5.2V	**CO-533KE:** – 4.5V **CO-533ME:** – 5.2V	– 5.2V	– 5.2V
Accuracy (at 25°C)	**CO-233ME:** ± 10 ppm ***CO-233MET:** ± 1 ppm **CO-233MEHA:** ± 50 ppm **CO-233MEHB:** ± 10 ppm *Tuning settable to ± 1 ppm	**CO-533ME:** ± 10 ppm **CO-533KE:** ± 10 ppm ***CO-533MET:** ± 1 ppm ***CO-533KET:** ± 1 ppm	**CO-633A:** ± 50 ppm **CO-633C:** ± 25 ppm **CO-633D:** ± 15 ppm **CO-633B:** ± 10 ppm	**CO-43☐A:** ± 50 ppm **CO-43☐C:** ± 25 ppm **CO-43☐D:** ± 15 ppm **CO-43☐B:** ± 10 ppm 1 for 4 pins 2 for 14 pins
Stability	**STANDARD:** 0°C to + 70°C: ± 25ppm Option **1:** – 55°C to + 85°C: ± 50ppm (– 30/ + 85°C above 110 MHz; 0/85°C for 100K ECL) Option **2:** – 55°C to + 125°C: ± 50ppm (N/A above 110 MHz) Option **3:** 0°C to + 50°C: ± 3ppm (N/A in CO-431/432 or above 150 MHz) Option **5:** 0°C to + 50°C: ± 5ppm Option **6:** 0°C to + 50°C: ± 10ppm Option **7:** – 55°C to + 125°C: ± 100ppm (N/A above 110 MHz) **Option **8:** 0°C to + 70°C: ± 100ppm (N/A in CO-431/432) Option **Y:** Aging improved from 5 to 1 ppm/yr typical (N/A in CO-431/432, or above 125 MHz in CO-233/CO-633) **Includes initial accuracy; do not specify A, B, C, D or T accuracy.			
Size	1½" x 1½" x ⅝"	2" x 3" x ¾"	.5" x .8" x .42"	.5" x .8" x .2"
Package	metal case "**C**" option for fully sealed	fully sealed metal case	epoxy case "**C**" option for fully sealed	resistance welded case
Environment	See chart on next page			

VECTRON CMOS Clock Oscillators

	PCB MOUNT	LOW PROFILE DIP PACKAGE		
Series	CO-236	**CO-411** (4 pins) **CO-412** (14 pins) QPL'd to MIL-O-55310/18	**CO-421** (4 pins) **CO-422** (14 pins)	**CO-441** (4 pins) **CO-442** (14 pins)
Features	*Broadest range of options*	*Standard CMOS 8-15V supply*	*Standard CMOS 5V supply*	*High Speed CMOS 5V supply*
Frequency	.01 Hz-15 MHz	1 Hz-15 MHz	1 Hz-8 MHz	1 Hz-50 MHz
Output	Standard CMOS	Standard CMOS	Standard CMOS	High Speed CMOS
Supply	5-15VDC	8-15VDC	5VDC	5VDC (3VDC optional to 20 MHz)
Accuracy (at 25°C)	**CO-236:** ± 10 ppm ***CO-236T:** ± 1 ppm *Tuning settable to ± 1 ppm	**CO-41☐A:** ± 50 ppm **CO-41☐C:** ± 25 ppm **CO-41☐D:** ± 15 ppm **CO-41☐B:** ± 10 ppm ****CO-41☐E:** ± 1 ppm 1 for 4 pin base, 2 for 14 pin base **E option allows setting via external capacitor (≤ 20 MHz only)	**CO-42☐A:** ± 50 ppm **CO-42☐C:** ± 25 ppm **CO-42☐D:** ± 15 ppm **CO-42☐B:** ± 10 ppm ****CO-42☐E:** ± 1 ppm	**CO-44☐A:** ± 50 ppm **CO-44☐C:** ± 25 ppm **CO-44☐D:** ± 15 ppm **CO-44☐B:** ± 10 ppm ****CO-44☐E:** ± 1 ppm
Stability	**STANDARD:** 0°C to + 70°C: ± 25ppm Option **1:** – 55°C to + 85°C: ± 50ppm Option **2:** – 55°C to + 125°C: ± 50ppm Option **3:** 0°C to + 50°C: ± 3ppm (only available in CO-236) Option **4:** 0°C to + 50°C: ± 1ppm (only available in CO-236, specify supply voltage) Option **5:** 0°C to + 50°C: ± 5ppm Option **6:** 0°C to + 50°C: ± 10ppm Option **7:** – 55°C to + 125°C: ± 100ppm ***Option **8:** 0°C to + 70°C: ± 100ppm (only available in CO-236) ***Option **9:** – 55°C to + 200°C: ± 300ppm (N/A in CO-236 or above 20 MHz in CO-441/442) Option **Y:** Aging improved from 5 to 1 ppm/yr typical (CO-236 only). ***Includes initial accuracy; do not specify A, B, C, D, E or T accuracy.			
Size	1½" x 1½" x ½"	0.5" x 0.8" x 0.2"		
Package	Metal can epoxy base. Option **C:** solder sealed case, .68" high	resistance welded metal case		
Environment	See chart on next page			

HOW TO ORDER VECTRON CLOCK OSCILLATORS

CO-400 SERIES

CO-4☐☐☐ – ☐☐ at ☐

TTL; 5V = 0
Standard CMOS; 8-15V = 1
Standard CMOS; 5V = 2
ECL; – 5.2V = 3
Hi-Speed CMOS; 5V = 4

4 pin base = 1
14 pin base = 2

Initial accuracy at 25°C (A, B, C, D, or E)

Temperature stability (0 for standard, or option 1, 2, 5, 6, 7 or 9)

*Screen test option (X, B, C, or D)

Frequency

*SCREEN TEST	MIL STD 883 METHOD	Standard LEVEL X	Options LEVEL C	LEVEL D	LEVEL B
Internal Visual	2017	X	X	X	X
Stabilization Bake (24 Hours @ 150°C)	1008, Cond C	X	X	X	X
Seal Test (Gross and Fine)	1014	X	X	X	X
Temperature Cycling (Thermal shock)	1010, Cond B		X	X	X
Burn-in, operating 168 hours @ 125°C	—			X	X
Acceleration (5000g in Y_1 axis)	2001, Cond A				X
			Complies with Class C Screen Test requirements of MIL-O-55310/16 & MIL-O-55310/18		Complies with Class B Screen Test requirements of MIL-O-55310/16 & MIL-O-55310/18

All other clock oscillator types

CO-☐ ☐ – ☐☐☐ at ☐

Basic Model

*Accuracy/tuning (A, B, C, D or T)

*Stability option (1, 2, 3, 4, 5, 6, 7 or 8)

*Y for improved aging

*C for solder sealed case

Frequency

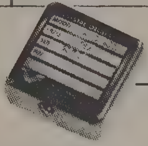
*leave blank if not applicable to your requirement

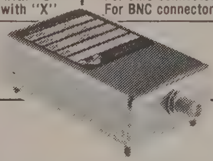
VECTRON

Sinewave Oscillators 50 Hz — 1 GHz

(for higher stability see TCXO and Oven Sections)

	Low Frequency **CO-281**	VHF **CO-233 SERIES**	UHF **CO-283W**	VHF High Power **CO-284W**
Frequency:	50 Hz-4 MHz	4 MHz-500 MHz	500.1-1000 MHz	4-500 MHz
Output Level:	Std: 1 vrms/1KΩ Opt: 0.5 vrms/50Ω above 10 KHz	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	1 watt/50Ω (+30 dBm) to 250 MHz 0.5 watt/50Ω (+27 dBm), 250-500 MHz
Supply:	+15 VDC. Any supply in 15-28 VDC range optional; supply less than 15 VDC subject to reduced output level			+15 VDC (+24 VDC optional to 300 MHz)
Accuracy:	±10 ppm at 25°C. Add "T" to model number for tuning adjustment with setability of ±1 ppm			
Stability:	**Standard:** 0°C to + 70°C: ±.0025% Option 1: −55°C to + 85°C: ±.005% Option 2: −55°C to +125°C: ±.005% (N/A for CO-283W or CO-284W) Option 3: 0°C to + 50°C: ±.0003% (N/A for CO-284W) Option 4: 0°C to + 50°C: ±.0001% (only for CO-281) Option 5: 0°C to + 50°C: ±.0005% Option 6: 0°C to + 50°C: ±.001% Option Y: Aging improved from 5 ppm/year typical to 2 ppm/year			
Noise:		−125 dB/Hz at 1 KHz and −150 dB/Hz at 50 KHz, typical to 100 MHz. 6 dB degradation per octave above 100 MHz		
Size:	2″ x 2″ x ¾″ 51 x 51 x 19 mm pins for pcb mount	**CO-233:** 5-149 MHz, 1½″ x ½″ x ⅝″, pins for pcb mount **CO-233H:** 150-300 MHz, 1½″ x ½″ x ⅝″, pins for pcb mount **CO-233FW:** 4-500 MHz, 2″ x 2″ x ¾″, chassis mount with SMA output connector (SMC or BNC optional)	2″ x 3″ x ¾″ (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"	2″ x 3″ x ¾″ (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"





Environmental Characteristics of Vectron Oscillators

	CO-400 SERIES LOW PROFILE CLOCKS	ALL OTHER MODELS
Operating Temperature	Per temperature stability specification (from +15/+35°C to −55/+200°C depending upon model and option selected)	
Storage Temperature	−55°C to +125°C	−55°C to +85°C (+125°C optional)
Shock	100g 6msec per MIL-STD-202 Method 213, Condition C	Standard: MIL-STD-202, Method 213, Condition J (30g, 11msec) Optional: same as left column for most types
Vibration	sine—20g to 2 KHz per MIL-STD-202 Method 204, Condition D . . . and random—20grms to 2 KHz per MIL-STD-202 Method 214, Condition I-F	Standard: MIL-STD-202, Method 201A plus 5g to 500 Hz Optional: same as left column for most types
Humidity	100% per MIL-STD-202, Method 103, Condition B	All models: 95%, no condensation Sealed models: same as left column
Seal	Hermetic per MIL-STD-883, Method 1014, 10^{-8} atm cc/second	Sealed models: MIL-STD-202, Method 112, Condition D N/A to non-sealed models
Altitude	Sea level to space	Sea level to space

NOTE: Vectron has produced oscillators for airborne, shipboard, manpack, mobile, spacecraft, rocket and missile applications.

About Vectron . . .

Facility

Vectron is housed in a new 60,000 square foot facility in which engineering, manufacturing and quality control have at their disposal the most advanced equipment and instrumentation available, including:

- Hybrid manufacturing and clean room facilities.
- Master frequency standard, internally calibrated to the National Bureau of Standards, from which reference signals are distributed to every test station.
- Automated test system comprised of a network of more than 70 temperature chambers controlled by a series of central computers.
- Scientific computer for engineering circuit design, analysis and data reduction.
- Environmental test laboratory including humidity, acceleration, shock, sinusoidal vibration, and random vibration equipment.

Military and Space Programs

Military and space applications represent approximately forty percent of Vectron's business. A few among the many vehicles and programs for which Vectron has delivered oscillators are the following:

Shipboard:	AEGIS, MARISAT, OMEGA, TERRIER M, NAVSTAR, TRIDENT, MARK-48 TORPEDO.
Aircraft:	F14, F16, P2V, P3V, B52, E2C, P3C.
Missile:	ATHENA H., PAVE-STRIKE
Spacecraft:	SKYLAB, SPACE SHUTTLE, GPS.
Manpack:	PRC-70, PRC-104, PRC-113.

Our quality control program meets the requirements of MIL-I-45208 and MIL-Q-9858 and our equipment calibration program conforms to MIL-C-45662.

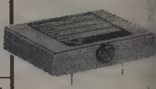
VECTRON

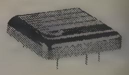
VECTRON LABORATORIES, INC. The CRYSTAL OSCILLATOR COMPANY
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796

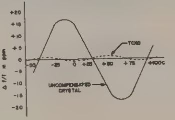
VECTRON TCXOs Temperature Compensated Crystal Oscillators

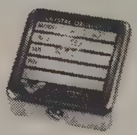
	50 Hz to 20 MHz		20+ MHz to 140 MHz	140 MHz to 420 MHz	420 MHz to 600 MHz
Temperature Stability:	**CO-251 SERIES** Moderate Stability Lower Cost	**CO-252 SERIES** High Stability	**CO-254 SERIES**	**CO-255 SERIES**	**CO-256 SERIES**
(Temp. Range **A**) +15°C to +35°C:	**CO-251A57:** $\pm5 \times 10^{-7}$ **CO-251A27:** $\pm2 \times 10^{-7}$	**CO-252A17:** $\pm1 \times 10^{-7}$ **CO-252A58:** $\pm5 \times 10^{-8}$	**CO-254A57:** $\pm5 \times 10^{-7}$ **CO-254A17:** $\pm1 \times 10^{-7}$	**CO-255A57:** $\pm5 \times 10^{-7}$ **CO-255A17:** $\pm1 \times 10^{-7}$	**CO-256A57:** $\pm5 \times 10^{-7}$ **CO-256A17:** $\pm1 \times 10^{-7}$
(Temp. Range **B**) 0°C to +50°C:	**CO-251B16:** $\pm1 \times 10^{-6}$	**CO-252B57:** $\pm5 \times 10^{-7}$ **CO-252B27:** $\pm2 \times 10^{-7}$ **CO-252B17:** $\pm1 \times 10^{-7}$	**CO-254B16:** $\pm1 \times 10^{-6}$ **CO-254B57:** $\pm5 \times 10^{-7}$ **CO-254B27:** $\pm2 \times 10^{-7}$	**CO-255B16:** $\pm1 \times 10^{-6}$ **CO-255B57:** $\pm5 \times 10^{-7}$ **CO-255B27:** $\pm2 \times 10^{-7}$	**CO-256B16:** $\pm1 \times 10^{-6}$ **CO-256B57:** $\pm5 \times 10^{-7}$ **CO-256B27:** $\pm2 \times 10^{-7}$
(Temp. Range **C**) 0°C to +70°C:	**CO-251C36:** $\pm3 \times 10^{-6}$	**CO-252C16:** $\pm1 \times 10^{-6}$ **CO-252C57:** $\pm5 \times 10^{-7}$ **CO-252C37:** $\pm3 \times 10^{-7}$	**CO-254C36:** $\pm3 \times 10^{-6}$ **CO-254C16:** $\pm1 \times 10^{-6}$ **CO-254C37:** $\pm3 \times 10^{-7}$	**CO-255C36:** $\pm3 \times 10^{-6}$ **CO-255C16:** $\pm1 \times 10^{-6}$ **CO-255C37:** $\pm3 \times 10^{-7}$	**CO-256C36:** $\pm3 \times 10^{-6}$ **CO-256C16:** $\pm1 \times 10^{-6}$ **CO-256C37:** $\pm3 \times 10^{-7}$
(Temp. Range **D**) −20°C to +70°C:	**CO-251D56:** $\pm5 \times 10^{-6}$	**CO-252D16:** $\pm1 \times 10^{-6}$ **CO-252D57:** $\pm5 \times 10^{-7}$	**CO-254D56:** $\pm5 \times 10^{-6}$ **CO-254D16:** $\pm1 \times 10^{-6}$ **CO-254D57:** $\pm5 \times 10^{-7}$	**CO-255D56:** $\pm5 \times 10^{-6}$ **CO-255D16:** $\pm1 \times 10^{-6}$ **CO-255D57:** $\pm5 \times 10^{-7}$	**CO-256D56:** $\pm5 \times 10^{-6}$ **CO-256D16:** $\pm1 \times 10^{-6}$ **CO-256D57:** $\pm5 \times 10^{-7}$
(Temp. Range **E**) −40°C to +75°C:	**CO-251E15:** $\pm1 \times 10^{-5}$	**CO-252E56:** $\pm5 \times 10^{-6}$ **CO-252E26:** $\pm2 \times 10^{-6}$ **CO-252E16:** $\pm1 \times 10^{-6}$	**CO-254E56:** $\pm5 \times 10^{-6}$ **CO-254E26:** $\pm2 \times 10^{-6}$ **CO-254E16:** $\pm1 \times 10^{-6}$	**CO-255E56:** $\pm5 \times 10^{-6}$ **CO-255E26:** $\pm2 \times 10^{-6}$ **CO-255E16:** $\pm1 \times 10^{-6}$	**CO-256E56:** $\pm5 \times 10^{-6}$ **CO-256E26:** $\pm2 \times 10^{-6}$ **CO-256E16:** $\pm1 \times 10^{-6}$
(Temp. Range **F**) −55°C to +85°C: (Higher temperature operation available)	**CO-251F25:** $\pm2 \times 10^{-5}$	**CO-252F56:** $\pm5 \times 10^{-6}$ **CO-252F26:** $\pm2 \times 10^{-6}$ **CO-252F16:** $\pm1 \times 10^{-6}$	**CO-254F56:** $\pm5 \times 10^{-6}$ **CO-254F26:** $\pm2 \times 10^{-6}$ **CO-254F16:** $\pm1 \times 10^{-6}$	**CO-255F56:** $\pm5 \times 10^{-6}$ **CO-255F26:** $\pm2 \times 10^{-6}$ **CO-255F16:** $\pm1 \times 10^{-6}$	**CO-256F56:** $\pm5 \times 10^{-6}$ **CO-256F26:** $\pm2 \times 10^{-6}$ **CO-256F16:** $\pm1 \times 10^{-6}$
Output Level & Frequency:	TTL: 50 Hz -20 MHz CMOS: 50 Hz -15 MHz SINE: 1 MHz-20 MHz		SINE: 20 MHz-140 MHz TTL: 20 MHz-100 MHz ECL: 20 MHz-140 MHz	SINE: 140 MHz-420 MHz ECL: 140 MHz-280 MHz	SINE: 420 MHz-600 MHz
Supply:	Any supply voltage in 5-28 VDC range; current as low as 3 ma for some models			12-28 VDC	12-28 VDC
Frequency Adjustment:	Screwdriver adjustment, setable to 1 x 10-7. Electronic tuning (TC/VCXO) capability optional.				
Aging Rate:	5 x 10–7 to 1 x 10–6 per year		1 to 2 x 10–6/year	1 to 2 x 10–6/year	1 to 2 x 10–6/year
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm) smaller size available		2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 3″ x ¾″ (51 x 76 x 19 mm)	2″ x 4″ x ¾″ (51 x 102 x 19 mm)

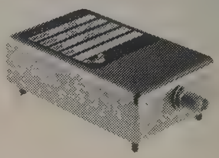
Low profile **MIL HYBRID TCXOs** are now available from Vectron. While more expensive than our standard TCXO line, these offer package size as small as 1.5″ x 1.5″ x 0.3″ (38 x 38 x 8 mm). The CO-258/259 Series are available with CMOS output from 400 Hz to 15 MHz, or TTL output from 20 KHz to 70 MHz. Please contact factory or your local representative for details.











Selecting Basic Model:

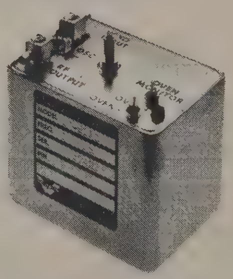
1. Determine appropriate column by frequency desired.
2. Determine appropriate row by operating temperature range desired.
3. Select a basic model from those available at the desired frequency and temperature range.
4. Specify supply voltage, output level and whether pcb mount or chassis mount with rf connector.

VECTRON Frequency Standards

Model:	**FS-321B**	**FS-323A**
Aging Rate:	3×10^{-10} per day at time of shipment 1×10^{-10} per day typical within 60 days "—1" OPTION 1×10^{-10} per day at time of shipment	
Frequencies:	5, 1 & 0.1 MHz	
Output Level:	1 vrms/50 ohms	
Temperature:	$\pm5 \times 10^{-10}$ over 0-50°C	
Noise Floor:	>150 db below 5 MHz output	
Oven Control:	Double proportional	
Supply:	115/230 VAC or 22-30 VDC	115/230 VAC or 22-30 VDC
Battery Life:	24 hours rechargeable	None
Size:	5¼″ x 19″ x 14″ (13.4 x 48.3 x 35.6 cm)	3½″ x 19″ x 14″ (8.9 x 48.3 x 35.6 cm)

VECTRON Replacement for Hewlett Packard Model 10811B

Vectron type CO-811B offers mechanical and electrical-interface interchangeability with discontinued HP10811B



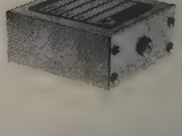
Aging:	5×10^{-10}/day 1×10^{-7}/year
0/+71°C: **−55/+71°C:**	2.5×10^{-9} p-p 4.5×10^{-9} p-p
Noise:	100 Hz: −140dBc/Hz 10 KHz: −160dBc/Hz
Crystal:	SC-cut for fast stabilization

VECTRON Hybrid Oven Low Profile Oscillator

- PCB Mounting
- Small (1″ high)
- Low power drain

CO-311 SERIES

Stability:	Same aging and temperature stability specs as CO-211 Series (see top of next page)
Output: **TTL** **CMOS** **SINE**	**Frequency Range** 250 KHz - 17 MHz 4-6 & 8-15 MHz 4-6 & 8-17 MHz
Supply:	15 VDC for oscillator 5 VDC also, if TTL out (5-28 VDC optional)
Input Power:	3 watts at turn-on 1.3 watts stabilized (25°C)
Frequency Adjust:	Mechanical; electronic optional
Size:	2¼″ x 2¼″ x 1″ (58 x 58 x 26mm)



VECTRON

Oven Controlled Oscillators
(with Ultra-Low Noise Options ✱)

High Frequency (to 25 MHz)

	HIGH STABILITY (to 5 x 10^{-10}/day)			ULTRA-STABLE (to 1 x 10^{-10}/day)	
	Most economical CO-211 SERIES	**Higher stability and output** CO-200 SERIES	**Superior temp. stability** CO-244 SERIES	**Best aging: single oven** CO-206 SERIES	**Best aging; double oven** CO-246 SERIES
Frequency:	1, 2, 4, 5 or 10 MHz standard (broad range of frequencies available)			.5 MHz standard (other frequencies available)	
Temperature: (Temp. Range A) +15/+35°C:	**CO-21 ☐ A38:** ±3 x 10^{-8} **CO-21 ☐ A59:** ±5 x 10^{-9}	**CO-20 ☐ A39:** ±3 x 10^{-9} **CO-20 ☐ A19:** ±1 x 10^{-9}	**CO-24 ☐ A510:** ±5 x 10^{-10}	**CO-20 ☐ A39-V:** ±3 x 10^{-9} **CO-20 ☐ A510-V:** ±5 x 10^{-10}	**CO-24 ☐ A210-V:** ±2 x 10^{-10}
(Temp. Range B) 0/+50°C:	**CO-21 ☐ B58:** ±5 x 10^{-8} **CO-21 ☐ B18:** ±1 x 10^{-8}	**CO-20 ☐ B59.** ±5 x 10^{-9} **CO-20 ☐ B39:** ±3 x 10^{-9}	**CO-24 ☐ B19:** ±1 x 10^{-9}	**CO-20 ☐ B59-V:** ±5 x 10^{-9} **CO-20 ☐ B19-V:** ±1 x 10^{-9}	**CO-24 ☐ B510-V:** ±5 x 10^{-10}
(Temp. Range D) −20/+70°C:	**CO-21 ☐ D17:** ±1 x 10^{-7} **CO-21 ☐ D38:** ±3 x 10^{-8}	**CO-20 ☐ D18:** ±1 x 10^{-8} **CO-20 ☐ D59:** ±5 x 10^{-9}	**CO-24 ☐ D39:** ±3 x 10^{-9}	**CO-20 ☐ D18-V:** ±1 x 10^{-8} **CO-20 ☐ D39-V:** ±3 x 10^{-9}	**CO-24 ☐ D19-V:** ±1 x 10^{-9} (−20/+60°C)
(Temp. Range G) −55/+75°C:	**CO-21 ☐ G27:** ±2 x 10^{-7} **CO-21 ☐ G58:** ±5 x 10^{-8}	**CO-20 ☐ G38:** ±3 x 10^{-8}	**CO-24 ☐ G18:** ±1 x 10^{-8}	**CO-20 ☐ G38-V:** ±3 x 10^{-8} **CO-20 ☐ G18-V:** ±1 x 10^{-8}	
Aging:	1 x 10^{-8}/day 5 x 10^{-9}/day 3 x 10^{-9}/day 1 x 10^{-9}/day 5 x 10^{-10}/day	1 x 10^{-8}/day 5 x 10^{-9}/day 3 x 10^{-9}/day 1 x 10^{-9}/day 5 x 10^{-10}/day	1 x 10^{-9}/day 5 x 10^{-10}/day	3 x 10^{-10}/day 5 x 10^{-8}/year 1 x 10^{-10}/day 3 x 10^{-8}/year	3 x 10^{-10}/day 5 x 10^{-8}/year 1 x 10^{-10}/day 3 x 10^{-8}/year
	*5 x 10^{-10}/day average aging rate models are only available at 1, 2, 4, 5 or 10 MHz			*1 x 10^{-10}/day models available only at 1, 5 and 10 MHz	
Output Level:	Standard: >1 vrms into 500Ω Optional: 0 or +7 dBm/50Ω; TTL or CMOS	Standard: >1 vrms into 50Ω Optional: TTL, CMOS, or ECL	Standard: >1 vrms into 500Ω Optional: 0, 7 or +13 dBm/50Ω TTL, CMOS or ECL	Standard: >1 vrms into 50Ω Optional: TTL or CMOS	
Supply Voltage:	24 VDC standard (Operation from any voltage in 5-28 VDC range optional)			24 VDC standard (Operation from any voltage in 15-28 VDC range optional)	
Input Power:	<6 watts at turn-on (−20/+70°C); <3 watts stabilized (25°C) reduced power drain available			<6 watts at turn-on (−20/+70°C) <3 watts stabilized (25°C)	<11 watts at turn-on (0-50°C) <5 watts stabilized (25°C)
Frequency Adjustment:	Screwdriver adjustment settable to 1 x 10^{-8} nominal. Electronic tuning (VCXO) option "V"			Screwdriver adjustment and electronic tuning	
Size:	2″ x 2″ x 3″ (51 x 51 x 76 mm)	2″ x 2″ x 4″ (51 x 51 x 104 mm)	2¼″ x 2¼″ x 4¼″ (57 x 57 x 110 mm)	2¼″ x 2¼″ x 4¼″ (57 x 57 x 110 mm)	3″ x 3″ x 5½″ (76 x 76 x 140 mm)

✱ **Phase noise (typical):** with sine output in 4-12 MHz range for "High Stability" Series and in 4-6 MHz range for "Ultra-Stable" Series

Offset from Carrier	Standard	Low Noise Option (L1)	*Ultra Low Noise Option (L2)
100 Hz	−130 dB/Hz	−135 dB/Hz	−145 dB/Hz
1 KHz	−140 dB/Hz	−145 dB/Hz	−155 dB/Hz
10 KHz	−143 dB/Hz	−148 dB/Hz	−160 db/Hz
50 KHz	−145 dB/Hz	−150 dB/Hz	−163 dB/Hz

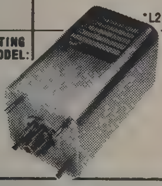
*L2 option restricted to CO-200 Series with sine output of +10 dBm or less

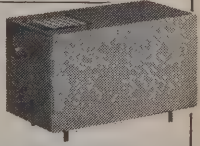
Offset from Carrier	Standard	*Ultra-Low Noise Option (L2)
10 Hz	−115 dB/Hz	−140 dB/Hz
100 Hz	−135 dB/Hz	−150 dB/Hz
1 KHz	−145 dB/Hz	−155 dB/Hz
10 KHz	−148 dB/Hz	−160 dB/Hz
50 KHz	−150 dB/Hz	−163 dB/Hz

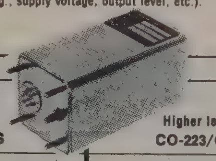
*L2 option restricted to +10 dBm or less output

SELECTING BASIC MODEL:

1. Select "Ultra Stable" if 3 x 10^{-10}/day aging or better is required; otherwise select "High Stability"
2. Select operating temperature range required (**A**, **B**, **D** or **G** from left column under "Temperature").
3. Select frequency stability desired over temperature, this determines the oscillator. (Temperature stability improves from left to right).
4. Select desired aging rate within Series to complete basic model number.
5. Determine whether you desired a low-noise option or any characteristic which is not standard (e.g., supply voltage, output level, etc.).







VHF (25-400MHz)

	Most economical CO-228/CO-229 SERIES			**Higher level and frequency** CO-223/CO-224 SERIES			**Superior aging and stability** CO-220/CO-225 SERIES		
Frequency:	25 MHz to 200 MHz			25 MHz to 400 MHz			25 MHz to 200 MHz		
Aging:		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-9}/day 1 x 10^{-6}/year	1 x 10^{-9}/day 3 x 10^{-7}/year
(Temp. Range A): +15°C to +35°C:	±3 x 10^{-8}: ±5 x 10^{-9}:	**CO-228A38** **CO-228A59**	**CO-229A38** **CO-229A59**	±3 x 10^{-8}: ±5 x 10^{-9}:	**CO-223A38** **CO-223A59**	**CO-224A38** **CO-224A59**	±1 x 10^{-8}: ±1 x 10^{-9}:	**CO-220A18** **CO-220A19**	**CO-225A18** **CO-225A19**
(Temp. Range B): 0°C to +50°C:	±5 x 10^{-8}: ±1 x 10^{-8}:	**CO-228B58** **CO-228B18**	**CO-229B58** **CO-229B18**	±5 x 10^{-8}: ±1 x 10^{-8}:	**CO-223B58** **CO-223B18**	**CO-224B58** **CO-224B18**	±5 x 10^{-8}: ±1 x 10^{-8}: ±2 x 10^{-9}:	**CO-220B58** **CO-220B18** **CO-220B29**	**CO-225B58** **CO-225B18** **CO-225B29**
(Temp. Range D): −20°C to +70°C:	±1 x 10^{-7}: ±3 x 10^{-8}:	**CO-228D17** **CO-228D38**	**CO-229D17** **CO-229D38**	±1 x 10^{-7}: ±3 x 10^{-8}:	**CO-223D17** **CO-223D38**	**CO-224D17** **CO-224D38**	±3 x 10^{-8}: ±1 x 10^{-8}: ±5 x 10^{-9}:	**CO-220D38** **CO-220D18** **CO-220D59**	**CO-225D38** **CO-225D18** **CO-225D59**
(Temp. Range G): −55°C to +75°C:	±2 x 10^{-7}: ±5 x 10^{-8}:	**CO-228G27** **CO-228G58**	**CO-229G27** **CO-229G58**	±2 x 10^{-7}: ±5 x 10^{-8}:	**CO-223G27** **CO-223G58**	**CO-224G27** **CO-224G58**	±1 x 10^{-7}: ±3 x 10^{-8}:	**CO-220G17** **CO-220G38**	**CO-225G17** **CO-225G38**
Output Level:	Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: TTL to 100 MHz			Standard: >1 vrms into 50Ω (+13 dBm) Optional: ECL, higher sinewave level			Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: +13 dBm ("R"), TTL, ECL		
Supply Voltage:	24 VDC standard. Operation from any specified voltage in 12-28 VDC range optional.								
Input Power:	<6 watts at turn-on (−20/ + 70°C); <3 watts stabilized (25°C)								
Frequency Adjustment:	Screwdriver adjust, settable to <1 x10^{-8} nominal. Electronic tuning (VCXO) option "V".								
Size:	2″ x 2″ x 3″ (51 x 51 x 77 mm)			2″ x 2″ x 4″ (51 x 51 x 104 mm)			2″ x 2″ x 4″ (51 x 51 x 104 mm)		

✱ **Phase noise:** typical, with sine output in 75-125 MHz range

CO-228/CO-229 SERIES:

Offset from Carrier	Standard	
100 Hz	−120 dB/Hz	Ultra-low noise option not available
1 KHz	−135 dB/Hz	
10 KHz	−140 dB/Hz	
50 KHz	−145 dB/Hz	

CO-223/CO-224 SERIES:

Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
100 Hz	−120 dB/Hz	−130 dB/Hz
1 KHz	−135 dB/Hz	−145 dB/Hz
10 KHz	−140 dB/Hz	−150 dB/Hz
50 KHz	−145 dB/Hz	−155 dB/Hz

*L2 option is restricted to 300 MHz with sine output of +10 dBm or less

CO-220/CO-225 SERIES:

Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
100 Hz	−105 dB/Hz	−120 db/Hz
1 KHz	−115 dB/Hz	−130 dB/Hz
10 KHz	−120 dB/Hz	−135 dB/Hz
50 KHz	−125 dB/Hz	−140 dB/Hz

*L2 option is available to 125 MHz

FOR PRICE OR TECHNICAL INFORMATION…CALL (203) 853-4433

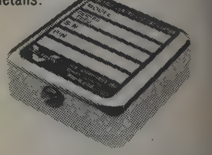
VECTRON

VECTRON LABORATORIES, INC. The Crystal Oscillator Company
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796

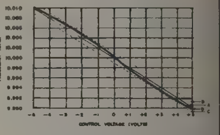
VECTRON VCXOs Voltage Controlled Crystal Oscillators

	WIDE DEVIATION AND/OR LINEAR APPLICATIONS				NARROW DEVIATION PHASE LOCK APPLICATIONS			
	BASIC MODELS		OVEN CONTROLLED	EXTRA WIDE DEVIATION	SINEWAVE OUTPUT	TTL OUTPUT	CMOS OUTPUT	ECL OUTPUT
Model:	CO-271V	CO-275V	a) CO-272V b) CO-276V	c) CO-273V d) CO-274V	CO-233V SERIES	e) CO-231V f) CO-231VH	CO-236V	CO-233MEV
Range of Available Center Frequencies:	2-20 MHz (higher and lower frequencies available)	20-400 MHz	a) 2-20 MHz b) 20-400 MHz	c) 0.5-8 MHz d) 8-80 MHz	*CO-233V: 5-149 MHz *CO-233VH: 150-200 MHz **CO-233VFW: 5-400 MHz ***CO-283VW: 401-600 MHz	e) 16 KHz-25 MHz f) 25.1 MHz-70 MHz	300 Hz-15 MHz	5-200 MHz
Output Level:	1 vrms into 1K (Option "R": 1 vrms into 50Ω; TTL, CMOS or ECL logic compatible output available on some models)	0.5 vrms into 50Ω	a) 1 vrms into 1K b) 0.5 vrms/50Ω	c) 1 vrms into 1K d) 0.5 vrms/50Ω	0.5 vrms into 50Ω Option "R": 1 Vrms into 50Ω	TTL compatible	CMOS compatible	ECL compatible
Deviation:	±0.1% (wider and narrower deviation available)	±0.1%	±0.1%	±0.5%	>±.003%. This allows correcting to specified center frequency over 0-50°C for 5-10 years. Wider deviation optional; for significantly wider deviation, see models on left side of page).			
Modulation Voltage:	±5 Volts, negative transfer function (either higher or lower sensitivity available)				0 to +6V (±3V to ±10V optional)	0 to +5V	0 to +5V	0 to −5V (±3 to ±10V optional)
Linearity:	±1% (For ±5% linearity, resulting in reduced cost, add "N" to Model No.)				±20% (±10% with bipolar input) Smooth monotonic characteristic. For improved linearity see models on left side of page.	±20%	±20%	±20% (±10% with bipolar input)
Transfer Function:	Negative; frequency decreases with increasing modulation voltage.				Positive (frequency increases with increasing control voltage) (units with bipolar input have negative transfer function)			Negative
Stability 0-50°C:	**CO-271VA:** ± .01% **CO-271VB:** ±.001% (higher stability and wider temperature range optional)	**CO-275VA:** ± .01% **CO-275VB:** ±.001%	±.0001%	±.025%	±.001% (wider temperature range optional)	±.001%	±.001%	±.001%
Supply:	+24 VDC standard (operation from any specified voltage in +12 VDC to +32 VDC range optional)				+15 VDC standard	+5 VDC	+12 VDC standard	−5.2 VDC
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 3″ x ¾″ (51 x 77 x 19 mm)	2″ x 2″ x 4″ (51 x 51 x 102 mm)	c) 2″ x 3″ x ¾″ d) 3″ x 3½″ x ¾″	*1½″x1½″x⅝″ **2″x2″x¾″ ***2″x3″x¾″	e) 1½″x1½″x½″ f) 1⅝″x1⅝″x½″	1½″x1½″x½″	2″x3″x½″
Mounting:	For P.C. Board mounting (rf connector optional)	For P.C. Board mounting (rf connector optional)	Octal plug-in or solder header and rf connector	For P.C. Board mounting (rf connector optional)	*For P.C. Board mounting **SMA output connector, studs for chassis mount	For P.C. Board mounting	For P.C. Board mounting	For P.C. Board mounting

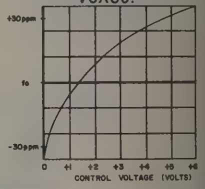
A series of **TC/VCXOs** is now available allowing significantly improved stability without an oven. Deviation is ± 100 ppm standard, with wider and narrower deviations available. Type CO-352V covers 3-60 MHz and Type CO-355V covers 60-400 MHz. Please contact factory or your local representative for details.



General characteristics of CO-270V Series Linear VCXOs.

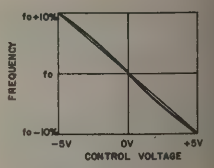


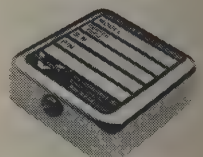
General characteristics of CO-230V Series VCXOs.



VECTRON VCOs Voltage Controlled Oscillators (Non-crystal)

	BASIC MODEL **VC-371**	OVEN CONTROLLED **VC-372**	LOW FREQUENCY **VC-381**
Range of available center frequencies:	500 KHz to 500 MHz		50 Hz to 500 KHz
Output Level:	>0.5 vrms into 50Ω (+7 dBm) Option "R": +13 dBm. TTL, CMOS and ECL also optional		>1 vrms into 1000Ω TTL and CMOS optional
Deviation:	±10% (Wider and narrower deviation optional; deviation as large as an octave). For deviation less than ±1%, consider a crystal controlled VCXO rather than a VCO.		±10%
Modulation Voltage:	±5V (both higher and lower sensitivity optional)		±5V
Linearity:	**Standard:** ±10% Option "A": ± 3% (only for deviation ≤±20%) Option "B": ± 1% (only for deviation ≤±10%) (smooth monotonic characteristics with no discontinuities)		±1%
Transfer Function:	negative		positive
Accuracy: Standard:	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.	Tuning adjustment setable to 0.1%.	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.
Optional:	"T": Tuning adjustment setable to 0.1%.		"T": Tuning adjustment setable to 0.1%.
	Standard: 0/+50°C: ±1% Option 1: −20/+70°C: ±2% Option 2: −55/+85°C: ±4% *Option 3: 0/+50°C: ±0.3% *Option 4: −20/+70°C: ±0.5% *Only for deviation ≤ ±10%	**Standard:** 0/+50°C: ±0.1% Option 1: −20/+70°C: ±0.2% Option 2: −55/+85°C: ±0.5% other temperature ranges available	**Standard:** 0/+50°C: ±1.5% Option 1: −20/+70°C: ±3% Option 2: −55/+85°C: ±6%
Supply Voltage:	+15 VDC (Operation from any supply in 12 to 28 VDC range is optional.)		+15 VDC
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 2″ x 4″ (51 x 51 x 104 mm)	2″ x 2″ x ¾″ (51 x 51 x 19 mm)
Mounting:	Pins for p.c. board mounting, RF connector optional.	Chassis mount with SMA output connector. SMC or BNC optional	Pins for p.c. board mounting.





VECTRON LABORATORIES, INC. The CRYSTAL OSCILLATOR COMPANY
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796

XSIS
ELECTRONICS

Advanced Design Microcircuit Crystal Oscillators

XSIS microcircuit crystal oscillators are not "JUST ANOTHER CLOCK OSCILLATOR" but are hi-rel devices using a premier design that is documented to be virtually without failure. Customers call it EXPERIENCED RELIABILITY.

XSIS microcircuit oscillators are manufactured to the electrical parameters of MIL-0-55310, workmanship standards are in accordance with MIL-M-38510, the quality system is as required by MIL-I-45208.

- **QPL To MIL-0-55310**
- **±.0015% CALIBRATION ACCURACY**
- **HERMETICALLY SEALED METAL PACKAGE**
- **.200 SEATED HEIGHT**
- **LOW POWER CONSUMPTION**
- **WIDE FREQUENCY RANGE**
- **VARIETY OF STABILITIES**
- **MULTIPLE TEMPERATURE RANGE SELECTION**
- **TTL-CMOS-GATED SCHOTTKY-ECL**
- **CUSTOM PACKAGE CONSIDERATIONS**
- **DUAL IN-LINE SPACING**
- **CUSTOM ELECTRICAL PARAMETERS**

XSIS IS A QPL SOURCE FOR MICROCIRCUIT CRYSTAL OSCILLATORS TO MIL-0-55310/8,/11,/14,/15,/16,/17,/18

TYPICAL SPECIFICATIONS AVAILABLE

100 Series-TTL		200 Series-CMOS**
100Hz to 70MHz	Frequency Range	250Hz to 10MHZ
±.0015%	Frequency @ +25°c	±.0015%

**Specify supply voltage when ordering

PACKAGE TYPE + PIN CONNECTIONS

OPTION 'X'	OPTION 'E'	OPTION 'M'	OPTION 'T' (4 PIN)
PIN 7 GRD 8 Output 14 B+ 1 thru 6 N/C 9 thru 13 N/C Same As M55310/16/18	PIN 4 B+ 5 Output 7 GRD/Case 1,2,3,6 N/C 8 thru 14 N/C Same As M55310/14	PIN 1 Output 2 Case 8 GRD 14 B+ 3 thru 7 N/C 9 thru 13 N/C Same As M55310/8/11/15	PIN 1 N/C 7 GRD 8 Output 14 B+ 2 thru 6 Missing 9 thru 13 Missing

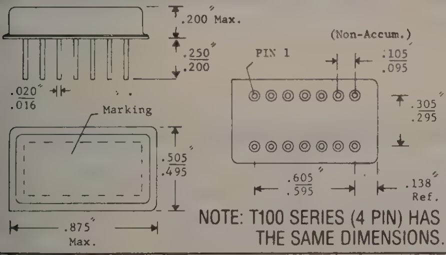
STABILITIES AVAILABLE

P/N	
1	± .1%
2	± .05%
3	± .01%
4	± .005%
5	± .0025% not available with -55 to +125°c

TEMPERATURE RANGES

P/N	
1	0° to 70°c
2	-30° to +85°c
3	-55° to +125°c

PACKAGE DIMENSIONS



NOTE: T100 SERIES (4 PIN) HAS THE SAME DIMENSIONS.

PART NUMBER ORDERING EXAMPLE

X143 - 20.0 MHz
- 14 PIN with Option 'X' PINOUT
- TTL Compatible
- ± .005% Stability
- -55° to +125° c Temperature Range

XSIS
ELECTRONICS

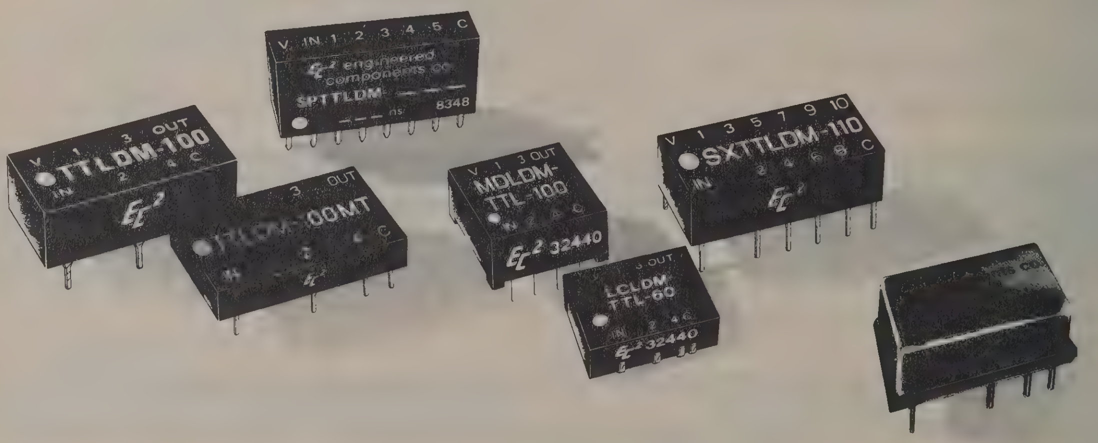
12620 W. 63rd St.
Shawnee, Kansas 66216
913-631-0448
Telex: 437227

DELAY MODULES FROM

EC² engineered components company

MADE IN USA

and we're proud of it!


V IN 1 2 3 4 5 C
EC² engineered components co.
SPTTLDM
ns
8348
V 1 3 OUT
TTLDM-100
IN 2 4 C
3 OUT
00MT
V 1 3 OUT
MDLDM-TTL-100
EC² 32440
V 1 3 5 7 9 10
SXTTLDM-110
IN 2 4 6 8 C
3 OUT
LCLDM TTL-60
EC² 32440

We make 'em regular, thinny, skinny, mini, leadless, 10 tap and hermetically sealed. The right part to suit your application.

THE BEST DOESN'T HAVE TO COST MORE

SEE OUR PAGES, THIS SECTION
1A•1484 — 1A•1508

EC² engineered components company
3580 SACRAMENTO DRIVE, P. O. BOX Y
SAN LUIS OBISPO, CALIFORNIA 93406
Phone: (805) 544-3800

Manufacturer	Passive				Digital		Video	Glass & Quartz	Other	Types
	Distributed Constant		Lumped Constant		Tapped	Programmable				
	Fixed	Variable	Fixed	Variable						
Allen Avionics	1A•1446 1A•1447		1A•1447 1A•1449	1A•1449			1A•1448			
Andersen Labs.								1A•1450	1A•1450	BAW, SAW, IMCON
Automatic Coil	1A•1451*				1A•1452 1A•1453					
Bel Fuse			1A•1464 1A•1465		1A•1454- 1A•1461	1A•1462 1A•1463				
Computer Devices			1A•1466*	1A•1466					1A•1466	ATC Transponder & Beacon Coding
Control Electronics	1A•1467*	1A•1468							1A•1468 1A•1469	Dispersive Audio Magnetostrictive Transponder Decoder Networks
Data Delay Devices	1A•1476* 1A•1478	1A•1478			1A•1479- 1A•1482	1A•1471 1A•1473- 1A•1475 1A•1480				
Engineered Components			1A•1485		1A•1485- 1A•1493 1A•1498	1A•1494- 1A•1497 1A•1499				
ESC Electronics	1A•1511* 1A•1512*				1A•1513- 1A•1518	1A•1519 1A•1520			1A•1512*	Trimmer
Hytek Microsys.	1A•1526* 1A•1527*				1A•1522- 1A•1525*					
JBM Electronics					1A•1530- 1A•1533				1A•1534- 1A•1536	Magnetostrictive
Kappa Networks	1A•1550- 1A•1552*		1A•1553		1A•1538- 1A•1547	1A•1548 1A•1549	1A•1553*		1A•1553*	Trimmers, Transponder Sonar
Nytronics Comps.			1A•1556* 1A•1557		1A•1554* 1A•1555*					
PCA Electronics	1A•1562- 1A•1564				1A•1558- 1A•1560					
Sawtek									1A•1565	SAW, Dispersive
TDK Corp.			1A•1567		1A•1567					
Technitrol			1A•1568 1A•1574*		1A•1569- 1A•1574*	1A•1571 1A•1572				
Toko America			1A•1575							

* Mil. Spec.

ALLEN AVIONICS, INC.

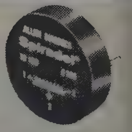
224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
FILTERS
SECTION 2700
WRITE FOR CATALOG

SPIRADEL* THE MOST COMPACT

Highest Time Delay to Rise Time Ratio DISTRIBUTED DELAY LINE

FOR IMMEDIATE DELIVERY!

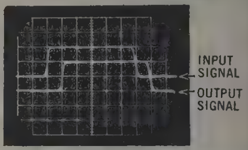


SPIRADEL is a small diameter, distributed constant fixed delay line, featuring higher delay to rise time ratio and excellent pulse fidelity. Its new shape offers greater package design versatility than most other delay lines available, and the entire unit is encapsulated for maximum environmental protection.

SPIRADEL covers a delay range of 20 to 6000 nanoseconds. Any delay within this range may be selected.

Time delay to rise time ratios range up to 30 to 1. Any impedance from 50 to 1000 ohms is available. Standard delay tolerance is 5%, although tighter tolerances can be held.

SPIRADEL is designed for operation from −55°C up to +105°C. Temperature coefficient over this range is 150 parts/million/°C. Bandwidth is from DC to frequency f = .35/rise time.



TO ORDER SPECIFY PART NUMBER   STANDARD HEIGHT OF ALL UNITS: 7/16"

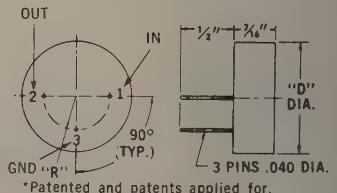
Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Band-width Minimum (MHz)	Diam. Inches
IMPEDANCE 50 OHMS				
SP0050Z050	50	10.0	35.0	1.60
SP0100Z050	100	13.0	26.9	2.00
SP0150Z050	150	14.0	25.0	2.50
SP0200Z050	200	16.0	21.9	2.50
SP0250Z050	250	19.0	18.4	3.25
SP0300Z050	300	21.0	16.7	3.25
SP0350Z050	350	24.0	14.5	3.25
SP0400Z050	400	27.0	12.9	3.75
SP0450Z050	450	28.0	12.5	3.75
SP0500Z050	500	29.0	12.0	3.75
IMPEDANCE 75 OHMS				
SP0025Z075	25	4.5	77.7	1.20
SP0050Z075	50	6.0	58.3	1.20
SP0100Z075	100	9.5	36.8	1.60
SP0150Z075	150	11.5	30.4	2.00
SP0200Z075	200	13.0	26.9	2.00
SP0250Z075	250	14.0	25.0	2.50
SP0300Z075	300	16.0	21.8	2.50
SP0350Z075	350	18.0	19.4	2.50
SP0400Z075	400	20.0	17.5	3.25
SP0450Z075	450	21.9	15.9	3.25
SP0500Z075	500	24.0	14.5	3.25
SP0550Z075	550	26.0	13.4	3.75
SP0600Z075	600	28.0	12.5	3.75
SP0650Z075	650	30.0	11.6	3.75
SP0700Z075	700	32.0	10.9	3.75
IMPEDANCE 100 OHMS				
SP0050Z100	50	7.3	47.9	1.20
SP0060Z100	60	7.5	46.6	1.20
SP0070Z100	70	7.7	45.4	1.20
SP0080Z100	80	8.2	42.6	1.20
SP0090Z100	90	9.1	38.4	1.20
SP0100Z100	100	10.0	35.0	1.60
SP0150Z100	150	12.5	28.0	1.60
SP0200Z100	200	14.0	25.0	2.00
SP0250Z100	250	16.0	21.8	2.00
SP0300Z100	300	18.0	19.4	2.50
SP0350Z100	350	20.0	17.5	2.50
SP0400Z100	400	22.0	15.9	2.50
SP0450Z100	450	24.5	14.2	2.50
SP0500Z100	500	27.0	12.9	3.25
SP0550Z100	550	29.5	11.8	3.25
SP0600Z100	600	31.0	11.2	3.25
SP0650Z100	650	32.5	10.7	3.25
SP0700Z100	700	34.0	10.2	3.25
SP0750Z100	750	36.0	9.7	3.75
SP0800Z100	800	38.0	9.2	3.75
SP0850Z100	850	39.5	8.8	3.75
SP0900Z100	900	41.0	8.5	3.75
SP0950Z100	950	42.5	8.3	3.75
SP1000Z100	1000	44.0	7.9	3.75

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Band-width Minimum (MHz)	Diam. Inches
IMPEDANCE 150 OHMS				
SP0020Z150	20	5.0	70.0	1.20
SP0030Z150	30	6.5	53.8	1.20
SP0040Z150	40	7.5	46.6	1.20
SP0050Z150	50	7.7	45.4	1.20
SP0060Z150	60	7.9	44.3	1.20
SP0070Z150	70	8.0	43.7	1.20
SP0080Z150	80	8.2	42.6	1.20
SP0090Z150	90	8.5	41.1	1.20
SP0100Z150	100	9.0	38.8	1.20
SP0150Z150	150	12.0	29.1	1.60
SP0200Z150	200	14.0	25.0	1.60
SP0250Z150	250	15.0	23.3	2.00
SP0300Z150	300	17.5	20.0	2.00
SP0350Z150	350	19.0	18.4	2.00
SP0400Z150	400	20.0	17.5	2.00
SP0450Z150	450	22.0	15.9	2.50
SP0500Z150	500	24.0	14.5	2.50
SP0550Z150	550	25.6	13.6	2.50
SP0600Z150	600	27.0	12.9	2.50
SP0650Z150	650	28.6	12.2	2.50
SP0700Z150	700	30.0	11.6	2.50
SP0750Z150	750	31.6	11.0	3.25
SP0800Z150	800	33.0	10.6	3.25
SP0850Z150	850	34.5	10.1	3.25
SP0900Z150	900	36.0	9.4	3.25
SP0950Z150	950	38.0	9.2	3.25
SP1000Z150	1000	40.0	8.7	3.25
IMPEDANCE 325 OHMS				
SP0100Z325	100	12.0	29.2	1.20
SP0150Z325	150	14.0	25.0	1.20
SP0200Z325	200	17.0	20.6	1.20
SP0250Z325	250	19.0	18.4	1.60
SP0300Z325	300	21.0	16.7	1.60
SP0350Z325	350	23.0	15.3	1.60
SP0400Z325	400	24.0	14.6	1.60
SP0450Z325	450	26.0	13.5	2.00
SP0500Z325	500	28.0	12.5	2.00
SP0550Z325	550	29.0	12.1	2.00
SP0600Z325	600	31.0	11.3	2.00
SP0650Z325	650	33.0	10.6	2.50
SP0700Z325	700	34.0	10.3	2.50
SP0750Z325	750	35.0	10.0	2.50
SP0800Z325	800	37.0	9.5	2.50
SP0850Z325	850	39.0	9.0	2.50
SP0900Z325	900	41.0	8.5	2.50
SP0950Z325	950	43.0	8.1	2.50
SP1000Z325	1000	45.0	7.8	2.50
SP1100Z325	1100	49.0	7.1	3.25
SP1200Z325	1200	52.0	6.7	3.25
SP1300Z325	1300	55.0	6.3	3.25
SP1400Z325	1400	59.0	5.9	3.25
SP1500Z325	1500	62.0	5.6	3.25

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Band-width Minimum (MHz)	Diam. Inches
IMPEDANCE 500 OHMS				
SP0300Z500	300	33.0	10.6	1.20
SP0400Z500	400	40.0	8.7	1.60
SP0500Z500	500	44.0	7.9	1.60
SP0600Z500	600	50.0	7.0	1.60
SP0700Z500	700	55.0	6.3	2.00
SP0800Z500	800	57.0	6.1	2.00
SP0900Z500	900	60.0	5.8	2.00
SP1000Z500	1000	66.0	5.3	2.00
SP1500Z500	1500	87.0	4.0	2.50
SP2000Z500	2000	110.0	3.1	2.50
SP2500Z500	2500	120.0	2.9	3.25
SP3000Z500	3000	137.0	2.5	3.25
SP3500Z500	3500	154.0	2.2	3.25
SP4000Z500	4000	165.0	2.1	3.25
IMPEDANCE 600 OHMS				
SP0400Z600	400	46.0	7.6	1.20
SP0500Z600	500	48.0	7.2	1.60
SP0600Z600	600	54.0	6.4	1.60
SP0700Z600	700	58.0	6.0	1.60
SP0800Z600	800	60.0	5.8	1.60
SP0900Z600	900	65.0	5.3	2.00
SP1000Z600	1000	70.0	5.0	2.00
SP1500Z600	1500	85.0	4.1	2.50
SP2000Z600	2000	100.0	3.5	2.50
SP2500Z600	2500	115.0	3.0	2.50
SP3000Z600	3000	125.0	2.8	3.25
SP3500Z600	3500	140.0	2.5	3.25
SP4000Z600	4000	150.0	2.3	3.25
SP4500Z600	4500	165.0	2.1	3.75
SP5000Z600	5000	170.0	2.0	3.75
SP5500Z600	5500	185.0	1.8	3.75
SP6000Z600	6000	200.0	1.7	3.75
IMPEDANCE 1000 OHMS				
SP0500Z01K	500	58.0	6.0	1.20
SP0600Z01K	600	63.0	5.5	1.20
SP0700Z01K	700	72.0	4.8	1.20
SP0800Z01K	800	80.0	4.3	1.20
SP0900Z01K	900	87.0	4.0	1.60
SP1000Z01K	1000	95.0	3.6	1.60
SP1500Z01K	1500	116.0	3.0	1.60
SP2000Z01K	2000	126.0	2.7	2.00
SP2500Z01K	2500	147.0	2.3	2.00
SP3000Z01K	3000	158.0	2.2	2.00
SP3500Z01K	3500	182.0	1.9	2.50
SP4000Z01K	4000	203.0	1.7	2.50
SP4500Z01K	4500	220.0	1.5	2.50
SP5000Z01K	5000	240.0	1.4	3.25

"TAPPED" UNITS AVAILABLE IN IMPEDANCES FROM 50 TO 325 OHMS INCLUSIVE.
CALL OR WRITE FOR COMPLETE CATALOG.

"D"	"R"
1.20"	.400"
1.60"	.600"
2.00"	.800"
2.50"	1.050"
3.25"	1.425"
3.75"	1.675"



*Patented and patents applied for.

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

DUAL-IN-LINE "MIDI" SPIRADEL®*

These LOW COST units offer the same excellent pulse fidelity and phase linearity as Standard Spiradel. Low silhouette and dual-in-line mounting permit packaging with semiconductor and comparable components.

PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Bandwidth Minimum (MHz)	Impedance (Ohms)
MD005Z100	5	2.0	180.0	100
RD005Z125	5	2.0	180.0	125
MD010Z100	10	2.5	144.0	100
RD010Z125	10	2.5	144.0	125
MD015Z100	15	3.0	120.0	100
MD020Z100	20	4.0	90.0	100
RD020Z200	20	4.0	90.0	200
MD025Z100	25	5.0	72.0	100
MD030Z100	30	6.0	60.0	100
RD030Z250	30	6.0	60.0	250
MD040Z100	40	7.5	48.0	100
RD040Z300	40	8.0	45.0	300
MD050Z100	50	9.0	40.0	100
RD050Z350	50	10.0	36.0	350
MD060Z175	60	11.0	32.7	175
RD060Z400	60	12.0	30.0	400
MD070Z175	70	12.0	30.0	175
RD070Z400	70	14.0	25.7	400
MD080Z175	80	13.0	27.7	175
RD080Z475	80	16.0	22.5	475

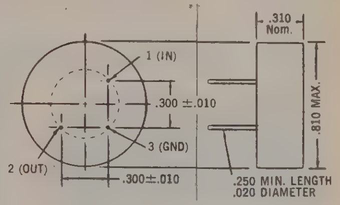
PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Bandwidth Minimum (MHz)	Impedance (Ohms)
MD090Z175	90	14	25.7	175
RD090Z500	90	18	20.0	500
MD100Z175	100	15	24.0	175
RD100Z500	100	20	18.0	500
MD125Z500	125	25	14.4	500
MD150Z500	150	29	12.1	500
RD150Z01K	150	30	12.0	1000
MD175Z500	175	32	11.3	500
RD175Z01K	175	35	10.3	1000
MD200Z500	200	35	10.3	500
RD200Z01K	200	40	9.0	1000
MD250Z500	250	40	9.0	500
MD300Z01K	300	60	6.0	1000
MD350Z01K	350	67	5.4	1000
MD400Z01K	400	74	4.9	1000
MD450Z01K	450	78	4.6	1000
MD500Z01K	500	81	4.4	1000
MD550Z01K	550	83	4.3	1000
MD600Z01K	600	85	4.2	1000

TO ORDER SPECIFY PART NUMBER

STOCKED

Epoxy Encapsulated. Temperature Coefficient: Less than 200 PPM/°C from −55°C to +105°C.

ALLEN AVIONICS



DUAL-IN-LINE "MINI" SPIRADEL®* FOR IMMEDIATE DELIVERY!

STOCKED

*Patented and patents applied for.

EXCELLENT PULSE FIDELITY • FLAT DELAY OVER WIDE FREQUENCY RANGE

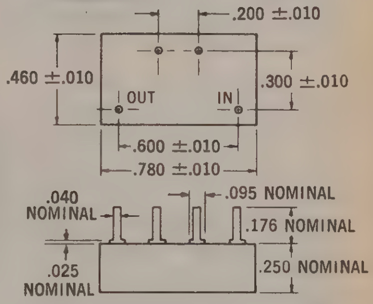
Operation from −55°C up to +105°C. Units exhibit a change of less than 175 parts/million/°C over this temperature range. Dual-in-line mounting. Compatible with integrated circuits. Maximum attenuation for all delays: 7%.

TO ORDER SPECIFY PART NUMBER

PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Impedance (Ohms)
MN005Z125	5	2.0	125
MN010Z125	10	2.5	125
MN020Z200	20	4.0	200
MN030Z250	30	6.0	250
MN040Z300	40	8.0	300
MN050Z350	50	10.0	350
MN060Z400	60	12.0	400
MN070Z400	70	14.0	400

PART NO.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Impedance (Ohms)
MN080Z475	80	16.0	475
MN090Z500	90	18.0	500
MN100Z500	100	20.0	500
MN125Z500	125	25.0	500
MN150Z01K	150	30.0	1000
MN175Z01K	175	35.0	1000
MN200Z01K	200	40.0	1000
MN250Z01K	250	50.0	1000

STANDARD DELAY TOLERANCE 10% (5% ON SPECIAL ORDERS)



"LC DIP 20" DUAL-IN-LINE 24 PIN TAPPED LUMPED CONSTANT DELAY LINE

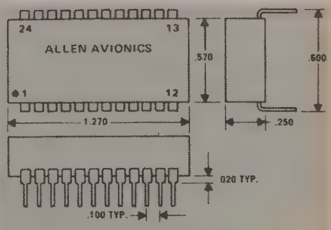
IMPEDANCE 100 OHMS

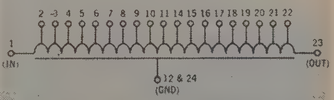
Part No.	Time Delay (Nanoseconds)	Rise Time (Nanoseconds)	Bandwidth Minimum (MHz)	Attenuation Maximum (%)
LCB010Z100	10	2.0	180.0	5
LCB020Z100	20	2.5	144.0	5
LCB030Z100	30	3.0	120.0	5
LCB040Z100	40	4.0	90.0	5
LCB050Z100	50	5.0	72.0	5
LCB060Z100	60	6.0	60.0	10
LCB070Z100	70	7.0	51.4	10
LCB080Z100	80	8.0	45.0	10
LCB090Z100	90	9.0	40.0	10
LCB100Z100	100	10.0	36.0	10
LCB150Z100	150	15.0	24.0	5
LCB200Z100	200	20.0	18.0	5
LCB250Z100	250	25.0	14.4	10
LCB500Z100	500	50.0	7.2	10
LCB750Z100	750	75.0	4.8	10
LCB01KZ100	1000	100.0	3.6	10

TO ORDER SPECIFY PART NUMBER

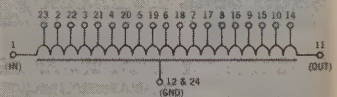
Time delay to rise time ratios — 10 to 1.
Temperature Coefficient — less than 100PPM/°C from 0°C to 80°C.
Total delay tolerance 5% or 1 nanosecond, whichever is greater.
20 equal delay increments.
TTL & DTL compatible.
Low attenuation.
Excellent pulse fidelity.
Exceeds applicable portions of MIL-D-23859.
Voltage rating 50 WVDC.

Where high bandwidths and low rise times are required in a small package, the "LC DIP 20" excels. It offers excellent pulse fidelity and low attenuation. Its compatibility with TTL & DTL along with its low profile makes for an extremely popular and adaptable unit for semiconductor and other related applications. Other delays and impedances are available on special order.





FOR DELAYS FROM 20 – 1000 NANOSECONDS



FOR 10 NANOSECONDS DELAY ONLY

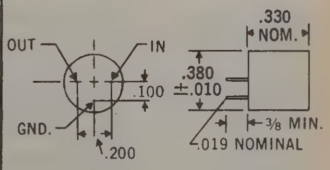
THE ULTIMATE IN MINIATURIZATION

T05 SERIES LUMPED CONSTANT DELAY LINE

Lumped Constant, completely passive, delay lines housed in a commercial T05 package (.385 dia. x .330 high). Designed for compatibility with semiconductor and logic assemblies where space and good performance are prime considerations. Stocked in delays from 10 to 100 nanoseconds.

Delay Tolerance: ±5%.
Working Voltage: 50 volts DC.
Temp. Coefficient Over 0 to 80°C: 100 parts/million/°C.

Part No.	Time Delay (Nano-seconds)	Rise Time Max. (Nano-seconds)	Band-width (MHz)	Impe-dance (Ohms)	Atten-uation (%)
T010	10	3	120.0	100	4
T020	20	4	90.0	100	5
T030	30	6	60.0	100	6
T040	40	8	45.0	100	7
T050	50	10	36.0	100	8
T060	60	12	30.0	50	8
T070	70	14	25.7	50	9
T080	80	16	22.5	50	10
T090	90	18	20.0	50	11
T01C	100	20	18.0	50	12

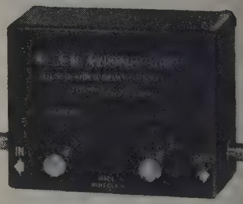


ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
FILTERS
SECTION 2700
WRITE FOR CATALOG

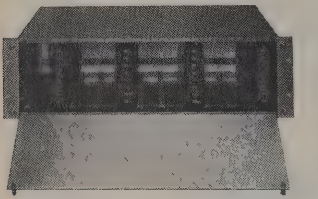
THE MOST COMPLETE LINE OF VIDEO DELAY LINES AVAILABLE FROM STOCK!



Allen Avionics, an established leader in the design and manufacture of Electromagnetic Delay Lines and L-C Filters has now developed a specialized group of products for the video market.

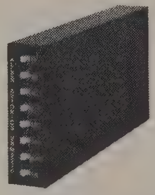
In color television broadcasting, accurate timing of signals is essential. This was initially achieved by the use of 75 ohm coaxial cable. The cost in time and materials to accomplish precise trimming and the lack of a rapid and convenient method of changing delays is currently responsible for the decline in cable usage. Television studios, studio equipment manufacturers and others engaged in the video industry are changing from 75 ohm cable to a more suitable method of achieving precise short delays. Allen Avionics now offers a line of Video Units for this purpose. Their use will result in a reduction of size, weight, installation cost and an overwhelming saving in time and effort to make delay changes.

RACK MOUNTABLE UNITS



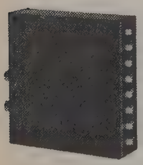
RACK MOUNT showing delay units with switches and terminals available for delay changes. Up to 11 delay units can be housed. Cards for mounting units in rack are purchased separately. Note hinged front panel.

This rack mountable series of video and pulse delay lines has the capability of replacing up to 1450 feet of cable.



Showing 8 individual slide switches for rapid delay changes.

Four variable slide switch units are being offered with total delays of 255, 637.5, 1275 and 2270 nanoseconds. Each unit contains 8 individual delay units. **Four strappable units** are also manufactured with total delays of 317.5, 635, 1270 and 2260 nanoseconds. The strappable units consist of 7 separate delay lines each having their own input and output terminals. The slide switches or terminal strapping provide methods for adding the individual lines together so that the output is always the summation of the individual lines. This eliminates most video distortions and assures good chrominance to luminance delay. Precision delay changes of as small as one nanosecond are easily accomplished. Low insertion loss, amplitude and delay flatness, along with excellent pulse fidelity, are characteristic of this series.



Units are rack mounted by attaching a durable plastic card to the large surface.

All units are manufactured to fit standard 19 inch racks and are provided with additional inserts to satisfy almost any mounting requirement. Delay units and racks can be purchased separately. The rack is manufactured with a hinged panel so that fast delay adjustments can be made. However, once adjustments are made, the front panel prevents further tampering with the slide switches or terminals.

Models VP0635, VP1270 and VP2075 are padded to provide a flat loss at any setting. As a result of this padding, these units will exhibit a maximum variation of ±.2db at any delay setting.

Model VP0010 was designed specifically to be used as a delay trimmer in conjunction with our other delay units or any 75 ohm system. It offers .5 nanosecond switching resolution with excellent amplitude flatness up to 5.5 MHz.

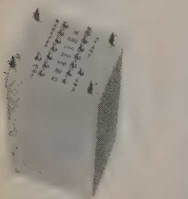
These new delay units feature extremely flat amplitude response to 5.5 MHz, small increments of delay variation, low signal distortion and tight delay tolerance. The delay networks are ideal for pulse applications because of their fast rise times and low distortion. Amplitude equalization is employed to achieve excellent flatness over the video frequency range. The delayed output of any model in this group is the summation of individual lines. It is not the result of a tapped line. This feature insures that output pulse distortions are minimized. Units will match to any 75 ohm system and can be directly connected into the video signal path by means of BNC connectors.

Part No.	Delay Range (Nano-Sec.)	Delay Steps (Nano-Sec.)	Method of Variation	Maximum Insertion Loss @ 100 KHz (db)	Amplitude Flatness At Any Delay Setting 100 KHz to 5.5 MHz (db)	Max. Rise Time (Nano-Sec.)	Package Size (Inches)
VAR005	3-7	Continuous	Trimmer	.20	.2 Max.	N.A.	3⅝ x 1½ x 1¼
VAR011	0-11	Continuous	Trimmer & Toggle	.20	.25	N.A.	4⅜ x 2⅜ x 1 1/16
VP0010	0-10.5	.5	Toggle	.15	.2	3	4⅜ x 2⅜ x 1 1/16
VP0127	0-127	1.0	Toggle	.15	.3	14	4⅜ x 2⅜ x 1 1/16
VP0255	0-255	1.0	Toggle	.15	.3	16	4⅜ x 2⅜ x 1 1/16
VP0317	0-317.5	2.5	Toggle	.15	.3	20	4⅜ x 2⅜ x 1 1/16
VP0635	0-635	5.0	Toggle	* .50	.4	25	4 11/16 x 3 11/16 x 2 1/16
VP1100	0-1100	10.0	Rotary	1.25	.4	30	4 11/16 x 3 11/16 x 2 1/16
VP1270	0-1270	10.0	Toggle	*3.00	.4	30	4 11/16 x 3 11/16 x 2 1/16
VP2075	0-2075	25.0	Toggle	*3.00	.5	40	7⅜ x 4 11/16 x 2 3/16
VS0315	0-315	5.0	Strap	.25	.4	28	4 x 2 x 1¼
VS0635	0-635	5.0	Strap	.60	.5	33	5 x 2 x 1¼
VS1275	0-1275	5.0	Strap	1.25	.5	33	5 x 3 x 1¼
VS2075	0-2075	25.0	Strap	2.50	.5	40	6½ x 3½ x 2
RACK MOUNTABLE UNITS							
VRM011	0-11	Continuous	Trimmer & Slide Switch	.30	.3 Max.	N.A.	1¼x4 5/32x4
VRM0255	0-255	1.0	Slide Switch	.40	.4	20	1⅛ x 4⅛ x 4
VRM0637	0-637.5	2.5	Slide Switch	*1.00	.4	28	1⅛ x 4⅛ x 6
VRM1275	0-1275	5.0	Slide Switch	*3.00	.4	33	1⅛ x 4⅛ x 9
VRM2270	0-2270	10.0	Slide Switch	*3.00	.5	40	1⅛ x 4⅛ x 9
VRS0317	0-317.5	2.5	Strap	.40	.5	26	1⅛ x 4⅛ x 4
VRS0635	0-635	5.0	Strap	.75	.5	35	1⅛ x 4⅛ x 6
VRS1270	0-1270	10.0	Strap	1.50	.5	37	1⅛ x 4⅛ x 9
VRS2260	0-2260	20.0	Strap	3.00	.5	40	1⅛ x 4⅛ x 9

* ±.2 db variation at any delay setting.

Impedance: 75 ohms.
Pulse Distortion: Less than 4% with an input pulse rise time of 20 nanoseconds.
Working Voltage: 50 volts maximum.
Return Loss: 20 db minimum.
Delay Tolerance: 5% or 1 nanosecond, whichever is greater.

TYPE AV-397 and 75-2A PULSE and VIDEO DELAY LINES



AV-397
2″ x 2½″ x 5½″

Maximum Delay: 2.075 microseconds ±3% variable in .025 μs. steps from .025 to 2.075 microseconds.
Time Delay of Individual Lines: 1, .5, .2, .2, .1, .05, .025 microseconds.
Rise Time for Entire Line: .06 microseconds maximum.
Frequency Response: 3 db down at 5 megahertz for 2.075 microseconds delay.

Distortion: 2% maximum with .2 microsecond input pulse.
Impedance: 75 ohms ±5%.
Working Voltage: 100.
Temperature Coefficient: 50 parts/million/°C from −55°C to 105°C.
Attenuation: 7% maximum for 2.075 microsecond delay.

75-2A
7⅜″ x 4 11/16″ x 2 3/16″

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
FILTERS
SECTION 2700

WRITE FOR CATALOG

"LC DIP" THE WORLD'S SMALLEST DUAL-IN-LINE 14 PIN TAPPED LUMPED CONSTANT DELAY LINE

The "LC DIP" represents the smallest delay line currently available. It is a lumped constant delay line offering the ultimate in high density packaging and tapping capabilities.

These units are excellent for high frequency applications. The availability of 10 equal delay increments and the dual-in-line packaging along with its low silhouette make for compatibility with semiconductor and other assemblies where circuit board height must be held to a minimum. The foregoing makes the "LC DIP" extremely adaptable for the computer and allied industries.

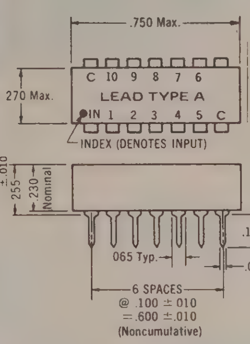
Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Band-width (MHz)	Max. Atten-uation (%)
IMPEDANCE: 50 OHMS				
LC010Z050B*	10	3.0	120.0	3
LC020Z050B*	20	4.5	80.0	4
LC025Z050B*	25	5.0	72.0	5
LC030Z050 A or B	30	6.0	60.0	6
LC040Z050 A or B	40	8.0	45.0	7
LC050Z050 A or B	50	10.0	36.0	8
LC060Z050 A or B	60	12.0	30.0	10
LC070Z050 A or B	70	14.0	25.7	12
LC080Z050 A or B	80	16.0	22.5	14
LC090Z050 A or B	90	18.0	20.0	15
LC100Z050 A or B	100	20.0	18.0	16
LC150Z050 A or B	150	30.0	12.0	19
LC200Z050 A or B	200	40.0	9.0	22
LC250Z050 A or B	250	50.0	7.2	25
LC300Z050 A or B	300	60.0	6.0	28
LC400Z050 A or B	400	80.0	4.5	34
LC500Z050 A or B	500	100.0	3.6	40

To order specify Part No. followed by the letter "A" or "B".

* Units with asterisk available in "B" Lead Configuration only.

For Lead Configuration "B", call factory and request catalog.

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Band-width (MHz)	Max. Atten-uation (%)
IMPEDANCE: 100 OHMS				
LC010Z100B*	10	2.5	144.0	4
LC020Z100 A or B	20	4.0	90.0	5
LC025Z100 A or B	25	5.0	72.0	5
LC030Z100 A or B	30	6.0	60.0	6
LC040Z100 A or B	40	8.0	45.0	7
LC050Z100 A or B	50	10.0	36.0	8
LC060Z100 A or B	60	12.0	30.0	9
LC070Z100 A or B	70	14.0	25.7	10
LC080Z100 A or B	80	16.0	22.5	11
LC090Z100 A or B	90	18.0	20.0	12
LC100Z100 A or B	100	20.0	18.0	12
LC150Z100 A or B	150	30.0	12.0	15
LC200Z100 A or B	200	40.0	9.0	23
LC250Z100 A or B	250	50.0	7.2	30
IMPEDANCE: 200 OHMS				
LC025Z200 A or B	25	5.0	72.0	3
LC050Z200 A or B	50	10.0	36.0	5
LC075Z200 A or B	75	15.0	24.0	8
LC100Z200 A or B	100	20.0	18.0	10
LC150Z200 A or B	150	30.0	12.0	14
LC200Z200 A or B	200	40.0	9.0	18



Lead Breakout

C — Ground
IN— Input
1 — 10% Delay
2 — 20% Delay
3 — 30% Delay
4 — 40% Delay
5 — 50% Delay
6 — 60% Delay
7 — 70% Delay
8 — 80% Delay
9 — 90% Delay
10—100% Output

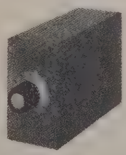
Delay Tolerance:

For delays less than 50 nanoseconds: ±10% or 1 nanosecond (whichever is greater).

For delays of 50 nanoseconds or more: ±5% or 4 nanoseconds (whichever is greater).

ATTN. COMMUNICATION FIELD: VARIABLE DELAY for RADIO PAGING

In recent years, the communication industries have directed a good deal of attention to the development of devices suitable for delay correction of signals sent to remote transmitters. Paging systems use this form of delay correction and are one of the popular fields to employ these delay units.



10 steps x 5 μs plus Fixed Delay	
Part No.	Fixed Delay Micro-seconds
AV400-0-50	0
AV400-50-50	50
AV400-100-50	100
AV400-150-50	150
AV400-200-50	200
AV400-250-50	250
AV400-300-50	300
AV400-350-50	350
AV400-400-50	400
AV400-450-50	450

10 steps x 10 μs plus Fixed Delay	
Part No.	Fixed Delay Micro-seconds
AV400-0-100	0
AV400-50-100	50
AV400-100-100	100
AV400-150-100	150
AV400-200-100	200
AV400-250-100	250
AV400-300-100	300
AV400-350-100	350
AV400-400-100	400

Total Delay Tolerance 5%.

Impedance 600 ohms unbalanced.

Bandwidth — greater than 3.2 KHz.

Units are supplied in metal can 2 x 3½ x 5 inches.

Four 8/32 inserts and the switch are located on one of the 2 x 3½ inch surfaces.

Four turret terminals (input, output and 2 grounds) are located on the opposite 2 x 3½ inch surface.

PART NO. AV-1031-0-1100

Total Delay Tolerances 5% — Insertion Loss 6db

This unit has two rotary switches. One rotary adjusts the delay in steps of one hundred microseconds for a total of 1000 microseconds. The second switch steps the delay up in 10 microsecond increments to 100 microseconds.

All delay outputs are the summation of individual lines. Impedance is 600 ohms unbalanced. Bandwidth for total delay of 1100 microseconds is greater than 3.2 KHz. Units are supplied in a metal can 2″ x 11″ x 4″. Four inserts and 2 switches are located on one of the 11″ x 2″ surfaces. Four turret terminals (input, output and 2 grounds) are located on the opposite 11″ x 2″ surface.

PART NO. AV-1031R-0-1100

Same as above except designed for 2 adjacent units to be rack mounted. Size: 3″ x 8″ x 8″.

SERIES "HF", "HR" & "VHR" LUMPED CONSTANT DELAY LINES

HIGHEST $\frac{\text{TIME DELAY}}{\text{RISE TIME}}$ RATIO EVER BUILT!

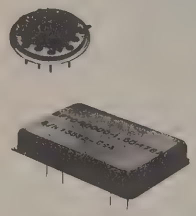
These Delay Lines have the highest ratio of time delay to rise time that has ever been built in a Lumped Constant Line. Unlike other types of high ratio lines, the Lumped Constant Delay Line has a passband from D.C. to its cutoff frequency and maintains a constant delay over these frequencies. These lines are also unique in that they offer relatively low insertion loss. The units are characterized by tight time delay tolerances, low pulse distortion, excellent phase linearity and good temperature stability.

To calculate rise time in microseconds, divide the ratio into the delay. To calculate bandwidth, divide rise time in microseconds into .36. Answer will be in MHz. Attenuation range 9 to 20db.

"HF"	"HR"	"VHR"
50/1 RATIO Delay Range .25 to 10 microseconds.	100/1 RATIO Delay Range 11 to 500 microseconds.	150/1 RATIO Delay Range 5 to 500 microseconds.
75/1 RATIO Delay Range .5 to 10 microseconds.	130/1 RATIO Delay Range 5 to 500 microseconds.	200/1 RATIO Delay Range 10 to 75 microseconds.
100/1 RATIO Delay Range 1 to 10 microseconds.		250/1 RATIO Delay Range 20 to 100 microseconds.

SAW Bandpass Filters:

Optimum amplitude and phase characteristics for radar, ECM, ESM and communications filtering.



Range of Performance	
Center Frequency	20-800 MHz
1 dB bandwidth	100KHz to 40% f_o
Rejection bandwidth	Δf + 600 KHz min
Transition bandwidth	300 KHz min
Shape factor (1 dB to 40 dB)	1.1 min
Insertion Loss	10 dB to 30 dB, 20 dB typical
Rejection level	30 dB to 55 dB, 45 dB typical
Amplitude ripple	±.2 dB to ±.5 dB, ±.3 dB typical
phase deviation from linear	±2° to ±5°, ±3° typical

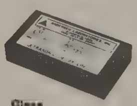
Frequency Synthesizers:

Unique design provides optimized programmable frequency source for today's most demanding applications including radar, radios, telecommunications, TACAN, telemetry, navigational equipment and satellite communications.

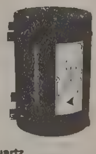
Frequency Output	.25 to 5 GHz
Stepping Bandwidth	600 MHz
Non Harmonic Spurious Harmonic Spurious	−60 dBc −35 dBc
Output Power	+23 dBm
Phase noise	−60 dBc at 10 Hz
Compact/Cavity Free	

Bulk Acoustic Wave (BAW) Delay Lines and Subsystems:

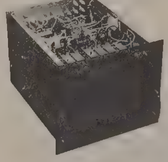
Practical and economical memory for radar, communications and TV signal processing.



Glass
Frequency 5 to 60 MHz
Bandwidth to 30 MHz
Delay 2 to 250 µs
Zero temperature coefficient



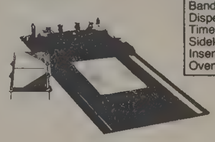
Quartz
Frequency 5 to 100 MHz
Bandwidth to 50 MHz
Delay 1 µs to 4.8 ms
Multiple channel assemblies



Radar MTI

SAW and IMCON Dispersive Delay Lines:

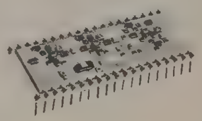
The powerful signal processing tool for radar, ELINT, ESM receivers



	SAW ID	SAW RAC	IMCON
Center Frequency	1000 MHz	1000 MHz	30 MHz
Bandwidth	<50% f_o	<50% f_o	<50% f_o
Dispersion	<50 µs	< 100 µs	< 600 µs
Time Bandwidth Product	< 2000	< 4000	< 4000
Sidelobes	30 db	35 db	40 db
Insertion Loss	30-50 db	30-50 db	20-40 db
Oven	No	Yes	Yes

SAW Hybrid Oscillators:

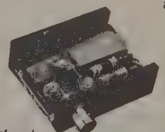
Compact, rugged, alignment-free frequency sources available in standard industry packages for PC mounting. Two types available:



SAW Delay Line Voltage Control Oscillators **SAW Resonator Stabilized Oscillators**	
Fundamental Frequency Output	.1 to 1.1 GHz
Non Harmonic Spurious Harmonic Spurious	−50 dBc −30 dBc
Output Power	+10 dBm min. into 2:1 load

Acousto-Optic Products:

Controlling laser energy in computer printing and semiconductor processing.



Modulators
UV, visible, near infrared
Modulation bandwidth to 20 MHz
Contrast ratio in excess of 1000 to 1
Deflection efficiency greater than 85%
Drivers available

Beam Deflectors
UV, visible, near infrared
Resolution to 300 spots
Access time 300 ns to 10 µs
Drivers available

Q-Switches
Available for all commercial YAG lasers
For up to 50 watt CW laser power output

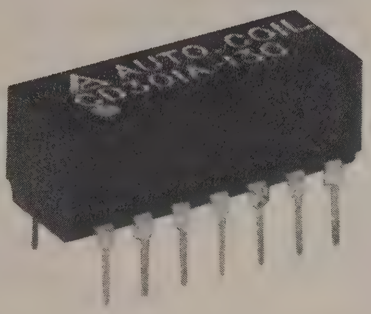
ANDERSEN LABORATORIES

Andersen Laboratories, Inc., 1280 Blue Hills Avenue, Bloomfield, CT 06002 Telephone (203) 242-0761/TWX 710-425-2390

CD300 Series
Passive Delay Line, 14 PIN DIP

- Standard 14 Pin DIP package
- Compatible with various logic systems including TTL and video
- Precise and stable delays
- Reliable hybrid construction
- Designed to meet MIL-D-23859
- Operating temperature −55° to +125°C

Style CD300D



Electrical Characteristics:

Total delay tolerances: ±2 NS or 5% whichever is greater
Tap interval tolerances:
Below 5.0 NS: ±0.5 NS or ±20% whichever is greater
5 NS and above: ±1.0 NS or ±10% whichever is greater
Impedance tolerance: ±10%
Temperature coefficient: 100 PPM/°C
Dielectric strength: 100 VDC @ 50 ma 5 Sec. Min.
Insulation resistance 1000 M Ω Min.
Attenuation: 10% Max.

Mechanical Specifications:

Case: Molded D.A.P.
Leads: Phosphor bronze or equiv. solder coated
Potting: Filled with a two component epoxy system
Marking: Epoxy ink, including Automatic Coil name, part number, date code and Pin 1 index

Also Available:

Intermediate delays
Special taps
Electrical parameters other than listed
Independent delay increments
Internal terminations
Tighter tolerances
Lower profiles
16 Pin configurations

Specifications subject to change without notice.

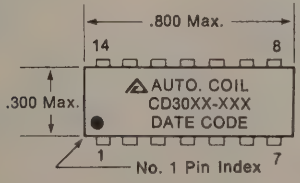
Test Conditions:

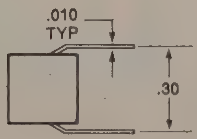
1) All measurements are made @ 25°C
2) Delays are measured @ 50% points
3) Rise times are measured from 10% to 90% points
4) Pulse width 3 x total delay

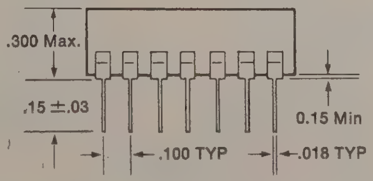
Total Delay (nsec)	Tap Interval (nsec)	Rise Time (nsec)	Automatic Coil Part Number								
			50 Ω			100 Ω			200 Ω		
5	.5	2.5	CD300D-101	CD301A-101	CD301K-101	CD300D-121	CD301A-121	CD301K-121	CD300D-141	CD301A-141	CD301K-141
10	1.0	3.5	CD300D-102	CD301A-102	CD301K-102	CD300D-122	CD301A-122	CD301K-122	CD300D-142	CD301A-142	CD301K-142
15	1.5	4.5	CD300D-103	CD301A-103	CD301K-103	CD300D-123	CD301A-123	CD301K-123	CD300D-143	CD301A-143	CD301K-143
20	2.0	5.5	CD300D-104	CD301A-104	CD301K-104	CD300D-124	CD301A-124	CD301K-124	CD300D-144	CD301A-144	CD301K-144
25	2.5	6.0	CD300D-105	CD301A-105	CD301K-105	CD300D-125	CD301A-125	CD301K-125	CD300D-145	CD301A-145	CD301K-145
30	3.0	6.5	CD300D-106	CD301A-106	CD301K-106	CD300D-126	CD301A-126	CD301K-126	CD300D-146	CD301A-146	CD301K-146
35	3.5	7.0	CD300D-107	CD301A-107	CD301K-107	CD300D-127	CD301A-127	CD301K-127	CD300D-147	CD301A-147	CD301K-147
40	4.0	8.0	CD300D-108	CD301A-108	CD301K-108	CD300D-128	CD301A-128	CD301K-128	CD300D-148	CD301A-148	CD301K-148
45	4.5	9.0	CD300D-109	CD301A-109	CD301K-109	CD300D-129	CD301A-129	CD301K-129	CD300D-149	CD301A-149	CD301K-149
50	5.0	10.0	CD300D-110	CD301A-110	CD301K-110	CD300D-130	CD301A-130	CD301K-130	CD300D-150	CD301A-150	CD301K-150
60	6.0	12.0	CD300D-111	CD301A-111	CD301K-111	CD300D-131	CD301A-131	CD301K-131	CD300D-151	CD301A-151	CD301K-151
70	7.0	14.0	CD300D-112	CD301A-112	CD301K-112	CD300D-132	CD301A-132	CD301K-132	CD300D-152	CD301A-152	CD301K-152
80	8.0	16.0	CD300D-113	CD301A-113	CD301K-113	CD300D-133	CD301A-133	CD301K-133	CD300D-153	CD301A-153	CD301K-153
90	9.0	18.0	CD300D-114	CD301A-114	CD301K-114	CD300D-134	CD301A-134	CD301K-134	CD300D-154	CD301A-154	CD301K-154
100	10.0	20.0	CD300D-115	CD301A-115	CD301K-115	CD300D-135	CD301A-135	CD301K-135	CD300D-155	CD301A-155	CD301K-155
125	12.5	25.0	CD300D-116	CD301A-116	CD301K-116	CD300D-136	CD301A-136	CD301K-136	CD300D-156	CD301A-156	CD301K-156
150	15.0	30.0	CD300D-117	CD301A-117	CD301K-117	CD300D-137	CD301A-137	CD301K-137	CD300D-157	CD301A-157	CD301K-157
200	20.0	40.0	CD300D-118	CD301A-118	CD301K-118	CD300D-138	CD301A-138	CD301K-138	CD300D-158	CD301A-158	CD301K-158
250	25.0	50.0	CD300D-119	CD301A-119	CD301K-119	CD300D-139	CD301A-139	CD301K-139	CD300D-159	CD301A-159	CD301K-159
300	30.0	60.0	CD300D-120	CD301A-120	CD301K-120	CD300D-140	CD301A-140	CD301K-140	CD300D-160	CD301A-160	CD301K-160

Complete technical specifications shown in catalog AC-37, available free upon request.

Pin numbers for reference only







Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.

Dept. E 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX 810-848-8097

CD501/502 Series

TTL Digital Delay Module, 14 PIN, 5 TAP & MULTI DELAY MODULE

- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10TTL loads/tap, 20TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55°C to +125°C

Electrical Characteristics:

VIH	(High level input voltage)	2.0 to 5.0V
IIH	(High level input current)	50 μA Max.
VIL	(Low level input voltage)	0.8V Max.
IIL	(Low level input current)	−2 ma Max.
VOH	(High level output voltage)	2.5V Min.
VOL	(Low level output voltage)	0.5V Max.
VCC	(Supply voltage)	5.0V ±0.25 VDC
ICC	(Supply current)	75 ma Max. (115 ma Max. for CD502)

Also Available:

Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications
Non tapped modules

Specifications subject to change without notice.

Mechanical Specifications:

Case: Epoxy filled D.A.P.
Leads: Alloy 42 or equiv. solder coated
Marking: White epoxy ink

Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

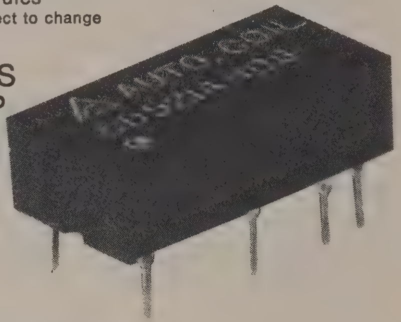
Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay (3 x for CD502)
4) Duty cycle < 25%

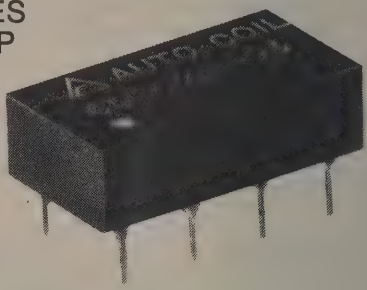
All digital delay modules can be operated at conditions other than specified.

Since accuracies may be slightly affected, we suggest that the module be evaluated under specific operating conditions.

501 SERIES
14 PIN DIP



502 SERIES
14 PIN DIP



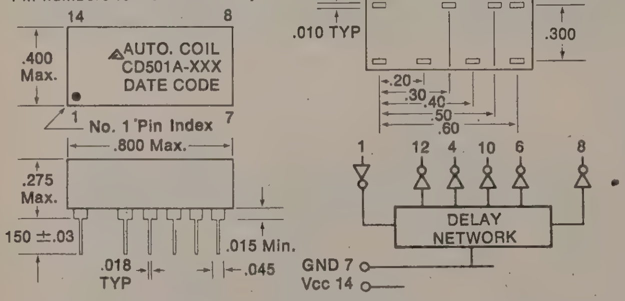
Ask for our high performance versions and 16 Pin configuration.

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 12	PIN 4	PIN 10	PIN 6	PIN 8
CD501A-101	5	10	15	20	25
CD501A-102	6	12	18	24	30
CD501A-103	7	14	21	28	35
CD501A-104	8	16	24	32	40
CD501A-105	9	18	27	36	45
CD501A-106	10	20	30	40	50
CD501A-107	15	30	45	60	75
CD501A-108	20	40	60	80	100
CD501A-109	25	50	75	100	125
CD501A-110	30	60	90	120	150
CD501A-111	40	80	120	160	200
CD501A-112	50	100	150	200	250
CD501A-113	60	120	180	240	300
CD501A-114	70	140	210	280	350
CD501A-115	80	160	240	320	400
CD501A-116	90	180	270	360	450
CD501A-117	100	200	300	400	500

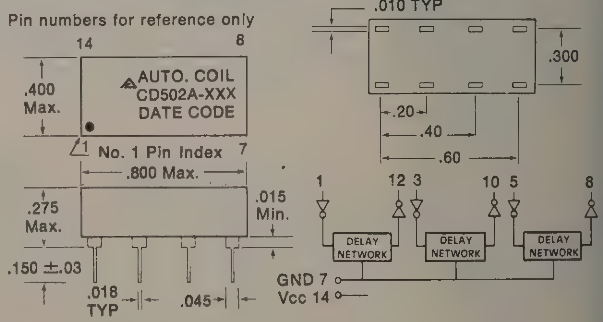
Delay (in NS) ±2 NS or 5% Whichever is Greater			
Automatic Coil Part Number	PIN 1 to 12	PIN 3 to 10	PIN 5 to 8
CD502A-101	5	5	5
CD502A-102	10	10	10
CD502A-103	20	20	20
CD502A-104	30	30	30
CD502A-105	40	40	40
CD502A-106	50	50	50
CD502A-107	60	60	60
CD502A-108	70	70	70
CD502A-109	80	80	80
CD502A-110	90	90	90
CD502A-111	100	100	100
CD502A-121	5	10	20
CD502A-122	10	20	20
CD502A-123	10	10	30
CD502A-124	20	30	50

Output rise time (TPLH) 4.0 NS (0.75 to 2.4V level).

Pin numbers for reference only


14
8
.400 Max.
AUTO. COIL
CD501A-XXX
DATE CODE
1
No. 1 Pin Index
7
.800 Max.
.275 Max.
150 ±.03
.015 Min.
.018 TYP
.045
.010 TYP
.300
.20
.30
.40
.50
.60
1
12
4
10
6
8
DELAY NETWORK
GND 7
Vcc 14

Pin numbers for reference only


14
8
.400 Max.
AUTO. COIL
CD502A-XXX
DATE CODE
1
No. 1 Pin Index
7
.800 Max.
.275 Max.
.015 Min.
.150 ±.03
.018 TYP
.045
.010 TYP
.300
.20
.40
.60
1
12
3
10
5
8
DELAY NETWORK
DELAY NETWORK
DELAY NETWORK
GND 7
Vcc 14

Complete technical specifications shown in catalog AC-37, available free upon request.

Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.

Dept. E 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX 810-848-8097

CD601/581 Series

Smallest Active Delay Line Series Made!

TTL Digital Delay Module, 14 PIN, 10 TAP & 8 PIN, 5 TAP

- TTL input and outputs
- Precise and stable delays
- Reliable hybrid construction
- No external components required
- Fan out 10TTL loads/tap, 20TTL loads/package
- Operating temperature 0° to 70°C
- Storage temperature −55° to 125°C

Electrical Characteristics:

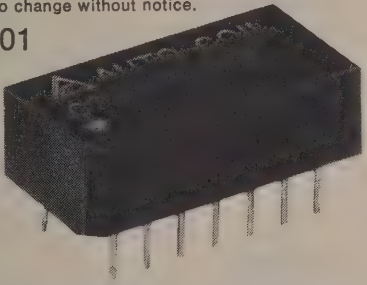
VIH	(High level input voltage)	2.0 to 5.0V
IIH	(High level input current)	50 μA Max.
VIL	(Low level input voltage)	0.8V Max.
IIL	(Low level input current)	−2 ma Max.
VOH	(High level output voltage)	2.5V Min.
VOL	(Low level output voltage)	0.5V Max.
VCC	(Supply voltage)	5.0V ±0.25 VDC
ICC	(Supply current)	150 ma Max. (75 ma Max. for CD581)

Also Available:

Intermediate delays
Non symmetrical tap delays
Tighter delay tolerances
Falling edge delay specifications

Specifications subject to change without notice.

SERIES CD601
14 PIN DIP



Mechanical Specifications:

Case: Epoxy filled D.A.P.
Leads: Tinned Cu. or Equiv.
Marking: White epoxy ink

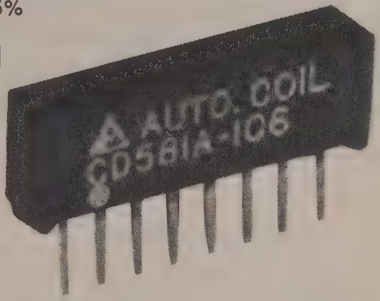
Test Conditions:

1) All measurements are made @ 25°C
2) VCC is maintained @ 5.0 VDC
3) All measurements are made with no loads on outputs
4) Delays are measured @ 1.5V level
5) Delays and tolerances for leading edges only (TPLH) — falling edges (TPHL) closely matched to TPLH

Input Conditions:

1) Pulse amplitude: 3.20V
2) Input rise time 3.0 NS (10 to 90%)
3) Pulse width 2 x total delay
4) Duty cycle < 25%

ULTRA THIN
ACTIVE SIP
8 PIN SIP

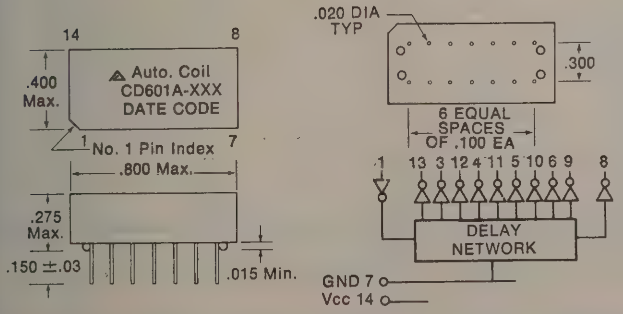

AUTO. COIL
CD581A-106

Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater		
Automatic Coil Part Number	Total Delay	Tap Delay
CD601A-101	50	5.0
CD601A-102	75	7.5
CD601A-103	100	10.0
CD601A-104	150	15.0
CD601A-105	200	20.0
CD601A-106	250	25.0
CD601A-107	300	30.0
CD601A-108	350	30.5
CD601A-109	400	40.0
CD601A-110	450	45.0
CD601A-111	500	50.0
CD601A-112	600	60.0
CD601A-113	700	70.0
CD601A-114	800	80.0
CD601A-115	900	90.0
CD601A-116	1000	100.0

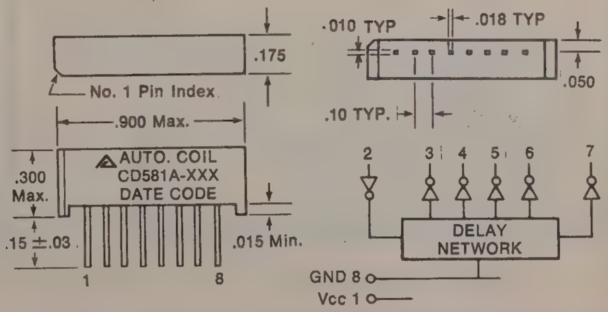
Nominal Delays (in NS) ±2 NS or 5% Whichever is Greater					
Automatic Coil Part Number	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
CD581A-101	5	10	15	20	25
CD581A-102	6	12	18	24	30
CD581A-103	7	14	21	28	35
CD581A-104	8	16	24	32	40
CD581A-105	9	18	27	36	45
CD581A-106	10	20	30	40	50
CD581A-107	15	30	45	60	75
CD581A-108	20	40	60	80	100
CD581A-109	25	50	75	100	125
CD581A-110	30	60	90	120	150
CD581A-111	40	80	120	160	200
CD581A-112	50	100	150	200	250
CD581A-113	60	120	180	240	300
CD581A-114	70	140	210	280	350
CD581A-115	80	160	240	320	400
CD581A-116	90	180	270	360	450
CD581A-117	100	200	300	400	500

Output rise times (TPLH) 4.0 NS (0.75 to 2.4V level).

Pin numbers for reference only


14
8
.400 Max.
Auto. Coil
CD601A-XXX
DATE CODE
1
No. 1 Pin Index
7
.800 Max.
.275 Max.
.150 ±.03
.015 Min.
.020 DIA TYP
.300
6 EQUAL SPACES OF .100 EA
1
13
3
12
4
11
5
10
6
9
8
DELAY NETWORK
GND 7
Vcc 14

Pin numbers for reference only


.175
No. 1 Pin Index
.900 Max.
.300 Max.
AUTO. COIL
CD581A-XXX
DATE CODE
.15 ±.03
.015 Min.
1
8
.010 TYP
.018 TYP
.050
.10 TYP.
2
3
4
5
6
7
DELAY NETWORK
GND 8
Vcc 1

Complete technical specifications shown in catalog AC-37, available free upon request.

Automatic Coil Corp.
SUBSIDIARY OF DESIGNATRONICS, INC.
Dept. E 455 East 10th Avenue, Hialeah, Florida 33010
Telephone: (305) 883-5311, TWX 810-848-8097

bel defining a degree of excellence

series 0447 DIGITAL

14 PIN - 5 TAP

TECHNICAL INFORMATION

Bel Fuse Digital Delay Lines Series 0447 features five equally tapped delay lines with total delays of 25 to 500 nanoseconds. The lines are compatible with TTL and DTL circuits. Either Logic "1" or Logic "0" inputs are accepted. Cascading of units causes no undesirable reflections. The reduced dimensions, with standard Dip Pin-Out permits dense packaging on your circuit board.
Special designs upon request.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. 40% of Total Delay
Supply Current	60 ma typ
Supply Voltage	5.0 Volts

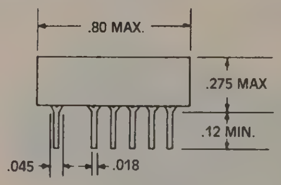
ELECTRICAL CHARACTERISTICS

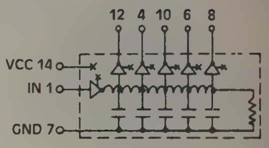
Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	− 2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

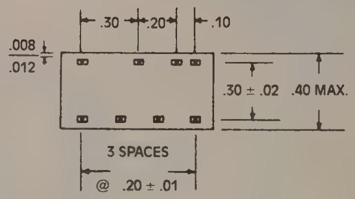
DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL) Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

- COMPATIBLE WITH TTL AND DTL CIRCUITS
- DELAY TOLERANCE ± 2Nsec or 5% WHICHEVER IS GREATER FROM INPUT TO TAP
- TAP TO TAP DELAY ± 2Nsec or 7% WHICHEVER IS GREATER
- OPERATING TEMPERATURE RANGE 0°C to 70°C
- OTHER DELAYS UPON REQUEST







Part Number	Total Delay [1, 3]	Delay/Tap [1, 3]	Rise Time [2, 3]
0447-0025-02	25NS	5NS	4NS
0447-0050-02	50NS	10NS	4NS
0447-0100-02	100NS	20NS	4NS
0447-0150-02	150NS	30NS	4NS
0447-0200-02	200NS	40NS	4NS
0447-0250-02	250NS	50NS	4NS
0447-0300-02	300NS	60NS	4NS
0447-0350-02	350NS	70NS	4NS
0447-0400-02	400NS	80NS	4NS
0447-0450-02	450NS	90NS	4NS
0447-0500-02	500NS	100NS	4NS

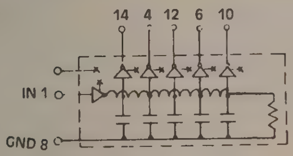
[1] Delays measured at 1.5 Volt level on Leading Edge only.
[2] Rise Times measured from .75 Volts to 2.4 Volts.
[3] Measured with no loads on taps.

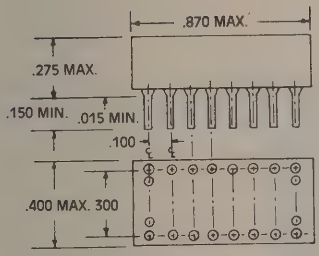
bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710-730-5301

bel defining a degree of excellence

DELAY LINES

16 PIN - 5 TAP

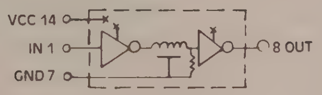


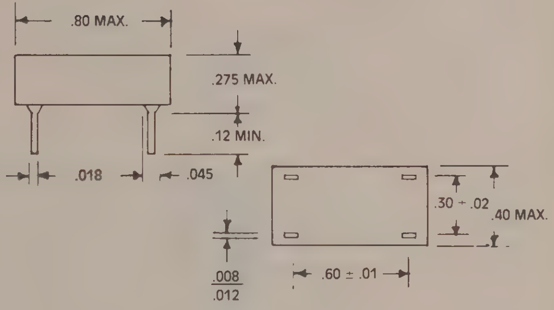


Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-01	25NS	5NS	4NS
0447-0050-01	50NS	10NS	4NS
0447-0100-01	100NS	20NS	4NS
0447-0150-01	150NS	30NS	4NS
0447-0200-01	200NS	40NS	4NS
0447-0250-01	250NS	50NS	4NS
0447-0300-01	300NS	60NS	4NS
0447-0350-01	350NS	70NS	4NS
0447-0400-01	400NS	80NS	4NS
0447-0450-01	450NS	90NS	4NS
0447-0500-01	500NS	100NS	4NS

[1] Delays measured at 1.5 Volt level on Leading Edge only.
[2] Rise Times measured from .75 Volts to 2.4 Volts.
[3] Measured with no loads on taps.

FIXED DELAY





Part Number	Total Delay 4, 3	Rise Time 2, 3	Part Number	Total Delay 4, 3	Rise Time 2, 3
0447-0010-06	10NS	4NS	0447-0125-06	125NS	4NS
0447-0020-06	20NS	4NS	0447-0150-06	150NS	4NS
0447-0030-06	30NS	4NS	0447-0175-06	175NS	4NS
0447-0040-06	40NS	4NS	0447-0200-06	200NS	4NS
0447-0050-06	50NS	4NS	0447-0250-06	250NS	4NS
0447-0060-06	60NS	4NS	0447-0300-06	300NS	4NS
0447-0070-06	70NS	4NS	0447-0350-06	350NS	4NS
0447-0080-06	80NS	4NS	0447-0400-06	400NS	4NS
0447-0090-06	90NS	4NS	0447-0450-06	450NS	5NS
0447-0100-06	100NS	4NS	0447-0500-06	500NS	5NS

[2] Rise Times measured from .75 Volts to 2.4 Volts.
[3] Measured with no loads on taps.
[4] Delays measured at 1.5 Volts on Leading Edge and Trailing Edge.

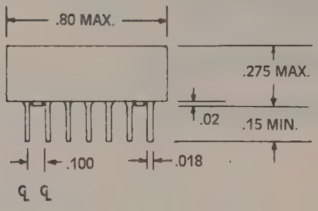
bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710 730 5301

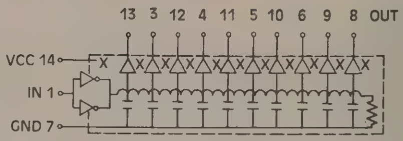
bel defining a degree of excellence

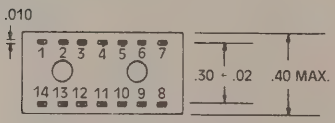
DIGITAL DELAY LINE SERIES 0447

10 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2NSec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2NSec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request







Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0050-10	50NS	5NS	4NS
0447-0100-10	100NS	10NS	4NS
0447-0150-10	150NS	15NS	4NS
0447-0200-10	200NS	20NS	4NS
0447-0250-10	250NS	25NS	4NS
0447-0300-10	300NS	30NS	4NS
0447-0350-10	350NS	35NS	4NS
0447-0400-10	400NS	40NS	4NS
0447-0500-10	500NS	50NS	5NS
0447-0750-10	750NS	75NS	5NS
0447-1000-10	1000NS	100NS	5NS

[1] Delays measured at 1.5 Volt level on Leading Edge only.
[2] Rise Times measured from .75 Volts to 2.4 Volts.
[3] Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Supply Current	120 ma TYP
Pulse Width	Min. of 40% Delay

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	100 Microamps Max.
Logic 0 Input Current	−4 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

All Measurements Made at VCC = 5.0 Volts (@ 25°C)

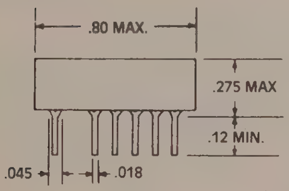
DRIVE CAPABILITIES

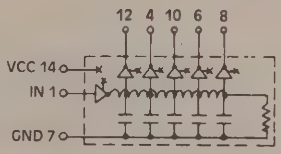
Logic 0 Output	10 TTL Loads/Tap Max. (20 TTl Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

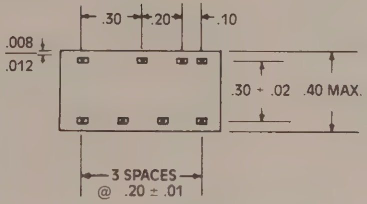
bel defining a degree of excellence

DIGITAL DELAY LINE SERIES 0447
CONTROLLED LEADING AND TRAILING EDGE DELAY MODULE
5 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2Nsec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2Nsec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request







Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-A1	25NS	5NS	4NS
0447-0050-A1	50NS	10NS	4NS
0447-0100-A1	100NS	20NS	4NS
0447-0150-A1	150NS	30NS	4NS
0447-0200-A1	200NS	40NS	4NS
0447-0250-A1	250NS	50NS	4NS
0447-0300-A1	300NS	60NS	4NS
0447-0350-A1	350NS	70NS	4NS
0447-0400-A1	400NS	80NS	4NS
0447-0450-A1	450NS	90NS	4NS
0447-0500-A1	500NS	100NS	5NS

1 Delays measured at 1.5 Volt level on Leading and Trailing Edge.
2 Rise and Fall Times measured from .75 to 2.2 Volts.
3 Measured with 1 STTL load per tap.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. of 20% of Total Delay
Supply Current	60 ma typ
Supply Voltage	5.0 Volts
PRR	Min 3 × Pulse Width

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	−2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

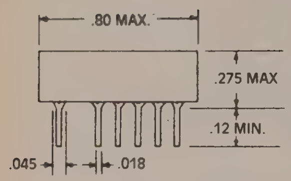
bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710-730-5301

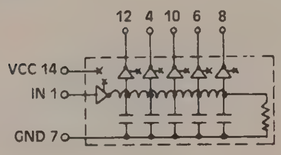
bel defining a degree of excellence

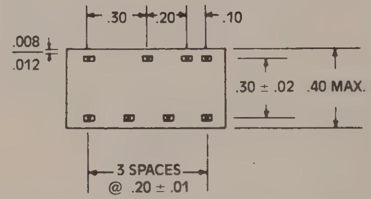
DIGITAL DELAY LINE SERIES 0447
LOW POWER MODULE 20MA TYP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2Nsec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2Nsec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request

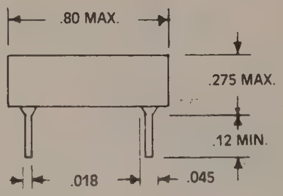
5 TAP

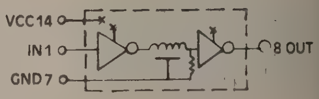


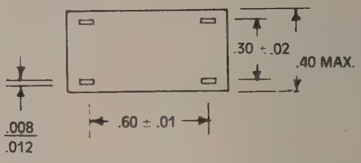




FIXED DELAY







Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-09	25NS	5NS	8NS
0447-0050-09	50NS	10NS	8NS
0447-0100-09	100NS	20NS	8NS
0447-0150-09	150NS	30NS	8NS
0447-0200-09	200NS	40NS	8NS
0447-0250-09	250NS	50NS	8NS
0447-0300-09	300NS	60NS	8NS
0447-0350-09	350NS	70NS	8NS
0447-0400-09	400NS	80NS	8NS
0447-0450-09	450NS	90NS	8NS
0447-0500-09	500NS	100NS	8NS

Part Number	Total Delay 1, 3	Rise Time 2, 3	Part Number	Total Delay 1, 3	Rise Time 2, 3
0447-0010-08	10NS	8NS	0447-0125-08	125NS	8NS
0447-0020-08	20NS	8NS	0447-0150-08	150NS	8NS
0447-0030-08	30NS	8NS	0447-0175-08	175NS	8NS
0447-0040-08	40NS	8NS	0447-0200-08	200NS	8NS
0447-0050-08	50NS	8NS	0447-0250-08	250NS	8NS
0447-0060-08	60NS	8NS	0447-0300-08	300NS	8NS
0447-0070-08	70NS	8NS	0447-0350-08	350NS	8NS
0447-0080-08	80NS	8NS	0447-0400-08	400NS	8NS
0447-0090-08	90NS	8NS	0447-0450-08	450NS	8NS
0447-0100-08	100NS	8NS	0447-0500-08	500NS	8NS

[1] Delays measured at 1.5 Volt level on Leading Edge only.
[2] Rise Times measured from .8 Volts to 2 Volts.
[3] Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. of 40% of Total Delay
Supply Current	20 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	20 Microamps Max.
Logic 0 Input Current	−.4 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

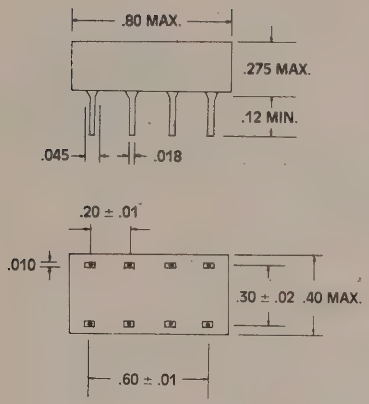
Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

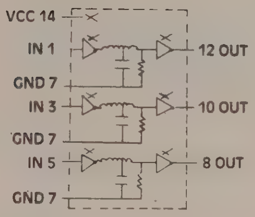
bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710-730-5301

bel defining a degree of excellence

DIGITAL DELAY LINE SERIES 0447
TRIPLE OUTPUT MODULE

- Compatible with TTL and DTL circuits
- Operating temperature range 0°C to 70°C
- Other delays upon request





Part Number	Delay Time 1, 3	Rise Time 2, 3
0447-0010-A3	10 NS ± 1.5 NS	3 NS
0447-0020-A3	20 NS ± 1.5 NS	3 NS
0447-0030-A3	30 NS ± 2.0 NS	3 NS
0447-0040-A3	40 NS ± 2.0 NS	3 NS
0447-0050-A3	50 NS ± 2.5 NS	3 NS
0447-0060-A3	60 NS ± 3.0 NS	4 NS
0447-0070-A3	70 NS ± 3.5 NS	4 NS
0447-0080-A3	80 NS ± 4.0 NS	4 NS
0447-0090-A3	90 NS ± 4.0 NS	4 NS
0447-0100-A3	100 NS ± 5.0 NS	4 NS
0447-0125-A3	125 NS ± 6.0 NS	4 NS

[1] Delays measured at 1.5 Volt Leading Edge only.
[2] Rise Times measured from .75 to 2.4 Volts.
[3] Measured with 1 STTL load (15PF) on each output.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3 Nsec.
Pulse Width	Min. 100% of Total Delay
Supply Current	Constant "0" in 115 ma max. Constant "1" in 90 ma max.
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

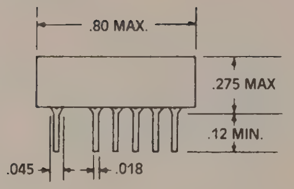
Supply Voltage Vcc	4.75 Volts to 5.25 Volts
Logic 1 Input Current	50 μa max.
Logic 0 Input Current	−2 ma max.
Logic 1 Output Voltage	2.6 Volts min.
Logic 0 Output Voltage	.5 Volts max.
Temperature Coefficient	1.5 Nsec + 100 ppm/°C max.

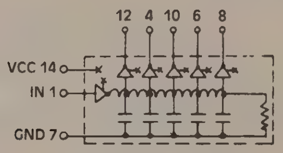
bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710-730-5301

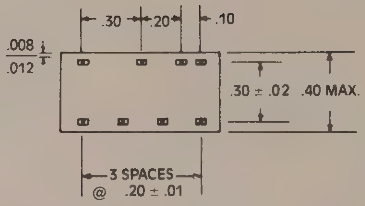
bel defining a degree of excellence

DIGITAL DELAY LINE SERIES 0447
DYNAMIC RAM TIMING MODULE

- Compatible with TTL and DTL circuits
- Operating temperature range 0°C to 70°C
- Other delays upon request







Part Number	Nominal Delay at each tap in Nsec 1, 3					Rise Time 2, 3
	P 12	P 4	P 10	P 6	P 8	
0447-0339-99	25 ± 5	45 ± 5	160 ± 8	185 ± 9	340 ± 17	4
0447-0399-99	30 ± 5	80 ± 5	220 ± 11	250 ± 12	400 ± 20	4
0447-0439-99	40 ± 5	100 ± 5	265 ± 13	290 ± 14	440 ± 22	4
0477-0499-99	85 ± 5	140 ± 7	320 ± 16	345 ± 17	515 ± 25	5

[1] Delays measured at 1.5 Volt level on Leading Edge only.
[2] Rise Times measured from .75 Volts to 2.4 Volts.
[3] Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. of 20% of Total Delay
Supply Current	60 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	−2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

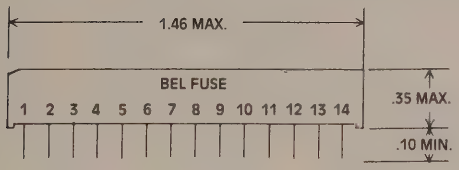
Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

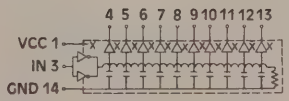
bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710-730-5301

bel defining a degree of excellence

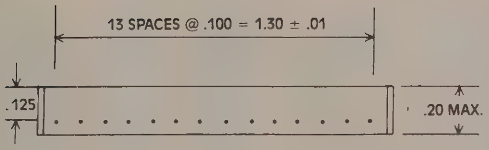
DIGITAL DELAY LINE SERIES 0447
SINGLE-IN-LINE
10 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2Nsec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2Nsec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request





Pins .012 × .020 flat lead or 24 awg tinned copper



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0050-07	50NS	5NS	4NS
0447-0100-07	100NS	10NS	4NS
0447-0150-07	150NS	15NS	4NS
0447-0200-07	200NS	20NS	4NS
0447-0250-07	250NS	25NS	4NS

[1] Delays measured at 1.5 Volt level Leading Edge only.
[2] Rise Times measured from .75 Volts to 2.4 Volts.
[3] Measured with no loads on taps.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. 40% of Total Delay
Supply Current	120 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	100 Microamps Max.
Logic 0 Input Current	−4 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

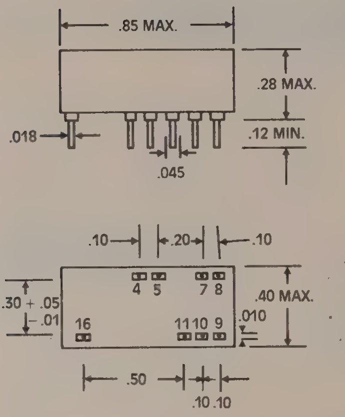
DRIVE CAPABILITIES

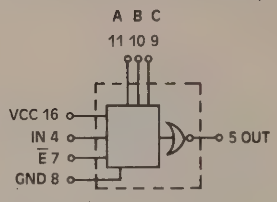
Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710 730 5301

bel defining a degree of excellence

DIGITAL DELAY LINE SERIES 0449
TTL PROGRAMMABLE LOGIC DELAY MODULE
3 BIT





$\overline{E}$ = ENABLE = 0

Part Number	* Min. Delay	** Max. Delay	Δ Delay Per Step	Tol. Per Step
0449-0014-07	7 ± .5NS	14NS	1 ± .5NS	± .8NS
0449-0021-07	7 ± .5NS	21NS	2 ± .6NS	± 1.2NS
0449-0028-07	7 ± .5NS	28NS	3 ± .7NS	± 1.6NS
0449-0035-07	7 ± .5NS	35NS	4 ± .8NS	± 1.8NS
0449-0042-07	7 ± .5NS	42NS	5 ± 1.0NS	± 2.0NS
0449-0049-07	7 ± .5NS	49NS	6 ± 1.2NS	± 2.4NS
0449-0056-07	7 ± .5NS	56NS	7 ± 1.4NS	± 2.8NS
0449-0063-07	7 ± .5NS	63NS	8 ± 1.6NS	± 3.2NS
0449-0070-07	7 ± .5NS	70NS	9 ± 1.8NS	± 3.6NS
0449-0077-07	7 ± .5NS	77NS	10 ± 2.0NS	± 4.0NS

C	B	A	
0	0	0	*
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	**

INPUT TEST CONDITIONS

Pulse Voltage	3 Volts
Rise Time	3 Nsec.
Pulse Width	150% of Max. Delay
Supply Current	40 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Voltage	2 Volts Min., 5.5 Volts Max.
Logic 0 Input Voltage	.8 Volts Max.
Logic 1 Output Voltage	2.5 Volts Min.
Logic 0 Output Voltage	0.5 Volts Max.
Temperature Range	0°C to 70°C
Temperature Coefficient	400 PPM/°C Max.

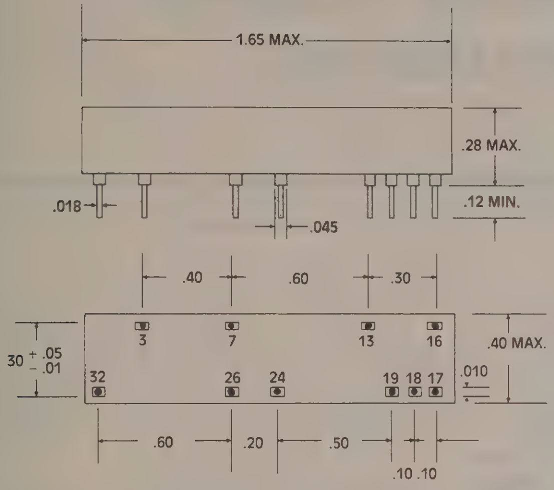
DRIVE DAPABILITIES

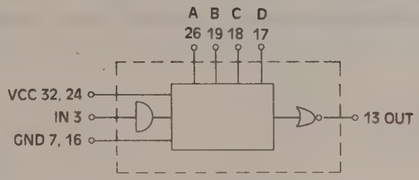
Fan Out	10 TTL Loads Max.

bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N.J. 07302 • (201) 432-0463 • TWX 710-730-5301

bel defining a degree of excellence

DIGITAL DELAY LINE SERIES 0449
TTL PROGRAMMABLE LOGIC DELAY MODULE
4 BIT





Part Number	*Min. Delay	**Max. Delay	ΔDelay Per Step	Tol. Per Step
0449-0031-15	15 ± 1NS	30NS	1 ± .7NS	± 1.5NS
0449-0045-15	15 ± 1NS	45NS	2 ± .7NS	± 2.0NS
0449-0060-15	15 ± 1NS	60NS	3 ± .7NS	± 2.3NS
0449-0075-15	15 ± 1NS	75NS	4 ± .8NS	± 2.6NS
0449-0090-15	15 ± 1NS	90NS	5 ± 1.0NS	± 2.8NS
0449-0105-15	15 ± 1NS	105NS	6 ± 1.2NS	± 3.2NS
0449-0120-15	15 ± 1NS	120NS	7 ± 1.4NS	± 3.6NS
0449-0135-15	15 ± 1NS	135NS	8 ± 1.6NS	± 4.0NS
0449-0150-15	15 ± 1NS	150NS	9 ± 1.8NS	± 4.5NS
0449-0165-15	15 ± 1NS	165NS	10 ± 2.0NS	± 5.0NS

D	C	B	A	
0	0	0	0	*
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	**

INPUT TEST CONDITIONS

Pulse Voltage	3 Volts
Rise Time	3 Nsec.
Pulse Width	150% of Max. Delay
Supply Current	100 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Voltage	2 Volts Min., 5.5 Volts Max.
Logic 0 Input Voltage	.8 Volts Max.
Logic 1 Output Voltage	2.5 Volts Min.
Logic 1 Output Voltage	0.5 Volts Max.
Temperature Range	0°C to 70°C
Temperature Coefficient	400 PPM/°C Max.

DRIVE DAPABILITIES

Fan Out	10 TTL Loads Max.

bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N.J. 07302 • (201) 432-0463 • TWX 710 730-5301

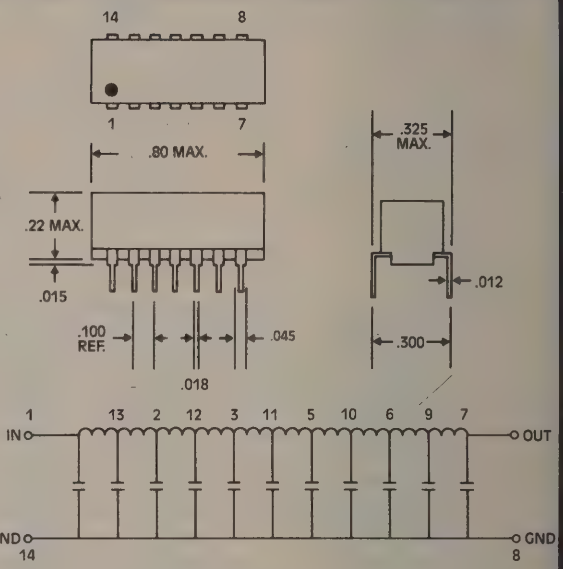
bel defining a degree of excellence

DELAY LINES

LUMPED CONSTANT

14 PIN DIP

- Built to conform to MIL-D-23859.
- Temperature Range −55°C to +125°C.
- Temperature Coefficient 100 ppm/°C or less.
- Will meet most stringent MIL requirements.
- Low attenuation.
- Excellent pulse fidelity.
- Compatible with TTL and other logic modes.
- Other delays available upon request.
- Contact Bel Engineering for special applications.
- Untapped Units Available Upon Request.
- 16 PIN DIP Also Available



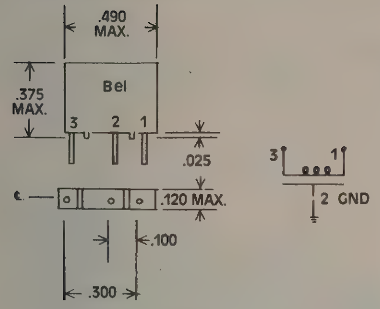
Total Delay ± 5%	Tap to Tap Delay	Distortion ± Max. %	Attenuation Max. %	Impedance ±10% 50Ω	100Ω	200Ω
5NS	.5 ± .3NS	10%	5%	0446-0005-50 Tr = 3	0446-0005-01 Tr = 3	0046-0005-02 Tr = 3.5
10NS	1 ± .35NS	10%	5%	0446-0010-50 Tr = 3.8	0446-0010-01 Tr = 3.8	0446-0010-02 Tr = 4
20NS	2 ± 1NS	10%	5%	0446-0020-50 Tr = 5	0446-0020-01 Tr = 5	0446-0020-02 Tr = 5
30NS	3 ± 1NS	10%	5%	0446-0030-50 Tr = 7	0446-0030-01 Tr = 7	0446-0030-02 Tr = 7
40NS	4 ± 1NS	10%	5%	0446-0040-50 Tr = 8.5	0446-0040-01 Tr = 8.5	0446-0040-02 Tr = 8.5
50NS	5 ± 2NS	10%	5%	0446-0050-50 Tr = 10	0446-0050-01 Tr = 10	0446-0050-02 Tr = 10
60NS	6 ± 2NS	10%	8%	0446-0060-50 Tr = 12	0446-0060-01 Tr = 12	0446-0060-02 Tr = 12
70NS	7 ± 2NS	10%	8%	0446-0070-50 Tr = 14	0446-0070-01 Tr = 14	0446-0070-02 Tr = 14
80NS	8 ± 2NS	10%	8%	0446-0080-50 Tr = 16	0446-0080-01 Tr = 16	0446-0080-02 Tr = 16
90NS	9 ± 2NS	10%	8%	0446-0090-50 Tr = 18	0446-0090-01 Tr = 18	0446-0090-02 Tr = 18
100NS	10 ± 3NS	10%	10%	0446-0100-50 Tr = 20	0446-0100-01 Tr = 20	0446-0100-02 Tr = 20
150NS	15 ± 3NS	10%	10%	0446-0150-50 Tr = 30	0446-0150-01 Tr = 28	0446-0150-02 Tr = 30
200NS	20 ± 3NS	10%	10%	0446-0200-50 Tr = 40	0446-0200-01 Tr = 35	0446-0200-02 Tr = 40
250NS	25 ± 3NS	10%	10%	0446-0250-50 Tr = 50	0446-0250-01 Tr = 45	0446-0250-02 Tr = 50
300NS	30 ± 3NS	10%	10%	0446-0300-50 Tr = 60	0446-0300-01 Tr = 60	0446-0300-02 Tr = 60
400NS	40 ± 3NS	10%	10%	0446-0400-50 Tr = 80	0446-0400-01 Tr = 80	0446-0400-02 Tr = 80
500NS	50 ± 3NS	10%	10%	0446-0500-50 Tr = 100	0446-0500-01 Tr = 100	0446-0500-02 Tr = 100

bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N. J. 07302 • (201) 432-0463 • TWX 710-730-5301

bel defining a degree of excellence

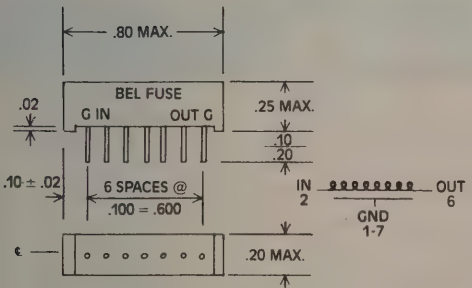
SINGLE-IN-LINE DELAY LINES

- Compatible with ECL and TTL circuits
- Temperature coefficient delay = 100 PPM/°C max.
- Operating temperature range −55°C to +125°C



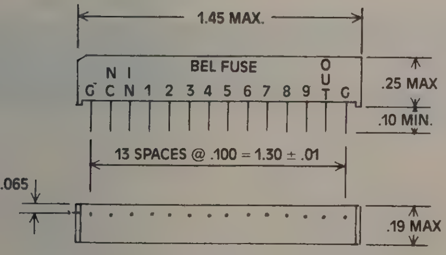
- Rise Time = 20-80%
- DWV = 50 VDC
- Pins 24 AWG tinned copper
- DIST. = 7.5% max.
- Bi-Directional

Time Delay	Rise Time	D.C.R. Max. in OHMS	Part Number	
			55 OHMS ± 10%	93 OHMS ± 10%
1 ± .2NS	1.6NS	.20	0402-0001-55	0402-0001-93
2 ± .2NS	1.6NS	.25	0402-0002-55	0402-0002-93
3 ± .2NS	1.7NS	.37	0402-0003-55	0402-0003-93
4 ± .2NS	1.7NS	.50	0402-0004-55	0402-0004-93
5 ± .25NS	1.8NS	.62	0402-0005-55	0402-0005-93
6 ± .3NS	2.0NS	.75	0402-0006-55	0402-0006-93
7 ± .3NS	2.2NS	.80	0402-0007-55	0402-0007-93
8 ± .3NS	2.4NS	.85	0402-0008-55	0402-0008-93
9 ± .3NS	2.6NS	.90	0402-0009-55	0402-0009-93
10 ± .3NS	2.8NS	.95	0402-0010-55	0402-0010-93



- Rise Time = 10 to 90%
- DWV = 50 VDC
- DIST = 10% max.
- Taps available upon request
- Other delays upon request
- Other PIN OUTS Available
- Pins .012 × .020

Time Delay	Rise Time	Atten. Max. in %	Part Number		
			55 OHMS ± 10%	100 OHMS ± 10%	200 OHMS ± 10%
1 ± .3NS	2.6NS	3	0403-0001-55	0403-0001-01	0403-0001-02
2 ± .3NS	2.75NS	3	0403-0002-55	0403-0002-01	0403-0002-02
3 ± .3NS	2.9NS	3	0403-0003-55	0403-0003-01	0403-0003-02
4 ± .3NS	3.15NS	3	0403-0004-55	0403-0004-01	0403-0004-02
5 ± .3NS	3.2NS	5	0403-0005-55	0403-0005-01	0403-0005-02
10 ± .5NS	4.0NS	5	0403-0010-55	0403-0010-01	0403-0010-02
15 ± .7NS	5.25NS	5	0403-0015-55	0403-0015-01	0403-0015-02
20 ± 1NS	6.1NS	5	0403-0020-55	0403-0020-01	0403-0020-02
25 ± 1.2NS	7.5NS	5	0403-0025-55	0403-0025-01	0403-0025-02
30 ± 1.5NS	9.0NS	6	0403-0030-55	0403-0030-01	0403-0030-02
35 ± 1.7NS	10.5NS	6	0403-0035-55	0403-0035-01	0403-0035-02
40 ± 2NS	12.5NS	6	0403-0040-55	0403-0040-01	0403-0040-02
45 ± 2.7NS	13.5NS	6	0403-0045-55	0403-0045-01	0403-0045-02
50 ± 2.5NS	15.0NS	6	0403-0050-55	0403-0050-01	0403-0050-02


1.45 MAX.
BEL FUSE
G C N I N 1 2 3 4 5 6 7 8 9 OUT G
.25 MAX
.10 MIN.
13 SPACES @ .100 = 1.30 ± .01
.065
.19 MAX

- Rise Time = 10-90%
- DWV = 50 VDC
- DIST. = 10% max.
- Other delays upon request
- Pins .012 × .020

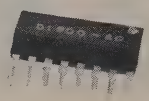
Time Delay ± 5%	Tap to Tap Delay	Rise Time	ZO ± 10% in OHMS	D.C.R. in OHMS	Part Number
10NS	1 ± .25NS	2.5NS	50	.8	0438-0010-50
20NS	2 ± .4NS	4NS	50	1	0438-0020-50
50NS	5 ± 1.5NS	9NS	50	2	0438-0050-50
100NS	10 ± 2NS	18NS	50	3	0438-0100-50
10NS	1 ± .25NS	2.5NS	100	1.6	0438-0010-01
20NS	2 ± .4NS	4NS	100	2	0438-0020-01
50NS	5 ± 1.5NS	9NS	100	4	0438-0050-01
100NS	10 ± 2NS	19NS	100	9	0438-0100-01
20NS	2 ± .4NS	4.5NS	200	5	0438-0020-02
50NS	5 ± 1.5NS	10NS	200	12	0438-0050-02
100NS	10 ± 2NS	20NS	200	17	0438-0100-02

bel BEL FUSE INC. 198 Van Vorst Street • Jersey City, N.J. 07302 • (201) 432-0463 • TWX 710-730-5301

FIXED AND TAPPED DELAY LINES

SUB-MINIATURE DUAL-IN-LINE TAPPED LUMPED CONSTANT LINES

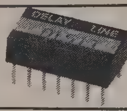
Each line has 10 tap delays spaced at equal intervals. Attenuation less than 1 dB. Temp. Coeff. less than 50 PPM/°C. DIP configuration compatible with automatic inserting equipment. Commercial and MIL Spec. models available.



MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
D1900-10	10 Nsec	2 Nsec	100	.21 x .30 x .78
D1900-20	20	3	100	.21 x .30 x .78
D1900-40	40	6	100	.21 x .30 x .78
D1900-60	60	9	100	.21 x .30 x .78
D1900-80	80	10	100	.21 x .30 x .78
D1900-100	100	20	100	.21 x .30 x .78
D8001	5	1	50	.21 x .30 x .78
D8004	10	2	100	.21 x .30 x .78
D8005	25	5	100	.21 x .30 x .78
D8007	30	6	100	.21 x .30 x .78

TAPPED DELAYS

Each line provides 10 tap delays spaced at equal intervals.



MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
D1511-1	10 Nsec	3 Nsec	100	Dual-In-Line Pin Spacing .21 x .39 x .7
D1511-2	20	6		
D1511-4	40	13		
D1511-6	60	20		
D1511-8	80	26		
D1511-10	100	33		

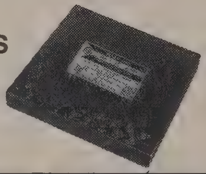
MINIATURE LUMPED CONSTANT

Hermetically sealed in a metal container. Delay tolerance ±5%. Temperature stability less than 50 PPM/°C, P.C. Mounting.

MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
D647-110	50 Nsec	12 Nsec	50	.30 x 1.0 x 1.25
D647-211	100	12.5	50	.30 x 1.0 x 2.45
D647-312	250	21	50	.30 x 1.0 x 3.45
D647-323	500	42	150	.30 x 1.0 x 3.45
D647-334	750	63	500	.30 x 1.0 x 3.45
D647-115	1,000	250	50	.30 x 1.0 x 1.25
D647-236	1,450	180	500	.30 x 1.0 x 2.45
D647-327	2,900	240	150	.30 x 1.0 x 3.45
D647-338	4,350	360	500	.30 x 1.0 x 3.45

ATC TRANSPONDER AND BEACON CODING DELAY LINES

Standard 1.45 μsec tap spacings plus other special delay points are provided. Hermetically sealed steel cased, plastic encapsulated and P.C. mounted units are offered.

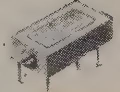


MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
D1560	10.15 μsec	.33 μsec	400	.55 x 2.25 x 3.62
D1365	20.3	.5	180	.87 x 3.5 x 3.5
D1000	20.3	.5	330	.35 x 2 x 4
D120	25.0	.55	180	.75 x 5 x 4.37
D298A	25.3	.6	500	1.62 x 2.87 x 4.25
D637	20.3	.3	180	2.37 x 2.75 x 3.18
D1190	20.3	.4	400	.63 x 4 x 5
D1191	24.65	.5	500	.63 x 4 x 5
D1210	8.0	.5	500	5 x 1 x 4

VARIABLE DELAY LINES

DUAL-IN-LINE COMPATIBLE VARIABLE DELAY LINES

Sealed in plastic case. Temp. coeff. less than 50 PPM/°C. .020″ P.C. mounting pins.



MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
V1570-1	0 - 10 Nsec	2 Nsec	100	.25 x .75 x 1.5
V1570-2	0 - 20	4	100	.25 x .75 x 1.5
V1570-3	0 - 40	8	100	.25 x .75 x 1.5
V1570-4	0 - 80	16	100	.25 x .75 x 1.5
V1570-5	0 - 160	32	200	.25 x .75 x 1.5
V1570-6	0 - 320	64	200	.25 x .75 x 1.5

MIL VERSION

Hermetically sealed in a metal case.

MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
V1768-1	0 - 10 Nsec	2 Nsec	100	.25 x .87 x 1.6
V1768-2	0 - 20	4	100	.25 x .87 x 1.6
V1768-3	0 - 40	8	100	.25 x .87 x 1.6

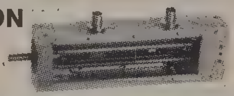
MINIATURE LUMPED VARIABLE Nanosecond Range

Hermetically sealed in a metal case. Lumped constant parameter. Temperature coefficient less than 50 PPM/°C. .030″ P.C. mounting pins.

MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
V447-1	0 - 55 Nsec	15 Nsec	150	.31 x 1 x 1.25
V447-2	0 - 100	30	50	.31 x 1 x 1.25
V447-3	0 - 150	25	150	.31 x 1 x 2.45
V447-4	0 - 250	30	50	.31 x 1 x 2.45
V447-5	0 - 300	30	150	.31 x 1 x 3.45
V447-6	0 - 500	60	50	.31 x 1 x 3.45

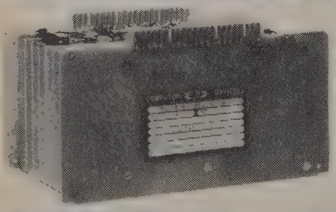
NOVEL INFINITE RESOLUTION

With input and output impedance of equal value. Voltage standing wave ratio less than ½ db to 45 MHz.



MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE OHMS	SIZE INCHES
DV575-1	2 - 25 Nsec	70 MHz	200	1 x 1.25 x 5.37
DV575-2	2 - 50	70	100	1 x 1.25 x 5.37
DV575-3	2 - 50	70	200	1 x 1.25 x 5.37
DV575-4	2 - 50	70	93	1 x 1.25 x 5.37
DV575-5	2 - 25	70	50	1 x 1.25 x 5.37
DV575-6	2 - 50	70	93	1 x 1.25 x 5.37

DELAY LINE COMPUTER MEMORIES DELCOMS



THE DELAY LINE COMPUTER MEMORY (DELCOM) offers the **Lowest Price Per Bit** of any high speed memory device. Computer Devices Corp. offers convenient standard packages for all practical storage capacities from 10 bits to 20,000 bits in single delay line units as well as multi delay line units with massive storage capacities. All Delcoms are compatible with DTL and T²L logic. Normal power requirements are +12 and −12 VDC and +5 VDC. However, Delcoms are tailored to your bit rate, delay, input-output logic and power requirements.

MANY OTHER MODELS AND SPECIALTY Delay Lines are available.
If exactly what you want is not listed, please call.

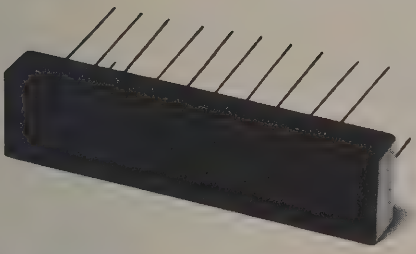
COMPUTER DEVICES CORP.
63 AUSTIN BOULEVARD COMMACK, N.Y. 11725
(516) 543-4220

Control Electronics
Military and Commercial
DELAY LINES

MINIATURE TAPPED DELAY LINES • MILITARY DELAY LINES • DISPERSIVE DELAY LINES • VARIABLE DELAY LINES TRANSPONDER DECODER NETWORKS • PRECISION AUDIO DELAY LINES • VARIABLE MAGLINES

MINIATURE TAPPED DELAY LINES

Compact packaging permits high delay-to-rise-time ratio at minimum cost.



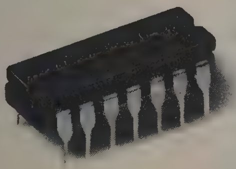
Delay μsec.	Bandwidth MHz	Impedance Range (Ohms)
0.05	72	50-100
0.1	36	50-200
0.2	18	50-200
0.3	12	50-500
0.4	9	50-500
0.5	7.2	50-500
0.6	6	50-500
0.7	5	100-500
0.8	4.5	100-500
0.9	4	100-1000
1.0	3.6	100-1000
2.0	1.8	100-1000
3.0	1.2	100-1000
4.0	.9	100-1000
5.0	.72	100-1000
6.0	.6	100-1000
7.0	.5	100-1000
8.0	.45	100-1000
9.0	.4	100-1000
10.0	.36	100-1000

SPECIFICATIONS

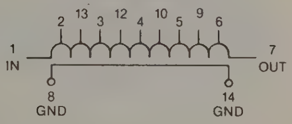
Delay Tolerance:	±3% or ±.01 μsec
Taps:	10, equally spaced
Temperature Coefficient:	50 ppm/°C
Rise Time Ratio:	10:1
Temperature Range:	−50°C to +25°C
Test Voltage:	300 VDC
Working Voltage:	100 VDC
Leads:	#22 AWG tinned copper or brass
Dimensions:	3″L x .5″W x .4″H

MILITARY DELAY LINES

Series MIL-23 Low Profile to MIL-D-23859/23



SCHEMATIC



Total Td ns	Rise Time max (ns)	P/N M23859/23- Impedance ±10%		
		50 Ω	100Ω	200Ω
20	5.5	004	104	
25	6	005	105	
30	6.5	006	106	
35	7	007	107	
40	8	008	108	208
45	9	009	109	209
50	10	010	110	210
55	11	011	111	211
60	12	012	112	212
65	13	013	113	213
70	14	014	114	214
75	15	015	115	215
80	16	016	116	216
85	17	017	117	217
90	18	018	118	218
95	19	019	119	219
100	20	020	120	220
110	22	021	121	221
120	24	022	122	222
130	26	023	123	223
140	28	024	124	224
150	30	025	125	225
160	32	026	126	226
170	34	027	127	227
180	36	028	128	228
190	38	029	129	229
200	40	030	130	230
210	45		131	231
220	45		132	232
230	50		133	233
240	50		134	234
250	50		135	235
260	55		136	236
270	55		137	237
280	60		138	238
290	60		139	239
300	60		140	240
310	65		141	241
320	65		142	242
330	70		143	243
340	70		144	244
350	70		145	245
360	75		146	246
370	75		147	247
380	80		148	248
390	80		149	249
400	80		150	250

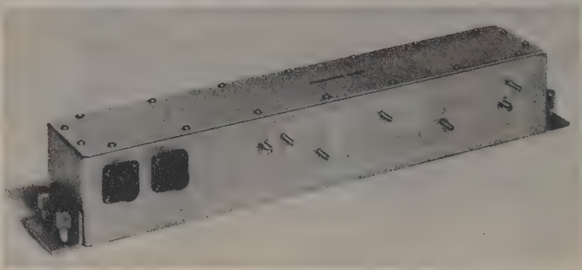
SPECIFICATIONS

Total Time Delay Tolerance:	±2 ns below 40 ns Delay ±5% above 40 ns Delay
No. of Taps:	10
Distortion:	±10% max
Attenuation:	10% max
Temperature Coefficient:	100 ppm/°C max
Temperature Range:	−55°C to +125°C
Dielectric Strength:	50 VDC
Environmental Conditions:	per MIL-D-23859/23
Dimensions:	14 PIN, .750″L x .300″W x .187″H

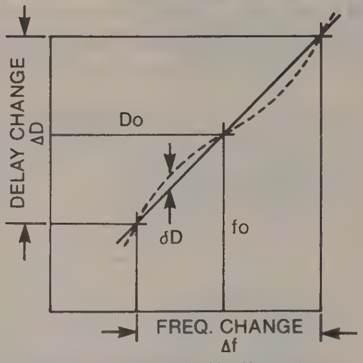
Control Electronics Co., Inc.

107 Allen Boulevard, Farmingdale, N.Y. 11735 • (516) 694-0125

DISPERSIVE DELAY LINES



SERIES DDL Delay varies with frequency. Prime application is in Pulse Compression Radar Systems to eliminate large, expensive filter components. Compression Ratios to 240:1. Units are lightweight, and offer increased radar range and better radar resolution at lower peak power than available without dispersive lines. Units can be housed in hermetically sealed oven assemblies, providing extremely stable performance over the full MIL environment.



Definition of Dispersive Delay Line Nomenclature

DELAY DISPERSION shows delay change versus frequency relationships for the ideal delay line with typical deviations from the ideal condition. The graph is helpful in analyzing the delay line specifications shown in the chart. Each column of specifications is for a specific delay line built & tested. Below are some definitions of terms used:

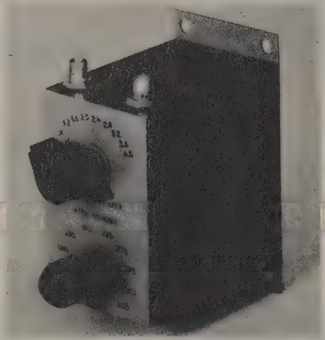
$\Delta D \bullet \Delta f$ = COMPRESSION RATIO OR DISPERSION FACTOR
$\frac{\Delta f}{fo}$ = BANDWIDTH %
fo = MIDBAND FREQUENCY
Do = MIDBAND DELAY

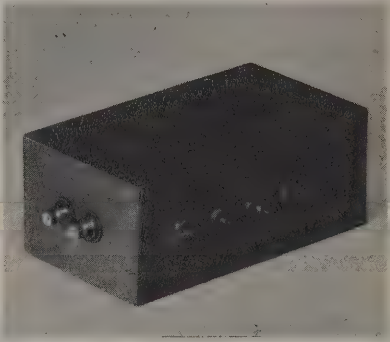
Part Number	Compression Ratio	Bandwidth MHz	Delay Change μsec	Midband Frequency MHz	Bandwidth %	Midband Delay μsec	Spurious Signals dB	Delay Linearity %	Insertion Loss dB	VSWR
DDL-100-1.67	100	1.67	60	15	11	150	35	2	35	2:1 max.
DDL-120-3	120	3	40	30	10	100	35	2	35	2:1 max.
DDL-150-3	150	3	50	30	10	140	30	4	40	2:1 max.

VARIABLE DELAY LINES

V1434

Sectional tap
with discrete
calibrated delays.





V1703

Unique calibrated
switched line,
in and out.

Model	Delay Adjustment	Rise Time	Adjustment Resolution	Impedance (Ohms)	Comments
VR903	0 to 950 nsec	90 nsec	1.5 nsec	500	Note 1
V1254	0-176 nsec	10 nsec	10 nsec	95	Notes 4 & 5 5 switches
V1434	0 to 4.4 μsec	0.2 μsec	.045 μsec	100	Notes 2 & 5
V1535	0 to 1280 nsec	25 nsec	2.5 nsec	95	Notes 4 & 5 9 switches
V1554	2 to 6.4 μsec	0.25 μsec	.045 μsec	100	Notes 2 & 5
V1611	10 to 150 nsec	15 nsec	.25 nsec	200	Note 1
V1702	0 to 200 nsec	10 nsec	10 nsec	95	Note 3 & 5
V1703	0 – 200 nsec	10 nsec	10 nsec	95	Notes 4 & 5 5 switches
V1743	100-250 nsec	20 nsec	10 nsec	500	Notes 4 & 5 4 switches

NOTES

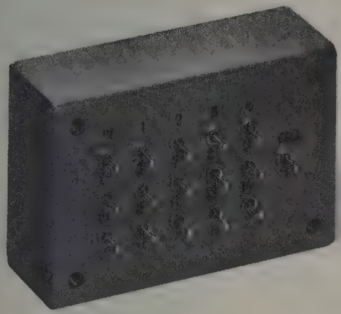
1. Continuously variable output, high impedance tap.
2. Variable output via a coarse control 10 steps of 0.4 μsec and a fine control of 10 steps of .045 μsec.
3. Delay adjustment programmable by remote control.
4. Variable output via discrete screw driver slotted switches.
5. No high impedance tap necessary.

Control Electronics Co., Inc.

107 Allen Boulevard, Farmingdale, N.Y. 11735 • (516) 694-0125

TRANSPONDER DECODER NETWORKS

Series F-848A High density, solid circuit, lumped-element lines with taps every 1.45 μsec.



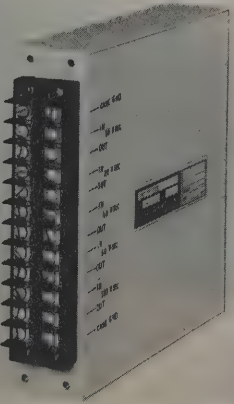
Extensive experience in dense packaging and in building delay lines for critical applications enables Control Electronics to offer a truly infinite number of custom-made delay lines. Rather than try to list all these custom delay units already constructed, we suggest you contact the factory directly. A "typical" custom delay line, as pictured, is a highly stable, accurate multi-tapped unit meeting full MIL specifications.

SPECIFICATIONS

Delay:	To 20.3 μsec
Taps:	Every 1.45 ± 0.05 μsec
Distortion:	Less than 10%
Attenuation:	Less than 4dB
Temperature Coefficient:	55 ppm/°C
Rise Time:	0.4 μsec, max
Impedance:	470 ohms
Connector:	Wire Terminals
Dimensions:	3″L x 2″W x 1″H

For Part Number, add delay in μsec to Series Number.
Example: For 21.85 μsec, P/N is F-848A-21.85.

PRECISION AUDIO DELAY LINES



Over the years Control Electronics has developed a special skill in precise audio delay lines, including sectional balanced and unbalanced units ranging into the millisecond region. The sectional line terminals are arranged so as to conveniently enable the user to externally connect and disconnect the various sections for proper delay.

Model	Total Delay μsec	Tol. %	Impedance (Ohms)	3 dB Bandwidth KHz	Dimensions (Inches)
F344	74.60	1	1170	25	4x2.31x1.31
F416	1700	1	1000	6	10x5x5
F483	1000	1	600*	15	19x3$\frac{15}{32}$x5½ Rack Mounted
FA784	5000	1	600*	5	19x5¼x10 Rack Mounted
FA573	25,000	1	1000	1	19x5¼x10 Rack Mounted
FA1772	10, 20, 40, 60, 100	3	600*	10	6½x6¾x2
FA1787	40, 80, 160, 320, 640	3	600*	10	6½x15x2¾
FA1812	50, 100, 200, 200	3	600*	10	6x5x3
FA1839	50, 100, 200 200 (6 sets)	3	600*	10	5¼ Rack Mounted
FA1840	50, 100, 200 200 (3 sets) + 1100	3	600*	10	5¼ Rack Mounted

*Balanced

VARIABLE MAGLINES

SPECIFICATIONS

Delay Range:	3 to 4000 μsec
Impedance Range:	50 ohms to 4K ohms
Min. Pulse Spacing:	3 μsec
Output when driven with 15 V Pk. — 1 μsec pulse:	10 mv
Turns for Full Delay:	28
Dimensions:	9″ OD x 3⅝″L
Weight:	5 lbs.

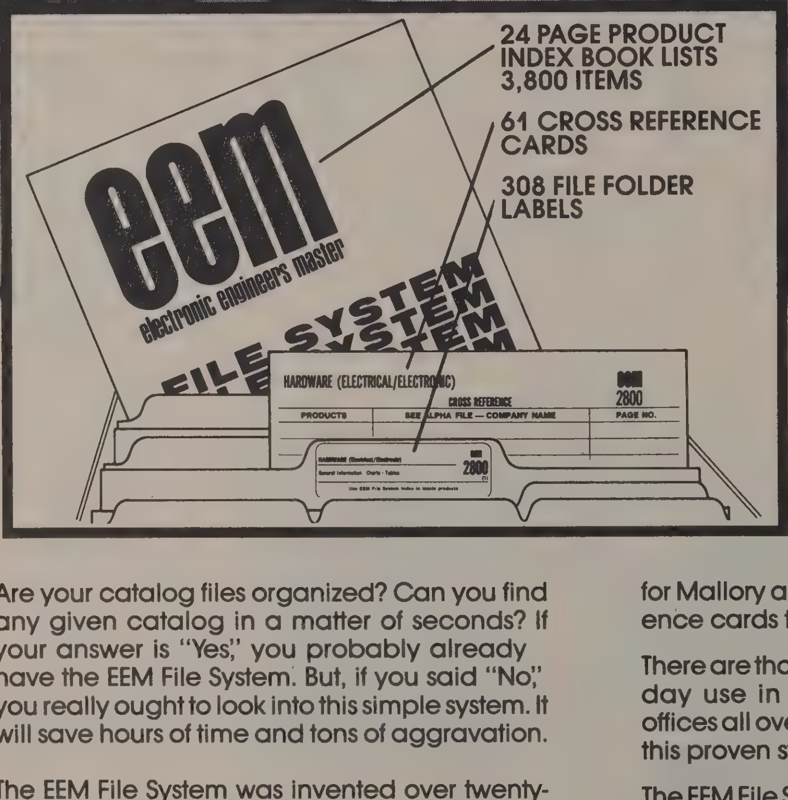
Model VM 1080

Control Electronics Co., Inc.

107 Allen Blvd., Farmingdale, N.Y. 11735 (516) 694-0125

An Atrium Industries Inc. Company

atrium industries


24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
eem
2800

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

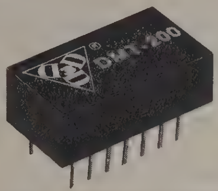
SHORT FORM CATALOG NO. 84

Call or write for a complete catalog of our products.

data delay devices, inc.®

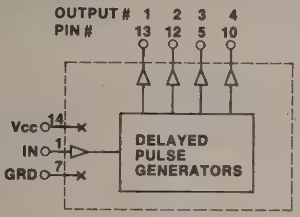
DRAM TIMER

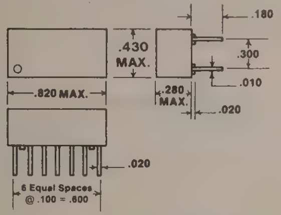
SERIES DMT-200 (TTL Interfaced) 14 pins DIP

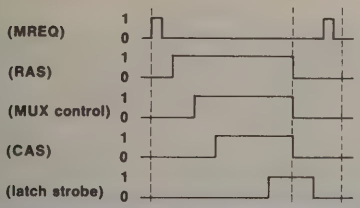


Specifications

- **Input requirement:** TTL logic, rising-edge triggered.
- **Input pulse width:** 10 NS typ.
- **Output fan-out:** TTL Schottky load.
- **Time delay tolerance:** ±5% or 2 NS whichever is greater.
- **Supply voltage (Vcc):** 5 Vdc ±5%.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** 740 MW max.


OUTPUT # 1 2 3 4
PIN # 13 12 5 10
Vcc 14
IN 1
GRD 7
DELAYED PULSE GENERATORS


.180
.430 MAX.
.300
.010
.820 MAX.
.280 MAX.
.020
.020
6 Equal Spaces @ .100 = .600

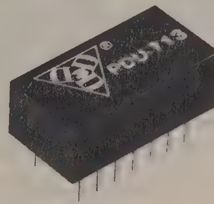

(MREQ)
(RAS)
(MUX control)
(CAS)
(latch strobe)
1
0

Part No.	Output 1 (RAS) LE	Output 1 (RAS) TE	Output 2 (MUX control) LE	Output 2 (MUX control) TE	Output 3 (CAS) LE	Output 3 (CAS) TE	Output 4 (Latch Strobe) LE	Output 4 (Latch Strobe) TE
DMT-201-1	15	190	40	190	65	190	140	190
DMT-201-2	15	165	40	165	65	165	115	215
DMT-201-3	15	190	40	190	65	190	190	240
DMT-201-4	15	215	40	215	65	215	165	265
DMT-201-5	15	265	40	265	115	265	215	315
DMT-201-6	15	215	40	215	65	215	165	335
DMT-201-7	15	165	30	165	50	165	115	265
DMT-201-8	15	135	30	135	50	135	85	235
DMT-201-9	15	275	40	275	65	275	220	370
DMT-202-1	15	265	65	265	90	265	215	315
DMT-202-2	15	290	65	290	115	290	240	340
DMT-202-3	15	315	65	315	140	315	265	365
DMT-203-1	25	300	75	300	125	300	250	350
DMT-203-2	25	500	75	500	125	500	450	550
DMT-203-3	25	500	75	500	150	500	400	500

1. All timing above in NS.
2. Many more customized designs available upon request.

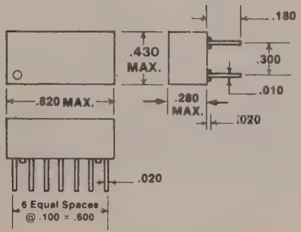
DIGITALLY PROGRAMMABLE DELAY LINES

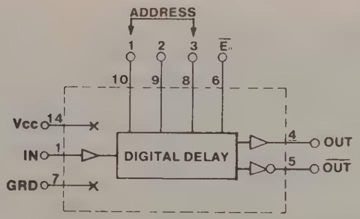
SERIES PDU-713 (TTL Interfaced) 3 BIT



Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Delay variation:** Monotonic in one direction.
- **Total programmed delay tolerance:** 5% or 1 NS whichever is greater.
- **Inherent delay:** 14 NS on pin 4, 11 NS on pin 5 } typical
- **Operating temperature:** 0° to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage Vcc:** 5 Vdc ± 5%.
- **Power dissipation:** 740 MW max.


.180
.430 MAX.
.300
.010
.820 MAX.
.280 MAX.
.020
.020
6 Equal Spaces @ .100 = .600


ADDRESS
1 2 3 E
10 9 8 6
Vcc 14
IN 1
GRD 7
DIGITAL DELAY
4 OUT
5 OUT

TRUTH TABLE

$\overline{\text{Enable}}$	Address (Bit No.) 3	Address (Bit No.) 2	Address (Bit No.) 1	Delay Out
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_1
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	ϕ	ϕ	ϕ	0

1 = High
0 = Low
ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

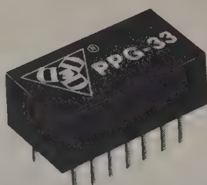
Part Number	Incremental Delay Per Step	Total Delay* Change	Part Number	Incremental Delay Per Step	Total Delay* Change
PDU-713-.5	.5 NS ± .3 NS	3.5NS	PDU-713-10	10 NS ± 1.0 NS	70 NS
PDU-713-1	1 NS ± .4 NS	7 NS	PDU-713-15	15 NS ± 1.3 NS	105 NS
PDU-713-2	2 NS ± .4 NS	14 NS	PDU-713-20	20 NS ± 1.5 NS	140 NS
PDU-713-3	3 NS ± .5 NS	21 NS	PDU-713-40	40 NS ± 2.0 NS	280 NS
PDU-713-5	5 NS ± .6 NS	35 NS	PDU-713-50	50 NS ± 2.5 NS	350 NS

*This delay value does not include T_0 delay.

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

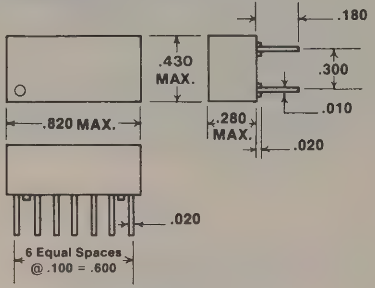
DIGITALLY PROGRAMMABLE PULSER

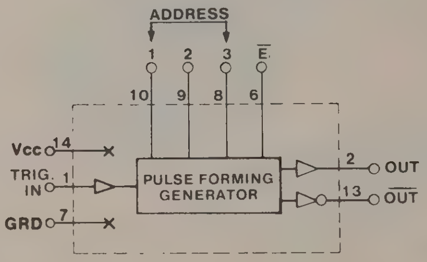
SERIES PPG-33
(TTL Interfaced)
3 BIT



Specifications

- **Input requirements:** TTL logic, rising-edge triggered.
- **Input pulse width:** 6 NS min.
- **Output fan-out:** TTL Schottky load.
- **Programmed pulse-width tolerance:** ±5% or 1 NS.
- **Supply voltage (Vcc):** 5 Vdc ±5%.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** 740 MW max.


.180
.430 MAX.
.300
.010
.820 MAX.
.280 MAX.
.020
.020
6 Equal Spaces @ .100 = .600


ADDRESS
1
2
3
E
10
9
8
6
Vcc 14
TRIG. IN 1
GRD 7
PULSE FORMING GENERATOR
2 OUT
13 OUT

TRUTH TABLE

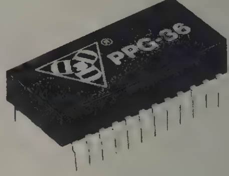
Enable	Address (Bit No.) 3	2	1	Pulse Width Out
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_3
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	ϕ	ϕ	ϕ	0

1 = High
0 = Low
ϕ = Don't care
T_0 = Reference or inherent pulse width.
T_1 to T_7 = Multiplier of pulse width.

Part Number	Incremental Pulse Width Per Step	Total Pulse Width Change
PPG-33-1	1 NS ± .4 NS	7 NS
PPG-33-2	2 NS ± .4 NS	14 NS
PPG-33-3	3 NS ± 5 NS	21 NS
PPG-33-5	5 NS ± 6 NS	35 NS
PPG-33-10	10 NS ±1.0 NS	70 NS
PPG-33-15	15 NS ±1.3 NS	105 NS
PPG-33-20	20 NS ±1 5 NS	140 NS
PPG-33-40	40 NS ±2.0 NS	280 NS
PPG-33-50	50 NS ±2.5 NS	350 NS

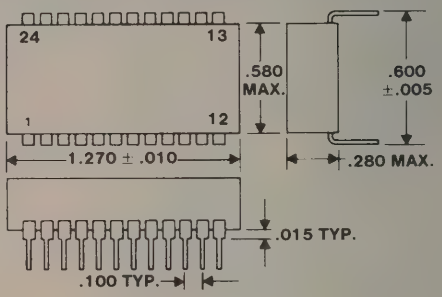
Contact us for specific requirements. We customize.

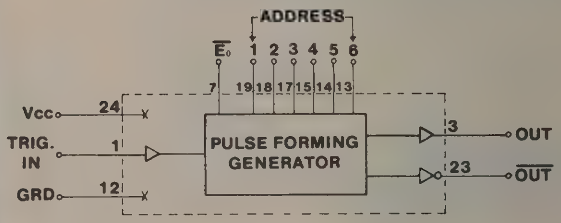
SERIES: PPG-36
(TTL Interfaced)
6 BIT



Specifications:

- **Input signal requirement:** TTL rising-edge.
- **Output fan-out:** TTL Schottky load.
- **Trigger inherent delay:** 6 NS Typ.
- **Inherent pulse-width:** 11 NS Typ.
- **Pulse-width variation:** monotonic in one direction.
- **Programmed pulse-width tolerance:** ±5% or 1 NS whichever is greater.
- **Supply voltage:** 5 Vdc.
- **Operating temperature:** 0° C to 70° C.
- **Temperature coefficient:** 100 PPM/° C.
- **Power dissipation:** 900 MW Typ.


24
13
1
12
.580 MAX.
.600 ±.005
1.270 ± .010
.280 MAX.
.015 TYP.
.100 TYP.


ADDRESS
E0
1
2
3
4
5
6
7
19
18
17
15
14
13
Vcc 24
TRIG. IN 1
GRD 12
PULSE FORMING GENERATOR
3 OUT
23 OUT

TRUTH TABLE

Address (Bit No.) 6	5	4	3	2	1	Enable ($\overline{E_0}$)	Pulse-Width Out
0	0	0	0	0	0	0	T_0
0	0	0	0	0	1	0	T_1
0	0	0	0	1	0	0	T_2.
0	0	0	0	1	1	0	T_3
0	0	0	1	0	0	0	T_4
0	0	0	1	1	1	0	T_7
0	0	1	0	0	0	0	T_8
0	0	1	1	1	1	0	T_{15}
0	1	0	0	0	0	0	T_{16}
0	1	1	1	1	1	0	T_{31}
1	0	0	0	0	0	0	T_{32}
1	1	1	1	1	1	0	T_{63}
ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	1	0

0 = Logic 0   1 = Logic 1   ϕ = Don't care.
T_0 = Reference or inherent pulse-width of unit.
T_1 — T_{63} = Multiplier of incremental pulse-width.

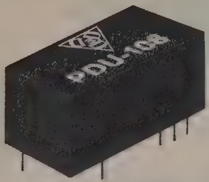
Part No.	Incremental Pulse-Width	Total Programmed Pulse-Width	Part No.	Incremental Pulse-Width	Total Programmed Pulse-Width
PPG-36-1	1 NS ± .5 NS	63 NS	PPG-36-6	6 NS ±1.5 NS	378 NS
PPG-36-2	2 NS ± .5 NS	126 NS	PPG-36-7	7 NS ±1.5 NS	441 NS
PPG-36-3	3 NS ±1.0 NS	189 NS	PPG-36-8	8 NS ±2.0 NS	504 NS
PPG-36-4	4 NS ±1.0 NS	252 NS	PPG-36-9	9 NS ±2.0 NS	567 NS
PPG-36-5	5 NS ±1.5 NS	315 NS	PPG-36-10	10 NS ±2.0 NS	630 NS

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

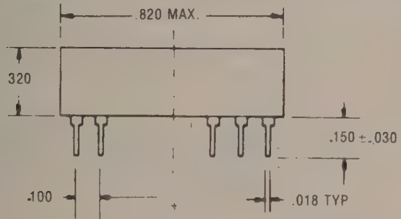
DIGITALLY PROGRAMMABLE DELAY LINES

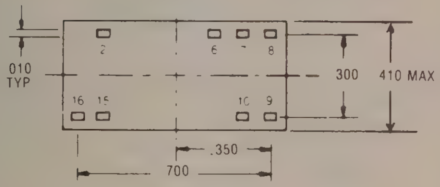
SERIES PDU-108
(ECL Interfaced)
3 BIT

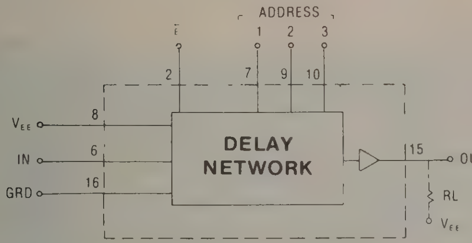


Specifications

- **Operating temperature:** 0° to 70°C.
- **Storage temperature:** −55° to +125°C.
- **Power dissipation:** 290 MW typ. (no load).
- **Temperature coefficient:** 100 PPM/°C
- **Delay variation:** Monotonic in one direction.
- **Total delay tolerance:** ±5% or 1 NS whichever is greater.
- **Inherent delay:** 5 NS typ.


.820 MAX.
320
.150 ±.030
.100
.018 TYP


010 TYP
2
6
7
8
16
15
10
9
300
410 MAX
.350
700


ADDRESS
E
1
2
3
2
7
9
10
V_EE
8
IN
6
GRD
16
DELAY NETWORK
15
OUT
RL
V_EE

TRUTH TABLE

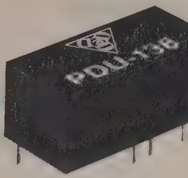
$\overline{\text{Enable}}$	Address (Bit No.)			Delay Out
	3	2	1	
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_3
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	ϕ	ϕ	ϕ	0

1 = High
0 = Low
ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

Part No.**	Min. Delay Increment	Total Delay* Change	Part No.**	Min. Delay Increment	Total Delay* Change
PDU-108.5	.5 NS ± .3 NS	3.5 NS	PDU-108-10	10 NS ± 1.0 NS	70 NS
PDU-108-1	1 NS ± .4 NS	7 NS	PDU-108-20	20 NS ± 1.5 NS	140 NS
PDU-108-2	2 NS ± .4 NS	14 NS	PDU-108-40	40 NS ± 2.0 NS	280 NS
PDU-108-3	3 NS ± .5 NS	21 NS	PDU-108-50	50 NS ± 2.5 NS	350 NS
PDU-108-5	5 NS ± .6 NS	35 NS			

*This delay value does not include the T_0 delay.
**Other delay increments available on request.

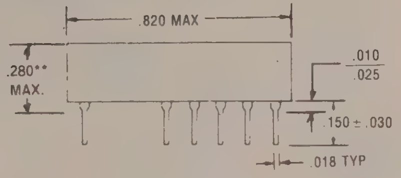
SERIES PDU-138
(TTL Interfaced)
3 BIT

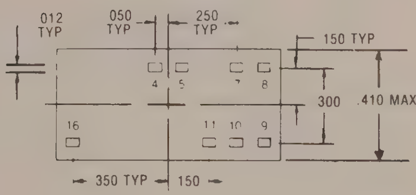


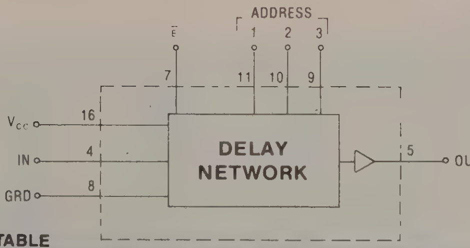
Specifications:

- **Supply voltage V_{CC}:** 4.75 to 5.25 V_{DC}
- **Operating temperature:** 0-70°C. (−55°C to +125°C on request)*
- **Inherent delay:** 7 NS ±1 NS.
- **Temperature coefficient:** 100 PPM/°C.
- **Delay variation:** Monotonic in one direction.
- **Total delay tolerance:** ±5% or 1 NS whichever is greater.

***Add "M" after PART NO. Example PDU-138-2M**
****.320 Max. for "M" Units**


.820 MAX
.280** MAX.
.010
.025
.150 ± .030
.018 TYP


012 TYP
050 TYP
250 TYP
150 TYP
4
5
7
8
300
.410 MAX
16
11
10
9
350 TYP
150


ADDRESS
E
1
2
3
7
11
10
9
V_CC
16
IN
4
GRD
8
DELAY NETWORK
5
OUT

TRUTH TABLE

$\overline{\text{Enable}}$	Address (Bit No.)			Delay Out
	3	2	1	
0	0	0	0	T_0
0	0	0	1	T_1
0	0	1	0	T_2
0	0	1	1	T_3
0	1	0	0	T_4
0	1	0	1	T_5
0	1	1	0	T_6
0	1	1	1	T_7
1	ϕ	ϕ	ϕ	0

1 = High
0 = Low
ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

Part ** Number	Incremental Delay Per Step	Total Delay* Change	Part ** Number	Incremental Delay Per Step	Total Delay* Change
PDU-138-.5	.5 NS ± .3 NS	3.5 NS	PDU-138-10	10 NS ± 1.0 NS	70 NS
PDU-138-1	1 NS ± .4 NS	7 NS	PDU-138-15	15 NS ± 1.3 NS	105 NS
PDU-138-2	2 NS ± .4 NS	14 NS	PDU-138-20	20 NS ± 1.5 NS	140 NS
PDU-138-3	3 NS ± .5 NS	21 NS	PDU-138-40	40 NS ± 2.0 NS	280 NS
PDU-138-5	5 NS ± .6 NS	35 NS	PDU-138-50	50 NS ± 2.5 NS	350 NS

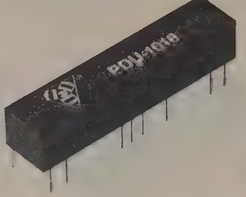
*This delay value does not include the T_0 delay.
** Other delay increments available on request.

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

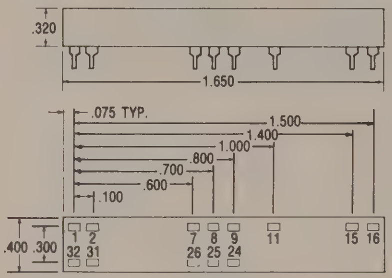
DIGITALLY PROGRAMMABLE DELAY LINES

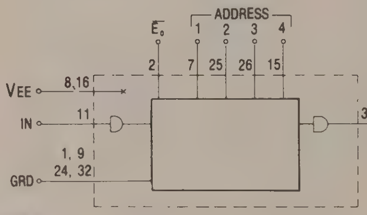
SERIES PDU-1016 (ECL Interfaced) 4-BIT



Specifications

- **Input signal requirement:** ECL logic.
- **Output fan-out:** ECL loads.
- **Delay variation:** Monotonic in one direction.
- **Delay tolerance:** ± 5% or 1 NS whichever is greater.
- **Inherent delay:** 11 NS ± 1 NS for PDU-1016 -1 thru -5. Greater for rest of Part Numbers.
- **Temperature range:** 0-70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage:** -5 Vdc.
- **Power dissipation:** 615 MW typ.





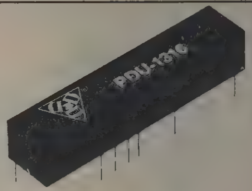
TRUTH TABLE

Enable (Eo)	Address (Bit No.)				Delay Out
	4	3	2	1	
0	0	0	0	0	T_0
0	0	0	0	1	T_1
0	0	0	1	0	T_2
0	0	0	1	1	T_3
0	0	1	0	0	T_4
0	0	1	0	1	T_5
0	0	1	1	0	T_6
0	0	1	1	1	T_7
0	1	0	0	0	T_8
0	1	0	0	1	T_9
0	1	0	1	0	T_{10}
0	1	0	1	1	T_{11}
0	1	1	0	0	T_{12}
0	1	1	0	1	T_{13}
0	1	1	1	0	T_{14}
0	1	1	1	1	T_{15}
1	ϕ	ϕ	ϕ	ϕ	0

0 = Logic 0
1 = Logic 1
ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{15} = Multiplier of incremental delay.

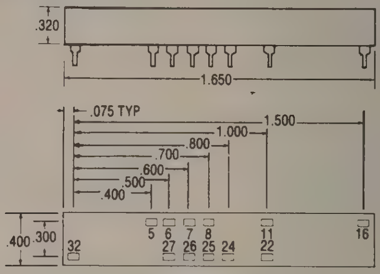
Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-1016-1	1	15	PDU-1016-20	20	300
PDU-1016-2	2	30	PDU-1016-25	25	375
PDU-1016-3	3	45	PDU-1016-30	30	450
PDU-1016-4	4	60	PDU-1016-35	35	525
PDU-1016-5	5	75	PDU-1016-40	40	600
PDU-1016-6	6	90	PDU-1016-45	45	675
PDU-1016-8	8	120	PDU-1016-50	50	750
PDU-1016-10	10	150	PDU-1016-60	60	900
PDU-1016-12	12	180	PDU-1016-80	80	1,200
PDU-1016-15	15	225	PDU-1016-100	100	1,500

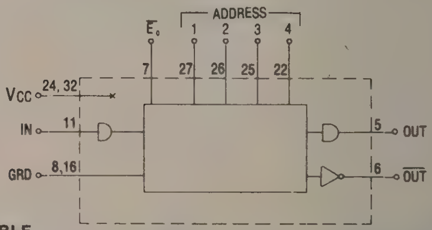
SERIES PDU-1316 (TTL Interfaced) 4 BIT



Specifications

- **Input signal requirements:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Delay variation:** Monotonic in one direction.
- **Delay tolerance:** ± 5% or 1 NS whichever is greater.
- **Inherent delay:** 19 NS ± 1 NS on pin 5, 15 NS ± 1 NS on pin 6 } for PDU-1316 -1 thru -10. Greater for rest of Part Numbers
- **Temperature range:** 0-70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Power dissipation:** 740 MW Max.





TRUTH TABLE

Enable $\overline{\text{(Eo)}}$	Address (Bit No.)				Delay Out
	4	3	2	1	
0	0	0	0	0	T_0
0	0	0	0	1	T_1
0	0	0	1	0	T_2
0	0	0	1	1	T_3
0	0	1	0	0	T_4
0	0	1	0	1	T_5
0	0	1	1	0	T_6
0	0	1	1	1	T_7
0	1	0	0	0	T_8
0	1	0	0	1	T_9
0	1	0	1	0	T_{10}
0	1	0	1	1	T_{11}
0	1	1	0	0	T_{12}
0	1	1	0	1	T_{13}
0	1	1	1	0	T_{14}
0	1	1	1	1	T_{15}
1	ϕ	ϕ	ϕ	ϕ	0

0 = Logic 0
1 = Logic 1
ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{15} = Multiplier of incremental delay.

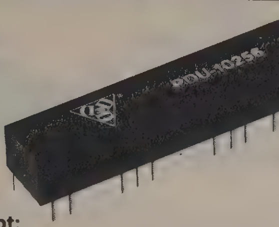
Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-1316-1	1	15	PDU-1316-20	20	300
PDU-1316-2	2	30	PDU-1316-25	25	375
PDU-1316-3	3	45	PDU-1316-30	30	450
PDU-1316-4	4	60	PDU-1316-35	35	525
PDU-1316-5	5	75	PDU-1316-40	40	600
PDU-1316-6	6	90	PDU-1316-45	45	675
PDU-1316-8	8	120	PDU-1316-50	50	750
PDU-1316-10	10	150	PDU-1316-60	60	900
PDU-1316-12	12	180	PDU-1316-80	80	1,200
PDU-1316-15	15	225	PDU-1316-100	100	1,500

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

DIGITALLY PROGRAMMABLE DELAY LINES

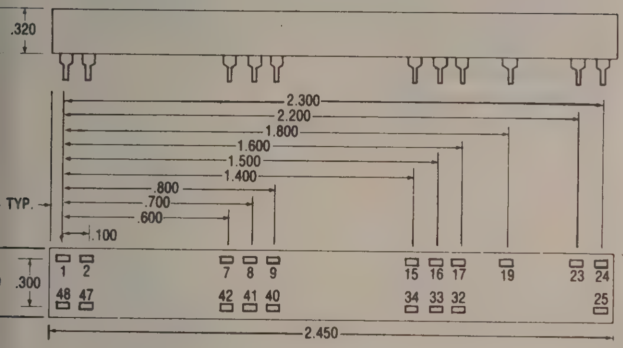
SERIES PDU-10256 (ECL Interfaced) 8-BIT

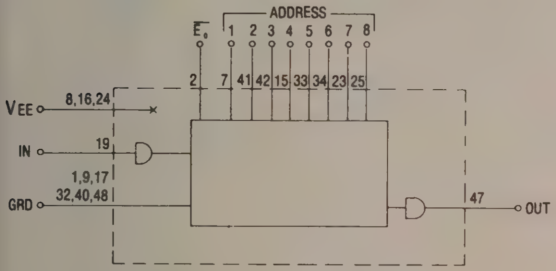


Specifications

Same as PDU-1016 except:

- **Inherent delay:** 16 NS typ.
- **Power dissipation:** 925 MW typ.


.320
2.300
2.200
1.800
1.600
1.500
1.400
.800
.700
.600
.100
TYP.
.300
1 2 7 8 9 15 16 17 19 23 24
48 47 42 41 40 34 33 32 25
2.450


ADDRESS
$\overline{E}_0$ 1 2 3 4 5 6 7 8
2 7 41 42 15 33 34 23 25
VEE 8,16,24
IN 19
1,9,17
GRD 32,40,48
47 OUT

TRUTH TABLE

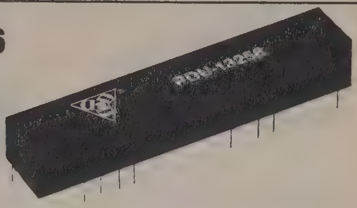
Address (Bit No.)								Enable (E_0)	Delay Out
8	7	6	5	4	3	2	1		
0	0	0	0	0	0	0	0	0	T_0
0	0	0	0	0	0	0	1	0	T_1
0	0	0	0	0	0	1	0	0	T_2
0	0	0	0	0	0	1	1	0	T_3
0	0	0	0	0	1	0	0	0	T_4
0	0	0	0	0	1	1	1	0	T_7
0	0	0	0	1	0	0	0	0	T_8
0	0	0	0	1	1	1	1	0	T_{15}
0	0	0	1	0	0	0	0	0	T_{16}
0	0	0	1	1	1	1	1	0	T_{31}
0	0	1	0	0	0	0	0	0	T_{32}
0	0	1	1	1	1	1	1	0	T_{63}
0	1	0	0	0	0	0	0	0	T_{64}
0	1	1	1	1	1	1	1	0	T_{127}
1	0	0	0	0	0	0	0	0	T_{128}
1	1	1	1	1	1	1	1	0	T_{255}
ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	1	0

0 = Logic 0 1 = Logic 1 ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{255} = Multiplier of incremental delay.

Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-10256-1	1	255	PDU-10256-6	6	1,530
PDU-10256-2	2	510	PDU-10256-7	7	1,785
PDU-10256-3	3	765	PDU-10256-8	8	2,040
PDU-10256-4	4	1,020	PDU-10256-9	9	2,295
PDU-10256-5	5	1,275	PDU-10256-10	10	2,550

NOTE: For the sake of simplicity all 256 programmable steps are not shown in this truth table.

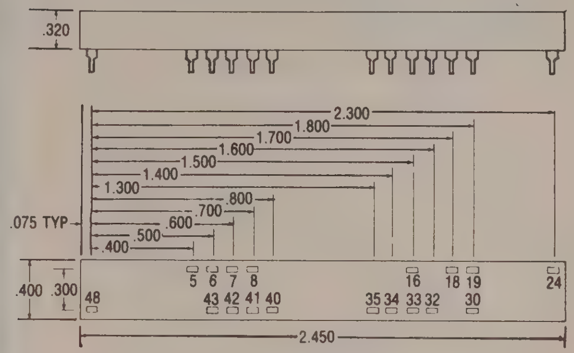
SERIES PDU-13256 (TTL Interfaced) 8-BIT

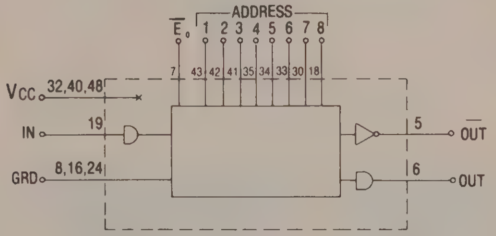


Specifications

Same as PDU-1316 except:

- **Inherent delay:** 44 NS on pin 6 } typ
  45 NS on pin 5 }
- **Power dissipation:** 1.1 W Max.


.320
2.300
1.800
1.700
1.600
1.500
1.400
1.300
.800
.700
.600
.500
.400
.075 TYP
.400
.300
48
5 6 7 8
43 42 41 40
16
18 19
24
35 34 33 32
30
2.450


ADDRESS
$\overline{E}_0$ 1 2 3 4 5 6 7 8
7 43 42 41 35 34 33 30 18
VCC 32,40,48
IN 19
GRD 8,16,24
5 $\overline{OUT}$
6 OUT

TRUTH TABLE

Address (Bit No.)								Enable (E_0)	Delay Out
8	7	6	5	4	3	2	1		
0	0	0	0	0	0	0	0	0	T_0
0	0	0	0	0	0	0	1	0	T_1
0	0	0	0	0	0	1	0	0	T_2
0	0	0	0	0	0	1	1	0	T_3
0	0	0	0	0	1	0	0	0	T_4
0	0	0	0	0	1	1	1	0	T_7
0	0	0	0	1	0	0	0	0	T_8
0	0	0	0	1	1	1	1	0	T_{15}
0	0	0	1	0	0	0	0	0	T_{16}
0	0	0	1	1	1	1	1	0	T_{31}
0	0	1	0	0	0	0	0	0	T_{32}
0	0	1	1	1	1	1	1	0	T_{63}
0	1	0	0	0	0	0	0	0	T_{64}
0	1	1	1	1	1	1	1	0	T_{127}
1	0	0	0	0	0	0	0	0	T_{128}
1	1	1	1	1	1	1	1	0	T_{255}
ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	1	0

0 = Logic 0 1 = Logic 1 ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{255} = Multiplier of incremental delay.

Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-13256-1	1	255	PDU-13256-6	6	1,530
PDU-13256-2	2	510	PDU-13256-7	7	1,785
PDU-13256-3	3	765	PDU-13256-8	8	2,040
PDU-13256-4	4	1,020	PDU-13256-9	9	2,295
PDU-13256-5	5	1,275	PDU-13256-10	10	2,550

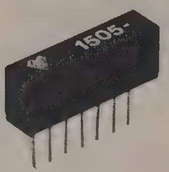
NOTE: For the sake of simplicity all 256 programmable steps are not shown in this truth table.

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

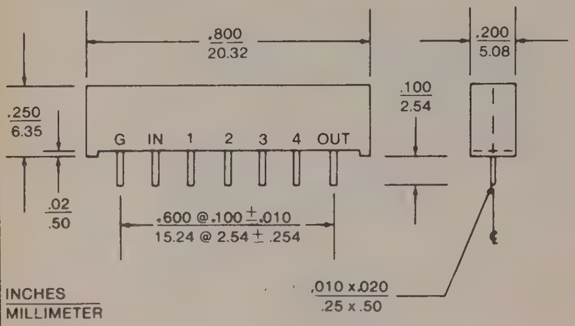
SIP-TAPPED DELAY LINES

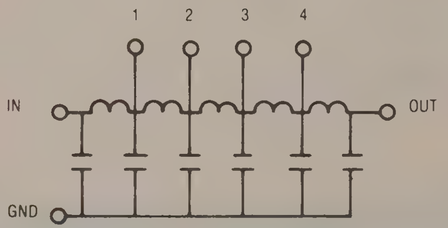
SERIES 1505
5 Taps,
7 Pins SIP



Specifications

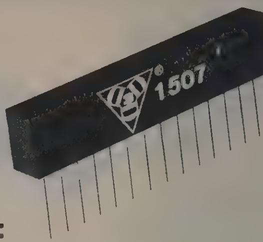
- **Low profile**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** -55°C to +125°C.
- **Storage temperature range:** -55°C to +125°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%


.800
20.32
.200
5.08
.100
2.54
.250
6.35
G IN 1 2 3 4 OUT
.02
.50
.600 @ .100 ± .010
15.24 @ 2.54 ± .254
.010 x .020
.25 x .50
INCHES
MILLIMETER


1
2
3
4
IN
OUT
GND

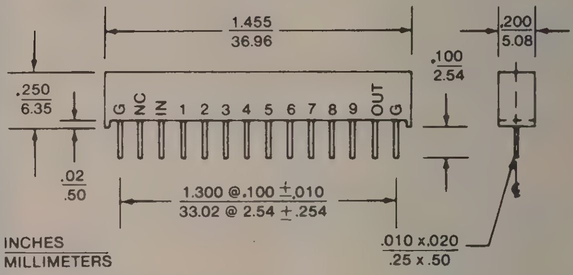
Part No.	Total Delay (NS)	Inp. (Ω)	Rdc (Ω)	Delay Per. Tap (NS)	Rise Time (NS)
1505-5A	5 ± 1.0	50	.6	1 ± .3	2.0
1505-10A	10 ± 1.0	50	.6	2 ± .4	3.0
1505-20A	20 ± 1.5	50	.7	4 ± .6	6.0
1505-30A	30 ± 2.0	50	.7	6 ± 1.0	9.0
1505-40A	40 ± 2.5	50	.9	.8 ± 1.5	12.0
1505-50A	50 ± 3.0	50	1.0	10 ± 1.8	15.0
1505-60A	60 ± 3.0	50	1.2	12 ± 2.0	18.0
1505-70A	70 ± 3.5	50	1.4	14 ± 2.0	21.0
1505-80A	80 ± 4.0	50	1.6	16 ± 2.0	24.0
1505-90A	90 ± 5.0	50	1.8	18 ± 3.0	27.0
1505-100A	100 ± 5.0	50	2.0	20 ± 3.0	30.0
1505-5B	5 ± 1.0	100	.7	1 ± .3	2.0
1505-10B	10 ± 1.0	100	.7	2 ± .4	3.0
1505-20B	20 ± 1.5	100	1.0	4 ± .6	6.0
1505-30B	30 ± 2.0	100	1.5	6 ± 1.0	9.0
1505-40B	40 ± 2.5	100	1.8	8 ± 1.5	12.0
1505-50B	50 ± 3.0	100	2.0	10 ± 1.8	15.0
1505-60B	60 ± 3.0	100	2.0	12 ± 2.0	18.0
1505-75B	75 ± 3.5	100	2.5	15 ± 2.0	24.0
1505-100B	100 ± 5.0	100	3.5	20 ± 3.0	30.0
1505-30C	30 ± 2.0	200	2.5	6 ± 1.0	9.0
1505-50C	50 ± 3.0	200	3.0	10 ± 1.8	15.0
1505-60C	60 ± 3.0	200	3.5	12 ± 2.0	18.0
1505-100C	100 ± 5.0	200	6.0	20 ± 3.0	30.0
1505-50G	50 ± 3.0	500	5.0	10 ± 1.8	15.0
1505-100G	100 ± 5.0	500	15.0	20 ± 3.0	30.0
1505-200G	200 ± 10.0	500	21.0	40 ± 6.0	60.0
1505-300G	300 ± 15.0	500	29.0	60 ± 8.0	90.0

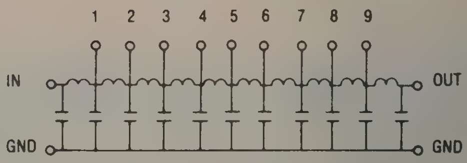
SERIES 1507
10 Taps,
14 pins SIP



Specifications:

- **Low profile.**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** -55°C to +125°C.
- **Storage temperature range:** -55°C to +125°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%.


1.455
36.96
.200
5.08
.100
2.54
.250
6.35
G NC IN 1 2 3 4 5 6 7 8 9 OUT G
.02
.50
1.300 @ .100 ± .010
33.02 @ 2.54 ± .254
.010 x .020
.25 x .50
INCHES
MILLIMETERS


1
2
3
4
5
6
7
8
9
IN
OUT
GND
GND

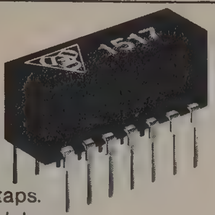
Part No.	Total Delay (NS)	Inp. (Ω)	Rdc (Ω)	Delay Per. Tap (NS)	Rise Time (NS)
1507-20A	20 ± 2.0	50	1.0	2 ± .4	4.0
1507-40A	40 ± 2.0	50	1.5	4 ± 1.0	8.0
1507-50A	50 ± 2.5	50	1.5	5 ± 1.5	9.0
1507-100A	100 ± 5.0	50	2.0	10 ± 2.0	18.0
1507-150A	150 ± 7.5	50	3.0	15 ± 2.0	28.0
1507-200A	200 ± 10.0	50	4.0	20 ± 3.0	38.0
1507-20B	20 ± 2.0	100	1.5	2 ± .4	4.0
1507-50B	50 ± 2.5	100	2.0	5 ± 1.5	9.0
1507-100B	100 ± 5.0	100	4.0	10 ± 2.0	18.0
1507-200B	200 ± 10.0	100	6.0	20 ± 3.0	38.0
1507-250B	250 ± 13.0	100	7.0	25 ± 4.0	48.0
1507-20C	20 ± 2.0	200	3.0	2 ± .4	4.0
1507-50C	20 ± 2.5	200	4.5	5 ± 1.5	9.0
1507-100C	100 ± 5.0	200	6.0	10 ± 2.0	18.0
1507-200C	200 ± 13.0	200	9.0	20 ± 3.0	38.0
1507-50G	50 ± 2.5	500	6.0	5 ± 1.5	9.0
1507-100G	100 ± 5.0	500	10.0	10 ± 2.0	18.0
1507-200G	200 ± 10.0	500	30.0	20 ± 3.0	38.0
1507-300G	300 ± 15.0	500	30.0	30 ± 4.0	58.0
1507-500G	500 ± 25.0	500	55.0	50 ± 5.0	98.0

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

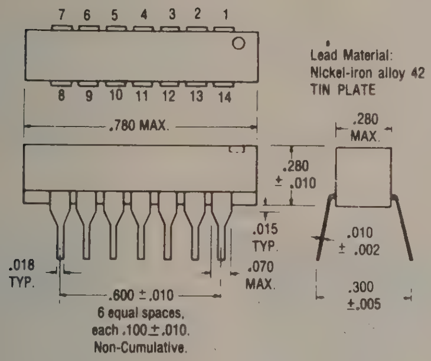
DIP-TAPPED DELAY LINES

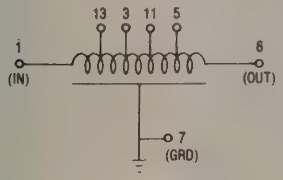
SERIES 1517
5 Taps



Specifications

- **Delay accuracy:** ± 5% (others on request).
- **No. taps:** 5 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10%.(others on request).
- **Rise-Time:** 30% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.

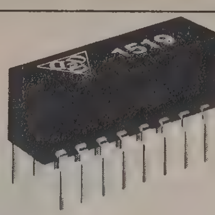

7 6 5 4 3 2 1
8 9 10 11 12 13 14
.780 MAX.
Lead Material:
Nickel-iron alloy 42
TIN PLATE
.280 MAX.
.280 ± .010
.015 TYP.
.010 ± .002
.018 TYP.
.070 MAX.
.600 ± .010
6 equal spaces,
each .100 ± .010.
Non-Cumulative.
.300 ±.005


13 3 11 5
1 (IN)
6 (OUT)
7 (GRD)

TAPS - CONNECTION

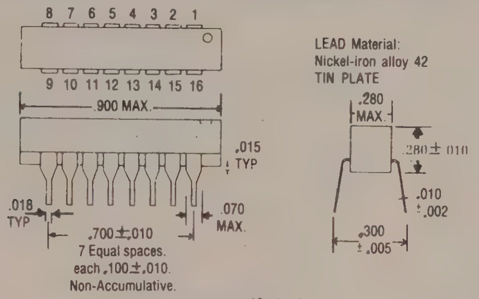
Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1517-10A	10	50	0.6	1517-150D	150	250	8.5
1517-15A	15	50	0.6	1517-15E	15	300	2.5
1517-20A	20	50	0.7	1517-30E	30	300	3.0
1517-30A	30	50	0.7	1517-50E	50	300	4.0
1517-40A	40	50	0.9	1517-60E	60	300	4.0
1517-5B	5	100	0.5	1517-75E	75	300	4.5
1517-10B	10	100	0.7	1517-90E	90	300	5.5
1517-15B	15	100	0.7	1517-120E	120	300	8.0
1517-20B	20	100	0.9	1517-130E	130	300	9.0
1517-25B	25	100	1.0	1517-180E	180	300	11.0
1517-30B	30	100	1.5	1517-220E	220	300	13.0
1517-40B	40	100	1.8	1517-20F	20	400	4.5
1517-50B	50	100	2.0	1517-40F	40	400	5.0
1517-60B	60	100	2.0	1517-60F	60	400	5.0
1517-75B	75	100	2.5	1517-80F	80	400	8.0
1517-10C	10	200	1.5	1517-100F	100	400	9.0
1517-20C	20	200	2.0	1517-120F	120	400	10.0
1517-30C	30	200	2.5	1517-160F	160	400	13.0
1517-40C	40	200	3.0	1517-180F	180	400	14.0
1517-50C	50	200	3.0	1517-240F	240	400	19.0
1517-60C	60	200	3.5	1517-300F	300	400	23.0
1517-80C	80	200	3.5	1517-25G	25	500	3.0
1517-90C	90	200	5.0	1517-50G	50	500	5.0
1517-120C	120	200	5.0	1517-75G	75	500	8.0
1517-150C	150	200	8.0	1517-100G	100	500	15.0
1517-25D	25	250	2.5	1517-125G	125	500	9.0
1517-37D	37	250	3.0	1517-150G	150	500	13.0
1517-50D	50	250	3.5	1517-200G	200	500	21.0
1517-60D	60	250	4.0	1517-225G	225	500	23.0
1517-75D	75	250	4.0	1517-300G	300	500	29.0
1517-100D	100	250	5.0				

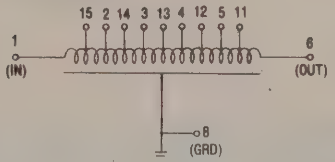
SERIES 1519
10 Taps



Specifications

- **Delay Accuracy:** ± 5% (others on request)
- **No. taps:** 10 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10% (others on request).
- **Rise-Time:** 20% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.


8 7 6 5 4 3 2 1
9 10 11 12 13 14 15 16
.900 MAX.
LEAD Material:
Nickel-iron alloy 42
TIN PLATE
.280 MAX.
.280 ± .010
.015 TYP
.018 TYP
.070 MAX.
.010 ±.002
.700 ± .010
7 Equal spaces.
each .100 ± .010.
Non-Accumulative.
.300 ± .005


15 2 14 3 13 4 12 5 11
1 (IN)
6 (OUT)
8 (GRD)

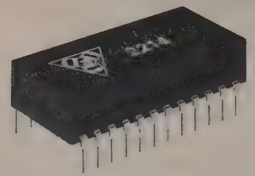
Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1519-20A	20	50	1.0	1519-200D	200	250	10.0
1519-25A	25	50	1.0	1519-225D	225	250	11.0
1519-30A	30	50	1.2	1519-300D	300	250	17.0
1519-40A	40	50	1.5	1519-375D	375	250	20.0
1519-45A	45	50	1.5	1519-500D	500	250	24.0
1519-50A	50	50	1.5	1519-30E	30	300	5.0
1519-60A	60	50	1.5	1519-60E	60	300	6.0
1519-75A	75	50	1.8	1519-90E	90	300	7.0
1519-100A	100	50	2.0	1519-120E	120	300	8.0
1519-10B	10	100	1.0	1519-150E	150	300	9.0
1519-20B	20	100	1.5	1519-180E	180	300	11.0
1519-30B	30	100	1.5	1519-240E	240	300	16.0
1519-40B	40	100	1.8	1519-270E	270	300	18.0
1519-50B	50	100	2.0	1519-360E	360	300	21.0
1519-60B	60	100	3.0	1519-450E	450	300	25.0
1519-80B	80	100	3.5	1519-600E	600	300	40.0
1519-90B	90	100	3.5	1519-40F	40	400	8.5
1519-100B	100	100	4.0	1519-80F	80	400	9.0
1519-120B	120	100	4.0	1519-120F	120	400	9.0
1519-150B	150	100	5.0	1519-160F	160	400	16.0
1519-200B	200	100	6.0	1519-200F	200	400	18.0
1519-250B	250	100	7.0	1519-240F	240	400	20.0
1519-20C	20	200	3.0	1519-320F	320	400	26.0
1519-40C	40	200	4.0	1519-360F	360	400	28.0
1519-60C	60	200	4.5	1519-480F	480	400	38.0
1519-80C	80	200	5.5	1519-600F	600	400	45.0
1519-100C	100	200	6.0	1519-800F	800	400	40.0
1519-120C	120	200	6.5	1519-50G	50	500	6.0
1519-160C	160	200	7.0	1519-100G	100	500	10.0
1519-180C	180	200	8.5	1519-150G	150	500	16.0
1519-200C	200	200	9.0	1519-200G	200	500	30.0
1519-240C	240	200	9.5	1519-250G	250	500	18.0
1519-300C	300	200	16.0	1519-300G	300	500	26.0
1519-400C	400	200	16.0	1519-400G	400	500	42.0
1519-50D	50	250	5.5	1519-450G	450	500	45.0
1519-75D	75	250	6.0	1519-500G	500	500	55.0
1519-100D	100	250	7.0	1519-600G	600	500	58.0
1519-125D	125	250	8.0	1519-750G	750	500	50.0
1519-150D	150	250	8.5	1519-1000G	1000	500	65.0

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

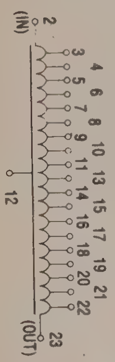
DIP-TAPPED DELAY LINES

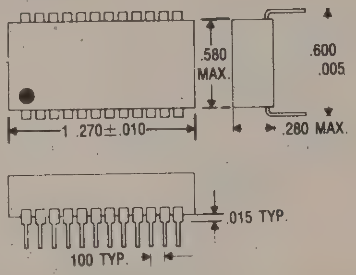
SERIES 2214
20 Taps



Specifications

- 20 Equally spaced taps.
- Td/Tr = 10/1.
- **Delay tolerance:** ± 5% or 1 NS whichever is greater.
- **Tap tolerance:** ± 5% or 1 NS whichever is greater.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -55°C to +125°C.
- **Dielectric breakdown:** 50 Vdc.
- **Meets or exceeds MIL-D-23859C.**
- **Epoxy encapsulated.**

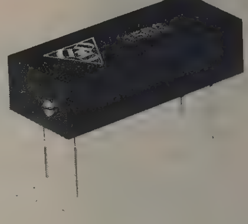




Part No.	Imp. (Ω)	Total Delay (NS)	Tap Increment (NS)	Rdc (Ω)
2214-50A	50	50	2.5	3.2
2214-60A	50	60	3.0	3.6
2214-80A	50	80	4.0	5.0
2214-100A	50	100	5.0	6.0
2214-150A	50	150	7.5	6.0
2214-200A	50	200	10.0	7.0
2214-50B	100	50	2.5	6.0
2214-60B	100	60	3.0	6.0
2214-80B	100	80	4.0	6.5
2214-100B	100	100	5.0	7.0
2214-150B	100	150	7.5	8.0
2214-200B	100	200	10.0	8.5
2214-300B	100	300	15.0	11.0
2214-400B	100	400	20.0	12.0
2214-40C	200	40	2.0	7.0
2214-80C	200	80	4.0	8.0
2214-120C	200	120	6.0	10.0
2214-200C	200	200	10.0	13.0
2214-300C	200	300	15.0	12.0
2214-400C	200	400	20.0	15.0
2214-500C	200	500	25.0	17.0
2214-600C	200	600	30.0	23.0
2214-800C	200	800	40.0	38.0
2214-50D	250	50	2.5	7.0
2214-100D	250	100	5.0	10.0
2214-150D	250	150	7.5	12.0
2214-200D	250	200	10.0	22.0
2214-250D	250	250	12.5	21.0
2214-300D	250	300	15.0	23.0
2214-400D	250	400	20.0	26.0
2214-500D	250	500	25.0	30.0
2214-600D	250	600	30.0	37.0
2214-800D	250	800	40.0	41.0
2214-1000D	250	1000	50.0	47.0
2214-200G	500	200	10.0	20.0
2214-300G	500	300	15.0	37.0
2214-400G	500	400	20.0	40.0
2214-500G	500	500	25.0	45.0
2214-600G	500	600	30.0	52.0
2214-800G	500	800	40.0	80.0
2214-1000G	500	1000	50.0	100.0
2214-1200G	500	1200	60.0	110.0
2214-1500G	500	1500	75.0	130.0
2214-2000G	500	2000	100.0	156.0

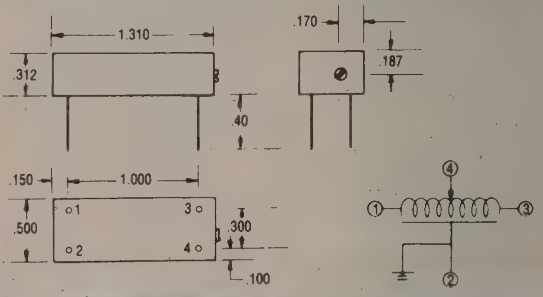
CONTINUOUSLY VARIABLE DELAY LINES

SERIES 1503



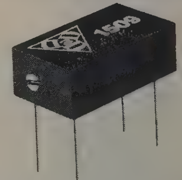
Specifications

- **Continuously variable delay.**
- **Multi-turn adjusting screw** (40 turns approx.).
- **Temperature coefficient:** 100 PPM/°C.
- **Rise-time:** 20% of time delay.
- **Flat leads** (.020 x .010).
- **Withstanding voltage:** 50 Vdc.
- **Resolution:** .12 NS approx.



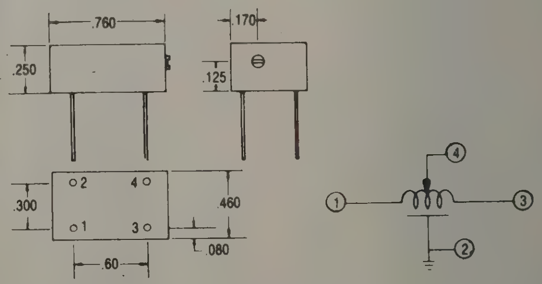
Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)
1503-15A	15	50	.7	1503-100B	100	100	6.0
1503-25A	25	50	.8	1503-120B	120	100	8.0
1503-30A	30	50	1.0	1503-160B	160	100	10.0
1503-40A	40	50	1.5	1503-200B	200	100	14.0
1503-50A	50	50	1.7	1503-30C	30	200	4.0
1503-60A	60	50	2.0	1503-60C	60	200	8.0
1503-80A	80	50	3.0	1503-100C	100	200	14.0
1503-100A	100	50	3.5	1503-20D	20	250	5.0
1503-15B	15	100	1.0	1503-20E	20	300	5.0
1503-30B	30	100	2.0	1503-30F	30	350	8.0
1503-50B	50	100	3.0	1503-25G	25	400	8.0
1503-60B	60	100	4.0	1503-40H	40	500	12.0
1503-80B	80	100	5.0				

SERIES 1509



Specifications

- Low cost unit.
- Fits standard DIP sockets.
- Continuously variable.
- 20 Turns approx.
- Resolution — .15 NS.
- Withstanding voltage — 100 Vdc.
- Temperature coefficient — 200 PPM/°C.
- Flat leads (.020 x .010).



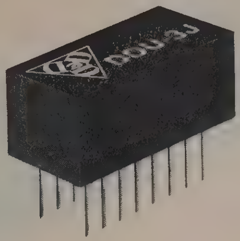
Part No.	Td (NS)	Impedance (Ω)	TR (NS)	Rdc (Ω)
1509-05B	5	100	3	.4
1509-20C	20	200	8	1.0
1509-30F	30	400	10	7.0
1509-40H	40	500	15	13.0

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

DIGITAL DELAY LINES

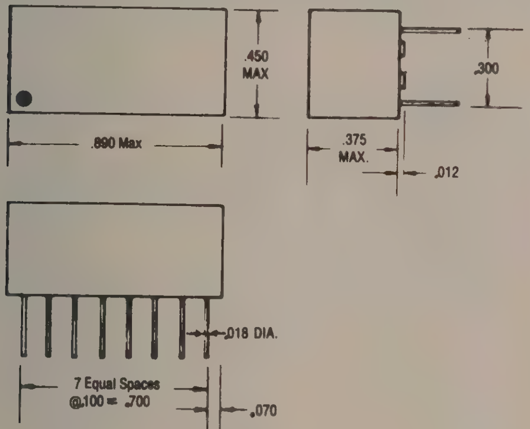
SERIES: DDU-3J
(TTL Interfaced)
1 to 5 Taps,
16 pins DIP

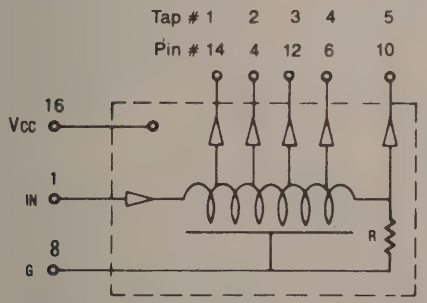


Specifications

- **Delay tolerance:** ±5% or better; or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -0°C to 70°C standard (-55°C to + 125°C on request.)*

***Add "M" to PART NO. Example DDU-3J-5100M**

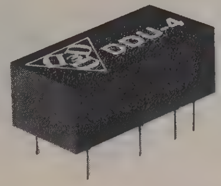

.450
MAX
.300
.890 Max
.375
MAX.
.012
.018 DIA.
7 Equal Spaces
@.100 = .700
.070


Tap # 1 2 3 4 5
Pin # 14 4 12 6 10
16
Vcc
1
IN
8
G
R

SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

Part No.	5 Delays Output (NS) Delay @ Pin #14	Delay @ Pin #4	Delay @ Pin #12	Delay @ Pin #6	Delay @ Pin #10
DDU-3J-5025	5	10	15	20	25
DDU-3J-5050	10	20	30	40	50
DDU-3J-5075	15	30	45	60	75
DDU-3J-5100	20	40	60	80	100
DDU-3J-5125	25	50	75	100	125
DDU-3J-5150	30	60	90	120	150
DDU-3J-5200	40	80	120	160	200
DDU-3J-5250	50	100	150	200	250
DDU-3J-5300	60	120	180	240	300
DDU-3J-5400	80	160	240	320	400
DDU-3J-5500	100	200	300	400	500

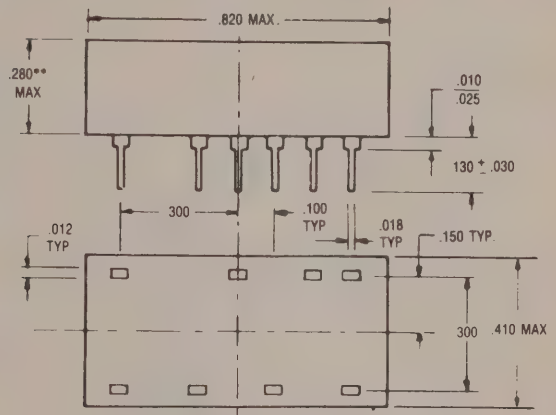
SERIES DDU-4
(TTL Interfaced)
1 to 5 Taps,
14 pins DIP

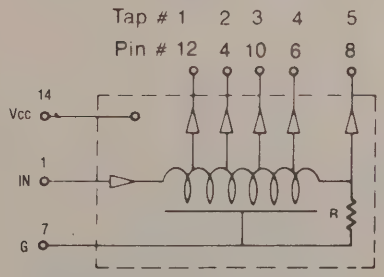


Specifications

- **Delay tolerance:** ±5% or better; or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -0°C to 70°C standard (-55°C to + 125°C on request.)*
- **Minimum pulse width:** 20% of total delay.

***Add "M" after PART NO. Example DDU-4-5100M**
****.320 Max. for "M" units.**


.820 MAX.
.280**
MAX
.010
.025
130 ± .030
300
.100
TYP
.012
TYP
.018
TYP
.150 TYP.
300
.410 MAX


Tap # 1 2 3 4 5
Pin # 12 4 10 6 8
14
Vcc
1
IN
7
G
R

SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

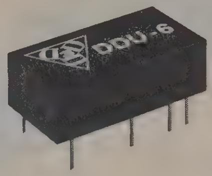
Part No.	5 Delays Output (NS) Delay @ Pin #12	Delay @ Pin #4	Delay @ Pin #10	Delay @ Pin #6	Delay @ Pin #8
DDU-4-5025	5	10	15	20	25
DDU-4-5050	10	20	30	40	50
DDU-4-5075	15	30	45	60	75
DDU-4-5100	20	40	60	80	100
DDU-4-5125	25	50	75	100	125
DDU-4-5150	30	60	90	120	150
DDU-4-5200	40	80	120	160	200
DDU-4-5250	50	100	150	200	250
DDU-4-5300	60	120	180	240	300
DDU-4-5400	80	160	240	320	400
DDU-4-5500	100	200	300	400	500

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

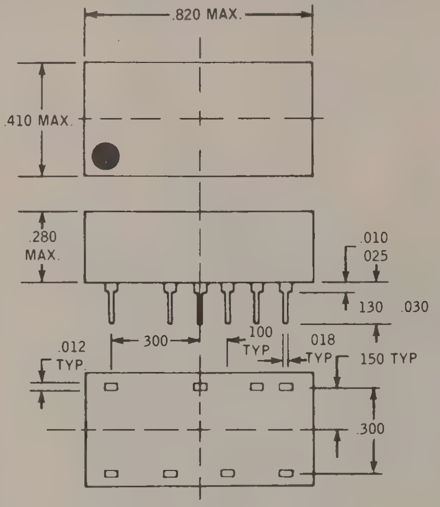
DIGITAL DELAY LINES

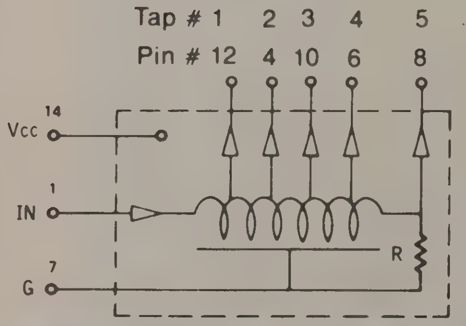
SERIES DDU-6 (TTL Interfaced) 14 pins DIP



Specifications

- **Outputs:** 5, equally spaced.
- **Delay tolerance:** see table.
- **Rise-time:** 4 NS typ.
- **Minimum pulse width:** 40% of total delay.
- **Temperature range:** 0 to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Input signal:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Power dissipation:** 375 mw max.

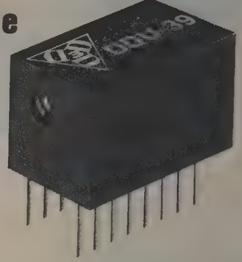

.820 MAX.
.410 MAX.
.280 MAX.
.010
.025
130
.030
.012 TYP.
300
100 TYP.
.018 TYP.
150 TYP
.300


Tap # 1 2 3 4 5
Pin # 12 4 10 6 8
14
Vcc
1
IN
7
G
R

Part No.	Total Delay (NS)	Tap Delay (NS)	Part No.	Total Delay (NS)	Tap Delay (NS)
*DDU-6-4	4 ± 1	1 ± 0.5	DDU-6-45	45 ± 3	9 ± 3
*DDU-6-6	6 ± 1	1.5 ± 0.5	DDU-6-50	50 ± 3	10 ± 3
*DDU-6-8	8 ± 2	2 ± 1	DDU-6-60	60 ± 3	12 ± 3
*DDU-6-10	10 ± 2	2.5 ± 1	DDU-6-75	75 ± 4	15 ± 3
*DDU-6-12	12 ± 2	3 ± 1	DDU-6-100	100 ± 5	20 ± 3
*DDU-6-16	16 ± 2	4 ± 1.5	DDU-6-125	125 ± 6.5	25 ± 3
*DDU-6-20	20 ± 3	5 ± 2	DDU-6-150	150 ± 7.5	30 ± 3
DDU-6-30	30 ± 3	6 ± 2	DDU-6-175	175 ± 8	35 ± 4
DDU-6-35	35 ± 3	7 ± 2	DDU-6-200	200 ± 10	40 ± 4
DDU-6-40	40 ± 3	8 ± 2	DDU-6-250	250 ± 12.5	50 ± 5

*Time delay measured with respect to 1st tap.

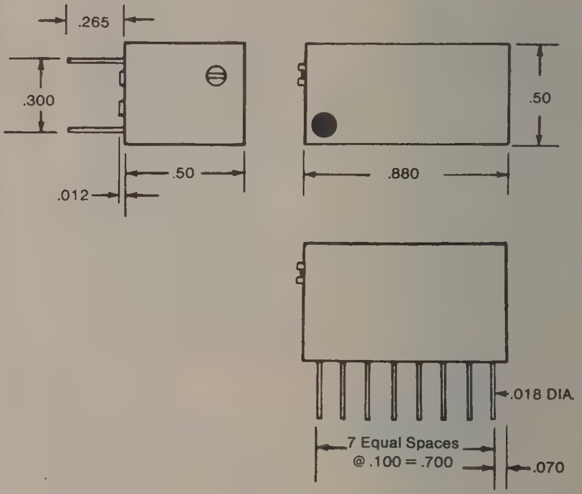
SERIES DDU-39 (TTL Interfaced) Continuously Variable

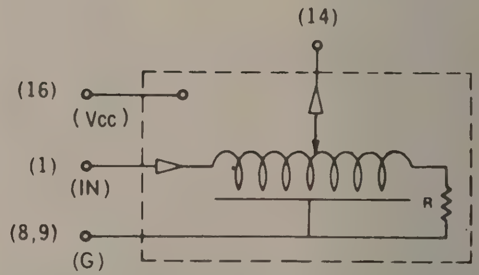


Specifications

- **Temperature coefficient:** 220 PPM/°C.
- **Rise-time:** 4 NS typically.
- **Delay:** Adjustable from 10 NS to 30 NS.
- **Temperature range:** 0°C to 70°C standard. (-55°C to +125°C on request)*
- **Supply voltage:** 4.5 to 5.5 Vdc.
- **Power dissipation:** 375 MW Max.

*Add "M" after PART NO. Example DDU-39M


.265
.300
.012
.50
.50
.880
.018 DIA.
7 Equal Spaces @ .100 = .700
.070

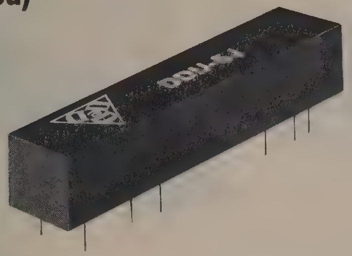

(14)
(16)
(Vcc)
(1)
(IN)
(8,9)
(G)
R

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

DIGITAL DELAY LINES

SERIES DDU-5J (TTL Interfaced) 10 Taps, 32 pins DIP

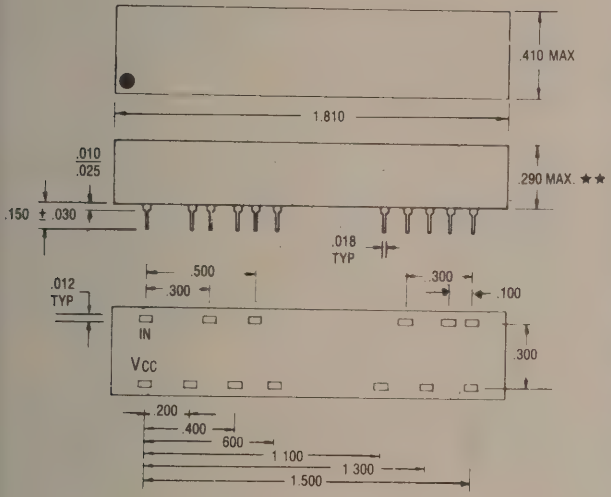


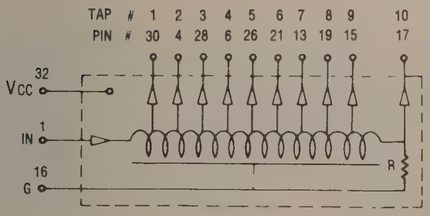
Specifications

- **Delay tolerance:** ±5% or better or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Minimum pulse width:** 20% of total delay.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -0°C to 70°C standard. (-55°C to +125°C on request)*

***Add "M" after PART NO. Example DDU-5J-10100M**

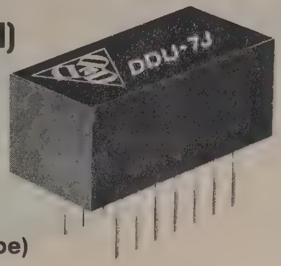
****.320 Max. for "M" units.**


.410 MAX
1.810
.010
.025
.290 MAX. ★★
.150 ± .030
.018
TYP
.012
TYP
.500
.300
.300
.100
IN
Vcc
.300
.200
.400
600
1 100
1 300
1.500


TAP # 1 2 3 4 5 6 7 8 9 10
PIN # 30 4 28 6 26 21 13 19 15 17
32
Vcc
1
IN
16
G
R

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
DDU-5J-10050	50	5	DDU-5J-10400	400	40
DDU-5J-10100	100	10	DDU-5J-10500	500	50
DDU-5J-10150	150	15	DDU-5J-101000	1000	100
DDU-5J-10200	200	20	DDU-5J-101500	1500	150
DDU-5J-10250	250	25	DDU-5J-102000	2000	200
DDU-5J-10300	300	30			

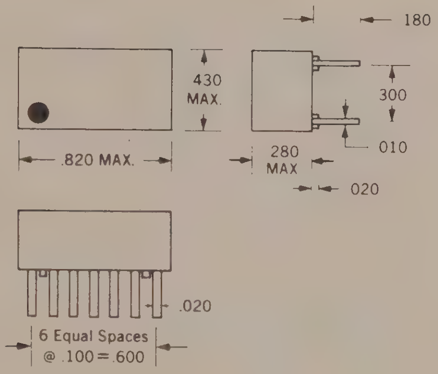
SERIES DDU-7J (TTL Interfaced) 10 Taps, 14 pins DIP

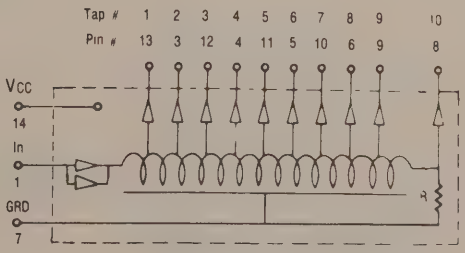


(Commercial Type)

Specifications:

- **No. Taps:** 10 equally spaced taps
- **Total delay tolerance:** ±5% or better or 2 NS whichever is greater.
- **Rise-time:** 4 NS typically.
- **Temperature coefficient:** 100 PPM°C.
- **Temperature range:** 0° to +70°C.
- **Supply voltage:** 4.5 to 5.5 Vdc.
- **Power dissipation:** 740 MW max.


180
430
MAX.
300
010
.820 MAX.
280
MAX
020
.020
6 Equal Spaces
@ .100 = 600


Tap # 1 2 3 4 5 6 7 8 9 10
Pin # 13 3 12 4 11 5 10 6 9 8
Vcc
14
In
1
GRD
7
R

Part No.	Total Delay NS	Delay Per Tap NS	Part No.	Total Delay NS	Delay Per Tap NS
*DDU-7J-10	9	1 ± .4	DDU-7J-200	200	20.0 ± 2
*DDU-7J-20	18	2 ± .5	DDU-7J-250	250	25.0 ± 2
*DDU-7J-25	22.5	2.5 ± .7	DDU-7J-300	300	30.0 ± 3
*DDU-7J-50	45	5.0 ± 1.5	DDU-7J-400	400	40.0 ± 4
DDU-7J-100	100	10.0 ± 2	DDU-7J-500	500	50.0 ± 5
DDU-7J-150	150	15.0 ± 2			

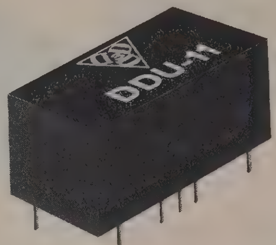
*Time delay referenced to 1st tap. Two (2) gates in parallel for input buffer.

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

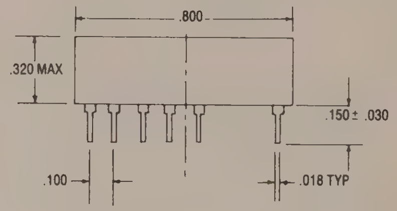
DIGITAL DELAY LINES

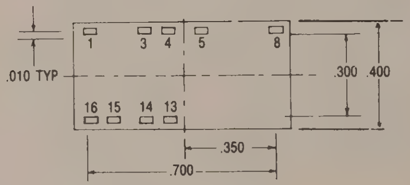
SERIES DDU-11 (ECL Interfaced) 5 Taps, 16 pins DIP

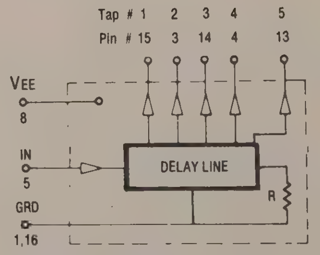


Specifications

- **Input & output completely buffered.**
- **Delay tolerance:** ± 5% or 2 NS whichever is greater.
- **Rise-time:** 2 NS typ.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -30°C to 85°C.
- **Supply voltage:** -5.2 Vdc.
- **Power dissipation:** 200 MW typ. (no load).


.800
.320 MAX
.150 ± .030
.100
.018 TYP


1
3
4
5
8
16
15
14
13
.010 TYP
.300
.400
.350
.700

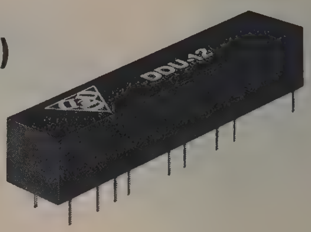

Tap # 1 2 3 4 5
Pin # 15 3 14 4 13
VEE
8
IN
5
GRD
1,16
DELAY LINE
R

Pull-down resistor on output taps not provided inside unit.

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
*DDU-11-5	4	1	DDU-11-150	150	30
*DDU-11-10	8	2	DDU-11-200	200	40
*DDU-11-20	16	4	DDU-11-250	250	50
*DDU-11-25	20	5	DDU-11-300	300	60
DDU-11-50	50	10	DDU-11-400	400	80
DDU-11-75	75	15	DDU-11-500	500	100
DDU-11-100	100	20			

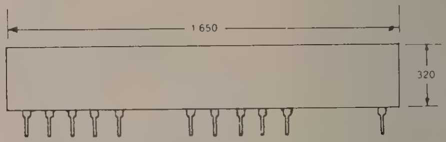
*Time delay measurements referenced to 1st tap

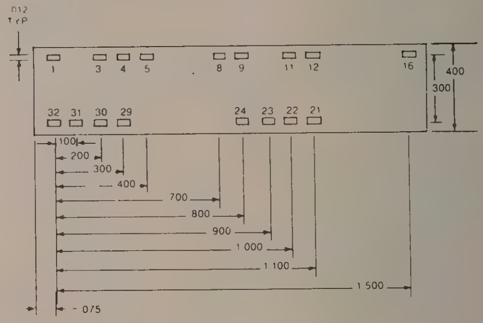
SERIES DDU-12 (ECL Interfaced) 10 Taps, 32 pins DIP

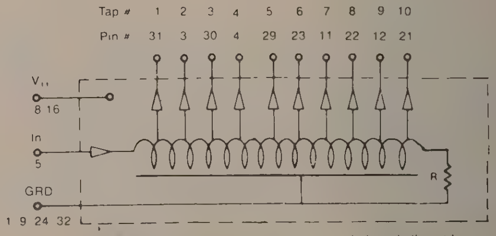


Specifications:

- **Total Delay Tolerance:** ±5% or better, or 2 NS whichever is greater.
- **No. Taps:** 10 equally spaced
- **Rise-Time:** 2 ns typical
- **Supply Voltage:** −5.2V
- **Operating Temperature:** −30°C to 85°C
- **Power Dissipation:** 400 MW typ. (no load)
- **Temperature Coefficient:** 100 PPM/°C




012 TYP
1
3
4
5
8
9
11
12
16
32
31
30
29
24
23
22
21
400
300
100
200
300
400
700
800
900
1 000
1 100
1 500
- 075


Tap # 1 2 3 4 5 6 7 8 9 10
Pin # 31 3 30 4 29 23 11 22 12 21
V
8 16
In
5
GRD
1 9 24 32
R

Pull down resistor on output taps not provided inside the unit

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
*DDU-12-10	9	1	DDU-12-200	200	20
*DDU-12-20	18	2	DDU-12-250	250	25
*DDU-12-25	22.5	2.5	DDU-12-300	300	30
*DDU-12-40	36	4	DDU-12-400	400	40
*DDU-12-50	45	5	DDU-12-500	500	50
DDU-12-75	75	7.5	DDU-12-750	750	75
DDU-12-100	100	10	DDU-12-1000	1000	100
DDU-12-150	150	15	DDU-12-1500	1500	150

*Time delay measurements referenced to 1st tap.

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

Call or write for a complete catalog of our products.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

EC^2 **engineered components company**
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

Engineered Components Company is pleased to introduce several new product lines and expanded capability in active digital modules. The succeeding 15 pages contain abbreviated data sheets covering 29 product lines of both passive-analog and active-digital delay lines

In addition to the delay lines shown, pages **1A**•1500 through **1A**•1507 in this section provide data on the following additional active digital products utilizing LC delay line technology:

Noise Filter Modules
Pulse Generator Modules
Square Wave Generator Modules
Digital Clock Modules
Digital Frequency Multiplier Modules

These modules are designed specifically for mounting on printed circuit boards in system applications where critical timing functions are required. These products find wide industrial applications in microcomputer, computer interface, radar timing, communication, instrumentation, dynamic and static memory timing and high speed RAM, PROM and IC test equipment.

The following active delay line modules are covered in this listing:

Five (5) output Logic Delay Modules
Ten (10) output Logic Delay Modules
Fixed Logic Delay Lines
Multiple Logic Delay Lines
Programmable Logic Delay Lines

These products are offered in modules compatible with T^2L Schottky, T^2L low power Schottky, ECL 10,000 and ECL 100K logic families.

CONSTRUCTION: The active digital modules shown in the following pages are of hybrid construction utilizing the proven technologies of active integrated circuitry and of passive networks utilizing capacitive, inductive and resistive elements. All integrated circuits used in these modules are pre-packaged by the manufacturer and burned-in to Level B of MIL-STD-883 to ensure a high MTBF. The passive elements utilized in the construction have been selected to provide adequate derating to preclude premature failures, thus contributing additionally to a high MTBF. On the detailed product pages, you will find MTBFs that are obtained by calculations per MIL-HDBK-217B for a 50°C ground fixed environment. In the case of the T^2L modules, the operating temperature is 0° to +70°C, for ECL 10,000 it is −30° to +85°C and for ECL 100K it is 0° to +85°C.

PACKAGING: The modules shown in the following pages are packaged in dual-in-line configuration. All modules are epoxy encapsulated in housings molded of flame-proof Diallyl Phthalate. Leads meet the solderability requirements of MIL-STD-202, Method 208. Standoffs are provided, either on the leads or on the housing, to provide positive standoff of the modules from the printed circuit boards to permit solder-fillet formation and flush cleaning of solder-flux residues for improved reliability.

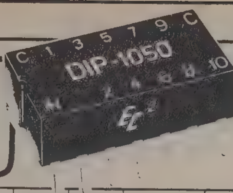
MARKING: Marking of all modules consists of manufacturer's name, logo (EC^2), part number, terminal identification and date code of manufacture. All marking is applied by silk screen process using white epoxy paint in accordance with MIL-STD-130, to meet the permanency of identification required by MIL-STD-202, Method 215.

EXTENDED TEMPERATURE RANGE: Many of the products shown in the following pages are also available as standard products in an extended temperature range of −55° to +125°C. These standard product lines are the TTLDL, TTLDM and the MTTLDL. Most products, however, can be supplied in the extended temperature range, based upon specific customer requirements, even though no standard product line exists.

SPECIALS: In addition to the items offered as standard products, we continually develop "made to order" parts where differences in tolerances, delays, silhouette, etc., are required. Engineered Components Company has the technical staff and capability, the modern equipment and extensive component inventory to support development and production of special variations of our standard product lines. Because of our experience and expertise in the unique products which we presently produce, in many instances we are able to develop entirely new special modules. Lead time for special versions is often only a matter of a few weeks and, in some cases, even days. We invite your inquiries.

Engineered Components Company is dedicated to customer service which includes on-time delivery, development of special products required to satisfy a particular need, customer satisfaction and a response to advanced state-of-the-art developments in active module products required by industry applications. We shall always strive to be progressive, innovative and responsible. Because of the extensive standard products available from our company, it is impossible to have all items in inventory at all times. We will make the commitment, however, to satisfy the customer's requirement for delivery and continually strive to "put out the fires" and to provide the product in sufficient numbers to prevent customer production problems whenever possible.

EC²
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

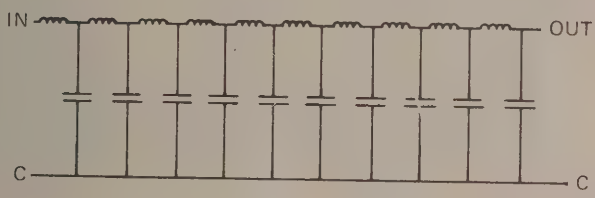


DIP LUMPED CONSTANT Low Profile

PASSIVE DELAY LINE

- Analog input and outputs
- Delays stable and precise
- 14-pin DIP package
- Available in delays from 10 to 150ns
- Available in impedances of 50,100 and 200 ohms
- Dimensions: .290 wide X .725 long X .225 high
- MTBF in excess of 2 million hours

BLOCK DIAGRAM IS SHOWN BELOW



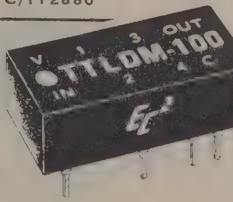
Part Number	Delay Time (ns)	Rise Time (ns)	ϕ-Tap Delay (ns)	Impedance (ohms)	DCR (ohms)
DIP 510	10	3.0	1.0	50	1.0
DIP 515	15	4.0	1.5	↑	1.0
DIP 520	20	5.0	2.0		1.0
DIP 525	25	5.5	2.5		1.5
DIP 530	30	7.0	3.0		1.5
DIP 540	40	8.5	4.0		1.8
DIP 550	50	10	5.0		2.0
DIP 560	60	11.5	6.0		2.5
DIP 570	70	13.0	7.0		2.8
DIP 580	80	14.5	8.0		3.0
DIP 590	90	16	9.0		3.3
DIP 5100	100	18.0	10.0	↓	3.5
DIP 5150	150	25.0	15.0	50	4.2
DIP 1010	10	3.0	1.0	100	1.3
DIP 1015	15	4.0	1.5	↑	1.5
DIP 1020	20	4.5	2.0		2.0
DIP 1025	25	5.0	2.5		2.2
DIP 1030	30	6.0	3.0		2.5
DIP 1040	40	7.5	4.0		2.8
DIP 1050	50	9.5	5.0		3.0
DIP 1060	60	11	6.0		3.2
DIP 1070	70	12.5	7.0		3.5
DIP 1080	80	14	8.0		3.7
DIP 1090	90	15	9.0	↓	4.0
DIP 10100	100	16.0	10.0	100	4.2
DIP 2010	10	3.7	1.0	200	2.0
DIP 2015	15	4.5	1.5	↑	2.5
DIP 2020	20	5.5	2.0		2.8
DIP 2025	25	6.2	2.5		3.0
DIP 2030	30	7.8	3.0		3.5
DIP 2040	40	8.8	4.0	↓	4.0
DIP 2050	50	10.6	5.0	200	4.5

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/112880

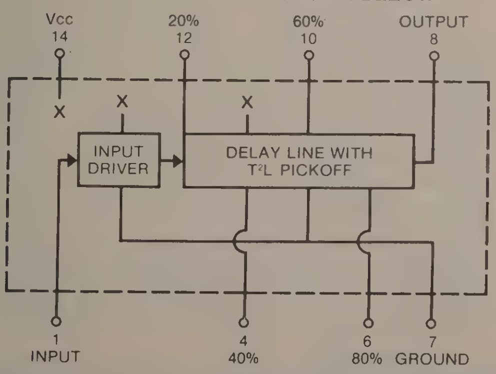
T²L COMPATIBLE Low Profile

LOGIC DELAY MODULE (Schottky)



- T²L input and outputs
- Delays stable and precise
- 14-pin DIP package
- Available in delays from 25 to 1000ns
- 20% taps — each isolated and with 10 T²L fan-out capacity
- Rise time 4ns maximum
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)

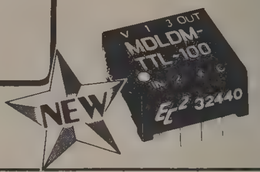
PART NO.	Tap 1	Tap 2	Tap 3	Tap 4	OUTPUT
TTLDM-25	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1
TTLDM-30	6 ±1	12 ±1	18 ±1	24 ±1	30 ±1
TTLDM-35	7 ±1	14 ±1	21 ±1	28 ±1.5	35 ±1.5
TTLDM-40	8 ±1	16 ±1	24 ±1.5	32 ±1.5	40 ±1.5
TTLDM-45	9 ±1	18 ±1	27 ±1.5	36 ±1.5	45 ±2
TTLDM-50	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2
TTLDM-75	15 ±1	30 ±1.5	45 ±2	60 ±2.5	75 ±2.5
TTLDM-100	20 ±1	40 ±1.5	60 ±2	80 ±3	100 ±3
TTLDM-125	25 ±1	50 ±2	75 ±2.5	100 ±3	125 ±4
TTLDM-150	30 ±1.5	60 ±2	90 ±3	120 ±4	150 ±5
TTLDM-175	35 ±1.5	70 ±2.5	105 ±4	140 ±5	175 ±5
TTLDM-200	40 ±1.5	80 ±2.5	120 ±4	160 ±5	200 ±6
TTLDM-225	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7
TTLDM-250	50 ±2	100 ±3	150 ±4.5	200 ±6	250 ±8
TTLDM-300	60 ±2	120 ±4	180 ±5	240 ±7	300 ±9
TTLDM-350	70 ±2	140 ±4.5	210 ±7	280 ±9	350 ±11
TTLDM-400	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12
TTLDM-450	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14
TTLDM-500	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15
TTLDM-600	120 ±4	240 ±7	360 ±11	480 ±15	600 ±18
TTLDM-700	140 ±4	280 ±9	420 ±13	560 ±17	700 ±20
TTLDM-800	160 ±5	320 ±10	480 ±15	640 ±19	800 ±20
TTLDM-900	180 ±6	360 ±11	520 ±16	720 ±20	900 ±22
TTLDM-1000	200 ±6	400 ±12	600 ±18	800 ±20	1000 ±22

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/91579

EC^2 engineered components company

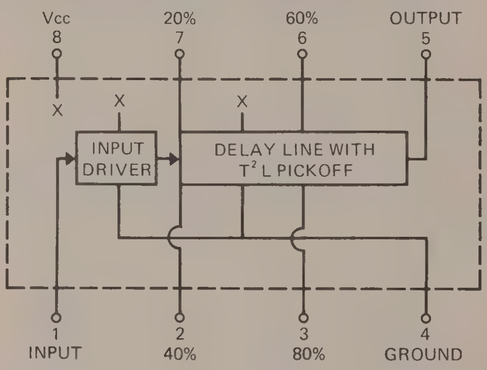
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*



T^{2}L COMPATIBLE "Mini DIP" Low Profile
LOGIC DELAY MODULE (Schottky)

- T^{2}L input and outputs
- Delays stable and precise
- 8-pin DIP package
- Available in delays from 25 to 500ns
- 20% taps — each isolated and with 10 Schottky T^{2}L fan-out capacity
- Fast rise time on all outputs
- Dimensions: .400 wide X .500 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours.
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW

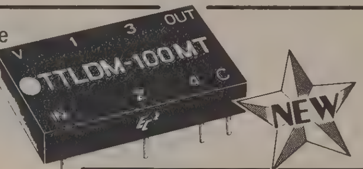


ϕDELAYS AND TOLERANCES (in ns)

Part Number	Tap 1	Tap 2	Tap 3	Tap 4	Output
MDLDM-TTL-25	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1
MDLDM-TTL-30	6 ±1	12 ±1	18 ±1	24 ±1	30 ±1
MDLDM-TTL-35	7 ±1	14 ±1	21 ±1	28 ±1.5	35 ±1.5
MDLDM-TTL-40	8 ±1	16 ±1	24 ±1.5	32 ±1.5	40 ±1.5
MDLDM-TTL-45	9 ±1	18 ±1	27 ±1.5	36 ±1.5	45 ±2
MDLDM-TTL-50	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2
MDLDM-TTL-75	15 ±1	30 ±1.5	45 ±2	60 ±2.5	75 ±2.5
MDLDM-TTL-100	20 ±1	40 ±1.5	60 ±2	80 ±3	100 ±3
MDLDM-TTL-125	25 ±1	50 ±2	75 ±2.5	100 ±3	125 ±4
MDLDM-TTL-150	30 ±1.5	60 ±2	90 ±3	120 ±4	150 ±5
MDLDM-TTL-175	35 ±1.5	70 ±2.5	105 ±4	140 ±5	175 ±5
MDLDM-TTL-200	40 ±1.5	80 ±2.5	120 ±4	160 ±5	200 ±6
MDLDM-TTL-225	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7
MDLDM-TTL-250	50 ±2	100 ±3	150 ±4.5	200 ±6	250 ±8
MDLDM-TTL-300	60 ±2	120 ±4	180 ±5	240 ±7	300 ±9
MDLDM-TTL-350	70 ±2	140 ±4.5	210 ±7	280 ±9	350 ±11
MDLDM-TTL-400	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12
MDLDM-TTL-450	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14
MDLDM-TTL-500	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

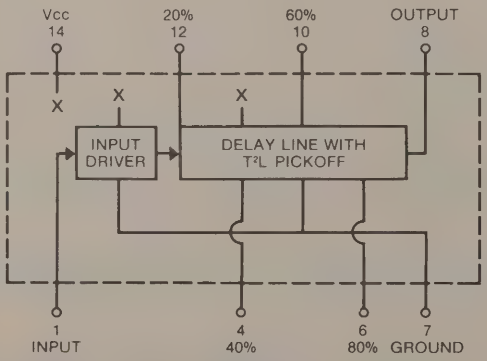
ABOVE DATA FROM CATALOG NO. C/012982



T^{2}L COMPATIBLE "Thinny DIP" Super Low Profile
LOGIC DELAY MODULE (Schottky)

- Full military temperature range
- T^{2}L input and outputs
- Delays stable and precise
- 14-pin DIP package
- Available in delays from 25 to 500ns
- 20% taps — each isolated and with 10 T^{2}L fan-out capacity
- Fast rise time on all outputs
- Dimensions: .500 wide X .800 long X .165 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of −55° to +125°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)

Part Number	Tap 1	Tap 2	Tap 3	Tap 4	Output
TTLDM-25MT	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1
TTLDM-30MT	6 ±1	12 ±1	18 ±1	24 ±1	30 ±1
TTLDM-35MT	7 ±1	14 ±1	21 ±1	28 ±1.5	35 ±1.5
TTLDM-40MT	8 ±1	16 ±1	24 ±1.5	32 ±1.5	40 ±1.5
TTLDM-45MT	9 ±1	18 ±1	27 ±1.5	36 ±1.5	45 ±2
TTLDM-50MT	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2
TTLDM-75MT	15 ±1	30 ±1.5	45 ±2	60 ±2.5	75 ±2.5
TTLDM-100MT	20 ±1	40 ±1.5	60 ±2	80 ±3	100 ±3
TTLDM-125MT	25 ±1	50 ±2	75 ±2.5	100 ±3	125 ±4
TTLDM-150MT	30 ±1.5	60 ±2	90 ±3	120 ±4	150 ±5
TTLDM-175MT	35 ±1.5	70 ±2.5	105 ±4	140 ±5	175 ±5
TTLDM-200MT	40 ±1.5	80 ±2.5	120 ±4	160 ±5	200 ±6
TTLDM-225MT	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7
TTLDM-250MT	50 ±2	100 ±3	150 ±4.5	200 ±6	250 ±8
TTLDM-300MT	60 ±2	120 ±4	180 ±5	240 ±7	300 ±9
TTLDM-350MT	70 ±2	140 ±4.5	210 ±7	280 ±9	350 ±11
TTLDM-400MT	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12
TTLDM-450MT	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14
TTLDM-500MT	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/060280R

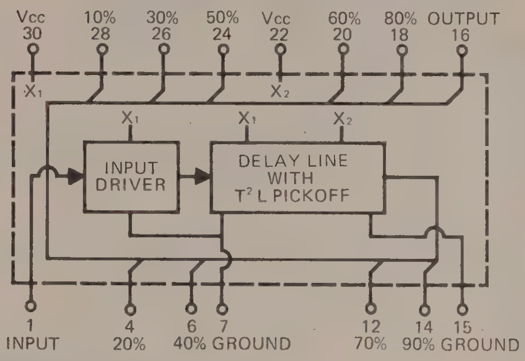
EC² engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

DTTLDM-100
V
1
3
5
6
8
OUT
4
C
IN
EC²

T²L COMPATIBLE Low Profile
DOUBLE LOGIC DELAY MODULE (Schottky)

- T²L input and outputs
- Delays stable and precise
- 30-pin DIP package
- Available in delays from 50ns to 1000ns
- 10% taps – each isolated and with 10 T²L fan-out capacity
- Fast rise time on all outputs
- Dimensions: .400 wide X 1.600 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



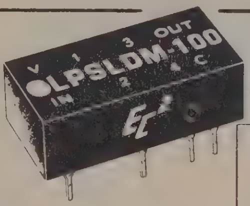
ϕDELAYS AND TOLERANCES (in ns)

Part Number	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5	Tap 6	Tap 7	Tap 8	Tap 9	Output
DTTLDM-50	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1.5	30 ±1.5	35 ±1.5	40 ±2	45 ±2	50 ±2
DTTLDM-60	6 ±1	12 ±1	18 ±1	24 ±1.5	30 ±1.5	36 ±1.5	42 ±2	48 ±2	54 ±2	60 ±2.5
DTTLDM 70	7 ±1	14 ±1	21 ±1	28 ±1.5	35 ±1.5	42 ±2	49 ±2	56 ±2	63 ±2.5	70 ±2.5
DTTLDM 80	8 ±1	16 ±1	24 ±1.5	32 ±1.5	40 ±2	48 ±2	56 ±2	64 ±2.5	72 ±2.5	80 ±3
DTTLDM-90	9 ±1	18 ±1	27 ±1.5	36 ±1.5	45 ±2	54 ±2	63 ±2.5	72 ±2.5	81 ±3	90 ±3
DTTLDM 100	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2	60 ±2.5	70 ±2.5	80 ±3	90 ±3	100 ±3
DTTLDM-150	15 ±1	30 ±1.5	45 ±2	60 ±2.5	75 ±2.5	90 ±3	105 ±4	120 ±4	135 ±4	150 ±5
DTTLDM 200	20 ±1	40 ±2	60 ±2.5	80 ±3	100 ±3	120 ±4	140 ±5	160 ±5	180 ±6	200 ±6
DTTLDM-250	25 ±1.5	50 ±2	75 ±2.5	100 ±3	125 ±4	150 ±5	175 ±5	200 ±6	225 ±7	250 ±8
DTTLDM-300	30 ±1.5	60 ±2.5	90 ±3	120 ±4	150 ±5	180 ±6	210 ±7	240 ±7	270 ±8	300 ±9
DTTLDM-350	35 ±1.5	75 ±2.5	105 ±4	140 ±5	175 ±5	210 ±7	245 ±8	280 ±9	315 ±10	350 ±11
DTTLDM-400	40 ±2	80 ±3	120 ±4	160 ±5	200 ±6	240 ±7	280 ±9	320 ±10	360 ±11	400 ±12
DTTLDM-450	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7	270 ±8	315 ±10	360 ±11	405 ±12	450 ±14
DTTLDM-500	50 ±2	100 ±3	150 ±5	200 ±6	250 ±8	300 ±9	350 ±11	400 ±12	450 ±14	500 ±15
DTTLDM-600	60 ±2.5	120 ±4	180 ±5	240 ±7	300 ±9	360 ±11	420 ±13	480 ±15	540 ±16	600 ±18
DTTLDM-700	70 ±2.5	140 ±5	210 ±7	280 ±9	350 ±11	420 ±13	490 ±15	560 ±17	630 ±19	700 ±20
DTTLDM 800	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12	480 ±15	560 ±17	640 ±19	720 ±20	800 ±20
DTTLDM 900	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14	540 ±16	630 ±19	720 ±20	810 ±20	900 ±22
DTTLDM-1000	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15	600 ±18	700 ±20	800 ±20	900 ±22	1000 ±22

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; For Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

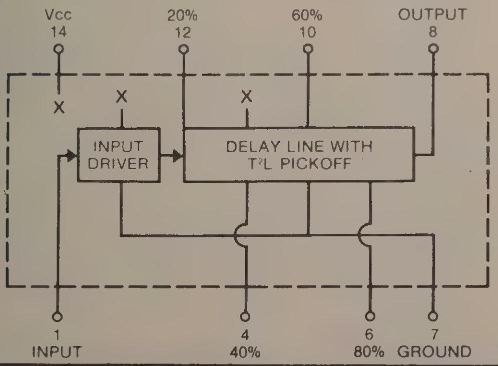
ABOVE DATA FROM CATALOG NO. C/010380

T²L COMPATIBLE Low Profile
LOGIC DELAY MODULE (Low Power Schottky)



- T²L input and outputs
- Delays stable and precise
- 14-pin DIP package
- Available in delays from 50 to 500ns
- 20% taps — each isolated and 20 low power Schottky T²L fan-out capacity
- Rise time 8ns maximum
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to 70°C

BLOCK DIAGRAM IS SHOWN BELOW



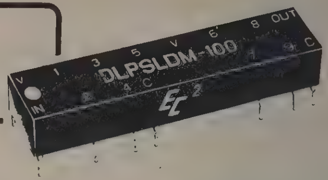
ϕDELAYS AND TOLERANCES (in ns)

PART NO.	Tap 1	Tap 2	Tap 3	Tap 4	OUTPUT
LPSLDM-50	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2
LPSLDM 55	11 ±1	22 ±1	33 ±1.5	44 ±2	55 ±2
LPSLDM-60	12 ±1	24 ±1.5	36 ±1.5	48 ±2	60 ±2
LPSLDM-65	13 ±1	26 ±1.5	39 ±1.5	52 ±2	65 ±2
LPSLDM-70	14 ±1	28 ±1.5	42 ±2	56 ±2	70 ±2.5
LPSLDM-75	15 ±1	30 ±1.5	45 ±2	60 ±2	75 ±2.5
LPSLDM-80	16 ±1	32 ±1.5	48 ±2	64 ±2	80 ±2.5
LPSLDM-85	17 ±1	34 ±1.5	51 ±2	68 ±2	85 ±2.5
LPSLDM-90	18 ±1	36 ±1.5	54 ±2	72 ±2.5	90 ±3
LPSLDM-95	19 ±1	38 ±1.5	57 ±2	76 ±2.5	95 ±3
LPSLDM-100	20 ±1	40 ±1.5	60 ±2	80 ±3	100 ±3
LPSLDM-125	25 ±1	50 ±2	75 ±2.5	100 ±3	125 ±4
LPSLDM-150	30 ±1.5	60 ±2	90 ±3	120 ±4	150 ±5
LPSLDM-175	35 ±1.5	70 ±2.5	105 ±4	140 ±5	175 ±5
LPSLDM-200	40 ±1.5	80 ±2.5	120 ±4	160 ±5	200 ±6
LPSLDM-225	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7
LPSLDM-250	50 ±2	100 ±3	150 ±4.5	200 ±6	250 ±8
LPSLDM-300	60 ±2	120 ±4	180 ±5	240 ±7	300 ±9
LPSLDM 350	70 ±2	140 ±4.5	210 ±7	280 ±9	350 ±11
LPSLDM-400	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12
LPSLDM-450	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14
LPSLDM-500	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/111579

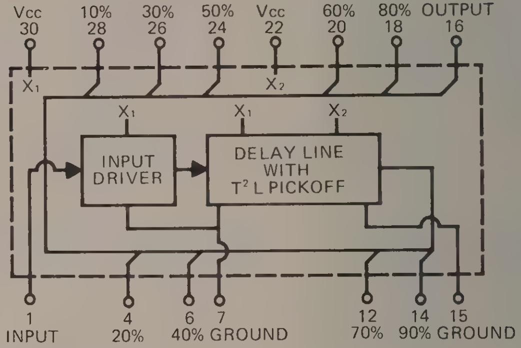
EC² engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*



T²L COMPATIBLE Low Profile
DOUBLE LOGIC DELAY MODULE (Low Power Schottky)

- T²L inputs and outputs
- Delays stable and precise
- 30-pin DIP package
- Available in delays from 100ns to 1000ns
- 10% taps – each isolated and with 20 low power Schottky T²L fan-out capacity
- Rise time 8ns maximum
- Dimensions: .400 wide X 1.600 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



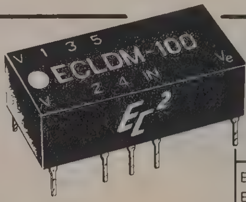
ϕDELAYS AND TOLERANCES (in ns)

Part Number	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5	Tap 6	Tap 7	Tap 8	Tap 9	Output
DLPSLDM 100	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2	60 ±2.5	70 ±2.5	80 ±3	90 ±3	100 ±3
DLPSLDM 150	15 ±1	30 ±1.5	45 ±2	60 ±2.5	75 ±2.5	90 ±3	105 ±4	120 ±4	135 ±4	150 ±5
DLPSLDM 200	20 ±1	40 ±2	60 ±2.5	80 ±3	100 ±3	120 ±4	140 ±5	160 ±5	180 ±6	200 ±6
DLPSLDM 250	25 ±1.5	50 ±2	75 ±2.5	100 ±3	125 ±4	150 ±5	175 ±5	200 ±6	225 ±7	250 ±8
DLPSLDM 300	30 ±1.5	60 ±2.5	90 ±3	120 ±4	150 ±5	180 ±6	210 ±7	240 ±7	270 ±8	300 ±9
DLPSLDM 350	35 ±1.5	75 ±2.5	105 ±4	140 ±5	175 ±5	210 ±7	245 ±8	280 ±9	315 ±10	350 ±11
DLPSLDM 400	40 ±2	80 ±3	120 ±4	160 ±5	200 ±6	240 ±7	280 ±9	320 ±10	360 ±11	400 ±12
DLPSLDM 450	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7	270 ±8	315 ±10	360 ±11	405 ±12	450 ±14
DLPSLDM 500	50 ±2	100 ±3	150 ±5	200 ±6	250 ±8	300 ±9	350 ±11	400 ±12	450 ±14	500 ±15
DLPSLDM 600	60 ±2.5	120 ±4	180 ±5	240 ±7	300 ±9	360 ±11	420 ±13	480 ±15	540 ±16	600 ±18
DLPSLDM 700	70 ±2.5	140 ±5	210 ±7	280 ±9	350 ±11	420 ±13	490 ±15	560 ±17	630 ±19	700 ±20
DLPSLDM 800	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12	480 ±15	560 ±17	640 ±19	720 ±20	800 ±20
DLPSLDM 900	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14	540 ±16	630 ±19	720 ±20	810 ±20	900 ±22
DLPSLDM 1000	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15	600 ±18	700 ±20	800 ±20	900 ±22	1000 ±22

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; For Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

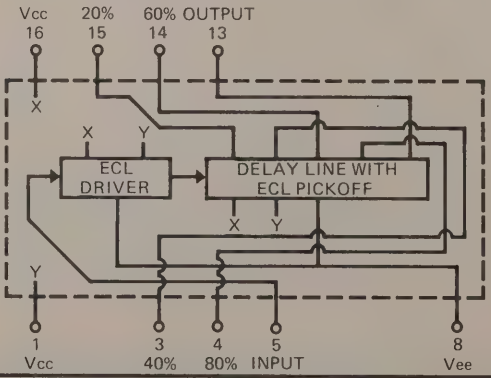
ABOVE DATA FROM CATALOG NO. C/021280

ECL 10K COMPATIBLE Low Profile
LOGIC DELAY MODULE



- ECL input and outputs
- Delays stable and precise
- 16-pin DIP package
- Available in delays from 25ns to 1000ns
- 20% taps – each isolated and with 70 ECL DC fan-out capacity
- Fast rise times on all outputs
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of −30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕRISE TIME, DELAYS AND TOLERANCES (in ns)

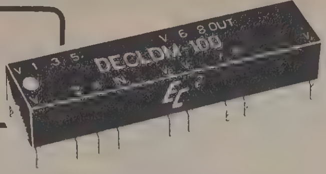
PART NUMBER	RISE TIME MAX.	Tap 1	Tap 2	Tap 3	Tap 4	OUTPUT
ECLDM-6	4	2 ±.2	3 ±.2	4 ±.2	5 ±.2	6 ±.2
ECLDM-10	4	2 ±.5	4 ±.5	6 ±.5	8 ±.5	10 ±.5
ECLDM-15	4	3 ±.5	6 ±.5	9 ±.5	12 ±.5	15 ±.5
ECLDM-20	4	4 ±.5	8 ±.5	12 ±.5	16 ±.5	20 ±.5
ECLDM-25	4	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1
ECLDM-30	4	6 ±1	12 ±1	18 ±1	24 ±1	30 ±1
ECLDM-35	4	7 ±1	14 ±1	21 ±1	28 ±1.5	35 ±1.5
ECLDM-40	4	8 ±1	16 ±1	25 ±1.5	32 ±1.5	40 ±1.5
ECLDM-45	5	9 ±1	18 ±1	27 ±1.5	36 ±1.5	45 ±2
ECLDM-50	5	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2
ECLDM-75	8	15 ±1	30 ±1.5	45 ±2	60 ±2.5	75 ±2.5
ECLDM-100	10	20 ±1	40 ±1.5	60 ±2	80 ±3	100 ±3
ECLDM-125	15	25 ±1	50 ±2	75 ±2.5	100 ±3	125 ±4
ECLDM-150	15	30 ±1.5	60 ±2	90 ±3	120 ±4	150 ±5
ECLDM-175	20	35 ±1.5	70 ±2.5	105 ±4	140 ±5	175 ±5
ECLDM-200	20	40 ±1.5	80 ±2.5	120 ±4	160 ±5	200 ±6
ECLDM-225	25	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7
ECLDM-250	25	50 ±2	100 ±3	150 ±4.5	200 ±6	250 ±8
ECLDM 300	30	60 ±2	120 ±4	180 ±5	240 ±7	300 ±9
ECLDM-350	35	70 ±2	140 ±4.5	210 ±7	280 ±9	350 ±11
ECLDM-400	40	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12
ECLDM-450	45	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14
ECLDM-500	50	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15
ECLDM-600	30	120 ±4	240 ±7	360 ±11	480 ±15	600 ±18
ECLDM-700	35	140 ±4	280 ±9	420 ±13	560 ±17	700 ±20
ECLDM-800	40	160 ±5	320 ±10	480 ±15	640 ±19	800 ±20
ECLDM-900	45	180 ±6	360 ±11	520 ±16	720 ±20	900 ±22
ECLDM-1000	50	200 ±6	400 ±12	600 ±18	800 ±20	1000 ±22

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/021580

engineered components company

3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

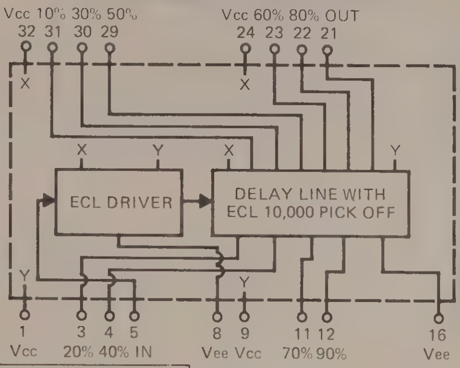


ECL 10K COMPATIBLE Low Profile

DOUBLE LOGIC DELAY MODULE

- ECL input and outputs
- Delays stable and precise
- 32-pin DIP package
- Available in delays from 11ns to 1000ns
- 10% taps – each isolated and with 70 ECL DC fan-out capacity
- Fast rise time on all outputs
- Dimensions: .400 wide X 1.600 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of –30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



φ DELAYS AND TOLERANCES (in ns)

Part Number	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5	Tap 6	Tap 7	Tap 8	Tap 9	Output
DECLDM-11	2 ±.5	3 ±.5	4 ±.5	5 ±1	6 ±1	7 ±1	8 ±1	9 ±1	10 ±1	11 ±1
DECLDM-20	2 ±.5	4 ±.5	6 ±1	8 ±1	10 ±1	12 ±1	14 ±1	16 ±1	18 ±1	20 ±1
DECLDM 30	3 ±.5	6 ±1	9 ±1	12 ±1	15 ±1	18 ±1	21 ±1	24 ±1.5	27 ±1.5	30 ±1.5
DECLDM-40	4 ±.5	8 ±1	12 ±1	16 ±1	20 ±1	24 ±1.5	28 ±1.5	32 ±1.5	36 ±1.5	40 ±2
DECLDM 50	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1.5	30 ±1.5	35 ±1.5	40 ±2	45 ±2	50 ±2
DECLDM 60	6 ±1	12 ±1	18 ±1	24 ±1.5	30 ±1.5	36 ±1.5	42 ±2	48 ±2	54 ±2	60 ±2.5
DECLDM 70	7 ±1	14 ±1	21 ±1	28 ±1.5	35 ±1.5	42 ±2	49 ±2	56 ±2	63 ±2	70 ±2.5
DECLDM 80	8 ±1	16 ±1	24 ±1.5	32 ±1.5	40 ±2	48 ±2	56 ±2	64 ±2.5	72 ±2.5	80 ±3
DECLDM-90	9 ±1	18 ±1	27 ±1.5	36 ±1.5	45 ±2	54 ±2	63 ±2	72 ±2.5	81 ±3	90 ±3
DECLDM 100	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2	60 ±2.5	70 ±2.5	80 ±3	90 ±3	100 ±3
DECLDM-150	15 ±1	30 ±1.5	45 ±2	60 ±2.5	75 ±2.5	90 ±3	105 ±4	120 ±4	135 ±4	150 ±5
DECLDM-200	20 ±1	40 ±2	60 ±2.5	80 ±3	100 ±3	120 ±4	140 ±5	160 ±5	180 ±6	200 ±6
DECLDM 250	25 ±1.5	50 ±2	75 ±2.5	100 ±3	125 ±4	150 ±5	175 ±5	200 ±6	225 ±7	250 ±8
DECLDM 300	30 ±1.5	60 ±2.5	90 ±3	120 ±4	150 ±5	180 ±6	210 ±7	240 ±7	270 ±8	300 ±9
DECLDM-350	35 ±1.5	75 ±2.5	105 ±4	140 ±5	175 ±5	210 ±7	245 ±8	280 ±9	315 ±10	350 ±11
DECLDM 400	40 ±2	80 ±3	120 ±4	160 ±5	200 ±6	240 ±7	280 ±9	320 ±10	360 ±11	400 ±12
DECLDM 450	45 ±2	90 ±3	135 ±4	180 ±6	225 ±7	270 ±8	315 ±10	360 ±11	405 ±12	450 ±14
DECLDM-500	50 ±2	100 ±3	150 ±5	200 ±6	250 ±8	300 ±9	350 ±11	400 ±12	450 ±14	500 ±15
DECLDM 600	60 ±2.5	120 ±4	180 ±6	240 ±7	300 ±9	360 ±11	420 ±13	480 ±15	540 ±16	600 ±18
DECLDM 700	70 ±2.5	140 ±5	210 ±7	280 ±9	350 ±11	420 ±13	490 ±15	560 ±17	630 ±19	700 ±20
DECLDM 800	80 ±3	160 ±5	240 ±7	320 ±10	400 ±12	480 ±15	560 ±17	640 ±19	720 ±20	800 ±20
DECLDM 900	90 ±3	180 ±6	270 ±8	360 ±11	450 ±14	540 ±16	630 ±19	720 ±20	810 ±20	900 ±22
DECLDM 1000	100 ±3	200 ±6	300 ±9	400 ±12	500 ±15	600 ±18	700 ±20	800 ±20	900 ±22	1000 ±22

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A•1500**; for Pulse Generator Modules, see pages **1A•1501** through **1A•1503**; For Square Wave Generator Modules and Digital Clocks, see pages **1A•1504** through **1A•1507**; for Digital Frequency Multiplier Modules, see page **1A•1508**.

ABOVE DATA FROM CATALOG NO. C/010480

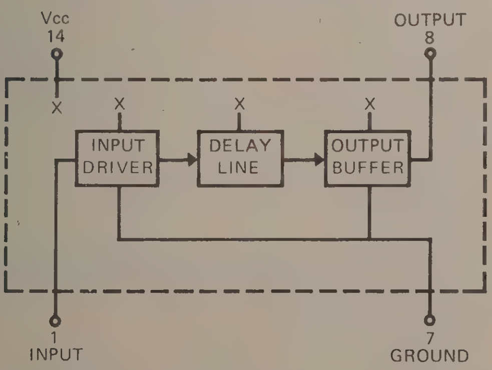
T^2L COMPATIBLE Low Profile

LOGIC DELAY LINE (Schottky)

V
OUT
TTLDL-100
IN
G
EC²

- T^2L input and output
- Delay stable and precise
- 14-pin DIP package
- Available in delays from 5ns to 1000ns
- Output isolated and with 10 T^2L fan-out capacity
- Rise time 4ns maximum
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



φ DELAYS AND TOLERANCES (in ns)

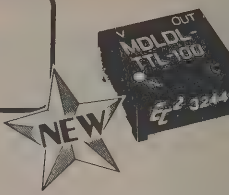
PART NO.	OUTPUT	PART NO.	OUTPUT
TTLDL-5	5 ±1	TTLDL-60	60 ±2
TTLDL-6	6 ±1	TTLDL-65	65 ±2.5
TTLDL-7	7 ±1	TTLDL-70	70 ±2.5
TTLDL-8	8 ±1	TTLDL-75	75 ±2.5
TTLDL-9	9 ±1	TTLDL-80	80 ±2.5
TTLDL-10	10 ±1	TTLDL-85	85 ±3
TTLDL-11	11 ±1	TTLDL-90	90 ±3
TTLDL-12	12 ±1	TTLDL-95	95 ±3
TTLDL-13	13 ±1	TTLDL-100	100 ±3
TTLDL-14	14 ±1	TTLDL-125	125 ±4
TTLDL-15	15 ±1	TTLDL-150	150 ±4.5
TTLDL-16	16 ±1	TTLDL-175	175 ±5
TTLDL-17	17 ±1	TTLDL-200	200 ±6
TTLDL-18	18 ±1	TTLDL-225	225 ±7
TTLDL-19	19 ±1	TTLDL-250	250 ±8
TTLDL-20	20 ±1	TTLDL-275	275 ±9
TTLDL-21	21 ±1	TTLDL-300	300 ±10
TTLDL-22	22 ±1	TTLDL-350	350 ±11
TTLDL-23	23 ±1	TTLDL-400	400 ±12
TTLDL-24	24 ±1	TTLDL-450	450 ±14
TTLDL-25	25 ±1	TTLDL-500	500 ±15
TTLDL-30	30 ±1.5	TTLDL-600	600 ±18
TTLDL-35	35 ±1.5	TTLDL-700	700 ±20
TTLDL-40	40 ±1.5	TTLDL-800	800 ±22
TTLDL-45	45 ±2	TTLDL-900	900 ±24
TTLDL-50	50 ±2	TTLDL-1000	1000 ±26
TTLDL-55	55 ±2		

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A•1500**; for Pulse Generator Modules, see pages **1A•1501** through **1A•1503**; for Square Wave Generator Modules and Digital Clocks, see pages **1A•1504** through **1A•1507**; for Digital Frequency Multiplier Modules, see page **1A•1508**.

ABOVE DATA FROM CATALOG NO. C/112279

EC² engineered components company

3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

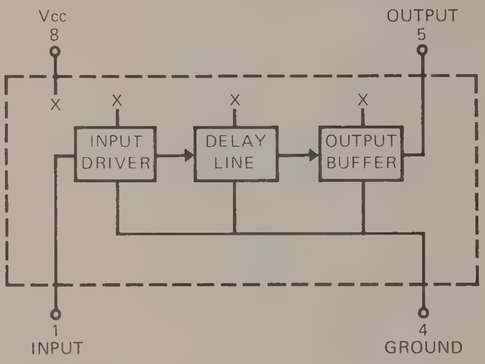


T²L COMPATIBLE "Mini DIP" Low Profile

LOGIC DELAY LINE (Schottky)

- T²L input and output
- Delay stable and precise
- 8-pin DIP package
- Available in delays from 5 to 500ns
- Output isolated and with 10 Schottky T²L fan-out capacity
- Rise time 4ns maximum
- Dimensions: .400 wide X .500 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



φDELAYS AND TOLERANCES (in ns)

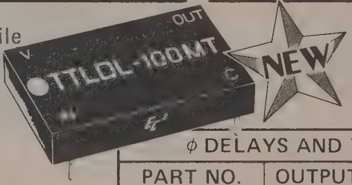
PART NO.	OUTPUT	PART NO.	OUTPUT
MDLDL-TTL-5	5 ±1	MDLDL-TTL-45	45 ±2
MDLDL-TTL-6	6 ±1	MDLDL-TTL-50	50 ±2
MDLDL-TTL-7	7 ±1	MDLDL-TTL-55	55 ±2
MDLDL-TTL-8	8 ±1	MDLDL-TTL-60	60 ±2
MDLDL-TTL-9	9 ±1	MDLDL-TTL-65	65 ±2.5
MDLDL-TTL-10	10 ±1	MDLDL-TTL-70	70 ±2.5
MDLDL-TTL-11	11 ±1	MDLDL-TTL-75	75 ±2.5
MDLDL-TTL-12	12 ±1	MDLDL-TTL-80	80 ±2.5
MDLDL-TTL-13	13 ±1	MDLDL-TTL-85	85 ±3
MDLDL-TTL-14	14 ±1	MDLDL-TTL-90	90 ±3
MDLDL-TTL-15	15 ±1	MDLDL-TTL-95	95 ±3
MDLDL-TTL-16	16 ±1	MDLDL-TTL-100	100 ±3
MDLDL-TTL-17	17 ±1	MDLDL-TTL-125	125 ±4
MDLDL-TTL-18	18 ±1	MDLDL-TTL-150	150 ±4.5
MDLDL-TTL-19	19 ±1	MDLDL-TTL-175	175 ±5
MDLDL-TTL-20	20 ±1	MDLDL-TTL-200	200 ±6
MDLDL-TTL-21	21 ±1	MDLDL-TTL-225	225 ±7
MDLDL-TTL-22	22 ±1	MDLDL-TTL-250	250 ±8
MDLDL-TTL-23	23 ±1	MDLDL-TTL-275	275 ±9
MDLDL-TTL-24	24 ±1	MDLDL-TTL-300	300 ±10
MDLDL-TTL-25	25 ±1	MDLDL-TTL-350	350 ±11
MDLDL-TTL-30	30 ±1.5	MDLDL-TTL-400	400 ±12
MDLDL-TTL-35	35 ±1.5	MDLDL-TTL-450	450 ±14
MDLDL-TTL-40	40 ±1.5	MDLDL-TTL-500	500 ±15

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/123081

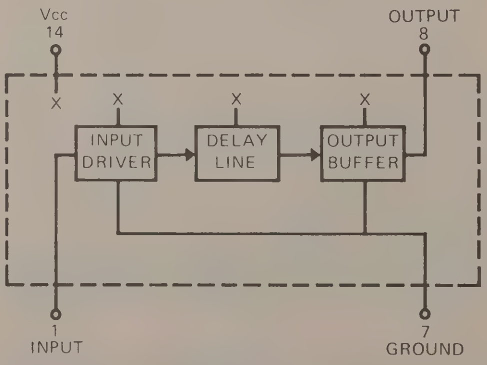
T²L COMPATIBLE "Thinny DIP" Super Low Profile

LOGIC DELAY LINE (Schottky)



- Full military temperature range
- T²L input and output
- Delay stable and precise
- 14-pin DIP package
- Available in delays from 5 to 500ns
- Output isolated and with 10 T²L fan-out capacity
- Rise time 4ns maximum
- Dimensions: .500 wide X .800 long X .165 high
- ICs burned in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of −55° to +125°C

BLOCK DIAGRAM IS SHOWN BELOW



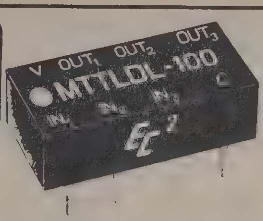
φ DELAYS AND TOLERANCES (in ns)

PART NO.	OUTPUT	PART NO.	OUTPUT
TTLDL-5MT	5 ±1	TTLDL-45MT	45 ±2
TTLDL-6MT	6 ±1	TTLDL-50MT	50 ±2
TTLDL-7MT	7 ±1	TTLDL-55MT	55 ±2
TTLDL-8MT	8 ±1	TTLDL-60MT	60 ±2
TTLDL-9MT	9 ±1	TTLDL-65MT	65 ±2.5
TTLDL-10MT	10 ±1	TTLDL-70MT	70 ±2.5
TTLDL-11MT	11 ±1	TTLDL-75MT	75 ±2.5
TTLDL-12MT	12 ±1	TTLDL-80MT	80 ±2.5
TTLDL-13MT	13 ±1	TTLDL-85MT	85 ±3
TTLDL-14MT	14 ±1	TTLDL-90MT	90 ±3
TTLDL-15MT	15 ±1	TTLDL-95MT	95 ±3
TTLDL-16MT	16 ±1	TTLDL-100MT	100 ±3
TTLDL-17MT	17 ±1	TTLDL-125MT	125 ±4
TTLDL-18MT	18 ±1	TTLDL-150MT	150 ±4.5
TTLDL-19MT	19 ±1	TTLDL-175MT	175 ±5
TTLDL-20MT	20 ±1	TTLDL-200MT	200 ±6
TTLDL-21MT	21 ±1	TTLDL-225MT	225 ±7
TTLDL-22MT	22 ±1	TTLDL-250MT	250 ±8
TTLDL-23MT	23 ±1	TTLDL-275MT	275 ±9
TTLDL-24MT	24 ±1	TTLDL-300MT	300 ±10
TTLDL-25MT	25 ±1	TTLDL-350MT	350 ±11
TTLDL-30MT	30 ±1.5	TTLDL-400MT	400 ±12
TTLDL-35MT	35 ±1.5	TTLDL-450MT	450 ±14
TTLDL-40MT	40 ±1.5	TTLDL-500MT	500 ±15

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/092280

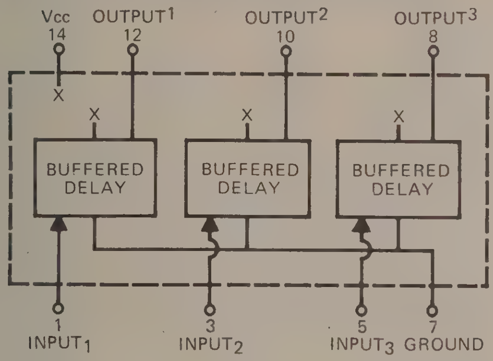
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*



T²L COMPATIBLE Low Profile MULTI-LOGIC DELAY LINE (Schottky)

- T²L inputs and outputs
- Delays stable and precise
- 14-pin DIP package
- Available in delays from 5ns to 250ns each isolated and with 10 T²L fan-out capacity
- Rise time 4ns maximum
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of 0° to +70°C.

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)

PART NO.	OUTPUT	PART NO.	OUTPUT
MTTLDL-5	5 ±1	MTTLDL-30	30 ±1.5
MTTLDL-6	6 ±1	MTTLDL-35	35 ±1.5
MTTLDL-7	7 ±1	MTTLDL-40	40 ±1.5
MTTLDL-8	8 ±1	MTTLDL-45	45 ±2
MTTLDL-9	9 ±1	MTTLDL-50	50 ±2
MTTLDL-10	10 ±1	MTTLDL-55	55 ±2
MTTLDL-11	11 ±1	MTTLDL-60	60 ±2
MTTLDL-12	12 ±1	MTTLDL-65	65 ±2.5
MTTLDL-13	13 ±1	MTTLDL-70	70 ±2.5
MTTLDL-14	14 ±1	MTTLDL-75	75 ±2.5
MTTLDL-15	15 ±1	MTTLDL-80	80 ±2.5
MTTLDL-16	16 ±1	MTTLDL-85	85 ±3
MTTLDL-17	17 ±1	MTTLDL-90	90 ±3
MTTLDL-18	18 ±1	MTTLDL-95	95 ±3
MTTLDL-19	19 ±1	MTTLDL-100	100 ±3
MTTLDL-20	20 ±1	MTTLDL-125	125 ±4
MTTLDL-21	21 ±1	MTTLDL-150	150 ±4.5
MTTLDL-22	22 ±1	MTTLDL-175	175 ±5
MTTLDL-23	23 ±1	MTTLDL-200	200 ±6
MTTLDL-24	24 ±1	MTTLDL-225	225 ±7
MTTLDL-25	25 ±1	MTTLDL-250	250 ±8

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

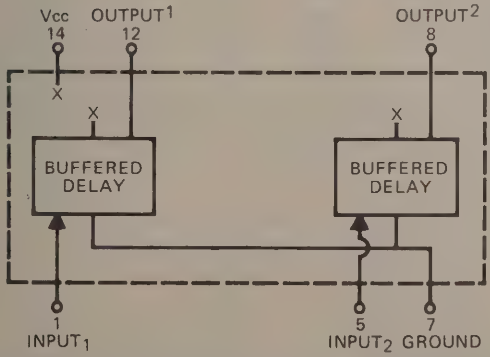
ABOVE DATA FROM CATALOG NO. C/011080

T²L COMPATIBLE "Thinny DIP" Super Low Profile MULTI-LOGIC DELAY LINE (Schottky)

V OUT1 OUT2
MTTLDL-50MT
NEW

- Full military temperature range
- T²L inputs and outputs
- Delays stable and precise
- 14-pin DIP package
- Available in delays from 5 to 250ns — each isolated and with 10 T²L fan-out capacity
- Rise time 4ns maximum
- Dimensions: .500 wide X .800 long X .165 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of −55° to +125°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)

PART NO.	OUTPUT	PART NO.	OUTPUT
MTTLDL-5MT	5 ±1	MTTLDL-30MT	30 ±1.5
MTTLDL-6MT	6 ±1	MTTLDL-35MT	35 ±1.5
MTTLDL-7MT	7 ±1	MTTLDL-40MT	40 ±1.5
MTTLDL-8MT	8 ±1	MTTLDL-45MT	45 ±2
MTTLDL-9MT	9 ±1	MTTLDL-50MT	50 ±2
MTTLDL-10MT	10 ±1	MTTLDL-55MT	55 ±2
MTTLDL-11MT	11 ±1	MTTLDL-60MT	60 ±2
MTTLDL-12MT	12 ±1	MTTLDL-65MT	65 ±2.5
MTTLDL-13MT	13 ±1	MTTLDL-70MT	70 ±2.5
MTTLDL-14MT	14 ±1	MTTLDL-75MT	75 ±2.5
MTTLDL-15MT	15 ±1	MTTLDL-80MT	80 ±2.5
MTTLDL-16MT	16 ±1	MTTLDL-85MT	85 ±3
MTTLDL-17MT	17 ±1	MTTLDL-90MT	90 ±3
MTTLDL-18MT	18 ±1	MTTLDL-95MT	95 ±3
MTTLDL-19MT	19 ±1	MTTLDL-100MT	100 ±3
MTTLDL-20MT	20 ±1	MTTLDL-125MT	125 ±4
MTTLDL-21MT	21 ±1	MTTLDL-150MT	150 ±4.5
MTTLDL-22MT	22 ±1	MTTLDL-175MT	175 ±5
MTTLDL-23MT	23 ±1	MTTLDL-200MT	200 ±6
MTTLDL-24MT	24 ±1	MTTLDL-225MT	225 ±7
MTTLDL-25MT	25 ±1	MTTLDL-250MT	250 ±8

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/100680

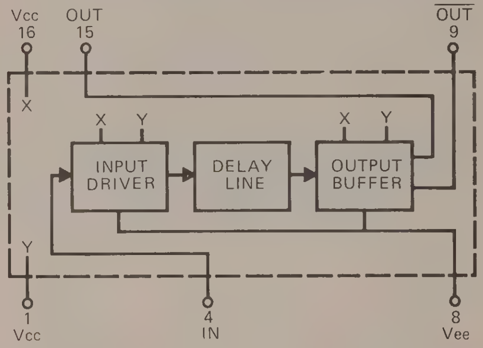
EC² engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

V
IN
ECLDL-100
V OUT
Vee
EC²

ECL 10K COMPATIBLE Low Profile
LOGIC DELAY LINE

- ECL input and output
- Delays stable and precise
- 16-pin DIP package
- Available in delays from 2ns to 1000ns
- Output isolated and with 70 ECL DC fan-out capacity
- Fast rise times on all outputs
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of −30°C to +85°C

BLOCK DIAGRAM IS SHOWN BELOW

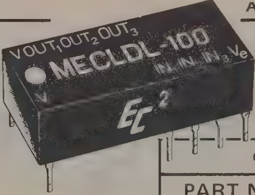


ϕ DELAYS AND TOLERANCES (in ns)

PART NO.	OUTPUT	PART NO.	OUTPUT
ECLDL-2	±.3	ECLDL-50	50 ±2
ECLDL-3	±.4	ECLDL-55	55 ±2
ECLDL-4	±.5	ECLDL-60	60 ±2
ECLDL-5	5 ±1	ECLDL-65	65 ±2.5
ECLDL-6	6 ±1	ECLDL-70	70 ±2.5
ECLDL-7	7 ±1	ECLDL-75	75 ±2.5
ECLDL-8	8 ±1	ECLDL-80	80 ±2.5
ECLDL-9	9 ±1	ECLDL-85	85 ±3
ECLDL-10	10 ±1	ECLDL-90	90 ±3
ECLDL-11	11 ±1	ECLDL-95	95 ±3
ECLDL-12	12 ±1	ECLDL-100	100 ±3
ECLDL-13	13 ±1	ECLDL-125	125 ±4
ECLDL-14	14 ±1	ECLDL-150	150 ±4.5
ECLDL-15	15 ±1	ECLDL-175	175 ±5
ECLDL-16	16 ±1	ECLDL-200	200 ±6
ECLDL-17	17 ±1	ECLDL-225	225 ±7
ECLDL-18	18 ±1	ECLDL-250	250 ±8
ECLDL-19	19 ±1	ECLDL-275	275 ±9
ECLDL-20	20 ±1	ECLDL-300	300 ±10
ECLDL-21	21 ±1	ECLDL-350	350 ±11
ECLDL-22	22 ±1	ECLDL-400	400 ±12
ECLDL-23	23 ±1	ECLDL-450	450 ±14
ECLDL-24	24 ±1	ECLDL-500	500 ±15
ECLDL-25	25 ±1	ECLDL-600	600 ±18
ECLDL-30	30 ±1.5	ECLDL-700	700 ±20
ECLDL-35	35 ±1.5	ECLDL-800	800 ±22
ECLDL-40	40 ±1.5	ECLDL-900	900 ±24
ECLDL-45	45 ±2	ECLDL-1000	1000 ±26

Note: For other active digital modules, i.e., Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508 and for Noise Filter Modules, see page **1A**•1500.

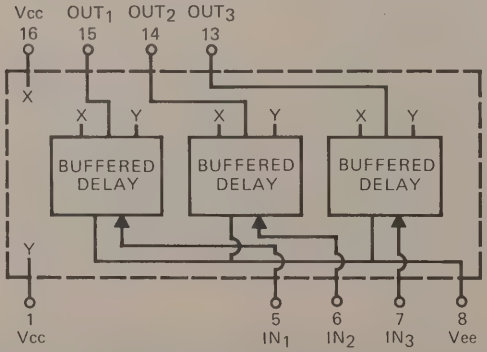
ABOVE DATA FROM CATALOG NO. C/011180



ECL 10K COMPATIBLE Low Profile
MULTI-LOGIC DELAY LINE

- ECL inputs and outputs
- Delays stable and precise
- 16-pin DIP package
- Available in delays from 5ns to 100ns
- Each output isolated and with 70 ECL DC fan-out capacity
- Fast rise times on all outputs
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of −30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)

PART NO.	OUTPUT	PART NO.	OUTPUT
MECLDL-5	5 ±1	MECLDL-23	23 ±1
MECLDL-6	6 ±1	MECLDL-24	24 ±1
MECLDL-7	7 ±1	MECLDL-25	25 ±1
MECLDL-8	8 ±1	MECLDL-30	30 ±1.5
MECLDL-9	9 ±1	MECLDL-35	35 ±1.5
MECLDL-10	10 ±1	MECLDL-40	40 ±1.5
MECLDL-11	11 ±1	MECLDL-45	45 ±2
MECLDL-12	12 ±1	MECLDL-50	50 ±2
MECLDL-13	13 ±1	MECLDL-55	55 ±2
MECLDL-14	14 ±1	MECLDL-60	60 ±2
MECLDL-15	15 ±1	MECLDL-65	65 ±2.5
MECLDL-16	16 ±1	MECLDL-70	70 ±2.5
MECLDL-17	17 ±1	MECLDL-75	75 ±2.5
MECLDL-18	18 ±1	MECLDL-80	80 ±2.5
MECLDL-19	19 ±1	MECLDL-85	85 ±3
MECLDL-20	20 ±1	MECLDL-90	90 ±3
MECLDL-21	21 ±1	MECLDL-95	95 ±3
MECLDL-22	22 ±1	MECLDL-100	100 ±3

Note: For other active digital modules, i.e., Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508 and for Noise Filter Modules, see page **1A**•1500.

ABOVE DATA FROM CATALOG NO. C/011880

engineered components company

3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

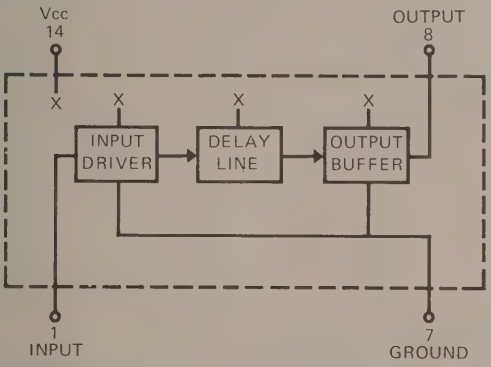
V
OUT
LPSLDL-100
IN
C
EC2

T²L COMPATIBLE Low Profile

LOGIC DELAY LINE
(Low Power Schottky)

- T²L input and output
- Delay stable and precise
- 14-pin DIP package
- Available in delays from 10ns to 500ns
- Output isolated and with 20 T²L fan-out capacity
- Rise time 8ns maximum
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to +70°C

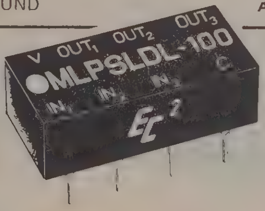
BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)			
PART NO.	OUTPUT	PART NO.	OUTPUT
LPSLDL-10	10 ±1	LPSLDL-60	60 ±2
LPSLDL-11	11 ±1	LPSLDL-65	65 ±2.5
LPSLDL-12	12 ±1	LPSLDL-70	70 ±2.5
LPSLDL-13	13 ±1	LPSLDL-75	75 ±2.5
LPSLDL-14	14 ±1	LPSLDL-80	80 ±2.5
LPSLDL-15	15 ±1	LPSLDL-85	85 ±3
LPSLDL-16	16 ±1	LPSLDL-90	90 ±3
LPSLDL-17	17 ±1	LPSLDL-95	95 ±3
LPSLDL-18	18 ±1	LPSLDL-100	100 ±3
LPSLDL-19	19 ±1	LPSLDL-125	125 ±4
LPSLDL-20	20 ±1	LPSLDL-150	150 ±4.5
LPSLDL-21	21 ±1	LPSLDL-175	175 ±5
LPSLDL-22	22 ±1	LPSLDL-200	200 ±6
LPSLDL-23	23 ±1	LPSLDL-225	225 ±7
LPSLDL-24	24 ±1	LPSLDL-250	250 ±8
LPSLDL-25	25 ±1	LPSLDL-275	275 ±9
LPSLDL-30	30 ±1.5	LPSLDL-300	300 ±10
LPSLDL-35	35 ±1.5	LPSLDL-350	350 ±11
LPSLDL-40	40 ±1.5	LPSLDL-400	400 ±12
LPSLDL-45	45 ±2	LPSLDL-450	450 ±14
LPSLDL-50	50 ±2	LPSLDL-500	500 ±15
LPSLDL-55	55 ±2		

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/021980

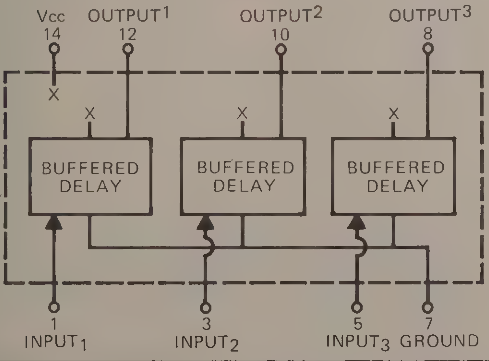


T²L COMPATIBLE Low Profile

MULTI-LOGIC DELAY LINE
(Low Power Schottky)

- T²L inputs and outputs
- Delays stable and precise
- 14-pin DIP package
- Available in delays from 10ns to 100ns – each isolated and with 20 low power Schottky T²L fan-out capacity
- Rise time 8ns maximum
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)			
PART NO.	OUTPUT	PART NO.	OUTPUT
MLPSLDL-10	10 ±1	MLPSLDL-30	30 ±1.5
MLPSLDL-11	11 ±1	MLPSLDL-35	35 ±1.5
MLPSLDL-12	12 ±1	MLPSLDL-40	40 ±1.5
MLPSLDL-13	13 ±1	MLPSLDL-45	45 ±2
MLPSLDL-14	14 ±1	MLPSLDL-50	50 ±2
MLPSLDL-15	15 ±1	MLPSLDL-55	55 ±2
MLPSLDL-16	16 ±1	MLPSLDL-60	60 ±2
MLPSLDL-17	17 ±1	MLPSLDL-65	65 ±2.5
MLPSLDL-18	18 ±1	MLPSLDL-70	70 ±2.5
MLPSLDL-19	19 ±1	MLPSLDL-75	75 ±2.5
MLPSLDL-20	20 ±1	MLPSLDL-80	80 ±2.5
MLPSLDL-21	21 ±1	MLPSLDL-85	85 ±3
MLPSLDL-22	22 ±1	MLPSLDL-90	90 ±3
MLPSLDL-23	23 ±1	MLPSLDL-95	95 ±3
MLPSLDL-24	24 ±1	MLPSLDL-100	100 ±3
MLPSLDL-25	25 ±1		

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/022680

engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

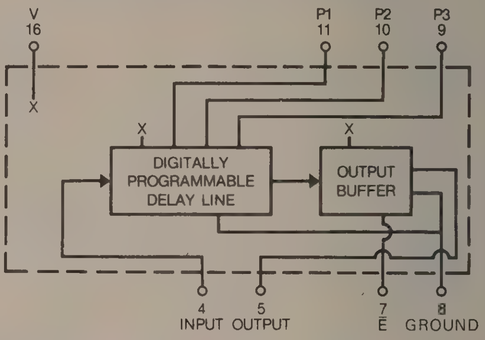
V
1 2 3
PTTLDL-7-1
IN OUT
E
C

T²L COMPATIBLE Low Profile

PROGRAMMABLE LOGIC DELAY LINE (3-Bit) (Schottky)

- T²L input and output
- Delays stable and precise
- 16-pin DIP package
- Available in delays up to 77ns
- Available in 10 delay steps with resolution from 1ns to 10ns
- Propagation delays fully compensated
- All delays digitally programmable
- 10 T²L fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 2 million hours.
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)				
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step	* *Maximum Deviation From Programmed Delay
PTTLDL-7-1	7 ±.3	14	1 ±.3	±.4
PTTLDL-7-2	7 ±.3	21	2 ±.4	±.6
PTTLDL-7-3	7 ±.3	28	3 ±.5	±.8
PTTLDL-7-4	7 ±.3	35	4 ±.5	±.9
PTTLDL-7-5	7 ±.3	42	5 ±.5	±1
PTTLDL-7-6	7 ±.3	49	6 ±.6	±1.2
PTTLDL-7-7	7 ±.3	56	7 ±.7	±1.4
PTTLDL-7-8	7 ±.3	63	8 ±.8	±1.6
PTTLDL-7-9	7 ±.3	70	9 ±.9	±1.8
PTTLDL-7-10	7 ±.3	77	10 ±1	±2

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/011780

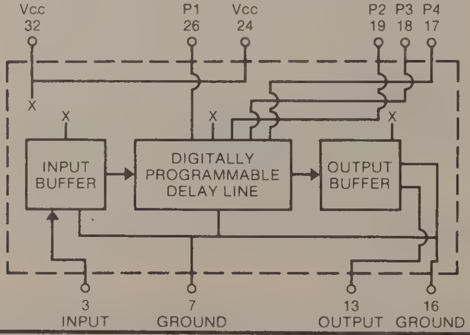
T²L COMPATIBLE Low Profile

PROGRAMMABLE LOGIC DELAY LINE (4-Bit) (Schottky)

V
1
V
2 3 4
C
PTTLDL 15-1

- T²L input and output
- Delays stable and precise
- 32-pin DIP package
- Available in delays up to 765ns
- Available in 18 delay steps with resolution from 1ns to 50ns
- Propagation delays fully compensated
- All delays digitally programmable
- 10 T²L fan-out capacity
- Dimensions: .400 wide X 1.650 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕDELAYS AND TOLERANCES (in ns)				
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step	**Maximum Deviation From Programmed Delay
PTTLDL-15-1	15 ±.6	30	1 ±.4	±.8
PTTLDL-15-2	15 ±.6	45	2 ±.5	±1.2
PTTLDL-15-3	15 ±.6	60	3 ±.5	±1.6
PTTLDL-15-4	15 ±.6	75	4 ±.6	±1.8
PTTLDL-15-5	15 ±.6	90	5 ±.6	±2.0
PTTLDL-15-6	15 ±.6	105	6 ±.8	±2.4
PTTLDL-15-7	15 ±.6	120	7 ±.8	±2.8
PTTLDL-15-8	15 ±.6	135	8 ±1	±3.2
PTTLDL-15-9	15 ±.6	150	9 ±1	±3.6
PTTLDL-15-10	15 ±.6	165	10 ±1	±4
PTTLDL-15-15	15 ±.6	240	15 ±1.5	±6
PTTLDL-15-20	15 ±.6	315	20 ±2	±8
PTTLDL-15-25	15 ±.6	390	25 ±2	±10
PTTLDL-15-30	15 ±.6	465	30 ±2.5	±12
PTTLDL-15-35	15 ±.6	540	35 ±2.5	±14
PTTLDL-15-40	15 ±.6	615	40 ±3	±16
PTTLDL-15-45	15 ±.6	690	45 ±3	±18
PTTLDL-15-50	15 ±.6	765	50 ±3	±20

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/012480

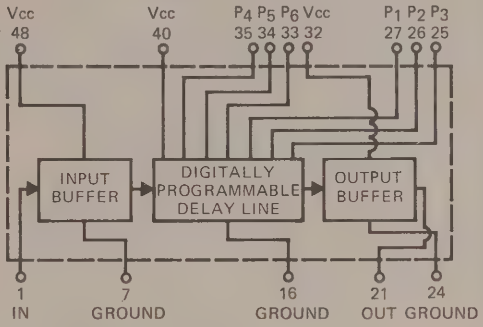
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

PTTLDL-14-1
OUT

T^2L COMPATIBLE Low Profile PROGRAMMABLE LOGIC DELAY LINE (6-Bit) (Schottky)

- T^2L input and output
- Delays stable and precise
- 48-pin DIP package
- Available in delays up to 329ns
- 5 delay steps available with resolution from 1ns to 5ns
- Propagation delays fully compensated
- All delays digitally programmable
- 10 T^2L fan-out capacity
- Dimensions: .400 wide X 2.450 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 500,000 hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW

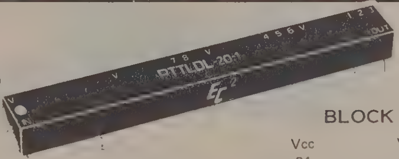

Vcc 48
Vcc 40
P_4 P_5 P_6 Vcc
35 34 33 32
P_1 P_2 P_3
27 26 25
INPUT BUFFER
DIGITALLY PROGRAMMABLE DELAY LINE
OUTPUT BUFFER
1 IN
7 GROUND
16 GROUND
21 OUT
24 GROUND

ϕ DELAYS AND TOLERANCES (in ns)				
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step (Nom)	**Maximum Deviation From Programmed Delay
PTTLDL-14-1	14 ±.3	77	1	±1.5
PTTLDL-14-2	14 ±.3	140	2	±2
PTTLDL-14-3	14 ±.3	203	3	±3
PTTLDL-14-4	14 ±.3	266	4	±4
PTTLDL-14-5	14 ±.3	329	5	±5

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A•1500**; for Pulse Generator Modules, see pages **1A•1501** through **1A•1503**; for Square Wave Generator Modules and Digital Clocks, see pages **1A•1504** through **1A•1507**; for Digital Frequency Multiplier Modules, see page **1A•1508**.

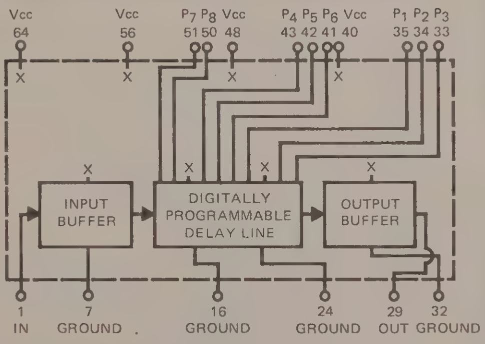
ABOVE DATA FROM CATALOG NO. C/013180

T^2L COMPATIBLE Low Profile PROGRAMMABLE LOGIC DELAY LINE (8-Bit) (Schottky)


PTTLDL-20-1
OUT

- T^2L input and output levels
- Delays stable and precise
- 64-pin DIP package
- Available in delays up to 1295ns
- 5 delay steps available with resolution from 1ns to 5ns
- Propagation delays fully compensated
- All delays digitally programmable
- 10 T^2L fan-out capacity
- Dimensions: .400 wide X 3.250 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 300,000 hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW

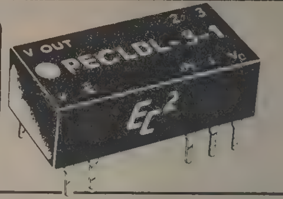

Vcc 64
Vcc 56
P_7 P_8 Vcc
51 50 48
P_4 P_5 P_6 Vcc
43 42 41 40
P_1 P_2 P_3
35 34 33
INPUT BUFFER
DIGITALLY PROGRAMMABLE DELAY LINE
OUTPUT BUFFER
1 IN
7 GROUND
16 GROUND
24 GROUND
29 OUT
32 GROUND

ϕ DELAYS AND TOLERANCES (in ns)				
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step (Nom)	**Maximum Deviation From Programmed Delay
PTTLDL-20-1	20 ±.5	275	1	±6
PTTLDL-20-2	20 ±.5	530	2	±8
PTTLDL-20-3	20 ±.5	785	3	±12
PTTLDL-20-4	20 ±.5	1040	4	±16
PTTLDL-20-5	20 ±.5	1295	5	±20

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A•1500**; for Pulse Generator Modules, see pages **1A•1501** through **1A•1503**; for Square Wave Generator Modules and Digital Clocks, see pages **1A•1504** through **1A•1507**; for Digital Frequency Multiplier Modules, see page **1A•1508**.

ABOVE DATA FROM CATALOG NO. C/020580

EC²
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

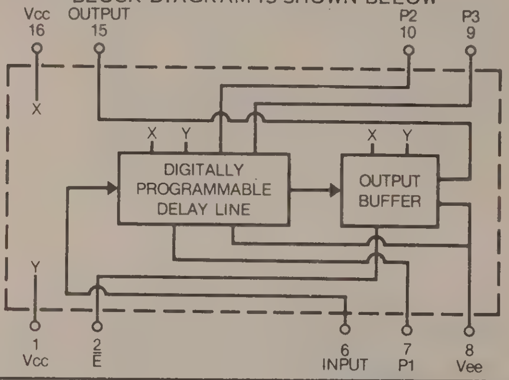


ECL 10K COMPATIBLE Low Profile

PROGRAMMABLE LOGIC DELAY LINE (3-Bit)

- ECL input and output levels
- Delays stable and precise
- 16-pin DIP package
- Available in delays up to 353ns
- Available in 18 delay steps with resolution from 1ns to 50ns
- Propagation delays fully compensated
- All delays digitally programmable
- 70 ECL DC fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of – 30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)

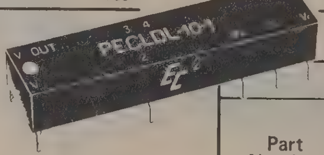
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step	**Maximum Deviation From Programmed Delay
PECLDL-3-1	2.8 ±.3	10	1 ±.3	±.4
PECLDL-3-2	2.8 ±.3	17	2 ±.4	±.6
PECLDL-3-3	2.8 ±.3	24	3 ±.5	±.8
PECLDL-3-4	2.8 ±.3	31	4 ±.5	±.9
PECLDL-3-5	2.8 ±.3	38	5 ±.5	±1
PECLDL-3-6	2.8 ±.3	45	6 ±.6	±1.2
PECLDL-3-7	2.8 ±.3	52	7 ±.7	±1.4
PECLDL-3-8	2.8 ±.3	59	8 ±.8	±1.6
PECLDL-3-9	2.8 ±.3	66	9 ±.9	±1.8
PECLDL-3-10	2.8 ±.3	73	10 ±1	±2
PECLDL-3-15	2.8 ±.3	108	15 ±1	±3
PECLDL-3-20	2.8 ±.3	143	20 ±1.5	±4
PECLDL-3-25	2.8 ±.3	178	25 ±1.5	±5
PECLDL-3-30	2.8 ±.3	213	30 ±2	±6
PECLDL-3-35	2.8 ±.3	248	35 ±2	±7
PECLDL-3-40	2.8 ±.3	283	40 ±2.5	±8
PECLDL-3-45	2.8 ±.3	318	45 ±2.5	±9
PECLDL-3-50	2.8 ±.3	353	50 ±2.5	±10

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/123079

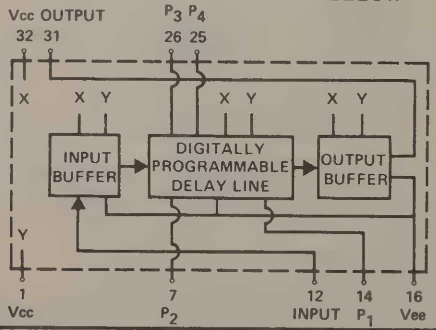
ECL 10K COMPATIBLE Low Profile

PROGRAMMABLE LOGIC DELAY LINE (4-Bit)



- ECL input and output levels
- Delays stable and precise
- 32-pin DIP package
- Available in delays up to 760ns
- Available in 18 delay steps with resolution from 1ns to 50ns
- Propagation delays fully compensated
- All delays digitally programmable
- 70 ECL DC fan-out capacity
- Dimensions: .400 wide X 1.600 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 800,000 hours
- Operating temperature range of – 30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



ϕ DELAYS AND TOLERANCES (in ns)

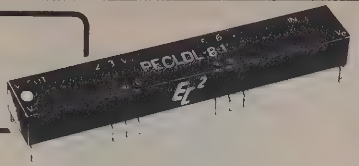
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step	**Maximum Deviation From Programmed Delay
PECLDL-10-1	10 ±.6	25	1 ±.4	±.8
PECLDL-10-2	10 ±.6	40	2 ±.5	±1.2
PECLDL-10-3	10 ±.6	55	3 ±.5	±1.6
PECLDL-10-4	10 ±.6	70	4 ±.6	±1.8
PECLDL-10-5	10 ±.6	85	5 ±.6	±2.0
PECLDL-10-6	10 ±.6	100	6 ±.8	±2.4
PECLDL-10-7	10 ±.6	115	7 ±.8	±2.8
PECLDL-10-8	10 ±.6	130	8 ±1	±3.2
PECLDL-10-9	10 ±.6	145	9 ±1	±3.6
PECLDL-10-10	10 ±.6	160	10 ±1	±4
PECLDL-10-15	10 ±.6	235	15 ±1.5	±6
PECLDL-10-20	10 ±.6	310	20 ±2	±8
PECLDL-10-25	10 ±.6	385	25 ±2	±10
PECLDL-10-30	10 ±.6	460	30 ±2.5	±12
PECLDL-10-35	10 ±.6	535	35 ±2.5	±14
PECLDL-10-40	10 ±.6	610	40 ±3	±16
PECLDL-10-45	10 ±.6	685	45 ±3	±18
PECLDL-10-50	10 ±.6	760	50 ±3	±20

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/030180

EC² engineered components company

3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

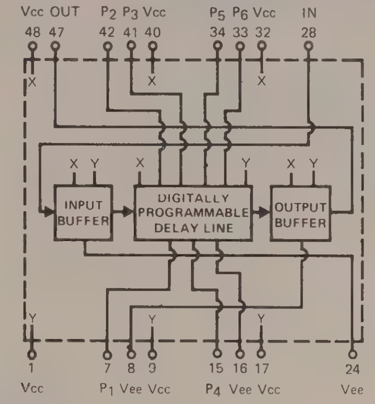

PECLDL-8-1
EC²

ECL 10K COMPATIBLE Low Profile

PROGRAMMABLE LOGIC DELAY LINE (6-Bit)

- ECL input and output levels
- Delays stable and precise
- 48-pin DIP package
- Available in delays up to 323ns
- Available in 5 delay steps with resolution from 1ns to 5ns
- Propagation delays fully compensated
- All delays digitally programmable
- 70 ECL DC fan-out capacity
- Dimensions: .400 wide X 2.400 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 500,000 hours
- Operating temperature range of –30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW


Vcc OUT
48 47
P2 P3 Vcc
42 41 40
P5 P6 Vcc
34 33 32
IN
28
INPUT BUFFER
DIGITALLY PROGRAMMABLE DELAY LINE
OUTPUT BUFFER
X
Y
1
Vcc
7 8 9
P1 Vee Vcc
15 16 17
P4 Vee Vcc
24
Vee

φ DELAYS AND TOLERANCES (in ns)				
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step (Nom)	**Maximum Deviation From Programmed Delay
PECLDL-8-1	8±.3	71	1	±1.5
PECLDL-8-2	8±.3	134	2	±2
PECLDL-8-3	8±.3	197	3	±3
PECLDL-8-4	8±.3	260	4	±4
PECLDL-8-5	8±.3	323	5	±5

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A•**1500; for Pulse Generator Modules, see pages **1A•**1501 through **1A•**1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A•**1504 through **1A•**1507; for Digital Frequency Multiplier Modules, see page **1A•**1508.

ABOVE DATA FROM CATALOG NO. C/031580

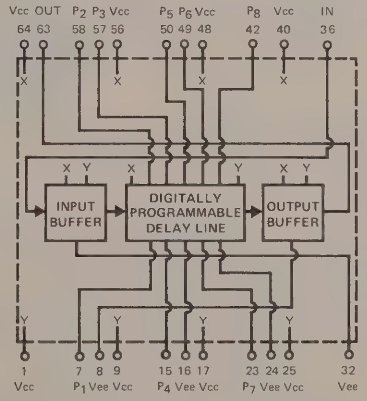
ECL 10K COMPATIBLE Low Profile

PROGRAMMABLE LOGIC DELAY LINE (8-Bit)

PECLDL-12-1
EC²

- ECL input and output levels
- Delays stable and precise
- 64-pin DIP package
- Available in delays up to 1287ns
- Available in 5 delay steps with resolution from 1ns to 5ns
- Propagation delays fully compensated
- All delays digitally programmable
- 70 ECL DC fan-out capacity
- Dimensions: .400 wide X 3.200 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 300,000 hours
- Operating temperature range of –30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW

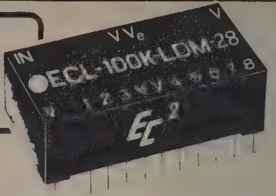

Vcc OUT
64 63
P2 P3 Vcc
58 57 56
P5 P6 Vcc
50 49 48
P8 Vcc
42 40
IN
36
INPUT BUFFER
DIGITALLY PROGRAMMABLE DELAY LINE
OUTPUT BUFFER
X
Y
1
Vcc
7 8 9
P1 Vee Vcc
15 16 17
P4 Vee Vcc
23 24 25
P7 Vee Vcc
32
Vee

φ DELAYS AND TOLERANCES (in ns)				
Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	Delay Change Per Step (Nom)	**Maximum Deviation From Programmed Delay
PECLDL-12-1	12±.5	267	1	±6
PECLDL-12-2	12±.5	522	2	±8
PECLDL-12-3	12±.5	777	3	±12
PECLDL-12-4	12±.5	1032	4	±16
PECLDL-12-5	12±.5	1287	5	±20

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A•**1500; for Pulse Generator Modules, see pages **1A•**1501 through **1A•**1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A•**1504 through **1A•**1507; for Digital Frequency Multiplier Modules, see page **1A•**1508.

ABOVE DATA FROM CATALOG NO. C/033180

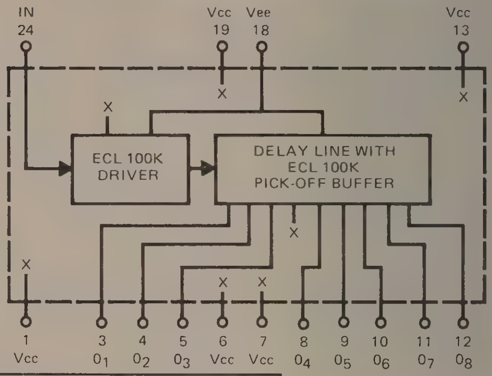
EC^2
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*


IN
V
VVe
ECL-100K-LDM-28
1 2 3 4 V 4 5 6 7 8
V
EC2

ECL 100K COMPATIBLE
LOGIC DELAY MODULE

- ECL 100K input and outputs
- Delays stable and precise
- 24-pin DIP package
- Available in delays from 16ns to 80ns
- 12.5% taps – each isolated and with 70 ECL DC fan-out capacity
- Dimensions: .500 wide X 1.300 long X .375 high
- Rise time 1ns nominal on all outputs
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1 million hours
- Operating temperature range of 0° to +85°C

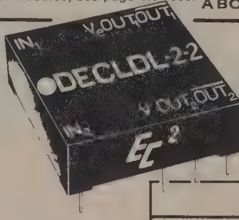
BLOCK DIAGRAM IS SHOWN BELOW


IN
24
Vcc
19
Vee
18
Vcc
13
X
X
X
ECL 100K DRIVER
DELAY LINE WITH ECL 100K PICK-OFF BUFFER
X
X
X
X
1
Vcc
3
0_1
4
0_2
5
0_3
6
Vcc
7
Vcc
8
0_4
9
0_5
10
0_6
11
0_7
12
0_8

ϕ RISE TIME, DELAYS AND TOLERANCES (in ns)									
Part Number	Rise Time Max.	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5	Tap 6	Tap 7	Output
ECL 100K LDM 16	2.0	2±.2	4±.4	6±.6	8±.8	10±1	12±1	14±1	16±1
ECL 100K LDM 20	2.0	2.5±.25	5±.5	7.5±.75	10±1	12.5±1	15±1	17.5±1	20±1
ECL 100K LDM 24	2.0	3±.3	6±.6	9±.9	12±1	15±1	18±1	21±1	24±1
ECL 100K LDM 28	2.0	3.5±.35	7±.7	10.5±1	14±1	17.5±1	21±1	24.5±1	28±1
ECL 100K LDM 32	2.5	4±.4	8±.8	12±1	16±1	20±1	24±1	28±1	32±1
ECL 100K LDM 36	2.5	4.5±.45	9±.9	13.5±1	18±1	22.5±1	27±1	31.5±1	36±1
ECL 100K LDM 40	2.5	5±.5	10±1	15±1	20±1	25±1	30±1	35±1	40±1.5
ECL 100K LDM 44	3.0	5.5±.55	11±1	16.5±1	22±1	27.5±1	33±1	38.5±1	44±1.5
ECL 100K LDM 48	3.0	6±.6	12±1	18±1	24±1	30±1	36±1	42±1.5	48±2
ECL 100K LDM 52	3.0	6.5±.65	13±1	19.5±1	26±1	32.5±1	39±1.5	45.5±2	52±2
ECL 100K LDM 56	3.0	7±.7	14±1	21±1	28±1	35±1	42±1.5	49±2	56±2
ECL 100K LDM 60	4.0	7.5±.75	15±1	22.5±1	30±1	37.5±1	45±1.5	52.5±2	60±2
ECL 100K LDM 64	4.0	8±.8	16±1	24±1	32±1	40±1.5	48±2	56±2	64±2
ECL 100K LDM 68	4.0	8.5±.85	17±1	25.5±1	34±1	42.5±1.5	51±2	59.5±2	68±2
ECL 100K LDM 72	4.5	9±.9	18±1	27±1	36±1	45±1.5	54±2	63±2	72±2.5
ECL 100K LDM 76	4.5	9.5±.95	19±1	28.5±1	38±1	47.5±2	57±2	66.5±2	76±2.5
ECL 100K LDM 80	4.5	10±1	20±1	30±1	40±1.5	50±2	60±2	70±2	80±2.5

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; For Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/040480R2


IN1
VeOUT1OUT1
DECLDL-2-2
IN2
V OUT2 OUT2
EC2

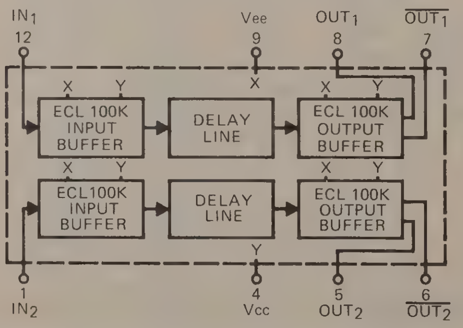
ECL 100K COMPATIBLE
DUAL LOGIC DELAY LINE

- ECL 100K input and output levels
- Delays stable and precise
- 12-pin DIP package
- Available in delays from 2ns to 20ns
- Outputs isolated and with 70 ECL DC fan-out capacity
- Rise time 1ns nominal
- Dimensions: .700 wide X .875 long X .325 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1 million hours
- Operating temperature range of 0° to +85°C

ϕ DELAYS AND TOLERANCES (in ns)			
PART NO.	OUTPUT	PART NO.	OUTPUT
DECLDL-2-2	2±.2	DECLDL-2-10	10±1
DECLDL-2-2.5	2.5±.2	DECLDL-2-10.5	10.5±1
DECLDL-2-3	3±.3	DECLDL-2-11	11±1
DECLDL-2-3.5	3.5±.3	DECLDL-2-11.5	11.5±1
DECLDL-2-4	4±.4	DECLDL-2-12	12±1
DECLDL-2-4.5	4.5±.4	DECLDL-2-12.5	12.5±1
DECLDL-2-5	5±.5	DECLDL-2-13	13±1
DECLDL-2-5.5	5.5±.5	DECLDL-2-13.5	13.5±1
DECLDL-2-6	6±.6	DECLDL-2-14	14±1
DECLDL-2-6.5	6.5±.6	DECLDL-2-14.5	14.5±1
DECLDL-2-7	7±.7	DECLDL-2-15	15±1
DECLDL-2-7.5	7.5±.7	DECLDL-2-16	16±1
DECLDL-2-8	8±.8	DECLDL-2-17	17±1
DECLDL-2-8.5	8.5±.8	DECLDL-2-18	18±1
DECLDL-2-9	9±.9	DECLDL-2-19	19±1
DECLDL-2-9.5	9.5±.9	DECLDL-2-20	20±1

Note: For other active digital modules, i.e., Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

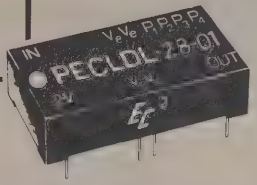
BLOCK DIAGRAM IS SHOWN BELOW


IN1
12
Vee
9
OUT1
8
$\overline{OUT_1}$
7
X Y
X
X Y
ECL 100K INPUT BUFFER
DELAY LINE
ECL 100K OUTPUT BUFFER
X Y
X Y
ECL100K INPUT BUFFER
DELAY LINE
ECL 100K OUTPUT BUFFER
Y
1
IN2
4
Vcc
5
OUT2
6
$\overline{OUT_2}$

ABOVE DATA FROM CATALOG NO. C/012580

EC2 engineered components company

3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

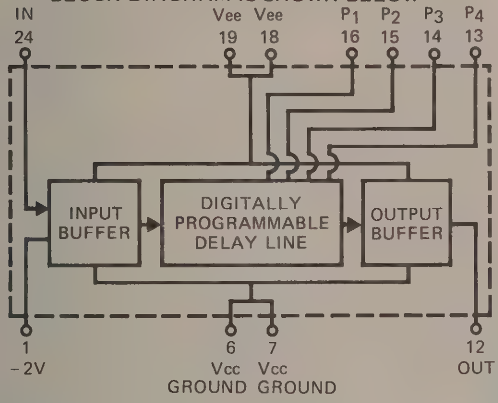

IN
PECLDL 2.8-01
OUT
EC2

ECL 100K COMPATIBLE

PROGRAMMABLE LOGIC DELAY LINE (4-Bit)

- ECL 100K input and output levels
- Delays stable and precise
- 24-pin DIP package
- Available in delays up to 77.8ns
- Available in 18 delay steps with resolution from 0.1ns to 5.0ns
- Propagation delays fully compensated
- All delays digitally programmable
- 70 ECL DC fan-out capacity
- Dimensions: .650 wide X 1.350 long X .375 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 750,000 hours
- Operating temperature range of 0° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW


IN
24
Vee
19
Vee
18
P1
16
P2
15
P3
14
P4
13
INPUT BUFFER
DIGITALLY PROGRAMMABLE DELAY LINE
OUTPUT BUFFER
1
-2V
6
Vcc GROUND
7
Vcc GROUND
12
OUT

ϕ DELAYS AND TOLERANCES (in ns)

Part Number	*Step Zero Delay Time	Maximum Delay Time (Nom)	**Maximum Deviation From Programmed Delay
PECLDL-2.8-0.1	2.8 ±.2	4.3	±.1
PECLDL-2.8-0.2	2.8 ±.2	5.8	±.2
PECLDL-2.8-0.3	2.8 ±.2	7.3	±.25
PECLDL-2.8-0.4	2.8 ±.2	8.8	±.3
PECLDL-2.8-0.5	2.8 ±.2	10.3	±.35
PECLDL-2.8-0.6	2.8 ±.2	11.8	±.4
PECLDL-2.8-0.7	2.8 ±.2	13.3	±.45
PECLDL-2.8-0.8	2.8 ±.2	14.8	±.5
PECLDL-2.8-0.9	2.8 ±.2	16.3	±.5
PECLDL-2.8-1.0	2.8 ±.2	17.8	±.5
PECLDL-2.8-1.5	2.8 ±.2	25.3	±.8
PECLDL-2.8-2.0	2.8 ±.2	32.8	±1.0
PECLDL-2.8-2.5	2.8 ±.2	40.3	±1.3
PECLDL-2.8-3.0	2.8 ±.2	47.8	±1.5
PECLDL-2.8-3.5	2.8 ±.2	55.3	±1.8
PECLDL-2.8-4.0	2.8 ±.2	62.8	±2.0
PECLDL-2.8-4.5	2.8 ±.2	70.3	±2.3
PECLDL-2.8-5.0	2.8 ±.2	77.8	±2.5

Note: For other active digital modules, i.e., Pulse Generator Modules, see pages 1A•1501 through 1A•1503; for Square Wave Generator Modules and Digital Clocks, see pages 1A•1504 through 1A•1507; for Digital Frequency Multiplier Modules, see page 1A•1508 and for Noise Filter Modules, see page 1A•1500.

ABOVE DATA FROM CATALOG NO. C/040180R

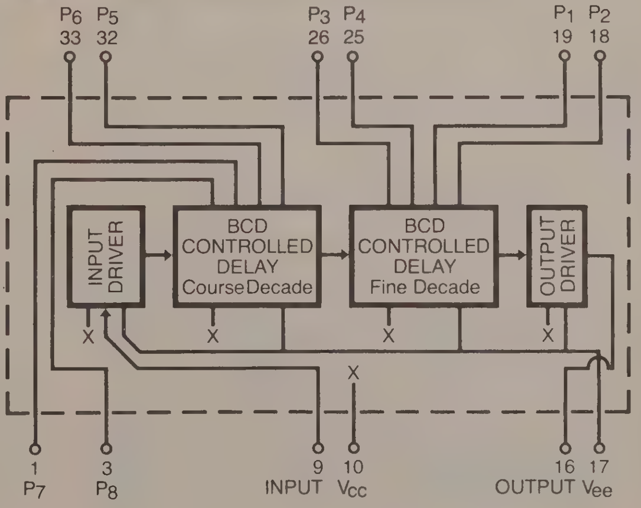
ECL 100K COMPATIBLE

SPECIAL PROGRAMMABLE LOGIC DELAY LINE

P6 P5
P3 P4
P1 P2
SPECLDL 121
EC2

- ECL 100K Input and output levels
- Delays stable and precise
- 34-pin DIP package
- 100 steps of BCD programming
- 100ps per step resolution
- Propagation delays fully compensated
- 70 ECL DC fan-out capacity
- Dimensions: .700 wide X 1.750 long X .500 high
- Rise time 1ns nominal
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 500,000 hours
- Operating temperature range of 0° to +85°C

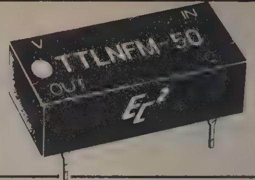
BLOCK DIAGRAM IS SHOWN BELOW


P6
33
P5
32
P3
26
P4
25
P1
19
P2
18
INPUT DRIVER
BCD CONTROLLED DELAY Course Decade
BCD CONTROLLED DELAY Fine Decade
OUTPUT DRIVER
X
X
X
X
X
1
P7
3
P8
9
INPUT
10
Vcc
16
OUTPUT
17
Vee

Note: For other active digital modules, i.e., Pulse Generator Modules, see pages 1A•1501 through 1A•1503; for Square Wave Generator Modules and Digital Clocks, see pages 1A•1504 through 1A•1507; for Digital Frequency Multiplier Modules, see page 1A•1508 and for Noise Filter Modules, see page 1A•1500.

ABOVE DATA FROM SPECLDL-121 BROCHURE PAGE

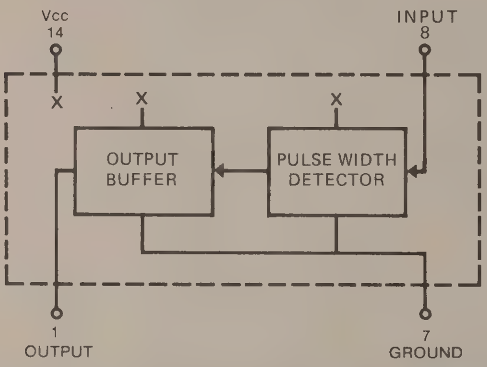
EC²
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*



T²L COMPATIBLE Low Profile LOGIC NOISE FILTER MODULE (Schottky)

- T²L input and output
- Pulse width detection stable and precise
- 14-pin DIP package
- Available in pulse widths from 5ns to 500ns
- 8 T²L fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3.5 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW

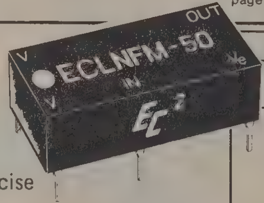


TIMES AND TOLERANCES (in ns)			
PART NO.	ϕ Pulse Widths		
	Nominal	Suppress	Pass
TTLNFM-5	5	<4	>6
TTLNFM-10	10	<9	≥11
TTLNFM-15	15	≤14	≥16
TTLNFM-20	20	≤19	≥21
TTLNFM-25	25	<24	≥26
TTLNFM-30	30	≤29	≥31
TTLNFM-35	35	<34	≥36
TTLNFM-40	40	≤39	≥41
TTLNFM-45	45	≤43.5	≥46.5
TTLNFM-50	50	≤48.5	≥51.5
TTLNFM-60	60	≤58	≥62
TTLNFM-70	70	<68	≥72
TTLNFM-75	75	≤73	≥77
TTLNFM-80	80	<78	≥82
TTLNFM-90	90	≤88	≥92
TTLNFM-100	100	≤98	≥102
TTLNFM-125	125	<123	≥127
TTLNFM-150	150	≤147	≥153
TTLNFM-175	175	≤172	≥178
TTLNFM-200	200	≤196	≥204
TTLNFM-250	250	≤245	≥255
TTLNFM-300	300	<294	≥306
TTLNFM-400	400	<392	≥408
TTLNFM-500	500	<490	≥510

The output of the module will remain at state "0" for any transient input pulses shorter than suppress times and will change to state "1" for pulses longer than pass times. Input pulse width is measured at the +1.5 level.

Note: For other active digital modules, i.e., Logic Delay Lines, see pages 1A•1485 through 1A•1499; for Pulse Generator Modules, see pages 1A•1501 through 1A•1503; for Square Wave Generator Modules and Digital Clocks, see pages 1A•1504 through 1A•1507; for Digital Frequency Multiplier Modules, see page 1A•1508.

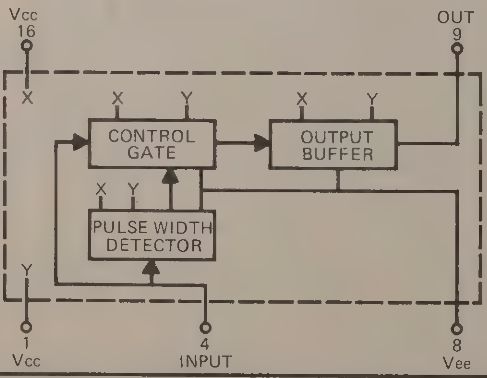
ABOVE DATA FROM CATALOG NO. C/013080



ECL 10K COMPATIBLE Low Profile LOGIC NOISE FILTER MODULE

- ECL input and output
- Pulse width detection stable and precise
- 16-pin DIP package
- Available in pulse widths from 5ns to 500ns
- 70 ECL DC fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3.5 million hours
- Operating temperature range of –30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



TIMES AND TOLERANCES (in ns)			
PART NO.	ϕ Pulse Widths		
	Nominal	Suppress	Pass
ECLNFM-5	5	<4	>6
ECLNFM-10	10	<9	>11
ECLNFM-15	15	<14	>16
ECLNFM-20	20	<19	>21
ECLNFM-25	25	<24	>26
ECLNFM-30	30	<29	>31
ECLNFM-35	35	<34	>36
ECLNFM-40	40	<39	>41
ECLNFM-45	45	<43.5	>46.5
ECLNFM-50	50	<48.5	>51.5
ECLNFM-60	60	<58	>62
ECLNFM-70	70	<68	>72
ECLNFM-75	75	<73	>77
ECLNFM-80	80	<78	>82
ECLNFM-90	90	<88	>92
ECLNFM-100	100	<98	>102
ECLNFM-125	125	<123	>127
ECLNFM-150	150	<147	>153
ECLNFM-175	175	<172	>178
ECLNFM-200	200	<196	>204
ECLNFM-250	250	<245	>255
ECLNFM-300	300	<294	>306
ECLNFM-400	400	<392	>408
ECLNFM-500	500	<490	>510

The output of the module will remain at state "0" for any transient input pulses shorter than suppress times and will change to state "1" for pulses longer than pass times. Input pulse width is measured at the – 1.3V level.

Note: For other active digital modules, i.e., Logic Delay Lines, see pages 1A•1485 through 1A•1499; for Pulse Generator Modules, see pages 1A•1501 through 1A•1503; for Square Wave Generator Modules and Digital Clocks, see pages 1A•1504 through 1A•1507; for Digital Frequency Multiplier Modules, see page 1A•1508.

ABOVE DATA FROM CATALOG NO. C/020480

engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

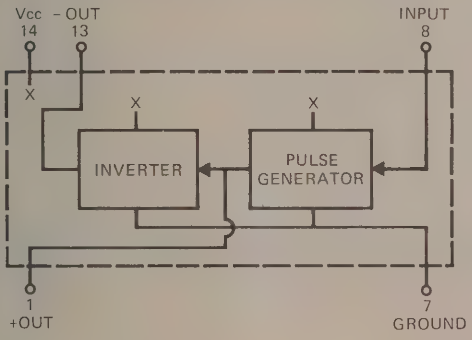
V
IN
TTLPGM-50

T2L COMPATIBLE Low Profile

PULSE GENERATOR MODULE (Schottky)

- T2L inputs and outputs
- Pulse widths stable and precise
- 14-pin DIP package
- Available in pulse widths from 5ns to 100ns
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 4 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Pulse Width (in ns)	Maximum Pulse Rate (in Mhz)
TTLPGM-5	5 ±1	98
TTLPGM-6	6 ±1	80
TTLPGM-7	7 ±1	70
TTLPGM-8	8 ±1	60
TTLPGM-9	9 ±1	54
TTLPGM-10	10 ±1	49
TTLPGM-15	15 ±1	32
TTLPGM-20	20 ±1	24
TTLPGM-25	25 ±1	19
TTLPGM-30	30 ±1	15
TTLPGM-35	35 ±1.5	13
TTLPGM-40	40 ±1.5	11
TTLPGM-45	45 ±1.5	10
TTLPGM-50	50 ±1.5	9
TTLPGM-60	60 ±1.5	8
TTLPGM-70	70 ±2	7
TTLPGM-75	75 ±2	6
TTLPGM-80	80 ±2	6
TTLPGM-90	90 ±3	5
TTLPGM-100	100 ±3	4

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/021180

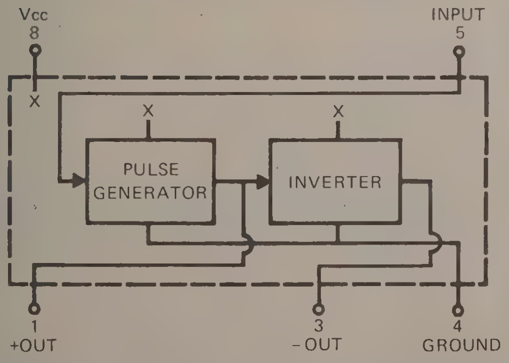
V
IN
MDPGM-TTL-50
32440
NEW

T2L COMPATIBLE "Mini DIP" Low Profile

PULSE GENERATOR MODULE (Schottky)

- T2L input and output
- Pulse widths stable and precise
- 8-pin DIP package
- Available in pulse widths from 5 to 500ns
- 8 Schottky T2L fan-out capacity
- Dimensions: .400 wide X .500 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 4 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Pulse Width (in ns)	Maximum Pulse Rate (in Mhz)
MDPGM-TTL-5	5 ±1	98
MDPGM-TTL-6	6 ±1	80
MDPGM-TTL-7	7 ±1	70
MDPGM-TTL-8	8 ±1	55
MDPGM-TTL-9	9 ±1	50
MDPGM-TTL-10	10 ±1	45
MDPGM-TTL-15	15 ±1	30
MDPGM-TTL-20	20 ±1	20
MDPGM-TTL-25	25 ±1	17
MDPGM-TTL-30	30 ±1	15
MDPGM-TTL-35	35 ±1.5	13
MDPGM-TTL-40	40 ±1.5	11
MDPGM-TTL-45	45 ±1.5	10
MDPGM-TTL-50	50 ±1.5	9
MDPGM-TTL-60	60 ±1.5	8
MDPGM-TTL-70	70 ±2	7
MDPGM-TTL-75	75 ±2	6
MDPGM-TTL-80	80 ±2	6
MDPGM-TTL-90	90 ±3	5
MDPGM-TTL-100	100 ±3	4
MDPGM-TTL-150	150 ±4	3
MDPGM-TTL-200	200 ±6	2
MDPGM-TTL-250	250 ±7	2
MDPGM-TTL-300	300 ±9	1.5
MDPGM-TTL-400	400 ±10	1.0
MDPGM-TTL-500	500 ±10	0.9

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/120181

EC² engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

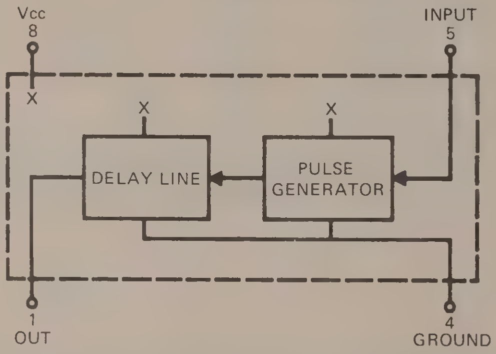
NEW
V
IN
MDDPGM-
TTL-25-10
EC²
32440

T^{2}L COMPATIBLE "Mini DIP" Low Profile

DELAYED PULSE GENERATOR MODULE (Schottky)

- T^{2}L input and output
- Pulse widths stable and precise
- 8-pin DIP package
- Available in pulse widths from 5 to 100ns
- 10 Schottky T^{2}L fan-out capacity
- Dimensions: .400 wide X .500 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 4 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Pulse Width (in ns)
MDDPGM-TTL-____-5	5 ±1
MDDPGM-TTL-____-6	6 ±1
MDDPGM-TTL-____-7	7 ±1
MDDPGM-TTL-____-8	8 ±1
MDDPGM-TTL-____-9	9 ±1
MDDPGM-TTL-____-10	10 ±1
MDDPGM-TTL-____-15	15 ±1
MDDPGM-TTL-____-20	20 ±1
MDDPGM-TTL-____-25	25 ±1
MDDPGM-TTL-____-30	30 ±1
MDDPGM-TTL-____-35	35 ±1.5
MDDPGM-TTL-____-40	40 ±1.5
MDDPGM-TTL-____-45	45 ±1.5
MDDPGM-TTL-____-50	50 ±1.5
MDDPGM-TTL-____-60	60 ±1.5
MDDPGM-TTL-____-70	70 ±2
MDDPGM-TTL-____-75	75 ±2
MDDPGM-TTL-____-80	80 ±2
MDDPGM-TTL-____-90	90 ±3
MDDPGM-TTL-____-100	100 ±3

Note: For other active digital modules, i.e., Logic Delay Lines, see pages 1A•1485 through 1A•1499; for Noise Filter Modules, see page 1A•1500; for Square Wave Generator Modules and Digital Clocks, see pages 1A•1504 through 1A•1507; for Digital Frequency Multiplier Modules, see page 1A•1508.

ABOVE DATA FROM CATALOG NO. C/011582

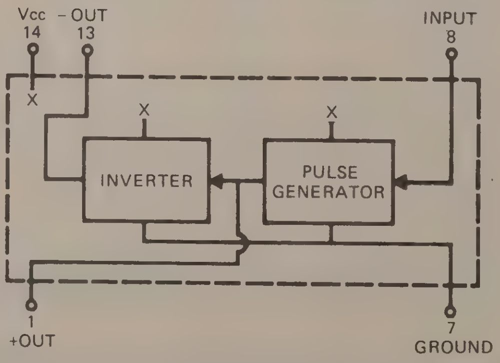
T^{2}L COMPATIBLE "Thinny DIP" Super Low Profile

PULSE GENERATOR MODULE (Schottky)

V
IN
TTLPGM-50MT
C
EC²
NEW

- Full military temperature range
- T^{2}L input and output
- Pulse widths stable and precise
- 14-pin DIP package
- Available in pulse widths from 5 to 100ns
- Dimensions: .500 wide X .800 long X .165 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 4 million hours
- Operating temperature range of −55° to +125°C

BLOCK DIAGRAM IS SHOWN BELOW

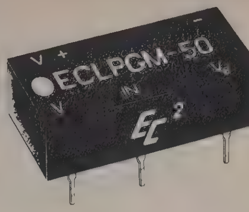


Part Number	Pulse Width (in ns)	Maximum Pulse Rate (in Mhz)
TTLPGM-5MT	5 ±1	98
TTLPGM-6MT	6 ±1	80
TTLPGM-7MT	7 ±1	70
TTLPGM-8MT	8 ±1	60
TTLPGM-9MT	9 ±1	54
TTLPGM-10MT	10 ±1	49
TTLPGM-15MT	15 ±1	32
TTLPGM-20MT	20 ±1	24
TTLPGM-25MT	25 ±1	19
TTLPGM-30MT	30 ±1	15
TTLPGM-35MT	35 ±1.5	13
TTLPGM-40MT	40 ±1.5	11
TTLPGM-45MT	45 ±1.5	10
TTLPGM-50MT	50 ±1.5	9
TTLPGM-60MT	60 ±1.5	8
TTLPGM-70MT	70 ±2	7
TTLPGM-75MT	75 ±2	6
TTLPGM-80MT	80 ±2	6
TTLPGM-90MT	90 ±3	5
TTLPGM-100MT	100 ±3	4

Note: For other active digital modules, i.e., Logic Delay Lines, see pages 1A•1485 through 1A•1499; for Noise Filter Modules, see page 1A•1500; for Square Wave Generator Modules and Digital Clocks, see pages 1A•1504 through 1A•1507; for Digital Frequency Multiplier Modules, see page 1A•1508.

ABOVE DATA FROM CATALOG NO. C/101080

EC²
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*


V+
ECLPGM-50
IN
V-
EC²

ECL 10K COMPATIBLE Low Profile

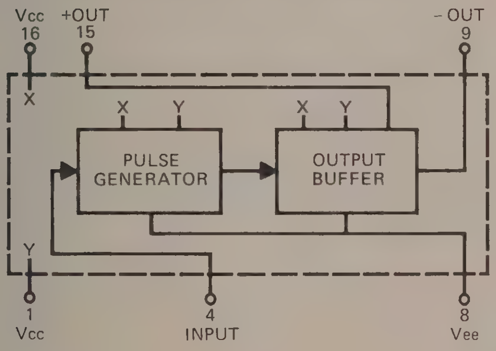
PULSE GENERATOR MODULE

- ECL input and outputs
- Pulse widths stable and precise
- 16-pin DIP package
- Available in pulse widths from 5ns to 100ns
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of −30° to +85°C

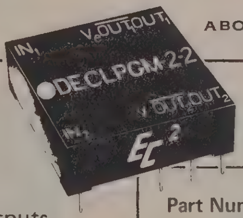
Part Number	Pulse Width (in ns)	Maximum Pulse Rate (in Mhz)
ECLPGM-5	5 ±1	98
ECLPGM-6	6 ±1	80
ECLPGM-7	7 ±1	70
ECLPGM-8	8 ±1	60
ECLPGM-9	9 ±1	54
ECLPGM-10	10 ±1	49
ECLPGM-15	15 ±1	32
ECLPGM-20	20 ±1	24
ECLPGM-25	25 ±1	19
ECLPGM-30	30 ±1	15
ECLPGM-35	35 ±1.5	13
ECLPGM-40	40 ±1.5	11
ECLPGM-45	45 ±1.5	10
ECLPGM-50	50 ±1.5	9
ECLPGM-60	60 ±1.5	8
ECLPGM-70	70 ±2	7
ECLPGM-75	75 ±2	6
ECLPGM-80	80 ±2	6
ECLPGM-90	90 ±3	5
ECLPGM-100	100 ±3	4

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

BLOCK DIAGRAM IS SHOWN BELOW


Vcc
16
+OUT
15
−OUT
9
X
X
Y
X
Y
PULSE GENERATOR
OUTPUT BUFFER
Y
1
Vcc
4
INPUT
8
Vee

ABOVE DATA FROM CATALOG NO. C/021880


IN1
Ve OUT OUT1
DECLPGM-2-2
V OUT OUT2
IN2
EC²

ECL 100K COMPATIBLE

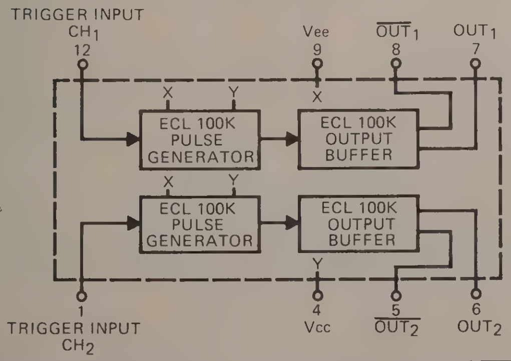
DUAL PULSE GENERATOR MODULE

- ECL 100K input and output levels
- Dual units with separate trigger inputs and outputs
- Pulse widths stable and precise
- 12-pin DIP package
- Available in pulse widths from 2ns to 50ns
- 70 ECL DC fan-out capacity
- Dimensions: .700 wide X .875 long X .325 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1 million hours
- Operating temperature range of 0° to +85°C

Part Number	Pulse Width (in ns)	Maximum Pulse Rate (in Mhz)
DECLPGM-2-2	2 ±.2	200
DECLPGM-2-3	3 ±.3	133
DECLPGM-2-4	4 ±.4	100
DECLPGM-2-5	5 ±.5	80
DECLPGM-2-6	6 ±.6	66
DECLPGM-2-7	7 ±.7	57
DECLPGM-2-8	8 ±.8	50
DECLPGM-2-9	9 ±.9	44
DECLPGM-2-10	10 ±1	40
DECLPGM-2-12	12 ±1	33
DECLPGM-2-14	14 ±1	28
DECLPGM-2-16	16 ±1	25
DECLPGM-2-18	18 ±1	22
DECLPGM-2-20	20 ±1	20
DECLPGM-2-25	25 ±1	16
DECLPGM-2-30	30 ±1	13
DECLPGM-2-35	35 ±1	11
DECLPGM-2-40	40 ±1	10
DECLPGM-2-45	45 ±1	9
DECLPGM-2-50	50 ±1	8

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507; for Digital Frequency Multiplier Modules, see page **1A**•1508.

BLOCK DIAGRAM IS SHOWN BELOW

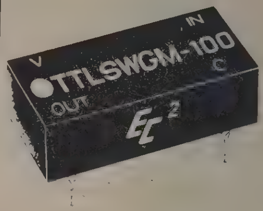

TRIGGER INPUT
CH$_1$
12
Vee
9
$\overline{\text{OUT}}_1$
8
OUT$_1$
7
X
Y
X
ECL 100K PULSE GENERATOR
ECL 100K OUTPUT BUFFER
X
Y
ECL 100K PULSE GENERATOR
ECL 100K OUTPUT BUFFER
Y
1
TRIGGER INPUT
CH$_2$
4
Vcc
5
$\overline{\text{OUT}}_2$
6
OUT$_2$

ABOVE DATA FROM CATALOG NO. C/022080

EC^2 engineered components company

3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406

Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*



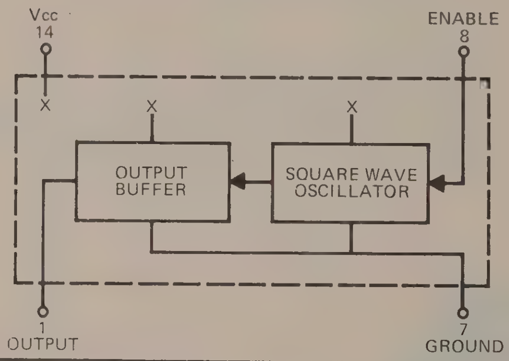
T^2L COMPATIBLE Low Profile SQUARE WAVE GENERATOR MODULE (Schottky)

- T^2L input and output
- Output wavetrain can be started in sync with random events
- 14-pin DIP package
- Available in frequencies from 2 Mhz to 100 Mhz
- Output frequencies controlled to within ±2%
- 10 T^2L fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to +70°C

Part Number	Output Frequency	Part Number	Output Frequency
TTLSWGM-2	2 Mhz	TTLSWGM-35	35 Mhz
TTLSWGM-3	3 Mhz	TTLSWGM-40	40 Mhz
TTLSWGM-4	4 Mhz	TTLSWGM-45	45 Mhz
TTLSWGM-5	5 Mhz	TTLSWGM-50	50 Mhz
TTLSWGM-10	10 Mhz	TTLSWGM-60	60 Mhz
TTLSWGM-15	15 Mhz	TTLSWGM-70	70 Mhz
TTLSWGM-20	20 Mhz	TTLSWGM-80	80 Mhz
TTLSWGM-25	25 Mhz	TTLSWGM-90	90 Mhz
TTLSWGM-30	30 Mhz	TTLSWGM-100	100 Mhz

Note: For other active digital modules, ie., Logical Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Digital Frequency Multiplier Modules, see page **1A**•1508.

BLOCK DIAGRAM IS SHOWN BELOW



ABOVE DATA FROM CATALOG NO. C/030580

T^2L COMPATIBLE "Mini DIP" Low Profile SQUARE WAVE GENERATOR MODULE (Schottky)

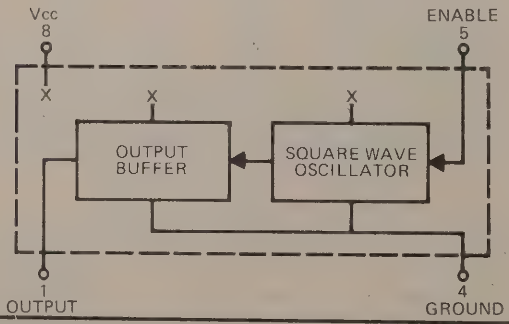
MDSWGM-TTL-100
V
IN
OUT
C
EC^2 32440
NEW

- T^2L input and output
- Output wavetrain can be started in sync with random events
- 8-pin DIP package
- Available in frequencies from 2 Mhz to 100 Mhz
- Output frequencies controlled to within ±2%
- 10 Schottky T^2L fan-out capacity
- Dimensions: .400 wide X .500 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to +70°C

Part Number	Output Frequency	Part Number	Output Frequency
MDSWGM-TTL-2	2 Mhz	MDSWGM-TTL-13	13 Mhz
MDSWGM-TTL-2.5	2.5 Mhz	MDSWGM-TTL-14	14 Mhz
MDSWGM-TTL-3	3 Mhz	MDSWGM-TTL-15	15 Mhz
MDSWGM-TTL-3.5	3.5 Mhz	MDSWGM-TTL-20	20 Mhz
MDSWGM-TTL-4	4 Mhz	MDSWGM-TTL-25	25 Mhz
MDSWGM-TTL-4.5	4.5 Mhz	MDSWGM-TTL-30	30 Mhz
MDSWGM-TTL-5	5 Mhz	MDSWGM-TTL-35	35 Mhz
MDSWGM-TTL-5.5	5.5 Mhz	MDSWGM-TTL-40	40 Mhz
MDSWGM-TTL-6	6 Mhz	MDSWGM-TTL-45	45 Mhz
MDSWGM-TTL-7	7 Mhz	MDSWGM-TTL-50	50 Mhz
MDSWGM-TTL-8	8 Mhz	MDSWGM-TTL-60	60 Mhz
MDSWGM-TTL-9	9 Mhz	MDSWGM-TTL-70	70 Mhz
MDSWGM-TTL-10	10 Mhz	MDSWGM-TTL-80	80 Mhz
MDSWGM-TTL-11	11 Mhz	MDSWGM-TTL-90	90 Mhz
MDSWGM-TTL-12	12 Mhz	MDSWGM-TTL 100	100 Mhz

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Digital Frequency Multiplier Modules, see page **1A**•1508.

BLOCK DIAGRAM IS SHOWN BELOW



ABOVE DATA FROM CATALOG NO. C/121581

engineered components company

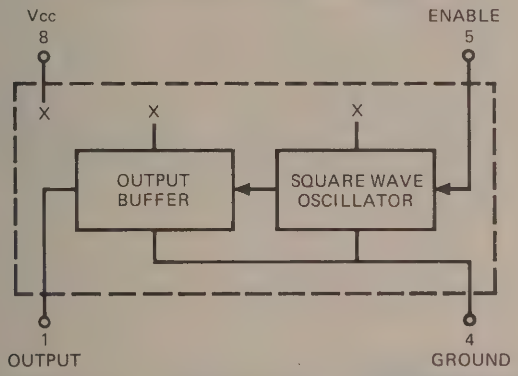
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

MDMPCM-TTL-50
32440
NEW

T^2L COMPATIBLE "Mini DIP" Low Profile
MICRO PROCESSOR CLOCK MODULE (Schottky)

- T^2L input and output (NMOS compatible)
- Output wavetrain can be delayed by enable (wait) line
- 8-pin DIP package
- Available in frequencies from 2 Mhz to 50 Mhz
- Output frequencies controlled to within ±2%
- 10 Schottky T^2L fan-out capacity
- Dimensions: .400 wide X .500 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of 0° to +70°C

BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Output Frequency	Part Number	Output Frequency
MDMPCM-TTL-2	2 Mhz	MDMPCM-TTL-11	11 Mhz
MDMPCM-TTL-2.5	2.5 Mhz	MDMPCM-TTL-12	12 Mhz
MDMPCM-TTL-3	3 Mhz	MDMPCM-TTL-13	13 Mhz
MDMPCM-TTL-3.5	3.5 Mhz	MDMPCM-TTL-14	14 Mhz
MDMPCM-TTL-4	4 Mhz	MDMPCM-TTL-15	15 Mhz
MDMPCM-TTL-4.5	4.5 Mhz	MDMPCM-TTL-20	20 Mhz
MDMPCM-TTL-5	5 Mhz	MDMPCM-TTL-25	25 Mhz
MDMPCM-TTL-5.5	5.5 Mhz	MDMPCM-TTL-30	30 Mhz
MDMPCM-TTL-6	6 Mhz	MDMPCM-TTL-35	35 Mhz
MDMPCM-TTL-7	7 Mhz	MDMPCM-TTL-40	40 Mhz
MDMPCM-TTL-8	8 Mhz	MDMPCM-TTL-45	45 Mhz
MDMPCM-TTL-9	9 Mhz	MDMPCM-TTL-50	50 Mhz
MDMPCM-TTL-10	10 Mhz		

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Digital Frequency Multiplier Modules, see page **1A**•1508.

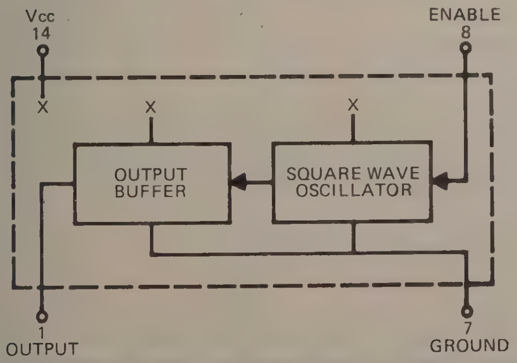
ABOVE DATA FROM CATALOG NO. C/021582

T^2L COMPATIBLE "Thinny DIP" Super Low Profile
SQUARE WAVE GENERATOR MODULE (Schottky)

TTLSWGM-50MT
OUT
NEW

- Full military temperature range
- T^2L input and output
- Output wavetrain can be started in sync with random events
- 14-pin DIP package
- Available in frequencies from 2 Mhz to 100 Mhz
- Output frequencies controlled to within ±2%
- 10 T^2L fan-out capacity
- Dimensions: .500 wide X .800 long X .165 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 3 million hours
- Operating temperature range of −55° to +125°C

BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Output Frequency	Part Number	Output Frequency
TTLSWGM-2MT	2 Mhz	TTLSWGM-13MT	13 Mhz
TTLSWGM-2.5MT	2.5 Mhz	TTLSWGM-14MT	14 Mhz
TTLSWGM-3MT	3 Mhz	TTLSWGM-15MT	15 Mhz
TTLSWGM-3.5MT	3.5 Mhz	TTLSWGM-20MT	20 Mhz
TTLSWGM-4MT	4 Mhz	TTLSWGM-25MT	25 Mhz
TTLSWGM-4.5MT	4.5 Mhz	TTLSWGM-30MT	30 Mhz
TTLSWGM-5MT	5 Mhz	TTLSWGM-35MT	35 Mhz
TTLSWGM-5.5MT	5.5 Mhz	TTLSWGM-40MT	40 Mhz
TTLSWGM-6MT	6 Mhz	TTLSWGM-45MT	45 Mhz
TTLSWGM-7MT	7 Mhz	TTLSWGM-50MT	50 Mhz
TTLSWGM-8MT	8 Mhz	TTLSWGM-60MT	60 Mhz
TTLSWGM-9MT	9 Mhz	TTLSWGM-70MT	70 Mhz
TTLSWGM-10MT	10 Mhz	TTLSWGM-80MT	80 Mhz
TTLSWGM-11MT	11 Mhz	TTLSWGM-90MT	90 Mhz
TTLSWGM-12MT	12 Mhz	TTLSWGM-100MT	100Mhz

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Digital Frequency Multiplier Modules, see page **1A**•1508.

ABOVE DATA FROM CATALOG NO. C/101680

engineered components company

3580 Sacramento Drive, P.O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

T2L COMPATIBLE Low Profile

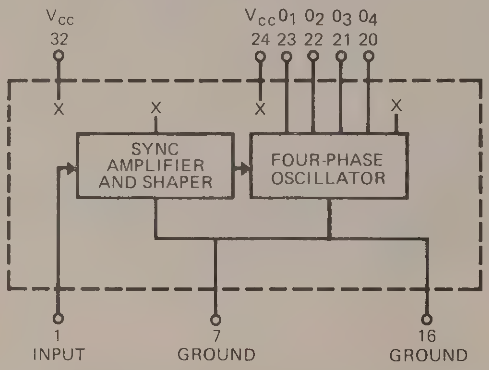
FOUR-PHASE CLOCK MODULE (Schottky)

- T2L input and outputs
- Output wavetrain synchronized with input square wave
- 32-pin DIP package
- Available in frequencies from 200 Khz to 12 Mhz
- 10 T2L fan-out capacity per phase
- Dimensions: .400 wide X 1.650 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of 0° to +70°C

Part Number	Operating Frequency	Part Number	Operating Frequency
TTLFPCM-0.2	200 Khz	TTLFPCM-3.0	3.0 Mhz
TTLFPCM-0.3	300 Khz	TTLFPCM-3.5	3.5 Mhz
TTLFPCM-0.4	400 Khz	TTLFPCM-4.0	4.0 Mhz
TTLFPCM-0.5	500 Khz	TTLFPCM-4.5	4.5 Mhz
TTLFPCM-0.6	600 Khz	TTLFPCM-5.0	5.0 Mhz
TTLFPCM-0.7	700 Khz	TTLFPCM-6.0	6.0 Mhz
TTLFPCM-0.8	800 Khz	TTLFPCM-7.0	7.0 Mhz
TTLFPCM-0.9	900 Khz	TTLFPCM-8.0	8.0 Mhz
TTLFPCM-1.0	1.0 Mhz	TTLFPCM-9.0	9.0 Mhz
TTLFPCM-1.5	1.5 Mhz	TTLFPCM-10.0	10.0 Mhz
TTLFPCM-2.0	2.0 Mhz	TTLFPCM-11.0	11.0 Mhz
TTLFPCM-2.5	2.5 Mhz	TTLFPCM-12.0	12.0 Mhz

Note: For other active digital modules, ie., Logical Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Digital Frequency Multiplier Modules, see page **1A**•1508.

BLOCK DIAGRAM IS SHOWN BELOW



ABOVE DATA FROM CATALOG NO. C/121579

MOS COMPATIBLE Low Profile

FOUR-PHASE CLOCK MODULE

MOSFPCM-5.0
5V
5V
2
3
4
C

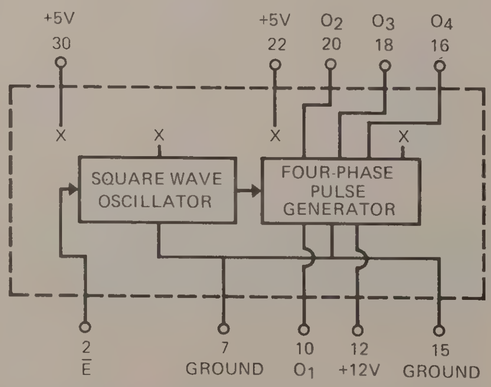
NEW

- T2L input and 12V MOS output
- 20% time slots result in non-overlapping phases
- 30-pin DIP package
- Available in frequencies from 500 Khz to 15 Mhz
- Dimensions: .400 wide X .1.600 long X .300 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 750,000 hours
- Operating temperature range of 0° to +70°C

Part Number	Operating Frequency	Part Number	Operating Frequency
MOSFPCM-0.5	500 Khz	MOSFPCM-4.5	4.5 Mhz
MOSFPCM-0.6	600 Khz	MOSFPCM-5.0	5.0 Mhz
MOSFPCM-0.7	700 Khz	MOSFPCM-6.0	6.0 Mhz
MOSFPCM-0.8	800 Khz	MOSFPCM-7.0	7.0 Mhz
MOSFPCM-0.9	900 Khz	MOSFPCM-8.0	8.0 Mhz
MOSFPCM-1.0	1.0 Mhz	MOSFPCM-9.0	9.0 Mhz
MOSFPCM-1.5	1.5 Mhz	MOSFPCM-10.0	10.0 Mhz
MOSFPCM-2.0	2.0 Mhz	MOSFPCM-11.0	11.0 Mhz
MOSFPCM-2.5	2.5 Mhz	MOSFPCM-12.0	12.0 Mhz
MOSFPCM-3.0	3.0 Mhz	MOSFPCM-13.0	13.0 Mhz
MOSFPCM-3.5	3.5 Mhz	MOSFPCM-14.0	14.0 Mhz
MOSFPCM-4.0	4.0 Mhz	MOSFPCM-15.0	15.0 Mhz

Note: For other active digital modules, ie., Logical Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Digital Frequency Multiplier Modules, see page **1A**•1508.

BLOCK DIAGRAM IS SHOWN BELOW



ABOVE DATA FROM CATALOG NO. C/032481

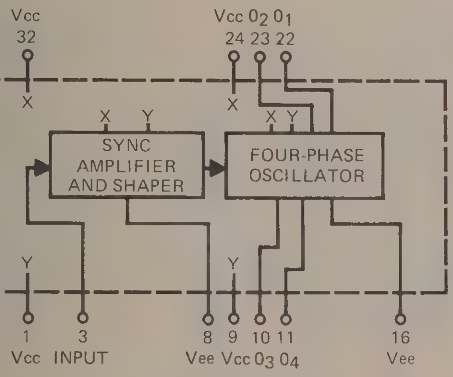
EC2 engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

ECL 10K COMPATIBLE Low Profile

FOUR-PHASE CLOCK MODULE

- ECL input and outputs
- Output wavetrain synchronized with input square wave
- 32-pin DIP package
- Available in frequencies from 200 Khz to 20 Mhz
- 70 ECL DC fan-out capacity per phase
- Dimensions: .400 wide X 1.600 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of −30° to +85°C

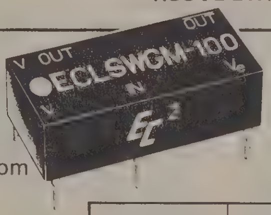
BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Operating Frequency	Part Number	Operating Frequency
ECLFPCM-0.2	200 Khz	ECLFPCM-4.0	4.0 Mhz
ECLFPCM-0.3	300 Khz	ECLFPCM-4.5	4.5 Mhz
ECLFPCM-0.4	400 Khz	ECLFPCM-5.0	5.0 Mhz
ECLFPCM-0.5	500 Khz	ECLFPCM-6.0	6.0 Mhz
ECLFPCM-0.6	600 Khz	ECLFPCM-7.0	7.0 Mhz
ECLFPCM-0.7	700 Khz	ECLFPCM-8.0	8.0 Mhz
ECLFPCM-0.8	800 Khz	ECLFPCM-9.0	9.0 Mhz
ECLFPCM-0.9	900 Khz	ECLFPCM-10.0	10.0 Mhz
ECLFPCM-1.0	1.0 Mhz	ECLFPCM-12.0	12.0 Mhz
ECLFPCM-1.5	1.5 Mhz	ECLFPCM-14.0	14.0 Mhz
ECLFPCM-2.0	2.0 Mhz	ECLFPCM-16.0	16.0 Mhz
ECLFPCM-2.5	2.5 Mhz	ECLFPCM-18.0	18.0 Mhz
ECLFPCM-3.0	3.0 Mhz	ECLFPCM-20.0	20.0 Mhz
ECLFPCM-3.5	3.5 Mhz		

Note: For other active digital modules, ie., Logical Delay Lines, see pages **1A•1485** through **1A•1499**; for Noise Filter Modules, see page **1A•1500**; for Pulse Generator Modules, see pages **1A•1501** through **1A•1503**; for Digital Frequency Multiplier Modules, see page **1A•1508**.

ABOVE DATA FROM CATALOG NO. C/022580

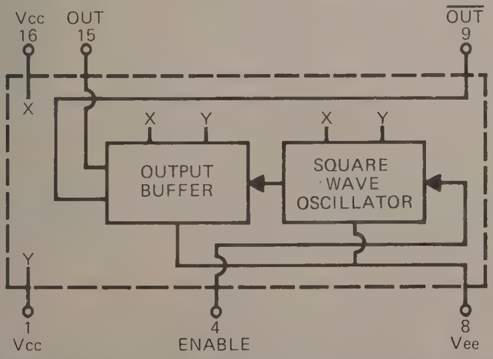


ECL 10K COMPATIBLE Low Profile

SQUARE WAVE GENERATOR MODULE

- ECL input and output
- Output wavetrain can be started in sync with random events
- 16-pin DIP package
- Available in frequencies from 2 Mhz to 100 Mhz
- Output frequencies controlled to within ±2%
- 70 ECL DC fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1.5 million hours
- Operating temperature range of −30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Output Frequency	Part Number	Output Frequency
ECLSWGM-2	2 Mhz	ECLSWGM-15	15 Mhz
ECLSWGM-3	3 Mhz	ECLSWGM-20	20 Mhz
ECLSWGM-4	4 Mhz	ECLSWGM-25	25 Mhz
ECLSWGM-5	5 Mhz	ECLSWGM-30	30 Mhz
ECLSWGM-6	6 Mhz	ECLSWGM-35	35 Mhz
ECLSWGM-7	7 Mhz	ECLSWGM-40	40 Mhz
ECLSWGM-8	8 Mhz	ECLSWGM-45	45 Mhz
ECLSWGM-9	9 Mhz	ECLSWGM-50	50 Mhz
ECLSWGM-10	10 Mhz	ECLSWGM-60	60 Mhz
ECLSWGM-11	11 Mhz	ECLSWGM-70	70 Mhz
ECLSWGM-12	12 Mhz	ECLSWGM-80	80 Mhz
ECLSWGM-13	13 Mhz	ECLSWGM-90	90 Mhz
ECLSWGM-14	14 Mhz	ECLSWGM-100	100 Mhz

Note: For other active digital modules, ie., Logical Delay Lines, see pages **1A•1485** through **1A•1499**; for Noise Filter Modules, see page **1A•1500**; for Pulse Generator Modules, see pages **1A•1501** through **1A•1503**; for Digital Frequency Multiplier Modules, see page **1A•1508**.

ABOVE DATA FROM CATALOG NO. C/031280

EC²
engineered components company
3580 Sacramento Drive, P. O. Box Y, San Luis Obispo, California 93406
Phone (805) 544-3800 — *For Calls Outside California, Toll Free (800) 235-4144*

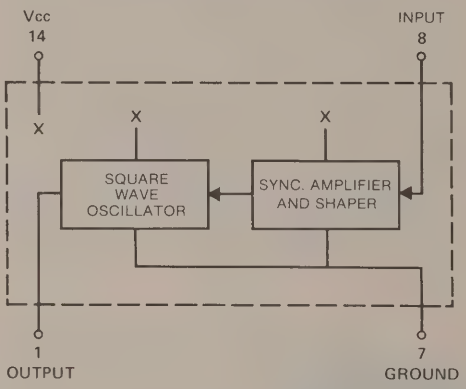
TTLDFMM-100
IN
OUT
V
G
EC²

T²L COMPATIBLE Low Profile

DIGITAL FREQUENCY MULTIPLIER MODULE (Schottky)

- T²L input and output
- Output wavetrain synchronized with input square wave
- 14-pin DIP package
- Available in frequencies from 2 Mhz to 100 Mhz
- 10 T²L fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned in to Level B of MIL-STD-883
- MTBF in excess of 2 million hours
- Operating temperature range of 0° to +70°C

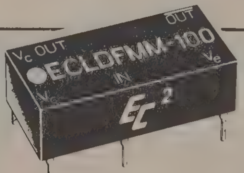
BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Output Frequency	Part Number	Output Frequency
TTLDFMM-2	2 Mhz	TTLDFMM-15	15 Mhz
TTLDFMM-3	3 Mhz	TTLDFMM-20	20 Mhz
TTLDFMM-4	4 Mhz	TTLDFMM-25	25 Mhz
TTLDFMM-5	5 Mhz	TTLDFMM-30	30 Mhz
TTLDFMM-6	6 Mhz	TTLDFMM-35	35 Mhz
TTLDFMM-7	7 Mhz	TTLDFMM-40	40 Mhz
TTLDFMM-8	8 Mhz	TTLDFMM-45	45 Mhz
TTLDFMM-9	9 Mhz	TTLDFMM-50	50 Mhz
TTLDFMM-10	10 Mhz	TTLDFMM-60	60 Mhz
TTLDFMM-11	11 Mhz	TTLDFMM-70	70 Mhz
TTLDFMM-12	12 Mhz	TTLDFMM-80	80 Mhz
TTLDFMM-13	13 Mhz	TTLDFMM-90	90 Mhz
TTLDFMM-14	14 Mhz	TTLDFMM-100	100 Mhz

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507.

ABOVE DATA FROM CATALOG NO. C/031980

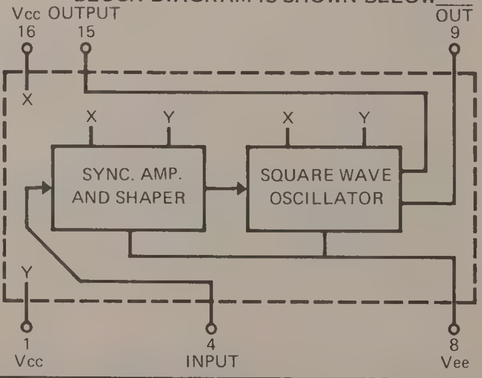


ECL 10K COMPATIBLE Low Profile

DIGITAL FREQUENCY MULTIPLIER MODULE

- ECL input and output
- Output wavetrain synchronized with input square wave
- 16-pin DIP package
- Available in frequencies from 2 Mhz to 100 Mhz
- 70 ECL DC fan-out capacity
- Dimensions: .400 wide X .800 long X .250 high
- ICs burned-in to Level B of MIL-STD-883
- MTBF in excess of 1 million hours
- Operating temperature range of −30° to +85°C

BLOCK DIAGRAM IS SHOWN BELOW



Part Number	Output Frequency	Part Number	Output Frequency
ECLDFMM-2	2 Mhz	ECLDFMM-15	15 Mhz
ECLDFMM-3	3 Mhz	ECLDFMM-20	20 Mhz
ECLDFMM-4	4 Mhz	ECLDFMM-25	25 Mhz
ECLDFMM-5	5 Mhz	ECLDFMM-30	30 Mhz
ECLDFMM-6	6 Mhz	ECLDFMM-35	35 Mhz
ECLDFMM-7	7 Mhz	ECLDFMM-40	40 Mhz
ECLDFMM-8	8 Mhz	ECLDFMM-45	45 Mhz
ECLDFMM-9	9 Mhz	ECLDFMM-50	50 Mhz
ECLDFMM-10	10 Mhz	ECLDFMM-60	60 Mhz
ECLDFMM-11	11 Mhz	ECLDFMM-70	70 Mhz
ECLDFMM-12	12 Mhz	ECLDFMM-80	80 Mhz
ECLDFMM-13	13 Mhz	ECLDFMM-90	90 Mhz
ECLDFMM-14	14 Mhz	ECLDFMM-100	100 Mhz

Note: For other active digital modules, i.e., Logic Delay Lines, see pages **1A**•1485 through **1A**•1499; for Noise Filter Modules, see page **1A**•1500; for Pulse Generator Modules, see pages **1A**•1501 through **1A**•1503; for Square Wave Generator Modules and Digital Clocks, see pages **1A**•1504 through **1A**•1507.

ABOVE DATA FROM CATALOG NO. C/022880

EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

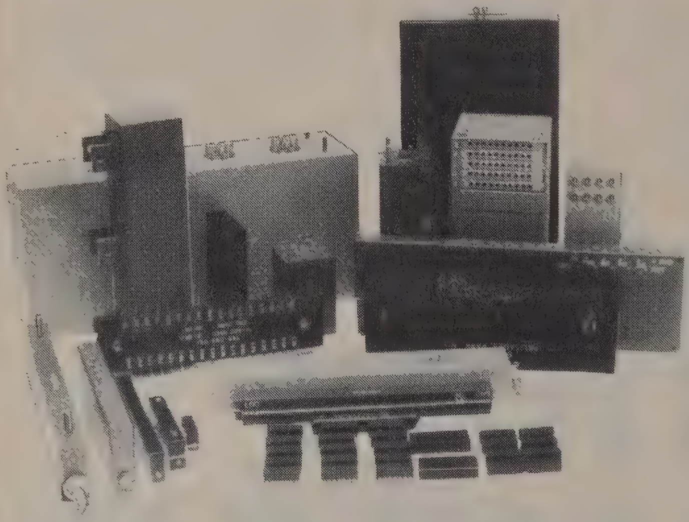
ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780

TOLL FREE
800-631-0853
(except N.J.)

DELAY LINES

OVER 30 YEARS OF SUPERIOR QUALITY AND RELIABILITY!

30 years of experience and expertise in delay line design and manufacture. The following pages list a large sampling of the industry's current demand for short delay lines both analog and digital types, but ESC is still the most chosen source for delay lines ranging up to several hundred milliseconds and with delay-to-rise time ratios up to 250:1. In addition to lumped constant types, also manufactured are distributed constant, voltage variables and mechanically variable devices.



ESC ALSO DESIGNS AND MANUFACTURES TYPICALLY:

Equalized, Precision tapped, low distortion, beam forming delay lines for sonars, scanners, transponders, sorters, Tacan and DME, etc.

Programmable and mechanically variable Delay lines for the TV Broadcast industry, including video cable simulators and voltage variable Delay Lines.

Proven design, manufacturing capabilities, and facilities encompassing all quality levels dictated by MIL-I-45208 and MIL-Q-9858A.

HIGH RELIABILITY:

The proven design and manufacturing techniques are employed by ESC for all levels of reliability required for the military, satellite or space probes and encompass quality levels dictated by MIL-I-45208 & MIL-Q-9858A as applicable.

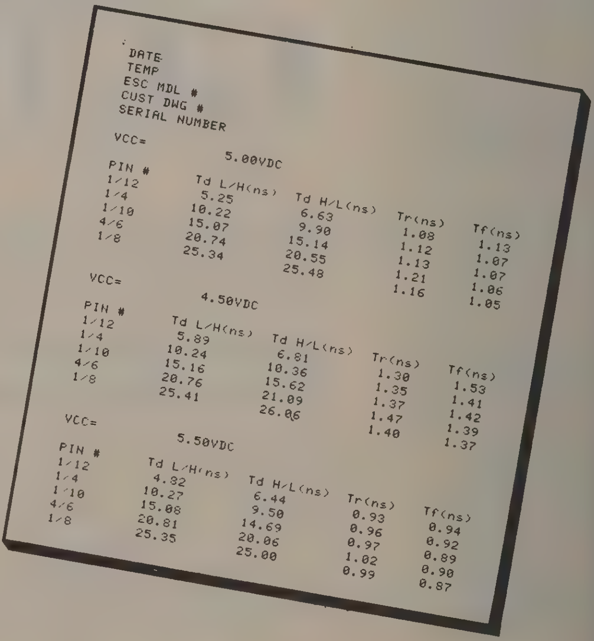
ESC has participated in many hi-rel programs over the years starting with Appolo, Minuteman and the Viking Probe and currently in such programs as Trident, F15, F16, B-1, Space Shuttle and Peacekeeper.

ESC maintains an extensive continuous program of life testing on the new generation of military TTL compatible hybrid delay lines. This program has accumulated in excess of 12.8 million unit hours of test, yielding a failure rate of .0234%/per 1000 hrs.

ESC has expanded its testing capabilities for the new generation of TTL, DTL & ECL Compatible hybrid delay lines. Testing is accomplished by computer controlled, state-of-the-art equipment, which is capable of recording leading and trailing edge delay time, rise and fall time, all within seconds. In addition and at comparable speeds, the hybrid delay line DC parameters such as Icc, Vi, Vol, Voh, Ii, Iil and Iin are swiftly measured and recorded if necessary.

The highly accurate and high speed testing system allows all parameters to be tested on a 100% basis guaranteeing the highest quality product to our customers.

At the side is a sample computer read-out exhibiting the leading and trailing delay and rise and fall times at three operating levels for a TTL hybrid delay line.



```
DATE
TEMP
ESC MDL #
CUST DWG #
SERIAL NUMBER
VCC=
              5.00VDC
PIN #
1/12      Td L/H(ns)  Td H/L(ns)  Tr(ns)  Tf(ns)
1/4         5.25        6.63       1.08    1.13
1/10       10.22        9.90       1.12    1.07
4/6        15.07       15.14       1.13    1.07
1/8        20.74       20.55       1.21    1.06
           25.34       25.48       1.16    1.05
VCC=
              4.50VDC
PIN #
1/12      Td L/H(ns)  Td H/L(ns)  Tr(ns)  Tf(ns)
1/4         5.89        6.81       1.30    1.53
1/10       10.24       10.36       1.35    1.41
4/6        15.16       15.62       1.37    1.42
1/8        20.76       21.09       1.47    1.39
           25.41       26.06       1.40    1.37
VCC=
              5.50VDC
PIN #
1/12      Td L/H(ns)  Td H/L(ns)  Tr(ns)  Tf(ns)
1/4         4.82        6.44       0.93    0.94
1/10       10.27        9.50       0.96    0.92
4/6        15.08       14.69       0.97    0.89
1/8        20.81       20.06       1.02    0.90
           25.35       25.00       0.99    0.87
```

Write or call for catalog!

DELAY LINES

DELAY LINES

SERIES SIL-7

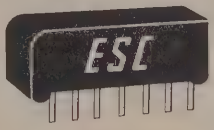
SINGLE-IN-LINE 5 TAPS

SPECIFICATIONS:

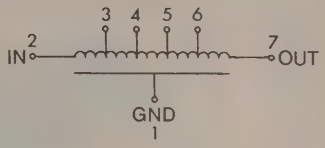
- Output Time Delay Tolerance:
  ± 5% for 20ns and above
  ± 10% for 10ns and below
- Distortion:
  ± 10% at output
- Attenuation:
  0.5 db max
- Temperature Coefficient:
  100 ppm/°C
- Operating Temperature Range:
  -55°C to + 125°C
- Dielectric Strength:
  50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: .800 lg X .200 w X .250 h

Time Delay (ns)	Rise Time max (ns)	No. of Taps	Delay/Tap	MODEL NO.	
				50 ohms ± 10%	100 ohms ± 10%
1	1.5	none	—	SLA-1	SLB-1
2	1.5	none	—	SLA-2	SLB-2
3	1.5	none	—	SLA-3	SLB-3
4	2.0	none	—	SLA-4	SLB-4
5	2.0	5	1 ± .3	SLA-5	SLB-5
10	3.0	5	2 ± .4	SLA-10	SLB-10
20	6.0	5	4 ± .5	SLA-20	SLB-20
30	9.0	5	6 ± 1.0	SLA-30	SLB-30
40	12.0	5	8 ± 1.0	SLA-40	SLB-40
50	15.0	5	10 ± 1.0	SLA-50	SLB-50

Consult Factory for Longer Delay Times

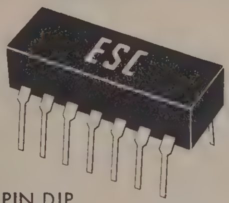


7 PIN



SERIES DIP-14

10 TAPS

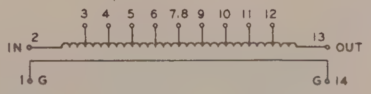


14 PIN DIP

SPECIFICATIONS:

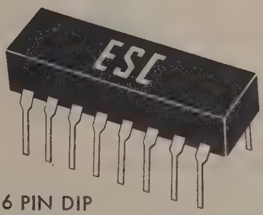
- Operating Temperature:
  - 55°C to + 125°C
- Temperature Coefficient:
  100ppm/°C max
- Attenuation: 1 db max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: .785 lg X .320 w X .300 h.

IMPEDANCE ± 10% →				50	75	100	200
Time Delay (nsec)± 5%	Rise Time (nsec)	No. of Taps	Delay per Tap (nsec) non-cumulative	MODEL NO.			
10 ± 1 ns	1.7	10	1.0 ± .5	5P10	7P10	1P10	—
20	3.3	10	2.0 ± .5	5P20	7P20	1P20	2P20
30	5.0	10	3.0 ± 1	5P30	7P30	1P30	2P30
40	6.5	10	4.0 ± 1	5P40	7P40	1P40	2P40
50	8.0	10	5.0 ± 1	5P50	7P50	1P50	2P50
100	16	10	10 ± 1.5	5P100	7P100	1P100	2P100
150	25	10	15 ± 1.5	—	—	1P150	2P150
200	35	10	20 ± 2	—	—	1P200	2P200



SERIES DIP-16

EXTENDED DELAY 10 TAPS

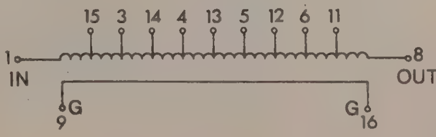


16 PIN DIP

Impedance ± 10% (ohms) →				100	200	300	500
Time Delay (ns) ± 5%	Rise Time (ns) max	No. of Taps	Delay per Tap (ns) ± 2 ns or 5% (whichever is greater)	MODEL NO.			
250	45	10	25	1N25	2N25	3N25	5N25
300	55	10	30	1N30	2N30	3N30	5N30
350	65	10	35	1N35	2N35	3N35	5N35
400	70	10	40	1N40	2N40	3N40	5N40
450	80	10	45	1N45	2N45	3N45	5N45
500	90	10	50	1N50	2N50	3N50	5N50
600	110	10	60	1N60	2N60	3N60	—
800	145	10	80	1N80	2N80	—	—
1000	180	10	100	1N100	2N100	—	—

SPECIFICATIONS:

- Operating Temperature Range: -55°C to + 125°C
- Temperature Coefficient: 100 ppm/°C
- Attenuation: 1 db max
- Distortion (at max. delay): ± 10% max
- Dielectric Strength: 25 VDC
- Size: .89 lg X .320 w X .280 h.
- Conforms to applicable portions of MIL-D-23859



Looking for LC Filters? See our page in Section 2700

ESC ELECTRONICS CORPORATION

ESC ELECTRONICS CORPORATION

534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE (201) 947-0400 ● TWX 710-991-9780

TOLL FREE
800-631-0853
(except N.J.)

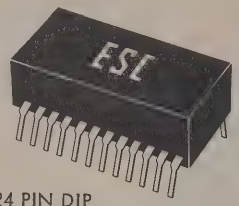
SERIES DIP-24

TO 2000 NSEC
20 TAPS

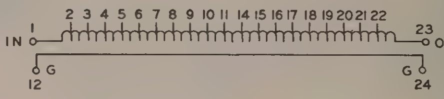
SPECIFICATIONS:

- Operating Temperature: -55°C to + 125°C
- Temperature Coefficient: 100ppm/°C
- Attenuation: 1 db max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Size: 1.3 lg X .580 w X .300 h.

IMPEDANCE 10% (OHMS) →				100	200
Time Delay ± 5%(ns)	Rise Time (ns)Max	No. of Taps	Delay per Tap	MODEL NO.˙	
500	42	20	25	124-5	224-5
600	50	20	30	124-6	224-6
800	67	20	40	124-8	224-8
1000	84	20	50	124-10	224-10
1200	110	20	60	124-12	224-12
1500	125	20	75	124-15	224-15
2000	170	20	100	—	224-20

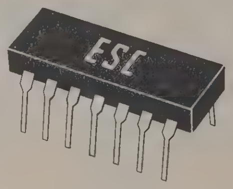


24 PIN DIP



SERIES MIL-23

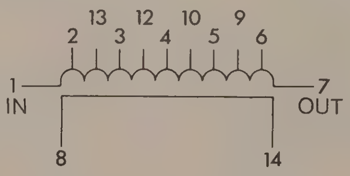
LOW PROFILE
TO
MIL-D-23859/23



14 PIN DIP

SPECIFICATIONS:

- Total Time Delay Tolerance: ± 2 ns Below 40 ns Delay; ± 5% Above 40 ns Delay
- No. of Taps: 10
- Temperature Coefficient: 100 ppm/°C max.
- Operating Temp. Range: ∓ 55°C to + 125°C
- Distortion at max delay: ± 10% max.
- Attenuation: 10% max.
- Dielectric Strength: 50 VDC
- Environmental Conditions: per MIL-D-23859/23
- Size: 14 Pin, .750L X .300W X .187H



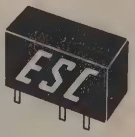
Total Td ns	Rise Time max(ns)	IMPEDANCE ± 10%		
		50Ω	100Ω	200Ω
10	3	A002	B102	-
15	4	A003	B103	-
20	5.5	A004	B104	-
25	6	A005	B105	-
30	6.5	A006	B106	-
35	7	A007	B107	-
40	8	A008	B108	C208
45	9	A009	B109	C209
50	10	A010	B110	C210
60	12	A012	B112	C212
80	16	A016	B116	C216
100	20	A020	B120	C220
120	24	A022	B122	C222
140	28	A024	B124	C224
150	30	A025	B125	C225
160	32	A026	B126	-
180	36	A028	B128	-
200	40	A030	B130	-
220	45	-	B132	-
240	50	-	B134	-
250	50	-	B135	-
260	55	-	B136	-
280	60	-	B138	-
300	60	-	B140	-
330	70	-	B143	-

SERIES ST

MINIATURE
SINGLES

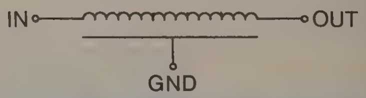
Miniature trimming delay lines in increments of 0.5 ns for your fine "tweeking."

Td (ns)	Impedance ± 10%	
	50 Ω	100 Ω
1.0	SAT-10	SBT-10
1.5	SAT-15	SBT-15
2.0	SAT-20	SBT-20
2.5	SAT-25	SBT-25
3.0	SAT-30	SBT-30
3.5	SAT-35	SBT-35
4.0	SAT-40	SBT-40
4.5	SAT-45	SBT-45
5.0	SAT-50	SBT-50



SPECIFICATIONS:

- Delay tolerance: ± .25 ns
- Operating Temp: -55°C to + 125°C
- Attenuation: 0.25db max
- Dielectric Strength: 50VDC
- Temp. coefficient: 100ppm/°C
- Conforms to applicable portion of MIL-D-23859
- Band width 200 Mhz (-3db)
- Size: .56L X .20W X .25H



DELAY LINES

DELAY LINES

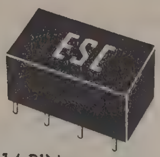
DIGITAL DELAY LINES

SERIES 14T

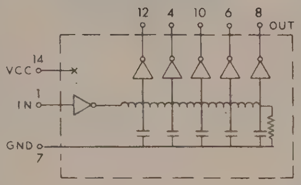
DIGITAL
TTL/DTL
5 TAPS

TTL,DTL

Model No.	Delay (ns)	Delay/ Tap (ns)
14T25	25	5
14T30	30	6
14T35	35	7
14T40	40	8
14T45	45	9
14T50	50	10
14T75	75	15
14T100	100	20
14T150	150	30
14T200	200	40
14T250	250	50
14T300	300	60
14T500	500	100



14 PIN



LOW POWER SCHOTTKY

Model No.	Delay (ns)	Delay Tap (ns)
14LT50	50	10
14LT75	75	15
14LT100	100	20
14LT150	150	30
14LT200	200	40
14LT250	250	50
14LT300	300	60
14LT500	500	100

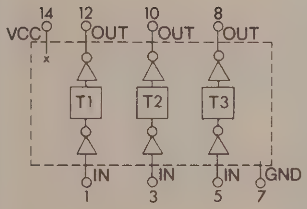
SERIES 14LT

LOW POWER
SCHOTTKY
5 TAPS

SERIES 14P

DIGITAL
TTL/DTL
TRIPLETS

Model No.	Delay per line (ns)
14P5	5
14P10	10
14P15	15
14P20	20
14P25	25
14P50	50
14P75	75
14P100	100



Model No.	Delay (ns)
14LP10	10
14LP15	15
14LP20	20
14LP25	25
14LP50	50
14LP75	75
14LP100	100

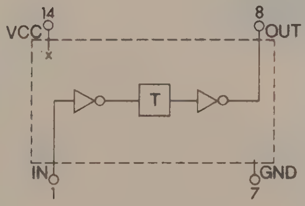
SERIES 14LP

LOW POWER
SCHOTTKY
TRIPLETS

SERIES 14G

DIGITAL
TTL/DTL
SINGLE
OUTPUT

Model No.	Delay (ns)
14G5	5
14G10	10
14G20	20
14G25	25
14G50	50
14G75	75
14G100	100
14G150	150
14G200	200
14G500	500



Model No.	Delay (ns)
14LG10	10
14LG20	20
14LG25	25
14LG50	50
14LG75	75
14LG100	100
14LG150	150
14LG200	200
14LG300	300

SERIES 14LG

LOW POWER
SCHOTTKY
SINGLE
OUTPUT

SPECIFICATIONS:

	TTL Series	14L Series
Supply Voltage	5V ± 5%	5V ± 5%
Supply Current	70 Ma Max	25 Ma Max
Rise & Fall Time	4 ns Max	6 ns Max
Operating Temp.	0 to 70°C	0 to 70°C
Size	.8 X .4 X .3	.8 X .4 X .3
Delay tolerance: ± 5% or 2 ns whichever is greater		

ESC can also supply these devices with ceramic IC's that have been screened to MIL-STD-883 for -55°C to + 125°C operation. Case size will be .8L X .4W X .36H. When ordering add Letter "C" after fourth digit in part number. Example: 14LP10 convert to 14LPC10.
14T100 convert to 14TC100

Looking for LC Filters? See our page in Section 2700

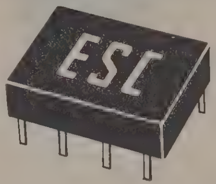
ESC ELECTRONICS CORPORATION

ESC ELECTRONICS CORPORATION

534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780

TOLL FREE
800-631-0853
(except N.J.)

LOW PROFILE DIGITAL DELAY LINES



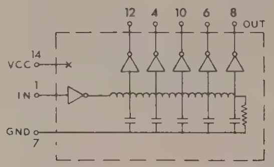
14 PIN

SERIES 9T

TTL/DTL COMPATIBLE
5 TAPS

TTL

Model No.	Delay (ns)	Delay/ Tap (ns)
9T25	25	5
9T30	30	6
9T35	35	7
9T40	40	8
9T45	45	9
9T50	50	10
9T75	75	15
9T100	100	20
9T150	150	30
9T200	200	40



LOW POWER SCHOTTKY

Model No.	Delay (ns)	Delay/ Tap (ns)
9LT50	50	10
9LT75	75	15
9LT100	100	20
9LT150	150	30
9LT200	200	40

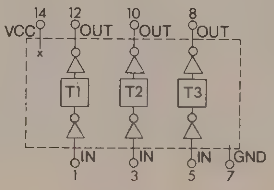
SERIES 9LT

LOW POWER SCHOTTKY
5 TAPS

SERIES 9P

TTL/DTL COMPATIBLE
TRIPLETS

Model No.	Delay per line (ns)
9P5	5
9P10	10
9P15	15
9P20	20
9P25	25
9P50	50



Model No.	Delay per line (ns)
9LP10	10
9LP15	15
9LP20	20
9LP25	25
9LP50	50

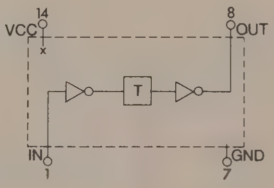
SERIES 9LP

LOW POWER SCHOTTKY
TRIPLETS

SERIES 9G

TTL/DTL COMPATIBLE
SINGLE OUTPUT

Model No.	Delay (ns)
9G5	5
9G10	10
9G20	20
9G25	25
9G50	50
9G100	100
9G200	200



Model No.	Delay (ns)
9LG10	10
9LG20	20
9LG25	25
9LG50	50
9LG100	100
9LG200	200

SERIES 9LG

LOW POWER SCHOTTKY
SINGLE OUTPUT

SPECIFICATIONS:

	TTL Series	9L Series
Supply Voltage	5.0 VDC ± 5%	5.0 VDC ± 5%
Supply Current	70 Ma Max	25 Ma Max
Rise & Fall Time	4.0 ns Max	6.0 ns Max
Operating Temp.	-55°C to + 125°C	-55°C to + 125°C
Size	.80L X .50W X .165H	
Delay Tolerance	± 5% or 2 ns whichever is greater	

These devices are supplied with ceramic IC's that have been screened to MIL-STD-883 for -55°C to + 125°C operation.

DELAY LINES

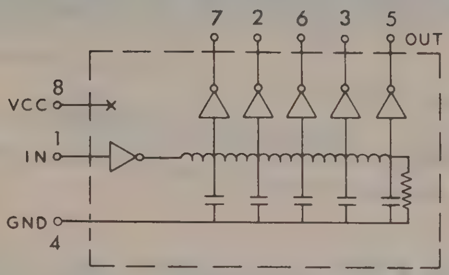
DELAY LINES

DIGITAL TTL, DTL-8, 14 AND 30 PIN

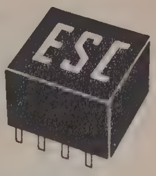
SERIES 8T

DIGITAL TTL/DTL COMPATIBLE 5 TAPS 8 PIN PACKAGE

Model No.	Delay (ns)	Delay/ Tap (ns)
8T25	25	5
8T30	30	6
8T40	40	8
8T50	50	10
8T75	75	15
8T100	100	20



Size: 8 Pin .50L X .40W X .25H



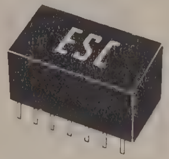
8 PIN

8G SERIES: Untapped version of above. Order as 8G25, 8G30..etc.

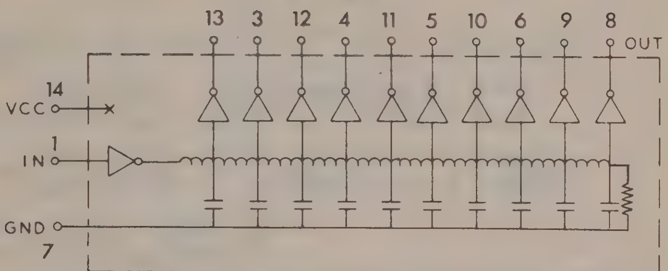
SERIES 10T

DIGITAL TTL/DTL COMPATIBLE 10 TAPS 14 PIN PACKAGE

Model No.	Delay (ns)	Delay/ Tap (ns)
10T50	50	5
10T60	60	6
10T70	70	7
10T80	80	8
10T90	90	9
10T100	100	10
10T150	150	15
10T200	200	20
10T250	250	25
10T500	500	50



14 PIN

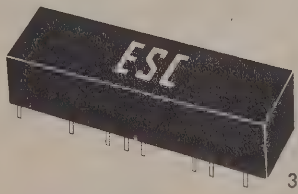


Size: 14 Pin .80L X .40W X .32H

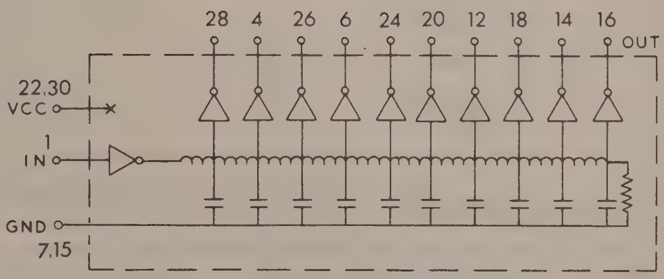
SERIES 30T

DIGITAL TTL/DTL COMPATIBLE 10 TAPS 30 PIN PACKAGE

Model No.	Delay (ns)	Delay/ Tap (ns)
30T50	50	5
30T60	60	6
30T70	70	7
30T80	80	8
30T90	90	9
30T100	100	10
30T150	150	15
30T200	200	20
30T250	250	25
30T500	500	50
30T1000	1000	100



30 PIN



Size: 30 Pin 1.70L X .40W X .30H

Looking for LC Filters? See our page in Section 2700

SPECIFICATIONS:

Supply voltage:	5V ± 5%
Logic 1 input current:	50 μA max.
Logic 0 input current:	2 MA max.
Logic 1 voltage out:	2.4V min.
Logic 0 voltage out:	0.5V max.
Operating temperature:	0 to + 70°C
Fan-out capabilities (max):	10 TTL loads/tap, 20 TTL loads/unit
Delay tolerances:	± 2 ns or ± 5% whichever is greater
Rise Time:	4 ns max

- Series 8T and 30T available for -55°C to + 125°C operation. Add letter "C" after "T" when specifying. Series 30T height will increase to .36.

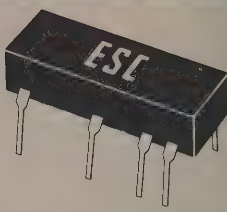
ESC ELECTRONICS CORPORATION

ESC ELECTRONICS CORPORATION

534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780

TOLL FREE
800-631-0853
(except N.J.)

Now Available...



MACHINE INSERTABLE DIP LOW PROFILE PACKAGE

(ONLY.250 INCH HEIGHT ABOVE SEATING PLANE)

From ESC the following SERIES of DIGITAL DELAY LINES

14T·14P·14G·14LT·14LP 14LG·10T

Specifications for DIL & DIP Packages are the same

DIL (Dual-In-Line)	Description	NEW DIP SERIES
14T	DIGITAL TTL/DTL 5 TAPS	14TD
14P	DIGITAL TTL/DTL TRIPLETS	14PD
14G	DIGITAL TTL/DTL SINGLE OUTPUT	14GD
14LT	LOW POWER SCHOTTKY 5 TAPS	14LTD
14LP	LOW POWER SCHOTTKY TRIPLETS	14LPD
14LG	LOW POWER SCHOTTKY SINGLE OUTPUT	14LGD
10T	DIGITAL TTL/DTL COMPATIBLE 10 TAPS 14 PIN PACKAGE	10TD

CONTACT PLANT FOR COMPLETE SPECIFICATIONS.

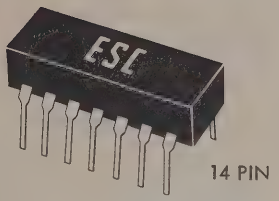
DELAY LINES

DELAY LINES

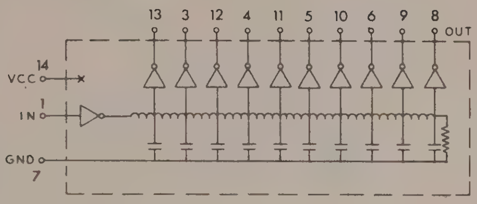
MACHINE INSERTABLE LOW PROFILE DIP DIGITAL DELAY LINES

SERIES 10TD

TTL/DTL COMPATIBLE
10 TAPS
14 PIN PACKAGE



Model No.	*Delay (ns)	*Delay/ Tap (ns)
10TD50	50	5
10TD100	100	10
10TD150	150	15
10TD200	200	20
10TD250	250	25
10TD300	300	30
10TD350	350	35
10TD400	400	40
10TD450	450	45
10TD500	500	50

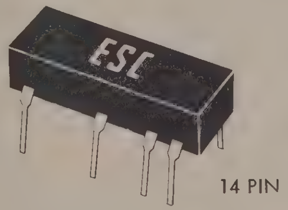


Size: .785 X .285 X .250

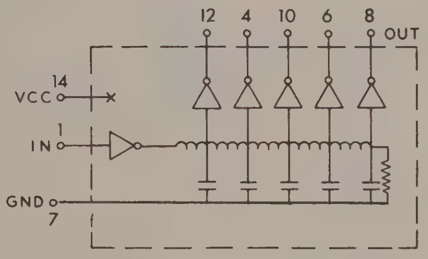
DC PARAMETERS		LIMITS	
		Min.	Max.
V_{oh}	Vcc = min I_{oh} = 1.0 mA	2.5V	—
V_{ol}	Vcc = min I_{ol} = 20 mA	—	0.5V
I_{ih}	Vcc = max V_{ih} = 2.7V	—	50 μA
I_{il}	Vcc = max V_{il} = 0.5V	-2.0 mA	—
I_i	Vcc = max V_i = 5.5V	—	1.0 mA
V_i	Vcc = min I_{in} = -18 madc	-1.2vdc	—
I_{cc}	Vcc = max outputs low	Series 10TD 140mA Series 14TD 70mA	

SERIES 14TD

TTL/DTL COMPATIBLE
5 TAPS
14 PIN PACKAGE



Model No.	*Delay (ns)	*Delay/ Tap (ns)
14TD25	25	5
14TD30	30	6
14TD35	35	7
14TD40	40	8
14TD45	45	9
14TD50	50	10
14TD75	75	15
14TD100	100	20
14TD150	150	30
14TD200	200	40
14TD250	250	50
14TD300	300	60
14TD500	500	100



Size: .785 X .285 X .250

Series 10TD and 14TD are interchangeable with series 10T and 14T

SPECIFICATIONS:

*● Delay Tolerances:	± 2ns or ± 5% whichever is greater
● Rise Time:	4ns max
● Five equally spaced taps	
● Operating Temp. Range:	0°C to + 70°C
● Terminal Leads:	Electro tin plated Alloy 42 .020 W X .010

TEST CONDITIONS:

- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- Input Test Pulse:

Pulse voltage:	3.0V
Pulse rise time:	2ns
Pulse width:	1.2 X max Td

14 Pin Auto Insertable Versions of ESC'S 14G and 14P Series are also available upon request.

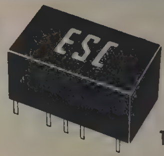
ESC ELECTRONICS CORPORATION

ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780

TOLL FREE
800-631-0853
(except N.J.)

ECL "10,000" DIGITAL DELAY LINES

These ECL Hybrid Delay Lines are contained in a 16 Pin DIP Package using ECL "10,000" Series Circuits



16 PIN

SPECIFICATIONS:

- Logic 1 (output): -.96 V min.
- Logic 0 (output): -1.65 V max.
- Delay tolerances: ± 1 ns below 20 ns delay; ± 1 ns or ± 5% whichever is greater above 20 ns delay.
- Operating temp: -0°C to + 70°C
- Storage temp. range: -55°C to + 125°C
- Size: .8L X .4W X .36H

TEST CONDITIONS:

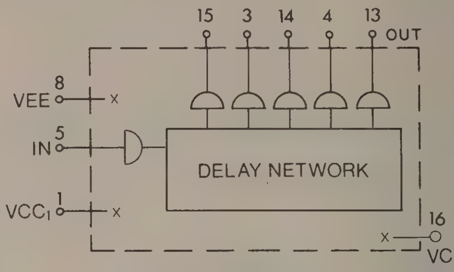
- Temp. = 25°C Vee = -5.2 VDC Vcc = Grd
- ** Input Amplitude: 1.0V (-.75V to -1.75V)
- Pulse Width: 3 X max Td
- Pulse Spacing: 5 X max Td
- Time delays measured at the -1.3 V level
- Output terminals connected through an external pulldown resistor of 100 Ω to -2 VDC

**Input pulse is provided by standard open emitter ECL 10,000 gate.

SERIES 16EC

ECL COMPATIBLE 5 TAPS

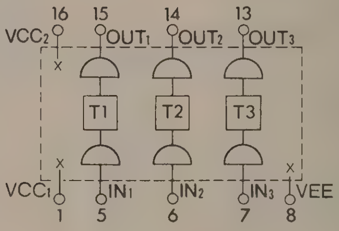
Model No.	Delay (ns)	Delay/ Tap (ns)
16EC10	10	2
16EC15	15	3
16EC20	20	4
16EC25	25	5
16EC30	30	6
16EC40	40	8
16EC50	50	10
16EC60	60	12
16EC80	80	16
16EC100	100.	20



SERIES 16EP

ECL COMPATIBLE TRIPLETS

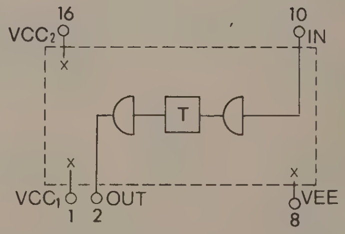
Model No.	Delay per line (ns)
16EP5	5
16EP10	10
16EP15	15
16EP20	20
16EP25	25
16EP50	50



SERIES 16EG

ECL COMPATIBLE SINGLE OUTPUT

Model No.	Delay (ns)
16EG5	5
16EG10	10
16EG15	15
16EG20	20
16EG25	25
16EG50	50
16EG75	75
16EG100	100



DELAY LINES

DELAY LINES

TTL DIGITAL PROGRAMMABLE DELAY LINES

This series of programmable hybrid delay lines utilize TTL Schottky circuits.

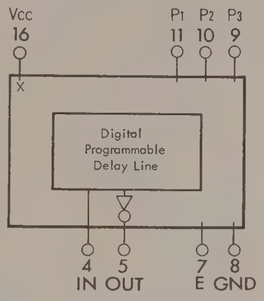
The PTT's are offered in 3, 4 & 6 Bit Series.

SERIES PTT3

TTL COMPATIBLE 3 BIT PROGRAMMABLE DELAY LINE

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT3-1	7 ± 2	14	1 ± .5
PTT3-2		21	2 ± .5
PTT3-3		28	3 ± .6
PTT3-4		35	4 ± .8
PTT3-5		42	5 ± 1
PTT3-6		49	6 ± 1
PTT3-7		56	7 ± 1
PTT3-8		63	8 ± 1
PTT3-9		70	9 ± 1
PTT3-10		77	10 ± 1

16 Pin DIL


Vcc
16
P1 P2 P3
11 10 9
Digital Programmable Delay Line
4 IN
5 OUT
7 E
8 GND

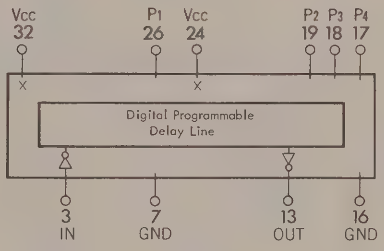
Size: .80L X .40W X .28 H

SERIES PTT4

TTL COMPATIBLE 4 BIT PROGRAMMABLE DELAY LINE

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT4-1	15 ± 2	30	1 ± .5
PTT4-2		45	2 ± .5
PTT4-3		60	3 ± .6
PTT4-4		75	4 ± .8
PTT4-5		90	5 ± 1
PTT4-6		105	6 ± 1
PTT4-7		120	7 ± 1
PTT4-8		135	8 ± 1
PTT4-9		150	9 ± 1
PTT4-10		165	10 ± 1

32 Pin DIL


Vcc
32
P1
26
Vcc
24
P2 P3 P4
19 18 17
Digital Programmable Delay Line
3 IN
7 GND
13 OUT
16 GND

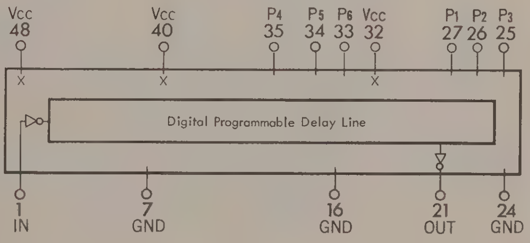
Size: 1.75L X .40W X .28 H

SERIES PTT6

TTL COMPATIBLE 6 BIT PROGRAMMABLE DELAY LINE

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT6-1	20 ± 2	83	1 ± .5
PTT6-2		146	2 ± .5
PTT6-3		209	3 ± .6
PTT6-4		272	4 ± .8
PTT6-5		335	5 ± 1

48 Pin DIL


Vcc
48
Vcc
40
P4 P5 P6 Vcc
35 34 33 32
P1 P2 P3
27 26 25
Digital Programmable Delay Line
1 IN
7 GND
16 GND
21 OUT
24 GND

Size: 2.55L X .40W X .28 H

SPECIFICATIONS:

● Logic 1 (output):	2.4 min
● Logic 0 (output):	.50 VDC max
● Operating Temp. Range:	0°C to + 70°C *
● Storage Temp. Range:	-55°C to + 125°C

*For -55°C to + 125°C operation – Contact Plant

TEST CONDITIONS:

● Vcc = 5 VDC Temp. = 25°C

● Input Pulse Width:	3 X max Td
● Input Rise Time:	2ns max
● Input Pulse Spacing:	5 X max Td

● Td measured at 1.5 V level

● Output loaded with 15pf

Looking for LC Filters? See our page in Section 2700

ESC ELECTRONICS CORPORATION

ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-3780

TOLL FREE
800-631-0853
(except N.J.)

ECL DIGITAL PROGRAMMABLE DELAY LINES

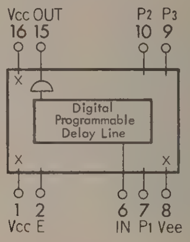
This series of programmable hybrid delay lines utilize ECL 10,000 Series IC's.
The PEC's are offered in 3, 4 & 6 Bit Series.

SERIES PEC3

3 BIT PROGRAMMABLE DELAY LINES

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC3-1	3 ± 2	10	1 ± .5
PEC3-2		17	2 ± .5
PEC3-3		24	3 ± .6
PEC3-4		31	4 ± .8
PEC3-5		38	5 ± 1

16 Pin DIL


Vcc OUT
16 15
P2 P3
10 9
Digital Programmable Delay Line
1 2
Vcc E
6 7 8
IN P1 Vee

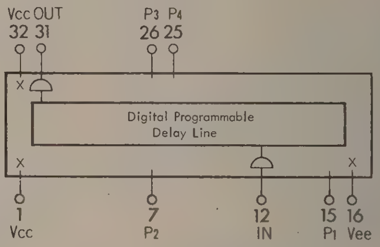
Size: .825L X .40W X .36H

SERIES PEC4

4 BIT PROGRAMMABLE DELAY LINES

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC4-1	10 ± 2	25	1 ± .5
PEC4-2		40	2 ± .5
PEC4-3		55	3 ± .6
PEC4-4		70	4 ± .8
PEC4-5		85	5 ± 1

32 Pin DIL


Vcc OUT
32 31
P3 P4
26 25
Digital Programmable Delay Line
1
Vcc
7
P2
12
IN
15 16
P1 Vee

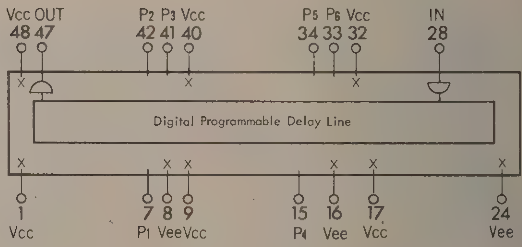
Size: 1.75L X .40W X .36H

SERIES PEC6

6 BIT PROGRAMMABLE DELAY LINES

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC6-1	8 ± 2	71	1 ± .5
PEC6-2		134	2 ± .5
PEC6-3		197	3 ± .6
PEC6-4		260	4 ± .8
PEC6-5		323	5 ± 1

48 Pin DIL


Vcc OUT
48 47
P2 P3 Vcc
42 41 40
P5 P6 Vcc
34 33 32
IN
28
Digital Programmable Delay Line
1
Vcc
7 8 9
P1 Vee Vcc
15
P4
16
Vee
17
Vcc
24
Vee

Size: 2.50L X .40W X .36H

SPECIFICATIONS:

● Logic 1 (output):	-.96V min
● Logic 0 (output):	-1.65V max
● Operating Temp. Range:	-0°C to + 70°C
● Storage Temp. Range:	-55°C to + 125°C

TEST CONDITIONS:

● Input Pulse Width:	3 X max delay time
● Input Pulse Spacing:	5 X max delay time
● Input Rise Time:	2 ns max
● Input Pulse Voltage:	1.0V (-.75V to -1.75V)
● Vee:	-5.2VDC

- Output connected to -2VDC through 100 ohms.
- Time delays measured at -1.3 Volt Level.

OVER 30 YEARS OF SUPERIOR QUALITY AND RELIABILITY!

DELAY LINES

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

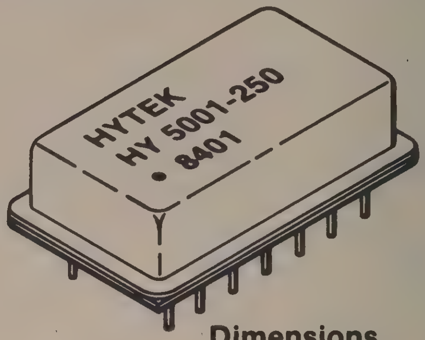
INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

5-TAP DIGITAL DELAY LINE
(Hi-Rel Package)

HY-5001

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Hermetically sealed metal package**
- **Low profile 14-pin DIP**
- **High MTBF**
- **Customs also available**


HYTEK
HY 5001-250
● 8401

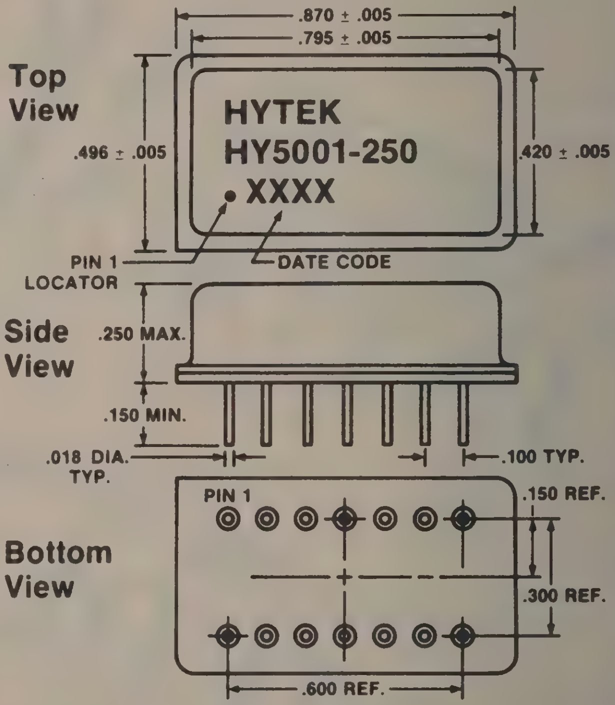
SPECIFICATIONS

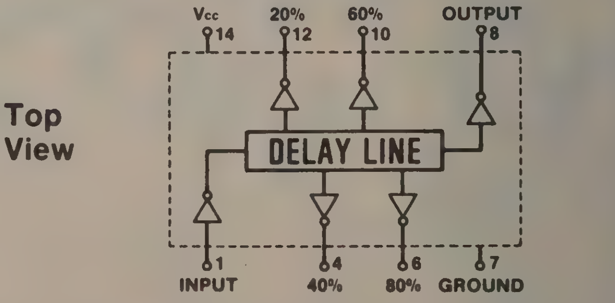
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec or ±5% whichever is greater
SUPPLY CURRENT	65 mA max., 45 mA typical
SUPPLY VOLTAGE (VCC)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	50μA @ VCC = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-2 mA max @ VCC = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max
LOGIC 1 INPUT VOLTAGE	2V min to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C
HERMETICITY	MIL-STD-883, method 1014, cond. A, C (leak rate < 1 X 10^{-8} ATM CC/S)

DELAY AT EA. TAP IN NSEC.					
Part No. †	Tap 1	Tap 2	Tap 3	Tap 4	Output
HY5001-025	5±2	10±2	15±2	20±2	25±2
HY5001-030	6±2	12±2	18±2	24±2	30±2
HY5001-035	7±2	14±2	21±2	28±2	35±2
HY5001-040	8±2	16±2	24±2	32±2	40±2
HY5001-045	9±2	18±2	27±2	36±2	45±2.3
HY5001-050	10±2	20±2	30±2	40±2	50±2.5
HY5001-075	15±2	30±2	45±2.3	60±3	75±3.8
HY5001-100	20±2	40±2	60±3	80±4	100±5
HY5001-150	30±2	60±3	90±4.5	120±6	150±7.5
HY5001-200	40±2	80±4	120±6	160±8	200±10
HY5001-250	50±2.5	100±5	150±7.5	200±10	250±12.5
HY5001-500	100±5	200±10	300±15	400±20	500±25

† Suffix designates
- standard 0°C to 70°C operation
M standard -55°C to125°C operation
Z - 883B screening (method 5004)

Dimensions
(Inches)


Top View
.870 ± .005
.795 ± .005
.496 ± .005
.420 ± .005
HYTEK
HY5001-250
• XXXX
PIN 1 LOCATOR
DATE CODE
Side View
.250 MAX.
.150 MIN.
.018 DIA. TYP.
.100 TYP.
Bottom View
PIN 1
.150 REF.
.300 REF.
.600 REF.


Top View
Vcc 14
20% 12
60% 10
OUTPUT 8
DELAY LINE
1 INPUT
4 40%
6 80%
7 GROUND

Specifications Subject to Change Without Notice

hytek microsystems incorporated

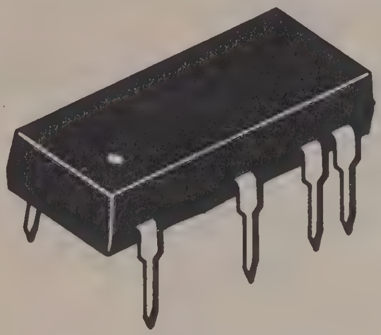
980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

HY-5003

5-TAP DIGITAL DELAY LINE
(Molded Package)

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Low profile (.220" with .015" standoff)**
- **Customs also available**
- **Auto Insertable**



SPECIFICATIONS

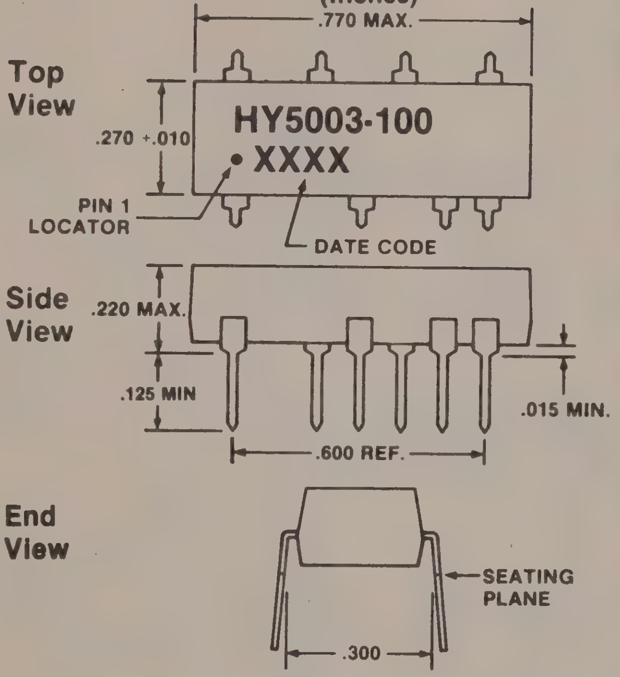
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (Vcc)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	65 mA max., 45 mA typical
SUPPLY VOLTAGE (Vcc)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	50μA @ Vcc = 5.25V and V_{IH} = 2.70V
LOGIC 0 INPUT CURRENT	-2 mA max. @ Vcc = 5.25V and V_{IL} = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. Vcc = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C

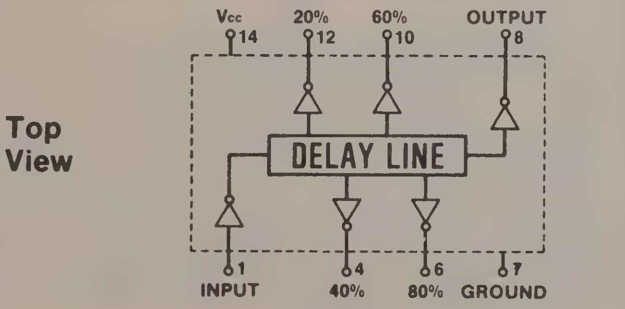
DELAY AT EA. TAP IN NSEC.

Part No. †	Tap 1	Tap 2	Tap 3	Tap 4	Output
HY5003-025	5±2	10±2	15±2	20±2	25±2
HY5003-030	6±2	12±2	18±2	24±2	30±2
HY5003-035	7±2	14±2	21±2	28±2	35±2
HY5003-040	8±2	16±2	24±2	32±2	40±2
HY5003-045	9±2	18±2	27±2	36±2	45±2.3
HY5003-050	10±2	20±2	30±2	40±2	50±2.5
HY5003-075	15±2	30±2	45±2.3	60±3	75±3.8
HY5003-100	20±2	40±2	60±3	80±4	100±5
HY5003-150	30±2	60±3	90±5.4	120±6	150±7.5
HY5003-200	40±2	80±4	120±6	160±8	200±10
HY5003-250	50±2.5	100±5	150±7.5	200±10	250±12.5

† Suffix designates:
= standard 0°C to 70°C operation
M = standard -55°C to 125°C operation

Dimensions
(Inches)





Specifications Subject to Change Without Notice

hytek microsystems incorporated

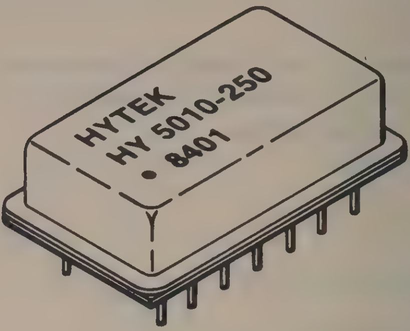
980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

10-TAP DIGITAL DELAY LINE
(Hi-Rel Package)

HY-5010

FEATURES

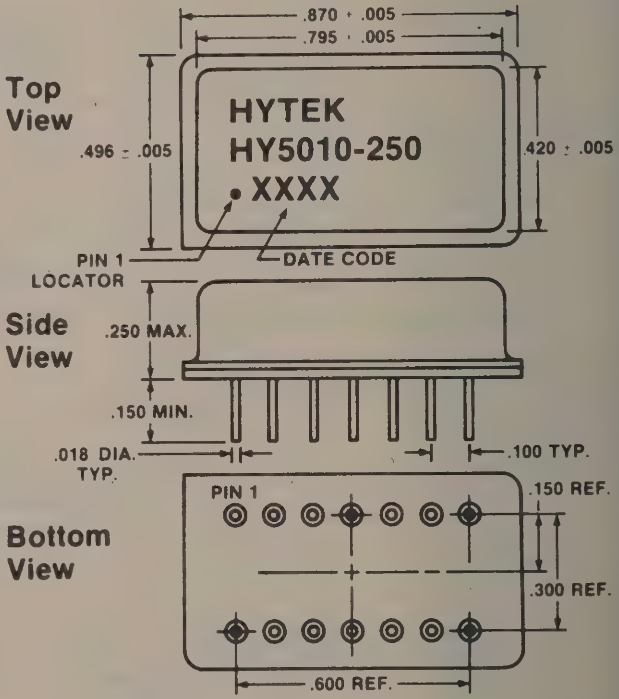
- **TTL Schottky buffered inputs and outputs**
- **Hermetically sealed metal package**
- **Low profile 14-pin DIP**
- **High MTBF**
- **Customs also available**


HYTEK
HY 5010-250
8401

SPECIFICATIONS

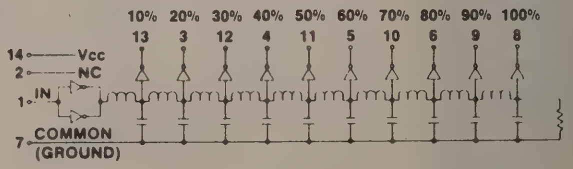
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max. 20 TTL loads/unit max. (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	120 mA max..
SUPPLY VOLTAGE (VCC)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	100μA @ VCC = 5.25V and V_{IH} = 2.70V
LOGIC 0 INPUT CURRENT	-4 mA max. @ VCC = 5.25V and V_{IL} = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C
HERMETICITY	MIL-STD-883, method 1014, cond. A, C.(leak rate < 1×10^{-6} ATM. CC/S)

Dimensions (Inches)


.870 ± .005
.795 ± .005
Top View
.496 ± .005
HYTEK
HY5010-250
XXXX
.420 ± .005
PIN 1 LOCATOR
DATE CODE
Side View
.250 MAX.
.150 MIN.
.018 DIA. TYP.
.100 TYP.
PIN 1
.150 REF.
Bottom View
.300 REF.
.600 REF.

DELAY AT EA. TAP IN NSEC.		
Part No.†	**Total Delay (nsec.)**	**Tap-To-Tap Delay (nsec.)**
HY5010-050	50 ± 2.5	5 ± 1.0
HY5010-100	100 ± 5.0	10 ± 1.0
HY5010-150	150 ± 7.5	15 ± 1.5
HY5010-200	200 ± 10.0	20 ± 2.0
HY5010-250	250 ± 13.5	25 ± 2.5
HY5010-500	500 ± 25	50 ± 5.0

† Suffix designates:
= standard 0°C to 70°C operation
M = standard -55°C to125°C operation
Z = 883B screening (method 5004)


10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
13
3
12
4
11
5
10
6
9
8
14
Vcc
2
NC
1
IN
7
COMMON
(GROUND)

Specifications Subject to Change Without Notice

hytek microsystems incorporated

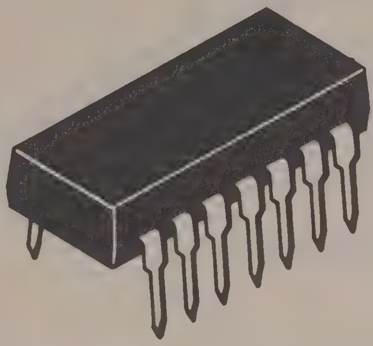
980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

HY-5030

10-TAP DIGITAL DELAY LINE
(Molded Package)

FEATURES

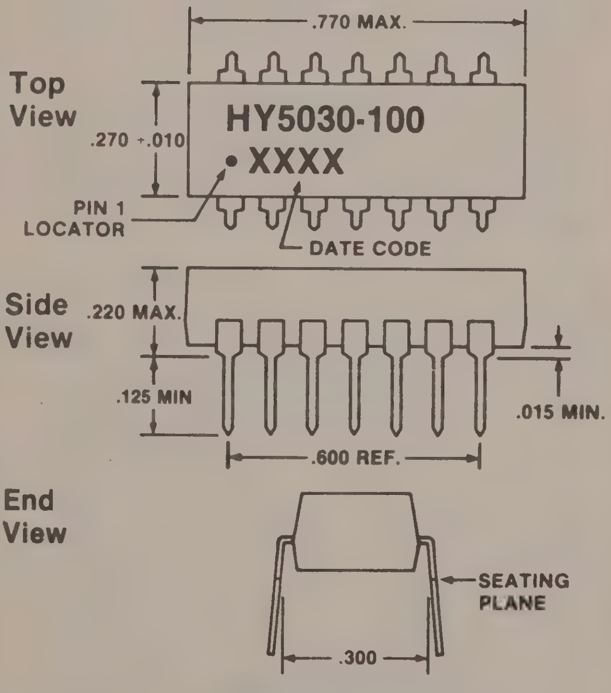
- TTL Schottky buffered inputs and outputs
- Low profile (.220" with .015" standoff)
- Customs also available
- Auto Insertable



SPECIFICATIONS

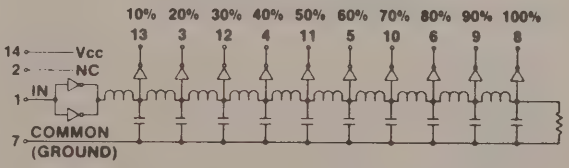
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (V_{CC})	5.0 VDC
PULSE VOLTAGE	Logic 1 3.2 volts Logic 0 0.0 volts
RISE TIME	3.0 nsec
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads tap max 20 TTL loads unit max (20 mA max.)
LOGIC 1	20 TTL loads tap and unit max (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	120 mA max.
SUPPLY VOLTAGE (V_{CC})	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	100μA @ V_{CC} = 5.25V and V_{IH} = 2.70V
LOGIC 0 INPUT CURRENT	-4 mA max. @ V_{CC} = 5.25V and V_{IL} = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. V_{CC} = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C

Dimensions (Inches)


.770 MAX.
Top View
.270 ±.010
HY5030-100
• XXXX
PIN 1 LOCATOR
DATE CODE
Side View
.220 MAX.
.125 MIN
.015 MIN.
.600 REF.
End View
SEATING PLANE
.300

DELAY AT EA. TAP IN NSEC.		
Part No.†	Total Delay (nsec.)	Tap-To-Tap Delay (nsec.)
HY5030-050	50 ± 2.5	5 ± 1.0
HY5030-100	100 ± 5.0	10 ± 1.0
HY5030-150	150 ± 7.5	15 ± 1.5
HY5030-200	200 ± 10.0	20 ± 2.0
HY5030-250	250 ± 13.5	25 ± 2.5

† Suffix designates
standard 0°C to 70°C operation
M standard -55°C to125°C operation


10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
13 3 12 4 11 5 10 6 9 8
14 Vcc
2 NC
1 IN
7 COMMON (GROUND)

Specifications Subject to Change Without Notice

hytek microsystems incorporated

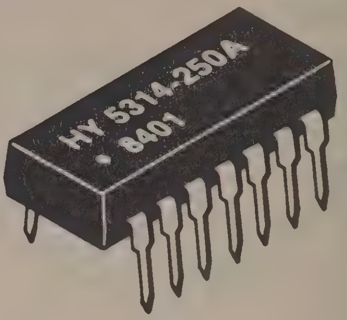
980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

10-TAP PASSIVE DELAY LINE
(14-PIN DIP)

HY-5314

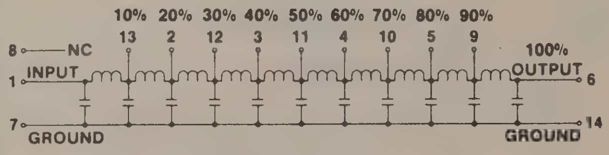
FEATURES

- Low profile 14 pin DIP
- 50, 100, and 200 ohm impedances
- TTL, ECL compatible
- Environmental - meets or exceeds MIL-D-23859

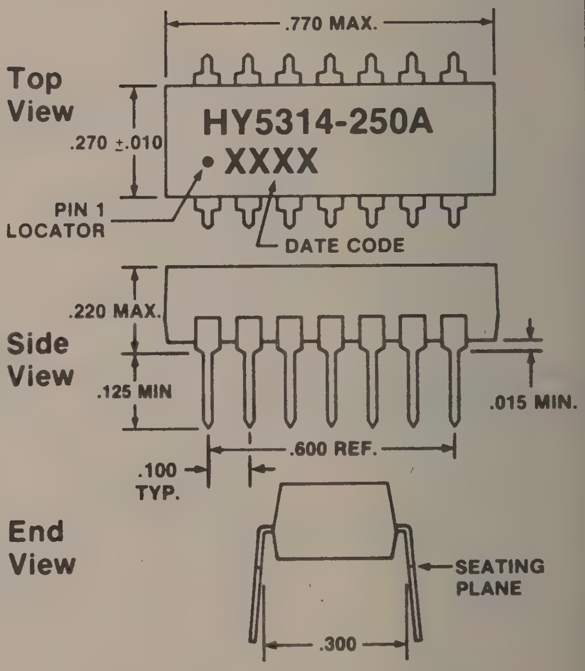

HY 5314-250A
8401

SPECIFICATIONS

DISTORTION	10% max.
TEMP COEFFICIENT	100 PPM/°C max
DELAY/RISE TIME RATIO	≥ 3:1
WITHSTANDING VOLTAGE	50 VDC min.
ATTENUATION	0.5db max.
TOTAL DELAY TOLERANCE	±5% or 2 nsec. whichever is greater
TAP-TO-TAP DELAY TOLERANCE	±10% or 0.5 nsec. whichever is greater


10%
20%
30%
40%
50%
60%
70%
80%
90%
13
2
12
3
11
4
10
5
9
8
NC
1
INPUT
100%
OUTPUT
6
7
GROUND
14
GROUND

Dimensions
(Inches)


Top View
.770 MAX.
.270 ±.010
HY5314-250A
• XXXX
PIN 1 LOCATOR
DATE CODE
Side View
.220 MAX.
.125 MIN
.015 MIN.
.600 REF.
.100 TYP.
End View
SEATING PLANE
.300

50 OHM IMPEDANCE				
Part No.	Total Delay (nsec.)	Rise Time (nsec.)	Delay/TAP (nsec.)	DCR (ohms)
HY5314-010A	10	3	1.0	.7
HY5314-025A	25	4	2.5	.9
HY5314-050A	50	7	5.0	1.3
HY5314-075A	75	10	7.5	1.8
HY5314-100A	100	14	10	2.1
HY5314-150A	150	20	15	2.3
HY5314-200A	200	30	20	2.4
HY5314-250A	250	35	25	2.5

100 OHM IMPEDANCE				
Part No.	Total Delay (nsec.)	Rise Time (nsec.)	Delay/TAP (nsec.)	DCR (ohms)
HY5314-025B	25	5.5	2.5	1.7
HY5314-050B	50	8.0	5.0	2.3
HY5314-075B	75	15	7.5	2.9
HY5314-100B	100	18	10	3.2
HY5314-150B	150	26	15	3.5
HY5314-200B	200	39	20	4.0
HY5314-250B	250	46	25	4.5

200 OHM IMPEDANCE				
Part No.	Total Delay (nsec.)	Rise Time (nsec.)	Delay/TAP (nsec.)	DCR (ohms)
HY5314-025C	25	9.0	2.5	1.8
HY5314-050C	50	15.5	5.0	2.4
HY5314-075C	75	18.0	7.5	2.5
HY5314-100C	100	20.0	10	3.0

Specifications Subject to Change Without Notice

hytek microsystems incorporated

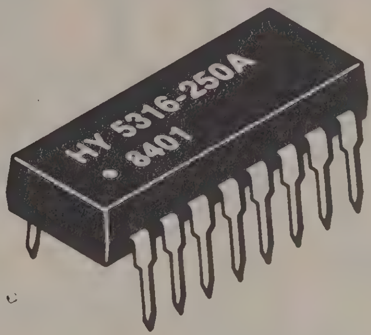
980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

HY-5316

10-TAP PASSIVE DELAY LINE
(16-PIN DIP)

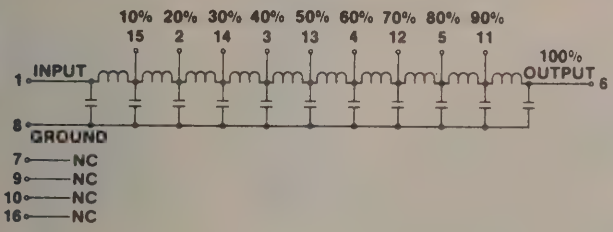
FEATURES

- **Low profile 16 pin DIP**
- **50, 100, and 200 ohm impedances**
- **TTL, ECL compatible**
- **Environmental - meets or exceeds MIL-D-23859**

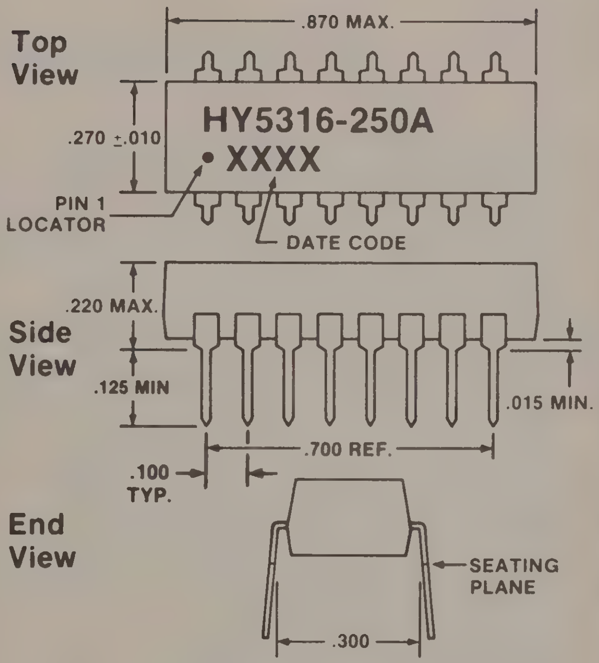

HY 5316-250A
• 8401

SPECIFICATIONS

DISTORTION	10% max.
TEMP. COEFFICIENT	100 PPM/°C max.
DELAY/RISE TIME RATIO	≥3:1
WITHSTANDING VOLTAGE	50 VDC min.
ATTENUATION	0.5db max
TOTAL DELAY TOLERANCE	±5% or 2 nsec. whichever is greater
TAP-TO-TAP DELAY TOLERANCE	±10% or 0 5 nsec. whichever is greater


10% 20% 30% 40% 50% 60% 70% 80% 90%
15 2 14 3 13 4 12 5 11
1 INPUT
100% OUTPUT 6
8 GROUND
7 NC
9 NC
10 NC
16 NC

Dimensions (Inches)


Top View
.870 MAX.
HY5316-250A
• XXXX
.270 ±.010
PIN 1 LOCATOR
DATE CODE
Side View
.220 MAX.
.125 MIN
.015 MIN.
.700 REF.
.100 TYP.
End View
SEATING PLANE
.300

50 OHM IMPEDANCE				
Part No.	**Total Delay (nsec.)**	**Rise Time (nsec.)**	**Delay/TAP (nsec.)**	**DCR (ohms)**
HY5316-010A	10	3	1.0	.7
HY5316-025A	25	4	2.5	.9
HY5316-050A	50	7	5.0	1.3
HY5316-075A	75	10	7.5	1.8
HY5316-100A	100	14	10	2.1
HY5316-150A	150	20	15	2.3
HY5316-200A	200	30	20	2.4
HY5316-250A	250	35	25	2.5

100 OHM IMPEDANCE				
Part No.	**Total Delay (nsec.)**	**Rise Time (nsec.)**	**Delay/TAP (nsec.)**	**DCR (ohms)**
HY5316-025B	25	5.5	2.5	1.7
HY5316-050B	50	8.0	5.0	2.3
HY5316-075B	75	15	7.5	2.9
HY5316-100B	100	18	10	3.2
HY5316-150B	150	26	15	3.5
HY5316-200B	200	39	20	4.0
HY5316-250B	250	46	25	4.5

200 OHM IMPEDANCE				
Part No.	**Total Delay (nsec.)**	**Rise Time (nsec.)**	**Delay/TAP (nsec.)**	**DCR (ohms)**
HY5316-025C	25	9.0	2.5	1.8
HY5316-050C	50	15.5	5.0	2.4
HY5316-075C	75	18.0	7.5	2.5
HY5316-100C	100	20.0	10	3.0

Specifications Subject to Change Without Notice

hytek microsystems incorporated

980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms **1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code **3**•1103
Batteries, Product Selection Guide **3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide **2**•1003
Capacitors, Basic Formulas **1A**•1093
Capacitors, Miniglossary **1A**•1069
Capacitors, Product Selection Guide **1A**•1003
Circuit Boards (Printed), Product Selection Guide **2**•1089
Coils, Chokes, & Inductors, Product Selection Guide **1A**•1219
Connectors, Miniglossary **2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide **2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **1A**•1309
Delay Lines, Product Selection Guide **1A**•1445
Discrete Semiconductors, Product Selection Guide **1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide **1B**•1021
EBCDIC Code **3**•1153
Encapsulation, Miniglossary **2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **2**•1801
Filters, Product Selection Guide **1A**•1577
Instruments, Graphic Recording, Product Selection Guide **3**•1381
Instruments, Panel Meters, Product Selection Guide **3**•1321
Instruments, Test & Measuring, Product Selection Guide **3**•1182
Interconnection Systems, Product Selection Guide **2**•1873
Keyboards & Keypads, Product Selection Guide **1B**•1759
Microwave Components, Product Selection Guide **1A**•1685
Military Qualified Products Lists **1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide **1B**•1121
Opto Semiconductors, Miniglossary **1B**•1218
Oscilloscopes, Product Selection Guide **3**•1361
Panel Hardware, Product Selection Guide **2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **1A**•2017
Power Supplies, Miniglossary **3**•1455
Power Supplies, AC, Product Selection Guide **3**•1815
Power Supplies, DC, Product Selection Guide **3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **1B**•1255
Relay Contact Forms **1B**•1317
Relays, Electromechanical, Miniglossary **1•B**1292
Relays, Product Selection Guide **1B**•1289
Resistor Color Codes **1A**•1791
Resistors, Product Selection Guide **1A**•1789
Servo Components, Miniglossary **3**•1935
Solenoids, Product Selection Guide **1B**•1481
Switches, Product Selection Guide **1B**•1499
Thyristors/High Power Diodes, Miniglossary **1A**•1652
Transducers & Encoders, Product Selection Guide **1B**•1827
Transformers, Product Selection Guide **1A**•2115
Wire & Cable, Product Selection Guide **2**•1935

JBM DELAY LINE HEADQUARTERS

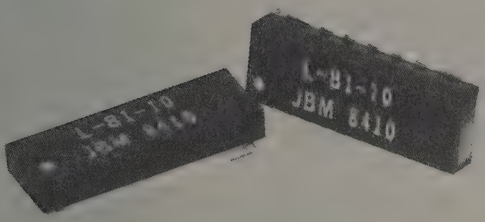
JBM produces one of the industry's broadest lines of active (digital) and passive magnetic delay lines for use in computers, communications equipment, military instrumentation, etc.

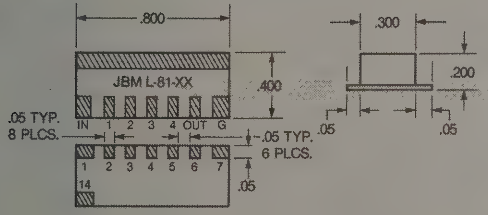
In addition to hundreds of standard models, we offer extensive capabilities for the design and production of custom units for special applications.

See the next 8 pages for a representative listing of JBM's broad selection of types and ratings

NEW

STYLE L-81 Surface Mounted Delay Lines





JBM Part No.	Total Delay	Tap Intervals	Rise Time Out Max.	Impedance (±10%)	Att. (Max.)
L-81-10	5ns ± 1ns	1.0ns ± .4ns	3.0ns	100Ω	3%
L-81-11	10ns ± 1ns	2.0ns ± .5ns	3.5ns	100Ω	3%
L-81-12	15ns ± 1ns	3.0ns ± .5ns	5.0ns	100Ω	3%
L-81-13	20ns ± 1ns	4.0ns ± .8ns	6.5ns	100Ω	3%
L-81-14	25ns ± 5%	5.0ns ± 1ns	8.0ns	100Ω	5%
L-81-15	30ns ± 5%	6.0ns ± 1ns	9.5ns	100Ω	5%
L-81-16	35ns ± 5%	7.0ns ± 1ns	11.0ns	100Ω	5%
L-81-17	40ns ± 5%	8.0ns ± 1ns	13.0ns	100Ω	5%
L-81-18	45ns ± 5%	9.0ns ± 1ns	15.0ns	100Ω	5%
L-81-19	50ns ± 5%	10.0ns ± 1ns	16.0ns	100Ω	7%
L-81-20	60ns ± 5%	12.0ns ± 10%	19.0ns	100Ω	7%
L-81-21	70ns ± 5%	14.0ns ± 10%	23.0ns	100Ω	7%
L-81-22	75ns ± 5%	15.0ns ± 10%	25.0ns	100Ω	10%
L-81-23	80ns ± 5%	16.0ns ± 10%	26.0ns	100Ω	10%
L-81-24	90ns ± 5%	18.0ns ± 10%	28.0ns	100Ω	10%
L-81-25	100ns ± 5%	20.0ns ± 10%	30.0ns	100Ω	10%

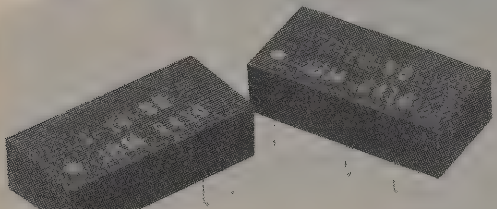
JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

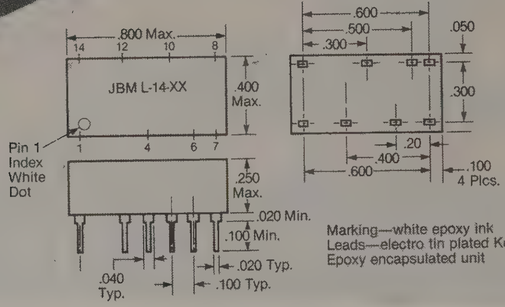
Active Delay Lines

jbm

NEW

STYLE L-14
Active Delay Line 5-Tap, Fast Rise Time



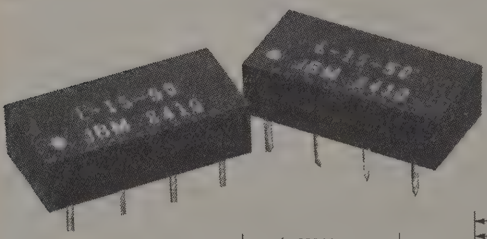

.800 Max.
14
12
10
8
JBM L-14-XX
.400 Max.
Pin 1 Index White Dot
1
4
6
7
.250 Max.
.020 Min.
.100 Min.
.020 Typ.
.040 Typ.
.100 Typ.
.600
.500
.300
.050
.300
.20
.400
.600
.100 4 Plcs.

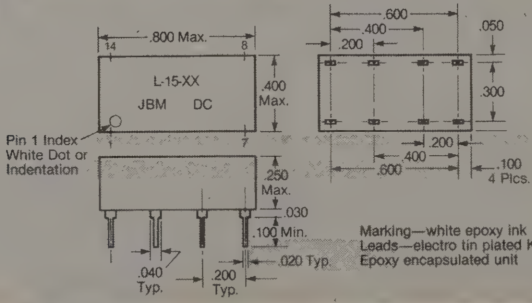
Marking—white epoxy ink
Leads—electro tin plated Kovar
Epoxy encapsulated unit

DELAY SPECIFICATIONS (all times in nanoseconds)						
JBM part #		**Tap 1 Pin 12**	**Tap 2 Pin 4**	**Tap 3 Pin 10**	**Tap 4 Pin 6**	**Output Pin 8**
L-14-050	lead	5 ± 3	10 ± 3	15 ± 3	20 ± 3	25 ± 2
	trail	5 ± 3	10 ± 3	15 ± 3	20 ± 3	25 ± 3
L-14-051	lead	6 ± 3	12 ± 3	18 ± 3	24 ± 3	30 ± 2
	trail	6 ± 3	12 ± 3	18 ± 3	24 ± 3	30 ± 3
L-14-052	lead	7 ± 3	14 ± 3	21 ± 3	28 ± 3	35 ± 2
	trail	7 ± 3	14 ± 3	21 ± 3	28 ± 3	35 ± 3
L-14-053	lead	8 ± 3	16 ± 3	24 ± 3	32 ± 3	40 ± 2
	trail	8 ± 3	16 ± 3	24 ± 3	32 ± 3	40 ± 4
L-14-054	lead	9 ± 3	18 ± 3	27 ± 3	36 ± 3	45 ± 2.5
	trail	9 ± 3	18 ± 3	27 ± 3	36 ± 3	45 ± 4
L-14-055	lead	10 ± 3	20 ± 3	30 ± 3	40 ± 3	50 ± 2.5
	trail	10 ± 3	20 ± 3	30 ± 3	40 ± 4	50 ± 4
L-14-056	lead	15 ± 3	30 ± 3	45 ± 3	60 ± 4	75 ± 4
	trail	15 ± 3	30 ± 3	45 ± 4	60 ± 5	75 ± 5
L-14-057	lead	20 ± 3	40 ± 3	60 ± 4	80 ± 4	100 ± 5
	trail	20 ± 3	40 ± 4	60 ± 5	80 ± 5	100 ± 6
L-14-058	lead	30 ± 3	60 ± 4	90 ± 5	120 ± 6	150 ± 7.5
	trail	30 ± 3	60 ± 5	90 ± 6	120 ± 9	150 ± 10
L-14-059	lead	40 ± 3	80 ± 4	120 ± 6	160 ± 8	200 ± 10
	trail	40 ± 4	80 ± 5	120 ± 8	160 ± 10	200 ± 12
L-14-060	lead	50 ± 4	100 ± 5	150 ± 8	200 ± 10	250 ± 12.5
	trail	50 ± 5	100 ± 6	150 ± 10	200 ± 12	250 ± 15
L-14-061	lead	60 ± 4	120 ± 6	180 ± 9	240 ± 12	300 ± 15
	trail	60 ± 5	120 ± 8	180 ± 11	240 ± 15	300 ± 18

NEW

STYLE L-15
Active Delay Line Multi-Buffered




.800 Max.
14
8
L-15-XX
JBM DC
.400 Max.
Pin 1 Index White Dot or Indentation
7
.250 Max.
.030
.100 Min.
.020 Typ.
.040 Typ.
.200 Typ.
.600
.400
.200
.050
.300
.200
.400
.600
.100 4 Plcs.

Marking—white epoxy ink
Leads—electro tin plated Kovar
Epoxy encapsulated unit

DELAY SPECIFICATIONS (all times in nanoseconds):			
JBM Part #	**Line 1 In 1—out 12**	**Line 2 In 3—out 10**	**Line 3 In 5—out 8**
L-15-050	5 ± 2	5 ± 2	5 ± 2
L-15-051	6 ± 2	6 ± 2	6 ± 2
L-15-052	7 ± 2	7 ± 2	7 ± 2
L-15-053	8 ± 2	8 ± 2	8 ± 2
L-15-054	9 ± 2	9 ± 2	9 ± 2
L-15-055	10 ± 2	10 ± 2	10 ± 2
L-15-056	15 ± 2	15 ± 2	15 ± 2
L-15-057	20 ± 2	20 ± 2	20 ± 2
L-15-058	30 ± 2	30 ± 2	30 ± 2
L-15-059	40 ± 3	40 ± 3	40 ± 3
L-15-060	50 ± 3	50 ± 3	50 ± 3
L-15-061	60 ± 3	60 ± 3	60 ± 3
L-15-062	70 ± 3.5	70 ± 3.5	70 ± 3.5
L-15-063	75 ± 4	75 ± 4	75 ± 4
L-15-064	80 ± 4	80 ± 4	80 ± 4
L-15-065	90 ± 4.5	90 ± 4.5	90 ± 4.5
L-15-066	100 ± 5	100 ± 5	100 ± 5
L-15-067	125 ± 6.5	125 ± 6.5	125 ± 6.5
L-15-068	150 ± 7.5	150 ± 7.5	150 ± 7.5
L-15-069	175 ± 9	175 ± 9	175 ± 9
L-15-070	200 ± 10	200 ± 10	200 ± 10

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

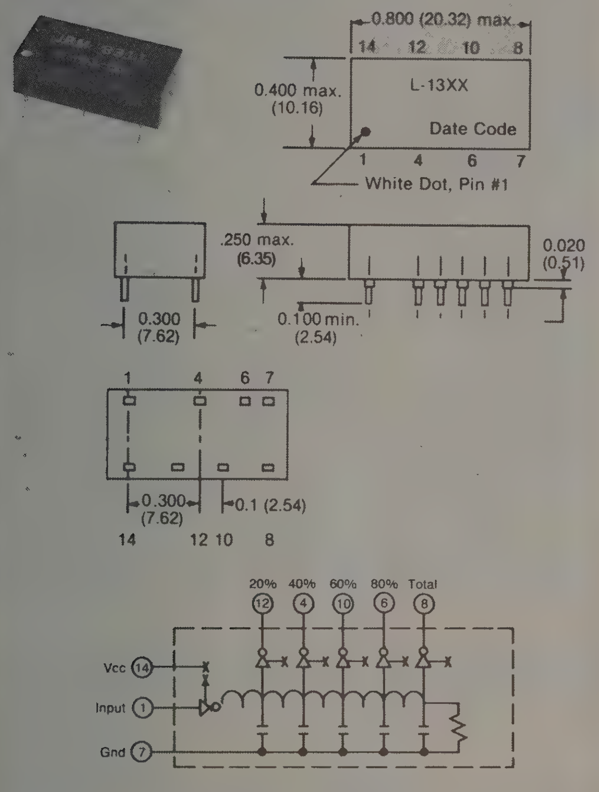
jbm

Active Delay Lines

Delay Range 25 thru 1000 nsec

STYLE L-13 (14-pin outline)

5 equally-spaced taps

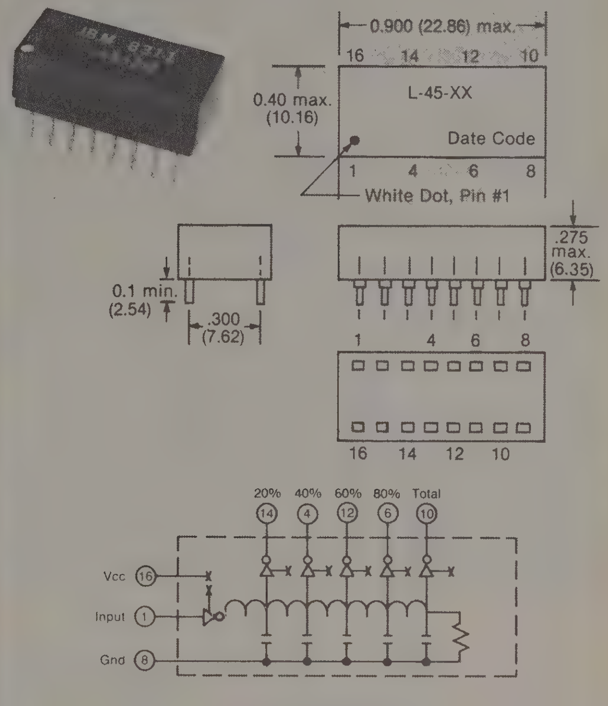

0.800 (20.32) max.
14 12 10 8
L-13XX
0.400 max. (10.16)
Date Code
1 4 6 7
White Dot, Pin #1
.250 max. (6.35)
0.020 (0.51)
0.300 (7.62)
0.100 min. (2.54)
1 4 6 7
0.300 (7.62)
0.1 (2.54)
14 12 10 8
20% 40% 60% 80% Total
12 4 10 6 8
Vcc 14
Input 1
Gnd 7

Dimensions in inches (mm).

Delay Range 25 thru 1000 nsec

STYLE L-45 (16-pins)

5 equally-spaced taps


0.900 (22.86) max.
16 14 12 10
L-45-XX
0.40 max. (10.16)
Date Code
1 4 6 8
White Dot, Pin #1
.275 max. (6.35)
0.1 min. (2.54)
.300 (7.62)
1 4 6 8
16 14 12 10
20% 40% 60% 80% Total
14 4 12 6 10
Vcc 16
Input 1
Gnd 8

Dimensions in inches (mm).

Operating Temp....................0° to +70°C
Storage Temp............ −55°C to +125°C
(All lines internally terminated)

I_{IH} Logic "1" Input Current.......50µA Max.
I_{IL} Logic "0" Input Current.... −2mA Max.
V_{OH} Logic "1" Voltage Out.........2.7V Min.
V_{OL} Logic "0" Voltage Out ....0.5V Max.

DRIVE CAPABILITIES
(TTL LOADS)

Logic "0"	10 Loads/Tap Max. 20 Loads/Unit Max.
Logic "1"	20 Loads/Unit Max.

TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM PART NUMBER L-	
			L-13 (14) PIN	L-45 (16) PIN
25	5	2.0	L-13-50	L-45-50
30	6	2.0	L-13-51	L-45-51
35	7	2.0	L-13-52	L-45-52
40	8	2.0	L-13-53	L-45-53
45	9	2.0	L-13-54	L-45-54
50	10	2.0	L-13-55	L-45-55
75	15	2.0	L-13-56	L-45-56
100	20	2.0	L-13-57	L-45-57
150	30	2.5	L-13-58	L-45-58
200	40	3.0	L-13-59	L-45-59
250	50	3.0	L-13-60	L-45-60
300	60	3.5	L-13-250	L-45-250
350	70	3.5	L-13-251	L-45-251
400	80	4.0	L-13-252	L-45-252
450	90	4.0	L-13-253	L-45-253
500	100	4.0	L-13-254	L-45-254
600	120	4.5	L-13-255	L-45-255
700	140	4.5	L-13-256	L-45-256
750	150	4.5	L-13-257	L-45-257
800	160	5.0	L-13-258	L-45-258
900	180	5.0	L-13-259	L-45-259
1000	200	5.0	L-13-260	L-45-260

*or ±5% whichever is greater.
Consult factory for other parameters and tolerances and low power (LS) versions.

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

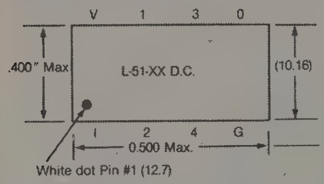
Active Delay Lines

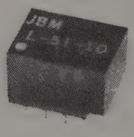
jbm

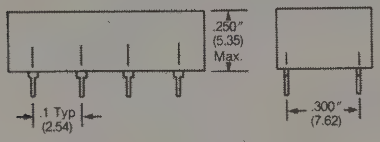
Delay Range 25 thru 500 nsec

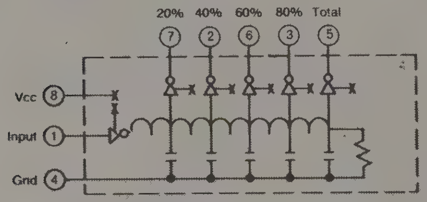
STYLE L-51 (8 pins)

5 equally-spaced taps


V
1
3
0
.400" Max
L-51-XX D.C.
(10.16)
1
2
4
G
0.500 Max.
White dot Pin #1 (12.7)




.250"
(5.35)
Max.
.1 Typ
(2.54)
.300"
(7.62)

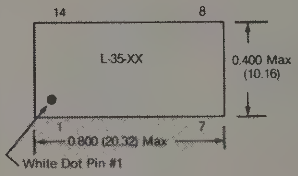

20%
40%
60%
80%
Total
7
2
6
3
5
Vcc 8
Input 1
Gnd 4

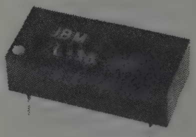
Dimensions in inches (mm).

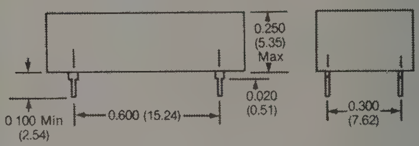
Delay Range 5 thru 1000 nsec

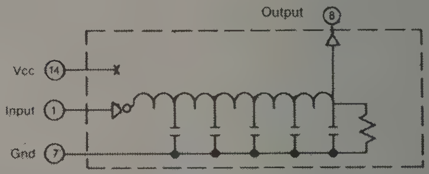
STYLE L-35 (14-pin outline)

Untapped


14
8
L-35-XX
0.400 Max
(10.16)
1
7
0.800 (20.32) Max
White Dot Pin #1




0.250
(5.35)
Max
0.020
(0.51)
0.100 Min
(2.54)
0.600 (15.24)
0.300
(7.62)


Output 8
Vcc 14
Input 1
Gnd 7

Dimensions in inches (mm).

Operating Temp..................0° to +70°C
Storage Temp........... −55°C to +125°C
(All lines internally terminated)

I_{IH} Logic "1" Input Current.....50μA Max.
I_{IL} Logic "0" Input Current.. −2mA Max.
V_{OH} Logic "1" Voltage Out.......2.7V Min.
V_{OL} Logic "0" Voltage Out......0.5V Max.

DRIVE CAPABILITIES
(TTL LOADS)

Logic "0" { 10 Loads/Tap Max.
20 Loads/Unit Max.

Logic "1" 20 Loads/Unit Max.

TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM P/N L-51-XX
25	5.0	2.0	L-51-50
30	6.0	↑	L-51-51
35	7.0		L-51-52
40	8.0		L-51-53
45	9.0		L-51-54
50	10.0		L-51-55
75	15.0	↓	L-51-56
100	20.0	2.0	L-51-57
150	30.0	2.5	L-51-58
200	40.0	3.0	L-51-59
250	50.0	3.0	L-51-60
300	60.0	3.5	L-51-61
350	70.0	3.5	L-51-62
400	80.0	4.0	L-51-63
450	90.0	4.0	L-51-64
500	100.0	4.0	L-51-65

TOTAL DELAY (nsec)	RISE TIME (ns MAX) (.8 to 2.0V)	JBM P/N L-35-XX
5 ± 1ns	2.0	L-35-00
7 ↑	↑	L-35-01
10		L-35-02
15 ↓		L-35-03
20 ± 1ns		L-35-04
25 ± 5%		L-35-05
30 ↑		L-35-06
40		L-35-07
50		L-35-08
70		L-35-09
100	↓	L-35-10
150	2.0	L-35-11
200	3.0	L-35-12
300	3.5	L-35-13
400	4.0	L-35-14
500	4.0	L-35-15
600	4.5	L-35-25
700	4.5	L-35-26
750	4.5	L-35-27
800	5.0	L-35-28
900 ↓	5.0	L-35-29
1000 ± 5%	5.0	L-35-30

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

jbm

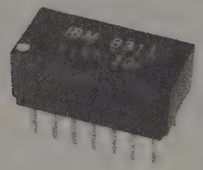
Active Delay Lines

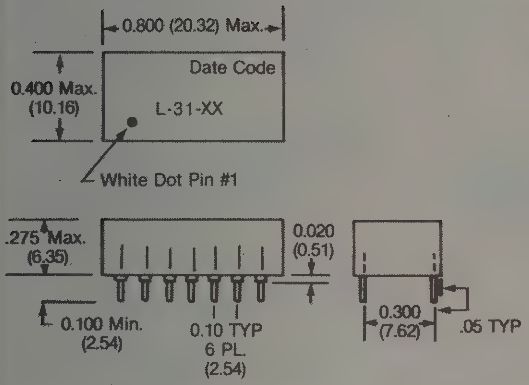
Delay Range 50 thru 1000 nsec

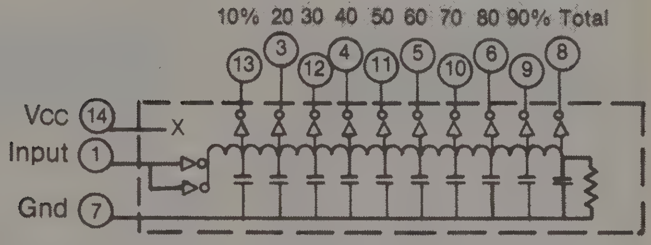
STYLE L-31 (14-pin DIP)

10 equally-spaced taps

TTL and DTL Compatible




0.800 (20.32) Max.
0.400 Max. (10.16)
Date Code
L-31-XX
White Dot Pin #1
.275 Max. (6.35)
0.020 (0.51)
0.100 Min. (2.54)
0.10 TYP 6 PL. (2.54)
0.300 (7.62)
.05 TYP


10% 20 30 40 50 60 70 80 90% Total
13
3
12
4
11
5
10
6
9
8
Vcc 14
Input 1
Gnd 7
X

Dimensions in inches (mm).

Operating Temp....................0° to +70°C
Storage Temp............ −55°C to +125°C
(All lines internally terminated)

I_{IH} Logic "1" Input Current.....100µA Max.
I_{IL} Logic "0" Input Current.... −4mA Max.
V_{OH} Logic "1" Voltage Out.........2.7V Min.
V_{OL} Logic "0" Voltage Out ....0.5V Max.

DRIVE CAPABILITIES
(TTL LOADS)

Logic "0"	10 Loads/Tap Max. 20 Loads/Unit Max.
Logic "1"	20 Loads/Unit Max.

TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM P/N L-31-XX
50	5.0	2.0	L-31-50
75	7.5	2.0	L-31-51
100	10.0	2.0	L-31-52
125	12.5	2.5	L-31-53
150	15.0	2.5	L-31-54
175	17.5	3.0	L-31-55
200	20.0	3.0	L-31-56
250	25.0	3.0	L-31-57
300	30.0	3.5	L-31-58
350	35.0	3.5	L-31-59
400	40.0	4.0	L-31-60
450	45.0	4.0	L-31-61
500	50.0	4.0	L-31-62
600	60.0	4.5	L-31-63
700	70.0	4.5	L-31-64
750	75.0	4.5	L-31-65
800	80.0	5.0	L-31-66
900	90.0	5.0	L-31-67
1000	100.0	5.0	L-31-68

*or ±5% whichever is greater.
Consult factory for other parameters, tolerances.

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

Passive Delay Lines

jbm

Compatible With Various Logic Systems Including TTL and Video Circuits.

- Total Delay Tolerance = ±5%
- Tap Interval Tolerance = ±10% or ±1 nsec, whichever is greater
- Impedance Tolerance = ±10%
- Temperature Coefficient of Delay = 100PPM/°C to 600ns, 200 PPM/°C thereafter
- Operating Temperature Range = −55°C to +125°C
- Voltage Rating = 50WVDC
- Epoxy encapsulated
- Td/Tr Ratio = 10:1
- Designed & manufactured to meet MIL-D-23859
- Typical attenuation = 10% max.

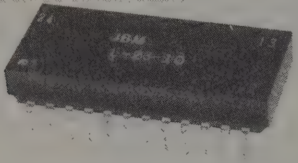
Delay Range 50 thru 2000 nsec

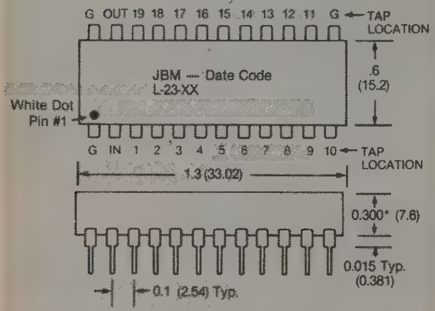
STYLE L-23

(24-pin DIP)

20 equally-spaced taps

Td/Tr = 10:1 (typ.)




G OUT 19 18 17 16 15 14 13 12 11 G
TAP LOCATION
JBM — Date Code
L-23-XX
.6
(15.2)
White Dot
Pin #1
G IN 1 2 3 4 5 6 7 8 9 10
TAP LOCATION
1.3 (33.02)
0.300* (7.6)
0.015 Typ.
(0.381)
0.1 (2.54) Typ.

Dimensions in inches (mm).

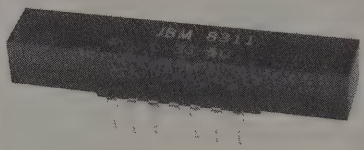
Delay Range 50 thru 2000 nsec

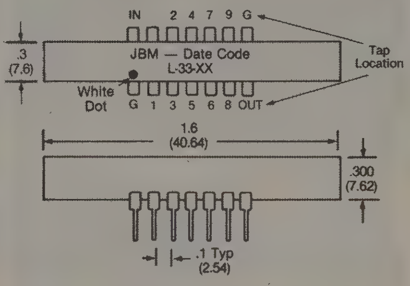
STYLE L-33

(14-pin DIP)

10 equally-spaced taps

Td/Tr = 10:1 (typ.)




IN 2 4 7 9 G
Tap Location
.3
(7.6)
JBM — Date Code
L-33-XX
White Dot
G 1 3 5 6 8 OUT
1.6
(40.64)
.300
(7.62)
.1 Typ
(2.54)

Dimensions in inches (mm).

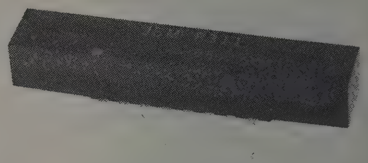
Delay Range 50 thru 2000 nsec

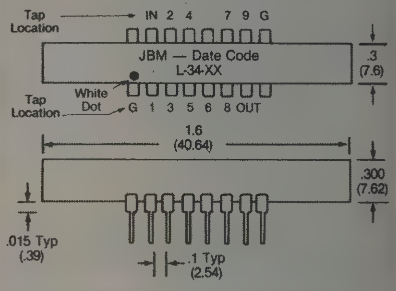
STYLE L-34

(16-pin DIP)

10 equally-spaced taps

Td/Tr = 10:1 (typ.)




Tap Location
IN 2 4 7 9 G
JBM — Date Code
L-34-XX
.3
(7.6)
Tap Location
White Dot
G 1 3 5 6 8 OUT
1.6
(40.64)
.300
(7.62)
.015 Typ
(.39)
.1 Typ
(2.54)

Dimensions in inches (mm).

TOTAL DELAY nsec ± 5%	TAP INTERVALS* (nsec)		RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-23-XX L-33/34-XX									
				50Ω		75Ω		100Ω		200Ω		350Ω	
	L-23	L-33/34		L-23	L-33/34	L-23	L-33/34	L-23	L-33/34	L-23	L-33/34	L-23	L-33/34
50	—	5.0	5.0	—	L-33/34-00	—	L-33/34-15	—	L-33/34-32	—	—	—	—
75	—	7.5	7.5	—	L-33/34-01	—	L-33/34-16	—	L-33/34-33	—	—	—	—
100	5.0	10.0	10.0	—	L-33/34-02	L-23-10	L-33/34-17	L-23-14	L-33/34-34	—	L-33/34-51	—	—
125	—	12.5	12.5	—	L-33/34-03	—	L-33/34-18	—	L-33/34-35	—	L-33/34-52	—	—
150	7.5	15.0	15.0	—	L-33/34-04	L-23-11	L-33/34-19	L-23-15	L-33/34-36	—	L-33/34-53	—	—
175	—	17.5	17.5	—	L-33/34-05	—	L-33/34-20	—	L-33/34-37	—	L-33/34-54	—	—
200	10.0	20.0	20.0	—	L-33/34-06	L-23-12	L-33/34-21	L-23-16	L-33/34-38	L-23-20	L-33/34-55	—	—
225	—	22.5	22.5	—	L-33/34-07	—	L-33/34-22	—	L-33/34-39	—	L-33/34-56	—	—
250	12.5	25.0	25.0	—	L-33/34-08	L-23-13	L-33/34-23	L-23-17	L-33/34-40	L-23-21	L-33/34-57	—	—
300	15.0	30.0	30.0	—	L-33/34-09	—	L-33/34-24	L-23-18	L-33/34-41	L-23-22	L-33/34-58	—	—
350	17.5	35.0	35.0	—	L-33/34-10	—	L-33/34-25	L-23-19	L-33/34-42	L-23-23	L-33/34-59	L-23-28	—
400	20.0	40.0	40.0	—	L-33/34-11	—	L-33/34-26	—	L-33/34-43	L-23-24	L-33/34-60	L-23-29	—
450	22.5	45.0	45.0	—	—	—	—	—	—	—	—	L-23-30	—
500	25.0	50.0	50.0	—	L-33/34-12	—	L-33/34-27	—	L-33/34-44	L-23-25	L-33/34-61	L-23-31	—
600	30.0	—	60.0	—	—	—	—	—	—	L-23-26	—	L-23-32	—
700	35.0	—	70.0	—	—	—	—	—	—	L-23-27	—	L-23-33	—
750	—	75.0	75.0	—	L-33/34-13	—	L-33/34-28	—	L-33/34-45	—	L-33/34-62	—	—
800	40.0	—	80.0	—	—	—	—	—	—	—	—	L-23-34	—
900	45.0	—	90.0	—	—	—	—	—	—	—	—	L-23-35	—
1000	50.0	100 0	100.0	—	L-33/34-14	—	L-33/34-29	—	L-33/34-46	—	L-33/34-63	L-23-36	—
1100	55.0	—	110.0	—	—	—	—	—	—	—	—	L-23-37	—
1200	60.0	—	120.0	—	—	—	—	—	—	—	—	L-23-38	—
1250	—	—	125.0	—	—	—	L-33/34-30	—	L-33/34-47	—	L-33/34-64	—	—
1500	—	—	150.0	—	—	—	L-33/34-31	—	L-33/34-48	—	L-33/34-65	—	—
1750	—	—	175.0	—	—	—	—	—	L-33/34-49	—	—	—	—
2000	—	—	200.0	—	—	—	—	—	L-33/34-50	—	—	—	—

* ±10% or ±1ns whichever is greater.
Consult factory for other parameters, tolerances and pin outs.

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

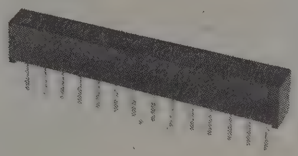
jbm

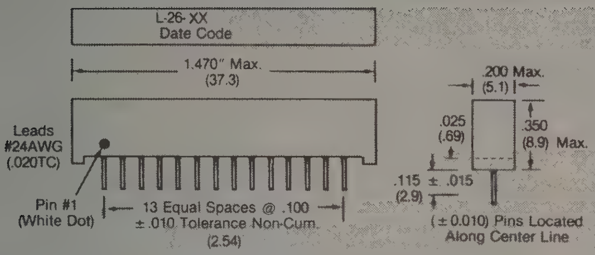
Passive Delay Lines

Delay Range 5 thru 450 nsec

STYLE L-26 (14-pin SIP)

10 equally-spaced taps
Td/Tr = 5:1 (typ.)





Dimensions in inches (mm).

CONNECTION	PIN #
GROUND	1
N/C	2
INPUT	3
TAP #1	4
TAP #2	5
TAP #3	6
TAP #4	7
TAP #5	8
TAP #6	9
TAP #7	10
TAP #8	11
TAP #9	12
OUTPUT	13
GROUND	14

Compatible With Various Logic Systems including TTL and Video Circuits

- Total Delay Tolerance = ±5% or ±1 nsec, whichever is greater.
- Impedance Tolerance = ±10%
- Temperature Coefficient of Delay = 100PPM/°C Max.
- Operating Temperature Range = −55°C to +125°C
- Voltage Rating = 50WVDC
- Td/Tr Ratio = 5:1 (also available, 10:1).
- Epoxy Encapsulated
- Engineered and manufactured to meet MIL-D-23859
- Typical attenuation = 10% max.

TOTAL DELAY (nsec)	TAP INTERVALS (nsec)	RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-26-XX			
			NOMINAL TERMINATING IMPEDANCE (±10%)			
			50Ω	75Ω	100Ω	200Ω
5.0 ± 1ns	0.50 ± .35ns	2.5	L-26-50	L-26-80	L-26-110	L-26-150
7.5 ↑	0.75 ↑	3.0	L-26-51	L-26-81	L-26-111	L-26-151
10.0	1.00	2.5	L-26-52	L-26-82	L-26-112	L-26-152
12.5	1.25	4.0	L-26-53	L-26-83	L-26-113	L-26-153
15.0	1.50 ↓	4.5	L-26-54	L-26-84	L-26-114	L-26-154
17.5 ↓	1.75 ± .35ns	5.0	L-26-55	L-26-85	L-26-115	L-26-155
20.0 ± 1ns	2.0 ± 20%	5.5	L-26-56	L-26-86	L-26-116	L-26-156
25.0 ± 5%	2.5 ↑	6.0	L-26-57	L-26-87	L-26-117	L-26-157
30.0 ↑	3.0	6.5	L-26-58	L-26-88	L-26-118	L-26-158
35.0	3.5	7.0	L-26-59	L-26-89	L-26-119	L-26-159
40.0	4.0	8.0	L-26-60	L-26-90	L-26-120	L-26-160
45.0	4.5 ↓	9.0	L-26-61	L-26-91	L-26-121	L-26-161
50.0	5.0 ± 20%	10.0	L-26-62	L-26-92	L-26-122	L-26-162
60.0	6.0 ± 1ns	12.0	L-26-63	L-26-93	L-26-123	L-26-163
70.0	7.0 ↑	14.0	L-26-64	L-26-94	L-26-124	L-26-164
80.0	8.0	16.0	L-26-65	L-26-95	L-26-125	L-26-165
90.0	9.0 ↓	18.0	L-26-66	L-26-96	L-26-126	L-26-166
100.0	10.0 ± 1ns	20.0	L-26-67	L-26-97	L-26-127	L-26-167
125.0	12.5 ± 10%	25.0	L-26-68	L-26-98	L-26-128	L-26-168
150.0	15.0 ↑	30.0	L-26-69	L-26-99	L-26-129	L-26-169
175.0	17.5	35.0	L-26-70	L-26-100	L-26-130	L-26-170
200.0	20.0	40.0	L-26-71	L-26-101	L-26-131	L-26-171
300.0	30.0	60.0	L-26-72	L-26-102	L-26-132	L-26-172
350.0	35.0	70.0	L-26-73	L-26-103	L-26-133	L-26-173
400.0 ↓	40.0 ↓	80.0	L-26-74	L-26-104	L-26-134	L-26-174
450.0 ± 5%	45.0 ± 10%	90.0	L-26-75	L-26-105	L-26-135	L-26-175

Consult factory for other parameters, tolerances and pin outs.

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

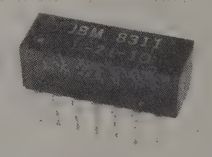
Passive Delay Lines

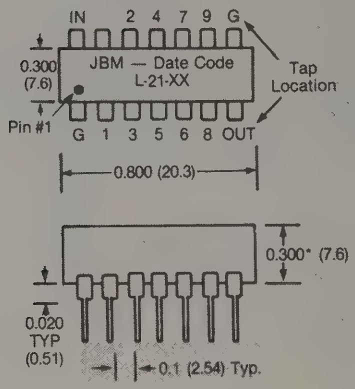
jbm

Delay Range 5 thru 1000 nsec

STYLE L-21 (14-pin DIP)

10 equally-spaced taps
Td/Tr = 5:1 (typ.)



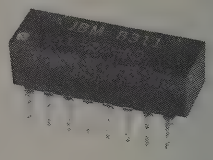


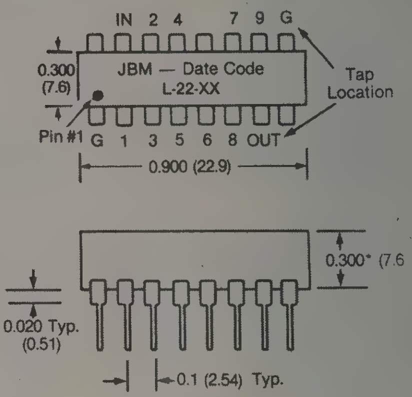
Dimensions in inches (mm).

Delay Range 5 thru 1000 nsec

STYLE L-22 (16-pin DIP)

10 equally-spaced taps
Td/Tr = 5:1 (typ.)





Dimensions in inches (mm).

Compatible With Various Logic Systems including TTL and Video Circuits

- Total Delay Tolerance = ±5%
- Impedance Tolerance = ±10%
- Temperature Coefficient of Delay = 100PPM/°C Max.
- Operating Temperature Range = −55°C to +125°C
- Voltage Rating = 50WVDC
- Typical attenuation = 10%
- Td/Tr Ratio = 5:1
- Designed & manufactured to meet MIL-D-23859
- Epoxy encapsulated

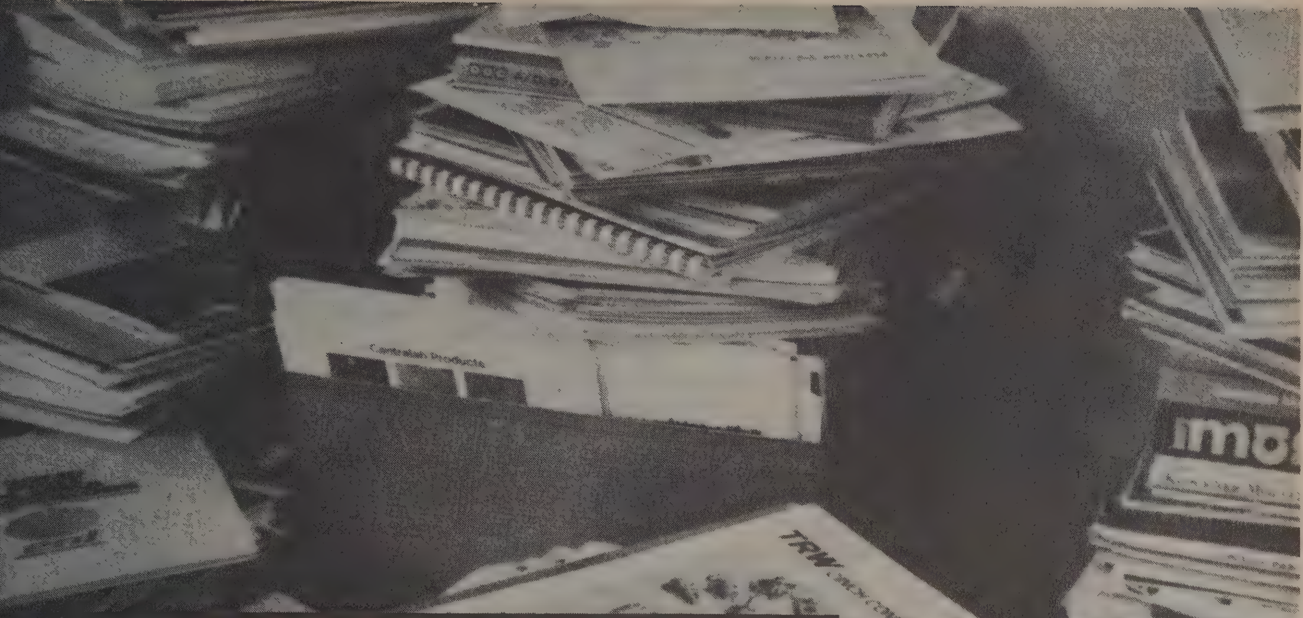
To order use prefix L-21 for 14 Pin & L-22 for 16 Pin. e.g. 100 ns, 100Ω is L-21-26 for 14 Pin and L-22-26 for 16 Pin.

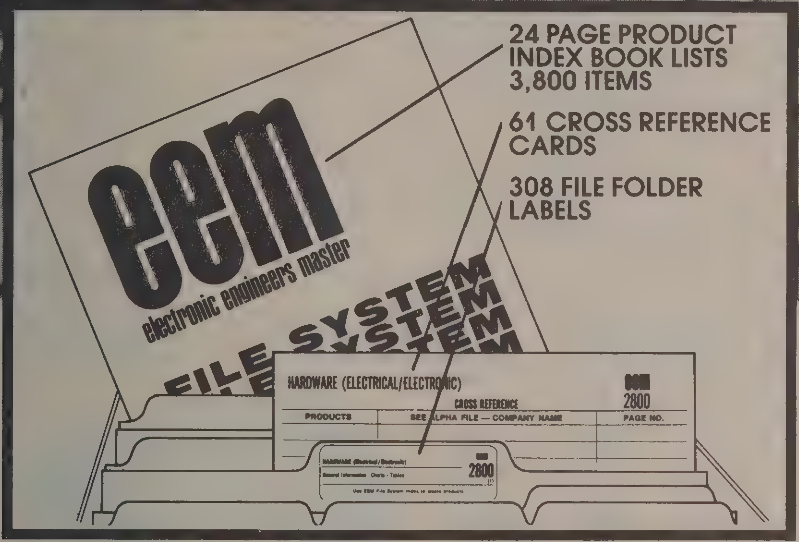
*Available in case heights of 0.220 (5.59) or 0.187 (4.75).

Consult factory for other parameters, tolerances and pin outs.

TOTAL DELAY (nsec)	TAP INTERVALS (nsec)	RISE TIME @ OUT (nsec) MAX	JBM PART NUMBER L-21/22—XXX NOMINAL TERMINATING IMPEDANCE (±10%)				
			50Ω	75Ω	100Ω	200Ω	500Ω
5.0 ± 1ns	0.50 ± .35ns	2.5	250	260	270	—	—
7.5 ↑	0.75 ↑	3.0	251	261	271	—	—
10.0	1.00	3.5	252	262	272	282	—
12.5	1.25	4.0	253	263	273	283	—
15.0	1.50 ↓	4.5	254	264	274	284	—
17.5 ↓	1.75 ± .35ns	5.0	255	265	275	285	—
20.0 ± 1ns	2.0 ± 20%	5.5	256	266	276	286	—
25.0 ± 5%	2.5 ↑	6.0	257	267	277	287	—
30.0 ↑	3.0	6.5	258	268	278	288	—
35.0	3.5	7.0	259	269	279	289	—
40.0	4.0 ↓	8.0	10	—	280	290	—
45.0	4.5 ± 20%	9.0	—	—	281	281	—
50.0	5.0 ± 1ns	10.0	11	—	21	31	41
60.0	6.0 ↑	12.0	12	—	22	32	42
70.0	7.0	14.0	13	—	23	33	43
80.0	8.0	16.0	14	—	24	34	44
90.0	9.0 ↓	18.0	15	—	25	35	45
100.0	10.0 ± 1ns	20.0	16	—	26	36	46
125.0	12.5 ± 10%	25.0	17	—	27	37	47
150.0	15.0 ↑	30.0	18	—	28	38	48
175.0	17.5	35.0	19	—	—	—	—
200.0	20.0	40.0	20	—	29	39	49
300.0	30.0	60.0	—	—	30	40	50
350.0	35.0	70.0	650	654	661	671	--
400.0	40.0	80.0	651	655	662	672	—
450.0	45.0	90.0	652	656	663	673	—
500.0	50.0	100.0	653	657	664	674	—
600.0	60.0	120.0	—	658	665	675	—
700.0	70.0	140.0	—	659	666	676	
750.0	75.0	150.0	—	660	667	677	—
800.0	80.0	160.0	—	—	668	—	—
900.0 ↓	90.0 ↓	180.0	—	—	669	—	—
1000 ± 5%	100.0 ± 10%	200.0	—	—	670	—	—

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978




24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
eem
2800
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

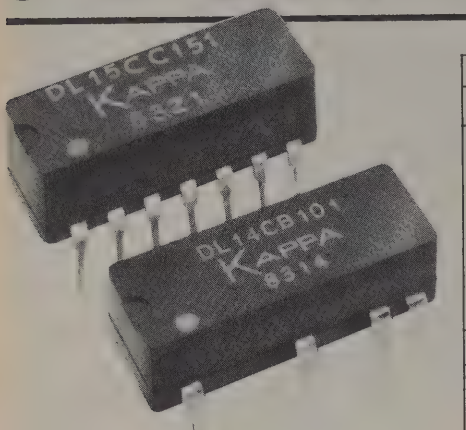
Don't waste any more time. Get organized now!

EEM FILE SYSTEM,

645 stewart ave., garden city, ny 11530

SERIES DL14C/DL15C TTL SCHOTTKY (14-PIN)

5- & 10-TAP DIGITAL DELAY LINES


DL15CC151
KAPPA
8321
DL14CB101
KAPPA
8314

FEATURES

- New Auto-Insertable 14-pin Package
- TTL Schottky Interfaced
- 5 or 10 equally spaced Taps
- Risetime: 4 ns max. (see Notes 2 and 3)

SPECIFICATIONS

Total Delay Times (ns)(1)(3):
25*, 50, 100, 150, 200, 250, 300*, 350*, 400*, 450*, 500*, 600*, 700*, 800*, 900*, 1000*.
*Available in Series DL14 only.

Tap Delay:
(DL14) 20% of nominal Total Delay Time.
(DL15) 10% of nominal Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number and Delay Time.

DL14CB **250**

BASIC SERIES #

DELAY TIME: Expressed in nanoseconds (ns)
First two digits are significant figures.
Last digit specifies number of zeros to follow.

Notes for Specifications above.

(1) Delays measured at 1.5V level on leading edge only, $V_{CC} = 5.0$, $T_A = +25°C$.
(2) Risetime measured from 0.75V to 2.4V, $V_{CC} = 5.0$, $T_A = +25°C$.
(3) Measured with no loads on Taps.

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, $I_I = I_{IK}$		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V		50	µA
		V_{CC} = max, V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

FIGURE 1 — SCHEMATIC

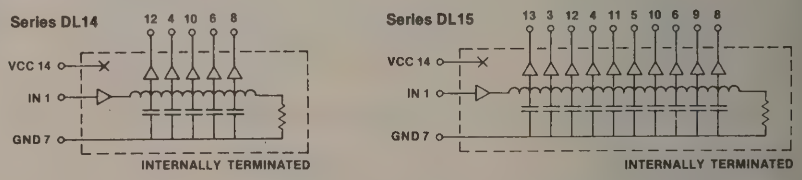
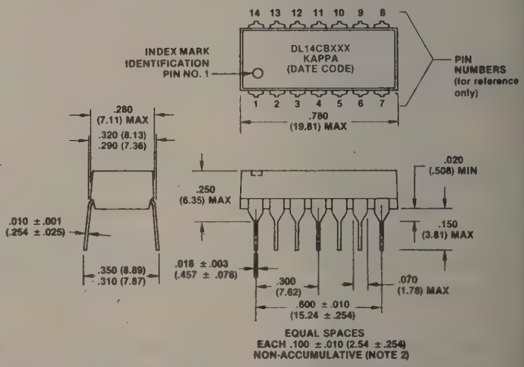

Series DL14
12
4
10
6
8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED
Series DL15
13
3
12
4
11
5
10
6
9
8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED

FIGURE 2 — MARKING & DIMENSIONS in inches and (mm)


14 13 12 11 10 9 8
DL14CBXXX
KAPPA
(DATE CODE)
INDEX MARK IDENTIFICATION PIN NO. 1
PIN NUMBERS (for reference only)
1 2 3 4 5 6 7
.780 (19.81) MAX
.280 (7.11) MAX
.320 (8.13)
.290 (7.36)
.010 ±.001 (.254 ±.025)
.350 (8.89)
.310 (7.87)
.250 (6.35) MAX
.018 ±.003 (.457 ± .076)
.020 (.508) MIN
.150 (3.81) MAX
.300 (7.62)
.070 (1.78) MAX
.600 ±.010 (15.24 ±.254)
EQUAL SPACES
EACH .100 ±.010 (2.54 ±.254)
NON-ACCUMULATIVE (NOTE 2)

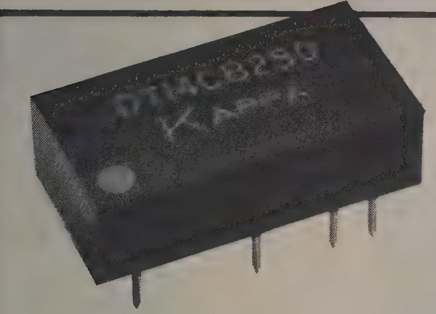
Notes for Figure 2:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.
(3) Series DL14 units may exclude terminals not shown in Figure 1 Schematic.

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DT14 TTL SCHOTTKY (14-PIN)

5-TAP DIGITAL DELAY MODULE

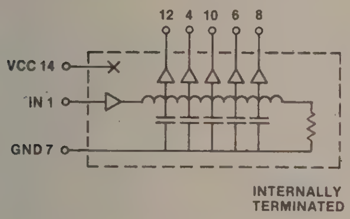

DT14CB250
KAPPA

PART NUMBER	Total Delay (ns)(1)(3) ±5%	Tap Delay (ns)(1)(3) ±5% or ±2ns, WIG(4)
DT14CB250	25	5
DT14CB500	50	10
DT14CB101	100	20
DT14CB151	150	30
DT14CB201	200	40
DT14CB251	250	50
DT14CB301	300	60
DT14CB351	350	70
DT14CB401	400	80
DT14CB451	450	90
DT14CB501	500	100
DT14CB601	600	120
DT14CB701	700	140
DT14CB801	800	160
DT14CB901	900	180
DT14CB102	1000	200

Notes:
(1) Delays measured at 1.5V level on leading edge only.
(2) Risetime measured from 0.75V to 2.4V.
(3) Measured with no loads on taps.
(4) Tap tolerances referenced from input.

FEATURES

- TTL Schottky Interfaced
- 14-pin package
- 5 equally spaced taps
- Operating Temperature Range: 0°C to +70°C
- Risetime: 4ns max. (See Notes 2 and 3)


12
4
10
6
8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED

INPUT TEST CONDITIONS

Pulse Voltage: 3.2V
Risetime: 2ns
Supply Current: (typical) 60mA
Pulse Width: 40% minimum of total delay

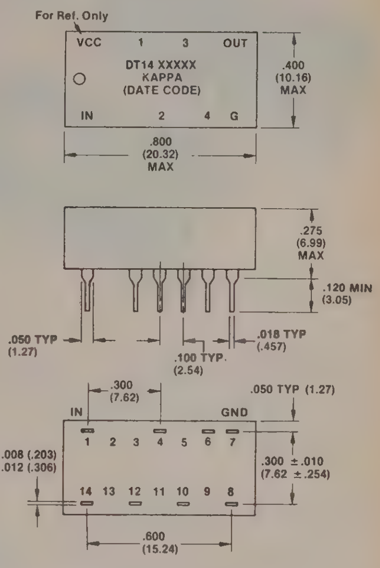
ELECTRICAL CHARACTERISTICS

Supply Voltage (V_{CC}): 5.0V (±0.25V)
Logic 1 Input Current: 50µA max.
Logic 0 Input Current: −2mA max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

DRIVE CAPABILITIES

Logic 0 Output:
10 TTL Loads/Tap max.
20 TTL Loads/Unit max.
Logic 1 Output: 20 TTL Loads/Unit max.

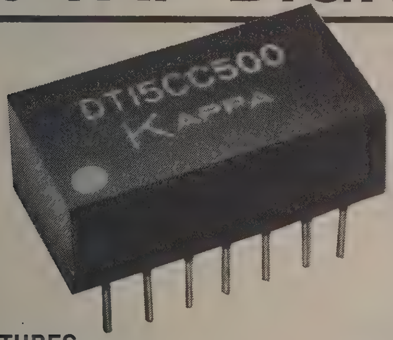
MARKING & DIMENSIONS in Inches and (mm)


For Ref. Only
VCC
1
3
OUT
DT14 XXXXX
KAPPA
(DATE CODE)
IN
2
4
G
.400 (10.16) MAX
.800 (20.32) MAX
.275 (6.99) MAX
.120 MIN (3.05)
.050 TYP (1.27)
.100 TYP. (2.54)
.018 TYP (.457)
.300 (7.62)
.050 TYP (1.27)
IN
GND
1 2 3 4 5 6 7
14 13 12 11 10 9 8
.008 (.203)
.012 (.306)
.300 ±.010 (7.62 ±.254)
.600 (15.24)

(Also available in Auto-Insertable DIP Package.)

SERIES DT15 TTL SCHOTTKY (14-PIN)

10-TAP DIGITAL DELAY MODULE

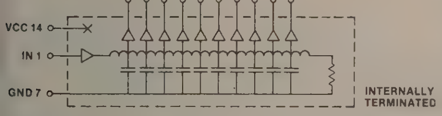

DT15CC500
KAPPA

PART NUMBER	Total Delay (ns)(1)(3) ±5%	Tap Delay (ns)(1)(3) ±5% or ±2ns, WIG(4)
DT15CC500	50	5 (±1)
DT15CC101	100	10
DT15CC151	150	15
DT15CC201	200	20
DT15CC251	250	25

Notes:
(1) Delays measured at 1.5V level on leading edge only.
(2) Risetime measured from 0.75V to 2.4V.
(3) Measured with no loads on taps.
(4) Tap tolerances referenced from input.

FEATURES

- TTL Schottky Interfaced
- 14-pin package
- 10 equally spaced taps
- Operating Temperature Range: 0°C to +70°C
- Risetime: 4ns max. (See Notes 2 and 3)


13 3 12 4 11 5 10 6 9 8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED

INPUT TEST CONDITIONS

Pulse Voltage: 3.2V
Risetime: 2ns
Supply Current: (typical) 60mA
Pulse Width: 40% minimum of total delay

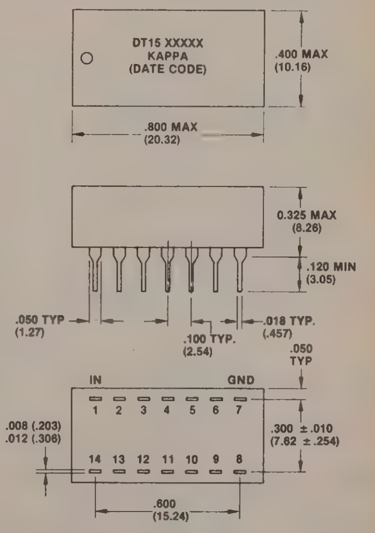
ELECTRICAL CHARACTERISTICS

Supply Voltage (V_{CC}): 5.0V (±0.25V)
Logic 1 Input Current: 50µA max.
Logic 0 Input Current: −2mA max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

DRIVE CAPABILITIES

Logic 0 Output:
10 TTL Loads/Tap max.
20 TTL Loads/Unit max.
Logic 1 Output: 20 TTL Loads/Unit max.

MARKING & DIMENSIONS in Inches and (mm)


DT15 XXXXX
KAPPA
(DATE CODE)
.400 MAX (10.16)
.800 MAX (20.32)
0.325 MAX (8.26)
.120 MIN (3.05)
.050 TYP (1.27)
.100 TYP. (2.54)
.018 TYP. (.457)
.050 TYP
IN
GND
1 2 3 4 5 6 7
14 13 12 11 10 9 8
.008 (.203)
.012 (.306)
.300 ±.010 (7.62 ±.254)
.600 (15.24)

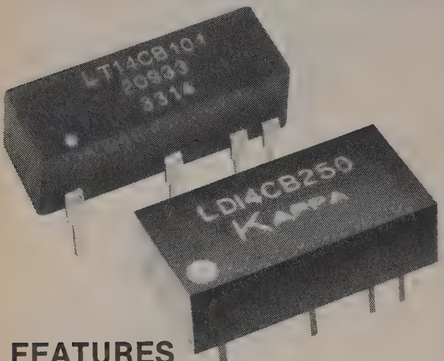
(Also available in Auto-Insertable DIP Package.)

KAPPA® NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES LT14/LD14 TTL SCHOTTKY (14-PIN)

5-TAP DIGITAL DELAY MODULES


LT14CB101
20933
3314
LD14CB250
KAPPA

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			– 18	mA
I_{OH}	High-Level Output Current			– 1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+ 70	°C
DC ELECTRICAL CHARACTERISTICS		**TEST CONDITIONS**			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		– 1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V V_{CC} = max, V_{IN} = 5.25V		50 1.0	μA mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		– 2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	– 40	– 100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

FEATURES

- T_{PLH} and T_{PHL} controlled
- 14-pin package
- Available in Auto-Insertable (LT14) and Standard Package (LD14)
- 5 equally spaced Delay Taps
- Operating Temperature Range: 0°C to +70°C

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 25, 30, 50, 60, 75, 100, 125,150, 175, 200, 225, 250, 300, 350, 400, and 500.

Tap Delay(1) (3): 5 equally-spaced delay taps at 20%, 40%, 60%, 80%, and 100% of nominal Total Delay.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

Output Risetime(2) (3): 4nS maximum.

Notes:

(1) Delays measured at 1.5V level on leading and trailing edges, V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on taps.

PART NUMBER EXAMPLE

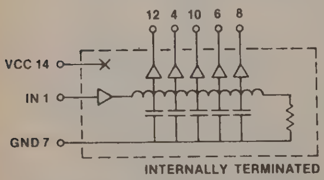
Typical Part Number is a combination of the Basic Series Number and Delay Time.

LT14CB **250**

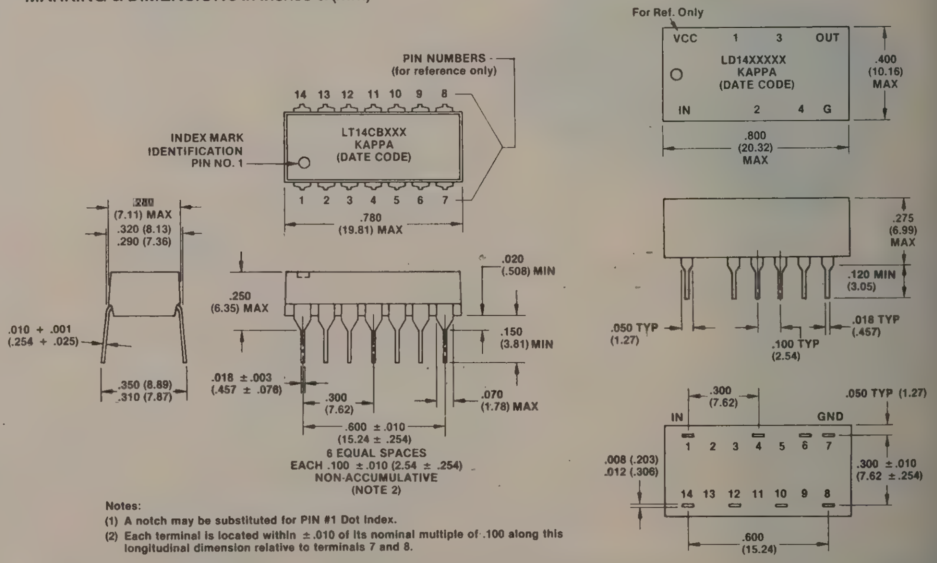
BASIC SERIES #

DELAY TIME

First two digits are significant figures.
Last digit specifies number of zeros to follow (ns).


12
4
10
6
8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches & (mm)


For Ref. Only
VCC
1
3
OUT
LD14XXXXX
KAPPA
(DATE CODE)
IN
2
4
G
.400 (10.16) MAX
.800 (20.32) MAX
PIN NUMBERS (for reference only)
14 13 12 11 10 9 8
LT14CBXXX
KAPPA
(DATE CODE)
INDEX MARK IDENTIFICATION PIN NO. 1
1 2 3 4 5 6 7
.780 (19.81) MAX
.280 (7.11) MAX
.320 (8.13)
.290 (7.36)
.010 + .001 (.254 + .025)
.350 (8.89)
.310 (7.87)
.250 (6.35) MAX
.020 (.508) MIN
.150 (3.81) MIN
.018 ± .003 (.457 ± .076)
.300 (7.62)
.070 (1.78) MAX
.600 ± .010 (15.24 ± .254)
6 EQUAL SPACES
EACH .100 ± .010 (2.54 ± .254)
NON-ACCUMULATIVE
(NOTE 2)
.275 (6.99) MAX
.120 MIN (3.05)
.050 TYP (1.27)
.100 TYP (2.54)
.018 TYP (.457)
.300 (7.62)
.050 TYP (1.27)
IN
GND
1 2 3 4 5 6 7
14 13 12 11 10 9 8
.008 (.203)
.012 (.306)
.300 ± .010 (7.62 ± .254)
.600 (15.24)

Notes:

(1) A notch may be substituted for PIN #1 Dot Index.

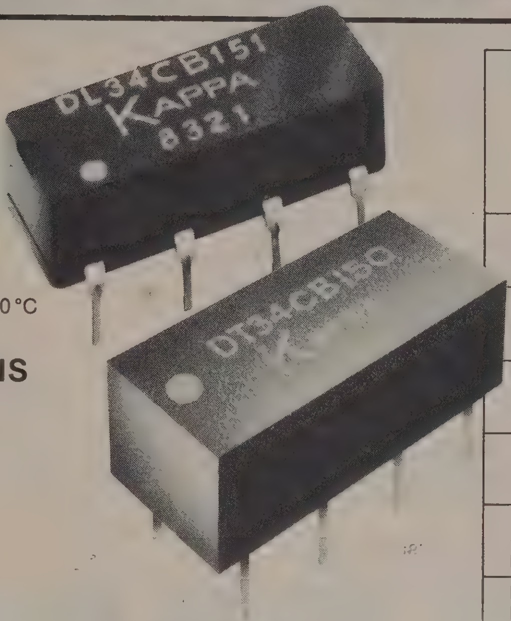
(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

KAPPA® NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DL34/DT34 TTL SCHOTTKY (14-PIN)

TRIPLE-IN-LINE DIGITAL DELAY MODULE



DL34CB151
KAPPA
8321
DT34CB150
KAPPA

FEATURES

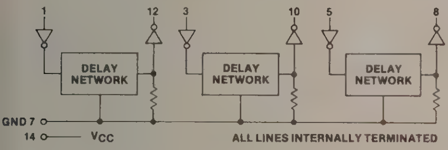
- 14-Pin DIL Package
- Available in Auto-Insertable (DL34) and Standard Package (DT34)
- Risetime 4ns Maximum
- Three Independent Equal Delays
- Operating Temperature 0 °C to + 70 °C
- TTL Schottky Interfaced

INPUT TEST CONDITIONS

V_{CC}: 5.00V ± 0.25V
Supply Current: I_{CCH} = 90mA max.
I_{CCL} = 115mA max.
Pulse Voltage: 3.2V ± 0.1V
Risetime: 2.0 ns max.
Pulse Width: 100% min. of Delay
Duty Cycle: 25% or less

DRIVE CAPABILITIES

10 TTL loads per line



1
12
3
10
5
8
DELAY NETWORK
DELAY NETWORK
DELAY NETWORK
GND 7
14
VCC
ALL LINES INTERNALLY TERMINATED

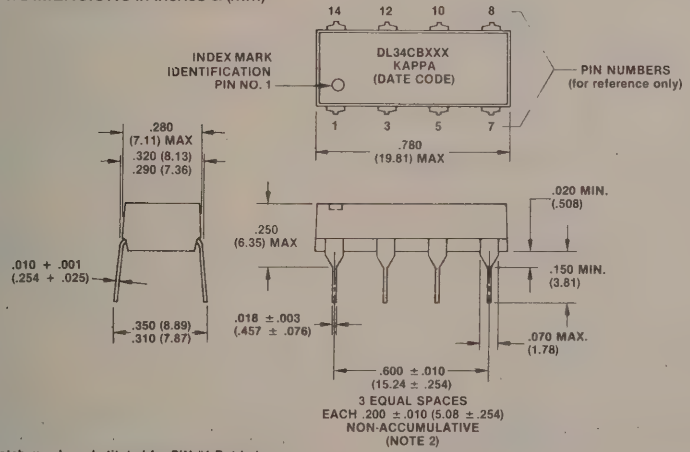
ELECTRICAL SPECIFICATIONS

Logic 1: 50μA max., 2.0V min.
Logic 0: − 2.0mA max., 0.8V max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

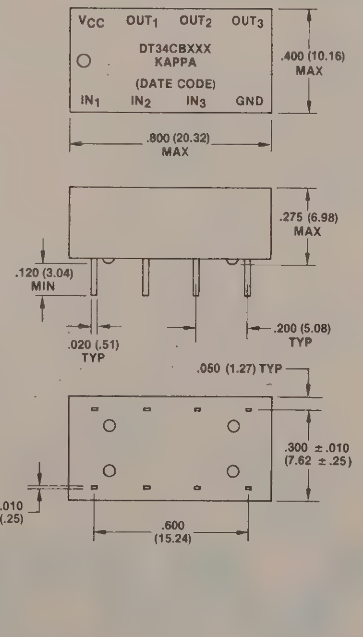
KAPPA PART # XXXXXXXXX		DELAY TIME (ns)(1) ± 5% or ± 2 ns, whichever is greater (unless otherwise specified)
DL34CB050	DT34CB050	5 ± 1.5
DL34CB100	DT34CB100	10 ± 1.5
DL34CB150	DT34CB150	15
DL34CB200	DT34CB200	20
DL34CB250	DT34CB250	25
DL34CB300	DT34CB300	30
DL34CB350	DT34CB350	35
DL34CB400	DT34CB400	40
DL34CB450	DT34CB450	45
DL34CB500	DT34CB500	50
DL34CB600	DT34CB600	60
DL34CB700	DT34CB700	70
DL34CB800	DT34CB800	80
DL34CB900	DT34CB900	90
DL34CB101	DT34CB101	100
DL34CB125	DT34CB125	125
DL34CB151	DT34CB151	150
DL34CB175	DT34CB175	175
DL34CB201	DT34CB201	200
DL34CB225	DT34CB225	225
DL34CB251	DT34CB251	250

(1) Delays measured at 1.5V level on leading edge only with no loads on taps.
(2) Risetime measured from 0.75V to 2.4V.

MARKING & DIMENSIONS in inches & (mm)



14
12
10
8
INDEX MARK IDENTIFICATION PIN NO. 1
DL34CBXXX
KAPPA
(DATE CODE)
PIN NUMBERS (for reference only)
1
3
5
7
.780 (19.81) MAX
.280 (7.11) MAX
.320 (8.13)
.290 (7.36)
.010 + .001 (.254 + .025)
.350 (8.89)
.310 (7.87)
.250 (6.35) MAX
.020 MIN. (.508)
.150 MIN. (3.81)
.018 ± .003 (.457 ± .076)
.070 MAX. (1.78)
.600 ± .010 (15.24 ± .254)
3 EQUAL SPACES
EACH .200 ± .010 (5.08 ± .254)
NON-ACCUMULATIVE
(NOTE 2)



VCC
OUT1
OUT2
OUT3
DT34CBXXX
KAPPA
(DATE CODE)
IN1
IN2
IN3
GND
.400 (10.16) MAX
.800 (20.32) MAX
.275 (6.98) MAX
.120 (3.04) MIN
.020 (.51) TYP
.200 (5.08) TYP
.050 (1.27) TYP
.300 ± .010 (7.62 ± .25)
.010 (.25)
.600 (15.24)

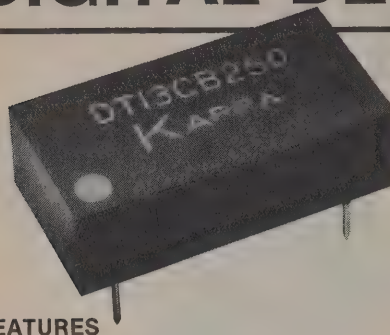
Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located within ± .010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

KAPPA® NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DT13 TTL SCHOTTKY (14-PIN)

DIGITAL DELAY MODULE


DT13CB250
KAPPA

FEATURES

- TTL Schottky Interfaced
- STANDARD 14-pin Package
- 3 ns typ. Risetime (4 ns max.)
- Operating Temperature Range: 0°C to +70°C

SERIES DT13 SPECIFICATIONS

Delay Times (ns): 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000 (other values available upon request).

Delay Tolerance: ±5% or ±2 ns, whichever is greater (tighter tolerances upon request).

INPUT TEST CONDITIONS

Pulse Voltage: 3.2V
Risetime: ≤ 2.0 ns
Supply Current: 75 mA max.
Pulse Width: 40% minimum of total delay
Duty Cycle: 50% max.

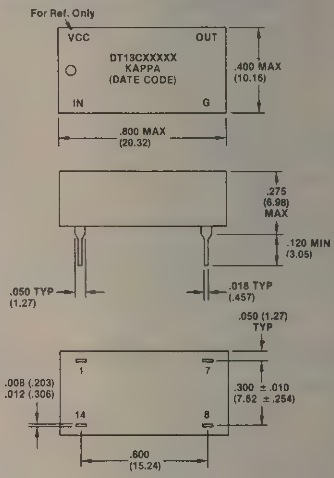
ELECTRICAL CHARACTERISTICS

Computer-Grade
Supply Voltage: 5.0V ±0.25V
Logic 1:
  Input Voltage: 2.0V min.
  Input Current: 50μA max.
  Output Voltage: 2.7V min.
Logic 0:
  Input Voltage: 0.8V max.
  Input Current: −2.0 mA max.
  Output Voltage: 0.5V max.

DRIVE CAPABILITIES

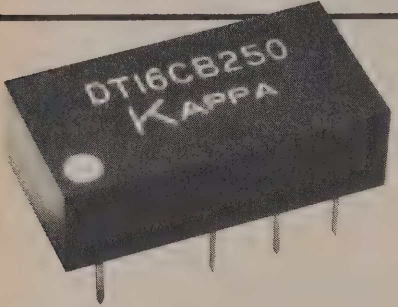
Logic 1 Output: 10 TTL Loads/Unit max.
Logic 0 Output: 10 TTL Loads/Unit max.

MARKING & DIMENSIONS in inches and (mm)


For Ref. Only
VCC
OUT
DT13CXXXXX
KAPPA
(DATE CODE)
IN
G
.400 MAX (10.16)
.800 MAX (20.32)
.275 (6.98) MAX
.120 MIN (3.05)
.050 TYP (1.27)
.018 TYP (.457)
.050 (1.27) TYP
1
7
14
8
.008 (.203)
.012 (.306)
.300 ± .010 (7.62 ± .254)
.600 (15.24)

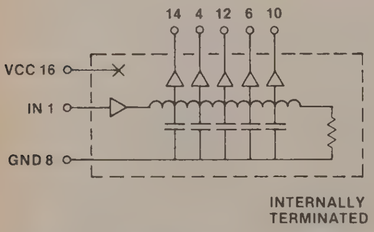
SERIES DT16 TTL SCHOTTKY (16-PIN)

5-TAP DIGITAL DELAY MODULE


DT16CB250
KAPPA

FEATURES

- TTL Schottky Interfaced
- STANDARD 16-pin Package
- 3 ns typ. Risetime (4 ns max.)
- Operating Temperature Range: 0°C to +70°C
- 5 equally spaced Taps


14
4
12
6
10
VCC 16
IN 1
GND 8
INTERNALLY TERMINATED

SERIES DT16 SPECIFICATIONS

Total Delay Times (ns): 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000 (other values available upon request).

Delay Tolerance: ±5% or ±2 ns, whichever is greater; Referenced from input.

Tap Delay: 20% of nominal Total Delay Time.

INPUT TEST CONDITIONS

Pulse Voltage: 3.2V
Risetime: ≤ 2.0 ns
Supply Current: 75 mA max.
Pulse Width: 40% minimum of total delay
Duty Cycle: 50% max.

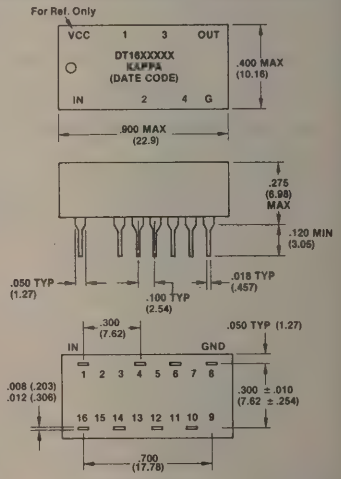
ELECTRICAL CHARACTERISTICS

Computer-Grade
Supply Voltage: 5.0V ±0.25V
Logic 1:
  Input Voltage: 2.0V min.
  Input Current: 50μA max.
  Output Voltage: 2.7V min.
Logic 0:
  Input Voltage: 0.8V max.
  Input Current: −2.0 mA max.
  Output Voltage: 0.5V max.

DRIVE CAPABILITIES

Logic 0 Output: 10 TTL Loads/Tap max.
20 TTL Loads/Unit max.
Logic 1 Output: 20 TTL Loads/Unit max.

MARKING & DIMENSIONS in inches and (mm)


For Ref. Only
VCC
1
3
OUT
DT16XXXXX
KAPPA
(DATE CODE)
IN
2
4
G
.400 MAX (10.16)
.900 MAX (22.9)
.275 (6.98) MAX
.120 MIN (3.05)
.050 TYP (1.27)
.100 TYP (2.54)
.018 TYP (.457)
.300 (7.62)
.050 TYP (1.27)
IN
GND
1 2 3 4 5 6 7 8
16 15 14 13 12 11 10 9
.008 (.203)
.012 (.306)
.300 ± .010 (7.62 ± .254)
.700 (17.78)

PART NUMBER EXAMPLE

DT13 (16) **250**

BASIC SERIES #

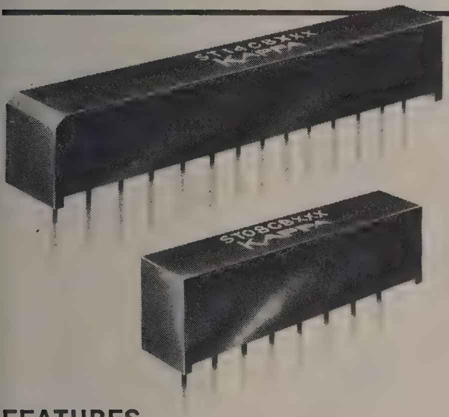
DELAY TIME: Expressed in nanoseconds (ns).
First two digits are significant figures.
Last digit specifies number of zeroes to follow.

KAPPA® NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES ST08C/ST14C TTL SCHOTTKY (8-PIN/14-PIN)

5- & 10-TAP DIGITAL DELAY LINES


ST14CBXXX
KAPPA
ST08CBXXX
KAPPA

FEATURES

- 8-Pin (ST08C) and 14-Pin (ST14C) SIP Package
- TTL Schottky interfaced
- 5 or 10 equally spaced Taps
- Risetime: 4 nS Max (See Notes 2 & 3)

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 25*, 50, 100, 150, 200, 250, 300*, 350*, 400*, 450*, 500*, 600*, 700*, 800*, 900*, 1000*.

*Available in Series ST08 only.

Tap Delay:
(ST08) 20% of nom. Total Delay Time.
(ST14) 10% of nom. Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

Notes for Specifications above.

(1) Delays measured at 1.5V level on leading edge only, $V_{CC} = 5.0V$, $T_A = +25°C$.

(2) Risetime measured from 0.75V to 2.4V, $V_{CC} = 5.0V$, $T_A = +25°C$.

(3) Measured with no loads on Taps.

PART NUMBER EXAMPLE

Typical Part Number is a combination of the Basic Series Number and Delay Time.

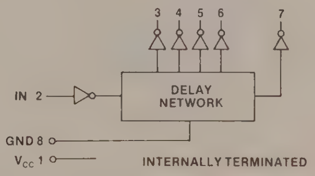
ST08CB **250**

BASIC SERIES #

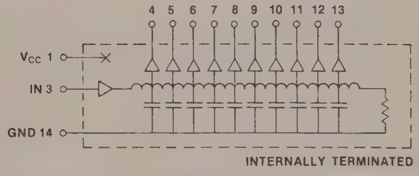
DELAY TIME
First two digits are significant figures.
Last digit specifies number of zeros to follow (ns).

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V V_{CC} = max, V_{IN} = 5.25V		50 1.0	μA mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

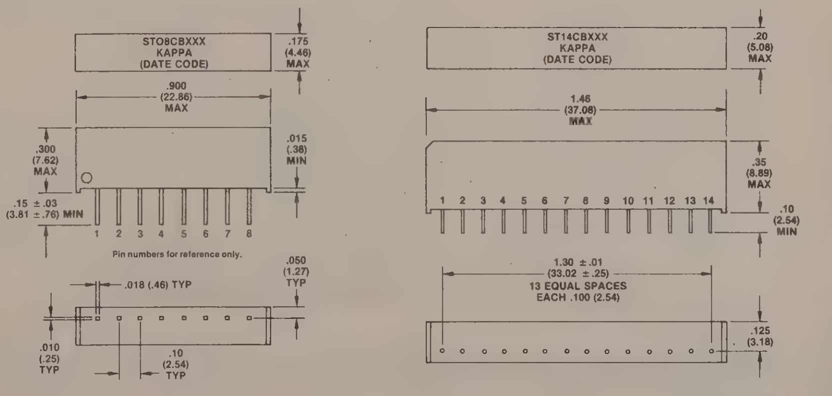
SERIES ST08 SCHEMATIC


3
4
5
6
7
IN 2
DELAY NETWORK
GND 8
Vcc 1
INTERNALLY TERMINATED

SERIES ST14 SCHEMATIC


4 5 6 7 8 9 10 11 12 13
Vcc 1
IN 3
GND 14
INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches & (mm)


STO8CBXXX
KAPPA
(DATE CODE)
.175 (4.46) MAX
.900 (22.86) MAX
.300 (7.62) MAX
.015 (.38) MIN
.15 ± .03 (3.81 ± .76) MIN
1 2 3 4 5 6 7 8
Pin numbers for reference only.
.050 (1.27) TYP
.018 (.46) TYP
.010 (.25) TYP
.10 (2.54) TYP
ST14CBXXX
KAPPA
(DATE CODE)
.20 (5.08) MAX
1.46 (37.08) MAX
.35 (8.89) MAX
1 2 3 4 5 6 7 8 9 10 11 12 13 14
.10 (2.54) MIN
1.30 ± .01 (33.02 ± .25)
13 EQUAL SPACES
EACH .100 (2.54)
.125 (3.18)

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 139408, KAPPA CRET
West Coast Office: 300 Cypress Ave., Alhambra, CA 01801, Phone (213) 283-2048, West Coast Distributor: Phone (213) 283-2058.

SERIES DT08 TTL SCHOTTKY (8-PIN)

5-TAP DIGITAL DELAY MODULE

PART NUMBER	Total Delay (ns)(1) (3) ± 5%	Tap Delay (ns)(1) (3) ± 5% or ± 2ns, WIG(4)
DT08CB250	25	5
DT08CB500	50	10
DT08CB101	100	20
DT08CB151	150	30
DT08CB201	200	40
DT08CB251	250	50
DT08CB301	300	60
DT08CB351	350	70
DT08CB401	400	80
DT08CB451	450	90
DT08CB501	500	100
DT08CB601	600	120
DT08CB701	700	140
DT08CB801	800	160
DT08CB901	900	180
DT08CB102	1000	200

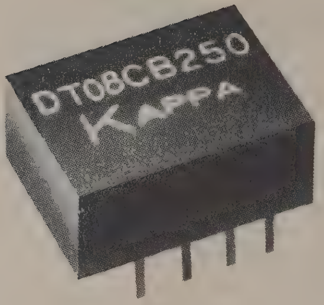
Notes:

(1) Delays measured at 1.5V level on leading edge only.

(2) Risetime measured from 0.75V to 2.4V.

(3) Measured with no loads on taps.

(4) Tap tolerances referenced from input.


DT08CB250
KAPPA

FEATURES

- TTL Schottky Interfaced
- 8-pin package
- 5 equally spaced taps
- Operating Temperature Range: 0°C to +70°C
- Risetime: 4ns max. (See Notes 2 & 3)

INPUT TEST CONDITIONS

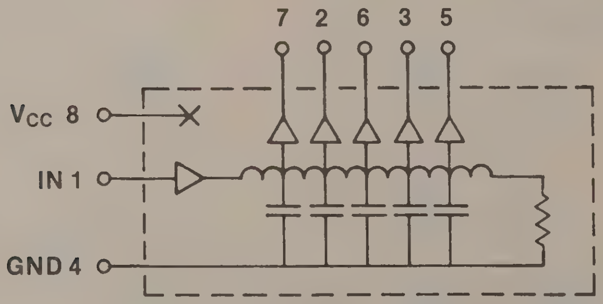
Pulse Voltage: 3.2V
Risetime: 2ns
Supply Current: (typical) 60mA
Pulse Width: 40% min. of total delay

ELECTRICAL SPECIFICATIONS

Supply Voltage (V_{CC}): 5.0V (±0.25V)
Logic 1 Input Current: 50μA max.
Logic 0 Input Current: −2mA max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

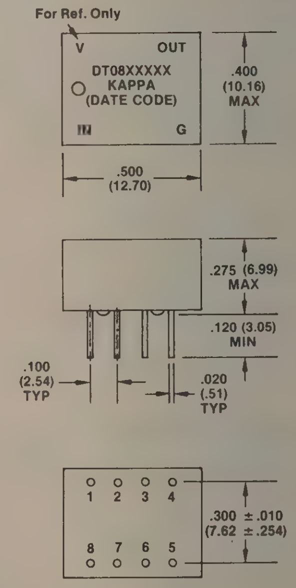
DRIVE CAPABILITIES

Logic 0 Output:	10 TTL Loads/Tap max. 20 TTL Loads/Unit max.
Logic 1 Output:	20 TTL Loads/Unit max.


7
2
6
3
5
VCC 8
IN 1
GND 4

INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches and (mm)

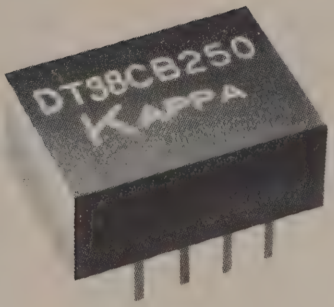

For Ref. Only
V
OUT
DT08XXXXX
KAPPA
(DATE CODE)
IN
G
.400 (10.16) MAX
.500 (12.70)
.275 (6.99) MAX
.120 (3.05) MIN
.100 (2.54) TYP
.020 (.51) TYP
1 2 3 4
8 7 6 5
.300 ±.010 (7.62 ±.254)

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DT38 TTL SCHOTTKY (8-PIN)

TRIPLE-IN-LINE DIGITAL DELAY MODULE


DT38CB250
KAPPA

FEATURES

- 8-Pin DIL Package
- Risetime 4ns Maximum
- Three Independent Equal Delays
- Operating Temperature Range: 0°C to +70°C
- TTL Schottky Interfaced

INPUT TEST CONDITIONS

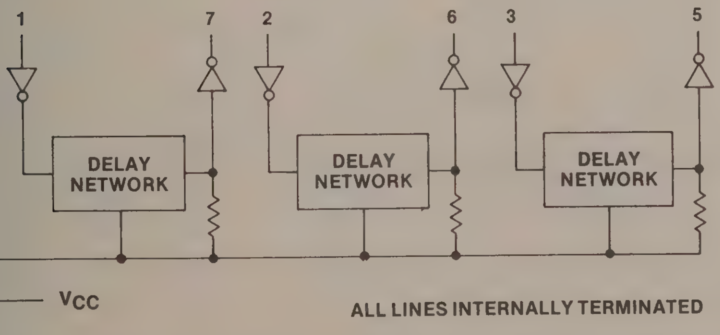
V_C: 5.0 ±0.25V
Supply Current: I_{CCH} = 90mA max.
I_{CCL} = 115mA max.
Pulse Voltage: 3.2V
Risetime: 2.0 ns
Pulse Width: 100% min. of Delay
Duty Cycle: 25% or less

ELECTRICAL SPECIFICATIONS

Logic 1: 50μA max., 2.0V min.
Logic 0: −2.0mA max., 0.8V max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

DRIVE CAPABILITIES

10 TTL loads per line


1
7
2
6
3
5
DELAY NETWORK
DELAY NETWORK
DELAY NETWORK
GND 4
8
VCC

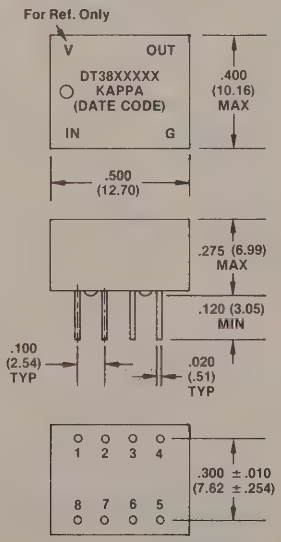
ALL LINES INTERNALLY TERMINATED

KAPPA PART # XXXXXXXXX	DELAY TIME (ns)(1) ±5% or ±2 ns, whichever is greater (unless otherwise specified)
DT38CB050	5 ±1.5
DT38CB100	10 ±1.5
DT38CB150	15 ±2.0
DT38CB200	20
DT38CB250	25
DT38CB300	30
DT38CB350	35
DT38CB400	40
DT38CB450	45
DT38CB500	50
DT38CB600	60
DT38CB700	70
DT38CB800	80
DT38CB900	90
DT38CB101	100
DT38CB125	125
DT38CB151	150
DT38CB175	175
DT38CB201	200
DT38CB225	225
DT38CB251	250

(1) Delays measured at 1.5V level on leading edge only with no loads on taps.

(2) Risetime measured from 0.75V to 2.4V.

MARKING & DIMENSIONS in inches and (mm)

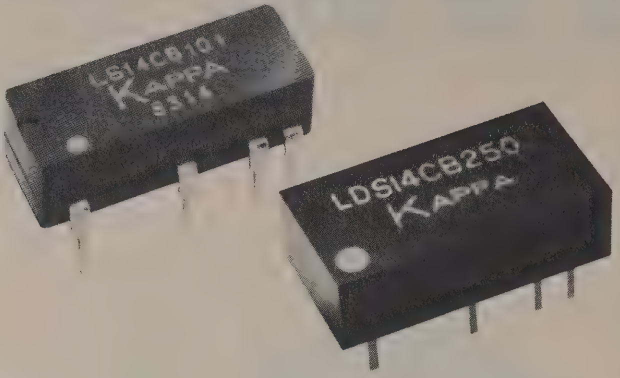

For Ref. Only
V
OUT
DT38XXXXX
KAPPA
(DATE CODE)
IN
G
.400 (10.16) MAX
.500 (12.70)
.275 (6.99) MAX
.120 (3.05) MIN
.100 (2.54) TYP
.020 (.51) TYP
1 2 3 4
8 7 6 5
.300 ±.010 (7.62 ±.254)

KAPPA® NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES LS14/LDS14 TTL LOW POWER SCHOTTKY (14-PIN)

5-TAP DIGITAL DELAY LINES



LS14CB101
KAPPA
8314
LDS14CB250
KAPPA

FEATURES

- 14-Pin Auto-Insertable (LS14) and Standard Package (LDS14)
- TTL Low Power Schottky Interfaced
- 5 Equally Spaced Taps
- Risetime: 8 nS Max (See Notes 2 & 3)
- Operating Temperature Range: 0°C to +70°C
- Drives up to 20 Low Power TTL Loads

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 50, 60, 75, 100, 125,150, 200, 250, 300, 400, and 500.

Tap Delay: 20% of nominal Total Delay Time

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

INPUT TEST CONDITIONS

V_{CC}: 5.0 ±0.25VDC
Pulse Voltage: 3.2 ±0.1V
Risetime: 2 nS Max.
Current: 6 mA Typical
Pulse Width: 100% of Total Delay Time
Rep. Rate: 1 MHz

PART NUMBER EXAMPLE

Typical Part Number is a combination of the Basic Series Number and Delay Time.

LS14CB **250**

BASIC SERIES # DELAY TIME

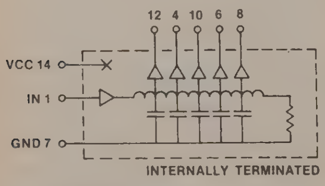
First two digits are significant figures. Last digit specifies number of zeros to follow (ns).

Notes for Specifications above.

(1) Delays measured at 1.5V level on leading edge only
V_{CC} = 5.0V, T_A = +25°C.

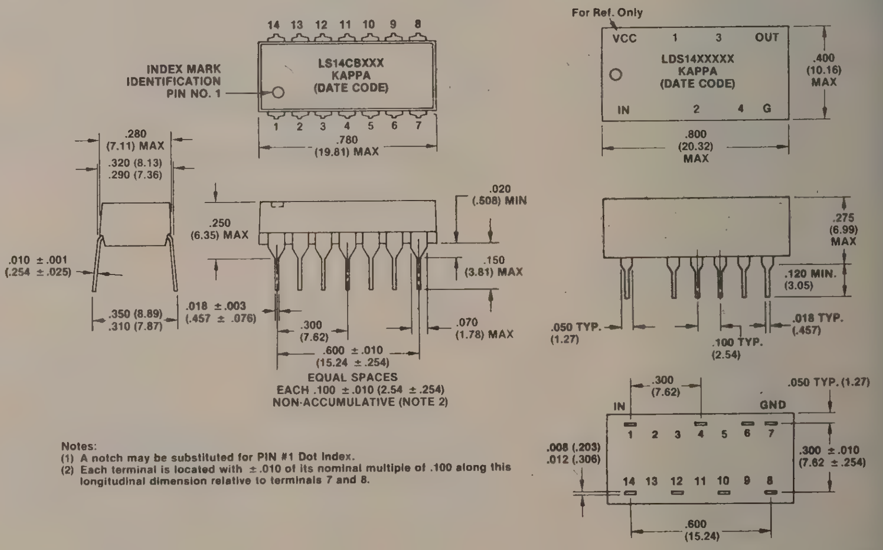
(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on Taps.



12 4 10 6 8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches & (mm)



14 13 12 11 10 9 8
INDEX MARK IDENTIFICATION PIN NO. 1
LS14CBXXX
KAPPA
(DATE CODE)
1 2 3 4 5 6 7
.780 (19.81) MAX
.280 (7.11) MAX
.320 (8.13)
.290 (7.36)
.010 ±.001 (.254 ±.025)
.350 (8.89)
.310 (7.87)
.018 ±.003 (.457 ± .076)
.250 (6.35) MAX
.020 (.508) MIN
.150 (3.81) MAX
.300 (7.62)
.070 (1.78) MAX
.600 ±.010 (15.24 ±.254)
EQUAL SPACES EACH .100 ±.010 (2.54 ±.254) NON-ACCUMULATIVE (NOTE 2)
For Ref. Only
VCC
1
3
OUT
LDS14XXXXX
KAPPA
(DATE CODE)
IN
2
4
G
.400 (10.16) MAX
.800 (20.32) MAX
.275 (6.99) MAX
.120 MIN. (3.05)
.050 TYP. (1.27)
.100 TYP. (2.54)
.018 TYP. (.457)
.300 (7.62)
.050 TYP. (1.27)
IN
GND
1 2 3 4 5 6 7
14 13 12 11 10 9 8
.008 (.203)
.012 (.306)
.300 ±.010 (7.62 ±.254)
.600 (15.24)

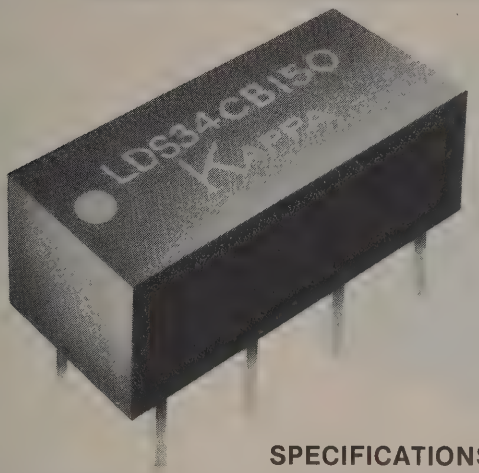
Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located with ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES LDS34 TTL LOW POWER SCHOTTKY (14-PIN)

5-TAP DIGITAL DELAY LINES


LDS34CB150
KAPPA

FEATURES

- 14-Pin Standard Package
- TTL Low Power Schottky Interfaced
- 3 Independent Equal Delays
- Risetime: 8 nS Max (See Notes 2 & 3)
- Operating Temperature Range: 0°C to +70°C
- Drives up to 20 Low Power TTL Loads

PART NUMBER EXAMPLE

Typical Part Number is a combination of the Basic Series Number and Delay Time.

LD34CB — **BASIC SERIES #**

250 — **DELAY TIME**
First two digits are significant figures.
Last digit specifies number of zeros to follow (ns).

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 50, 60, 75, 100, 125,150, 200, 250.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

INPUT TEST CONDITIONS

V_{CC}: 5.0 ±0.25VDC
Pulse Voltage: 3.2 ±0.1V
Risetime: 2 nS Max.
Current: 6 mA Typical
Pulse Width: 100% of Total Delay Time
Rep. Rate: 1 MHz

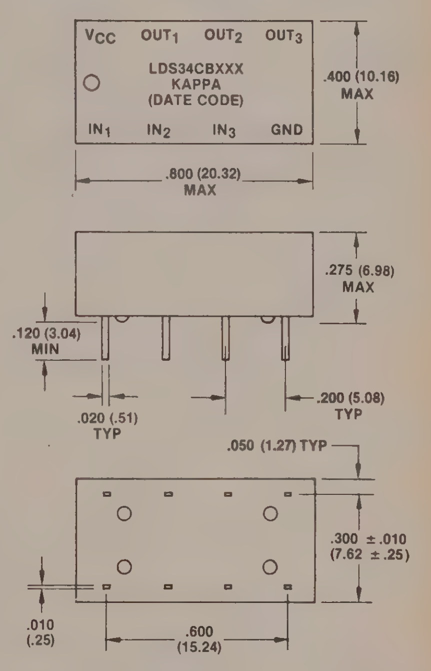
Notes for Specifications above.

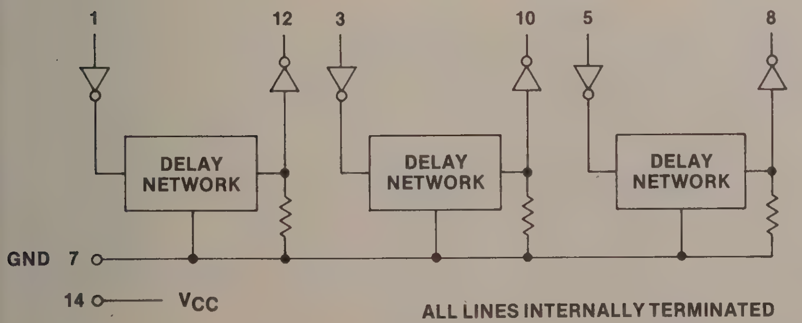
(1) Delays measured at 1.5V level on leading edge only, V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on Taps.

MARKING & DIMENSIONS in inches & (mm)


VCC
OUT1
OUT2
OUT3
LDS34CBXXX
KAPPA
(DATE CODE)
IN1
IN2
IN3
GND
.400 (10.16) MAX
.800 (20.32) MAX
.275 (6.98) MAX
.120 (3.04) MIN
.020 (.51) TYP
.200 (5.08) TYP
.050 (1.27) TYP
.300 ±.010 (7.62 ±.25)
.010 (.25)
.600 (15.24)


1
12
3
10
5
8
DELAY NETWORK
DELAY NETWORK
DELAY NETWORK
GND 7
14
VCC

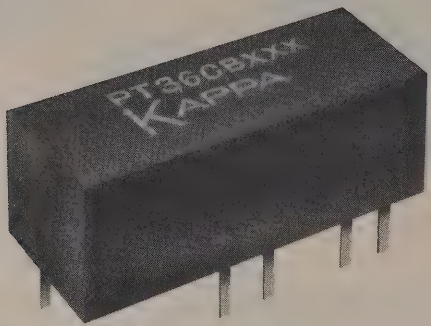
ALL LINES INTERNALLY TERMINATED

KAPPA® NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES PT36 TTL SCHOTTKY (16-PIN)

3-BIT PROGRAMMABLE DELAY LINE


PT36CBXXX
KAPPA

Part** Number	Incremental Delay Per Step	Total Delay* Change
PT36CB010	1 ns ± .4 ns	7 ns
PT36CB020	2 ns ± .4 ns	14 ns
PT36CB030	3 ns ± .5 ns	21 ns
PT36CB050	5 ns ± .6 ns	35 ns
PT36CB100	10 ns ± 1.0 ns	70 ns
PT36CB150	15 ns ± 1.3 ns	105 ns
PT36CB200	20 ns ± 1.5 ns	140 ns
PT36CB400	40 ns ± 2.0 ns	280 ns
PT36CB500	50 ns ± 2.5 ns	350 ns

*This delay value does not inclue the T_0 delay.
**Other delay increments available on request.

FEATURES

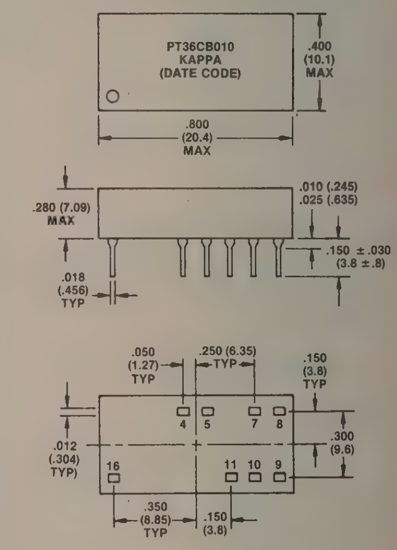
- Inherent Delay: 7 ns ±1 ns
- 16-Pin DIL package
- Total Delay Tolerance: ±5% or ±1 ns, WIG
- Operating Temperature Range: 0°C to +70°C
- TTL Schottky Interfaced

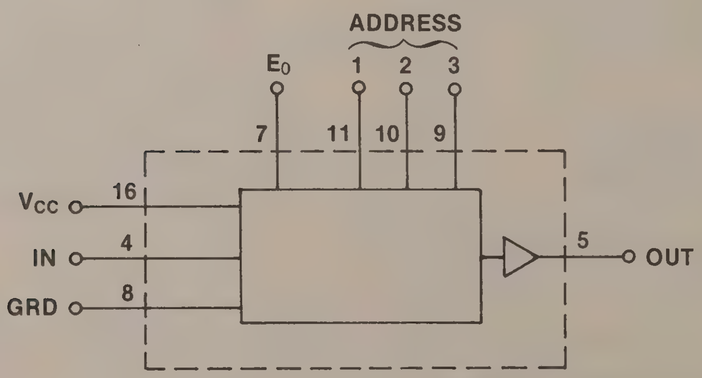
FUNCTION TABLE

Enable	Address (Bit No.)			Delay Out
	3	2	1	
L	L	L	L	T_0
L	L	L	H	T_1
L	L	H	L	T_2
L	L	H	H	T_3
L	H	L	L	T_4
L	H	L	H	T_5
L	H	H	L	T_6
L	H	H	H	T_7
H	X	X	X	L

H = High
L = Low
X = Don't care
T_0 = Reference or Inherent delay of circuit.
T_1 to T_7 = Multiplier of incremental delay.

MARKING & DIMENSIONS in inches & (mm)


PT36CB010
KAPPA
(DATE CODE)
.400
(10.1)
MAX
.800
(20.4)
MAX
.280 (7.09)
MAX
.010 (.245)
.025 (.635)
.150 ±.030
(3.8 ±.8)
.018
(.456)
TYP
.050
(1.27)
TYP
.250 (6.35)
TYP
.150
(3.8)
TYP
4
5
7
8
.012
(.304)
TYP)
16
11
10
9
.300
(9.6)
.350
(8.85)
TYP
.150
(3.8)

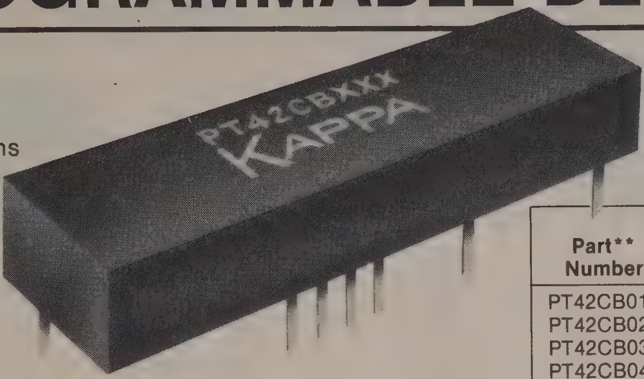

ADDRESS
E_0
1
2
3
7
11
10
9
V_{CC}
16
IN
4
GRD
8
5
OUT

KAPPA® NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES PT42 TTL SCHOTTKY (32-PIN)

4-BIT PROGRAMMABLE DELAY LINE


PT42CBXXX
KAPPA

FEATURES

- Inherent Delay: 15 ns ±1 ns
- Input signal requirements: TTL logic
- Output fan-out: TTL Schottky load
- Total Delay Tolerance: ±5% or ±1 ns, WIG
- Operating Temperature Range: 0°C to +70°C

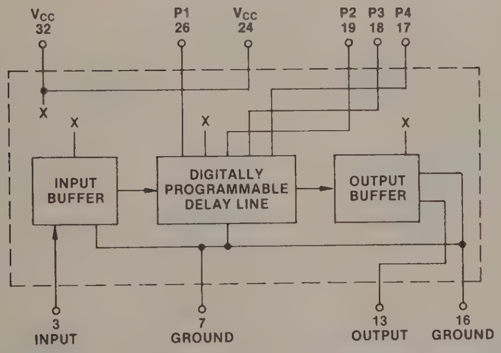
FUNCTION TABLE

	Address (Bit No.)				Delay Out
Enable	4	3	2	1	
L	L	L	L	L	T_0
L	L	L	L	H	T_1
L	L	L	H	L	T_2
L	L	L	H	H	T_3
L	L	H	L	L	T_4
L	L	H	L	H	T_5
L	L	H	H	L	T_6
L	L	H	H	H	T_7
L	H	L	L	L	T_8
L	H	L	L	H	T_9
L	H	L	H	L	T_{10}
L	H	L	H	H	T_{11}
L	H	H	L	L	T_{12}
L	H	H	L	H	T_{13}
L	H	H	H	L	T_{14}
L	H	H	H	H	T_{15}
H	X	X	X	X	L

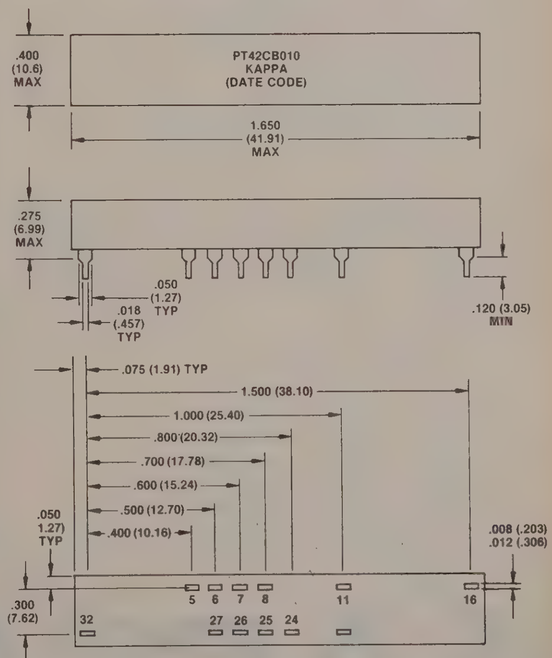
L = Logic 0
H = Logic 1
X = Don't care
T_0 = Reference or Inherent delay of circuit.
T_1 to T_{15} = Multiplier of incremental delay.

Part** Number	Incremental Delay Per Step	Total Delay* Change
PT42CB010	1 ns	15 ns
PT42CB020	2 ns	30 ns
PT42CB030	3 ns	45 ns
PT42CB040	4 ns	60 ns
PT42CB050	5 ns	75 ns
PT42CB060	6 ns	90 ns
PT42CB080	8 ns	120 ns
PT42CB100	10 ns	150 ns
PT42CB120	12 ns	180 ns
PT42CB150	15 ns	225 ns
PT42CB200	20 ns	300 ns
PT42CB250	25 ns	375 ns
PT42CB300	30 ns	450 ns
PT42CB350	35 ns	525 ns
PT42CB400	40 ns	600 ns
PT42CB450	45 ns	675 ns
PT42CB500	50 ns	750 ns
PT42CB600	60 ns	900 ns
PT42CB800	80 ns	1,200 ns
PT42CB101	100 ns	1,500 ns

*This delay value does not include the T_0 delay.
**Other delay increments available on request.


Vcc 32
P1 26
Vcc 24
P2 19
P3 18
P4 17
X
X
X
X
INPUT BUFFER
DIGITALLY PROGRAMMABLE DELAY LINE
OUTPUT BUFFER
3 INPUT
7 GROUND
13 OUTPUT
16 GROUND

MARKING & DIMENSIONS in inches & (mm)


.400 (10.6) MAX
PT42CB010
KAPPA
(DATE CODE)
1.650 (41.91) MAX
.275 (6.99) MAX
.050 (1.27) TYP
.018 (.457) TYP
.120 (3.05) MIN
.075 (1.91) TYP
1.500 (38.10)
1.000 (25.40)
.800 (20.32)
.700 (17.78)
.600 (15.24)
.500 (12.70)
.400 (10.16)
.050 1.27) TYP
.008 (.203)
.012 (.306)
.300 (7.62)
5 6 7 8
11
16
32
27 26 25 24

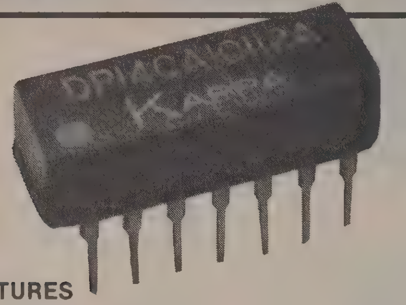
KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DP14C/DP16C ANALOG

14-PIN & 16-PIN DIP DELAY LINES

(available in full-MIL conformance as Series DP14M/DP16M)



FEATURES

- TTL and DTL compatible
- Meets applicable requirements of MIL-D-23859
- 5/1 Delay-to-Risetime Ratio
- 10 Equally Spaced Taps
- Wide Operating Temperature Range
- Low cost

ELECTRICAL SPECIFICATIONS

Total Delay: 10 to 1000 ns
Tap Delays: 10% increments standard (other increments available upon request)
Risetime: 20% maximum of total delay (see Table 1)
Characteristic Impedance: 50 to 500 ohms (± 10%)
Attenuation: 2dB maximum (see Table 1)
Distortion: ± 10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min. @ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II and III
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See FIGURE 2)

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, Impedance, and Pin Sequence Code.

EXAMPLE: DP14CA10112A

(100ns, 100 ohm, 0.200" (5.08mm) Max. Height, using the code "A" Pin Sequence).

DP14(16)C A 101 12 A

DP14C is 14-Pin DIP
DP16C is 16-Pin DIP

MOUNTING HEIGHT CODE (See TABLE IV)

DELAY TIME: Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeros to follow

IMPEDANCE: Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow

PIN SEQUENCE CODE (See TABLE II and III). "STANDARD" Pin Sequence if omitted.

TABLE I

Td (ns)[1] (±5%)	Td/tap (ns)[2] [3] (±10%)	Tr (ns) MAX.	ATTENUATION (%) TYPICAL per IMPEDANCE (Ω)				
			50	100	200	300	500
10	1	3		5			
20	2	5.5	3	5	5		
30	3	6.5	3	5	5		
40	4	8	3	5	5	5	
50	5	10	3	5	5	5	7
60	6	12	3	5	5	5	7
75	7½	15	3	5	5	5	7
100	10	20	3	5	5	7	7
120	12	24	3	5	6	7	8
150	15	30	3	5	6	7	8
180	18	36	4	5	6	7	8
200	20	40	4	5	6	7	8
220	22	44	4	5	6	7	8
250	25	50	4	5	6	7	8
300	30	60		5	8	10	10
375	37½	75		7	8	10	10
500	50	100		8	10	12	12
600	60	120				15	15
750	75	150				15	20
1000	100	200					20

(1) Or ± 2ns, whichever is greater. (2) Or ± 1ns, whichever is greater. (3) For 10-tap lines only.

TABLE II. PIN-NUMBER SEQUENCE (FOR DP14C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
Standard	14	2	12	3	11	4	5	10	6	9	7	1. 8
A	1	2	13	3	12	4	10	5	9	6	7	14
B	2	3	4	5	6	7	9	10	11	12	13	1, 14
C	7	9	6	10	5	11	12	3	13	2	14	1, 8
D	1	13	2	12	3	11	4	10	5	9	6	7. 8. 14
E	2	3	4	5	6	7,8	9	10	11	12	13	1, 14
F	1	13	2	12	3	11	4	10	5	9	6	7
G	2	13	3	12	4	11	5	10	6	9	7	8, 14
H	2	3	4	5	6	7	9	10	11	12	13	1
I	1	13	2	12	3	11	5	10	6	9	7	8, 14
J	1	2	13	3	12	4	10	5	9	6	7	8, 14
U	2	3	4	5	6	8	9	10	11	12	13	1, 7
V	2	3	4	5	6	8	9	10	11	12	13	1
W	1	13	2	12	3	11	4	10	5	9	6	7, 14

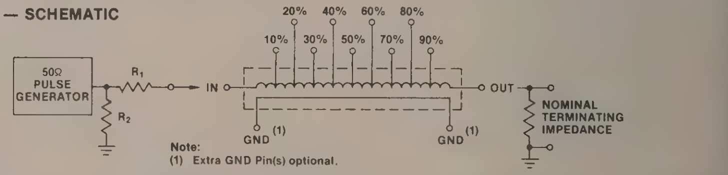
*Other pin sequences available upon request.

TABLE III. PIN-NUMBER SEQUENCE (FOR DP16C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
A	15	2	14	3	13	4	5	11	6	10	7	1, 9
B	1	15	2	14	3	13	4	12	5	11	6	8
C	1	15	3	14	4	13	5	12	6	11	8	9, 16

*Other pin sequences available upon request.

FIGURE 1 — SCHEMATIC

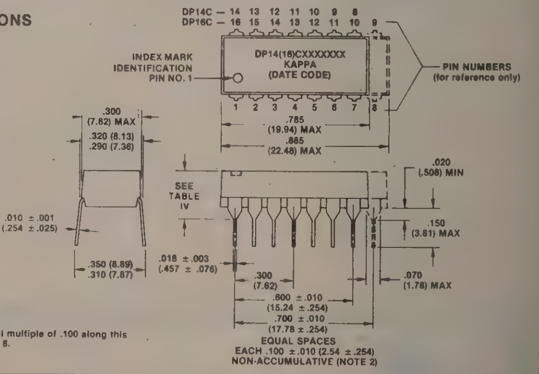

20%
40%
60%
80%
10%
30%
50%
70%
90%
50Ω PULSE GENERATOR
R_1
R_2
IN
OUT
GND (1)
GND (1)
NOMINAL TERMINATING IMPEDANCE

Note:
(1) Extra GND Pin(s) optional.

FIGURE 2 — MARKING & DIMENSIONS in inches and (mm)

TABLE IV
MOUNTING HEIGHT

CODE	DIMENSION (MAX)
A	.200 (5.08)
B	.250 (6.35)
C	.300 (7.62)


DP14C — 14 13 12 11 10 9 8
DP16C — 16 15 14 13 12 11 10 9
INDEX MARK IDENTIFICATION PIN NO. 1
DP14(16)CXXXXXXX
KAPPA
(DATE CODE)
PIN NUMBERS (for reference only)
1 2 3 4 5 6 7 8
.300 (7.62) MAX
.320 (8.13)
.290 (7.36)
.785 (19.94) MAX
.885 (22.48) MAX
SEE TABLE IV
.020 (.508) MIN
.010 ± .001 (.254 ± .025)
.150 (3.81) MAX
.350 (8.89)
.310 (7.87)
.018 ± .003 (.457 ± .076)
.300 (7.62)
.070 (1.78) MAX
.600 ± .010 (15.24 ± .254)
.700 ± .010 (17.78 ± .254)
EQUAL SPACES EACH .100 ± .010 (2.54 ± .254) NON-ACCUMULATIVE (NOTE 2)

Notes
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located with ± .010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DP24C ANALOG

24-PIN DIP DELAY LINE

(available in full-MIL conformance as Series DP24M)

DP24CC40112B
KAPPA

TABLE I

PART NUMBER	Td (ns)(1) (±5%)	Td/tap (ns)(2) (±10%)	Tr (ns) (Max.)	Zo (ohms) (±10%)
20051	20	1	3	50
40051	40	2	4	
60051	60	3	6	
80051	80	4	8	
10151	100	5	10	
20151	200	10	20	
20012	20	1	3	100
40012	40	2	4	
60012	60	3	6	
80012	80	4	8	
10112	100	5	10	
20112	200	10	20	
30112	300	15	30	
40112	400	20	40	
50112	500	25	50	
60112	600	30	60	
80112	800	40	80	
10212	1000	50	100	
12212	1200	60	120	
15212	1500	75	150	
40022	40	2	4	200
60022	60	3	6	
80022	80	4	8	
10122	100	5	10	
20122	200	10	20	
30122	300	15	30	
40122	400	20	40	
50122	500	25	50	
60122	600	30	60	
80122	800	40	80	
10222	1000	50	100	
12222	1200	60	120	
15222	1500	75	150	
20222	2000	100	200	

Notes: (1) Or ±2ns. whichever is greater. (2). Or ±1ns. whichever is greater.

ELECTRICAL SPECIFICATIONS

Total Delay: 20 to 2000 ns
Tap Delays: 5% increments standard
(other increments available upon request)
Risetime: 10% maximum of total delay
(see Table 1)
Characteristic Impedance: 50 to 200 ohms (±10%)
Attenuation: 2dB maximum (see Table 1)
Distortion: ±10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min.
@ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See FIGURE 2)

TABLE II. PIN-NUMBER SEQUENCE*

CODE	TAP #	IN	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	OUT	GND
A		2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22	23	1, 24
B		2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	22	23	12
C		1	2	3	4	5	6	7	8	9	10	11	14	15	16	17	18	19	20	21	22	23	12, 24

*Other pin sequences available upon request.

FIGURE 1 — SCHEMATIC

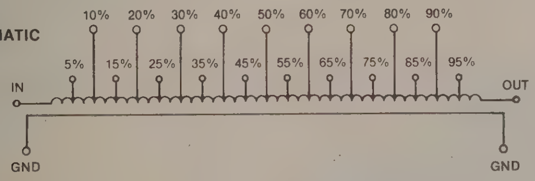


FIGURE 2 — MARKING & DIMENSIONS in inches and (mm)

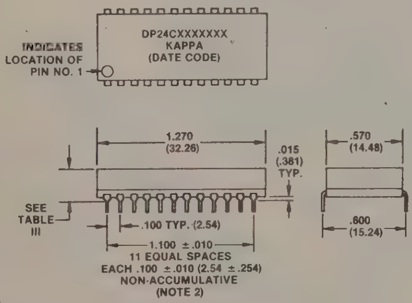


TABLE III. MOUNTING HEIGHT

CODE	DIMENSION (MAX.)
B	.250 (6.35)
C	.300 (7.62)

Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located with ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 12 and 13.

HOW TO ORDER

1. Select MOUNTING HEIGHT CODE from Table III.
2. Select PART NUMBER CODE from Table I.
3. Select PIN-NUMBER SEQUENCE CODE from Table II.
4. Construct the MODEL NUMBER.
(See example below.)

This example, Model DP24CB-40112B, identifies a 400ns, 100-ohm line with 0.300″ mounting height and the "B" pin-number sequence.

DP24C	C	40112	B
BASIC SERIES NUMBER	MOUNTING HEIGHT CODE (Table III)	PART NUMBER (Table I)	PIN-NUMBER SEQUENCE (Table II)

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES SP07 ANALOG
7-PIN SIP DELAY LINE

FEATURES
- 7-Pin SIP Package
- Five (5) Equally-Spaced Delay Taps
- Operating Temperature Range: 0°C to +70°C
- Low Output Distortion — ±10% Max.
- 5 ns to 100 ns Delay Range
  (other values available upon request)

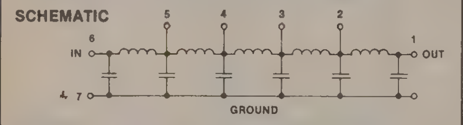
ELECTRICAL SPECIFICATIONS
Total Delay: 5 to 100 ns
Tap Delays: 20% increments
Risetime: See Table 1
Characteristic Impedance: 50 to 100 ohms (±10%)
Attenuation: 5% maximum
Distortion: ± 10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.

MECHANICAL SPECIFICATIONS
Case Configuration: See Dimension Drawing
Case Material: Molded Epoxy
Terminals: Flat, DIP-type or 24 AWG Tinned Copper Leads
Terminal Material: Kovar or equivalent, tin-plated
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See Dimension Drawing)

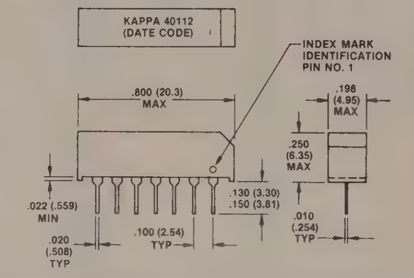
TABLE I

TOTAL DELAY (ns)	TAP DELAY (ns)	RISETIME (ns) MAX	DC RESISTANCE (Ω) MAX. PER IMPEDANCE (Ω)	
			50	100
5 ±0.5	1 ±0.3	2.0	0.3	0.5
10 ±1.0	2 ±0.4	3.3	0.5	1.0
20 ±1.5	4 ±0.6	6.0	0.8	1.5
30 ±2.0	6 ±1.0	9.0	1.2	2.5
40 ±2.5	8 ±1.5	12.0	1.8	4.0
50 ±3.0	10 ±1.8	15.0	2.3	5.0
60 ±3.5	12 ±2.0	18.0	2.5	
70 ±4.0	14 ±2.0	22.0	3.5	
80 ±4.5	16 ±2.0	24.0	4.2	
90 ±5.0	18 ±3.0	27.0	4.5	
100 ±5.0	20 ±3.0	28.0	5.2	

SCHEMATIC



MARKING & DIMENSIONS
In Inches and (mm)



PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, and Impedance

EXAMPLE: SP07CB10051

SP07C B 100 51

BASIC SERIES NUMBER — SP07C
MOUNTING HEIGHT CODE — B
DELAY TIME: Expressed in nanoseconds (ns) First two digits are significant figures. Last digit specifies number of zeros to follow — 100
IMPEDANCE: Expressed in ohms (Ω) First digit is significant Last digit specifies number of zeros to follow. — 51

SERIES SP14 ANALOG
14-PIN SIP DELAY LINE

FEATURES
- 14-Pin SIP Package
- Ten (10) Equally-Spaced Delay Taps
- Low Attenuation — 5% Maximum
- Optional Internal Termination

ELECTRICAL SPECIFICATIONS
Total Delay: 10 to 200 ns
Tap Delays: 10% increments
Risetime: 20% maximum of total delay (see Table II)
Characteristic Impedance: 50 to 100 ohms (±10%)
Distortion: 10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: 0°C to +70°C
Storage Temperature Range: −55°C to +125°C

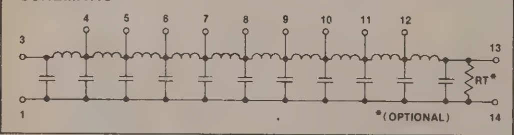
MECHANICAL SPECIFICATIONS
Same as Series SP07 above.

TABLE II

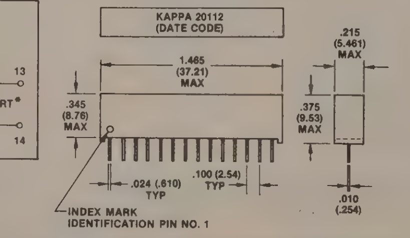
TOTAL DELAY (ns) ±5% *	TAPE DELAY (ns) ±10% *	RISETIME (ns) MAX	DC RESISTANCE (Ω) MAX. PER IMPEDANCE (Ω)	
			50	100
10	1.0 ±0.3	2.0	1.0	
20	2.0 ±0.4	4.0	1.0	4.0
30	3.0 ±0.5	6.0	1.0	
40	4.0 ±0.6	8.0	1.0	4.0
50	5.0 ±0.8	10.0	1.0	
60	6.0	12.0	2.0	4.0
70	7.0	14.0	2.0	
80	8.0	16.0	2.0	4.0
90	9.0	18.0	2.0	
100	10.0	20.0	2.0	4.0
120	12.0	24.0		6.0
140	14.0	28.0		6.0
160	16.0	32.0		6.0
180	18.0	36.0		6.0
200	20.0	40.0		6.0

* Or ±1 ns, whichever is greater, referenced from input.

SCHEMATIC



MARKING & DIMENSIONS in Inches and (mm)



PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, and Impedance

EXAMPLE: SP14CD10051T

SP14C D 100 51 T

BASIC SERIES NUMBER — SP14C
MOUNTING HEIGHT CODE — D
DELAY TIME: Expressed in nanoseconds (ns) First two digits are significant figures. Last digit specifies number of zeros to follow — 100
IMPEDANCE: Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow. — 51
INTERNAL TERMINATION: (OPTIONAL) — T

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

CUSTOM MINIATURE & PRECISION DELAY LINES...

Optimization of Most Critical Parameters as Required.

Over the past two decades, **Kappa** has optimized, packaged, and critically tested literally thousands of specific variations of several hundred different passive and hybrid delay lines: fixed tapped, continuously adjustable, and electrically trimmable (varactor-tuned) lines; over virtually the complete signal spectrum from control (subaudio), through audio, sonar, RF, HF, and a wide variety of pulse rates widths and duty cycles.

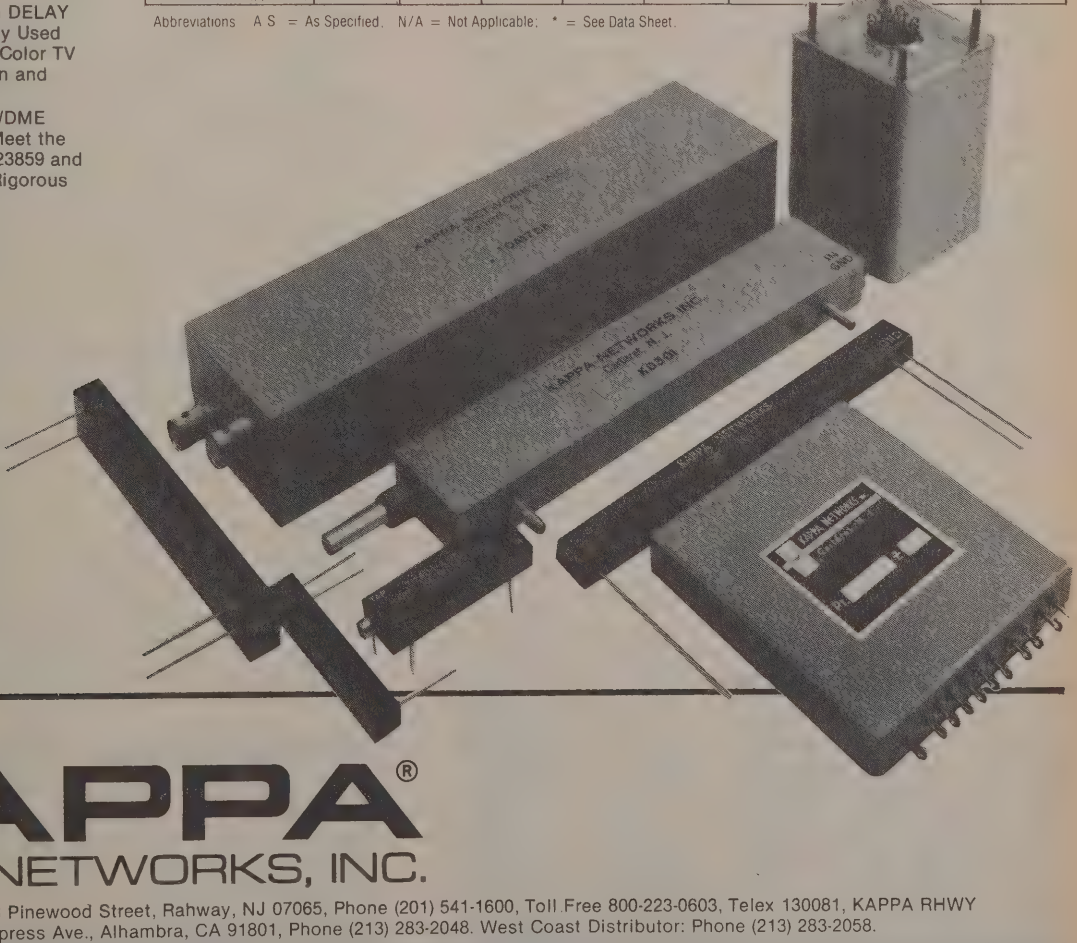
Typical design families include:

- PRECISION SONAR DELAY LINES (Series A) 500 μsec to 10^6 μsec ±1%; linear to ±0.05%
- LOW-DISTORTION LINES (Series D) Delay-to-Rise-time Ratio: 50 max.; Bandwidth: 50 MHz max.
- MINIATURE CONTINUOUSLY VARIABLE DELAY TRIMMERS (Series TT) Size: ¼ Cubic Inch; up to 120 ns; resolution ≤0.25 ns.
- SUPER-η™ DELAY LINES (Series H) Embody New Design Principle Providing the Highest Efficiency Yet Obtainable in Lumped-Constant Delay lines.
- MINITRIM DELAY LINE (Series MT) Resolution Less Than .5 ns and Delay Ranges Up to 300 ns.
- VIDEO BROADCASTING DELAY LINES (Series BC) Widely Used in the Most Demanding Color TV Applications in American and European Systems
- TRANSPONDER/TACAN/DME (Series C) Designed to Meet the Requirements of MIL-D-23859 and to Withstand the Most Rigorous Military Environments.

ELECTRICAL SPECIFICATIONS

DESCRIPTION	PRECISION AUDIO/SONAR	VIDEO BROADCAST	LOW DISTORTION	STD. DIST. CONSTANT	SUPER η	CONTINUOUS VARIABLE	STD. LUMPED CONSTANT	MINI ® TRIM	TINY ® TRIM
SERIES NUMBER	**A**	**BC**	**D**	**DC**	**H**	**K**	**LC**	**MT**	**TT**
DELAY RANGE (in microseconds)	500 to 10^6	.05 to 10	up to 100	up to 3	.5 to 500	up to .5	.05 to 10^6	up to .25	up to .12
STANDARD DELAY TOLERANCES (±%)	1	2	1	5	5	+10 −0	5	+10 −0	+10 −0
IMPEDANCE RANGE (in ohms)	500 to 10K	75	100 to 1K	300 to 2K	50 to 2K	100 to 1K	100 to 20K	50 to 1K	300 to 500
STANDARD IMPEDANCE TOLERANCES (±%)	5	2	5	10	5	10	5	10	10
DELAY RESOLUTION	N/A	N/A	N/A	N/A	N/A	> of .1% or 1 ns	N/A	.25ns	.25ns
DELAY-to-RISETIME RATIO (max.)	N/A	N/A	50	11	150	8	200	7	4
DELAY LINEARITY (±%)	.05 to .25	.025 to 1	.25	N/A	1	N/A	.5	N/A	N/A
BANDWIDTH (max.)	70 KHz	20 MHz	50 MHz	30 MHz	10 MHz	25 MHz	250 MHz	100 MHz	70 MHz
ATTENUATION (in dB)	A.S.	A.S.	A.S.	*	A.S.	*	A.S.	<.5 dB	<25 dB
DISTORTION (±%)	N/A	A.S	1 to 2	*	10	15	10	15	15
DIELECTRIC STRENGTH (VDC)	100	100	100	100 or A S.	100 or A S.	100 or A S	A S	100	100
OPERATING TEMP. RANGE (°C)	−55/+85 A.S	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125	−55/+125
DELAY STABILITY vs. TEMPERATURE (ppm/°C)	50	50	50	200	50	50 or 200	50	200	200

Abbreviations A S = As Specified. N/A = Not Applicable; * = See Data Sheet.

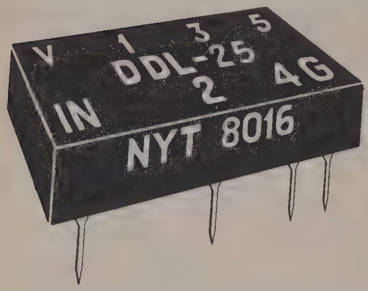


KAPPA®
NETWORKS, INC.

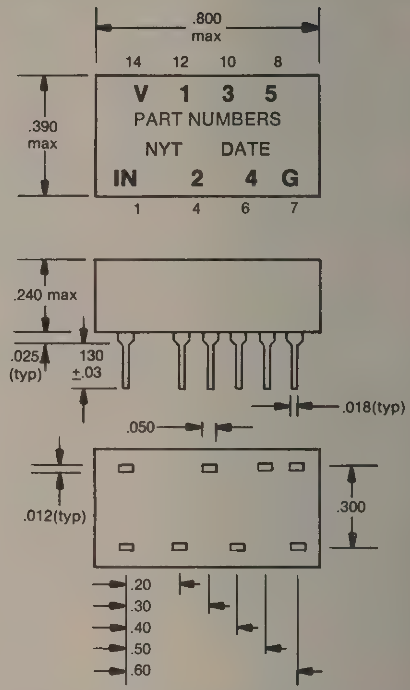
U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

DDL-XXX SCHOTTKY DELAY LINES



Nytronics Components Group, Inc. Digital Delay Lines provide a solution to terminating, driving and loading problems traditionally associated with delay line applications.



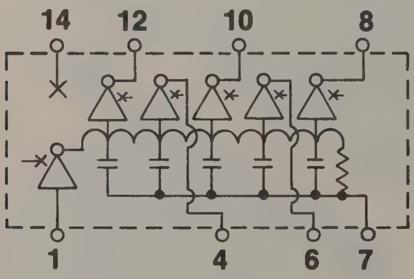
Eighteen (18) standard delay lines are offered ranging from 25ns to 500ns. Other combinations available include:

- Intermediate total delay values
- Non-symmetrical tapping points
- 2 or 3 delay lines per unit
- Closer tap and total delay tolerances
- Specified fall times and trailing edge delay times

Nytronics Components Group, Inc. Delay Line Engineering stands ready to help solve your delay line applications problems.

DIGITAL DELAY LINES FEATURE:

1) TTL Driven Inputs
2) TTL Buffered Outputs
3) Internal Terminations
4) Low Profile Packages (.240″)
5) 14-Pin, DIP-IC Compatible
6) Output Rise Time 4.0ns max. (0.75v to 2.40v)



PART NUMBER	TOTAL DELAY (NS) (1) (2)	TAP DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
DDL-25	25	5	10
DDL-30	30	6	12
DDL-35	35	7	14
DDL-40	40	8	16
DDL-45	45	9	18
DDL-50	50	10	20
DDL-75	75	15	30
DDL-100	100	20	40
DDL-125	125	25	50
DDL-150	150	30	60
DDL-175	175	35	70
DDL-200	200	40	80
DDL-250	250	50	100
DDL-300	300	60	120
DDL-350	350	70	140
DDL-400	400	80	160
DDL-450	450	90	180
DDL-500	500	100	200

(1) Measured at 1.5V level leading edge; Vcc = 5.00VDC; No loads; at +25°C.
(2) Nominal delay, ±2NS or ±5%, whichever is greater; reference to input.

ELECTRICAL CHARACTERISTICS

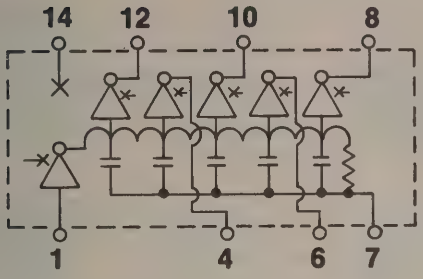
(VIH) High-Level Input Voltage	2.0 to 5.0V
(IIH) High-Level Input Current	50ua Max.
(VIL) Low-Level Input Voltage	0.8V Max.
(IIL) Low-Level Input Current	−2ma Max.
(VOH) High-Level Output Voltage	2.4V Min.
(VOL) Low-Level Output Voltage	0.4V Max.
High-Level Output Drives	20 TTL Loads/Unit Max.
Low-Level Output Drives	10 TTL Loads/Tap Max. 20 TTL Loads/Unit Max.

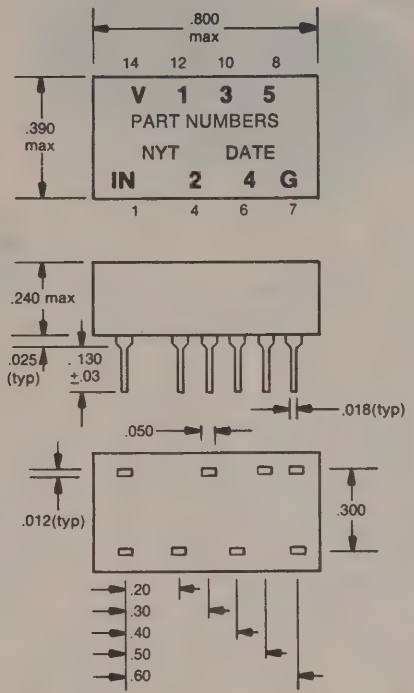
RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage	5.00 ±0.25VDC
(Icc) Supply Current	60ma (typ.)
(TRin) Input Rise Time	3ns.
(TWin) Input Pulse Width	40% of Delay
(Ein) Input Pulse Voltage	3.20VDC
Operating Temperature	0°C to 70°C
Storage Temperature	−55°C to +125°C

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

DDL-XXXF & LPS-XXX ADVANCED SCHOTTKY DELAY LINES





ADVANCED SCHOTTKY (DDL-XXXF)

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage	5.00 ±0.25 VDC
(Icc) Supply Current	35 ma (typ.)
(TRin) Input Rise Time	3 ns.
(TWin) Input Pulse Width	40% of Delay
(Ein) Input Pulse Voltage	3.20 VDC
Operating Temperature	0°C to 70°C
Storage Temperature	−55°C to 125°C

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage	2.0 to 5.0V
(IIH) High-Level Input Current	20 μa Max.
(VIL) Low-Level Input Voltage	0.8V Max.
(IIL) Low-Level Input Current	−0.6 ma Max.
(VOH) High-Level Output Voltage	2.4V Min.
(VOL) Low-Level Output Voltage	0.4V Max.
High-Level Output Drives	25 TTL Loads/Unit Max.
Low-Level Output Drives	12.5 TTL Loads/Tap Max. 25 TTL Loads/Unit Max.

ADVANCED LOW-POWER SCHOTTKY (LPS-XXX)

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage	5.00 ±0.25 VDC
(Icc) Supply Current	25 ma (typ.)
(TRin) Input Rise Time	3 ns.
(TWin) Input Pulse Width	40% of Delay
(Ein) Input Pulse Voltage	3.20 VDC
Operating Temperature	0°C to 70°C
Storage Temperature	−55°C to +125°C

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage	2.0 to 5.0V
(IIH) High-Level Input Current	20 μa Max.
(VIL) Low-Level Input Voltage	0.8V Max.
(IIL) Low-Level Input Current	−0.2 ma Max.
(VOH) High-Level Output Voltage	2.4V Min.
(VOL) Low-Level Output Voltage	0.4V Max.
High-Level Output Drives	10 TTL Loads/Unit Max.
Low-Level Output Drives	5 TTL Loads/Tap Max. 10 TTL Loads/Unit Max.

OUTPUT RISE TIME (0.75v to 2.40v)
DDL-XXXF SERIES = 4.0 ns Max.
LPS-XXX SERIES = 6.0 ns Max.

PART NUMBER	PART NUMBER	TOTAL DELAY (NS) (1) (2)	TAP DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
DDL-25F	LPS-25	25	5	10
DDL-30F	LPS-30	30	6	12
DDL-35F	LPS-35	35	7	14
DDL-40F	LPS-40	40	8	16
DDL-45F	LPS-45	45	9	18
DDL-50F	LPS-50	50	10	20
DDL-55F	LPS-55	55	11	22
DDL-60F	LPS-60	60	12	24
DDL-65F	LPS-65	65	13	26
DDL-70F	LPS-70	70	14	28
DDL-75F	LPS-75	75	15	30
DDL-100F	LPS-100	100	20	40
DDL-125F	LPS-125	125	25	50
DDL-150F	LPS-150	150	30	60
DDL-175F	LPS-175	175	35	70
DDL-200F	LPS-200	200	40	80
DDL-250F	LPS-250	250	50	100
DDL-300F	LPS-300	300	60	120
DDL-350F	LPS-350	350	70	140
DDL-400F	LPS-400	400	80	160
DDL-450F	LPS-450	450	90	180
DDL-500F	LPS-500	500	100	200

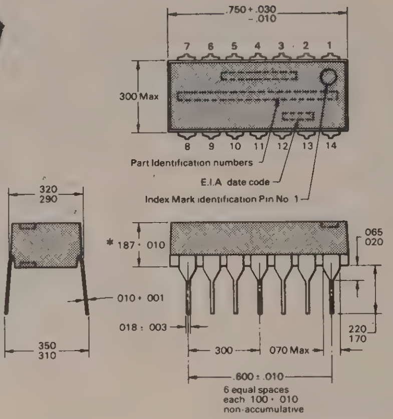
(1) Measured at 1.5v level leading edge; Vcc = 5.00 VDC; No loads; at +25°C.
(2) Nominal delay ±2 NS or ±5%; whichever is greater; reference to input.

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

DL-8000-
14 PIN PASSIVE DELAY LINES

SERIES DL-8000


.750 + .030
- .010
7 6 5 4 3 2 1
300 Max
8 9 10 11 12 13 14
Part Identification numbers
E.I.A date code
Index Mark identification Pin No 1
320
290
* 187 · 010
065
020
010 + 001
018 ± 003
350
310
300
070 Max
220
170
.600 ± .010
6 equal spaces
each 100 · 010
non-accumulative

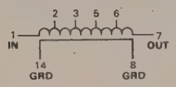
Insulation Resistance: 100,000 megohms at 25°C.

Dielectric Withstanding Voltage 250VDC @ 50 milliamps, 5 sec Min.

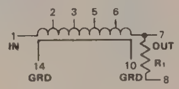
Temperature Coefficient (Typ.): 100ppm/°C.

FEATURES

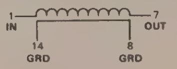
- Low Profile
- 14-Lead, DIP-IC Compatible Packages
- Standard Delay Times from 5 nsec to 500 nsec
- Standard Impedances of 50, 100, 200, 360 and 500 ohms
- Standard and Special Attenuations
- Easy to Order Special Models
- Drift Elimination by Lumped Constant Design
- Meets or Exceeds Applicable Requirements of MIL-STD-202 and MIL-STD-833
- Epoxy Transfer Molding for Cost/Delivery Time Savings
- Economy and Prompt Delivery on Standard Models
- High Reliability, Precision Performance, Broad Temperature Range Stability, Long Storage and Operational Life


2 3 5 6
1 IN
7 OUT
14 GRD
8 GRD

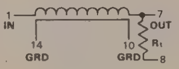
A


2 3 5 6
1 IN
7 OUT
R_t
14 GRD
10 GRD
8

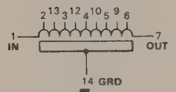
B


1 IN
7 OUT
14 GRD
8 GRD

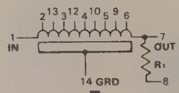
C


1 IN
7 OUT
R_t
14 GRD
10 GRD
8

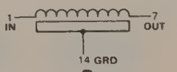
D


2 13 3 12 4 10 5 9 6
1 IN
7 OUT
14 GRD

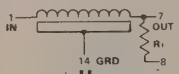
E


2 13 3 12 4 10 5 9 6
1 IN
7 OUT
R_t
14 GRD
8

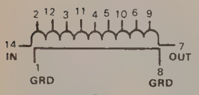
F


1 IN
7 OUT
14 GRD

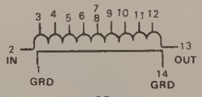
G


1 IN
7 OUT
R_t
14 GRD
8

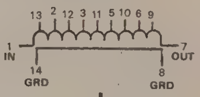
H


2 12 3 11 4 5 10 6 9
14 IN
7 OUT
1 GRD
8 GRD

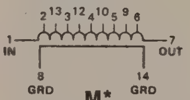
J


3 4 5 6 7 8 9 10 11 12
2 IN
13 OUT
1 GRD
14 GRD

K


13 2 12 3 11 5 10 6 9
1 IN
7 OUT
14 GRD
8 GRD

L


2 13 3 12 4 10 5 9 6
1 IN
7 OUT
8 GRD
14 GRD

M*

R_t = Terminating Resistor (value of Z_o) ±5%, ⅛ watt, carbon.

Taps in equal increments of total delay.

* BUILT TO MEET MILITARY SPECIFICATION MIL-D-23859/23C

HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

Example: DL-8000-045-09-100-05 A
14-Pin Lumped Constant Dual In-Line Delay Line, 45 nsec T_d, 9 nsec T_r, 100 ohm impedance, 5% (Max.) attenuation, internal configuration "A."

DL-8000 045 09 100 05 A

PLACE 1
Base No. DL-8000 = 14-pin, Lumped Constant Dual In-Line Delay Lines (6 characters and dash)

PLACE 2
Delay Time (T_d)
Standard Models:
005 = 5 nsec, 050 = 50 nsec.
150 = 150 nsec, etc., from above table (3 digits)
Special Orders:
Enter full 3-digit nsec value (e.g., 075)

PLACE 3
Rise Time (T_r)
Standard Models:
Enter nsec digit Value from table (e.g., 2.0, 6.5, 40)
Special Orders:
Enter desired rise time in nsec (2 or more digits)

PLACE 4
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms
100 = 100 ohms, 360 = 360 ohms
(3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g., 075)

PLACE 5
Attenuation
Standard Models:
Enter 2-digit percent value from table (e.g., 05, 10)
Special Orders:
Enter Max. allowable percent attenuation (2 digits)

PLACE 6
Internal Configuration
Enter Schematic reference Letters
(1 letter)

Formerly Manufactured By McGraw-Edison Comp.: Edison Electronics Division
DAVEN DESIGN

STANDARD DL-8000 MODELS

Delay Time (T_d), nsec*	Rise Time (T_r), Max nsec	% Attenuation Max Per Impedance†				
		50 ohms	100 ohms	200 ohms	360 ohms	500 ohms
5	02	3	5	5	5	7
10	03	3	5	5	5	7
15	04	3	5	5	5	7
20	05.5	3	5	5	5	7
25	05	3	5	5	5	7
30	06.5	3	5	5	5	7
35	07	3	5	5	5	7
40	08	3	5	5	5	7
45	09	3	5	5	5	7
50	10	3	5	5	5	7
55	11	3	5	5	5	7
60	12	3	5	5	5	7
65	13	3	5	5	5	7
70	14	3	5	5	5	7
75	15	3	5	5	5	7
80	16	3	5	5	5	7
85	17	3	5	5	5	7
90	18	3	5	5	5	7
95	19	3	5	5	5	7
100	20	3	5	5	5	7
110	22	3	5	6	7	8
120	24	3	5	6	7	8
130	26	3	5	6	7	8
140	28	3	5	6	7	8
150	30	3	5	6	7	8
160	32	3	5	6	7	8
170	34	3	5	6	7	8
180	36	3	5	6	7	8
190	38	3	5	6	7	8
200	40	3	5	6	7	8
210	45	5	5	6	7	8
220	45	5	5	6	7	8
230	50	5	5	6	7	8
240	50	5	5	6	7	8
250	50	5	5	6	7	8
260	55	5	5	6	7	8
270	55	5	5	6	7	8
280	60	5	5	6	7	8
290	60	5	5	6	7	8
300	60	5	5	6	7	8
310	65	5	7	8	10	10
320	65	5	7	8	10	10
330	70	5	7	8	10	10
340	70	5	7	8	10	10
350	70	5	7	8	10	10
360	75	5	7	8	10	10
370	75	5	7	8	10	10
380	80	5	7	8	10	10
390	80	5	7	8	10	10
400	80	5	7	8	10	10
410	85	5	8	10	10	10
420	85	5	8	10	10	10
430	90	5	8	10	10	10
440	90	5	8	10	10	10
450	90	5	8	10	10	10
460	95	5	8	10	10	10
470	95	5	8	10	10	10
480	100	5	8	10	10	10
490	100	5	8	10	10	10
500	100	5	8	10	10	10

* ±5% Tolerance for 40 through 500 nsec T_d.
2 nsec for 5 through 40 nsec T_d.

† ±10% Impedance Tolerance.

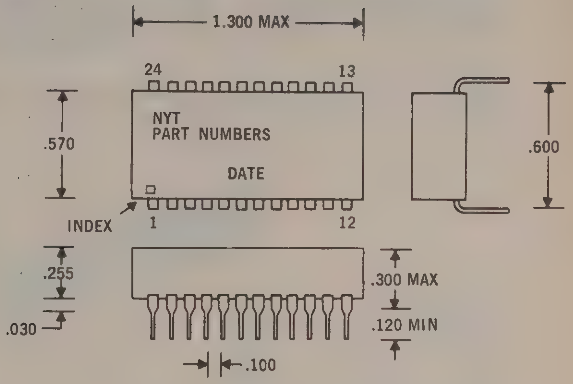
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**DL-2400-
24 PIN PASSIVE
DELAY LINES**

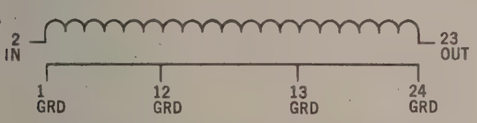
DL-2400 SERIES

FEATURES

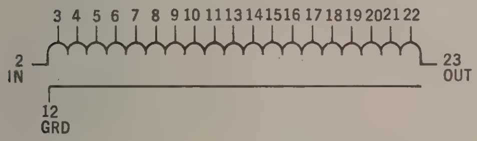
- Standard 24 Pin Dip
- Epoxy Encapsulated
- Operating Temp. −55°C to +125°C
- Hi-Pot = 100VDC
- Up to 20 Outputs
- Temp. Coeff. of Delay
  - Up to 1000ns = 100ppm/°C
  - Above 1000ns = 200ppm/°C
- Easy to Order Specials
- 1%, 2%, and Other Tolerances Available
- Many Other Delays, Impedances, and Rise Times Available
- Many Other Schematics Available


1.300 MAX
24
13
NYT
PART NUMBERS
DATE
.570
.600
INDEX
1
12
.255
.300 MAX
.030
.120 MIN
.100

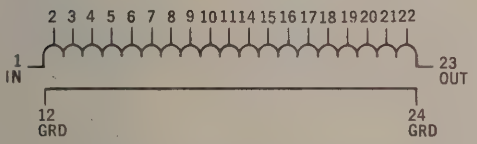
A


2
IN
23
OUT
1
GRD
12
GRD
13
GRD
24
GRD

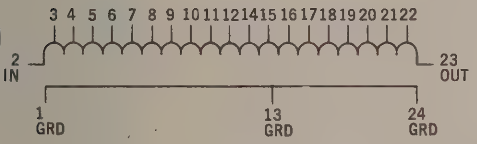
B


3 4 5 6 7 8 9 10 11 13 14 15 16 17 18 19 20 21 22
2
IN
23
OUT
12
GRD

C


2 3 4 5 6 7 8 9 10 11 14 15 16 17 18 19 20 21 22
1
IN
23
OUT
12
GRD
24
GRD

D


3 4 5 6 7 8 9 10 11 12 14 15 16 17 18 19 20 21 22
2
IN
23
OUT
1
GRD
13
GRD
24
GRD

Delay Time (Td), nsec*	Rise Time (Tr), Max nsec	% Attenuation Max. per Impedance†				
		50 ohms	100 ohms	200 ohms	360 ohms	500 ohms
50	5	6	6	8	—	—
100	10	6	8	8	8	8
150	15	8	8	8	8	8
200	20	8	8	8	8	10
250	25	8	8	8	10	10
300	30	8	8	8	10	10
400	40	8	8	10	10	10
500	50	8	8	10	10	10
600	60	8	8	10	10	10
700	70	8	8	10	10	10
800	80	8	10	10	10	15
900	90	8	10	10	10	15
1000	100	8	10	10	10	15
1500	150	—	10	10	15	15
2000	200	—	10	15	15	15
3000	300	—	—	15	15	15
4000	400	—	—	15	15	15
5000	500	—	—	—	15	15
6000	600	—	—	—	15	—
7000	700	—	—	—	15	—

* ±5% Tolerance
† ±10% Impedance Tolerance.
Taps in equal increments of total delay.

HOW TO ORDER

To allow the greatest possible range of parameters, the following ordering system should be followed on both standard and special orders.

EXAMPLE: DL-2400-1000-100-100-10A

24-Pin Lumped Constant Dual In-Line Delay Line, 1000 nsec Td, 100 nsec Tr, 100 ohm impedance, 10% (Max.) attenuation, internal configuration "A".

DL-2400 — 1000 — 100 — 100 — 10 — A

PLACE 1
Base No. DL-2400 24-Pin,
Lumped Constant Dual
In-Line Delay Lines
(6 Characters and dash)

PLACE 2
Delay Time (Td)
Standard Models:
005 = 5 nsec, 050 = 50 nsec,
150 = 150 nsec, 1500 = 1500 nsec,
etc., from above table (3 digits
or more)

PLACE 3
Rise Time (Tr)
Standard Models:
Enter nsec digit Value from table
(e.g. 05, 50, 500, etc.)
Special Orders:
Enter desired rise time in nsec
(2 or more digits)

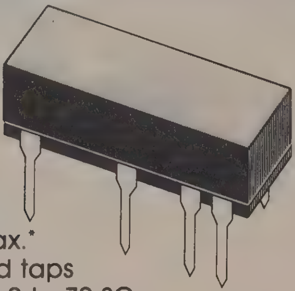
PLACE 4
Impedance (Z_o)
Standard Models:
050 = 50 ohms, 200 = 200 ohms,
100 = 100 ohms, 360 = 360 ohms
(3 digits)
Special Orders:
Enter full 3-digit Ohm value (e.g. 075)

PLACE 5
Attenuation
Standard Models:
Enter 2-digit percent value from table
(e.g., 06, 10)
Special Orders:
Enter Max. allowable percent attenuation
(2 digits)

PLACE 6
Internal Configuration
Enter Schematic reference
Letters
A, B, C or D (1 letter)

5 Tap TTL Compatible Active Delay Lines

HI REP RATE

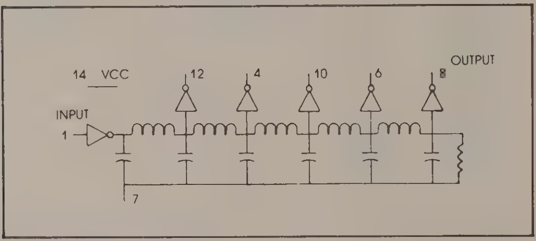


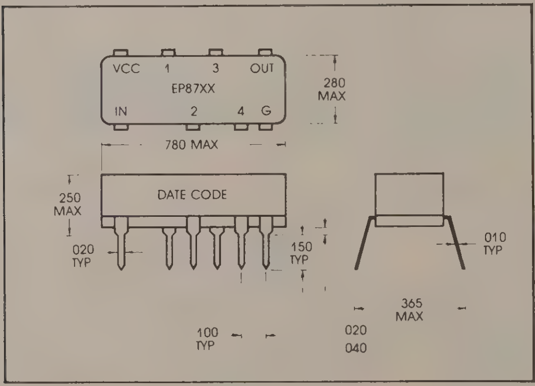
Features

- Schottky TTL
- Rise time 4nS max.*
- 5 equally spaced taps
- Operating temp. 0 to 70 °C
- Available from 25nS to 1000ns
- Low profile 14 pin DIP for auto-insertion

Input Test Conditions

- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 60mA TYP.
- Pulse Width: 50% of Total Delay
- Rep. Rate: 3 MHz (TD ≤ 500ns)
  2 MHz (TD > 500ns)





TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
5, 10, 15, 20	25	EP8700
6, 12, 18, 24	30	EP8713
7, 14, 21, 28	35	EP8714
8, 16, 24, 32	40	EP8715
9, 18, 27, 36	45	EP8716
10, 20, 30, 40	50	EP8701
12, 24, 36, 48	60	EP8711
15, 30, 45, 60	75	EP8717
20, 40, 60, 80	100	EP8702
25, 50, 75, 100	125	EP8719
30, 60, 90, 120	150	EP8703
35, 70, 105, 140	175	EP8720
40, 80, 120, 160	200	EP8704
45, 90, 135, 180	225	EP8721
50, 100, 150, 200	250	EP8705
60, 120, 180, 240	300	EP8706
70, 140, 210, 280	350	EP8707
80, 160, 240, 320	400	EP8708
84, 168, 252, 336	420	EP8718
88, 176, 264, 352	440	EP8722
90, 180, 270, 360	450	EP8709
94, 188, 282, 376	470	EP8723
100, 200, 300, 400	500	EP8710
110, 220, 330, 440	550	EP8730
120, 240, 360, 480	600	EP8724
130, 260, 390, 520	650	EP8731
140, 280, 420, 560	700	EP8725
150, 300, 450, 600	750	EP8729
160, 320, 480, 640	800	EP8726
170, 340, 510, 680	850	EP8732
180, 360, 540, 720	900	EP8727
190, 380, 570, 760	950	EP8733
200, 400, 600, 800	1000	EP8728

DELAY TIMES REFERENCED FROM INPUT TO LEADING AND TRAILING EDGES
TAP DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
TOTAL DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
*5 NS FOR 550-1000 NS TOTAL DELAYS

PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

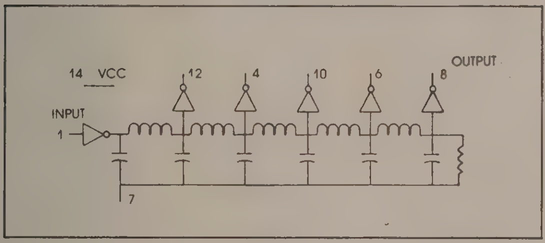
5 Tap TTL Compatible Active Delay Lines

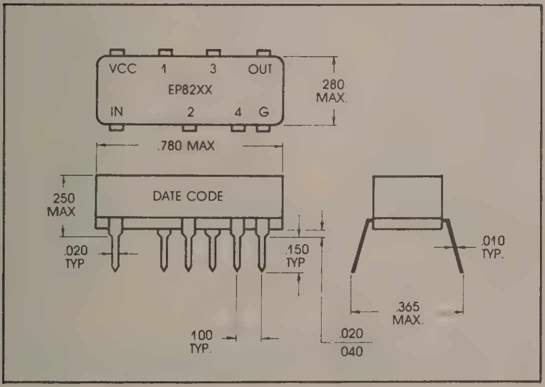
Features

- Schottky TTL
- Rise time 4nS max.*
- 5 equally spaced taps
- Operating temp. 0 to 70 °C
- Available from 25nS to 1000ns
- Low profile 14 pin DIP for auto-insertion

Input Test Conditions

- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 60mA TYP.
- Pulse Width: 1.1 x Total Delay
- Rep. Rate: 1 MHz (TD ≤ 500ns) 500 KHz (TD > 500ns)





TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
5, 10, 15, 20	25	EP8200
6, 12, 18, 24	30	EP8213
7, 14, 21, 28	35	EP8214
8, 16, 24, 32	40	EP8215
9, 18, 27, 36	45	EP8216
10, 20, 30, 40	50	EP8201
12, 24, 36, 48	60	EP8211
15, 30, 45, 60	75	EP8217
20, 40, 60, 80	100	EP8202
25, 50, 75, 100	125	EP8219
30, 60, 90, 120	150	EP8203
35, 70, 105, 140	175	EP8220
40, 80, 120, 160	200	EP8204
45, 90, 135, 180	225	EP8221
50, 100, 150, 200	250	EP8205
60, 120, 180, 240	300	EP8206
70, 140, 210, 280	350	EP8207
80, 160, 240, 320	400	EP8208
84, 168, 252, 336	420	EP8218
88, 176, 264, 352	440	EP8222
90, 180, 270, 360	450	EP8209
94, 188, 282, 376	470	EP8223
100, 200, 300, 400	500	EP8210
110, 220, 330, 440	550	EP8230
120, 240, 360, 480	600	EP8224
130, 260, 390, 520	650	EP8231
140, 280, 420, 560	700	EP8225
150, 300, 450, 600	750	EP8229
160, 320, 480, 640	800	EP8226
170, 340, 510, 680	850	EP8232
180, 360, 540, 720	900	EP8227
190, 380, 570, 760	950	EP8233
200, 400, 600, 800	1000	EP8228

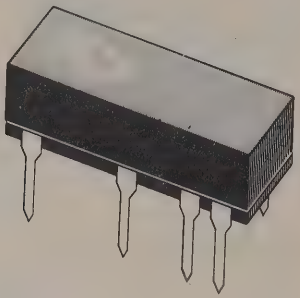
DELAY TIMES REFERENCED FROM INPUT TO LEADING EDGES
TAP DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
TOTAL DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
*5 NS FOR 550-1000 NS TOTAL DELAYS

PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

5 Tap Low Power TTL Compatible Active Delay Lines

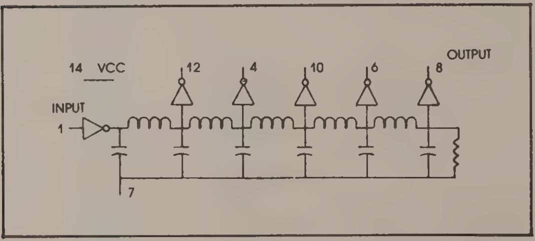


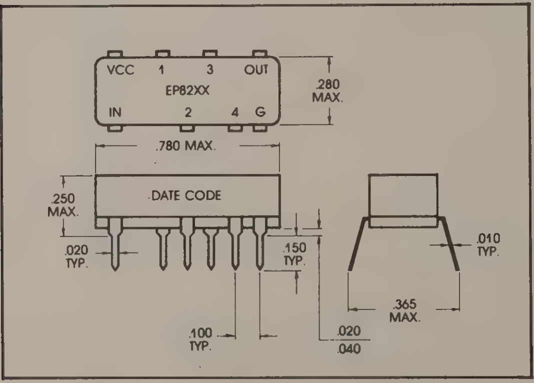
Features

- Low power Schottky TTL
- Rise time 8nS max.*
- 5 equally spaced taps
- Operating temp. 0 to 70 °C
- Drives up to 20 low power TTL loads
- Low profile DIP for auto-insertion

Input Test Conditions

- VCC: 5.0 VDC
- Pulse Voltage: 3.2V
- Rise Time: 2nS
- Input Current: 25mA TYP.
- Pulse Width: 1.1 x Total Delay
- Rep. Rate: 1 MHz (TD ≤ 500ns)
  500 KHz (TD > 500ns)





TAP DELAYS ±5% OR 2 NS	TOTAL DELAYS ±5% OR 2 NS	PART NUMBER
10, 20, 30, 40	50	EP8270
11, 22, 33, 44	55	EP8271
12, 24, 36, 48	60	EP8272
13, 26, 39, 52	65	EP8273
14, 28, 42, 56	70	EP8274
15, 30, 45, 60	75	EP8275
16, 32, 48, 64	80	EP8276
17, 34, 51, 68	85	EP8277
18, 36, 54, 72	90	EP8278
19, 38, 57, 76	95	EP8279
20, 40, 60, 80	100	EP8280
25, 50, 75, 100	125	EP8281
30, 60, 90, 120	150	EP8282
35, 70, 105, 140	175	EP8283
40, 80, 120, 160	200	EP8284
45, 90, 135, 180	225	EP8285
50, 100, 150, 200	250	EP8286
55, 110, 165, 220	275	EP8287
60, 120, 180, 240	300	EP8288
70, 140, 210, 280	350	EP8289
80, 160, 240, 320	400	EP8290
90, 180, 270, 360	450	EP8291
100, 200, 300, 400	500	EP8292

DELAY TIMES REFERENCED FROM INPUT TO LEADING EDGES
TAP DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER
TOTAL DELAY TOLERANCE ±5% OR 2 NS WHICHEVER GREATER

PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

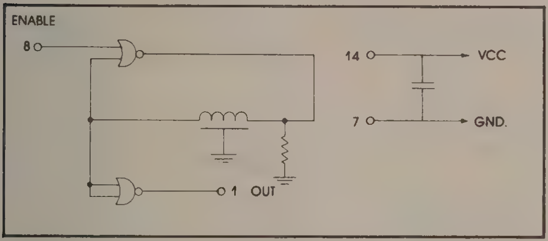
PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

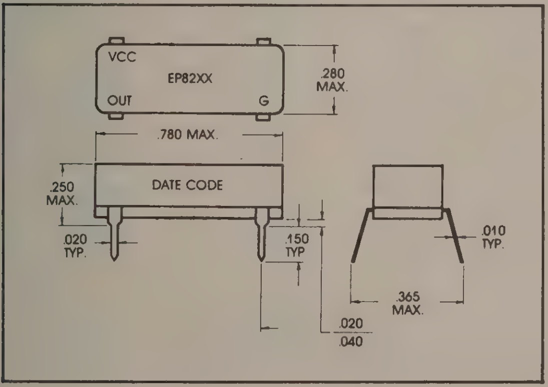
TTL Square-Wave Generator

Features

- Output frequencies from 2 to 100 MHz ±5%
- Low profile 14 pin dual-inline package
- Operating temperature range 0 to 70 °C
- Output synchronized using enable line
- 50% duty cycle
- Schottky TTL

P/N	MHz	P/N	MHz
EP8250	2	EP8259	35
EP8251	3	EP8260	40
EP8252	4	EP8261	45
EP8253	5	EP8262	50
EP8254	10	EP8263	60
EP8255	15	EP8264	70
EP8256	20	EP8265	80
EP8257	25	EP8266	90
EP8258	30	EP8267	100


ENABLE
8
14
VCC
7
GND.
1
OUT

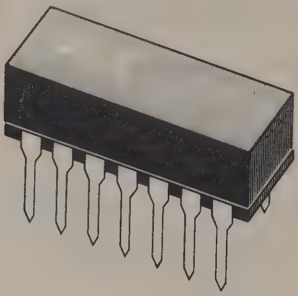

VCC
EP82XX
OUT
G
.280 MAX.
.780 MAX.
DATE CODE
.250 MAX.
.020 TYP.
.150 TYP
.010 TYP.
.365 MAX.
.020
.040

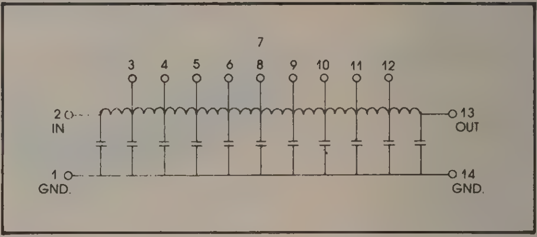
PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

14 Pin Dip Delay Lines



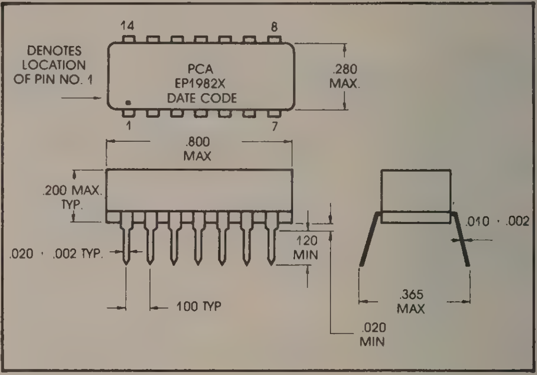

7
3
4
5
6
8
9
10
11
12
2 IN
13 OUT
1 GND.
14 GND.

Features

- 10 equally spaced taps
- Operating temp. 0 to 70 °C
- Available from 25nS to 1000ns
- Low profile 14 pin DIP for auto-insertion
- Temperature Coefficient <100 PPM/° C

Input Test Conditions

- Pulse Voltage: 10V
- Pulse Width: 3 x Total Delay
- Rep. Rate: 300 KHz - 1 MHz


14
8
DENOTES LOCATION OF PIN NO. 1
PCA
EP1982X
DATE CODE
.280 MAX.
1
7
.800 MAX
.200 MAX. TYP.
.020 · .002 TYP.
120 MIN
100 TYP
.010 · .002
.365 MAX
.020 MIN

IMPEDANCE OHMS ±10%	DELAY TIME NS ±5%	ΔT NS PER TAP (±3 NS)	DIST. % MAX.	RISE TIME NS MAX.	ATTENUATION % MAX.	PCA PART NUMBER
50	50	5 (± 2NS)	10	8.5	1.6	EP19821
50	100	10	10	17	3.8	EP19822
50	125	12.5	10	21	6.5	EP19823
100	50	5 (± 2NS)	10	8.5	2.0	EP19824
100	100	10	10	17	4.0	EP19825
100	125	12.5	10	21	7.0	EP19826
100	150	15	10	25	8.0	EP19827
100	200	20	10	34	10.0	EP19828
100	250	25	10	42	12.0	EP19829

TRANSFER MOLDED TO MEET MIL-D-23859 and MIL-STD-202C.
COMPATIBLE WITH AUTOMATIC INSERTION EQUIPMENT.
PEAK PULSE VOLTAGE, 50 VOLTS.

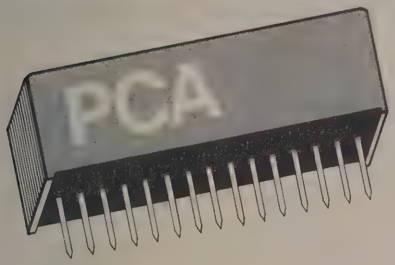
DELAY TIMES MEASURED FROM TAP TO TAP
TOTAL DELAY REFERENCED FROM INPUT
OTHER DELAYS AVAILABLE UPON REQUEST

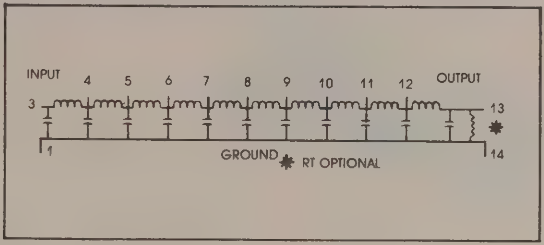
PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

14 Pin Single-in-Line Package Delay Lines



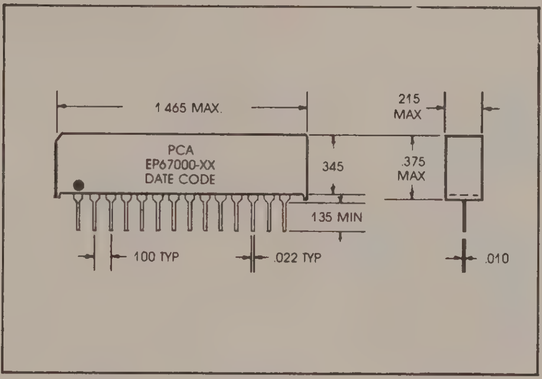


Features

- 10 equally spaced taps
- Internal termination optional
- Available from 10nS to 200ns
- Operating temp. 0 to 70 °C
- Temperature Coefficient <100 PPM/°C

Input Test Conditions

- Pulse Voltage: 10V
- Pulse Width: 3 x Total Delay
- Rep. Rate: 300 KHz - 1 MHz



IMPEDANCE OHMS ±10%	TOTAL DELAY TIME NS ±5% OR 2NS	ΔT NS PER TAP (±5% OR 2NS)	RISE TIME NS MAX	DCR OHMS MAX.	DISTORTION AT OUTPUT % MAX.	PCA PART NUMBER*
50	10 NS	1 NS	2 NS	1 OHM	10	EP6700-1
50	20 NS	2 NS	4 NS	1 OHM	10	EP6700-2
50	30 NS	3 NS	6 NS	1 OHM	10	EP6700-3
50	40 NS	4 NS	8 NS	1 OHM	10	EP6700-4
50	50 NS	5 NS	10 NS	1 OHM	10	EP6700-5
50	60 NS	6 NS	12 NS	2 OHM	10	EP6700-6
50	70 NS	7 NS	14 NS	2 OHM	10	EP6700-7
50	80 NS	8 NS	16 NS	2 OHM	10	EP6700-8
50	90 NS	9 NS	18 NS	2 OHM	10	EP6700-9
50	100 NS	10 NS	20 NS	2 OHM	10	EP6700-10
100	20 NS	2 NS	4 NS	4 OHM	10	EP6700-11
100	40 NS	4 NS	8 NS	4 OHM	10	EP6700-12
100	60 NS	6 NS	12 NS	4 OHM	10	EP6700-13
100	80 NS	8 NS	16 NS	4 OHM	10	EP6700-14
100	100 NS	10 NS	20 NS	4 OHM	10	EP6700-15
100	120 NS	12 NS	24 NS	6 OHM	10	EP6700-16
100	140 NS	14 NS	28 NS	6 OHM	10	EP6700-17
100	160 NS	16 NS	32 NS	6 OHM	10	EP6700-18
100	180 NS	18 NS	36 NS	6 OHM	10	EP6700-19
100	200 NS	20 NS	40 NS	6 OHM	10	EP6700-20

DELAY TIMES MEASURED FROM TAP TO TAP   TOTAL DELAY REFERENCED FROM INPUT   OTHER DELAYS AVAILABLE UPON REQUEST

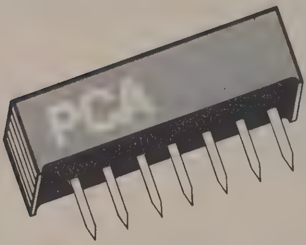
*ADD -T TO PART NUMBER FOR OPTIONAL INTERNAL TERMINATING RESISTOR

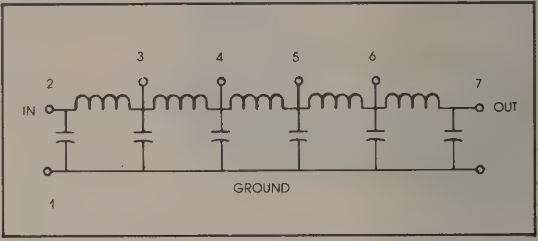
PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

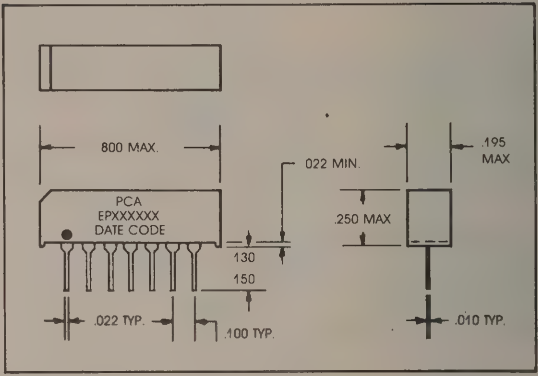
7 Pin Single-in-Line Package Delay Lines





Features
- 5 equally spaced taps
- Available from 5nS to 1000ns
- Operating temp. 0 to 70 °C
- Temperature Coefficient <100 PPM/°C

Input Test Conditions
- Pulse Voltage: 10V
- Pulse Width: 3 x Total Delay
- Rep. Rate: 300 KHz - 1 MHz



IMPEDANCE OHMS ±10%	TOTAL DELAY TIME NS ±5% OR 2NS	ΔT NS PER TAP (±5% OR 2NS)	RISE TIME NS MAX	DCR OHMS MAX.	DISTORTION AT OUTPUT % MAX.	PCA PART NUMBER
50	5 NS	1 NS	2.0 NS	0.3	10	120650
50	10 NS	2 NS	3.2 NS	0.5	10	120651
50	20 NS	4 NS	6.0 NS	0.8	10	120652
50	30 NS	6 NS	9.0 NS	1.2	10	120653
50	40 NS	8 NS	12.0 NS	1.8	10	120654
50	50 NS	10 NS	15.0 NS	2.3	10	120655
50	60 NS	12 NS	18.0 NS	2.5	10	120656
50	70 NS	14 NS	22.0 NS	3.5	10	120657
50	80 NS	16 NS	24.0 NS	4.2	10	120658
50	90 NS	18 NS	27.0 NS	4.5	10	120659
50	100 NS	20 NS	28.0 NS	5.2	10	120660
100	5 NS	1 NS	2.0 NS	0.5	10	120661
100	10 NS	2 NS	3.3 NS	1.0	10	120662
100	20 NS	4 NS	6.0 NS	1.5	10	120663
100	30 NS	6 NS	9.0 NS	2.5	10	120664
100	40 NS	8 NS	11.0 NS	4.0	10	120665
100	50 NS	10 NS	14.0 NS	5.0	10	120666

DELAY TIMES MEASURED FROM TAP TO TAP
TOTAL DELAY REFERENCED FROM INPUT
OTHER DELAYS AVAILABLE UPON REQUEST

PCA ELECTRONICS INC.

16799 SCHOENBORN STREET
SEPULVEDA, CA 91343

PHONE: (818) 892-0761
TELEX: 67-4681
TWX: 910-496-1525

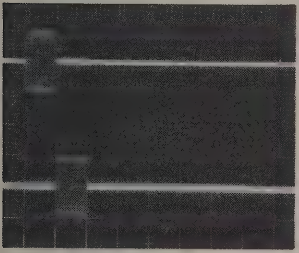
SAW Delay Lines

Surface Acoustic Wave Technology provides performance advantages and design flexibility that have proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance bandpass filters, resonator products, and other state-of-the-art signal processing components including dispersive, non-dispersive and tapped delay lines. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements a frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks composed of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW delay line products produced by Sawtek and their characteristics are summarized below.

NON-DISPERSIVE

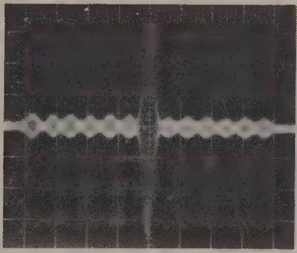
Sawtek produces non-dispersive delay lines for oscillator control, discriminator applications, and other signal processing delay requirements. SAW delay lines exhibit inherent bandpass characteristics and simultaneously provide selectivity in many cases. They are available with fractional bandwidths as large as 65% at frequencies up to 1000 MHz. The widest bandwidths require the use of lithium niobate materials with temperature coefficients of 72 to 94 PPM/°C. Quartz stability is offered for narrower band and frequency control applications with bandwidths from a few tenths percent to more than 5%. Delays from a few hundred nanoseconds to 40 microseconds are achievable. Insertion loss from 20 dB to 35 dB is typical to optimize group delay and time spurious performance. The photograph below shows a 400 MHz pulse input and subsequent output from a 2 microsecond, 250 MHz bandwidth delay line. Time spurious, including triple transit, is suppressed more than 40 dB. Low-loss versions can often be provided also.



TAPPED DELAY

SAW tapped delay lines are most frequently used to provide fixed-code generation or correlation for identification systems and spread spectrum communications. A familiar example of SAW devices of this type is demonstrated by a 13 bit Barker code at 60 MHz center frequency. The PSK code is generated by impulsing a complimentary SAW device and the subsequent matched filter output is shown below. Code lengths up to 127 bits are common. Fractional bandwidths are typically below 30% at center frequencies up to 500 MHz.

Tapped delay lines may also be used with external switches to provide variable delay or programmability. In this case, tap spacing is limited by rf feedthrough to delays larger than 100 nanoseconds. A more versatile approach to achieve programmable matched filtering is offered by SAW convolver technology. Some standard products are available and Sawtek offers rapid custom design for your specific applications.



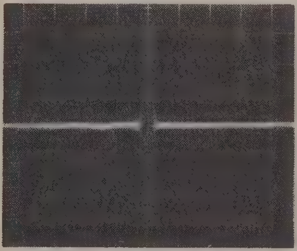
DISPERSIVE — LINEAR FM

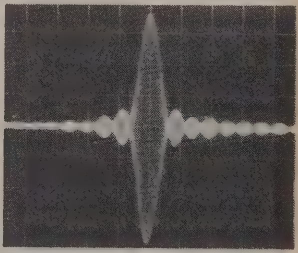
Sawtek supplies state-of-the-art linear FM delay lines for dispersive applications. Principal uses include pulse expansion and compression for radar, signal analysis for EW receivers, and transform processing for programmable filtering functions. Several different dispersive techniques are used to provide a wide parameter range: center frequencies from 10 MHz to 1 GHz, fractional bandwidths from 1% to 65%, and dispersive delays from 0.5 microsecond to 100 microseconds. Time-bandwidth products as large as 10,000 can be achieved although 50 to 2000 are more frequently used. Compressed pulse sidelobes vary from 13 dB nominally for unweighted frequency responses to 40 dB for some high performance weighted devices. A signal-to-noise ratio within 0.5 dB to 1.0 dB of theory is typical. Although all parameters cannot be optimized simultaneously, a thorough understanding of their interdependence permits maximum utilization of the advantages of SAW technology.

Conventional interdigital techniques easily achieve bandwidths up to 25% and time lengths as long as 20 usec. With quartz substrates for temperature stability, insertion loss of 40 dB to 50 dB is common for the wider fractional bandwidths. The compressed pulse shown on the left below has time sidelobes of 32 dB and is produced by a SAW expansion/compression pair at 30 MHz with 13 usec dispersive delay and 6 MHz bandwidth.

Dispersive delays up to 100 usec are implemented using Reflective Array Compressor (RAC) techniques. Compressed pulse performance is highlighted by time sidelobe suppression of 35 dB to 40 dB in most radar applications. These device types can be used to achieve very flat amplitude and accurate group delay response for EW receiver applications. This characteristic is demonstrated by the sin x/x compressed pulse at the lower right produced by a 40 microsecond RAC delay line.

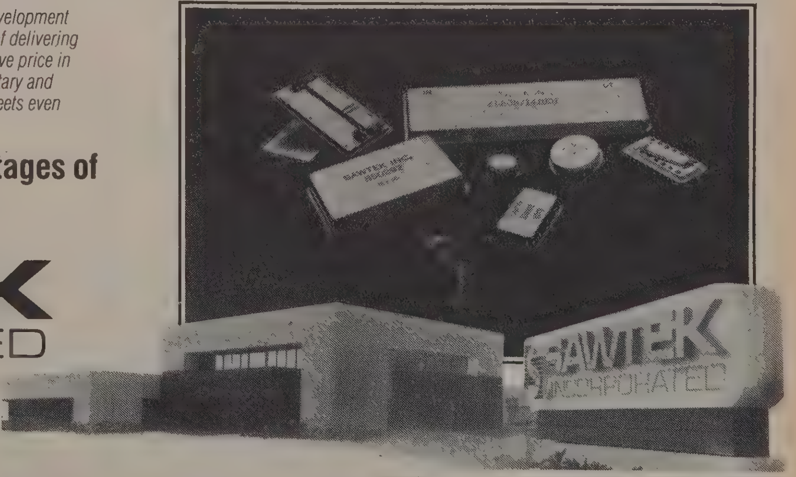
RAC devices are usually supplied in an oven to minimize temperature effects on performance. In addition to ovenized assemblies, Sawtek also designs and manufactures custom subsystems employing SAW dispersive components.





Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology. . . Demand Sawtek.



SAWTEK INCORPORATED

P.O. Box 18000, Dept. EM, Orlando, FL 32860, (305) 886-8860
TELEX 529118 TWX 810-862-0835

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

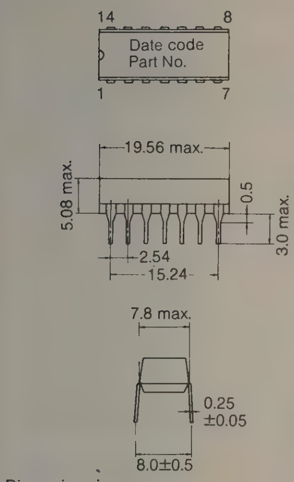
YIG yttrium iron garnet

TDK

DELAY LINES

DCE SERIES DELAY LINES

KP-64-1 TYPE


14
8
Date code
Part No.
1
7
19.56 max.
5.08 max.
0.5
3.0 max.
2.54
15.24
7.8 max.
0.25
±0.05
8.0±0.5

Dimensions in mm

TDK dual-in-line delay lines are products in which the high level wiring technology corresponds to inductors which use TDK's high performance ferrite and multilayer ceramic capacitors. These are compact, highly reliable delays lines which are molded from high quality resin and in which transmission characteristics, temperature characteristics and mechanical vibration are excellent.

Features

1) Excellent quality due to transfer molding using high quality resin.
2) Compact, DIP type, with a height of 5 mm.
3) Since inductors are used which are excellent in frequency and temperature characteristics, transmission characteristics and are extremely stable.
4) Wide operating temperature range of −10 to 85°C.
5) Wide selection of types.

Applications

Waveform converters, pulse generators, computer, video systems, measuring equipment, and other electronic equipment requiring a delay time of 1 to 350 ns.

Part No.	Total delay time (ns ±5%)	Characteristic impedance (Ω ±10%)	Delaytime between taps ns ±3 ns	Pulse rise time (ns max.)
DCE01-10	10 ±2 ns	100	1 ±0.4	2
DCE02-10	20 ±2 ns	100	2 ±0.6	4
DCE03-10	30 ±2 ns	100	3 ±0.8	6
DCE04-10	40	100	4 ±1.0	8
DCE05-10	50	100	5	10
DCE10-10	100	100	10	20
DCE05-20	50	200	5	10
DCE10-20	100	200	10	20
DCE15-20	150	200	15	30
DCE20-20	200	200	20	40
DCE25-10	250	200	25	50
DCE30-20	300	200	30	60
DCE35-20	350	200	35 ±3.5	70
DCE05-35	50	350	5	10
DCE10-35	100	350	10	20
DCE15-35	150	350	15	30
DCE20-35	200	350	20	40
DCE25-35	250	350	25	50
DCE30-35	300	350	30	60

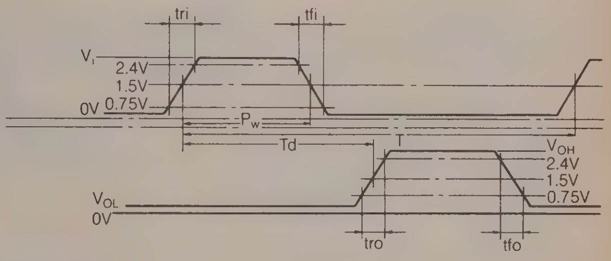
Attenuation: 10% (Max.)

ADL SERIES ACTIVE DELAY LINES

ADL Delay Lines are 5 output lumped constant types with built in TTL logic (Shottky). Waveform shaping is not needed. Hi-rel chip inductors and capacitors are used. The case is transfer molded. Maximum Ratings: Power Supply (V_{cc}): 7.0 V; Input (V_I): −0.5 to +5.5 Vdc; Oper.: 0 to +70°C; Stor.: −55 to +125°C.

Part No.	Total delay time (ns)	Delay time between taps (ns)	Rise time (ns) max.
ADL-020 ☐*	20 ±3	4 ±2	4
ADL-025 ☐*	25 ±3	5 ±2	4
ADL-050 ☐*	50 ±3	10 ±2	4
ADL-100 ☐*	100 ±5	20 ±3	4
ADL-150 ☐*	150 ±5	30 ±3	4
ADL-200 ☐*	200 ±5	40 ±3	4
ADL-250 ☐*	250 ±5	50 ±3	4

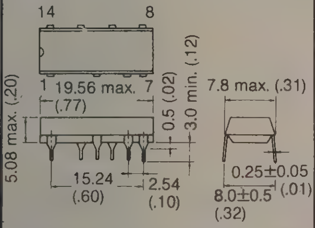
(V_{cc}: 5.0 ±0.1V, Ta: 25 ±1°C, each tap no load)
* When ordering, insert the code (S or L) in the ☐.


tri
tfi
Vi
2.4V
1.5V
0V 0.75V
Pw
Td
T
VOH
2.4V
1.5V
0.75V
VOL
0V
tro
tfo

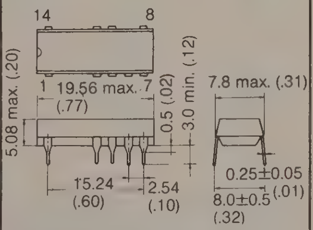
Vi: Signal level
Td: Delay time
Pw: Pulse width
tri: Input pulse rise time
tfi: Input pulse fall time

tro: Output pulse rise time
tfo: Output pulse fall time
VOL: Output "L" level voltage
VOH: Output "H" level voltage

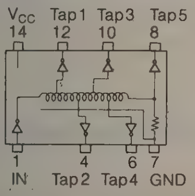
S TYPE


14
8
1
7
19.56 max.
(.77)
5.08 max. (.20)
0.5 (.02)
3.0 min. (.12)
7.8 max. (.31)
15.24
(.60)
2.54
(.10)
0.25±0.05
(.01)
8.0±0.5
(.32)

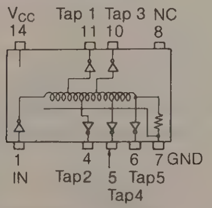
L TYPE


14
8
1
7
19.56 max.
(.77)
5.08 max. (.20)
0.5 (.02)
3.0 min. (.12)
7.8 max. (.31)
15.24
(.60)
2.54
(.10)
0.25±0.05
(.01)
8.0±0.5
(.32)

CONNECTION AND PIN NUMBERING


VCC
Tap1
Tap3
Tap5
14
12
10
8
1
4
6
7
IN
Tap2
Tap4
GND

Dimensions in mm (inch)


VCC
Tap 1
Tap 3
NC
14
11
10
8
1
4
5
6
7 GND
IN
Tap2
Tap5
Tap4

Input/Output characteristics

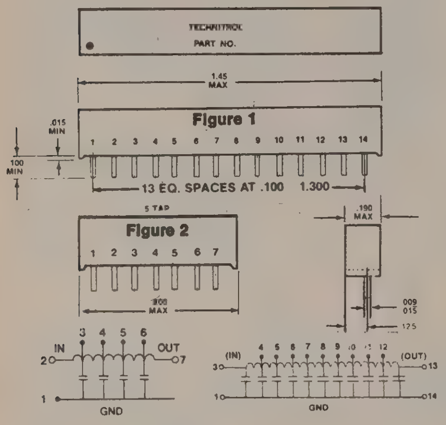
Item	Symbol	Rated value			Measurement conditions
		Minimum	Standard	Maximum	
"H" level input voltage	V_{IH} (V)	2.0	–	–	
"L" level input voltage	V_{IL} (V)	–	–	0.8	
"H" level output voltage	V_{OH} (V)	2.7	3.4	–	V_{CC} = 4.75V, V_{IL} = 0.8V, I_{OL} = −1 mA
"L" level output voltage	V_{OL} (V)	–	–	0.5	V_{CC} = 4.75V, V_{IH} = 2.0V, I_{OL} = 20 mA
"H" level input current	I_{IH} (μA)	–	–	50	V_{CC} = 5.25V, V_I = 2.7V
"L" level input current	I_{IL} (μA)	–	–	−2	V_{CC} = 5.25V, V_I = 0.5V
Operating current	I_{CCL} (mA)	–	30	54	V_{CC} = 5.25V, V_{IH} = 4.5V

Technitrol, Inc.

SINGLE AND DUAL-IN-LINE DELAY LINES
LOW PROFILE MINIATURE LUMPED CONSTANT

Features

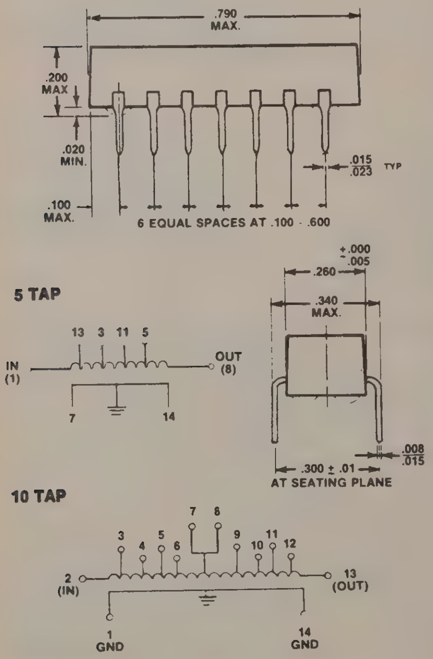
- Available in 50, 75, 100 and 200 ohm impedances
- Typical distortion: ±10% maximum
- Insulation resistance: 10K megohms at 50 VDC
- Temperature coefficent: 100 PPM/°C
- Temperature range: −55°C to +125°C
- Lead material: alloy 42, bright tin plate


TECHNITROL
PART NO.
1.45 MAX
Figure 1
.015 MIN
.100 MIN
1 2 3 4 5 6 7 8 9 10 11 12 13 14
13 EQ. SPACES AT .100 1.300
5 TAP
Figure 2
1 2 3 4 5 6 7
.800 MAX
.190 MAX
.009 .015
.125
IN 2
3 4 5 6
OUT 7
1
GND
(IN) 3
4 5 6 7 8 9 10 11 12
(OUT) 13
1
GND
14

SINGLE-IN-LINE DELAY LINES

	Part No.	Delay* (NS)	Rise Time (NS-Max.)	Impedance (Ohms) +10%	DCR (Ohms Max.)	Tap* Delay (NS)
10 TAP (FIG. 1)	SF10D1	10	2.0	100	1.0	1.0
	SF10F1	20	4.0	100	1.0	2.0
	SF10G1	25	5.0	100	1.0	2.5
	SF10K1	50	10.0	100	1.5	5.0
	SF10M1	100	20.0	100	3.2	10.0
	SF10P1	200	40.0	100	4.1	20.0
	SF10Q1	250	50.0	100	5.0	25.0
	SF10R1	500	100.0	100	7.5	50.0
	SF10S1	1000	200.0	100	10.0	100.0
5 TAP (FIG. 2)	SF05C1	5.0	2.0	100	1.0	1.0
	SF05D1	10.0	3.5	100	1.0	2.0
	SF05F1	20.0	7.0	100	1.5	4.0
	SF05G1	25.0	8.5	100	1.5	5.0
	SF05K1	50.0	17.0	100	3.2	10.0
	SF05M1	100.0	35.0	100	4.1	20.0
	SF05P1	200.0	67.0	100	5.0	40.0
	SF05Q1	250.0	85.0	100	6.0	50.0
	SF05R1	500.0	170.0	100	7.0	100.0

* Delay Tolerance ±1.5ns or 5% whichever is greater


.790 MAX.
.200 MAX
.020 MIN.
.100 MAX.
.015 .023 TYP
6 EQUAL SPACES AT .100 · .600
+.000 −.005
.260
.340 MAX.
.008 .015
.300 ± .01
AT SEATING PLANE
5 TAP
13 3 11 5
IN (1)
OUT (8)
7
14
10 TAP
7 8
3 4 5 6
9 10 11 12
2 (IN)
13 (OUT)
1 GND
14 GND

DUAL-IN-LINE DELAY LINES

	Part No.	Delay* (NS)	Rise Time (NS-Max.)	Impedance (Ohms) +10%	DCR (Ohms Max.)	Tap* Delay (NS)
10 TAP	LF10D1	10	2.2	100	1.0	1.0
	LF10E1	12.5	2.5	100	1.0	1.2
	LF10F1	20	4.0	100	1.5	2.0
	LF10G1	25	5.0	100	1.5	2.5
	LF10K1	50	10.0	100	2.5	5.0
	LF10M1	100	20.0	100	5.0	10.0
	LF10P1	200	40.0	100	11.5	20.0
5 TAP	LF05C1	5.0	2.0	100	1.0	1.0
	LF05D1	10.0	3.5	100	1.0	2.0
	LF05E1	12.5	5.0	100	1.0	2.5
	LF05F1	20.0	7.0	100	1.0	4.0
	LF05G1	25.0	8.5	100	1.5	5.0
	LF05K1	50.0	17.0	100	2.5	10.0
	LF05M1	100.0	35.0	100	5.0	20.0

Standoff configuration may vary.
All specifications subject to change without notice.
* Delay Tolerance ±1.5ns or 5% whichever is greater

Technitrol, Inc.

DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

Specialists in transformers and completely transfer molded, DIP delay lines under 3/16" high

Technitrol, Inc.

HIGH PERFORMANCE TTL DELAY MODULE
5 TAP

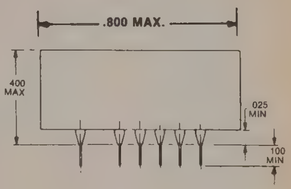
MEETS MIL SPEC M-D-23859

DELAY CHARACTERISTICS

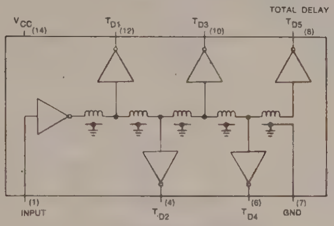
Part No.	NANOSECONDS					All Taps
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+ & T_R-
TTLDL020	10.0 ±1.5	12.5 ±1.5	15.0 ±1.5	17.5 ±1.5	20.0 ±1.5	≤2.0 ≤2.0 nsec.
TTLDL025	5.0 ±1.5	10.0 ±1.5	15.0 ±1.5	20.0 ±1.5	25.0 ±1.5	≤2.0 ≤2.0 nsec.
TTLDL050	10.0 ±1.5	20.0 ±1.5	30.0 ±1.5	40.0 ±2.0	50.0 ±2.5	≤2.0 ≤2.0 nsec.
TTLDL075	15.0 ±1.5	30.0 ±1.5	4.50 ±2.25	60.0 ±3.0	75.0 ±3.75	≤2.0 ≤2.0 nsec.
TTLDL100	20.0 ±1.5	40.0 ±2.0	60.0 ±3.0	80.0 ±4.0	100.0 ±5.0	≤2.0 ≤2.0 nsec.
TTLDL125	25.0 ±1.5	50.0 ±2.5	75.0 ±3.75	100.0 ±5.0	125.0 ±6.25	≤2.0 ≤2.0 nsec.
TTLDL150	30.0 ±1.5	60.0 ±3.0	90.0 ±4.5	120.0 ±6.0	150.0 ±9.0	≤2.0 ≤5.0 nsec.
TTLDL200	40.0 ±2.0	80.0 ±4.0	120.0 ±6.0	160.0 ±8.0	200.0 ±10.0	≤2.0 ≤5.0 nsec.
TTLDL250	50.0 ±2.5	100.0 ±5.0	150.0 ±7.5	200.0 ±10.0	250.0 ±12.5	≤2.0 ≤5.0 nsec.
TTLDL500	100.0 ±5.0	200.0 ±10.0	200.0 ±15.0	400.0 ±20.0	500.0 ±25.0	≤2.0 ≤9.0 nsec.

Delay Characteristics @ V_{cc} = 5.0V, 25°C no load

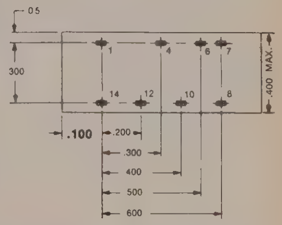
HIGH PERFORMANCE TTLDL	
Pulse Width	20%
Temp. Coefficient ...	±2%



Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply Voltage V_{cc}	4.5	5.0	5.5	Volts
Operating Free Air Temp. Range	0	25	75	°C



CONNECTION DIAGRAM
5 TAP VERSION



STANDARD TTL DELAY MODULE

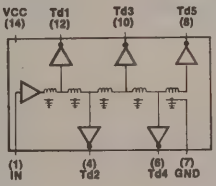
LOW PROFILE TTL DELAY MODULE CHARACTERISTICS

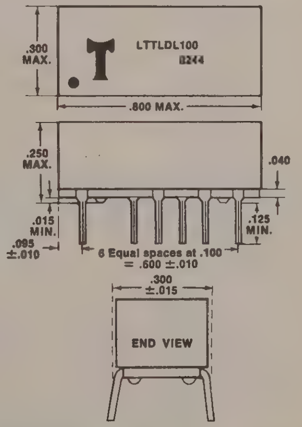
Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-
LTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
LTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
LTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
LTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
LTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
LTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
LTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0
LTTLDL250	50.0	100.0	150.0	200.0	250.0	2.0	5.0
LTTLDL500	100.0	200.0	200.0	400.0	500.0	2.0	9.0

Delay Characteristics @ V_{cc} = 5.0V, 25°C no load
Delay Tolerance ±2 NS or 5% whichever is greater

STANDARD MODULE LTTLDL	
Pulse Width	40%
Temp. Coefficient	±4%

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply Voltage V_{cc}	4.5	5.0	5.5	Volts
Operating Free Air Temp. Range	0	25	70	°C





TTL DELAY MODULES

TTL Delay Modules are designed to be used directly with super high speed TTL, standard TTL, and DTL logic circuits. They provide many timing applications without any or with minimum interface.

TTL Delay Modules can be cascaded to get any combination of delay without degrading output rise time (T_R+ or T_R-). The delay to rise time ratio (T_D/T_R) of individual modules is very high (approximately 50:1) and improves with cascading modules.

Output rise times of each module are independent of input rise times up to 50 nsec. TTL Delay Modules are encapsulated by transfer molding. They are pin compatible with 74/54 Series TTL/SSI 14 Lead DIP Circuits.

Technitrol, Inc.

DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

Specialists in transformers and completely transfer molded, DIP delay lines under 3/16″ high

Technitrol, Inc.

ULTRA STABLE TTL DELAY LINE

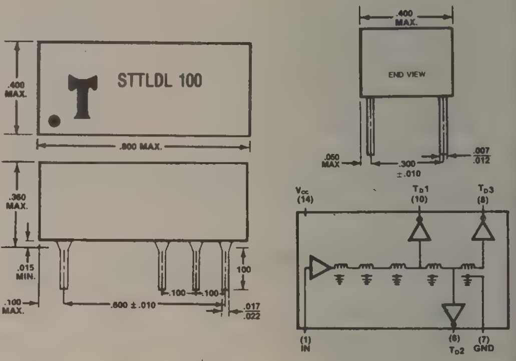
MEETS MIL SPEC M-D-23859

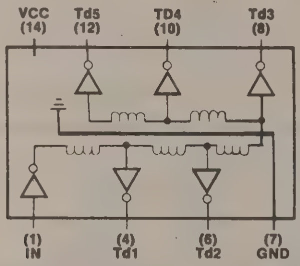
Part No.	NANOSECONDS			All Taps (Max.)	
	T_D1	T_D2	T_D3	T_R+	T_R-
STTLDL025	15.0	20.0	25.0	2.0	2.0
STTLDL050	30.0	40.0	50.0	2.0	2.0
STTLDL075	45.0	60.0	75.0	2.0	2.0
STTLDL100	60.0	80.0	100.0	2.0	2.0
STTLDL125	75.0	100.0	125.0	2.0	2.0
STTLDL150	90.0	120.0	150.0	2.0	5.0
STTLDL200	120.0	160.0	200.0	2.0	5.0
STTLDL250	150.0	200.0	250.0	2.0	5.0
STTLDL500	200.0	400.0	500.0	2.0	9.0

Delay Characteristics @ V_{cc} = 4.5V to 5.5V, T_R = 0-70°C
Delay Tolerance ±1.5 ns or 5% whichever is greater

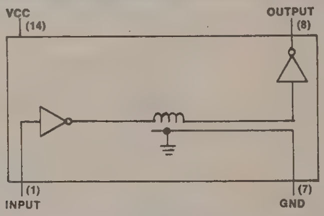
ULTRA STABLE MODULE STTDL	
Pulse Width	20%
Temp. Coefficient (@ max. delay)	100 ppm/°C

Recommended Operating Conditions	MIN.	TYP.	MAX.	UNIT
Supply Voltage V_{cc}	4.5	5.0	5.5	Volts
Operating Free Air Temp. Range	0	25	70	°C.


STTLDL 100
.400 MAX.
.800 MAX.
.360 MAX.
.015 MIN.
.100 MAX.
.600 ± .010
.100
.100
100
.017
.022
END VIEW
.400 MAX.
.050 MAX
.300 ±.010
.007
.012
V_{cc} (14)
T_D1 (10)
T_D3 (8)
(1) IN
(6) T_D2
(7) GND

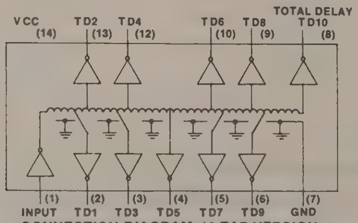

VCC (14)
Td5 (12)
TD4 (10)
Td3 (8)
(1) IN
(4) Td1
(6) Td2
(7) GND

SINGLE OUTPUT


VCC (14)
OUTPUT (8)
(1) INPUT
(7) GND

Buffered delay lines available from 5 NS to 500 NS only pins used brought out specification similar to standard 5 tap units.
Part Number TTLISXXX XXX = Delay, 025 etc.

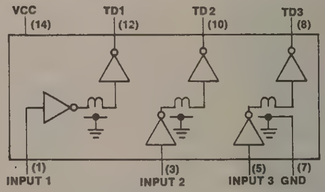
TEN TAP


VCC (14)
TD2 (13)
TD4 (12)
TD6 (10)
TD8 (9)
TOTAL DELAY TD10 (8)
(1) INPUT
(2) TD1
(3) TD3
(4) TD5
(5) TD7
(6) TD9
(7) GND

CONNECTION DIAGRAM 10 TAP VERSION

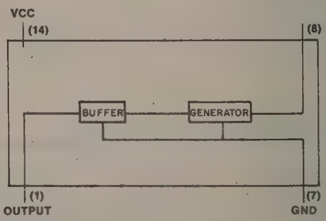
TTL buffered delay lines available with 3 individual inputs and outputs in delays from 5 NS to 250 NS (each delay).
Part Number TTLDDXXX, XXX = Delay each section.

TRIPLE OUTPUT


VCC (14)
TD1 (12)
TD2 (10)
TD3 (8)
(1) INPUT 1
(3) INPUT 2
(5) INPUT 3
(7) GND

Delay Modules are now available in 10 tap versions from 50 to 500 NS total delay. Specifications are comparable to the standard 5 tap units. The physical outline is the same as the 5 tap with the exception of 5 additional pins as noted in the connection diagram.
Part Number TTL3SXXX, = Delay.

SQUARE WAVE OSCILLATOR


VCC (14)
(8)
BUFFER
GENERATOR
(1) OUTPUT
(7) GND

TTL Square Wave Oscillators are available in the range of 2 MHz to 100 MHz. Frequency tolerance ±2%. Physical outline same as 5 tap standard TTL delay line.
Part Number TTLOSXXX, XXX = Frequency.

Technitrol, Inc.

DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

Specialists in transformers and completely transfer molded, DIP delay lines under 3/16" high

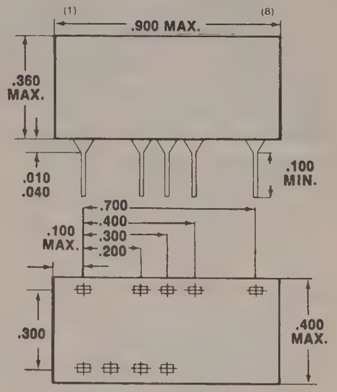
Technitrol, Inc.

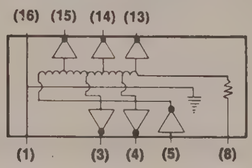
ECL DELAY MODULE

DELAY CHARACTERISTICS

Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+*	T_R-*
ECLDL025	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1	4	4
ECLDL050	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2.5	4	4
ECLDL075	15 ±1	30 ±1.5	45 ±2	60 ±3	75 ±3.75	5	5
ECLDL100	20 ±1	40 ±2	60 ±3	80 ±4	100 ±5	6	6
ECLDL125	25 ±1	50 ±2.5	75 ±3.75	100 ±5	125 ±6.0	7	7
ECLDL150	30 ±1.5	60 ±3.0	90 ±4.5	120 ±6	150 ±7.5	7	7
ECLDL200	40 ±2	80 ±4	120 ±6	160 ±8	200 ±10	8	8
ECLDL250	50 ±2.5	100 ±5	150 ±7.5	200 ±10	250 ±12.5	10	10
ECLDL300	60 ±3	120 ±6	180 ±9	240 ±12	300 ±15	15	15
ECLDL350	70 ±3.5	140 ±7	210 ±10.5	280 ±14	350 ±17.5	15	15
ECLDL400	80 ±4	160 ±8	240 ±12	320 ±16	400 ±20	15	15
ECLDL450	90 ±4.5	180 ±9	270 ±13.5	350 ±18	450 ±22.5	20	20
ECLDL500	100 ±5	200 ±10	300 ±15	400 ±20	500 ±25	20	20

* T_R = Measured from 20% to 80%


(1)
.900 MAX.
(8)
.360 MAX.
.010
.040
.100 MIN.
.700
.400
.300
.200
.100 MAX.
.300
.400 MAX.


(16)
(15)
(14)
(13)
(1)
(3)
(4)
(5)
(8)

ELECTRICAL CHARACTERISTICS

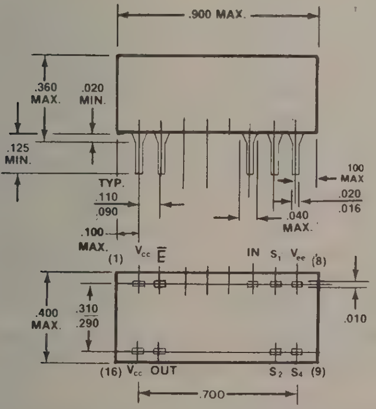
Over operating temperature range and Vee = −5.2 ±0.01V with 500 liner FPM air flow and all output terminals with 50 to −2.0 VDC.

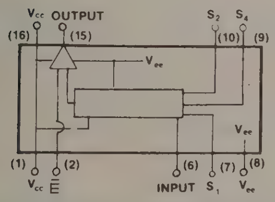
Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		75	MA	
I_{IH}	Input Current HIGH		425	MA	V_{IH} = −.810V
I_{LH}	Input Current LOW	.5		MA	V_{IL} = −1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "O" Output Voltage	−1.890	−1.615	VDC	V_{IL} = −1.850

All specifications are subject to change without notice.

Recommended Operating Conditions	Min.	Typ.	Max.
Vee	−5.72	−5.2	−4.68
Operating Temp Range With Airflow 500 LFPM	−30°C	25°C	80°C
Fan Out		85 ECL Loads	

10K ECL PROGRAMMABLE DELAY LINE MODULE


.900 MAX.
.360 MAX.
.020 MIN.
.125 MIN.
TYP.
.110
.090
.100 MAX.
100 MAX
.020
.016
.040 MAX.
(1)
V_{cc}
$\overline{E}$
IN
S_1
V_{ee}
(8)
.400 MAX.
.310
.290
.010
(16)
V_{cc}
OUT
S_2
S_4
(9)
.700


V_{cc}
OUTPUT
S_2
S_4
(16)
(15)
(10)
(9)
V_{ee}
V_{ee}
(1)
(2)
(6)
(7)
(8)
V_{cc}
$\overline{E}$
INPUT
S_1
V_{ee}

DELAY CHARACTERISTICS Ta = 25°C

TECHNITROL PART NO.	STEP DELAY ns ±ns	MAX. DELAY ns ±ns
ECLPG301	1.0 ±.4	11.0 ±1.5
ECLPG302	2.0 ±.6	17.0 ±1.5
ECLPG303	3.0 ±1.0	24.0 ±1.5
ECLPG304	4.0 ±1.0	31.0 ±2.0
ECLPG305	5.0 ±1.5	38.0 ±2.0
ECLPG306	6.0 ±1.5	45.0 ±2.5
ECLPG307	7.0 ±1.5	52.0 ±2.5
ECLPG308	8.0 ±1.5	59.0 ±3.0
ECLPG309	9.0 ±1.5	66.0 ±3.5
ECLPG310	10.0 ±1.5	73.0 ±4.0
ECLPG315	15.0 ±1.5	108.0 ±5.0
ECLPG320	20.0 ±1.5	143.0 ±7.0
ECLPG325	25.0 ±1.5	178.0 ±9.0
ECLPG330	30.0 ±2.0	213.0 ±11.0
ECLPG335	35.0 ±2.0	248.0 ±12.0
ECLPG340	40.0 ±2.5	283.0 ±14.0
ECLPG345	45.0 ±2.5	318.0 ±16.0
ECLPG350	50.0 ±2.5	353.0 ±17.0

ELECTRICAL CHARACTERISTICS over operating temperature range

- V_{ee} = −5.2 ±.01 VDC
- 500 linear FPM air flow and output terminated with 50Ω to −2.0 VDC

SYMBOL	PARAMETER	MIN.	MAX.	UNIT	CONDITIONS
I_{ee}	Supply Current	—	100	MA.	——
I_{ih}	Input Current HIGH	—	13.0	MA.	V_{ih} = −.810V
I_{il}	Input Current LOW	.5	600	MA.	V_{il} = −1.850V
V_{oh}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{ih} = −0.810
V_{ol}	Logic "0" Output Voltage	−1.890	−1.615	VDC	V_{il} = −1.850

All specifications subject to change without notice

Technitrol, Inc.

DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

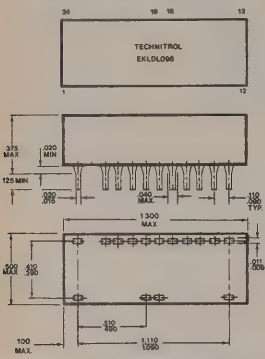
Specialists in transformers and completely transfer molded, DIP delay lines under 3/16" high

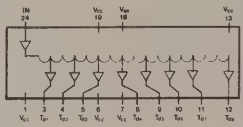
Technitrol, Inc.

100K ECL DELAY MODULE

FEATURES

- 100K ECL input and output
- 24 pin transfer molded dip package on .400 lead center
- Available in delays from 5 ns to 200 ns
- Eight (8) equal taps each buffered with 70 ECL fanout capacity
- Operating temperature range 0°C to +85°C
- Other delays available


24
16
13
TECHNITROL
EKLDL098
1
12
.375 MAX
.020 MIN
125 MIN
.020 .016
.040 MAX.
.110 .090 TYP.
1.300 MAX
.500 MAX
.410 .390
.011 .009
.510 .490
1.110 1.090
100 MAX.


IN 24
Vcc 19
Vee 18
Vcc 13
1 Vcc
3 TD1
4 TD2
5 TD3
6 Vcc
7 Vcc
8 TD4
9 TD5
10 TD6
11 TD7
12 TD8

DELAY CHARACTERISTICS: TA, +25°C, V −4.5V ±.1V

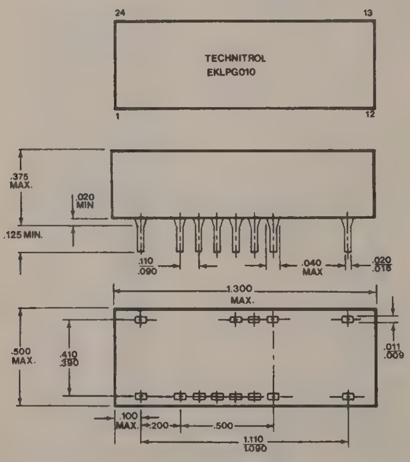
Technitrol Part No.	T_D1 ns	T_D2 ns	T_D3 ns	T_D4 ns	T_D5 ns	T_D6 ns	T_D7 ns	T_D8 ns	T_D1 TOL. WIG.
EKLDL005	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	±.25 or 10%
EKLDL008	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	±.40 ns
EKLDL016	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	±.50 or 5%
EKLDL025	4.0	7.0	10.0	13.0	16.0	19.0	22.0	25.0	±1. ns or 5%
EKLDL032	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	±1.5 or 5%
EKLDL040	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	±1.5 or 5%
EKLDL048	6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0	±1.5 or 5%
EKLDL056	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	±1.5 or 5%
EKLDL064	8.0	16.0	24.0	32.0	40.0	48.0	56.0	64.0	±1.5 or 5%
EKLDL072	9.0	18.0	27.0	36.0	45.0	54.0	63.0	72.0	±1.5 or 5%
EKLDL080	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	±1.5 or 5%
EKLDL100	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	±1.5 or 5%
EKLDL120	15.0	30.0	45.0	60.0	75.0	90.0	105.0	120.0	±1.5 or 5%
EKLDL160	20.0	40.0	60.0	80.0	100.0	120.0	140.0	160.0	±1.5 or 5%
EKLDL200	25.0	50.0	75.0	100.0	125.0	150.0	175.0	200.0	±1.5 or 5%

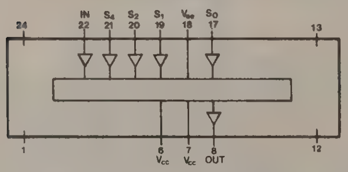
Tolerance ±ns or % whichever is greater.
Specifications subject to change without notice.

100K ECL PROGRAMMABLE DELAY LINE MODULE

FEATURES

- 100K ECL input and output
- Four (4) bit binary (1, 2, 4, 8) programming gives 15 equal step delays
- Available in 18 step delays from .1 ns to 10 ns; other step delays available
- Low inherent delay (T_O) $T_O = 2.0 \pm 1.0$ ns
- Seventy (70) ECL fanouts
- Temperature range 0°C to +85°C


24
13
TECHNITROL
EKLPG010
1
12
.375 MAX.
.020 MIN
.125 MIN.
.110 .090
.040 MAX
.020 .016
1.300 MAX.
.500 MAX.
.410 .390
.011 .009
.100 MAX.
.200
.500
1.110 1.090


IN 22
S4 21
S2 20
S1 19
Vee 18
S0 17
24
13
1
6 Vcc
7 Vcc
8 OUT
12

DELAY CHARACTERISTICS Ta = 25°C

Technitrol Part No.	Step Delay ns	± ns	Max. Delay ns	± ns
EKLPGR10	0.10	±0.05	3.50	±1.0
EKLPGR25	0.25	±0.13	5.75	±1.0
EKLPGR50	0.50	±0.20	9.50	±1.0
EKLPGR75	0.75	±0.25	13.25	±1.5
EKLPG010	1.00	±0.40	17.00	±1.5
EKLPG015	1.50	±0.50	24.50	±1.5
EKLPG020	2.00	±0.50	32.00	±1.5
EKLPG025	2.50	±0.50	39.50	±2.0
EKLPG030	3.00	±0.50	47.00	±2.5
EKLPG035	3.50	±0.50	54.50	±2.5
EKLPG040	4.00	±0.50	62.00	±3.0
EKLPG045	4.50	±0.50	69.50	±3.0
EKLPG050	5.00	±1.00	77.00	±4.0
EKLPG060	6.00	±1.00	92.00	±5.0
EKLPG070	7.00	±1.00	107.00	±5.0
EKLPG080	8.00	±1.00	122.00	±6.0
EKLPG090	9.00	±1.00	137.00	±7.0
EKLPG100	10.00	±1.00	152.00	±8.0

ELECTRICAL CHARACTERISTICS for 100K ECL Programmable Delay Line Module

- $V_{ee} = 4.5\,V \pm 5\%$
- 500 linear FPM air flow and output terminated with 50 ohm to −2.0 VDC

SYMBOL	PARAMETER	MIN.	MAX.	UNIT	TEST CONDITIONS
I_{ee}	Supply Current		115	MA.	
I_{ih}	Input Current HIGH		13.0	MA.	$V_{ih} = -.880V$
I_{il}	Input Current LOW	.5	.600	MA.	$V_{il} = -1.810V$
V_{oh}	Logic "1" Output Voltage	−1.025	−.880	VDC	$V_{ih} = -0.880$
V_{ol}	Logic "0" Output Voltage	−1.810	−1.620	VDC	$V_{il} = -1.810$

Specifications subject to change without notice.

Technitrol, Inc.

DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

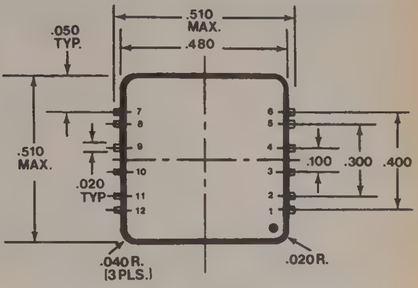
Specialists in transformers and completely transfer molded, DIP delay lines under 3/16″ high

Technitrol, Inc.

CHIP CARRIER DELAY LINE — ½″

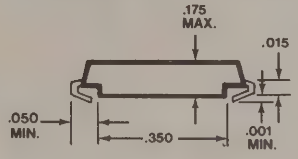
FEATURES

- Compact module .175″ high
- Ten tap line provides delays from 10 ns to 100 ns
- Can be mounted in standard chip carrier socket
- Designed to use with TTL logic
- Designed for surface mounting using reflow soldering
- Military temperature range −55°C to 125°C


.510 MAX.
.480
.050 TYP.
.510 MAX.
.020 TYP.
.100
.300
.400
7
8
9
10
11
12
6
5
4
3
2
1
.040 R. (3 PLS.)
.020 R.

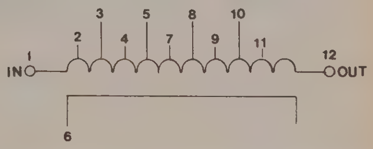
ELECTRICAL CHARACTERISTICS

- Impedance (Z_O) .... 100 ohms ±10%
- Tap delay .... every 10% of total delay
- Distortion .... ±10%
- Temperature Coefficient (T_D) .... 100 PPM/°C
- Delay Tolerance .... ±1.0 ns or 5% W.I.G.
- Input Pulse Width .... Minimum 3 times output rise time
- Input Rise Time .... 2 ns maximum
- Also available .... 50 ohm and 200 ohm impedance


.175 MAX.
.015
.050 MIN.
.350
.001 MIN.

Part No.	Total Delay T_D (ns)	Rise Time T_R (ns)	RDC (ohms)
BF10D1	10.0	2.2	1.0
BF10F1	20.0	4.0	2.0
BF10G1	25.0	5.0	3.0
BF10K1	50.0	10.0	5.0
BF10L1	75.0	15.0	6.5
BF10M1	100.0	20.0	8.0

Specifications subject to change without notice

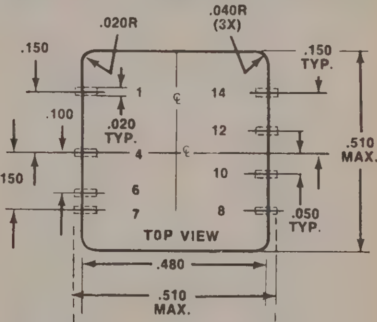

1
IN
2
3
4
5
7
8
9
10
11
12
OUT
6

CHIP CARRIER TTL DELAY MODULE

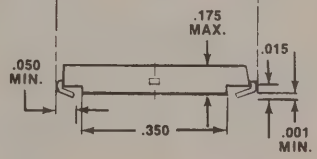
CHIP CARRIER TTL DELAY MODULE CHARACTERISTICS

Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-
BTTLDL020	10.0	12.5	15.0	17.5	20.0	2.0	2.0
BTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
BTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
BTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
BTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
BTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
BTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
BTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0

Delay Characteristics @ V_{CC} = 5.0V, 25°C no load
Delay Tolerance ±2 NS or 5% whichever is greater

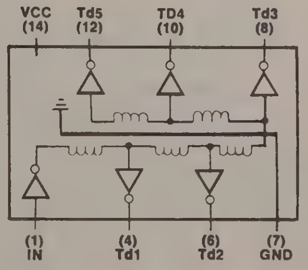

.020R
.040R (3X)
.150
.150 TYP.
.100
.020 TYP.
.150
.510 MAX.
.050 TYP.
1
4
6
7
14
12
10
8
TOP VIEW
.480
.510 MAX.

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply Voltage V_{CC}	4.5	5.0	5.5	Volts
Operating Free Air Temperature Range	0	25	70	°C


.175 MAX.
.015
.050 MIN.
.350
.001 MIN.

OTHER AVAILABLE MODULES

- **Standard commercial** — (listed) Commercial grade IC's (plastic package), temperature range 0° to +70°C.
- **Commercial with additional testing** — Per customer specification; add suffix "MY" to part number.
- **Military** — Temperature range −55°C to +125°C, ceramic package IC to meet MIL-STD-883 but not screened to that specification. Add suffix "M" to part number.
- **Military Hi-Rel** — Temperature range −55°C to +125°C, ceramic package IC meeting MIL-STD-883 and 38510/Mach IV program screened and burned in; add suffix "MX" to part number.
- **Low power Schottky** — LS hex inverters used.
- **Single output versions** — No taps.
- **Multiple (up to 3) individual lines per module** — Can be same or different delays.
- **Unequal taps** — Within a single line.
- **Programmable delay modules**


VCC (14)
Td5 (12)
TD4 (10)
Td3 (8)
(1) IN
(4) Td1
(6) Td2
(7) GND

Technitrol, Inc.

DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

Specialists in transformers and completely transfer molded, DIP delay lines under $^3/_{16}$″ high

Technitrol, Inc.

CHIP CARRIER DELAY LINE PASSIVE

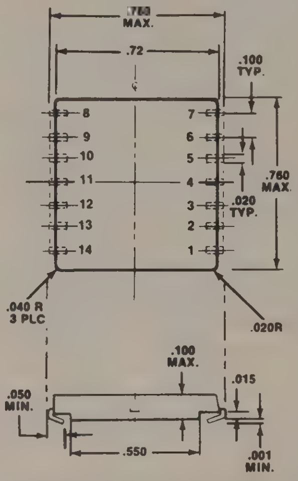
Part No.	Total Delay T_D (NS)	Rise Time T_R (NS)	RDC (ohms)
CF10D1	10.0	2.2	1.0
CF10F1	20.0	4.0	2.0
CF10G1	25.0	5.0	3.0
CF10K1	50.0	10.0	5.0
CF10M1	100.0	20.0	8.0
CF10N1	125.0	25.0	9.0
CF10P1	150.0	30.0	10.0
CF10Q1	200.0	40.0	12.0

ELECTRICAL CHARACTERISTICS

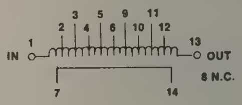
- Impedance (Z_O): 100 ohms ±10%
- Tap Delay: Every 10% of total delay
- Distortion: ±10%
- Temperature Coefficient (T_D): 100 PPM/°C
- Delay Tolerance: ±1.0 NS or 5% W.I.G.
- Input Pulse Width: Minimum 3 times output rise time
- Input Rise Time: 2 NS maximum
- Also available: 50 ohm and 200 ohm impedance

FEATURES

- Compact module .10″ high
- Ten tap line provides delays from 10 NS to 200 NS
- Designed to use with TTL logic
- Can be mounted in standard chip carrier socket
- Designed for surface mounting using reflow soldering
- Military temperature range −55°C to +125°C

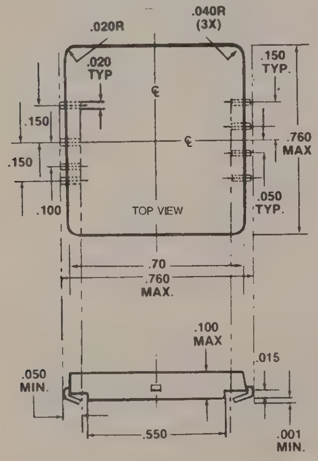


.760 MAX.
.72
.100 TYP.
8
9
10
11
12
13
14
7
6
5
4
3
2
1
.760 MAX.
.020 TYP.
.040 R 3 PLC
.020R
.100 MAX.
.015
.050 MIN.
.550
.001 MIN.



3 5 9 11
2 4 6 10 12
1
IN
13
OUT
8 N.C.
7
14

CHIP CARRIER TTL DELAY MODULES



.020R
.040R (3X)
.020 TYP
.150 TYP.
.150
.150
.760 MAX
.100
TOP VIEW
.050 TYP.
.70
.760 MAX.
.100 MAX
.015
.050 MIN.
.550
.001 MIN.

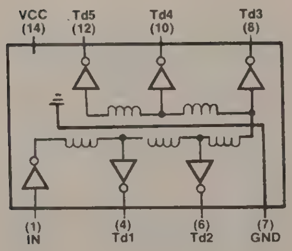
FEATURES

- Compact module only .10″ high
- Five tap line provides delays from 20 to 200 ns
- Designed for use with Schottky TTL, TTL and low power Schottky TTL
- Can be mounted in standard chip carrier socket—
- Designed for surface mounting
- Designed for vapor phase reflow soldering

CHIP CARRIER TTL DELAY MODULE CHARACTERISTICS

Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-
CTTLDL020	10.0	12.5	15.0	17.5	20.0	2.0	2.0
CTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
CTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
CTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
CTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
CTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
CTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
CTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0

Delay Characteristics @ V_{cc} = 5.0 V., 25°C. no load
Delay Tolerance ±2ns or 5% whichever is greater
Also Available in −55° to +120°C temp. range



VCC (14)
Td5 (12)
Td4 (10)
Td3 (8)
(1) IN
(4) Td1
(6) Td2
(7) GND

Recommended Operating Conditions	MIN.	TYP.	MAX.	UNIT
Supply Voltage V_{cc}	4.5	5.0	5.5	Volts
Operating Free Air Temp. Range	0	25	70	°C.

Technitrol, Inc.

DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

Specialists in transformers and completely transfer molded, DIP delay lines under 3/16″ high

TOKO AMERICA DELAY LINES

Toko Delay lines are mainly the lumped constant type.

Application of high quality design techniques permit efficient utilization of electromagnetic coupling to achieve low distortion and fast rise time characteristics. Stable and dependable products are realized with automated production processes and use of specially selected ferrites, capacitors and mold materials.

- Timing adjuster circuit ● Phase correction ● Pulse oscillatory circuit and so on.
- Applications Computer, peripheral terminal, automatic control device, medical electronics instrument, measuring instrument, telecommunication equipment, Video related apparatus, system device, personal computers.

GENERAL SPECIFICATIONS

	R5ET	JAT	PICODELAY	RET	RHT
Temperature Range Operating	0 to +70°c	0 to 70°c	--	0 to +70°c	0 to 70°c
Storage	−55° to +125°c	−45° to +125°c	--	−50 to +125°c	−40 to +120°c
Insulation Resistance	>100 mΩ @ 50 vdc	100 mΩ @ 50 vdc	Over 100 mΩ (50 vdc)	50 vdc 100 mΩ min	--
Waveform Distortion	Within ±10%	Within ±15%	Within ±10%	Within ±10%	--
Temperature Coefficient	50v	150 ppm/°c	Below ±100 ppm/°c	Within ± 100 ppm/c	--
Peak Pulse	<±100 ppm/°c	--	50v	50v	--
Packaging			Epoxy Transfer Molded		

ELECTRICAL SPECIFICATIONS

R5ET TYPE

Type No.	Total Delay Time Td(ns) ±5%	per tap (ns) Delay Time	Rise Time Tr (ns) Max
101R5ET/IMPEDANCE 20(Ω) ±10% −100			
1007	10 ±2	2 ±0.7	4.0
2007	20 ±2	4 ±1.0	7.0
2507	25 ±2	5 ±1.0	8.5
5007	50	10 ±2.0	14.5
1006	100	20 ±3.0	35.0
1506	150	30 ±4.0	43.0
2006	200	40 ±4.0	59.0
2506	250	50 ±5.0	70.0
201R5ET/IMPEDANCE 20(Ω) ±10% −200			
1007	10 ±2	2 ±0.7	4.0
2007	20 ±2	4 ±1.0	6.5
5007	50	10 ±2.0	15.0
1006	100	20 ±3.0	32.0
2006	200	40 ±4.0	61.0
3006	300	60 ±5.0	86.0
301R5ET/IMPEDANCE 20(Ω) ±10% −300			
2007	20 ±2	4 ±1.0	8.0
5007	50	10 ±2.0	15.0
1006	100	20 ±3.0	32.0
1506	150	30 ±4.0	45.0
2006	200	40 ±4.0	57.0
501R5ET/IMPEDANCE 20(Ω) ±10% −500			
5007	50	10 ±2.0	15.0
1006	100	20 ±3.0	29.0

JAT TYPE

Type No.	Impedance Zo (Ω) ±10%	Delay Time Td (ns) ±5%
101JAT/IMPEDANCE 20(Ω) ±10% −100		
1007L	100	10 ±2
2007L	100	20 ±2
3007L	100	30 ±2
4007L	100	40
5007L	100	50
6007L	100	60
7007L	100	70
8007L	100	80
9007L	100	90
1006L	100	100
1256L	100	125
1506L	100	150
2006L	100	200
2506L	100	250
3006L	100	300
201/JAT/IMPEDANCE 20(Ω) ±10% −200		
3007L	200	30 ±2
4007L	200	40

Type No.	Impedance Zo (Ω) ±10%	Delay Time Td (ns) ±5%
201/JAT/IMPEDANCE 20(Ω) ±10% −200		
5007L	200	50
1006L	200	100
1506L	200	150
2006L	200	200
2506L	200	250
3006L	200	300
301JAT/IMPEDANCE 20(Ω) ±10% −300		
5007L	300	50
1006L	300	100
1506L	300	150
2006L	300	200
2506L	300	250
501JAT/IMPEDANCE 20(Ω) ±10% −500		
5007L	500	50
1006L	500	100
1506L	500	150

PICODELAY™

Type No.	Delay Time Td(PS) ±10%	Delay Time per Tap Td(PS)	Rise Time Tr(PS) Max
101RET/CHAR. IMPEDANCE 20(Ω) ±10% −100			
2008L−2	2000	200	1800
5008L−2	5000	500	2200
1007L−2	10000	1000	3000
101R20ET/CHAR. IMPEDANCE 20(Ω) ±10% −100			
2008F−1	2000	200	1800
5008F−1	5000	500	2200
1007F−1	10000	1000	3000

RET TYPE

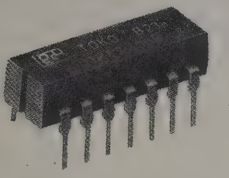
Type No.	Total Delay Time Td(ns) ±5%	Delay Time per tap (ns)	Rise Time Tr(ns) Max
L-CONNECTIONS 101RET/IMPEDANCE 20(Ω) ±10% −100			
1007L	10 ±1	1 ±0.4	3.0
2007L	20 ±2	2 ±0.7	4.5
3007L	30 ±2	3 ±1.0	6.5
4007L	40	4 ±1.2	7.0
5007L	50	5 ±1.5	9.0
6007L	60	6 ±1.6	10.5
7007L	70	7 ±1.7	12.5
8007L	80	8 ±1.8	14.0
9007L	90	8 ±1.9	16.0
1006L	100	10 ±2.0	17.5
1256L	125	12.5 ±2.5	22.0
1506L	150	15 ±2.5	26.5
2006L	200	20 ±3.0	35.0
2506L	250	25 ±3.0	44.0
3006L	300	30 ±3.5	52.5
201RET/IMPEDANCE 20(Ω) ±10% −200			
3007L	30 ±2	3 ±1.0	6.0
4007L	40	4 ±1.2	7.0
5007L	50	5 ±1.5	9.0
1006L	100	10 ±2.0	17.5
1506L	150	15 ±2.5	26.5
2006L	200	20 ±3.0	35.0
2506L	250	25 ±3.0	45.0
3006L	300	30 ±3.5	54.0
301RET/IMPEDANCE 20(Ω) ±10% −300			
5007L	50	5 ±1.5	9.0
1006L	100	10 ±2.0	17.5
1506L	150	15 ±2.5	26.5
2006L	200	20 ±3.0	35.0
2506L	250	25 ±3.0	48.0
501RET/IMPEDANCE 20(Ω) ±10% −500			
5007L	50	5 ±1.5	11.5
1006L	100	10 ±2.0	18.0
1506L	150	15 ±2.5	32.0
L-5 CONNECTIONS 101RET/IMPEDANCE 20(Ω) ±10% −100			
1007L-5	10 ±1	1 ±0.4	3.0
2007L-5	20 ±2	2 ±0.7	4.5
5007L-5	50	5 ±1.5	9.0
1006L-5	100	10 ±2.0	17.5
2006L-5	200	20 ±3.0	35.0

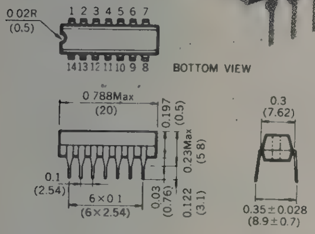
RHT TYPE/BUFFERED

201RHT/Vcc = 5.0 ±0.1V, Ta = +25°C ±2°C

Type No.	Total Delay Time ±5% (ns)	Delay Time per Tap (ns)	Rise Time Tro Max (ns)	No. of taps
2007	20 ±2	4 ±2	3	5
2507	25 ±2	5 ±2	3	5
5007	50	10 ±2	3	5
7507	75	15 ±2	3	5
1006	100	20 ±2	3	5
1506	150	30 ±3	3	5
2006	200	40 ±4	4	5
2506	250	50 ±5	4	5

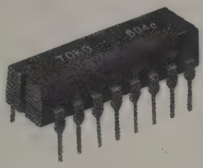
R5ET TYPE
JAT TYPE
PICODELAY™
RET TYPE

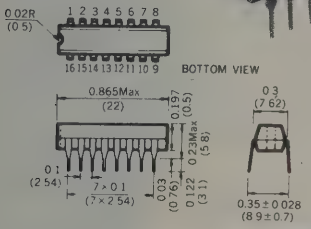



0 02R
(0.5)
1 2 3 4 5 6 7
14 13 12 11 10 9 8
BOTTOM VIEW
0 788Max
(20)
0.197
(0.5)
0.23Max
(5 8)
0.1
(2.54)
6×0 1
(6×2.54)
0.03
(0.76)
0.122
(3.1)
0.3
(7.62)
0.35±0.028
(8.9±0.7)

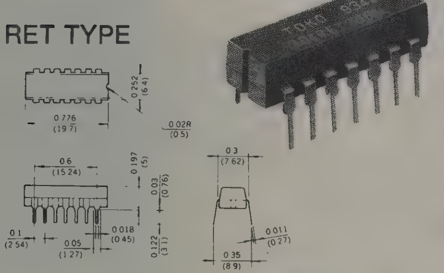
14 PINS DUAL IN LINE

PICODELAY™ R20ET

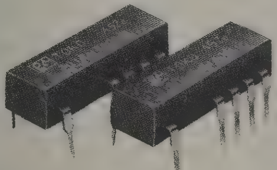



0 02R
(0 5)
1 2 3 4 5 6 7 8
16 15 14 13 12 11 10 9
BOTTOM VIEW
0.865Max
(22)
0.197
(0.5)
0 23Max
(5 8)
0 1
(2 54)
7×0 1
(7×2 54)
0 03
(0 76)
0 122
(3 1)
0 3
(7 62)
0.35±0 028
(8 9±0.7)

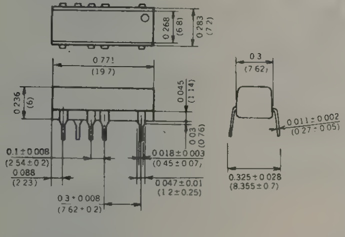
RET TYPE


0 252
(6 4)
0 776
(19 7)
0 02R
(0 5)
0 6
(15 24)
0 197
(5)
0 03
(0 76)
0 1
(2 54)
0 05
(1 27)
0 018
(0 45)
0 122
(3 1)
0 3
(7 62)
0 011
(0 27)
0 35
(8 9)

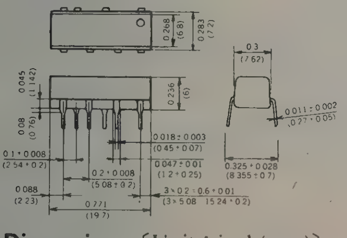
RHT TYPE/ BUFFERED



●L Type


0 268
(6 8)
0 283
(7 2)
0 771
(19 7)
0 236
(6)
0 045
(1 14)
0 03
(0 76)
0.1±0 008
(2 54±0 2)
0 088
(2 23)
0 018±0 003
(0 45±0 07)
0 047±0.01
(1 2±0.25)
0 3+0 008
(7 62+0 2)
0 3
(7 62)
0 011±0 002
(0 27±0 05)
0.325±0 028
(8.355±0 7)

●P Type


0 268
(6 8)
0 283
(7 2)
0 045
(1 142)
0 236
(6)
0 08
(0 76)
0 1+0 008
(2 54+0 2)
0 2+0 008
(5 08±0 2)
0 018±0 003
(0 45+0 07)
0 047±0 01
(1 2+0 25)
0 088
(2 23)
3×0 2=0.6+0 01
(3×5 08 15 24+0 2)
0 771
(19 7)
0 3
(7 62)
0 011±0 002
(0 27+0 05)
0.325+0 028
(8 355±0 7)

Dimensions 〔Unit : inch(mm)〕

TOKO AMERICA INC. / 5520 WEST TOUHY AVENUE / SKOKIE, ILLINOIS 60077
TEL. 312-677-3640 / TELEX 230-724372 (203-724372 TOKO AM SKO) / FACSIMILE-1-312-674-2910 (G III)
CALIF. OFFICE: 10050 N. WOLFE RD. / SWI-297 / CUPERTINO CA 95014 /TEL. 408-996-7575

EMI FILTER
CAPITAL OF THE WORLD

FROM CERAMIC POWDER TO MIL-APPROVED TEST LABS . . . MURATA ERIE HAS IT ALL – 100% IN-HOUSE

Only one company can deliver your total EMI Ceramic Filter needs . . .Murata Erie.

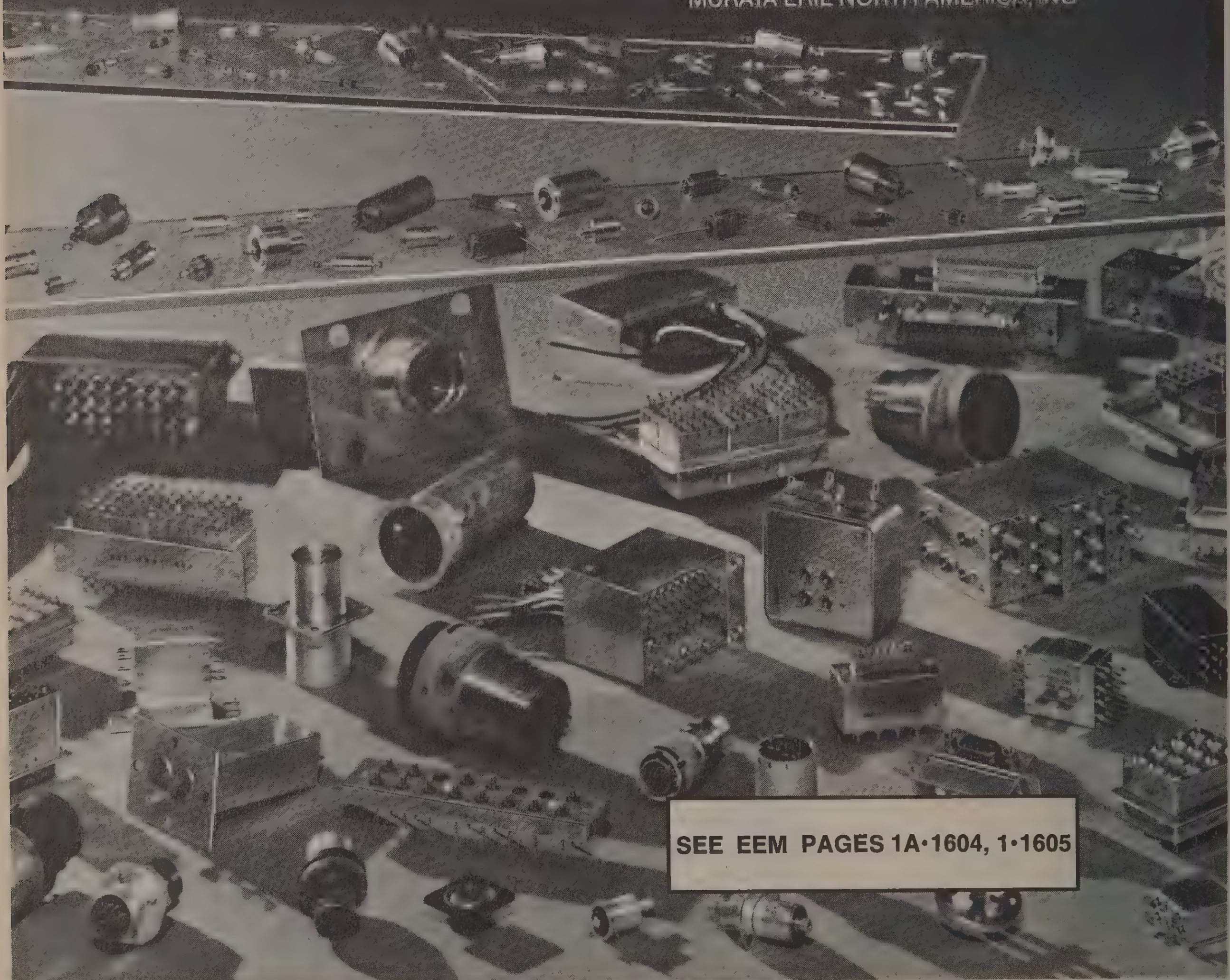
We've been applying sophisticated ceramic and related technologies to developing superior filters for more than 40 years. Today, Murata Erie has, by far, the broadest line of subminiature EMI Filters in the world.

The scope of our product line extends from tiny high frequency filters through AC power line filters specifically designed to meet FCC requirements – filtered connectors and custom filter assemblies . . . all offering the ultimate in quality. With this experience, you receive a unique responsibility, for only Murata Erie builds the complete filter in a plant devoted exclusively to the design and manufacture of EMI Filters.

Whatever your application, we can help you achieve EMC (electromagnetic compatibility).

Write for our complete catalog EMI Filters . . . Murata Erie North America, Inc.,
5 Fraser Avenue, Trenton, Ontario, Canada K8V5S1.
For technical assistance, call 613-392-2581.

muRata ERIE
MURATA ERIE NORTH AMERICA, INC



SEE EEM PAGES 1A•1604, 1•1605

filters-2700

Manufacturer	EEM Page No.	Low Pass	High Pass	Band-pass (Incl. SAW)	Band Reject	AF	IF	RF/ Micro-wave	VHF/ UHF	Active	Digital	Variable (Incl. Prgrmbl.)	LC	EMI/RFI	Video	Equal-izer	Other
Allen Avionics	1A•1578- 1A•1583	●	●	●	●			●	●				●			●	Monitors, Micro-wave; Equalizers, Delay; Linear Phase
AMP Incorporated	1A•1584													●			
A. P. Circuit	1A•1585	●	●	●	●	●				●		●					Hybrid
Chesterfield Products	1A•1586	●	●	●													
Compac	1A•1587	●						●						●			
Comstron Corp.	1A•1588	●		●	●	●	●	●	●	●			●				MIL; Hybrid; Telemetering; Vestigial Sideband; Single Sideband
Corcom	1A•1589													●			
Data Delay Devices	1A•1592	●	●	●	●					●							
Delta Electronic	1A•1590 1A•1591													●			
Electronic Precision Comps.	1A•1593	●	●	●	●	●	●			●			●			●	Telemetering; MIL; Tone
ESC Electronics	1A•1594		●	●	●	●	●	●	●				●				Linear Phase; MIL
Fil-Coil Economy	1A•1595													●			MIL
Filter Concepts	1A•1596 1A•1597													●			Chokes
Frequency Devices	1A•1624	●	●	●	●						●	●					
Hertz Filter	1A•1598	●	●	●				●					●				
Hisonic	1A•1599							●									MIL
JMK Inc.	1A•1600													●			
KR Electronics	1A•1601	●	●	●	●		●	●					●		●	●	Linear Phase
Metuchen Capacitors	1A•1602 1A•1603													●			
Murata Erie	1A•1576 1A•1604 1A•1605													●			MIL; Filtered Connectors
Panel Components	1A•1606- 1A•1610													●			
Piconics	1A•1611	●	●	●	●	●		●	●				●				Linear Phase; Vestigial Sideband; MIL; Coaxial
Potter	1A•1612													●			
Precision Filters	1A•1613- 1A•1617	●	●	●	●					●		●					Linear Phase; Synchronous Tracking
RFI Corp.	1A•1618													●			MIL
RTE Aerovox	1A•1619- 1A•1621													●			
Sawtek	1A•1622 1A•1623			●			●	●									SAW
Spectrum Control	1A•1625- 1A•1627													●			Filtered Connectors
Standex Electronics	1A•1628 1A•1629													●			
TDK Corp.	1A•1630													●			
Toko America	1A•1631					●		●		●	●		●		●		Mechanical; Ceramic
TTE, Inc.	1A•1632- 1A•1641	●	●	●	●	●	●	●	●	●							Telemetering; Linear Phase
TRW Inductive	1A•1642	●	●	●	●												MIL

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: (516) 248-8080 OR (516) 747-5450

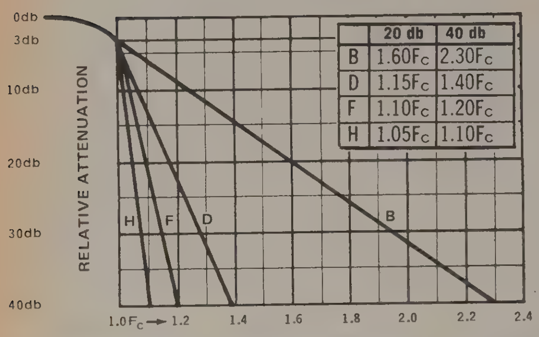
SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

CUSTOM-BUILT LOWPASS & HIGHPASS L-C FILTERS

FAST DELIVERY ON PROTOTYPES

Types: Butterworth, Tchebycheff, Gaussian, Bessel and Elliptic Function.
Frequency Range: 200 Hz to 200 MHz.
Construction: Epoxy encapsulated or sealed in metal can.
The Lowpass and Highpass Filters listed below are typical units that we build. We do manufacture units with shape factors and cut-off frequencies in-between those listed.

LOW PASS FILTERS

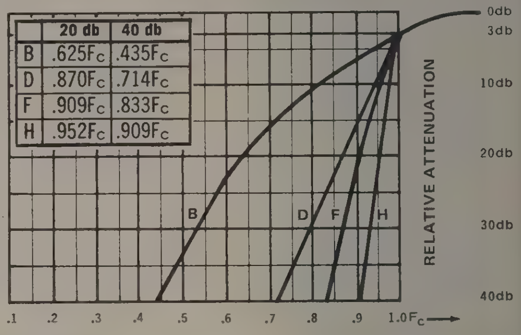


SIZE (INCHES)

Sealed in Metal Can with B.N.C. Connectors:
L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250

Encapsulated in Epoxy Container:
S — 1.25 x .875 x .625
U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

HIGH PASS FILTERS



1 db MAXIMUM RIPPLE — 2 db MAXIMUM INSERTION LOSS

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size
200 Hz	500-1500	B	Z
		D	Z
400 Hz	500-3K	B	Y
		D	Z
1 kHz	500-10K	B	Y
		D	Z
		F	Z
2.5 kHz	500-20K	B	Y
		D	Z
		F	Z
5 kHz	50-20K	B	Y
		D	Z
	150-20K	F	Z
7.5 kHz	50-20K	B	Y
		D	Z
	150-20K	F	Z
10 kHz	50-10K	B	X
		D	Z
	150-10K	F	Z
25 kHz	50-10K	B	X
		D	Z
	150-10K	F	Z
50 kHz	50-10K	B	X
		D	Z
	150-10K	F	Y
		H	Z
75 kHz	50-10K	B	W
		D	Y
	150-10K	F	Y
		H	Z
100 kHz	50-10K	B	W
		D	Y
		F	Y
		H	Z
200 kHz	50-10K	B	U
		D	W
	50-5K	F	Y
		H	Z
300 kHz	50-5K	B	U
		D	W
	50-5K	F	Y
		H	Z
400 kHz	50-5K	B	U
		D	W
		F	Y
		H	Z
500 kHz	50-5K	B	U
		D	W
		F	Y
		H	Z
600 kHz	50-2.5K	B	U
		D	W
	50-2K	F	Y
		H	Z
700 kHz	50-2.5K	B	U
		D	W
	50-2.0K	F	Y
		H	Z
800 kHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	Z
900 kHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	Y
1 MHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	O
2 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
3 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
4 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
5 MHz	50-250	B	S
		D	W
	50-100	F	X
		H	O
6 MHz	50-100	B	S
		D	U
		F	X
		H	O
7 MHz	50-100	B	S
		D	U
		F	M
		H	O
8 MHz	50-100	B	S
		D	U
		F	M
		H	O
9 MHz	50-100	B	S
		D	U
		F	M
		H	N
10 MHz	50-100	B	S
		D	S
		F	M
		H	N
15 MHz	50-100	B	S
		D	S
		F	M
		H	N
20 MHz	50-100	B	S
		D	S
	50	F	M
		H	N
25 MHz	50	B	S
		D	S
		F	M
		H	N
30 MHz	50	B	S
		D	S
		F	M
35 MHz	50	B	L
		D	M
		F	M
40 MHz	50	B	L
		D	M
		F	M
50 MHz	50	B	L
		D	M
		F	N
75 MHz	50	B	M
		D	N
* 100 MHz to 400 MHz	50	B	M

* Lowpass only.

REQUEST THE MOST COMPREHENSIVE L-C FILTERS CATALOG

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

Call/Write for Most Comprehensive L-C Filters Catalog in Industry

Allen Avionics is staffed and organized to provide precision L-C Filters and Delay Lines with fast delivery. Your most difficult engineering problems are solved by our high level engineering staff in conjunction with sophisticated computer programs, enabling rapid filter design determination.

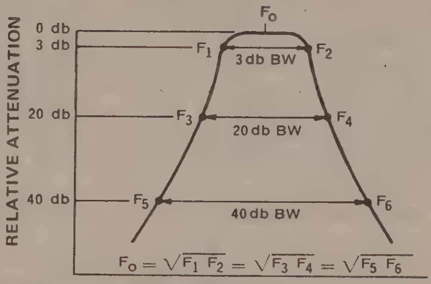
Allen Avionics computer designs are generated for the four basic filter types: Lowpass, Highpass, Bandpass, and Bandstop. These are built-in Butterworth, Tchebycheff, Elliptical, Gaussian, and Bessel functions. All Allen Avionics products are manufactured in the U.S.A.

BANDPASS

FAST DELIVERY ON PROTOTYPES

Types: Butterworth, Tchebycheff, and Elliptic Function.
Frequency Range: 400 Hz to 30 MHz.
Impedance Range: 50 ohms to 10K ohms.
Construction: Epoxy encapsulated or sealed in metal can.
Order any center frequency required. Interpolation between frequencies listed below is valid.

Shape Factor	20 db BW / 3 db BW	40 db BW / 3 db BW
Ao	3.65	7.85
B	1.60	2.50
C	1.45	1.85
E	1.20	1.45



1 db MAXIMUM RIPPLE

SIZE (INCHES)

Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:

M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250
P — 6.00 x 1.500 x 1.250
Q — 7.00 x 1.500 x 1.250
NN — 4.00 x 4.000 x 1.250
OO — 5.00 x 4.000 x 1.250

Encapsulated in Epoxy Container:

V — 1.75 x 1.750 x .875
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Y_1 — 4.00 x 2.000 x 1.250
Z — 4.50 x 2.500 x 1.375

Center Frequency (Fo)	Q Range Fo / 3 db BW	Impedance Range (Ohms)	Shape Factor	Insertion Loss	Size
400 Hz	1-10	1K-10K	Ao	2-8 db	Y_1
1 kHz	1-20	1K-10K	Ao	2-8 db	Y, Y_1
	1-8	1K-10K	B	4-8 db	Z
5 kHz	1-25	500-10K	Ao	1-8 db	X, Y, Y_1
	1-10	500-10K	B	2-8 db	Y_1, Z
	1-5	1K	C	3-8 db	Z
10 kHz	1-50	100-1K	Ao	1-8 db	X, Y, Y_1
	1-25	100-10K	B	2-8 db	Y, Y_1, Z
	1-20	100-500	C	3-8 db	Y_1, Z
	1-5	500	E	4-8 db	Z
25 kHz	1-50	100-10K	Ao	1-8 db	W, X, Y
	1-40	100-5K	B	2-8 db	X, Y, Y_1
	1-25	100-500	C	3-8 db	Y_1, Z
	1-5	100-500	E	4-8 db	Z
50 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-40	100-500	B	2-8 db	X, Y, Y_1
	1-25	100-250	C	3-8 db	Y_1, Z
	1-5	100-500	E	4-8 db	Z
75 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-30	100-500	B	2-8 db	X, Y, Y_1
	1-25	100-250	C	3-8 db	Y_1, Z
	1-6	50-200	E	4-8 db	Z
100 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-35	50-150	B	2-8 db	X, Y, Y_1
	1-25	50-100	C	3-8 db	Y_1, Z
	1-8	50-100	E	4-8 db	Z
200 kHz	1-50	50-5K	Ao	1-7 db	V, W, X
	1-25	50-50K	B	2-7 db	W, X, Y
	1-25	50-100	C	3-7 db	X, Y, Y_1
	1-8	50-100	E	4-7 db	Y_1, Z
300 kHz	1-50	50-5K	Ao	1-7 db	V, W, X
	1-25	50-5K	B	2-7 db	W, X, Y
	1-15	50-100	C	3-7 db	Y, Y_1
	1-6	50-100	E	4-7 db	Z
400 kHz	1-50	50-5K	Ao	1-8 db	V, W, X
	1-25	50-5K	B	2-8 db	W, X, Y
	1-12	50-100	C	3-8 db	Y_1, Z
	1-6	50-100	E	4-8 db	Z
500 kHz	1-50	50-5K	Ao	1-8 db	V, W, X
	10-25	50-5K	B	2-8 db	W, X, Y
	1-12	50-100	C	3-8 db	X, Y, Y_1
	1-5	50-100	E	4-8 db	Y, Z
750 kHz	1-50	50-2K	Ao	1-10 db	W, X, Y
	1-25	50-5K	B	2-8 db	X, Y, Y_1
	1-10	50-2K	C	3-8 db	Y, Y_1
	1-3	50-100	E	4-8 db	Y_1, Z

OUR COMPLETE CATALOG INCLUDES LINEAR PHASE LOWPASS & BANDPASS, BAND REJECT, SHARP CUT-OFF LOWPASS & HIGHPASS & VIDEO FILTERS.

REQUEST CATALOG

Center Frequency (Fo)	Q Range Fo / 3 db BW	Impedance Range (Ohms)	Shape Factor	Insertion Loss	Size
1 MHz	1-50	50-100	Ao	1-10 db	W, X, Y
	1-25	50-100	B	2-8 db	X, Y, N
	1-10	50-100	C	3-8 db	M, N. O
	1-5	50	E	3-8 db	NN
2 MHz	1-50	50-100	Ao	1-10 db	M, N, O
	1-25	50-100	B	2-8 db	N, O, P
	1-10	50-100	C	3-8 db	N, O, P
	1-5	50	E	3-8 db	P, NN
3 MHz	1-50	50-100	Ao	1-10 db	M, N, O
	1-20	50-100	B	2-8 db	N, O, P
	1-10	50-100	C	3-8 db	N, O, P
	1-5	50	E	3-8 db	P, NN
4 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
5 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
7.5 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
10 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-12	50	C	3-8 db	O, P, Q
	1-6	50	E	3-8 db	Q, NN, OO
15 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-8 db	N, O, P
	1-10	50	C	2-6 db	O, P, Q
	1-3	50	E	3-7 db	Q, NN, OO
20 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-6 db	N, O, P
	1-10	50	C	2-6 db	O, P, Q
	1-5	50	E	3-7 db	Q, NN, OO
25 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-6 db	N, O, P
	1-10	50	C	2-6 db	Q, NN
	1-3	50	E	3-7 db	Q, NN, OO
30 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-12	50	B	2-6 db	N, O, P
	1-6	50	C	3-7 db	P, Q, NN
	1-3	50	E	3-7 db	Q, NN, OO

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

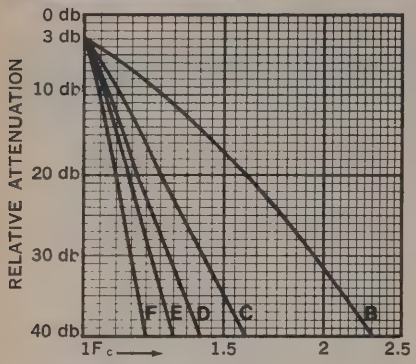
SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

SUB-MINIATURE FILTERS

FROM 5 MHz TO 500 MHz • PASSIVE L-C FILTER DESIGN

LOW PASS FILTERS

50 OHMS — ½db MAX. RIPPLE — ½db MAX. INSERTION LOSS



Shape Factor (See Graph)	20db	40db	Size
B	1.60	2.30	SA
C	1.25	1.60	SA
D	1.15	1.40	SB
E	1.14	1.30	SB
F	1.10	1.20	SC

FEATURING:
- Small size, lightweight.
- Low insertion loss — ½db Max.
- .5db Maximum Ripple.
- SMA Connectors standard.
- Order any cut-off frequency from 5 to 500 MHz.
- Good temperature stability.

ORDERING PROCEDURE:

Filter Type	Cut-Off Frequency	Shape Factor B, C, D, E, F (See Graph)	S (for SMA Connectors) *P (for Printed Circuit Mtg.)

EXAMPLES: ML — 500P — B — S
ML — 5P55 — D — P

Cut-off frequency can be any 3 digit number from 5 to 500 MHz. "P" represents decimal point and must be used in 2nd, 3rd or 4th location.

Examples: 5P55 = 5.55 MHz
58P7 = 58.7 MHz
500P = 500 MHz

* PC Mounting optional for cut-off frequencies of 100 MHz or less.

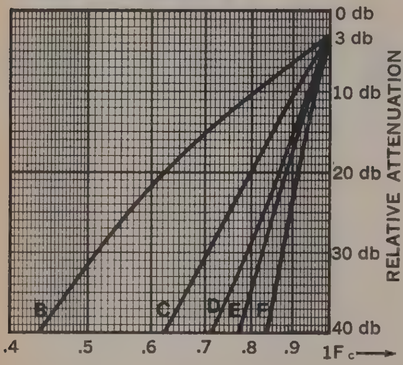
SIZE (INCHES)

Units normally supplied in metal cans with SMA Connectors on each end (.5″ x .5″).

SA — .80 x .50 x .50
SB — 1.00 x .50 x .50
SC — 1.25 x .50 x .50

HIGH PASS FILTERS

50 OHMS — 1db MAX. RIPPLE — 1db MAX. INSERTION LOSS



Shape Factor (See Graph)	20db	40db	Size
B	.625	.435	SA
C	.800	.625	SA
D	.870	.714	SB
E	.877	.769	SB
F	.909	.833	SC

FEATURING:
- Small size, lightweight.
- Low insertion loss — 1db Max.
- 1db Maximum Ripple.
- SMA Connectors standard.
- Order any cut-off frequency from 5 to 500 MHz.
- Good temperature stability.

ORDERING PROCEDURE:

Filter Type	Cut-Off Frequency	Shape Factor B, C, D, E, F (See Graph)	S (for SMA Connectors) *P (for Printed Circuit Mtg.)

EXAMPLES: MH — 500P — E — P
MH — 58P7 — F — S

Cut-off frequency can be any 3 digit number from 5 to 500 MHz. "P" represents decimal point and must be used in 2nd, 3rd or 4th location.

Examples: 5P55 = 5.55 MHz
58P7 = 58.7 MHz
500P = 500 MHz

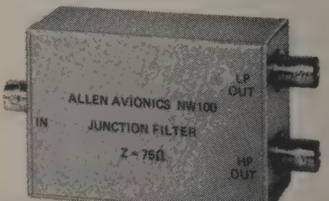
* PC Mounting optional for cut-off frequencies of 50 MHz or less.

NETWORKS

RANDOM NOISE MEASUREMENT NETWORKS (EIA STANDARD RS-250B)

Most of the video industry has found a need for passive networks designed for use in making noise measurements in a 75 ohm system. Allen Avionics now manufactures three passive networks for noise measurement. They include:

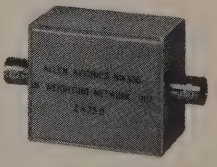
1) A Junction Filter to cut-off all frequencies below 10 KHz
2) A Lowpass Filter to cut-off all frequencies above 5 MHz
3) A Weighting Network to shape the passband



IMPEDANCE 75 OHMS

Part No.	Description	Size
NW100	Junction Filter	3″ x 2″ x 1¼″
NW200	5 MHz Lowpass Filter	3″ x 1⅝″ x 1⅛″
NW300	Weighting Network	2″ x 1⅝″ x 1⅛″

UNITS SUPPLIED IN METAL CANS WITH BNC CONNECTORS



ALLEN AVIONICS NW200
IN
LOWPASS FILTER
OUT
FC=5.0 MHZ
Z=75Ω

PRE-EMPHASIS & DE-EMPHASIS WAVE SHAPING NETWORKS

Pre-emphasis networks are used preceding the FM modulator in order to optimize the TV transmission.

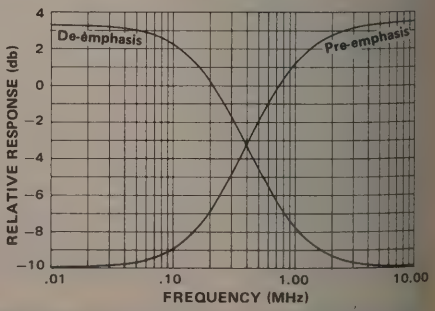
De-emphasis follows the demodulator and serves to restore the wave shape of the demodulated signal.

IMPEDANCE 75 OHMS

Part No.	Description	Size
NW400	Pre-emphasis	2″ x 1⅝″ x 1⅛″
NW500	De-emphasis	2″ x 1⅝″ x 1⅛″

UNITS SUPPLIED IN METAL CANS WITH BNC CONNECTORS

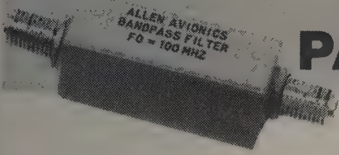
ALLEN AVIONICS NW500
DE-EMPHASIS NETWORK OUT
Z=75Ω

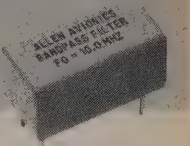


ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

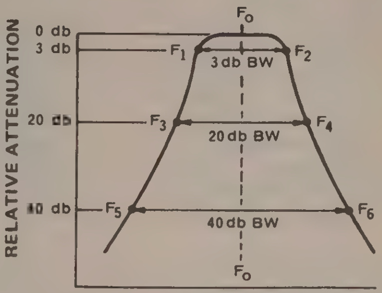
SUB-MINIATURE BANDPASS FILTERS
FROM 10MHz to 500MHz
PASSIVE L-C FILTER DESIGN





50 Ohms—1db Maximum Ripple

All of our filters are specified as having a minimum bandwidth at the −3db points and a maximum bandwidth at the −20 and −40db points. These filters are no exception. Most of the bandpass filters on this page do not exhibit arithmetic or geometric symmetry. However, to insure our customers of a simple method of determining their requirements, we are specifying the −3db, −20db and −40db bandwidths as if all had arithmetic symmetry. This will guarantee that at least ½ of the 3db passband will exist on each side of the center frequency. The −20db and −40db points will be no greater than ± ½ of their respective bandwidth away from the center frequency.



F_1 to F_o and F_o to F_2 > ½ 3db bandwidth
F_3 to F_o and F_o to F_4 < ½ 20db bandwidth
F_5 to F_o and F_o to F_6 < ½ 40db bandwidth

ORDERING PROCEDURE

Filter Type	Center Frequency (F_o)	3db Bandwidth $(F_c)=\frac{F_o}{Q}$	Shape Factor (See Table)	S (for SMA Connectors)
	Can be any 3 digit number from 10 to 500MHz. "P" represents decimal point and must be used in 2nd, 3rd or 4th location.	Can be any 3 digit number up to 125MHz (a center frequency of 500MHz with a Q of 4). "P" represents decimal point & must be used in one of the 4 locations. The specified bandwidth must be within the limits of the tabulated Q. (See examples below.)		*P (for Printed Circuit Mtg.)

EXAMPLE: MB – 99P5 – 4P50 – A – S

This Part No. describes a bandpass filter having its center frequency at 99.5MHz and having a 3db bandwidth of 4.50MHz with an "A" shape factor and SMA Connectors. Note in tabulation below that for a center frequency of 100MHz, and a shape factor of "A", a Q of up to 30 is realizable.

EXAMPLE: MB – 10P0 – P200 – A – S

This Part No. describes a bandpass filter having its center frequency at 10.0MHz and having a 3db bandwidth of .200MHz with an "A" shape factor and SMA Connectors. Note in tabulation below that for a center frequency of 10MHz, and a shape factor of "A", a Q of 50 is realizable.

*PC Mounting optional for center frequencies of 100MHz or less.

Shape Factor	20db / 3db	40db / 3db
A	3.6	8.0
B	2.6	4.8
C	2.3	3.4
D	2.0	2.6

SIZE (INCHES)

Units normally supplied in metal cans with SMA Connectors on each end (.5" x .5").

SA – .80 x .50 x .50
SB – 1.00 x .50 x .50
SC – 1.25 x .50 x .50

Center Frequency (Fo)	Q Range Fo / 3db BW	Shape Factor	Insertion Loss (db)	Size
10MHz	10-25	A	3-8	SA
	25-50	A	7-15	SA
	8-25	B	4-9	SB
	25-35	B	8-15	SB
	6-15	C	3-7	SB
	15-30	C	6-13	SB
	4-10	D	2-7	SC
	10-15	D	6-12	SC
25MHz	10-25	A	3-8	SA
	25-50	A	7-15	SA
	8-25	B	4-9	SB
	25-35	B	8-15	SB
	6-15	C	3-7	SB
	15-30	C	6-13	SB
	4-10	D	2-7	SC
	10-15	D	6-12	SC
50MHz	10-25	A	4-8	SA
	25-45	A	7-15	SA
	8-25	B	5-9	SB
	25-30	B	8-15	SB
	6-15	C	3-7	SB
	15-25	C	6-13	SB
	4-10	D	3-8	SC
	10-15	D	6-12	SC

Center Frequency (Fo)	Q Range Fo / 3db BW	Shape Factor	Insertion Loss (db)	Size
75MHz	10-25	A	4-8	SA
	25-40	A	7-15	SA
	8-15	B	5-9	SB
	15-25	B	8-13	SB
	6-15	C	4-7	SB
	15-20	C	6-12	SC
	4-10	D	3-8	SC
	10-15	D	6-12	SC
100MHz	10-25	A	4-8	SA
	25-30	A	7-13	SA
	8-15	B	5-9	SB
	15-22	B	8-13	SB
	6-10	C	4-6	SB
	10-15	C	5-10	SC
	4-10	D	4-8	SC
	10-15	D	6-12	SC
150MHz	10-15	A	4-8	SA
	15-25	A	7-13	SA
	8-15	B	5-9	SB
	15-20	B	8-13	SB
	6-10	C	4-6	SB
	10-15	C	5-10	SC
	4-10	D	4-8	SC
	10-15	D	6-12	SC

Center Frequency (Fo)	Q Range Fo / 3db BW	Shape Factor	Insertion Loss (db)	Size
200MHz	10-15	A	4-8	SA
	15-20	A	7-12	SA
	8-12	B	5-9	SB
	12-15	B	8-13	SB
	6-10	C	4-6	SB
	10-13	C	5-10	SB
	4-10	D	4-8	SC
	10-13	D	6-12	SC
250MHz	10-15	A	4-8	SA
	15-20	A	7-12	SA
	8-12	B	5-9	SB
	12-15	B	8-13	SB
	6-10	C	4-6	SB
	10-12	C	5-10	SB
	4-10	D	4-8	SC
	10-12	D	6-12	SC
300MHz to 500MHz	10-15	A	4-8	SA
	8-12	B	5-9	SB
	12-15	B	8-13	SB
	6-10	C	4-6	SB
	10-12	C	5-10	SB
	4-10	D	4-8	SC
	10-12	D	6-12	SC

ALLEN AVIONICS, INC.
224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

CUSTOM-BUILT L-C FILTERS LINEAR PHASE LOWPASS

LINEAR PHASE LOWPASS FILTERS

Types:
Bessel, Gaussian, Equal Phase Ripple and Transitional (Gaussian to 6 db).

Frequency Range:
400Hz to 50MHz.

Impedance Range:
50 ohms to 20K ohms.

Low Delay and Phase Distortion in Passband.

Very Low Pulse Distortion (Low Overshoot).

Construction:
Epoxy encapsulated or sealed in metal can.

DELIVERY: PROTOTYPES CAN OFTEN BE DELIVERED IN LESS THAN 7 DAYS

The lowpass filters listed below are typical units that we build. We do manufacture linear phase lowpass filters with any cut-off frequency between 1KHz and 50MHz.

SIZE (INCHES)

Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:

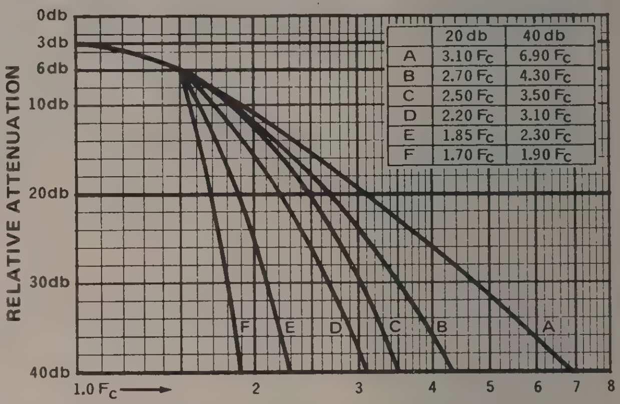
K — 1.50 x 1.000 x .800
L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250

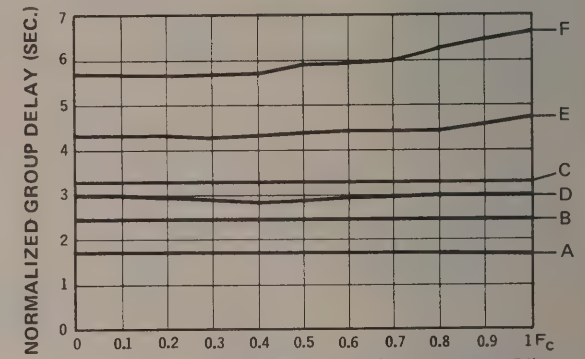
Encapsulated in Epoxy Container:

U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

The graph at right illustrates ideal delay characteristics.
Consult table below for typical realizable values.

Shape Factor	Max. Phase Distortion	Maximum Overshoot	Typical Delay Variation
A	±2°	1.5%	3%
B	±2°	1.5%	3%
C	±2°	1.5%	3%
D	±3°	3%	8%
E	±7°	6%	13%
F	±12°	9%	17%





$$\text{GROUP DELAY} = \frac{\text{NORMALIZED (GROUP DELAY)}}{2\pi F_c\ (\text{Hz})}$$

½ db MAXIMUM RIPPLE — 1 db MAXIMUM INSERTION LOSS

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size Range
1KHz	500-10K	A	X
	500-10K	B	Y, Z
	500-10K	C	Z
	500-10K	D	Y
	500-10K	E	Y, Z
	500-10K	F	Z
5KHz	50-20K	A	X
	50-20K	B	Y, Z
	50-15K	C	Y, Z
	50-20K	D	Y
	50-20K	E	Y, Z
	50-10K	F	Z
10KHz	50-10K	A	W, X
	50-10K	B	X, Y
	50-10K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X, Y
	50-10K	F	Y, Z
50KHz	50-10K	A	W, X
	50-10K	B	X
	50-5K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X, Y
	50-10K	F	X, Y
100KHz	50-10K	A	U, W
	50-5K	B	W, X
	50-5K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X
	50-10K	F	X, Y

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size Range
500KHz	50-3K	A	U, W
	50-3K	B	W
	50-1K	C	W, X
	50-5K	D	W
	50-5K	E	W, X
	50-5K	F	X, Y
750KHz	50-2.5K	A	U, W
	50-2.5K	B	W, X
	50-1K	C	X, Y
	50-5K	D	U, W
	50-5K	E	W, X
	50-5K	F	X
1MHz	50-500	A	L
	50-500	B	M
	50-500	C	M
	50-500	D	W
	50-500	E	W, X
	50-500	F	X
2MHz	50-500	A	L
	50-500	B	M
	50-500	C	M
	50-500	D	W
	50-500	E	W, X
	50-500	F	W, X
5MHz	50-500	A	L
	50-500	B	M
	50-200	C	M
	50-500	D	L
	50-500	E	M
	50-500	F	M

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size Range
7.5MHz	50-500	A	K
	50-250	B	L
	50-100	C	M
	50-500	D	L
	50-500	E	M
	50-500	F	M
10MHz	50-100	A	K
	50-100	B	L
	50-100	C	M
	50-100	D	L
	50-100	E	M
	50-100	F	M
20MHz	50-100	A	K
	50-100	B	L
	50-100	D	L
	50-100	E	M
	50-100	F	N
30MHz	50-100	A	K
	50-100	B	L
	50-100	D	L
	50-100	E	M
	50-100	F	N
40MHz	50	A	K
	50	B	L
	50	D	L
	50	E	M
	50	F	M
50MHz	50	A	K
	50	D	L
	50	E	M
	50	F	M

SHARP DELAY EQUALIZED LOWPASS FILTERS

By the utilization of delay equalization techniques, Allen Avionics now designs and manufactures a complete line of sharper cut-off, flat delay lowpass filters than shown above. We offer these with 40db to 3db ratios as small as 1.22 and delay distortion of less than 10%.

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

VIDEO FILTERS

DELAY EQUALIZED NTSC LOWPASS FILTERS — VFL, MVFL & VCL SERIES

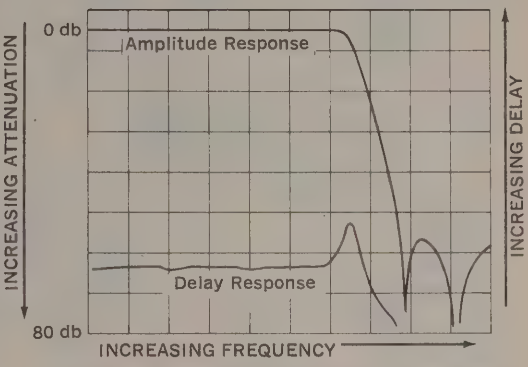
For the video field, we have built many lowpass filters having sharp roll-offs and good passband delay linearity with cut-off frequencies from .1 MHz to 10 MHz. The most popular of these are used to attenuate the harmonics of the NTSC color sub-carrier frequency 3.58 MHz. The most commonly used filters in this group are tabulated below:

VFL & MVFL SERIES — IMPEDANCE = 75 OHMS

Standard Size Max. Insertion Loss 1 db Part No.	Miniature Size Max. Insertion Loss 2db Part No.	Max. .25 db Attenuation @ Frequency (MHz)	Max. 3 db Attenuation @ Frequency (MHz)	Min. 45 db Attenuation @ Frequency (MHz)	Approximate Passband Delay (Nanoseconds)
VFL1P7	MVFL1P7	1.75	1.92	2.41	1691
VFL2P2	MVFL2P2	2.25	2.45	3.10	1325
VFL2P7	MVFL2P7	2.75	3.00	3.77	1082
VFL3P2	MVFL3P2	3.20	3.50	4.40	928
VFL3P5	MVFL3P5	3.50	3.84	4.82	846
VFL3P8	MVFL3P8	3.80	4.16	5.22	781
VFL4P0	MVFL4P0	4.00	4.38	5.51	741
VFL4P5	MVFL4P5	4.50	4.93	6.19	659
VFL5P2	MVFL5P2	5.20	5.70	7.16	570
VFL6P0	MVFL6P0	6.00	6.58	8.27	494
VFL6P5	MVFL6P5	6.50	7.12	8.95	457

Max. Delay Variation=±3% to −.25 db Freq. Max. Passband Ripple=±.25 db.
VFL Size: 4″ x 2″ x 1¼″ in metal can with BNC Connectors.
MVFL Size: 3″ x 1⅝″ x ½″ in metal can with terminals for PC mounting.

DELIVERY FROM STOCK

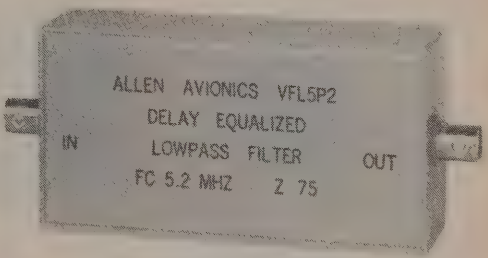


TYPICAL AMPLITUDE & DELAY RESPONSE OF VFL & MVFL SERIES

VCL SERIES — IMPEDANCE = 75 OHMS

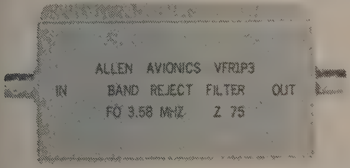
Part No.	Maximum ±3% Delay Distortion to Frequency (MHz)	Maximum .25 db Attenuation @ Frequency (MHz)	Minimum 45 db Attenuation @ Frequency (MHz)	Approximate Passband Delay (Nanoseconds)
VCL3P2	2.7	3.2	3.63	1100
VCL3P5	2.9	3.5	3.97	1010
VCL3P8	3.2	3.8	4.31	930
VCL4P2	3.5	4.2	4.76	840
VCL4P5	3.8	4.5	5.10	780
VCL4P9	4.1	4.9	5.56	720
VCL5P2	4.4	5.2	5.90	680
VCL5P7	4.8	5.7	6.46	620

Max. Insertion Loss @ 100 KHz=2.5 db. Max. Passband Ripple=±.25 db.
Size: 6″ x 2″ x 1¼″ in metal can with BNC Connectors.



NTSC REJECT FILTERS

Some of the most frequent specifications that we encounter in the video industry are based upon rejection of the color information in the video signal to provide isolation from the luminance signal. These specifications require very low phase distortion to the luminance signal. To satisfy this requirement, Allen Avionics has designed a group of band reject filters with phase equalization where necessary. One of the most often used applications for this band reject filter is in color systems for monochrome transmission to prevent color flashes from appearing on the screen. Since various segments of the television industry have different passband requirements, we are listing three filters with different reject bandwidths.



Impedance = 75 ohms.
Maximum Insertion Loss @ 100 KHz = 3 db.
Maximum Passband Ripple to 5.5 MHz = ±.25 db.

Part No.	Maximum 3 db Attenuation @ Frequency (MHz)	Minimum Attenuation @ 3.58 MHz
VFR4P6	1.95 — 6.55	40 db
VFR1P3	3.00 — 4.30	40 db
VFR0P5	3.37 — 3.88	30 db

Size: 4″ x 2″ x 1¼″ in metal can with BNC Connectors.

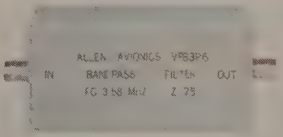
NTSC BANDWIDTH FILTER

Allen Avionics sub-carrier bandpass filter is a low distortion unit designed to attenuate the luminance information in color TV signals. This filter is useful in most applications where it is required to isolate the chrominance information.

Impedance = 75 ohms.
Maximum Insertion Loss @ 3.58 MHz = 1.5 db.
Maximum Ripple = ±.25 db.

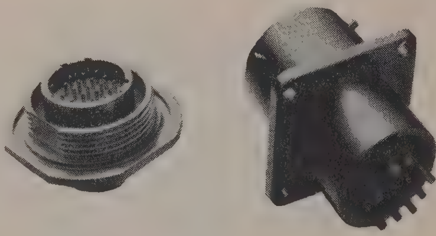
Part No.	Maximum 3 db Attenuation @ Frequency (MHz)	Minimum 30 db Attenuation @ Frequency (MHz)
VFB3P6	3.40 — 3.70	2.40 — 5.80

Size: 4″ x 2″ x 1¼″ in metal can with BNC Connectors.



COMPLETE LINE OF GAUSSIAN LOWPASS FILTERS AVAILABLE — REQUEST VIDEO CATALOG

AMP Makes the Difference in Filters



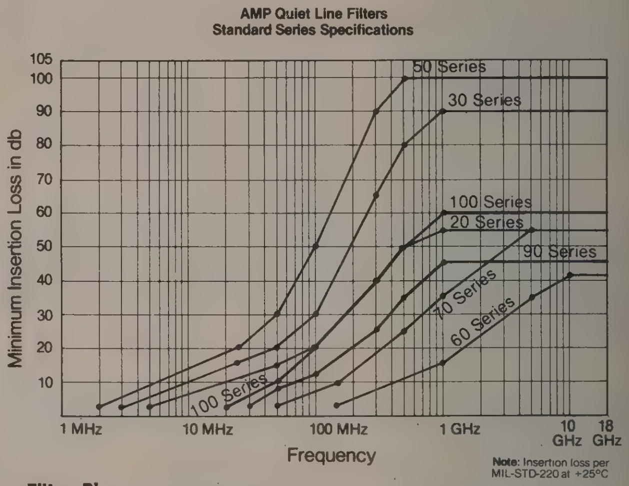
All the above connectors are available in filtered version.

Proven, Inexpensive Filtering. AMP Quiet Line Filters provide proven, inexpensive filtering of conducted electro-magnetic interference (EMI) and general system noise. Available as loose pieces or as components of preassembled connectors, AMP Quiet Line Filters are divided into Standard and Premium groups. Standard series filters are appropriate for most commercial applications. Generally, Premium series filters offer higher operating voltage maximums, withstand higher operating temperatures and provide higher dielectric withstanding voltage and insulation resistance. Also, Premium series filters are subjected to environmental testing typical of components for military applications.

Standard and Premium filter groups are divided as follows: Within the Standard group there are three series having normal capacitance (20, 30 and 50 series having 1000, 2000 and 3000 picofarads min., respectively). Within the Premium group there are three series having normal capacitance (20P, 30P and 50P series having 1500, 3000 and 4000 picofarads min., respectively).

Standard mid-capacitance filters are divided into two series: The 90 series having 600 picofarads max. and the 100 series having 1000 picofarads max.

Standard low capacitance filters are divided into two series: The 60 series having 175 picofarads max., and 70 series having 400 picofarads max.



AMP Quiet Line Filters
Standard Series Specifications

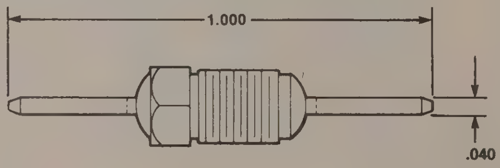
Note: Insertion loss per MIL-STD-220 at +25°C

Filter Pins

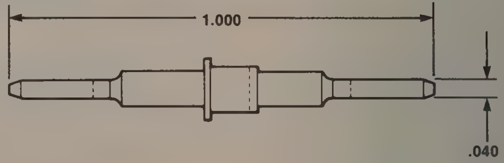
Style	"20" Series Part No.	"30" Series Part No.	"50" Series Part No.	"60" Series Part No.	"70" Series Part No.
Bolt (8-32)	859619-1	859618-1	859617-1	859659-1	859658-1
Bolt (12-32)	—	859645-1	859646-1	—	859681-1
Eyelet	859616-1	859615-1	859614-1	859656-1	859655-1
Pin/Sleeve	859613-1	859612-1	859611-1	859653-1	859652-1

"30" Series Filters
(Shown as typical)

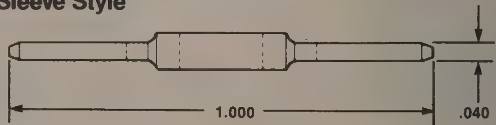
Bolt Style
(8-32 Thread Size)



Eyelet Style



Pin-Sleeve Style



Request Catalog No. 78-487 and 80-565 for complete listing

Need more details? Call AMP Customer Service at (717) 780-4400,
or write AMP Incorporated, Harrisburg, PA 17105.

Specifications subject to change. Consult AMP Incorporated for latest design specifications.

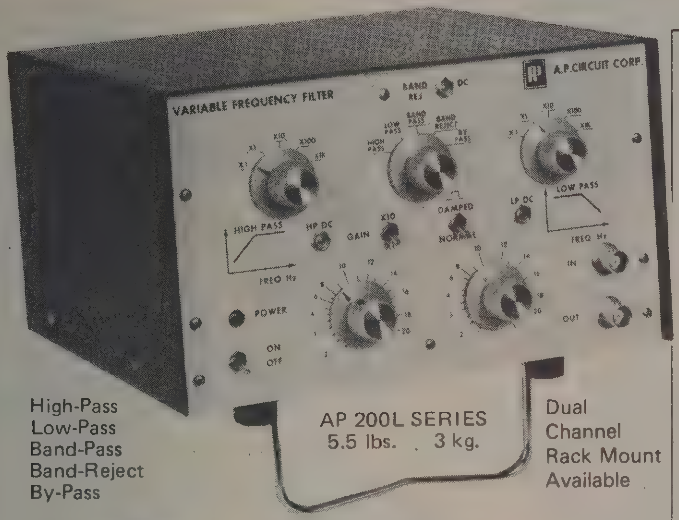
AMP — Trademark of AMP Incorporated

AMP
INCORPORATED

Active Electronic Filters

Instruments and custom-built modules. Expert assistance in filter selection. Fast prototype service.

NEW! HYBRID CONSTRUCTION PROGRAMMABLE FILTERS



High-Pass
Low-Pass
Band-Pass
Band-Reject
By-Pass

AP 200L SERIES
5.5 lbs. 3 kg.

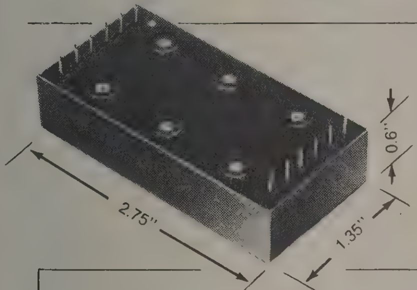
Dual
Channel
Rack Mount
Available

VARIABLE FREQUENCY INSTRUMENTS FEATURE:

- Low Noise (50 micro Volt RMS)
- High Input, Low Output impedance
- 0 dB insertion loss or +20 dB Preamplifier
- 24 dB / octave slope
- Frequency range 0.01 Hz to 5 MHz
- Portable battery operated option

Partial List of Models	FUNCTION				Tuning Range	
	Low Pass	High Pass	Band Pass	Band Reject		
APVL-43-5	✓				0.02Hz–2KHz	A
APVL-44-5	✓				0.2Hz–20KHz	A
APVL-45-5	✓				2.0Hz–200KHz	A
APVH-43-5		✓			0.02Hz–2KHz	A
APVH-44-5		✓			0.2Hz–20KHz	A
AP255-5	✓	✓	✓	✓	0.2Hz–20KHz	B
AP260-5	✓	✓	✓	✓	0.1Hz–10KHz	B
AP265-5	✓	✓	✓	✓	0.02Hz–2KHz	B
AP280-5	✓	✓	✓	✓	2.0Hz–200KHz	B
AP220-5	✓	✓	✓	✓	20Hz–2MHz	B
AP 301			✓		0.1–10KHz	B
AP 401			✓	✓	0.1–10KHz	B

A: Rack mounted option - 4 channel std.
B: Rack mounted option - 2 channel std.



6 pole
Band Pass
Band Reject
with trimming
potentiometers
for fine tuning

FILTER MODULES

FIXED FREQUENCIES • EXTERNALLY TUNEABLE
DUAL IN LINE CONSTRUCTION

Feature Low Noise, High Input, Low Output Impedance. O insertion Loss.

- Low-Pass
- High-Pass
- Band-Pass
- Band Reject

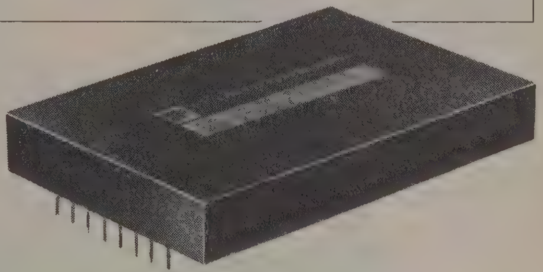
STD. FREQUENCIES:
0.01 Hz—500 KHz
4 pole 24 dB/octave or
6 pole 36 dB/octave or
8 pole 48 dB/octave

High Q Band reject including 60 Hz noise elimination filter.

Signal conditioning units assembled to customer specifications.

Ultra low power options available

For a complete catalog and additional information write to Dept. P.



Programmable Filters

Model AP-DP-8S-5P

Cut off Frequency	Bit 3	Bit 2	Bit 1
f_0	0	0	0
$2f_0$	0	0	1
$4f_0$	0	1	0
$8f_0$	0	1	1
$16f_0$	1	0	0
$32f_0$	1	0	1
$64f_0$	1	1	0
$128f_0$	1	1	1

Voltage Tunable Filters*

MODEL AP-6VC

6 Pole Voltage-Controlled

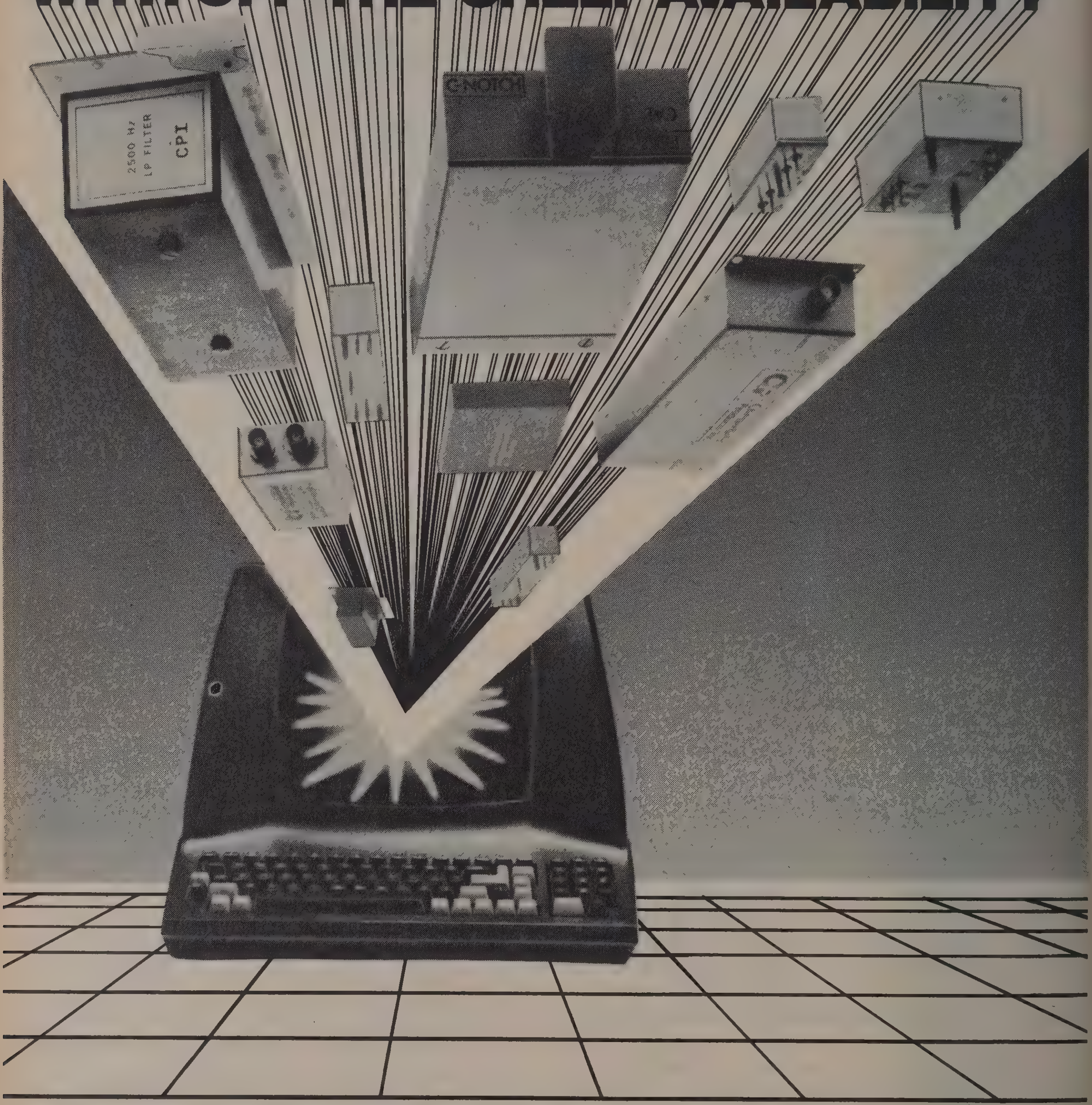
- Low-Pass
- High-Pass
- Band-Pass
- Band-Reject

**Particularly useful as Antialiasing Filters*

A. P. CIRCUIT CORPORATION

513 EAST 86th STREET, NEW YORK, N.Y. 10028
TEL: 212 / 737-1348

CUSTOM LC FILTERS, WITH OFF-THE-SHELF AVAILABILITY



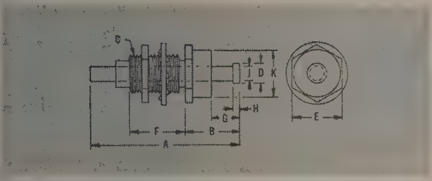
LOW PASS, HIGH PASS, BAND PASS, BAND STOP, EQUALIZERS, WEIGHTING, ROOFING, C-NOTCH, C-MESSAGE AND JUNCTION FILTERS.

CP Chesterfield Products/inc.

THE LEADER IN LC FILTERS
37 Midland Avenue, Elmwood Park, NJ 07407
Telephone: 201/797-9655

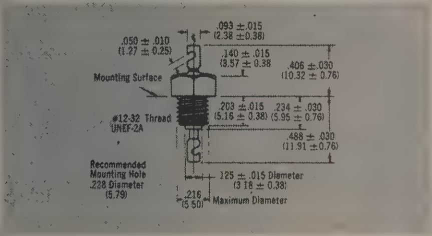
COMPAC™

FILTERS & FEED-THRUS



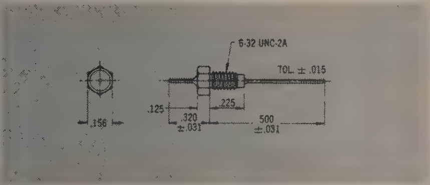
PLAIN TEFLON FEED-THRU

PART NO.	DIMENSIONS									
	A	B	C	D	E	F	G	H	J	K
100-1001	0.690	0.287	12-28 UNF-2A	0.082	0.250	0.225	0.163	0.031	0.062	0.188


.093 ± .015
(2.38 ± 0.38)
.050 ± .010
(1.27 ± 0.25)
.140 ± .015
(3.57 ± 0.38
.406 ± .030
(10.32 ± 0.76)
Mounting Surface
.203 ± .015
(5.16 ± 0.38)
.234 ± .030
(5.95 ± 0.76)
#12-32 Thread
UNEF-2A
.488 ± .030
(11.91 ± 0.76)
Recommended
Mounting Hole
.228 Diameter
(5.79)
.125 ± .015 Diameter
(3.18 ± 0.38)
.216
(5.50)
Maximum Diameter

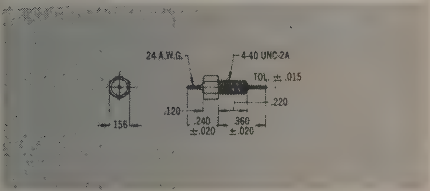
PART NO.	DIMENSIONS									
	A	B	C	D	E	F	G	H	J	K
100-1002	.874	0.406	12-32 UNF-2A	0.093	0.312	0.234	—	0.031	—	—

Capacitance 1000 pF

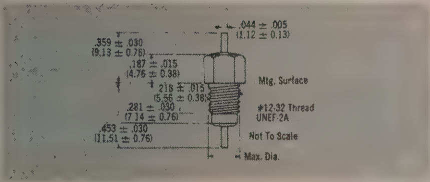

6-32 UNC-2A
TOL. ± .015
.125
.225
.156
.320
±.031
.500
±.031

RFI/EMI SUPPRESSION FILTERS

PART NO.	RATED IDC	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1003	3 Amps	200 VDC	100 VDC	.01	.001 MFD	—	3	40	50	70	70
100-1004	10 Amps	200 VDC	100 VDC	.01	.022 MFD	10	28	50	60	60	60


24 A.W.G.
4-40 UNC-2A
TOL. ± .015
.220
.120
.156
.240
±.020
.360
±.020

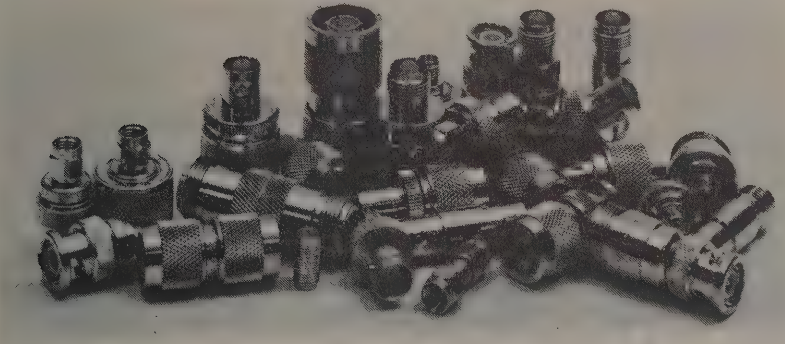
PART NO.	RATED IDC	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1005	10 Amps	200 VDC	100 VDC	.01	.0015 MFD	—	5	42	60	65	65
100-1006	10 Amps	200 VDC	100 VDC	.01	.022 MFD	20	30	50	55	65	65


.044 ± .005
(1.12 ± 0.13)
.359 ± .030
(9.13 ± 0.76)
.187 ± .015
(4.76 ± 0.38)
.218 ± .015
(5.56 ± 0.38)
Mtg. Surface
.281 ± .030
(7.14 ± 0.76)
#12-32 Thread
UNEF-2A
.453 ± .030
(11.51 ± 0.76)
Not To Scale
Max. Dia.

HIGH FREQUENCY LOWPASS FEED-THRU FILTERS

PART NO.	RATED IDC	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1007	10 Amps	200 VDC	100 VDC	—	5500 pf	—	10	50	70	70	70

ADAPTERS



SIMPLIFIED ADAPTER PART NUMBERS
SELECT CONNECTOR TYPE

N = N
TNC = T
BNC = B
BULKHEAD = Prefix with B
RIGHT ANGLE = Prefix with R
PANEL = Prefix with P
SMA = S
SMB = SMB
SMC = SMC
FEMALE = F
MALE = M

EXAMPLES:	PART NO.
N (male) to SMA (female)	NM-SF
TNC (female) to SMA (female)	TF-SM
BNC (male) to BNC (female)	BM-BF
SMB (male) to SMC (female)	SMBM-SMCF

COMPAC
279 SKIDMORE ROAD
DEER PARK, NEW YORK 11729
TELEPHONE 516/667-3933
TWX 510-227-1064

comstron corporation

TECHNOLOGY "+" FILTERS

The Extra Edge in Systems Performance DC to 1 GHz

Comstron has developed optimum frequency or time domain filters to produce near theoretical system performance. These technology + filters are available as catalog items or custom tailored to your needs.

Design

Comstron has implemented modern network synthesis and physical realization techniques to the point where highly reliable, compact, LC and crystal filters are available – quickly and economically. Proprietary computer analysis, modeling, and optimization programs efficiently arrive at near-optium solutions to spectral, time domain, and stochastic problems. The Company's Enhanced Synthesis Program (ESP), Filter Optimization Program (FOP) and Parameter Optimization Program (POP) provide design parameters for systems oriented functions. Requirements for group delay equalization, wide band arithmetic symmetry, x/sin x amplitude correction, corrected Nyquist filters, phase compensation, and time domain response designs are routinely and efficiently handled.

Test

The Company's commitment to excellence is evident in its extensive test facilities. Automatic computer based network analyzers cover the frequency range from dc to 1.3 GHz with full plotting and printer output capability. Parameters which are automatically measured include amplitude response, phase response, group delay, and return loss. Time domain testing can also be performed to verify impulse response or response to complex waveforms.

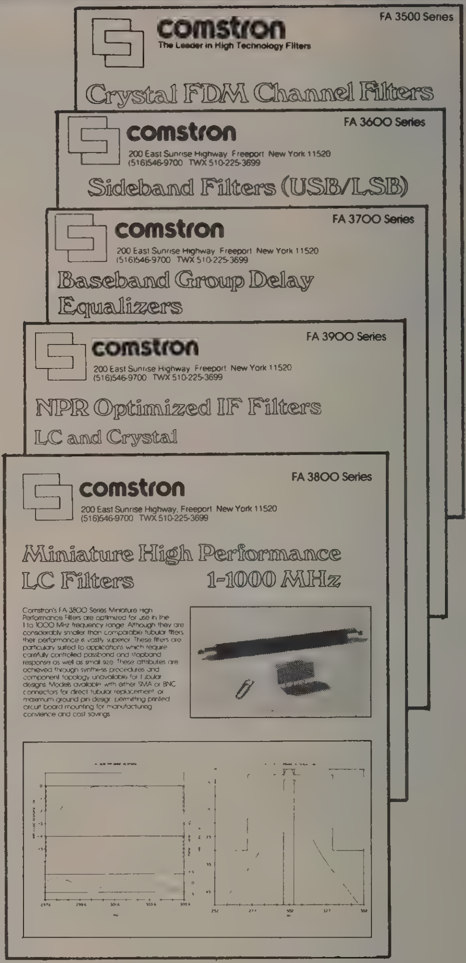
Computer directed environmental testing allows unattended measurements of performance over temperature on a production basis. Comstron's proprietary Automatic Filter Test (AFT) programs permits rapid and accurate generation of acceptance test procedures as well as full documentation and data files when required.

Quality Control

Comstron maintains a Quality Control Department that ensures compliance with MIL-I-45208A and MIL-Q-9858A when applicable. Microscopic inspection, controlled environment, material control and traceability, solder training programs, and strict configuration management all contribute to producing an exceptionally reliable product.

The quality control program is continuously monitored. Over the years since its inception, Comstron has assembled a dedicated, conscientious staff whose pride of workmanship and customer loyalty is the keynote of the Company.

Send for our complete Data Sheets.



comstron
The Leader in High Technology Filters
FA 3500 Series
Crystal FDM Channel Filters

comstron
200 East Sunrise Highway Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3600 Series
Sideband Filters (USB/LSB)

comstron
200 East Sunrise Highway Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3700 Series
Baseband Group Delay Equalizers

comstron
200 East Sunrise Highway Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3900 Series
NPR Optimized IF Filters
LC and Crystal

comstron
200 East Sunrise Highway, Freeport New York 11520
(516)546-9700 TWX 510-225-3699
FA 3800 Series
Miniature High Performance LC Filters 1-1000 MHz

Comstron's FA 3800 Series Miniature High Performance Filters are optimized for use in the 1 to 1000 MHz frequency range. Although they are considerably smaller than comparable tubular filters their performance is vastly superior. These filters are particulary suited to applications which require carefully controlled passband and stopband response as well as small size. These attributes are achieved through synthesis procedures and component topology unavailable for tubular designs. Models available with either SMA or BNC connectors for direct tubular replacement or maximum ground pin design permitting printed circuit board mounting for manufacturing convience and cost savings.

Standard Filter Catagories

- FDM Channel
- Quad Phase Matched
- Miniature LC.
- USB/LSB
- Fiber Optic Repeater
- Group Delay Equalizer
- NPR Optimized
- Pulse Response Optimized
- Nyquist
- Video
- Speech Plus
- Group/Super Group/Master Group/Pilot Notch
- 70/140 MHz Satellite IF Filters
- 70 MHz Switchable Equalizer (Delay or Amplitude)

Call Comstron for applications assistance for your LC and Crystal Filter requirements.

comstron corporation

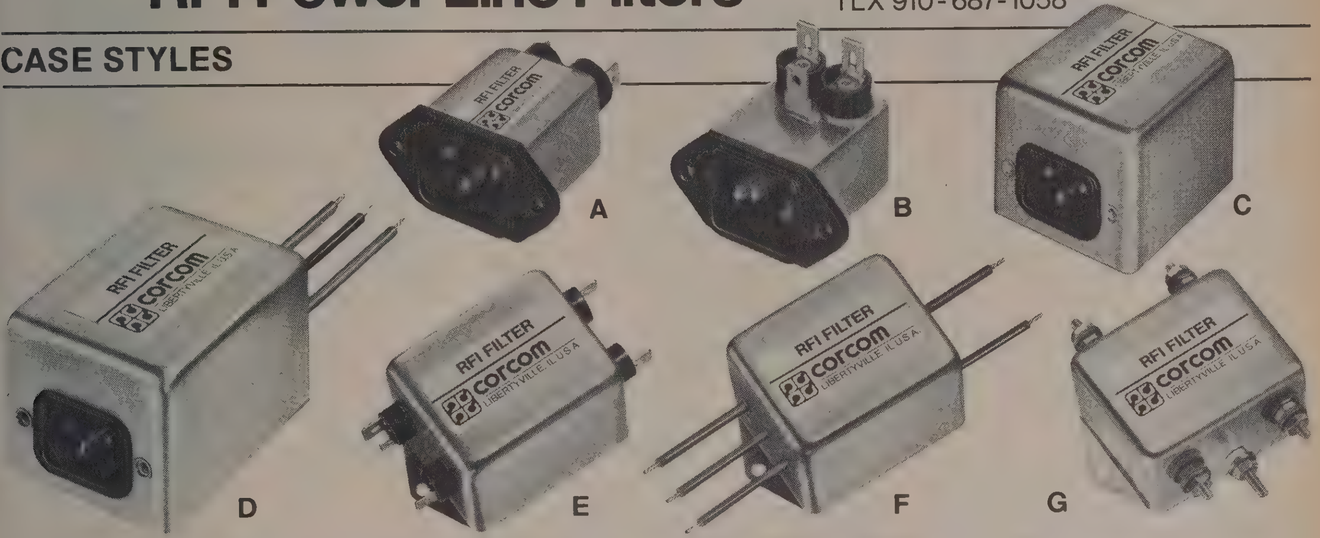
200 East Sunrise Highway, Freeport New York 11520
(516)546-9700 TWX 510-225-3699

corcom
RFI Power Line Filters

World Leader In RFI Technology

1600 Winchester Road
Libertyville, IL 60048 USA
312-680-7400
TLX 910-687-1058

CASE STYLES



CORCOM'S FAMILY OF PRODUCTS

B Series
General purpose common mode filters. Available in case styles E, F, and G.
Current ratings: 1, 2, 3, 5, 10, 20, 30 amps.

EF Series
Attenuation performance similar to B series, small package with IEC connector. Available in case styles A and B.
Current ratings: 1, 3, 6 amps.

ED & EC Series *
Enhanced common mode plus differential mode performance in the EF package for the ED series. Enhanced common mode plus enhanced differential mode performance in a stretched EF package for the EC series. Available in case styles A and B.
Current ratings: 1, 3, 6 amps. *ED models only.

H Series
Special purpose filters for medical equipment that must meet the extremely low leakage current requirements of UL544, Patient Care category. Available in case styles A, B, and E.
Current rating: 6 amps.

K Series
General purpose common mode performance (similar to B and EF) plus differential mode performance. Available in case styles C, E, F, and G. Current ratings: 1, 2, 3, 5, 10, 20, 30 amps.

R Series
Dual section filter for high common and differential mode performance in low impedance equipment such as synchronous motors. Available in case styles C, E, F, and G.
Current ratings: 1, 2, 3, 5, 10, 20 amps.

S, V, W Series
In addition to common mode attenuation, these units provide significantly higher differential mode inductance. Available in case style E.
Current ratings: 3, 6, 10, 20 amps.

S—Differential mode performance with common mode attenuation optimized for 150kHz to 30MHz.

V—Additional differential mode element over the S series for use with low impedance equipment.

W—Differential mode performance of V series with common mode enhancement in the mid and high frequency ranges, for use with high impedance equipment.

SK Series
Enhanced common mode and differential mode performance with high peak current capability; best suited for FCC emission control applications including switching power supplies. Available in case styles C, E, and F.
Current ratings: 3, 6, 10 amps.

EP Series
Superior common and differential mode performance from 150kHz to 30MHz, with high peak current capability for switching power supplies, to meet VDE 0871 A-level and FCC Class B emission limits. Available in case styles C, E, and F.
Current ratings: 3, 6, 10 amps.

SP Series
Similar to EP, but premium common mode performance at the expense of higher leakage current. Available in case style E.
Current ratings: 3, 6, 10 amps.

T Series
Superior common and differential mode performance from 10kHz to 30MHz with high peak current capability for switching power supplies, to meet VDE 0871 A-level emission limits and guidelines down to 10kHz. Available in case styles D, E, and F.
Current ratings: 3, 6, 10 amps.

Q Series
Premium common and differential mode performance from 10kHz to 30MHz with high peak current capability for switching power supplies, to meet VDE 0871 B-level emission limits down to 10kHz. Available in case styles D, E, and F.
Current ratings: 3, 6 amps.

J SERIES AND M SERIES/POWER ENTRY PRODUCTS

418 419 756

J Series/Voltage Selecting and Fused Connector

Developed for the manufacturer who markets products worldwide, the VS & F Connector eliminates the need for internal wiring changes, special power supplies or the need for stocking different line cords. Designed with an internationally approved line cord connector, a fuse holder and a unique voltage selector card. Available unfiltered or filtered.

M Series/Power Entry Module Patent Pending

Corcom's Power Entry Module is the new generation of Corcom's VS & F Connector. Incorporated into one unit are the following:
- IEC Line Cord Connector, internationally accepted design
- Fuse Holder, capable of using one U.S. or two European fuses
- Optional DPST Power On/Off Rocker Switch
- Optional 2-Voltage or 4-Voltage Card Selection

©Corcom Inc.

DELTA EMI POWER LINE FILTERS

AK Series, AR Series
AK Series is a compact design for general purpose filtering. AR Series incorporate two stage filtering to eliminate switching power supply noise. Both series include an IEC connector, fuse (5 x 20mm), VDE approved power switch (optional), VDE approved voltage selector switch (optional). All parts rated 6 amp and feature easy installation and low cost. Spare fuse storage in fuse holder and safety interlock prevents fuse removal with line plug inserted.

BE Series
BE Series are designed as a general purpose fused connector filter (IEC fuse 5 x 20mm) providing effective EMI suppression of both line-to-line and line-to-ground noise with low leakage current. Spare fuse storage in fuse holder and safety interlock prevents fuse removal with line plug inserted.

DE Series
DE Series filters are compact and reliable at lowest cost. With an IEC power line connector, they are designed as general purpose filters providing effective EMI suppression of line-to-ground noise.

GE Series
GE Series are designed as a high performance general purpose filter providing more effective EMI suppression of line-to-line and low frequency line-to-ground noise which helps reduce power supply conducted noise to comply with VDE and FCC requirements. Compact and reliable at low cost and low leakage current. IEC power line connector used.

SE Series
SE Series filters are designed to reduce conducted noise to acceptable limits for switching power supplies that have to comply with VDE and FCC requirements. These filters are suitable for custom design. IEC power line connector used.

DB Series
These filters are designed as general purpose filters which can be used in a wide variety of electrical and electronic equipment. DB series filters effectively provide EMI suppression of line-to-ground noise in a small size at lowest cost.

DK Series
DK Series filters are very effective in suppressing line-to-line and line-to-ground EMI noise. They are used in computers, peripheral equipment and industrial applications where pulsed, continuous and/or intermittent noise is present.

DP Series
DP Series filters are designed to reduce conducted noise to acceptable limits for switching power supplies that have to comply with VDE and FCC requirements. They are designed to provide high insertion loss for line-to-line and line-to ground emission throughout the frequency range.

DR Series
DR Series filters provide premium performance in suppressing line-to-line and line-to-ground noise at moderate cost. They are very suitable for low impedance load equipment where EMI noisy environments are present and can be used in many kinds of industrial equipment and computers where pulsed, continuous and/or intermittent EMI noise is present.

DD Series, SD Series
These filters are also designed to reduce conducted noise to acceptable limits for switching power supplies that have to comply with VDE and FCC requirements. Besides being suitable for custom designs, DD series are designed for high impedance loads while SD series are designed for low impedance loads.

DC Series, SC Series
DC series and SC series filters are designed to reduce conducted noise to acceptable limits for switching power supplies that have to comply with VDE and FCC requirements, and are suitable for custom designs. Both filters provide ground-lead inductors to attenuate high frequency line-to-ground noise. DC series filters are designed for high impedance loads and SC series filters for low impedance loads.

Specifications For All Series

Rated voltage: 115/250 VAC

Operating frequency: 50-60 Hz

Maximum leakage current: each line to ground:
115V 60 Hz — 0.25 mA
250V 50 Hz — 0.40 mA
measured according to UL 1283 PAR. 24

High pot test, 1 minute line to ground: 2250 VDC
line to line: 1450 VDC

Minimum insertion loss in dB, in 50 ohm system

PART No.	FREQUENCY — MHz								
	.02	.05	.10	.15	.50	1.0	5.0	10	30
01, 03 DE	7	13	19	24	28	34	52	54	55
06 DE	2	5	10	14	20	25	40	50	55
01, 03 GE	9	15	21	26	35	42	54	55	55
06 GE	3	6	11	15	25	30	44	50	55
01, 03 SE	10	10	30	40	65	70	65	55	45
06 SE	5	7	9	24	46	56	60	55	45
02, 04, 06 BE	8	16	23	26	35	45	50	55	55
01 ~ 10 DB	8	15	20	25	30	38	50	50	50
20 DB	3	8	11	13	20	25	40	45	48
01 ~ 10 DK	2	15	20	22	30	38	50	55	55
20 DK	6	10	12	14	19	28	42	45	50
01 ~ 05 DR	8	10	30	45	65	70	70	65	55
10, 20 DR	7	10	15	20	44	60	70	60	50
06 AK	4	7	11	12	20	25	42	50	45
06 AR	8	14	22	34	60	65	50	50	40
03 DC, SC	14	25	26	28	40	50	60	60	50
06 DC, SC	12	23	25	28	33	44	55	48	40
10 DC, SC	6	15	18	20	30	40	60	50	40
03 DD, SD	15	25	44	50	70	70	65	60	50
06 DD, SD	10	15	32	42	60	70	60	60	50
10 DD, SD	10	18	30	40	58	70	60	55	50
03 DP	20	35	55	65	75	75	70	60	50
06 DP	16	25	44	58	70	70	70	60	50
10 DP	17	26	40	58	70	70	70	70	30

Main Features of Delta EMI Filters

DELTA EMI filters are designed and built in full conformance with UL Standard 1283, CSA Standard C22.2 No. 0.8 and VDE 0565 parts 1, 2 and 3. All EMI filters are UL recognized (ЯU), most have CSA (Ⓒ) approval, and VDE approval is in process for the entire line. Latest agency approvals are detailed in our complete catalog, available upon request.

All filters are built with a specially designed core cover that automatically maintains sufficient creepage distance between compensation choke windings. All terminals have an anti-rotation feature and are designed to maintain sufficient creepage distance between terminal and ground.

All electrical connections are soldered and mechanically secured. Every filter must pass 100% hipot, leakage current and insertion loss tests before shipment.

Custom Designs

Contained herein is Delta's complete line of standard filters. If our standard products cannot solve your particular EMI problems, our engineers will work with you to design and fabricate custom filters that are tailored to your specific requirements.

Service and Support

Delta filters are stocked at selected distributors nationwide, and our local sales representatives in your area are ready to help you select the right Delta filter for your requirements. Please contact our Customer Service Department at (415) 785-5231 for further information.

Delta's Part Numbering System

Delta's part numbering system is made up of three elements which, when properly sequenced, fully and easily identify the required filter.
For example:

05	DB	AG3W2
CURRENT RATING	SERIES	MECHANICAL CONSTRUCTION

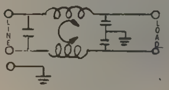
Current Rating: AC RMS
e.g.: 05 = 5 Amps AC RMS

Series: Electrical Circuits — see adjacent table

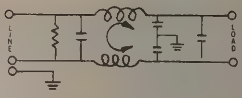
Mechanical Construction:
A = Case Style — see examples on adjacent page
G = Lug
W = PVC Wire
S = Screw
e.g.: G3W2 = 3 lugs + 2 lead wires

Electrical Schematics

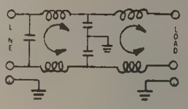
, DE, GE Series



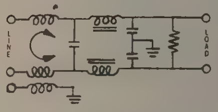
DK Series



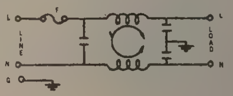
SE Series



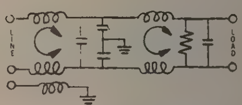
DC Series



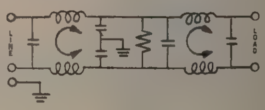
BE Series



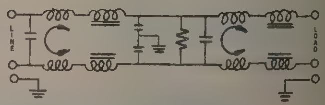
SD Series



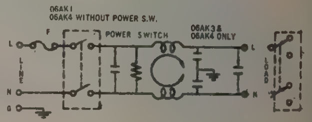
DR Series



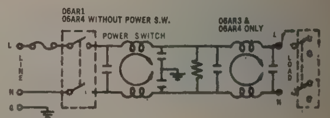
DP Series



AK Series

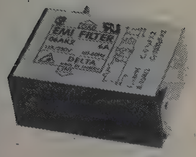


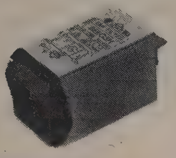
AR Series

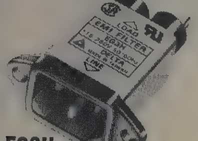


DELTA
ELECTRONIC INDUSTRY USA
3401 Investment Blvd., Suite 5, Hayward, CA 94545, Tel: (415) 785-5231, TLX: 4992342 DELTAITTHY

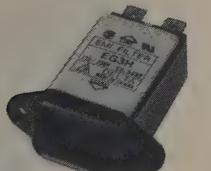
DELTA EMI POWER LINE FILTERS

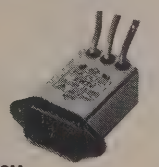

AR & AK

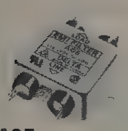

BEEG3H

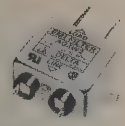

EG3H

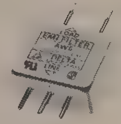
EG3V


EG3M

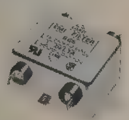

EW3V

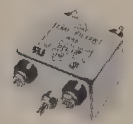

AG5


AG3W2

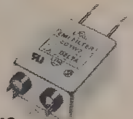

AW5

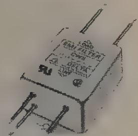
AS5


BG5


BS5

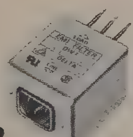
CG5

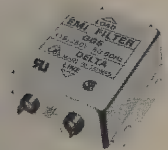

CG3W2

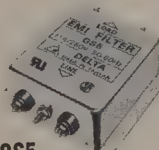

CW5

CS5

DG3


DW3


GG5


GS5

SERIES DIMENSIONS

CURRENT RATING	P/N	SIZE (INCH)		
		L	W	H
AK 6A	06AK1	2.18	2.64	1.14
	06AK2	2.18	2.64	1.14
	06AK2D	2.18	2.64	1.14
6A/115V 4A/250V	06AK3	2.40	2.64	1.14
	06AK3D	2.40	2.64	1.14
	06AK4	2.40	2.64	1.14
AR 6A	06AR1	2.38	2.64	1.14
	06AR2	2.38	2.64	1.14
	06AR2D	2.38	2.64	1.14
A/115V A/250V	06AR3	2.59	2.64	1.14
	06AR3D	2.59	2.64	1.14
	06AR4	2.59	2.64	1.14
DE 1A	01DEEG3H	2.08	1.99	0.82
	01DEEG3V	1.52	1.99	0.82
	01DEEG3M	1.95	1.99	0.82
	01DEEW3V	1.52	1.99	0.82
3A	03DEEG3H	2.08	1.99	0.82
	03DEEG3V	1.52	1.99	0.82
	03DEEG3M	1.95	1.99	0.82
	03DEEW3V	1.52	1.99	0.82
6A	06DEEG3H	2.08	1.99	0.82
	06DEEG3V	1.52	1.99	0.82
	06DEEG3M	1.95	1.99	0.82
	06DEEW3V	1.52	1.99	0.82
GE 1A	01GEEG3H	2.11	1.99	0.82
	01GEEW3V	1.67	1.99	0.82
3A	03GEEG3H	2.11	1.99	0.82
	03GEEW3V	1.67	1.99	0.82
6A	06GEEG3H	2.11	1.99	0.82
	06GEEW3V	1.67	1.99	0.82
BE 2A	02BEEG3H	2.52	1.73	1.30
4A	04BEEG3H	2.52	1.73	1.30
	04BEEG3S	2.32	1.73	1.30
6A	06BEEG3H	2.52	1.73	1.30
SE 1A	01SE EG3H	3.65	1.97	0.88
	01SE EG3V	3.04	1.97	0.88
3A	03SE EG3H	3.65	1.97	0.88
	03SE EG3V	3.04	1.97	0.88
6A	06SE EG3H	3.65	1.97	0.88
	06SE EG3V	3.04	1.97	0.88
DB 1A	01DB AG5	2.13	2.05	0.63
	01DB AG3W2	1.51	2.50	0.63
	01DB AW5	0.94	2.50	0.63
	01DB DG3	3.20	2.20	1.25
	01DB DW3	2.16	2.20	1.25
2A	02DB AG5	2.13	2.50	0.63
	02DB AG3W2	1.15	2.50	0.63
	02DB AW5	0.94	2.50	0.63
	02DB DG3	3.20	2.20	1.25
	02DB DW3	2.61	2.20	1.25
3A	03DB AG5	2.52	2.50	0.75
	03DB AG3W2	1.94	2.50	0.75
	03DB AW5	1.31	2.50	0.75
	03DB DG3	3.20	2.20	1.25
	03DB DW3	2.61	2.20	1.25
5A	05DB AG5	2.52	2.50	0.75
	05DB AG3W2	1.94	2.50	0.75
	05DB AW5	1.31	2.50	0.75
	05DB DG3	3.20	2.20	1.25
	05DB DW3	2.61	2.20	1.25
	05DB AS5A	3.35	2.75	1.13
10A	10DB AG5	2.52	2.50	1.16
	10DB AG3W2	1.94	2.50	1.16
	10DB AW5	1.31	2.50	1.16
	10DB AS5	2.64	2.50	1.16
20A	20DB AG5	3.23	2.75	1.13
	20DB AS5	3.35	2.75	1.13
DK 1A	01DK AG5	2.97	2.75	0.88
	01DK AG3W2	2.36	2.75	0.88
	01DK AW5	1.81	2.75	0.88
	01DK DG3	3.20	2.20	1.25
	01DK DW3	2.61	2.20	1.25
2A	02DK AG5	2.97	2.75	0.88
	02DK AG3W2	2.36	2.75	0.88
	02DK AW5	1.81	2.75	0.88
	02DK DG3	3.20	2.20	1.25
	02DK DW3	2.61	2.20	1.25
3A	03DK AG5	2.97	2.75	1.13
	03DK AG3W2	2.36	2.75	1.13
	03DK AW5	1.81	2.75	1.13
	03DK DG3	3.20	2.20	1.25
	03DK DW3	2.61	2.20	1.25
DK 5A	05DK AG5	2.97	2.75	1.13
	05DK AG3W2	2.36	2.75	1.13
	05DK AW5	1.81	2.75	1.13
	05DK AS5	3.35	2.75	1.13
	05DK DG3	3.20	2.20	1.25
	05DK DW3	2.61	2.20	1.25
10A	10DK AG5	3.23	2.75	1.13
	10DK AG3W2	2.62	2.75	1.13
	10DK AW5	2.06	2.75	1.13
	10DK AS5	3.35	2.75	1.13
	10DK DG3	3.64	2.20	1.25
	10DK DW3	3.10	2.20	1.25
	10DK DG3S	3.20	2.20	1.25
	10DK DW3S	2.61	2.20	1.25
20A	20DK BG5	3.23	3.32	1.50
	20DK BS5	3.35	3.32	1.50
DP 3A	03DP CG5	6.48	2.00	1.75
	03DP CW5	6.00	2.00	1.75
	03DP CG5S	3.73	2.00	1.75
	03DP CW5S	3.32	2.00	1.75
	03DP DG3	3.20	2.20	1.75
	03DP DW3	2.61	2.20	1.75
6A	06DP CG5	6.48	2.00	2.25
	06DP CW5	6.00	2.00	2.25
10A	10DP CG5	6.48	2.00	2.75
	10DP CW5	6.00	2.00	2.75
DR 1A	01DR CG5	3.23	1.75	1.13
	01DR CG3W2	2.99	1.75	1.13
	01DR CW5	2.75	1.75	1.13
	01DR DG3	4.33	2.17	1.25
	01DR DW3	3.75	2.17	1.25
2A	02DR CG5	3.23	1.75	1.13
	02DR CG3W2	2.99	1.75	1.13
	02DR CW5	2.75	1.75	1.13
	02DR DG3	4.33	2.17	1.25
	02DR DW3	3.75	2.17	1.25
3A	03DR CG5	3.73	2.00	1.13
	03DR CG3W2	3.52	2.00	1.13
	03DR CW5	3.32	2.00	1.13
	03DR DG3	4.33	2.17	1.25
	03DR DW3	3.75	2.17	1.25
5A	05DR CG5	3.73	2.00	1.13
	05DR CG3W2	3.52	2.00	1.13
	05DR CW5	3.32	2.00	1.13
	05DR DG3	4.33	2.17	1.25
	05DR DW3	3.75	2.17	1.25
10A	10DR CG5	3.73	2.00	1.50
	10DR CG3W2	3.52	2.00	1.50
	10DR CW5	3.32	2.00	1.50
	10DR CS5	3.85	2.00	1.50
	10DR DG3	4.33	2.17	1.25
	10DR DW3	3.75	2.17	1.25
20A	20DR GG5	5.12	4.12	1.50
	20DR GS5	5.23	4.12	1.50
DC **SC** 3A	03DC CG5	3.73	2.00	1.50
	03SC CG5	3.73	2.00	1.50
	03DC CW5	3.32	2.00	1.50
	03SC CW5	3.32	2.00	1.50
6A	06DC CG5	3.73	2.00	1.50
	06SC CG5	3.73	2.00	1.50
	06DC CW5	3.32	2.00	1.50
	06SC CW5	3.32	2.00	1.50
10A	10DC CG5	3.73	2.00	1.75
	10SC CG5	3.73	2.00	1.75
	10DC CW5	3.32	2.00	1.75
	10SC CW5	3.32	2.00	1.75
DD **SD** 3A	03DD CG5	3.73	2.00	1.50
	03SD CG5	3.73	2.00	1.50
	03DD CW5	3.32	2.00	1.50
	03SD CW5	3.32	2.00	1.50
6A	06DD CG5	3.73	2.00	1.50
	06SD CG5	3.73	2.00	1.50
	06DD CW5	3.32	2.00	1.50
	06SD CW5	3.32	2.00	1.50
10A	10DD CG5	3.73	2.00	1.75
	10SD CG5	3.73	2.00	1.75
	10DD CW5	3.32	2.00	1.75
	10SD CW5	3.32	2.00	1.75

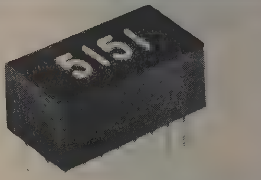
DELTA
ELECTRONIC INDUSTRY USA
1355 Yosemite Way, Hayward, CA 94545, Tel: (415) 785-5231, TLX: 4992342 DELTAITTHY

data delay devices, inc.

385 Lakeview Ave., Clifton, N.J. 07011
Tel: (201) 772-1106

SHORT FORM CATALOG

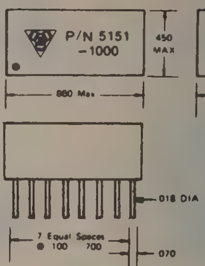
DIP-ACTIVE FILTERS SERIES 5151-5353



SPECIFICATIONS

- **Transfer characteristics** — Butterworth
- **Gain in pass-band** — 0 db ± .2 db.
- **Cut-off frequency accuracy** — ± 2% @ -3 db.
- **Maximum input voltage** — 10 volts peak.
- **Skirt Attenuation** — 24 db / octave.
- **DC drift** — 20uV / °C typical.
- **Supply Voltage** — ±15V typical (±9V to ±18V operational).
- **Temperature range** — 0° to +70°C (standard); -55°C to + 125°C (on request).
- **Temperature Coefficient** — .03% / °C. Better on request.
- **Power Consumption** — 200MW Maximum.

LOW-PASS FILTERS				HIGH-PASS FILTERS			
PART NO.	3 db FREQUENCY (HZ)	PART NO.	3 db FREQUENCY (HZ)	PART NO.	3 db FREQUENCY (HZ)	PART NO.	3 db FREQUENCY (HZ)
5151-1	1	5151-400	400	5353-10	10	5353-2,500	2,500
5151-10	10	5151-1,000	1,000	5353-100	100	5353-3,250	3,250
5151-20	20	5151-1,200	1,200	5353-160	160	5353-4,000	4,000
5151-40	40	5151-2,500	2,500	5353-400	400	5353-13,000	13,000
5151-50	50	5151-4,000	4,000	5353-500	500	5353-16,000	16,000
5151-100	100	5151-5,000	5,000	5353-1,000	1,000	5353-20,000	20,000
5151-200	200	5151-20,000	20,000	5353-1,800	1,800		



FUNCTION	PIN #
INPUT	1
OUTPUT	11
GND	15
V+	12
V−	8

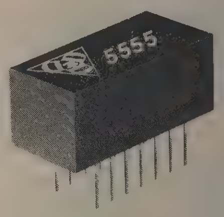
NOTE: The above table gives only a small number of designs available. Many other designs are availabe on request. Any frequency from 1HZ to 25KHZ can be selected. To make a part number, simply use the basic series number and the cut-off frequency.

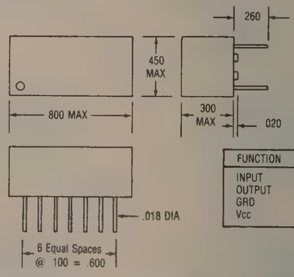
BAND-PASS FILTER SERIES 5555

PART NO.	fc(Hz)	PART NO.	fc(Hz)	PART NO.	fc(Hz)
5555-360	360	5555-1260	1260	5555-2280	2280
5555-420	420	5555-1320	1320	5555-2340	2340
5555-480	480	5555-1336	1336	5555-2400	2400
5555-540	540	5555-1380	1380	5555-2460	2460
5555-600	600	5555-1440	1440	5555-2520	2520
5555-560	660	5555-1477	1477	5555-2580	2580
5555-697	697	5555-1500	1500	5555-2640	2640
5555-720	720	5555-1560	1560	5555-2700	2700
5555-770	770	5555-1620	1620	5555-2760	2760
5555-780	780	5555-1633	1633	5555-2820	2820
5555-840	840	5555-1680	1680	5555-2280	2880
5555-852	852	5555-1740	1740	5555-2940	2940
5555-900	900	5555-1800	1800	5555-3000	3000
5555-941	941	5555-1860	1860	5555-3060	3060
5555-960	960	5555-1920	1920	5555-3120	3120
5555-1020	1020	5555-1980	1980	5555-3180	3180
5555-1080	1080	5555-2040	2040	5555-3240	3240
5555-1140	1140	5555-2100	2100	5555-3300	3300
5555-1200	1200	5555-2160	2160	5555-3360	3360
5555-1209	1209	5555-2220	2220		

SPECIFICATIONS

- **Response:** See graph.
- **Gain @ fc:** 10 db typical.
- **Center Frequency Accuracy:** ±1%.
- **Input Voltage:** 1v rms Max.
- **Supply Voltage:** 15Vdc.
- **Temperature Range:** 0° to 70°C.
- **Temperature Coefficient:** .03%/°C.
- **Power Consumption:** 625 MW @ 25°C.
- **Output Load:** 600 Min.

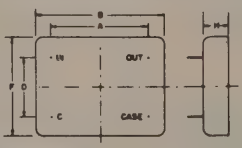


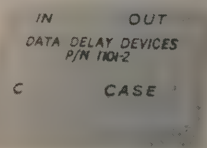


FUNCTION	PIN #
INPUT	12
OUTPUT	10
GRD	7
Vcc	14

LOW PROFILE FILTERS SERIES 1100

CASE Metal flat case to reduce hum pick-up.
PINS Straight pins for PC mounting





LOW-PASS

PART NO.	Imp. IN/OUT	PASS-BAND (1db)	PASS-BAND (3db)	STOP-BAND	CASE NO.
1101-1	10K	DC to 460Hz	600Hz	40db above 750Hz	1
1101-2	600	DC to 3KHz	3.4KHz	40db above 4.2KHz	1
1101-3	10K	DC to 4.4KHz	5KHz	43db above 6.3 KHz	1
1101-4	1K	DC to 9KHz	10KHz	43db above 12.8KHz	1
1101-5	600	DC to 15KHz	18KHz	43 db above 23KHz	1
1101-6	600	DC to 43KHz	50KHz	43db above 64KHz	2

HIGH-PASS

PART NO.	Imp. IN/OUT	PASS-BAND (1db)	PASS-BAND (3db)	STOP-BAND	CASE NO.
1102-1	10K	300Hz & above	200Hz	40db below 140Hz	1
1102-2	10K	600Hz & above	400Hz	40db below 280Hz	1
1102-3	10K	1.2KHz & above	800Hz	40db below 560Hz	1
1102-4	10K	3KHz & above	2KHz	40db below 1.4KHz	2
1102-5	10K	6KHz & above	4KHz	40db below 2.8KHz	2

BROAD BAND-PASS

PART NO.	Imp. IN/OUT	PASS-BAND	STOP-BAND (36db) BELOW	STOP-BAND (36db) ABOVE	CASE NO.
1103-1	10K	1KHz to 2KHz	0.5KHz	4KHz	3
1103-2	10K	2KHz to 4KHz	1KHz	8KHz	3
1103-3	10K	4KHz to 8KHz	2KHz	16KHz	3
1103-4	10K	10KHz to 20KHz	5KHz	40KHz	4

CASE DIMENSIONS

CASE NO.	A		B		D		F		H	
	IN.	M.M.	IN.	M.M.	IN.	M.M.	IN.	M.M.	IN.	M.M.
1	1.4	35.56	1.875	47.63	1.4	35.56	2.0	50.8	0.5	12.70
2	1.4	35.56	2.0	50.8	0.8	20.32	1.5	38.1	0.375	9.53
3	1.4	35.56	2.0	50.8	0.8	20.32	1.5	38.1	0.5	12.70
4	0.8	20.32	1.25	31.75	1.0	25.4	1.75	44.45	0.375	9.53

DATA DELAY DEVICES INC. • 385 Lakeview Avenue, Clifton, N.J. 07011 • (201) 772-1106

epc
CORPORATION

MANUFACTURERS OF ACTIVE AND PASSIVE FILTERS—DC TO 500MHz.

LOWPASS, HIGHPASS, BANDPASS, BANDREJECT CUSTOM OR STANDARD DESIGNS.

FILTER TYPES

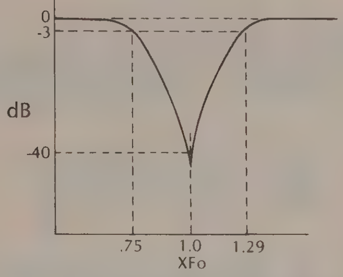
- Elliptic
- Chebychev
- Butterworth
- Bessel
- Gaussian
- Legendre
- Inverted Chebychev
- Audio Frequency
- Equalizers
- Harmonic
- IF
- Video
- Telemetering
- Tone, Telegraph
- Constant group delay
- Wideband Band Pass
- Phase matched
- Attenuation matched

Components manufactured to rigid MIL-STD specifications with operating temperature range from −55°C to + 125°C.

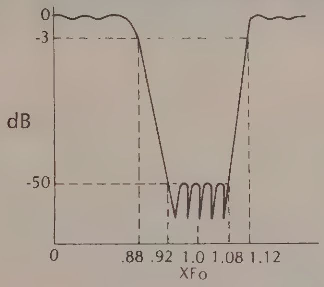
CUSTOM BUILT FILTERS
PROMPT DELIVERY

The filters listed here are some of the typical units we build. We can design filters to your exact specifications. Call for more information.

ACTIVE NOTCH FILTER

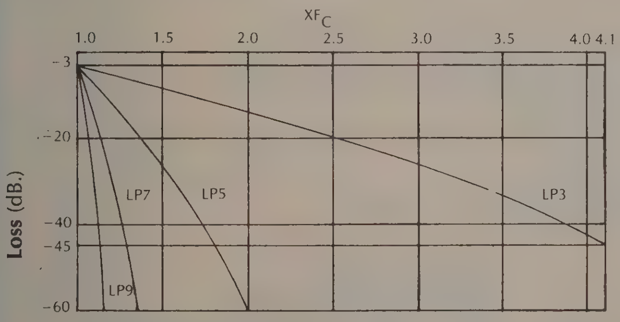


LC BAND REJECT FILTER



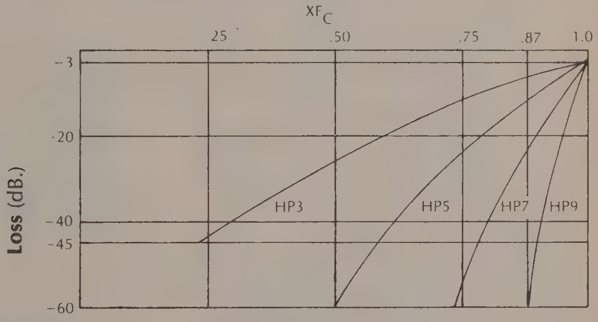
LC LOW PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
LP3	>45dB @ 4.1 Fc & above	1x1x.6″
LP5	>60dB @ 2 Fc & above	1.25x1.25x.6″
LP7	>60dB @ 1.35 Fc & above	1.5x1.5x.6″
LP9	>60dB @ 1.15 Fc & above	2x1.75x.6″



LC HIGH PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
HP3	>45dB @ .24 Fc & below	1x1x.6″
HP5	>60dB @ .5 FC & below	1.25x1.25x.6″
HP7	>60dB @ .74 Fc & below	1.5x1.5x.6″
HP9	>60dB @ .87 Fc & below	2x1.75x.6″



LC NARROW BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
NB-2	±2	.98 Fo & 1.02 Fo	.85 Fo & below 1.17 Fo & above
NB-3	±3	.97 Fo & 1.03 Fo	.80 Fo & below 1.25 Fo & above
NB-4	±4	.96 Fo & 1.04 Fo	.74 Fo & below 1.35 Fo & above

LC WIDEBAND BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
WB-25	25	.87 Fo & 1.14 Fo	.58 Fo & below 1.70 Fo & above
WB-50	50	.78 Fo & 1.28 Fo	.38 Fo & below 2.60 Fo & above
WB-100	100	.62Fo & 1.62 Fo	.21 Fo & below 4.65 Fo & above

CASE DIMENSIONS: 2″x1.75″x.6″ MAX

ELECTRONIC PRECISION COMPONENTS CORPORATION
11 SANDFORD BLVD., MT. VERNON, N.Y. 10550 • TELEPHONE (914) 664-2333

ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780

TOLL FREE
800-631-0853
(except N.J.)

LC FILTERS
DC TO 500 MHZ

30 Year Leadership in Quality and Reliability!

Covering a range of DC to 500 Mhz, ESC designs and manufactures a wide variety of LC filters for commercial and military high reliability applications. Starting with computer aided design through final test on ESC's computer controlled Network Analyzer, ESC's long history of quality and experience assures maximum component efficiency and reliability. ESC has established controlled manufacturing facilities with certified operators to produce components to all levels of reliability from missile applications to space probe environments. Conformance to MIL-F-18327 is normal and to MIL-Q-9858A as required.

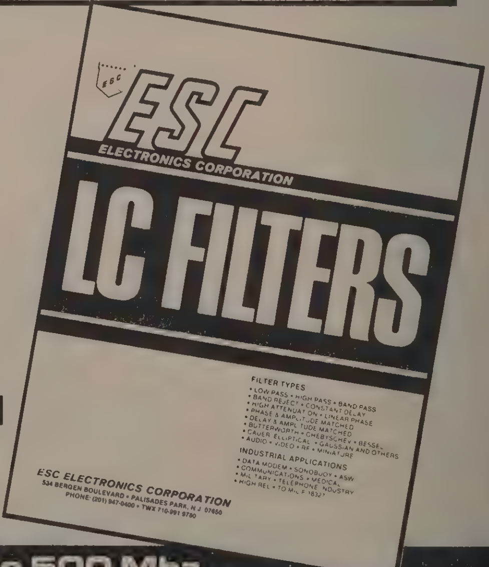
Dual-in-Line (14 Pin) LC Filters–Miniature
Size: .76L X .46W X .28H, From 1Khz to 10 Mhz.
Series DIFL20 – Low Pass, 20db Stopband at $1.4f_c$
Series DIFL39 – Low Pass, 39db Stopband at $2.5f_c$
Series DIFLP – Linear Phase, 30db at $5.0f_c$
Series DIFH20 – High Pass, 20db at $.715f_c$
Series DIFH39 – High Pass, 39db at $.4f_c$

Flatpack LC Filter Series–2Khz at 50 Khz
Epoxy molded for P.C. Board mounting, maximum height of .350 and volume of .35 to .55 cubic inches.
Series FL – Low Pass, 130db/octave roll-off
Series MFL – Low Pass, 100db/octave roll-off
Series MFH – High Pass, 100db/octave roll-off
Series CF – 15% Band Pass
Series DF – 20% Band Pass
Series LF – 60% Band Pass

High Frequency Filter Series–Reduced Sizes
Series HFLD – Low Pass 50 to 500 Mhz
60db Stopband $1.4f_c$ and above
Size: 2.1 X .65 X .30
Series HFLB – Low Pass 50 to 500 Mhz
60db Stopband $1.2f_c$ and above
Size: 2.5 X 1.0 X .30
Series HF – Band Pass 50 to 200 Mhz
Size: 2.1 X .65 X .30

FILTER TYPES
- LOW PASS • HIGH PASS • BAND PASS
- BAND REJECT • CONSTANT DELAY
- HIGH ATTENUATION • LINEAR PHASE
- PHASE & AMPLITUDE MATCHED
- DELAY & AMPLITUDE MATCHED
- BUTTERWORTH • CHEBYSCHEV • BESSEL
- CAUER (ELLIPTICAL) • GAUSSIAN AND OTHERS;
- AUDIO • VIDEO • RF • MINIATURE...

INDUSTRIAL APPLICATIONS
- DATA MODEM • SONOBUOY • ASW
- COMMUNICATIONS • MEDICAL
- MILITARY • TELEPHONE INDUSTRY
- HIGH REL • TO MIL-F-18327



ESC
ELECTRONICS CORPORATION
LC FILTERS

FILTER TYPES
• LOW PASS • HIGH PASS • BAND PASS
• BAND REJECT • CONSTANT DELAY
• HIGH ATTENUATION • LINEAR PHASE
• PHASE & AMPLITUDE MATCHED
• DELAY & AMPLITUDE MATCHED
• BUTTERWORTH • CHEBYSCHEV • BESSEL
• CAUER ELLIPTICAL • GAUSSIAN AND OTHERS
• AUDIO • VIDEO • RF • MINIATURE
INDUSTRIAL APPLICATIONS
• DATA MODEM • SONOBUOY • ASW
• COMMUNICATIONS • MEDICAL
• MILITARY • TELEPHONE INDUSTRY
• HIGH REL • TO MIL-F-18327
ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD • PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 • TWX 710-991-9780

Write or call for catalog!

Looking for Delay Lines? See our pages in Section 2350

LC FILTERS DC to 500 Mhz

LOW PRICE — ON SHELF — STANDARDS CERTIFICATION

FIL-COIL RFI/EMI POWER LINE FILTERS

Electrical Specifications

LEAKAGE CURRENT:
Line to Ground
@ 115 VAC 60 Hz — .65 mA
@ 250 VAC 50 Hz — 1.25 mA

TEST VOLTAGE:
Line to Ground — 2250 VDC
Line to Line — 1450 VDC

OPERATING FREQUENCY: 50-400 Hz

RATED VOLTAGE: 115-250 VAC

Usage

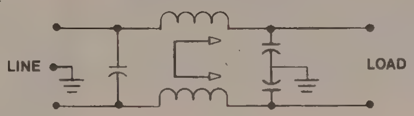
FCEIA SERIES (Econo-Universal)
Line to Ground Protection

FCEIJ Series (Econo-Super)
Line to Line and
Line to Ground Protection

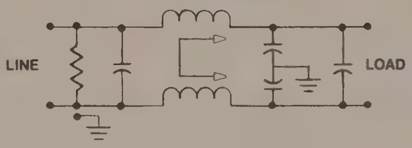
FCEIG SERIES (Econo-Med)
Patient Care Equipment

Customers Inquiry Should Specify: Rated Voltage, Current, Line Freq., Max. Operating Ambient Temp. @ Rated Current, Max. Leakage Current (Line to Ground), Humidity Range, Current Overload, Dimensions, HiPot (Line to Ground and Line to Line), Insulation Resistance, Insertion Loss.

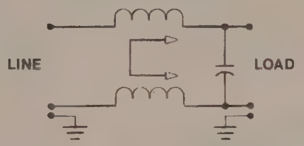
FCEIA SERIES



FCEIJ SERIES



FCEIG SERIES



Fil-Coil Numbering Code

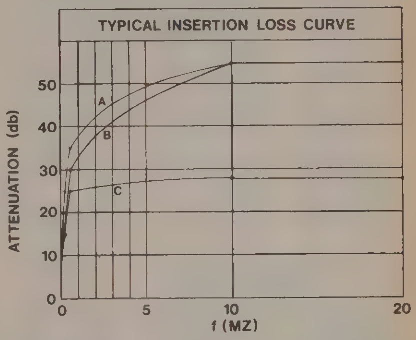
FCEIA - 2 - 5
Amperes
Configuration (Line & Load Termination)
Series

Fil-Coil Series will carry U.L., CSA, VDE, SEV, SEMCO, ASA, CISPR approvals as required and will meet FCC Rules, Part 15, subpart "J".

MIL-STD-220 Insertion Loss (db)

Amp	Frequency .15	.2	.5	MHz 10	20
1, 3 (A)	20	25	35	55	55
2, 5, (B) 10, 20	15	20	30	55	55
30 (B)	15	20	30	55	55
6 (C)	12	15	25	28	28

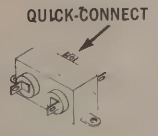
Typical Insertion Loss Curve



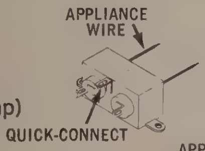
Recognized Components, Electromagnetic Noise Filter (UL 1283), for use in:
Data Processing (UL-478)
Medical & Dental (UL-544)
Office Appliance (UL-114)
Graphic Arts (UL-775)
Teaching & Instruction (UL-960)

Configurations

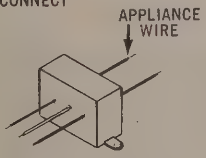
FCEIG-1
(6 Amp only)
FCEIA-1
FCEIJ-1
(1, 2, 3, 5, 10, 20 Amp)



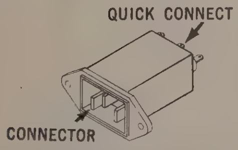
FCEIA-2
FCEIJ-2
(1, 2, 3, 5, 10 Amp)



FCEIA-3
FCEIJ-3
(1, 2, 3, 5, 10 Amp)

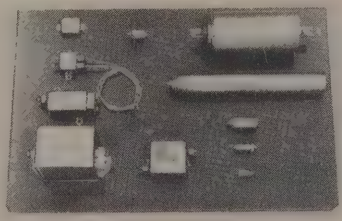


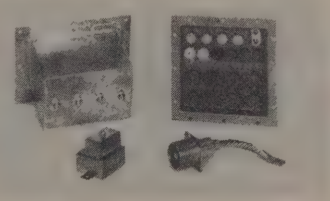
FCEIG-4
(6 Amp only)



RFI/EMC EXCELLENCE

ELECTRONIC FILTERS FOR MILITARY, INDUSTRIAL AND COMMERCIAL USERS





- FILTERS FOR POWER LINE
- SECURE CONMUNICATIONS
- SCREEN ROOM
- RFI/EMC FILTERS
- FIL-COIL COMMUNICATION & SIGNAL LINE FILTERS
- TELEPHONE LINE FILTERS
- RF FILTERED & SHIELDED CIRCUIT BREAKER PANEL BOXES

Frequency Range — 0 Hz to over 50 GHz
Current Range — 0 Amps to over 1500 Amps
Voltage Ratings — Up to 2400 V.A.C.: 10,000 V.D.C.
Quality 1. Complies with MIL-F-15733
2. Where required, manufactured to UL, QPL, CSA, VDE and other international testing standards

UL APPROVED

fil-coil

SEND FOR FREE CATALOG

ECONOMY INTERNATIONAL, INC.
800 AXINN AVE., GARDEN CITY, NY 11530 • TELEPHONE (516) 294-5445

HIGH-PERFORMANCE APPLICATION ENGINEERED EMI FILTERS

- PERFORMANCE PROVEN & TESTED with OEM & custom design switching and linear power supplies
- INDUSTRY'S WIDEST SELECTION OF EMI filters for switchers requiring single or multiple phase AC power

SE SERIES
SWITCHING POWER SUPPLY FILTER

Our most compact and economical T section filter for applications using switching power supplies and required to meet FCC conducted EMI specifications.

SE Series EMI filters are designed to provide balanced differential and common mode insertion loss for reliable performance at 450KHz and above with the typical off line type switcher.

Part No.	Current	Case	Leakage*
SE3	3A	2.75x1.75x.87	0.8mA
SE7	7.5A	2.75x2.0x1.25	0.8mA
SE15	15A	3.31x2.0x1.5	0.8mA
SE20	20A	3.67x2.12x1.75	0.8mA
SE30	30A	4.0x2.8x2.0	1.6mA
SE50	5.0A	5.5x3.0x2.7	1.6mA

Rated Voltage: 250VAC 47-63HZ
Test Voltages: Line To Line: 1.5 KVDC
Line To Gnd: 2.2 KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	7db	15db	50db	65db	65db	55db
L/L	7db	15db	50db	60db	55db	50db

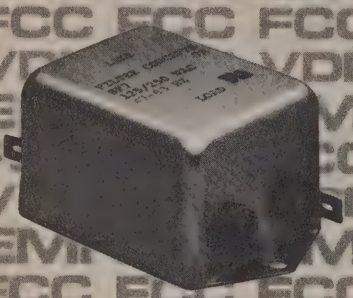
SF SERIES
HIGH PERFORMANCE SWITCHING SUPPLY FILTER

Designed for applications required to meet the VDE conducted EMI spectrum, the SF Series filters are designed to effectively attenuate differential and common mode noise from switching supplies down to the 150KHz limit of VDE 0871 and 0875 spectrums.

Part No.	Current	Case	Leakage*
SF3	3A	2.75x2.0x1.25	0.8mA
SF5	5A	2.5x2.0x1.5	0.8mA
SF7	7.5A	3.31x2.0x1.5	0.8mA
SF10	10A	3.67x2.12x1.75	0.8mA
SF15	15A	4x2.87x2.0	0.8mA
SF30	30A	5.5x3.0x2.75	1.6mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	8db	45db	65db	65db	65db	60db
L/L	15db	45db	60db	60db	65db	60db



SX SERIES
PREMIUM SWITCHING POWER SUPPLY FILTER

With an extra 15 db of performance at 150KHz, our SX Series filters solve severe conducted EMI problems in equipment required to meet VDE 0871 and 0875 spectrums.

SX Series T section filters are designed to remain effective independent of wide variations in line and load impedance and noise characteristics.

Part No.	Current	Case	Leakage*
SX3	3A	3.31x2.0x1.5	0.8mA
SX7	7.5A	5.0x2.0x2.0	0.8mA
SX15	15A	5.5x3.0x2.75	1.6mA
SX30	30A	8.25x3.0x2.75	1.6mA
SX60	60A	12.0x6.5x4.5	2.4mA

Rated Voltage: 250VAC, 47-63HZ
Test Voltages: Line To Line: 1.5VDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	20db	60db	65db	65db	60db	55db
L/L	30db	60db	65db	65db	60db	50db

SW SERIES
WIDE BAND HIGH PERFORMANCE FILTER

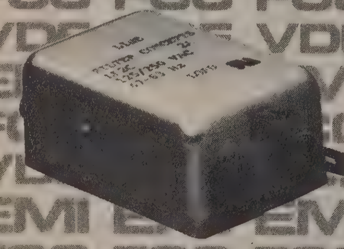
Extended high and low frequency insertion loss characteristics are featured with the SW Series filters.

Designed to provide the wider EMI performance often required for MIL STD. 461B type requirements, the SW Series also maintains low leakage current for enhanced safety.

Part No.	Current	Case	Leakage*
SW5	5A	5.0x2.0x2.0	2.4mA
SW10	10A	5.5x3.0x3.0	2.4mA
SW20	20A	8.25x3.0x3.0	2.4mA
SW30	30A	6.62x4.0x4.0	2.4mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	0.5MHz	5.0MHz	50MHz	0.1GHz	0.2GHz
L/G	35db	70db	70db	60db	55db	45db
L/L	50db	70db	70db	60db	55db	45db



TF SERIES
HIGH PERFORMANCE LOW LEAKAGE SWITCHING SUPPLY FILTER

High performance low leakage T section filter provides extended low frequency attenuation for applications required to meet enforced VDE conducted EMI spectrums.

TF Series filters provide the balanced differential and common mode performance plus the low leakage current often required for products using off line switching power supplies.

Part No.	Current	Case	Leakage*
TF2	2A	2.75x1.75x1.12	.45mA
TF3	3A	2.75x2.0x1.25	.45mA
TF5	5A	3.31x2.0x1.5	.45mA
TF10	10A	6.0x2.0x1.5	.45mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	48db	65db	65db	65db	60db
L/L	12db	40db	55db	60db	60db	60db

DF SERIES
SWITCHING POWER SUPPLY OUTPUT FILTER

Differential and common mode filter for the regulated DC outputs of switchers allows error free operation of low level analog circuitry.

DF Series filters are designed to work with the logic and drive voltages of typical peripheral devices.

Part No.	Current	Case	Leakage*
DF104	10 Amps	2.75x2.0x1.25	N/A
DF106	10 Amps	3.31x2.0x1.50	N/A

Rated Voltage: 50VDC
Test Voltage: Line To Gnd: 100VDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	15db	25db	35db	50db	50db	50db
L/L	3db	15db	35db	45db	50db	50db

Includes a minimum of 10mfds at the load.

*Each line to Gnd @250 VAC/50 Hz

FCI **FILTER CONCEPTS INC.**

2624 S. Rousselle St., Santa Ana, CA 92707 • (714) 545-7003

HIGH-PERFORMANCE APPLICATION ENGINEERED EMI FILTERS

- PERFORMANCE PROVEN & TESTED with OEM & custom design switching and linear power supplies
- INDUSTRY'S WIDEST SELECTION OF EMI filters for switchers requiring single or multiple phase AC power

LF SERIES
LOW LEAKAGE π SECTION FILTER FOR SWITCHERS

High performance low leakage π section filter offers enhanced differential insertion loss in an inexpensive compact package.

The LF Series is designed to work with the existing input filter in an off line switcher. The LF filter improves common mode performance and provides the extra differential insertion loss required to meet FCC or VDC specifications.

Part No.	Current	Case	Leakage*
LF2	2A	2.75x1.75x.87	.45mA
LF3	3A	2.75x2.0x1.25	.45mA
LF5	5A	2.5x2.0x1.5	.45mA
LF7	7A	3.31x2.0x1.5	.45mA
LF10	10A	3.67x2.12x1.75	.45mA
LF15	15A	4.0x2.87x2.0	.45mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	18db	30db	42db	50db	50db	50db
L/L	6db	30db	60db	60db	60db	60db

LX SERIES
PREMIUM LOW LEAKAGE π SECTION FILTER FOR SWITCHERS

Providing significant performance from 10KHz to 30 MHz, the LX Series filter is designed for applications required to meet the 10KHz to 150KHz extension of VDE 0871.

The LX Series EMI filter is designed to work with the existing filter in a switching supply or as a stand alone unit. It provides the extra differential and common mode low frequency insertion loss required while maintaining good high frequency characteristics.

Part No.	Current	Case	Leakage*
LX1	1.5A	2.75x.20x1.25	0.45mA
LX3	3A	3.31x2.0x1.5	0.45mA
LX7	7.5A	4.0x2.87x2.0	0.8mA
LX15	15A	6.0x3.0x2.75	1.2mA

Rated Voltage: 250VAC 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	30db	40db	50db	50db	50db	50db
L/L	45db	65db	65db	65db	65db	60db

3E SERIES
3 PHASE T SECTION FILTER

High performance with switching power supplies in 3 phase Wye or Delta configurations is offered by this Series.

3E Series T section filters are proven performers with single or multiple switching supplies in balanced or unbalanced load configurations.

Part No.	Current	Case	Leakage*
3E30	30A/PH	4.81x4.0x4.0	2.0mA
3E60	60A/PH	10x5.0x4.5	3.0mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltage: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	3db	25db	55db	60db	50db	50db
L/L	12db	22db	50db	55db	50db	50db

3F SERIES
HIGH PERFORMANCE 3 PHASE FILTER

Extended low frequency performance for 3 phase applications required to meet VDE conducted EMI spectrums with switch mode power supplies.

3F Series T section filters effectively attenuate differential and common mode noise from switching power supplies down to the 150KHz limit of VDE 0871 and 0875 spectrums.

Part No.	Current	Case	Leakage*
3F15	15A/PH	6.5x4.0x4.0	2.0mA
3F30	30A/PH	10x5.0x4.5	2.4mA
3F60	60A/PH	14x6.5x4.5	3.0mA

Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 2.2KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	50db	65db	65db	65db	60db
L/L	15db	50db	60db	60db	60db	55db

3X SERIES
PREMIUM 3 PHASE FILTER

The extra 15db of insertion loss at 150KHz provided by the 3X Series is often required in 3Ø power systems with multiple high power switch mode supplies.

The SX Series maintains its enhanced performance in balanced or unbalanced and in Wye or Delta configurations.

Part No.	Current	Case	Leakage*
3X7	7.5A/PH	6.5x4.0x4.0	2.0mA
3X15	15A/PH	10x5.0x4.5	2.0mA
3X30	30A/PH	14x6.5x4.5	2.4mA

Rated Voltage: 250VAC,47-63Hz
Test Voltages: Line To Line: 2.2KVDC
Line To Gnd: 2.2KVDC
Insertion loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	20db	60db	65db	65db	60db	60db
L/L	30db	65db	65db	65db	60db	55db

GF SERIES
L SECTION FILTER WITH SYSTEM GROUND ISOLATOR

A system filter with good general purpose performance, the GF Series was designed for AC input and distribution application.

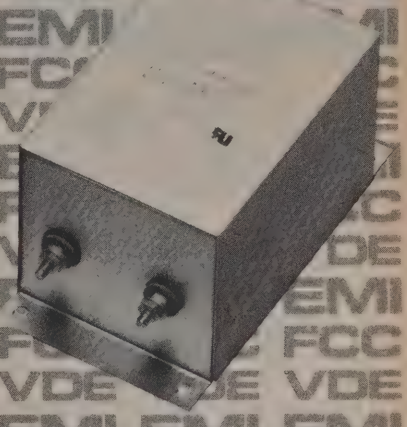
GF filters include an alternate ground termination for the AC power cord. This termination isolates high frequency noise from the AC mains via a low reactance series inductor. This high frequency ground isolator is very effective in inter-connected systems where AC power is derived from multiple outlets.

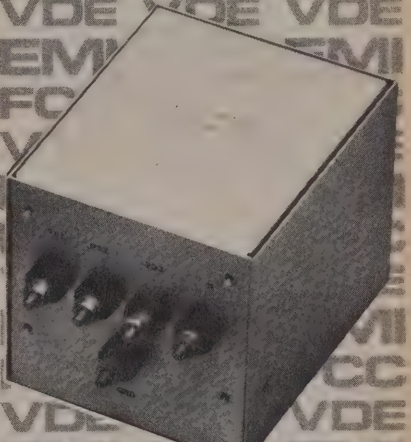
Part No.	Current	Case	Leakage*
GF10	10A	3.31x2.0x1.5	1.0mA
GF20	20A	4.0x2.87x2.0	1.0mA
GF30	30A	4.0x2.87x2.0	1.5mA

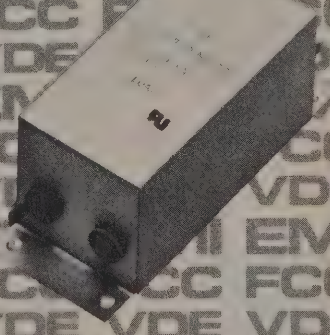
Rated Voltage: 250VAC, 47-63Hz
Test Voltages: Line To Line: 1.5KVDC
Line To Gnd: 2.2KVDC
Insertion Loss: (50 ohms)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	22db	32db	45db	50db	40db
L/L	15db	25db	35db	35db	30db	40db

*Each line to Gnd @250 VAC/50 Hz





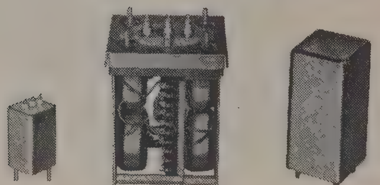


FCI reserves the right to make specification changes without notice. Consult the factory for current information.

FILTER CONCEPTS INC.
2624 S. Rousselle St., Santa Ana, CA 92707 • (714) 545-7003

HERTZ FILTERS

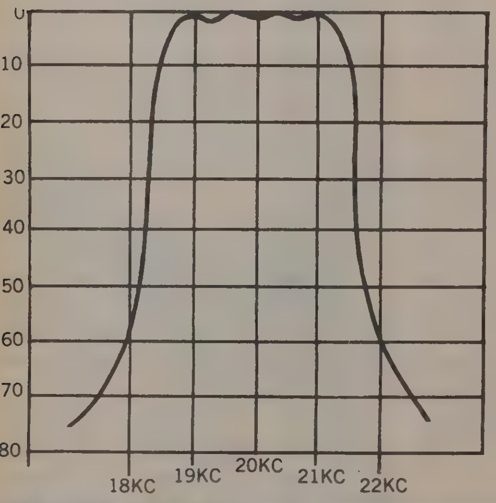
BAND PASS FILTERS CUSTOM DESIGNED TO FILL YOUR NEEDS



Hertz Filter Corporations' engineering department is made up entirely of specialists in the field of custom design of band pass filters. They are all fully experienced and prepared to help you solve your filter problems. Call or write Hertz for reliable service and prompt delivery.

FEATURES

1. Filters, Band Pass, Passive
2. Center Frequencies — 50 Hz to 50 Meg Hz
3. Shape factors — better than 2.0 for ratios of 60 db to 3 db
4. Bandwidth to center frequency ratio — up to 10%
5. Phase linearity — within 10° through passband
6. Low passband insertion loss
7. Better than 80 db attenuation 50% above and below center frequency
8. Input and output impedances as required
9. Low input and output impedances in stop band
10. Low passband ripple
11. L, C, and R elements only



PARTIAL LIST OF HERTZ FILTERS

(all filters in accordance with MIL-F-18327)

BAND PASS

PART NO.	PASS BAND	STOP BAND	Z_o	I.L.@CF	SIZE
BP-7907-1	3db(150-300)Hz	60db(50-850)Hz	600	1db	2 x 2¼ x 4
BP-7907-2	3db(300-600)Hz	60db(110-1700)Hz	600	1db	2 x 2¼ x 4
BP-7907-3	3db(600-1200)Hz	60db(210-3400)Hz	600	1db	2 x 2¼ x 4
BP-7907-4	3db(1.2-2.4)KHz	60db(.43-6.8)KHz	600	1db	2 x 2¼ x 4
BP-7907-5	3db(2.4-4.8)KHz	60db(.85-13.5)KHz	600	1db	2 x 2¼ x 4
BP-7907-6	3db(4.8-9.6)KHz	60db(1.7-27)KHz	600	1db	2 x 2¼ x 4
BP-7907-7	3db(8.9-11.2)KHz	60db(3.1-32)KHz	600	1db	2 x 2 x 3
BP-7996-1	3db(825-1,175)Hz	40db(650-1,350)Hz	30K	3db	1 x 2¼ x 4½
BP-8004-10	3db(8-26)KHz	30db(4-30)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-11	3db(19.5-33.5)KHz	30db(16.5-36.5)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-12	3db(26.25-40.25)KHz	30db(23.25-43.25)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-13	3db(32.6-52.6)KHz	30db(27.6-57.6)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-7897-1	3db(37.5-40.5)KHz	30db(34.5-43.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-2	3db(40.5-43.5)KHz	30db(37.5-46.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-3	3db(43.5-46.5)KHz	30db(40.5-49.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-4	3db(46.5-49.5)KHz	30db(43.5-52.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-5	3db(49.5-52.5)KHz	30db(46.5-55.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-6	3db(52.5-55.5)KHz	30db(49.5-58.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-7	3db(55.5-58.5)KHz	30db(52.5-61.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-8	3db(58.5-61.5)KHz	30db(55.5-64.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-9	3db(61.5-64.5)KHz	30db(58.5-67.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-10	3db(64.5-67.5)KHz	30db(61.5-70.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-11	3db(67.5-70.5)KHz	30db(64.5-73.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-12	3db(70.5-73.5)KHz	30db(67.5-76.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-13	3db(73.5-76.5)KHz	30db(70.5-79.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-14	3db(76.5-79.5)KHz	30db(73.5-82.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-15	3db(79.5-82.5)KHz	30db(76.5-85.5)KHz	10K/1K	4db	1¼ x 1¼ x 2

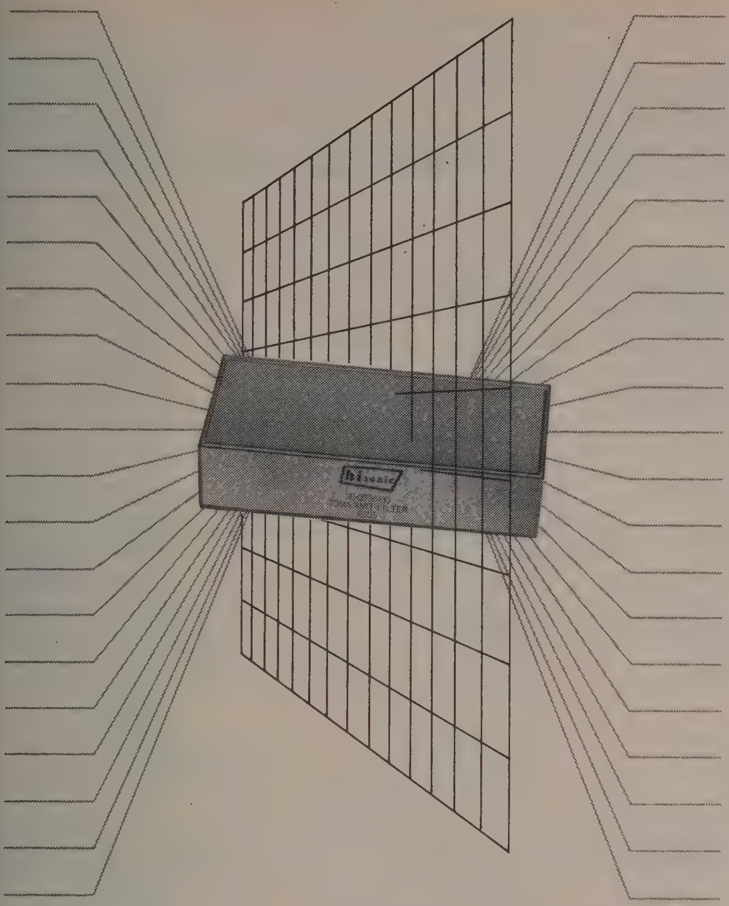
LOW PASS

PART NO.	PASS BAND	STOP BAND	Z_o	SIZE
LP-7907-1	4db@300Hz, 1db@225Hz	60db@850Hz	600	2 x 2 x 3
LP-7907-2	4db@600Hz, 1db@450Hz	60db@1700Hz	600	2 x 2 x 3
LP-7907-3	4db@1.2KHz, 1db@.9KHz	60db@3.4KHz	600	2 x 2 x 3
LP-7907-4	4db@2.4KHz, 1db@1.8KHz	60db@6.8KHz	600	2 x 2 x 3
LP-7907-5	4db@4.8KHz, 1db@3.6KHz	60db@13.5KHz	600	2 x 2 x 3
LP-7907-6	4db@9.6KHz, 1db@7.2KHz	60db@27KHz	600	2 x 2 x 3
LP-7907-7	4db@11.2Hz, 1db@10KHz	60db@32KHz	600	1⅜ x 1⅝ x 2¾
LP-7996-1	5db@1,175Hz, 2db@1,000Hz	40db@650Hz	30K	1⅜ x 1⅝ x 2¾
LP-8004 10	5db@26KHz, 1db@17KHz	30db@30KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-11	5db@33.5KHz, 1db@26.5KHz	30db@36.5KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-12	5db@40.25KHz, 1db@33.25KHz	30db@43.25KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-13	5db@52.6KHz, 1db@42.6KHz	30db@57.6KHz	10K/2K	1¼ x 1¼ x 2

PART NO. HIGH PASS	PASS BAND	STOP BAND	Z_o	SIZE
HP-7907-1	4db@150Hz, 1db@225Hz	60db@50Hz	600	2 x 2 x 3
HP-7907-2	4db@300Hz, 1db@450Hz	60db@110Hz	600	2 x 2 x 3
HP-7907-3	4db@600Hz, 1db@900Hz	60db@210Hz	600	2 x 2 x 3
HP-7907-4	4db@1.2KHz, 1db@1.8KHz	60db@.43KHz	600	2 x 2 x 3
HP-7907-5	4db@2.4Hz, 1db@3.6KHz	60db@.85KHz	600	2 x 2 x 3
HP-7907-6	4db@4.8Hz, 1db@7.2KHz	60db@1.7KHz	600	2 x 2 x 3
HP-7907-7	4db@8.9KHz, 1db@10KHz	60db@3.1KHz	600	1⅜ x 1⅝ x 2¾
HP-7996-1	5db@825Hz, 2db@1,000Hz	40db@1,350Hz	30K	1⅜ x 1⅝ x 2¾
HP-8004-10	5db@8KHz, 1db@17KHz	30db@4KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-11	5db@19.5KHz, 1db@26.5KHz	30db@16.5KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-12	5db@26.25KHz, 1db@33.25KHz	30db@23.25KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-13	5db@32.6KHz, 1db@42.6KHz	30db@27.6KHz	10K/2K	1¼ x 1¼ x 2

HERTZ

HERTZ FILTER CORPORATION
3 AERIAL WAY • SYOSSET, NEW YORK 11791
TELEPHONE (516) 822-4770



HISONIC... pioneers in filter network design.

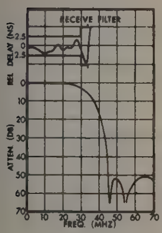
Communications are dependable only with quality components.

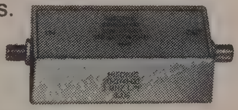
The staff at Hisonic, Inc. includes pioneer specialists with over 31 years experience in filter network design. It also includes mathematicians whose backgrounds of program development enable them to achieve design excellence in producing filters for your "out of this world" requirements . . . They use late generation computers, programmed to pre-test any design network. All types of packaging are available.

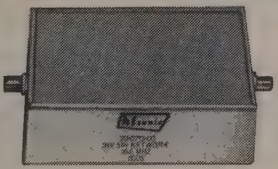
CUSTOM FILTERS

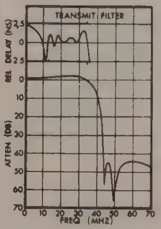
Modern Filters for Satellite Communication:

Special Attenuation shapes and controlled delay can be furnished to provide optimum transmission characteristics for TDMA Signals. BNC, SMA, or PC Terminations.





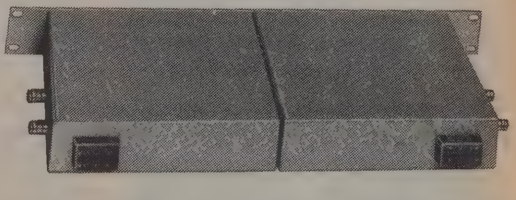




Telephone Interconnect Filters:

Base Group Interconnect 60-108 KHZ
P/N 20-0999-00

Super Group Interconnect 312-552 KHZ
P/N 20-0651-02



Base Band Separation Filters:

Supergroup 1-2	Supergroup 2-3
0-300 KHZ LP	0-552 KHZ LP
312-12000 KHZ HP	564-12000 KHZ HP
P/N 20-0998-00	P/N 20-0688-02

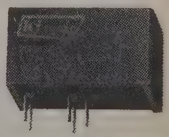
Many others available or we'll custom design.
Let us know your needs.

hisonic inc.

Hisonic, Inc.
249 N. Troost
Dept. EM-84
P.O. Box 1130
Olathe, Kansas 66061
PHONE: 913-782-0012
TELEX: 4-2562

Many other Specialized Applications:

- Ultra-sharp transition characteristics (quartz crystals)
- Controlled Delay • Controlled Phase
- Special Attenuation Shapes



We Also Make:

- Conventional Filters
- Filters to MIL-F-18327

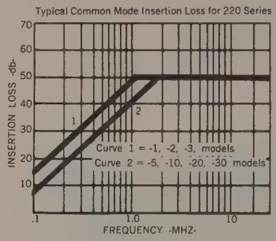
OTHER PRODUCTS: (Mil Spec & Commercial) Power & Precision Inductors • Transformers • Tuned Circuits • Amp/phase Equalizers • Lumped Constant Delay Lines

JMK INCORPORATED filters

JMK has the filter just right for your power application. Whether it has to do with audio systems, lab test equipment, medical equipment, printers, power converters, video displays, modems, processors, cash registers, pinball machines, televisions, aircraft power supplies, or whatever your specific application may be, we have the filter.

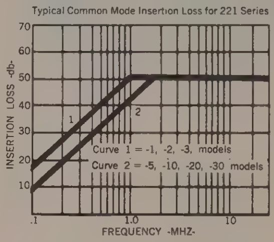
220 Series

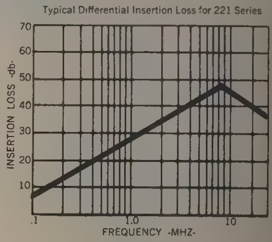
The 220 series is designed to give excellent filtering of "common mode," line-to-ground interference on computer-peripheral and other electronic hardware. Line-to-ground interference is the most common interference experienced and is generally the major source of "interference caused" malfunctions.

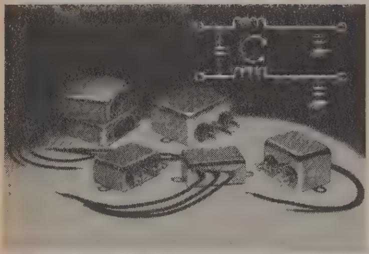

Typical Common Mode Insertion Loss for 220 Series

221 Series

The 221 series has the same "common mode" performance as the 220 series but the circuit has been modified to give substantial "differential mode" rejection of noise caused by switching transistors and power supply diodes.

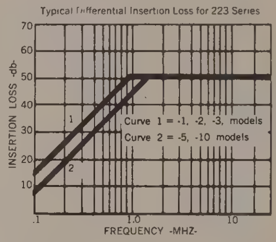

Typical Common Mode Insertion Loss for 221 Series

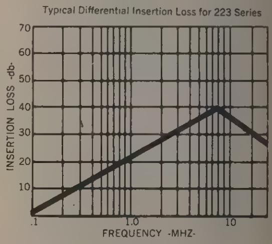

Typical Differential Insertion Loss for 221 Series



223 Series

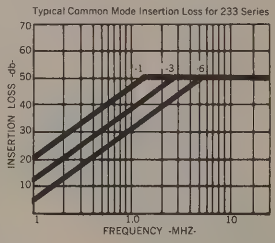
The 223 series in intended as an economical compromise between the 220 and 221 series. This filter has the same "common mode" performance as the 220 model with approximately one-half the differential attenuation of the 221 series.

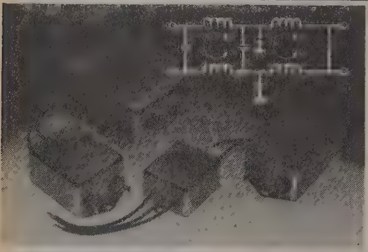

Typical Differential Insertion Loss for 223 Series


Typical Differential Insertion Loss for 223 Series

233 Series

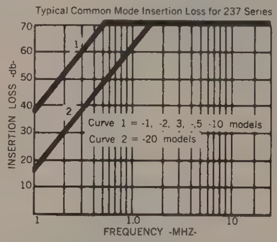
The 233 series filter is a compact filter with an integral IEC connector. This filter gives effective line-to-ground insertion loss and has low leakage current to meet VDE, SEV and other safety organization requirements. If you want an integral filter and connector ask your representative or contact the factory. Many of our other filters can be made available with the IEC connector.

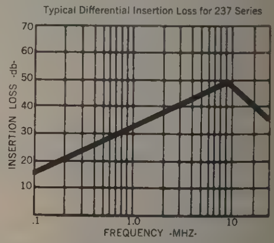

Typical Common Mode Insertion Loss for 233 Series

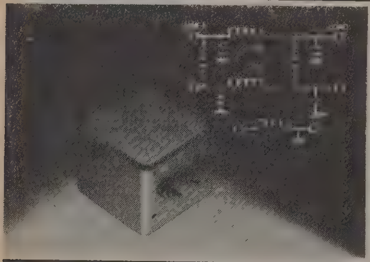


237 Series

This series is a high performance package where filtering requirements are more stringent than those associated with the 220 or 221 series. This package incorporates very high attenuation of both "common mode" and "differential mode" interference yet the cost for such attenuation is moderate.

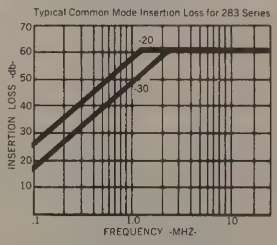

Typical Common Mode Insertion Loss for 237 Series

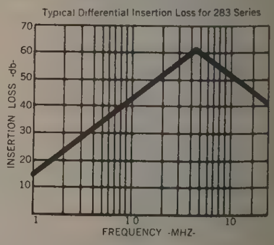

Typical Differential Insertion Loss for 237 Series



283 Series

The 283 series is a compact single phase high current filter. This filter is rated for 20 and 30 amps and has good common mode and differential mode insertion loss. This filter has a ground coil for high frequency ground isolation which may be included or omitted as desired.


Typical Common Mode Insertion Loss for 283 Series


Typical Differential Insertion Loss for 283 Series

JMK INCORPORATED • 15 CALDWELL DRIVE • AMHERST, NH 03031 • (603) 886-4100

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (201) 636-1900

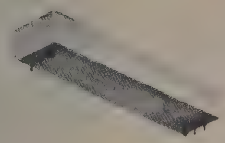
LOW PASS FILTERS

Frequency Range: DC to 50MHz
Impedance Range: 1 ohm to ∞
Stop Bands: 10 to 80db

BAND PASS FILTERS

Frequency Range: DC to 50MHz
Band Width: 1% to >100%
Stopband: 10 to 80db
Impedance Range: 1 ohm to ∞

HIGH PASS FILTERS



Frequency Range: DC to 50MHz
Impedance Range: 1 ohm to ∞
Stop Bands: 10 to 80db

BAND REJECT FILTERS

Frequency Range: DC to 50MHz
Band Width: 1% to >100%
Stop Band: 10 to 80db
Impedance Range: 1 to ∞

Custom LC Filters

☐ Filters ☐ Attenuation Equalizers ☐ Group Delay Equalizers ☐ Cable Equalizers ☐ Phase Equalizers ☐ Phase and Attenuation Matched ☐ Delay Lines

Computer-Assisted Design

Shown here are some typical examples of our LC filter design capabilities. Through the use of in-house computers, plus computer time-sharing, we can quickly generate and evaluate such output data as frequency vs. impedance, attenuation, phase, group delay and phase delay in order to provide an immediate quotation.

KR Electronics has computer programs for:

1. Analysis of network behavior to determine attenuation, phase, group delay, transient response and response to a step function and a tone burst.
2. Predistortion of a network and synthesis of a network directly from the poles and zeros.
3. Designing equal ripple group delay networks from your error curve.
4. Determining a network's tolerance sensitivity and reliability.
5. Determining degree of success that can be achieved in production of matched networks.

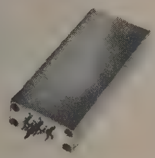
Some of the specialized test equipment used:

1. Computer controlled HP 3042A automatic test set can supply tabular or graphic data with each unit.
2. Programmable synthesizer, phase, gain test sets.
3. Swept low frequency group delay and attenuation test set.
4. Spectrum analyzer.
5. Swept high frequency test set.

DIP Filters

For information on our complete line of DIP filters, send for comprehensive catalog.

MATCHED PHASE & ATTENUATION

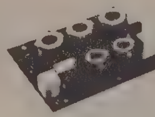


Typical Specifications:
Phase Matched ± 2½° in Pass Band
Attenuation Matched ±.25db in Pass Band for use in Sonar & other multi channel systems.

MAXIMUM FLAT DELAY (BESSEL) FILTER

Size (Typical): .75″ x .75″ x 1.5″
Frequency Range: 1.5KHz to 1MHz
Z Range: 50 to 10 K
Overshoot: <1%
Delay Flat: <2% to Fc

LINEAR GROUP DELAY VIDEO FILTER



Typical Specifications:
L.P. Cutoff: 4.5 MHz
I.L.: <1db
Passband Ripple: <±.1db
Pass Band Delay Distortion: <25 nsec.
Stopband: >25db

GROUP DELAY & ATTENUATION EQUALIZER NETWORK

To correct system introduced delay distortion & attenuation roll off.

Constant Group Delay Filters

Computer-designed and checked to give equal ripple delay over the pass band insuring exact delay and attenuation characteristics.

Frequency Range: DC to 50 MHz
Impedance Range: 1 ohm to ∞
Temperature Range: —55°C to +125°C.
Complete Encapsulation
Hermetic Seal
P.C. Board Construction
Case Configuration:
Stock or Custom Designed
P.C. Card
Dual In-Line
Standard Hardware Program

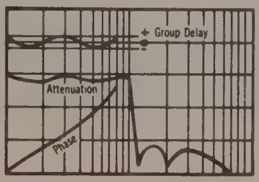
All filters conform to applicable mil specifications.

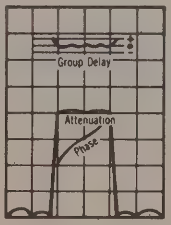
Phase & Attenuation Matching

Differential phase and attenuation matched to eliminate the need for adjustments in multi-channeled systems.

Linear Phase Filters

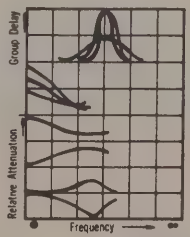
To reduce distortions and lower transient response in modulated systems.





Equalizers

Phase/Delay/Attenuation
Computer-designed correction networks derived from system error curves.



Printed in USA

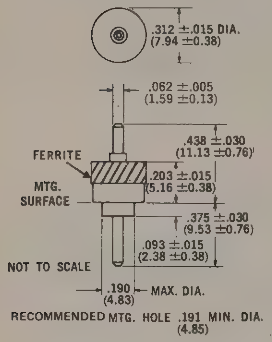
METUCHEN CAPACITORS INC.

EMI/RFI Suppression Filters

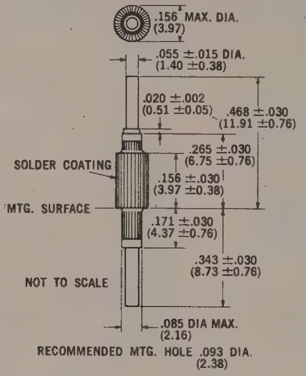
RESIN SEAL THREAD BUSHING

Specifications	Type FCS-C	Type SMFB-A4	Type SMF0-1 Type SMFB-A1	Type SMFB-A2 Type SMF0-2
Attenuation 100 MHz - 10 GHz	25 dB @ 25°C 20 dB @ 85°C	50 dB @ 25°C 45 dB @ 125°C	35 dB @ 25°C 35 dB @ 125°C	60 dB @ 25°C 50 dB @ 85°C
Operating Temperature Range	−55°C to +85°C	−55°C to +125°C	−55°C to +125°C	−55°C to +85°C
DC Working Voltage	500 Volts	500 Volts	200 Volts	200 Volts
Feed-Thru Current	25 Amperes	10 Amperes	10 Amperes	10 Amperes
Capacitance (pF)	1000	2500	1300	5500
Feed-Thru Terminal Resistance	0.01 Ohm Maximum			

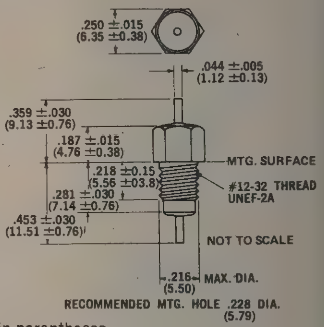
TYPE FCS-C


.312 ±.015 DIA.
(7.94 ±0.38)
.062 ±.005
(1.59 ±0.13)
.438 ±.030
(11.13 ±0.76)
FERRITE
MTG.
SURFACE
.203 ±.015
(5.16 ±0.38)
.375 ±.030
(9.53 ±0.76)
.093 ±.015
(2.38 ±0.38)
NOT TO SCALE
.190
(4.83)
MAX. DIA.
RECOMMENDED MTG. HOLE .191 MIN. DIA.
(4.85)

TYPES SMFO-1, SMFO-2


.156 MAX. DIA.
(3.97)
.055 ±.015 DIA.
(1.40 ±0.38)
.020 ±.002
(0.51 ±0.05)
.468 ±.030
(11.91 ±0.76)
.265 ±.030
(6.75 ±0.76)
SOLDER COATING
.156 ±.030
(3.97 ±0.38)
MTG. SURFACE
.171 ±.030
(4.37 ±0.76)
.343 ±.030
(8.73 ±0.76)
NOT TO SCALE
.085 DIA MAX.
(2.16)
RECOMMENDED MTG. HOLE .093 DIA.
(2.38)

TYPES SMFB-A1, SMFB-A2, SMFB-A4


.250 ±.015
(6.35 ±0.38)
.044 ±.005
(1.12 ±0.13)
.359 ±.030
(9.13 ±0.76)
.187 ±.015
(4.76 ±0.38)
MTG. SURFACE
.218 ±0.15
(5.56 ±03.8)
#12-32 THREAD
UNEF-2A
.281 ±.030
(7.14 ±0.76)
.453 ±.030
(11.51 ±0.76)
NOT TO SCALE
.216
(5.50)
MAX. DIA.
RECOMMENDED MTG. HOLE .228 DIA.
(5.79)

mm are in parentheses

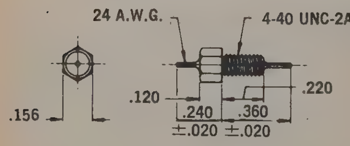
ORDERING INFORMATION

Previous Type Number	Ordering Number
FCS-C	51-722-001 51-722-002 with solder mounting washer
SMFB-A1	51-719-022 with nut and lockwasher
SMFB-A2	51-719-021 with nut and lockwasher
SMFB-A4	51-719-011 with nut and lockwasher

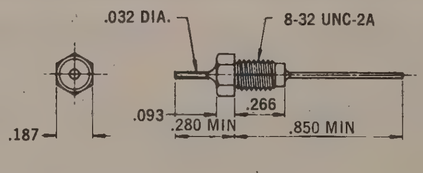
Previous Type Number	Ordering Number
SMF0-1	51-723-303 51-723-304 with solder mounting washer
SMF0-2	51-723-301 51-723-302 with solder mounting washer

TYPES

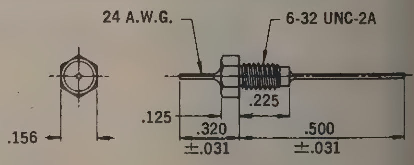
51-729


24 A.W.G.
4-40 UNC-2A
.156
.120
.220
.240
±.020
.360
±.020

51-712


.032 DIA.
8-32 UNC-2A
.187
.093
.266
.280 MIN
.850 MIN

51-726


24 A.W.G.
6-32 UNC-2A
.156
.125
.225
.320
±.031
.500
±.031

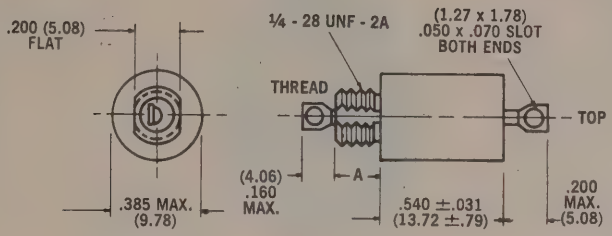
Spectrum Control No.	Rated I_{DC} in Amps	Working Volts, DC		DCR Max.	Capacitance Reference Only µF	Insertion Loss dB					
		+85 °C	+125 °C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-729-303	10	200	100	.01	.0015	—	5	42	60	65	65
51-729-304	10	200	100	.01	.022	7	27	43	50	60	60
51-726-001	3	200	100	.01	.0015	—	3	42	50	70	70
51-726-002	10	200	100	.01	.022	7	27	43	50	60	60
51-712-001	10	200	100	.01	.0015	—	5	43	50	70	70
51-712-003	10	200	100	.01	.022	10	28	45	50	70	70

All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control Inc. . .**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

METUCHEN CAPACITORS INC.

EMI/RFI Suppression Filters HERMETIC SEAL


.200 (5.08)
FLAT
.385 MAX.
(9.78)
¼ - 28 UNF - 2A
THREAD
(1.27 x 1.78)
.050 x .070 SLOT
BOTH ENDS
TOP
(4.06)
.160
MAX.
A
.540 ±.031
(13.72 ±.79)
.200
MAX.
(5.08)

50 VDC +85°C L SECTION 28 VDC +125°C

Spectrum Control No.	A Thread Length	Inductor Location	Rated Current	DCR Max.	Insertion Loss dB 30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
51-353-007	.187 (4.75)	Thread	60 ma.	70	44	70	70	70	70	70
51-353-086	.312 (7.92)	End								
51-353-094	.187 (4.75)	Top								
51-353-102	.312 (7.92)	End								
51-353-006	.187 (4.75)	Thread	150 ma.	12	24	52	64	70	70	70
51-353-087	.312 (7.92)	End								
51-353-095	.187 (4.75)	Top								
51-353-103	.312 (7.92)	End								
51-353-005	.187 (4.75)	Thread	250 ma.	4	18	42	56	70	70	70
51-353-088	.312 (7.92)	End								
51-353-096	.187 (4.75)	Top								
51-353-104	.312 (7.92)	End								
51-353-004	.187 (4.75)	Thread	300 ma.	2.3	16	35	44	62	70	70
51-353-089	.312 (7.92)	End								
51-353-097	.187 (4.75)	Top								
51-353-105	.312 (7.92)	End								

mm are in parentheses

50 VDC +85°C L SECTION 28 VDC +125°C

Spectrum Control No.	A Thread Length	Inductor Location	Rated Current	DCR Max.	Insertion Loss dB 30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
51-353-003	.187 (4.75)	Thread	450 ma.	1.2	15	31	37	55	70	70
51-353-090	.312 (7.92)	End								
51-353-098	.187 (4.75)	Top								
51-353-106	.312 (7.92)	End								
51-353-276	.187 (4.75)	Thread	1 amp	.25	15	33	44	70	70	70
51-353-091	.312 (7.92)	End								
51-353-099	.187 (4.75)	Top								
51-353-107	.312 (7.92)	End								
51-353-277	.187 (4.75)	Thread	5 amps	.015	15	28	33	46	70	70
51-353-092	.312 (7.92)	End								
51-353-100	.187 (4.75)	Top								
51-353-108	.312 (7.92)	End								
51-353-001	.187 (4.75)	Thread	10 amps	.01	15	28	33	44	64	70
51-353-093	.312 (7.92)	End								
51-353-101	.187 (4.75)	Top								
51-353-109	.312 (7.92)	End								

Fig #1

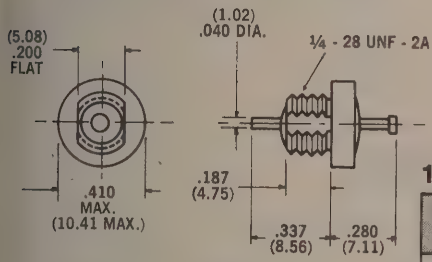
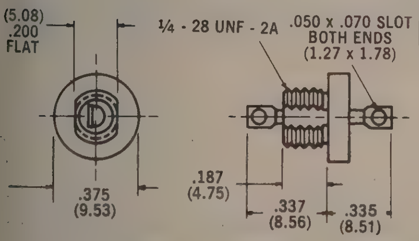
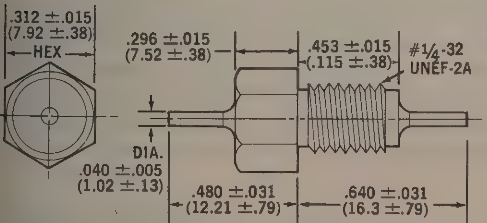

(5.08)
.200
FLAT
.410
MAX.
(10.41 MAX.)
(1.02)
.040 DIA.
¼ - 28 UNF - 2A
.187
(4.75)
.337
(8.56)
.280
(7.11)

Fig #2


(5.08)
.200
FLAT
.375
(9.53)
¼ - 28 UNF - 2A
.050 x .070 SLOT
BOTH ENDS
(1.27 x 1.78)
.187
(4.75)
.337
(8.56)
.335
(8.51)

100 VDC +85°C L SECTIONS 125 VAC +125°C

Spectrum Control No.	Rated I_{DC}	Working Volts +85°C	+125°C	DCR Max.	Capacitance Reference Only	Insertion Loss dB 30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz	FIG.
51-717-001	15 amps	100 VDC	50 VDC	0.1	1.4 MFD	15	28	33	44	60	70	1
51-717-007	15 amps	125 VAC	125 VAC	0.1	.015 ±20%	—	—	—	10	30	70	1
51-359-001	15 amps	100 VDC	50 VDC	0.1	1.4 MFD	15	28	33	44	60	70	2
51-359-007	15 amps	125 VAC	125 VAC	0.1	.015 ±20%	—	—	—	10	30	70	2


.312 ±.015
(7.92 ±.38)
HEX
.296 ±.015
(7.52 ±.38)
.453 ±.015
(.115 ±.38)
#¼-32
UNEF-2A
DIA.
.040 ±.005
(1.02 ±.13)
.480 ±.031
(12.21 ±.79)
.640 ±.031
(16.3 ±.79)

Spectrum Control Number	Rated DC Current	WVDC @ 125°C	DCR	CKT	CAP.	Minimum Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-732-002	10A	100	.01	L	.1 μF	18	65	70	70	70	70

All Feed-thru Capacitors and RFI Filters stocked by MCI are manufactured in the U.S.A. by **Spectrum Control Inc. . .**
The world's leading manufacturer of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

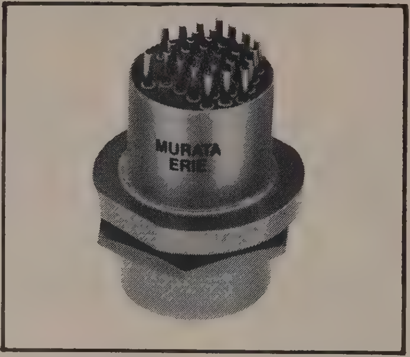
Metuchen Capacitors Inc. / Dept. EM, 420 Park Avenue, Perth Amboy, NJ 08861 / (201) 442-0500 / TWX 710-998-0892

EMI/RFI filter connectors

MURATA ERIE NORTH AMERICA, INC.

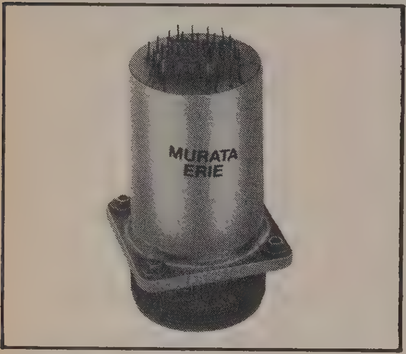
Cylindrical Connectors

Murata Erie cylindrical filter connectors can be found in numerous military, aerospace and commercial programs and have to be of the highest reliability. Because of the large variations in requirements for specific applications, Murata Erie has a competent staff of applications engineers available to aid in custom designs. Shown are some typical examples of Murata Erie cylindrical filter connectors and the appropriate MIL specifications which they meet.

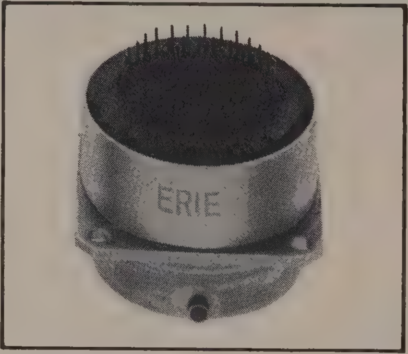


1255-080 Series to MIL-C-83723
Hermetically sealed, 2-61 line insert arrangements

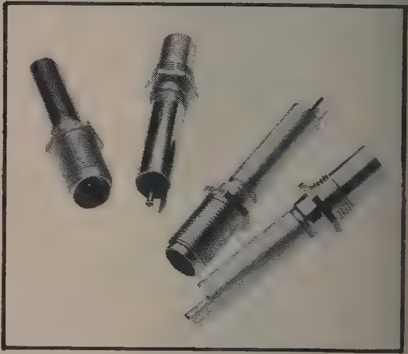
1255-100 Series to MIL-C-26482
Wide capacitance range. Directly replaces ITT "PVJ" and Bendix "FPT"



1255-070 Series to MIL-C-5015
Power connector with #12 or #16 contacts



1255-090 Series to MIL-C-38999
Low profile. 3-128 lines with from #12 to #22 contacts



1240-010 Series — UG/U Types
For audio lines. TNC/BNC compatible

"D" Connectors
1255-030 Series to MIL-C-24308

A complete line of high quality subminiature filtered connectors is available in 9, 15, 25, 37, and 50 contact arrangements, per MIL-C-24308. Capable of withstanding MIL-F-15733 testing including vibration and moisture resistance, these rugged assemblies are of a complete solder construction, thereby delivering the highest possible insertion loss at frequencies up to 10 GHz. The rear termination is available in solder-cup, .025" square wire wrap or .030" round PC board variations.

CUSTOM DESIGNS

Murata Erie specializes in developing sophisticated circuit designs and creating high component density packaged networks in-house. Our engineering design teams analyze individual customer problems, design specific components or networks to solve the problem, build prototypes and test the complete system. To support the high technological content of these custom networks, the engineering and test capabilities at our facility have become one of the most advanced in the industry today. The reliability of every component and network is assured by a comprehensive battery of tests performed under carefully controlled conditions. Then in-line prototype techniques further validate component performance prior to volume production. These technical support activities permit Murata Erie to respond to customer needs promptly and efficiently with positive performance engineered into the customer's system. If your requirements are unique, if you have a critical space, weight, or environmental problem, Murata Erie can help solve your specific requirements for you with a custom designed filter network.

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

EMI/RFI filters

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.

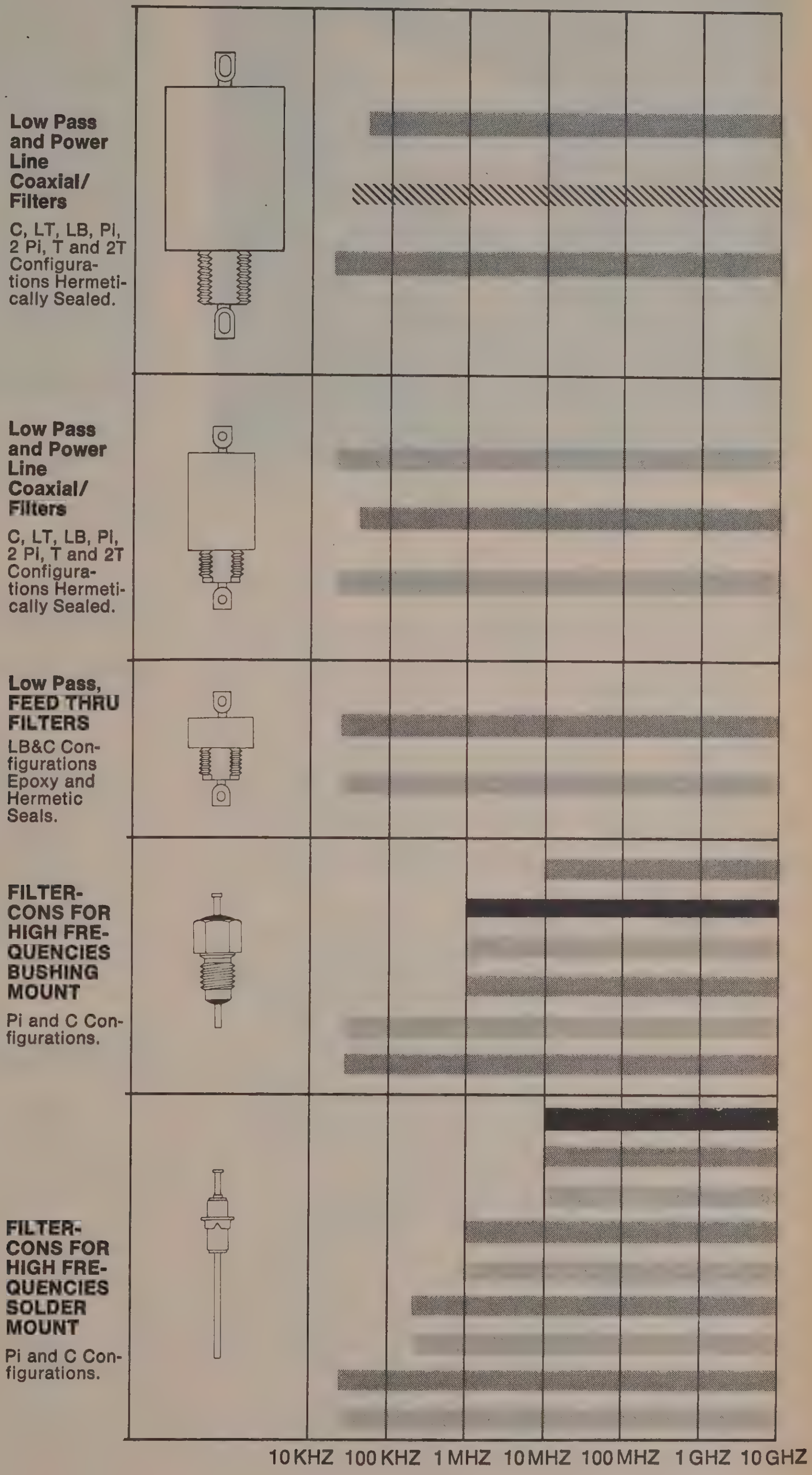
Murata Erie manufactures a complete line of EMI/RFI suppression, low pass filters in Pi, C, L, LT and LB configurations. These units, as well as a complete line of Power Line filters, are offered in both coaxial and bushing mount styles and to MIL-F-15733.

Long term reliability is assured through a quality assurance system meeting or exceeding the requirements of MIL-Q-9859 and DND-1015.

To complement this line of filters, Murata Erie has a complete Customer Service and Customer Engineering staff to provide specific application assistance and custom designs.

Illustrated are typical EMI/RFI filter configurations and their frequency/voltage capabilities.

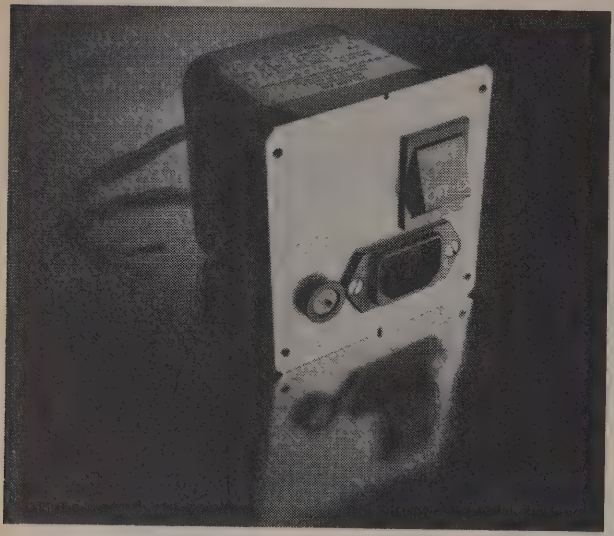
Typical Filter Configurations vs Frequency



WORKING VOLTAGE
0-100V ░
100-250V ▒
250-500V ▨
500-2500V ■

muRata ERIE

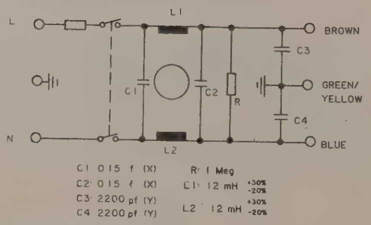
INTERNATIONAL



Specifications

Part number:	8843.N4.9001.A
Working voltage:	110-250 Volts AC
Frequency:	50-60 Hz
Current (at all voltages in above range)	4 amps
Operating temperature range:	−25 to +85°C (VDE class HPF)
Leakage current:	less than 0.5 mA at 250 VAC
Power dissipation:	less than 8 Watts at 4A
Weight:	approximately 490 grams (17 oz.)
Method of connection:	wire leads: color-coded brown, blue, green/yellow; 20 cm (approx. 7.9 inches) long; wire size is 1.0 mm² (approximately 16 AWG, which is 1.23 mm²); wire leads are terminated by two Amp connectors, P/N 350536-0005, and one terminal lug on the ground, Amp P/N 2-31890-1. Custom connections available on special order.
Test agency approvals:	SEV and VDE approved; UL recognized; CSA certified

Schematic


L
N
L1
L2
C1
C2
R
C3
C4
BROWN
GREEN/
YELLOW
BLUE
C1 0 15 f (X)
C2 0 15 f (X)
C3 2200 pf (Y)
C4 2200 pf (Y)
R: 1 Meg
L1: 12 mH +30% -20%
L2 12 mH +30% -20%

This INTERNATIONAL Power Module combines in one package four basic primary circuit components:

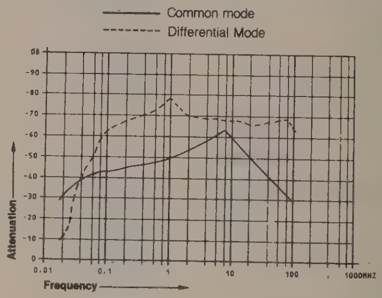
- rocker power switch (push button switch is available as an option)
- fuseholder that accepts either a 5 × 20 mm or ¼ × 1¼ inch fuse
- IEC-320/CEE-22 primary circuit connector
- high performance single-stage RFI power filter

The entire power module is designed from the beginning to satisfy the test requirements of UL, CSA, VDE & SEV. Use of this component can simplify the foreign approval process because it will eliminate the delays and extra costs associated with having unrecognized components tested or in sourcing approved primary circuit components.

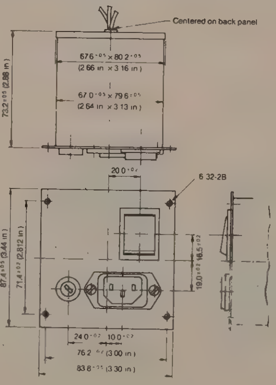
The filter itself is designed to provide high attenuation in the range under 500 kHz. This makes it especially effective for use with switching power supplies. Its low leakage allows its use in portable equipment in accordance with VDE and SEV requirements.

Performance

Common & Differential Mode Insertion Loss
as measured in a 50Ω/50Ω system



Dimensions


Centered on back panel
67.6 ±0.5 × 80.2 ±0.5
(2.66 in × 3.16 in)
67.0 ±0.5 × 79.6 ±0.5
(2.64 in × 3.13 in)
73.2 ±0.5 (2.88 in)
20.0 ±0.2
6 32-2B
87.4 ±0.5 (3.44 in)
71.4 ±0.2 (2.812 in)
18.5 ±0.2
19.0 ±0.2
24.0 ±0.2
10.0 ±0.2
76.2 ±0.2 (3.00 in)
83.8 ±0.5 (3.30 in)

PANEL COMPONENTS CORPORATION P.O. Box 6626, Santa Rosa, CA 95406 • (707) 523-0600 • TX 176-747

Power Module

FELLER AG 8843.N3.9005.E
SWISS MADE
ON I
OFF O

The 8843.N3.9005.E international power module combines in one package four basic primary power components:

- Rocker power switch (the power module is available without this rocker power switch as a special option)
- fuseholder that accepts only a 5 x 20 mm international fuse
- IEC 320/CEE-22 primary power connector
- high-performance, 2-stage RFI power filter

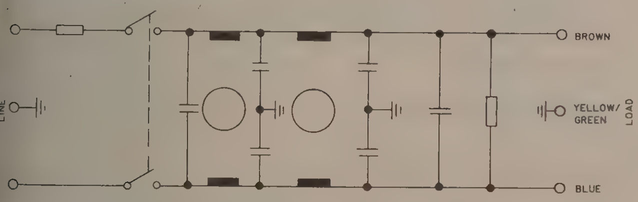
This power module is designed to satisfy the test requirements of UL, CSA, VDE, SEMKO and SEV.

The filter itself is designed to provide especially high levels of insertion loss in the range from 100 kHz to 1 MHz and is therefore especially attractive for use with switching power supplies which draw 3 amps or less at 250 VAC and 4 amps or less at 120 VAC.

Specifications

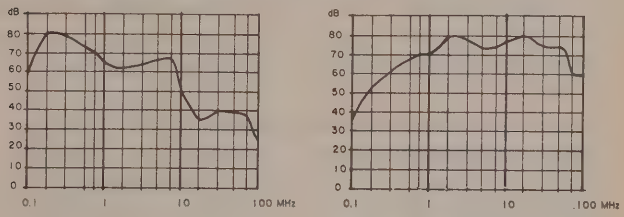
Part number:	8843.N3.9005.E
Working voltage:	110-250 VAC
Power line frequency:	50-60 Hz
Current:	3A – 250 VAC 4A – 120 VAC
Operating temperature range	−25 to +85°C (VDE Class HPF)
Leakage current:	<.8 mA at 250 VAC, 50 Hz
Power dissipation:	5.0W at 4A
Weight:	467 grams
Method of connection:	Standard — see drawing Custom Specifications Welcome
Test agency approvals:	UL recognized, CSA recognized, VDE, SEV approved

Schematic


LINE
BROWN
YELLOW/GREEN
LOAD
BLUE

Performance

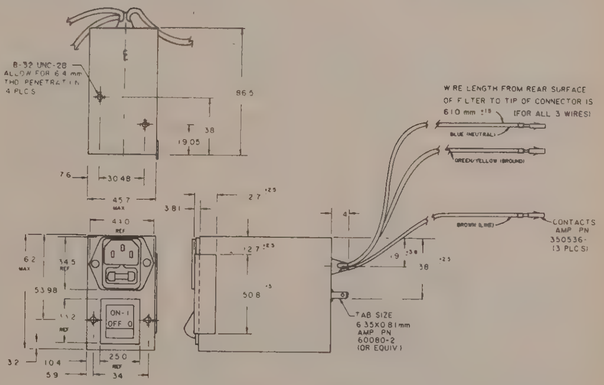
Common & Differential Mode Insertion Loss
as measured in a 50Ω/50Ω system



Common Mode

Differential Mode

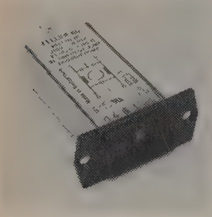
Dimensions

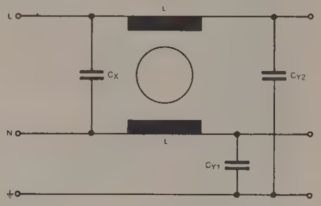

8-32 UNC-2B ALLOW FOR 6.4 mm THD PENETRATION 4 PLCS
86.5
38
19.05
7.6
30.48
45.7 MAX
44.0 REF
3.81
2.7 ±.25
4
6.2 MAX
34.5 REF
53.98
11.2 REF
3.2
10.4
5.9
25.0 REF
34
12.7 ±.25
50.8 ±.5
19 ±.38
38 ±.25
ON-I
OFF O
WIRE LENGTH FROM REAR SURFACE OF FILTER TO TIP OF CONNECTOR IS 610 mm ±15 (FOR ALL 3 WIRES)
BLUE (NEUTRAL)
GREEN/YELLOW (GROUND)
BROWN (LINE)
CONTACTS AMP PN 350536- (3 PLCS)
TAB SIZE 6.35X0.81mm AMP PN 60080-2 (OR EQUIV)

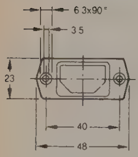
PANEL COMPONENTS CORPORATION P.O. Box 6626, Santa Rosa, CA 95406 • (707) 523-0600 • TX 176-747

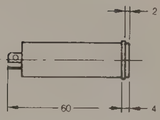
INTERNATIONAL

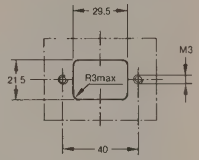
RFI filter with integral AC connector









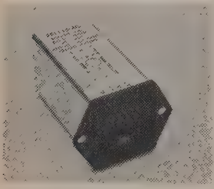


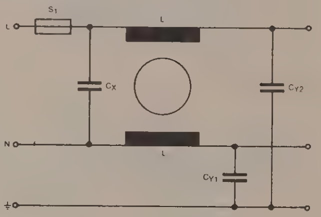
DESCRIPTION:
For Class I applications
Operating voltages up to 250 VAC, 50-60 Hz
Temperature class in accordance with DIN 40040: HPF
Operating temperature range −25° C to +85° C
Ambient temperature for operation at full rated current: 40° C
Test voltage: line-ground & neutral-ground, 2000 VAC, 50 Hz, 1 min.; line-neutral, 1075 VDC, 1 min.
Approvals, recognition, certification: UL, CSA, VDE, SEMKO, SEV, DEMKO
Housing: Rust-protected metal
Connector: IEC 320/CEE-22, molded from black thermoplastic
Contacts: .250 inch solderable quick disconnects
Available with 1 meg ohm, ½ watt discharge resistor on special order

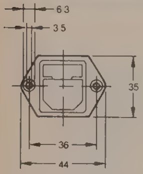
All dimensions in mm.

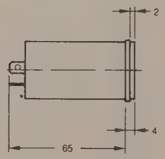
Part Number	Current Rating (Amps)	Leakage Current (mA max) (@ 250 VAC)	X Capacitors (μF)	Y Capacitors (pF)	Inductor (mH)	Weight (g)	Insertion Loss - dB						
								100kHz	400kHz	1Mz	4mHz	10mHz	100mHz
8843.N1.20.60	1	0.5	0.047	2200	11	70	Common Mode	45	58	62	60	62	37
							Differential Mode	10	32	50	72	70	47
8843.N2.20.60	2	0.5	0.047	2200	4	70	Common Mode	36	48	53	53	53	37
							Differential Mode	15	24	40	70	80	45
8843.N4.20.60	4	0.5	0.047	2200	1.6	70	Common Mode	27	38	50	58	62	42
							Differential Mode	10	18	30	60	76	48
8843.N6.20.60	6	0.5	0.047	2200	0.4	70	Common Mode	19	28	38	50	60	55
							Differential Mode	11	19	28	46	55	45

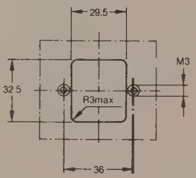
RFI filter with integral AC connector & 5 X 20 mm fuseholder











DESCRIPTION:
For Class I applications
Operating voltages up to 250 VAC, 50-60 Hz
Temperature class in accordance with DIN 40040: HPF
Operating temperature range −25° C to +85° C
Ambient temperature for operation at full rated current: 40° C
Test voltage: line-ground & neutral-ground, 2000 VAC, 50 Hz, 1 min.; line-neutral, 1075 VDC, 1 min.
Approvals, recognition, certification: UL, CSA, VDE, SEMKO, SEV
Housing: Rust-protected metal
Connector: IEC 320/CEE-22 with integral 5 X 20 mm fuseholder, molded from black thermoplastic
Contacts: .250 inch solderable quick disconnects
Available with 1 meg ohm, ½ watt discharge resistor on special order

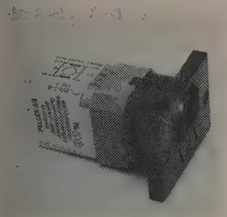
All dimensions in mm.

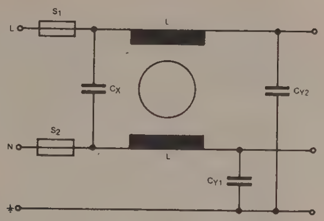
Part Number	Current Rating (Amps)	Leakage Current (mA max) (@ 250 VAC)	X Capacitors (μF)	Y Capacitors (pF)	Inductor (mH)	Weight (g)	Insertion Loss - dB						
								100kHz	400kHz	1Mz	4mHz	10mHz	100mHz
8843.N1.30.60	1	0.5	0.1	2200	11	95	Common Mode	32	52	58	56	58	37
							Differential Mode	10	30	56	61	67	41
8843.N2.30.60	2	0.5	0.1	2200	4	95	Common Mode	32	48	55	57	59	46
							Differential Mode	10	20	42	62	64	52
8843.N4.30.60	4	0.5	0.1	2200	1.6	95	Common Mode	27	36	45	55	61	45
							Differential Mode	11	18	30	57	64	39

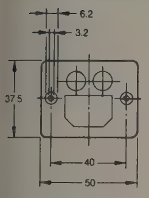
PANEL COMPONENTS CORPORATION P.O. Box 6626, Santa Rosa, CA 95406 • (707) 523-0600 • TX 176-747

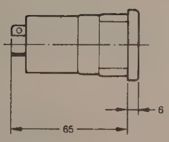
RFI Power Line Filters

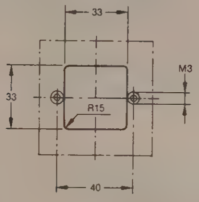
RFI filter with integral AC connector & dual 5 X 20 mm fuseholder











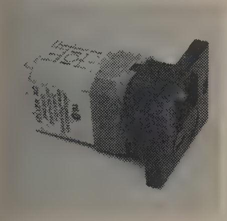
DESCRIPTION:
For Class I applications
Operating voltages up to 250 VAC, 50-60 Hz
Temperature class in accordance with DIN 40040: HPF
Operating temperature range −25° C to +85° C
Ambient temperature for operation at full rated current: 40° C
Test voltage: line-ground & neutral-ground, 2000 VAC,
50 Hz, 1 min.; line-neutral, 1075 VDC, 1 min.
Approvals, recognition: UL*, VDE, SEMKO, SEV
Housing: Rust-protected metal
Connector: IEC 320/CEE-22 with dual 5 X 20 mm fuseholders, molded from black thermoplastic
Contacts: .250 inch solderable quick disconnects
Available with 1 meg ohm, ½ watt discharge resistor on special order

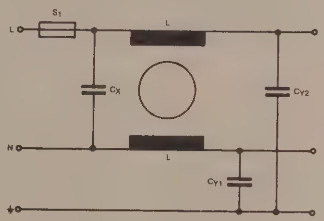
All dimensions in mm.

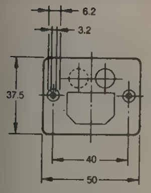
*UL recognized only for 240 VAC two phase applications

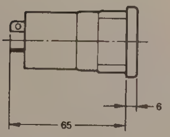
Part Number	Current Rating (Amps)	Leakage Current (mA max) (@ 250 VAC)	X Capacitors (µF)	Y Capacitors (pF)	Inductor (mH)	Weight (g)	Insertion Loss - dB						
								100kHz	400kHz	1Mz	4mHz	10mHz	100mHz
8843.N1.40.60	1	0.5	0.1	2200	11	90	Common Mode	43	57	60	55	57	37
							Differential Mode	10	32	60	62	63	50
8843.N2.40.60	2	0.5	0.1	2200	4	90	Common Mode	33	46	50	50	53	42
							Differential Mode	8	24	45	57	61	47
8843.N4.40.60	4	0.5	0.1	2200	1.6	90	Common Mode	20	32	40	52	60	45
							Differential Mode	9	20	29	42	52	40

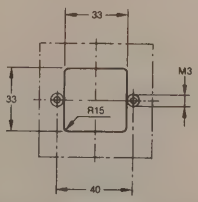
RFI filter with integral AC connector & 5 X 20mm fuseholder











DESCRIPTION:
For Class I applications
Operating voltages up to 250 VAC, 50-60 Hz
Temperature class in accordance with DIN 40040: HPF
Operating temperature range −25° C to +85° C
Ambient temperature for operation at full rated current: 40° C
Test voltage: line-ground & neutral-ground, 2000 VAC,
50 Hz, 1 min.; line-neutral, 1075 VDC, 1 min.
Approvals, recognition, certification: UL, CSA, VDE, SEMKO, SEV
Housing: Rust-protected metal
Connector: IEC 320/CEE-22 with integral 5 X 20 mm fuseholder, molded from black thermoplastic
Contacts: .250 inch solderable quick disconnects
Available with 1 meg ohm, ½ watt discharge resistor on special order

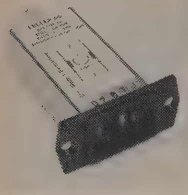
All dimensions in mm.

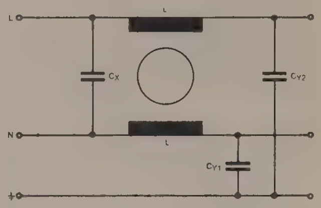
Part Number	Current Rating (Amps)	Leakage Current (mA max) (@ 250 VAC)	X Capacitors (µF)	Y Capacitors (pF)	Inductor (mH)	Weight (g)	Insertion Loss - dB						
								100kHz	400kHz	1Mz	4mHz	10mHz	100mHz
8843.N1.50.60	1	0.5	0.1	2200	11	90	Common Mode	42	58	59	56	58	40
							Differential Mode	12	30	60	60	61	50
8843.N2.50.60	2	0.5	0.1	2200	4	90	Common Mode	32	48	56	59	60	46
							Differential Mode	10	22	38	47	60	46
8843.N4.50.60	4	0.5	0.1	2200	1.6	90	Common Mode	19	30	38	51	60	44
							Differential Mode	10	20	30	45	51	40

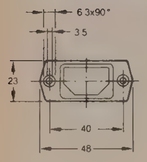
PANEL COMPONENTS CORPORATION P.O. Box 6626, Santa Rosa, CA 95406 • (707) 523-0600 • TX 176-747

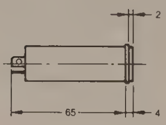
INTERNATIONAL RFI Power Line Filters

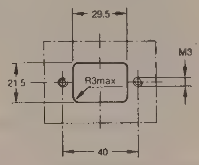
Low leakage RFI filter with integral AC connector











DESCRIPTION:

For Class I applications
Operating voltages up to 250 VAC, 50-60 Hz
Temperature class in accordance with DIN 40040: HPF
Operating temperature range −25° C to +85° C
Ambient temperature for operation at full rated current: 40° C
Test voltage: line-ground & neutral-ground, 2000 VAC, 50 Hz, 1 min.; line-neutral, 1075 VDC, 1 min.
Approvals, recognition, certification: UL, CSA, SEMKO, SEV
Housing: Rust-protected metal
Connector: IEC 320/CEE-22, molded from black thermoplastic
Contacts: .250 inch solderable quick disconnects
Low leakage RFI filter for medical applications

All dimensions in mm.

Part Number	Current Rating (Amps)	Leakage Current (μA max) (@ 250 VAC)	X Capacitors (μF)	Y Capacitors (pF)	Inductor (mH)	Weight (g)	Insertion Loss - dB						
								100kHz	400kHz	1Mz	4mHz	10mHz	100mHz
8843.N2.23.60	2	80	0.047	470	4	70	Common Mode	34	38	38	42	41	42
							Differential Mode	8	15	28	60	67	53
8843.N6.23.60	6	80	0.047	470	0.8	70	Common Mode	15	32	31	38	43	50
							Differential Mode	7	12	20	48	68	66
8843.N2.24.60	2	5	0.047	—	4	70	Common Mode	23	38	53	47	42	22
							Differential Mode	7	18	32	65	72	38
8843.N6.24.60	6	5	0.047	—	0.8	70	Common Mode	18	26	32	35	36	24
							Differential Mode	7	14	23	50	64	38

PANEL
COMPONENTS
CORPORATION
P.O. Box 6626, Santa Rosa, CA 95406 • (707) 523-0600 • TX 176-747

PICONICS®

L/C FILTERS

PICONICS is a pioneer in the development of Magnetic Hybrid Components, circuits and Filters. Our 20,000 square foot facility features modern ultra clean production, inspection, and storage facilities. On site test and environmental laboratory, including x-ray, shock, vibration, hermeticity, etc. that satisfy all the necessary military and commercial testing requirements.

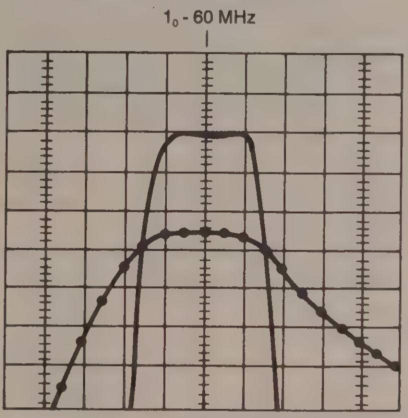
We will design and optimize your filter requirements using sophisticated computer programs. Our designs are computer analyzed and optimized prior to assembly. Tuning and testing are achieved with the latest precision equipment.

MINIATURE HYBRID BUTTERWORTH BANDPASS FILTER

FILTER TYPE	**BANDPASS**
Filter Characteristic	Butterworth
Number of Poles	4
Center Frequency	60 MHz
Bandwidth −3 dB	30 MHz
Insertion Loss	0.5 dB
Group Delay	25 nsec

PHOTO SCALE

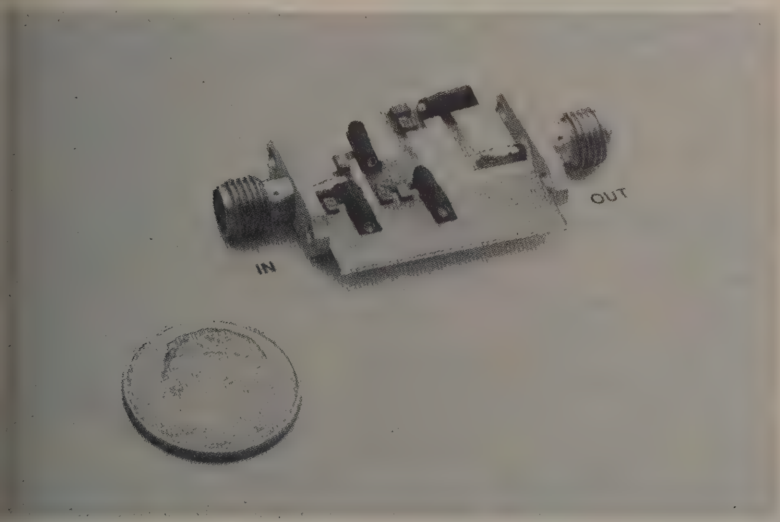
TOP TRACE	BOTTOM TRACE
Freq Vs Ampl (dB)	Freq Vs Ampl (dB)
Vertical: 1 dB/Div	10 dB/Div
Horizontal: 10 MHz/Div	10 MHz/Div



MARKER SPACING 5 MHz

CONSTRUCTION

CHIP INDUCTORS
AND CAPACITORS
MOUNTED ON
AN ALUMINA SUBSTRATE



L/C filters are specified in either the Frequency or the Time Domain. Frequency Domain filters emphasize pass-band ripple and stop-band attenuation. Butterworth, Chebyshev, and Elliptic Function filters are included in this category. Time Domain filters emphasize the time-amplitude domain characterized by phase linearity and constant group delay. Bessel, Gaussian and other linear phase designs are included in this category.

Low-pass, Hi-pass, Band-pass, and Band-reject designs are available in the frequency range up to 800 MHz. Special Low-pass and Band-pass filters have been achieved featuring notches placed at desired frequencies in the stop-band to further attenuate undesired or spurious signals.

For those filter applications where size and weight are the prime consideration, PICONICS offers a line of chip inductor-capacitor designs. Low-pass, High-pass, and Band-pass types mounted on alumina substrates are available. Common substrate sizes are 1 × 1 inch and 2 × 1 inch. Overall package height is determined by orientation and size of the chip inductors.

To meet environmental military applications, filter networks are packaged in metal shielded cases with r.f. connectors. Printed circuit and end terminals are also available. Epoxy encapsulation is optional. For units assembled with chip inductors and capacitors on alumina/ceramic substrates, shield covers are optional. This is usually determined by the environment surrounding the device.

CALL OR WRITE
FOR COMPLETE
CATALOG AND FOR DESIGN/
APPLICATION ENGINEERING
SUPPORT.

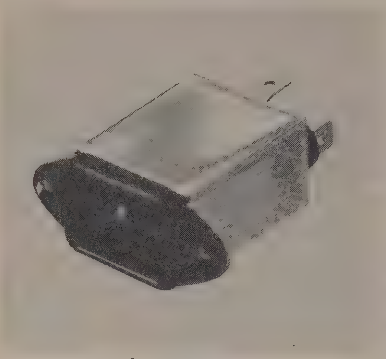
See section 1800 pg. 1A•1277 for your INDUCTOR requirements and section 3130 pg. 1A•1680 for HYBRIDS.

PICONICS INC. P.O. BOX 387, TYNGSBORO, MA 01879 • TEL: (617) 649-7501 • TELEX: 754759

POTTER COMPANY

EMI Power Line Filters

varian



Case style G

Case style H

Case style 625A3

Case style 625G3

POTTER COMPANY

P.O. BOX 337,
WESSON, MISSISSIPPI 39191
(601) 643-2215

608 SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 608 Series features the IEC international power line connector and is designed to provide superior insertion loss down to 10 KHz. This will help switching power supply manufacturers meet the new VDE low frequency conducted EMI requirements. Series 608 is designed to meet the requirements of IEC, CSA, BSI, VDE, SEV and UL. The series is UL recognized. CSA, VDE and SEV approvals are pending.

Ask for Bulletin 8101

Case style G

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE:	115-250VAC
OPERATING FREQUENCY RANGE:	50-60 Hz
MAXIMUM LEAKAGE CURRENT:	
Applied Voltage	CURRENT
250 VAC @ 50 Hz	0.5 mA
TEST VOLTAGE:	
Line-to-ground	2250 VDC
Line-to-line	1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency In MHz						
AMP	.01	.05	.1	.5	1	10	20
1	28	36	45	60	60	60	60
2	18	28	36	54	58	60	60
3	14	25	31	46	52	50	60
4	10	21	27	40	46	60	60
6	8	15	20	31	40	57	60

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

609 SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 609 Series was designed as a companion to our 610 Super Series. It also meets the requirements of VDE and features the IEC international power line connector. The compact construction complies with IEC, CSA, BSI, VDE and SEV. The series is UL recognized. CSA, VDE and SEV approvals are pending.

Ask for Bulletin 8102

Case styles G and H

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE:	115-250 VAC
OPERATING FREQUENCY RANGE:	50-60 Hz
MAXIMUM LEAKAGE CURRENT:	
Applied Voltage	CURRENT
250 VAC @ 50 Hz	0.5 mA
TEST VOLTAGE:	
Line-to-ground	2250 VDC
Line-to-line	1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency in MHz					
AMP	.15	.5	1	5	10	20
1	30	45	54	60	60	55
3	24	38	45	60	60	55
6	17	32	40	58	60	55

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

610 SUPER SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 610 Super Series was designed specifically to meet the low frequency requirements of the latest VDE EMI specifications and features the IEC international power line connector. Series 610 is designed to meet the requirements of IEC, BSI, VDE, and SEV. The series is UL recognized, and CSA approval is pending.

Ask for Bulletin 8103

Case styles G and H

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE:	115-250 VAC
OPERATING FREQUENCY RANGE:	50-60 Hz
MAXIMUM LEAKAGE CURRENT:	
Applied Voltage	CURRENT
250 VAC @ 50 Hz	0.5 mA
TEST VOLTAGE:	
Line-to-ground	2250 VDC
Line-to-line	1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency in MHz					
AMP	.15	.5	1	5	10	30
1	24	34	40	47	50	50
3	19	29	35	43	47	50
6	13	22	28	40	42	47

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

625 SUPER SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 625 Super Series provides additional insertion loss down to 10 KHz to meet the latest VDE EMI specifications. They are designed primarily for the effective reduction of line-to-ground (common mode) and line-to-line (differential mode) interference in equipment which must meet the requirements of FCC and VDE specifications. All models are UL recognized. Low leakage current models are available in all ratings. To order these, replace the "V" suffix with an "E."

Ask for Bulletin 8104

Case styles 625A3 and 625G3

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE:	115-250 VAC	
OPERATING FREQUENCY RANGE:	50-60 Hz	
MAXIMUM LEAKAGE CURRENT:		
	CURRENT	
Applied Voltage	"V"	"E"
115 VAC @ 60 Hz	0.5 mA	0.25 mA
250 VAC @ 50 Hz	1.0 mA	0.5 mA
TEST VOLTAGE:		
Line-to-ground	2250 VDC	
Line-to-line	1500 VDC	

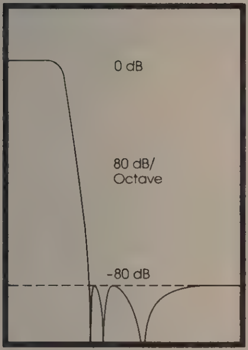
TYPICAL INSERTION LOSS (dB):
FILTER RATED AT 3.0A RMS ONLY

	Frequency In MHz								
	.01	.02	.05	.15	.5	1	5	10	20
625VS	22	27	37	50	55	55	55	55	55
625ES	22	27	36	47	47	45	45	45	45

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

BEGONE CURSED ALIAS

FILTER SYSTEMS



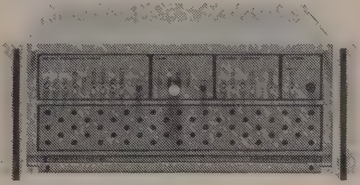
You want analog data to come clean before digital conversion.

We keep extending your choice of Precision systems for HP, LP, TD, BP, BR and anti-alias filters.

All are programmable. All offer time delay filters superior to Bessel. All offer elliptics with 80 dB/octave attenuation. All offer the option of fixed frequencies for economy. All have phase match of 1° or better. All can interface with mini or micro with serial, parallel or GPIB.

Individually, they provide different cost-performance parameters and options to provide the Precision Conditioners you need.

PRECISION 616



System offers our highest cutoff frequencies with exceptional phase match of 1°. Standard maximum frequency is 150 kHz; 300 kHz is available as a special. Four ranges with a resolution of 5 bits provide 124 programmable cutoff frequencies. Up to 16 programmable filter channels. Wide variety of options tailors this Precision Conditioner to your application.

PRECISION 616 AND 602 CUTOFF FREQUENCIES

FREQUENCY RANGE (Hz)	FREQUENCY STEP (Hz)	†MODEL 616-XX-LP1		
	XX→	01	02	03
10,000-150,000	10,000	H	—	—
1,000-15,000	1,000	MH	H	—
100-1,500	100	ML	MH	H
10-150	10	L	ML	MH
1-15	1	—	L	ML
0.1-1.5	0.1	—	—	L

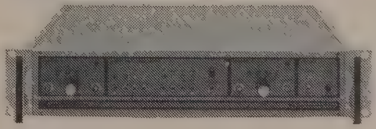
Four frequency ranges in each model: H, MH, ML, L.

CUTOFF FREQUENCIES FOR PRECISION 616 WITH OPTION 05

FREQUENCY RANGE (Hz)	FREQUENCY STEP (Hz)	†MODEL 616-XX-LP1-05		
	XX→	01	02	03
5,000-155,000	5,000	H	—	—
500-15,500	500	MH	H	—
50-1,550	50	ML	MH	H
5-155	5	L	ML	MH
0.5-15.5	0.5	—	L	ML
0.05-1.55	0.05	—	—	L

Four frequency ranges in each model: H, MH, ML, L

PRECISION 602



System provides most of the performance characteristics of the Precision 616 in two programmable channels. Our most economical system where only one or two channels are needed.

† How to Build a Catalog Number

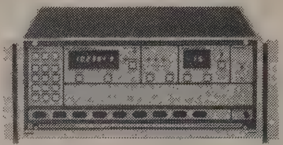
616-02-LP1-01-05-11

Options 01, 05 and 11
Filter type
Frequency range
System number

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

† See other products in Section 1100

PRECISION 636



Our most resolute alias stopper. Standard resolution is 3 digit in four ranges for 4092 cutoff frequency selections. Optional 3½ digit instrument provides 6141 cutoff frequencies. Precision 636 with 3½ option offers our highest standard cutoff frequency of 204.7 kHz, with 1° phase match. Convenient keyboard entry and LED displays. Up to 16 channels. Many options.

PRECISION 636 CUTOFF FREQUENCIES

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	FREQUENCY STEPS (Hz)	†MODEL 636-XX-LP1 XX→ 01	02
100-3100	3200-102,300	100	H	—
10-310	320-10,230	10	MH	H
1-31	32-1,023	1	ML	MH
0.1-3.1	3.2-102.3	0.1	L	ML
0.01-0.31	0.32-10.23	0.01	—	L

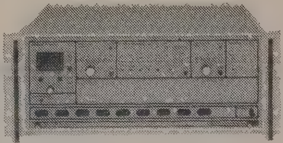
Four cutoff frequency ranges in each model: H, MH, ML, L

CUTOFF FREQUENCIES FOR PRECISION 636 WITH 3½ OPTION

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	FREQUENCY STEPS (Hz)	†MODEL 636-XX-LP1-3½ XX→ 01	02	03
100-3100	3200-204,700	100	H	—	—
10-310	320-20,470	10	M	H	—
1-31	32-2,047	1	L	M	H
0.1-3.1	3.2-204.7	0.1	—	L	M
0.01-0.31	0.32-20.47	0.01	—	—	L

Three cutoff frequency ranges in each model: H, M, L

PRECISION 416



Goodbye alias, hello gain. This combined filter-amplifier system lets you save 25% to 35% by buying one instrument instead of two. 62 programmable cutoff frequencies. DC differential input stage with 100 dB CMRR. Programmable prefilter and postfilter gain of 1-1000. Overload detectors built in. Up to 16 channels.

PRECISION 416 CUTOFF FREQUENCIES

FREQUENCY RANGE (Hz)	FREQUENCY STEPS (Hz)	†MODEL 416-XX-LP1 XX→ 01	02	03	04	05
10K-150K	10K	H	—	—	—	—
1K-15K	1K	L	H	—	—	—
100-1.5K	100	—	L	H	—	—
10-150	10	—	—	L	H	—
1-15	1	—	—	—	L	H
0.1-1.5	0.1	—	—	—	—	L

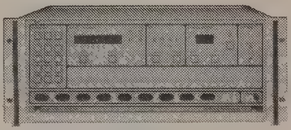
Two frequency ranges in each model: H, L.

CUTOFF FREQUENCIES FOR PRECISION 416 WITH OPTION 05

FREQUENCY RANGE (Hz)	FREQUENCY STEPS (Hz)	†MODEL 416-XX-LP1-05 XX→ 01	02	03	04	05
5K-155K	5K	H	—	—	—	—
500-15.5K	500	L	H	—	—	—
50-1.55K	50	—	L	H	—	—
5-155	5	—	—	L	H	—
0.5-15.5	0.5	—	—	—	L	H
0.05-1.55	0.05	—	—	—	—	L

Two frequency ranges in each model: H, L.

PRECISION 32



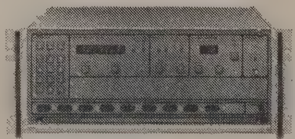
Double trouble for aliases. Precision System 32 saves 25% to 40% per channel by packing 32 programmable channels into the same 7 inches of rack previously needed for 16. Three digit resolution with 3069 programmable cutoff frequencies. 102.3 kHz maximum cutoff. An excellent price-performance value.

PRECISION 32 CUTOFF FREQUENCIES

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	FREQUENCY STEPS (Hz)	†MODEL 32-XX-LP1 XX→ 01	02	03
100-3100	3200-102,300	100	H	—	—
10-310	320-10,230	10	M	H	—
1-31	32-1,023	1	L	M	H
0.1-3.1	3.2-102.3	0.1	—	L	M
0.01-0.31	0.32-10.23	0.01	—	—	L

Three frequency ranges in each model: H, M, L.

PRECISION 64



Double trouble doubled. Precision System 64 packs 64 programmable filters into the same 7 inches of rack space previously needed for 16 or 32. Savings per channel can run more than 50% over 16 channel systems. 2½ digit resolution with 510 programmable cutoff frequencies. Maximum cutoff is 25.5 kHz.

PRECISION 64 CUTOFF FREQUENCIES

RANGE (Hz) REDUCED PERFORMANCE	RANGE (Hz) SPECIFIED PERFORMANCE	RANGE MULTIPLIER †MODEL 64-XX-LP1 XX→ 01	02	03	04	05	06	07	08	09
0.01-0.09	0.10-2.55	10K 1K 100			1K 100 10			100 10 1		
0.05-0.45	0.50-12.75		1K 100 10			100 10 1			10 1 .1	
0.02-0.18	0.20-5.11			1K 100 10			100 10 1			10 1 .1

Three cutoff frequency ranges in each model.

†See previous page for how to build a catalog number.

THE PRECISION CONDITIONERS™

†See other products in Section 1100.

FILTER SYSTEM SELECTION GUIDE

	PRECISION 616	PRECISION 602	PRECISION 636	PRECISION 416	PRECISION 32	PRECISION 64
Number of channels per system	16	2	16	16	32	64
Number of channels per card	1	1	1	1	2	4
Maximum cutoff frequency (kHz)	155*	150	204.7**	155*	102.3	25.5
Minimum cutoff frequency (Hz)	0.05	0.1	0.32	0.05	0.32	0.02
Number of frequency ranges	4	4	4/3**	2	3	3
Phase match (degrees max.)	1°	1°	1°	1°	1°	3°
Amplitude accuracy (dB)	0.05	0.05	0.05	0.05	0.1	0.2
Cutoff accuracy (%)	1/4	1/4	1/4	1/4	1/4	1/2
Steps in decade	10/20*	10	900/1800**	10/20*	900	229
Bits in a range	4/5*	4	10/11**	4/5*	10	8

*with option 05
**with option 3½

OPTION SELECTION GUIDE

	PRECISION 616	PRECISION 602	PRECISION 636	PRECISION 416	PRECISION 32	PRECISION 64
G Programmable gain	1,2,5,10	1,2,5,10	1,2,5,10	Std. A	B	B
1 AC coupled input	Yes	No	Yes	No	Yes	No
2 AC coupled output	Yes	No	Yes	No	No	No
3 Unbalanced differential input	Yes	No	Yes	No	Yes	Yes
4 Output sense	Yes	No	Yes	No	No	No
5 Extra bit F_C	Yes	No	3½ C	Yes	No	No
6 Change F_C range	Yes	Yes	Yes	Yes	Yes	Yes
7 Fixed input gain	Yes	Yes	Yes	No	Yes	Yes
8 Fixed output gain	Yes	Yes	Yes	No	Yes	Yes
9 Change front panel	Yes	Yes	Yes	Yes	Yes	Yes
10 Change control format	Yes	Yes	Yes	Yes	Yes	Yes
11 Filter by-pass	Yes	Yes	Yes	No	Yes	Yes
12 Post warranty calibration	Yes	Yes	Yes	Yes	Yes	Yes
13 Output mux	Yes	No	Yes	No	No	Yes
14 Differential input	Yes	No	Yes	Std.	Yes	No
15 AC coupled differential input	Yes	No	Yes	No	No	No
16 Delete F_C range	Yes	Yes	Yes	Yes	Yes	Yes
17 Switched input gain	Yes	No	Yes	No	Yes D	No
18 Switched AC coupled input	Yes	No	Yes	No	Yes D	No
20 Programmable AC/DC coupling	No	No	No	No	Yes D	No
21 Programmable input gain	No	No	No	No	Yes D	No

A. Prefilter gain 1, 2, 5, 10, 20, 50.
Postfilter gain 1, 2, 5, 10, 20.
B. Gain from 0.50 to 12.75 in steps of 0.05.
C. 3½ digit cutoff frequency resolution—lose lowest range.
D. Cannot have more than one of options 17, 18, 20 or 21.

FILTER SELECTION GUIDE

		MODEL HP1	MODEL LP1	MODEL LP2	MODEL LP3	MODEL TD1	MODEL TD2
Filter type		HP	LP	LP	LP	LP	LP
Function		Cauer	Cauer	Cauer	Cauer	E	Bessel F
Number of poles, zeros		6p,6z	6p,6z	6p,6z	6p,6z	6p,6z	6p or 6p,6z
Passband ripple (dB p-p)		0.1	0.1	0.1	0.1	0.35	—
Passband limit		1.081 F_C	0.925 F_C	F_C	F_C	0.78 F_C	—
Cutoff frequency	Amplitude (dB)	-3.01	-3.01	-0.1	-0.1	-3.01	-3.01
	Phase (degrees)	+358.5	-358.5	-296.7	-300	-305.8	-155
Stop band limit		0.5 F_C	2 F_C	1.744 F_C	2.13 F_C	3.24 F_C	—
Stop band attenuation (dB)		80	80	67.8	80	70	—
Attenuation slope (dB/octave)		80	80	96.9	80	42	36
Settling time (1%) $\left(\frac{\text{SECS}}{F_C}\right)$		5.4/F_C	5.4/F_C	5.25/F_C	5.0/F_C	3.1 F_C	—
Zero frequency time delay		—	.79/F_C	.71/F_C	.73/F_C	.85/F_C	.86/F_C
Cutoff frequency accuracy (%)		1/4	1/4	1/4	1/4	1/4	1/4
Amplitude accuracy (dB)		0.05	0.05	0.05	0.05	0.05	0.05
Phase accuracy (degrees) Max.		1/2	1/2	1/2	1/2	1/2	1/2
Phase accuracy (degrees) Typ.		1/4	1/4	1/4	1/4	1/4	1/4
Phase match (degrees) Max.		1	1	1	1	1	1
Phase match (degrees) Typ.		1/2	1/2	1/2	1/2	1/2	1/2

E. Equi-ripple delay (±2.5° phase ripple) with 6 zeros.
F. 6 pole Bessel or 6 pole, 6 zero with Bessel poles.

A Filter For Every Need

All Precision Filter systems use the same high-performance filters.

For the frequency domain, there is a Cauer (elliptic) high-pass or low-pass filter with 0.1 dB peak-to-peak passband ripple and 80 dB stop-band attenuation. Compare its attenuation slope of 80dB/octave with an 8 pole Butterworth's 48 dB/octave.

For the time domain, there is the TD1, a 6 pole, 6 zero equi-ripple delay (linear phase) filter, which has less attenuation in the passband and more attenuation in the stop-band than an 8 pole Bessel. Yet, it maintains a linear phase response within ± 2.5°. There is also the TD2 which offers both a 6 pole Bessel and a 6 pole, 6 zero time delay filter.

In any case, you get a tightly controlled elliptic or linear phase filter with phase match better than 1° and usually better than 1/2°

For bandpass operation, cascade a high-pass and low-pass filter to form a bandpass filter with 80 dB attenuation an octave above and below the center frequency.

For band-reject operation, parallel the inputs of a high-pass and low-pass filter and add their outputs through 1 k resistors to form a band-reject filter.

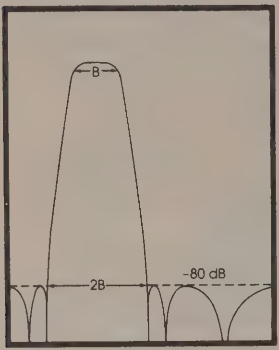
For tough anti-alias applications, cascade two LP2 filters to provide 90 dB of attenuation at 1.56 times the cutoff frequency.

For lowest cost solutions, we provide the option of fixed frequency filters.

† See other products in Section 1100

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

FREQUENCY-BAND TRANSLATORS



NEW SPECTRUM SLICER

Precision System 1776 is the industry's first multi-channel programmable frequency-band translator for signal conditioning.

It draws heavily on our advanced filter technology to provide usefulness not previously associated with frequency-band translators for applications like these:

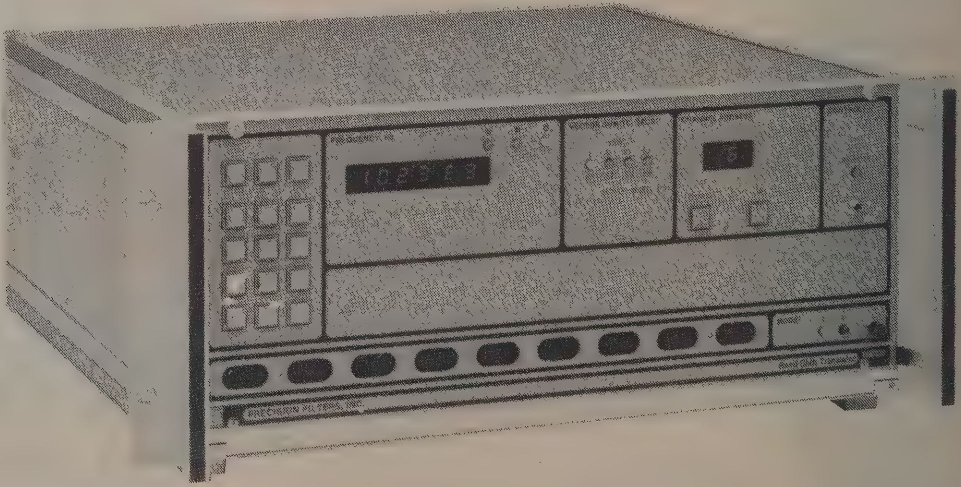
- Super bandpass filter.
- Analog zoom for spectrum analysis, modal analysis and beam forming.

The Precision 1776 cuts far more sharply than any conventional bandpass filter can.

In fact, it's nearly perfect. The system translates band center frequency to zero, passing the signal band through sharp low-pass filters to obtain 80 dB/*bandwidth-octave* skirts. Q's can go higher than 10,000.

From there, the instrument can translate back to the starting band, acting as a super bandpass filter. Or it can translate to any other part of the spectrum.

Configured as a super bandpass filter, the Precision 1776 can have up to eight channels.



THE PRECISION CONDITIONERS™

†See other products in Section 1100

PRECISION FILTERS, INC.
Band Shift Translator

NEW SUPER ZOOMER

The Precision 1776 translator also can zoom in to make existing equipment do more work.

Ahead of an FFT spectrum analyzer, the analog zoom extends frequency range while making possible much finer resolution.

For modal analysis and beam forming, the 1776 discards unwanted noise and lowers the sampling frequency. As a result, old limits for computer speed, memory and AD conversion rates are overcome. Sampling rates can be decreased. Dynamic range and signal-to-noise ratio are enhanced.

For analog zoom, a 16 channel configuration is available for this Precision Conditioner.

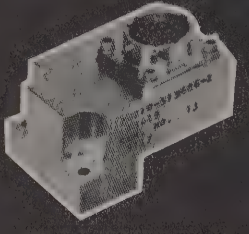
Precision 1776 Features:

- Programmable center frequency: 3.2 Hz—200 kHz.
- Programmable bandwidth: 1 Hz—25 kHz.
- Phase match: 2° maximum, 1° typical.
- Wide dynamic range.
- Low noise: 250 microvolts in 20 MHz BW.
- Interfaces: serial, parallel, GPIB.
- $\frac{-80 \text{ dB bandwidth}}{-\ 3 \text{ dB bandwidth}} < 2$
- Passband ripple: 0.15 dB pk-pk.
- Outband rejection: 80 dB minimum.
- Hum: < – 100 dB, re full-scale.
- Noise: < – 100 dB, re full-scale.
- Intermodulation: < – 80 dB, re full-scale.

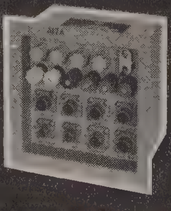
† See other products in Section 1100

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850, Tel. 607-277-3550

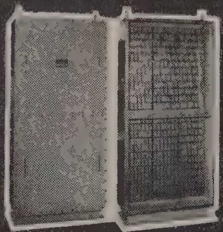
NO. 1 MANUFACTURER OF RFI/EMC FILTERS.



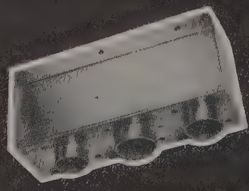
FILTER FOR INSTALLATION IN CRITICAL VOLUME CONFIGURATION



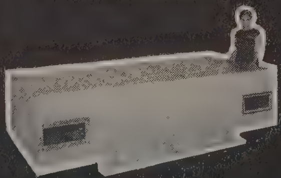
MULTI-CIRCUIT FILTER ASSEMBLY WITH INPUT POWER CONNECTORS



1100 CIRCUIT SIGNAL LINE FILTER CABINET



156 CIRCUIT, HIGH RELIABILITY FILTER PACKAGE FOR AEROSPACE APPLICATION



1300 AMP. 3 PHASE 380 VAC FILTER ASSEMBLY

We've got over 20,000 filter designs on file to meet your basic or most sophisticated needs ...

and more parts QPL listed to MIL-F-15733 than any other manufacturer.

The fact that we've got so many filter designs available is only one part of our success story.

Our 23 years of engineering experience and expertise in providing custom engineered filters is the other part.

Our technology has provided our customers with the golden edge in filter performance. We've helped plan and expedite efficient and economical filter systems ... from the simplest to the most intricate.

"Made by RFI" doesn't only tell you who made it, but how well it was made. After all, we sell more than just filters. We sell ideas.

Write for our complete FREE catalog.

RFI Corporation

A KDI COMPANY

100-E PINE AIRE DRIVE
BAY SHORE, LONG ISLAND
NEW YORK 11706

(516) 231-6400
TWX 510-227-6233

AeroFilter™ Series

General Purpose 1, 2, 3, 4

The General Purpose 1 EMI Power Line Filters are designed for common mode applications to provide the minimum cost solution for most general purpose applications.

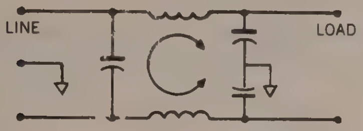
The General Purpose 2 EMI Power Line Filters are an alternate packaged version of the General Purpose 1 Filters utilizing an IEC power line connector to offer direct plug-in capability. As with the General Purpose 1 EMI Filters, these filters are also particularly suited for applications where pulsed, continuous and intermittent EMI interferences are present.

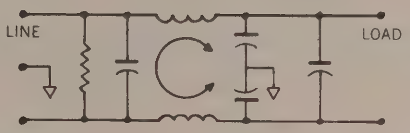
The General Purpose 3 EMI Power Line Filters are packaged in a configuration to include the IEC power line connector in order to offer a direct plug-in capability. They offer improved performance comparable to the Series 1 General Purpose Filters and are effective in applications where line to line and low frequency line to ground noise must be controlled and for upgrading electronic equipment to comply with FCC conductive emmissions standards.

The General Purpose 4 EMI Power Line Filters are designed to provide additional protection from line noise and protection of the line from load generated noise. They are particularly suited for applications where pulsed, continuous and/or intermittent EMI interference is present.

These filters are designed and built to meet or exceed various safety agency standards and requirements and are U.L. recognized under File No. E83355 as part of the U.L. Component Program. They are also CSA certified. VDE pending, File No. 12509-4730.

GENERAL PURPOSE 1, 2, & 3





GENERAL PURPOSE 4

Operating Specifications

Rated Voltage: 115/250 VAC
Rated Frequency: 50/60 Hz
Rated Temperature: 40°C @ Rated Current

Performance Specifications

Hi Pot Test (one minute)
Line-to-ground 2250VDC Line-to-line 1450VDC
Insulation resistance: 6,000 Mefohms at 100VDC
Maximum leakage current

Line-to-ground	C	D
@ 115 VAC/60 Hz	0.5 mA	0.25 mA
@ 250 VAC/50 Hz	1.0 mA	0.40 mA

CURRENT RATINGS/CASE STYLE

SERIES	GEN 1					GEN 2		GEN 3		GEN 4						
CURRENT RATINGS	1 & 2	3 & 5	10	20	30	1, 3,6	1, 3, 6	1, 3, 6	1, 3, 6	1 & 2	3 & 5	20	30	3 & 5	10	10
CASE STYLE	11 & 13	11 & 13	11, 13 & 16	11 & 16	66	22, 24	21, 23	21	22	11 & 13	11 & 13	11 & 16	66	17	17	11, 13 & 16
LENGTH	.940	1.25	1.25	2.00	3.75	1.50	1.50	1.50	1.50	1.75	1.75	2.00	3.75	2.50	3.00	2.00
WIDTH	1.75	1.75	1.75	2.00	3.31	1.16	1.16	1.16	1.16	2.00	2.00	2.50	3.31	2.19	2.19	2.00
HEIGHT	0.63	0.75	1.13	1.13	1.50	0.83	0.79	0.79	0.83	0.88	1.13	1.50	1.50	1.25	1.25	1.13

All dimensions in inches.

MINIMUM INSERTION LOSS

GEN 1

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
C	1, 2, 3, 5	15	30	38	50	50	52
	10, 20, 30	6	17	25	40	42	48
D	1, 2, 3, 5	20	31	38	45	45	48
	10, 20	8	21	26	34	37	42

GEN 2

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
D	1	22	35	41	48	50	52
	3	15	25	30	46	50	55
	6	10	21	27	44	48	52

GEN 3

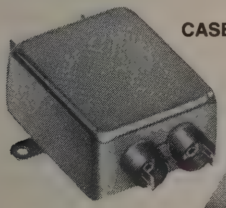
Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
D	1	25	35	40	48	50	54
	3	20	30	35	43	49	53
	6	15	22	28	40	45	50

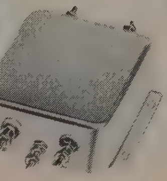
GEN 4

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.50	1	5	10	30
C	1, 2, 3	15	30	40	50	50	50
	5, 10, 20, 30	8	21	28	42	46	50
D	1, 2, 3	15	30	35	45	45	50
	5, 10, 20	8	20	25	38	40	45

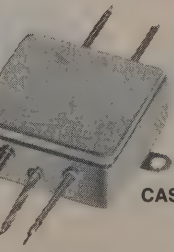


CASE STYLE 11



CASE STYLE 66

CASE STYLE 22



CASE STYLE 13

RTE Aerovox® INC.
FILTER DIVISION
740 Belleville Ave., New Bedford, MA 02745 U.S.A. 617-994-9661

AeroFilter™ Series

High Performance 1 & 2
Premium Performance 1 & 2

The High Performance General 1 Filters offer higher insertion losses for both line to line and line to ground emmissions.

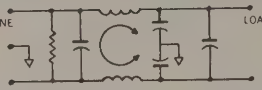
The High Performance General 2 Filters are a dual T-section which provides small leakage currents at minimum costs without sacrificing high insertion loss capabilities. They are particularly suited for low impedance loads and insuring protection against pulse, continuous and or intermittent interference for protecting both equipment from the power line and the power line from the equipment.

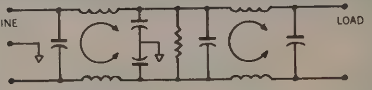
The Premium Performance 1 Filters are designed to provide extremely high insertion losses for both line-to-ground and line-to-line emissions at frequencies ranging from .150 MHz to 30 MHz. They are particularly effective for equipment that must meet both stringent emissions and low leakage current requirements.

The Premium Performance 2 filters are particularly effective with systems utilizing switching power supplies and SCRs. The high insertion losses accomplished without any degradation of performance which could be caused by high peak currents which can be encountered in SCRs and switching power supplies.

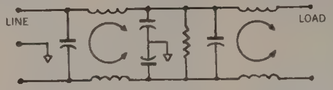
These filters are designed and built to meet or exceed various safety agency standards and requirements and are U.L. recognized under File No. E83355 as part of the U.L. Component Program. They are also CSA certified. VDE pending, File No. 12509-4730.

HPG 1





HPG 2



PRP 1
PRP 2

Operating Specifications

Rated Voltage: 115/250 VAC
Rated Frequency: 50/60 Hz
Rated Temperature: 40°C @ Rated Current

Performance Specifications

Line-to-ground 2250VDC Line-to-line 1450VDC
Insulation resistance: 6,000 Migohms at 100VDC
Maximum leakage current

Line-to-ground	C	D	F
@ 115 VAC/60 Hz	0.50 mA	0.25 mA	2.0 mA
@ 250 VAC/50 Hz	1.0 mA	0.40 mA	3.0 mA

CURRENT RATINGS/CASE STYLE

SERIES	HPG 1						HPG 2						PRP 1				PRP 2		
CURRENT RATINGS	3	6	10	3	10	6	1 & 2	3, 5 & 10	10	20	3 & 5	10	3	6	10	3	3	6	10
CASE STYLE	11 & 13	11 & 13	11 & 13	17	17	17	11 & 13	11 & 13	11, 13 & 16	61 & 66	17	17	11 & 13	11 & 13	11 & 13	17	11	11	11
LENGTH	2.50	3.00	3.00	2.50	3.50	2.50	2.00	2.50	2.50	3.75	3.62	3.62	2.50	5.25	5.25	2.50	5.25	5.25	5.25
WIDTH	2.00	2.19	2.19	2.19	2.19	2.19	1.75	2.00	2.00	3.32	2.19	2.19	2.00	2.00	2.00	2.19	2.00	2.00	2.00
HEIGHT	1.13	1.25	1.75	1.50	1.75	1.75	1.13	1.13	1.50	1.50	1.25	1.50	1.75	2.25	2.75	1.75	1.75	2.25	2.75

All dimensions in inches.

MINIMUM INSERTION LOSS

HPG 1

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	APPLICATION & CURRENT RATING	FREQUENCY – MHz. .01	.08	.10	.15	.5	1	5	10	30
C	Line-to-ground - all current ratings	5	23	25	30	45	45	43	41	30
	Line-to-line - all current ratings	1	3	10	25	60	65	62	40	40
D	Line-to-ground - all current ratings	5	22	25	30	42	40	36	36	28
	Line-to-line - all current ratings	1	3	10	25	60	65	65	40	40

HPG 2

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	APPLICATION & CURRENT RATING	FREQUENCY – MHz. .15	.5	1	5	10	30
C	1, 2, 3	30	65	65	65	65	65
	5, 10, 20	12	50	62	65	65	60
D	1, 2, 3	25	60	65	65	65	65
	5, 10, 20	2	35	51	65	60	50

PRP 1

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

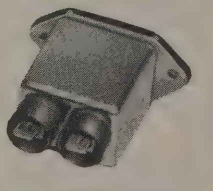
LEAKAGE CURRENT	APPLICATION & CURRENT RATING	FREQUENCY – MHz. .01	.03	.06	.15	.5	1	5	10	30
D	Line-to-ground All Current Ratings	1	1	12	60	65	65	65	60	25
D	Line-to-line 3 Amps	1	2	5	36	65	65	65	65	58
D	Line-to-Line 6 & 10 Amps	1	2	4	30	65	65	65	65	35

PRP 2

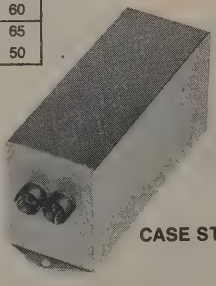
Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	APPLICATION & CURRENT RATING	FREQUENCY – MHz. .01	.03	.06	.15	.5	1	5	10	30
F	Line-to-ground	1	1	40	65	67	70	69	65	30
F	Line-to-line 3 Amps	1	3	6	35	65	65	65	65	57
F	Line-to-Line 6 & 10 Amps	1	2	15	35	65	65	60	55	37

CASE STYLE 61



CASE STYLE 21



CASE STYLE 11

RTE Aerovox® INC.
FILTER DIVISION
740 Belleville Ave., New Bedford, MA 02745 U.S.A. 617-994-9661

AeroFilter™ Series

Dual Mode Suppression 1, 2, 3 & 4

Medical 1

The Dual Mode Suppression Filters utilize the same effective general purpose designs for providing control of line-to-ground noise but with additional circuitry to reduce low frequency line-to-line noise and transient. This additional circuitry in the Dual Mode Suppression Filters is a line-to-line filter with high rejection at low frequencies for limiting the line to line noise.

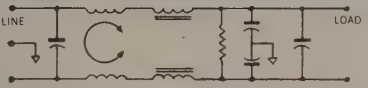
These filters will protect equipment from malfunctions due to conducted interference coming into the equipment from the line. These filters will also provide the needed suppression to allow most equipment to meet FCC and VDE specifications for conducted emissions. Dual Mode Suppression Filters are available in our 1, 2, 3 and 4 configuration and are particularly effective when applied in equipment utilizing switching type power supplies and SCR components. **These filters are designed and built to meet or exceed various safety agency standards and requirements are U.L. recognized under File No. E83355 as part of U.L. Component Program and are also CSA certified. VDE pending, File No. 12509-4730.**

Medical 1 Series Underwriters Laboratory medical and dental equipment specification U.L. 544 is applicable to this series. AeroFilter medical filters meet the U.L. specification for patient care equipment of a maximum leakage current of 100 micro amps at 120 VAC, 60 Hz.

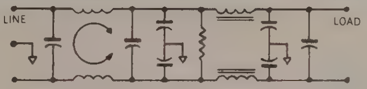
For non-patient equipment, where the maximum leakage current of 500 micro amps at 120 VAC, 60 Hz. is allowed, the General Purpose and High Performance General Purpose Filters have special versions with low leakage requirements to meet the U.L. non-patient equipment standard. The Aerovox Medical Filter 1 has two micro amps maximum leakage current used with hospital grade/low leakage line cord (6 micro amps maximum leakage current).

These filters are designed and built to meet or exceed various safety agency standards and requirements and are U.L. recognized under File No. E83355 as part of the U.L. Component Program. They are also CSA certified. VDE pending, File No. 12509-4730.

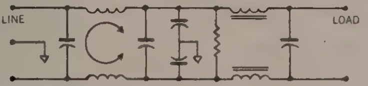
DMS 1 & 4



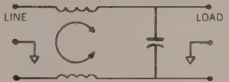
DMS 3



DMS 2



MED 1



Operating Specifications

Rated Voltage: 115/250 VAC
Rated Frequency: 50/60 Hz
Rated Temperature: 40°C @ Rated Current

Performance Specifications

Hi-Pot Test (one minute)
Line-to-ground 2250VDC Line-to-line 1450VDC
Insulation resistance: 6,000 Megohms at 100VDC
Maximum leakage current

Line-to-ground	C	D	F	G
@ 115 VAC/60 Hz	0.50 mA	0.25 mA	2 mA	2 mA
@ 250 VAC/50 Hz	1.00 mA	0.40 mA	3 mA	5 mA

CURRENT RATINGS/CASE STYLE

SERIES	DUAL MODE SUPPRESSION FILTERS 1, 2, 3			DMS 4			AEROFILTER SERIES MEDICAL 1		
CURRENT RATINGS	3	6 & 10	20	3	3	3	6	6	6
CASE STYLE	11	11	61	11, 13	17, 77	18, 88	11	21	22
LENGTH	2.00	2.50	3.75	2.50	3.00	3.00	.940	1.50	1.50
WIDTH	1.75	2.00	3.31	2.00	2.19	2.19	1.75	1.16	1.16
HEIGHT	1.25	1.50	1.50	1.75	1.75	1.75	0.62	0.79	0.83

All dimensions in inches.

DMS 1, 2, 3 & 4

Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

Line-To-Ground

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .01	.02	.05	.15	.5	1	5	10	30
DMS1	3, 6, 10	—	—	—	13	28	37	32	51	42
C	20	—	—	—	17	32	39	40	44	39
DMS2	3, 6, 10	—	—	—	16	28	41	59	55	48
C	20	—	—	—	14	29	42	61	47	30
DMS3	3	—	—	—	15	25	34	65	65	61
C	6, 10, 20	—	—	—	12	31	33	65	65	56
DMS4 D	3	23	26	36	46	48	43	45	45	45
DMS4 F	3	23	26	37	50	55	55	50	55	55

DMS 1, 2, 3 & 4

Minimum insertion loss in dB: Line-to-line in 50 ohm circuit.

Line-To-Line

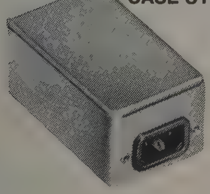
LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .01	.02	.05	.15	.5	1	5	10	30
DMS1	3, 10	—	—	—	40	65	65	55	50	50
C	6, 20	—	—	—	40	65	65	65	53	50
DMS2	3, 10	—	—	—	25	65	65	60	55	50
C	6, 20	—	—	—	40	65	65	65	60	55
DMS3	3, 6, 10	—	—	—	25	65	65	62	55	38
C	20	—	—	—	28	65	65	65	65	65
DMS4 D	3	1	18	41	65	75	75	65	65	60
DMS4 F	3	1	18	41	65	75	75	60	65	65

MED 1

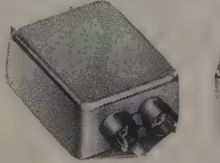
Minimum insertion loss in dB: Line-to-ground in 50 ohm circuit.

LEAKAGE CURRENT	CURRENT RATING	FREQUENCY — MHz. .15	.5	1	5	10	30
G	6	10	18	25	28	26	19

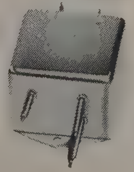
CASE STYLE 17



CASE STYLE 11



CASE STYLE 13



CASE STYLE 24

RTE Aerovox® INC.
FILTER DIVISION
740 Belleville Ave., New Bedford, MA 02745 U.S.A. 617-994-9661

SAW Bandpass Filters

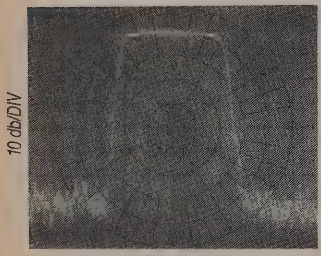
Surface Acoustic Wave Technology provides performance advantages and design flexibility that has proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance bandpass filters and other state-of-the-art signal processing components such as pulse compressors, delay lines, and resonator products. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks comprised of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW bandpass filter products produced by Sawtek and their characteristics are summarized below.

WIDE BANDWIDTH

TVRO and other receiver applications often require wide bandwidth filters designed to provide superior rejection and group delay performance. SAW bidirectional bandpass filters are available with fractional bandwidths as large as 60% at frequencies approaching 1000 MHz. The high coupling materials used to achieve these bandwidths exhibit temperature coefficients of 72 to 94 PPM/°C. Insertion loss from 25 dB to 30 dB is typical of this class of filters in order to optimize group delay and time spurious performance. Shape factors (45 dB:1 dB) normally vary from 1.4:1 to 1.8:1.

Among a family of 70 MHz IF filters that is available off-the-shelf with bandwidths of 10 MHz to more than 36 MHz is the representative filter shown in the photograph below. This device provides a 24 MHz 3-dB bandwidth, 1.35:1 shape factor, and ±10 nsec maximum group delay variation. The packaged filter dimensions are either 0.87″×0.5″×0.2″ or 0.6″ diameter. Similar products are available at many other 1st or 2nd IF frequencies.

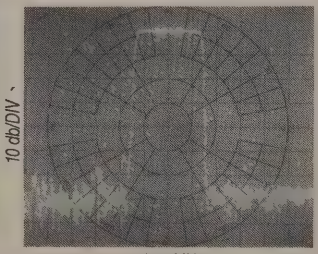


70 MHz
6 MHz/DIV

LOW SHAPE FACTOR

CATV modulator requirements and many similar applications require very low shape factor (45 dB:1 dB) to eliminate adjacent channel interference while preserving linear phase. Sawtek manufactures numerous VSB filters for both U.S. and European CATV requirements. This class of filters exhibits shape factors between 1.15:1 and 1.3:1 with an insertion loss of 20 dB to 30 dB depending on the bandwidth and center frequency. Such low shape factors are offered for fractional bandwidths from approximately 10% to 20%. These performance features are achieved in a 1.5″×1.0″×0.2″ dual in-line package and clearly demonstrate the size advantages of SAW technology.

A representative filter shown below delivers 5.5 MHz bandwidth at 43.75 MHz center frequency and a shape factor of 1.2:1 with ±1° phase linearity and greater than 60 dB rejection. Other products offered in this bandwidth range include Nyquist filters for CATV demodulators as well as various inexpensive components for modem, translator, and convertor applications with slightly higher shape factor requirements.

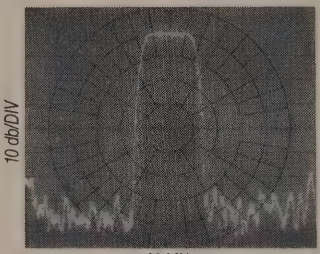


43.75 MHz
2 MHz/DIV

TEMPERATURE STABILITY

Quartz materials are frequently used in narrower band applications where increased stability is necessary. Filters with bandwidths from a few tenths percent to more than 5% are designed for quartz and exhibit total frequency shifts that are smaller than 50 PPM for a 0°C to 60°C commercial temperature range and nominally 200 PPM for most −55°C to +85°C military requirements. Shape factors from 1.5:1 to 3.6:1 are typical for these designs without sacrificing the high rejection expected of SAW devices. Insertion loss is normally 20-25 dB in order to maintain time spurious suppression of 45-50 dB. Bandwidths as large as 30% are implemented using quartz where higher insertion loss is tolerable and quartz performance is necessary. Both bandwidth and shape factor influence filter size, with larger sizes required for narrow bandwidths and low shape factors.

The performance shown below is a 60 MHz center frequency device with a 1.0 MHz bandwidth, 60 dB near-in rejection, and phase linearity of ±2°. The shape factor (55 dB:1 dB) is less than 1.8:1. Sawtek has many existing quartz filter designs at other IF frequencies.

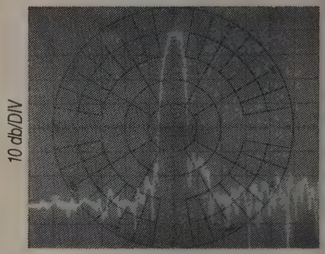


60 MHz
0.5 MHz/DIV

LOW LOSS

Sawtek offers low-loss SAW filters with insertion loss from 4 dB to 10 dB. The achievable insertion loss depends on many interrelated factors including the substrate material chosen, fractional bandwidth, the Q of matching components, the center frequency, and other design and fabrication parameters. This class of filters can also achieve triple transit suppression of 45 to 55 dB without the added insertion loss required for bidirectional filters. Rejection is typically 40 dB to 50 dB with shape factors greater than 1.6:1. These capabilities enable low-loss SAW filters to be used for front-end filters and in other applications where noise figure or dynamic range are limited by filter insertion loss.

The filter example below achieves 5 dB insertion loss on quartz at 261 MHz with a 0.5 MHz bandwidth. Passband ripple is less than 0.04 dB and triple transit suppression exceeds 50 dB. Some standard products are available and Sawtek offers rapid custom design for those applications that require this technique.



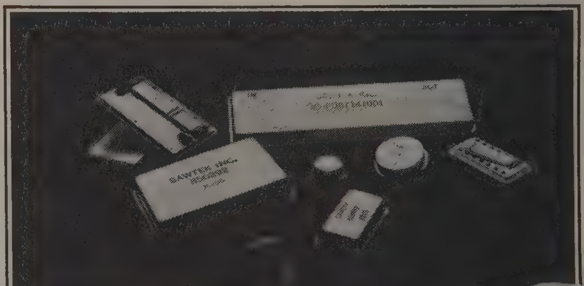
261 MHz
1 MHz/DIV

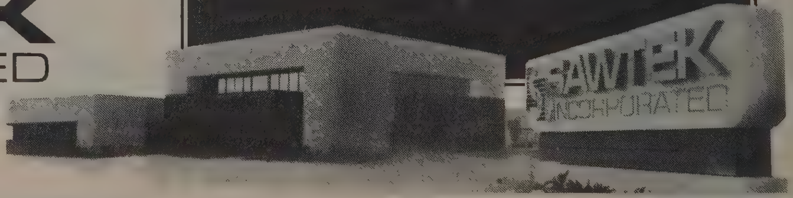
Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology . . . Demand Sawtek.

SAWTEK
INCORPORATED

P.O. Box 18000, Dept. EM, Orlando, FL 32860, (305) 886-8860





SAW Resonator Products

Surface Acoustic Wave Technology provides performance advantages and design flexibility that has proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance resonators, resonator filters, oscillators, and other state-of-the-art signal processing components such as pulse compressors, delay lines, and bandpass filter products. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks comprised of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW resonator products produced by Sawtek and their characteristics are summarized below.

SAW RESONATORS

Sawtek offers SAW resonators at fundamental frequencies from 100 MHz to more than 1000 MHz. These are high Q components which are primarily intended to be used in oscillators and are also used for both bandpass and notch filters. Sawtek resonators are inherently spur free in oscillator applications, exhibit low motional resistance, and have a pulling range comparable to a 3rd overtone bulk wave crystal. Typical values of R_S range from 15 Ω to 150 Ω and capacitance ratios are nominally 2000:1. Incorporation of special metalization improves oscillator noise performance by permitting drive levels up to +20 dBm. These quartz devices can achieve temperature stability of less than 50 PPM from 0°C to 60°C. Both one-port and two-port configurations are available.

Sawtek maintains a large inventory of pre-tooled SAW resonator crystals including many frequencies for CATV convertor applications. New designs can also be tooled rapidly to meet custom requirements. The 668 MHz resonator shown below is representative of Sawtek's low-cost standard products.

SAW OSCILLATORS

SAW resonator-controlled oscillators are currently produced by Sawtek for military and aerospace systems. Because they are able to operate at fundamentals of over 1000 MHz, SAW oscillators simplify design, reduce cost, and improve noise performance through the elimination of multiplier stages. In many applications it is also possible to achieve adequate power in one stage to directly drive a mixer and thereby eliminate the need for a buffer/amplifier stage.

Typical of the company's oscillator products is a fixed frequency, oven stabilized SAW resonator oscillator at 740 MHz. All spurious and harmonics are down 60 dB; the short-term stability is $\pm 2.5\times10^{-10}$ for 1.0 to 25 second averaging times and the phase noise is 120 dBc/Hz for a 2.5 kHz offset. The frequency versus temperature stability of this miniature ovenized unit is ±2 PPM from −15° to +60°C. A maximum power consumption of only 1.75 watts at −15°C ambient is achieved. Sawtek also offers assistance in oscillator design for low-cost consumer and commercial applications and is prepared to help evaluate the suitability of SAW oscillators for each new application.

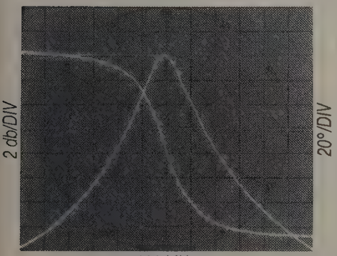
SAW RESONATOR FILTERS

SAW resonator filters provide high rejection and low loss for narrowband applications requiring 0.01% to 0.25% fractional bandwidths. This family of Sawtek's resonator filters is characterized by a "new shape" in narrowband filter technology. The unique shape demonstrated in the performance photographs below arises from the combination of transversal filter and resonator characteristics: the narrowband response produced by the resonant cavity emerges from the broader passband of the input and output transducers.

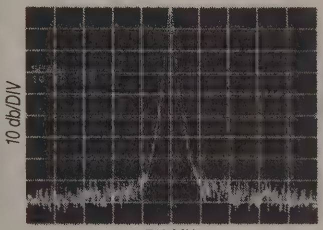
Two pole versions typically exhibit from 2 dB to 5 dB insertion loss with 15 dB to 20 dB near-in rejection and 55 dB to 75 dB ultimate rejection. The two-pole 537 MHz resonator filter shown on the left below has a matched insertion loss of only 4.5 dB, 18 dB close-in rejection, and 60 dB ultimate rejection.

Rejection which is beyond the measurable range of most test instruments can be achieved by cascading these two-pole units into multipole configurations. Depending on the number of poles, this technique provides from 20 dB to 60 dB of near-in rejection, improved shape factor and reduced flyback. Insertion loss generally increases at a rate of less than 1 dB per pole for these filters. The six pole 149.3 MHz filter on the bottom right has an insertion loss of only 5.7 dB and an ultimate rejection of over 100 dB.

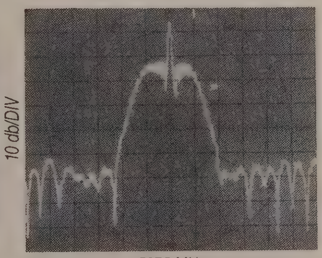
Sawtek's resonator filters are provided in individual two-pole stages in TO-8 and TO-5 packages and in custom modules when several of these 2 pole units are cascaded. Sawtek offers standard resonator filters and also rapid custom design.



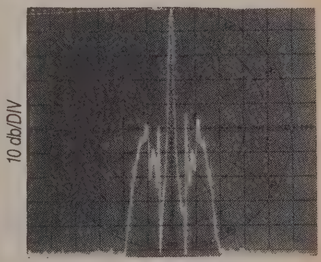
668 MHz
85 KHz/DIV



740 MHz
1 KHz/DIV



537.5 MHz
5 MHz/DIV



149.3 MHz
1.5 MHz/DIV

Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology... Demand Sawtek.

SAWTEK
INCORPORATED

P.O. Box 18000, Dept. EM, Orlando, FL 32860, (305) 886-8860

SAWTEK
INCORPORATED

DIGITALLY PROGRAMMABLE ACTIVE FILTERS

COMPLETE WITH INTERNAL SOLID STATE SWITCHES

A Design and Application Breakthrough

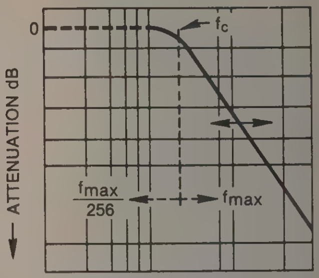
Internal switches eliminate electromechanical relays, along with their problems. Now filtering becomes digitally programmable under a computer or any proper digital data source...Reliability, versatility and compact size made possible by internal solid state switching.

Enhances "Intelligent" and Complex Applications

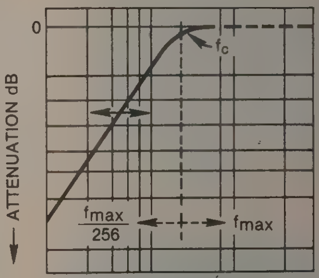
- Anti-Alias Prefiltering
- Data Acquisition Systems
- Programmable Automatic Test (A.T.E) Systems
- Seismic Exploration
- Production Test Systems
- Industrial Process Control
- Real and Compressed Time Data Analysis
- Biomedical Measurements

Fills Long-Felt Need for TUNABLE Classical Filter Responses

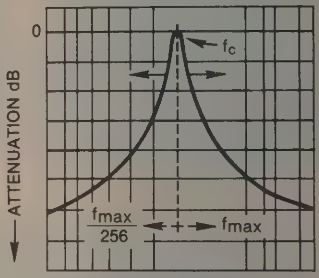
- Digitally-Programmable 4-Pole Lowpass, Highpass and Bandpass Butterworth, Bessel and Chebycheff Models
- Internal 3-Mode CMOS Interface Latches Frequency Selection Bytes
- Plug-in and Ready-to-Use Finished Filter Components
- A 256:1 Tuning Range Over Five Frequency Bands Between 0.1Hz and 51.2 kHz
- Internal Solid State switches Extend Operational Lifetime
- Readily Available
- Sensibly Priced



NORMALIZED FREQUENCY f/fc
844 SERIES LOWPASS



NORMALIZED FREQUENCY f/fc
874 SERIES HIGHPASS



NORMALIZED FREQUENCY f/fc
864 SERIES BANDPASS

844 SERIES 4-POLE LOWPASS FILTERS

		CHEBYCHEFF RESPONSE		
BUTTERWORTH RESPONSE	BESSEL RESPONSE	Passband Ripple 0.2dB	0.5dB	PROGRAMMABLE TUNING RANGE (Hz)
844P8B-1	844P8L-1	844P8YA2W-1	844P8YA5W-1	0.1 to 25.6
844P8B-2	844PBL-2	844P8YA2W-2	844P8YA5W-2	1.0 to 256
844P8B-3	844P8L-3	844P8YA2W-3	844P8YA5W-3	10 to 2560
844P8B-4	844P8L-4	844P8YA2W-4	844P8YA5W-4	100 to 25.6k
844P8B-5	844P8L-5	844P8YA2W-5	844P8YA5W-5	200 to 51.2k

Other Frequency Devices filter products include the following:

- The 900 Series Filter Instrument ...Front-Panel-Switch Tunable
- Resistive Tunable Lowpass, Highpass and Bandpass Filters
- The 9000 Series Digitally Programmable Multi- Channel Filter Instrument
- Fixed Frequency Lowpass, Highpass and Bandpass Filters
- Touch Tone Encoders and Decoders, FSK, PCM and Modem Filters
- Precision Single-Phase and Quadrature Sinewave Oscillators

Our filters span the needs of most technologies, so call Frequency Devices first. Call today with your standard or special, limited-quantity and OEM filter requirements.

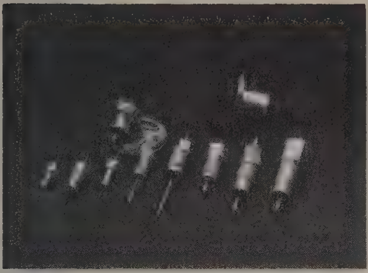
FREQUENCY DEVICES™

25 Locust Street
Haverhill, Massachusetts 01830
(617) 374-0761 TWX 710-347-0314

SPECTRUM CONTROL INC.

IN STOCK

EMI/RFI FILTERS AND CAPACITORS

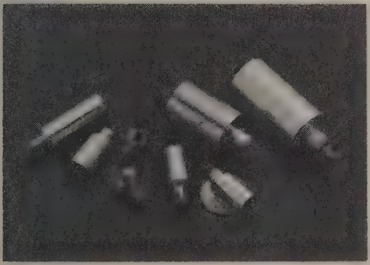


RESIN SEALED EMI/RFI FEED THROUGH CAPACITORS AND FILTERS

These filters and capacitors depend on ceramic capacitors and ferrite beads to achieve their high degree of miniaturization and volume efficiency. All bushings are suitably plated and supplied with lockwasher and nut or solder preforms as required. The capacitor elements are protected from the environment with a proprietary resin formulation.

Distributor stocked items are shown on page 2 of this catalog.

For a full line listing of Spectrum's resin seal filters and capacitors, request bulletins 27-0027-46 and 27-0027-47.



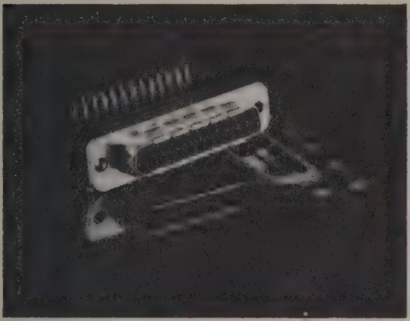
HERMETICALLY SEALED EMI/RFI FILTERS AND CAPACITORS

These hermetic seal styles of filters and feed-thru capacitors are intended for bulkhead mounting to prevent spurious signals from entering or leaving a chassis, compartment or equipment. The discoidal ceramic capacitors used in Spectrum's filters "self resonate" at much higher frequencies than other types of capacitors (mylar and foil, tantalum, electrolytic paper, etc.).

Distributor stocked items are shown on page 3 of this catalog.

For a full line listing of Spectrum's glass seal filters and feed-thru capacitors, request bulletins 27-0027-42 and 27-0027-43.

EMI FILTERED D SUBMINIATURE CONNECTORS



EMI FILTERED D SUBMINIATURE CONNECTORS

Spectrum D Subminiature filtered connectors feature a unique ground plane to effectively block bulkhead leakage of EMI. The design also provides line to line isolation to limit cross talk (line to line mutual coupling) to an absolute minimum. A most important feature is the coaxial spring contact that provides proper electrical grounding when mating one connector to another connector. Spectrum connectors are designed to provide compatibility with EIA RS-232 and RS-449 and will mount in existing chassis hole patterns.

DISTRIBUTOR STOCKED FILTERED CONNECTORS ARE SHOWN ON PAGES 2•1569 THROUGH 2•1573 OF EEM SECTION 2100

For a full line listing of Spectrum's EMI D Subminiature Connectors, request bulletin 27-0027-53.

SPECTRUM'S COMPUTERIZED STOCKING PROGRAM ENSURES THAT THE PRODUCTS IN THIS CATALOG ARE AVAILABLE "OFF-THE-SHELF" FROM AUTHORIZED DISTRIBUTORS

ASCHBACHER & ASSOCIATES
Dayton, OH
(513) 252-7785

METUCHEN CAPACITORS
Perth Amboy, NJ
(201) 442-0500

CAPTRONICS INC.
Dallas, TX
(214) 340-3592

Houston, TX
(713) 776-2100

Austin, TX
(512) 459-4328

SUMMIT DISTRIBUTORS
Buffalo, NY
(716) 887-2800

Rochester, NY
(716) 334-8110

Dania, FL
(305) 920-6253

NEWARK ELECTRONICS
Chicago, IL
(312) 638-4411

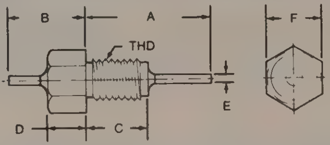
CYPRESS ELECTRONICS, INC.
San Jose, CA
(408) 945-8400

Torrance, CA
(213) 533-6005

SPECTRUM CONTROL, INC. 2185 West Eighth St., Erie, PA 16505 Phone (814) 455-0966 TWX 510-699-6871

SPECTRUM CONTROL INC.

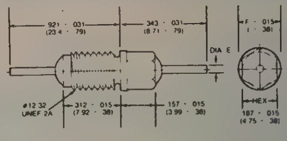
RESIN SEAL EMI/RFI SUPPRESSION FILTERS



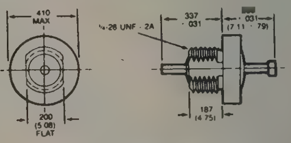
IN STOCK

ORDERING NUMBER	WORKING VOLTAGE (Vdc)		CAP VALUE	RATED DC CURRENT	DCR	CKT	A +.031 (.79)	B +.031 (.79)	C +.015 (.38)	D +.015 (.38)	E +.005 (.13)	F +.015 (.38)	THREAD SIZE	INSERTION LOSS dB				
	+85°	+125°												1 Mhz	10 Mhz	100 Mhz	300 Mhz	1 Ghz
51-729-303	200	100	1500pf	10 amp	.01	pi	.360 (9.4)	.240 (6.10)	.220 (5.59)	.120 (3.06)	.018 (.46)	.156 (3.96)	4-40 UNC-2A	-	5	42	65	70
51-729-304	200	100	.022uf	10 amp	.01	L	.360 (9.4)	.240 (6.10)	.220 (5.59)	.120 (3.06)	.018 (.46)	.156 (3.96)	4-40 UNC-2A	7	27	43	47	55
51-726-002	200	100	.022uf	10 amp	.01	L	.500 (12.7)	.320 (8.13)	.225 (5.72)	.125 (3.18)	.032 (.81)	.156 (3.96)	6-32 UNC-2A	7	27	43	50	60
51-712-001	200	100	1500pf	10 amp	.01	pi	.890 (22.6)	.312 (7.92)	.266 (6.76)	.094 (2.39)	.032 (.81)	.187 (4.75)	8-32 UNC-2A	-	5	42	65	70
51-712-003	200	100	.022uf	10 amp	.01	L	.850 (21.6)	.280 (7.11)	.266 (6.76)	.094 (2.39)	.040 (1.02)	.187 (4.75)	8-32 UNC-2A	7	27	43	50	60
51-744-002	200	100	5500pf	10 amp	.01	pi	.413 (10.5)	.265 (6.73)	.242 (6.15)	.094 (2.39)	.040 (1.02)	.187 (4.75)	8-32 UNC-2A	-	14	55	70	70
51-719-011		500	2500pf	10 amp	.01	pi	.453 (11.5)	.359 (9.12)	.281 (7.11)	1.87 (4.75)	.040 (1.12)	.250 (6.35)	12-32 UNEF-2A	-	12	45	60	70
51-719-021		200	5500pf	10 amp	.01	pi	.453 (11.5)	.359 (9.12)	.281 (7.11)	.187 (4.75)	.040 (1.12)	.250 (6.35)	12-32 UNEF-2A	-	12	50	70	70
54779001X5U102P	200	100	1000pfGMV	3 amp	.01	FT	.500 (12.7)	.320 (8.13)	.225 (5.72)	.125 (3.18)	.032 (.81)	.156 (3.96)	6-32 UNC-2A					
54713001X5F101M	200	100	100pf± 20%	10 amp	.01	FT	.631 (16.03)	.267 (6.77)	.256 (6.34)	.093 (2.38)	.051 (1.3)	.187 (4.75)	8-32 UNC-2A					
54713001X5U102P	200	100	1000pfGMV	10 amp	.01	FT	.631 (16.03)	.267 (6.77)	.256 (6.34)	.093 (2.38)	.051 (1.3)	.187 (4.75)	8-32 UNC-2A					
54743001X5U102Z	500	250	1000pf $^{+80\%}_{-20\%}$	10 amp		FT	.594 (15.08)	.406 (10.36)	.312 (7.93)	.156 (3.96)	.051 (1.3)	.250 (6.34)	12-28 UNF-2A					
54-785-005	100	100	.05uf GMV	10 amp		FT	.421 (10.7)	.328 (8.33)	.234 (5.94)	.140 (3.56)	.040 (1.02)	.187 (4.75)	8-32 UNC-2A					
54-786-014	50	50	1.0uf GMV	10 amp		FT	.500 (12.7)	.359 (9.12)	.328 (8.33)	.171 (4.34)	.040 (1.02)	.218 (5.54)	10-32 UNF-2A					

SCI PART NUMBER	CAPACITANCE AND TOLERANCE	RATED DC VOLTAGE	RATED CURRENT	ELECTRICAL CIRCUIT	MINIMUM INSERTION LOSS (dB) PER MIL. STD. 220								E	F
					100 KHz	1 MHz	3 MHz	10 MHz	30 MHz	100 MHz	300 MHz	1-10 GHz		
51-714-002	5000pF REF	100V	10A	Pi	—	—	7	12	35	60	70	70	.032 (.81)	.250±.015 (6.35±.38)

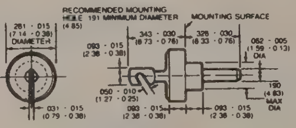

HEX
#12 32 UNEF 2A
DIA E

SPECTRUM CONTROL NUMBER	RATED DC CURRENT	WORKING VOLTS		DCR MAX.	REFER CAP.	MINIMUM INSERTION LOSS dB					
		+85°C	+125°C			30KHz	150KHz	300KHz	1MHz	10MHz	1GHz
51-717-001	15A	100Vdc	50Vdc	.01	1.4 uF	15	28	33	44	60	70

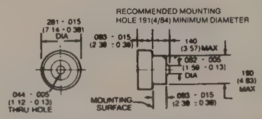

¼-28 UNF - 2A
FLAT

FEED-THRU CERAMIC CAPACITORS 500VDC −55° TO +85°C

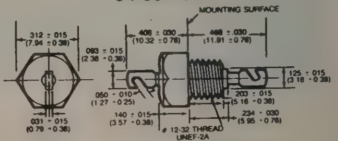
54-794-002


RECOMMENDED MOUNTING HOLE 191 MINIMUM DIAMETER
MOUNTING SURFACE
DIAMETER
DIA
MAX DIA

54-802-002


RECOMMENDED MOUNTING HOLE 191(4/84) MINIMUM DIAMETER
DIA
MAX
THRU HOLE
MOUNTING SURFACE

54-804-002

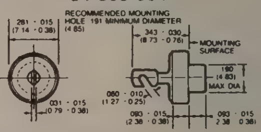

MOUNTING SURFACE
12-32 THREAD UNEF-2A

SPECTRUM CONTROL NUMBER	HARDWARE SUPPLIED
54-794-002	Solder Preform
54-802-002	Solder Preform
54-803-004	Solder Preform
54-804-002	Nut & Washer

STANDARD CAPACITANCE & TOLERANCE

CAP.	TOL.	EIA CODE
470pf	± 20%	471M
1000pf	GMV	102P

54-803-004


RECOMMENDED MOUNTING HOLE 191 MINIMUM DIAMETER
MOUNTING SURFACE
MAX DIA

ORDERING EXAMPLE: 54-794-002-102P

THE PRODUCTS ON THIS PAGE ARE IN STOCK AT SPECTRUM AUTHORIZED DISTRIBUTORS.

SPECTRUM CONTROL INC.

Since 1968 . . . . Making Technology Compatible With Technology

2185 West Eighth St., Erie, PA 16505 Phone (814) 455-0966 TWX 510-699-6871

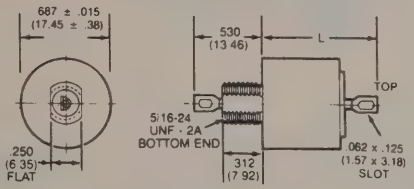
HERMETIC SEAL EMI/RFI SUPPRESSION FILTERS

IN STOCK

SPECTRUM CONTROL INC.

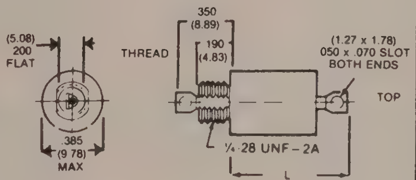
240VAC @ 125°C L, Pi, T 0-60Hz

SPECTRUM CONTROL NUMBER	RATED DC CURRENT	CKT	LENGTH "L" ± .030 (.76)	DCR. MAX.	MINIMUM INSERTION LOSS dB PER MIL - STD 220					
					75KHz	150KHz	300KHz	1MHz	10MHz	1GHz
51-320-024	1A	L Top	1.006 (25.55)	.3	15	30	38	60	70	70
51-320-026	3A	L Top	1.006 (25.55)	.03	6	19	25	45	70	70
51-320-028	5A	L Top	1.006 (25.55)	.1	6	19	24	37	70	70
51-321-318	3A	Pi	1.170 (29.72)	.03	6	31	55	80	80	80
51-321-610	1A	T	1.170 (29.72)	.6	25	49	60	70	70	70

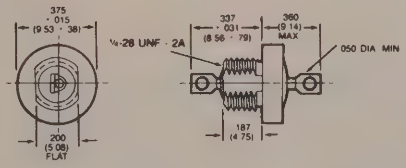

687 ± .015
(17.45 ± .38)
.250
(6 35)
FLAT
530
(13 46)
L
TOP
5/16-24
UNF - 2A
BOTTOM END
312
(7 92)
.062 x .125
(1.57 x 3.18)
SLOT

100VDC @ 125°C

SPECTRUM CONTROL NUMBER	RATED DC CURRENT	CKT	LENGTH "L" ± .030 (.76)	DCR. MAX.	MINIMUM INSERTION LOSS dB PER MIL - STD 220				
					75KHz	150KHz	300KHz	1MHz	1GHz
51-351-605	2 A	T	1.164 (29.57)	.1	6	25	34	57	80
51-353-123	3 A	L Top	.728 (18.49)	.06	6	22	29	44	70
51-311-322	5 A	Pi	.778 (19.76)	.015	—	—	28	65	80

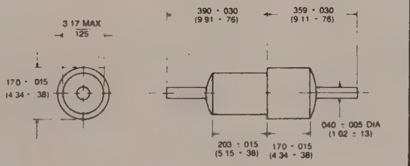

(5.08)
200
FLAT
.385
(9 78)
MAX
THREAD
350
(8.89)
190
(4.83)
(1.27 x 1.78)
050 x .070 SLOT
BOTH ENDS
TOP
¼-28 UNF – 2A
L

SPECTRUM CONTROL NUMBER	RATED DC CURRENT	WORKING VOLTS		DCR MAX.	REFER CAP.	MINIMUM INSERTION LOSS dB					
		+85°C	+125°C			30KHz	150KHz	300KHz	1MHz	10MHz	1GHz
51-359-001	15A	100Vdc	50Vdc	.01	1.4 uF	15	28	33	44	60	70


375
· 015
(9 53 · 38)
200
(5 08)
FLAT
¼-28 UNF · 2A
337
· 031
(8 56 · 79)
360
(9 14)
MAX
050 DIA MIN
187
(4 75)

SOLDER-IN EMI/RFI CAPACITOR

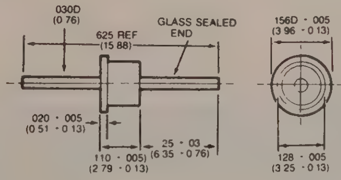
SPECTRUM CONTROL NUMBER	RATED DC CURRENT	WVDC @ 125°C	CAP.	MINIMUM INSERTION LOSS dB							
				30KHz	100KHz	1MHz	10MHz	30MHz	100MHz	300MHz	1-10GHz
54-785-002	10A	100	.05uFGMV	—	—	16	33	41	45	48	50


3 17 MAX
125
170 · 015
(4 34 · 38)
390 · 030
(9 91 · 76)
359 · 030
(9 11 · 76)
040 ± 005 DIA
(1 02 ± 13)
203 ± 015
(5 15 · 38)
170 · 015
(4 34 · 38)

SERIES SCI 9900/9910/9920

All units are hermetically sealed (glass to metal) on one end, while the other end is epoxy sealed. Series 99XX units are designed to be soldered in place. Maximum soldering temperature is +200°C (400°F).

SERIES	SCI 9900	SCI 9910	SCI 9920
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115VAC 60Hz
DC AMPS. MAX.	5	5	5
CAPACITANCE (GMV)	100pF 1200pF 2700pF 5000pF	100pF 1200pF 2700pF 5000pF	100pF 1200pF


030D
(0 76)
625 REF
(15 88)
GLASS SEALED
END
020 · 005
(0 51 · 0 13)
110 · 005)
(2 79 · 0 13)
25 · 03
(6 35 · 0 76)
156D · 005
(3 96 · 0 13)
128 · 005
(3 25 · 0 13)

THE PRODUCTS ON THIS PAGE ARE IN STOCK AT SPECTRUM AUTHORIZED DISTRIBUTORS.

SPECTRUM CONTROL INC.

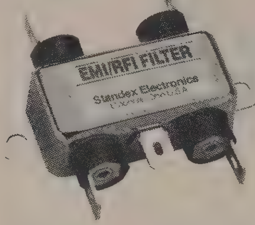
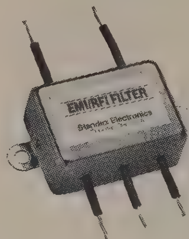
Since 1968 . . . . Making Technology Compatible With Technology

2185 West Eighth St., Erie, PA 16505 Phone (814) 455-0966 TWX 510-699-6871

Standex Electronics

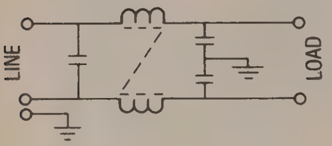
4538 Camberwell Road
Cincinnati, Ohio 45209
Phone (513) 871-3777

EMI/RFI Power Line Filters

SERIES A GENERAL PURPOSE FILTERS

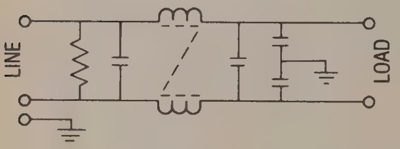
The A Series of EMI/RFI filters is a general purpose, common mode line. Available in a broad selection at lowest cost. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.5 mA at 115 VAC, 60 Hz. 1.0 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000A101	1	2.50 x 2.11 x 0.63
F6000A102	2	2.50 x 2.11 x 0.63
F6000A103	3	2.50 x 2.50 x 0.75
F6000A105	5	2.50 x 2.50 x 0.75
F6000A110	10	2.50 x 2.50 x 1.13
F6000A120	20	3.23 x 2.78 x 1.13
F6000A301	1	2.50 x 0.94 x 0.63
F6000A302	2	2.50 x 0.94 x 0.63
F6000A303	3	2.50 x 1.31 x 0.75
F6000A305	5	2.50 x 1.31 x 0.75
F6000A310	10	2.50 x 1.31 x 1.13
F6000A610	10	2.50 x 2.60 x 1.13
F6000A620	20	3.35 x 2.78 x 1.13
F6000A630	30	5.22 x 4.12 x 1.50

SERIES B GENERAL PURPOSE FILTERS

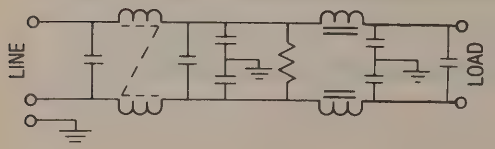
General purpose, common-mode and differential-mode filters. Effective where pulsed, continuous and/or intermittent interference is present. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case)** 0.5 mA at 115 VAC, 60 Hz. 1.0 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000B101	1	2.78 x 2.98 x 0.88
F6000B102	2	2.98 x 2.78 x 0.88
F6000B103	3	2.98 x 2.78 x 1.13
F6000B105	5	2.98 x 2.78 x 1.13
F6000B10	10	3.23 x 2.78 x 1.13
F6000B120	20	3.23 x 3.23 x 1.50
F6000B301	1	2.78 x 1.81 x 0.88
F6000B302	2	2.78 x 1.81 x 0.88
F6000B303	3	2.78 x 1.81 x 1.13
F6000B305	5	2.78 x 1.81 x 1.13
F6000B310	10	2.78 x 2.06 x 1.13
F6000B610	10	3.35 x 2.78 x 1.13
F6000B620	20	3.35 x 3.20 x 1.50
F6000B630	30	5.23 x 4.12 x 1.50
F6000B703	3	3.15 x 2.19 x 1.25
F6000B705	5	3.15 x 2.19 x 1.25
F6000B710	10	3.64 x 2.19 x 1.25

SERIES F SWITCHING TYPE POWER SUPPLY FILTERS

This series has been designed to protect equipment from malfunctions. Especially effective where switching type power supplies, SCR's and T²L circuits are utilized. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.5 mA at 115 VAC, 60 Hz. 1.0 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000F103	3	3.23 x 2.75 x 1.25
F6000F106	6	3.73 x 3.32 x 1.50
F6000F110	10	3.73 x 3.32 x 1.50
F6000F120	20	5.11 x 4.12 x 1.50

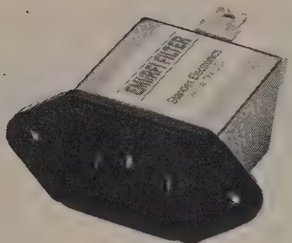
Standex Electronics

4538 Camberwell Road
Cincinnati, Ohio 45209
Phone (513) 871-3777

a Standex company

EMI/RFI Power Line Filters

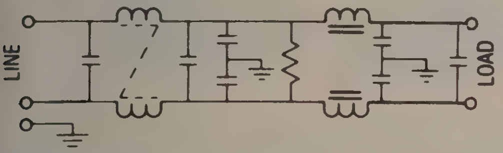
EMI/RFI FILTER
Standex Electronics



EMI/RFI FILTER
Standex Electronics

SERIES S HIGH PERFORMANCE POWER LINE FILTERS

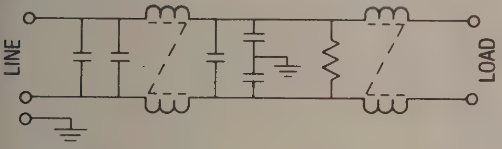
The Series S is particularly suited for equipment with high line-to-case as well as line-to-line emissions. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.25 mA at 115 VAC, 60 Hz. 0.40 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000S103	3	3.68 x 3.32 x 1.13
F6000S106	6	4.16 x 3.80 x 1.25
F6000S110	10	4.80 x 4.44 x 1.25
F6000S303	3	3.32 x 2.51 x 1.13
F6000S306	6	3.80 x 2.99 x 1.25
F6000S310	10	4.44 x 3.63 x 1.75
F6000S203	3	3.09 x 2.19 x 1.50
F6000S706	6	3.09 x 2.19 x 1.75
F6000S710	10	4.21 x 2.19 x 1.75

SERIES J SWITCHING POWER SUPPLY NOISE SUPPRESSION FILTERS

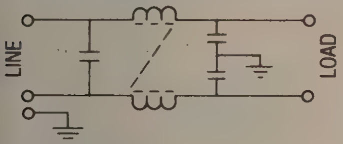
The Series J is well suited to meet VDE 0871, B level and FCC Part 15J, Class B. all models meet UL544 non-patient medical equipment requirements. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case)** 0.25 mA at 115 VAC, 0.40mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000J103	3	3.74 x 3.32 x 1.75
F6000J106	6	6.49 x 6.00 x 2.25
F6000J110	10	6.49 x 6.00 x 2.75
F6000J303	3	3.32 x 2.56 x 1.75
F6000J306	6	6.00 x 5.31 x 2.25
F6000J310	10	6.00 x 5.31 x 2.75
F6000J703	3	3.15 x 2.19 x 1.75

SERIES L HIGH PERFORMANCE FILTERS

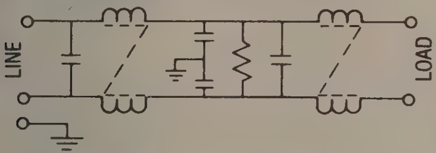
The Series L offers prime performance in controlling line-to-line and low-frequency line-to-line noise. It offers superior performance to comparable sized filters. All units incorporate an IEC power line connector. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.25 mA at 115 VAC, 60 Hz. 0.50 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000L801	1	2.16 x 1.97 x 0.79
F6000L803	3	2.16 x 1.97 x 0.79
F6000L806	6	2.16 x 1.97 x 0.79
F6000L901	1	1.97 x 1.55 x 0.83
F6000L903	3	1.97 x 1.55 x 0.83
F6000L906	6	1.97 x 1.55 x 0.83

SERIES R LOW IMPEDENCE LOAD FILTERS

This series offers premium performance for low impedance loads. It protects equipment from power line noise as well as protecting the line from equipment noise. A further advantage is low leakage of current. All units meet VDE portable equipment requirements, as well UL544 nonpatient medical equipment requirements at 120V. **Rated Voltage:** 115/250 VAC, 50/60 Hz. **Max. Leakage Current (Line-to-case):** 0.25 mA at 115 VAC, 60 Hz. 0.40 mA at 250 VAC, 50 Hz. **Test Voltage:** Line-to-case 2250 VDC, line-to-line 1450 VDC.



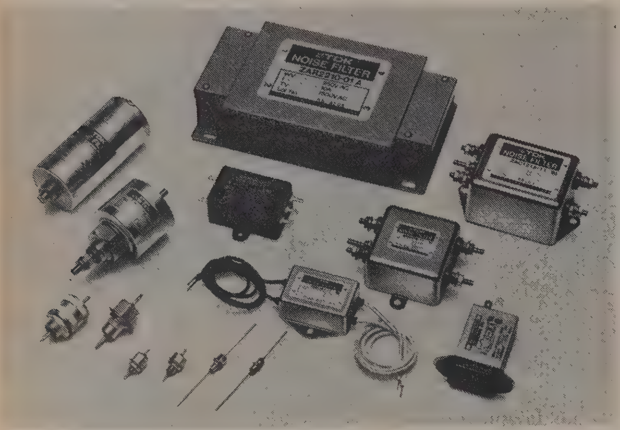
Standex Number	Max. Line Current Amps	Size Inches L x W x H
F6000R101	1	3.23 x 2.75 x 1.13
F6000R102	2	3.23 x 2.75 x 1.13
F6000R103	3	3.73 x 3.32 x 1.13
F6000R105	5	3.73 x 3.32 x 1.13
F6000R110	10	3.73 x 3.32 x 1.50
F6000R120	20	5.11 x 4.12 x 1.50
F6000R301	1	2.75 x 2.06 x 1.13
F6000R302	2	2.75 x 2.06 x 1.13
F6000R303	3	3.32 x 2.56 x 1.13
F6000R305	5	3.32 x 2.56 x 1.13
F6000R310	10	3.32 x 2.56 x 1.50
F6000R203	3	4.28 x 2.19 x 1.25
F6000R205	5	4.28 x 2.19 x 1.25
F6000R210	10	4.28 x 2.19 x 1.50

All Standex EMI/RFI filters are UL recognized, with CSA certification in progress and designed to meet VDE specifications.

TDK

EMI FILTERS

EMI FILTERS



TDK manufactures an exceptionally broad line of EMI filters ranging from the miniature ZBF series to the sophisticated filter/power socket combinations. TDK's long experience in ferrite and SF cores as well as ceramic capacitors has resulted in EMI filters with superior performance. A condensed list appears below. For more details, ask for Catalogue BCE.

FEATURES

High permeability ferrite and/or high saturation SF cores are used as required for maximum performance and minimum size. High dielectric ceramic capacitors contribute to performance. A full series is available to meet any EMI filter need. Meet or exceed all FCC, UL, CSA, VDE & TUV requirements.

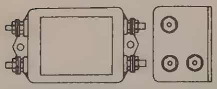
Series	Normal Mode MHz	Common Mode MHz	Recog. by			
			UL	CSA	TUV	VDE
ZAC	0.15-30.0	0.15-30.0	X		X	
ZHC	0.15-30.0	0.15-30.0	X		X	
ZSB	0.15-30.0	0.15-30.0				X
ZSG	0.15-30.0	0.15-30.0	X	X		
ZCB	0.15-30.0	0.15-30.0	X	X	X	
ZGB	0.15-30.0	0.15-30.0	X	X		
ZMB	0.15-30.0	0.15-30.0	X			X
ZUB	0.15-300	0.15-300	X	X	X	
ZUG-11	0.15-300	0.15-300	X	X	X	
ZUG-12	0.15-300	0.15-300	X	X	X	
ANF-U	0.15-30.0	0.15-30.0	X			
ZFN	—	0.15-1000				
ZJK05	—	0.22-200				
ZBF	*	*				

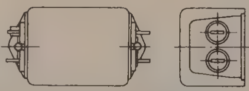
* Impedance over 30 Ohms from 10 to 1000 MHz

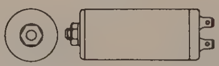
Series	Type	Rated Amps	Rated Vac	Test Vac	Leakage mA	Mass g.
ZAC	ZAC2206-11	6.0	250	1500	<1.0*	280
	ZAC2210-11	10.0	250	1500	<1.0*	300
ZHC	ZHC2206-11	6.0	250	1500	<1.0*	260
	ZHC2210-11	10.0	250	1500	<1.0*	280
ZSB	ZSB2208-02	8.0	250	1500	<1.0*	120
ZSG	ZSG1215-06A	15.0	125	1500	<0.5*	170
ZCB	ZCB2203-11	3.0	250	1500	<0.75*	45
	ZCB2206-11	6.0	250	1500	<0.75*	45
ZGB	ZGB22R5-01	0.5	250	1500	<1.0*	65
	ZGB2201-01	1.0	250	1500	<1.0*	65
	ZGB2202-01	2.0	250	1500	<1.0*	62
	ZGB2203-01	3.0	250	1500	<1.0*	65
ZMB	ZMB2201-11	2.0	250	1500	<1.0*	65
	ZMB2203-11, 13	3.0	250	1500	<1.0*	65, 45
ZUB	ZUB2203-00	3.0	250	1500	<0.5*	50
	ZUB2206-00	6.0	250	1500	<0.5*	50

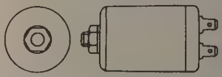
* @ 250V, 60 Hz ** @ 125V, 60 Hz

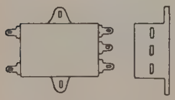
Series	Type	Rated Amps	Rated Vac	Test Vac	Leakage mA	Mass g.
ZUG-11	ZUG2203-11	3.0	250	1500	<0.5*	48
	ZUG2206-11	6.0	250	1500	<0.5*	48
	ZUG2203-11A	3.0	250	1500	<0.5*	48
	ZUG2206-11A	6.0	250	1500	<0.5*	48
ZUG-12A	ZUG2203-12A	3.0	250	1500	<0.75*	32
	ZUG2206-12A	6.0	250	1500	<0.75*	32
ANF-U	ANF-106U	6.0	125	1500	<0.5**	160
ZFN	ZFN5101-00R	1.0	50 Vdc	125 Vdc	—	40
	ZFN5103-00R	3.0	50 Vdc	125 Vdc	—	5
	ZFN5203-00R	3.0	500 Vdc	1250 Vdc	—	5
	ZFN5205-00R	5.0	500 Vac/ 125 Vdc	1500 Vdc	—	40
	ZFN5101-01R	1.0	50 Vdc	125 Vdc	—	2
	ZFN5103-11R	3.0	50 Vdc	125 Vdc	—	0.8
	ZFN5103-01R	3.0	50 Vdc	125 Vdc	—	
ZJK-05	ZJK51R1-05	0.1	50 Vdc	125 Vdc	—	0.8
	ZJK51R5-05	0.5	50 Vdc	125 Vdc	—	0.8
	ZJK5103-05	3.0	50 Vdc	125 Vdc	—	0.8
ZBF	ZBF253S-01	3.0	50 Vdc	——	—	0.5
	ZBF253D-01	3.0	50 Vdc	——	—	0.5
	ZBF503D-01	3.0	50 Vdc	——	—	0.5
	ZBF503S-01TA	3.0	50 Vdc	——	—	0.5

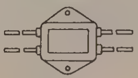

ZAC

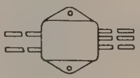

ZHC

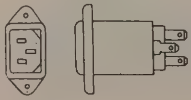

ZSB

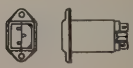

ZSG

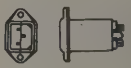

ZCB

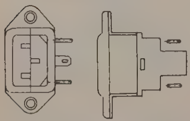

ZGB

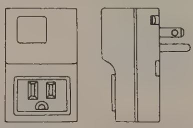

ZMB

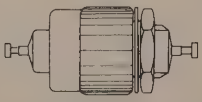

ZUB

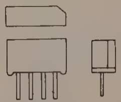

ZUG-11

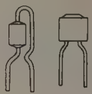

ZUG-11A


ZUG-12A


ANF-U


ZFN

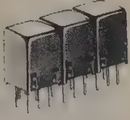

ZJK05

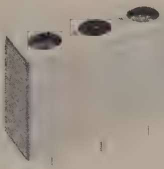
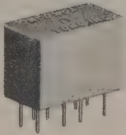
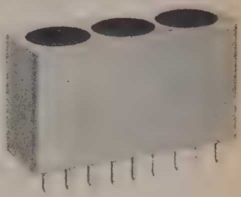

ZBF

TDK CORPORATION OF AMERICA • 4711 W. GOLF ROAD, SKOKIE, IL 60076 • (312) 679-8200

TOKO AMERICA FILTERS

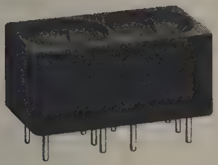
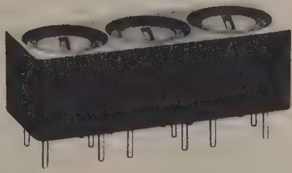
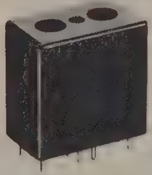
LC FILTERS



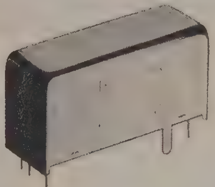
Type	5 VUS	5 VST	7 VUS	7 VST	5 VNW	ABT-07
Freq.	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	100 KHz ~ 10 MHz	10 KHz ~ 200 KHz
Impedance	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	100Ω ~ 10 KΩ	1 KΩ ~ 10 KΩ
Ht/Lth/Wd	8/6.1/6.1	8/18/6.1	15/8/8	16/26/10	8/12.5/6.5	13.5/25/9
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

LC FILTERS

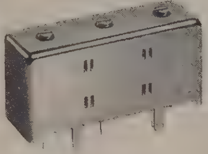
Type	ABW-10L	ABT-10L	LPFS-21
Freq.	10 KHz ~ 200 KHz	10 KHz ~ 200 KHz	10 KHz ~ 200 KHz
Impedance	1 KΩ ~ 10 KΩ	1 KΩ ~ 10 KΩ	1 KΩ ~ 10 KΩ
Ht/Lth/Wd	10/23/13.5	10/34/13.5	16.5/21/11.5
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

DIGITAL AUDIO FILTERS



Type	PALI 0900	PALH 1100
Freq.	5 KHz ~ 20 KHz	5 KHz ~ 20 KHz
Impedance	10 KΩ	10 KΩ
Ht/Lth/Wd	20.5/38.5/13.5	20.5/38.5/13.5
Temp. Range	−10° ~ +60°C	−10° ~ +60°C

HELICAL FILTERS

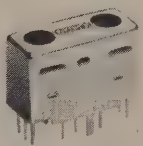
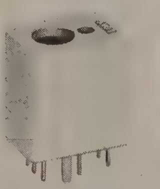
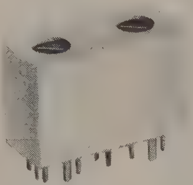


Type	7 HW	7 HT	HRW	CBT
Freq.	435 MHz - 904 MHz	904 MHz	427.5 MHz	145 MHz
Impedance	50Ω - 500Ω	50Ω - 500Ω	50Ω	50Ω - 500Ω
Ht/Lth/Wd	14.7/15.5/8	14.7/22.9/8	24/32/19	20.6/38.9/13
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

AM MECHANICAL FILTERS

Type	CFL	CFMS
Freq.	455 KHz	455 KHz
Impedance	3 KΩ	1 KΩ ~ 2.5 KΩ
Ht/Lth/Wd	6.5/9.5/4	6.5/8.2/4
Temp. Range	−10° ~ +60°C	−10° ~ +60°C

AM CERAMIC FILTERS

Type	CFZ	CFT	CFMA	CFMQ
Freq.	455 KHz ±3.5 KHz	455 KHz ±3.5 KHz	455 ±5KHz	455 ±1.5 KHz
Impedance	200 KΩ	200 KΩ	200 KΩ	200 KΩ
Ht/Lth/Wd	12/14/7.5	12/18/7.5	14/13/10	14/21/9.5
Temp. Range	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C	−10° ~ +60°C

FM CERAMIC

Type	CFSK	CFSH
Freq.	10.7 MHz	10.7 MHz
Impedance	330Ω	330Ω
Ht/Lth/Wd	6/9/3.5	9/9/4
Temp. Range	−20° ~ +80°C	−20° ~ +80°C

~ Denotes: Numerous variations available between values listed.

Toko filters are available in a variety of types and sizes for use in a wide range of electronic equipment. Applications include: video cassette recorders, video disc players, radio and hi-fi equipment, cordless telephones and digital audio equipment.
We are interested in custom design for filters also. If you have trouble finding that right filter give Toko a call.

TOKO AMERICA INC. / 5520 WEST TOUHY AVENUE / SKOKIE, ILLINOIS 60077
TEL. 312-677-3640 / TELEX 230-724372 (203-724372 TOKO AM SKO) / FACSIMILE-1-312-674-2910 (G III)
CALIF. OFFICE: 10050 N. WOLFE RD. / SWI-297 / CUPERTINO CA 95014 /TEL. 408-996-7575

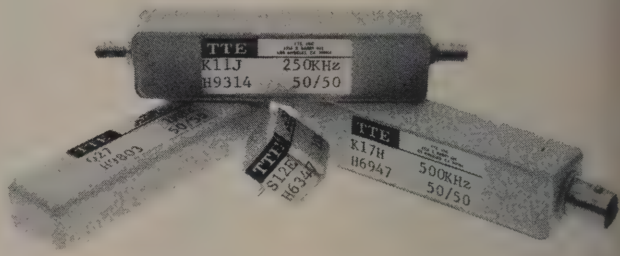
TTE® *miniature passive* FILTERS

T T E, Inc. is a California Corporation, established in 1954 and incorporated in 1957. Housed in its facility in West Los Angeles, are the sales offices, R & D department and manufacturing operation. Since its' beginnings T T E® has designed and manufactured both Active and Passive Filters.

When using this catalog, please remember the graphs are intended as a visual aid, not as a specification. The guaranteed specification is the specification listed in the individual product tables.

T T E® has no minimum order. There are no set-up charges for standard filter types and no engineering costs are charged to T T E® customers.

The first five pages of this listing are Passive Filters followed by the Active Filters, pages 7 through 9, the case and base dimensions for all types and the Passive Band Reject Filters are listed on page 10.



WIDE BAND FILTERS: A Bandwidth of ±20% or greater can be obtained by ordering T T E® standard Highpass and Lowpass filter sections as a composite network. Select the numbers from the Series H and J listing on pages 4-6 which give the desired attenuation slopes and combine these numbers. For example to obtain a slope of 40dB at 0.65 of the lower frequency, Fc1, (Highpass section) and 40dB at 1.6 of the upper frequency, Fc2, (Lowpass section) use Highpass series H69 plus Lowpass series J59. The resulting Bandpass number is K6959. THE HIGHPASS SERIES NUMBER IS FIRST FOLLOWED BY THE LOWPASS SERIES NUMBER. Types with dissymmetrical attenuation can be combined.

Insertion losses for bandpass types between equal terminations are from 0.5dB to 12dB depending upon the bandwidth, frequency and size. K10 and K11 types have about 10dB insertion loss and K12 types about 7dB flat loss. Specials are available for center frequencies from 10Hz upwards. Others are available with 60dB to 3dB bandwidth ratios of 2.0:1. Please contact us with your specification.

miniature — BANDPASS FILTERS — specify any frequency from 10Hz to 20MHz

Series No.	(Fc) Center Freq. Range Minimum	(Fc) Center Freq. Range Maximum	% Bandwidth @ −3dB	Stopband Attenuation	Source (ohms) Minimum	Source (ohms) Maximum	Load (ohms) Minimum	Load (ohms) Maximum	Case Type & Number Chassis	Case Type & Number PCB
K10B	500Hz	10KHz	±1%Fc		1K	500K	1K	500K	4	17
K10C	10KHz	100KHz	±1%Fc	30dB @ .92Fc & 1.1Fc &	500	10K	500	10K	3	11
K10F	100KHz	1MHz	±1%Fc	40dB @ .86Fc & 1.2Fc	500	1K	500	1K	613 (A or B)	11
K10G	1MHz	20MHz	±1%Fc		50	75	50	75	613 (A or B)	11
K11H	500Hz	10KHz	±1%Fc		1K	500K	1K	500K	4	17
K11J	10KHz	100KHz	±1%Fc	30dB @ .94Fc & 1.06Fc &	500	10K	500	10K	3	13
K11M	100KHz	1MHz	±1%Fc	40dB @ .93Fc & 1.1Fc	500	1K	500	1K	613 (A or B)	12
K11P	1MHz	20MHz	±1%Fc		50	75	50	75	613 (A or B)	12
K12D	500Hz	10KHz	±2%Fc	30dB @ .92Fc & 1.1Fc	1K	10K	1K	10K	4	17
K12H	10KHz	100KHz	±2%Fc	30dB @ .92Fc & 1.1Fc	500	10K	500	10K	3	12
K12J	100KHz	1MHz	±2%Fc	30dB @ .92Fc & 1.1Fc	500	1K	500	1K	613 (A or B)	12
K12L	1MHz	20MHz	±2%Fc	30dB @ .92Fc & 1.1Fc	50	75	50	75	613 (A or B)	12
K18A	30Hz	1000Hz	±5%Fc	55dB @ .5Fc & 2Fc	1K	500K	1K	500K	5	
K18B	1000Hz	300Hz	±5%Fc	60dB @ .5Fc & 2Fc	500	10K	500	10K	4	17
K18C	300Hz	3KHz	±5%Fc	40dB @ .5Fc & 2Fc	500	15K	500	15K	3	12
K18D	3KHz	10KHz	±5%Fc	50dB @ .5Fc & 2Fc	100	50K	100	50K	3	11
K18E	10KHz	100KHz	±5%Fc	60dB @ .5Fc & 2Fc	100	100K	100	100K	3	
K18F	10KHz	100KHz	±5%Fc	60dB @ .5Fc & 2Fc	500	10K	500	10K		11
K18G	100KHz	1MHz	±5%Fc	60dB @ .5Fc & 2Fc	500	1K	500	1K	613 (A or B)	11
K18H	1MHz	20MHz	±5%Fc	50dB @ .5Fc & 2Fc	50	75	50	75	613 (A or B)	11
K20E	100Hz	1KHz	±7.5%Fc	40dB @ .57Fc & 1.75Fc	500	10K	500	10K	4	17
K20F	1KHz	10KHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	10K	500	10K	3	13
K20G	10KHz	100KHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	10K	500	10K	3	11
K20L	100KHz	1 MHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	1K	500	1K	613 (A or B)	11
K20M	1MHz	20MHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	50	75	50	75	613 (A or B)	11
Q20	1KHz	10KHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	1K	10K	1K	10K	5	14
Q22	1KHz	10KHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	1K	10K	1K	10K	6	17
Q23	10KHz	100KHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	600	10K	600	10K	4	13
Q24	10KHz	100KHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	600	10K	600	10K	5	16
Q25	100KHz	1MHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	500	1K	500	1K	613 (A or B)	12
Q26	100KHz	1MHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	500	1K	500	1K	720 (A or B)	15/22
Q27A	1MHz	20MHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	50	75	50	75	613 (A or B)	12
Q28A	1MHz	20MHz	±7.5%Fc	50dB @ .75Fc & 1.3Fc	50	75	50	75	720 (A or B)	15/22
K30E	100Hz	1KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	500	10K	500	10K	4	17
K30F	1KHz	10KHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	10K	500	10K	3	13
K30G	10KHz	100KHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	10K	500	10K	3	11
K30H	100KHz	1MHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	1K	500	1K	613 (A or B)	11
K30L	1MHz	20MHz	±15%Fc	40dB @ .45Fc & 2.2Fc	50	75	50	75	613 (A or B)	11
Q30	1KHz	10KHz	±15%Fc	30dB @ .67Fc & 1.37Fc	1K	10K	1K	10K	5	14
Q32	1KHz	10KHz	±15%Fc	50dB @ .73Fc & 1.31Fc	1K	10K	1K	10K	6	17
Q33	10KHz	100KHz	±15%Fc	30dB @ .67Fc & 1.37Fc	600	10K	600	10K	4	13
Q34	10KHz	100KHz	±15%Fc	50dB @ .73Fc & 1.31Fc	600	10K	600	10K	5	16
Q35A	100KHz	1MHz	±15%Fc	30dB @ .67Fc & 1.37Fc	500	1K	500	1K	613 (A or B)	12
Q36	100KHz	1MHz	±15%Fc	50dB @ .73Fc & 1.31Fc	500	1K	500	1K	720 (A or B)	15/22
Q37A	1MHz	20MHz	±15%Fc	30dB @ .67Fc & 1.37Fc	50	75	50	75	613 (A or B)	12
Q38A	1MHz	20MHz	±15%Fc	50dB @ .73Fc & 1.31Fc	50	75	50	75	720 (A or B)	15/22

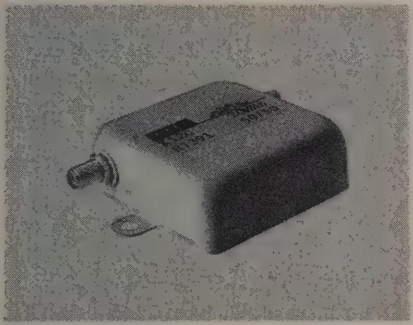
Case and Mounting dimensions are listed on page 10.

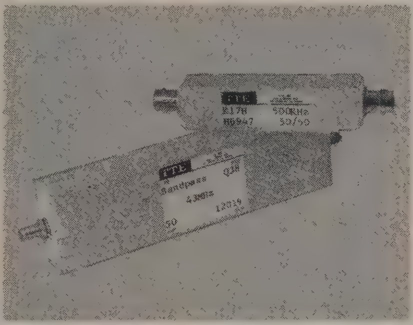
TTE® *subminiature passive* FILTERS

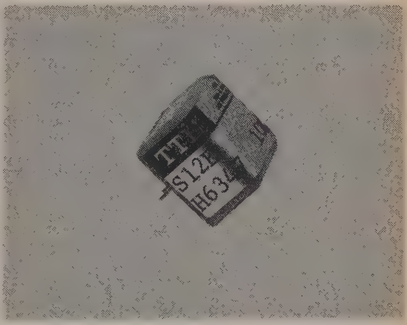
subminiature — BANDPASS FILTERS — specify any frequency from 300Hz to 20MHz

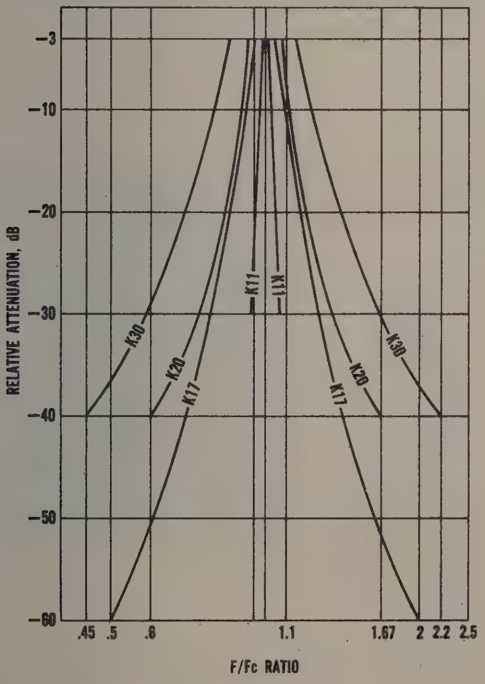
Series No.	(Fc) Center Freq. Range		% Bandwidth @ −3dB	Stopband Attenuating	Source (ohms)		Load (ohms)		Case Type & No. PCB
	Minimum	Maximum			Minimum	Maximum	Minimum	Maximum	
S10D	300Hz	1KHz	±7.5%Fc	35dB @ .55Fc & 1.8Fc	10K	10K	10K	10K	231
S11D	1KHz	5KHz	±7.5%Fc	40dB @ .55Fc & 1.8Fc	1K	10K	1K	10K	231
S12D	5KHz	50KHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	1K	10K	1K	10K	231
S12E	5KHz	50KHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	1K	1K	1K	1K	230
S13D	50KHz	1MHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	500	1K	500	1K	231
S13E	50KHz	1MHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	500	1K	500	1K	230
S14D	1MHz	20MHz	±7.5%Fc	40dB @ .58Fc & 1.75Fc	50	500	50	500	231
S20D	300Hz	1KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	10K	10K	10K	10K	231
S21D	1KHz	5KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	1K	10K	1K	10K	231
S24D	5KHz	50KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	1K	10K	1K	10K	231
S22E	5KHz	50KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	1K	10K	1K	10K	230
S23D	50KHz	1MHz	±15%Fc	40dB @ .4Fc & 2.5Fc	500	1K	500	1K	231
S23E	50KHz	1MHz	±15%Fc	40dB @ .4Fc & 2.5Fc	500	1K	500	1K	230
S24D	1MHz	20MHz	±15%Fc	40dB @ .4Fc & 2.5Fc	50	500	50	500	231

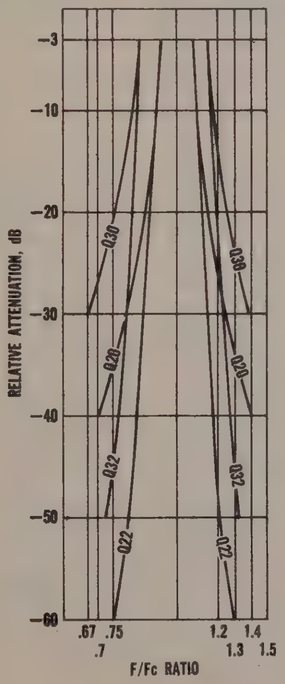
TO ORDER BANDPASS FILTERS — specify (1) TTE® series number, (2) the center frequency, (3) the source and load impedance; TO ORDER SPECIALS — also specify (4) the 3dB frequencies and (5) the stopband frequencies. The price range for the standard types listed is from $35 to $200 each in prototype quantities. PLEASE CONTACT US WITH YOUR SPECIFICATION.

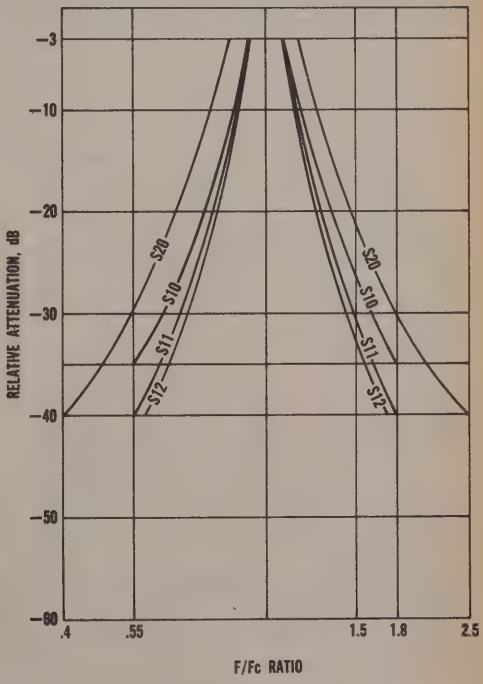












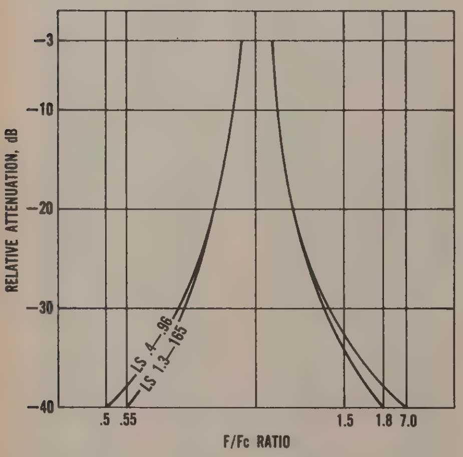
Case and Mounting dimensions are listed on page 10.

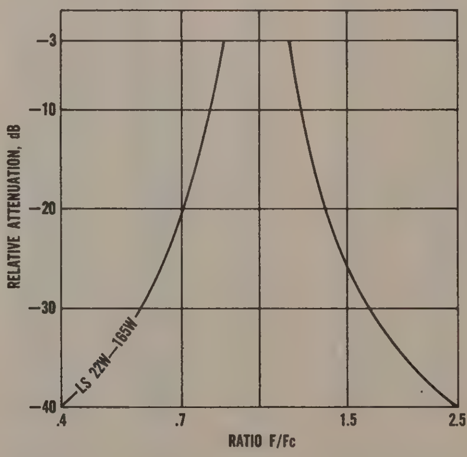
TTE® *subminiature passive* FILTERS

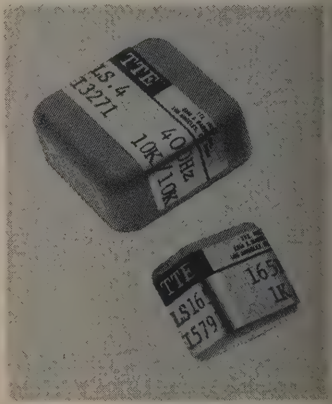
subminiature — TELEMETERING BANDPASS FILTERS FROM *STOCK

Chan. No.	Model No.	Fc	−3dB BW	Stopband Attenuation	Source/Load (ohms)	Case No.
1	LS.4	400Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
2	LS.56	560Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
3	LS.73	730Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
4	LS.96	960Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
5	LS1.3	1300Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
6	LS1.7	1700Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
7	LS2.3	2300Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
8	LS3.0	3000Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
9	LS3.9	3900Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
10	LS5.4	5400Hz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
11	LS7.35	7350Hz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
12	LS10.5	10.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
13	LS14.5	14.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
14	LS22	22KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
15	LS30	30KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
16	LS40	40KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
17	LS52.5	52.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
18	LS70	70KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
19	LS93	93KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
20	LS124	124KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
21	LS165	165KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
A	LS22W	22KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
B	LS30W	30KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
C	LS40W	40KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
D	LS52.5W	52.5KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
E	LS70W	70KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
F	LS93W	93KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
G	LS124W	124KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
H	LS165W	165KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231

TO ORDER — specify the model number and channel needed. This series is a **STOCK ITEM**, however, the stock is limited to two of each frequency and are offered on a first come first served basis. There is a limit of two of each line item per customer if stock delivery is required. If T T E® is out of stock when your order is placed, T T E® will manufacture these networks and ship them to you within 7 working days; this service is provided at no additional charge. If you require sharper slopes the series Q bandpass filter may be specified. Shipment will be in accordance with the standard delivery schedule for that series. The series Q is available for IRIG channels in PCB cases even though PCB cases are not listed in the literature for that series. Please contact T T E® for exact dimensions.





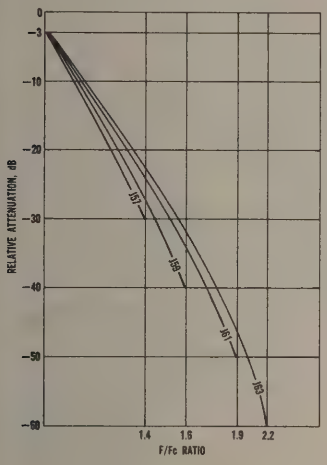


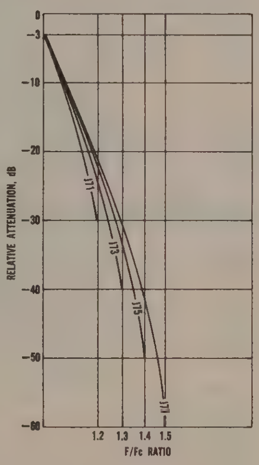
Case and Mounting dimensions are listed on page 10.

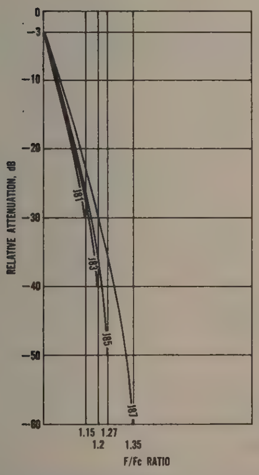
TTE® *miniature passive* FILTERS

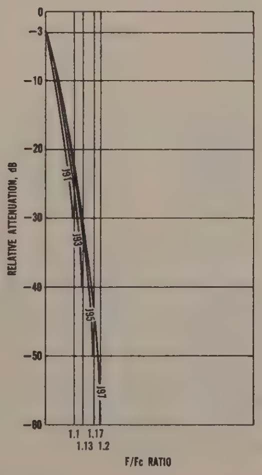
miniature — LOWPASS FILTERS — any frequency from 10Hz to 20MHz may be specified.

Series No.	Min. Attn. dB	Cut-Off Ratio F/Fc	Case Selection Guide Freq. Range	Case Number Chassis	Case Number PCB
			10-74Hz	5	
			75-99Hz	4	
			100-199Hz	4	13
J57F	30	1.4	200-999Hz	4	12
J59F	40	1.6	1000-1999Hz	3	12
J61F	50	1.9	2000-4999Hz	3	11
J63F	60	2.2	5KHz-99.9KHz	2	11
			100KHz-20MHz	718 (A/B)	11
			10-74Hz	6	
			75-99Hz	5	
			100-199Hz	5	17
J71F	30	1.2	200-499Hz	5	16
J73F	40	1.3	500-999Hz	5	12
J75F	50	1.4	1000-2499Hz	4	12
J77F	60	1.5	2500-4999Hz	4	11
			5KHz-99.9KHz	3	11
			100KHz-20MHz	613 (A/B)	11
			75-99Hz	6	
			100-199Hz	5	
J81F	30	1.15	200-499Hz	5	17
J83F	40	1.20	500-999Hz	5	15
J85F	50	1.27	1000-2499Hz	4	15
J87F	60	1.35	2500-4999Hz	4	12
			5KHz-99.9KHz	3	12
			100KHz-20MHz	613 (A/B)	12
			100-199Hz	6	
J91F	30	1.10	200-999Hz	5	
J93F	40	1.13	1000-4999Hz	5	20
J95F	50	1.17	5000-9999Hz	4	20
J97F	60	1.20	10KHz-99.9KHz	4	22
			100KHz-20MHz	720 (A/B)	22

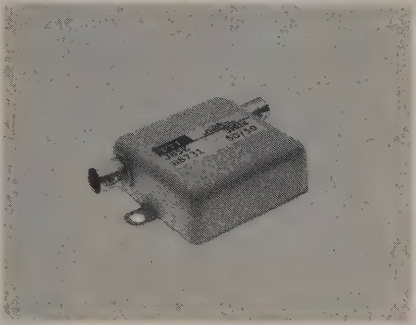








Case and Mounting dimensions are listed on page 10.



The Lowpass Filters cataloged on this page may be specified for any frequency from 10Hz to 20MHz. Frequency range and the case selections are listed to the right of each series.

The passband ripple is 0.4dB peak to valley for most types. Exceptions include series J91 through J97. Typical passband ripple for this series is 0.6dB peak to valley. If the small PCB cases are specified for low frequency networks the passband ripple may increase to 1dB peak to valley.

Phase linearity is reasonable, phase matched sets of filters may be specified. If phase shift is critical in your application T T E® also manufactures Bessel, Gaussian and Butterworth designs. Specify from 2 to 10 poles. The frequency range offered is from 1000Hz to 100KHz.

The maximum power measured at the filters' output terminal is 20 milliwatts. Exceptions are, the Subminiature series and again the low frequency filters and particularly miniaturized low frequency types. Please remember that T T E® also offers Active Filters that are substantially smaller at low frequency and less expensive; please see pages 7 through 9.

In the tables under the heading of chassis mounting cases are listed case 613, 718 and 720. These cases may be specified with either BNC or SMA connectors. Please note your choice when ordering by following the case number with B for BNC or A for SMA (i.e. 720A). The case dimensions and mounting information is listed on page 10. Please note that these networks should not be mounted near transformers or other strong magnetic fields.

To Order: specify (1) the T T E® series number and; (2) the cut-off frequency and (3) the source and load impedance (resistive), the impedance guide is below for your convenience. The approximate price range is $35 to $175 each in quantities of 1-24 units.

IMPEDANCE GUIDE FOR MINIATURE LOWPASS TYPES

Fc —3dB	10Hz 50Hz	50Hz 100Hz	100Hz 500Hz	500Hz 5KHz	5KHz 10KHz	10KHz 100KHz	100KHz 500KHz	500KHz 1MHz	1MHz 5MHz	5MHz 20MHz
Z Min. Ω	10K	10K	5K	1K	500	100	50	50	50	50
Z Max. Ω	15K	39K	39K	39K	20K	3K	3K	1K	300	75

T T E, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TTE® *miniature passive* FILTERS

subminiature — HIGHPASS

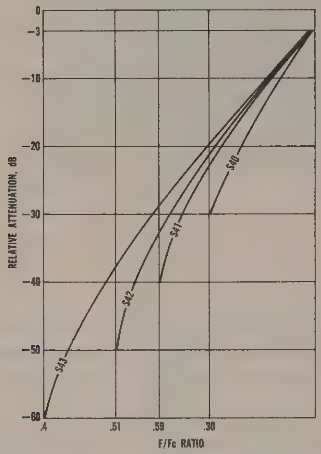
specify any frequency from 1KHz to 20MHz

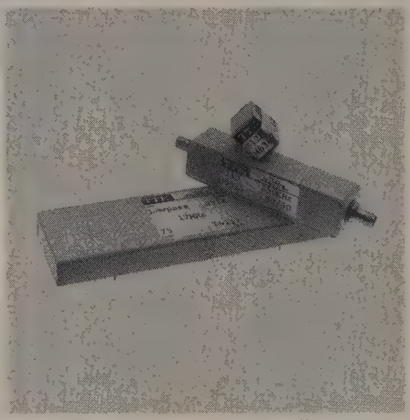
Series No.	Min. Attn. dB	Cut-Off Ratio F/Fc	Case Selection Guide	
			Frequency Range	Case No. PCB
S40D	30	.70	1KHz-9.9KHz	231
S41C	40	.59	10KHz-999.9KHz	230
S42C	50	.51	1KHz-20MHz	231

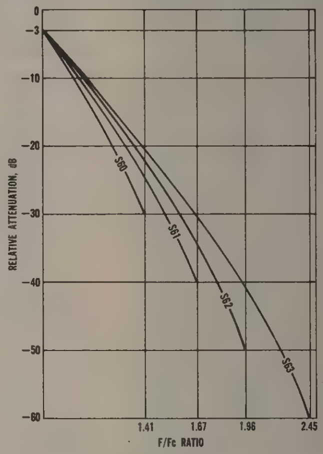
subminiature — LOWPASS

specify any frequency from 1KHz to 20MHz

Series No.	Min. Attn. dB	Cut-off Ratio F/Fc	Case Selection Guide	
			Frequency Range	Case No. PCB
S60D	30	1.41	1KHz-9.9KHz 10KHz-999KHz 1KHz-20MHz	231 230 231
S61C	40	1.67		
S62C	50	1.96		
S63C	60	2.45		







IMPEDANCE GUIDE FOR SUBMINIATURE HIGHPASS AND LOWPASS TYPES

Fc —3dB	1KHz 5KHz	5KHz 20KHz	20KHz 100KHz	100KHz 500KHz	500KHz 1MHz	1MHz 10MHz	10MHz 20MHz
Z Min. Ω	10K	1K	300	50	50	50	50
Z Max. Ω	10K	10K	1K	1K	300	75	75

GAUSSIAN and BUTTERWORTH LOWPASS FILTERS

gaussian — LOWPASS

specify any frequency from 1KHz to 100 KHz

Series No.	Min. Attn. (dB)	Cut-off Ratio F/Fc	Frequency Range	Case Number	
				Chassis	PCB
LG 20	24	5	1KHz-9.9KHz	3	9
			10KHz-100KHz		10
LG 40	34	5	1KHz-9.9KHz	3	*11T
			10KHz-100KHz		11
LG 60	50	5	1KHz-9.9KHz	4	13
			10KHz-100KHz		12
LG 80	58	5	1KHz-9.9KHz	5	16
			10KHz-100KHz		15
LG 100	70	5	1KHz-9.9KHz	6	16
			10KHz-100KHz		15

*Case 11T has the base & mounting dimensions as Case 11, however, the height is .75".

butterworth — LOWPASS

specify any frequency from 1KHz to 100KHz

Series No.	Min. Attn. (dB)	Cut-off Ratio F/Fc	Frequency Range	Case Number	
				Chassis	PCB
LG 20	12	2	1KHz-9.9KHz	3	9
			10KHz-100KHz		10
LG 40	24	2	1KHz-9.9KHz	3	*11T
			10KHz-100KHz		11
LG 60	36	2	1KHz-9.9KHz	4	13
			10KHz-100KHz		12
LG 80	48	2	1KHz-9.9KHz	5	16
			10KHz-100KHz		15
LG 100	60	2	1KHz-9.9KHz	6	16
			10KHz-100KHz		15

IMPEDANCE GUIDE FOR GUASSIAN and BUTTERWORTH LOWPASS FILTERS

Fc-3dB	1KHz to 9.9KHz	10KHz to 49KHz	50KHz to 100KHz
Z min Ω	1K	500	250
Z max Ω	10K	10K	1K

GAUSSIAN LOWPASS FILTERS are frequently specified by designers of pulse communication systems. This design features low ringing or overshoot. If the designer requires sharper cut-off ratios and can tolerate greater ringing or overshoot, the **BUTTERWORTH LOWPASS FILTER** should be considered. This design, like the Gaussian, features passbands and stopbands that contain no ripple.

TO ORDER: specify (1) the TTE® series number, (2) the cut-off frequency (Fc), (3) the source and load impedance (resistive) and (4) the case number. Prices range from $35.00 to $125.00 each in prototype quantities; there is a set-up charge for these series of lowpass filters.

Case and Mounting dimensions are listed on page 10.

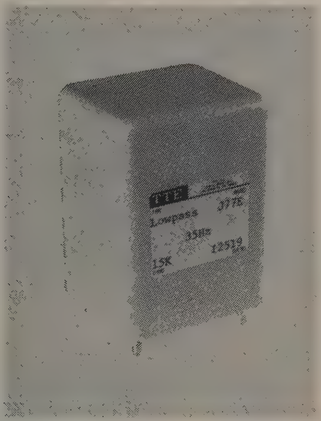
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TTE® *miniature passive* FILTERS

miniature — HIGHPASS FILTERS —

specify any frequency from 75Hz to 20MHz

Series No.	Min.Attn. dB	Cut-off Ratio F/Fc	Case Selection Guide Frequency Range	Case Number Chassis	PCB
			75-99Hz	4	
H60F	30	.45	100-199Hz	3	
H62F	40	.35	200-499Hz	3	9
H64F	50	.25	500-999Hz	2	10
H66F	60	.15	1KHz-99.9KHz	2	10
			100KHz-20MHz	718 (A/B)	10
			75-99Hz	4	
H67F	30	.70	100-199Hz	4	13
H69F	40	.60	200-999Hz	4	12
H71F	50	.52	1000-1999Hz	3	12
H73F	60	.45	2000-4999Hz	3	11
			5KHz-99.9KHz	2	11
			100KHz-20MHz	718 (A/B)	11
			75-99Hz	5	
			100-199Hz	5	17
H81F	30	.81	200-499Hz	5	16
H83F	40	.75	500-999Hz	5	12
H85F	50	.70	1000-2499Hz	4	12
H87F	60	.65	2500-4999Hz	4	11
			5KHz-99.9KHz	3	11
			100KHz-20MHz	613 (A/B)	11
			75-99Hz	6	
			100-199Hz	5	
H91F	30	.85	200-499Hz	5	17
H93F	40	.80	500-999Hz	5	15
H95F	50	.75	1000-2499Hz	4	15
H97F	60	.70	2500-4999Hz	4	12
			5KHz-99.9KHz	3	12
			100KHz-20MHz	613 (A/B)	12



The Highpass Filters cataloged on this page may be specified for any frequency from 75Hz to 20MHz. The frequency range and the case selections are listed to the right of each series.

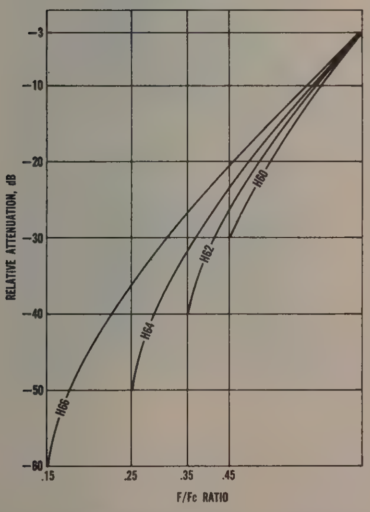
The passband ripple is 0.4dB peak to valley for most types. Phase linearity is reasonable, phase matched sets are available.

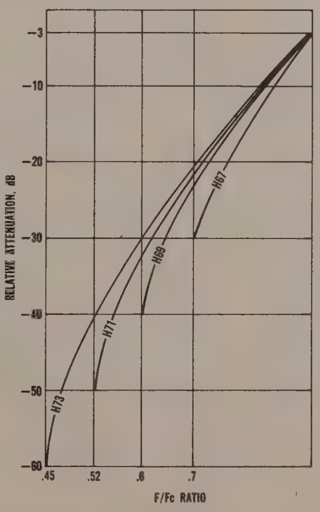
The maximum power measured at the filters output terminal is 20 milliwatts for the series H and 10 milliwatts for the series S listed on page 5.

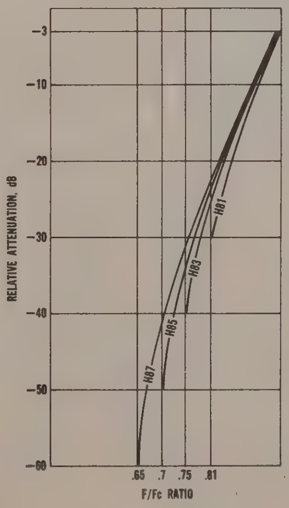
TO ORDER: specify (1) the TTE series number and; (2) the cut-off frequency and (3) the source and load impedance (resistive), the impedance guide is below for your convenience. The approximate price range is $35 to $125 each in quantities of 1-24 units.

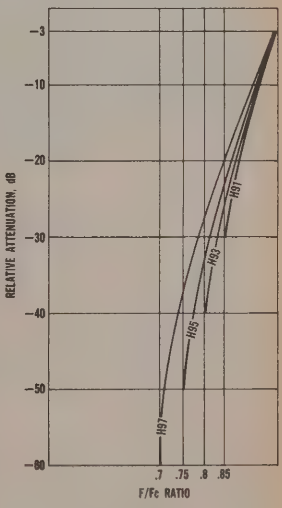
IMPEDANCE GUIDE FOR MINIATURE HIGHPASS TYPES

Fc —3dB	10Hz 50Hz	50Hz 100Hz	100Hz 500Hz	500Hz 5KHz	5KHz 10KHz	10KHz 100KHz	100KHz 500KHz	500KHz 1MHz	1MHz 5MHz	5MHz 20MHz
Z Min. Ω	10K	10K	5K	1K	500	100	50	50	50	50
Z Max. Ω	15K	39K	39K	39K	20K	3K	3K	1K	300	75









Case and Mounting dimensions are listed on page 10.

TTE® *miniature active* FILTERS

miniature — ACTIVE BUTTERWORTH BANDPASS FILTERS

any freq. from 10Hz to 200KHz may be specified

Series No.	%BW @ −3dB	Stopband Attenuation	Supply Current Maximum	Case No.
ABB20	±0.5%	30dB @ .8 & 1.25Fc	5.6mA	810
ABB40	±0.5%	40dB @ .9 & 1.11Fc	8.4mA	811
ABB60	±0.5%	60dB @ .7 & 1.40Fc	11.2mA	815
ABB22	±1.0%	30dB @ .7 & 1.40Fc	5.6mA	810
ABB42	±1.0%	40dB @ .8 & 1.22Fc	8.4mA	811
ABB62	±1.0%	50dB @ .8 & 1.20Fc	11.2mA	815
ABB24	±2.0%	30dB @ .5 & 2.00Fc	5.6mA	810
ABB44	±2.0%	40dB @ .74 & 1.35Fc	8.4mA	811
ABB64	±2.0%	60dB @ .65 & 1.50Fc	11.2mA	815
ABB26	±5.0%	30dB @ .25 & 4.0Fc	5.6mA	810
ABB46	±5.0%	30dB @ .4 & 2.5Fc	8.4mA	811
ABB66	±5.0%	50dB @ .3 & 3.3Fc	11.2mA	815

GENERAL SPECIFICATIONS

Input impedance: 100K ohms (maximum)

Output impedance: 500 ohms (minimum)

Output short circuit protection: Continuous

Offset voltage: 2mV

Supply voltage: ±18VDC (maximum)

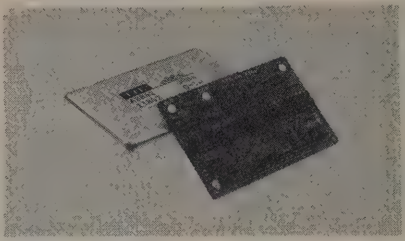
Gain: 1 ±0.1 (non-inverting) — Higher gains may be specified.

Operating Temperature: 0 to +70 degrees C

Storage temperature: −30 to +120 degrees C

Case: TTE filters are epoxy encased within hermetically sealed steel cases. The case finish is copper plate per MIL-C-1450 under fused tin per MIL-T-10727A.

TO ORDER: (1) specify the TTE series number and (2) specify the center frequency. The prices range from $37 to $125 each in prototype quantities. Specials are available at standard prices. Please contact us with your specification.



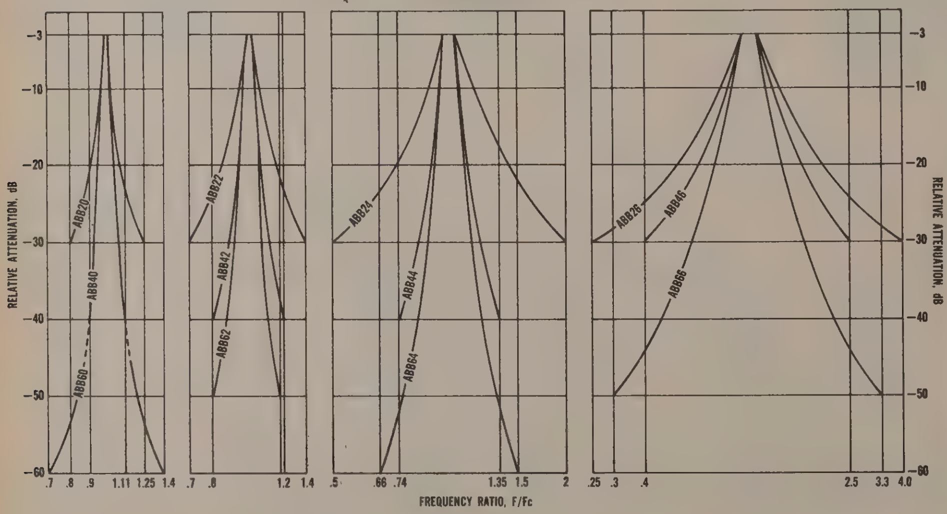
Active Filters are desirable at low frequencies as they are lighter and smaller than Passive Filters; impedance matching is not required and gains at the output may be specified.

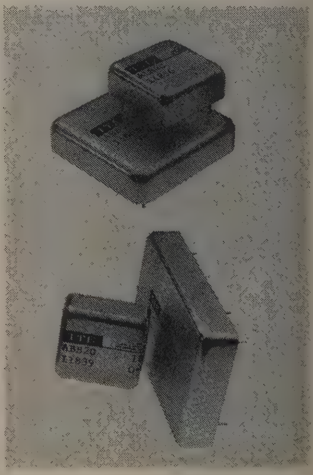
This section of the catalog contains specifications and descriptions of TTE's Active Filter line. Additional Lowpass and Highpass Filters, Band Reject Filters and Tunable Filters, will be released during the next several months and incorporated in the next cataloging. Individual product data pages will be available soon, please contact us with your specification.

When using this section of the catalog, please remember the graphs are visual aids, not specifications. The guaranteed specifications are (1) the attenuation at the passband edge (Fc) is −3dB ±0.5dB and (2) that the stopband attenuation listed in the catalog is the minimum attenuation that each filer type will develop. The output gain is unity ±0.1. Other gains may be specified.

Now the designer is able to specify either Active or Passive Filters from one supplier, this saves time for both the designer and the purchasing agent. At TTE there is NO MINIMUM ORDER, and NO ENGINEERING CHARGE for any standard series filter.

TYPICAL RESPONSE CURVES





Case and Mounting dimensions are listed on page 10.

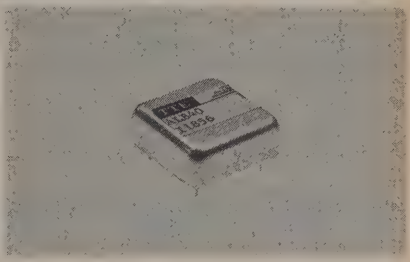
TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TTE® *miniature active* FILTERS

miniature — ACTIVE BUTTERWORTH LOWPASS FILTERS

any frequency from 10Hz to 200KHz may be specified

Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
ALB20	12	2	5.6mA	810
ALB40	24	2	5.6mA	810
ALB60	36	2	8.4mA	811
ALB80	48	2	8.4mA	812
ALB100	60	2	11.2mA	815



miniature — ACTIVE BUTTERWORTH HIGHPASS FILTERS

any frequency from 10Hz to 200KHz may be specified

Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
AHB20	12	.50	5.6mA	810
AHB40	24	.50	5.6mA	810
AHB60	36	.50	8.4mA	811
AHB80	48	.50	8.4mA	812
AHB100	60	.50	11.2mA	815

TO ORDER: specify (1) the TTE series number and (2) the minus 3dB frequency. These filters range in price from $37 to $101 each in prototype quantities. **SPECIALS:** other types of both Active and Passive Filters are available. Please contact us with your specification.

GENERAL SPECIFICATIONS

Input impedance: 100K ohms (maximum)

Output impedance: 500 ohms (minimum)

Output short circuit protection: Continuous

Offset voltage: 2mV

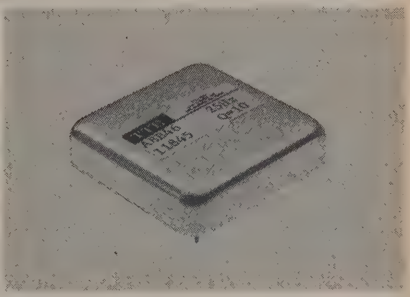
Supply voltage: ±18VDC (maximum)

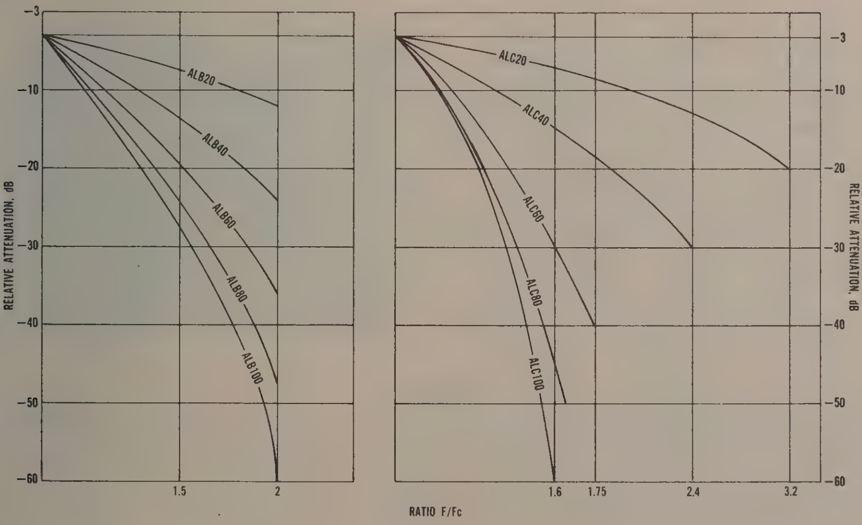
Gain: 1 ±0.1 (non-inverting) — Higher gains may be specified.

Operating Temperature: 0 to +70 degrees C

Storage temperature: −30 to +120 degrees C

Case: TTE filters are epoxy encased within hermetically sealed steel cases. The case finish is copper plate per MIL-C-1450 under fused tin per MIL-T-10727A.





Case and Mounting dimensions are listed on page 10.

TTE® *miniature active* FILTERS

miniature — ACTIVE TSCHEBYSCHEFF LOWPASS FILTERS

any frequency from 10Hz to 200KHz may be specified

Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
ALC20	20	3.2	5.6mA	810
ALC40	40	2.4	5.6mA	810
ALC60	40	1.75	8.4mA	811
ALC80	50	1.65	8.4mA	812
ALC100	60	1.6	11.2mA	815

TTE
ALC80
11849

miniature — ACTIVE TSCHEBYSCHEFF HIGHPASS FILTERS

any frequency from 10Hz to 200KHz may be specified

Series No.	Minimum Attenuation (dB)	Cut-off Ratio F/Fc	Supply Current Maximum	Case No.
AHC20	20	.31	5.6mA	810
AHC40	40	.41	5.6mA	810
AHC60	40	.55	8.4mA	811
AHC80	50	.60	8.4mA	812
AHC100	60	.60	11.2mA	815

TO ORDER: specify (1) the TTE series number and (2) the minus 3dB frequency. These filters range in price from $37 to $101 each in prototype quantities. **SPECIALS:** other types of both Active and Passive Filters are available. Please contact us with your specification.

GENERAL SPECIFICATIONS

Input impedance: 100K ohms (maximum)

Output impedance: 500 ohms (minimum)

Output short circuit protection: Continuous

Offset voltage: 2mV

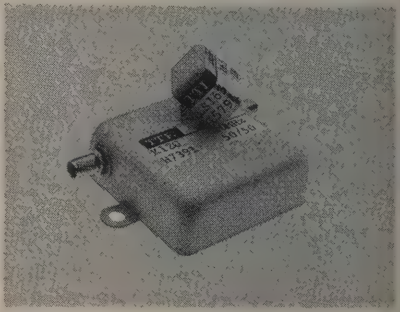
Supply voltage: ±18VDC (maximum)

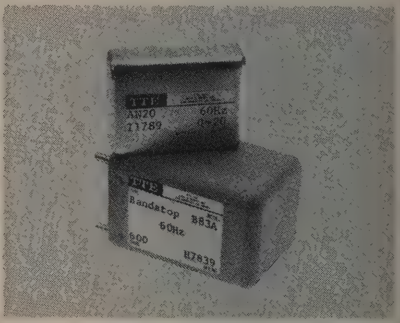
Gain: 1 ±0.1 (non-inverting) — Higher gains may be specified.

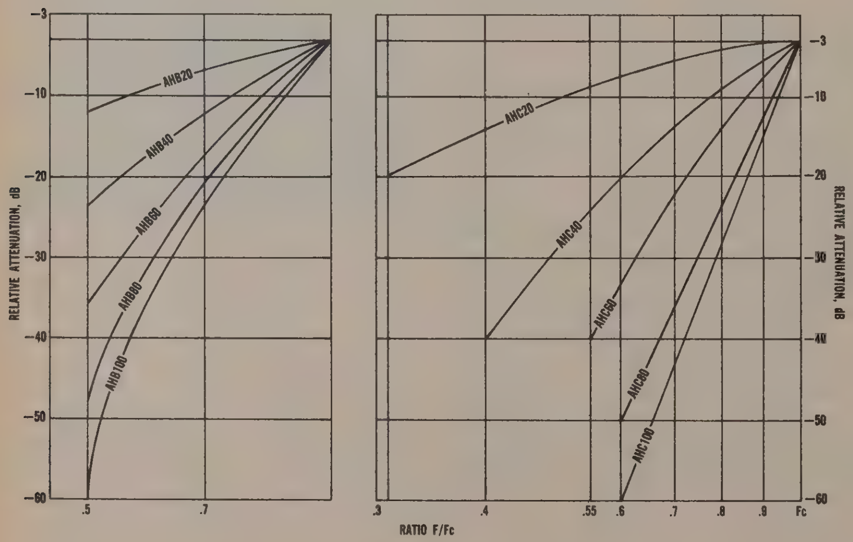
Operating Temperature: 0 to +70 degrees C

Storage temperature: −30 to +120 degrees C

Case: TTE filters are epoxy encased within hermetically sealed steel cases. The case finish is copper plate per MIL-C-1450 under fused tin per MIL-T-10727A.







Case and Mounting dimensions are listed on page 10.

TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

TTE® *miniature* FILTERS

miniature — PASSIVE BAND REJECTION FILTERS

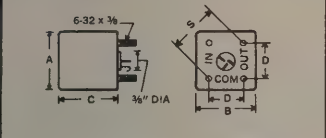
Series No.	(Fc) Center Frequency Range		Bandwidth @ −3dB	Attenuation @ Fc	Impedance (ohms)		Case Type/No.	
	Minimum	Maximum			Minimum	Maximum	Chassis	PCB
B83B	25Hz	100Hz	.6Fc & 1.4Fc	40dB	600	50K	4	
B83C	50Hz	10KHz	.77Fc & 1.3Fc	50dB	50	1Meg	4	
B83D	10KHz	100KHz	.77Fc & 1.3Fc	50dB	50	1Meg	3	14
B83E	100KHz	1MHz	.77Fc & 1.3Fc	50dB	50	50K		13/18
D	10Hz	100KHz	.25Fc & 4Fc	50dB	50	1Meg	2	11

miniature — ACTIVE BAND REJECTION FILTERS

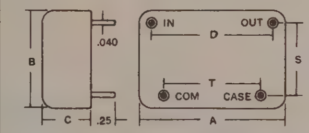
Series No.	(Fc) Center Frequency Range		Bandwidth @ −3dB	Stopband Attenuation	Supply Current Maximum	Maximum Volts (DC)	Case No.
	Minimum	Maximum					
AN20	10Hz	10KHz	±2.5%Fc	−40dB min. @ Fc	5.6mA	±18	811
AN10	10Hz	10KHz	±5%Fc	−40dB min. @ Fc	5.6mA	±18	811
AN05	10Hz	10KHz	±10%Fc	−40dB min. @ Fc	5.6mA	±18	811

TO ORDER: specify (1) TTE series number, (2) the notch frequency; and for Passive Filters also specify (3) the source and load impedance and case selection if available. Prices range from $22 to $150 each in prototype quantities.

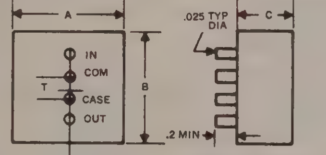
CASE DIMENSIONS AND MOUNTING INFORMATION



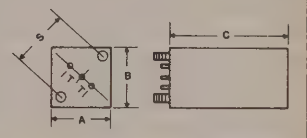
CASE 1-6



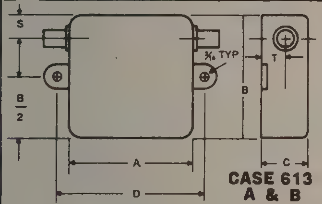
CASE 9-22



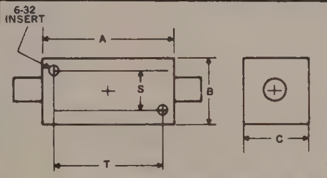
CASE 230-231



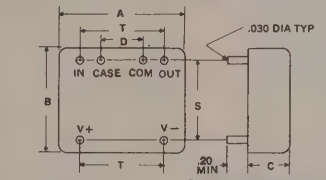
CASE AG



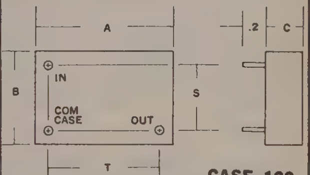
CASE 613 A & B



CASE 718/720 A & B



CASE 810-815



CASE 136

Dim.	Chassis Cases						PCB Cases									
	AG	2	3	4	5	6	9	10	11	12	13	15	16	17	18	19
A	1.0	1.19	1.31	1.63	1.81	2.06	1.27	1.27	1.88	2.0	2.0	2.96	2.96	2.96	3.0	3.0
B	1.0	1.19	1.31	1.63	1.94	2.31	1.27	1.27	1.44	2.0	2.0	1.93	1.93	1.93	.75	.75
C	1.38	1.25	1.75	2.38	2.44	3.13	1.0	.5	.5	.5	.75	.5	.75	1.25	.75	.5
D	—	.75	—	1.19	1.38/ 1.25	1.69/ 1.44	.9	.9	1.5	1.5	1.5	2.4	2.4	2.4	2.4	2.4
S	.75	—	1.25	—	—	—	.9	.9	1.0	1.5	1.5	1.4	1.4	1.4	.4	.4
T	.22	—	—	—	—	—	.6	.6	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0
Mtg.	2-4-40 X3/8	(4)	(2)	(4) 6-32 x 3/8 studs	(4)	(4)	Printed Circuit Board Mounting									

Dim.	PCB Cases										VHF-UHF Connectors					
	20	22	136	229	230	231	810	811	812	815	613A	613B	718A	718B	720A	720B
A	5.03	5.03	1.6	.75	.75	1.19	1.27	1.88	2.0	2.96	2.0	2.0	3.0	3.0	5.03	5.03
B	1.42	1.42	1.0	.75	.75	1.19	1.27	1.44	2.0	1.93	2.0	2.0	.75	.75	1.42	1.42
C	.5	.75	.5	.5	.5	.5	.5	.5	.5	.5	.75	.75	.75	.75	.75	.75
D	4.0	4.0	—	—	—	—	.6	.75	.8	1.0	2.38	2.38	—	—	—	—
S	1.0	1.0	.65	—	—	—	.9	1.0	1.5	1.4	.38	.38	.40	.40	1.0	1.0
T	3.0	3.0	1.3	.1	.1	.2	.9	1.5	1.5	2.4	.38 (SMA)	.38 (BNC)	2.0 (SMA)	2.0 (BNC)	4.0 (SMA)	4.0 (BNC)
Mtg.	Printed Circuit Board Mtg.										6-32 Inserts		2	2	4	4

TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

Selection Guide for TRW Filters

FILTERS

Almost 40 years of specialization in selective networks, from image parameter design to modern network synthesis are reflected in the superior performance, miniaturization, stability, and reliability of the electric wave filters produced by TRW today.

Because of the tremendous variation in requirements of frequency, band width, impedance, shape factor, size configuration, and other special characteristics such as envelope delay distortion, and return loss, TRW Inductive Products' catalog items are only a portion of the filters made. Special "custom" designs to customers' specifications range from DC to 30 MHz, from a volume of less than 0.1 cubic inches to more than 250 cubic inches. They cover applications such as telephone, telegraph, telemetering, multiplexing, carrier elimination and restoration, etc.

FOR SPECIAL DESIGNS the following information must be known: source and load impedances, insertion loss, pass band, stop band, operating level, operating temperature range, and size restrictions, plus any other special requirements such as phase matching, insertion loss matching, or attenuation matching, between units, envelope delay distortion, return loss limits, etc.

Since filters usually contain many precisely adjusted elements and are used in critical applications where continued reliable performance is a necessity, all TRW filters, both stock and specials, are manufactured and guaranteed to MIL-F-18327.

Units with identical electrical and mechanical characteristics as stock items, except for center frequency on band pass filters, or cutoff frequency on low and high pass filters, are known as stock specials. For example, a band pass filter identical to the BPM series with a center frequency of 2700 Hz would be identified as BPM-2700, a 2700 Hz center frequency band pass filter identical to the MNF series would be identified as MNF-2.7, a low pass similar to LPM series with a 2700 Hz cutoff frequency would be identified as LPM-2700.

FOR WIDE BAND PASS applications (more than an octave wide) low pass and high pass filters may be connected in tandem. For instance, the FLH-5000 in tandem with the FHH-200 will result in an attenuation characteristic flat within 1 dB from 300 to 4200 Hz, approximately 3 dB at 200 and 5000 Hz, 40 dB below 140 Hz, and 43 dB above 6400 Hz.

FOR BAND REJECT applications, the BPM band pass minifilters may be used by connecting as shown in our catalog.

Generally, on stock filters, variations of ±20% in the source and load impedances will have negligible effect on the attenuation response. FHH, FLH, FLL, BPM, and BMI filters may be used with a much lower source impedance and still give satisfactory results.

The nominal test level, E_g is 2.0 Volts RMS for all stock filters except 0.5 Volt on the BPM and 1.0 Volt on the LPM.

BAND PASS

Type No.	Center Frequency Range	Band Width	Source (Ohms)	Load (Ohms)	MIL Grade
MNF	400 Hz to 165 kHz	±7.5%	10K	10K	7
MWF	22 kHz to 165 kHz	±15%	10K	10K	7
BPM	400 Hz to 20 kHz	±3%	10K	10K or Grid	6
BMI	30 Hz to 400 Hz	±3%	10K	Grid	6
TGT	425 Hz to 3315 Hz	±42.5 Hz	600	600	6
TGR	425 Hz to 3315 Hz	±42.5 Hz	600	600	6

BAND REJECT

Type No.	Frequency Range	Source & Load (Ohms)	MIL Grade
BPM	400 Hz to 20 kHz	10K	6

LOW PASS

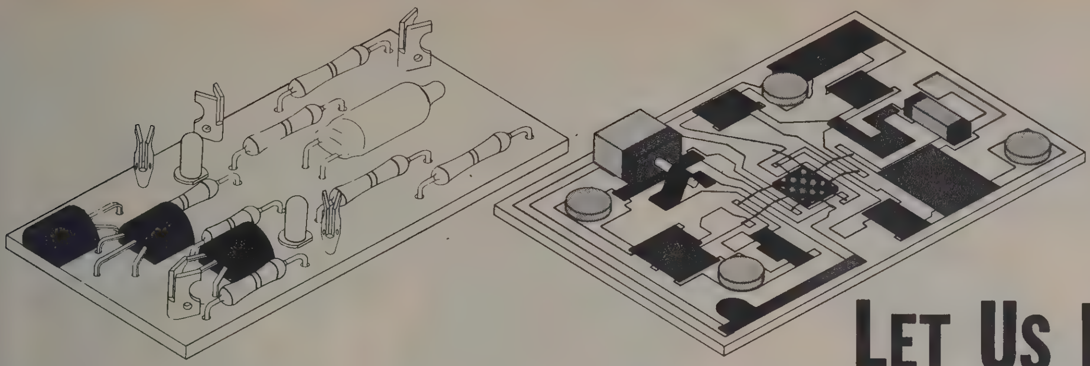
Type No.	Cutoff Frequency Range	Source & Load (Ohms)	MIL Grade
LPM	200 Hz to 15 kHz	10K	6
FLH	600 Hz to 5 kHz	10K	6
FLL	3.5 kHz to 50 kHz	600	6
LMI	50 Hz to 150 Hz	10K	6
LML	500 Hz to 12 kHz	600	6

HIGH PASS

Type No.	Cutoff Frequency Range	Source & Load (Ohms)	MIL Grade
FHH	200 Hz to 10 kHz	10K	6
HMI	50 Hz to 400 Hz	10K	6

CALL FACTORY FOR DETAILS OR SPECIAL REQUIREMENTS ON FILTER APPLICATIONS

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722



LET US BE YOUR MANUFACTURING FACILITY

Do You Need Help To Get The End Product You Want?

After you have your design to meet your circuit performance requirements, ACC's Engineering Staff can assist you to package your circuit. We have a complete staff of electrical, mechanical, industrial, and chemical engineers to develop the most cost-effective assembly to compliment your product.

Custom Thick Film Hybrid?
If space is a problem, thick film hybrids are the answer to reduced manufacturing cost and component inventories. ACC can design and deliver a custom thick film hybrid to meet your performance, space, and cost requirements. For less stringent space requirements, formed discrete components or SOT packages are quite adequate. If space is tight or you have your own custom chip, a chip and wire hybrid may be the best approach.

The results to you are smaller size, improved reliability, and in most cases, better circuit performance due to the fact that thick film allows you to choose the exact resistor values and tolerances you want.

We have the capability to build your product to any stage of completion you desire. From a thick film print, fire, and trim, only, to a finished encased product, or any stage in between, by using custom thick film hybrids or printed circuit assemblies.

We will work with you during your development stage. We possess the capability to deliver into the millions, if necessary.

Automotive Controls Corporation (ACC) has over 200,000 square feet of production space. This facility, located in Southeast Kansas is staffed with a quality-conscious, dependable, rural and small-town work force. Our employees, to whom we owe our success, will build your product.

Printed Circuit Assembly?
If space is not a problem, then an automatically inserted printed circuit assembly is the most cost effective approach. ACC's printed circuit assembly area is equipped to insert components and wave solder boards up to 16 inches wide. Water washing is standard. Chlorinated cleaning solvents are available. The ACC facility is equipped and the personnel are trained to handle electrostatic sensitive components at all stages of production.

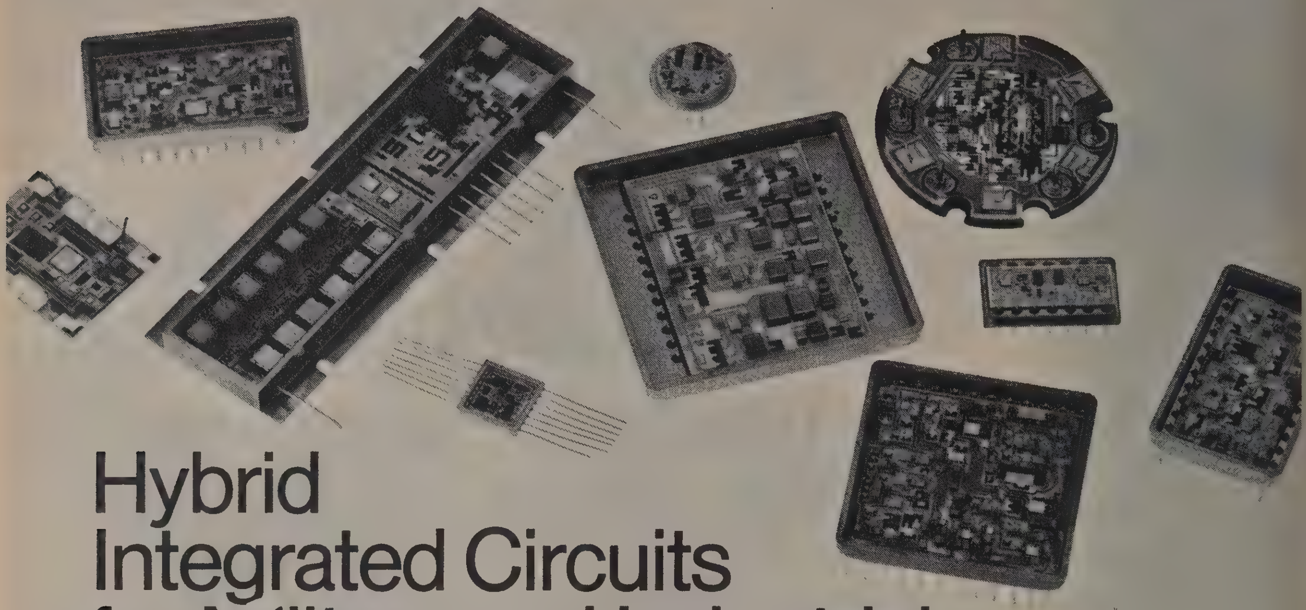
Packaging Support
In support of the electronic assembly, ACC can offer single-sided printed circuit boards, coil winding, transfer and injection molding, potting, metal and lead frame stampings, metal plating, and painting, if required.

Total Design Capability through manufacture, test and delivery

ACC
ELECTRONICS
AN ECHLIN COMPANY
1300 West Oak Independence, Kansas 67301 (316) 331-1000

Manufacturers of custom circuits for Industry.

Call us on our Inward Wats Line 800-835-0362 and ask for ACC Electronics Application Engineering, Extension 422.



Hybrid Integrated Circuits for Military and Industrial Applications

Aeroflex designs, develops and manufactures custom hybrids for both military and industrial customers. We are qualified for use on B1, B52, F15, F16 and LAMPS MK III, plus numerous other ground and airborne systems and medical and communications equipment.

Will a custom hybrid do your job? Hybrid technology combines the quick-response design and manufacturing economies of the printed circuit assembly with the reliability and small size of the monolithic IC. To help you determine when the method will be cost effective, Aeroflex's experienced engineers will consider the circuit itself, manufacturing lead time, and the quantities involved.

Once the decision has been made, Aeroflex has the technical and manufacturing support to meet your most exacting requirements. Our circuit designers will put your parameters together into the smallest, lightest package consistent with effective performance.

We excel in designing active filters, sample and hold networks, low noise pre-amps, voltage regulators, drivers and receivers and digital interface circuits to meet MIL-STD-1553. Electrical performance is guaranteed by our automatic test systems.

In our complete manufacturing facility, Aeroflex has the skilled personnel and production equipment to meet every hybrid design and manufacturing requirement. For most designs, we use thick film deposition for its great flexibility. On occasion, however, we will utilize thin film chip components in conjunction with thick film resistors and conductors. Gold conductors and various silver alloys are often employed, as well as a variety of resistor inks to cover the full range of resistor values. We have and use both laser, for active trimming, and airbrasive trimming systems.

Packaging for all environments. Aeroflex commercial hybrids are often epoxy sealed in ceramic for industrial applications. Heavy duty packaging options include welded hermetically sealed all-metal cases including flat packs, dips, plug-ins and "TO" cans for military requirements.

Product Assurance, in and out. Our Product Assurance Department meets the requirements of MIL-Q-9858A. Quality Assurance, Quality Control, Qualification Testing and Equipment Calibration are its responsibilities. Incoming inspection is performed on semiconductors in accordance with MIL-STD-883, Method 2010.1 Level B. Similar criteria are applied to hybrid inspection. Screening and qualification testing to MIL-STD-883B, Method 5008 and MIL-M-38510 are also available.

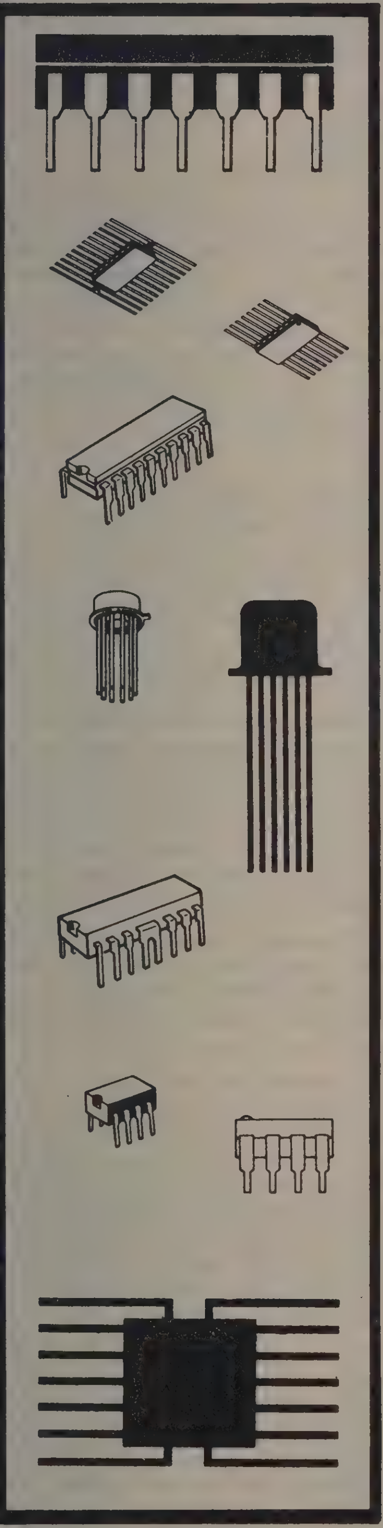
Microelectronics Division
AEROFLEX LABORATORIES INC.

35 South Service Road
Plainview, New York 11803
Tel. 516-694-6700 TWX 510-224-6417

AMS

AMERICAN MICROSEMICONDUCTOR INC.

IC's THE #1 SOURCE FOR SEMICONDUCTORS



7400 SERIES TTL FAMILIES

7400
74ALS00
74C00
74H00
74HC00
74L00
74LS00
74S00

C/MOS

4000
4001
4002
4006
4007
4009
4010
4011
4012
4013
4014
4015
4016
4017
4018
4019
4020
4021
4022
4023
4024
4025
4026
4027
4028
4029
4030
4034
4035
4040
4041
4042
4043
4044
4045
4046
4047
4048
4049
4050
4051
4052
4053
4056
4059
4060
4066
4068
4069
4070
4071
4072
4073
4075
4076
4078
4081
4082
4093
4098
4502
4503
4506
4507
4508
4510
4511
4512
4514
4515
4516
4518
4519
4520
4526
4528
4529
4531
4538
4541
4543
4556
4562
4566
4583
4584
4585
4723
4724
4725
14409
14410
14411
14412
14419
14433
14490

LINEARS

301
307
310
317
339
348
358
359
531
555
556
564
565
566
567
709
710
711
733
739
741
747
748
1458
1488
1489
3010
3035
3081
3082
3096
3130
3401
3900

MEMORIES

RAMS
2101
2102
2112
2114
2148
4027
4116
48256
5101
5261
5262
5270
5280
5290
5298
6116
7489
74C920
74S200
82S10

ROMS
2513
2708
2516
2532
2564
2716
2732
2764
87S180
87S181
87S190
87S191

DTL

830
832
833
836
837
838
840
841
844
845
846
848
849
852
853
855
856
857
861
862
863
951

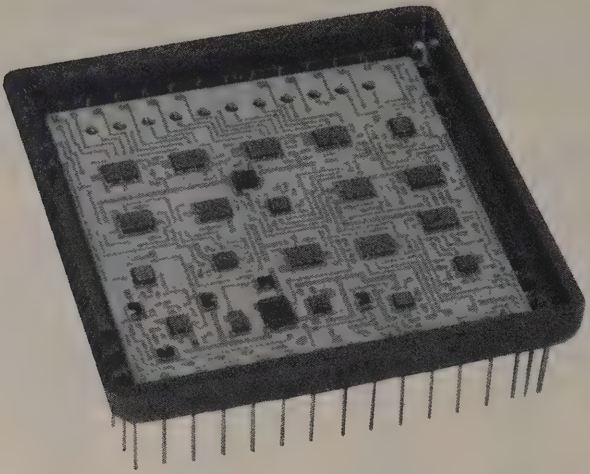
MISCELLANEOUS

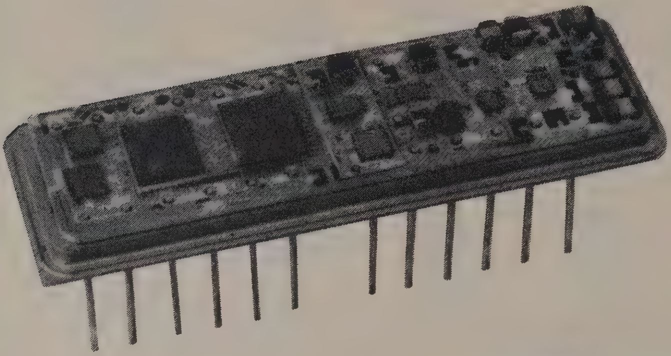
6800
7805
7812
7815
7824
7905
7912
7915
7924
Z80
8080
8085
8086
8088
8136
8212
8223
8224
8251
8255
8748
8749
9600
9601
9602

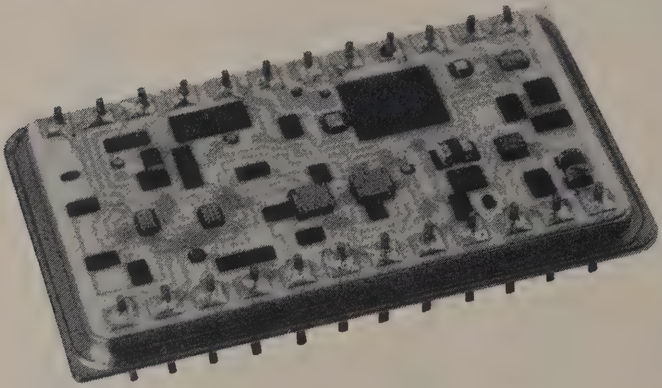
CALL OR WRITE FOR COMPLETE LISTING

AMERICAN MICROSEMICONDUCTOR INC.

133 KINGS ROAD • MADISON, NEW JERSEY 07940 • (201) 377-9566 TELEX: 710-986-8500







CTS®

HI-REL HYBRIDS

THICK & THIN FILM HYBRID TECHNOLOGY

CTS Microelectronics produces high quality thick film hybrid circuits. The modern 101,000 square foot manufacturing facility in West Lafayette, Indiana, specializes in volume production of "Hi-Rel" and commercial grade chip and wire hybrid circuits, quality discrete hybrids and custom resistor networks.

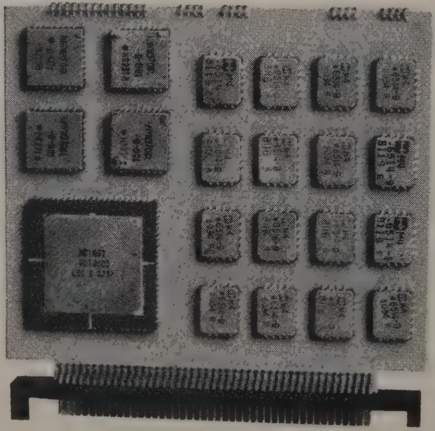
CUSTOM DESIGN/ QUALITY ASSURANCE.

CTS Microelectronics works directly with the customer to establish and maintain testing procedures that will insure the highest standards of quality and reliability. Specification reviews are a standard practice at CTS. Representatives from the quality assurance, sales and engineering departments met with the customer to establish the requirements of each designed circuit prior to any production run, following the general requirements of MIL-STD-883 and MIL-M-38510.

All incoming materials go through quality assurance. There, samples are taken, tested and quarantined until written approval is given to release them to stock.

The in-process inspection system checks circuits at all stages of manufacturing to insure highest quality workmanship and adherence to specifications. Finally, quality assurance inspectors thoroughly test the finished circuits. Records from each stage of design and manufacturing for all circuits assure complete traceability of a project.

CTS Microelectronics' in-house testing facilities include vibration, shock, centrifuge, thermal shock, temperature cycling, moisture resistance, leak testing, PIND, burn-in, life testing and moisture/gas analysis. These are applied as an effective check-and-balance system to assure consistent quality and reliability in circuit manufacturing.



HALEX DIVISION
1202 McGraw Avenue
Irvine, California 92714
Phone: (714) 556-2850
TELEX: 68-3448

MICROELECTRONICS DIVISION
1201 Cumberland Avenue
West Lafayette, Indiana 47906
Post Office Box 1278
Lafayette, Indiana 47902
Phone: (317) 463-2565
TWX: 810-342-1882

CTS® CORPORATION

MICROELECTRONICS DIVISION
HALEX DIVISION

WE'LL "SECOND SOURCE" STANDARD HYBRIDS **YOUR** WAY

STANDARD HI-REL HYBRIDS AVAILABLE TO YOUR SPECIFICATION FROM CTS MICROELECTRONICS, INC.

Now get standard pin-for-pin Hi-Rel Hybrid replacements with production extras like special screening, environmental testing, data logging and electrical testing.

For more than 20 years CTS Microelectronics has been a leading producer of Hi-Hel Hybrids that can withstand the harshest environments. These hybrids will meet test standards set out by MIL-STD 883. And now they are available for fast delivery in many pin-for-pin configurations.

When you need a reliable second source for Hi-Rel Hybrids, tested to your custom specifications, think first of CTS Microelectronics. For complete technical information, prices and delivery projection, get in touch with CTS Microelectronics, 1201 Cumberland Avenue, West Lafayette, IN 47906.

Or call (317) 463-2565.

CTS HYBRID STANDARD DESIGNS

PRODUCT NO.	DESCRIPTION	REPLACES PRODUCT NO.
Operational Amplifiers:		
CTS 0004	High Voltage Operational Amplifier	National LH 0004/883B
CTS 0021 H/B	Power Operational Amplifier	National LH 0021/883B
CTS 0024	High Slew Operational Amplifier	National LH 0024/883B
CTS 0032	Ultrafast FET Operational Amplifier	National LH 0032/883B
CTS 0041 H/B	Power Operational Amplifier	National LH 0041/883B
CTS 0042	Low Cost FET Operational Amplifier	National LH 0042/883B
CTS 101A H/B	High Performance Operational Amplifier	National LH 101/883B
CTS 2101	Dual High Performance Operational Amplifier	National LH 2101/883B
CTS 108A H/B	Super Beta Operational Amplifier	National LH 108/883B
CTS 2108	Dual Super Beta Operational Amplifier	National LH 2108/883B
CTS 111 H/B	Operational Amplifier	National LH 111/883B
CTS 2111	Dual Voltage Comparator	National LH 2111/883B
CTS 861	Log IF Amplifier	Plessy SL 521
Buffers:		
CTS 0002	Current Amplifier	National LH 0002/883B
CTS 0033	Fast Buffer Amplifier	National LH 0033/883B
Sample & Hold Amplifiers:		
CTS 0023	Sample & Hold Circuit	National LH 0023/883B
MOS Clock Drivers:		
CTS 0007	DC Coupled MOS Clock Driver	National MH 0007/883B
CTS 0009	Two Phase MOS Clock Driver	National MH 0009/883B
Digital Drivers:		
CTS 0006 H/B	Current Driver	National DH 0006/883B
CTS 0008 H/B	High Voltage Current Driver	National DH 0008/883B
CTS 0034	High Speed Dual Level Translator	National DH 0034/883B

AVAILABLE HOW YOU WANT THEM.

Others say — "Take-it-the-way-we-make-it." CTS will "second source" standard hybrids your way.

What a great alternate source for standard pin-for-pin Hi-Rel Hybrid replacements! When you are faced with the "take-it-or-leave-it" attitude that some major suppliers have adopted on Hi-Rel Hybrid standards — look to CTS Microelectronics. CTS will provide Hi-Rel Hybrids just as you want them. And, our prices are very competitive.

Don't settle for standard hybrids that don't meet your individual needs. Ask about the CTS-0002, 6, 8, 21, 32, 33, 34 and 41 as alternates for the LH and DH series. We'll make your standards to custom requirements.

MICROELECTRONICS DIVISION, 1201 Cumberland Avenue, West Lafayette, Indiana 47906
Post Office Box 1278, Lafayette, Indiana 47902 • Phone: (317) 463-2565, TWX: 810-342-1882

HALEX DIVISION, 1202 McGraw Avenue, Irvine, California 92714
Phone: (714) 556-2850, TELEX: 68-3448

CTS® CORPORATION

MICROELECTRONICS DIVISION
HALEX DIVISION

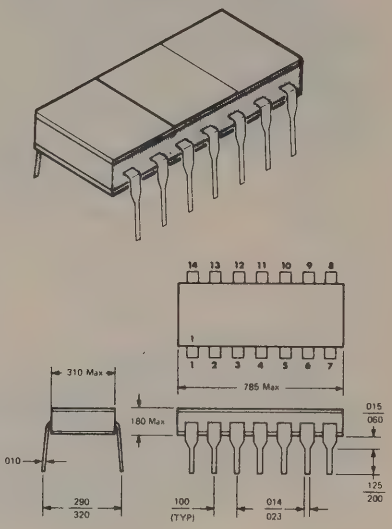
WE'LL "SECOND SOURCE"
STANDARD HYBRIDS **YOUR WAY**

Now get standard pin-for-pin Hi-Rel Hybrid replacements with production extras like special screening, environmental testing, data logging and electrical testing.

For more than 20 years CTS Microelectronics has been a leading producer of Hi-Hel Hybrids that can withstand the harshest environments. These hybrids will meet test standards set out by MIL-STD 883. And now they are available for fast delivery in many pin-for-pin configurations.

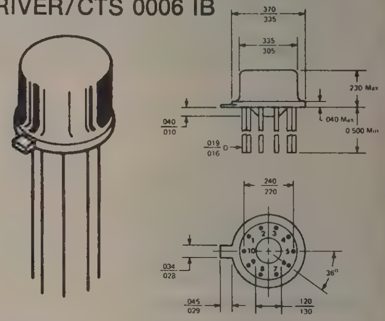
When you need a reliable second source for Hi-Rel Hybrids, tested to your custom specifications, think first of CTS Microelectronics. For complete technical information, prices and delivery projection, get in touch with CTS Microelectronics, 1201 Cumberland Avenue, West Lafayette, IN 47906. **Or call (317) 463-2565.**

DUAL HIGH SPEED LEVER SHIFTER/CTS 0034 CB


14 13 12 11 10 9 8
1
1 2 3 4 5 6 7
310 Max
785 Max
180 Max
015
060
010
125
200
290
320
100
(TYP)
014
023

The Model CTS 0034 CB Dual High Speed Level Shifter is used to provide an interface between TTL/DTL, and MOS/JFET, voltages. The circuit features large output swings to 25 volts, output currents to 100 mA and high-speed operation.

HIGH VOLTAGE CURRENT DRIVER/CTS 0006 IB


370
335
335
305
230 Max
040
010
040 Max
0 500 Min
019
016
D
240
220
034
028
36°
045
029
120
130

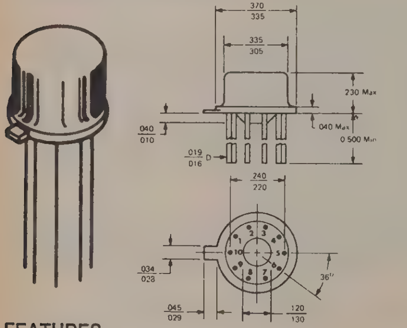
FEATURES
1. Operation from a single +10V to +45V power supply.
2. Low standby power dissipation of only 35MW for 28V power supply
3. 1.5A, 50MS pulse current capability.

The CTS 0006 IB is a hybrid high voltage, high current driver, designed to accept standard DTL or TTL input levels and provide a pulsed load up to 1.5A from a continuous supply voltage up to 45V. AND inputs are provided with an EXPANDER connection, should additional gating be required.

Since one side of the load is grounded, there is less likelihood of false turn-on due to an inadvertant short in the drive line.

The high pulse current capability makes the CTS 0006 IB ideal for driving nonlinear resistive loads such as incandescent lamps. The circuit also requires only one power supply for functional operation.

HIGH VOLTAGE HIGH CURRENT DRIVER/CTS 0008 IB


370
335
335
305
230 Max
040
010
040 Max
0 500 Min
019
016
D
240
220
034
028
36°
045
029
120
130

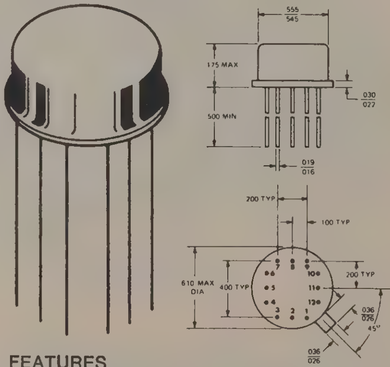
FEATURES
1. Operation from a single +10V to +45V power supply.
2. Low standby power dissipation of only 35MW for 28V power supply.
3. 3.0A, 50MS pulse current capability.

The CTS 0008 IB is a hybrid high voltage, high current driver, designed to accept standard DTL or TTL input levels and provide a pulsed load up to 3A from a continuous supply voltage up to 45V. AND inputs are provided with an EXPANDER connection, should additional gating be required.

Since one side of the load is grounded, there is less likelihood of false turn-on due to an inadvertant short in the drive line.

The high pulse current capability makes the CTS 0008 IB ideal for driving nonlinear resistive loads such as incandescent lamps. The circuit also requires only one power supply for functional operation.

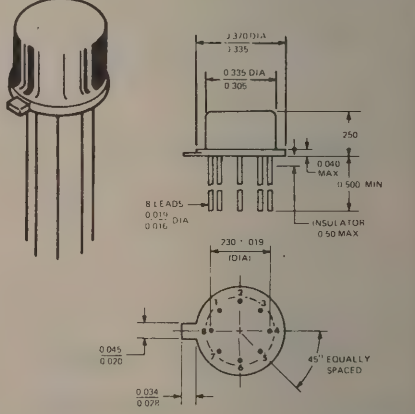
SAMPLE AND HOLD CIRCUIT/ CTS 0023 ZB


555
545
175 MAX
500 MIN
030
027
019
016
200 TYP
100 TYP
200 TYP
610 MAX DIA
400 TYP
036
026
45°
036
026

FEATURES
1. Output short circuit protected.
2. Extremely low drift rate: .5 mV/sec typ. with .01 μF teflon capacitor.
3. TTL or DTL compatible logic input.
4. Operates with just ±15V or with ±15V and a separate +5V logic supply for improved noise immunity.
5. Voltage offset adjustable to zero using a 10K pot with wiper at V−.
6. Military grade processing per MIL-STD-883.
7. Pin-for-pin replacement for LH 0023.

The CTS 0023 ZB is a high performance sample and hold circuit that exhibits an extremely low drift rate. Some typical applications include: Sampled Data Systems, D/A Deglitchers, Analog De-Multiplexers and A/D inputs.

LOG INTERMEDIATE FREQUENCY AMPLIFIER/ CTS 861 GB


0.370 DIA
0.335
0.335 DIA
0.305
250
0.040 MAX
0.500 MIN
8 LEADS
0.019
0.016
DIA
INSULATOR
0.50 MAX
230 · 019
(DIA)
0.045
0.020
0.034
0.028
45° EQUALLY SPACED

The CTS 861 GB is a cermet hybrid integrated circuit. This wideband amplifier is intended primarily for use as one stage of a log IF amplifier, with midband frequency of 10 MHz to 100 MHz. It has a voltage gain of typically 12 dB, which is flat to within .6 dB typically from 30 to 100 MHz. These units have RF output which is limited to .5V typical and can be directly coupled to the following stage. The detector has current output which makes possible the direct summing of several output stages.

MICROELECTRONICS DIVISION, 1201 Cumberland Avenue, West Lafayette, Indiana 47906
Post Office Box 1278, Lafayette, Indiana 47902 • Phone: (317) 463-2565, TWX: 810-342-1882

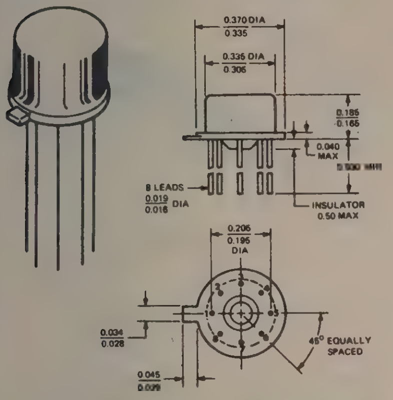
HALEX DIVISION, 1202 McGraw Avenue, Irvine, California 92714
Phone: (714) 556-2850, TELEX: 68-3448

CTS® CORPORATION
MICROELECTRONICS DIVISION
HALEX DIVISION

WE'LL "SECOND SOURCE"
STANDARD HYBRIDS **YOUR WAY**

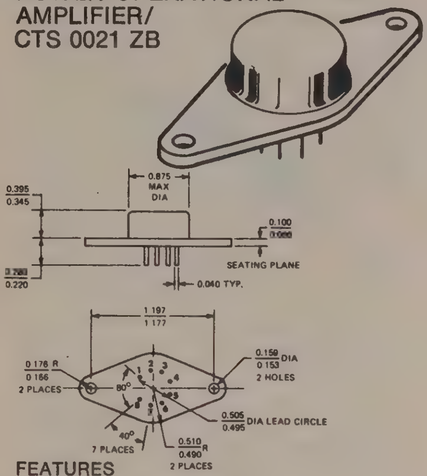
OPERATIONAL AMPLIFIERS

HIGH SLEW RATE OPERATIONAL AMPLIFIER/CTS 0024 GB


0.370 DIA
0.335
0.336 DIA
0.306
0.185
0.165
0.040
MAX
0.500 MIN
8 LEADS
0.019
0.016
DIA
INSULATOR
0.50 MAX
0.206
0.196
DIA
1
2
3
4
5
6
7
8
0.034
0.028
45° EQUALLY SPACED
0.045
0.029

The CTS 0024 GB is a very wide bandwidth, high slew rate operational amplifier intended to fulfill a wide variety of high speed applications such as buffers to A to D and D to A converters and high speed comparators. The device exhibits useful gain in excess of 50 MHz making it possible to use in video applications requiring higher gain accuracy than is usually associated with such amplifiers. It is plug-in compatible with LH 0024.

POWER OPERATIONAL AMPLIFIER/ CTS 0021 ZB

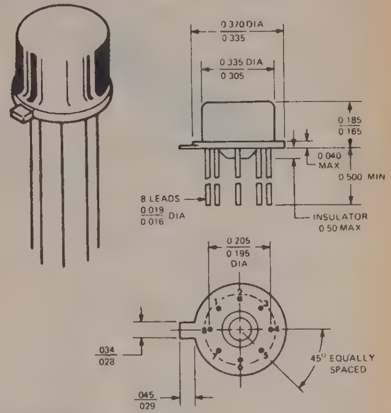

0.875
MAX
DIA
0.395
0.345
0.100
0.080
SEATING PLANE
0.260
0.220
0.040 TYP.
1 197
1 177
0 176 R
0 166
2 PLACES
80°
1
2
3
4
5
6
7
8
0.159 DIA
0 153
2 HOLES
0.505
0.495
DIA LEAD CIRCLE
40°
7 PLACES
0.510
0.490
R
2 PLACES

FEATURES

1. Output current 1.0 Amp.
2. Low input offset voltage and current.
3. Output voltage swing ±12V into 10 ohms.
4. Options on high reliability processing.
5. Moisture less than 1000 PPM.
6. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 0021 ZB is a general purpose operational amplifier featuring an output current in excess of one ampere at voltage levels of ±12V and is compensated with a single external capacitor.

BUFFER AMPLIFIER/ CTS 0002 GB

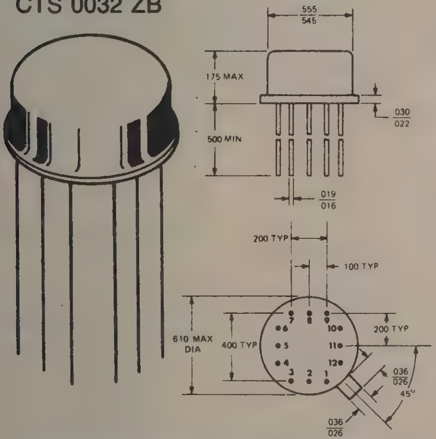

0 370 DIA
0 335
0 335 DIA
0 305
0 185
0 165
0 040
MAX
0 500 MIN
8 LEADS
0 019
0 016
DIA
INSULATOR
0 50 MAX
0 205
0 195
DIA
1
2
3
4
5
6
7
8
034
028
45° EQUALLY SPACED
045
029

FEATURES

1. Slew rate 200 V/μsec.
2. Bandwidth 300 MHz.
3. Output current (pulsed) 400 mA.
4. Output voltage swing approaches supply voltages.
5. Input impedance 400 KΩ.
6. Output impedance 6Ω.
7. AC current gain 20 A/mA.

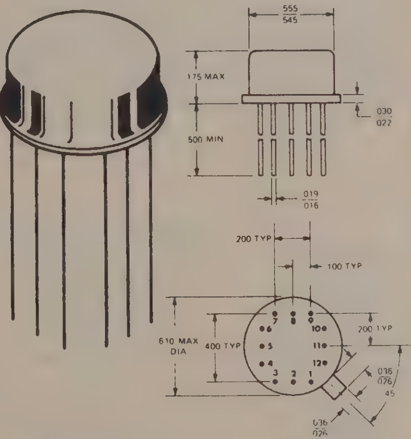
The CTS 0002 GB Buffer Amplifier is a high speed, high impedance follower used with operational amplifiers to increase the current output drive. Other applications include line driving, and high speed D/A conversion.

HIGH SLEW RATE FET OPERATIONAL AMPLIFIER/ CTS 0032 ZB


555
545
175 MAX
500 MIN
030
022
019
016
200 TYP
100 TYP
610 MAX
DIA
400 TYP
200 TYP
1
2
3
4
5
6
7
8
9
10
11
12
036
026
45°
036
026

The Model CTS 0032 ZB FET Operation Amplifier is a high speed device capable of 500 V/μsec, slew rates and band widths of 70 MHz. The JFET input provides input impedances of 10^{12} ohms. The high speed, high impedance performance lends itself for use in D-A summing amplifiers, sample and hold circuits, integrators and video amplifiers.

BUFFER AMPLIFIER/ CTS 0033 ZB

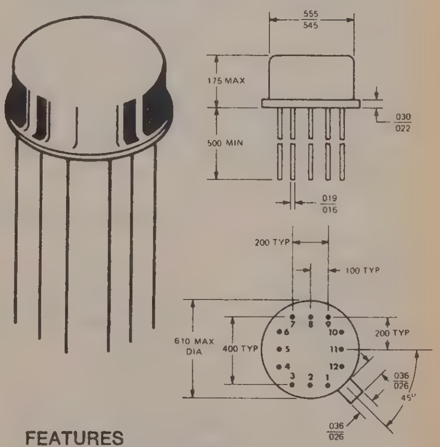

555
545
175 MAX
500 MIN
030
022
019
016
200 TYP
100 TYP
610 MAX
DIA
400 TYP
200 TYP
1
2
3
4
5
6
7
8
9
10
11
12
036
026
45
036
026

FEATURES

1. Slew rate 1500 V/μsec.
2. Propagation delay 1.2 nsec.
3. Input impedance 10^{11} ohm.
4. Input bias current 50 pa.
5. Output impedance 6 ohm.
6. Output voltage swings ±13V.
7. Bandwidth 100 MHz.

The Model CTS 0033 ZB Voltage Follower is a high-speed buffer used to provide high input impedance and low output impedance for interfacing and line driving requirements. Typical performance specifications permit wide-range usage in many applications.

0.2 AMP POWER OPERATIONAL AMPLIFIER/ CTS 0041 ZB


555
545
175 MAX
500 MIN
030
022
019
016
200 TYP
100 TYP
610 MAX
DIA
400 TYP
200 TYP
1
2
3
4
5
6
7
8
9
10
11
12
036
026
45°
036
026

FEATURES

1. Output current 0.2 amp.
2. Offset null capability.
3. Low input offset voltage and current.
4. Output voltage swing ±14V into 100 ohms.
5. Options on high reliability processing.
6. Moisture less than 1000 PPM.
7. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 0041 ZB is a general purpose operational amplifier featuring an output current in excess of 200 mA at voltage levels of ±12V and is compensated with a single external capacitor.

MICROELECTRONICS DIVISION, 1201 Cumberland Avenue, West Lafayette, Indiana 47906
Post Office Box 1278, Lafayette, Indiana 47902 • Phone: (317) 463-2565, TWX: 810-342-1882

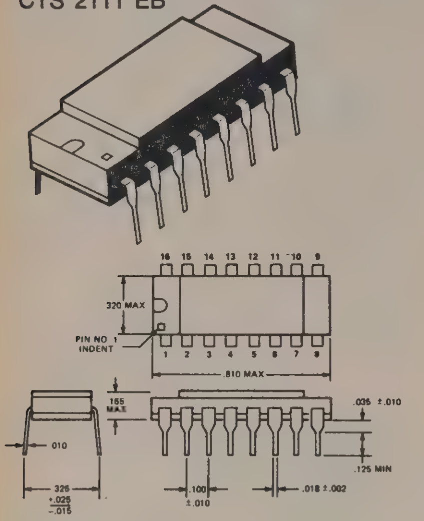
HALEX DIVISION, 1202 McGraw Avenue, Irvine, California 92714
Phone: (714) 556-2850, TELEX: 68-3448

CTS® CORPORATION
MICROELECTRONICS DIVISION
HALEX DIVISION

WE'LL "SECOND SOURCE"
STANDARD HYBRIDS **YOUR WAY**

OPERATIONAL AMPLIFIERS

DUAL VOLTAGE COMPARATOR/ CTS 2111 EB

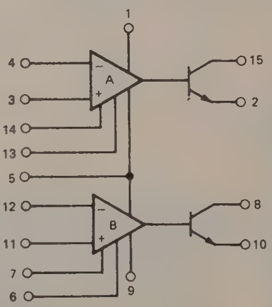


FEATURES
1. Short circuit protection.
2. Offset null capability.
3. Large common-mode and differential voltage range.
4. Low power consumption
5. Options on high reliability processing.
7. Moisture less than 1000 ppm.
8. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 2111 EB Dual Voltage Comparator consists of two 111 type voltage comparators in a single hermetic package. The 111 voltage comparator has input currents approximately a hundred times lower than devices like the uA710. They are designed to operate over a wider range of supply voltages; from standard ±15V Op Amp supplies down to the single 5V supply used for IC logic. The output is compatible to RTL, DTL, and TTL as well as MOS circuits. Further, it can drive lamps or relays, switching voltages up to 50V at currents as high as 50 mA.

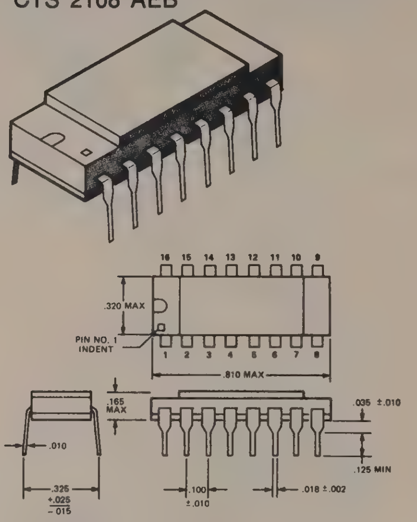
SCHEMATIC DIAGRAM

PIN CONFIGURATION
1. V+ A
2. GND (Emitter) A
3. Non-Inverting Input A
4. Inverting Input A
5. V− A and B
6. Balance B
7. Balance/Strobe B
8. Output B
9. V+ B
10. GND (Emitter) B
11. Non-Inverting Input B
12. Inverting Input B
13. Balance A
14. Balance/Strobe A
15. Output A
16. NC



NOTE 1: The Dual-In-Line package must be derated based on a thermal resistance of 100°C/W, junction to ambient.
NOTE 2: This rating applies for ±15V supplies. The positive input voltage limit is 30V above the negative supply. The negative input voltage limit is equal to the negative supply, whichever is less.

DUAL OPERATIONAL AMPLIFIER/ CTS 2108 AEB

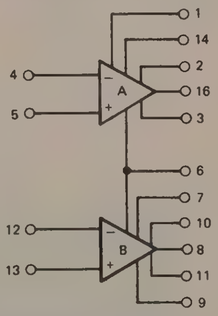


FEATURES
1. Maximum input bias current of 3.0 nA over temperature.
2. Offset voltage less than .5 mV.
3. Offset current less than 400 pA over temperature.
4. Low supply current.
5. Drift 5 μV/°C.
6. Options on high reliability processing.
7. Moisture less than 1000 ppm.
8. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 2108 AEB Dual Operational Amplifier consists of two 108A type Op Amps in a single hermetic package. The 108A Op Amp is a precision operational amplifier featuring low input currents and extremely low offset voltage, making it possible in most cases, to eliminate offset adjustments.

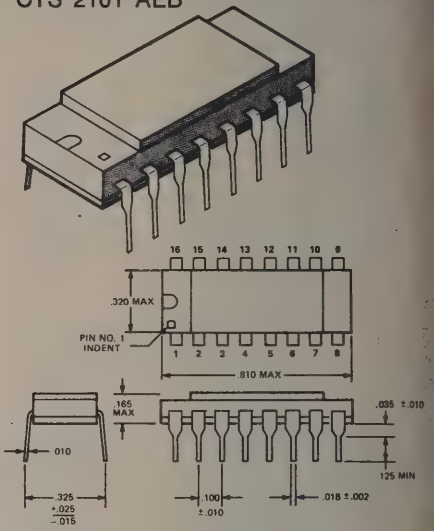
SCHEMATIC DIAGRAM

PIN CONFIGURATION
1. V+ A
2. Freq. Comp. A
3. Freq. Comp. A
4. Inverting Input A
5. Non-Inverting Input A
6. V− A and B
7. NC
8. Output B
9. V+ B
10. Freq. Comp. B
11. Freq. Comp. B
12. Inverting Input B
13. Non-Inverting Input B
14. NC
15. NC
16. Output A



NOTE 1: The Dual-In-Line package must be derated based on a thermal resistance of 100°C/W, junction to ambient.
NOTE 2: The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1V is applied between the inputs unless some limiting resistance is used.
NOTE 3: For supply voltage less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

DUAL OPERATIONAL AMPLIFIER/ CTS 2101 AEB

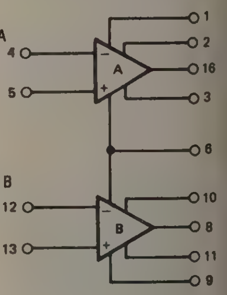


FEATURES
1. Short circuit protection.
2. Offset null capability.
3. Large common-mode and differential voltage range.
4. Low power consumption.
5. No latch up.
6. Options on high reliability processing.
7. Moisture less than 1000 ppm.
8. Solderability shall conform to MIL-STD-883B, Method 2003.

The CTS 2101 AEB Dual Operational Amplifier consists of two 101A type Op Amps in a single hermetic package. The 101A Op Amp is a general purpose operational amplifier featuring high gain, short circuit protection, simplified compensation and excellent temperature stability.

SCHEMATIC DIAGRAM

PIN CONFIGURATION
1. V+ A
2. Freq. Comp. A
3. Freq.Comp./Offset Null A
4. Inverting Input A
5. Non-Inverting Input A
6. V− A and B
7. Offset Null B
8. Output B
9. V+B
10. Freq. Comp. B
11. Freq. Comp./Offset Null B
12. Inverting Input B
13. Non-Inverting Input B
14. Offset Null A
15. NC
16. Output A



NOTE 1: The Dual-In-Line package must be derated based on a thermal resistance of 100°C/W, junction to ambient.
NOTE 2: For ambient voltage less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

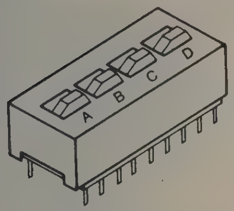
MICROELECTRONICS DIVISION, 1201 Cumberland Avenue, West Lafayette, Indiana 47906
Post Office Box 1278, Lafayette, Indiana 47902 • Phone: (317) 463-2565, TWX: 810-342-1882

HALEX DIVISION, 1202 McGraw Avenue, Irvine, California 92714
Phone: (714) 556-2850, TELEX: 68-3448

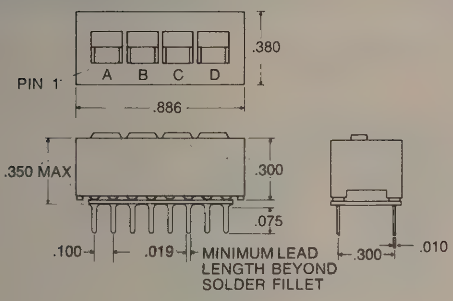
CTS® CORPORATION
MICROELECTRONICS DIVISION
HALEX DIVISION

WE'LL "SECOND SOURCE" STANDARD HYBRIDS YOUR WAY

ATTENUATORS
DIP ATTENUATOR/SERIES 196



NOTES:
1. Refer to drawing above and to schematic below.
2. Switch positions as shown have all attenuators in.
3. Dimensions shown are nominal.



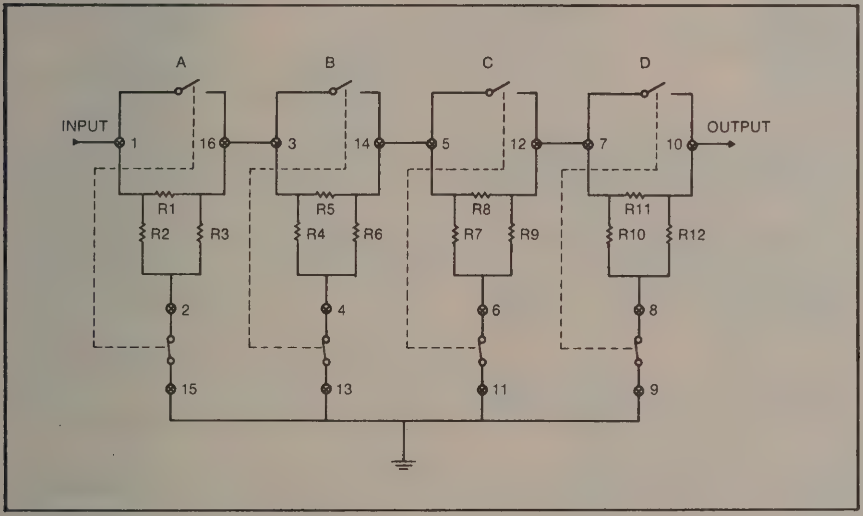
The 196 Series is a very reliable replacement for thumbwheel switch-type attenuators providing substantial cost savings. It is available with a bottom-seal or both top and bottom sealed switch. When ordering or requesting pricing please specify seal type, part number, and attenuation option required. For example:

"196600-02 top and bottom seal" is a totally sealed 600 ohm 1, 2, 4, and 8 dB attenuator. "196075-04 bottom seal" is a 75 ohm attenuator with bottom seal and 2, 4, 8, and 16 dB attenuation values.

The 196 Series Switchable Attenuator is available in 75 Ohm and 600 Ohms and is in a standard DIP package. Attenuators are 600 Ohm or 75 Ohm unbalanced PI or T configuration networks. Standard attenuators are available in values ranging from .1 dB to 16 dB in increments of .1 dB to 2 dB. This product can be designed to meet your attenuation characteristics. The following are some popular attenuation values:

OPTION VAR.	ATTENUATOR SECTION A	B	C	D
-01-	.1	.2	.4	.8
-02-	1	2	4	8
-03-	1.6	3.2	6.4	12.8
-04-	2	4	8	16
-05-	.25	.5	1	2
-06-	1.5	3	6	12

UNBALANCED "PI" ATTENUATOR

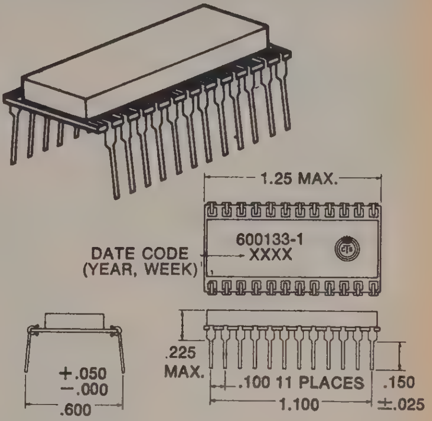


NOTE 1: Switch positions are with all attenuators in.
NOTE 2: × indicates switch terminals.
NOTE 3: Interconnections shown by heavy lines are typical.

Attenuation Range (see note 1)	Individual Attenuation Tolerance dB		Attenuation Range (see note 1)	Individual Attenuation Tolerance dB		Attenuation Range (see note 1)	Individual Attenuation Tolerance dB	
	75 ohm	600 ohm		75 ohm	600 ohm		75 ohm	600 ohm
≤.8 dB	±.0125	±.0125	4 dB	±.040	±.025	12 dB	±.090	±.050
≤2 dB	±.025	±.025	6 dB	±.054	±.025	16 dB	±.105	±.050
3 dB	±.029	±.025	8 dB	±.070	±.025	20 dB	±.115	±.050

NOTE 1: Please consult the factory for other attenuation values available between .1 dB and 20 dB.
NOTE 2: The maximum cumulative tolerance for any combination of attenuations from different ranges may be calculated by summing the individual attenuator tolerances.

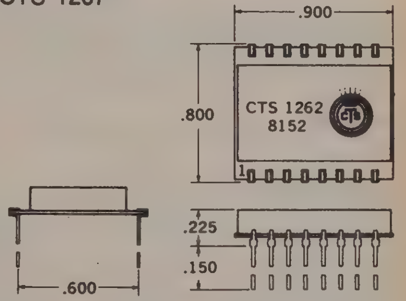
PCM TRANSMIT FILTER/ CTS 600133
PCM RECEIVE FILTER/CTS 600134



The 600133 is a modified fifth order elliptic lowpass filter which passes frequencies to 3.2 kHz and attenuates all stopband frequencies above 4.5 kHz. The 600133 is a plug in replacement for the National AF133.

The 600134 is a modified fifth order elliptic lowpass filter which passes frequencies to 3.2 kHz while compensating for the (SIN X) /X response and attenuates stopband frequencies above 4.5 kHz. The 600134 is a plug in replacement for the National AF134.

300 BAUD FSK TRANSMIT HYBRID/ CTS 1262
300 BAUD FSK RECEIVE HYBRID/ CTS 1267



The CTS 1262 is a switchable bandpass transmit filter which includes a duplexer (two-to-four wire converter) and a voltage-controlled squelch. The part is fully electrically compatible (pin-for-pin) with Cermetek's CH 1262. It is intended for use between an FSK modulator and the telephone line in 103/113-type modems.

The CTS 1267 is a switchable bandpass/ bandreject filter and a soft-limiter/amplifier. The part is fully electrically compatible (pin-for-pin) with Cermetek's CH 1267. It is intended for use between a telephone line, data coupler, or line hybrid and an FSK demodulator in 103/113-type modems.

MICROELECTRONICS DIVISION, 1201 Cumberland Avenue, West Lafayette, Indiana 47906
Post Office Box 1278, Lafayette, Indiana 47902 • Phone: (317) 463-2565, TWX: 810-342-1882

HALEX DIVISION, 1202 McGraw Avenue, Irvine, California 92714
Phone: (714) 556-2850, TELEX: 68-3448

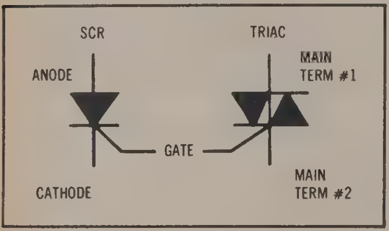
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

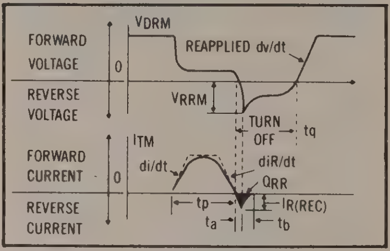


Fig. 1. Concurrent voltage and current waveforms

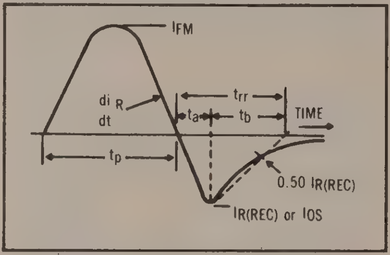


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$: *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature*.

$T_{J(MAX)}$: *Maximum allowable junction temp*.

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

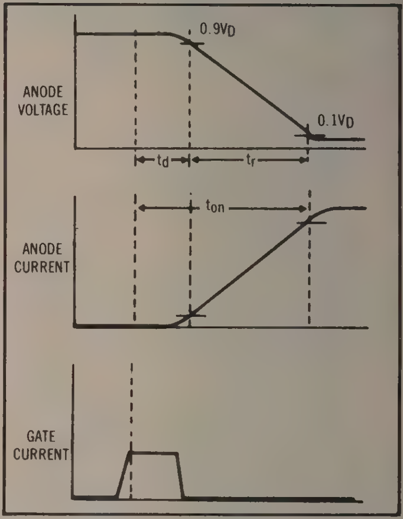


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time*. Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

élantec

HIGH PERFORMANCE ANALOG IC's GUARANTEED.

ELH0002 • ELH0021 • ELH0032 • ELH0033 • ELH0041 • ELH0101

From Elantec. Wide band, high slew rate operational amplifiers. High speed buffers. High current output amps. And more.

The ironclad guarantee. If any Elantec amplifier fails to perform to Elantec's published specifications, we'll replace it. And give you an additional part. Free.

Commercial or MIL STD-883. All MIL STD-883 devices are 100% made in the U.S.A. And, if special testing or processing is required, we'll work with you every step of the way.

Off-the-shelf availability. You'll find stocking distributors of Elantec devices throughout North America. And the world.

Answers when you need them. When you call Elantec, you'll get answers. Fast. Data sheets. Technical assistance. Test procedures. Everything. Because we don't just pay lip service to quality and service. We guarantee them.

Need parts fast? Call us for the name of your nearest stocking distributor. Or, TWX us at 910-997-0649. We'll solve the problem. With élan.

Toll Free 800-821-7429

STATE	PHONE	STATE	PHONE
AL	205-830-4030	NH	603-772-3300
AZ	602-998-3688	NM	505-293-1399
CA	415-962-0660	NJ	609-966-4070
CA	213-883-7606	NJ	201-263-1535
CO	303-779-0666	NY	516-757-1606
CT	203-269-7964	NC	704-541-2628
FL	305-368-7373	NC	919-784-7304
FL	813-584-8110	OH	513-521-8800
FL	305-724-8294	OH	513-293-4044
GA	404-329-0530	OH	216-942-3407
IL	312-956-1000	OR	503-642-1818
IN	219-486-1912	PA	215-638-4850
IN	317-271-5183	PA	412-963-0727
IA	319-393-5763	TN	615-883-1411
MD	301-944-8262	TN	615-753-8081
MA	617-444-8071	TX	512-250-0320
MI	616-468-4200	TX	713-772-4988
MI	313-348-3811	TX	214-867-0592
MN	612-888-8088	UT	801-973-7969
MO	816-763-5385	WA	206-451-0568
MO	314-434-1678	WI	414-782-1171

JAPAN INTERNIX, TOKYO 369-1101

Elantec, Inc., P.O. Box 866, Milpitas, California 95035, (408) 945-1323

GORDOS ARKANSAS

I/O MODULES
(Thick Film Hybrid)

Gordos is the first manufacturer of I/O modules to offer the higher reliability and cost advantages of hybrid construction. Each module is functionally trimmed and optimized during manufacture — for module-to-module uniformity in the field. For use in harsh environments, Gordos thick film technology also affords superior thermal properties, noise immunity, and shock and vibration resistance.

- 5, 15, or 24 volt logic compatible
- Up to 280 VAC or 200 VDC line voltages
- 600V blocking and VDE specs available
- 2500 VAC photo isolation
- Zero voltage turn-on (AC output)
- Excellent surge protection
- Component values laser trimmed to ±0.3%
- Room temperature encapsulation
- Single hold-down screw
- −30° to 80°C temperature range
- UL recognized and CSA certified
- VDE I/O modules that comply with VDE specs 0730, 0730 part 2P, 0806, and IEC Specs 380 and 435 are available. Add a "V" to the end of the part number to designate VDE (Not available in DC versions)

AC INPUT MODULE
(Yellow Module)

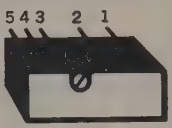
PIN DESIGNATION

Pin 1	AC input
Pin 2	AC input
Pin 3	Logic supply voltage
Pin 4	Output
Pin 5	Logic ground

Parameter	IAC5 IAC5A	IAC15 IAC15A	IAC24 IAC24A	Units
Output Specifications(1)				
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	2.75	12	20	VDC
Maximum Logic Supply Current(6)	16	16	16	mADC
Maximum Logic Supply Leakage Current	10	10	10	µADC
Maximum Output Voltage(7)	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current	10	10	10	µADC
Maximum Output Voltage Drop	100	100	100	mVDC

Parameter	IAC5 IAC15 IAC24	IAC5A IAC15A IAC24A	Units
Input Specifications(1)			
Nominal Input Voltage(8)	120	240	Vrms/VDC
Maximum Input Voltage	140	280	Vrms/VDC
Minimum Input Voltage	90	90	Vrms/VDC
Maximum Input Current	10	10	mA
Drop Out Current(9)	2.5	1.5	mA
Allowable Input for no Output(9)	3.0	2.0	mA
Allowable Input for no Output	50	50	Vrms/VDC

DC INPUT MODULE
(White Module)



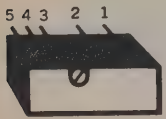
PIN DESIGNATION

Pin 1	+ DC input
Pin 2	− DC input
Pin 3	Logic supply voltage
Pin 4	Output
Pin 5	Logic ground

Parameter	IDC5	IDC15	IDC24	Units
Output Specifications(1)				
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	2.75	12	20	VDC
Maximum Logic Supply Current(6)	16	16	16	mADC
Maximum Logic Supply Leakage Current	10	10	10	µADC
Maximum Output Voltage(7)	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current	10	10	10	µADC
Maximum Output Voltage Drop	100	100	100	mVDC
Input Specifications(1)				
Maximum Input Voltage	32	32	32	VDC
Minimum Input Voltage	3.3	3.3	3.3	VDC
Input Resistance(3)	1K	1K	1K	Ohms
Maximum Input Current(4)	32	32	32	mADC
Drop-Out Current	1.0	1.0	1.0	mADC
Allowable Input for no Output(5)	1.5	1.5	1.5	mADC
Allowable Input for no Output	2.0	2.0	2.0	VDC

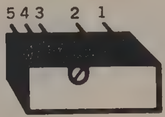
FOOTNOTES:
(1) Specifications apply to T_a −30 to +80°C unless otherwise noted.
(3) Does not include IRED impedance (drop).
(4) At 32 VDC input.
(5) Series operation with GORDOS ODC modules is permitted.
(6) With external LED indicator. 18 mADC without external LED.
(7) Breakdown voltage of output transistor.
(8) Gordos IAC modules will operate on AC or DC input voltage.
(9) Series operation with Gordos standard OAC modules is permitted. Does not include 'A' versions.

BUFFERED AC INPUT MODULES

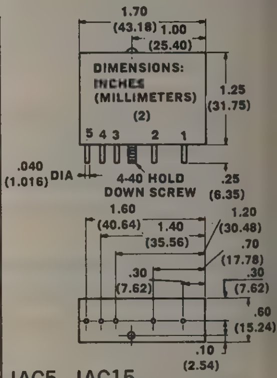


Parameter	IACB	IACBA	Units
Output Specifications(1)			
Minimum Logic Supply Voltage	3.3	3.3	VDC
Maximum Logic Supply Voltage	26.5	26.5	VDC
Maximum Logic Supply Current	14	14	mADC
Max. Logic Supply Leakage Current(4)	100	100	µADC
Maximum Output Voltage(5)	30	30	VDC
Maximum Output Current	50	50	mADC
Maximum Output Leakage Current(6)	100	100	µADC
Maximum Output Voltage Drop	400	400	mVDC
Maximum Turn-On Time(7)	20	20	mSec
Maximum Turn-Off Time(7)	20	20	mSec
Input Specifications(1)			
Nominal Input Voltage	120	240	Vrms
Maximum Input Voltage	140	280	Vrms
Minimum Input Voltage	90	90	Vrms
Maximum Input Current(3)	10	10	mArms
Drop-Out Current	2.0	2.0	mArms
Allowable Input for no Output	1.5	1.5	mArms
Allowable Input for no Output	50	100	Vrms

BUFFERED DC INPUT MODULES



Parameter	IDCB	Units
Output Specifications(1)		
Minimum Logic Supply Voltage	3.3	VDC
Maximum Logic Supply Voltage	26.5	VDC
Maximum Logic Supply Current	14	mADC
Maximum Logic Supply Leakage Current(4)	100	µADC
Maximum Output Voltage(5)	30	VDC
Maximum Output Current	50	mADC
Maximum Output Leakage Current(6)	100	µADC
Maximum Output Voltage Drop	400	mVDC
Maximum Turn-On Time(7)	0.5	mSec
Maximum Turn-Off Time(7)	1.0	mSec
Input Specifications(1)		
Maximum Input Voltage	32	VDC
Minimum Input Voltage	3.3	VDC
Maximum Input Current(3)	9.0	mADC
Drop-Out Current	1.0	mADC
Allowable Input for no Output	1.5	mADC
Allowable Input for no Output	2.0	VDC



IAC5, IAC15, IAC24, IAC5A, IAC15A, IAC24A, IDC5, IDC15, IDC24, IACB, IACBA, IDCB

FOOTNOTES:
(1) Specifications apply to T_a −30 to +80°C unless otherwise specified.
(3) At maximum input voltage.
(4) With module "OFF."
(5) Breakdown voltage of output transistor.
(6) At T_a of 25°C and maximum logic voltage.
(7) At Vlogic of 5V, Vout of 30V, Iout of 25mA, Vin at maximum voltage and T_a of 25°C.

GORDOS ARKANSAS/1000 N. SECOND STREET, ROGERS, ARKANSAS 72756 USA/PHONE (501) 636-5000/TWX: 910-720-7998

GORDOS ARKANSAS

I/O MODULES (Thick Film Hybrid)

AC OUTPUT MODULES

Parameter	OAC5 OAC15 OAC24	OAC5A OAC15A OAC24A	OAC5A6 OAC15A6 OAC24A6	Units
Output Specifications(1)				
Nominal Line Voltage	120	240	240	Vrms
Minimum Line Voltage	12	24	24	Vrms
Maximum Line Voltage	140	280	280	Vrms
Maximum Peak Off-State Volt(5)	400	500	600	Vpeak
Maximum Off-State Leakage(6)	3.0	6.0	6.0	mArms
Static (Off-State) dv/dt	200	200	200	V/µS
Maximum On-State Current(7)	3.5	3.5	3.5	Arms
Minimum On-State Current	.05	.05	.05	Arms
Maximum 1 Cycle Surge(8)	100	100	100	Apeak
Peak On-State Voltage(9)	1.6	1.6	1.6	Vpeak
Parameter	**OAC5 OAC5A OAC5A6**	**OAC15 OAC15A OAC15A6**	**OAC24 OAC24A OAC24A6**	**Units**
Input Specifications(1)				
Nominal Input Voltage	5.0	15	24	VDC
Minimum Turn-On Voltage	2.75	9.0	18	VDC
Maximum Input Voltage	8.0	18	32	VDC
Drop Out Voltage	1.0	1.0	1.0	VDC
Maximum Input Current(3)	16	16	12	mADC
Nominal Input Resistance(4)	250	1K	2K	Ohms

FOOTNOTES:

(1) Specifications apply to T_A −30 to +80°C unless otherwise noted.
(3) At nominal input voltage.
(4) Does not include IRED impedance (Drop).
(5) One minute maximum duration.
(6) At T_A of 25°C and maximum line voltage.
(7) At T_A of 40°C, derate by 58 mA/°C to 80°C.

DC OUTPUT MODULES

Parameter	ODC5 ODC15 ODC24	ODC5A ODC15A ODC24A	Units
Output Specifications(1)			
Maximum Line Voltage	60	200	VDC
Minimum Line Voltage	3.0	5.0	VDC
Maximum Off-State Voltage	60	200	VDC
Maximum Off-State Leakage(10)	1.0	2.0	mADC
Maximum On-State Current(11)	3.0	1.0	ADC
Minimum On-State Current	10	10	mADC
Maximum 1 Sec Surge(8)	5.0	5.0	ADC
Peak On-State Voltage(12)	1.5	1.5	VDC

Parameter	ODC5 ODC5A	ODC15 ODC15A	ODC24 ODC24A	Units
Input Specifications(1)				
Nominal Input Voltage	5.0	15	24	VDC
Minimum Turn-On Voltage	2.75	9.0	18	VDC
Maximum Input Voltage	8.0	18	32	VDC
Drop Out Voltage	1.0	1.0	1.0	VDC
Maximum Input Current(3)	16	16	16	mADC
Nominal Input Resistance(4)	250	1K	2K	Ohms

(8) At T_A of 25°C, non-repetitive.
(9) At T_A of 25°C and maximum on-state current.
(10) At T_A of 80°C and maximum line voltage.
(11) At T_A of 20°C, derate 38 mA/°C to 80°C for standard version.
At T_A of 45°C, derate 18 mA/°C to 80°C for "A" version.
(12) At T_A of 25°C, and maximum rated current.

BUFFERED AC OUTPUT MODULES

Parameter	OACB	OACBA	OACBA6	Units
Output Specifications(1)				
Nominal Line Voltage	120	240	240	Vrms
Maximum Line Voltage	140	280	280	Vrms
Minimum Line Voltage	12	24	24	Vrms
Maximum Off-State Voltage(4)	400	500	600	Vpeak
Maximum Off-State Leakage(5)	5.0	8.0	8.0	mArms
Static (Off-State) DV/DT	200	200	200	v/µSec
Maximum On-State Current(6)	3.5	3.5	3.5	Arms
Minimum On-State Current	.05	.05	.05	Arms
Maximum Surge Current(7)	100	100	100	Apeak
Peak On-State Voltage(8)	1.6	1.6	1.6	Vpeak
Response Time(9)	.5	.5	.5	Cycle
Input Specifications(1)				
Minimum Logic Supply Voltage	3.3	3.3	3.3	VDC
Maximum Logic Supply Voltage	26.5	26.5	26.5	VDC
Maximum Logic Supply Current(3)	14	14	14	mADC
Max. Logic Supply Leakage Current	100	100	100	µADC
Minimum Turn-Off Voltage	2.0	2.0	2.0	VDC
Maximum Turn-Off Voltage	26.5	26.5	26.5	VDC
Maximum Turn-On Voltage	0.7	0.7	0.7	VDC
Maximum Turn-On Current	50	50	50	µADC
Nominal Input Impedance	200K	200K	200K	Ohms

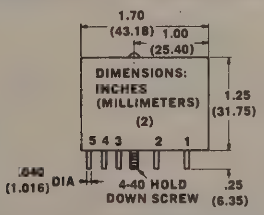
FOOTNOTES:

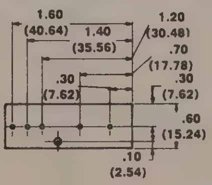
(1) Specifications apply to T_A −30 to +80°C unless otherwise noted.
(3) At maximum logic supply voltage.
(4) One minute maximum duration.
(5) At T_A of 25°C and maximum line voltage.

BUFFERED DC OUTPUT MODULES

Parameter	ODCB	Units
Output Specifications(1)		
Maximum Line Voltage	60	VDC
Minimum Line Voltage	3.0	VDC
Maximum Off-State Voltage	60	VDC
Maximum Off-State Leakage(5)	100	µADC
Maximum On-State Current(10)	3.0	ADC
Minimum On-State Current	100	µADC
Maximum One Second Surge Current(7)	5.0	ADC
Peak On-State Voltage(8)	1.5	Vpeak
Turn-On Time(9)	500	µSec
Turn-Off Time(9)	2.5	mSec
Input Specifications(1)		
Minimum Logic Supply Voltage	3.3	VDC
Maximum Logic Supply Voltage	26.5	VDC
Maximum Logic Supply Current(3)	14	mADC
Maximum Logic Supply Leakage Current	100	µADC
Minimum Turn-Off Voltage	2.0	VDC
Maximum Turn-Off Voltage	26.5	VDC
Maximum Turn-On Voltage	0.7	VDC
Maximum Turn-On Current	50	µADC
Nominal Input Impedance	200K	Ohms

(6) At T_A of 40°C, derate 58 mA/°C to 80°C.
(7) At T_A of 25°C, non-repetitive.
(8) At T_A of 25°C and maximum rated current.
(9) At T_A of 25°C, maximum voltage and current, nominal logic supply voltage.
(10) At T_A of 20°C, derate 38 mA/°C to 80°C.





OAC5, OAC5A, OAC5A6,
OAC15, OAC15A, OAC15A6,
OAC24, OAC24A, OAC24A6,
ODC5, ODC5A, ODC15,
ODC15A, ODC24, ODC24A,
OACB, OACBA, OACBA6, ODCB

GORDOS ARKANSAS/1000 N. SECOND STREET, ROGERS, ARKANSAS 72756 USA/PHONE (501) 636-5000/TWX: 910-720-7998

GORDOS ARKANSAS

I/O MODULES

NOISE IMMUNE AC INPUT MODULES

Parameter	IAC5N IAC5AN	IAC15N IAC15AN	IAC24N IAC24AN	Units
Output Specifications[1]				
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	2.75	12	20	VDC
Maximum Logic Supply Current[5]	16	16	16	mADC
Max. Logic Supply Leakage Current	10	10	10	μADC
Maximum Output Voltage[6]	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current	10	10	10	μADC
Maximum Output Voltage Drop	100	100	100	mVDC

Parameter	IAC5N IAC15N IAC24N	IAC5AN IAC15AN IAC24AN	Units
Input Specifications[1]			
Nominal Input Voltage[3]	120	240	Vrms/VDC
Maximum Input Voltage	140	280	Vrms/VDC
Minimum Input Voltage	90	90	Vrms/VDC
Maximum Input Current	10	10	mArms
Drop Out Current[4]	2.5	1.5	mArms
Allowable Input for No Output[4]	3.0	2.0	mArms
Allowable Input for No Output	50	50	Vrms/VDC

FOOTNOTES:

[1] Specifications apply to T_A −30 to +80°C unless otherwise noted.

[3] Gordos IAC modules will operate on AC or DC input voltage.

[4] Series operation of Gordos standard IAC modules is permitted. Does not include "A" versions.

[5] With external LED indicator. 18 mADC without external LED.

[6] Breakdown voltage of output transistor.

NOISE IMMUNE DC INPUT MODULES

Parameter	IDC5N	IDC15N	IDC24N	Units
Output Specifications[1]				
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	2.75	12	20	VDC
Maximum Logic Supply Current[6]	16	16	16	mADC
Max. Logic Supply Leakage Current	10	10	10	μADC
Maximum Output Voltage[7]	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current	10	10	10	μADC
Maximum Output Voltage Drop	100	100	100	mADC
Input Specifications[1]				
Maximum Input Voltage	60	60	60	VDC
Minimum Input Voltage	3.3	3.3	3.3	VDC
Input Resistance[3]	1.5K	1.5K	1.5K	Ohms
Maximum Input Current[4]	40	40	40	mADC
Drop Out Current	1.0	1.0	1.0	mADC
Allowable Input for No Output[5]	1.0	1.0	1.0	mADC
Allowable Input for No Output	2.0	2.0	2.0	VDC

FOOTNOTES:

[1] Specifications apply to T_A −30 to +80°C unless otherwise noted.

[3] Does not include IRED impedance (drop).

[4] At maximum input voltage.

[5] Series operation with GORDOS ODC modules is permitted.

[6] With external LED indicator. 18 mADC without external LED.

[7] Breakdown voltage of output transistor.

FAST SWITCHING DC INPUT MODULES

Parameter	IDC5F	IDC15F	IDC24F	Units
Output Specifications[1]				
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	2.75	12	20	VDC
Maximum Logic Supply Current[6]	16	16	16	VDC
Max. Logic Supply Leakage Current	10	10	10	μADC
Maximum Output Voltage[7]	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current	10	10	10	μADC
Maximum Output Voltage Drop	100	100	100	mVDC
Input Specifications[1]				
Maximum Input Voltage	30	30	30	VDC
Minimum Input Voltage	3.3	3.3	3.3	VDC
Input Resistance[3]	500	500	500	Ohms
Maximum Input Current[4]	60	60	60	mADC
Drop-Out Current	1.0	1.0	1.0	mADC
Allowable Input for No Output[5]	1.5	1.5	1.5	mADC
Allowable Input for No Output	1.5	1.5	1.5	VDC

FOOTNOTES:

[1] Specifications apply to T_A −30 to +80°C unless otherwise noted.

[3] Does not include IRED impedance (drop).

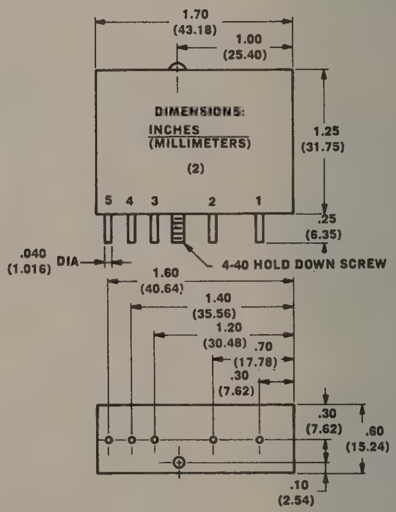
[4] At maximum input voltage.

[5] Series operation with Gordos ODC modules is permitted.

[6] With external LED indicator. 18 mADC without external LED.

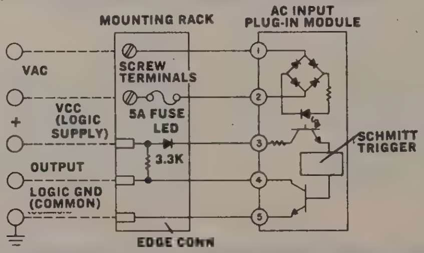
[7] Breakdown voltage of output transistor.

SCHEMATICS

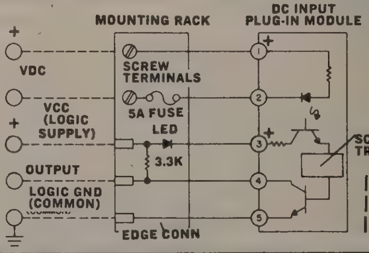

1.70
(43.18)
1.00
(25.40)
DIMENSIONS:
INCHES
(MILLIMETERS)
(2)
5 4 3 2 1
1.25
(31.75)
.25
(6.35)
.040
(1.016)
DIA
4-40 HOLD DOWN SCREW
1.60
(40.64)
1.40
(35.56)
1.20
(30.48)
.70
(17.78)
.30
(7.62)
.30
(7.62)
.60
(15.24)
.10
(2.54)

IAC5N, IAC15N, IAC24N, IAC5AN, IAC15AN, IAC24AN, IDC5N, IDC15N, IDC24N, IDC5F, IDC15F, IDC24F

WIRING DIAGRAMS


MOUNTING RACK
AC INPUT PLUG-IN MODULE
VAC
SCREW TERMINALS
VCC (LOGIC SUPPLY)
+
5A FUSE
LED
3.3K
OUTPUT
LOGIC GND (COMMON)
SCHMITT TRIGGER
EDGE CONN
1
2
3
4
5

IAC5N, IAC15N, IAC24N, IAC5AN, IAC15AN, IAC24AN


MOUNTING RACK
DC INPUT PLUG-IN MODULE
+
VDC
SCREW TERMINALS
VCC (LOGIC SUPPLY)
+
5A FUSE
LED
3.3K
OUTPUT
LOGIC GND (COMMON)
SCHMITT TRIGGER
EDGE CONN
1
2
3
4
5

IDC5N, IDC15N, IDC24N, IDC5F, IDC15F, IDC24F

GORDOS ARKANSAS/1000 N. SECOND STREET, ROGERS, ARKANSAS 72756 USA/PHONE (501) 636-5000/TWX: 910-720-7998

GORDOS ARKANSAS

I/O MODULES

RANDOM TURN-ON AC OUTPUT MODULES

Parameter	OAC5RN OAC15RN OAC24RN	OAC5ARN OAC15ARN OAC24ARN	Units
Output Specifications[1]			
Nominal Line Voltage	120	240	Vrms
Minimum Line Voltage	12	24	Vrms
Maximum Line Voltage	140	280	Vrms
Maximum Peak Off-State Voltage	400	600	Vpeak
Maximum Off-State Leakage[5]	1.5	3.0	mArms
Static (Off-State) DV/DT	250	250	V/μSec
Maximum On-State Current[6]	4.0	4.0	Arms
Minimum On-State Current	.05	.05	Arms
Maximum One Cycle Surge[7]	150	150	Apeak
Peak On-State Voltage Drop[8]	1.6	1.6	Vpeak

Parameter	OAC5RN OAC5ARN	OAC15RN OAC15ARN	OAC24RN OAC24ARN	Units
Input Specifications[1]				
Nominal Input Voltage	5.0	15	24	VDC
Minimum Turn-On Voltage	3.0	9.0	18	VDC
Maximum Input Voltage	8.0	18	32	VDC
Drop Out Voltage	1.0	1.0	1.0	VDC
Maximum Input Current[3]	18	16	12	mADC
Nominal Input Resistance[4]	235	1K	2K	Ohms

FOOTNOTES:

[1] Specifications apply to T_A −30 to +80°C unless otherwise noted.
[3] At nominal input voltage.
[4] Does not include IRED impedance (drop).
[5] At T_A of 25°C and maximum line voltage.
[6] At T_A of 40°C, derate 67 mA/°C to 80°C.
[7] At T_A of 25°C, non repetitive.
[8] At T_A of 25°C and maximum on-state current.

NOISE IMMUNE AC OUTPUT MODULES

Parameter	OAC5N OAC15N OAC24N	OAC5AN OAC15AN OAC24AN	Units
Output Specifications[1]			
Nominal Line Voltage	120	240	Vrms
Minimum Line Voltage	12	24	Vrms
Maximum Line Voltage	140	280	Vrms
Maximum Peak Off-State Voltage	400	600	Vpeak
Maximum Off-State Leakage[5]	1.5	3.0	mArms
Static (Off-State) DV/DT	250	250	V/μS
Maximum On-State Current[6]	4.0	4.0	Arms
Minimum On-State Current	.05	.05	Arms
Maximum One Cycle Surge[7]	150	150	Apeak
Peak On-State Voltage[8]	1.6	1.6	Vpeak

Parameter	OAC5N OAC5AN	OAC15N OAC15AN	OAC24N OAC24AN	Units
Input Specifications[1]				
Nominal Input Voltage	5.0	15	24	VDC
Minimum Turn-On Voltage	3.0	9.0	18	VDC
Maximum Input Voltage	8.0	18	32	VDC
Drop Out Voltage	1.0	1.0	1.0	VDC
Maximum Input Current[3]	18	16	12	mADC
Nominal Input Resistance[4]	235	1K	2K	Ohms

FOOTNOTES:

[1] Specifications apply to T_A −30 to +80°C unless otherwise noted.
[3] At nominal input voltage.
[4] Does not include IRED impedance (drop).
[5] At T_A of 25°C and maximum line voltage.
[6] At T_A of 40°C, derate 67 mA/°C to 80°C.
[7] At T_A of 25°C, non repetitive.
[8] At T_A of 25°C and maximum on-state current.

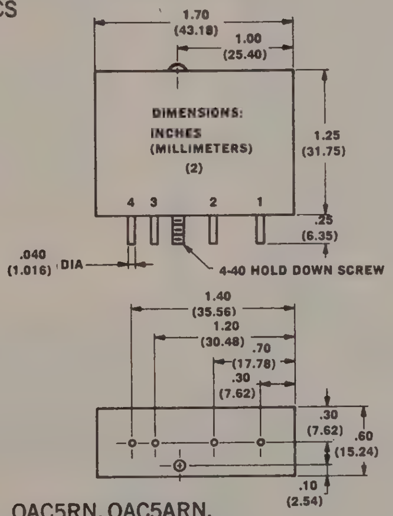
FAST SWITCHING DC OUTPUT MODULES

Parameter	ODC5F	ODC15F	ODC24F	Units
Output Specifications[1]				
Maximum Line Voltage	60	60	60	VDC
Minimum Line Voltage	3.0	3.0	3.0	VDC
Maximum Off-State Voltage	60	60	60	VDC
Maximum Off-State Leakage[5]	1.0	1.0	1.0	mADC
Maximum On-State Current[6]	4.0	4.0	4.0	ADC
Minimum On-State Current	10	10	10	mADC
Maximum One Sec. Surge[7]	5.0	5.0	5.0	ADC
Maximum On-State Voltage[8]	1.5	1.5	1.5	VDC
Input Specifications[1]				
Nominal Input Voltage	5.0	15	24	VDC
Minimum Turn-On Voltage	2.75	9.0	18	VDC
Maximum Input Voltage	8.0	18	32	VDC
Drop-Out Voltage	1.0	1.0	1.0	VDC
Maximum Input Current[3]	18	16	13	mA
Nominal Input Resistance[4]	235	1K	2K	Ohms

FOOTNOTES:

[1] Specifications apply to T_A −30 to +80°C unless otherwise noted.
[3] At nominal input voltage.
[4] Does not include IRED impedance (drop).
[5] At T_A of 80°C and maximum line voltage.
[6] At T_A of 40°C, derate 67 mA/°C to 80°C.
[7] At T_A of 25°C, non repetitive.
[8] At T_A of 25°C and maximum rated current.

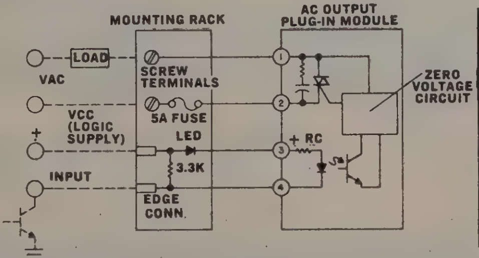
SCHEMATICS


1.70
(43.18)
1.00
(25.40)
DIMENSIONS:
INCHES
(MILLIMETERS)
(2)
1.25
(31.75)
4
3
2
1
.25
(6.35)
.040
(1.016)
DIA
4-40 HOLD DOWN SCREW
1.40
(35.56)
1.20
(30.48)
.70
(17.78)
.30
(7.62)
.30
(7.62)
.60
(15.24)
.10
(2.54)

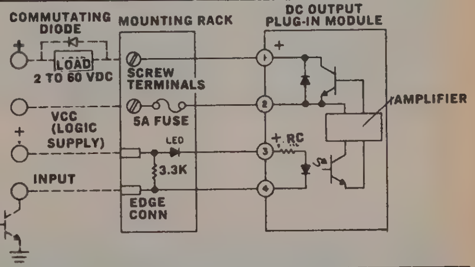
OAC5RN, OAC5ARN,
OAC15RN, OAC15ARN,
OAC24RN, OAC24ARN,
OAC5N, OAC5AN,
OAC15N, OAC15AN,
OAC24N, OAC24AN

WIRING DIAGRAMS

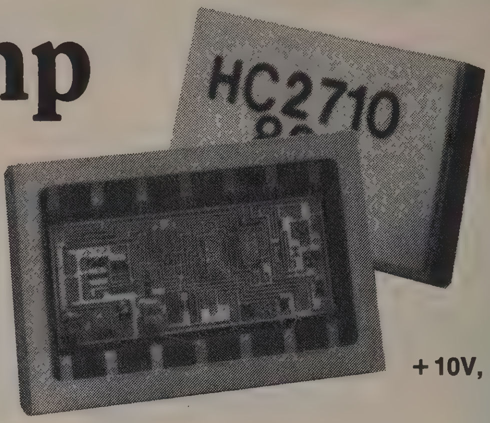
OAC5RN, OAC5ARN,
OAC15RN, OAC15ARN,
OAC24RN, OAC24ARN,
OAC5N, OAC5AN,
OAC15N, OAC15AN,
OAC24N, OAC24AN,
ODC5F, ODC15F,
ODC24F.


MOUNTING RACK
AC OUTPUT
PLUG-IN MODULE
LOAD
VAC
SCREW
TERMINALS
ZERO
VOLTAGE
CIRCUIT
VCC
(LOGIC
SUPPLY)
5A FUSE
+
LED
+ RC
3.3K
INPUT
EDGE
CONN.
1
2
3
4

ODC5F
ODC15F
ODC24F


COMMUTATING
DIODE
MOUNTING RACK
DC OUTPUT
PLUG-IN MODULE
+
LOAD
2 TO 60 VDC
SCREW
TERMINALS
AMPLIFIER
VCC
(LOGIC
SUPPLY)
5A FUSE
+
LED
+ RC
3.3K
INPUT
EDGE
CONN
1
2
3
4

Today's New HyComp Delivers



Precision Thin-Film
VOLTAGE REFERENCES

+10V, −10V, ±10V

FEATURES

- **MIL-STD-883C** and industrial versions
- Excellent **thermal stability** over temperature (to ±1 ppm/°C)
- **Fully guaranteed** to ±10mA output over full operating temperature range
- Short circuit **protected**
- **No need** for external temperature-stabilizing elements
- Available in **several packages** (hermetically sealed 14 pin DIP, leadless chip carrier, flatpacks)
- Proprietary **Nichrome** resistors, **laser** trimming and **stabilization**

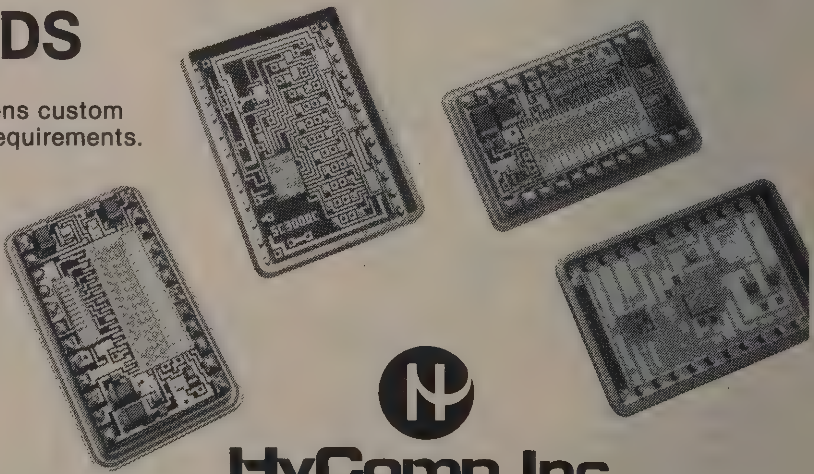
PARAMETERS	MODEL →	HC2700/2720/2701/2702	HC2710/2721/2711/2712
Output Voltage			
HC2700/2710		+10.000 ±0.005V	+10.000 ±0.001V
HC2720/2721		+10.000 ±0.002V	+10.000 ±0.001V
HC2701/2711		−10.000 ±0.005V	−10.000 ±0.001V
HC2702/2712		±10.000 ±0.005V	±10.000 ±0.001V
Temperature Drift (1)			
HC2700/2710		±3ppm/°C max.	±1ppm/°C max. (2)
HC2720/2721		±4ppm/°C max.	±1ppm/°C max. (2)
HC2701/2711		±5ppm/°C max.	±1ppm/°C max. (2)
HC2702/2712	+10V Output	±5ppm/°C max.	±1ppm/°C max. (2)
	−10V Output	±5ppm/°C max.	±2ppm/°C max. (2)
Line Regulation			
HC2720/2721		200μV/V max.	200μV/V max.
All Others		250μV/V max.	200μV/V max.
Load Regulation			
HC2720/2721		50μv/mA. typ.	50μV/mA. typ.
All Others		100μV/mA. max.	50μV/mA. max.
Output Current (3)			
HC2720/2721		5mA	5mA
All Others (Over Temp.)		±10mA	±10mA
Long Term Stability		25ppm/1000 Hours, All Models	
Operating Temperature (4)			
HC27XX		−25°C to +85°C	
HC27XX-883		−55°C to +125°C	
Package Style			
HC2720/2721		T0-99	T0-99
HC2720/2721-LCC		Leadless Chip Carrier	Leadless Chip Carrier
All Others		14-Pin DIP	14-Pin DIP

NOTES:
1. Measured from 25°C to T (min) and 25°C to T (max).
2. Temperature drift ±5ppm/°C outside the −25°C to +85°C range.
3. For specified load regulation.
4. For specified temperature drift.

Thin-Film
CUSTOM HYBRIDS

HyComp designs, manufactures and screens custom hybrids for industrial and MIL-STD-883C requirements. Whatever you need, including:

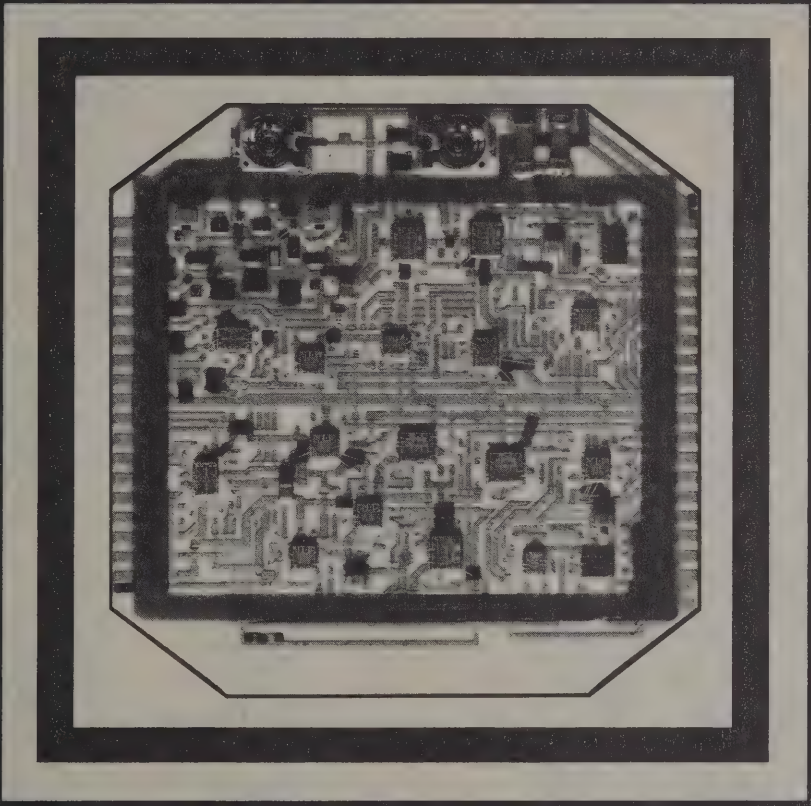
- **Stable Instrumentation Amplifiers:** Variable gain; accurate to 0.01%
- **Complete A/D and D/A Converters:** 8-, thru 12-bit models
- **Precision Signal Filtering:** Anti-Alias, Low Pass, High Pass and Bandpass precision filters
- **Specialized signal gain functions:** Computer-controlled amplifiers



HyComp, Inc.
Union Ave., Sudbury, MA 01776-0377
Tel: (617) 443-4631 • TWX: 710-347-0385

Bring us **your** hybrid circuit application. If our standard hybrids won't do the job, we'll design and build the exact circuit required. **Call us today for fast results.**

since 1974
we have built
OVER TEN MILLION
custom hybrid circuits



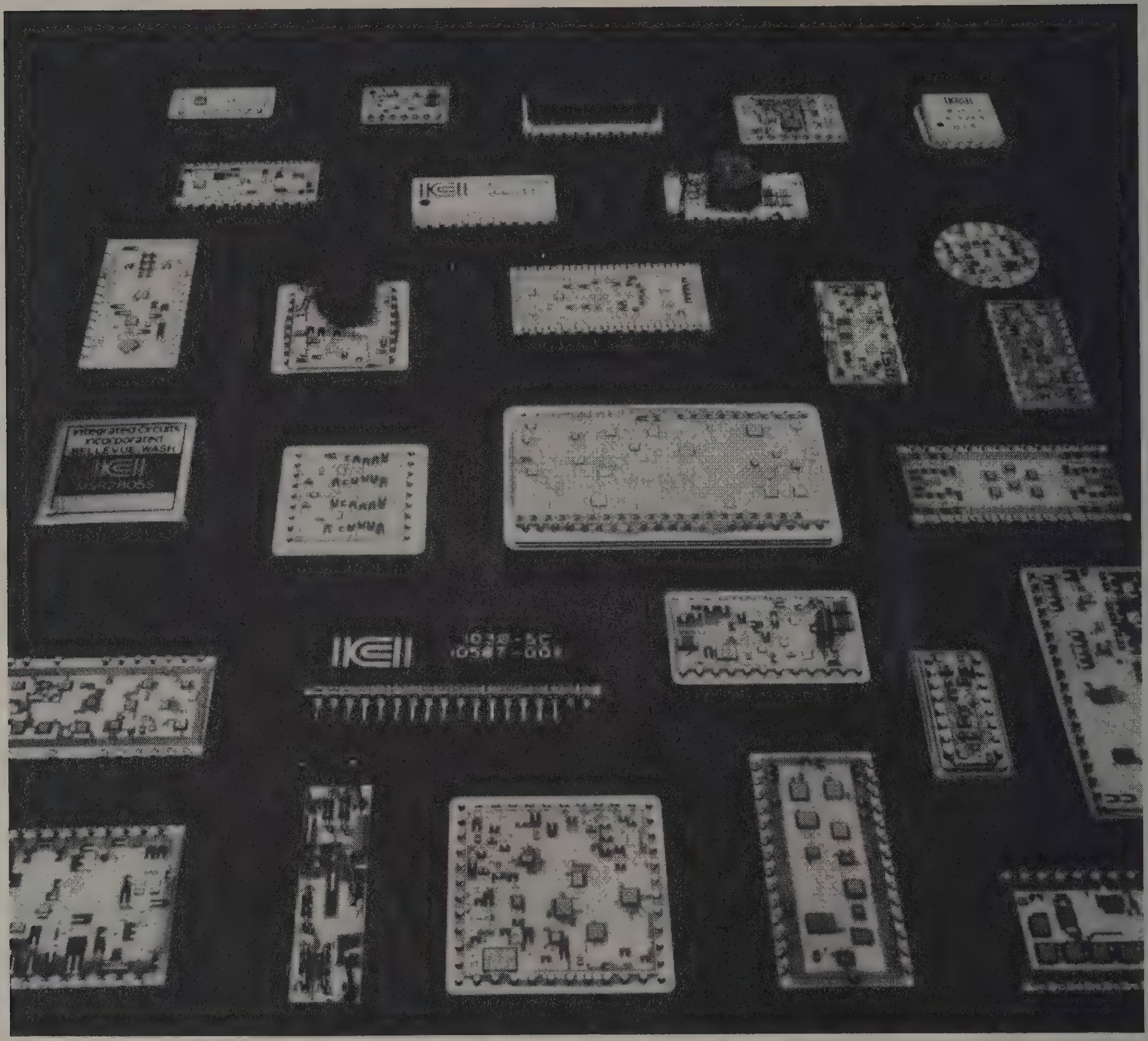
May we build
YOUR next million??

hytek microsystems
incorporated

980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

Integrated Circuits Incorporated

CUSTOM HYBRID CIRCUITS



Producing high quality custom hybrid circuits is an art no one learns overnight. And producing circuitry consistently recognized as the finest in the industry takes years.

That's the secret behind the success of Integrated Circuits Incorporated. Building custom thick-film hybrid circuits has been our specialty since 1969. And we've used all of that experience to perfect our expertise in not only technical capabilities and quality, but also in program management and customer coordination.

We can design a circuit to your specification, or convert your circuit to a miniature hybrid design. Either way, it must pass the rigid quality assurance requirements basic at ICI - MIL-I-45208, MIL-STD-883, MIL-M-38510, and MIL-Q-9858 as applicable.

For military, airborne or industrial requirements, you'll find ICI to be responsive, capable and reliable.

Integrated
Circuits
Incorporated

10301 Willows Road
Redmond, Washington 98052
(206) 882-3100
TWX: 910-443-2302

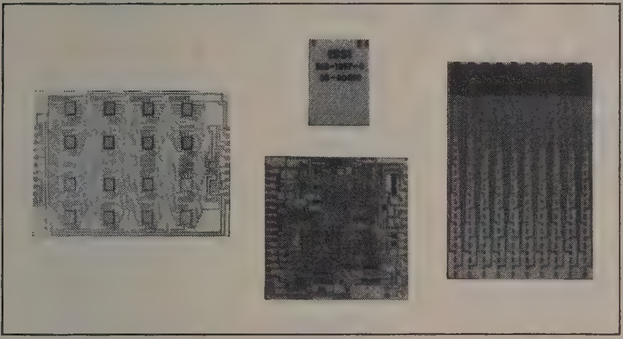
INTERNATIONAL SENSOR SYSTEMS INC.

P.O. Box 345 - Industrial Park - Aurora, NE 68818 - Telephone (402) 694-6111

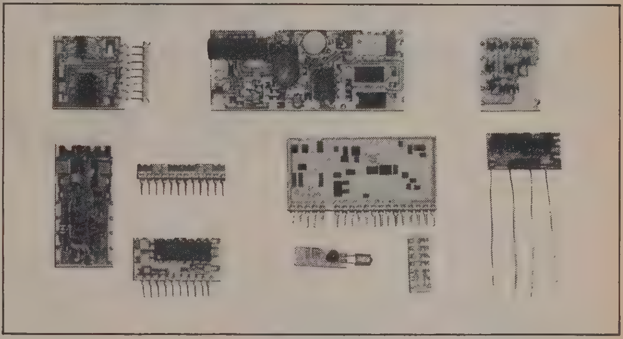
HYBRID THICK FILM TECHNOLOGY

FEATURES

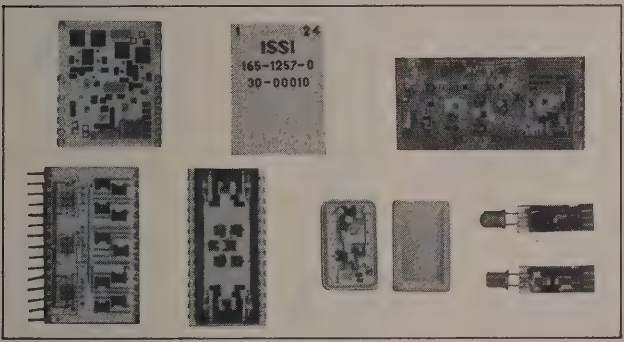
- one time insertion costs
- functional modularity
- high quality components
- compact
- low profile
- low mass
- high performance
- small
- extreme temperature operating range
- military specification capabilities



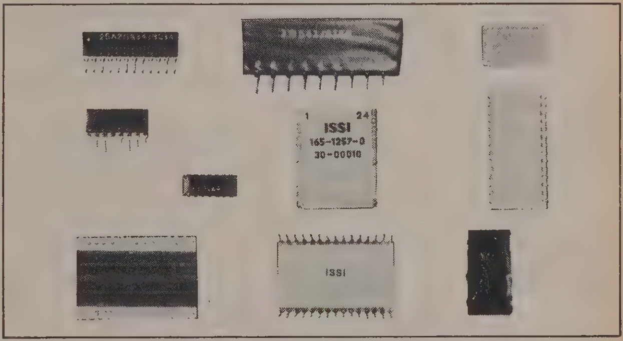
METALIZED SUBSTRATES—Simple or complex, single or multi-layer conductor patterns with Pd. Ag (Palladium Silver), Pt. Ag. (Platinum Silver), Au, (Gold), Pt. Au. (Platinum Gold) inks. Insulation with high temperature glass dielectric or low temperature glaze. Film Resistors from 1 ohm to 150 megohm, tolerances to ±0.1%, T.C.R. to 50 ppm, 1/10 w to 10 watt power dissipation, laser or abrasive trimming.



SOLDER REFLOW TECHNOLOGY—Compact networks with thick film resistors, IC packages, chip capacitors, inductors, discrete components, SOT package, diode bridge assembly, high and low temperature solder, standard or custom pinouts. Special devices with photo-transistors, LED's and functional sub-assemblies.



CHIP AND WIRE TECHNOLOGY—Microcircuit assembly of functional thin film integrated circuit or component chips into operational devices. All available IC & component chips assembled to a thick film circuit by solder or epoxy bonding. Chips wired into circuit with either gold or aluminum wire. (Thermocompression or thermosonic wire bonding). Special handling for static control. Components actively or passively trimmed to guarantee functional specifications.



CUSTOM PACKAGES—Single-in-line or Dual-in-line pinout packages, conformally coated, metal can, plastic or ceramic covered and sealed. Customer markings as well as manufacturer's identification for traceability. Leak tested, temperature cycling and burn-in before final test to insure reliability. Heat sink attached to either alumina or beryllium oxide to obtain maximum power dissipation.

TECHNICAL SERVICES

• Circuit design • layout (including conversion of existing circuitry to thick film technology) • material selection • rubylith production • screen fabrication • product tooling • product testing • and building to print. Testing includes functional electrical and mechanical parameters • burn-in • leak testing • and temperature cycling.

APPLICATIONS

• Memory • logic • linear circuits • A-D • D-A • timing • filters • isolation • pulse shaping • impedance matching • signal generation • switching • sequencing • and many other medium range energy dissipation functions or a combination thereof.

ISSI MILITARY SPECIFICATION CAPABILITIES

MIL-I-45208 Inspection System Requirements
MIL-C-45662 Calibration System Requirements
MIL-STD-883 Test Methods & Procedures for Microelectronics
Certificate of Compliance furnished upon request.

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

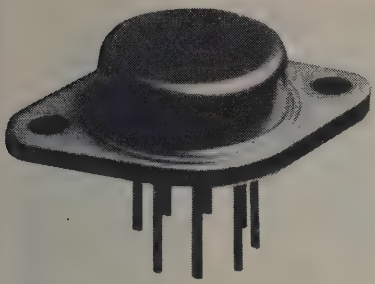
WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms	**1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code	**3**•1103
Batteries, Product Selection Guide	**3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide	**2**•1003
Capacitors, Basic Formulas	**1A**•1093
Capacitors, Miniglossary	**1A**•1069
Capacitors, Product Selection Guide	**1A**•1003
Circuit Boards (Printed), Product Selection Guide	**2**•1089
Coils, Chokes, & Inductors, Product Selection Guide	**1A**•1219
Connectors, Miniglossary	**2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide	**2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**1A**•1309
Delay Lines, Product Selection Guide	**1A**•1445
Discrete Semiconductors, Product Selection Guide	**1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide	**1B**•1021
EBCDIC Code	**3**•1153
Encapsulation, Miniglossary	**2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**2**•1801
Filters, Product Selection Guide	**1A**•1577
Instruments, Graphic Recording, Product Selection Guide	**3**•1381
Instruments, Panel Meters, Product Selection Guide	**3**•1321
Instruments, Test & Measuring, Product Selection Guide	**3**•1182
Interconnection Systems, Product Selection Guide	**2**•1873
Keyboards & Keypads, Product Selection Guide	**1B**•1759
Microwave Components, Product Selection Guide	**1A**•1685
Military Qualified Products Lists	**1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide	**1B**•1121
Opto Semiconductors, Miniglossary	**1B**•1218
Oscilloscopes, Product Selection Guide	**3**•1361
Panel Hardware, Product Selection Guide	**2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**1A**•2017
Power Supplies, Miniglossary	**3**•1455
Power Supplies, AC, Product Selection Guide	**3**•1815
Power Supplies, DC, Product Selection Guide	**3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**1B**•1255
Relay Contact Forms	**1B**•1317
Relays, Electromechanical, Miniglossary	**1•B**1292
Relays, Product Selection Guide	**1B**•1289
Resistor Color Codes	**1A**•1791
Resistors, Product Selection Guide	**1A**•1789
Servo Components, Miniglossary	**3**•1935
Solenoids, Product Selection Guide	**1B**•1481
Switches, Product Selection Guide	**1B**•1499
Thyristors/High Power Diodes, Miniglossary	**1A**•1652
Transducers & Encoders, Product Selection Guide	**1B**•1827
Transformers, Product Selection Guide	**1A**•2115
Wire & Cable, Product Selection Guide	**2**•1935

IXYS
SOLUTIONS FOR POWER CONTROL

3685 ENOCHS
SANTA CLARA, CA 95051
TELEPHONE: (408) 733-4045

XPC PWM-CONTROLLERS



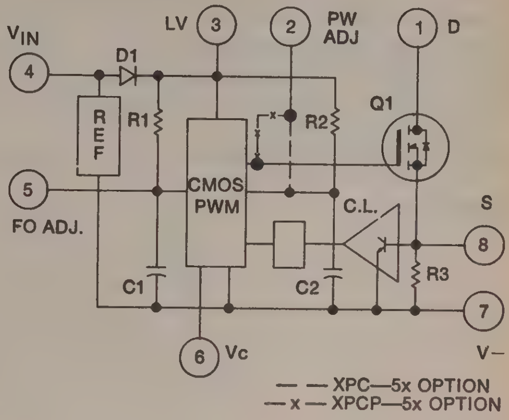
FEATURES:

- CMOS contoller directly coupled to Power-MOS Switch
- Internal Power-MOS catch diode
- Full frequency and duty cycle adjustibility
- Adjustable current limit
- XPCP High Power Option for external paralleling of Power MOSFETS
- Internal thermal shutdown
- Remote shutdown
- Low noise low ground leakage construction
- Internally set for 100KHz operation
- Operational to 250KHz
- High efficiency operation; controller requires less than 2mA for 100KHz operation
- Standard package and heat sink Isolated case

DESCRIPTION

The XPC-5X series are power control circuits with internal CMOS PWM controller and Power MOS switch having 100V, 450V or 850V ratings in a hermetically sealed 8 pin TO-3 package. It facilitates the design of advanced DC to DC converters, Switch Mode Power Supplies (SMPS), servo closed loop control systems and PWM amplifiers/controllers. The controller is internally set for 100 kHz operation, but is adjustable downwards or upwards to 250 kHz. The power MOSFET and controller are electrically isolated from the case to minimize noise and capacitive coupling to ground. The low dissipation controller can be fed via a capacitor from the AC line directly. An optional configuration (XPCP-5X) allows driving external Power MOSFET devices for higher power applications — at the expense of PW adjustability.

EQUIVALENT SCHEMATIC



APPLICATIONS

- Off-Line applications
- DC-DC converters
- Servo switch mode control system
- Switch Mode Power Supplies with lowest component count
- Motion Control
- Temperature Control
- Battery based power control
- PWM-Controller/Regulator circuit designs
- XPCP High Power Option

ORDERING INFORMATION

Part Number	Max. MOS Rating
XPC-5H	100V @ 10A
XPC-5T	450V @ 3A
XPC-5X	800V @ 2A

ABSOLUTE MAXIMUM RATINGS (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	XPC-5H	XPC-5T	XPC-5X	UNITS
Output Voltage (pin 1)	Vd	100	450	800	V
Output Current — continuous — pulsed	Id	8 16	3 6	2 4	A A-peak
Typical on Resistance @ ID	R(on)	0.5@4A	3@1.5A	8@1A	Ohms
Input Current (pin 4)	Iin	50			mA
Input Voltage (pin 4)	Vin	18			V
Input Voltage (pins 2, 5, 6)		V-(7)-0.3 to Vin(4)			V
Max LV external current (pin 3)	I_{LV}	0 to Iin(4)			mA
Operating Temperature	Tj	−50 to +150			°C
Storage Temperature	Tstq	−65 to +150			°C
Max Lead Solder Temp for 10 sec (1.6 mm below seating plane)	T_L	260			°C
Internal Power Dissipation derate above Tc=25°C	Pd	25 −0.2			W W/°C

THERMAL RESISTANCE

PARAMETER	SYMBOL	XPC-5H	XPC-5T	XPC-5X	UNITS
Junction to case	θjc	5			°C/W
Case to ambient (1)	θca	30			°C/W

(1) natural convection cooling no heat sink

ELECTRICAL CHARACTERISTICS (Ta=25°C, Vin=+15 VDC unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Supply Current	Iin				4	mA
Input Supply Voltage	Vin	2<Iin <20mA	14.25	15	15.75	V
Operating Frequency	fo		95	100	105	kHz
Free Running Duty Cycle	D	Vc (pin 6) open	44	47	49	%
Open Circuit Control Voltage	Vc	Vc (pin 6) open	8.8	9.4	9.6	V
Max Control Bias Current	Ic	Vc (pin 6) = 0V		150	200	μA

MADE IN THE USA

SEE OUR OTHER PAGES IN EEM-SECTION 3700/SECTION 4000

LEACH® CONTROL PRODUCTS DIVISION

HYBRID CIRCUITS

60 YEARS OF EXCELLENCE . . . . .

LEACH, CPD has consistently demonstrated its excellence in the design, development and manufacture of high quality, thick film hybrid microcircuits for aerospace, military and industrial applications. These high reliability hybrids are currently used on the Space Shuttle, B-1B, navigation satellites, missiles, numerous airborne systems and other similarly demanding applications.

LEACH continues its committment to excellence thru:

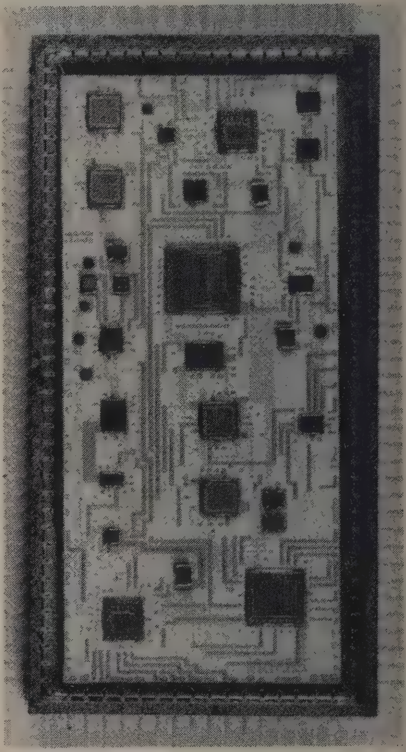
DESIGN: .... Proven excellence in the design of multi-layer hybrids using both analog and digital integrated circuits, with "State of the Art" products for 1553B Data Bus requirements, crystal controlled programmable timing arrays, low noise pre-amps, and line drivers satisfy the most exacting applications. Customers are provided with engineering assistance for hybrid circuit applications, specification requirements, and circuit design.

MANUFACTURE: .... Fabrication to various NASA and MIL-STD-883 specification is available. Production can handle both high volume commercial and high reliability space and military projects.

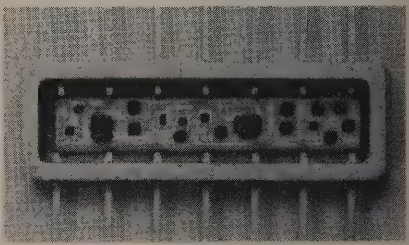
QUALITY ASSURANCE .... Established to a MIL-Q-9858 level, the quality program meets or exceeds those requirements relative to MIL-M-38510, MIL-STD-883, MIL-STD-1772, and other customer specifications as required.

TESTING .... Testing capabilities include complete automated electrical testing from chip probing to computerized functional device testing. In addition, LEACH has the ability to perform shock, vibration, thermal cycling, burn-in and life tests to MIL-STD-202 and MIL-STD-883, Method 5008.

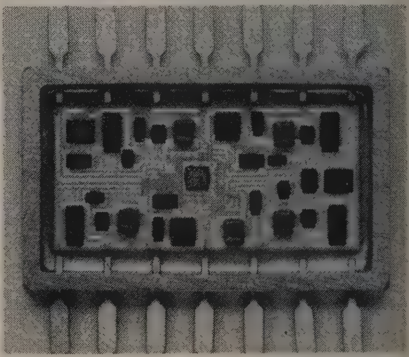
FOR MILITARY AEROSPACE AND HIGH RELIABILITY INDUSTRIAL APPLICATIONS



▲ 200% SIZE



▲ ▼ 258% SIZE



SEND YOUR DRAWINGS AND SPECIFICATIONS OR CALL THE LEACH SALES DEPARTMENT FOR IMMEDIATE ASSISTANCE AND/OR PRODUCT INFORMATION.

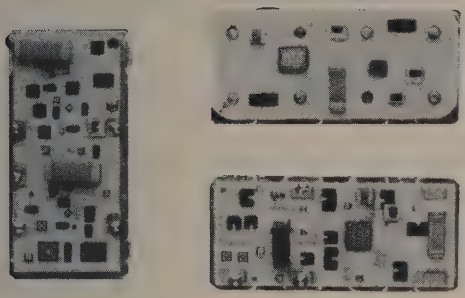
CRYSTAL CLOCK OSCILLATORS

Please turn to the Leach page in this volume of EEM (Section 2300) for a description of Leach Crystal Clock Oscillators. These high reliability products offer the highest quality at competitive prices and with excellent delivery.

6900 ORANGETHORPE AVE., BUENA PARK, CA 90620 • (714) 739-0770 • TWX 910-596-2867

LEACH® CORP.

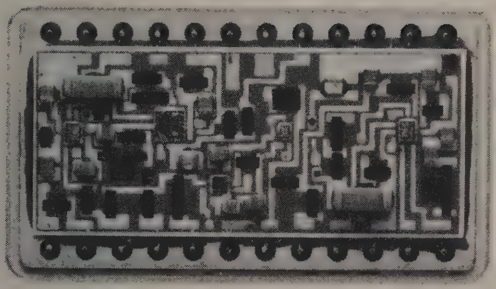
CONTROL PRODUCTS DIVISION
6900 ORANGETHORPE AVENUE
BUENA PARK, CALIFORNIA 90620
TELEPHONE: (714) 739-0770
TWX 910-596-2867



HISTORY OF HIGH QUALITY ELECTRONICS

The need for high quality thick film hybrid microcircuits for aerospace and military applications lead to Leach Corporation's entry into the field in the early 1970's. The initial 400 square foot engineering lab has evolved into a 22,000 square foot facility housing both engineering and total manufacturing capabilities.

Products include both analog and digital circuitry for interface and switching applications, and consist of both proprietary Leach products and customer designed custom hybrids.



MANAGEMENT PHILOSOPHY

Primarily designed for high reliability applications, products are manufactured to MIL-STD-883 requirements. Military environmental specifications and criteria are standard Leach practice, and products are qualified to MIL-R-83726, MIL-M-38510, and NASA standards.

ENVIRONMENTAL TESTING / QUALITY CONTROL

Within a building separate from the manufacturing area, the environmental test lab continuously maintains Leach QPL listings and conducts qualification testing to customer requirements.

Testing in accordance with MIL-STD-202 includes:

- Sine vibration with concurrent temperature testing
- Shock
- Altitude/temperature altitude
- Thermal shock and temperature cycling
- Load and life testing

HYBRID MANUFACTURING FACILITIES

Total facilities for all aspects of thick film hybrid manufacturing as well as hybrid/electromechanical interfacing are contained within the manufacturing area.

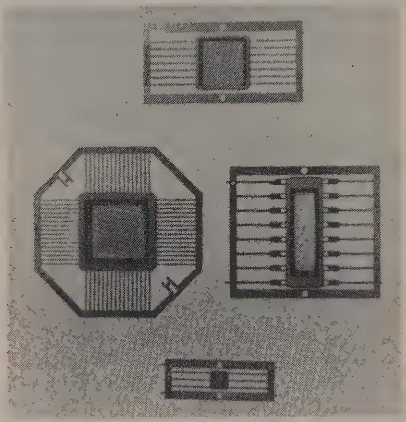
- Screen and firing
- Trimming
- Wire bonding
- Eutectic and epoxy die bonding
- Reflow soldering
- Photo processing
- Computerized testing of hardware
- Laminar flow benches
- Inert storage atmosphere

HERMETIC PACKAGES FOR HYBRID MICROCIRCUITS

MSI

MINI-SYSTEMS, INC.
Electronic Package Division, 168 East Bacon St., P.O. Box 1597, Plainville, MA 02762
Telephone: (617) 695-2000 • Telex: 710-348-0564

GLASS FLATPACKS & CHIP-CARRIERS



- Most economical means of hermetically enclosing small hybrids
- Easily and economically customized to your needs
- Meet MIL-M-38510 requirements
- Sealed by reflow soldering with combination lids

SELECTION GUIDE

Case Size: Flatpack — case sizes ⅛″ x ⅛″ to 1″ x 1″; Dual-In-Line — case size ¼″ x ¾″

Glass Free Area: Flatpack — .040″ x .070″ to .810″ x .810″

Number of Leads: 1 to 84, depending on case size

Lead Centers: .050″, .040″, .030″, or as specified

Configuration: Leads and pads on 2 sides; Leads on 2 sides; Pads on 4 sides; Leads and pads on 4 sides

Base Material: Metal, ceramic, or beryllia

Plating: Gold or Nickel, all over or selective

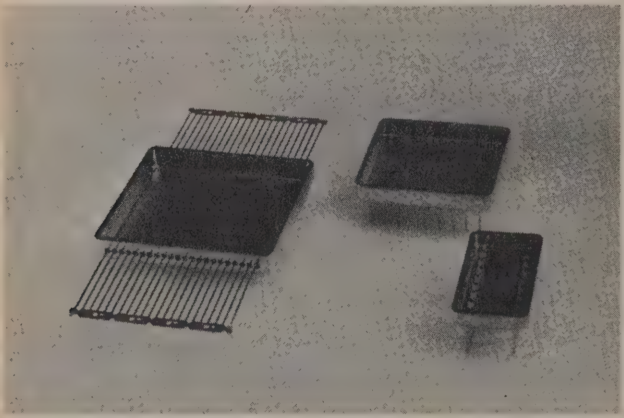
AVAILABILITY

Popular Packages — 2 weeks

Custom Packages — 8 weeks

WRITE FOR OUR DETAILED CATALOG

METAL PLUG-INS AND FLATPACKS



- Strongest and most reliable means of enclosing all size hybrids
- Package variations available built to your requirements
- Meet MIL-M-38510 Class S and all highest reliability requirements
- Sealed by seam welding with stepped lids or reflow combination lids

SELECTION GUIDE

Case Size: Plug-In and Flatpack case sizes ranging from .380″ x .625″ to 1.970″ x 2.970″

Number Pins/Leads: 1 to 188, depending on case size

Pin/Lead Centers: .100″ Plug-In; .050″ Flatpack

Configuration: Pins/Leads on 1, 2, 3, or 4 sides

Plating: Gold or Nickel, all over or selective

AVAILABILITY

Tooled Packages — 4 weeks

Custom Packages — 10 weeks

WRITE FOR OUR DETAILED CATALOG

MOTOROLA

SEMICONDUCTORS

3501 ED BLUESTEIN BLVD., AUSTIN, TEXAS 78721

MOS LOGIC AND SPECIAL FUNCTIONS

LOGIC FAMILIES

SERIES MC54/74HCxxx — The newest addition to Motorola's CMOS logic families, these SSI and MSI functions offer over 100 device types to serve the high performance user. These devices incorporate the LSTTL features of wide fanout and high speed and the CMOS features of low power consumption and high noise immunity. These devices have pinout configurations identical with many of the popular 54/74 series LSTTL and MC14000 series CMOS devices. Devices are available in both −40 to 85°C and −55 to 125°C temperature ranges.

SERIES MC14000/MC14500 — These standard lines of MSI/SSI circuits contain a complement of nearly 200 device types with which to implement complete system designs. They feature the JEDEC B-Series specifications with low-power-Schottky compatible outputs. A faster nonbuffered line of devices is compatible with the B-Series, as well as with standard Schottky TTL, for mix-and-match versatility.

SPECIAL FUNCTIONS

SERIES MC14400 AND MC145000 SERIES — This series of higher complexity dedicated LSI devices consist of single-chip "subsystems" designed for specific applications. Most circuits utilize the latest wafer processing techniques in silicon-gate technology for higher performance. Included in the family of dedicated LSI functions are the following 7 groups or sub-families.

GENERAL PURPOSE FREQUENCY SYNTHESIZERS — Phase-locked loop and programmable divider variations are available in either single or dual modulus configurations. This group offers up to 25 MHz typical input frequency and a programmable reference divider. Parallel, serial, or 4-bit data bus input formats are available with the feature of an on-board reference oscillator.

TV/CATV PLL FREQUENCY SYNTHESIZERS — This family of specific purpose frequency synthesizers are designed for TV/CATV uses. They include circuitry for keyboard scan, both up and down. They operate from a 5 volt power supply. All products have an on-board reference oscillator with full remote control capability. Included in the design is the capability of programming 100 channels in various signalling formats.

CMOS DATA CONVERSION CIRCUITS — A full line of A/D converter products are available in single slope, dual slope or successive approximation formats. Multiplexed channels accommodate up to 15 channels. Full MPU compatible (68xx format). Products are available that can offer a full 8 bits of resolution at 1 MHz with 32 μs conversion times. DACs are also available.

OP AMPS AND COMPARATORS — This family is available with operational amplifier and comparator separately or both on the same chip. The devices are all internally compensated and also offer very low input current <1 nA. Bias currents are externally programmable.

CMOS DISPLAY DRIVERS — These devices can drive LED, LCD, or VF display segments. CMOS technology means very low power dissipation but each device can produce very high current drive. A master/slave combination can drive 48 segments (master) and 44 segments (slave). Segments or dot patterns can be driven up to 1 sq. centimeter in size.

REMOTE CONTROL ENCODER/DECODER PAIRS — This group pairs a transmitter and a receiver for full remote control applications. Decoder configurations can be 5 address/4 data, 4 address/5 data or all 9 address. The decoder can interpret up to 19,683 different codes.

CMOS SMOKE DETECTORS — Smoke detectors are popular for both residential or industrial uses. The package is a small 16-pin DIP with very low power consumption. They are ideal for battery applications. A smoke alarm is triggered via external transducer and internal "on-chip" drivers for lights, horns and other detector unit functions.

INTEGRATED CIRCUITS FOR TOMORROW'S TELECOMMUNICATION

(MOS AND BIPOLAR)

TELECOMMUNICATIONS

Motorola offers a comprehensive line of telecommunications products, including a broad family of modems and modem filters, crosspoint switches, and filters. To service the growing office automation market, Motorola's monocircuits, Time Slot Assigner Circuits (TSACs), Continuously Variable Slope Delta Modulator/Demodulators (CVSDs), and advance voice/data ICs are available. Dialers, ringers, and complete telephone sets are designed to accommodate the rapidly expanding telephone market.

MONO-CIRCUIT
- MC14400
- MC14401
- MC14402
- MC14403
- MC14405

SLIC
- MC3419

TSAC
- MC14416
- MC14417
- MC14418

CROSSPOINT SWITCHES
- MC142100
- MC145100
- MC3416

MODEMS
- MC14411
- MC14412
- MC145440/41
- MC145445
- MC145450
- MC6860
- MC6172
- MC6173

FILTERS
- MC14413
- MC14414
- MC145414
- MC145415
- MC145432
- MC145433
- MC145440/41

VOICE/DATA
- MC145422
- MC145426
- MC145428
- MC145429

CVSD
- MC3417
- MC3418

RINGERS
- MC34012
- MC34017

COMPLETE TELEPHONES
- MC34010
- MC34011

DIALERS
- MC14408
- MC14409
- MC14410
- MC14419
- MC34010
- MC34011
- MC34012
- MC34013
- MC34014
- MC34015

MOTOROLA

SEMICONDUCTORS

3501 ED BLUESTEIN BLVD., AUSTIN, TEXAS 78721

MEMORIES Selector Guide ROMs PROMs EPROMs

TTL RAMs

Organization	Part Number	Access Time (ns max)	Output	No. of Pins
1024 × 1	MCM93415	45	O.C.	16
1024 × 1	MCM93425	45	3-State	16
256 × 4	MCM93L422	60	3-State	22
256 × 4	MCM93L422A	45	3-State	22
256 × 4	MCM93422	45	3-State	22
256 × 4	MCM93422A	35	3-State	22

ROMs

MOS CHARACTER GENERATORS[2] (+5 Volts)

Organization	Part Number	Access Time (ns max)	No. of Pins
128 × (7 × 5)	MCM6670P	350	18
128 × (7 × 5)	MCM6674P	350	18
128 × (9 × 7)	MCM66700P	350	24
128 × (9 × 7)	MCM66710P	350	24
128 × (9 × 7)	MCM66714P	350	24
128 × (9 × 7)	MCM66720P	350	24
128 × (9 × 7)	MCM66730P	350	24
128 × (9 × 7)	MCM66734P	350	24
128 × (9 × 7)	MCM66740P	350	24
128 × (9 × 7)	MCM66750P	350	24
128 × (9 × 7)	MCM66760P	350	24
128 × (9 × 7)	MCM66770P	350	24
128 = (9 × 7)	MCM66780P	350	24
128 × (9 × 7)	MCM66790P	350	24

MOS Binary ROMs (+5 Volts)

Organization	Part Number	Access Time (ns max)	No. of Pins
2048 × 8	MCM68A316EP	350	24
2048 × 8	MCM68A316EP91[3]	350	24
4096 × 8	MCM68A332P	350	24
4096 × 8	MCM68A332P2[3]	350	24
8192 × 8	MCM68364P20	200	24
8192 × 8	MCM68364P25	250	24
8192 × 8	MCM68364P35	350	24
8192 × 8	MCM68364P35-3[3]	350	24
8192 × 8	MCM68365P25	250	24
8192 × 8	MCM68365P35	350	24
8192 × 8	MCM68366P25	250	24
8192 × 8	MCM68366P35	350	24
8192 × 8	MCM68367P	450	24
8192 × 8	MCM68368P	450	24
8192 × 8	MCM68369P20	200	28
8192 × 8	MCM68369P25	250	28
8192 × 8	MCM68369P30	300	28
8192 × 8	MCM68370P20	200	28
8192 × 8	MCM68370P25	250	28
8192 × 8	MCM68370P30	300	28
8192 × 10	MCM68380P	300[9]	24
16384 × 8	MCM63128P15	150	28
16384 × 8	MCM63128P20	200	28
32768 × 8	MCM63256P15	150	28
32768 × 8	MCM63256P20	200	28

CMOS ROMs (+5 Volts)

Organization	Part Number	Access Time (ns max)	No. of Pins
2048 × 8	MCM65516P43	430	18
2048 × 8	MCM65516P43M[3]	430	18
2048 × 8	MCM65516P55	550	18
32768 × 8	MCM65256P35	350	28

EPROMs

MOS EPROMs

Organization	Part Number	Access Time (ns max)	Power Supplies[4]	No. of Pins
8192 × 8	MCM68764C35	350	+5 V, 25 V	24
8192 × 8	MCM68764C	450	+5 V, 25 V	24
8192 × 8	MCM68766C30	300	+5 V, 25 V	24
8192 × 8	MCM68766C35	350	+5 V, 25 V	24
8192 × 8	MCM68766C40	400	+5 V, 25 V	24
8192 × 8	MCM68766C	450	+5 V, 25 V	24

PROMs

ECL PROMs

Organization	Part Number	Access Time (ns max)	No. of Pins
32 × 8	MCM10139	20	16
256 × 4	MCM10149	25	16
256 × 4	MCM10149A*	15	16

TTL PROMs (3-State Outputs)

Organization	Part Number	Access Time (ns max)	No. of Pins
32 × 8	MCM27S19*	25	16
512 × 4	MCM7621	70	16
512 × 4	MCM7621A	60	16
512 × 8	MCM7641	70	24
512 × 8	MCM7641A	60	24
512 × 8	MCM7649	60	20
512 × 8	MCM7649A	50	20
512 × 8	MCM27S29A*	35	20
512 × 8	MCM27S31A*	35	24
512 × 8	MCM27S25A*	See Note 5	24
512 × 8	MCM27S27A*	See Note 5	22
1024 × 4	MCM7643	70	18
1024 × 4	MCM7643A	50	18
1024 × 8	MCM7681	70	24
1024 × 8	MCM7681A	50	24
1024 × 8	MCM27S181*	35	24[6]
1024 × 8	MCM27S281*	35	24[1]
1024 × 8	MCM27S35A[7]*	See Note 5	24
1024 × 8	MCM27S37A[8]*	See Note 5	24
2048 × 4	MCM7685	70	18
2048 × 4	MCM7685A	55	18
2048 × 8	MCM76161	70	24
2048 × 8	MCM76161A	60	24
2048 × 8	MCM27S191*	35	24[6]
2048 × 8	MCM27S291*	35	24[1]
2048 × 8	MCM27S45A*[7]	See Note 5	24
2048 × 8	MCM27S47A*[8]	See Note 5	24
4096 × 4	MCM76165	50	20
4096 × 4	MCM76165A	35	20

*To be introduced.
(Not all speed selections shown)

[4] +5 volt for all read operations, except for programming, where +25 volts are required.

[5] Registered Outputs — 20 ns max clock to output
35 ns max address to clock setup time

[6] 600 mil package

[7] Asynchronous register

[8] Synchronous register

[9] Typical access

MOTOROLA

SEMICONDUCTORS

3501 ED BLUESTEIN BLVD., AUSTIN, TEXAS 78721

MEMORIES
Selector Guide
RAMs

Motorola has developed a very broad range of reliable MOS and bipolar memories for virtually any digital data processing system application.

New Motorola memories are being introduced continually. **This selector guide lists all those available as of May 1984.** For later releases, additional technical information or pricing, contact your nearest authorized Motorola distributor or Motorola sales office.

Data sheets may be obtained from your in-plant VSMF Data Center, distributors, Motorola sales office or by writing to:

Literature Distribution Center
Motorola Semiconductor Products Inc.
P.O. Box 20912
Phoenix, AZ 85036

RAMs

MOS DYNAMIC RAMs

Organization	Part Number	Access Time (ns Max)	Power Supplies	No. of Pins
16384 × 1	MCM4116BP15	150	+ 12, ± 5 V	16
16384 × 1	MCM4116BP20	200	+ 12, ± 5 V	16
16384 × 1	MCM4116BP25	250	+ 12, ± 5 V	16
16384 × 1	MCM4517P10	100	+ 5 V	16
16384 × 1	MCM4517P12	120	+ 5 V	16
16384 × 1	MCM4517P15	150	+ 5 V	16
65536 × 1	MCM6665AP15	150	+ 5 V	16
65536 × 1	MCM6665AP20	200	+ 5 V	16
65536 × 1	MCM6665BP15	150	+ 5 V	16
65536 × 1	MCM6665BP20	200	+ 5 V	16
262,144 × 1	MCM6256P10*	100	+ 5 V	16
262,144 × 1	MCM6256P12*	120	+ 5 V	16
262,144 × 1	MCM6256P15*	150	+ 5 V	16
262,144 × 1	MCM6257P10*	100	+ 5 V	16
262,144 × 1	MCM6257P12*	120	+ 5 V	16
262,144 × 1	MCM6257P15*	150	+ 5 V	16

MOS STATIC RAMs (+ 5 Volts)

Organization	Part Number	Access Time (ns max)	No. of Pins
128 × 8	MCM6810	450	24
128 × 8	MCM68A10	360	24
128 × 8	MCM68B10	250	24
1024 × 4	MCM2114P20	200	18
1024 × 4	MCM2114P25	250	18
1024 × 4	MCM2114P30	300	18
1024 × 4	MCM2114P45	450	18
2048 × 8	MCM2016HP45	45	24
2048 × 8	MCM2016HN45	45	24[1]
2048 × 8	MCM2016HY45	45	24[1]
2048 × 8	MCM2016HP55	55	24
2048 × 8	MCM2016HN55	55	24[1]
2048 × 8	MCM2016HY55	55	24[1]
2048 × 8	MCM2016HP70	70	24
2048 × 8	MCM2016HN70	70	24[1]
2048 × 8	MCM2016HY70	70	24[1]
16384 × 1	MCM2167HP35	35	20
16384 × 1	MCM2167HL35	35	20
16384 × 1	MCM2167HZ35	35	20
16384 × 1	MCM2167HP45	45	20
16384 × 1	MCM2167HL45	45	20
16384 × 1	MCM2167HZ45	45	20
16384 × 1	MCM2167HP70	70	20
16384 × 1	MCM2167HL70	70	20
16384 × 1	MCM2167HZ70	70	20

Notes:
Operating temperature ranges:
MOS — 0°C to 70°C
ECL — 0°C to 75°C
TTL — Military −55°C to +125°C, Commercial 0°C to 75°C
* To be introduced.
(Not all speed selections shown)

[1] 300 mil package

[2] Character generators include shifted and unshifted characters, ASCII alphanumeric control, math, Japanese, British, German, European and French symbols.

CMOS STATIC RAMs (+ 5 Volts)

Organization	Part Number	Access Time (ns max)	No. of Pins
4096 × 1	MCM6147P55	55	18
4096 × 1	MCM6147P70	70	18
4096 × 1	MCM61L47P55	55	18
4096 × 1	MCM61L47P70	70	20
4096 × 4	MCM6168HP35*	35	20
4096 × 4	MCM6168HP45*	45	20
4096 × 4	MCM6168HP55*	55	20
4096 × 4	MCM6169HP35*	35	22
4096 × 4	MCM6169HP45*	45	22
4096 × 4	MCM6169HP55*	55	22
2048 × 8	MCM6116P12	120	24
2048 × 8	MCM6116P15	150	24
2048 × 8	MCM6116P20	200	24
2048 × 8	MCM61L16P12	120	24
2048 × 8	MCM61L16P15	150	24
2048 × 8	MCM61L16P20	200	24

ECL 10K, 10KH RAMs (Open Emitter)

Organization	Part Number	Access Time (ns max)	Pins
8 × 2	MCM10143	15.5	24
16 × 4	MC10H145	6	16
16 × 4	MCM10145	15	16
64 × 1	MCM10148	15	16
128 × 1	MCM10147	15	16
256 × 1	MCM10144	26	16
256 × 1	MCM10152	15	16
1024 × 1	MCM10146	29	16
1024 × 1	MCM10415 20	20	16
1024 × 1	MCM10415-15	15	16
1024 × 1	MCM10415-10*	10	16
256 × 4	MCM10422-15*	15	24
256 × 4	MCM10422-10*	10	24
4096 × 1	MCM10470-25*	25	18
4096 × 1	MCM10470-15*	15	18
1024 × 4	MCM10474-25*	25	24
1024 × 4	MCM10474-15*	15	24
16384 × 1	MCM10480-20*	20	20
4096 × 4	MCM10484-20*	20	28

ECL 100K RAMs (Open Emitter)

Organization	Part Number	Access Time (ns max)	Pins
1024 × 1	MCM100415-10*	10	16
256 × 4	MCM100422-10*	10	24
4096 × 1	MCM100470-15*	15	18
1024 × 4	MCM100474-15*	15	24
16384 × 1	MCM100480-20*	20	20
4096 × 4	MCM100484-20*	20	28

[3] Standard Patterns for MOS ROMs:
MCM68A316EP91 — Universal Code Coverter and Character Generator
MCM68A332P2 — Sine/Cosine Look-Up Table
MCM68364P35-3 — Log/Antilog Look-Up Table
MCM65516P43M — MC146805 Monitor Program

MOTOROLA

SEMICONDUCTORS

3501 ED BLUESTEIN BLVD., AUSTIN, TEXAS 78721

8-Bit MPUs
8-Bit MCUs
8-Bit Peripherals

Motorola has an unequaled line of single-chip microcomputers (MCUs) in depth and breath. By utilizing the "core concept", unlimited MCU possibilities are created while the processing element, or core, remains constant.

THE HMOS M6805 FAMILY PROCESSORS: MEDIUM-PERFORMANCE MCUs

Device	No. of Pins	Memory (Bytes)			I/O Lines	Special Features
		ROM	EPROM	RAM		
MC6805P2	28	1100	–	64	20 Programmable Bidirectional	Self-Check
MC6805P4	28	1100	–	112	20 Programmable Bidirectional	Self-Check, Standby RAM
MC6805R2	40	2048	–	64	2 to 5 Inputs, 24 Programmable Bidirectional	1 to 4 Channel 8-Bit A/D, Self-Check
MC6805R3	40	3776	–	112	2 to 5 Inputs, 24 Programmable Bidirectional	1 to 4 Channel 8-Bit A/D, Self-Check
MC6805T2	28	2508	–	64	2 Special Function, 19 Programmable Bidirectional	PPL, Self-Check
MC6805U2	40	2048	–	64	8 Inputs, 24 Programmable Bidirectional	Self-Check
MC6805U3	40	3776	–	112	8 Inputs, 24 Programmable Bidirectional	Self-Check
MC68705P3	28	–	1804	112	20 Programmable Bidirectional	Self-Programming Bootstrap
MC68705P5	28	–	1804	112	20 Programmable Bidirectional	Self-Programming Bootstrap, Security
MC6805P6	28	1804	–	64	20 Programmable Bidirectional	Self-Check
MC6805R3	40	–	3776	112	2 to 5 Inputs, 24 Programmable Bidirectional	1 to 4 Channel 8-Bit A/D Self-Check
MC68705R5	40	–	3776	112	2 to 5 Inputs, 24 Programmable Bidirectional	1 to 4 Channel 8-Bit A/D Self-Programming Bootstrap, Security
MC68705U3	40	–	3776	112	8 Inputs, 24 Programmable Bidirectional	Self-Programming Bootstrap
MC68705U5	40	0	3776	112	8 Inputs, 24 Programmable Bidirectional	Self-Programming Bootstrap, Security

THE CMOS M146805 FAMILY PROCESSORS: MEDIUM-PERFORMANCE MCUs

Device	No. of Pins	Memory (Bytes)			I/O Lines	Special Features
		ROM	RAM	EPROM		
MC68HC05C4	40	4096	176	–	24 Programmable Bidirectional	SPI, SCI
MC146805E2	40	–	112	–	16 Programmable Bidirectional	External Bus
MC146805F2	28	1089	64	–	16 Programmable Bidirectional	Self-Check
MC146805G2	40	2106	112	–	32 Programmable Bidirectional	Self-Check
MC146805H2	40	2106	112	–	32 Programmable Bidirectional	Freq. Synthesis
MC1468705F2	28	–	64	1089	16 Programmable Bidirectional	Bootstrap
MC1468705F5	28	–	64	1089	16 Programmable Bidirectional	Bootstrap, Security
MC1468705G2	40	–	–	2106	32 Programmable Bidirectional	Bootstrap

THE M6804 FAMILY PROCESSORS: VLE MCUs (Very Low End)

Device	No. of Pins	Memory (Bytes)			I/O Lines	Special Features
		ROM	RAM	EPROM		
HMOS						
MC6804J2	20	1024	–	32	14 Programmable Bidirectional	Self-Check, 64 Bytes Data ROM
MC6804P2	28	1024	–	32	20 Programmable Bidirectional	Self-Check, 64 Bytes Data ROM
MC68704P2	28	–	1024	32	20 Programmable Bidirectional	Bootstrap, Self-Check
CMOS — DEVICES COMING SOON						

8-BIT MPUs/MCUs/PERIPHERALS (Continued)

THE M6801 FAMILY PROCESSORS: HIGH-PERFORMANCE MCUs

Frequency				
1 MHz	1.25 MHz	1.5 MHz	2 MHz	Memory
MC6801	MC6801-1	MC68A01	MC68B01	2048 ROM, 128 Bytes RAM, Expansion Bus
MC68701	MC68701-1	—	—	2048 EPROM, 128 Bytes RAM, Expansion Bus
MC6803	MC6803-1	MC68A03	MC68B03	No ROM, 128 Bytes RAM, Expansion Bus
MC6803E	MC6803E-1	—	—	No ROM, 128 Bytes RAM, External Clock, Expansion Bus
MC6801U4	MC6801U4-1	—	—	4096 ROM, 192 Bytes RAM, Expansion Bus
MC68701U4	MC68701U4-1	—	—	4096 EPROM, 192 Bytes RAM, Expansion Bus
MC68701U5	MC68701U5-1	—	—	4096 EPROM, 192 Bytes RAM, Expansion Bus, Security
MC6803U4	MC6803U4-1	—	—	No ROM, 192 Bytes RAM, Expansion Bus
MC68120	MC68120-1	—	—	2048 ROM, 128 Bytes Dual-Port RAM, Expansion Bus
MC68121	MC68121-1	—	—	No ROM, 128 Bytes Dual-Port RAM, Expansion Bus

THE M6809 FAMILY PROCESSORS: HIGH-PERFORMANCE MPUs

PROCESSORS

Device	Features
MC6809	On-Chip Oscillator
MC6809E	External Clocking for Synchronization of Multiprocessor Systems

THE M6800 FAMILY

Device	Function
MC6800	MPU
MC6802	MPU (with Clock, RAM)
MC6808	MPU (with Clock)

THE M68000 FAMILY — AN INVESTMENT IN THE FUTURE

16-Bit Microprocessor Family

Led by the MC68000 Microprocessing Unit (MPU) and followed by a host of peripherals, the M68000 Family offers the engineer a set of building blocks to construct cost-effective solutions to an ever-widening range of complex 16/32 bit applications. The tremendous popularity of the M68000 Family is not without warrant. HMOS technology, performance, and support are but a few of the many reasons why the M68000 Family continues to be the 16 bit industry leader.

It should be noted that the M68000 Family is a not-so-distant relative of the MC6800. All M6800 Family peripherals interface directly with the MC68000, so upward compatibility is built in. Where low cost and medium performance are required, they present a very attractive alternative. The plan for the M68000 Family is a simple one. Provide the marketplace with the best 16-bit family and back it up with support that is second to none. And it's happening now.

What about expandability? The M68000 Family is designed with this in mind. All the way from an internally microcoded 32-bit architecture to the third-generation EXORmacs development system. Efficient high level language support provided by Pascal allows upward compatibility of software from 8-bit to 16-bit to 32-bit machines.

The majority of today's 16-bit microprocessor applications are quite complex, with long design times. Clearly, the required investment in design resources requires finished products to have increased longevity. Motorola understands this, and is committed to offering a family which will allow these products to remain state-of-the-art for years to come. Thus, the M68000 Family is an investment in the future.

68000 FAMILY DEVICES

68000	16-Bit MPU	Now
68008	8-Bit 68000	Now
68010	VM Processor	Now
68020	32-Bit 68000	4 Q 1984
68120	IPC	Now
68121	IPC-NR	Now
68230	PI/T	Now
68440	DDMA	Now
68450	DMAC	Now
68451	MMU	Now
68452	BAM	Now
68454	IMDC	1 Q 1985
68562	DUSCC	1 Q 1985
68590	LANCE	4 Q 1984
68652	MPCC	Now
68653	PGC	Now
68661	EPCI	Now
68681	DUART	Now
68881	FPCP	1 Q 1985
68901	MFP	3 Q 1984

EXORmacs is a trademark of Motorola Inc.

MOTOROLA *Semiconductor Products Inc.*

3501 ED BLUESTEIN BLVD., AUSTIN, TEXAS 78721 • A SUBSIDIARY OF MOTOROLA INC.

MOTOROLA
SEMICONDUCTORS
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

BIPOLAR DIGITAL LOGIC FAMILIES

MECL INTEGRATED CIRCUITS

Motorola's Emitter Coupled Logic (MECL) is a nonsaturating form of digital logic which eliminates transistor storage time as a speed limiting characteristic, permitting very high-speed operation.

Family Characteristics

MECL 10K

Trends in large high-speed systems demonstrated the need for an easy to use logic family with 2.0 ns propagation delays. To fill this requirement, Motorola introduced the MECL 10K series, which has become the industry standard for high-speed applications.

MECL 10KH

Motorola's new MECL 10KH family features 100% improvement in propagation delay and clock speeds while maintaining power supply current equal to MECL 10K. This new MECL family is voltage compensated which allows guaranteed dc and switching parameters over a ±5.0% power supply range.

MECL III

MECL III, with its 1.0 ns gate propagation delays and greater than 1.0 GHz flip-flop toggle rates, remains the industry leader.

SCHOTTKY TTL INTEGRATED CIRCUITS

Low Power Schottky LS TTL has become the industry standard logic in recent years, replacing the original 7400 TTL with lower power and higher speeds. In addition to offering standard LS TTL circuits, Motorola offers the advanced versions of ALS and FAST.

Family Characteristics

LS TTL

The Low Power Schottky (LS TTL) family combines a current and power reduction improvement over standard 7400 TTL by a factor of 5. This is accomplished by using Schottky diode clamping to prevent saturation and advanced processing.

ALS TTL

The Advanced Low Power Schottky TTL family (ALS TTL) provides a 50% power reduction compared to standard 54/74 LS TTL and yet offers improved circuit performance over standard LS due to Motorola's state-of-the-art oxide isolated process (MOSAIC).

FAST TTL

The FAST Schottky TTL family provides a 75–80% power reduction compared to standard Schottky (54/74 S) TTL and yet offers a 20–40% improvement in circuit performance over the standard Schottky due to the MOSAIC process.

The three Schottky TTL families are compared in the table below. Variations are shown for both commercial and military versions within each product family.

Other Logic Families

MHTL Series MC660 — for use in equipment designed for high-noise environments.

MDTL Series MC830/930 — An early logic family manufactured primarily for replacement purposes.

PLL Series — Motorola offers the designer an array of devices to perform phase-locked loop functions, such as phase detectors, dividers, and oscillators. These devices include both TTL and MECL (MC12000/12500) technologies.

SPEED/POWER CHARACTERISTICS FOR (MECL)(1)

(ALL TYPICAL RATINGS)

		MECL 10K				10KH	III	
Characteristic	Symbol	MC101xx	MC102xx	MC105xx	MC106xx	MC10H1xx	MC16xx	Units
Quiescent Supply Current/Gate	I_G	5.0	5.0	5.0	5.0	5.0	10	mA
Power/Gate (Quiescent)	P_G	26	26	26	26	26	54	mW
Propagation Delay	t_p	2.0	1.5	2.0	1.5	1.0	1.1	ns
Speed Power Product	—	52	39	52	39	26	59	pJ
Clock Frequency (D-F/F)	f_{max}	150	225	150	225	300	550	MHz
Clock Frequency (Counter)	f_{max}	150	—	150	—	300	1200	MHz

NOTES: 1. Specifications are shown for the following conditions:
a) V_{EE} = −5.2 Vdc (10K, III), −5.2 Vdc ± 5.0% (10KH)
b) T_A = 25°C
c) C_L = <5.0 pF

SPEED/POWER CHARACTERISTICS FOR SCHOTTKY TTL LOGIC(1)

(ALL TYPICAL RATINGS)

Characteristic	Symbol	LS	ALS	FAST	Units
Quiescent Supply Current/Gate	I_G	0.4	0.2	1.1	mA
Power/Gate (Quiescent)	P_G	2.0	1.0	5.5	mW
Propagation Delay	t_p	9.0	7.0	3.7	ns
Speed Power Product	—	18	7.0	19.2	pJ
Clock Frequency (D-F/F)	f_{max}	33	35	125	MHz
Clock Frequency (Counter)	f_{max}	40	45	125	MHz

NOTES: 1. Specifications are shown for the following conditions:
a) V_{CC} (TTL) = 5.0 Vdc ± 5.0% (DC); 5.0 Vdc (AC);
b) T_A = 25°C
c) C_L = 50 pF for ALS, FAST; 15 pF for LS
2. ( ) Specification for V_{CC} = 5.0 V ± 5.0%

MOTOROLA

SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

BIPOLAR DIGITAL LOGIC FAMILIES

BIPOLAR AND HCMOS MACROCELL ARRAY FAMILIES

The logical approach for proprietary application-specific LSI/VLSI

High Performance ALS-TTL-Compatible Macrocell Arrays

In addition to standard logic lines, Motorola also offers a variety of TTL-compatible Macrocell Arrays. These products provide a means for developing economical custom LSI/VLSI logic circuits. Performance is achieved by the combination of an advanced MOSAIC I (Motorola Oxide-Isolated Self-Aligned Implanted Circuit) oxide isolated bipolar integrated circuit process and a series gated emitter-coupled logic (ECL) macrocell circuit technology. Input and output circuits provide level translation to and from the internal array logic for standard TTL/MOS interface.

ECL 10,000 Macrocell Array Family

The Macrocell Array Concept combines a pre-diffused array of components with computer-aided design techniques to offer system designers a rapid, cost-effective means for implementing semi-custom, high-speed digital logic systems with VLSI circuitry.

Compared with equivalent systems developed with discrete logic (separately packed SSI/MSI logic functions) the high packing density of the Macrocell array chip offers up to 100-to-1 reduction in system component count, with a power dissipation improvement (reduction) of as much as 12 to 1.

MECL Macrocell Array family members presently consist of the MCA1200ECL (68 Pin) Array, the MCA600ECL (28, 40 and 68 Pin) Array, and the MCA2500ECL (149 Pin) Array.

HCMOS Macrocell Array Family

The HCA6300 Series Macrocell Arrays are fabricated using a 3.0 µ silicon gate CMOS dual level metal technology. This technology allows for the high speed performance of Schottky TTL while maintaining the high noise immunity and low power consumption of CMOS.

A macrocell library provides a selection of fully characterized logic functions, similar to an IC data book. Using the library, a designer can draw schematics for LSI macrocell array circuits similar to drawing printed circuit board schematics. The only restrictions are that designs are limited to logic functions that can be implemented using the library, the number of primary cells on the array, and the number of available signal pins.

Motorola's Computer Aided Design system is the engineering design interface between Motorola and customers for developing macrocell circuits (options). Customers can access the CAD system either from terminals at their own location or a Motorola Regional CAD Design Center, in both cases using phone lines or data communication networks. The CAD software contains programs to assist in each stage of option design, as well as special programs to catch syntactical errors or design violations during the design procedure rather than at test.

The CAD system is common to both the HCA6300 Series HCMOS Macrocell Arrays and the MCA II Series Bipolar Macrocell Arrays such that designing with one array is only "cosmetically" different from designing with another. Motorola offers families of ECL, ALS and HCMOS array products so that array size, performance, power dissipation, and package can be optimized to match system requirements.

Compared with gate arrays, the macrocell array approach, which makes use of higher component density and more efficiently designed logic elements (macros), yields a substantial improvement in performance (circuit speed), while a greater utilization of on-chip components reduces potential system costs.

	MCA600ECL	MCA1200ECL	MCA2500ECL	MCA500ALS	MCA1300ALS	MCA2800ALS	MCA2900ETL	HCA6306	HCA6312	HCA6324	HCA6325	HCA6348
Technology	ECL			TTL			ECL/TTL	3-Micron Silicon-Gate HCMOS				
Gate Equivalent	652	1192	2472	533	1280	2720	2958	648	1200	2295	2430	4860
Major Macrocells	24	48	110	24	60	130	130					
Primary Cells								216	400	765	810	1620
Input Ports	46	60	120	43	76	120	70 TTL 120 ECL	2 + 1*	17 + 1*	55 + 1*	11 + 1*	53 + 1*
I/O Ports	18	26	68	15 Output 12 I/O	40	120	40 TTL 48 ECL	35	42	56	80	54
Max. Gate Delay (ns)	1.2	1.2	0.5	3.0	3.0	1.1	1.1	4.5				
Max. Toggle Freq. (MHz)	160	160	300	80	80	125	125	40				
Power Diss. (w) typ.	2.2	4.0	6.5	1.0	1.4	2.5	4	Dependent on the number of outputs switched simultaneously.				
Packages												
Dual In-Line	28,40			28,40,48	40,48			28,40	28,40,48	40,48	40,48	
LCC-Ceramic	68	68		68	68,84	84		28,44	28,44,68	44,68,84,124	44,68,84,124	84,124
Pin Grid Array	72	72	149			149	149		68	68,84,124	68,84,124	84,124
PCC-Plastic								28,44	28,44,68	44,68,84,124	44,68,84,124	84,124
Features												
Temp. Range (Ambient)	0–70°C			0–70°			0–70°C	−40°C to +85°C				
Compatibility	10K,10KH	10K,10KH	10K,10KH 100K	LS TTL	LS TTL	LS TTL	LS TTL 10K,10KH	CMOS/LS TTL				
Design Interface	CAD			CAD			CAD	CAD				
Availability	NOW			NOW			2Q,'84	NOW	1Q,'84	NOW	2Q,'84	NOW

MOTOROLA

SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

VOLTAGE REGULATORS

VOLTAGE REGULATOR SELECTOR GUIDE

Fixed Voltage, 3-Terminal Regulators for Positive or Negative Polarity Power Supplies

V_{out} Volts	Tol.† Volts	I_O mA Max	Device Positive Output	Device Negative Output
2	±0.1	1500	—	MC7902C
5	±0.5	100	MC78L05C	MC79L05C
	±0.25		MC78L05AC	MC79L05AC
		500	MC78M05C	MC79M05C
	±0.4	1500	LM109	—
			LM209	—
	±0.25		LM309	—
	±0.35		MC7805*	—
	±0.25		MC7805B#	—
			MC7805C	MC7905C
	±0.2		MC7805A*	—
			MC7805AC	MC7905AC
	±0.25		LM140-5*	—
	±0.2		LM140A-5*	—
	±0.25		LM340-5	—
	±0.2		LM340A-5	—
	±0.1		TL780-05C	—
	±0.25	3000	MC78T05*	—
			MC78T05C	—
	±0.2		MC78T05A*	—
			MC78T05AC	—
	±0.4		LM123*	—
			LM223	—
	±0.25		LM323	—
	±0.2		LM123A	—
			LM223A	—
			LM323A	—
5.2	±0.26	1500	—	MC7905.2C
6	±0.3	500	MC78M06C	
	±0.35	1500	MC7806*	—
	±0.3		MC7806B#	—
			MC7806C	MC7906C
	±0.24		MC7806A*	—
			MC7806AC	—
	±0.3		LM140-6*	—
			LM340-6	—
		3000	MC78T06*	—
			MC78T06C	—
8	±0.8	100	MC78L08C	—
			MC78L08AC	—
	±0.4	500	MC78M08C	—
		1500	MC7808*	—
			MC7808B#	—
			MC7808C	MC7908C
	±0.3		MC7808A*	—
			MC7808AC	—
	±0.4		LM140-8*	—
			LM340-8	—
		3000	MC78T08*	—
			MC78T08C	—
12	±1.2	100	MC78L12C	MC79L12C
	±0.6		MC78L12AC	MC79L12AC
		500	MC78M12C	MC79M12C
12	±0.6	1500	MC7812*	—
			MC7812B#	—
			MC7812C	MC7912C
	±0.5		MC7812A*	—
			MC7812AC	—
	±0.6		LM140-12*	—
	±0.5		LM140A-12*	—
	±0.6		LM340-12	—
	±0.5		LM340A-12	—
	±0.24		TL780-12C	—
	±0.6	3000	MC78T12*	—
			MC78T12C	—
	±0.5		MC78T12A*	—
			MC78T12AC	—
15	±1.5	100	MC78L15C	MC78L15C
	±0.75		MC78L15AC	MC78L15A
		500	MC78M15C	MC79M15C
		1500	MC7815*	—
			MC7815B#	—
			MC7815C	MC7915C
	±0.6		MC7815A*	—
			MC7815AC	—
	±0.75		LM140-15*	—
	±0.6		LM140A-15*	—
	±0.75		LM340-15	—
	±0.6		LM340A-15	
	±0.3		TL780-15C	—
	±0.75	3000	MC78T15*	—
			MC78T15C	—
	±0.6		MC78T15A*	—
			MC78T15AC	—
18	±1.8	100	MC78L18C	MC79L18C
	±0.9		MC78L18AC	MC79L18AC
		500	MC78M18C	—
		1500	MC7818*	—
			MC7818B#	—
	±0.7		MC7818C	MC7918C
			MC7818A*	—
			MC7818AC	—
	±0.9		LM140-18*	—
			LM340-18	—
		3000	MC78T18*	—
			MC78T18C	—
20	±1.0	500	MC78M20C	—
24	±2.4	100	MC78L24C	MC79L24C
	±1.2		MC78L24AC	MC79L24AC
		500	MC78M24C	
		1500	MC7824*	—
			MC7824B#	—
			MC7824C	MC7924C
	±1.0		MC7824A*	—
			MC7824AC	—
	±1.2		LM140-24*	—
			LM340-24	—
		3000	MC78T24*	
			MC78T24C	

#T_J = −40 to +125°C
*T_J = −55 to +150°C
†Output Voltage Tolerance for Worst Case

MOTOROLA

SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

VOLTAGE REGULATORS

Positive Adjustable Output Regulators

I_O mA Max	Device	Suffix	V_{out} Volts		V_{in} Volts		V_{in} — V_{out} Differential Volts Min	P_D Watts Max		Regulation % V_{out} @ T_A = 25°C Max		TC V_{out} Typ %/°C	T_J = °C Max	Case
			Min	Max	Min	Max		T_A = 25°C	T_C = 25°C	Line	Load			
100	LM317L	H,Z	1.2	37	5.0	40	3.0	Internally Limited		0.04	0.5	0.006	125	29, 79
	LM217L#									0.02	0.3	0.004	150	
	LM117L*											0.003		
150	MC1723	CP	2.0	37	9.5	40	3.0	1.25	—	0.1	0.3	0.003	150	646
		CG						1.0	2.1			0.003		603C
		G										0.002		
		CL						1.5	—			0.003	175	632
		L							—			0.002		
		CD						1.25	—			0.003	150	751A
500	LM317M	T	1.2	37	5.0	40	3.0	Internally Limited		0.04	0.5	0.0056	125	221A
1500	LM317	T	1.2	37	5.0	40	3.0	Internally Limited		0.04	0.5	0.006	125	221A
	LM317	H, K												79, 1
	LM217#											0.004		
	LM117*									0.02	0.3	0.003	150	
3000	LM350	T	1.2	33	5.0	36	3.0	Internally Limited		0.03	0.5	0.008	125	221A
	LM350	K												1
	LM250#									0.01	0.3	0.0057	150	
	LM150*											0.0051		

Negative Adjustable Output Regulators

I_O mA Max	Device	Suffix	V_{out} Volts		V_{in} Volts		V_{in} — V_{out} Differential Volts Min	P_D Watts Max		Regulation % V_{out} @ T_A = 25°C Max		TC V_{out} Typ %/°C	T_J = °C Max	Case
			Min	Max	Min	Max		T_A = 25°C	T_C = 25°C	Line	Load			
500	LM337M	T	−1.2	−37	5.0	40	3.0	Internally Limited		0.04	1.0	0.0048	125	221A
1500	LM337	T	−1.2	−37	5.0	40	3.0	Internally Limited		0.04	1.0	0.0048	125	221A
	LM337	H, K												79, 1
	LM237#									0.02	0.5	0.0034	150	
	LM137*											0.0031		

#T_J = −25 to +150°C
*T_J = −55 to +150°C

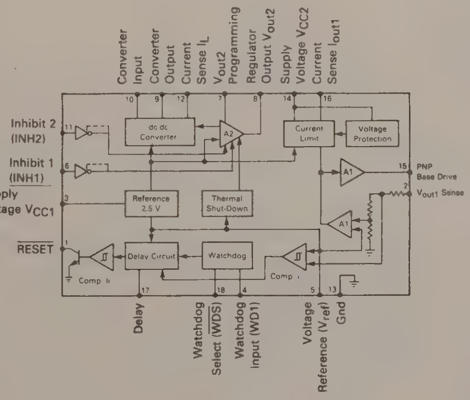
Specialty Regulator

TCA5600
TCF5600

UNIVERSAL MICROPROCESSOR POWER SUPPLY CONTROLLER

The TCA5600, TCF5600 is a versatile power supply control circuit for microprocessor based systems and mainly intended for automotive applications and battery powered instruments. To cover a wide range of applications, the device offers high circuit flexibility with minimum of external components.

Functions included in this IC are a temperature compensated voltage reference, on chip dc/dc converter, programmable and remote controlled voltage regulator, fixed 5.0 V supply voltage regulator with external PNP power device, undervoltage detection circuit, power-on RESET delay and watchdog feature for orderly microprocessor operations.


Converter Input
Converter Output
Current Sense I_L
V_{out2} Programming
Regulator Output V_{out2}
Supply Voltage V_{CC2}
Current Sense I_{out1}
10
9
12
7
8
14
16
Inhibit 2 (INH2)
11
Inhibit 1 (INH1)
6
Supply Voltage V_{CC1}
3
$\overline{RESET}$
1
dc dc Converter
A2
Current Limit
Voltage Protection
A1
15
PNP Base Drive
2
V_{out1} Sense
A1
Reference 2.5 V
Thermal Shut-Down
Delay Circuit
Watchdog
Comp II
Comp I
17
18
4
5
13
Delay
Watchdog Select ($\overline{WDS}$)
Watchdog Input (WD1)
Voltage Reference (V_{ref})
Gnd

APPLICATIONS INCLUDE

- Microprocessor Systems with E^{2}PROMs
- High Voltage Crystal and Plasma Displays
- Decentralized Power Supplies in Computer and Telecommunication Systems

MOTOROLA

SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

VOLTAGE REGULATORS

Switching Regulators

These cost-effective ICs are designed to improve reliability and performance by providing all necessary circuit functions to control various configurations of off-line and dc to dc switching regulators through pulse-width modulation (PWM).

I_O (mA) Max	V_{CC} (Volts)		f_O (kHz)		Device Number	Suffix	T_A (°C)	Case
	Min	Max	Min	Max				
40	10	30	2.0	100	MC3420	P	0 to +70	648
						L		620
					MC3520	L	55 to +125	620
250*	7.0	40	1.0	300	MC34060	P	0 to +70	646
						L		632
					MC35060	L	−55 to +125	632
250	7.0	40	1.0	300	TL494	CN	0 to +70	648
						CJ		620
						IN	−25 to +85	648
						IJ		620
						MJ	−55 to +125	620
250	7.0	>40	1.0	300	TL495**	CN	0 to +70	707
						CJ		726
						IN	−25 to +85	707
						IJ	−25 to +85	726
±400	8.0	40	0.1	400	SG3525A	N	0° to +70	648
					SG3525A	J	0° to +70	620
					SG2525A	N	−40 to +85	648
					SG2525A	J		620
					SG1525A	J	−55 to +125	620
±400	8.0	40	0.1	400	SG3527A	N	0 to +70	648
					SG3527A	J		620
					SG2527A	N	−40 to +85	648
					SG2527A	J		620
					SG1527A	J	−55 to +125	620
±200	8.0	40	0.001	400	SG3526	N	0 to +70	707
					SG3526	J		726
					SG2526	N	−40 to +85	707
					SG2526	J		726
					SG1526	J	−55 to +125	726
1500	5.0	40	1.0	40	µA78S40	PC	0 to +70	648
					µA78S40	DC		620
					µA78S40	DM	−55 to +125	
1500	2.5	40	1.0	40	MC34063	P1	0 to +70	626
					MC34063	U		693
					MC33063	P1	−40 to +85	626
					MC33063	U		693
					MC35063	U	−55 to +125	693

*Single output device
**Internal 39 V zener for <40 volt operation

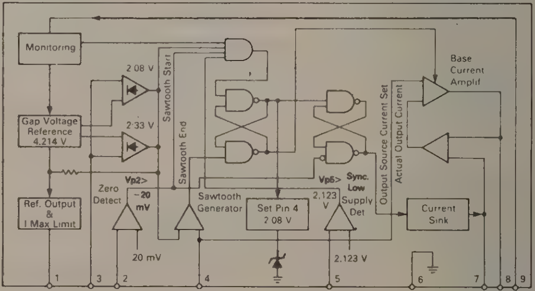
CONTROL IC FOR LINE ISOLATED FREE RUNNING FLYBACK CONVERTER

TDA4600

The bipolar integrated circuit TDA4600 drives, regulates and monitors the switching transistor in power supplies based on the free oscillating flyback converter principle.

Wide regulating range and the high-voltage stability during large load changes provides excellent switch mode performance in hi-fi equipment, active loudspeakers, as well as applications in TV receivers and video recorders.

The TDA4600 is available in a 9-pin SIP plastic medium-power package. The ambient temperature range is from −15°C to +85°C.


Monitoring
Gap Voltage Reference 4.214 V
Ref. Output & I Max Limit
2 08 V
2·33 V
Sawtooth Start
Sawtooth End
Vp2>
Zero Detect
−20 mV
20 mV
Sawtooth Generator
Set Pin 4 2 08 V
Vp5>
Sync. Low
2.123 V
Supply Det
2.123 V
Output Source Current Set
Actual Output Current
Base Current Amplif
Current Sink
1
3
2
4
5
6
7
8
9

MOTOROLA
SEMICONDUCTORS
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

OPERATIONAL AMPLIFIERS

HIGH SLEW RATE, WIDE BANDWIDTH, SINGLE SUPPLY QUAD OPERATIONAL AMPLIFIER

MC34074,A
MC35074,A
MC33074,A

A standard low-cost Bipolar technology with innovative design concepts is employed for the MC34074 series of monolithic quad operational amplifiers. These devices offer 4.5 MHz of gain bandwidth product, 13 V/μs slew rate, and fast settling time without the use of JFET device technology. In addition, low input offset voltage can economically be achieved. Although these devices can be operated from split supplies, they are particularly suited for single supply operation, since the common mode input voltage range includes ground potential (V_{EE}). The all NPN output stage, characterized by no deadband crossover distortion and large output voltage swing, also provides high capacitive drive capability, excellent phase and gain margins, low open-loop high frequency output impedance and symmetrical source/sink ac frequency response.

The MC34074/33074/35074 series of devices are available in standard or prime performance (A Suffix) grades and specified over commercial, industrial/vehicular or military temperature ranges.

TRIMFET is a trademark of Motorola Inc.

Features

- Wide Bandwidth: 4.5 MHz
- High Slew Rate: 13 V/μs
- Fast Settling Time: 1.1 μs to 0.10%
- Wide Single Supply Operating Range: 3.0 to 44 Volts
- Wide Input Common Mode Range Including Ground (V_{EE})
- Low Input Offset Voltage: 2.0 mV Maximum (A Suffix)
- Large Output Voltage Swing: −14.7 V to +14.0 V for V_S = ±15 V
- Large Capacitance Drive Capability: 0 to 10,000 pF
- Low T.H.D. Distortion: 0.02%
- Excellent Phase Margins: 60°
- Excellent Gain Margin: 12 dB

GENERAL OP-AMP SELECTOR GUIDE

General Purpose Op-Amps

Single		Dual	Quad
Compensated	LF351 LF355 LF356 LF357 MC1741 MC34001 TL081	LF353 LM358 MC1458 MC1747 MC3458 MC4558 MC34002 TL082	LF347 LM324 MC3403 MC4741 MC34004 TL084
Uncompensated	LM301A MC1709 MC1748	MC1437	

JFET (BIFET) INPUT — High Impedance		
Single	**Dual**	**Quad**
LF351 LF355 LF356 LF357 MC34001 TL071 TL081	LF353 MC34002 TL072 TL082	LF347 MC34004 TL074 TL084 MC34084 MC34085

Low Noise

Single	Dual	Quad
OP-37 OP-27 TL071	TL072	TL074

High Slew Rate

Slew Rate (V/μs)			
5.0	**8.0 to 20**		**≥ 40**
LF355	LF347 LF351 LF353 LF356 MC1458S MC1741S MC34074 OP-37	MC34001 MC34002 MC34004 TL071 TL072 TL074 TL081 TL082 TL084	LF357 MC34084 MC34085

Programmable

Adjustable bias current varies noise bandwidth, power consumption, etc.

Single
MC1776 MC3476

Low Drift Over Temperature (TCV_{IO})

TCV_{IO} ≤ 5.0 μV/°C Max*	
LM11	LM308A OP-27 OP-37

*Input offset voltage temperature coefficient

Wide Bandwidth

Bandwidth (MHz)				
3.0	**4.0**	**5.0**	**10–20**	**50–100**
MC4558S	MC3401 MC34001 MC34002 MC34004 LM3900	LF356 MC34074	LF357 MC34084 MC34085 OP-27	NE592 MC1733 OP-37

Low Offset Voltage

V_{IO} Max (μV)			
≤ 200	**500**	**2000**	
OP-27 OP-37	LM11C LM308A	MC34001A MC34002A MC34074A	MC1709A LM301A LM308

Single-Supply

Dual	Quad	
LM358 LM2904 MC3458 MC3405	LM324 LM2902 MC3301 MC3401 MC3403 MC34074	LM2900 LM3900

Technology Leadership In Synchro Converters

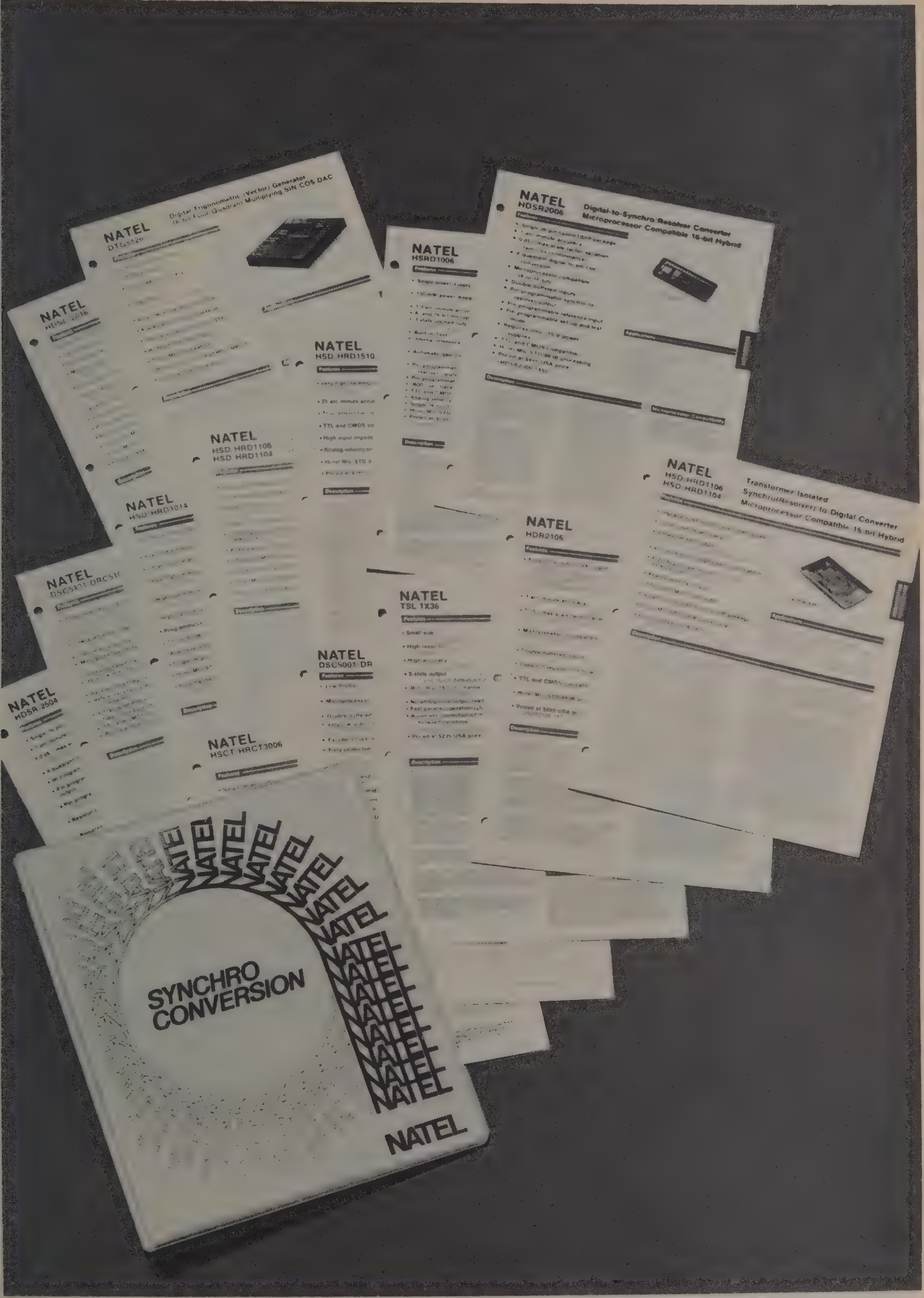
Natel offers the widest selection of synchro-to-digital and digital-to-synchro converters...as well as synchro instrumentation.

And...Natel means more than technological superiority in standard products. It also stands for the best in Custom Hybrids. Our new, expanded, automated, class 10,000 hybrid facility is at your disposal...fully MIL qualified, and ready for volume production.

Call or write for our product line, 3-ring binder and/or our facilities brochure.

N NATEL Engineering Co., Inc.

4550 Runway Street, Simi Valley, CA 93063 (USA)
Phone: (805) 581-3950 TWX: 910-494-1959


NATEL
DTG5126
Digital Trigonometric (Vector) Generator
16 bit Four Quadrant Multiplying SIN COS DAC
NATEL
HDSC 2016
NATEL
HDSR2006
Digital-to-Synchro/Resolver Converter
Microprocessor Compatible 16-bit Hybrid
NATEL
HSRD1006
NATEL
HSD HRD1510
NATEL
HSD HRD1106
HSD HRD1104
NATEL
HSD HRD1014
NATEL
HSD HRD1106
HSD HRD1104
Transformer Isolated
Synchro/Resolver to Digital Converter
Microprocessor Compatible 16 bit Hybrid
NATEL
HDR2106
NATEL
DSC5101 DRC510
NATEL
TSL 1X36
NATEL
DSC5001 DR
NATEL
HDSR 2504
NATEL
HSCT HRCT3006
SYNCHRO
CONVERSION
NATEL

PICONICS

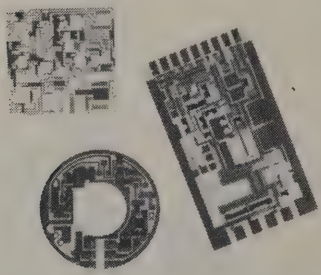
HYBRID MICROCIRCUITS
THICK FILM — THIN FILM — HYBRIDS

Piconics, an innovative microtechnology company has developed an extensive in-house hybrid capability. This capability encompasses hybrid microcircuit design and layout, thick film processing, thin film precision resistor technology and assembly. The assembly area utilizes both chip and wire as well as SMD reflow techniques in both hermetic (parallel seam seal welding) as well as non-hermetic packaging.

Our *in house* Quality Assurance test capability covers hermeticity (gross and fine), shock, vibration, moisture, burn-in, x-ray and most other common military screening tests. Documentation can be provided if necessary.

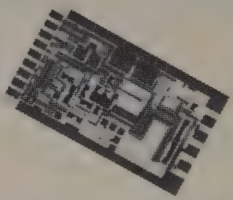
With Piconics full technology in-house options, we can select your hybrid circuit to the most advantageous cost effective production methods.

Our full source capability provides a choice by combining the best features of thick film, thin film and hybrid assembly technologies.



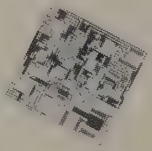
CALL OR WRITE FOR
COMPLETE CATALOG AND
FOR DESIGN/APPLICATION
ENGINEERING SUPPORT.

THICK FILM



FEATURES:
Gold, Platinum Gold, Palladium Silver, Silver Conductors
Solderable, Wire Bondable Conductor
Multi-Layer Capability
Resistor Range: 1 ohm to 100 megohm
Tolerance ta: ± .5% Absolute
Adaptable to Standard Assembly Methods
Glazed or Unglazed Resistor Films
Beryllia Subtrates for Higher Power Available

THIN FILM
PRECISION NICHROME THIN FILM



FEATURES:
Gold Conductors
Passivated or non-passivated
TCR: ± 25 ppm — can be tailored to ± 5 ppm within this range
TC Tracking: 1-2 ppm
Tolerance: ta ± .1% Absolute
(Value Dependent) Ratio to 12 Bit accuracy (.005%)
Noise: <– 35 dB Johnson Noise
Stability: Absolute <.1% with 150°C Bake
<.2% with 200°C Bake
Value Range: 2 ohm to 10 megohm

HYBRID

FEATURES:
Thermosonic Automatic Gold Ball Bonds
Eutectic or Epoxy Chip Mount
SMD Solder Capability
Parallel Seam Seal Welding (Hermetic)
Laser Trim Capability
Full In-House Environmental Lab
Hermeticity, Shock, Vibration, Moisture, X-Ray, etc.

See section 1800 pg. 1A•1277 for your INDUCTOR requirements and section 2700 pg. 1A•1680 for FILTERS.

PICONICS INC. P.O. BOX 387, TYNGSBORO, MA 01879 • TEL: (617) 649-7501 • TELEX: 754759

LINEAR INTEGRATED CIRCUITS

UNITRODE

Pulse Width Modulators

TYPE	Voltage Reference ± 4%	Voltage Reference ± 1%	Soft Start	PWM Latch	Under-Voltage Lockout	Pulse-by-Pulse Current Limiting	Shutdown Terminal	Output Current	Feed Forward	Maximum Frequency Oscillator	Dual Uncommitted Outputs	Single-Ended Output	Totem Pole Outputs	Separate Oscillator Sync Terminal	Adjustable Deadtime Control	Latch Off or Continuous Retry Mode	Double Pulse Suppression	Low Current Start Up	Package
Regulating PWMs UC1524/2524/3524 UC1524/883B	X						X	100mA		300kHz	X								16 Pin DIP
Advanced Regulating PWMs UC1524A/2524A/3524A UC1524A/883B		X		X	X	X	X	200mA		500kHz	X						X		16 Pin DIP
Advanced Regulating PWMs UC1525A/2525A/3525A UC1525A/883B		X	X	X	X		X	100mA 0.4A Pulse		500kHz			X	X	X				16 Pin DIP
Advanced Regulating PWMs UC1527A/2527A/3527A UC1527A/883B		X	X	X	X		X	100mA 0.4A Pulse		500kHz			X	X	X				16 Pin DIP
Advanced Regulating PWMs UC1526/2526/3526 UC1526/883B		X	X	X	X	X	X	100mA		400kHz			X	X	X		X		18 Pin DIP
Regulating PWMs UC493/UC494/		X						200mA		300kHz	X				X		X		16 Pin DIP
UC495																			18 Pin DIP
Advanced Regulating PWMs UC493A/UC493AC UC494A/UC494AC		X			X			200mA		300kHz	X				X		X		16 Pin DIP
UC495A/UC495AC UC495B/UC495BC																			18 Pin DIP
Current Mode PWM Controllers UC1846/2846/3846 UC1846/883B		X	X	X	X	X	X	200mA	X	500kHz			X	X	X	X	X		16 Pin DIP
Current Mode PWM Controllers UC1847/2847/3847 UC1847/883B		X	X	X	X	X	X	200mA	X	500kHz			X	X	X	X	X		16 Pin DIP
Programmable Primary Side PWMs UC1840/2840/3840 UC1840/883B		X	X	X	X	X	X	200mA	X	500kHz		X			X	X	N/A	X	18 Pin DIP
Programmable Primary Side PWMs UC1842/2842/3842 UC1842/883B		X		X	X	X		100mA 1A Pulse	X	500kHz		X			X		N/A	X	8 Pin DIP

UNITRODE CORPORATION • 5 FORBES ROAD
LEXINGTON, MA 02173 • TEL. (617) 861-6540
TWX (710) 326-6509 • TELEX 95-1064

PRINTED IN U.S.A.

UNITRODE

Power Supply Support Functions

TYPE	DESCRIPTION	KEY FEATURES	PACKAGE
UC1543/2543/3543 UC1544/2544/3544	Power Supply Supervisory Circuit, Monitors and Controls Power Supply Output	• Over/Under-Voltage, and Current Sensing Circuits • Programmable Time Delays • SCR "Crowbar" Drive of 300mA • Optional Over-Voltage Latch • Internal 1% Accurate Reference • Remote Activation Capability • Uncommitted Comparator • Inputs for Low Voltage Sensing (UC1544 series only)	16 Pin DIL (1543 Series) 18 Pin DIL (1544 series)
UC1706/2706/3706	Dual High Current MOSFET Compatible Output Driver	• Dual, 1.5A, Totem Pole Outputs • Parallel or Push-Pull Operations • Single-Ended to Push-Pull Conversion • Internal Overlap Protection • Analog, Latched Shutdown • High-Speed, Power MOSFET Compatible • Thermal Shutdown Protection • 5 to 40V Operation • Low Quiescent Current	16 Pin DIL
UC1834/2834/3834	High Efficiency Linear Regulator, Low Input-Output Differential	• Minimum V_{IN}—V_{OUT} less than 0.5V at 5A Load with External Pass Device • Equally Usable for either Positive or Negative Regulator Design • Adjustable Low Threshold Current Sense Amplifier • Under- and Over-Voltage Fault Alert with Programmable Delay • Over-Voltage Fault Latch with 100mA Crowbar Drive Output	16 Pin DIL
UC1901/2901/3901	Isolated Feedback Generator Stable and Reliable Alternative to an Optical Coupler	• An Amplitude-Modulation System for Transformer Coupling an Isolated Feedback Error Signal • Internal 1% Reference and Error Amplifier • Loop Status Monitor • Low-Cost Alternative to Optical Couplers • Internal Carrier Oscillator Usable to 5MHz • Modulator Synchronizable to an External Clock	14 Pin DIL
UC1903/2903/3903	Quad Supply and Line Monitor Precision System	• Monitor Four Power Supply Output Voltage Levels • Both Over- and Under-Voltage Indicators • Internal Inverter for Negative Level Sense • Adjustable Fault Window • Additional Input for Early Line Fault Sense • On Chip, High-Current General Purpose OP-AMP	18 Pin DIL

Functional Circuit

TYPE	DESCRIPTION	KEY FEATURES	PACKAGE
UC1704/3704	Bridge Transducer Switch	• Dual Matched Current Sources • High-Gain Differential Sensing Circuit • Wide Common-Mode Input Capability • Complimentary Digital Open-Collector Outputs • Externally Programmable Time Delay • Optional Output Latch with Reset • Built-in Diagnostic Activation • Wide Supply Voltage Range • High Current Heater Power Source Driver	16 Pin DIL
UC2906/3906	Sealed-Lead Acid Battery Charger	• Optimum Control for Maximum Battery Capacity and Life • Internal State Logic Provides Three Charge States • Precision Reference Tracks Battery Requirements over Temperature • Controls both Voltage and Current at Charger Output • System Interface Functions • Typical Standby Supply Current of only 1.6mA	16 Pin DIL

UNITRODE CORPORATION • 5 FORBES ROAD
LEXINGTON, MA 02173 • TEL. (617) 861-6540
TWX (710) 326-6509 • TELEX 95-1064

PRINTED IN U.S.A.

UNITRODE

Three Terminal Voltage Regulators, Adjustable

TYPE	OUTPUT CURRENT (A)	POLARITY	REGULATED OUTPUT VOLTAGE (V)	PACKAGE
UC117K/LM117K UC217K/LM217K *UC317K/LM317K	1.5A	Pos.	Adjustable from 1.2V to 37V	TO-3 TO-3 TO-3
UC137K/LM137K UC237K/LM237K *UC337K/LM337K	1.5A	Neg.	Adjustable from −1.2V to −37V	TO-3 TO-3 TO-3
UC150K/LM150K UC250K/LM250K *UC350K/LM350K	3.0A	Pos.	Adjustable from 1.2V to 33V	TO-3 TO-3 TO-3

Three Terminal Voltage Regulators, Fixed, Positive

TYPE	OUTPUT CURRENT (A)	POLARITY	REGULATED OUTPUT VOLTAGE (V)			PACKAGE
UC7800AK/LM140AK SERIES *UC7800ACK/LM340AK SERIES	1.5A	Pos.	5V ± 1%	12V ± 1%	15V ± 1%	TO-3 TO-3
UC7800K/LM140K SERIES *UC7800CK/LM340K SERIES	1.5A	Pos.	5V ± 4%	12V ± 4%	15V ± 4%	TO-3 TO-3

Three Terminal Voltage Regulators, Fixed, Negative

TYPE	OUTPUT CURRENT (A)	POLARITY	REGULATED OUTPUT VOLTAGE (V)			PACKAGE
UC7900AK/LM120K SERIES *UC7900ACK SERIES	1.5A	Neg.	−5V ± 1%	−12V ± 1%	−15V ± 1%	TO-3 TO-3
UC7900K SERIES *UC7900CK/LM320K SERIES	1.5A	Neg.	−5V ± 4%	−12V ± 4%	−15V ± 4%	TO-3 TO-3

• Also available in TO-220 package.

Motor Control Circuits

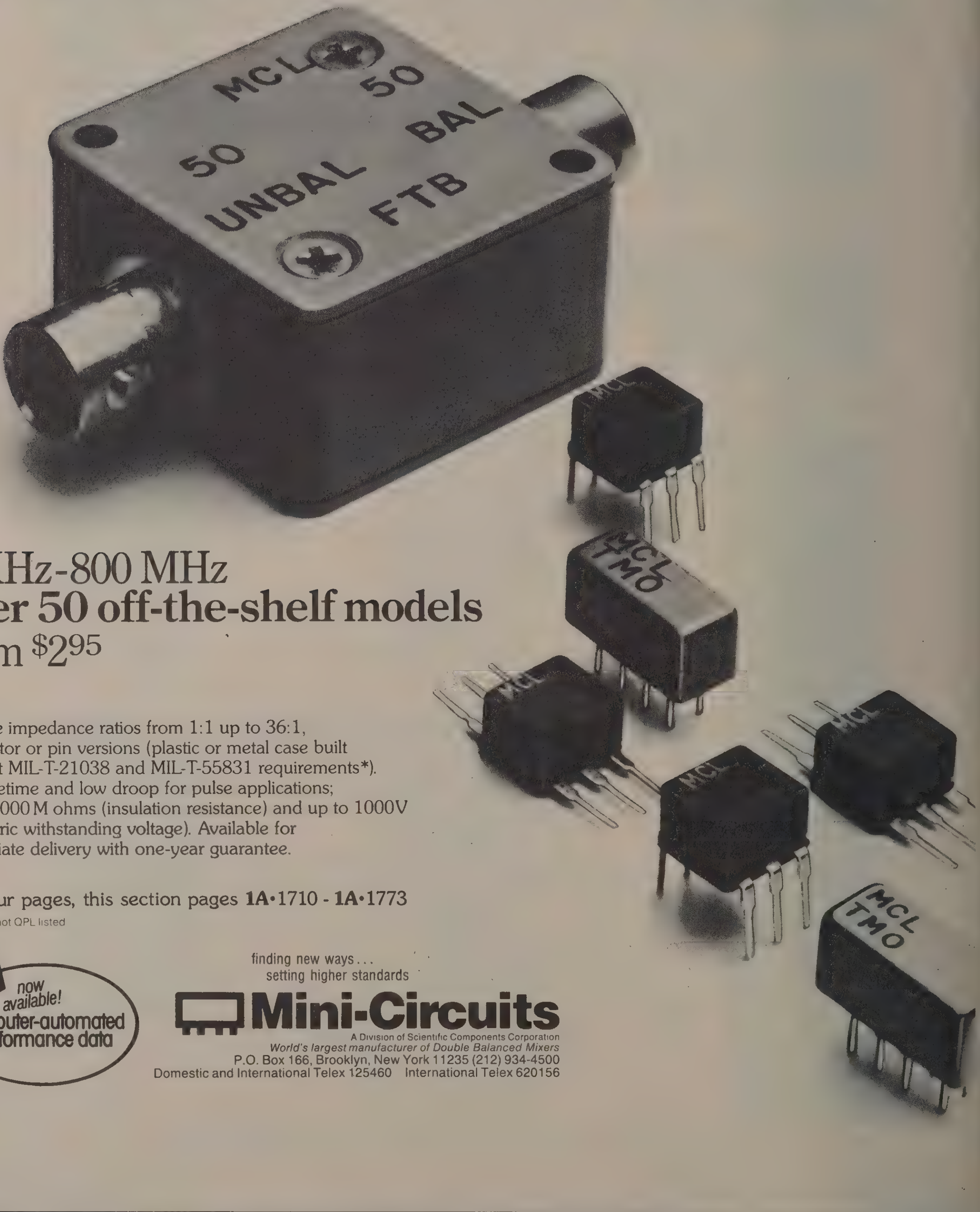
TYPE	DESCRIPTION	KEY FEATURES	PACKAGE
L292	2A, 36V, 30KHz, H-Bridge Motor Driver	• External Loop Adjustment • Single Power Supply (18-36V) • Input Signal Symmetric to Ground • Thermal Protection	15 Pin Power SIP
L293B/293E	Four Channel Push-Pull Drivers for Inductive Loads	• 1A Output per Channel (2A peak non-repetitive) • Supply Voltage to 36V • Inhibiting Facility • Thermal Protection • High Noise Immunity • E-Version Provides for External Emitter Sense Resistors • Compatible with Standard TTL Logic Inputs	L293 16 Pin "Batwing" Dip L293E 20 Pin "Batwing" Dip
L295	Dual PWM Solenoid Driver and Stepper Motor Driver	• 3A Peak Current Per Driver • Supply Voltage to 40V • Current Limiting • Thermal Protection • Compatible with Standard TTL Logic Inputs	15 Pin Power SIP
PIC900 B, C, D	5A; 60V, 80V, 100V H-Bridge Hybrid Circuit	• Designed and Characterized for Inductive Loads as Stepper Motors, DC Motor Drives, Full Bridge DC Converters • Fast Switching Times with Low (5mA) Drive Current • Electrically Isolated 18-Pin Dip with Integral Heat Spreader • Compatible with Automatic Insertion	18 Pin DIL with Integral Heat Spreader
UC1637/2637/3637	Switched Mode Controller for DC Motor Drive	• Single or Dual Supply Operation • ± 2.5 to ± 20V Input Supply Range • ± 5% Initial Oscillator Accuracy; ± 10% Over Temperature • Pulse-by-Pulse Current Limiting • Under-Voltage Lockout • Uncommitted PWM Comparators for Design Flexibility	18 Pin Dip
UC1717/UC3717	Stepper Motor Drive Circuit	• Half-Step and Full-Step Mode • Bipolar Constant Current Chopper Drive • Built-In Protection Diodes (Schottky) • Wipe Range of Current Control 5-1000mA • Wide Voltage Range 10-45V • Designed for Unregulated Motor Supply Voltage • Thermal Overload Protection	16 Pin Dip

Note: U2TA506, 8 & 10 and U2TA606, 8 & 10 TO-92 Darlingtons are appropriate for driving DC brushless motors and other inductive loads.

UNITRODE CORPORATION • 5 FORBES ROAD
LEXINGTON, MA 02173 • TEL. (617) 861-6540
TWX (710) 326-6509 • TELEX 95-1064

PRINTED IN U.S.A.

RF transformers



3 KHz-800 MHz
over 50 off-the-shelf models
from $2^{95}

Choose impedance ratios from 1:1 up to 36:1, connector or pin versions (plastic or metal case built to meet MIL-T-21038 and MIL-T-55831 requirements*). Fast risetime and low droop for pulse applications; up to 1000 M ohms (insulation resistance) and up to 1000V (dielectric withstanding voltage). Available for immediate delivery with one-year guarantee.

See our pages, this section pages **1A**•1710 - **1A**•1773

*units are not QPL listed

CAPD now available! computer-automated performance data

finding new ways...
setting higher standards

Mini-Circuits
A Division of Scientific Components Corporation
World's largest manufacturer of Double Balanced Mixers
P.O. Box 166, Brooklyn, New York 11235 (212) 934-4500
Domestic and International Telex 125460 International Telex 620156

eem selection guide microwave components-3450

Manufacturer	Terminations EEM Page No.	Antenna	Coaxial	Feed-through	RF Switches EEM Page No.	Diodes	Transfer	MIC	Phase Shifters	Mixers	Oscil-lators	RF Relays	Phase Detectors
Applied Research	1A•1687												
Arra, Inc.	1A•1687				1A•1689	●			1A•1689				
Compac	1A•1690		●	●	1A•1691		●					1A•1691	
Daico Industries					1A•1692- 1A•1701	●		●	1A•1699			1A•1697*	
General Microwave					1A•1704	●		●		1A•1704			
JFW Industries	1A•1705				1A•1705								
Kay Elemetrics					1A•1708								
Matrix Systems					1A•1709								
Mini-Circuits					1A•1762 1A•1763	●				1A•1716* 1A•1720- 1A•1737*			1A•1722 1A•1752
North Hills	1A•1774												
Premier Microwave	1A•1775								1A•1775				
Trak Microwave										1A•1780- 1A•1783*	1A•1780- 1A•1783*		
Weinschel Engrg.	1A•1787												

* Mil. Spec.

Manufacturer	Attenuators EEM Page No.	Fixed	Variable	Step	Coaxial	Program-mable	Couplers & Hybrids (Dirct'l.)	Power Dividers (Micro-wave)	(UHF/VHF)	Filters EEM Page No.	Wave-guide	Coax
Applied Research	1A•1687	●					1A•1686*			1A•1686		
Arra, Inc.	1A•1689*	●	●		●		1A•1689	1A•1689		1A•1689	●	●
Compac	1A•1690	●			●							
Daico Industries	1A•1698 1A•1699 1A•1700			● ●	● ●	● ●						
General Microwave	1A•1704*				●	●						
JFW Industries	1A•1705- 1A•1707	●	●		●	●						
Kay Elemetrics	1A•1708		●	●		●						
Mini-Circuits	1A•1762- 1A•1765	●			●	●	1A•1738- 1A•1751*	1A•1738- 1A•1749*	1A•1738- 1A•1749*			
North Hills							1A•1774	1A•1774	1A•1774			
Premier Microwave	1A•1775						1A•1775			1A•1775		
Telonic Berkeley	1A•1777	●		●		●				1A•1777		
Trak Microwave										1A•1783		
Wavetek Indiana	1A•1785	●			●	●				1A•1784*		
Weinschel Engrg.	1A•1787	●	●		●			1A•1787				

* Mil. Spec.

APPLIED RESEARCH Inc.

DEPT. EM, 160 DUPONT STREET, PLAINVIEW, NEW YORK 11803. (516) 349-9200

Over 30 Years as a Supplier to the Military/Industrial RF Markets.

RF FILTERS, MULTIPLEXERS, CONVERTERS, POWER AMPLIFIERS, MULTIPLIERS, SIGNAL SOURCES, MULTICOUPLERS and COMPLETE RF SYSTEMS.

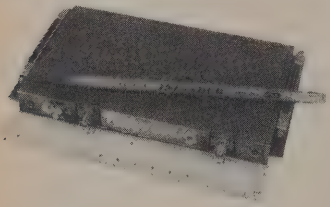
MULTIPLIERS

FREQUENCY GENERATION THROUGH MULTIPLICATION OR PHASE-LOCK TECHNIQUES/VHF to Ku-Band (10 MHz to 1.5 GHz)

Applied Research offers many proven designs using either technique or combinations. And we're capable of meeting your exact requirements, precisely.

Our Phase-lock loops, comprised of I.C. components, together with RF devices, yield outputs of up to 10 watts at microwave frequencies. And our multipliers are available as passive devices or in combination with amplifiers having multiplication factors of from 2 to 2000. In combination with varactor multiplier devices output in Ku-band can be obtained.

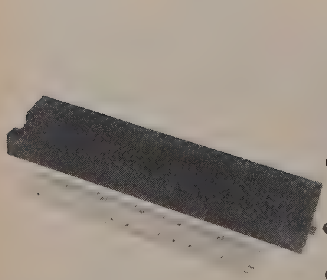
What's more, we can supply crystal oscillators, or internal drivers to provide a self-contained source.



Frequency sources with mutiplication up to 29 and multiples thereof are available deriving signals in the L, S, and C-bands.

ELECTRICAL CHARACTERISTICS (TYPICAL)

- Input Frequency: 100 MHz ±10 MHz
- Output Frequency:
  Type-1, 6400 MHz (X64)
  Type 2, 5800 MHz (X58)
- RF Power
  Input Power: +5 dBm, ±3 dB
  Output Power: +5 dBm, ±2 dBm over temperature
- Discrete spurious outputs: Harmonics below −60 dBc, others at a maximum of −60 dBc.
- Temperature: −54°C to +85°C



ELECTRICAL CHARACTERISTICS
C-BAND PASSIVE BROADBAND HIGH POWER MULTIPLIERS

- Input Power: +40 dBm
  Output Power: +32.6 dBm ±0.5 dB
- Spurious Response: >−70 dBc inband
- Bandwidth: 5.9 to 6.4 GHz

MULTICOUPLERS

Multicoupler Model HFM-2 (TX)-230-8-40 is one of a series of multicouplers designed and manufactured by Applied Research Inc. This model, operating over a frequency range of 2 to 32 MHz, has 8 to 32 independent outputs for inputs of up to +20 dBm.

PERFORMANCE SPECIFICATIONS
Frequency Range: 0.5 to 32 MHz
Number of Outputs: Up to 32
Isolation Between Outputs: To be specified by customer — Up to 70 db.
Overall Gain (Input to Output): 0 dB
Connectors: To be specified by customer.

The HFM Series covers the frequency range of 0.5 MHz to the Telemetery Bands, and has been designed for applications where weight and space are critical such as submarine, shipboard, or mobile installations.

MODEL	NO. OF OUTPUTS	FREQUENCY RANGE
HFM-2(TX)0532 8/40	6 to 32	500 KHz-32 MHz
HFM-2(TX)232 8/40	6 to 32	2 MHz-32 MHz
HFM-2(TX)140 12/40	6 to 32	10 MHz-400 MHz
HFM-2(TX)2410 8/40	6 to 32	20 MHz-1100 MHz
HFM-2(TX)1415 6/50	6 to 32	1400 MHz-1600 MHz
HFM-2(TX)2223 8/50	6 to 32	2200 MHz-2300 MHz
HFM-2(TX)1423 8/50	6 to 32	1400 MHz-2300 MHz

SOLID STATE TRANSMITTERS and POWER AMPLIFIERS in P, L, S and C BANDS.

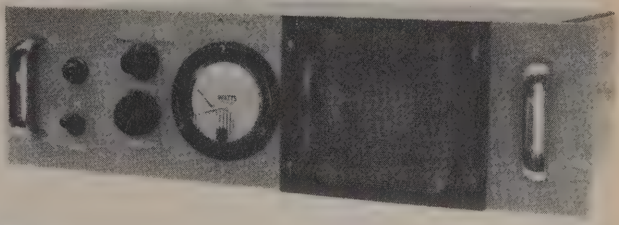
TRANSMITTERS

Transmitter (P/N 504488)

RF OUTPUT
Range: 400-550 MHz
Control: Field Tuneable in 0.5 MHz increments
DC/AC Power: 24-30 volts at 9 amperes/115/230 VAC 5/2 Amps

Stability: ±0.005%
Power: 30 watts, minimum
MODULATION: Frequency Modulation

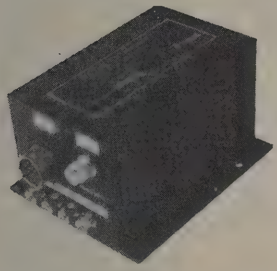
POWER AMPLIFIERS



200 Watt RF Power Amplifier (P/N 504495)

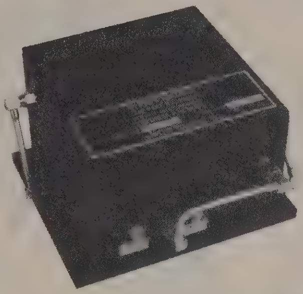
Frequency Range: 400 to 550 MHz

AEROSPACE COMPONENTS



L-BAND TRANSMITTER

Frequency: Tunable, 1650-1670 MHz
Power Output: +28 dBm min.
Modulation: FM; 1-35 KHz
Stability: ±3 MHz
Power Input: +22 to +34 VDC, .75A max.
Weight: 1 kg max.



G-BAND RECEIVER

Frequency: 4.4 to 5.0 GHz*
Stability: ±.005%
Sensitivity: −90 dBm for 10 dB S/N and ±250 KHz deviation
IF Bandwidth: 1 MHz nominal
Power Input: +21 to 30 volts, .75A max.
Weight: 3.5 lbs. max.
* Factory set

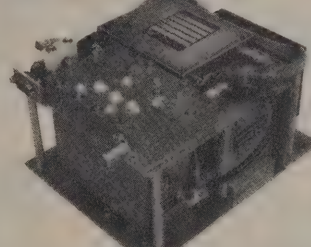
FIXED PAD ATTENTUATORS & TERMINATIONS (DC-2GHz)

FOR TYPES BNC, TNC, C, N, AND OSM CONNECTORS

Integrated line of fixed pad attenuators, terminations, and impedance-matching transformers provides means for rapid and accurate division of voltages over the frequency range of DC-2 GHz, and for the matching of different impedances with minimum loss over a broad frequency band. The unit cost is within the practical price range of the large and small equipment user, as well as the research and experimental user.

GENERAL CHARACTERICTICS
Frequency Range: DC-2 GHz
VSWR: 1.25:1
Attenuation Accuracy:
−0.1 dB +0.3 dB for values of 1 to 12 dB
−0.2 dB +0.5 dB for values of 15 to 20 dB
Impedances (Nominal): 50, 75 90 ohms
Attenuation Values:
1, 2, 3, 4, 6, 10, 12, 15, 20 dB (standard).
Other values up to 30 dB Special

TELEMETRY CONVERTERS



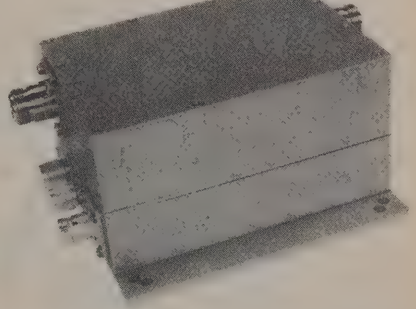
Down converters for military and commercial application are available throughout the frequency range from VHF to K-band. Applied Research manufacturers the filters, oscillator sources, the IF amplifiers, and complete packages that are associated with down converters.

These units permit the ready adapting of existing UHF telemetry receiving equipment for use in the 1435 to 1540 and 2200 to 2300 MHz telemetry band with high conversion gain.

GENERAL CHARACTERISTICS
Long Term Stability: Better than ±.1 PPM over temperature range
Image Rejection: >50 dB
Noise Figure: Better than 5 dB for 100 mc bandwidth (2.2 to 2.3 GHz)

Converters meeting special requirements which include group delay or phase and amplitude characteristics can be designed to meet special needs.

MULTIPLEXERS



State of the Art Multiplexers, applying Applied Research Inc.'s experience in the design and manufacture of NOTCH FILTERS, BANDPASS FILTERS, and BAND REJECT FILTERS allows for the ultimate in performance.

TYPICAL TRIPLEXER CHARACTERISTICS
Frequency Range: 5 kHz to 500 MHz
Frequency Breaks: 500 kHz and 32 MHz
Passband Attenuation: 1.5 dB maximum
Crossover Losses: 4.5 dB maximum
Reject Characteristics: 42 dB minimum, other bands
Ripple: 0.5 dB peak to peak maximum
Impedance: All ports shall be 50 ohms unbalanced
VSWR: 1.5:1 maximum, 2:1 through crossover

APPLIED RESEARCH Inc.

DEPT. EM, 160 DUPONT STREET, PLAINVIEW, NEW YORK 11803, (516) 349-9200

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

ARRA INC.
ANTENNA & RADOME RESEARCH ASSOCIATES

Coaxial • Waveguide • Solid State

microwave

Components • Assemblies • Sub-Systems

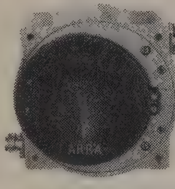
VARIABLE ATTENUATORS DC THRU 18000 MHz

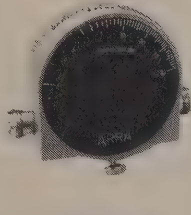
Direct Reading

Low Ins. Loss • 1.5 Max. VSWR • 10 Watts Aver. Power

Freq. Range (GHz)	Atten. Range (dB)	Atten. vs. Freq. (±dB)	Form Type	Model No.
DC-0.1	30	0.5	4450	†0682-30F
DC-0.5	10	0.25	4450	†0682-10G
0.5-1.0	60	1.0	0-214	2952-60
0.5-1.0	100	1.5	0-214	2952-100
0.9-1.3	60	1.0	0-660	2-3952-60
0.9-1.3	100	1.5	0-660	2-3952-100
1.0-2.0	10	1.0	0-1014	3617-10F
1.0-2.0	60	1.0	0-660	3952-60X
1.0-2.0	100	1.5	0-660	3952-100X
1.4-2.4	80	1.25	0-660	3-4952-80
2.0-4.0	10	1.0	0-51	4674-10F
2.0-4.0	20	1.5	0-51	4674-20F
2.0-4.0	30	2.0	0-51	4674-30F
2.0-4.0	60	1.0	0-660	4952-60X
2.0-4.0	100	1.5	0-660	4952-100X
2.5-4.0	10	0.75	0-51	4674-10G
2.5-4.0	20	1.0	0-51	4674-20G
4.0-8.0	10	0.6	0-701-2	5684-10F
4.0-8.0	20	1.0	0-701-2	5684-20F
4.0-8.0**	60	1.0	0-660	5952-60X
4.0-8.0**	100	1.5	0-660	5952-100X
5.4-11.0	10	1.0	0-701-2	5-6684-10F
5.4-11.0	20	1.5	0-701-2	5-6684-20F
7.0-11.0	10	0.5	0-701-2	6684-10F
7.0-11.0	20	1.0	0-701-2	6684-20F
8.0-12.4	10	0.5	0-701-2	6684-10X
8.0-12.4	20	1.0	0-701-2	6684-20X
12.4-18.0	10	0.5	0-701-2	9684-10F
12.4-18.0	20	1.0	0-701-2	9684-20F
12.4-18.0	30	1.0	0-701-2	9684-30F

*See catalog for VSWR, Ins. Loss and Power.
**Only less than octave — consult factory.
†1 Watt Average Power.


Form 0-660: 5″ Dia.
Form 0-214: 6″ Dia.

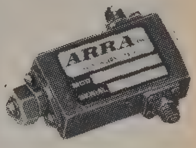

Form 0-701: 3″ Dia.
Form 0-51: 5″ Dia.

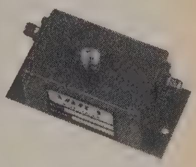
Miniature

0.5 dB Max. Ins. Loss • 5 Watts Aver. 3 KW Peak • 2 Ounces

Freq. Range (GHz)	Atten. Range (dB)	Atten. vs. Freq. (±dB)	Max. VSWR	Form Type	Model No.
DC-0.1	20	0.6	1.3	4242	**0682-20
DC-0.25	15	1.5	1.5	4242	**0682-15
DC-0.5	10	0.25	1.5	4449	**0682-10
1.0-2.0	10		1.8	3651	3814-10
1.5-2.0	15		1.7	3651	3814-15
2.0-4.0	10		1.8	2191	4804-10
2.0-4.0	20		1.5	3651	4814-20
2.5-4.0	10		1.5	2191	4804-10X
4.0-8.0	10		1.5	2191	5804-10
4.0-8.0	20		1.5	2191	5804-20
4.0-8.0	30		1.5	3651	5814-30
6.0-11.0	10		1.5	2191	5-6804-10
6.0-11.0	20		1.5	2191	5-6804-20
6.0-11.0	30		1.5	2191	5-6804-30
6.0-11.0	40		1.5	3651	5-6814-40
8.0-18.0	10	1.5	1.5*	2191	9803-10
8.0-12.4	10		1.5*	2191	6804-10
8.0-12.4	20		1.5*	2191	6804-20
8.0-12.4	30		1.5*	2191	6804-30
8.0-12.4	40		1.5*	3651	6814-40
8.5-10.5	10	0.5	1.5	2191	6803-10A
8.5-10.5	20	0.5	1.5	2191	6803-20A
10.5-12.4	10	0.5	1.6	2191	6803-10B
10.5-12.4	20	0.5	1.6	2191	6803-20B
12.0-18.0	10		1.5	2191	9804-10X
12.0-18.0	20		1.5	2191	9804-20X
12.0-18.0	30		1.7	2191	9804-30X
12.0-18.0	40		1.7	2191	9804-40X
12.0-18.0	10	1.0	1.5	2191	9803-10A
12.0-18.0	15	1.0	1.7	2191	9803-15A

*1.7 VSWR above 11.0 GHz.
**1 Watt Average Power.


Form 2191: 1¾x1x½″
Form 3651: 2x1¼x½″


Form 4242: 2.2x1.37x1.2″

BROADBAND DIODE DEVICES

SP4T

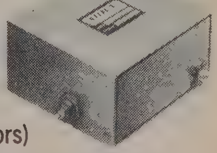
SPST & SPNT Switches

- High Isolation
- Low Insertion Loss
- Integrated Drivers Available

Con-figuration	Freq. Range (MHz)	Switching Time (nsec)	Average Power (Watts)	Model Number With Driver	Model Number Without Driver
SPST	100-18000	50	5	8753-40D	8753-40
SPST	500-18000	10	2	H8753-40D	H8753-40
SPST	200-18000	50	5	8753-80D	8753-80
SPST	500-18000	10	2	H8753-80D	H8753-80
SPDT	2000-18000	2000	2	2-9753R	2-9753
SP3T	2000-18000	2000	2	3-9753R	3-9753
SP4T	2000-18000	2000	2	4-9753R	4-9753

Attenuators & Modulators

- Absorptive for all Values
- Each Model 200-18000 MHz
- Low Insertion Loss
- Integrated Linearized Driver (Attenuators)
- TTL Compatible Driver (Modulators)


Model 8752-30D

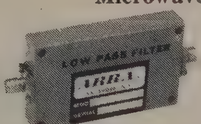
Configuration	Attenuation (dB)	Switching Time	Model No.
Cont. Variable	35	50 μsec	8752-35D
Cont. Variable	65	50 μsec	8752-65D
On/Off	30	20 nsec	8752-30M
On/Off	65	20 nsec	8752-65M

COAXIAL COMPONENTS

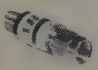
Phase Shifters

DC-18GHz Models

Microwave Filters


.03-18GHz Bandpass & Reject

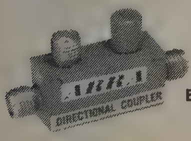
Broadband Fixed Attenuators


DC-18GHz High Power

Broadband Terminations

DC-18GHz High Power

Couplers & Hybrids


Bands from .5-18GHz

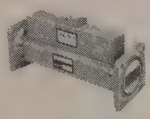
Power Dividers

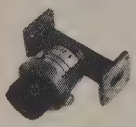
Bands from .25-18GHz

Motorized Variable Attenuators
500 Watt Variable Attenuators . . . Lots More

WAVEGUIDE COMPONENTS & ASSEMBLIES

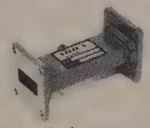
ARRA will fabricate your special waveguide assemblies in any material and finish . . . from the simplest straight section and single bend to complex combinations of bends, miters, twists, etc.

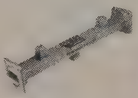

Broadband Diode Switches

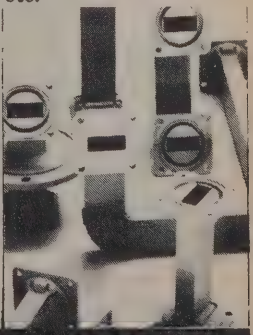

Variable Attenuators

Cross Guide Couplers

Dummy Loads


Fixed Attenuators


Filters



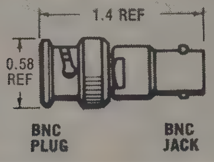
Send for Complete New Catalog

15 Harold Court • Bay Shore, L.I., N.Y. 11706 • Phone: (516) 231-8400 • TWX: 510-227-6231

COMPAC™

COAXIAL ATTENUATORS

BNC / DC TO 2.0 GHz

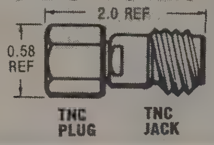


BNC/DC TO 2.0 GHz

Operating Temperature Range:
−55 to +125°C
Total Input Power: 1 watt average
Impedance: 50 ohms
VSWR: DC to 1 GHz 1.2 to 1
1 GHz to 2 GHz 1.4 to 1
Accuracy: DC to 1 GHz ±.5 dB
1 GHz to 2 GHz ±.8 dB

PART NO.	ATTENUATION VALUE
130-1001	1 dB
130-1002	2 dB
130-1003	3 dB
130-1006	6 dB
130-1010	10 dB
130-1020	20 dB
130-1030	30 dB

TNC / DC TO 2.0 GHz

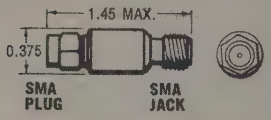


TNC/DC TO 2.0 GHz

Operating Temperature Range:
−55 to +125°C
Total Input Power: 1 watt average
Impedance: 50 ohms
VSWR: DC to 1 GHz 1.2 to 1
1 GHz to 2 GHz 1.4 to 1

PART NO.	ATTENUATION VALUE
130-2001	1 dB
130-2002	2 dB
130-2003	3 dB
130-2006	6 dB
130-2010	10 dB
130-2020	20 dB
130-2030	30 dB

SMA / DC TO 2.5 GHz

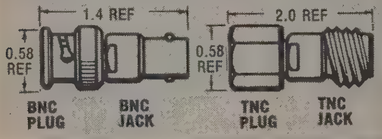


SMA/DC TO 2.5 GHz

Operating Temperature Range:
−20 to +125°C
Total Input Power: 1 watt average
Finish: Passivated Stainless
Accuracy: DC to 1 GHz ±.5 dB
1 GHz to 2.5 GHz ±1 dB
Impedance: 50 ohms
VSWR: DC to 1 GHz 1.2 to 1 Max.
1 GHz to 2.5 GHz 1.4 to 1 Max.

PART NO.	ATTENUATION VALUE
130-3001	1 dB
130-3002	2 dB
130-3003	3 dB
130-3006	6 dB
130-3010	10 dB
130-3020	20 dB
130-3030	30 dB

IMPEDANCE MATCHING PADS

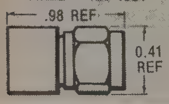


IMPEDANCE MATCHING PADS

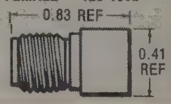
SPECIFICATION	MODEL 130-1050	MODEL 130-2050	MODEL 130-1075	MODEL 130-2075
Frequency Range	DC to 1 GHz	DC to 1 GHz	DC to 1 GHz	DC to 1 GHz
Impedance	50 ohm male 75 ohm female	75 ohm male 50 ohm female	50 ohm male 75 ohm female	75 ohm male 50 ohm female
Attenuation (Loss)	5.7 dB	5.7 dB	5.7 dB	5.7 dB
VSWR (Max)	1.2 to 1	1.2 to 1	1.2 to 1	1.2 to 1
Connections	BNC	BNC	TNC	TNC
Accuracy	±.5 dB	±.5 dB	±.5 dB	±.5 dB

COAXIAL TERMINATIONS

MALE — 120-1001

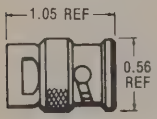


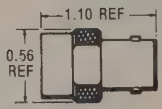
FEMALE — 120-1002



SMA/DC TO 2.5 GHz

SPECIFICATIONS
120-1001/120-1002
Power: 1 watt average
Material: Passivated stainless steel
Impedance: 50 ohm nominal
Temperature Range: −20 to +125°C
VSWR: DC to 2.5 GHz 1.2 to 1 maximum

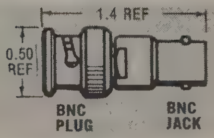




BNC

SPECIFICATIONS
Power: 1 watt average
VSWR: 1.1 to 1 maximum
DC to 2 GHz — 50 ohms
Male: 120-1003
Female: 120-1004
DC to 1 GHz — 75 ohms
Male: 120-1005
Female: 120-1006

FEED-THRU TERMINATIONS



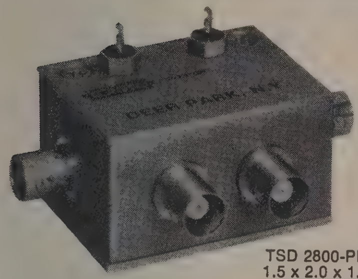
	MODEL 120-1007	MODEL 120-1008
Power	1 watt average	1 watt average
Ohms	50	75
Frequency	DC to 1000 MHz	DC to 500 MHz
VSWR	DC to 500 MHz 1.1 to 1/500 to 1000 MHz 1.2 to 1	1.2 to 1

All dimensions in inches.
Additional products which do not appear on this page can be designed to meet your requirements.

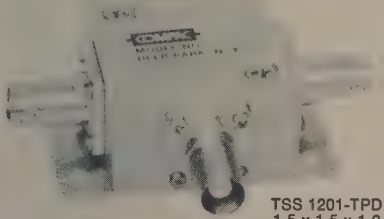
COMPAC
279 SKIDMORE ROAD
DEER PARK, NEW YORK 11729
TELEPHONE 516/667-3933
TWX 510-227-1064

COMPAC™

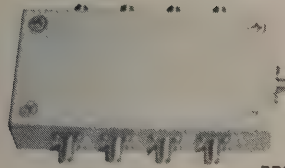
RF RELAYS & TRANSFER SWITCHES



TSD 2800-PD
1.5 x 2.0 x 1.2



TSS 1201-TPD
1.5 x 1.5 x 1.2
ext. cover 1.5 x 2.25

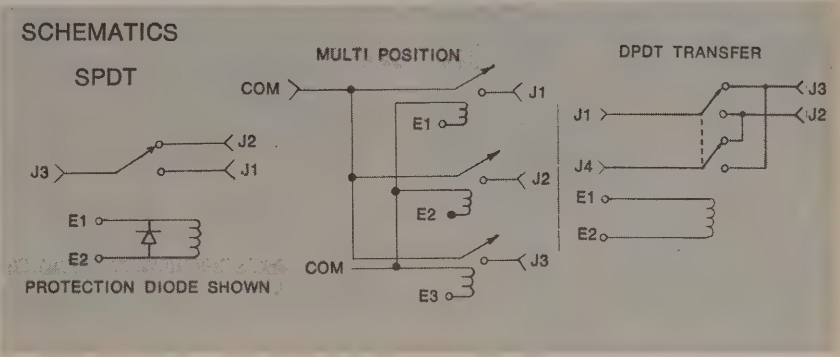


PR8-2831-TTLF
3.0 x 5.0 x 1.5
ext. cover 3 x 5.75

Single Pole 2 to 16 Position
Double Pole Double Throw Transfer
Signal and Power Lever Units

- ☐ Lightweight
- ☐ Low Cost
- ☐ Small Size

Also Available:
Custom Power Attenuators, Power Terminations, Flange mounted, no air flow required
50 — 800 watts
DC — 1 GHz



SPECIFICATIONS:

	Signal Level	Power Level
Frequency Range	DC-500 MHz	DC-400 MHz
Power Level	1 Watt	75 Watts
VSWR	1.2 Typ.	1.3 Typ.
Isolation	40 dB	35 dB
Insertion Loss	0.3 dB	0.2 dB
Switching Speed	10 m Sec	15 m Sec

DETAILED SPECIFICATIONS UPON REQUEST

HOW TO ORDER

TS 4—28 0 1—TPD

SWITCH TYPE
TS — Signal
PR — Power

SWITCH CONFIGURED
D — Transfer
S — SPDT
3-16 — Multi Position

COIL VOLTAGE
05, 06, 12, 18, 24, 28

CONNECTOR TYPE
0 - BNC
1 - SMA
2 - TNC
3 - N

MOUNTING
0 - Flush
1 - Extended Flange

OPTIONS
T — Termination 50 ohm ⅛W STD
PD — Protection Diode POS COM STD
TTL — TTL Interface Active High STD
C — DC Connector D Submin Type STD
L — Latching
F — Failsafe
SPECIAL CONFIGURATIONS
Other Options Available

* OTHER OPTIONS AVAILABLE. CONSULT FACTORY *

COMPAC
279 SKIDMORE ROAD
DEER PARK, NEW YORK 11729
TELEPHONE 516/667-3933
TWX 510-227-1064

DAICO

MIC SWITCHES

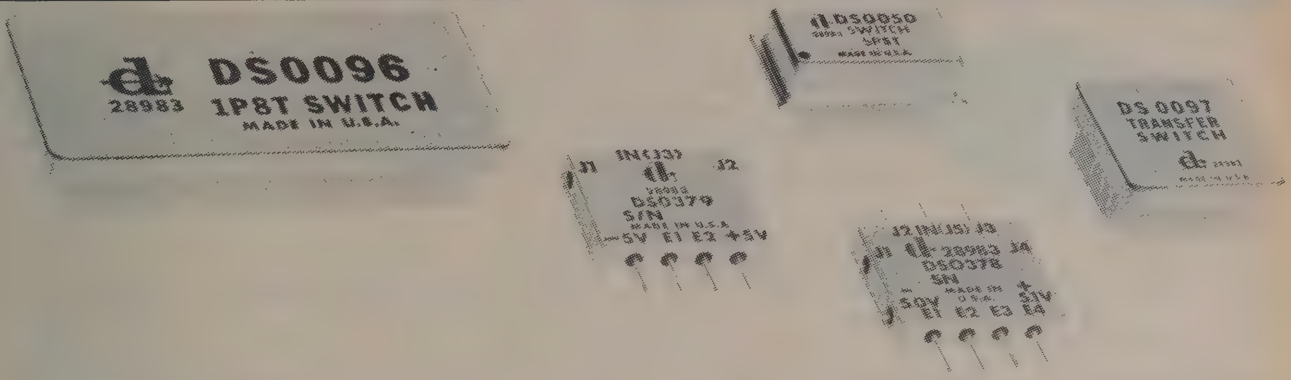
The M.I.C. (Microwave Integrated Circuits) Switches are built utilizing Daico's inhouse Hi-Rel Thin Film Technology, which provides excellent stability over temperature extremes. All switches are encased in shielded hermetic enclosures providing maximum protection to the circuitry with minimum RF leakage. The switches include drivers compatible with TTL or CMOS. Frequency ranges from DC-6000 MHz with isolation over 75 dB are available.

Spec. Frequency MHz	Usable Frequency MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Package
SPST												
3-150	3-150	DS0111	0.025	40	1.0	+6	1.25	+5	90	TTL	50	14 Pin DIP
10-200	5-400	DS0050	0.025	50	1.5	+10	1.25	+5	100	TTL	50	14 Pin DIP
10-200	10-300	DS0235	0.025	60	2.5	+16	1.25	+5	230	TTL	50 or 93	.750 Sq. 14 Pin
100-500	70-700	DS0141	0.025	50	3.0	+17	1.4	+5	200	TTL	Open	14 Pin DIP
400-450	100-1000	DS0411	0.5	60	1.2	+13	1.25	+5	110	TTL	50	14 Pin DIP
DUAL SPST												
45-75	10-1000	DS0343	1.	50	1.5	+10	1.4	+5 -5.2	55 40	TTL	50	.800 Sq. 14 Pin
460-500	70-700	DS0321	1.	60	1.5	+10	1.4	+5 -5	55 40	TTL	50	.800″ Sq. 14 Pin
3-SPST												
10-500	10-700	DS00031	2.	50	1.0	+13	1.25	+5	110	TTL	Open	.380 x .655 22 Lead Planar
SP2T												
1-100	1-150	DS0042-10	0.04	60	1.0	+6	1.25	+5	100	TTL	Open	14 Pin DIP
3-300	1-500	DS0252	0.015	45	1.5	+10	1.25	+5	170	TTL	50	14 Pin D DIP
5-500	5-500	DS0386	20.	60	1.0	+10	1.25	+15	15	CMOS	50	14 Pin DIP
5-1500	5-1500	DS0074	5.	35	1.5	+5	1.25	+12	4.5	CMOS	Open	14 Pin DIP
8-180	8-500	DS0175	100.	45	1.4	+0	1.25	+15	5	CMOS	50	14 Pin DIP
10-150	10-500	DS0082	0.3	50	1.0	+0	1.3	+5	70	TTL	50	14 Pin DIP
10-200	10-300	DS0042-100	0.04	60	1.5	+6	1.4	+5	100	TTL	Open	14 Pin DIP
10-350	10-500	DS0108	0.03	25	1.5	+15	1.25	+5	180	TTL	50 or Ground	14 Pin DIP
20-80	10-500	DS0397	5.	55	0.8	+20	1.25	+15	14	TTL	50	14 Pin DIP
20-500	10-500	DS0047	1.	40	1.0	+10	1.18	+5 -5	40 30	TTL	50	14 Pin DIP
20-80	10-500	DS0112	5.	55	0.8	+20	1.25	+15	30	TTL	50	14 Pin D DIP
20-180	10-500	DS0152	100.	40	0.7	+15	1.25	+15	8	CMOS	Open	TO-8
20-300	20-500	DS0158	0.03	25	1.25	+15	1.25	+5	130	TTL	50 or Ground	14 Pin DIP
20-1000	10-1000	DS0052	1.	30	2.0	+10	1.25	+5 -5	25 15	TTL	50	14 Pin DIP
20-2000	20-2000	DS0352	1.	30	2.5	+10	1.5	+5 -5	25 15	TTL	50	14 Pin DIP
30-85	30-85	DS0024	15.	75	1.5	+10	1.2	+12	4	CMOS	Open	14 Pin DIP
40-200	30-300	DS0022	0.2	45	1.0	+10	1.2	+5	40	TTL	Open	14 Pin DIP
50-90	10-100	DS0083	5.	60	1.2	+15	1.25	+15	5	CMOS	75	14 Pin DIP
50-140	10-500	DS0164	15.	45	0.7	+16	1.2	+15 -15	15 15	TTL	50	.375 x .655 22 Lead Planar
50-300	50-500	DS0075	5.	50	1.2	+20	1.25	+15	5	CMOS	50	14 Pin DIP
60-1500	40-1500	DS0068	20.	40	1.3	+10	1.25	+12	8	CMOS	Open	14 Pin DIP
70-1000	10-1000	DS0320	0.2	40	3.	+10	1.5	+5	225	TTL	Ground	18 Pin D DIP
100-500	70-700	DS0142	0.025	45	2.5	+17	1.5	+5	200	TTL	Open	16 Pin D DIP
160-500	160-500	DS0271	2.	50	1.2	+10	1.25	+5 -5	11 6	TTL	50	14 Pin DIP .400 Pin Row
225-400	225-400	DS0332	0.1	40	1.5	+10	1.3	+5	100	TTL	50	14 Pin DIP .400 Pin Row
225-400	225-800	DS0342	6.	60	0.5	+10	1.25	+5 -3	35 15	TTL	Ground	14 Pin DIP
250-450	10-500	DS0229	2.	60	1.0	+10	1.25	+5 -5	40 25	TTL	Open	14 Pin DIP .400 Pin Row
345-425	300-700	DS0189	10.	40	1.0	+15	1.2	+15	8	CMOS	Open	TO-8
490-590	70-700	DS0322	1.	60	1.5	+15	1.4	+5 -5	35 20	TTL	50	.800″ Sq. 14 Pin
500-2000	400-2000	DS0257	0.4	35	1.5	+10	1.4	+5 -5	25 25	TTL	50	14 Pin DIP .400 Pin Rows
1197-1605	600-3000	DS0292	2.	60	2.	+10	1.4	+5 -5	10 10	TTL	50	18 Pin D DIP
1900-4100	1000-5000	DS0379	0.5	50	1.2	+10	1.6	+5 -5	25 18	TTL	Ground	.625 x .750 Planar

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

MIC SWITCHES

DAICO

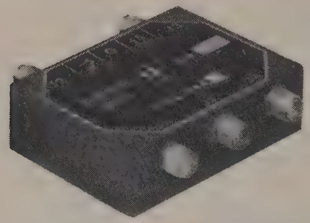


Spec. Frequency MHz	Usable Frequency MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Termination Ohms	Package
								Volts	mA			
DUAL SP2T												
10-100	10-200	DS0241	0.05	40	0.8	+10	1.15	+5	200	TTL	50 or Ground	16 Pin D DIP
20-60	10-500	DS0020	100.	50	1.0	+10	1.25	+15	4	CMOS	Open	16 Pin DIP
20-300	10-500	DS0043	50.	30	1.0	+10	1.25	+15	8	CMOS	Open	16 Pin DIP
20-750	20-750	DS0017	1.	30	1.3	+10	1.5	+5	120	TTL	Open	16 Pin DIP
SP3T												
20-80	20-250	DS0113	5.	55	0.8	+20	1.25	+15	40	TTL	Open	14 Pin DIP .400 Pin Row
50-500	30-700	DS0073	2.	40	1.0	+10	1.25	+15	5	CMOS	50	.8 Sq. 24 Pin Plug In
250-460	100-600	DS0233	1.	35	1.2	+20	1.25	+15	5	CMOS	50	.8 Sq. 24 Lead Plug In
250-500	250-500	DS0270	2.5	45	0.8	+10	1.25	+15	5	CMOS	50	.8 Sq. 24 Lead Plug In
2700-5000	2000-6000	DS0433	0.5	60	1.5	+10	1.6	+5 -5	40 30	TTL	Ground	.625 x .750 Planar
SP4T												
DC-12	DC-20	DS0294	10.	50	1.2	+20	1.4	+10 -5	7 5	TTL	Open	18 Pin D DIP
10-500	10-500	DS0085	35.	25	0.8	+10	1.2	+15	6	CMOS	50	14 Pin DIP .400 Pin Row
10-100	10-150	DS0033	0.2	50	0.6	+10	1.25	+5	160	TTL	50	.8 Sq. 24 Lead Plug In
10-100	10-500	DS0221	20.	35	1.0	+27	1.2	+5 -15	60 50	TTL	Ground	16 Pin D DIP
10-100	10-500	DS0222	20.	35	1.0	+27	1.2	+5 -15	60 50	TTL	Ground	16 Pin D DIP
50-70	20-500	DS0078	1.	60	1.0	+23	1.2	+5 -12	10 10	TTL	50	.8 Sq. 24 Lead Plug In
159-209	30-400	DS0014	0.5	45	1.0	+10	1.25	+5 -5	35 30	TTL	50	1″ Sq. 13 Lead Planar
225-400	225-400	DS0304	0.1	40	1.5	+10	1.3	+5	135	TTL	50	24 Pin D DIP
200-1500	200-1500	DS0069	20.	20	1.1	+10	1.25	+12	5	CMOS	Open	.8 Sq. 24 Lead Plug In
300-550	300-700	DS0354	2.	60	1.5	+30	1.25	+15 -15	50 75	TTL	50	1.036 x 1.925 34 Lead Planar
130-570	50-500	DS0362	1.	50	1.5	+15	1.4	+5 -5.2	75 45	TTL	50	24 Pin D DIP
500-2000	500-2000	DS0259	0.4	35	1.5	+10	1.4	+5 -5	45 25	TTL	50	24 Pin D DIP
1900-4100	1000-5000	DS0378	0.5	50	1.2	+10	1.6	+5 -5	40 30	TTL	Ground	.625 x .750 Planar
SP5T												
645-795	10-800	DS0347	1.	40	1.5	+10	1.3	+5 -5.2	65 40	TTL	50	38 Pin DIP .800 Pin Row
20-300	10-700	DS0028	1.	40	1.0	+10	1.3	+5 -5	20 80	TTL	50	24 Pin D DIP
130-180	30-300	DS0018	100.	40	1.0	+10	1.25	+5	10	CMOS	50	24 Pin D DIP
SP6T												
400-450	200-500	DS0208	0.1	36	2.5	+15	1.5	+5	400	TTL	Ground	38 Pin DIP .800 Pin Row
SP7T												
100-400	30-500	DS0137	100.	40	1.5	+10	1.5	—	—	—	Open	16 Pin D DIP
SP8T												
20-1200	20-1200	DS0328	20.	40	1.5	+10	1.35	+5 -15	40 15	CMOS	Ground	38 Pin DIP .800 Pin Row
25-520	10-700	DS0338	10.	40	1.5	+10	1.35	+12	6	CMOS	50	38 Pin DIP .800 Pin Row
DUAL BY PASS												
450-550	30-700	DS0079	5.	25	1.7	+10	1.25	+15	6	CMOS	N/A	14 Pin DIP
TRANSFER												
15-45	10-500	DS0097	10.	50	1.0	+10	1.25	+5	20	CMOS	N/A	.8 Sq. 24 Lead Plug In
50-100	10-500	DS0110	10.	50	1.0	+5	1.15	+12	30	CMOS	N/A	.8 Sq. 24 Lead Plug In
70-1000	50-1000	DS0319	10.	40	1.5	+10	1.3	+15	15	CMOS	N/A	18 Pin D DIP

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

DAICO

CONNECTORIZED SOLID STATE RF SWITCHES



The Solid State Connectorized Switches are available with SMA connectors. Units with BNC, TNC or N type connectors are offered on special order. Frequency ranges from DC-2000 MHz with switching speeds from 15 nano-seconds are obtainable. Switches with RF peak power to 3000 watts with reduced switching speed are also available.

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Termination Ohms	Connector	Size
								Volts	mA				
SPST													
30-300	5-400	100D0581	2.	50	0.5	+10	1.25	+ 5 - 5	45 15	TTL	50	SMA	1 x 1.5 x .675
10-200	5-300	100C1041	0.025	50	1.5	+10	1.25	+ 5	100	TTL	50	SMA	2 x 1.5 x .5
10-500	10-500	100D0801	0.8	60	1.2	+10	1.5	+ 5 - 5	75 45	TTL	50 or open	SMA	1.5 x 1.5 x .69
15-1000	15-1000	100C1291	20.	60	1.5	+22	1.5	+10	3	CMOS	50	SMA	1 x 1.5 x .9
20-300	20-800	100D0591	4.	50	0.7	+27	1.25	+15 -15	60 50	TTL	50	SMA	1 x 1.5 x .675
20-300	10-200	100C1051	0.035	55	2.0	+10	1.4	+ 5	200	TTL	50	SMA	2 x 2 x .48
20-600	10-600	100C1281	0.5	70	1.3	+13	1.25	+ 5	75	TTL	50	SMA	1 x 1.5 x .72
300-350	100-500	100C1570	0.05	90	3.	+10	1.4	+ 5	270	TTL	50	SMA	1.5 x 2 x .54
SP2T													
DC-50	DC-50	100C1562	2.	65	2.5	+25	1.35	+15 -15	10 20	TTL	50	SMA	2 x 3 x 1
1-100	1-100	100C1042	0.015	60	0.8	+ 8	1.2	+ 5	130	TTL	Open	SMA	1.5 x 1.5 x .5
2-500	2-600	100C1052	0.04	40	1.5	+10	1.4	+ 5	160	TTL	50	SMA	2 x 2 x .48
30-300	10-300	100D0582	2.	50	1.0	+10	1.25	+ 5 - 5	45 15	TTL	50	SMA	1 x 1.5 x .675
10-500	5-600	100D0802	0.8	70	1.0	+10	1.2	+ 5 - 5	40 25	TTL	50	SMA	2 x 1.5 x .68
10-700	10-1000	100C1172	5.	50	1.2	+20 Over 100 MHz	1.25	+15	20	CMOS	50	SMA	2 x 2 x .48
20-2000	20-2000	100C1558	1.	20	2.5	+10	1.5	+ 5 - 5	25 15	TTL	50	SMA	1.5 x 2 x .44
10-1000	10-1000	100C1182	10.	35	1.0	+15	1.25	+15	5	CMOS	50	SMA	2 x 2 x .48
15-1000	15-1000	100C1292	20.	60	1.5	+22 Over 80 MHz	1.5	+15	3	CMOS	50	SMA	1.5 x 1.5 x .6
20-300	20-800	100D0592	4.	55	0.7	+27	1.25	+15 -15	60 50	TTL	50	SMA	1.5 x 1.5 x .78
20-600	10-700	100C1282	0.5	70	1.2	+10	1.25	+ 5	50	TTL	50	SMA	1.5 x 1.5 x .6
40-1000	30-1000	100D1102-HF	5.	35	1.2	+10	1.25	+12	10	CMOS	50	SMA	2 x 2 x .48
10-500	10-700	100D1102-LF	10.	50	1.0	+10	1.25	+12	10	CMOS	50	SMA	2 x 2 x .48
150-1500	100-2000	100C1244	1.	45	0.5	+30	1.3	+ 5 +15 -15	60 25 25	TTL	Ground	SMA	2.75 x 1.75 x 1
500-2000	300-2000	100C1515	0.4	35	1.5	+10	1.4	+ 5 - 5	25 25	TTL	50	SMA	1.5 x 1.5 x .625
SP3T													
1-30	1-30	100C0624	5.	65	0.5	+10	1.25	+ 5 -15	60 30	TTL	50	SMA	1.5 x 1.5 x .675
30-300	5-800	100D0583	2.	50	0.5	+10	1.25	+ 5 - 5	65 40	TTL	50	SMA	1.5 x 1.5 x .675
10-500	10-700	100D0803	0.8	70	1.2	+10	1.5	+ 5 - 5	100 100	TTL	50	SMA	2.5 x 1.3 x .67
15-1000	10-1000	100C1293	20.	60	1.5	+22 Over 80 MHz	1.5	+15	3	CMOS	50	SMA	2 x 1.5 x .72
20-300	20-800	100D0593	4.	55	0.7	+27	1.25	+15 -15	75 50	TTL	50	SMA	2 x 1.5 x .68
20-600	10-700	100C1283	0.5	70	1.3	+10	1.25	+ 5	170	TTL	50	SMA	2 x 1.5 x .72
250-1150	200-1500	100C1204	10.	65	1.0	+10	1.25	+ 5 - 5	40 45	TTL	50	SMA	3 x 3 x 1
SP4T													
DC-12	DC-20	100C1526	10.	50	1.2	+20	1.4	+10 - 5	7 5	TTL	Ground	SMA	2 x 3 x .54
1-32	.1-32	100C1684	50.	75	2.5	+27	1.2	+15 -15 + 5	20 20 350	TTL	50	SMA	3.75 x 2 x 1.34
1-100	1-200	100C1021	10.	80	0.6	+ 5	1.2	+ 5 - 5	200 50	TTL	50	SMA	3 x 3 x 1.03
30-300	5-500	100D0584	2.	50	0.5	+10	1.3	+ 5 - 5	75 75	TTL	50	SMA	2 x 1.5 x .68

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

CONNECTORIZED SOLID STATE RF SWITCHES

DAICO

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss- dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Termination Ohms	Connector	Size
								Volts	mA				
SP4T (Continued)													
10-500	10-700	100D0804	0.8	70	1.6	+10	1.2	+5 -5	80 150	TTL	50	SMA	3 x 1.75 x .67
10-1000	10-1000	100C1449	10.	50	1.5	+15	1.3	+5 -5	100 100	TTL	50	SMA	3 x 3 x 1.125
15-1000	10-1000	100C1294	20.	55	1.5	+22 Over 80 MHz	1.5	+10	3	CMOS	50	SMA	3 x 1.75 x .6
20-80	10-700	100D1304	4.	90	1.5	+20	1.3	+5 +15	25 30	TTL	50	SMA	3 x 1.79 x .95
20-600	10-600	100C1284	0.5	70	1.4	+10	1.25	+5	130	TTL	50	SMA	3 x 1.75 x .6
20-300	20-300	100D0594	4.	60	0.7	+27	1.25	+12 -12	130 100	TTL	50	SMA	2.5 x 1.5 x .69
500-2000	300-2000	100C1514	0.4	35	1.5	+10	1.4	+5 -5	45 25	TTL	50	SMA	2 x 1.5 x .625
DP4T													
20-200	10-200	100C1024	0.05	55	0.5	+10	1.25	+5	150	TTL	Open	SMA	3 x 1.5 x .67
SP5T													
2-32	1-200	100C1215	110.	45	0.7	+17	1.5	+12 +5	220 20	TTL	50	BNC	5 x 3 x 1.375
30-300	5-400	100D0585	2.	50	0.5	+10	1.3	+5 -5	125 75	TTL	50	SMA	2.5 x 1.5 x .675
15-1000	10-1500	100C1295	20.	50	1.5	+22 Over 80 MHz	1.5	+15	3	CMOS	50	SMA	3.5 x 1.75 x .6
20-500	15-500	100D0805	1.	80	1.3	+10	1.3	+5 -5	40 50	TTL	50	SMA	3.5 x 1.75 x .67
20-500	20-500	100D0970	2.	40	1.0	+20	1.5	+5 -5	150 20	TTL	50	SMA	2.5 x 1.5 x .675
20-600	10-700	100C1285	0.5	60	1.8	+10	1.35	+5	175	TTL	50	SMA	3.5 x 1.75 x .6
SP6T													
30-300	5-500	100D0586	2.	50	.8	+10	1.4	+5 -5	150 90	TTL	50	SMA	3 x 1.5 x .675
10-500	10-500	100D0826	4.	70	2.0	+30	1.5	+15 -15	85 260	TTL	50	SMA	4.5 x 2.5 x .95
10-1000	10-1000	100C1448	10.	45	2.5	+15	1.3	+5 -5	200 150	TTL	50	SMA	5 x 4 x 1.3
15-1000	10-1000	100C1296	20.	50	1.8	+22 Over 100 MHz	1.4	+15	20	CMOS	50	SMA	4 x 1.75 x .6
20-600	20-600	100C1286	0.5	70	2.	+10	1.25	+5	250	TTL	50	SMA	4 x 1.75 x .6
SP8T													
4-6	1-40	100C1348	0.9	60	1.5	+ 3	1.25	+5	400	TTL	50	SMA	5 x 2.5 x 1
10-350	10-500	100C1188	5.	70	1.3	0	1.5	+5 -5	200 300	TTL	50	SMA	6 x 3 x .63
50-750	10-1000	100C1560	20.	65	2.	+15	1.4	+15	22	CMOS	50	SMA	3.13 x 5.8 x .84
SP12T													
15-500	10-700	100D1450	10.	55	2.0	+15	1.3	+5 -5	300 150	TTL	50	SMA	5 x 3 x 3.75
SP14T													
2-32	1-40	100D1247	20.	40	1.2	+10	1.35	+5	1.5A	TTL	50	BNC	12 x 6 x 1.12
SP16T													
10-1000	10-1000	100D1447	10.	45	3.0	+15	1.3	+8 -8	300 150	TTL	50	SMA	5 x 3 x 3.75
TRANSFER													
30-300	1-600	100C0587	2.	50	0.8	+10	1.3	+5 -5	90 90	TTL	N/A	SMA	2 x 1.5 x .94
15-1000	10-1000	100C1297	20.	70	1.2	+15 Over 70 MHz	1.25	+15	20	CMOS	N/A	SMA	2 x 1.5 x .69
20-600	20-1000	100C1287	1.	50	0.8	+10	1.25	+5	80	TTL	N/A	SMA	2 x 1.5 x .69

DAICO HIGH SPEED RF SWITCHES

HIGH SPEED MIC SWITCHES

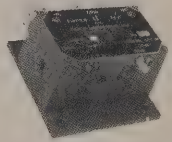
Daico's High Speed Switches are available in both M.I.C. (Microwave Integrated Circuit) as well as connectorized form. Switching speeds as low as 15 nanoseconds are available. The M.I.C. units are packaged in hermetic DIP configurations, while the connectorized units have SMA connectors for convenient cable attachment.

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Nanosec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Package
SPST												
3-150	3-150	DS0111	25	40	1.0	+6	1.25	+5	90	TTL	50	14 Pin DIP
10-200	5-400	DS0050	25	50	1.5	+10	1.25	+5	100	TTL	50	14 Pin DIP
10-200	10-300	DS0235	25	60	2.5	+16	1.25	+5	230	TTL	50	.750 Sq. 14 Pin Plug In
100-500	70-700	DS0141	25	50	3.0	+17	1.4	+5	150	TTL	Open	14 Pin DIP
SP2T												
1-100	1-150	DS0042-10	40	60	1.0	+6	1.25	+5	100	TTL	Open	14 Pin DIP
3-300	1-500	DS0252	15	45	1.5	+10	1.25	+5	170	TTL	50	14 Pin D DIP
10-200	10-300	DS0042-100	40	60	1.5	+6	1.4	+5	100	TTL	Open	14 Pin DIP
10-350	10-500	DS0108	30	25	1.5	+15	1.25	+5	180	TTL	50	14 Pin DIP
20-300	20-500	DS0158	30	25	1.25	+15	1.25	+5	130	TTL	50 or Ground	14 Pin DIP
100-500	70-700	DS0142	25	45	2.5	+17	1.5	+5	200	TTL	Open	16 Pin D DIP
DUAL SP2T												
10-100	10-200	DS0241	50	40	.8	+10	1.15	+5	200	TTL	50	16 Pin D DIP

CONNECTORIZED HIGH SPEED SWITCHES

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Nanosec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Connectors	Size
SPST													
10-200	5-300	100C1041	25	50	1.5	+10	1.25	+5	100	TTL	50	SMA	2x1.5x.5
20-300	10-300	100C1051	35	55	2.0	+10	1.4	+5	200	TTL	50	SMA	2x2x.48
300-350	100-500	10DC1570	50	90	3.0	+10	1.4	+5	270	TTL	50	SMA	1.5x2x.54
SP2T													
1-100	1-100	100C1042	15	60	.8	+8	1.2	+5	130	TTL	Open	SMA	1.5x1.5x.5
2-500	2-600	100C1052	40	40	1.5	+10	1.4	+5	160	TTL	50	SMA	2x2x.48
DP4T													
20-200	10-200	100C1024	50	55	.5	+10	1.25	+5	150	TTL	Open	SMA	3x1.5x.67

DAICO HIGH POWER RF SWITCHES



The Daico High Power RF Switches handle peak power to 3000 watts with CW power to 1000 watts. Frequency ranges from 1-2000 MHz are available. These High Power Diode Switches have been used successfully in numerous CW and pulse systems.

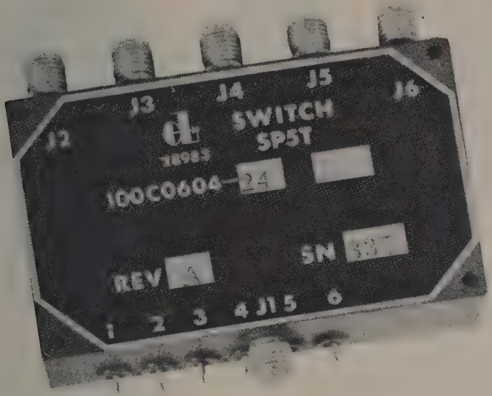
CONNECTORIZED HIGH POWER SWITCHES

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power Watts CW	RF Power Watts Peak	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Connectors	Size
SP2T														
20-80	15-150	100C1142	20	60	.25	1000	3000	1.15	+5 −300	250 15	TTL	Ground	N	4x5x2.75
20-100	10-200	100D1078	20	70	.5	250	500	1.15	+5 −15	350 15	TTL	Open	N	6x3x2.5
20-500	20-500	100C1592	10	55	.75	20	100	1.25	+5 −15	220 20	TTL	Ground	SMA	2.75x3x1.4
100-500	50-500	100C1492	30	45	.4	100	500	1.25	+5 −50	300 10	TTL	Ground	N	4x4.75x1.3
100-1400	70-1500	100C1032	10	40	.5	20	250	1.3	+5 −5	160 160	TTL	Open	SMA, NC, TNC	2.75x1.75x1
950-1225	925-1250	100C0932	10	23	.5	20	2000	1.25	+5 −15	65 25	TTL	Ground	N	3x4x1.38
1060-1100	1060-1100	100C1246	10	35	1.0	10	2000	1.4	+5 −70	300 5	TTL	50	SMA	3x3x1.12
SP4T														
1700-2000	1700-2000	100D1004	30	30	1.0	220	2000	1.4	+5 −150	700 4	TTL	Open	TNC	6x3.5x2.13
TRANSMIT/BY PASS														
225-400	225-400	100C1545	50	30	.15	600	2000	1.25	+5 −200	800 25	TTL	Open	TNC	7x5.25x2.5
TRANSMIT/RECEIVE														
Xmtr. 100-400 Rcvr.	100-400	100D1569	15	30 80	.2 .8	1000 .02	1500 10	1.25	125 VAC 400 Hz	100	Line Rcvr.	Ground	SC TNC	5x6x3.16

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

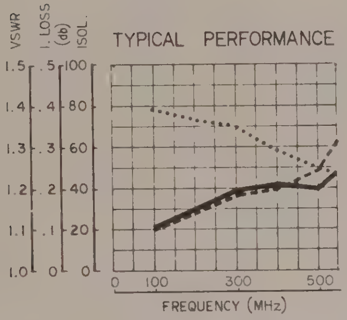
DAICO

RF RELAYS

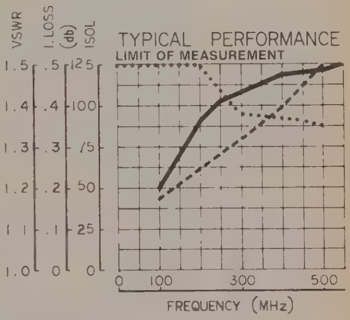


Daico Industries RF relays employ hermetically sealed switching elements which provide extreme resistance to the severe environments encountered in military aircraft and communications systems, including 20 g's vibration to 3 kHz, 80 g's shock and altitude in excess of 100,000 ft. A continual test and evaluation program assures switch performance in excess of 20 million operations. These units are operable at extremely low current levels and may be ordered with 6-, 12-, 18- or 24-volt coils.

STANDARD

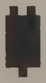
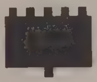
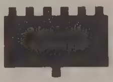
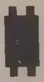


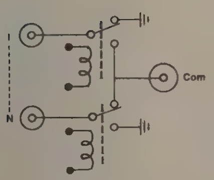
HIGH ISOLATION



LEGEND

....	Isolation
— — — —	Insertion Loss
————	VSWR

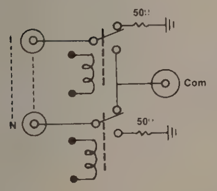
RF RELAYS DC-500 MHz 50 watts cw SMA Connections SIZE MATRIX	SPST	 SP2T	SP3T	SP4T	 SP5T	 SP6T	 TRANS.
STANDARD		100C0073 1x1½x.56	100C0254 1½x1½x.63	100C0259 2x1½x.63	100C0604 2½x1½x.69	100C0605 3x1½x.69	100C0347 2x1½x.87
HIGH ISOLATION		100C0109 1½x1½x.63	100C0630 1½x1¾x1.5	100C0104 1½x1¾x1.5			100C0608 1¼x1¼x1.3
STANDARD 50 OHM TERMINATION	100C0610 1x1½x.55	100C0611 1½x1½x.63	100C0612 2x1½x.63	100C0613 2½x1½x.63	100C0614 3x1½x.63	100C0615 3½x1¾x.63	
HIGH ISOLATON & 50 OHM TERMINATION	100C0609 1x1½x.50	100C0350 1½x1½x.75	100C0285 2x1½x.75	100C0485 2½x1½x.75			



Switching Speed: 5 millisec. max

RF Power: 50W CW, 50W Peak

Drive Current: 24 mills nom. at 24 VDC. Other coils available include 6, 12, 18 VDC.



Units can be provided with Fail Safe (no power) to a through path.

Can be operated directly from TTL with integrated circuit 75450 Dual Driver, 54 45 Decoder or equivalent.

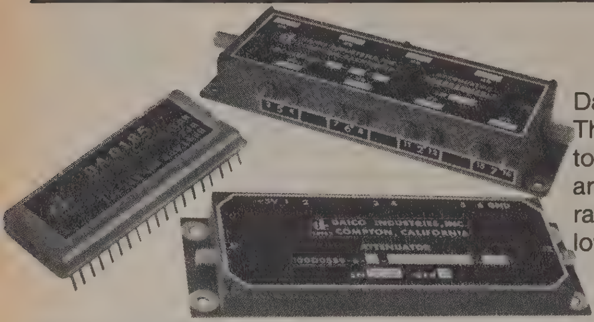
ALSO AVAILABLE

Type	Part Number	Frequency	Isolation	Connector
SP2T	100C0878	DC-1250 MHz	45 dB	SMA
SP2T	100C0076	DC-400 MHz	45 dB	BNC or TNC
SP2T	100C0942	DC-100 MHz	70 dB	75 Ohm SMC
SP2T	100C1003	DC-1250 MHz	45 dB	SMA or BNC or TNC
SP3T	100C1015	DC-450 MHz	50 dB	BNC or TNC
SP4T	100C0954	DC-100 MHz	55 dB	75 Ohm TNC
SP4T	100C1423	DC-500 MHz	45 dB	BNC or TNC
SP6T	100C1026	DC-450 MHz	45 dB	BNC or TNC or SMA
SP7T	100C1094	DC-200 MHz	50 dB	SMA
SP8T	100C1159	DC-200 MHz	50 dB	SMA
2P4T	100C0368	DC-250 MHz	100 dB	SMA
14P2T	100D0872	DC-200 MHz	60 dB	SMA
14P4T	100D0873	DC-500 MHz	40 dB	SMA

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

DAICO

STEP ATTENUATORS



Daico's complete line of Programmable Step Attentuators include Thin Film M.I.C. (Microwave Integrated Circuits), Solid State Connectorized, as well as RF Relay Control. Binary steps from 1 through 10 are available with total attenuation values to 111 dB. Frequency ranges from DC to 2350 MHz are covered with switching speeds as low as 25 nanoseconds.

MIC STEP ATTENUATORS

Number of Steps	Available Range dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Package
1	24	25-35	7-200	DA0130	0.04	2.	+10	1.2	+5	75	TTL	14 Pin DIP
1	24	25-35	10-100	DA0188	0.05	3.	+17	1.2	+5	100	TTL	14 Pin DIP
1	4 or 8 or 16	50-500	50-500	DA0240	10.	1.2	+10	1.2	+15	12	CMOS	TO-8
1	20	140-160	10-700	DA0491	5.	1.2	+10	1.5	+15	5	CMOS	14 Pin DIP
1	20	200-240	50-500	DA0236	4.	1.2	+10	1.2	+5	8	CMOS	TO-8
2	1-33	20-250	10-500	DA0351	20.	2.	+10	1.25	+5	12	CMOS	14 Pin DIP
2	.25/40	20-250	20-250	DA0051	1.	1.8	+10	1.25	+15	6.5	CMOS	14 Pin DIP
2	8-16	20-200	10-300	DA0147	0.035	4.	+17	1.25	+5	100	TTL	14 Pin D DIP
2	8-24	250-460	250-460	DA0230	25.	2.	+10	1.3	+15	10	CMOS	16 Pin DIP
4	2-30	10-100	10-100	DA0104	0.05	5.	+10	1.35	+5	240	TTL	38 Pin Plug In 1.998 x .988
4	.1-1.5	20-40	20-300	DA0264	0.05	5.	+10	1.3	+5	175	TTL	24 Pin D DIP
4	1.6-24	20-40	20-300	DA0265	0.05	5.	+10	1.3	+5	165	TTL	24 Pin D DIP
4	.5-32.6	20-200	10-300	DA0146	0.035	5.	+17	1.25	+5	200	TTL	24 Pin D DIP
4	1-15	20-200	10-300	DA0145	0.035	5.	+17	1.25	+5	200	TTL	24 Pin D DIP
4	1.5-22.5	20-200	10-300	DA0129	0.035	4.	+20	1.3	+5	200	TTL	24 Pin D DIP
4	2-24	25-35	10-300	DA0181	0.050	6.	+17	1.2	+5	200	TTL	24 Pin D DIP
4	.5-7.5	25-35	10-300	DA0186	0.050	6.	+17	1.2	+5	200	TTL	24 Pin D DIP
4	8-32	25-35	10-300	DA0187	0.050	6.	+17	1.2	+5	200	TTL	24 Pin D DIP
5	.5-15.5	40-80	20-500	DA0245	20.	5.	+10	1.5	+5	10	CMOS	24 Pin D DIP
5	1-31	345-425	50-500	DA0178	15.	6.	+10	1.3	+5	6	CMOS	24 Pin D DIP
6	1-63	30-300	30-300	DA0204	1.	4.	+10	1.5	+5	250	TTL	38 Pin Plug In .998 x 1.988
6	1-63	40-150	10-700	DA0296	0.050	8.	+10	1.35	+5	500	TTL	38 Pin Plug In .998 x 1.988
6	1-63	45-75	10-300	DA0376	1.	5.	+10	1.35	+5	600	TTL	38 Pin Plug In .998 x 1.988
7	.5-63.5	30-500	30-500	DA0285	20.	6.	+10	1.35	+5 to +15	30	CMOS	38 Pin Plug In .998 x 1.988
7	.5-63.5	30-500	30-500	DA0295	20.	6.	+10	1.35	+5	50	TTL	38 Pin Plug In .998 x 1.988
7	.1-12.7	45-75	10-300	DA0375	0.035	3.5	+10	1.35	+5	540	TTL	38 Pin Plug In .998 x 1.988
7	.5-63.5	45-75	10-300	DA0377	0.035	5.8	+10	1.35	+5	640	TTL	38 Pin Plug In .998 x 1.988

RF RELAY STEP ATTENUATORS

Number of Steps	Standard Range* dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Millisec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.		Connector	Size
1	24	30-300	10-1000	100C1629	5.	0.6	+33	1.2	RF Relay Attenuators Available With 6, 12, 18, or 24 Volt Coils	SMA	1 x 1.5 x .65
2	16-48	DC-500	DC-500	100C1428	5.	1.	+20	1.2		SMA	1.5 x 1.5 x .63
3	10-30	DC-1000	DC-1000	100C0994	5.	0.5	+33	1.4		SMA	2.75 x 2 x .88
4	2-30	DC-500	DC-500	100D0809-4	5.	3.5	+20	1.2		SMA, BNC, TNC	1.5 x 3.5 x .88
5	1-32	DC-500	DC-500	100D0809-5	5.	3.5	+20	1.2		SMA, BNC, TNC	1.5 x 3.5 x .88
5	1-31	DC-500	DC-500	100C1427	5.	2.	+20	1.2		SMA	3 x 1.5 x .63
6	1-63	DC-200	DC-400	100C0469 6 Bit	5.	2.5	+20	1.3		SMA	1.75 x 5.75 x .88
7	.5-63.5	DC-200	DC-400	100C0469 7 Bit	5.	2.5	+20	1.3		SMA	1.75 x 5.75 x .88
7	1-63	DC-400	DC-400	100D0712	5.	3.5	+20	1.25		SMA	1.75 x 5.75 x .88
8	1-127	DC-200	DC-400	100D0469 8 Bit	5.	2.5	+20	1.3		SMA	1.75 x 5.75 x .88
9	1-106	DC-15	DC-15	100C1403 TTL Control	5.	0.8	+33	1.2		BNC	5.75 x 1.75 x 1.25
10	1-111	DC-500	DC-500	100C1426	5.	3.5	+20	1.3		SMA	4.25 x 1.5 x 2.25

SOLID STATE CONNECTORIZED STEP ATTENUATORS

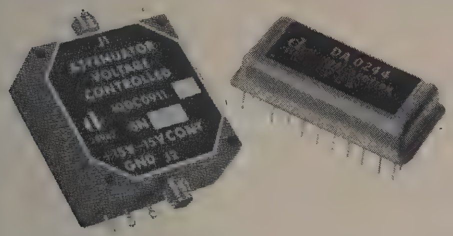
Number of Steps	Standard Range* dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Connector	Size
2	3-9	20-300	20-500	100D0589-2	1.	1.	+13	1.35	+5	70	TTL	SMA	1.75 x 2.5 x .5
3	6-42	30-300	10-1000	100C1628	1.	2.	+10	1.5	+5	170	TTL	SMA	1.75 x 3.75 x .5
4	2-24	25-35	10-300	100C1418	0.05	6.	+17	1.2	+5	250	TTL	SMA	2 x 1.5 x .53
4	1-15	20-300	20-500	100D0589-4	1.	2.	+13	1.35	+5	140	TTL	SMA	1.75 x 3.75 x .5
6	1-63	20-300	20-500	100D0589-6	1.	3.	+13	1.35	+5	210	TTL	SMA	1.75 x 5.25 x .5
6	1-63	200-400	200-400	100D1513	1.	10.	+20	1.35	+5	60	TTL	SMA	10 x 3.25 x 1.06
6	1-63	1128-2350	1128-2350	100D1071	0.5	10.	+10	1.5	+5 -5	1 Amp 1 Amp	TTL	SMA	7 x 6.5 x 2.19
7	5-63.5	30	10-300	100D1350	0.025	12.	+16	1.2	+5	500	TTL	SMA	1.75 x 3.5 x .4
7	.5-63.5	30-500	20-1000	100C1585	20.	6.	+13	1.35	+5 to +15	25	CMOS	SMA	1.75 x 3 x .54
7	.5-63.5	30-500	20-1000	100C1595	20.	6.	+13	1.35	+5	50	TTL	SMA	1.75 x 3 x .54
8	.5-63.5	20-300	20-300	100D1438	1.	3.5	+13	1.3	+5	300	TTL	SMA, BNC, TNC, N	6 x 3 x 1.18

* In addition to the standard ranges listed, most attenuators available with the following pad values: .1, .2, .4, .5, .8, 1, 1.6, 2, 3.2, 4, 6.4, 8, 12.8, 16, 32.

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

VOLTAGE CONTROLLED ATTENUATORS

DAICO



The Daico Voltage Controlled Attenuators are available both as M.I.C. (Microwave Integrated Circuits) as well as in Solid State Connectorized form. Linearity of ±.75 dB from best straight line is achieved with frequency ranging from 10 to 1300 MHz. Constant impedance of 50 ohms is maintained at input and output ports over full attenuation range. VSWR over band is 1.25 typical.

MIC VOLTAGE CONTROLLED ATTENUATORS

Atten. Range dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Control Volts DC	Atten. Slope dB/Volt	Slew Rate dB/ Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	Line-arity dB	DC Power		Con-nector	Size
											Volts	mA		
18	20-300	20-700	DA0035	0 to +5	6.5	6.	1.5	+10	1.25	±0.8	+15 -15	25 25	—	14 Pin DIP
28	558-568	30-1300	DA0260	0 to +5	7.	3.	5.	+10	1.7	±2.	+15 -15	60 80	—	1 x 1 Planar 13 Leads
35	25-37	20-300	DA0308	0 to +5	15.	4.5	3.	+10	1.25	±0.5	+15 -15	40 50	—	14 Pin DIP .400 Pin Rows
40	20-300	20-500	DA0098	0 to +5	15.	6.	2.	+10	1.35	±2.	+15 -15	40 50	—	14 Pin DIP .400 Pin Rows
40	100-300	100-300	DA0408	0 to +5	15.	6.	3.5	+15	1.25	±2.	+15 -15	30 40	—	18 Pin D DIP
40	50-1300	50-1300	DA0243	0 to +5	13.	3.	3.5	+10	1.5	±2.	+15 -15	60 80	—	1 x 1 Planar 13 Leads
Dual Section 20/Section	80-120	80-120	DA0138	0 to +5	6.5	6.	1.	+10	1.25	±1.	+15 -15	40 60	—	28 Pin Plug In .58 x 1.18
Dual Section 20/Section	80-120	80-120	DA0244	0 to +5	6.8	6.	1.	+10	1.25	±0.75	+15 -15	60 80	—	28 Pin Plug In .58 x 1.18

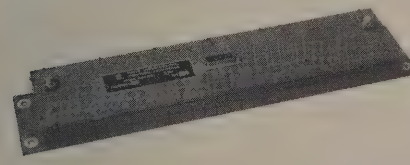
SOLID STATE CONNECTORIZED VOLTAGE CONTROLLED ATTENUATORS

Atten. Range dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Control Volts DC	Atten. Slope dB/Volt	Slew Rate dB/ Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	Line-arity dB	DC Power		Con-nector	Size
											Volts	mA		
18	20-700	20-300	100C0911	0 to +5	6.5	6.	1.5	+10	1.25	±1.	+15 -15	25 25	SMA	1.5 x 1.5 x .69
40	20-300	20-700	100C0912	0 to +5	15.	6.	2.	+10	1.35	±2.	+15 -15	40 50	SMA	2 x 1.5 x .75
40	50-1300	50-1300	100C1521	0 to +5	13.	3	3.5	+10	1.5	±2.	+15 -15	60 80	SMA	1.5 x 2 x .43
Dual Section 20/Section	30-200	30-200	100C1522	0 to +5	6.5	6.	1.	+10	1.25	±0.75	+15 -15	60 80	SMA	1.5 x 2 x .54
60	60	10-200	100C1463	0 to +5	19.5	6.	3.	+20	1.5	±4.	+15 -15	75 85	SMA	3 x 2.38 x .75

PHASE COMPENSATED VOLTAGE CONTROLLED ATTENUATORS

Atten. Range dB	Spec. Freq. MHz	Usable Freq. MHz	Phase Stability Degrees	Part Number	Control Volts DC	Atten. Slope dB/Volt	Slew Rate dB/ Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	Line-arity dB	DC Power		Con-nector	Size
												Volts	mA		
40	150-250	150-250	10	100C1575	0 to +5	15	6	4	+15	1.25	±2	+15 -15	40 40	SMA	1.5 x 2 x .6

DAICO PHASE SHIFTERS



Daicos Phase Shifters utilize either solid state or RF relay switching. Steps from 1 through 9 are available, allowing from 1.41° to 718.61° phase shift. Switching speed as low as 50 nanoseconds are obtainable.

SOLID STATE CONNECTORIZED

Number of Steps	Available Range	Center Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Connector	Size
									Volts	mA			
1	180°	60	40-80	100C1146	5.	1.3	+7	1.2	+5	40	TTL	SMA	2 x 1.5 x .94
1	180°	350	100-500	100C1157	10.	0.8	+37	1.3	+5 -15	200 5	TTL	SMA	2.5 x 2.5 x 1
6	5.63-354.8	660	640-680	100C0792	5.	4.	+12	1.2	+5	250	TTL	SMA	3 x 3 x .72
6	5.63-354.8	fo	20-300	100D0896	4.	4.	+10	1.5	+5	375	TTL	SMA, TNC, BNC	11.5 x 3 x 1.13
7	2.81-714.4	1080	960-1215	100C1140	0.5	4.	+10	1.7	+5 -5	90 90	TTL	SMA	9 x 6 x 1.5
8	1.41-358.61	fo	20-300	100D0898	4.	5.	+10	1.5	+5	375	TTL	SMA	3 x 14.5 x 1.13
8	1.41-358.61	60	55-65	100D1187	0.05	14.4	+10	1.5	+5	1.45A	TTL	SMA	3 x 14.5 x 1.13

RF RELAY

Number of Steps	Available Range	Center Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Connector	Size
									Volts	mA			
8	1.41-358.61	fo	30-300	100D0888	5.	2.5	+20	1.3	RF Relay Phase Shifters Available With 6, 12, 18, or 24 Volt Coils			SMA	14.5 x 3 x 1.13
9	1.41-718.61	70	65-75	100D1433	5.	3.	+20	1.2				SMA	14.5 x 3 x 1.13

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

DAICO

PERFORMANCE NOTES

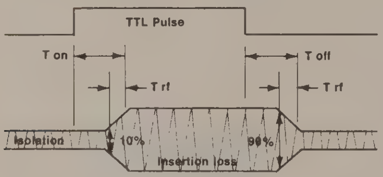
SPECIFICATION FREQUENCY vs. USABLE FREQUENCY

Although a device is designed for optimum characteristics over a specified frequency, the part is functional with slight performance reduction over a broader frequency range. This broader band is the Usable Frequency.

SWITCHING SPEED

A review of the adjacent figure will reveal that the switching time T_{on} is measured from the 50% point of the leading edge of the square wave control (TTL, CMOS or ECL) to the 90% point of the leading edge of the resultant RF envelope. Similarly, T_{off} is measured from the 50% point of the trailing edge of the square wave control pulse to the 10% point of the trailing edge of the resultant RF envelope. Switching speed is defined as the greater of these two values.

Of specific interest is the RF switching envelope which is defined as T_{rf} from 10-90% of the RF envelope. Systems requiring excessively high speed operation occasionally program the switch operation with a delay or anticipatory circuit to be able to accommodate only the T_{rf}. Values of five nanoseconds are readily available.



TRANSIENTS

During the switching of one part to another, video transients are incurred with characteristics that are occasionally disturbing to RF components following the switch. Daico Industries has over the years developed balanced designs which will provide less than 10-15 millivolts of in-band transients at switching speeds (T_{rf}) of 5-10 nanoseconds. Where lower transients are required during the switching period, it is recommended that slow switching speeds be tolerated or discussed with the manufacturer.

ISOLATION

The minimum isolation in dB is the worst case condition over the specification frequency between any two ports, with all other ports terminated in 50 ohms.

INSERTION LOSS

Insertion loss is defined as the worst case path loss between the input port and any output port in the "ON" state with all other ports "OFF" and terminated in 50 ohms. Insertion loss for attenuators is measured with zero or minimum attenuation level from the input to output and is as the reference level for all attenuation values.

NOISE FIGURE

Experience has shown that the Noise Figure (N.F.) of a switch may be assumed to be equal to the Insertion Loss. This assumption can be made without introducing substantial error.

RF POWER

The RF power level (measured in dBm) is the level of CW input power that results in not more than 0.1 dB compression at the output. The maximum RF power level is also the maximum signal level at which the device will meet all RF specifications.

VSWR

The maximum VSWR in a 50 ohm system applies only to the thru condition, unless otherwise specified. Devices with open or short to ground terminations exhibit total refection.

DC POWER

The typical current for the maximum regulated DC supply voltage is listed. Exceeding the DC voltage may damage the device. Nominal ±0.25V.

CONTROL

The driver control circuitry is listed as either TTL or CMOS. TTL devices may be driven directly from system TTL outputs. 5 volt CMOS devices may be driven directly from system TTL outputs with a pull up resistor to +5 volts. Hi-voltage CMOS devices (8 to 15 volts) may be driven with TTL using a pull up resistor to VCC with an open collector transistor, or the 5400 series of Hi-voltage TTL compatible buffers. CMOS control lines should be pulled up to VCC to prevent possible damage to internal drivers.

RF relays may be made TTL compatible using the SN55450 series of relay drivers. See RF DESIGN AIDS.

TERMINATION

Internally terminated switches are so defined.

PACKAGE OR SIZE

The outline configuration is given in inches or standard DIP configurations. The DIP package has .100" pin spacings with .300" pin rows. A DDIP has .600" pin rows.

PHASE SHIFT OF VOLTAGE CONTROLLED ATTENUATORS

The phase shift of Daico VCAs is a function of the attenuation. The phase at the output will vary smoothly from the reference value at minimum attenuation to its maximum value at maximum attenuation. The maximum phase shift for a single section VCA can be as little as a 10° lead at low frequencies to as much as an 80° lead at high frequencies. With some effort the phase vs. attenuation can be held constant to within +2° to +5° (again depending on frequency) at an increase in price of about 20% and some NRE depending upon quantity. We will be pleased to quote on any specific applications.

STEP ATTENUATORS

Actual attenuation value and associated accuracy applies with actual insertion loss subtracted from total attenuation value.

TEMPERATURE

Specifications are applicable from −55°C to +85°C. Some derating of performance may occur when operated over the MIL temperature of −55°C to +125°C.

DESIGN AIDS

DAICO

ELECTRICAL PRECAUTIONS

For a device to operate properly, the body must be connected to RF ground and with a M.I.C. device, the body and unused pins must both be grounded.

All unused ports of a switch should be terminated in 50 ohms to obtain optimum characteristics of the unit.

If a control line is to be at logic "0", it must be grounded.

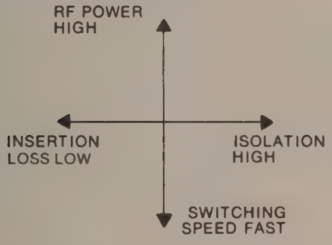
The low current CMOS device drivers are static sensitive and precautions must be exercised to prevent driver damage.

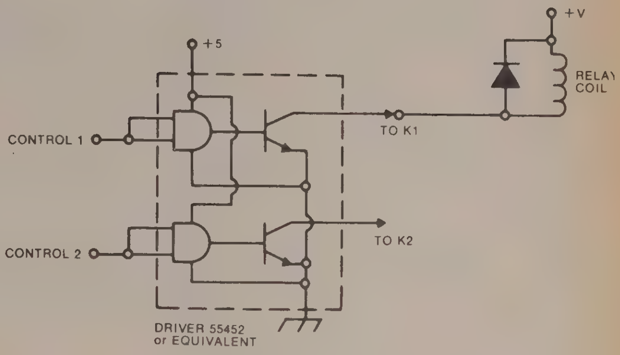
Excess voltage, wrong polarity, or spikes on the DC supply or control lines may damage the device.

Only devices specified as having an all OFF or center position off condition may have all ports OFF. Most devices require one port to be ON at all times for proper operation.

CUSTOM/OPTIMIZED DESIGNS

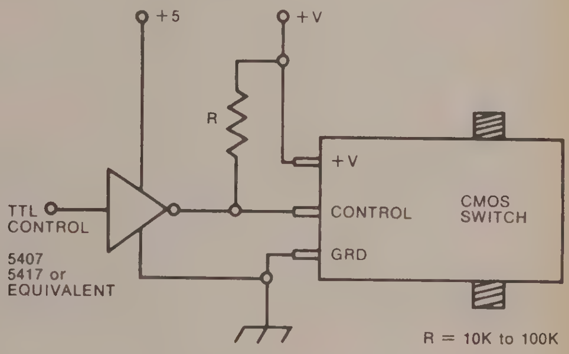
Daico Industries' engineering department welcomes your inquiry regarding special applications or optimized designs. An approximate guide regarding trade-offs are presented in the attached figure, i.e., high power means lower switching speed: high isolation suggests higher insertion loss.

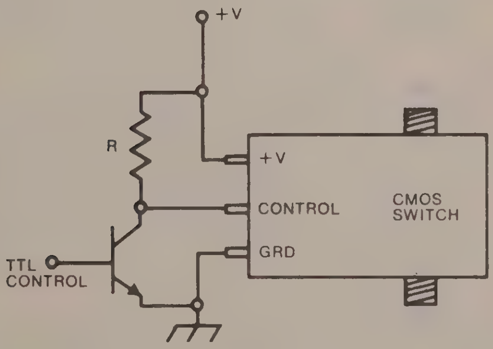

RF POWER HIGH
INSERTION LOSS LOW
ISOLATION HIGH
SWITCHING SPEED FAST


+V
+5
RELAY COIL
CONTROL 1
TO K1
CONTROL 2
TO K2
DRIVER 55452 or EQUIVALENT

RF RELAY DRIVERS

To drive Daico RF relay switches, attenuators, or phase shifters, using TTL logic, the above is suggested. The driver is a dual section which allows one device to control two relays.


+5
+V
R
+V
CONTROL
CMOS SWITCH
GRD
TTL CONTROL
5407
5417 or
EQUIVALENT
R = 10K to 100K


+V
R
+V
CONTROL
CMOS SWITCH
GRD
TTL CONTROL

TTL TO CMOS INTERFACE

To switch CMOS Switch control lines with open collector TTL, the above is suggested to avoid damaging the CMOS Driver.

DAICO

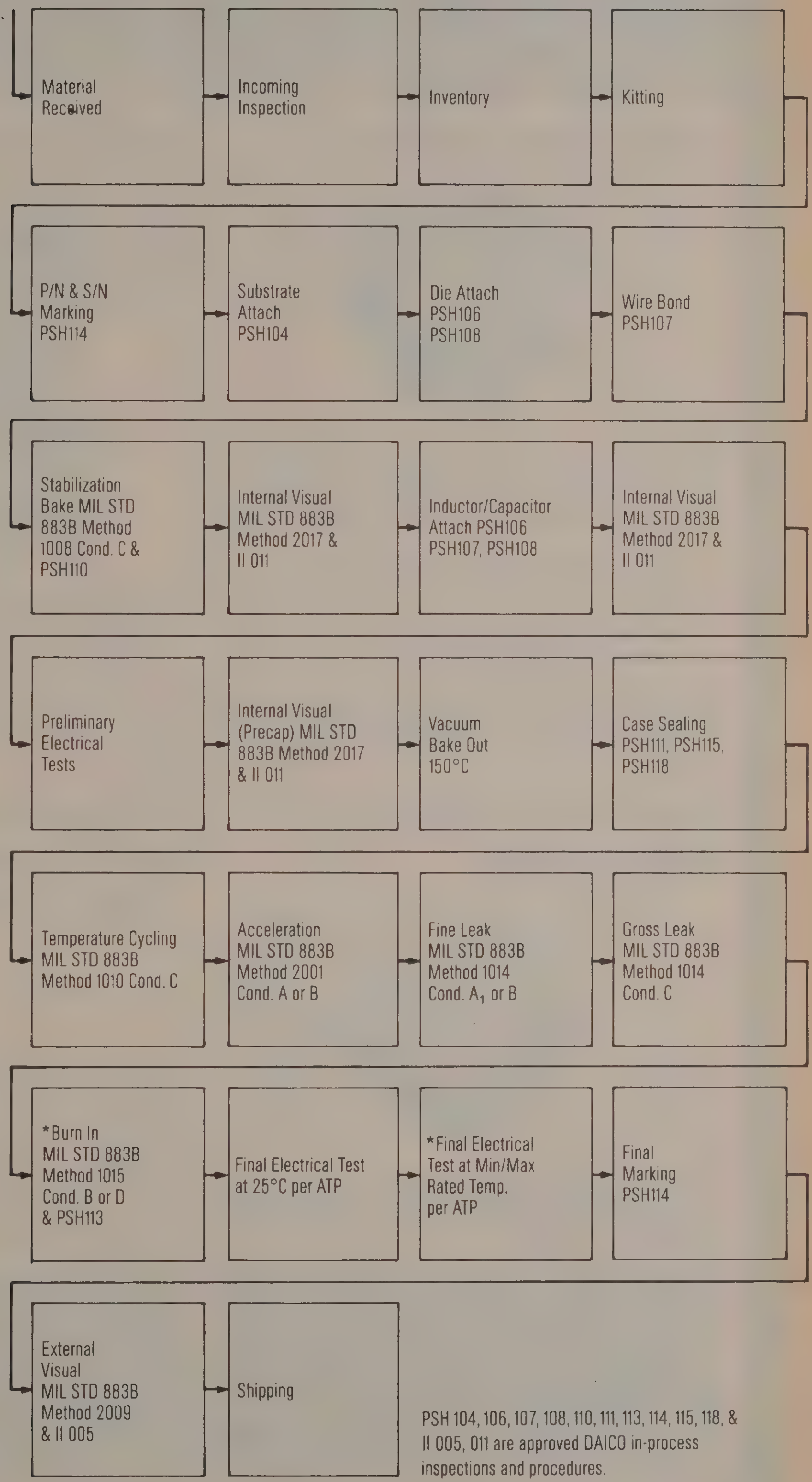
QUALITY ASSURANCE

Daico Industries Engineering and Manufacturing teams have proven conclusively that high quality is the most direct and sustaining path to increased profits. Our comprehensive Quality Assurance Program is integrated throughout all the various operational and engineering functions within the company. The quality element in Daico Industries components is planned and built into all the following functions:

- PREPLANNING
  - Customer source control drawing review
  - Contract/P.O. Review
  - Work instruction initiation and maintenance
  - Application Engineering/customer interface
  - Quality engineering/customer interface
- DESIGN
  - Reliability/survivability, designed consideration
  - Engineering model approach
  - Formal design review
  - Standardized process/circuit approach
  - Engineer support/follow up in manufacturing/test
  - MTBF analysis
- MATERIALS
  - Certified high reliability procurements
  - Positive control of non-conforming materials
- MANUFACTURING
  - Comprehensive process controls
  - Quality auditing
  - 100% fab and assembly inspection
  - Formal material review board
  - Quality documentation
  - Positive control of non-conforming material
  - Corrective action system
  - Personnel training and certification
  - State-of-the-art assembly/inspection equipment
  - Automatic, computer-controlled bonding and die attach equipment
- TESTING
  - 100% in-house MIL-STD 883B screening
  - Comprehensive test program (please see chart)
  - Trained/certified technicians
  - State-of-the-art automatic test equipment
  - ATP—Engineering/customer interface

DAICO QUALITY ASSURANCE

TYPICAL MIC ASSEMBLY CYCLE


Material Received
Incoming Inspection
Inventory
Kitting
P/N & S/N Marking PSH114
Substrate Attach PSH104
Die Attach PSH106 PSH108
Wire Bond PSH107
Stabilization Bake MIL STD 883B Method 1008 Cond. C & PSH110
Internal Visual MIL STD 883B Method 2017 & II 011
Inductor/Capacitor Attach PSH106 PSH107, PSH108
Internal Visual MIL STD 883B Method 2017 & II 011
Preliminary Electrical Tests
Internal Visual (Precap) MIL STD 883B Method 2017 & II 011
Vacuum Bake Out 150°C
Case Sealing PSH111, PSH115, PSH118
Temperature Cycling MIL STD 883B Method 1010 Cond. C
Acceleration MIL STD 883B Method 2001 Cond. A or B
Fine Leak MIL STD 883B Method 1014 Cond. A1 or B
Gross Leak MIL STD 883B Method 1014 Cond. C
*Burn In MIL STD 883B Method 1015 Cond. B or D & PSH113
Final Electrical Test at 25°C per ATP
*Final Electrical Test at Min/Max Rated Temp. per ATP
Final Marking PSH114
External Visual MIL STD 883B Method 2009 & II 005
Shipping

PSH 104, 106, 107, 108, 110, 111, 113, 114, 115, 118, & II 005, 011 are approved DAICO in-process inspections and procedures.

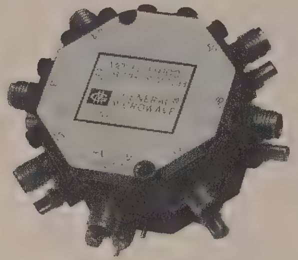
*Optional Testing

ADDITIONAL ENVIRONMENTAL TESTING AVAILABLE

Vibration:	MIL STD 202 Method 204 64g RMS, 1.5 hrs. each axis
Mechanical Shock:	MIL STD 883 Method 2002 Condition C, 3000g Y axis
Moisture Resistance:	MIL STD 883 Method 1004
Salt Atmosphere:	MIL STD 883 Method 1009
Thermal Shock:	MIL STD 883 Method 1011 Condition B, 15 cycles
Lead Integrity:	MIL STD 883, Method 2004 Condition B_2
Solderability:	MIL STD 883 Method 2003 260°C±10°C
Resistance to Solvents:	MIL STD 883, Method 2015

PIN DIODE CONTROL DEVICES FROM GENERAL MICROWAVE

PIN Diode Switches

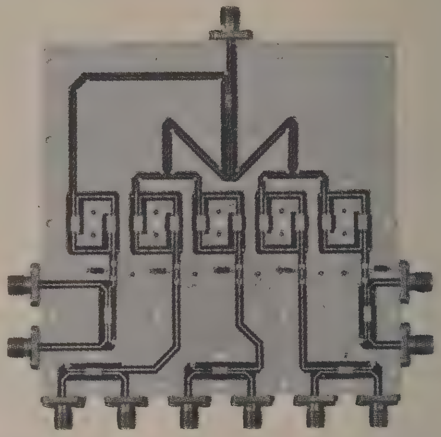


General Microwave's complete line of high performance broadband switches, with and without integral drivers, are available in three basic series.

- Ultra Broadband Series: 0.2 to 18 GHz, SPST to SP5T
- Multi Octave Band - Miniature Series: 0.2 to 4 GHz (Series 92) 2-18 GHz (Series 91); SPST TO SP7T
- Octave Band - High Speed Series: 10 nsec switching speed, 2-18 GHz; SP2T

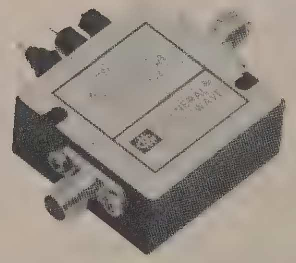
Many models of each type are available to satisfy most requirements. Non-reflective switches, space qualified units and other special designs are also available.

MIC Assemblies



General Microwave MIC assemblies can combine: • Frequency Translators • High Speed Digitally Controlled Attenuators • Power Combiners and Dividers • High Speed Switches • Mixers • Amplifiers • Isolators • Directional Couplers • Phase Modulators • Filters and other signal conditioning and processing devices.

PIN Diode Modulators/ Attenuators



General Microwave's Series of PIN diode modulators/attenuators provide octave-band and greater than octave-band performance from 0.5 to 18 GHz. All at low cost.

Series	Bandwidth	Atten. Range (dB)	Control
D195	Octave	60	Linear Voltage
D196	Multi-octave	60	Linear Voltage
195	Octave	60	Current
M180	Ultra-broadband	60	Linear Voltage

Digitally Programmable PIN Diode Attenuators

GENERAL MICROWAVE
PROGRAMMABLE

General Microwave's Series of Digitally Programmable PIN Diode Attenuators provide octave-band and greater than octave-band performance from 0.2 to 18 GHz with wide programming flexibility. All at low cost. Their compact, rugged packages are well suited to military applications. They are available in drop-in module type configurations and hermetically sealed packages. Nanosecond switching speed modules are also available.

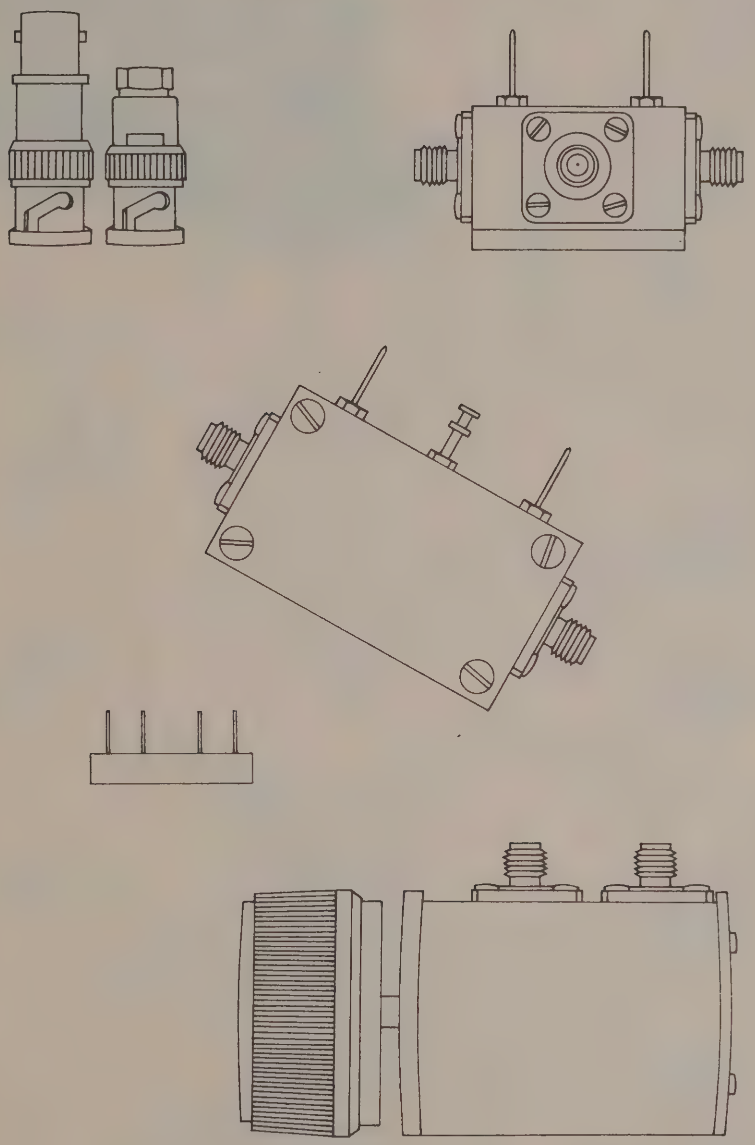
Series	Bandwidth	Atten. Range (dB)	LSB (dB)
329	Octave	80 & 120	0.1
345	Octave	60	0.25
346	Multi-octave	60	0.25
325	Ultra-broadband	120	1.0

GENERAL MICROWAVE

155 Marine Street, Farmingdale, L.I., New York 11735, Tel: 516-694-3600

SPECIALISTS IN ATTENUATION

JFW



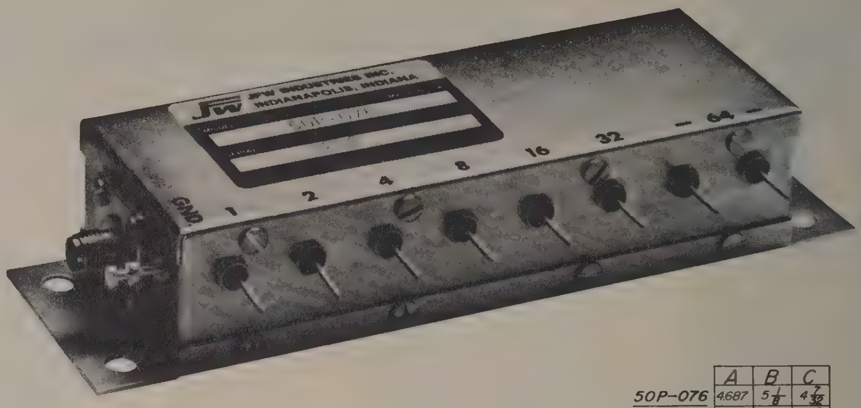
FIXED ATTENUATORS
TERMINATIONS
COAXIAL SWITCHES
VARIABLE ATTENUATORS
PROGRAMMABLE ATTENUATORS
ANALOG PROGRAMMABLE ATTENUATORS

JFW INDUSTRIES, INC. P.O. BOX 336 BEECH GROVE, IN. 46107 317 - 783 - 9875

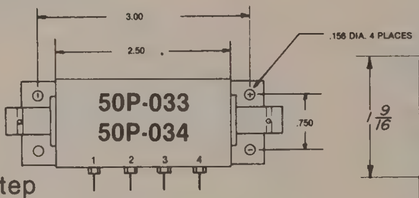
Programmable Attenuators

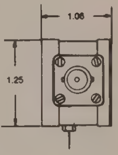
Model 50P-033

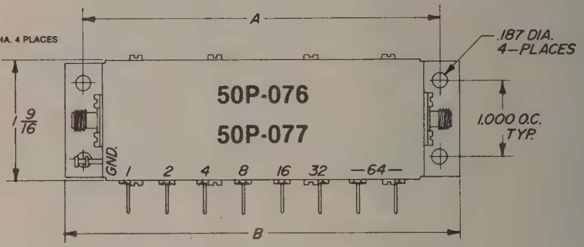
Frequency Range
DC-1500 MHz
Impedance
50 Ohms
Attenuation Range
0-10 dB
Attenuation Steps
1, 2, 3 and 4 dB
VSWR
DC-1000 MHz 1.4:1
1000-1500 MHz 1.5:1
Insertion Loss
2.0 dB @ 1000 MHz
Attenuation Accuracy
DC-500 MHz ± .2 dB
500-1000 MHz ± .3 dB
1000-1500 MHz ± .4 dB
Switching Speed
6 Milliseconds
DC Supply
+ 12 Vdc @ 30 mA per step
DC Connectors
.040 Diameter Solder Terminals
Operating Temperature Range
−20 °C to + 85 °C
Input Power
2 Watts Average
RF Connectors
BNC, TNC, SMA or N Female

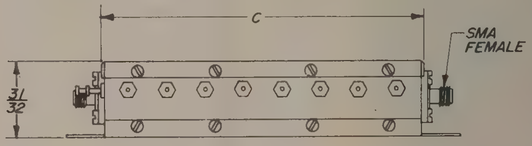


	A	B	C
50P-076	4.687	5 1/8	4 7/32
50P-077	3.687	4 1/8	3 7/32









Model 50P-034

Frequency Range
DC-1500 MHz
Impedance
50 Ohms
Attenuation Range
0-100 dB
Attenuation Steps
10, 20, 30, and 40 dB
VSWR
DC-1000 MHz 1.4:1
1000-1500 MHz 1.5:1
Insertion Loss
2.0 dB @ 1000 MHz
Attenuation Accuracy
DC-500 MHz ± .5 dB
500-1000 MHz ± 1.0 dB
1000-1500 MHz ± 1.5 dB
Switching Speed
6 Milliseconds
DC Supply
+ 12 Vdc @ 30 mA per step
DC Connectors
.040 Diameter Solder Terminals
Operating Temperature Range
−20 °C to + 85 °C
Input Power
1 Watt Average
RF Connectors
BNC, TNC, SMA or N Female

Model 50P-076

Frequency Range
DC-1000 MHz
Impedance
50 Ohms
Attenuation Range
0-127 dB in 1 dB steps
Attenuation Steps
1, 2, 4, 8, 16, 32 and 64 dB
VSWR
1.4:1 Maximum
Insertion Loss
3.5 dB Maximum
Attenuation Accuracy
(Maximum Attenuation)
DC-100 MHz ± .5 dB
100-500 MHz ± .75 dB
500-1000 MHz ± 1.0 dB
Switching Speed
6 Milliseconds
DC Supply
+ 12 Vdc @ 30 mA per step
DC Connectors
.040 Diameter Solder Terminals
Operating Temperature Range
−20 °C to + 85 °C
Input Power
1 Watt Average
RF Connectors
BNC, TNC, SMA or N Female

Model 50P-077

Frequency Range
DC-1000 MHz
Impedance
50 Ohms
Attenuation Range
0-63 dB in 1 dB steps
Attenuation Steps
1, 2, 4, 8, 16 and 32 dB
VSWR
1.4:1 Maximum
Insertion Loss
2.5 dB Maximum
Attenuation Accuracy
(Maximum Attenuation)
DC-100 MHz ± .3 dB
100-500 MHz ± .5 dB
500-1000 MHz ± .75 dB
Switching Speed
6 Milliseconds
DC Supply
+ 12 Vdc @ 30 mA per step
DC Connectors
.040 Diameter Solder Terminals
Operating Temperature Range
−20 °C to + 85 °C
Input Power
1 Watt Average
RF Connectors
BNC, TNC, N or SMA

JFW INDUSTRIES, INC. 2719 EAST TROY AVENUE, INDIANAPOLIS, INDIANA 46203 317-783-9875

JFW

Fixed Attenuators

MODEL 50F-XXX-BNC MODEL 50F-XXX-SMA
MODEL 50F-XXX-TNC MODEL 50F-XXX-N

Frequency Range
DC-2000 MHz

Impedance
50 Ohms

Attenuation Values
1 thru 20 dB in any 1 dB increment (XXX) insert value, i.e., 50F-020-BNC, specifies an attenuator with attenuation of 20 dB.

VSWR (Max.)
DC-1000 MHz 1.2:1; 1000-2000 MHz 1.4:1

Accuracy
DC-1000 MHz ± .5 dB; 1000-2000 MHz ± .8 dB

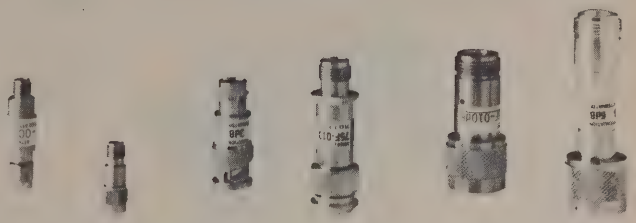
Input Power
1 Watt average

Operating Temperature Range
−20 °C to + 85 °C

Connectors
BNC, TNC, SMA, and N

Dimensions

BNC: Length; $1\frac{13}{32}$,	Body Dia: $\frac{7}{16}$
TNC: Length; $1\frac{15}{16}$,	Body Dia: ½
SMA: Length; $1\frac{13}{32}$,	Body Dia: ⅜
N: Length; 2⅓,	Body Dia: ½



These extremely small, low-cost fixed attenuators provide a flat frequency response and low VSWR.

75 Ohm models are also available.

MODEL 50HF-XXX-SMA

Frequency Range
DC-18 GHz

Impedance
50 Ohms Nominal

Attenuation Values
1 thru 40 dB in any 1 dB increment (XXX) insert value, i.e., 50HF-020-SMA, specifies an attenuator with attenuation of 20 dB.

VSWR (Max.)
DC-4 GHz 1.2:1 Maximum
4-8 GHz 1.25:1 Maximum
8-12 GHz 1.3:1 Maximum
12-18 GHz 1.4:1 Maximum

Attenuation Accurary
1 thru 6 dB ± .3 dB
7 thru 20 dB ± .5 dB
21 thru 40 dB ± .75 dB

Power
2 Watts @ 25 °C
derate to .5 Watts @ 125 °C

Operating Temperature Range
−55 °C to + 125 °C

Connectors
SMA

Construction
Stainless steel body and connectors

Dimensions:

Length:		Body Dia:
1-10 db	11-40 db	.28
.86 ± .02	1.02 ± .02	

NEW!

MODEL 50HF-XXX-N

Frequency Range
DC-18 GHz

Impedance
50 Ohms Nominal

Attenuation Values
1 thru 40 dB in any 1 dB increment (XXX) insert value, i.e., 50HF-020-N, specifies an attenuator with attenuation of 20 dB.

VSWR (Max.)
DC-4 GHz 1.2:1 Maximum
4-8 GHz 1.25:1 Maximum
8-12 GHz 1.3:1 Maximum
12-18 GHz 1.4:1 Maximum

Attenuation Accuracy
1 thru 6 dB ± .3 dB
7 thru 20 dB ± .5 dB
21 thru 40 dB ± .75 dB

Power
2 Watts @ 25 °C
derate to .5 Watts @ 125° C

Operating Temperature Range
−55 °C to + 125 °C

Connectors
N

Construction
Stainless steel body and connectors

Dimensions
Length: $1\frac{25}{32}$ Body Dia: ¾

JFW INDUSTRIES, INC. 2719 EAST TROY AVENUE, INDIANAPOLIS, INDIANA 46203 317-783-9875

HIGH QUALITY ATTENUATORS!

Kay switch attenuators are constructed with patended switches using teflon housings and gold plated silver contacts. These high quality switches have been field proven for over 10 years. All Kay attenuators are equipped with precision resistors.

Kay rotary switch attenuators are gold plated printed circuit contact with dual contacts at each connector. This design provides superior electrical contact.

Kay has designed over 200 special attenuators for OEM applications using our extensive design capabilities. We can adapt our current line to fit specific requirements.

Please call or write for our complete attenuator catalog.

OEM PROGRAMMABLE ATTENUATORS

- LOGIC ADAPTORS AVAILABLE

4000 SERIES

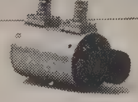
IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	4440	DC-1.5GHz	0-130dB in 10dB steps
75	4447	DC- 1GHz	0-130dB in 10dB steps
50	4450	DC-1.5GHz	0-127dB in 1dB steps
75	4457	DC- 1GHz	0-127dB in 1dB steps
50	4460	DC-1.5GHz	0- 31dB in 1dB steps
75	4467	DC- 1GHz	0- 31dB in 1dB steps
50	1/4450	DC- 1GHz	0-16.5dB in .1dB steps
75	1/4457	DC-750MHz	0-16.5dB in .1dB steps

OEM STEP ATTENUATORS

- HIGH RELIABILITY
- DUAL CONTACT

5400 SERIES

MODEL 5436 ATTENUATOR
KAY



500 SERIES

IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	500	DC- 2GHz	0-10dB in 1dB steps
50	1/500	DC- 1GHz	0- 1dB in .1dB steps
75	510	DC-1.5GHz	0-10dB in 1dB steps
75	1/510	DC-500MHz	0- 1dB in .1dB steps
50	520	DC- 2GHz	0-70dB in 10dB steps
75	530	DC-1.5GHz	0-70dB in 10dB steps
50	5435	DC- 1GHz	0-81dB in .1dB steps
75	5445	DC- 1GHz	0-81dB in .1dB steps
50	5436	DC- 2GHz	0-80dB in 1dB steps
75	5446	DC-1.5GHz	0-80dB in 1dB steps

BENCH STEP ATTENUATORS

- HIGH ACCURACY
- POSITIVE REPEATABILITY
- COMPACT DESIGN

400 SERIES

Attenuator
Attenuator

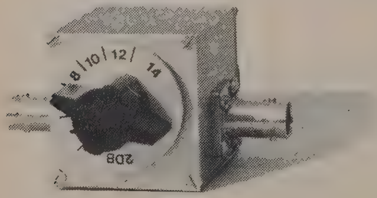
5000, 5100 SERIES

IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	5050	DC- 1GHz	0- 81dB in .1dB steps
75	5075	DC- 1GHz	0- 81dB in .1dB steps
50	5150	DC- 2GHz	0- 80dB in 1dB steps
75	5175	DC-1.5GHz	0- 80dB in 1dB steps
50	430	DC- 1GHz	10- 51dB in 1dB steps
50	431	DC- 1GHz	0- 41dB in 1dB steps
50	432	DC- 1GHz	0-101dB in 1dB steps
50	1/432	DC-500MHz	0-22.1dB in .1dB steps
50	437M	DC- 1GHz	0-102.5dB in .5dB steps
50	438M	DC- 1GHz	0- 41dB in 1dB steps
50	439M	DC- 1GHz	0-101dB in 1dB steps
50	1/439M	DC- 1GHz	0-22.1dB in .1dB steps
75	441	DC- 1GHz	0- 41dB in 1dB steps
75	442	DC- 1GHz	0-101dB in 1dB steps
75	1/442	DC-500MHz	0-22.1dB in .1dB steps
75	447	DC- 1GHz	0-102.5dB in .5dB steps
75	449M	DC- 1GHz	0-101dB in 1dB steps
75	1/449M	DC-500MHz	0-22.1dB in .1dB steps
50	460M	DC- 1GHz	0-132dB in 1dB steps
75	470M	DC- 1GHz	0-132dB in 1dB steps

90 Ω ALSO AVAILABLE

*M - MINIATURE

CONTINUOUSLY VARIABLE ATTENUATORS

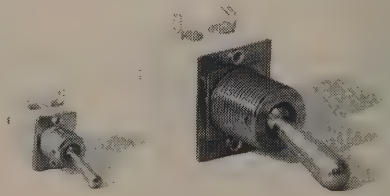


0/400, 0/410 SERIES

0/400 DC-500MHz 1-13dB
0/410 DC-400MHz 2-14dB

R.F. MEGA SWITCHES

- DC-1000 MHz
- LOW INDUCTANCE, CAPACITANCE & RESISTANCE



254 SERIES

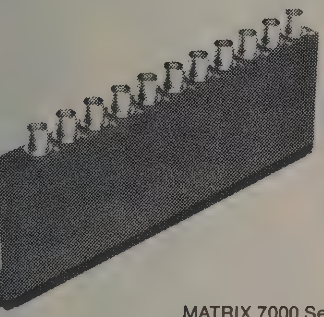
0.15pf Between switch arms
0.1pf Between open contacts and switch arm

KAY

Kay Elemetrics Corp
13 Maple Avenue
Pine Brook, N.J. 07058
(201) 227-2000

MATRIX
SYSTEMS CORPORATION
5177 NORTH DOUGLAS FIR ROAD
CALABASAS, CALIFORNIA 91302
(213) 992-6776 • TWX 910-494-4975

COAXIAL RELAY MODULE



FEATURES

- Two to twenty four throws
- Continuous shield continuity
- Rugged machined aluminum housing
- Crosstalk always less than isolation
- Switchpoints individually field replaceable
- Extremely low EMI
- Low VSWR
- Maitrix configuration easily assembled using 9000 series cross straps
- Signal circuits isolated from control circuitry

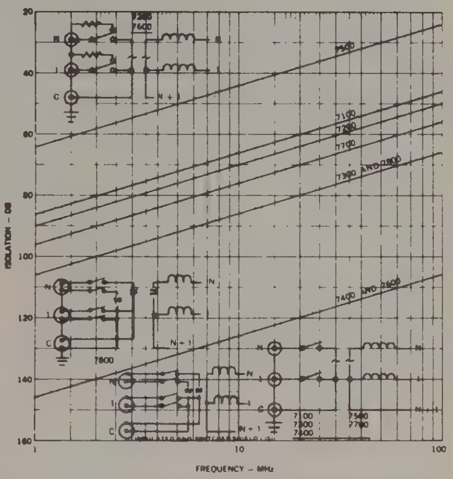
MATRIX 7000 Series Switch Modules are designed to maintain coaxial switching continuity over a wide range of critical and high environmental applications. The switch housings are constructed on precision machined aluminum alloy for structural integrity and hard anodized for durability. All signal shield paths are silver plated with covers gasketed for maximum EMI protection. The basic reed switch elements are hermetically sealed in nitrogen filled gas envelopes and employ rhodium plated contacts to insure non-stick operation. Applications for MATRIX 7000 Series include:

— R.F. and I.F. switching where a low VSWR is required .

— CCTV, base band video and pulse switching where low phase distortion and high pulse fidelity are required.

— Applications requiring a high degree of shielding integrity and low contact and induced noise such as pre amp input switching or the switching of high impedance operational amplifier inputs.

Matrix and hybrid switching systems are easily constructed by using Series 9000 (no output), 9100 (one output) or 9200 (two output) push-on cross straps which mate with the BNC connectors on the switch modules. The cross strap output connectors are BNC female type UG 1094/U. The model number of the cross strap is assigned by replacing the two zeros of the series number with the number of inputs desired. For example, a Model 9108 has eight inputs and one output.



SERIES 7000

7100— Standard
7200— Self-terminating
7300— High isolation
7400— Highest isolation
7500— High power
7600— Highest isolation self-terminating
7700— Mercury wetted contacts
7800— Twinax

MODEL NUMBER ASSIGNMENT

7 X XX -X

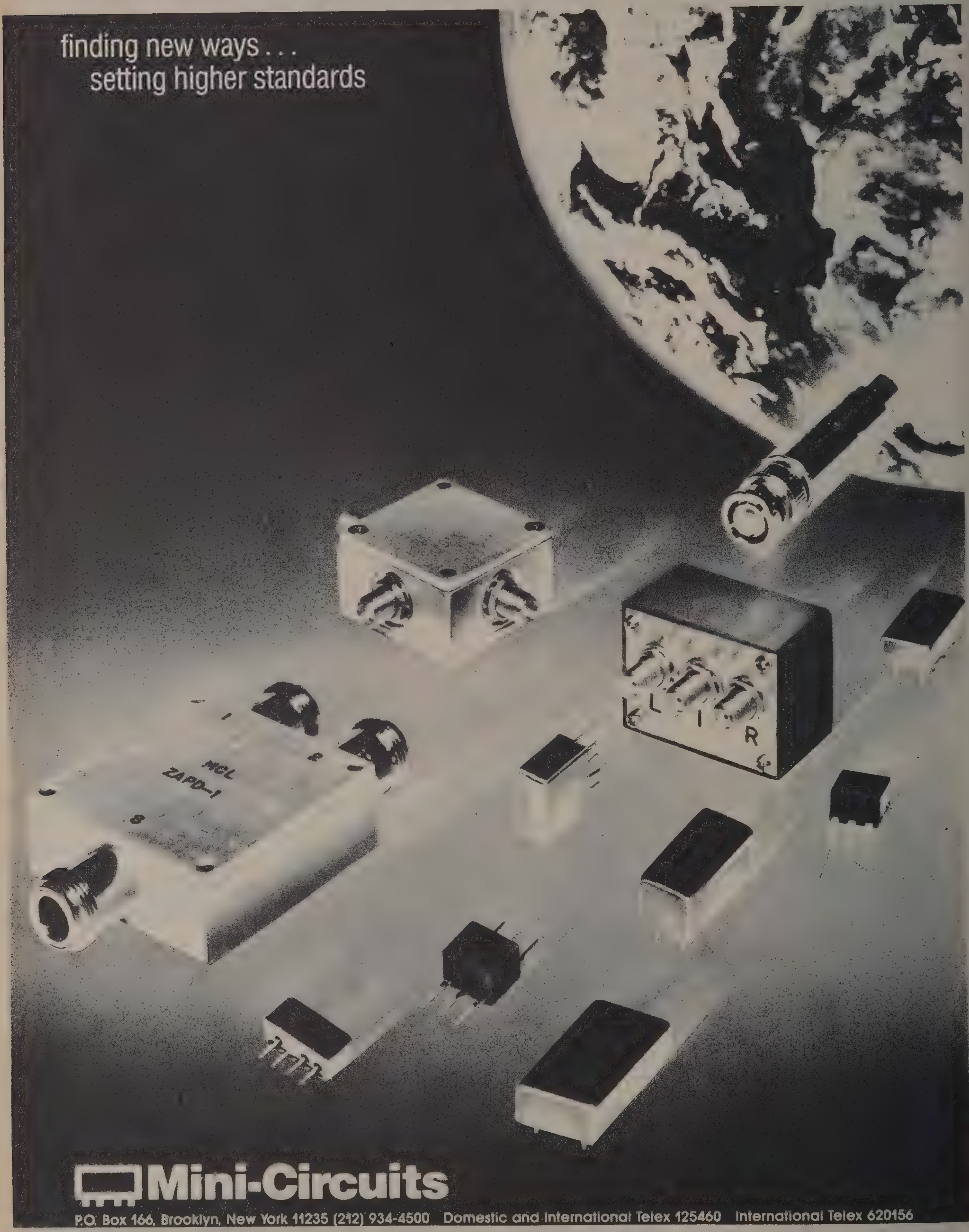
Series
Number of throws
Coil suppression diodes — DR
TNC connectors — T
Self-terminating resistance — ohms
Insulated shield — I
Insulated and switched shield — IS
Expander output — E
Chassis mount — C

SPECIFICATIONS

FREQUENCY RANGE:	0 - 300MHz
CHARACTERISTIC IMPEDANCE:	50 ohms - 75 ohm optional
SWITCHING CONFIGURATION:	Single or double pole, two thru twenty four throws
SWITCHING SPEED:	Less than one millisecond
ISOLATION:	See graph
CONTROL - CONNECTOR:	28 VDC,30 MA D type - subminiature connector
SIGNAL CONNECTOR:	BNC - UG1094/U, TNC and SMA optional
OPERATING TEMPERATURE AND HUMIDITY RANGE:	−30°F to + 150°F, 0 to 98 percent R.H.
OPERATING SHOCK AND VIBRATION:	50 G's -1MS,2G's p-p 20-2000 Hz
DIMENSIONS:	.625″ W × 3.25″ H × 1.44″ + .625″ × Number of throws
MOUNTING:	Three 6-32 tapped holes in base

	7100	7200	7300	7400	7500	7600	7700	7800
CONTACT RATING:	100 vdc .250 amp 10 W	28 vdc .250 amp 3 W	100 vdc .250 amp 10 W	28 vdc .250 amp 3 W	400 vdc 1 amp 15 W	28 vdc .250 amp 3 W	100 vdc 2.0 amp 50 W	100 vdc .250 amp 10 W
CONTACT RESISTANCE:	.150ohm	.300ohm	.300ohm	.300ohm	.060ohm	.300ohm	.050ohm	.300ohm

Matrix Systems Corporation manufactures a variety of Switching Devices. Whether you are Switching VHF, Video, Pulse or Audio or your control requirements are programmable or manual. Give us a call. We specialize in specials. (213) 992-6776


finding new ways . . .
setting higher standards
1
2
MCL
ZAPD-1
S
L
I
R
Mini-Circuits

P.O. Box 166, Brooklyn, New York 11235 (212) 934-4500 Domestic and International Telex 125460 International Telex 620156

RF/IF signal processing components guide
finding new ways . . .
setting higher standards
Mini-Circuits

at Mini-Circuits
we're dedicated to pursue
product innovations and
improvements to satisfy
our customers' current
and future needs.

finding new ways...
such as a proprietary HTRB
diode-screening technique,
computer-automated performance
data (CAPD) documentation
and off-the-shelf TX mixers.

setting higher standards
with the industry's only 3-year
guaranteed mixers,
+55 dB guaranteed third-order IM mixers,
highest output (1000 mv) phase detectors,
widest bandwidth directional couplers
...just to name a few.

Our committment to
the customer never ends.

finding new ways . . .
setting higher standards

Mini-Circuits

Table of Contents

general information

Ordering information and warranty 3
Model Index 4
How to use this catalog 5
Reliability and Quality Control 6-7
Environmental specifications and absolute maximum ratings 7
"Eliminating guesswork in Systems design CAPD" 8-13
"Mastering the mixer maze" 14-15
Outline drawings 58-62
Worldwide sales offices 63

specifications and performance data

amplifiers

general information 46
50mW (10MHz to 2000MHz) 50
1 Watt (50KHz to 4.2GHz) 47, 49, 51
2 Watt (5MHz TO 800MHz) 48

attenuators, fixed

pin models 54
connector models 55

attenuators/switches, electronic

pin and connector models 52
CAPD tables 53

directional couplers

pin models 40
connector models 41

frequency doublers

pin models 56
connector models 57

limiters

pin models 43

phase detectors

pin models 42

frequency mixers

level 7 pin models 16-17
level 7 connector models 18-19
level 10, broadband 20
level 13, broadband 21
level 17, very high dynamic range 22-23
level 17S, very low distortion 24-25
level 23, ultra low distortion 26
level 23S, ultra low distortion 27
level 27, ultra low distortion 27

power splitter/combiners

2 Way-0° 28-29
2 Way-90° 30
2 Way-180° 31
3 Way-0° 32
4 Way-0° 33
5 Way-0° 34
6 Way-0° 35
8 Way-0° 36
12 Way-0° 37
16 Way-0° 38
24 Way-0° 39
48 Way-0° 39

transformers, RF

general information 44
pin and connector models 45

ordering information *Federal supply code: 15542*

how to order

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data.
Your order may be sent directly to Mini-Circuits or to any of the local sales offices listed.
Prices listed in this catalog are domestic F.O.B. Brooklyn, New York. Mini-Circuits reserves the right to change specifications, models, prices or designs without prior notice and without liability for such changes.

shipping instructions

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits will specify the carrier to be used.

terms

Net 30 days from date of invoice. If credit is not established with Mini-Circuits, shipments will be made C.O.D. (cash on delivery) or prepaid. When sending prepayments, please include freight.

warranty

Scientific Components Corporation, Mini-Circuits division, warrants each product manufactured by Mini-Circuits to meet all published specifications and to be free from defects in material and workmanship. The Company's liability under this warranty is limited to repair, adjustment and/or replacement of defective parts returned, freight paid by Buyer, to the factory within a period of one year from date of shipment from the factory unless a shorter period is specified. International customers may ship to the Company's nearest Distributor.
Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly voids this warranty.
SINCE MINI-CIRCUITS HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMER'S INTENDED USE, BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER. Equipment shipped F.O.B. Mini-Circuits' plant shall become the property of the Buyer upon delivery to carrier. Damage in shipment should be handled by the Buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment.
A fee will be charged to the Buyer to cover the costs of inspection and test of units returned under this warranty and subsequently found to meet specifications or to be faulty for reasons which are not Mini-Circuits' responsibility. This warranty excludes all other warranties expressed or implied. Mini-Circuits shall not be liable for any special, indirect or consequential damages.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Model Index

amplifiers, broadband

model	page
ZFL-2000	50
ZHL-1A	47
ZHL-1-2W	48
ZHL-2	49
ZHL-2-8	49
ZHL-2-12	49
ZHL-3A	47
ZHL-7-2W	48
ZHL-32A	47
ZHL-42	51

directional couplers

model	page
PDC-10-1	40
PDC-10-1-75	40
PDC-10-2	40
PDC-10-21	40
PDC-10-22	40
PDC-15-6	40
PDC-15-6-75	40
PDC-20-1	40
PDC-20-3	40
PDC-20-3-75	40
TDC-10-1	40
ZDC-10-1	41
ZDC-10-1-75	41
ZDC-10-2	41
ZDC-15-6	41
ZDC-15-6-75	41
ZDC-20-1	41
ZDC-20-3	41
ZDC-20-3-75	41
ZDC-2375	41
ZEDC-10-2	41
ZEDC-15-2	41
ZFDC-10-1	41
ZFDC-10-2	41
ZFDC-10-21	41
ZFDC-10-22	41
ZFDC-15-6	41
ZFDC-15-6-75	41
ZFDC-20-3	41
ZFDC-20-4	41
ZFDC-20-5	41
ZMDC-10-1	41
ZMDC-10-2	41
ZMDC-15-6	41
ZMDC-20-1	41
ZMDC-20-3	41
ZMDC-30-1	41

electronic attenuator/switch

model	page
PAS-1	52
PAS-2	52
PAS-3	52
PSW-1111	53
PSW-1211	53
ZAS-1	52
ZAS-3	52
ZFAS-15	52
ZMAS-1	52
ZMAS-3	52
ZMSW-1111	53
ZMSW-1211	53

fixed attenuators

model	page
AT-3	54
AT-3-75	54
AT-6	54
AT-6-75	54
AT-10	54
AT-10-75	54
AT-20	54
AT-20-75	54
AT-30	54
AT-40	54
CAT-3	55
CAT-3-75	55
CAT-6	55
CAT-6-75	55
CAT-10	55
CAT-10-75	55
CAT-20	55
CAT-20-75	55
CAT-30	55
CAT-40	55
MAT-3	54
MAT-6	54
MAT-9	54
MAT-10	54
MAT-12	54
MAT-15	54
MAT-20	54
MAT-30	54
NAT-3	55
NAT-6	55
NAT-10	55
NAT-20	55
NAT-30	55
NAT-40	55
TAT-3	55
TAT-6	55
TAT-10	55
TAT-20	55
TAT-30	55
TAT-40	55
SAT-3	55
SAT-6	55
SAT-9	55
SAT-10	55
SAT-12	55
SAT-15	55
SAT-20	55
SAT-30	55

frequency doublers

model	page
AK-2	56
FD-2	57
FK-5	57
GK-2	57
GK-3	57
GK-5	57
MK-2	57
MK-3	57
MK-5	57
RK-2	56
RK-3	56
RK-6	56
SK-2	56

limiters

model	page
PLS-1	43
PLS-2	43
PLS-6	43

mixers

model	page
ASK-1	17
GRA-1	16
GRA-3	16
GRA-6	16
GRA-8	16
GRA-1H	22
GRA-3H	22
GRA-6H	22
LMX-113	17
LMX-123	20
LMX-124	17
LMX-125MH	21
LMX-148	20
LMX-149	17
PAM-42	17
RAY-1	26
RAY-2	26
RAY-3	26
RAY-6	26
SAM-1	17
SAM-2	17
SAM-3	17
SAM-4	17
SAM-5	17
SAY-1	27
SAY-2	27
SAY-11	27
SBL-1	16
SBL-1MH	21
SBL-1X	16
SRA-1	16
SRA-1TX	16
SRA-1-1	16
SRA-1W	16
SRA-2	16
SRA-2CM	16
SRA-3	16
SRA-4	16
SRA-5	16
SRA-6	16
SRA-8	16
SRA-11	16
SRA-12	16
SRA-1H	22
SRA-1WH	22
SRA-2H	22
SRA-3H	22
SRA-11H	22
SRA-1MH	21
SRA-3MH	21
SRA-215	20
SRA-220	20
SRA-173H	22
SRA-2000	16
TAK-5	16
TAK-5R	16
TAK-6	16
TAK-6R	16
TAK-7	16
TAK-1H	24
TAK-1WH	24
TAK-3H	24
TFM-2	17
TFM-3	17
TFM-4	17
TFM-11	17
TFM-12	17
TFM-15	20
TFM-150	20
TFM-1MH	21
TFM-3MH	21
TFM-1H	24
TFM-2H	24
TFM-3H	24
TFM-4H	24
TSM-1	17
TSM-3	17
VAY-1	27
ZAD-1	18
ZAD-1-1	18
ZAD-1W	18
ZAD-2	18
ZAD-3	18
ZAD-4	18
ZAD-6	18
ZAD-8	18
ZAD-11	18
ZAD-12	18
ZAD-1H	22
ZAD-1WH	22
ZAD-2H	22
ZAD-3H	22
ZAD-11H	22
ZAD-1SH	25
ZAD-1WSH	25
ZAD-3SH	25
ZAM-42	19
ZAY-1	26
ZAY-2	26
ZAY-3	26
ZEM-2	19
ZFM-1W	19
ZFM-2	19
ZFM-3	19
ZFM-4	19
ZFM-11	19
ZFM-12	19
ZFM-15	20
ZFM-150	20
ZFM-1H	25
ZFM-2H	25
ZFM-3H	25
ZFM-4212	19
ZFY-1	27
ZFY-2	27
ZFY-11	27
ZLW-1	18
ZLW-1-1	18
ZLW-1W	18
ZLW-2	18
ZLW-3	18
ZLW-5	18
ZLW-6	18
ZLW-8	18
ZLW-11	18
ZLW-12	18
ZLW-1H	22
ZLW-1WH	22
ZLW-2H	22
ZLW-3H	22
ZLW-11H	22
ZLW-1SH	25
ZLW-1WSH	25
ZLW-3SH	25
ZMA-2	18
ZMA-3	18
ZMY-1	26
ZMY-2	26
ZMY-3	26
ZP-10514	18

power splitter/combiners

model	page
LPS-109	28
MSC-2-1	28
MSC-2-1W	28
PSC-2-1	28
PSC-2-1-75	28
PSC-2-1W	28
PSC-2-2	28
PSC-2-4	28
PSC-2375	28
PSC-3-1	32
PSC-3-1-75	32
PSC-3-1-75-2	32
PSC-3-1W	32
PSC-3-2	32
PSC-3-13	32
PSC-4-1	33
PSC-4-1-75	33
PSC-4-3	33
PSC-4A-4	33
PSC-4-6	33
PSC-5-1	34
PSC-5-1-75	34
PSC-6-1	35
PSC-6-1-75	35
PSC-8-1	36
PSC-8-1-75	36
PSC-8A-4	36
PSC-8-6	36
PSC-8A4-75	36
PSCJ-2-1	31
PSCJ-2-2	31
PSCQ2-1.5	30
PSCQ2-3.4	30
PSCQ2-6.4	30
PSCQ2-7.5	30
PSCQ2-10.5	30
PSCQ2-13	30
PSCQ2-14	30
PSCQ2-21.4	30
PSCQ2-40	30
PSCQ2-50	30
PSCQ2-70	30
PSCQ2-90	30
PSCQ2-120	30
PSCQ2-180	30
PSCQ2-250	30
PSCQ2-400	30
PSCQ2-450	30
TSC2-1	28
ZAPD-1	29
ZAPD-2	29
ZAPD-4	29
ZAPD-21	29
ZAPDQ-2	30
ZAPDQ-4	30
ZA3PD-1	32
ZA3PD-1.5	32
ZA3PD-2	32
ZA3PD-4	32
ZA4PD-2	33
ZA4PD-4	33
ZB4PD-4	33
ZB4PD-42	33
ZB8PD-2	36
ZB8PD-4	36
ZFSC-2-1	29
ZFSC-2-1W	29
ZFSC-2-1-75	29
ZFSC-2-2	29
ZFSC-2-4	29
ZFSC-2-5	29
ZFSC-2-6	29
ZFSC-2-6-75	29
ZFSC-3-1	32
ZFSC-3-1W	32
ZFSC-3-13	32
ZFSC-4-1	33
ZFSC-4-1W	33
ZFSC-4375	33
ZFSC-4-3	33
ZFSC-4-2-75-1	33
ZFSC-6-1	35
ZFSC-6-1-75	35
ZFSC-8-1	36
ZFSC-8-1-75	36
ZFSC-8375	36
ZFSC-8-4	36
ZFSC-8-6	36
ZFSC-84-75	36
ZFSC-8-43	36
ZFSC-12-1	37
ZFSC-12-11	37
ZFSC-16-1	38
ZFSC-16-3	38
ZFSC-16-675	38
ZFSC-16-12	38
ZFSC-24-1	39
ZFSC-24-6	39
ZFSC-24-11	39
ZFSC-48-1	39
ZFSC-48-1-75	39
ZFSCJ-2-1	31
ZFSCJ-2-3	31
ZMSC-2-1	29
ZMSC-2-1W	29
ZMSC-2-2	29
ZMSC-3-1	32
ZMSC-3-2	32
ZMSC-4-1	33
ZMSC-4-2	33
ZMSC-4-3	33
ZMSCJ-2-1	31
ZMSCJ-2-2	31
ZMSCQ-2-50	30
ZMSCQ-2-90	30
ZMSCQ-2-180	30
ZSC-2-1	29
ZSC-2-1-75	29
ZSC-2-1W	29
ZSC-2-2	29
ZSC-2-4	29
ZSC-2375	29
ZSC-3-1	32
ZSC-3-1-75	32
ZSC-3-2	32
ZSC-3-2-75	32
ZSC-4-1	33
ZSC-4-1-75	33
ZSC-4-2	33
ZSC-4-3	33
ZSCJ-2-1	31
ZSCJ-2-2	31
ZSCQ-2-50	30
ZSCQ-2-90	30
ZSCQ-2-180	30

transformers, RF

model	page
FT1.5-1	45
FTB1-1	45
FTB1-6	45
FTB1-1-75	45
T1-1	45
T1-1H	45
T1-1T	45
T1.5-1	45
T1.5-6	45
T1-6	45
T1-6T	45
T2-1	45
T2-1T	45
T2.5-6	45
T2.5-6T	45
T3-1	45
T3-1T	45
T4-1	45
T4-2	45
T4-6	45
T4-1H	45
T5-1T	45
T8-1	45
T9-1	45
T9-1H	45
T13-1T	45
T14-1	45
T16-1	45
T16-1H	45
T16-6T	45
T36-1	45
TT1-6	45
TT1.5-1	45
TT2.5-6	45
TT4-1	45
TT25-1	45
TTMO1-1	45
TMO1-1	45
TMO1-1T	45
TMO1.5-1	45
TMO2-1	45
TMO2-1T	45
TMO2.5-6	45
TMO2.5-6T	45
TMO3-1	45
TMO3-1T	45
TMO4-1	45
TMO4-2	45
TMO4-6	45
TMO5-1T	45
TMO8-1	45
TMO9-1	45
TMO13-1T	45
TMO14-1	45
TMO16-1	45

phase detectors

model	page
RPD-1	42
MPD-1	42

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

how to use this catalog

Over 1,000 RF/microwave signal-processing components are available to the design engineer from Mini-Circuits. This catalog has been organized to simplify the process of selecting the component best suited to your application and need, to speed location of specs for a particular model, and to provide helpful application assistance.

A complete listing of all the product family groups — from frequency mixers to power splitters to RF transformers — plus warranty and ordering details are found on page 3.

Looking for data on a specific model? Page 4 contains a list of all models in alphabetical/numerical order, available from Mini-Circuits with reference to specific data pages.

For a concise production/test flow diagram illustrating Mini-Circuits quality-control procedures. Turn to pages 6 and 7. Also detailed information on our Hi-Rel, HTRB and TX products for your military, space or rugged industrial applications.

CAPD
now available!
computer-automated performance data
(see technical section)

Computer-automated-performance data (CAPD) is a Mini-Circuits' innovation offering the most complete data base for catalog RF signal-processing components. What's involved in CAPD and its benefits towards your new designs are described on pages 8-13.

"Mastering the Mixer Maze"...
Mixer selection, with hundreds of models to choose from, can be confusing. The penalty for improper selection? Overspecify and pay extra; underspecify and face marginal performance. Read pages 14-15 for a clearly-detailed procedure for choosing the optimum mixer for your needs.

Data pages are grouped by product line. Each data page is organized by series within the product line and by models within the series.

Information given includes CAPD data, National Stock Numbers (NSN), equivalent MIL — part numbers, pin connection designations, case styles, and notes to the tables.

Full technical data for each model is given in table form. The tables are arranged by sequence of model number for each series. The various models within a series differentiate from each other by the frequency range they cover. Frequency range is defined in the tables by the lowest frequency fL to the highest frequency fu. For most models, the frequency range is further subdivided into three segments; L = low range, M = mid range, and U = upper range. Each range L, M, U is defined at the bottom of each table in terms of fL and fu.

Mixer selection is primarily determined by selecting a mixer level suitable for the application. Therefore, to aid the designer, frequency mixers are organized in sequence of mixer level — Level 7, 10, 13, 17, 17S, 23, 23S and 27. A Level 7 mixer operates with +7 dBm LO drive, a Level 13 mixer operates with +13 dBm LO drive, etc. For each level mixer, a maximum RF input level for linear operation is specified.

Power splitters are organized in numerical sequence of power split; from 2 way 0°, 2 way 90°, 2 way 180°, 3-, 4-, 5-, 6-, 8-, 12-, 24-, to 48 way 0°.

Case style and dimensions are easy to find... each data page includes a photo of the particular case style for each series and, within the data, there is reference to case style number and outline drawing letter. Turn to pages 58 to 62 for case style dimensions, tolerances and bracket options where applicable.

For example, the SRA-1 mixer detailed on page 16 calls for case A01. The dimensions and outline drawing are given in the table on page 58 and figure A on page 59.

Need Mini-Circuits components in a hurry? Refer to page 63 for a listing of our world-wide network of sales representatives and distributors ready to serve your needs, supply your orders, and answer your questions promptly and courteously.

reliability and hi-rel components

All Mini-Circuits' RF signal-processing components are subjected to rigid quality control procedures starting from raw material procurement through product production and final inspection; the objective—to supply our customers with the finest RF signal-processing components available. Here's a list of some of the procedures taken to insure high-quality performance and product reliability:

A. 100% testing of each diode.

B. 100% testing of each unit.

C. 100% inspection of every solder connection.

D. All transformers bonded to the header for protection against severe shock and vibration.

E. All diodes, resistors and capacitors bonded to the header for protection against severe shock and vibration conditions.

F. Diode and resistor power dissipation derated greater than 50%.

G. All components rated for greater than + 125°C.

H. All transformer leads double wrapped.

I. Heavy coated wire insulation for HiPot/altitude.

J. Completely encapsulated for protection against mechanical shock and vibration as well as temperature shock.

K. Permanent case marking of model number cannot be removed by cleaning agents.

L. Cupro-Nickel case for long-lasting finish especially under salt atmosphere conditions.

Every unit shipped from Mini-Circuits carries a full-year guarantee; in fact, our industry-standard SRA-1 mixer offers an exclusive three-year guarantee.

High-temperature, Reverse-bias (HTRB) testing is an accelerated-life screening test generally reserved for space applications. Here the Schottky and PIN diodes are subjected to a one-volt negative bias at 150°C for 168 hours. The objective of this accelerated aging stress is to force time/temperature-related failures and thus screen out potentially unreliable devices; in conventional "baking" processes, the diode does not experience anywhere near the stress imposed by the HTRB program. The result: highly-reliable Schottky and PIN diodes ready for wiring into assemblies.

Next, the assembled units are subjected to additional testing procedures including
(1) burn-in for 96 hours at 100°C with 8 ma at 1 KHz
(2) thermal shock per MIL-STD 202, Method 107
(3) Gross and fine leak tests according to MIL-STD 202, Test Method 112B, Conditions A and C

As a consequence of the above HTRB, final seal, and burn-in testing, Mini-Circuits components offer an unprecedented high level of reliability. In fact, Mini-Circuits' industry-standard SRA-1 is the only double-balanced mixer in the world to be offered with an exclusive *three-year* guarantee.

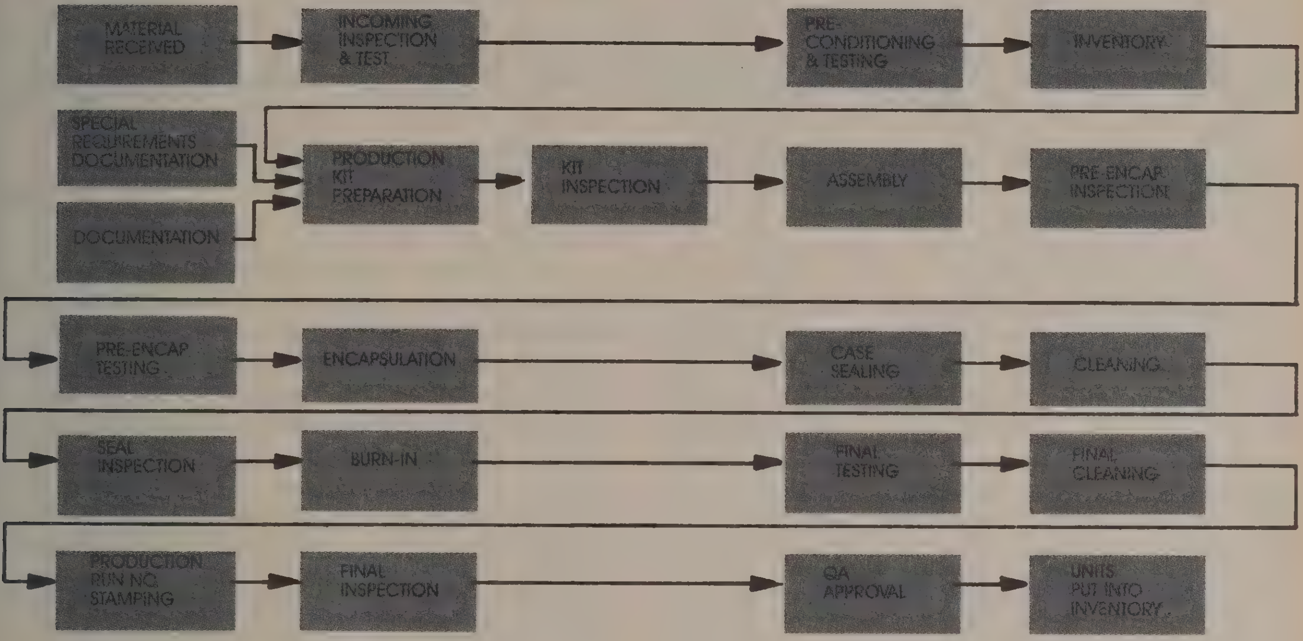
TX mixers

For the most critical space, military or industrial applications in hostile environments, Mini-Circuits offers TX mixers. Stringent screening and stressing are applied to the TX mixers which employ TX hermetically-sealed diodes that have passed the following tests per MIL-STD-750:
(1) high-temperature storage for 340 hours at 150°C, Method 1032; (2) thermal shock, Method 1051, Test Condition C (−65°C to +150°C, 10 cycles); (3) constant acceleration, Method 2006, Y1 orientation, 20,000 G's; (4) fine leak, Method 1071, Condition H; (5) gross leak, Method 1071, Condition C; (6) burn-in for 96 hours at 25°C, 75mW/junction at 60 Hz, Method 1038, Condition B.
Those diodes that pass these rigid tests are then electrically tested to ensure that they meet specifications. They are then assembled into TX mixers which are then further exposed to these stress tests: (1)thermal shock, MIL-STD 202, Method 107; (2) burn-in for 96 hours at 100°C, with 8 ma at 1 KHz; (3) gross and fine leak, MIL-STD 202, Method 112B, Conditions A and C
The SRA-1TX is the first off-the-shelf TX mixer in the industry available for immediate delivery. All other Mini-Circuits' mixers are available with TX screening and testing.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

quality control

how Mini-Circuits achieves high reliability


MATERIAL RECEIVED
INCOMING INSPECTION & TEST
PRE-CONDITIONING & TESTING
INVENTORY
SPECIAL REQUIREMENTS DOCUMENTATION
DOCUMENTATION
PRODUCTION KIT PREPARATION
KIT INSPECTION
ASSEMBLY
PRE-ENCAP INSPECTION
PRE-ENCAP TESTING
ENCAPSULATION
CASE SEALING
CLEANING
SEAL INSPECTION
BURN-IN
FINAL TESTING
FINAL CLEANING
PRODUCTION RUN NO. STAMPING
FINAL INSPECTION
QA APPROVAL
UNITS PUT INTO INVENTORY

environmental specifications

All MCL components are manufactured under exacting quality assurance and control standards. They will meet or exceed published specifications over the operating temperature range of −54° to +100°C, and after being subjected to any or all of the following physical or environmental tests of MIL-STD 202E which are applicable.

	TEMPERATURE CYCLING: −65° to +125°C	102 C
	ALTITUDE: 656,000 feet	105 G
(2)	HUMIDITY: 90% RH, 65°C	106
	THERMAL SHOCK: −65°C to +125°C	107 B
(1) (2)	SEAL: Less than 10^5 Atm. cc/sec	112 A
	DROP: Random, 45 min.	203
	VIBRATION: 2 to 2,000 cps, 20g, 12 hrs.	204 D
	SOLDER HEAT: 260°C, 10 sec.	210 B
(1)	SOLDERABILITY: 95% coverage	208
	TERMINAL TENSILE STRENGTH: 4½ lbs., 10 sec.	211 A
(1)	TERMINAL FATIGUE: 2 lbs., 3 cycles	211 C
	MECHANICAL SHOCK: 100g, 6ms	213 I
	SOLVENT RESISTANCE: Alcohol, Trichloroethan, Freon	215

NOTE:

(1) These specifications do not apply to coaxial connector models.

(2) Exceptions are non-hermetic case styles 6, 38, 46.

absolute maximum ratings

OPERATING AND STORAGE TEMPERATURE −55°C to +100°C

eliminating guesswork in systems design

CAPD (computer-automated performance data)

Today, RF and Microwave subsystem and system designs must be more precisely detailed as performance demands become more stringent. Radars must be more accurate, communications systems must be more noise-free, and guidance systems must be more rigorous, and all are required to meet quality and reliability levels considered unattainable a decade ago. These new demands place a heavy burden on the design engineer, the project manager, the quality assurance group...and the suppliers of the components to be assembled into these systems. In addition to the stricter performance and reliability specs, the designer faces escalating costs if, at the last stages before system delivery, unexpected surprises occur in the form of spurious signals, high VSWR or other pitfalls not anticipated.

Until now, the designer selected his RF/Microwave components, such as mixers, power splitters, and amplifiers, using manufacturers' data sheets to provide detailed specs, performance curves, and environmental ratings. Indeed, the design engineer did receive a workable package of information to see how his design might proceed...but it was not a detailed, close-up look. The reason is simple—it has just been too expensive to take an enormous number of test points, at a considerable number of specific frequencies, tabulate the results and then repeat at other input levels.

As an example, a two-tone intermodulation distortion chart for mixer performance would require at least 100 measurement points plus 10 additional calibration points and would take an experienced technician at least a half-day to complete.

For those customers who required their data at specific frequencies or under conditions other than is offered on the manufacturers' data sheets, extra charges were justifiably added to offset the additional labor costs.

Now, a new computer-automated performance data (CAPD) service offered exclusively by Mini-Circuits to its customers at no additional charge. Based on over 20 years of RF test experience and six years of engineering manpower-hours, the CAPD service provides detailed specs never available previously on mixer conversion loss, isolation, VSWR and intermod; for directional couplers and power splitters, details on insertion loss, isolation, phase unbalance and VSWR vs. frequency; for amplifiers, VSWR, gain changes and compression point vs frequency. In fact, all Mini-Circuits' products are available with CAPD specs.

test setup is self checking

The heavy investment in CAPD, using a Hewlett-Packard Model 85 computer and HP8566A spectrum analyzer as key elements, allows the previously-mentioned, two-tone IM test to be completed in less than ten minutes compared with the manually performed sequence requiring 4-5 hours. Here's how stringent the computer-automated set up dictates each measurement: each point is measured three times, with a maximum allowable deviation of less than 0.05 dB between the three; otherwise the test is repeated. Before each measurement is taken, the computer checks the reference voltage level for any variation due to line voltage, temperature, etc., changes and compensates as required. Similarly, frequency is monitored before each test and any drift is automatically corrected. Such continuous and rapid inspection and correction ensure highly-reliable CAPD data. And, by using a large number of closely-spaced frequency points for component measurement, effects of narrow-band suck-outs or resonances (often missed with manual test procedures) are immediately identified.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

a close-up view of performance

What's the significance of CAPD to the designer? Is it a sales "gimmick" or is it truly a design tool? Review these points and judge for yourself.

A competent RF/Microwave design engineer, drawing on his experience and expertise over years of varied projects, still must be concerned with unforeseen problems when the prototype is first turned on. Generation of spurious signals, changes in dc offset level, affects of LO drive variations and other vexing problems often become evident to extend delivery time and escalate costs. In many instance, a more precise definition of the component specs could have pinpointed the potential problem areas; with CAPD, it's now possible.

Let's assume you are specifying a double-balanced mixer for a wideband front-end design. Here are a number of profound questions you face:

- In a wideband design, the local oscillator (LO) output might vary over the band and could fall below the level required by the mixer spec. Should you spend additional money to flatten LO output or do you boost LO output if it is not sufficient?... Wouldn't it be valuable to know exactly how performance will be affected since you might find performance acceptable without any additional investment? with CAPD, a close point-by-point printout of key parameters as a function of LO level is available (fig. 1) — now you can make your decision based on a close-up, view of LO drive effects on mixer performance.
- How about VSWR over the full range of receiver specs? Generally, mixer VSWR specs are given at one particular frequency. With manual-test procedures, it's a time-consuming task for the components manufacturer or systems house; with CAPD it's available at no extra charge (fig. 2).
- How does the filter in the design match the mixer IF output and what is the impedance match in-band as well as out-of-band where spurious responses become a threat? CAPD VSWR data tells it all. How will the mixer conversion loss affect receiver sensitivity over the full frequency range? And, how will flatness of conversion loss affect the degree of image rejection in an image-reject mixer? CAPD data (fig. 1) will pinpoint these details.

If the mixer is being used as a phase detector, it may be critical to know how dc offset voltage varies with frequency. Most mixer specs list dc offset at only one frequency; with CAPD, this parameter is given over the full range of frequency (fig 4).

- Harmonic and intermod signals invariably plague your final design. The effects of, for example, a 4th harmonic of the LO mixing with the 5th harmonic of the RF is given on many spec sheets, but at a specific LO and RF level. The effects of LO level changes might be crucial to your design; with manual point-by-point testing, extensive and costly technician test time would be demanded or, more likely, such tests just won't be performed. With CAPD capabilities, such intricate interactions are quickly run, and made available to the designer (fig. 3).

If you are specifying directional couplers and/or power splitter/combiners in your systems, you can now closely examine how VSWR, insertion loss, isolation and amplitude/phase unbalance vary at closely-spaced points over the frequency range of interest, (fig. 5). You can now evaluate the effects of the VSWR of the termination at the S-port and, another industry-first, inspect intermod data of a power splitter caused by saturation of the cores within the unit.

Amplifier performance is clearly shown with CAPD data as a function of dc power supply changes, (fig. 6). You'll be able to closely examine how VSWR, compression point and gain are influenced by dc supply fluctuations; this could reduce your power-supply costs, since it will conveniently point to the degree of voltage regulation required to meet the amplifier performance needed. Also, it's common to furnish amplifier specs over the frequency band of interest, but CAPD testing offers an opportunity to examine the amplifier characteristics, outside the band to foresee the effects of harmonic and spurious signals; for example, an amplifier that is flat to 1200 MHz offers what gain and what VSWR for second-harmonic 2400 MHz signals? Knowing these details can thwart potential systems problems.

Even a relatively common component such as an RF transformer is now available with CAPD data, (fig. 7). The significance...previously insertion loss vs frequency was considered flat over a specified frequency range. With closely spaced CAPD test prints, even slight variations which could affect systems performance become apparent.

CAPD is your microscope

Look at CAPD as a microscope, revealing the "real world" details affecting your design decisions. Most important, CAPD was involved with one uppermost objective—to assist you, the design engineer, in producing a more effective end product. To accomplish this, you may require CAPD data at very specific frequency points not provided by our programmed steps. Not to worry...just furnish us with precise needs for your specific application. Be assured we'll do our best to comply.

eliminating guesswork in systems design

CAPD (computer-automated performance data)

SRA-1 mixer

mixer conversion loss and isolation

			C-LOSS (dB)				L-R (dB)				L-I (dB)			
RF (MHz)	RF-Level (dBm)	LO (MHz)	LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm	LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm	LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm
10.00	−14.97	40.00	6.84	6.21	5.48	5.73	48.83	51.66	56.57	56.14	48.48	51.72	56.14	55.84
35.78	−14.92	65.78	7.32	6.68	5.71	5.91	49.28	51.47	54.93	54.83	48.04	50.90	54.75	53.93
61.56	−14.97	91.56	6.96	6.30	5.82	5.76	49.31	50.86	53.42	51.81	48.16	49.62	52.86	51.92
87.34	−14.96	57.34	6.99	6.38	5.77	5.86	49.40	51.62	54.58	55.74	48.70	50.97	54.02	54.69
113.12	−14.96	83.12	6.65	6.73	5.66	6.01	49.23	51.39	54.09	52.15	48.11	50.40	53.81	52.37
138.90	−14.95	108.90	6.10	5.52	5.81	5.05	49.03	50.58	52.04	50.35	48.10	48.84	51.56	50.73
164.68	−14.96	134.68	6.49	5.56	5.77	5.16	48.24	49.50	48.19	48.13	47.47	48.08	48.20	48.64
190.46	−15.02	160.46	6.14	5.41	5.62	5.01	47.61	48.20	46.85	46.44	46.51	47.18	46.27	46.53
216.24	−14.96	186.24	6.03	5.49	5.85	5.11	47.27	45.80	44.88	45.34	44.96	46.25	44.72	45.78
242.02	−14.99	212.02	7.11	6.53	5.91	6.05	46.49	44.25	43.74	43.47	44.64	44.80	43.20	43.56
267.80	−14.92	237.80	6.88	6.33	5.79	5.87	45.17	43.44	42.49	42.93	44.18	44.21	42.27	43.21
293.58	−14.96	263.58	7.08	6.61	6.01	6.17	42.69	42.29	40.93	40.87	42.63	42.74	40.33	40.79
319.36	−15.00	289.36	6.97	6.41	6.03	6.04	41.59	40.77	38.59	39.64	41.75	41.10	39.70	39.51
345.14	−14.97	315.14	7.41	6.71	5.99	6.26	39.60	39.02	37.93	37.84	41.39	40.74	38.97	38.82
370.92	−14.95	340.92	7.58	6.91	6.62	6.17	40.15	38.78	37.22	37.21	41.67	39.80	39.26	37.44
396.70	−15.00	366.70	8.22	7.42	6.93	6.39	39.81	38.10	36.79	35.84	40.85	38.81	37.86	37.46
422.48	−14.97	392.48	8.46	6.99	7.27	5.57	39.50	38.16	36.76	35.79	38.93	36.27	34.74	36.69
448.26	−14.96	418.26	9.44	7.80	7.76	6.22	39.02	37.60	36.14	36.29	38.29	36.00	34.76	33.54
474.04	−15.02	444.04	10.04	8.03	8.13	6.49	39.39	38.03	37.53	36.73	36.78	34.93	35.30	33.84
500.00	−14.92	470.00	10.31	8.43	8.10	6.84	41.24	40.71	40.19	40.14	36.15	34.30	33.89	33.63

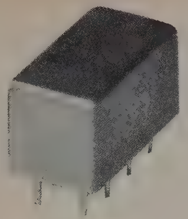
FIG. 1

mixer VSWR

Freq.	VSWR, RF port			VSWR, LO port			VSWR, IF port		
Freq. (MHz)	LO +4dBm	LO +7dBm	LO +10dBm	LO +4dBm	LO +7dBm	LO +10dBm	LO +4dBm	LO +7dBm	LO +10dBm
.500	2.57		2.52	3.57		3.82	1.37		1.07
5.000	1.16			2.28			1.16		
26.789	1.06	1.08	1.25	1.41	2.28	3.09	1.43	1.19	1.09
53.079	1.12	1.13	1.24	1.33	2.10	2.99	1.41	1.24	1.14
79.368	1.18	1.18	1.27	1.37	2.08	3.24	1.46	1.29	1.21
105.658	1.30	1.23	1.43	1.37	2.13	2.82	1.73	1.37	1.37
131.947	1.35	1.29	1.46	1.42	2.16	3.01	1.77	1.47	1.45
158.237	1.41	1.35	1.49	1.47	2.12	3.07	1.82	1.54	1.47
184.526	1.48	1.42	1.53	1.46	2.12	2.73	1.96	1.67	1.59
210.816	1.53	1.47	1.57	1.53	2.16	2.83	2.09	1.74	1.67
237.105	1.78	1.53	1.80	1.53	2.19	2.77	2.67	1.82	1.99
263.395	1.81	1.62	1.84	1.57	2.19	2.61	2.60	1.95	2.00
289.684	1.65	1.70	1.66	1.64	2.19	2.72	2.23	2.07	1.83
315.974	1.82	1.76	1.78	1.67	2.22	2.52	2.74	2.16	2.08
342.263	1.88	1.83	1.84	1.79	2.32	2.55	2.94	225	2.21
368.553	1.96	1.87	1.90	1.77	2.40	2.56	3.15	2.29	2.35
394.842	2.00	1.92	1.91	1.70	2.43	2.44	3.11	2.36	2.31
421.132	1.75	2.02	1.71	1.66	2.43	2.54	2.47	2.48	2.00
447.421	1.91	2.04	1.85	1.61	2.40	2.44	3.15	2.41	2.35
473.710	2.06	2.03	1.94	1.57	2.35	2.39	3.56	2.35	2.47
500.000	1.94	2.07	1.85	1.47	2.32	2.37	3.12	2.37	2.30

FIG. 2

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500



Mini-Circuits

mixer harmonic intermodulation

(Relative to desired IF Output)

LO at +4dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	36	17	24	24	29	33	45	49	49	65	57	59	60	65	58
1	0	18	—	33	18	35	31	45	40	52	50	55	58	49	63	54	65
2	74	42	49	41	63	45	57	57	58	55	67	69	72	72	71	70	70
3	78	66	40	51	35	54	38	57	57	69	63	70	70	72	72	71	71
4	79	68	72	66	69	63	69	63	69	71	72	67	71	70	70	71	72
5	78	72	71	72	65	68	59	60	59	71	70	70	70	71	71	72	72
6	77	70	71	71	72	73	72	73	72	71	71	72	71	70	71	70	72
7	78	71	69	71	71	71	72	71	71	71	71	71	72	71	72	70	70
8	78	72	71	71	70	71	71	70	71	72	71	72	71	71	70	72	70
9	80	72	72	68	70	71	71	72	72	71	71	72	71	71	71	72	70
10	80	71	72	71	70	72	71	71	72	73	71	70	72	72	71	72	72
11	79	71	72	72	72	71	70	70	71	72	72	71	73	72	72	72	71
12	79	71	71	72	71	72	71	71	71	71	71	72	71	71	71	70	72
13	78	71	71	71	70	72	71	71	71	70	71	70	72	71	71	71	72
14	80	72	71	72	71	71	71	71	71	70	71	71	71	72	71	72	72
15	73	66	73	71	71	71	71	72	72	72	72	70	70	71	71	73	71

Harmonic LO Order

LO at +7dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	31	17	27	22	28	30	39	49	46	58	57	58	59	66	53
1	0	17	—	37	11	33	37	47	36	50	53	60	58	59	62	61	67
2	74	48	47	50	52	49	60	56	58	50	69	65	72	73	72	73	71
3	78	66	56	58	46	57	44	68	60	64	58	72	69	72	74	72	74
4	79	71	71	72	70	73	69	70	72	73	73	71	72	71	73	72	73
5	78	73	73	72	73	73	71	72	68	72	73	72	72	71	73	72	73
6	77	73	71	72	71	73	73	73	73	72	73	72	74	73	73	71	72
7	78	73	71	72	71	73	73	73	73	72	73	72	74	73	73	71	72
8	78	74	72	72	71	74	74	73	71	72	73	72	72	73	73	72	72
9	80	74	72	73	72	72	72	73	73	73	72	73	72	74	73	72	73
10	80	73	74	73	71	73	73	73	73	72	73	73	74	72	73	74	72
11	79	71	73	73	72	72	72	71	73	72	74	73	73	73	75	72	73
12	79	73	73	72	74	72	73	72	72	73	74	72	71	72	73	73	71
13	78	73	73	73	73	72	73	73	71	72	72	72	73	72	73	73	71
14	80	73	72	73	73	73	73	73	71	72	72	71	72	73	73	72	73
15	73	66	73	72	73	73	73	73	73	73	72	71	71	73	73	72	73

Harmonic LO Order

LO at +10dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	26	13	25	16	21	21	34	43	38	61	48	54	50	54	47
1	0	19	—	42	10	30	30	39	34	49	50	52	58	57	59	60	64
2	74	63	53	71	59	58	62	58	59	54	71	66	71	73	73	73	74
3	78	69	63	70	69	73	64	72	72	70	63	71	71	73	74	74	73
4	79	72	73	74	72	73	73	74	73	72	72	71	72	73	72	73	73
5	78	72	72	74	74	74	72	73	73	72	72	72	73	73	73	72	73
6	77	71	72	73	72	73	73	72	73	74	73	72	72	72	72	73	72
7	78	72	72	71	73	72	73	73	74	73	73	74	72	71	73	72	72
8	78	72	71	72	72	72	74	73	73	73	73	73	71	72	73	73	73
9	80	74	71	71	71	72	73	73	71	73	73	71	73	73	72	73	73
10	80	73	73	72	72	74	72	73	71	74	74	73	74	71	74	73	71
11	79	73	73	72	73	73	73	71	70	74	73	72	72	74	74	73	72
12	79	73	73	73	73	73	73	72	71	73	74	73	73	72	72	71	73
13	78	73	73	74	72	73	72	73	72	72	71	73	74	72	73	73	73
14	80	72	73	72	74	74	74	73	71	72	73	71	72	72	74	73	72
15	73	66	73	73	73	72	73	73	73	72	73	73	72	72	73	72	73

Harmonic LO Order

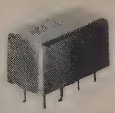
test conditions

RF = 400.1 MHz at −10dBm
LO = 370.01 MHz
For other test frequencies, contact factory.

FIG. 3

eliminating guesswork in systems design

CAPD (computer-automated performance data)



SRA-1 mixer

mixer phase detection (+7 dBm)

model SRA-1

max. output/DC offset Vs. freq.

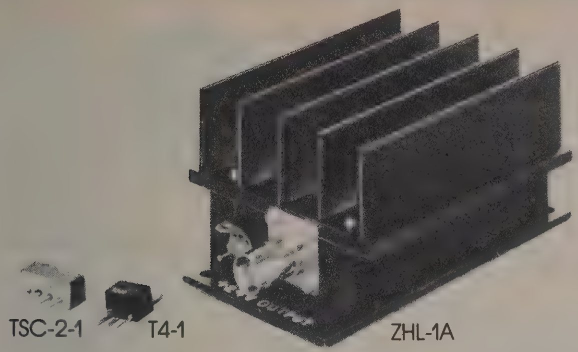
Freq. (MHz)	max. DC output mV	DC offset mV
10.00	−262.53	− .57
30.42	−263.46	− .54
50.83	−260.71	− .54
71.25	−260.38	− .51
91.67	−264.70	− .46
112.08	−265.05	− .42
132.50	−266.23	− .38
152.92	−263.79	− .34
173.33	−263.92	− .34
193.75	−268.92	− .37
214.17	−274.08	− .32
234.58	−276.75	− .33
255.00	−275.81	− .53
275.42	−270.65	− .63
295.83	−266.67	− .35
316.25	−256.71	− .52
336.67	−251.84	− .82
357.08	−236.17	− .63
377.50	−228.06	−1.01
397.92	−217.55	−1.38
418.33	−214.55	−1.88
438.75	−214.43	−1.58
459.17	−210.65	−1.86
479.58	−206.27	−2.74
500.00	−204.64	−2.69

output voltage Vs. phase, 10 MHz

Phase, degrees	output, mV
0 deg.	−262 mVOLT
10 deg.	−258 mVOLT
20 deg.	−246 mVOLT
30 deg.	−227 mVOLT
40 deg.	−200 mVOLT
50 deg.	−168 mVOLT
60 deg.	−131 mVOLT
70 deg.	−89 mVOLT
80 deg.	−45 mVOLT
90 deg.	0.6 mVOLT
100 deg.	46 mVOLT
110 deg.	90 mVOLT
120 deg.	132 mVOLT
130 deg.	169 mVOLT
140 deg.	202 mVOLT
150 deg.	228 mVOLT
160 deg.	247 mVOLT
170 deg.	259 mVOLT
180 deg.	263 mVOLT
190 deg.	259 mVOLT
200 deg.	247 mVOLT
210 deg.	228 mVOLT
220 deg.	292 mVOLT
230 deg.	169 mVOLT
240 deg.	132 mVOLT
250 deg.	90 mVOLT
260 deg.	46 mVOLT
270 deg.	0.6 mVOLT
280 deg.	−45 mVOLT
290 deg.	−89 mVOLT
300 deg.	−131 mVOLT
310 deg.	−168 mVOLT
320 deg.	−200 mVOLT
330 deg.	−227 mVOLT
340 deg.	−246 mVOLT
350 deg.	−258 mVOLT
360 deg.	−262 mVOLT

FIG. 4

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500



Mini-Circuits

power splitter/combiners

model TSC-2-1

Insertion loss, Amplitude Unbalance, Isolation

MHz	REF. (dBm)	S-1 (dB)	S-2 (dB)	Unbal. (dB)	ISO (dB)
1.00	−4.99	3.25	3.21	−.04	36.02
22.00	−4.95	3.20	3.20	0.00	46.30
43.00	−4.97	3.24	3.21	−.03	40.42
64.00	−4.99	3.25	3.25	0.00	36.77
85.00	−4.92	3.30	3.29	−.01	34.79
106.00	−4.99	3.28	3.28	0.00	33.30
127.00	−5.06	3.29	3.32	.03	32.27
148.00	−5.02	3.31	3.33	.02	31.51
169.00	−5.02	3.31	3.36	.05	30.95
190.00	−5.08	3.30	3.40	.10	30.64
211.00	−4.91	3.30	3.44	.14	30.51
232.00	−4.91	3.30	3.47	.17	30.62
253.00	−4.99	3.33	3.49	.16	31.06
274.00	−4.96	3.34	3.52	.18	31.94
295.00	−5.03	3.32	3.57	.25	33.35
316.00	−4.95	3.39	3.62	.23	35.36
337.00	−5.02	3.39	3.67	.28	39.90
358.00	−4.95	3.40	3.78	.38	45.13
379.00	−5.00	3.44	3.83	.39	40.23
400.00	−4.00	3.49	3.97	.48	32.15

VSWR

MHz	S	1	2
5.00	1.12	1.12	1.12
25.78	1.13	1.11	1.11
46.56	1.13	1.10	1.10
67.34	1.12	1.09	1.09
88.12	1.12	1.09	1.09
108.90	1.12	1.09	1.09
129.68	1.11	1.08	1.10
150.46	1.11	1.08	1.10
171.24	1.10	1.08	1.11
192.02	1.10	1.08	1.12
212.80	1.09	1.08	1.14
233.58	1.10	1.09	1.16
254.36	1.11	1.11	1.16
275.14	1.12	1.13	1.18
295.92	1.15	1.15	1.21
316.70	1.18	1.18	1.24
337.48	1.22	1.21	1.28
358.26	1.27	1.24	1.31
379.04	1.32	1.28	1.35
400.00	1.39	1.33	1.40

FIG. 5

RF transformers

model T4-1

Insertion loss

MHz	REF. (dBm)	I.L. (dB)
.200	−14.95	3.29
.350	−14.92	2.34
2.001	−15.03	1.58
18.612	−14.97	1.21
37.021	−14.99	1.30
55.433	−15.03	1.37
73.843	−14.99	1.39
92.253	−15.02	1.49
100.001	−14.99	1.50
110.661	−14.96	1.67
129.070	−15.06	1.71
147.480	−14.98	1.73
165.890	−15.09	1.85
184.310	−14.93	2.04
202.720	−15.00	2.07
221.131	−15.09	2.12
239.540	−14.94	2.29
257.850	−15.06	2.43
276.359	−14.93	2.49
294.770	−15.03	2.54
299.999	−15.03	2.59
313.180	−15.03	2.71
331.590	−15.09	2.79
350.000	−14.96	2.81

REMARK; 2 units connected back to back

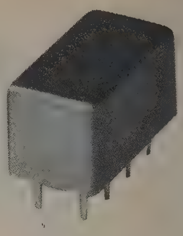
FIG. 7

power amplifiers

model ZHL-1A

FREQ. (MHz)	GAIN (dB)				REVERSE GAIN (dB)				VSWR (IN)				VSWR (OUT)			
	12V	15V	20V	24V	12V	15V	20V	24V	12V	15V	20V	24V	12V	15V	20V	24V
2.00	17.90	18.27	18.46	18.52	29.03	29.07	28.96	28.88	1.09	1.13	1.14	1.14	1.10	1.16	1.15	1.15
28.21	17.88	18.27	18.48	18.52	29.53	29.72	29.54	29.24	1.09	1.11	1.13	1.14	1.20	1.19	1.19	1.18
54.42	17.88	18.33	18.54	18.59	29.57	29.62	29.58	29.39	1.12	1.12	1.13	1.14	1.24	1.24	1.24	1.24
80.63	17.94	18.41	18.65	18.70	29.91	29.78	29.64	29.56	1.19	1.17	1.16	1.16	1.30	1.29	1.30	1.30
106.84	17.90	18.41	18.69	18.78	29.85	30.12	29.97	29.75	1.31	1.24	1.21	1.21	1.36	1.36	1.37	1.37
133.05	17.91	18.42	18.75	18.83	30.02	30.06	30.15	29.87	1.42	1.32	1.28	1.27	1.41	1.41	1.42	1.44
159.26	17.68	18.34	18.71	18.81	30.25	30.32	30.03	30.00	1.56	1.42	1.36	1.34	1.46	1.48	1.50	1.52
185.47	17.64	18.34	18.78	18.84	30.50	30.36	30.12	29.99	1.71	1.553	1.45	1.43	1.50	1.53	1.57	1.60
211.68	17.52	18.25	18.74	18.82	30.50	30.64	30.19	30.05	1.83	1.63	1.52	1.50	1.51	1.56	1.63	1.67
237.89	17.46	18.20	18.73	18.81	30.85	30.64	30.35	30.32	1.96	1.72	1.59	1.57	1.52	1.58	1.67	1.73
264.10	17.34	18.09	18.66	18.74	30.99	30.75	30.40	30.43	2.04	1.79	1.64	1.62	1.48	1.56	1.66	1.75
290.31	17.28	18.03	18.58	18.69	31.08	30.89	30.66	30.58	2.14	1.86	1.69	1.66	1.44	1.53	1.66	1.76
316.52	17.33	18.08	18.69	18.79	30.64	30.77	30.51	30.49	2.16	1.88	1.70	1.67	1.40	1.50	1.64	1.75
342.73	17.32	18.06	18.69	18.79	30.50	30.44	30.41	30.44	2.17	1.87	1.69	1.65	1.33	1.43	1.59	1.71
368.94	17.30	18.04	18.71	18.79	30.09	30.23	30.24	30.27	2.09	1.81	1.63	1.59	1.27	1.35	1.49	1.62
395.15	17.23	18.02	18.67	18.82	29.81	29.95	29.91	30.18	2.03	1.75	1.57	1.53	1.24	1.28	1.41	1.55
421.36	17.32	18.13	18.83	18.98	29.19	29.36	29.52	29.85	1.96	1.68	1.49	1.44	1.32	1.29	1.36	1.50
447.57	17.37	18.23	18.96	19.08	28.50	28.79	29.05	29.22	1.90	1.61	1.41	1.36	1.47	1.36	1.34	1.43
473.78	17.17	18.10	18.90	19.08	27.94	28.28	28.64	28.82	1.93	1.64	1.42	1.37	1.68	1.51	1.39	1.42
500.00	17.07	18.14	19.06	19.26	27.68	27.17	28.22	28.50	2.07	1.79	1.57	1.54	1.01	1.79	1.61	1.58

FIG. 6



mastering the mixer maze...

or selecting the right model for your application.

Mixers are abundant in electronic systems ranging from inexpensive consumer products to sophisticated military hardware. You'll find them in video games, TV sets and video cassette recorders as well as communications gear, test instruments, radar units and countermeasure systems. Mini-circuits offers well over a hundred different off-the-shelf models with thousands of variations. Different connector configurations, tighter specs, Hi-Rel options are available on request. Improper mixer selection bears a penalty—underspecify and face marginal performance; overspecify and pay extra for unnecessary performance characteristics.

making the right choice

Simply stated, there are three basic steps—
(1) deciding on a printed-circuit (PC) or connector version, (2) selecting the mixer level required in the applications, and (3) picking a model that extends over the frequency range involved. Sounds simple enough so let's examine some of the details.
The first step involves the decision on whether the mixer will be mounted to a PC board or be connected by cable to other subsystem components. The next two steps require understanding your specific needs; so it is strongly recommended that you organize the requirements for your application and put it in writing. Decide what frequency range is involved, the LO drive available, the level of harmonic and two-tone, third-order intermodulation (IM) distortion you can tolerate and other dynamic range factors, see Fig. 1.

1 dB compression point key to mixer level

What does the 1 dB compression point signify? As RF input level is increased, IF output should follow in a linear manner. However, after a certain point, IF output increases at a lower rate until mixer output becomes fairly constant. The point at which IF output deviates from linearity with RF input 1 dB is termed the 1 dB compression point. This figure is useful in comparing dynamic range, maximum output and two-tone performance of various mixers. It is a basis on which mixer level is established.

The 1 dB compression point, which defines the linearity of a mixer at high RF input levels, is relatively simple to test and thus this parameter is included on data sheets supplied by all mixer manufacturers. But, in real life, mixer linearity may be specified in accordance with the intended application. For example, in a receiver application, two-tone, third-order intermod may be the critical parameter; for TV applications, percent distortion or intercept point may be specified; and in an attenuator measurement system, compression point may be important for a given RF input level. With this in mind, the engineer needs a convenient means to relate the particular parameter for his application with the published spec, the 1 dB compression point.

Fig. 1 lists the various ways mixer linearity might be specified.

FIG. 1

Dynamic range parameters affecting mixer selection

1. maximum RF input level anticipated
2. percent distortion acceptable
3. intercept point
4. Two-tone, 3rd order IM ______________dB
   at ________dBm, RF input
5. 1 dB RF input compression level
6. LO power available
7. none of the above specified

Let's convert every parameter with the published 1 dB compression point and then show how simple it is to select the proper mixer level, *see Fig. 2 for Mini-Circuits' mixer level/1 dB compression point chart.*

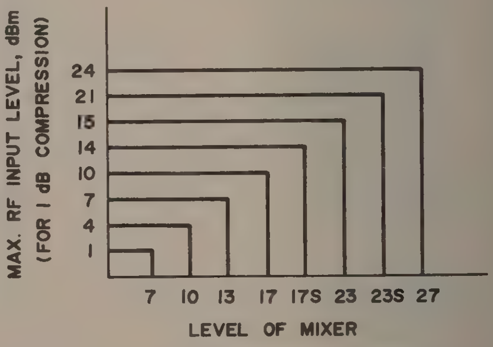


FIG. 2 THE 1 dB COMPRESSION POINT AS A FUNCTION OF THE LEVEL OF MIXER.

1. Maximum RF input level anticipated. If you know this parameter, simply select the lowest level mixer whose maximum RF input level exceeds your requirement. For example, if the maximum encountered RF level is +5 dBm, select a Level 13 mixer, rated at +7 dBm maximum RF input for 1 dB compression point.

2. Percent distortion. The percent distortion is usually specified in voltage. Thus, a 0.1% distortion figure means 0.999 of the input voltage appears at the mixer output. Next, convert this voltage ratio to a power ratio in dB by squaring and taking ten times the log. The resultant figure is the amount of compression for the specified RF input level. Now this must be extrapolated to 1 dB compression for a corresponding RF input level. As a rule of thumb, extrapolation may be achieved by assuming a linear relationship, in dB, between compression and RF input level. So a ten-times increase in compression corresponds to a ten-times increase in RF input level.

Let's illustrate with an example using a 0.1 percent distortion spec at −10 dBm RF input level. The 0.1 percent corresponds to a 0.999 voltage output; squaring this yields 0.998 power ratio or 0.009 dB. We, therefore, know that 0.1% distortion at −10 dBm input means the maximum allowable compression is 0.009 dB. Extrapolating, using the rule-of-thumb relationship, states that 0.09 dB compression corresponds to an allowable RF of 0 dBm, and further extrapolating results in 0.9 dB compression at a maximum allowable RF input level of 10 dBm. So which mixer level is appropriate? A Level 17S, with +13 dBm RF Input level at the 1 dB compression point, see Fig. 2.

3. Intercept point.

This parameter is a figure of merit corresponding to the amount of intermodulation products generated relative to the desired IF output. An intercept point can be defined for a second order, third order, fifth order, product, etc. As a rule-of-thumb, two-tone third order intercept point is approximately 15 dB above the 1 dB compression point. So, if the intercept point figure is given, merely subtract 15 dB from this figure and pick a mixer which meets the 1 dB compression point spec, see Fig. 2.

4. Two-tone, third-order intermodulation (IM).

When a two-tone, third-order IM spec is given, the intercept point can be calculated. Remember that for each 10 dB increase in signal level, there is a 20 dB degradation in two-tone, third-order product. Once the intercept point is calculated, simply subtract 15 dB from the figure to find the 1 dB compression point and select the appropriate mixer.

5. 1dB Rf input compression level.

This key parameter is listed on mixer spec sheets so merely choose the lowest level mixer that will meet the requirement.

6. LO drive.

The LO dirve is critical since the function of the LO drive is to switch the mixer diodes fully on and off for lowest distortion. So, for optimum performance, select the mixer level to match the LO drive. Mini-Circuits conveniently identifies its mixer levels by the LO drive requirement; thus a Level 7 mixer refers to a LO drive level of +7 dBm. If there are constraints on the LO power available, select the lowest level mixer closest to the available LO power. For example, if +12 dBm LO drive is available, select a Level 10 mixer.

7. No particular spec to meet.

Choose a Level 7 mixer. Why? Because it is the most popular and it offers the widest choice of models at lowest cost.

Freq. range last deciding factor

Once the mixer level has been decided, you may find a wide variety of models to exercise your decision making. You may notice models within a series with overlapping frequency ranges. Why? So you can choose the optimum mixer for your requirement. Each model within a series has a different low-frequency limit. Select a mixer with the highest low frequency limit and whose mid-band range best covers your application.

Specs on the data sheets are given in three ranges. The lower frequency range, L, covers the lowest specified frequency to one decade higher; the upper frequency range, U, covers the highest frequency to one octave lower and mid-range, M, covers the frequency between L and U. Thus, a mixer specified from 0.5 to 500 MHz could offer a low-frequency range of 0.5 to 5 MHz, an upper frequency range of 250 to 500 MHz, and a mid-range of 5 MHz to 250 MHz.

What about "Specials"?

Although most Mini-Circuits mixers are 50 ohm devices, models are available in 75 ohms. Need connector types different than those listed for standard models? No problem. Some applications require matched mixer pairs that must be amplitude (conversion loss) and phase matched. Most Mini-Circuits mixers are tested to within 0.2 dB for the entire production run. Not tight enough? Let us know your exact requirement and we'll screen and test to meet it.

In summary, contact us about "specials" and we'll do our best to satisfy your needs without excessive cost or delivery date extensions. Sometimes, "special" means shipping a quantity of mixers within a very short time span; since Mini-Circuits is the largest manufacturer of mixers in thè world, this may hardly be considered "special" and you may be pleasantly surprised. Try us.

order Mini-Circuits Q&A No. 4 Now...

There's lots more to mixer specs, applications and testing. Phone or write for Mini-Circuits' Q&A #4 for a provocative question-and-answer exchange on these topics.

most widely-used

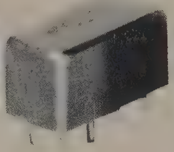
Frequency Mixers

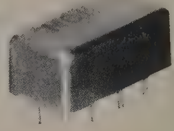
LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

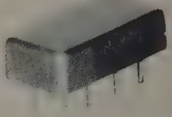
case style selection

outline drawings pages 58-62

GRA


SRA


SBL


TAK

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
GRA case D09	GRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	12.95	(6-49)
	GRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(6-49)
	GRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	22.95	(5-24)
	GRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	25.95	(5-24)
SRA case A01	●SRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	11.95	(1-49)
	SRA-1TX	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	49.95	(1-49)
	SRA-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	14.95	(5-24)
	SRA-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	13.95	(5-24)
	SRA-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	30	20	30	20	14.95	(5-24)
	SRA-2CM	5-1000	DC-1000	6.0	7.0	6.5	8.5	60	50	35	30	30	25	50	45	30	25	25	20	14.95	(1-49)
	SRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	14.95	(5-24)
	SRA-4	5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	16.95	(5-24)
	SRA-5	5-1500	10-600	7.0	8.0	7.5	8.5	50	45	35	30	30	20	45	40	30	25	25	15	21.95	(5-24)
	SRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	21.95	(5-24)
	SRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	26.95	(5-24)
case A06	SRA-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	26.95	(5-24)
	SRA-12	800-1250	50-90	—	—	6.0	7.5	32	25	35	25	35	25	30	20	30	20	30	20	24.95	(5-24)
	SRA-2000 NEW	100-2000	DC-600	6.0	8.0	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	31.95	(1-24)
SBL case A06	SBL-1	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	4.50	(10-49)
	SBL-1X	10-1000	5-500	6.0	7.5	7.0	9.0	50	35	40	25	30	20	45	30	35	20	25	20	5.95	(10-49)
TAK case A04	TAK-5	.01-250	DC-250	5.5	7.0	6.5	8.5	60	50	50	35	40	35	55	45	45	30	35	25	18.95	(1-4)
	TAK-5R	.05-200	DC-200	5.5	6.5	6.5	8.0	55	50	45	35	45	35	50	45	40	30	40	30	15.95	(5-24)
	TAK-6	.5-600	DC-600	5.5	7.5	6.5	8.5	60	50	50	30	40	25	55	45	45	30	30	20	18.95	(1-4)
	TAK-6R	5-500	DC-500	6.0	7.0	6.5	8.0	55	50	45	30	35	40	45	40	40	25	30	25	15.95	(5-24)
	TAK-7	2-1000	5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	20.95	(1-4)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to $f_U/2$)   U = upper range ($f_U/2$ to f_U)

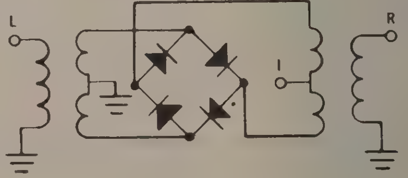
m = mid band (2f_L to $f_U/2$)

NOTES:

- ● HTRB tested, 3 year guarantee

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 50 mW, peak IF current 40 mA, see pg. 7.
6. Prices and specifications subject to change without notice.
7. PAM-42 protected under patent 4,430,758.

schematic



pin connections

see case style outline drawing

Series	GRA	SRA					SBL		TAK			
models	all models	−1 −1TX −1 −1 −3	−2 −4	−6 −8	−1W −2cm	−5 −11 −12	−1	−1X	−5 −6	−7	−5R	−6R
LO	1	8	8	8	8	8	8	8	8	8	8	1
RF	6	1	3,4	1	1	1	1	3,4	1	3,4	1	8
IF	4	3,4*	1	3,4*	3,4*	3	3,4*	1	3,4*	1	3,4*	5,6*
GND	2,3,5	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,4,7
CASE GND	—	2	2,5,6,7	—	2,5,6,7	2,5,6,7	—	2,5,6,7	2	2,5,6,7	—	3,4,7

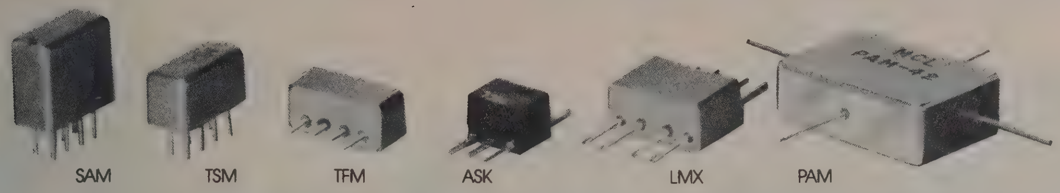
*pins must be connected together externally

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

For manufacturers' sales offices, see yellow pages

500 Hz to 4.2 GHz

Mini-Circuits



	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SAM case A03	**SAM-1**	1-600	DC-600	5.5	7.0	6.5	8.5	55	45	45	30	35	20	50	40	40	25	30	20	15.95	(1-24)
	SAM-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	25	17.95	(1-24)
	SAM-3	0.1-500	DC-500	5.5	7.0	6.5	8.5	60	50	50	35	35	30	50	40	45	30	30	20	17.95	(1-24)
	SAM-4	5-1250	0.5-1000	6.5	8.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	19.95	(1-24)
	SAM-5	5-1500	0.5-1000	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	24.95	(1-24)
TSM case A11	**TSM-1**	1-500	DC-500	6.0	7.5	6.5	8.5	60	45	45	35	35	25	55	45	40	30	35	25	17.95	(5-24)
	TSM-3	0.1-400	DC-400	5.3	7.5	6.5	8.5	60	50	50	35	35	25	55	45	45	30	35	25	19.95	(5-24
TFM case B02	**TFM-2**	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	11.95	(1-49)
	TFM-3	0.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	19.95	(5-49)
	TFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	21.95	(5-49)
case B13	**TFM-11**	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	10	45	40	27	20	25	20	39.95	(1-24)
	TFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	39.95	(1-24)
ASK case W38	**ASK-1** NEW	1-600	DC-600	5.5	7.0	6.0	8.5	50	40	35	25	30	20	45	35	30	20	25	15	5.95	(10-49)
LMX case BB48	**LMX-113** NEW	5-1000	DC-1000	6.5	7.0	7.0	8.0	50	40	40	30	35	25	45	35	35	30	30	20	14.95	(6-24)
	LMX-124 NEW	0.5-500	DC-500	5.5	6/5	6.0	7.0	50	40	45	30	45	25	45	40	40	30	30	20	22.95	(6-24)
	LMX-149 NEW	10-1500	DC-1500	6.0	7.0	6.0	10.0	55	45	45	35	30	20	50	45	40	25	20	12	24.95	(6-24)
PAM case AA46	**PAM-42** NEW	2.0-4.2GHz	DC-1.3GHz	—	—	7.0	8.5	—	—	25 (typ)	17 (min)	—	—	—	—	18 (typ)	10 (min)	—	—	26.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)
m = mid band (2f_L to $f_U/2$)

MIL-M-288837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1		07 N
GRA-1 HI-REL		07 S
SAM-1	5895-01-117-2926	
SAM-3	5895-01-062-9973	
SAM-5	5895-01-036-9507	
SBL-1	9058-00-256-6818	
SRA-1	6625-00-008-8272	03 N
SRA-1 HI-REL		03 S
SRA-1-1	5962-01-113-5431	
SRA-1W		09 N
SRA-1W HI-REL		09 S
SRA-3	5895-01-021-5914	
SRA-6	5895-01-124-0117	
SRA-8	5985-01-081-0977	12 N
SRA-8 HI-REL		12 S
TAK-5R		01 N
TAK-5R HI-REL		01 S
TAK-6R		02 N
TAK-6R HI-REL		02 S
TFM-2-408	5821-01-076-2497	
TFM-3	5840-01-112-0031	
TSM-1	5895-01-121-7958	

*units are not QPL-listed

SAM			TSM	TFM	ASK	LMX	PAM
−1 −3	−4 −5	−2	all models	all models	all models	all models	all models
8	8	8	8	4	1	8	3
1	3,4	1	1	1	4	5	1
3,4*	1	3,4*	3,4*	2	5	4	4
2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	3	2,3,6	2,3,6,7	2
2	2,5,6,7	2,5,6,7	2	3	—	2,3,6,7	2

In Stock... Immediate Delivery

widest-variety of connector types

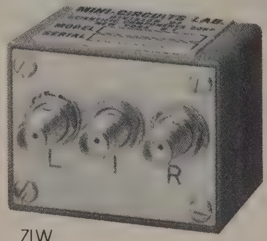
Frequency Mixers

LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

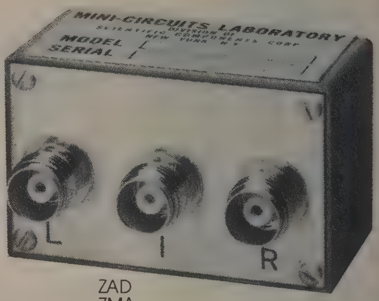
case style selection

outline drawings pages 58-62

ZP



ZLW



ZAD
ZMA

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
ZP case GG60	ZP10514 NEW	.2-500	DC-500	5.5	7.0	6.5	8.5	55	45	50	35	35	30	50	40	36	30	30	20	51.95	(1-49)
ZLW case M21	ZLW-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	39.95	(4-24)
	ZLW-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	44.95	(4-24)
	ZLW-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	41.95	(4-24)
	ZLW-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	20	44.95	(4-24)
	ZLW-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	41.95	(4-24)
	ZLW-5	5-1500	5-100	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	51.95	(4-24)
	ZLW-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	49.95	(4-24)
	ZLW-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	54.95	(4-24)
	ZLW-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	61.95	(4-24)
	ZLW-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	61.95	(4-24)
ZAD case M22	ZAD-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	29.95	(4-24)
	ZAD-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	34.95	(4-24)
	ZAD-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	31.95	(4-24)
	ZAD-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	39.95	(4-24)
	ZAD-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	31.95	(4-24)
	ZAD-4	.5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	41.95	(4-24)
	ZAD-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	39.95	(4-24)
	ZAD-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	44.95	(4-24)
	ZAD-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	51.95	(4-24)
	ZAD-12	800-1250	50-90	6.0	7.5	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	51.95	(4-24)

L = low range (f_L to 10 f_L)

M = mid range (10f_L to $f_U/2$)

m = mid band (2f_L to $f_U/2$)

U = upper range ($f_U/2$ to f_U)

single-balanced (1 to 3 GHz)

	MODEL NO.	LO/RF f_L-f_U	IF	Mid-Band m*		Total Range		L*		M*		U*		L*		M*		U*			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
ZMA case M23	ZMA-2*	1-2.5GHz	DC-150	7.0	8.5	8.0	9.0	25	20	22	17	20	15	50	35	40	30	35	25	63.95	(1-9)
	ZMA-3*	1.4-3.0GHz	DC-500	6.5	8.0	7.0	9.0	25	20	28	18	23	15	50	35	50	30	50	30	67.95	(1-9)

*m = 500MHz *L = f_L to (f_L+500) *M = (f_L+500) to (f_U −500) *U = f_U to (f_U −500)

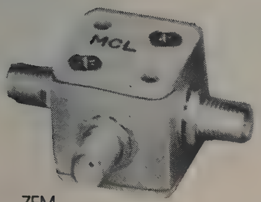
NOTES:

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF Power 50mW, peak IF current 40mA.
6. For connector types and case mounting options, see case style outline drawing.
7. Prices and specifications subject to change without notice.

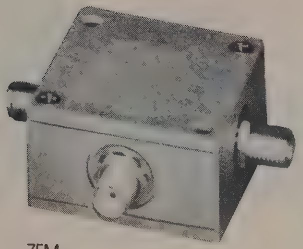
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

500 Hz to 4.2 GHz

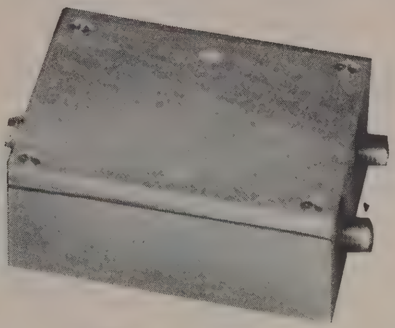
Mini-Circuits



ZEM



ZFM



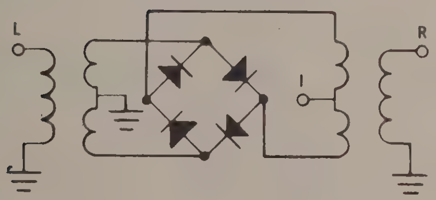
ZAM

		FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
	MODEL NO.	LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
ZEM case V37	ZEM-2	10-1000	DC-1000	6.0	7.0	6.5	8.5	55	50	30	25	25	20	55	45	30	20	25	20	49.95	(4-24)
ZFM case K18	ZFM-1W	10-750	DC-750	6.0	7.0	6.2	8.0	50	45	45	30	35	25	45	40	40	25	27	20	41.95	(4-24)
	ZFM-2	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	43.95	(1-24)
	ZFM-3	.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	51.95	(1-24)
	ZFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	51.95	(1-24)
	ZFM-11	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	20	45	40	27	20	25	20	81.95	(1-24)
	ZFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	71.95	(1-24)
	NEW ZFM-4212	2000-4200	DC-1300	—	—	7.0	8.5	—	—	25	17	—	—	—	—	18	10	—	—	39.95	(1-9)
ZAM case F14	ZAM-42 NEW	1500-4200	DC-500	—	—	7.0	8.5	25	20	25	17	25	20	18	10	18	10	18	10	39.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)

m = mid band (2f_L to $f_U/2$)

schematic



MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
ZAD-1B	5895-00-280-7750
ZAD-4B	5895-01-127-0376
ZAD-6B	5865-21-200-6364
ZFM-12-1	5825-01-127-3377
ZLW-1W	5840-00-607-7010
ZLW-2B	6920-01-037-1974
ZLW-5-1	4920-01-017-2753
ZMA-3	5865-01-064-0212

coaxial connections

see case style outline drawing

Series	ZP	ZLW	ZAD (ex-2, -4)	ZAD -2, -4	ZMA	ZEM	ZFM	ZAM
models	all models	all models	all models	all models	all models	all models	all models	all models
L	L	1	1	1	1	1	1	2
R	X	3	3	2	2	2	2	1
I	R	2	2	3	3	3	3	3

In Stock...Immediate Delivery

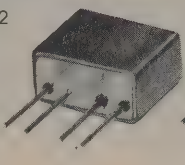
broadband, high dynamic range

Frequency Mixers

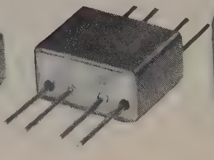
LEVEL 10 (+10dBm LO, up to +5dBm RF)

case style selection

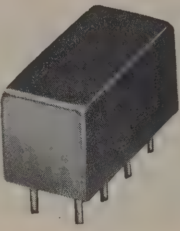
outline drawings pages 58-62



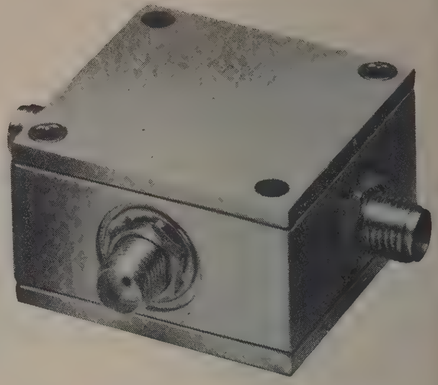
TFM



LMX



SRA



ZFM

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	CONVERSION LOSS dB Mid-Band m Max.	CONVERSION LOSS dB Total Range Typ.	CONVERSION LOSS dB Total Range Max.	LO-RF ISOLATION, dB L Typ.	LO-RF ISOLATION, dB L Min.	LO-RF ISOLATION, dB M Typ.	LO-RF ISOLATION, dB M Min.	LO-RF ISOLATION, dB U Typ.	LO-RF ISOLATION, dB U Min.	LO-IF ISOLATION, dB L Typ.	LO-IF ISOLATION, dB L Min.	LO-IF ISOLATION, dB M Typ.	LO-IF ISOLATION, dB M Min.	LO-IF ISOLATION, dB U Typ.	LO-IF ISOLATION, dB U Min.	PRICE, $ Ea.	PRICE, $ Qty.
TFM case B13	**TFM-15**	10-3000	10-800	6.3	8.0	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	49.95	(1-9)
	TFM-150*	10-2000	DC-1000	6.0	8.0	6.5	8.0	32	25	35	25	35	25	33	20	30	20	30	20	39.95	(1-9)
LMX case BB48	**LMX-123**	10-3000	10-3000	7.5	8.0	7.5	8.5	35	25	35	20	30	15	35	25	30	25	30	20	59.95	(6-24)
	LMX-148	10-1500	DC-1500	6.0	7.0	6.0	10	45	40	35	30	25	20	40	35	35	25	20	12	24.95	(6-24)
SRA case A01	**SRA-215**	.05-1500	.05-500	6.0	7.5	7.0	9.0	25	20	35	25	30	20	25	20	35	25	25	15	23.95	(5-24)
	SRA-220	.05-2000	.05-500	6.0	7.5	7.0	9.0	25	20	40	30	30	20	25	20	40	30	25	15	26.95	(5-24)
ZFM case K18	**ZFM-15**	10-3000	10-800	6.3	7.5	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	79.95	(1-9)
	ZFM-150	10-2000	DC-1000	6.0	7.0	6.5	8.0	32	25	35	25	35	20	33	28	30	20	25	20	59.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

harmonic attenuation

MODEL TFM-15

Harmonics RF Order	RF CAL	1	2	3	4	5	6	7	8	9	10
1	0	0	31	17	42	32	48	47	52	65	59
2	83	38	45	39	48	46	76	69	70	64	71
3	87	39	49	37	52	42	57	63	65	65	65
4	89	64	60	58	56	59	60	62	69	74	70
5	90	74	69	59	72	55	74	58	71	67	72
6	83	83	76	74	67	69	67	72	70	74	78
7	83	76	83	81	79	69	71	66	70	69	77
8	84	75	76	81	82	77	77	80	78	78	77
9	84	77	76	75	82	80	81	82	80	79	80
10	81	76	76	74	75	80	81	81	81	80	81

Harmonic LO Order

Model: TFM-15 S/N: sample band-width: 0-99999 MHz
999.100 MHZ input P. −.06 dBm
969.010 MHz input P. +9.96 dBm
IF = 30.090 MHz | LO = +10 dBm, 969.01 MHz
IF amplit. −7.14 dBm | RF = 0 dBm, 999.1 MHz

Final Spectrum Analyzer HP-8566A Parameters:
RES BW 1KHz VBW 3kHz
SWP 300 msec ATTEN 10 dB 5 dB/ div SPAN 100 kHz

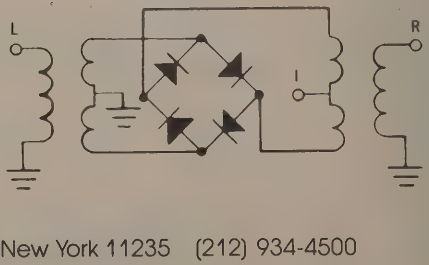
LO drive adjusted with 19.75db Weinschel S/N:G4047 RF,IF attenuator
10.0dB Tektronix S/N:011-0085-00

NOTES:

* Below 10 MHz IF, conversion loss increases up to 6dB higher as frequency decreases to DC.

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings, RF power 50 mW level 10, 200mW level 13, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

schematic



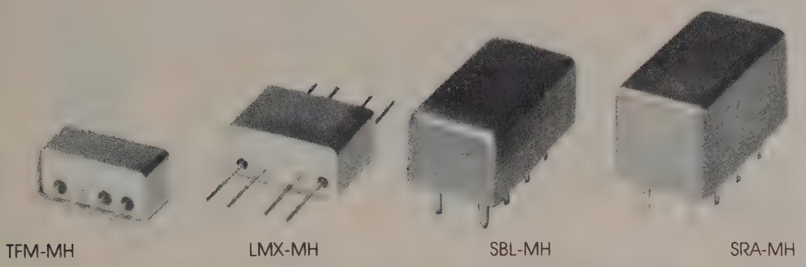
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

50 KHz to 3 GHz

LEVEL 13 (+13dBm LO, up to +9dBm RF)

NEW



	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
TFM-MH case B02	**TFM-1MH**	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	21.95	(5-24)
	TFM-3MH	.1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	21.95	(5-24)
LMX-MH case BB48	**LMX-125MH**	0.5-500	DC-500	6.0	7.0	7.0	9.0	45	40	45	40	40	30	45	40	40	35	35	25	54.95	(6-24)
SBL-MH case A06	**SBL-1MH**	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	9.50	(10-49)
SRA-MH case A01	**SRA-1MH**	5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	13.95	(5-24)
	SRA-3MH	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

pin and coaxial connections

see case style outline drawing

Series	TFM	LMX	SRA	ZFM	TFM-MH	LMX-MH	SBL-MH	SRA-MH
Models	all models	all models	all models	all models	all models	all models	all models	all models
LO	4	8	8	1	4	8	8	8
RF	1	5	1	2	1	5	1	1
IF	2	4	3	3	2	4	3,4*	3,4*
GND	3	2,3,6,7	2,5,6,7	—	3	2,3,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,3,6,7	2,5,6,7	—	3	2,3,6,7	—	2

*pins must be connected together externally

CAPD

now available!

computer-automated performance data

(see technical section)

In Stock... Immediate Delivery

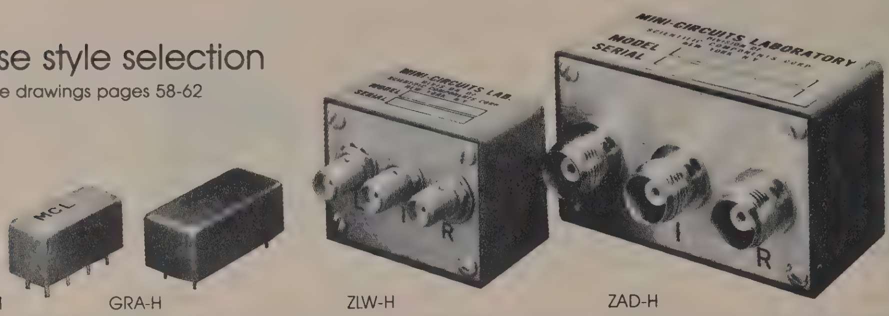
very high dynamic range

Frequency Mixers

LEVEL 17 (+17 dBm LO, up to +10 dBm RF)

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SRA-H case A01	● SRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	17.95	(5-24)
	● SRA-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	40	45	25	35	25	45	35	40	30	30	20	21.95	(5-24)
	● SRA-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	30	30	20	25	20	29.95	(5-24)
	● SRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	50	45	40	30	35	25	45	35	40	30	30	20	19.95	(5-24)
	SRA-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	39.95	(1-24)
	SRA-173H NEW	5-1200	DC-1200	6.0	7.0	7.0	9.0	25	20	25	18	25	18	27	20	25	18	25	18	29.95	(1-5)
GRA-H case D08	GRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	18.95	(5-24)
	GRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	20.95	(5-24)
	GRA-6H	.01-50	DC-50	5.5	6.0	5 5	7.0	50	45	45	30	35	25	50	40	47	35	32	25	26.95	(5-24)
ZLW-H case M21 SMA	● ZLW-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	45.95	(4-24)
	● ZLW-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	49.95	(4-24)
	● ZLW-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	59.95	(4-24)
	● ZLW-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	47.95	(4-24)
	ZLW-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	91.95	(4-24)
ZAD-H case M22 BNC, TNC	● ZAD-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	35	40	30	30	20	35.95	(4-24)
	● ZAD-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	39.95	(4-24)
	● ZAD-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	49.95	(4-24)
	● ZAD-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	37.95	(4-24)
	ZAD-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	81.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:

● HTRB tested

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings, RF power 200 mW, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1H		06N
GRA-1H Hi-Rel		06S
GRA-1H		10N
GRA-1H		10S
GRA-3H		05N
GRA-3H Hi-Rel		05S
SRA-1H	6625-00-594-0223	08N
SRA-1 Hi-Rel		08S
SRA-1WH	5840-00-576-0716	
SRA-2H	5895-01-063-1078	
SRA-3H	5895-01-117-4537	
ZAD-1WH	5895-01-045-4647	
ZLW-1H	5985-01-080-7637	
ZLW-1H-B	5962-045-7500	

*units are not QPL listed

pin and coaxial connections

see case style outline drawing

Series	SRA					GRA-H	ZLW-H	ZAD-H
Models	−1H −3H	−1WH −2H	−11H	−173H Configuration 1	−173H Configuration 2	all models	all models	all models
LO	8	8	8	3,4*	8	1	1	1
RF	1	1	1	1	1	6	3	3
IF	3,4*	3,4*	3	8	3,4*	4	2	2
GND	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,5	—	—
CASE GND	2	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—	—	—

*pins must be connected together externally

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

10 KHz to 3 GHz

Mini-Circuits

computer-automated performance data

typical production unit / for data of other models consult factory

SRA-1H

RF (MHz)	LO (MHz)	CONVERSION LOSS (dB)			ISOLATION (dB)								VSWR (+17dBm LO)		
					L-R				L-I						
		LO+10 dBm	LO+15 dBm	LO+17 dBm	LO+7 dBm	LO+10 dBm	LO+15 dBm	LO+17 dBm	LO+7 dBm	LO+10 dBm	LO+15 dBm	LO+17 dBm	LO	RF	IF
10.00	40.00	6.99	6.36	6.15	54.08	56.43	54.97	54.54	52.32	51.54	50.87	50.53	—	—	—
35.70	65.70	7.32	6.45	6.24	53.91	51.73	49.79	49.89	50.23	48.49	47.55	46.59	2.40	1.13	1.21
61.56	91.56	6.91	6.19	6.06	52.44	50.08	48.37	47.04	48.30	46.56	44.44	44.06	2.68	1.13	1.20
87.34	57.34	6.87	6.27	6.09	53.43	54.16	51.79	51.34	51.12	50.03	48.89	47.85	2.33	1.13	1.20
113.12	83.12	7.22	6.46	6.28	52.65	50.32	48.99	47.43	48.68	47.19	45.07	44.75	2.63	1.16	1.24
138.90	108.90	5.83	6.18	6.09	51.41	48.68	46.06	45.59	46.51	44.71	42.83	42.51	2.48	1.22	1.36
164.68	134.68	6.06	6.38	6.24	48.62	46.56	43.46	43.17	44.84	42.84	40.96	40.59	2.30	1.31	1.47
190.46	160.46	5.91	6.24	6.12	47.58	44.71	41.57	41.29	43.33	41.13	39.43	38.96	2.46	1.34	1.58
216.24	186.24	5.89	6.27	6.14	46.31	43.35	40.90	40.77	41.89	40.25	38.44	37.95	2.15	1.32	1.57
242.02	212.02	6.97	6.39	6.27	44.86	41.28	39.90	39.73	41.22	39.15	37.32	36.66	2.44	1.30	1.56
267.80	237.80	6.89	6.27	6.14	43.39	40.11	38.57	38.38	40.38	37.88	36.03	35.60	2.13	1.29	1.60
293.58	263.58	7.12	6.57	6.35	42.94	39.51	37.78	37.29	39.34	36.32	34.56	34.34	2.20	1.35	1.86
319.36	289.36	6.82	6.36	6.25	42.95	39.40	38.51	37.90	38.29	35.30	33.21	32.87	2.00	1.40	2.26
345.14	315.14	7.16	6.67	6.48	40.60	37.77	38.42	37.63	37.52	34.26	32.09	31.51	2.10	1.39	2.51
370.90	340.92	7.31	6.73	6.46	38.07	36.51	38.02	36.99	36.70	33.98	31.44	30.59	1.88	1.32	2.38
396.70	366.70	7.80	6.91	6.57	38.32	36.15	37.63	37.27	37.02	34.60	31.29	30.28	2.21	1.25	2.11
422.48	392.48	8.05	6.97	6.57	38.36	36.13	36.72	37.13	35.55	33.82	31.33	30.13	1.82	1.22	2.02
448.26	418.26	7.89	7.43	7.02	38.68	36.11	35.45	35.92	33.99	32.13	31.15	30.54	2.09	1.26	2.18
474.04	444.04	8.48	7.74	7.34	38.75	36.37	35.46	35.47	32.62	30.50	29.83	39.60	1.88	1.30	2.46
500.00	470.00	8.84	7.62	6.95	37.95	36.25	35.58	35.66	30.74	28.73	28.642	28.63	1.99	1.35	2.58

SRA-1H

harmonic intermodulation

(Relative to desired IF Output)

Harmonics RF Order	RF CAL	RF Input power 0dBm									
1	0	0	46	10	44	17	45	28	48	33	50
2	75	75	75	75	75	73	75	71	75	69	75
3	73	64	73	66	72	55	70	51	66	50	64
4	105	74	84	82	85	79	86	78	91	78	93
5	106	74	82	72	80	68	80	65	82	64	81
6	105	83	84	83	84	84	86	86	90	88	92
7	104	84	85	82	85	80	87	78	90	79	91
8	104	86	74	85	84	86	84	87	88	92	91
9	102	83	86	84	85	85	86	86	89	89	93
10	105	84	84	83	84	84	84	87	87	90	92
		1	2	3	4	5	6	7	8	9	10

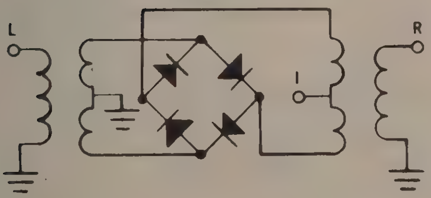
Harmonic LO Order

Harmonics RF Order	RF CAL	RF Input power −10dBm									
1	0	0	47	10	44	18	44	30	46	36	47
2	84	78	78	76	78	72	78	70	83	70	82
3	91	73	79	70	79	65	78	62	78	62	77
4	95	64	83	82	85	83	86	86	87	88	86
5	95	84	80	84	82	83	84	86	88	88	88
6	95	82	81	83	83	84	84	86	87	87	87
7	95	81	84	81	82	83	85	85	86	86	87
8	96	82	65	84	83	83	83	85	86	88	87
9	95	81	85	82	83	82	85	85	87	88	86
10	95	83	83	83	82	83	83	85	87	87	88
		1	2	3	4	5	6	7	8	9	10

Harmonic LO Order

test conditions RF = 10 MHZ LO = 40 MHz at +17dBm
for other test frequencies, contact factory

schematic



In Stock... Immediate Delivery

For manufacturers' sales offices, see yellow pages

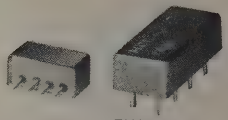
very low distortion

Frequency Mixers

LEVEL 17S (+17dBm LO, up to +14dBm RF)

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
TFM-H case B02	TFM-1H	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	23.95	(5-24)
	TFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	45	40	30	30	20	45	40	35	25	25	17	31.95	(5-24)
	TFM-3H	.1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	23.95	(5-24)
case B13	TFM-4H NEW	5-1200	DC-1200	6.5	8.0	7.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	33.95	(5-24)
TAK-H case A05	TAK-1H	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	19.95	(5-24)
	TAK-1WH	5-750	DC-750	6.2	7.5	7.0	9.0	50	40	40	30	30	25	45	35	35	25	30	20	23.95	(5-24)
	TAK-3H	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	21.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)

m = mid band (2f_L to $f_U/2$)

NOTES:

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications, see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 200 mW, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

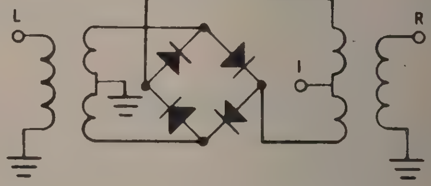
pin and coaxial connections

see case style outline drawing

Series	TFM-H	TAK-H		ZFM-H	ZLW-SH	ZAD-SH
Models	all models	–1H –3H	–1WH	all models	all models	all models
LO	4	8	8	1	1	1
RF	1	1	1	2	3	3
IF	2	3,4*	3,4*	3	2	2
GND	3	2,5,6,7	2,5,6,7	—	—	—
CASE GND	3	2	2,5,6,7	—	—	—

*pins must be connected externally

schematic



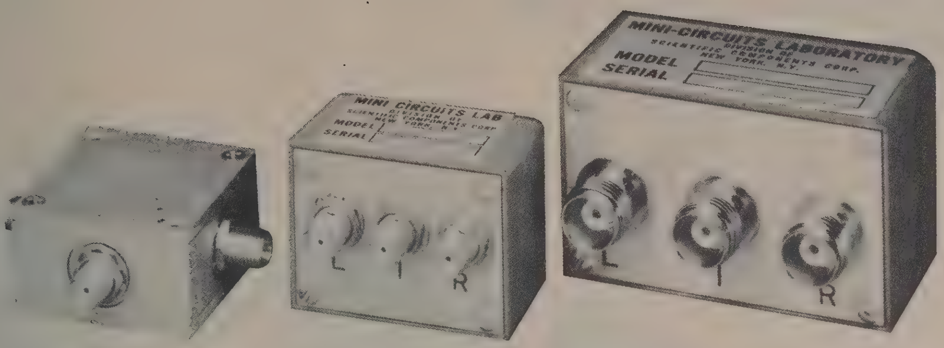
MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
TFM-1H	5895-01-129-0110

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

10 KHz to 1.2 GHz



ZFM-H ZLW-SH ZAD-SH

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
		f_L-f_U		Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
ZFM-H case K18	**ZFM-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	25	45	35	35	25	25	20	53.95	(1-24)
	ZFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	40	40	30	30	20	45	40	35	25	25	17	61.95	(1-24)
	ZFM-3H	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	54.95	(1-24)
ZLW-SH case M21	**ZLW-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	50.95	(4-24)
	ZLW-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	54.95	(4-24)
	ZLW-3SH	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	52.95	(4-24)
ZAD-SH case M22	**ZAD-1SH**	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	40.95	(4-24)
	ZAD-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	44.95	(4-24)
	ZAD-3SH	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	42.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

CAPD computer-automated performance data

typical production unit / for data of other models consult factory

TFM-1H

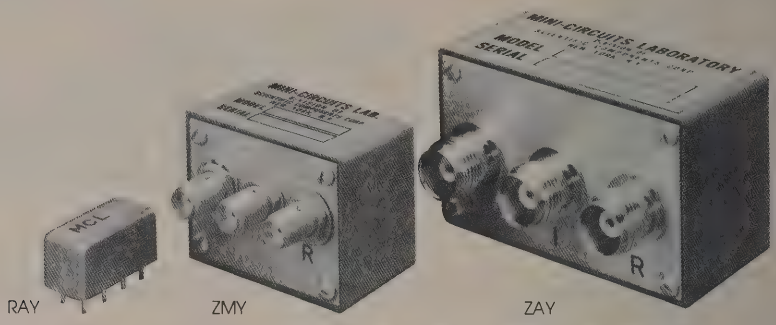
RF (MHz)	LO (MHz)	CONVERSION LOSS (dB)	ISOLATION (dB)		VSWR		
			L-R	L-R	LO	RF	IF
10.00	40.00	5.89	52.26	54.10	1.59	1.15	1.33
35.78	65.78	6.15	47.79	50.70	1.67	1.10	1.34
61.56	91.56	6.24	45.16	47.94	1.51	1.09	1.34
87.34	57.34	6.16	48.87	51.91	1.53	1.08	1.35
113.12	83.12	6.03	46.18	48.52	1.57	1.08	1.35
138.90	108.90	6.29	43.89	45.76	1.57	1.08	1.36
164.68	134.68	6.13	41.75	44.17	1.55	1.08	1.37
190.46	160.46	5.89	40.42	42.16	1.50	1.07	1.38
216.24	186.24	6.13	38.76	40.87	1.51	1.07	1.40
242.02	212.02	6.00	37.29	38.89	1.47	1.07	1.41
267.00	237.80	5.86	36.41	37.32	1.47	1.06	1.42
293.58	263.58	6.12	35.27	36.40	1.48	1.06	1.44
319.36	289.36	6.03	34.46	34.97	1.44	1.05	1.45
345.14	315.14	5.94	33.99	34.19	1.48	1.05	1.48
370.92	340.92	6.01	33.19	32.90	1.47	1.04	1.50
396.70	366.70	6.00	32.52	32.93	1.45	1.04	1.52
422.48	392.48	6.19	32.12	32.12	1.48	1.04	1.56
448.26	418.26	6.39	31.50	31.13	1.47	1.05	1.57
474.04	444.04	6.22	31.48	30.35	1.50	1.05	1.61
500.00	470.00	6.44	31.93	29.87	1.47	1.06	1.64

In Stock... Immediate Delivery

ultra-low distortion

Frequency Mixers

LEVEL 23 (+23dBm LO, up to +15dBm RF)
10 KHz to 1 GHz



	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
RAY	● RAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
case A01	● RAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	54.95	(4-9)
	● RAY-3	.07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
	RAY-6 NEW	0.01-50	DC50	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	31.95	(1-24)
ZMY	● ZMY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
case M21	● ZMY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	77.95	(1-9)
	● ZMY-3	.07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
ZAY	● ZAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)
case M22	● ZAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	67.95	(1-9)
	● ZAY-3	.07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)

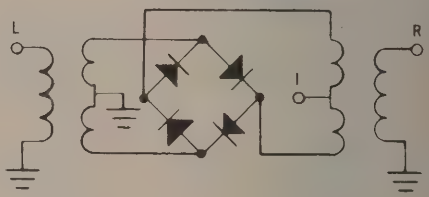
m = mid band (2f_L to $f_U/2$)

NOTES:

- ● HTRB tested

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section".
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 350 mW for level 23, 23S and 700 mW for level 27. Peak IF current 40 mA.
6. For connector types and case mounting options, see case style outline drawing.
7. Prices and specifications subject to change without notice.

schematic



pin and coaxial connections

see case style outline drawing

Series	RAY			ZMY	ZAY	SAY	ZFY	VAY
Models	−1 −3	−2	−6	all models	all models	all models	all models	all models
LO	8	8	8	1	1	8	1	8
RF	1	1	1	3	3	1	2	1
IF	3,4*	3,4*	3,4*	2	2	3	3	3
GND	2,5,6,7	2,5,6,7	2,5,6,7	—	—	2,5,6,7	—	2,5,6,7
CASE GND	2	2,5,6,7	—	—	—	2,5,6,7	—	2,5,6,7

*pins must be connected externally

MIL-M-28837/1A, NSN GUIDE

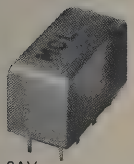
MCL NO.	NSN	MIL-M-28837/1A*
RAY-1	5825-01-105-6188	04N
RAY-1 Hi-Rel		04S
RAY-2	5895-01-111-7368	
RAY-3	5895-01-064-5082	
ZMY-2	4935-01-080-7636	

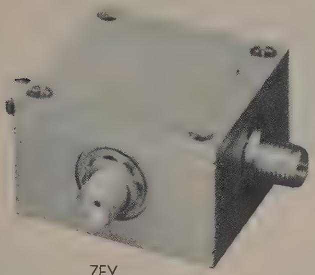
*units are not QPL listed

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

LEVEL 23S (+23dBm LO, up to +20dBm RF)
100 KHz to 2.4 GHz

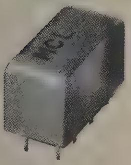

SAY


ZFY

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
		f_L-f_U		Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SAY case A01	**SAY-1**	0.1-500	.01-500	5.3	6.0	5.3	7.5	47	40	46	35	40	30	47	40	46	35	40	30	54.95	(1-9)
	SAY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	47	40	40	30	30	25	47	40	40	25	25	20	59.95	(1-9)
	SAY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	64.95	(1-9)
ZFY case K18	**ZFY-1**	0.1-500	.01-500	5.3	6.0	5.3	7.5	47	40	46	35	40	30	47	40	46	35	40	30	74.95	(1-9)
	ZFY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	47	40	40	30	30	25	47	40	40	25	25	20	79.95	(1-9)
	ZFY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	84.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

LEVEL 27 (+27dBm LO, up to +24dBm RF)
50 KHz to 500 MHz


VAY-1

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
		f_L-f_U		Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
VAY-1 case A01	**VAY-1**	NEW .05-500	.02-500	6.0	7.5	7.5	8.5	47	40	46	35	35	25	47	40	46	35	35	25	74.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

CAPD
now available!
computer-automated performance data
(see technical section)

In Stock... Immediate Delivery

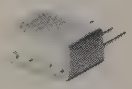
Power Splitter/Combiners

2 WAY-0°

2 KHz to 4.2 GHz

case style selection

outline drawings pages 58-62



LPS

PSC-2

MCS-2

TSC-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.		M Typ.		U Typ.		INSERTION LOSS, dB Above 3dB L Typ.		M Typ.		U Typ.		PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
				L Min.		M Min.		U Min.		L Max.		M Max.		U Max.								
LPS case BB48	**LPS-109** NEW	10-500	35	25	30	25	30	25	0.3	0.5	0.4	0.6	0.5	0.8	2.0	3.0	2.0	0.15	0.2	0.3	15.95	(5-24)
PSC-2 case A01	**PSC-2-1**	0.1-400	20	15	25	20	25	20	0.2	0.6	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	9.95	(6-49)
	PSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.6	0.5	0.9	0.7	1.0	2.0	3.0	4.0	0.15	0.2	0.3	14.95	(6-49)
	PSC-2-2	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	0.15	.25	0.3	19.95	(6-49)
	PSC-2-4	10-1000	30	25	25	20	25	20	0.6	1.0	0.6	1.2	0.7	1.2	2.0	8.0	20	0.15	0.2	0.4	19.95	(6-49)
	■ **PSC-2375**	55-85	—	—	35	25	—	—	—	—	0.3	0.5	—	—	—	1.0	—	—	0.1	—	19.95	(6-24)
	■ **PSC-2-1-75**	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	0.15	0.2	0.3	11.95	(6-49)
MSC-2 case A03	**MSC-2-1**	0.1-450	20	15	30	20	30	20	0.3	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	16.95	(5-24)
	MSC-2-1W	2-650	22	18	30	25	22	18	0.3	0.5	0.5	0.8	0.8	1.2	1.0	2.0	4.0	0.15	0.2	0.3	17.95	(5-24)
TSC-2 case B02	**TSC-2-1** NEW	1-400	30	25	30	25	30	20	0.25	0.5	0.4	0.75	0.8	1.0	2.0	3.0	4.0	0.15	0.2	0.6	13.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

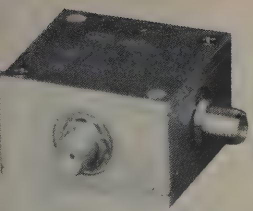
PSC-2-1

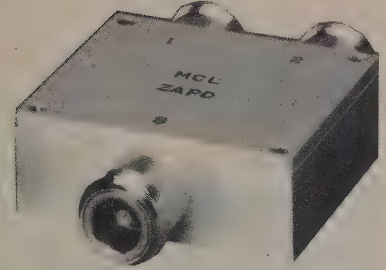
FREQUENCY MHz	INSERTION LOSS (dB) S-1	INSERTION LOSS (dB) S-2	UNBALANCE (dB) 1-2	ISOLATION (dB) 1-2	VSWR SUM	VSWR 1	VSWR 2
.10	3.33	3.33	.02	21.96	1.40	1.14	1.14
21.147	3.19	3.19	0.00	33.40	1.12	1.11	1.12
42.194	3.19	3.19	0.00	34.63	1.13	1.11	1.11
63.241	3.27	3.25	−.02	33.73	1.13	1.11	1.11
84.288	3.24	3.25	.01	32.70	1.13	1.11	1.11
105.335	3.27	3.27	.00	31.70	1.13	1.11	1.10
126.382	3.27	3.27	0.00	31.06	1.13	1.11	1.11
147.429	3.29	3.29	0.00	30.47	1.13	1.11	1.11
168.476	3.29	3.29	0.00	30.05	1.14	1.11	1.11
189.523	3.32	3.32	0.00	29.71	1.15	1.12	1.12
210.570	3.34	3.34	0.00	29.42	1.16	1.14	1.14
231.617	3.36	3.37	.01	29.18	1.18	1.15	1.15
252.664	3.37	3.41	.04	28.85	1.21	1.17	1.17
273.711	3.43	3.47	.04	28.53	1.25	1.20	1.20
294.758	3.45	3.45	0.00	27.90	1.30	1.23	1.23
315.805	3.47	3.49	.02	27.03	1.34	1.26	1.26
336.852	3.48	3.50	.03	25.92	1.40	1.29	1.29
357.899	3.50	3.56	.06	24.51	1.46	1.32	1.33
378.946	3.58	3.62	.06	22.93	1.54	1.36	1.37
400.000	3.70	3.74	.04	21.19	1.63	1.40	1.41

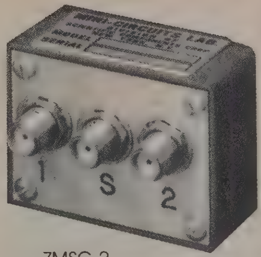
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

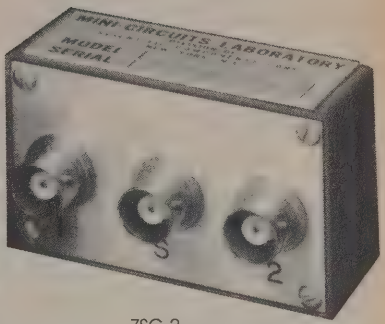
Mini-Circuits

50 ohms and 75 ohms


SC-2


ZAPD


ZMSC-2


ZSC-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB						INSERTION LOSS, dB Above 3dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
ZFSC-2	ZFSC-2-1	5-500	30	25	28	20	25	20	0.2	0.5	0.3	0.6	0.6	0.8	2.0	4.0	4.0	.15	.15	0.3	31.95	(4-24)
case K18	■ ZFSC-2-1-75 NEW	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	32.95	(4-24)
	ZFSC-2-1W	1-750	30	20	28	20	25	20	0.2	0.5	0.4	0.8	0.8	1.0	2.0	4.0	4.0	.15	.15	0.3	35.95	(4-24)
	ZFSC-2-2	10-1000	30	20	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	39.95	(4-24)
	ZFSC-2-4	0.2-1000	20	15	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	44.95	(4-24)
	ZFSC-2-5	10-1500	25	15	30	20	25	18	0.25	0.6	0.5	1.0	0.8	1.5	5.0	8.0	10.0	.15	0.2	0.5	49.95	(4-24)
	ZFSC-2-6	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	36.95	(4-24)
	■ ZFSC-2-6-75	0.004-60	30	20	35	20	25	20	0.5	0.8	0.4	0.8	0.7	1.0	1.0	2.0	3.0	.15	0.2	0.3	38.95	(4-24)
		GHz																				
ZAPD	ZAPD-1	0.5-1.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	1	—	—	0.2	—	39.95	(1-9)
case F14	ZAPD-2	1.0-2.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	2	—	—	0.2	—	39.95	(1-9)
	ZAPD-4	2.0-4.2	25	19	25	19	25	19	0.4	0.8	0.4	0.8	0.4	0.8	—	6	—	—	0.4	—	39.95	(1-9)
case F53	ZAPD-21 NEW	0.5-2.0	25	19	25	19	25	19	0.25	0.8	0.25	0.8	0.25	0.8	—	2	—	—	0.2	—	49.95	(1-9)
		MHz																				
ZMSC-2	ZMSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	37.95	(4-24)
case M21	ZMSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	42.95	(4-24)
	ZMSC-2-2	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	47.95	(4-24)
ZSC-2	ZSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	27.95	(4-24)
case M22	ZSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	32.95	(4-24)
	ZSC-2-2	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	37.95	(4-24)
	ZSC-2-4	10-1000	25	20	35	20	25	20	0.2	0.5	0.5	0.8	0.7	1.3	2.0	4.0	6.0	.15	0.2	0.3	37.95	(4-24)
	■ ZSC-2375	55-85	35	25	35	25	35	25	0.3	0.5	0.3	0.5	0.3	0.5	—	1.0	—	—	0.1	—	37.95	(4-24)
	■ ZSC-2-1-75	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	29.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For Quality Control procedures, see page 6.
2. For environmental specifications, see page 7.
3. Absolute Maximum Ratings, Matched power rating ZAPD 10W all other models 1W, Internal load dissipation 0.125W, see page 6.
4. For connector types and case mounting options, see case style outline drawing.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground
LPS	1	4	5	2,3,6,7,8
PSC-2	1	5	6	2,3,4,7,8
MSC-2	1	5	6	2,3,4,7,8
TSC-2	1	2	4	3
ZFS-2	3	1	2	—
ZAPD-2	3	1	2	—
ZMSC-2	2	1	3	—
ZSC-2	2	1	3	—

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
MSC-2-1	6625-01-124-8595	02
PSC-2-1	5820-00-548-0739	01
PSC-2-2	5825-01-044-8944	
ZFSC-2-2A	6625-01-079-7021	
ZMSC-2-1W	5895-01-127-0232	
ZSC-2-1-BNC	5895-01-036-6254	
ZSC-2-1B	5820-00-270-3055	
ZSC-2-1-B-TNC	5820-01-109-3706	
ZSC-2-2-75B	5915-01-012-8162	

*units are not QPL listed

In Stock...Immediate Delivery

Power Splitter/Combiners

2 WAY-90°

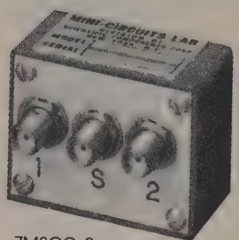
1.4 MHz to 4.2 GHz

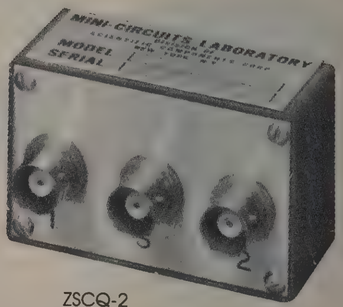
case style selection

outline drawings page 58-62

PSCQ-2

ZAPDQ


ZMSCQ-2


ZSCQ-2

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB		INSERTION LOSS dB Avg. of Coupled Outputs less 3 dB		PHASE UNBALANCE Degrees	AMPLITUDE UNBALANCE dB	PRICE $	
			Typ.	Min.	Typ.	Max.	Max.	Max.	Ea.	Qty.
PSCQ-2 case A01	**PSCQ-2-1.5**	1.4-1.7	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-3.4	3.0-3.8	30	25	0.4	0.7	3.8	1.2	16.95	(5-49)
	PSCQ-2-6.4	5.8-7.0	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-7.5	7.0-8.0	35	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-10.5	9.0-11.0	25	20	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-13	12-14	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-14	12-16	30	25	0.3	0.6	3.0	1.8	16.95	(5-49)
	PSCQ-2-21.4 NEW	20-23	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-50	25-50	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-70 NEW	40-70	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	19.95	(5-49)
	PSCQ-2-120 NEW	80-120	25	18	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	19.95	(5-49)
	PSCQ-2-250 NEW	150-250	25	18	0.4	0.8	4.0	1.5	19.95	(5-49)
	PSCQ-2-400 NEW	250-400	23	16	0.5	0.9	4.0	1.5	19.95	(5-49)
	PSCQ-2-450 NEW	350-450	23	16	0.5	0.9	5.0	1.5	19.95	(5-49)
ZAPDQ case F14	**ZAPDQ-2**	1000-2000	22	16	0.4	0.9	5.0	1.0	59.95	(1-9)
	ZAPDQ-4	2000-4200	22	16	0.4	0.9	5.0	1.0	59.95	(1-9)
ZMSCQ-2 case M21	**ZMSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	49.95	(4-24)
	ZMSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	49.95	(4-24)
	ZMSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	49.95	(4-24)
ZSCQ-2 case M22	**ZSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	39.95	(4-24)
	ZSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	39.95	(4-24)
	ZSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	39.95	(4-24)

NOTES:

1. For Quality Control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings,
   Matched power rating ZAPDQ(10W),
   all other models (1W),
   Internal load dissipation (0.125W), see page 7.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground	Terminate 50 ohms
PSCQ-2	1	2	5	3,4,7,8	6
PSCJ-2	1	5	6	2,3,4,7,8	—
ZAPDQ	3	1	2	—	—
ZMSCQ-2	2	1	3	—	—
ZSCQ-2	2	1	3	—	—
ZFSCJ-2	3	1	2	—	—
ZMSCJ-2	2	1	3	—	—
ZSCJ-2	2	1	3	—	—

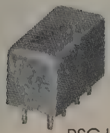
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

50 ohms

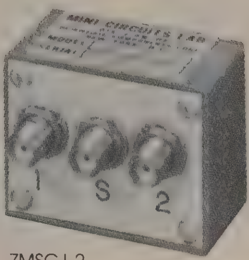
2 WAY-180°

10 KHz to 500 MHz

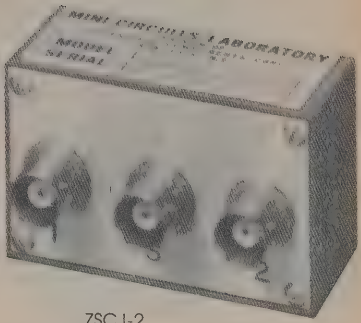


PSCJ-2

ZFSCJ-2



ZMSCJ-2



ZSCJ-2

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB						INSERTION LOSS, dB Above 3dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
PSCJ-2 case A01	**PSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.5	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	19.95	(5-49)
	PSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	29.95	(5-49)
ZFSCJ-2 case K18	**ZFSCJ-2-1**	1-500	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	49.95	(4-24)
	ZFSCJ-2-3	5-300	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	39.95	(4-24)
ZMSCJ-2 case M21	**ZMSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	47.95	(4-24)
	ZMSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	57.95	(4-24)
ZSCJ-2 case M22	**ZSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	37.95	(4-24)
	ZSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	47.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PSCJ-2-1

FREQUENCY MHz	INSERTION LOSS (dB)		UNBAL. (dB)	ISOLATION (dB)	VSWR		
	S-1	S-2	1-2	1-2	Sum	1	2
1.20	3.79	3.64	.15	30.98	1.06	1.15	1.15
11.473	3.60	3.44	.16	32.77	1.04	1.19	1.19
21.946	3.56	3.47	.09	33.61	1.06	1.20	1.20
32.419	3.60	3.51	.09	34.38	1.08	1.21	1.22
42.892	3.61	3.52	.09	35.06	1.10	1.22	1.24
53.365	3.72	3.53	.19	35.92	1.11	1.24	1.25
63.838	3.64	3.53	.11	36.93	1.13	1.25	1.27
74.311	3.79	3.58	.21	38.25	1.15	1.26	1.29
84.784	3.77	3.57	.20	39.86	1.17	1.28	1.31
95.257	3.82	3.62	.20	41.94	1.19	1.29	1.33
105.73	3.88	3.65	.23	45.24	1.22	1.31	1.36
116.203	3.83	3.66	.17	48.23	1.24	1.33	1.38
126.676	3.92	3.66	.26	48.12	1.27	1.34	1.41
137.149	3.92	3.65	.27	44.90	1.29	1.36	1.43
147.622	3.96	3.65	.31	40.93	1.31	1.38	1.46
158.395	4.02	3.69	.33	39.29	1.34	1.40	1.50
168.568	3.97	3.68	.29	35.97	1.36	1.42	1.53
179.041	4.08	3.66	.42	34.09	1.39	1.45	1.56
189.514	4.09	3.68	.41	32.50	1.42	1.47	1.60
200.00	4.03	3.65	.38	30.89	1.44	1.49	1.64

In Stock...Immediate Delivery

Power Splitter/Combiners

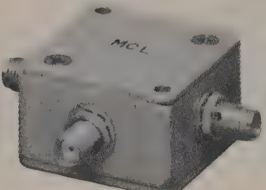
3 WAY-O°

10 KHz to 4.2 GHz

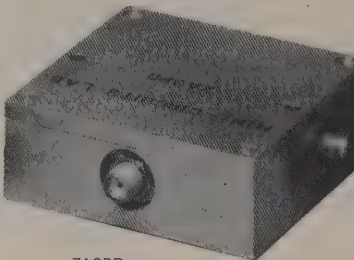
case style selection

outline drawings page 58-62

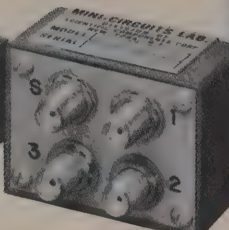
PSC-3



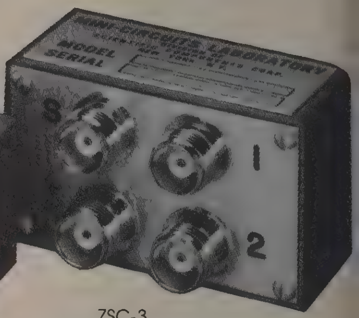
ZFSC-3



ZA3PD



ZMSC-3



ZSC-3

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 4.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-3 case A01	● PSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	19.95	(5-49)
	PSC-3-1W	5-500	25	20	31	15	25	15	0.4	0.8	0.4	1.4	0.8	1.4	6.0	14.	20.	0.1	0.3	0.6	29.95	(5-49)
	PSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	29.95	(5-49)
	■ PSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.3	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	20.95	(5-49)
	NEW ■ PSC-3-1-75-2	10-300	28	20	25	20	28	20	0.2	0.4	0.3	0.5	0.4	0.7	2.0	3.0	4.0	.15	0.2	0.3	22.95	(5-49)
	PSC-3-13	1-200	45	35	45	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	4.0	0.1	0.2	0.2	24.95	(5-49)
ZFSC-3 case J17	ZFSC-3-1	1-500	30	20	30	20	25	18	0.4	.75	0.5	0.9	0.8	1.2	2.0	3.0	4.0	0.2	0.3	0.4	39.95	(4-24)
	ZFSC-3-1W	2-750	30	20	30	20	25	18	0.4	.75	0.5	1.0	1.0	1.6	3.0	5.0	7.0	0.2	0.3	0.5	41.95	(4-24)
	ZFSC-3-13	1-200	45	30	48	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	5.0	0.1	0.2	0.2	39.95	(4-24)
		GHz																				
ZA3PD case CC51	ZA3PD-1 NEW	0.5-1.0	20	15	20	15	20	18	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.4	0.4	0.4	79.95	(1-9)
	ZA3PD-1.5 NEW	0.75-1.5	20	16	20	16	20	16	0.3	0.7	0.3	0.7	0.3	0.7	—	—	—	0.5	0.3	0.3	79.95	(1-9)
	ZA3PD-2 NEW	1-2	20	18	20	18	20	18	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.3	0.3	0.3	79.95	(1-9)
	ZA3PD-4 NEW	2-4.2	18	14	18	14	18	14	0.7	1.0	0.7	1.0	0.7	1.0	—	—	—	0.8	0.8	0.8	79.95	(1-9)
		MHz																				
ZMSC-3 case P26	ZMSC-3-1	1-200	45	35	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	47.95	(4-24)
	ZMSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	57.95	(4-24)
ZSC-3 case P25	ZSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	37.95	(4-24)
	ZSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	47.95	(4-24)
	■ ZSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.4	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	38.95	(4-24)
	■ ZSC-3-2-75	0.02-20	35	30	35	25	30	20	0.2	0.5	.25	0.6	.45	.75	2.0	3.0	4.0	0.2	0.3	0.4	48.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN
PSC-3-1	5820-01-015-6027
ZSC-3-1B	5820-01-008-9566
ZSC-3-2B	5825-01-120-9320
PSC-4-1	5821-01-065-0106
PSC-4-2	5825-01-044-8945
PSC-4-3	5825-01-105-6189
ZSC-4-1B	5820-00-270-3056
ZSC-4-2B	5820-01-120-5238
ZSC-4-3B	6920-01-038-8553

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Ground
PSC-3 except PSC-3-1W, PSC-3-1-75-2	6	1	2	5	—	3,4,7,8
PSC-3-1W PSC-3-1-75-2	1	5	7	8	—	2,3,4,6
PSC-4	4	7	8	1	2	3,5,6
PSC-4A	2	8	12	5	9	1,3,4,6,7,10 11,13,14,15,16

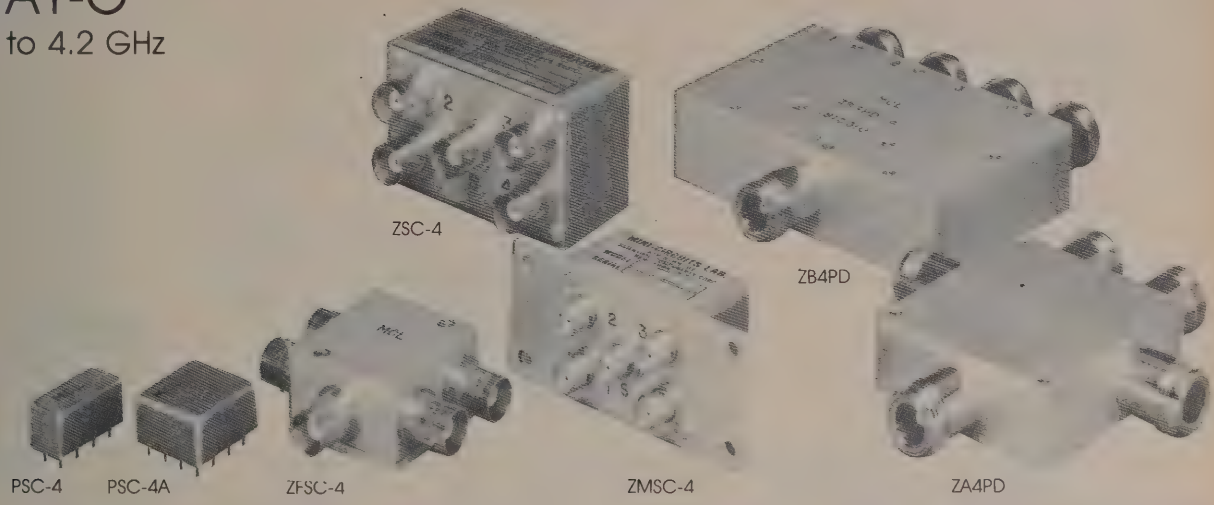
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

50 ohms and 75 ohms

4 WAY-0°

2 KHz to 4.2 GHz



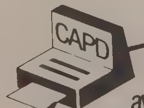
	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 6dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
PSC-4 case A01	PSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	28.95	(6-49)
	■ PSC-4-1-75	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.9	0.7	1.2	4.0	6.0	10.0	.15	.20	0.3	24.95	(6-49)
	PSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	8.0	.15	.20	.25	23.95	(6-49)
	PSC-4-6	0.01-40	35	29	32	25	25	18	0.4	0.8	0.3	0.5	0.5	1.0	4.0	6.0	8.0	.10	.15	.20	29.95	(6-49)
PSC-4A case C07	PSC-4A-4	10-1000	25	20	21	15	18	15	0.5	0.8	0.8	1.1	1.5	2.5	4.0	16.0	20.0	.20	.30	.20	49.95	(6-49)
ZFSC-4 case G15	ZFSC-4-1	1-1000	25	20	23	18	20	15	0.4	0.8	0.6	1.5	1.6	2.5	4.0	8.0	8.0	0.2	0.4	0.7	89.95	(1-4)
	ZFSC-4-1W	10-500	23	20	23	20	23	20	0.6	1.5	0.6	1.5	0.6	1.5	4.0	8.0	8.0	0.2	0.3	0.4	74.95	(1-4)
	ZFSC-4-3	10-300	32	28	38	30	38	30	0.5	0.8	0.6	0.9	0.9	1.2	4.0	6.0	8.0	0.1	0.1	0.2	69.95	(1-4)
	■ ZFSC-4375 NEW	50-90	34	30	34	30	34	30	0.3	0.8	0.3	0.8	0.3	0.8	4.0	6.0	8.0	0.15	0.15	0.15	89.95	(1-4)
	▲■ ZFSC-4-2-75-1	200-800	25	20	25	20	25	20	0.8	1.0	0.8	1.0	0.8	1.0	4.0	16.0	20.0	0.4	0.4	0.4	74.95	(1-4)
ZMSC-4 case N24	ZMSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	1.0	.15	.20	.25	56.95	(4-24)
	ZMSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZMSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	53.95	(4-24)
ZSC-4 case N27	ZSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	46.95	(4-24)
	■ ZSC-4-1-75	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.8	0.7	1.2	0.4	6.0	10.0	.15	.20	0.3	46.95	(4-24)
	ZSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	43.95	(4-24)
ZA4PD case DD52	ZA4PD-2	GHz 1-2	25	18	25	18	25	18	0.3	0.8	0.3	0.8	0.3	0.8	—	6.0	—	0.7	0.7	0.7	79.95	(1-9)
	ZA4PD-4	2-4.2	25	18	25	18	25	18	0.5	0.8	0.3	0.8	0.3	0.8	—	16.0	—	0.8	0.8	0.8	79.95	(1-9)
ZB4PD case EE54	ZB4PD-42 NEW	1.7-4.2	23	16	23	16	23	16	0.5	1.1	0.5	1.1	0.5	1.1	—	8.0	—	0.8	0.8	0.8	99.95	(1-9)
	ZB4PD-4 NEW	3.7-4.2	24	16	24	16	24	16	0.6	1.1	0.6	1.1	0.6	1.1	—	16.0	—	0.8	0.8	0.8	89.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.
● Model PSC-3-1 manufactured under license protected by patent 3,428,920.
▲ On Model ZFSC-4-2-75-1, up to 15V and 15mA DC may be passed from input to all outputs.

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings;
   Matched power rating ZA3PD, ZA4PD, ZB4PD(10W.)
   all other models (1W)
   Internal load dissipation
   all 3-way models (0.375W) all 4-way models (0.25W), see page 7.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All 3-way power dividers with exception of ZA3PD are licensed under U.S. Patent 3,428,920; reissued as RE 27,299.



now available!
computer-automated performance data
(see technical section)

In Stock...Immediate Delivery

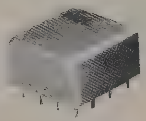
Power Splitter/Combiners

5 WAY-O°

1 MHz to 300 MHz

case style selection

outline drawings page 58-62



PSC-5

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 7.0dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L		M		U		L		M		U		L	M	U	L	M	U		
		f_L-f_U	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Ea.	Qty.
PSC-5 case C07	**PSC-5-1** NEW	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)
	■ **PSC-5-1-75** NEW	1-300	35	25	30	23	25	18	0.4	0.6	0.6	0.9	0.9	1.3	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt
   internal load dissipation, 0.5 watt.
2. Refer to table of contents for qualtiy control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Ground	Not Used
PSC-5	1	4	8	12	16	15	—	2,5,7,11,13,14	3,6,9,10
PSC-6	1	3	4	8	12	16	15	2,5,7,11,13,14	6,9,10

50 ohms and 75 ohms

Mini-Circuits

6 WAY-0°

1 MHz to 300 MHz

MINI-CIRCUITS LAB
ZFSC-6

PSC-6 ZFSC-6

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-6	**PSC-6-1**	1-175	30	24	26	18	26	18	0.5	0.8	0.7	1.0	1.0	1.5	4.0	6.0	12.0	0.2	0.4	0.8	68.95	(1-5)
case C07 ■	**PSC-6-1-75** NEW	1-300	35	25	30	23	25	18	0.4	0.6	0.6	0.9	0.6	1.1	2.0	6.0	12.0	0.2	0.3	0.6	78.95	(1-5)
ZFSC-6	**ZFSC-6-1**	1-175	27	22	26	20	26	20	0.75	1.0	0.75	1.2	0.8	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)
case Q28 ■	**ZFSC-6-1-75**	1-200	30	25	30	22	20	18	0.75	1.0	0.75	1.0	0.9	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

PSC-6-1 CAPD computer-automated performance data

typical production unit / for data of other models consult factory

INSERTION LOSS MHz	S-1 (dB)	S-2 (dB)	S-3 (dB)	S-4 (dB)	S-5 (dB)	S-6 (dB)	UNBAL.
1.00	8.39	8.40	8.42	8.43	8.45	8.43	0.06
10.157	8.16	8.17	8.14	8.19	8.19	8.20	0.05
28.471	8.24	8.24	8.23	8.27	8.27	8.29	0.04
55.942	8.32	8.36	8.30	8.35	8.35	8.36	0.06
83.413	8.39	8.43	8.38	8.42	8.46	8.43	0.08
101.727	8.48	8.52	8.49	8.48	8.52	8.52	0.04
120.041	8.62	8.62	8.55	8.58	8.62	8.63	0.07
138.355	8.62	8.65	8.56	8.58	8.68	8.67	0.12
156.669	8.68	8.72	8.60	8.65	8.75	8.72	0.15
175.00	8.76	8.80	8.65	8.70	8.84	8.77	0.19

ISOLATION MHz	1-2 (dB)	1-3 (dB)	1-5 (dB)	2-3 (dB)	4-5 (dB)	4-6 (dB)	5-6 (dB)
1.00	30.19	31.52	40.69	28.79	29.26	31.97	27.69
10.157	28.66	29.66	41.38	27.98	27.74	30.15	26.56
28.471	28.10	29.10	40.68	27.35	26.92	29.51	26.09
55.942	27.03	28.32	38.27	25.95	25.40	28.46	25.26
83.413	25.99	27.54	36.33	24.53	23.90	27.41	24.34
101.727	25.30	27.03	35.43	23.65	23.00	26.76	23.74
120.041	24.71	26.59	34.81	22.91	22.22	26.24	23.22
138.355	24.15	26.16	34.29	22.19	21.43	25.74	22.69
156.669	23.57	25.72	34.02	21.43	20.75	25.27	22.17
175.00	23.01	25.22	34.07	20.74	20.09	24.76	21.57

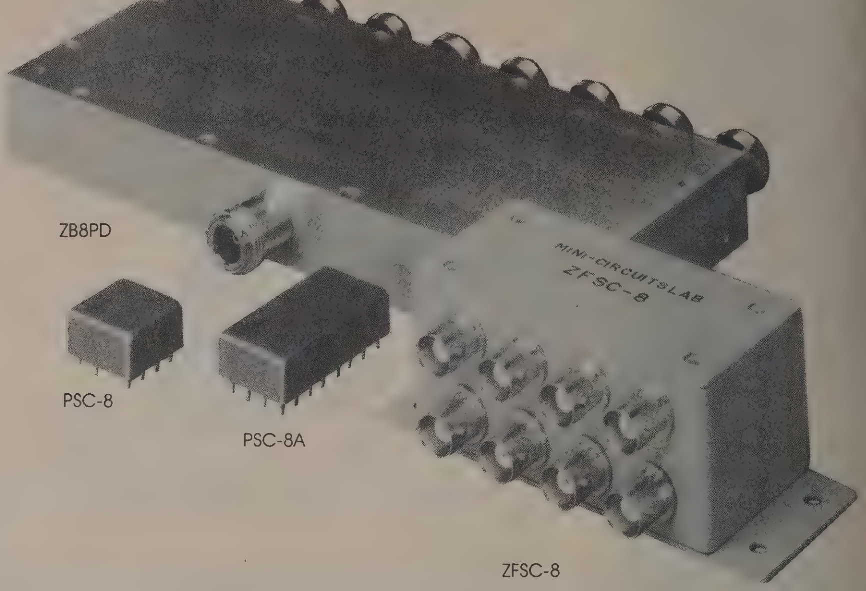
VSWR MHz	#S VSWR	#1 VSWR	#2 VSWR	#3 VSWR	#4 VSWR	#5 VSWR	#6 VSWR
1.00	1.12	1.11	1.10	1.10	1.11	1.09	1.10
10.00	1.25	1.09	1.07	1.08	1.09	1.06	1.12
27.36	1.26	1.08	1.07	1.08	1.08	1.04	1.11
53.40	1.30	1.08	1.08	1.08	1.09	1.05	1.09
88.12	1.37	1.08	1.09	1.09	1.09	1.05	1.11
105.48	1.39	1.08	1.10	1.09	1.09	1.05	1.12
122.84	1.40	1.08	1.11	1.10	1.10	1.05	1.13
140.20	1.39	1.08	1.11	1.10	1.10	1.05	1.15
157.56	1.37	1.08	1.12	1.11	1.11	1.05	1.15
175.00	1.34	1.09	1.13	1.13	1.13	1.05	1.16

In Stock... Immediate Delivery

Power Splitter/Combiners

8 WAY-O°

10 KHz to 4.2 GHz



case style selection

outline drawings pages 58-62

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 9dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L		M		U		L		M		U		L	M	U	L	M	U		
		f_L-f_U	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Ea.	Qty.
PSC-8	PSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	68.95	(1-5)
case C07	■ PSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.2	0.3	69.95	(1-5)
	PSC-8-6	0.01-10	40	30	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	79.95	(1-5)
PSC-8A	PSC-8A-4	5-500	25	20	23	18	20	15	0.7	1.2	1.0	1.8	1.4	2.0	3.0	8.0	16.0	0.2	0.3	0.5	89.95	(1-4)
case E10	■ PSC-8A4-75 NEW	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	79.95	(1-4)
ZFSC-8	ZFSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	89.95	(1-4)
case R29	■ ZFSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.3	0.5	90.95	(1-4)
	■ ZFSC-84-75 NEW	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	119.95	(1-4)
	■ ZFSC-8375	50-90	30	30	30	25	25	25	1.0	1.0	1.0	1.3	1.3	1.3	2.0	2.0	2.00	0.2	0.2	0.2	119.95	(1-4)
	ZFSC-8-4	5-700	35	25	25	20	20	17	0.8	1.2	1.2	1.8	1.8	2.5	2.0	5.0	15.0	0.2	0.4	0.7	129.95	(1-4)
	ZFSC-8-43 NEW	30-1000	23	20	25	20	26	20	1.0	1.3	1.4	1.8	2.1	2.7	5.0	10.0	20.0	0.2	0.4	0.7	139.95	(1-4)
	ZFSC-8-6	0.01-10	40	30	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	109.95	(1-4)
		GHz																				
ZB8PD	ZB8PD-2	1-2	24	16	24	16	24	16	0.8	1.3	0.8	1.3	0.8	1.3	1.3	1.3	1.3	0.7	0.7	0.7	149.00	(1-9)
case Z40	ZB8PD-4	2-4.2	23	16	23	16	23	16	0.8	1.4	0.8	1.4	0.8	1.4	—	—	—	0.9	0.9	0.9	149.00	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt.
   internal load dissipation, 0.62 watts.
2. Refer to table of contents for quality control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8	Ground	Not Used
PSC-8	2	1	5	9	13	16	12	8	4	3,6,7,14,15	10,11
PSC-8A	29	7	16	31	24	9	2	26	17	1,3,4,5,6,8,10,11,12,13,14,15,18,19,20,21,22,23,25,27,28,30,32	

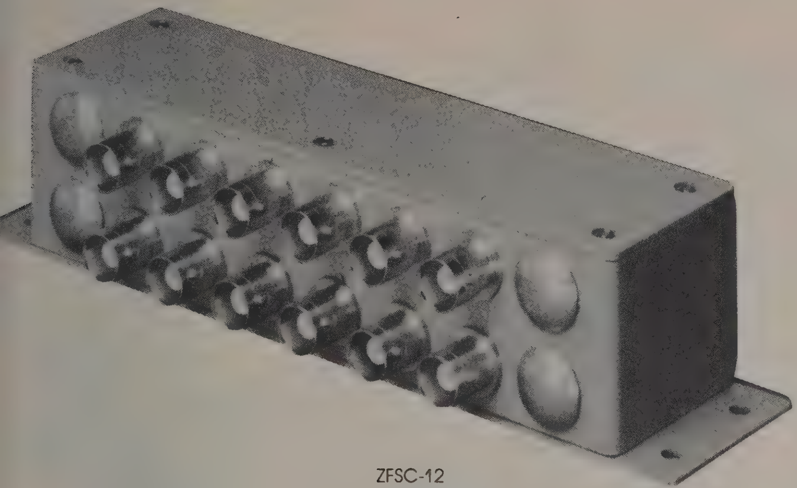
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

50 ohms and 75 ohms

12 WAY-O°

1 MHz to 300 MHz



ZFSC-12

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 10.8dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
ZFSC-12 case R67	**ZFSC-12-1** NEW	1-200	30	25	35	30	28	20	0.8	1.2	1.1	1.4	1.3	1.6	2.0	4.0	6.0	0.1	0.2	0.3	174.95	(1-4)
	ZFSC-12-11 NEW	10-300	28	20	33	25	28	20	1.1	1.3	1.1	1.5	1.5	1.8	2.0	4.0	6.0	0.2	0.3	0.4	174.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PSC-8A-4

INSERTION LOSS, dB

MHz	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	UNBAL.
5.00	9.60	9.60	9.60	9.62	9.62	9.62	9.59	9.60	.03
31.05	9.66	9.68	9.68	9.67	9.65	9.67	9.65	9.67	.03
57.11	9.78	9.80	9.81	9.80	9.79	9.77	9.77	9.78	.04
109.21	10.00	10.01	10.02	10.02	9.96	9.96	9.96	9.97	.06
161.32	10.35	10.36	10.36	10.36	10.27	10.27	10.26	10.29	.10
213.42	10.54	10.53	10.55	10.54	10.42	10.41	10.42	10.43	.14
265.53	10.72	10.69	10.72	10.70	10.56	10.55	10.57	10.59	.17
317.63	10.78	10.75	10.79	10.77	10.62	10.61	10.64	10.67	.18
395.79	10.79	10.76	10.79	10.79	10.63	10.60	10.65	10.68	.19
500.00	10.86	10.85	10.89	10.90	10.77	10.71	10.78	10.81	.19

ISOLATION, dB

MHz	1-2	1-3	1-8	3-4	5-6	5-7	7-8
5.00	26.25	37.38	50.07	27.19	26.02	37.42	26.55
31.05	23.99	34.75	46.72	24.18	23.73	34.49	24.07
57.11	22.23	31.50	43.09	22.40	22.17	31.09	22.36
109.21	21.46	27.29	38.07	21.86	22.23	26.78	21.88
161.32	21.22	24.76	35.44	21.85	23.18	24.25	21.99
213.42	21.19	23.24	33.61	22.06	24.75	22.78	22.46
265.53	21.39	22.41	32.29	22.47	27.11	22.02	23.28
317.63	21.84	22.04	31.09	22.98	30.46	21.84	24.52
395.79	22.53	22.23	29.80	23.70	36.05	22.56	27.24
500.00	22.74	24.07	28.71	23.44	31.27	25.96	30.63

VSWR

MHz	#S	#1	#2	#3	#4	#5	#6	#7	#8
5.00	1.30	1.36	1.36	1.38	1.38	1.35	1.35	1.37	1.37
31.05	1.33	1.31	1.31	1.32	1.32	1.30	1.30	1.31	1.31
57.11	1.38	1.27	1.28	1.28	1.28	1.25	1.26	1.27	1.27
109.21	1.51	1.28	1.29	1.29	1.29	1.23	1.24	1.26	1.26
161.32	1.63	1.30	1.31	1.32	1.31	1.23	1.24	1.26	1.27
213.42	1.71	1.32	1.33	1.33	1.32	1.22	1.23	1.26	1.26
265.53	1.73	1.32	1.32	1.33	1.32	1.20	1.21	1.25	1.25
317.63	1.68	1.31	1.31	1.31	1.30	1.17	1.18	1.23	1.23
395.79	1.50	1.28	1.27	1.27	1.26	1.15	1.15	1.20	1.21
500.00	1.19	1.27	1.25	1.23	1.23	1.17	1.15	1.22	1.22

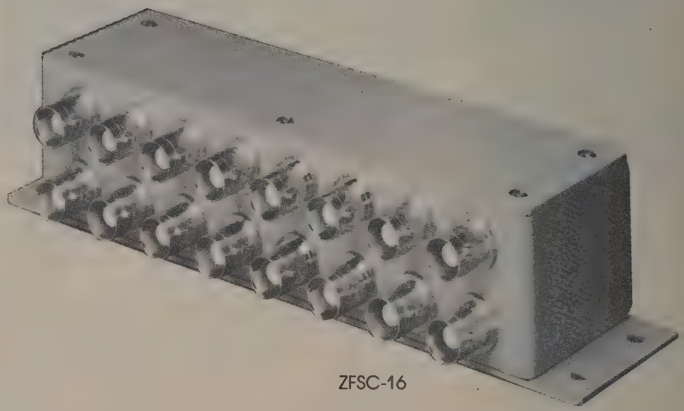
Power Splitter/Combiners

16 WAY-0°

10 KHz to 200 MHz

case style selection

outline drawings page 58-62



ZFSC-16

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB						INSERTION LOSS, dB Above 12dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L		M		U		L		M		U		L	M	U	L	M	U		
			Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Ea.	Qty.
ZFSC-16 case R30	ZFSC-16-1	0.5-125	30	24	25	18	20	15	1.0	1.2	1.1	1.3	1.2	1.4	1.0	3.0	5.0	0.1	0.2	0.5	174.95	(1-4)
	ZFSC-16-3 NEW	1-30	45	40	45	40	41	35	0.5	0.9	0.5	0.9	0.5	0.9	1.0	2.0	3.0	0.1	0.1	0.1	174.95	(1-4)
	■ ZFSC-16-675 NEW	0.01-25	25	20	40	25	25	20	0.8	1.1	0.4	0.8	1.0	1.6	1.0	3.0	5.0	0.1	0.2	0.4	189.95	(1-4)
	ZFSC-16-12 NEW	0.1-200	33	20	27	20	26	20	0.6	1.5	0.7	1.0	0.9	1.2	2.0	6.0	9.0	0.1	0.2	0.4	189.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

- ■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt
   Internal load dissipation, 0.87 watt.
2. Refer to table of contents for qualtiy control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

MIL-P-23971, *NSN GUIDE

MCL NO.	NSN
ZFSC-16-1	5820-01-120-9321

*Units are not QPL listed.

now available!
computer-automated performance data
(see technical section)

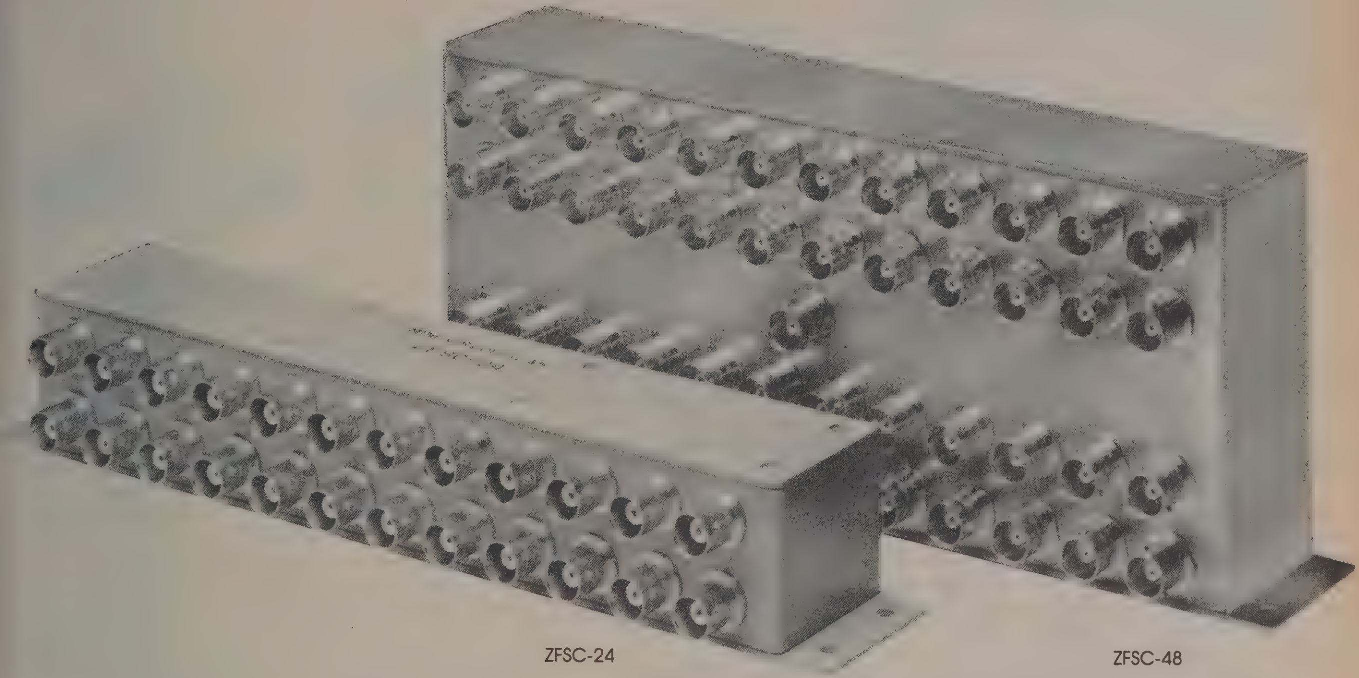
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

50 ohms and 75 ohms

Mini-Circuits

24 WAY-O°
25 KHz to 200 MHz

48 WAY-O°
10 MHz to 300 MHz



ZFSC-24

ZFSC-48

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB 24 way (above 13.8dB) 48 way (above 16.8dB) L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
ZFSC-24 case R31	**ZFSC-24-1**	0.2-100	25	20	25	20	25	20	1.0	2.0	1.0	2.0	1.0	2.0	2.0	3.0	5.0	0.2	0.4	0.5	264.95	(1-4)
	ZFSC-24-11 NEW	1-200	33	25	22	20	20	17	0.4	0.8	0.6	1.0	1.3	2.0	2.0	4.0	8.0	0.2	0.4	0.6	274.95	(1-4)
	ZFSC-24-6 NEW	0.025-50	30	25	39	30	30	25	0.4	1.0	0.4	0.8	0.6	1.2	2.0	4.0	6.0	0.2	0.3	0.4	274.95	(1-4)
ZFSC-48 case HH68	**ZFSC-48-1** NEW	10-300	30	25	28	20	23	20	1.0	1.5	1.8	2.2	2.0	2.5	—	—	—	0.6	0.7	0.9	595.00	(1-4)
	■ **ZFSC-48-1-75** NEW	10-300	30	25	28	20	23	20	1.2	2.0	2.1	2.5	2.3	3.0	—	—	—	0.6	0.7	1.0	595.00	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

In Stock... Immediate Delivery

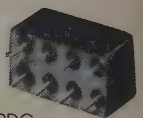
very broadband
Directional Couplers

10 to 30dB
10KHz to 2000 MHz

case style selection

outline drawings pages 58-62

TDC


PDC

	MODEL NO.	FREQUENCY MHz	COUPLING dB		MAINLINE LOSS* dB						DIRECTIVITY dB						VSWR	POWER INPUT, W		PRICE, $	
					L		M		U		L		M		U			L	M,U		
		f_L-f_U	Nom.	Flatness	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Max.	Ea.	Qty.
TDC case B02	**TDC 10-1**	1-400	10.0±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	20	15	1.5	1	2	15.95	(5-49)
PDC case A01	**PDC-10-1**	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	11.95	(5-49)
	PDC-10-2	250-1000	10.5±0.5	±1.0	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	27.95	(5-49)
	▲PDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.2	1.6	2	40	30	25	20	25	20	1.2	1	2	24.95	(5-49)
	PDC-10-22	5-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.6	1.9	35	30	25	20	25	20	1.25	1	2	19.95	(5-49)
	PDC-15-6	0.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	19.95	(5-49)
	†PDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	19.95	(5-49)
	PDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	13.95	(5-49)
	■PDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	12.95	(5-49)
	■PDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	20.95	(5-49)
	■PDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2	2	4	12.95	(5-49)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

NOTES:

- ★ Includes theoretical power loss at coupled port.
- ■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.
- † Models PDC-20-1, ZDC-20-1, ZMDC-20-1:
  L = 25-50 MHz, M = 50-300 MHz, U = 300-400 MHz
- ● Model ZFDC-20-5: above 1000 MHz, coupling flatness ±1.5dB
- ▲ Models PDC-10-21, ZFDC-10-21: Upper range coupling ±0.75dB

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All models are licensed under U.S. Patent 3,426,298.

MIL-M-15370/18, NSN GUIDE

MCL NO.	NSN	MIL-M-15370/18*
PDC-10-1		002
PDC-10-2		008
PDC-10-21	5985-01-130-0177	003
PDC-20-3	5985-01-076-8477	001
ZDC-10-1-BNC	5985-01-125-3467	
ZDC-20-3-BNC	5985-01-096-5007	
ZFDC-20-5	5985-01-097-2192	

*units are not QPL listed

pin and coaxial connections

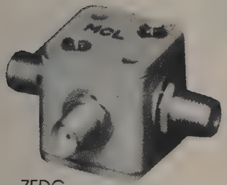
see case style outline drawing

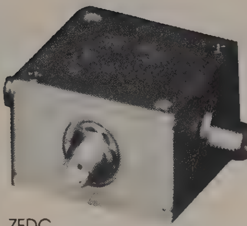
Series	In	Out	Cpl	Case Ground	Not Used
PDC	1	4	3	2,5,7,8	6
TDC	1	2	4	3	—
ZEDC	1	2	3	—	—
ZMDC	3	2	1	—	—
ZDC	3	2	1	—	—
ZFDC (except 20—4, —5)	1	2	3	—	—
ZFDC 20—4, —5	3	1	2	—	—

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

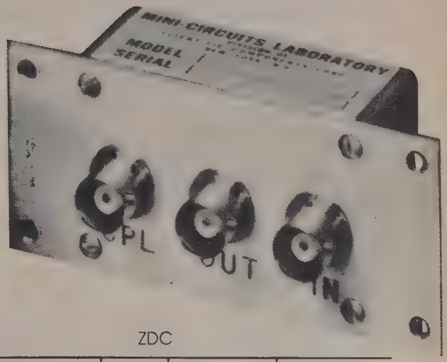
50 ohms and 75 ohms

Mini-Circuits


ZEDC


ZFDC

ZMDC


ZDC

	MODEL NO.	FREQ. MHz	COUPLING dB		MAINLINE LOSS* dB						DIRECTIVITY dB						VSWR	POWER INPUT, W		PRICE, $	
					L		M		U		L		M		U			L	M,U		
		f_L-f_U	Nom.	Flatness	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Max.	Ea.	Qty.
ZEDC case V37	ZEDC-10-2	1-1000	11±0.5	±0.75	1.3	1.5	1.5	1.8	1.5	1.8	35	30	30	20	18	13	1.3	1.5	3	54.95	(4-24)
	ZEDC-15-2	1-1000	15±0.5	±0.5	0.5	1.0	0.8	1.2	1.0	1.4	35	30	30	25	25	15	1.15	1.5	3	54.95	(4-24)
ZFDC case K18	ZFDC-10-1	1-500	10.5±0.25	±0.6	1.0	1.3	0.8	1.1	1.0	1.3	32	25	33	25	22	15	1.2	1.5	3	29.95	(4-24)
	ZFDC-10-2	10-1000	10.75±0.5	±0.5	1.5	2.0	1.2	1.6	1.5	2.0	35	28	30	25	27	20	1.5	1.5	3	39.95	(4-24)
	▲ZFDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2.0	40	30	25	20	25	20	1.2	1	2	44.95	(4-24)
	ZFDC-10-22	1-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.4	1.9	35	30	25	20	25	20	1.25	1	2	34.95	(4-24)
	ZFDC-15-6	0.03-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	34.95	(4-24)
	ZFDC-20-3	0.2-250	19.5±0.5	±0.25	0.35	0.6	0.25	0.5	0.35	0.6	36	25	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	ZFDC-20-4	1-1000	19.5±0.5	±0.5	1.2	1.5	0.6	0.8	1.2	1.5	36	28	27	20	23	18	1.1	5	2	59.95	(1-4)
	●ZFDC-20-5	0.1-2000	19.5±0.5	±0.5	0.3	1	0.7	1.4	1.5	2.3	30	20	27	20	22	10	1.2	.5	2	79.95	(1-4)
	■ZFDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	35.95	(4-24)
ZMDC case M21	ZMDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	39.95	(4-24)
	ZMDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	47.95	(4-24)
	ZMDC-15-6	.01-35	15±0.5	±0.5	0.4	0.6	0.2	0.4	0.4	0.6	38	30	35	25	28	20	1.15	2	4	47.95	(4-24)
	†ZMDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	47.95	(4-24)
	ZMDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.5	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	39.95	(4-24)
	ZMDC-30-1	0.1-250	30±0.5	±0.5	0.4	0.6	0.5	0.8	0.55	0.85	23	18	20	15	17	10	1.5	1.0	3	39.95	(4-24)
ZDC case M22	ZDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	29.95	(4-24)
	ZDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	37.95	(4-24)
	ZDC-15-6	.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	37.95	(4-24)
	†ZDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	37.95	(4-24)
	ZDC-20-3	0.2-250	19±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	■ZDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	29.95	(4-24)
	■ZDC-15-6-75	.02-35	14.5±0.5	±0.6	0.3	0.6	0.2	0.4	0.4	0.6	35	30	35	25	28	20	1.5	2	4	38.95	(4-24)
	■ZDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	15	2	2	4	30.95	(4-24)
	■ZDC-2375	55-85	10.5±0.5	±0.5	1.6	2.1	1.6	2.1	1.6	2.1	35	30	35	30	35	30	1.3	—	4	38.95	(4-24)
	■ZDC-20-3-75-1	55-90	18.6±0.5	±0.3	0.4	0.6	0.4	0.6	0.4	0.6	35	30	35	30	35	30	1.2	—	4	38.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PDC-10-1

FREQUENCY (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	VSWR IN	VSWR OUT	VSWR CPL
.50	.73	11.17	37.21	1.11	1.13	1.09
26.789	.62	11.50	36.92	1.10	1.13	1.06
53.078	.66	11.49	36.96	1.09	1.13	1.08
105.656	.72	11.52	36.48	1.06	1.14	1.09
158.234	.74	11.52	35.07	1.04	1.14	1.12
210.812	.81	11.60	32.60	1.02	1.15	1.12
263.39	.84	11.59	30.32	1.01	1.15	1.12
315.968	.92	11.56	27.36	1.01	1.15	1.13
368.546	.95	11.50	24.22	1.01	1.15	1.15
421.124	1.02	11.49	21.84	1.01	1.14	1.17
500.00	1.12	11.43	18.71	1.01	1.12	1.22

In Stock...Immediate Delivery

highest figure of merit

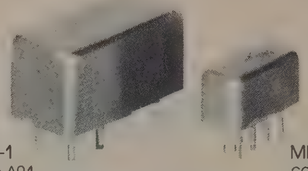
Phase Detectors

1000mV DC output, +7dBm RF

1MHz to 100 MHz

case style selection

outline drawings pages 58-62



RPD-1
case A01

MPD-1
case A11

description

These new high efficiency phase detectors are the only units in the world offering a figure-of-merit greater than 125 for only $15.95.

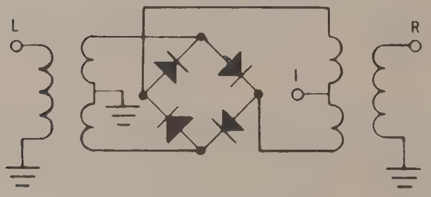
The figure-of-merit M or efficiency of a phase detector can be defined as the ratio of maximum DC output voltage (in mV) divided by the RF power (in dBm). The maximum DC output from these units is 1000 mV with +7 dBm applied to the LO and RF ports, and DC offset is typically 400 micro-volts. Thus, its figure-of-merit M is 143, which indicates a highly efficient phase detector. For comparison, a double-balanced mixer used as a phase detector offers 350 mV DC output with the same LO and RF inputs for a figure-of-merit M of 50.

Both the RPD-1 and MPD-1 are packaged in a hermetically-sealed EMI-shielded metal case. The miniature RPD-1 measures 0.4 x 0.8 x 0.4 in. and the micromin MPD-1 is only 0.2 x 0.5 x 0.25 in.

So when your system requires a high output phase detector, specify the new RPD or MPD series.

NOTES:

1. Maximum RF input power, 50mW.
   peak IF current, 20mA.
2. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.



pin connections

see case style outline drawing

Series		RPD-1	MPD-1
REF.	L	8	8
RF in:	R	1	1
DC out:	I	*3,4	*3,4
GND.		2,5,6,7	2,5,6,7
CASE GND.		2	2

*pins must be externally connected together

applications

- Radar
- ECM Systems
- Test Instruments
- Phase-lock loops

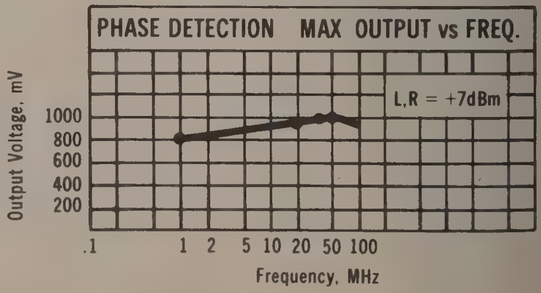
cost (5-24)

RPD-1 $15.95 MPD-1 $18.95

RPD-1, MPD-1 specifications

FREQUENCY RANGE:	
L and R ports	1-100 MHz
Output ports	DC-50 MHz
SCALE FACTOR	8 mV/Degree
IMPEDANCE	
L and R ports	50 ohms
I port	500 ohms
L and R SIGNAL LEVELS	+7 dBm
ISOLATION, L-R	40 dB min
MAXIMUM DC OUTPUT, mV	1000 mV typ 750 mV min
DC OUTPUT POLARITY (L and R in-phase)	Negative
DC OUTPUT OFFSET	0.2 mV typ 1 mV max
FIGURE-OF-MERIT, M	143 Typical
SIZE	
RPD-1	0.4 X 0.8 X 0.4
MPD-1	0.2 X 0.5 X 0.25

Model RPD-1



Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

broadband, minimal phase change
Limiters

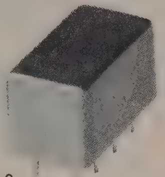
50 ohms

Mini-Circuits

+3 to +20 dBm input
3 KHz to 900 MHz

case style selection

outline drawings pages 58-62


PLS

	Model No.	FREQUENCY MHz f_L f_U	INPUT dBm Min.	INPUT dBm Max.	*OUTPUT dBm Typ.	CONTROL CURRENT (mA) Typ.	LIMITING Input range, dBm	LIMITING Δ Output/Δ 1dB Input amp, dB	LIMITING Δ Output/Δ 1dB Input phase, deg.	PRICE, $ Ea.	PRICE, $ Qty.
PLS case A01	**PLS-1**	0.1-150	6	20	−1.6	3	6 to 10	0.1	0.5	18.95	5-49
							10 to 16	0.1	0.5		
							16 to 20	0.2	1.0		
	PLS-2	100-900	3	15	−5.0	10	3 to 8	0.2	2.0	18.95	5-49
							8 to 12	0.4	2.0		
							12 to 15	0.2	2.0		
	PLS-6	0.003-1	6	20	−3.0	5	6 to 10	0.2	1.0	29.95	5-49
							10 to 16	0.1	1.0		
							16 to 20	0.2	1.0		

* Typical output level at typical control current.
Level may be changed by varying current.

pin connections

see case style outline drawing

Series	PLS		
Model	−1	−2	−6
INPUT	1	1	1
OUTPUT	8	8	8
CONTROL	*3,4	*3,4	*3,4
GND.	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND.	2	2,5,6,7	—

*Pins must be externally connected together

NOTES:

1. Maximum RF input power, 100mW.
   Maximum control current, 10 mA.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
PLS-1	5825-01-105-7820

PLS-1 LIMITING

computer-automated performance data

typical production unit / for data of other models consult factory

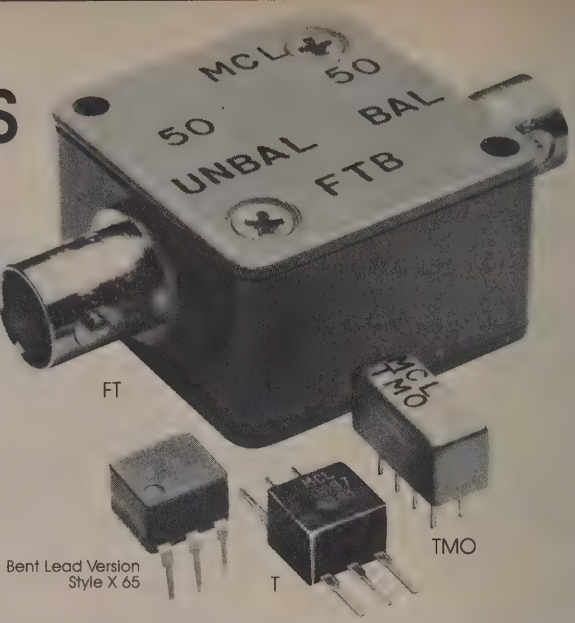
MHz	Output (20 dBm IN)	Output (16 dBm IN)	Output (10 dBm IN)	Output (6 dBm IN)	Delta, Out (20 to 16 dBm IN)	Delta, Out (16 to 10 dBm IN)	Delta, Out (10 to 6 dBm IN)
.100	−1.36	−1.47	−1.77	−2.15	.11	.30	.38
7.990	−.77	−1.02	−1.28	−1.65	.25	.26	.37
15.880	−.81	−.97	−1.35	−1.65	.16	.38	.30
23.769	−.79	−.95	−1.35	−1.64	.16	.40	.29
31.658	−.77	−.94	−1.38	−1.54	.17	.44	.16
39.547	−.71	−.93	−1.34	−1.47	.22	.41	.13
47.437	−.86	−1.08	−1.41	−1.46	.22	.33	.05
55.327	−.88	−1.03	−1.40	−1.73	.15	.37	.33
63.217	−.86	−1.05	−1.48	−1.63	.19	.43	.15
71.105	−1.02	−1.01	−1.42	−1.78	−.01	.41	.36
78.995	−1.05	−1.05	−1.37	−1.57	0.00	.32	.20
86.884	−.95	−1.08	−1.49	−1.78	.13	.41	.29
94.775	−.98	−1.12	−1.40	−1.73	.14	.28	.33
102.661	−1.06	−1.15	−1.50	−1.59	.09	.35	.09
110.551	−1.14	−1.29	−1.58	−2.32	.15	.29	.74
118.440	−1.09	−1.19	−1.58	−1.98	.10	.39	.40
126.330	−1.03	−1.21	−1.53	−1.65	.18	.32	.12
134.221	−1.10	−1.31	−1.59	−2.28	.21	.28	.69
142.111	−1.19	−1.44	−1.70	−1.98	.25	.26	.28
150.000	−1.16	−1.47	−1.72	−2.07	.31	.25	.35

REMARK: Control Current: 5.6mA

In Stock... Immediate Delivery

wideband
RF Transformers

3KHz to 800MHz



case style selection

outline drawings pages 58-62

T, TH, case W 38, X 65
TMO, case A 11, †case B 13
FT, FTB, case H 16

For PC applications, select from the low-cost, plastic-case T series (small enough to be inserted into a standard 1/3 DIP socket), or the hermetically-sealed RFI shielded TMO metal-case series (requiring less PC area than a flatpack or TO-5 can), or the plastic-case T-H series designed to handle up to 100 mA in the primary winding without appreciable saturation or change in RF characteristics.

Transformer core saturation is influenced by (1) dc current through the winding, (2) RF input power, and (3) frequency of operation. These three variables interact to affect the point at which saturation occurs, see Figs. (1) and (2). These curves show the point where distortion occurs, by visual observation, and illustrate how saturation is influenced by dc current through the winding, RF input power level and frequency of operation: See that (1) if the dc current through the winding increases, the allowable RF input power decreases and the minimum frequency of operation will increase, (2) if RF input power increases, the maximum allowable dc current through the winding will decrease and the minimum frequency of operation will increase, (3) if the frequency of operation increases, then the RF input power can be increased and the dc current through the winding can also be increased.

Now comparing the T-H series to the conventional T-series in Figs. (1) and (2), note that saturation effects are negligible with the T16-1H; so for wide dynamic range applications, specify the T-H series.

Coaxial connector models are available from 10 KHz to 500 MHz and are offered with 50 ohm and 75 ohm impedances; 75 ohm connectors are used at 75 ohm ports. The FT1.5-1, with unbalanced input and output, is especially useful for 50 ohm to 75 ohm matching applications. The FTB series with unbalanced output and balanced input (connector ground insulated from the case) helps eliminate ground loop problems, especially when long cable runs are involved.

As shown in the data chart on the following page, models are available in five basic configurations.

These transformers may be operated as low as 12.5 ohms at the primary with essentially the same impedance matching ratio and only a slight change in frequency response.

For each RF transformer model, the minimum and maximum frequency is given for the insertion loss at the 3 dB, 2 dB and 1 dB points, as shown in Fig. (3) and listed in the data chart. For example, the T1-1 insertion loss is 1 dB from 2 to 50 MHz and 3 dB from 0.15 to 400 MHz.

performance saturation curves T, TH series

(RF power & DC current at which signal saturation begins)

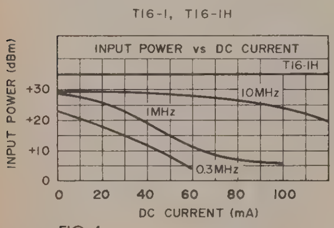


FIG. 1

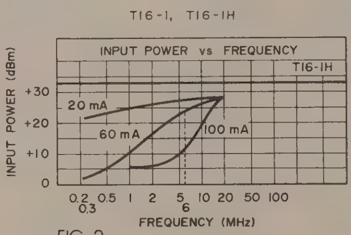


FIG. 2

frequency response curve

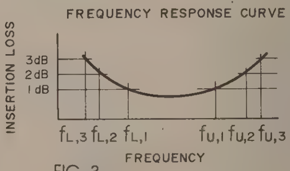


FIG. 3

NSN GUIDE

MCL NO.	NSN
T1-1	5950-01-128-3745
T2-1	5950-01-106-1218
T4-1	5950-01-024-7626
TMO4-1	5950-01-067-1012
TMO4-2	5950-01-091-3553
T9-1	5950-01-105-8153
TMO9-1A	5950-01-098-6315
T16-1	5950-01-094-7439

*FOR A AND B CONFIGURATIONS

Maximum Amplitude Unbalance	Maximum Phase Unbalance
0.1 dB over 1 dB frequency range	1.0° over 1 dB frequency range
0.5 dB over entire frequency range	5.0° over entire frequency range

NOTES:

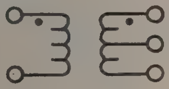
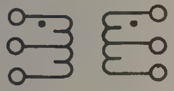
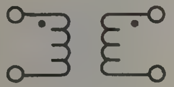
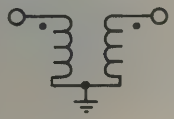
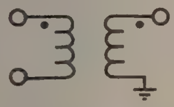
■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For Quality Control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings, see page 7, except for T & TH Series, temperature range is −20 to +85°C.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

12.5 to 800 ohms

Mini-Circuits

case style number see opposite page.		MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS			PRICE $	
					3dB MHz	2dB MHz	1dB MHz	Ea.	Qty.
A* 	T	T1-1T	1	.05-200	.05-200	.08-150	.2-80	3.95	(10-49)
		T1-6T NEW	1	.003-300	.003-300	.01-150	.02-50	5.95	(10-49)
		T2-1T	2	.07-200	.07-200	.1-100	.5-50	4.25	(10-49)
		T2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	4.25	(10-49)
		T3-1T	3	.05-250	.05-250	.1-200	.5-70	3.95	(10-49)
		T4-1	4	.2-350	.2-350	.35-300	2-100	2.95	(10-49)
		T4-6T	4	.02-250	.02-250	.05-150	0.1-100	3.95	(10-49)
		T5-1T	5	.3-300	.3-300	.6-200	.5-100	4.25	(10-49)
		T8-1T NEW	8	.03-140	.03-140	.10-90	1-60	6.95	(10-49)
		T13-1T	13	.3-120	.3-120	.7-80	5-20	4.25	(10-49)
		T16-6T	16	.03-75	.03-75	.06-30	.1-20	4.95	(10-49)
	TH	T4-1H	4	8-350	8-350	15-300	25-200	4.95	(10-49)
	TMO	TMO1-1T	1	.05-200	.05-200	.08-150	.2-80	6.45	(10-49)
		TMO2-1T	2	.07-200	.07-200	.1-100	.5-50	6.75	(10-49)
		† TMO2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	6.75	(10-49)
		† TMO3-1T	3	.05-250	.05-250	.1-200	.5-70	6.45	(10-49)
		TMO4-1	4	.2-350	.2-350	.35-300	2-100	4.95	(10-49)
		TMO5-1T	5	.3-300	.3-300	.6-200	5-100	6.75	(10-49)
		TMO13-1T	13	.3-120	3-120	.7-80	5-20	6.75	(10-49)
B* NEW 	TT	TT1-6	1	.004-500	.004-500	.02-200	.1-50	5.95	(10-49)
		TT1.5-1	1.5	.075-500	.075-500	.2-100	.1-50	4.95	(10-49)
		TT2.5-6	2.5	.01-50	.01-50	.025-25	.05-10	5.25	(10-49)
		TT4-1	4	.05-200	.05-200	.2-50	1-30	4.95	(10-49)
		TT25-1	25	.02-30	.02-30	.05-20	.1-10	7.95	(10-49)
	TTMO	TTMO1-1	1	.005-100	.005-100	.01-75	.05-40	10.95	(10-49)
C 	T	T1-1	1	.15-400	.15-400	.35-200	2-50	2.95	(10-49)
		T1-6 NEW	1	.01-150	.01-150	.02-100	.05-50	4.95	(10-49)
		T1.5-1	1.5	.1-300	.1-300	.2-150	.5-80	3.95	(10-49)
		T1.5-6 NEW	1.5	.02-100	.02-100	.05-50	0.1-25	4.95	(10-49)
		T2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	3.95	(10-49)
		T4-6	4	.02-200	.02-200	.05-150	.1-100	3.95	(10-49)
		T9-1	9	.15-200	.15-200	.3-150	2-40	3.45	(10-49)
		T16-1	16	.3-120	.3-120	.7-80	.5-20	3.95	(10-49)
		T36-1	36	.03-20	.03-20	.05-10	.1-5	5.95	(10-49)
	TH	T1-1H	1	8-300	8-300	10-200	25-100	4.95	(10-49)
		T9-1H	9	2-90	2-90	3-75	6-50	5.45	(10-49)
		T16-1H	16	7-85	7-85	10-65	15-40	5.95	(10-49)
	TMO	TMO1-1	1	.15-400	.15-400	.35-200	2-50	4.95	(10-49)
		TMO1.5-1	1.5	.1-300	.1-300	.2-150	.5-80	6.75	(10-49)
		† TMO2.5-6	2.5	.01-100	.01-100	.02-50	.05.20	6.45	(10-49)
		† TMO4-6	4	.02-200	.02-200	.05-150	.1-100	6.45	(10-49)
		TMO6-1	6	.3-200	.3-200	.5-150	5-50	6.45	(10-49)
		TMO9-1	9	.15-200	.15-200	.3-150	2-40	6.45	(10-49)
		TMO1 6-1	16	.3-120	.3-120	.7-80	5-20	6.45	(10-49)
D 	T	T2-1	2	.025-600	.025-600	.05-400	.5-200	3.45	(10-49)
		T3-1	3	.5-800	.5-800	.2-400	—	4.25	(10-49)
		T4-2	4	.2-600	.2-600	.5-500	.2-250	3.45	(10-49)
		T8-1	8	.15-250	.15-250	25-200	2-100	3.45	(10-49)
		T14-1	14	.2-150	.2-150	.5-100	2-50	4.25	(10-49)
	TMO	TMO2-1	2	.025-600	.025-600	.05-400	.5-200	5.95	(10-49)
		TMO3-1	3	.5-800	.5-800	2-400	—	6.95	(10-49)
		TMO4-2	4	.2-600	.2-600	.5-500	2-250	5.95	(10-49)
		TMO8-1	8	.15-250	.15-250	.25-200	2-100	5.95	(10-49)
		TMO14-1	14	.2-150	.2-150	.5-100	2-50	6.75	(10-49)
E 	FT	FT1.5-1	1.5	.1-400	.1-400	.5-200	1-100	29.95	(1-4)
	FTB	FTB1-1	1	.2-500	.2-500	.5-300	10-100	29.95	(1-4)
		FTB1-6	1	.01-125	.01-125	.05-50	.1-25	29.95	(1-4)
		■ FTB1-1-75	1	.5-500	.5-500	5-300	10-100	29.95	(1-4)

pin connections see case style outline drawings

CONFIGURATION	*A DC Isolated Center-Tap Secondary		*B DC Isolated Center-Tap Primary, Secondary		C,E DC Isolated		D Unbalanced Primary, Secondary	
SERIES	T, TH	TMO	T	TMO	T, TH	TMO	T	TMO
Primary DOT	4	1	4	1	4	1	6	1
Primary	6	5	6	5	6	5	3◇	6◇◇
Primary CT	—	—	5	3	—	—	—	—
Secondary Dot	3	2	3	2	3	2	1	2
Secondary	1	6	1	6	1	6	3◇	6◇◇
Secondary CT	2	4	2	4	—	—	—	—
Case Gnd.	—	7,8	—	7,8	—	7,8	—	7,8

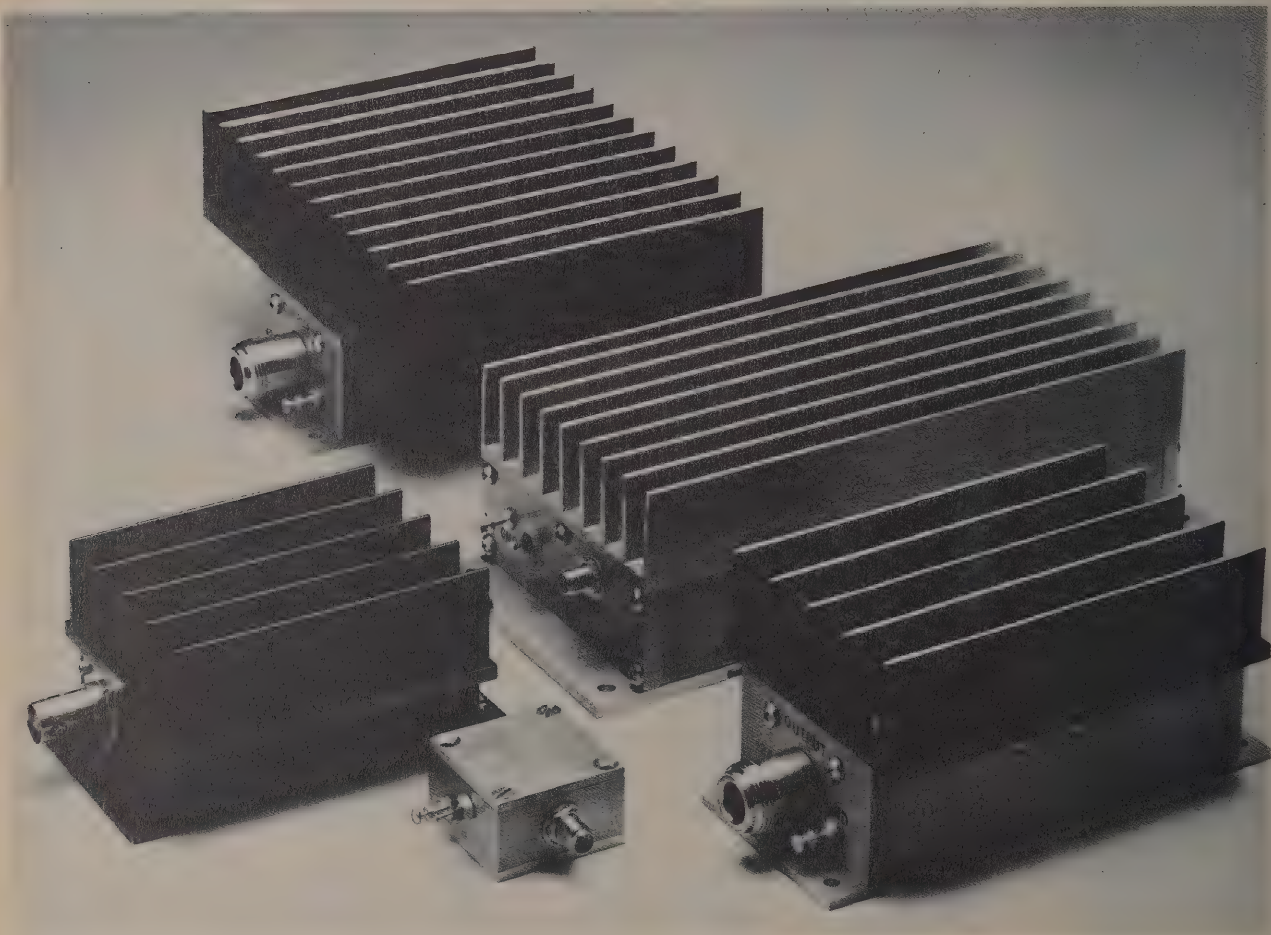
◇ pin 3 must be grounded
◇◇ pin 6 must be grounded

broadband linear

Power Amplifiers

up to 2 Watts (+33 dBm)

50 KHz to 4.2 GHz



Up to 1 watt linear output at 4.2 GHz, 2 watts at 800 MHz are now available at exceptionally low prices with Mini-Circuits' line of broadband amplifiers. Ultra-linear Class A design provides unconditional stability so any load impedance may be connected without concern for damage or oscilation. These amplifiers are ideally suited for TACAN, mobile radio, telemetry, anti-collision and satellite communications systems. Use these amplifiers to boost signal/sweep generator output to achieve broadband isolation, and to provide four test setups, using only one generator with a 4-way splitter...to name just a few applications.

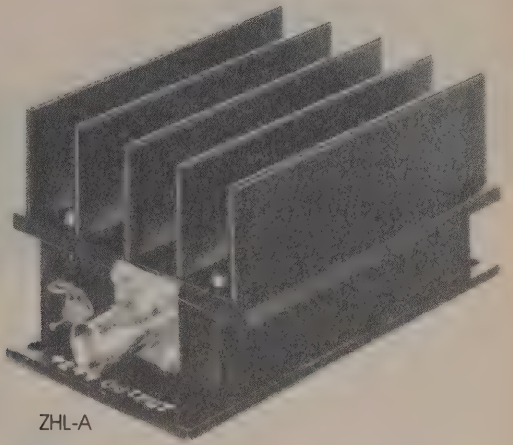
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

50 ohms

Mini-Circuits

up to 1 Watt (+30 dBm)

50 KHz to 500 MHz



ZHL-A

case style selection

outline drawings pages 58-62

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-A case S 32	**ZHL-1A**	2-500	16	±1.0	+28	+20	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-3A	0.4-150	24	±1.0	+29.5	+10	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-32A	0.05 -130	25	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	199	1-9

NOTES:

1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
ZHL-1A	6130-01-088-2322

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-1A

FREQ. (MHz)	GAIN (dB) 12V	GAIN (dB) 15V	GAIN (dB) 20V	GAIN (dB) 24V	REVERSE GAIN (dB) 12V	REVERSE GAIN (dB) 15V	REVERSE GAIN (dB) 20V	REVERSE GAIN (dB) 24V	VSWR (IN) 12V	VSWR (IN) 15V	VSWR (IN) 20V	VSWR (IN) 24V	VSWR (OUT) 12V	VSWR (OUT) 15V	VSWR (OUT) 20V	VSWR (OUT) 24V
2.00	17.90	18.27	18.46	18.52	29.03	29.07	28.96	28.88	1.09	1.13	1.14	1.14	1.10	1.16	1.15	1.15
28.21	17.88	18.27	18.48	18.52	29.53	29.72	29.54	29.24	1.09	1.11	1.13	1.14	1.20	1.19	1.19	1.18
54.42	17.88	18.33	18.54	18.59	29.57	29.62	29.58	29.39	1.12	1.12	1.13	1.14	1.24	1.24	1.24	1.24
80.63	17.94	18.41	18.65	18.70	29.91	29.78	29.64	29.56	1.19	1.17	1.16	1.16	1.30	1.29	1.30	1.30
106.84	17.90	18.41	18.69	18.78	29.85	30.12	29.97	29.75	1.31	1.24	1.21	1.21	1.36	1.36	1.37	1.37
133.05	17.91	18.42	18.75	18.83	30.02	30.06	30.15	29.87	1.42	1.32	1.28	1.27	1.41	1.41	1.42	1.44
159.26	17.68	18.34	18.71	18.81	30.25	30.32	30.03	30.00	1.56	1.42	1.36	1.34	1.46	1.48	1.50	1.52
185.47	17.64	18.34	18.78	18.84	30.50	30.36	30.12	29.99	1.71	1.553	1.45	1.43	1.50	1.53	1.57	1.60
211.68	17.52	18.25	18.74	18.82	30.50	30.64	30.19	30.05	1.83	1.63	1.52	1.50	1.51	1.56	1.63	1.67
237.89	17.46	18.20	18.73	18.81	30.85	30.64	30.35	30.32	1.96	1.72	1.59	1.57	1.52	1.58	1.67	1.73
264.10	17.34	18.09	18.66	18.74	30.99	30.75	30.40	30.43	2.04	1.79	1.64	1.62	1.48	1.56	1.66	1.75
290.31	17.28	18.03	18.58	18.69	31.08	30.89	30.66	30.58	2.14	1.86	1.69	1.66	1.44	1.53	1.66	1.76
316.52	17.33	18.08	18.69	18.79	30.64	30.77	30.51	30.49	2.16	1.88	1.70	1.67	1.40	1.50	1.64	1.75
342.73	17.32	18.06	18.69	18.79	30.50	30.44	30.41	30.44	2.17	1.87	1.69	1.65	1.33	1.43	1.59	1.71
368.94	17.30	18.04	18.71	18.79	30.09	30.23	30.24	30.27	2.09	1.81	1.63	1.59	1.27	1.35	1.49	1.62
395.15	17.23	18.02	18.67	18.82	29.81	29.95	29.91	30.18	2.03	1.75	1.57	1.53	1.24	1.28	1.41	1.55
421.36	17.32	18.13	18.83	18.98	29.19	29.36	29.52	29.85	1.96	1.68	1.49	1.44	1.32	1.29	1.36	1.50
447.57	17.37	18.23	18.96	19.08	28.50	28.79	29.05	29.22	1.90	1.61	1.41	1.36	1.47	1.36	1.34	1.43
473.78	17.17	18.10	18.90	19.08	27.94	28.28	28.64	28.82	1.93	1.64	1.42	1.37	1.68	1.51	1.39	1.42
500.00	17.07	18.14	19.06	19.26	27.68	27.17	28.22	28.50	2.07	1.79	1.57	1.54	1.01	1.79	1.61	1.58

In Stock...Immediate Delivery

broadband linear

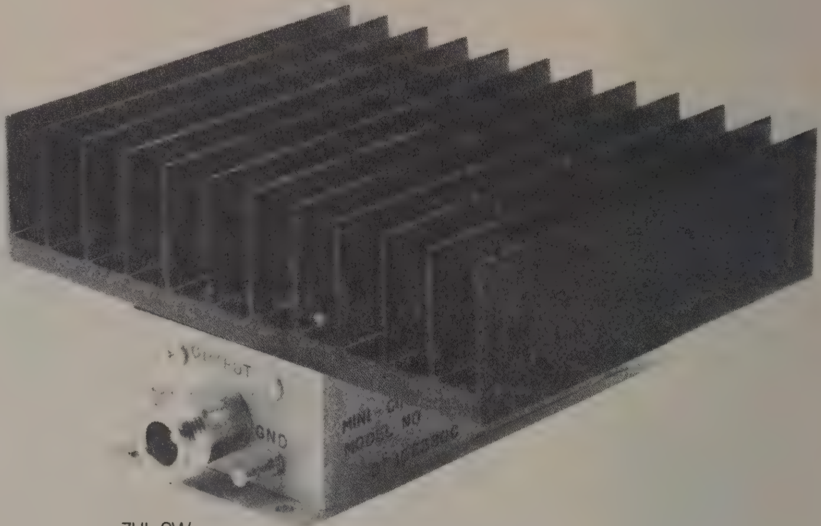
Power Amplifiers

up to 2 Watts (+33 dBm)

5 MHz to 800 MHz

case style selection

outline drawings pages 58-62



ZHL-2W

	MODEL NO.	FREQUENCY MHz	GAIN, dB		MAXIMUM POWER, dBm		DYNAMIC RANGE		VSWR		DC POWER		PRICE $	
			Min.	Flatness Max.	Output (1dB) Compression	Input (no damage)	NF, dB Typ.	Intercept pt., dBm 3rd order Typ.	In	Out	Volt.	Current	Ea.	Qty.
ZHL-2W case T 35	ZHL-1-2W	5-500	29	±1.0	+33	+10	12	+44	2:1	2:1	+24V	0.9A	495	1-9
	ZHL-7-2W NEW	600-800	28	±1.0	+33	+10	12	+43	2:1	2:1	+24V	0.9A	525	1-9

NOTES:

1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

ZHL-1-2W

FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY P_{out} (dBm)	LINEARITY Comp. (dB)
5.00	32.25	16.59	1.46	1.65	32.86	0.25
031.05	31.64	17.55	1.39	1.67	32.74	0.26
057.10	31.58	16.46	1.38	1.70	32.70	0.36
083.15	31.59	17.70	1.36	1.74	32.58	0.42
109.20	31.51	16.92	1.33	1.80	32.56	0.39
135.25	31.43	17.30	1.28	1.85	32.48	0.51
161.30	31.49	17.02	1.22	1.91	32.49	0.52
187.35	31.46	16.61	1.15	1.99	32.39	0.61
213.40	31.39	16.91	1.08	2.05	32.38	0.60
239.45	31.39	17.63	1.03	2.07	32.38	0.62
265.50	31.32	16.44	1.12	2.03	32.34	0.66
291.55	31.25	17.19	1.24	1.89	32.31	0.64
317.60	31.22	18.48	1.36	1.67	32.38	0.64
343.65	31.11	20.85	1.49	1.43	32.33	0.70
369.70	30.89	21.35	1.59	1.20	32.35	0.58
395.75	30.74	15.87	1.67	1.04	32.43	0.66
421.80	30.70	15.95	1.73	1.24	32.41	0.67
447.85	30.73	15.78	1.78	1.49	32.38	0.64
473.90	31.07	15.83	1.83	1.76	32.31	0.77
500.00	31.95	15.87	1.90	1.99	32.02	1.00

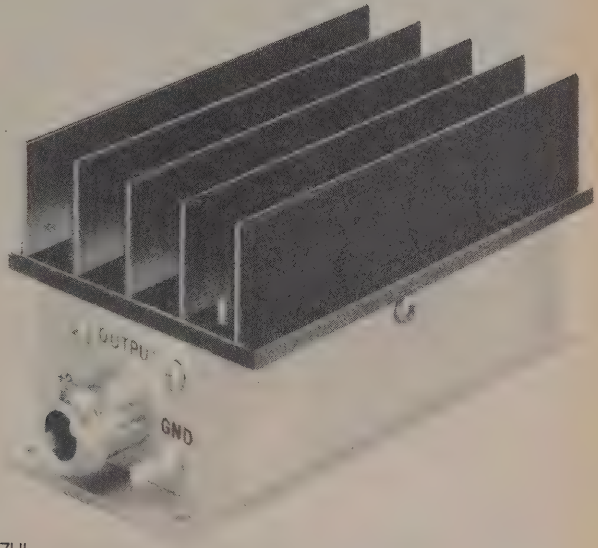
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

Mini-Circuits

50 ohms

up to 1 Watt (+30 dBm)

10 MHz to 1200 MHz



ZHL

	MODEL NO.	FREQUENCY MHz	GAIN, dB		MAXIMUM POWER, dBm		DYNAMIC RANGE		VSWR		DC POWER		PRICE $	
			Min.	Flatness Max.	Output (1dB) Compression	Input (no damage)	NF, dB Typ.	Intercept pt., dBm 3rd order Typ.	In	Out	Volt.	Current	Ea.	Qty.
ZHL case T 34	**ZHL-2**	10-1000	16	±1.0	+29	+20	18	+38	2:1	2:1	+24V	0.6A	349	1-9
	ZHL-2-8	10-1000	27	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	474	1-9
	ZHL-2-12 *	10-1200	24	±1.0	+29★	+10	10	+38	2:1	2:1	+24V	0.75A	599	1-9

★ +28.5 dBm maximum output 1000 to 1200 MHz; available only with SMA

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-2

FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
10.00	16.85	39.91	1.12	1.88	29.81	0.24
62.05	17.06	39.66	1.19	1.80	29.77	0.27
114.10	17.19	39.40	1.28	1.70	29.66	0.32
166.15	12.18	39.08	1.38	1.61	29.50	0.42
218.20	17.17	39.18	1.49	1.54	29.46	0.48
270.25	17.23	38.58	1.57	1.48	29.51	0.40
322.30	17.29	37.81	1.64	1.44	29.45	0.58
374.35	17.15	37.43	1.68	1.42	29.41	0.53
426.40	17.10	36.70	1.70	1.36	29.42	0.59
478.45	17.11	36.23	1.72	1.28	29.39	0.55
530.50	17.09	35.35	1.75	1.19	29.37	0.59
582.55	17.15	35.20	1.77	1.14	29.37	0.63
634.60	17.38	34.64	1.74	1.29	29.41	0.59
686.65	17.28	33.51	1.69	1.53	29.39	0.52
738.70	17.14	32.25	1.67	1.71	29.39	0.57
790.75	17.25	30.98	1.71	1.76	29.37	0.56
842.80	17.32	29.64	1.80	1.61	29.27	0.72
894.85	17.44	28.71	1.90	1.31	29.25	0.66
946.90	17.49	28.01	1.88	1.12	29.22	0.75
999.00	16.89	28.24	1.63	1.48	29.06	0.96

ZHL-2-8

FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
10.00	39.33	50.00	2.48	2.74	39.73	0.40
62.05	29.38	40.00	1.41	1.66	29.51	0.45
114.10	29.22	40.00	1.36	1.60	29.46	0.54
166.15	29.13	40.00	1.31	1.59	29.40	0.63
218.20	29.08	40.00	1.26	1.61	29.37	0.67
270.25	29.03	40.00	1.23	1.66	29.27	0.71
322.30	28.97	40.00	1.27	1.74	29.29	0.72
374.35	29.00	40.00	1.36	1.81	29.37	0.64
426.40	28.82	40.00	1.45	1.80	29.40	0.64
478.45	28.58	40.00	1.53	1.68	29.41	0.52
530.50	28.39	40.00	1.58	1.50	29.51	0.59
582.55	28.30	40.00	1.59	1.29	29.45	0.60
634.60	28.47	40.00	1.55	1.08	29.36	0.61
686.65	28.73	40.00	1.47	1.13	29.43	0.53
738.70	28.94	40.00	1.42	1.34	29.52	0.49
790.75	29.04	40.00	1.48	1.50	29.45	0.48
842.80	28.99	40.00	1.62	1.51	29.42	0.60
894.85	28.86	40.00	1.76	1.41	29.38	0.62
946.90	28.61	40.00	1.82	1.36	29.24	0.73
999.00	28.11	40.00	1.83	1.53	29.14	0.81

In Stock... Immediate Delivery

broadband linear

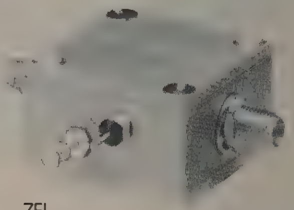
Power Amplifiers

up to 50mW (+17 dBm)

10 MHz to 2000 MHz

case style selection

outline drawings pages 58-62



ZFL

	MODEL NO.	FREQUENCY MHz	GAIN, dB		MAXIMUM POWER, dBm		DYNAMIC RANGE		VSWR		DC POWER		PRICE $	
			Min.	Flatness Max	Output (1dB) Compression	Input (no damage)	NF, dB Typ.	Intercept pt., dBm 3rd order Typ.	In	Out	Volt.	Current	Ea.	Qty.
ZFL case Y 39	**ZFL-2000**	10-2000	20	±1.5	+17*	+5	7.0	+25	2:1	2:1	+15V	100mA	179	(1-9)

NOTES:

* +16dBm at 1000 MHz.

1. Operating temperature −55°C to +100°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

CAPD ZFL-2000

FREQUENCY (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
10.00	22.68	33.41	1.44	1.28	15.44	1.26
105.42	22.58	33.31	1.46	1.21	15.35	1.26
200.83	22.60	33.35	1.44	1.13	15.32	1.30
296.25	22.48	33.37	1.35	1.09	15.24	1.28
391.67	22.32	33.45	1.24	1.13	15.19	1.05
487.08	21.96	33.60	1.18	1,14	15.11	0.92
582.50	21.63	34.05	1.21	1.18	14.74	0.80
677.92	21.60	34.33	1.37	1.24	14.86	0.82
773.33	22.03	34.03	1.48	1.30	15.28	0.74
868.75	22.42	33.59	1.53	1.36	15.74	0.71
964.17	22.64	33.12	1.49	1.45	15.98	0.62
1059.40	22.89	32.74	1.39	1.59	16.25	0.68
1154.70	23.14	32.22	1.25	1.71	16.42	0.79
1250.20	23.44	31.64	1.05	1.76	16.54	0.88
1345.80	23.34	31.15	1.19	1.67	16.57	0.73
1441.00	23.18	30.81	1.44	1.52	16.55	0.63
1535.90	22.96	30.64	1.64	1.31	16.45	0.49
1631.50	22.64	30.73	1.77	1.10	16.22	0.38
1726.90	22.32	30.57	1.78	1.11	15.97	0.33
1822.20	22.08	30.05	1.67	1.28	15.80	0.26
1917.60	21.70	29.21	1.54	1.43	15.67	0.03
2014.80	21.03	29.26	1.55	1.53	15.58	−0.46
2108.20	20.24	28.70	1.97	1.57	15.20	−0.89
2204.00	19.23	28.44	2.93	1.48	14.47	−1.17
2299.70	18.26	28.28	4.15	1.29	13.35	−1.11

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

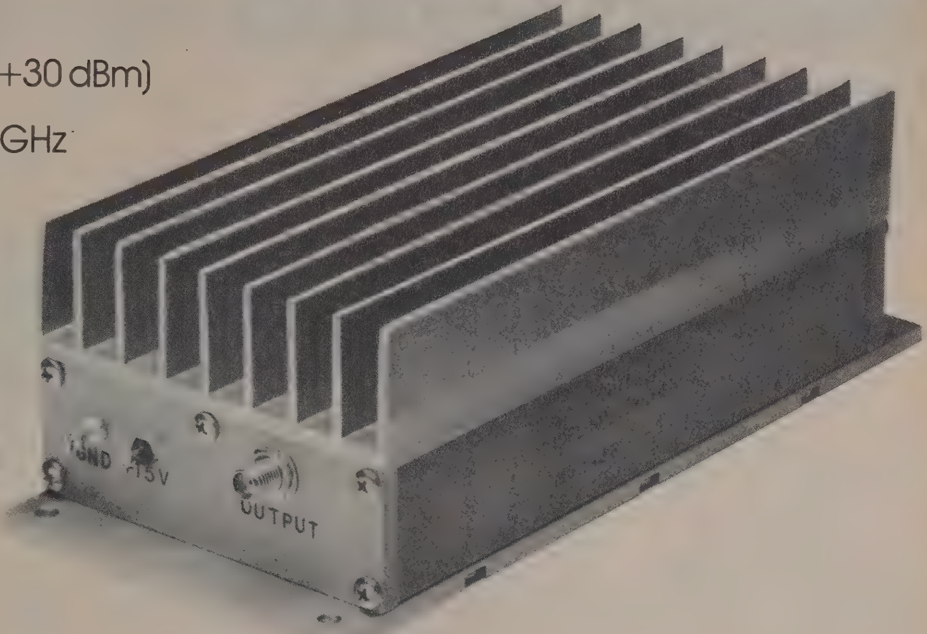
50 ohms

Mini-Circuits

up to 1 Watt (+30 dBm)

700 MHz to 4.2 GHz

NEW



ZHL-42

ZHL-42
case U 36

MODEL NO.	FREQUENCY GHz	GAIN, dB Min.	GAIN, dB Flatness Max	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-42	0.7-4.2	30	±1.0	+29	+10	10	+38	2.5:1	2.5:1	15	0.69A	895	(1-9)

NOTES:
1. Operating temperature −20°C to +65°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-42

FREQUENCY (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
700.25	33.56	47.42	1.57	1.98	28.91	1.18
845.84	33.44	47.61	1.54	1.67	28.82	1.05
991.85	33.61	47.66	1.51	1.42	29.29	0.86
1137.60	34.37	47.97	1.46	1.37	29.98	0.93
1283.50	34.54	47.96	1.43	1.36	30.42	0.61
1429.70	34.09	48.08	1.60	1.33	30.65	0.07
1575.50	34.06	48.00	1.67	1.47	30.53	0.16
1720.90	34.65	48.03	1.72	1.43	30.65	0.80
1866.60	35.05	48.15	1.62	1.32	30.46	1.41
2013.10	35.42	48.30	1.57	1.20	30.57	1.75
2158.00	35.21	48.36	1.47	1.21	30.53	1.40
2304.20	34.72	48.35	1.48	1.16	30.13	1.30
2448.60	34.42	48.27	1.49	1.15	29.77	1.22
2595.20	34.55	48.36	1.51	1.18	29.91	1.05
2741.40	33.78	48.26	1.37	1.24	30.01	0.31
2887.60	34.03	48.29	1.34	1.52	30.35	0.32
2999.40	34.25	48.39	1.28	1.94	30.38	0.49
3033.30	34.05	48.50	1.24	1.99	30.50	0.29
3179.70	33.85	48.35	1.24	1.74	30.27	0.36
3324.30	34.01	48.62	1.30	1.56	30.04	0.77
3470.30	34.34	48.51	1.39	1.43	30.19	0.79
3616.70	34.49	48.76	1.58	1.28	29.91	1.07
3763.00	34.65	48.61	1.67	1.11	29.73	0.72
3909.00	32.36	48.49	1.54	1.21	29.69	0.33
4053.50	33.32	48.74	1.39	1.39	30.30	0.05
4199.90	34.60	48.69	1.44	1.84	30.04	0.08

In Stock... Immediate Delivery

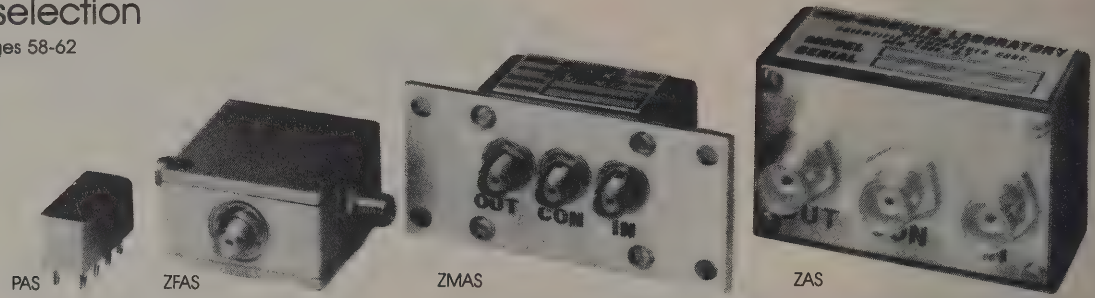
low current, low voltage

Electronic Attenuators/Switches

1.4 to 60 dB 1 MHz to 2.5 GHz

case style selection

outline drawings pages 58-62



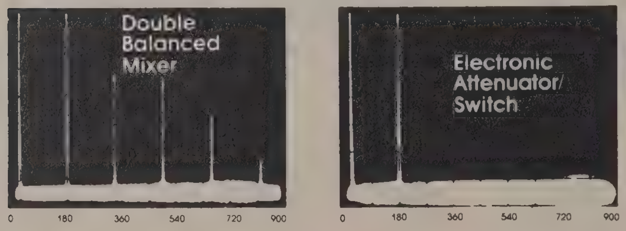
	MODEL NO.	FREQUENCY MHz IN f_L-f_U	FREQUENCY MHz CON	INSERTION LOSS dB Mid-Band m Typ.	Max.	INSERTION LOSS dB Total Range Typ.	Max.	IN-OUT ISOLATION dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	IN-CON ISOLATION dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE, $ Ea.	Qty.
PAS case A01	**PAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	45	35	35	25	35	25	25	15	20	10	27.95	(5-24)
	PAS-2	10-1000	DC-0.05	4.0	6.0	6.5	8.5	50	40	40	30	35	25	30	20	17	10	17	10	37.95	(5-24)
	PAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	28.95	(5-24)
ZFAS case K18	**ZFAS-15**	10-2500	DC-200	3.5	4.0	3.5	5.0	20	18	35	25	30	20	19	15	28	20	20	15	89.95	(1-4)
ZMAS case M21	**ZMAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	55.95	(4-24)
	ZMAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	56.95	(4-24)
ZAS case M22	**ZAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	45.95	(4-24)
	ZAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	46.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

typical harmonic spectrum comparing attenuators

Double Balanced Mixer Vs. Electronic Attenuator



NOTES: (both pages)

1. Maximum RF input power, 1 watt. Maximum control current, 40 mA.
2. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. For PSW and ZMSW models
    a) VSWR 1.5 max. ("on" state)
    b) Switching speed 1μ sec. max.
    c) Maximum RF input +20 dBm
    d) Control voltage +5V (5mA max.) on condition
    0V off condition
5. Prices and specifications subject to change without notice.

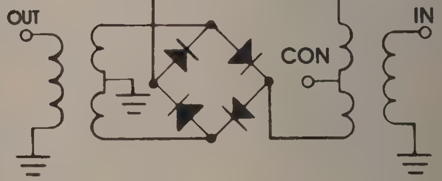
pin and coaxial connections

see case style outline drawings

Series	PAS		ZFAS	ZMAS	ZAS
Models	−1 −3	−2	all models	all models	all models
OUT	8	8	1	1	1
IN	1	1	2	3	3
CONTROL	*3,4	*3,4	3	2	2
GND	2,5,6,7	2,5,6,7	—	—	—
CASE GND	2	2,5,6,7	—	—	—

*pins 3 and 4 must be connected together externally

schematic



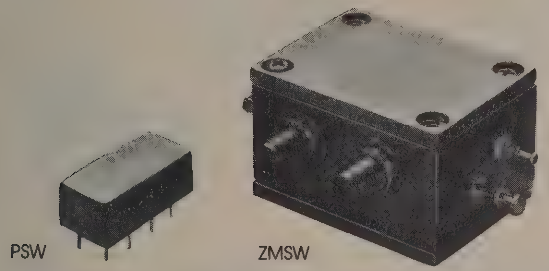
NSN GUIDE

MCL NO.	NSN
PAS-3	5985-01-067-3035

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

pin diode
Switches
SPST/SPDT
10 to 2500 MHz

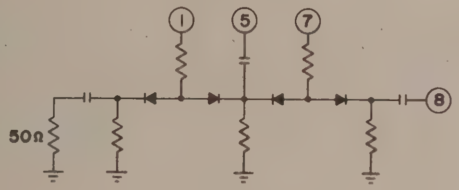
Mini-Circuits



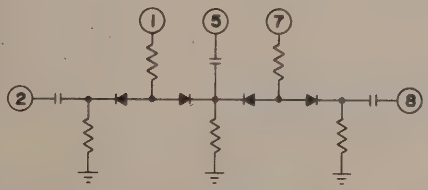
	MODEL NO.	TYPE	FREQUENCY MHz	INSERTION LOSS dB				IN-OUT ISOLATION dB						PRICE, $	
				low-band lw		Upper band U		L		M		U			
			f_L-f_U	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
PSW case A06	**PSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
	PSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
PSW case JJ77	**ZMSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)
	ZMSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
lw = low-band (f_L to f_U/2)

Model
PSW-1111



Model
PSW-1211



pin and coaxial connections
see case style outline drawings

Series	PSW		ZMSW	
Models	1111	1211	1111	1211
RF COMMON	5	5	com	com
RF-1 port	8	2	—	RF-1
RF-2 port	—	8	RF-2	RF-2
CONTROL RF-1	7	1	—	1
CONTROL RF-2	—	7	2	2
CONTROL 50 ohm	1	—	1	—
TERMINATION			—	—
GND	2,4	4	—	—
CASE GND	3,6	3,6	—	—

CAPD

computer-automated performance data
typical production unit / for data of other models consult factory

PSW-1211

RF (MHz)	INSERTION LOSS, dB com RF-1	INSERTION LOSS, dB com RF-2	ISOLATION, dB com RF-1	ISOLATION, dB com RF-2
10	−1.29	−1.38	−49.04	−49.44
110	− .93	− .97	−49.74	−49.78
210	− .91	− .90	−48.87	−44.32
310	− .92	− .84	−44.55	−45.60
410	− .83	− .71	−42.88	−44.53
610	−1.09	− .96	−39.47	−39.28
810	−1.13	−1.12	−37.53	−36.80
1010	−1.12	−1.09	−35.83	−34.95
1310	−1.14	−1.10	−33.28	−32.77
1510	−1.16	−1.12	−32.93	−32.41
1810	−1.30	−1.26	−31.80	−31.32
2010	−1.40	−1.32	−30.31	−29.93
2110	−1.45	−1.34	−28.33	−28.99
2310	−1.44	−1.31	−28.08	−28.09
2510	−1.59	−1.45	−27.89	−28.11

In Stock... Immediate Delivery

rugged, one-piece design

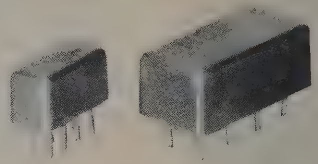
Fixed Attenuators

NEW

3 to 40 dB
DC to 1500 MHz

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz	ATTENUATION dB Nom.	Flatness Total Range	Flatness DC-1000MHz	VSWR Max. Total Range	VSWR Max. DC-1000 MHz	PRICE $ Ea.	PRICE $ Qty.
MAT case A11	**MAT-3**	DC-1500	3±0.2	1.0	0.6	1.5	1.3	4.95	(10-49)
	MAT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-9	DC-1500	9±0.3	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-10	DC-1500	10±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-12	DC-1500	12±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-15	DC-1500	15±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-20	DC-1500	20±0.5	1.0	0.6	1.5	1.3	4.95	(10-49)
	MAT-30	DC-1000	30±0.5	—	1.0	—	1.5	4.95	(10-49)
AT case A04	**AT-3**	DC-1500	3±0.2	1.0	0.6	1.5	1.3	3.95	(10-49)
	■ **AT-3-75**	DC-1000	3±0.3	—	1.0	—	1.5	3.95	(10-49)
	AT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ **AT-6-75**	DC-1000	6±0.4	—	1.0	—	1.5	3.95	(10-49)
	AT-10	DC-1500	10±0.3	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ **AT-10-75**	DC-1000	10±0.5	—	1.0	—	1.5	3.95	(10-49)
	AT-20	DC-1500	20±0.4	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ **AT-20-75**	DC-1000	20±0.6	—	1.2	—	1.5	3.95	(10-49)
	AT-30	DC-1000	30±0.5	—	1.0	—	1.5	3.95	(10-49)
	AT-40	DC-500	40±0.6	1.0	—	1.5	—	3.95	(10-49)

designers kit available

KAT-1... 4 of each (3, 6, 10, 20 dB), only $39.95
KMAT-1... 2 of each (3, 6, 9, 10, 12, 15, 20), only $39.95

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings, see page 7; maximum RF power; AT, CAT, NAT, TAT series (1 watt). MAT, SAT series (0.5 watt).
4. Connector models available with female/male connectors. For other versions consult factory.
5. Prices and specifications subject to change without notice.

pin connections

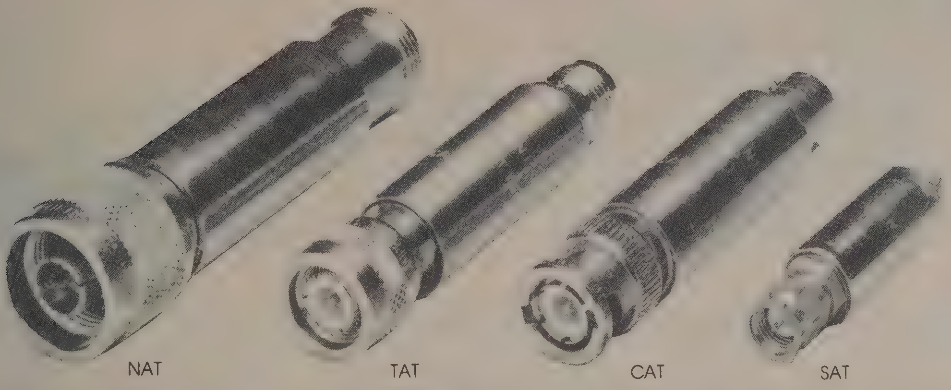
see case style outline drawing

SERIES	In	Out	Ground
MAT	1	8	2,3,4,5,6,7
AT	1	8	2,3,4,5,6,7

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

50 ohms and 75 ohms

Mini-Circuits



	MODEL* NO.	FREQUENCY MHz	ATTENUATION dB			VSWR Max.		PRICE, $ Ea.			
			Nom.	Flatness Total Range	Flatness DC-1000MHz	Total Range	DC-1000 MHz	NAT	TAT	CAT	Qty.
	___AT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
	■ CAT-3-75	DC-1000	3±0.3	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
	___AT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
*NAT	■ CAT-6-75	DC-1000	6±0.4	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
case FF57	___AT-10	DC-1500	10±0.3	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
*TAT	■ CAT-10-75	DC-1000	10±0.5	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
case FF58	___AT-20	DC-1500	20±0.4	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
*CAT	■ CAT-20-75	DC-1000	20±0.6	—	1.2	—	1.5	15.95	12.95	11.95	(1-49)
case FF55	___AT-30	DC-1000	30±0.5	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
	___AT-40	DC-500	40±0.5	1.0	—	1.5	—	15.95	12.95	11.95	(1-49)

*add suffix letter N, T, or C to ___AT, where applicable.

								SAT	
SAT	SAT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	14.95	(1-49)
case FF56	SAT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-9	DC-1500	9±0.3	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-10	DC-1500	10±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-12	DC-1500	12±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-15	DC-1500	15±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-20	DC-1500	20±0.5	1.0	0.6	1.5	1.3	14.95	(1-49)
	SAT-30	DC-1000	30±0.5	—	1.0	—	1.5	14.95	(1-49)

computer-automated performance data

typical production unit / for data of other models consult factory

SAT-SERIES

FREQUENCY (MHz)	SAT-3	SAT-6	SAT-10	SAT-20
1.00	2.93	5.86	9.87	19.97
53.526	2.98	5.87	9.91	20.01
106.052	3.01	5.90	9.93	20.01
158.578	3.02	5.92	9.94	20.02
211.104	3.03	5.92	9.95	20.02
263.63	3.05	5.93	9.95	20.02
316,156	3.09	5.96	9.97	20.06
368.682	3.08	5.97	9.99	20.04
421.208	3.07	5.94	9.96	20.01
473.734	3.12	5.98	9.98	20.00
526.26	3.11	5.96	9.98	19.99
578.786	3.11	5.94	9.96	19.96
631.312	3.14	5.98	9.98	19.97
683.838	3.18	6.01	10.04	19.99
736.364	3.19	5.99	10.01	19.94
788.89	3.23	6.03	10.04	19.95
841.416	3.21	6.01	10.00	19.89
893.942	3.25	6.04	10.05	19.92
946.468	3.26	6.01	9.99	19.82
999.00	3.33	6.06	10.07	19.85
1250.00	3.52	6.20	10.36	19.77
1500.00	3.65	6.29	10.52	19.77

In Stock...Immediate Delivery

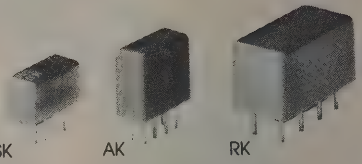
high rejection of 1st and 3rd harmonics

Frequency Doublers

input power 0 to +20dBm

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz		RF INPUT PWR. dBm		CONVERSION LOSS, dB			*HARMONIC OUTPUT, dB						PRICE, $	
									F1		F3		F4			
		Input	Output	Min.	Max.	Input freq.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SK case B02	SK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	21.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
AK case A03	AK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	19.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
RK case A01	RK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	15.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	RK-3	0.05-150	0.1-300	0	13	0.05- 50	11.0	13.0	40	30	45	30	16	12	14.95	(5-24)
						50-150	11.5	15.0	35	20	40	20	16	12		
	RK-6 NEW	0.005-25	0.01-50	0	10	0.005-1	11.0	13.0	40	30	45	30	16	12	21.95	(5-24)
						1-25	11.5	15.0	35	20	40	20	16	12		

*Harmonic Output below power of F2.

NOTES:

1. Maximum RF input power, 200mW.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	SK	RK			AK
Models	all models	−2	−3	−6	all models
IN	*1,2	*1,3,4	*1,3,4	*1,3,4	*1,3,4
OUT	4	8	8	8	8
GND	3	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,5,6,7	2	—	2,5,6,7

*pins must be connected together externally

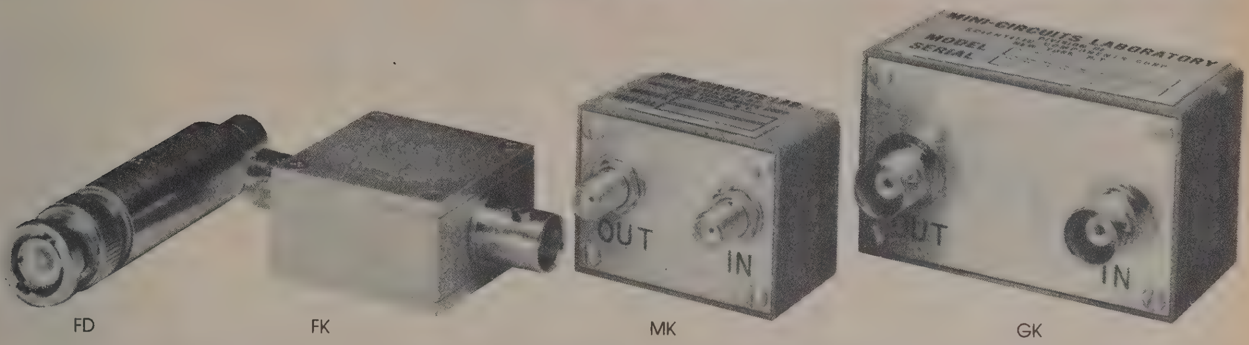
applications

- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

5 KHz to 2000 MHz

Mini-Circuits



FD FK MK GK

	MODEL NO.	FREQUENCY MHz		RF INPUT PWR. dBm		CONVERSION LOSS, dB			*HARMONIC OUTPUT, dB						PRICE, $	
									F1		F3		F4			
		Input	Output	Min.	Max.	Input freq.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
FD case FF55	FD-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
FK case H16	FK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	59.95	(1-4)
MK case L19	MK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	42.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	MK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	37.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	MK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0							67.95	(1-4)
						600-1000	14.0	17.0	20	15	25	20	—	—		
GK case L20	GK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-600	14.0	16.5	20	15	30	25	16	12		
	GK-3	0.05-150	0.1-300	0	13	0.05- 50	11.0	13.0	40	30	45	30	16	12	30.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	GK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	57.95	(1-4)

*Harmonic Output below power of F2.
**ABOVE 700 MHz, min. input power +13dBm

computer-automated performance data

typical production unit / for data of other models consult factory

harmonic* attenuation tables

MODEL FD-2

IN FREQ. MHz	1	2	3	4	5
30	47.1	13.4	51.3	14.9	55.4
35	47.0	13.5	51.0	14.8	54.0
40	46.5	13.6	50.9	15.0	52.6
45	45.9	13.6	50.7	15.2	51.4
50	45.4	13.5	49.8	15.8	50.6
55	43.7	13.4	47.4	15.8	50.2
60	43.7	13.7	46.5	15.6	49.3
65	43.4	13.7	45.4	14.7	48.7
70	43.1	13.7	44.7	14.5	47.7
75	43.1	13.7	44.2	14.2	47.2
80	43.1	13.7	43.6	13.9	46.5

Harmonics Order
INPUT POWER, +5dBm

MODEL FK-5

IN FREQ. MHz	1	2	3	4	5
10	14.9	13.6	34.7	18.1	34.1
20	16.5	13.0	34.8	17.3	34.5
50	15.3	13.4	31.0	17.5	32.8
100	15.2	13.1	26.9	16.5	29.5
250	16.0	12.8	21.7	17.4	29.4
500	25.4	12.6	33.6	22.5	45.7
600	22.8	13.0	31.2	16.3	28.9
700	22.5	13.9	38.1	16.2	26.7
800	17.7	14.6	30.6	14.6	35.4
900	17.5	14.6	28.0	16.2	37.2
999	19.1	14.2	19.7	20.3	41.6

Harmonics Order
INPUT POWER, +13dBm

* all harmonics except 2nd order, are relative to F2
second order is relative to IN PWR

case style outline dimensions (inch/mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
R 29	4.06 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.81 20.58	.06 1.53				300.0	A1, C2, D9
R 30	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.55 13.97	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D10
R 31	9.31 236.98	1.60 40.64	1.50 38.10	8.84 224.54	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.54 13.72	.66 16.77	8.34 211.84	.81 20.58	.06 1.53				700.0	A5, C2, D11
R 67	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	1.22 30.99	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D12
S 32	3.75 95.25	2.00 50.80	1.8 45.7	.19 4.83	3.375 85.73	.19 4.83	1.625 41.28	.144 3.66	.6 15.24	.4 10.16	.5 12.7	1.30 33.02	.09 2.29						220.0	A7 D20
T 34	4.75 120.65	2.00 50.80	2.21 56.14	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	4 00 101.60	30 7.62	2 60 66.04	440.0	A8 D20
T 35	4.75 120.65	2.00 50.80	2.46 62.49	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	4.00 101.60	1.50 38.10	5.00 127.00	700.0	A8 D20
U 36	7.00 177.80	3.25 82.55	2.13 54.10	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.97	.88 22.35	.73 18.54	.63 16.01	1.13 28.70	2.23 56.64	.125 3.18	.50 12.70	6.00 152.40			900.0	A8 D6
V 37	.80 20.32	.80 20.32	.75 19.05	.40 10.16	.38 9.65	.485 12.32	.110 2.79	.485 12.32											33.0	A5, C1, D6
W 38	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.09 2.29	.37 9.40									.50	A3
X 65	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.04 1.02	.12 3.05	.300 7.62	.35 8.89							.50	A3
Y 39	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.36 9.15	1.000 25.40	1.000 25.40	.125 3.18	.125 3.18	.46 11.69	2.18 55.38	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	50.0	A4, B1, D6
Z 40	7.06 179.32	3.13 79.50	.88 22.35	.250 6.35	1.750 44.45	5.310 134.87	6.810 172.97	.312 7.92	2.875 73.03	.144 3.66	3.53 89.66	.44 11.18	.415 10.54	.89 22.61					800.0	A4 or D14
AA 46	.830 21.08	.580 14.73	.265 6.73	.13 3.30	.415 10.54	.340 8.64	.025 .64	.50 12.70											6.4	A2
BB 48	.50 12.70	.39 9.91	.225 5.72	.025 .64	.07 1.79	.100 2.54	.250 6.35	.350 8.89	.06 1.53	.31 7.87									3.0	A1
CC 51	2.00 50.80	2.00 50.80	.75 19.05	.938 23.83	.13 3.30	1.750 44.45	.125 3.18	.375 9.53	1.00 25.40	1.25 31.75									120.0	A4, D14
DD 52	2.00 50.80	2.00 50.80	.75 19.05	.900 22.86	.156 3.96	1.688 42.88	.125 3.18	.392 9.96	1.00 25.40	.50 12.70	1.00 25.40	1.25 31.75							225.0	A4, D14
EE 54	3.50 88.90	2.13 54.10	.88 22.35	.250 6.35	1.750 44.45	3.250 82.55	.250 6.35	1.813 46.05	.125 3.18	.44 11.18	.415 10.54	.89 22.61							250.00	A4, D14
FF 55	1.40 35.56	.58 14.73	.73 18.54	2.59 65.79	— —														40.0	A9, D15
FF 56	.98 24.89	.43 10.92	.47 11.94	1.70 43.18	— —														18.0	A9, D16
FF 57	1.54 39.12	.72 18.92	.81 20.58	3.05 77.47	.82 20.83														90.0	A9, D17
FF 58	1.40 35.56	.58 14.73	.61 15.50	2.59 65.79	.64 16.26														45.0	A9, D18

tolerance x ±.1 xx ±.03 xxx ±.015

oz. = grams x .0353

*NOTES:

MATERIAL & FINISH

A1. Header material CRS; Pin material; #52 alloy. Finish: electro tin hot-oil flowed, Cover material; cupro-nickel.

A2. Case material CRS; Pin material; #52 alloy; Covers stainless steel. Finish; gold flash per MIL-G-45204.

A3. Case material plastic. Pin material; iron-nickel alloy. Finish; bright tin-plate per MIL-T-10727.

A4. Case material aluminum. Finish; iridite.

A5. Case material CRS. Finish; baked grey enamel over hot-tin dip.

A7. Case material aluminum. Finish; black enamel. Heat Sink; black anodize.

A8. Case material aluminum. Finish; iridite. Heat sink; black anodize.

A9. Case material brass. Finish; nickel plate.

MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

C2. Consecutive marking, n = no. of way power splitter.

CONNECTORS

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D9. Connectors: BNC standard, TNC on request (add $10.00 to unit cost), Female SMA on request (add $25.00 to unit cost).

D10. Connectors: BNC standard, TNC on request (add $20.00 to unit cost), SMA on request (add $45.00 to unit cost).

D11. Connectors: BNC standard, TNC on request (add $35.00 to unit cost), SMA on request (add $65.00 to unit cost).

D12. Connectors: BNC standard, TNC on request (add $15.00 to unit cost), SMA on request (add $35.00 to unit cost).

D14. Connectors: Please specify: Type N or SMA

D15. Connectors: male BNC, female BNC standard. Other combinations with SMA available on request (add $2.00 to unit cost).

D16. Connectors: male SMA, Female SMA only.

D17. Connectors: male N, female N standard. Combinations with BNC, SMA, TNC available on request (add $3.00 to unit cost).

D18. Connectors: male TNC, Female TNC only.

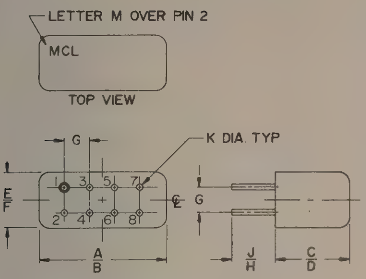
D20. Connectors: please specify, unless otherwise noted. BNC is standard, TNC, SMA or Type N (add $10.00 to unit cost).

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

& outline drawings

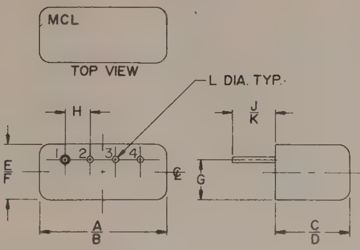
Mini-Circuits

A


LETTER M OVER PIN 2
MCL
TOP VIEW
G
K DIA. TYP
1 3 5 7
2 4 6 8
E
F
℄
G
A
B
J
H
C
D

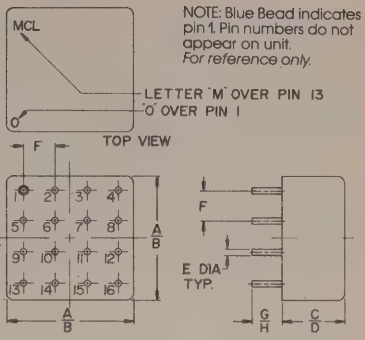
NOTE: Blue Bead indicates pin 1. Pin numbers do not appear on unit. *For reference only.*

B


MCL
TOP VIEW
L DIA. TYP.
H
J
K
1 2 3 4
E
F
℄
G
A
B
C
D

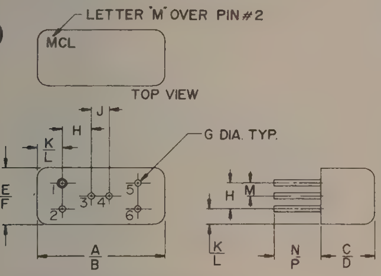
NOTE: Blue Bead indicates pin 1. Pin numbers do not appear on unit. *For reference only.*

C


MCL
LETTER "M" OVER PIN 13
"O" OVER PIN 1
TOP VIEW
F
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
℄
A
B
E DIA. TYP.
G
H
C
D

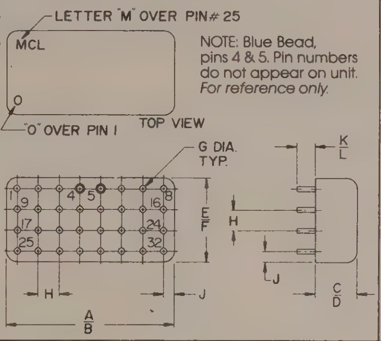
NOTE: Blue Bead indicates pin 1. Pin numbers do not appear on unit. *For reference only.*

D


LETTER "M" OVER PIN #2
MCL
TOP VIEW
J
H
K
L
G DIA. TYP.
1 3 4 5
2 6
E
F
A
B
H
M
K
L
N
P
C
D

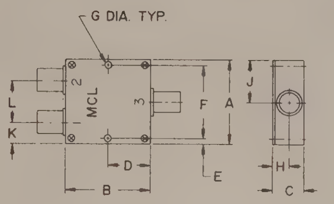
NOTE: Blue Bead indicates pin 1. Pin numbers do not appear on unit. *For reference only.*

E

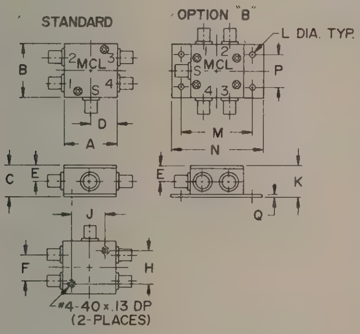

LETTER "M" OVER PIN # 25
MCL
"O" OVER PIN 1
TOP VIEW
G DIA. TYP.
1 4 5 8
9 16
17 24
25 32
E
F
H
K
L
J
H
J
A
B
C
D

NOTE: Blue Bead, pins 4 & 5. Pin numbers do not appear on unit. *For reference only.*

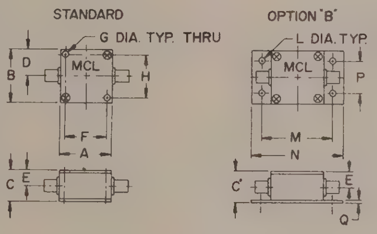
F


G DIA. TYP.
2
MCL
3
L
K
F
A
J
D
E
B
H
C

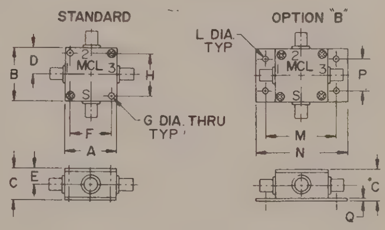
G


STANDARD
OPTION "B"
L DIA. TYP.
B
2 MCL 3
1 S 4
D
A
P
M
N
C
E
K
Q
J
F
H
#4-40 x .13 DP (2-PLACES)

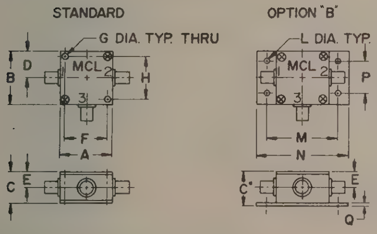
H


STANDARD
OPTION "B"
G DIA. TYP. THRU
L DIA. TYP.
D
B
MCL
H
F
A
P
M
N
C
E
Q

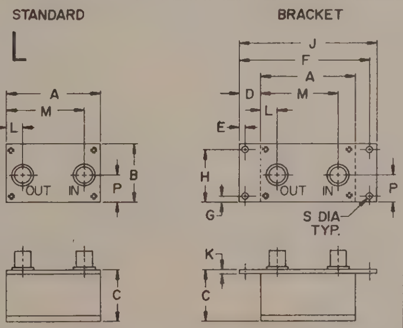
J


STANDARD
OPTION "B"
L DIA. TYP
D
B
2
MCL 3
1 S
H
G DIA. THRU TYP
F
A
P
M
N
C
E
Q

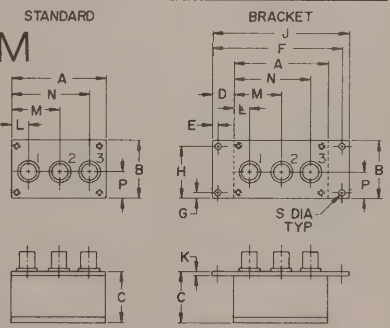
K


STANDARD
OPTION "B"
G DIA. TYP. THRU
L DIA. TYP.
D
B
MCL 2
1 3
H
P
F
A
M
N
C
E
Q

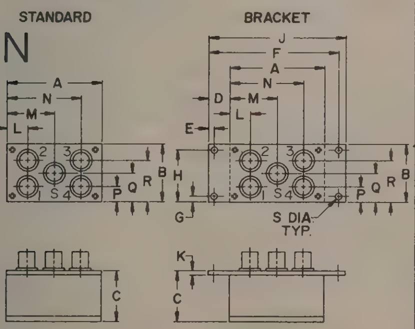
L


STANDARD
BRACKET
A
M
L
OUT
IN
P
B
J
F
A
D
M
L
E
H
G
S DIA. TYP.
K
C

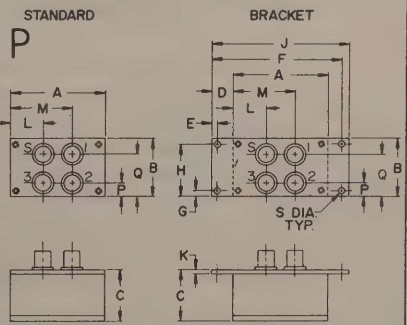
M


STANDARD
BRACKET
A
N
M
L
1 2 3
P
B
J
F
A
D
N
M
L
E
H
G
S DIA. TYP
K
C

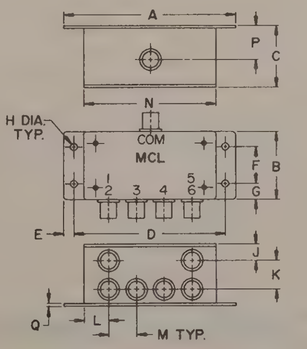
N


STANDARD
BRACKET
A
N
M
L
2 3
1 S 4
P
Q
R
B
J
F
A
D
N
M
L
E
H
G
S DIA. TYP.
K
C

P


STANDARD
BRACKET
A
M
L
S 1
3 2
P
Q
B
J
F
A
D
M
L
E
H
G
S DIA. TYP.
K
C

Q


A
P
C
N
H DIA. TYP.
COM
MCL
1 2 3 4 5 6
F
B
G
E
D
J
K
Q
L
M TYP.

case style outline dimensions (inch/mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
A01	.770 19.56	.800 20.32	.385 9.78	.400 10.16	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1
A03	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									2.3	A1
A04	.770 19.56	.800 20.32	.200 5.08	.210 5.33	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1
A05	.770 19.56	.800 20.32	.240 6.10	.250 6.35	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1
A06	.770 19.56	.800 20.32	.285 7.24	.310 7.88	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1
A11	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									1.9	A1
B02	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								1.9	A1
B13	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								2.3	A1
C07	.770 19.56	.810 20.58	.380 9.66	.410 10.42	.030 .77	.200 5.08	.20 5.08	.14 3.56											11.0	A1
D08	1.000 25.40	1.025 26.04	.390 9.91	.430 10.93	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					8.5	A1
D09	1.000 25.40	1.025 26.04	.240 6.10	.280 7.12	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					7.5	A1
E10	1.540 39.12	1.620 41.15	.380 9.66	.410 10.42	.770 19.56	.810 20.58	.030 .77	.200 5.08	.10 2.54	.20 5.08	.14 3.56								23.0	A1
F14	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.25 6.35	1.500 38.10	.13 3.31	.39 9.91											170.0	A4, B1, D2
F53	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.13 3.31	1.750 44.45	.13 3.31	.39 9.91											170.0	A4, B1, D2
G15	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	.63 16.01	— —	.800 20.32	.800 20.32	.76 19.31	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				85.0	A4, B1, D1
H16	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A4, A5, B1 D2, D3, D4
J17	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				75.0	A4 or A5 B1, D2, D3
K18	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A4 or A5 B1, C1, D2, D3
L19	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	1.19 30.23	— —	.66 16.77	— —	— —	.150 3.81		37.0	A4 or A6 B2, D6
L20	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.86 47.25	— —	.64 16.26	— —	— —	.150 3.81		74.0	A4 or A6 B2, D5
M21	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	.75 19.05	1.19 30.23	.66 16.76	— —	— —	.150 3.81		40.0	A4 or A6 B2, C1, D6
M22	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.15 29.21	1.86 47.25	.64 16.26	— —	— —	.150 3.81		74.0	A4 or A6 B2, C1, D5
M23	2.25 57.15	1.38 35 05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.63 16.00	1.06 26.93	1.63 41.40	.69 17.53	— —	— —	.150 3.81		70.0	A4 or A6 B2, C1, D6
N24	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.32 8.13	.75 19.05	1.18 29.97	.31 7.88	.56 14.23	.81 20.58	.150 3.81		45.0	A4 or A6 B2, D6
N27	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.42 10.67	1.13 28.70	1.84 46.74	.38 9.65	.69 17.53	1.00 25.40	.150 3.81		92.0	A4 or A6 B2, D7
P25	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.78 19.81	1.47 37.34	— —	.38 9.65	1.00 25.40	— —	.150 3.81		86.0	A4 or A6 B2, D7
P26	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.50 12.70	1.00 25.40	— —	.31 7.88	.81 20.58	— —	.150 3.81		42.5	A4 or A6 B2, D6
Q28	40.6 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.81 20.58	.06 1.53				300.0	A5, D8

tolerance x ± .1 xx ± .03 xxx ± .015

oz. = grams x .0353

*NOTES:

MATERIAL & FINISH

A1. Header material CRS; Pin material; #52 alloy. Finish: electro tin hot-oil flowed, Cover material; cupro-nickel.

A4. Case material aluminum. Finish; iridite.

A5. Case material CRS. Finish; baked grey enamel over hot-tin dip.

A6. Case material aluminum. Finish; blue baked enamel over phosphoric etch per MIL-C-15328.

MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

B2. Mounting bracket available on request. Add suffix B to part number. Add $1.50 to unit cost.

MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

CONNECTORS

D1. Connectors: SMA Standard. BNC on request (no charge). Male SMA on request (add $5.00 to unit cost).

D2. Connectors: please specify, unless otherwise noted; BNC is standard, TNC no charge, SMA and Type N add $5.00 per unit. (ZAPD only, Dash – 4 units not available with BNC).

D3. For Type N or TNC connectors this dimension, "C*", changes from 0.75 to 0.94 inches.

D4. Isolated BNC connectors are standard, FTB models only.

D5. Connectors: BNC standard, TNC on request (no charge).

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D7. Connectors: BNC only.

D8. Connectors: BNC standard, TNC on request (add $10.00 to unit cost), Female SMA on request (add $15.00 to unit cost).

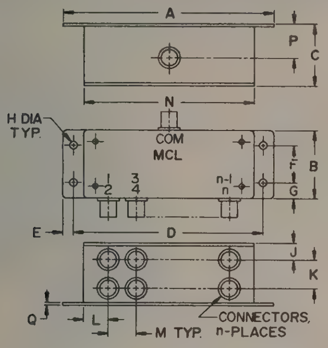
D9. Male BNC, Male N available: (add $2.00 to unit price. Specify ports for Male connectors).

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (212) 934-4500

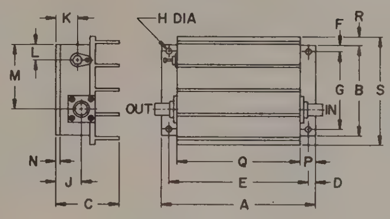
& outline drawings

Mini-Circuits

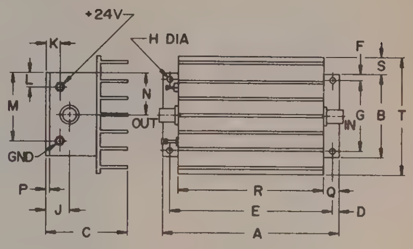
R


A
P
C
N
H DIA TYP.
COM
MCL
1
2
3
4
n-1
n
F
B
G
E
D
J
K
Q
L
M TYP.
CONNECTORS, n-PLACES

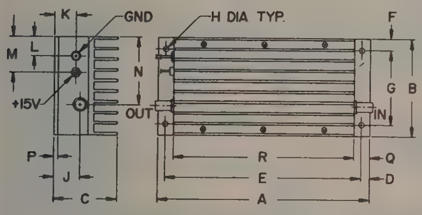
S


K
H DIA
F
R
L
M
OUT
IN
G
B
S
N
J
C
Q
P
E
D
A

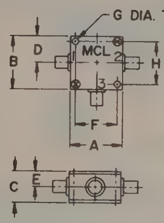
T


+24V
K
H DIA
F
S
L
M
N
OUT
IN
G
B
T
GND
P
J
C
R
Q
E
D
A

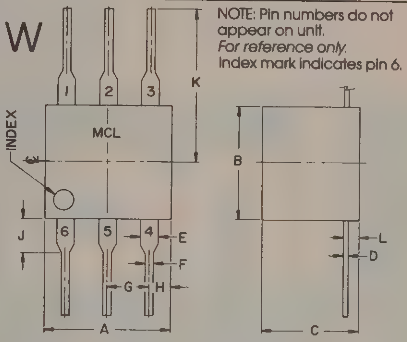
U


K
GND
H DIA TYP.
F
M
L
N
+15V
OUT
IN
G
B
P
J
C
R
Q
E
D
A

V

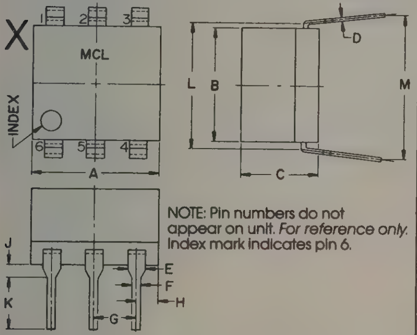

G DIA. TYP. THRU
D
MCL
B
2
H
1
3
F
A
C
E

W


1
2
3
K
MCL
INDEX
6
5
4
J
E
F
G
H
A
B
L
D
C

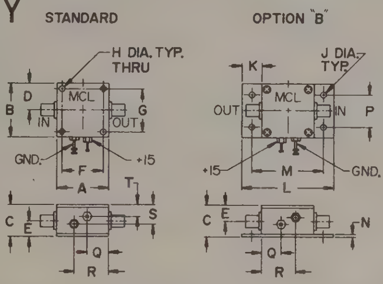
NOTE: Pin numbers do not appear on unit. *For reference only.* Index mark indicates pin 6.

X

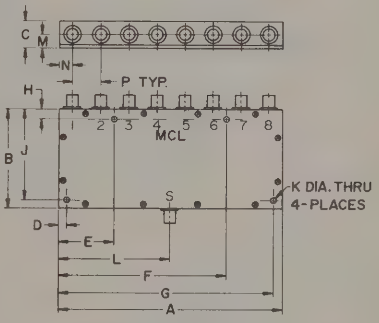

1
2
3
MCL
INDEX
6
5
4
A
L
B
D
M
C
J
E
F
K
G
H

NOTE: Pin numbers do not appear on unit. *For reference only.* Index mark indicates pin 6.

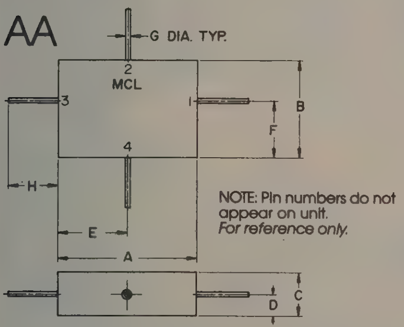
Y


STANDARD
OPTION "B"
H DIA. TYP. THRU
D
B
MCL
IN
OUT
G
GND.
+15
F
A
T
S
C
E
Q
R
K
J DIA. TYP.
OUT
IN
P
+15
M
L
GND.
N

Z

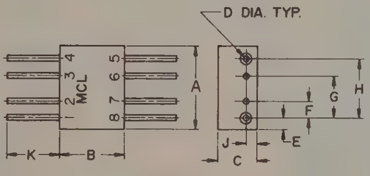

C
M
N
P TYP.
H
1
2
3
4
5
6
7
8
MCL
B
J
S
K DIA. THRU 4-PLACES
D
E
L
F
G
A

AA


G DIA. TYP.
2
MCL
3
1
B
F
4
H
E
A
C
D

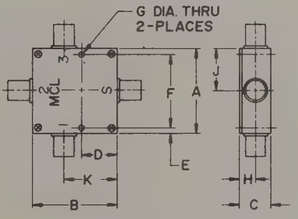
NOTE: Pin numbers do not appear on unit. *For reference only.*

BB

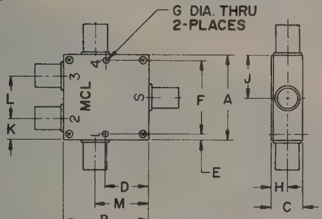

D DIA. TYP.
4
3
MCL
2
1
5
6
7
8
A
H
G
F
K
B
J
C
E

NOTE: Pin numbers do not appear on unit. *For reference only.*

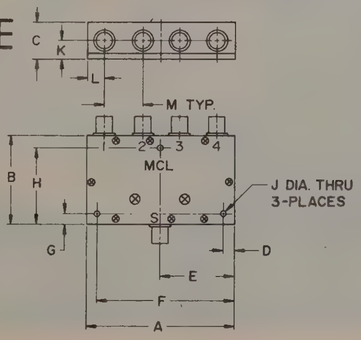
CC


G DIA. THRU 2-PLACES
3
MCL
2
S
J
F
A
D
E
K
B
H
C

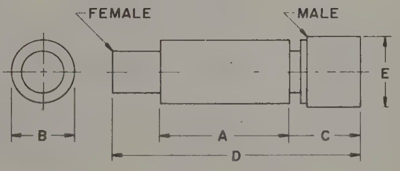
DD


G DIA. THRU 2-PLACES
4
3
MCL
2
1
S
J
L
K
F
A
E
D
M
B
H
C

EE


C
K
L
M TYP.
1
2
3
4
MCL
B
H
J DIA. THRU 3-PLACES
S
G
D
E
F
A

FF


FEMALE
MALE
E
B
A
C
D

case style outline dimensions (inch/mm) & drawings

Mini-Circuits

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
GG 60	2.31 58.68	1.20 30.48	.60 15.24	.125 3.18	2.062 52.38	.30 7.62	.53 13.46	.63 16.00											75.0	A4, D19
HH 68	9.31 236.47	1.60 40.64	3.57 90.68	9.84 224.54	.25 6.35	.88 22.35	.36 9.14	.160 4.06	.34 8.37	.69 17.53	.54 13.72	.66 16.76	8.34 211.84	.33 8.38	.06 1.52				1090.0	A5, D13
JJ 77	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.14 3.55	.850 21.60	2.50 63.50	.10 2.54	.44 11.17	.75 19.05	.63 16.00	.37 9.39	.54 13.71	.43 10.92	.150 3.81	.73 18.54	50.0	D6

tolerance x ±.1 xx ±.03 xxx ±.015 oz. = grams x .0353

*NOTES:

MATERIAL & FINISH

A4 Case material aluminum
Finish; iridite

A5. Case material CRS.
Finish; baked grey enamel
over hot-tin dip

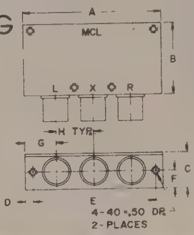
CONNECTORS

D6. Connectors: Female SMA only
Male SMA available on request

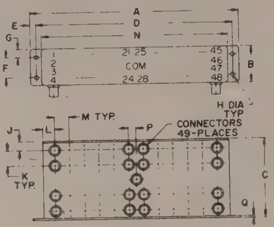
D13. Connectors: BNC standard,
SMA on request
(add $130.00 to unit cost)

D19 Connectors: BNC standard,
SMA on request
(add $15.00 to unit cost)

GG


A
MCL
B
L X R
H TYP
G
C
F
D
E
4-40 x .50 DP
2-PLACES

HH


A
D
N
E
G
F
21 25
COM
24 28
45
46
47
48
B
1
2
3
4
H DIA TYP
M TYP
P
CONNECTORS 49-PLACES
J
L
K TYP
C
Q

JJ

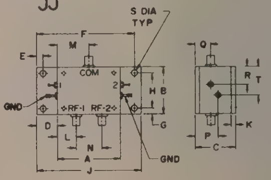
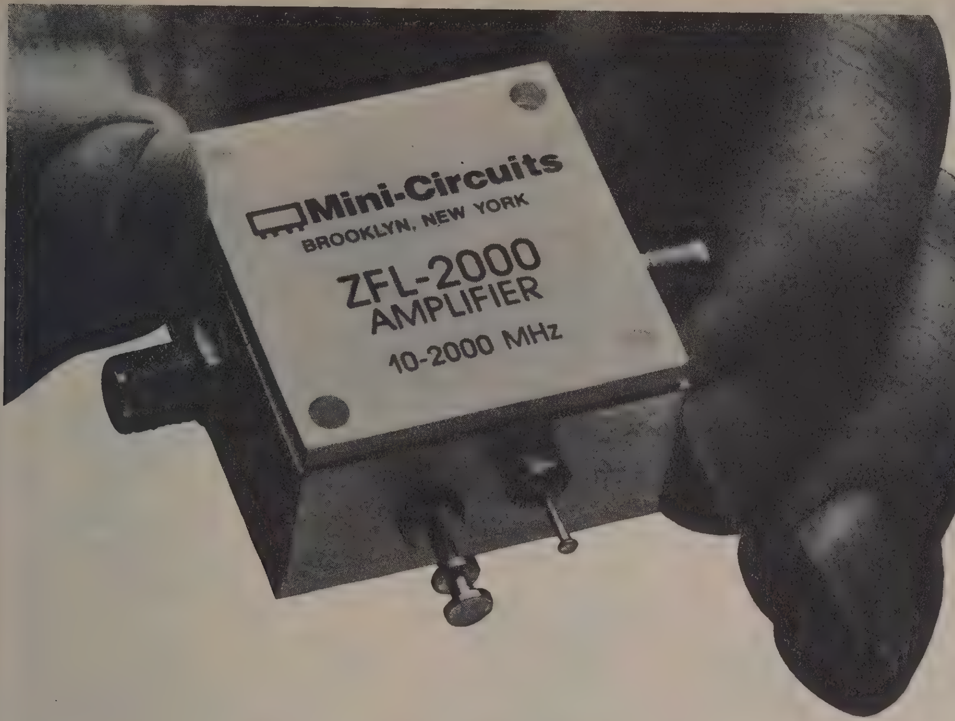

S DIA TYP
F
M
E
COM
1
2
H
B
GND
RF-1
RF-2
D
L
N
A
J
G
GND
Q
R
T
P
C
K

Photo. E. Akis Photography N.Y., N.Y

incredible!
OUTPUT
GND
+15V
Mini-Circuits
1 watt 0.7 to 4.2 GHz amplifiers...only $895



amplify or isolate? it does both.

22 dB gain and 40 dB isolation, 10-2000 MHz. . . only $179

Either way, the ZFL-2000 miniature wideband amplifier is an engineer's problem solver. Some examples of solutions offered by the ZFL-2000 are

- Boosting signal/sweep/synthesizer outputs to 50 mW.
- Achieving broadband isolation, especially when combining 2 signal generators for a two-tone intermodulation measurement.
- Increasing the dynamic range of spectrum analyzers.
- Driver for power amplifiers, such as Mini-Circuits' 1 and 2 watt ZHL series.
- Extending the frequency range of signal generators when using a frequency doubler, filter and then amplifying.
- Creating multiple output ports for one signal generator when amplifying and then adding a Mini-Circuits power splitter or divider.

These unconditionally stable wideband amplifiers are available with SMA connectors and are housed with an internal heat sink in a rugged 1.25 in. sq. by 0.75 in. high RFI shielded case.

Meets MIL-STD 202, these units operate from −55°C to +100°C.
One week delivery and a one-year guarantee, of course.

For complete specifications and performance curves refer to the Goldbook, EEM, EBG, or Mini-Circuits catalog

ZFL-2000 SPECIFICATIONS

FREQUENCY	10-2000 MHz
GAIN	20 dB
GAIN FLATNESS	±1.5 dB
OUTPUT POWER (1 dB compression)	+17 dBm
NOISE FIGURE	7.0 dB
INTERCEPT POINT (3rd order)	25 dBm
VSWR, 50 OHMS	2:1
DC POWER volt, current	+15 V, 100 mA
HEAT SINK	Internal
OPERATING TEMP	−55°C to +100°C

finding new ways . . .
setting higher standards

Mini-Circuits
A Division of Scientific Components Corporation
World's largest manufacturer of Double Balanced Mixers
P.O. Box 166, Brooklyn, New York 11235 (212) 934-4500
Domestic and International Telex 125460 International Telex 620156

CAPD
now available!
computer-automated performance data

C98 REV. A

WIDEBAND POWER DIVIDERS/COMBINERS, HYBRID TRANSFORMERS, & TERMINATIONS

North Hills

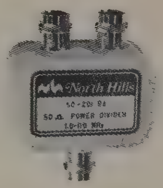
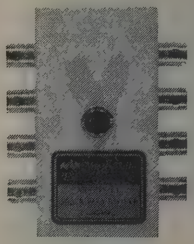
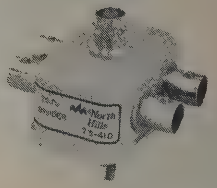
POWER DIVIDERS/COMBINERS

0.2 - 110 and 30 - 225 MHz
2, 4, and 8-way
50 and 75 ohms

Series 01 and 10 Power Dividers are designed for low power applications in the 0.2 to 110 and 30 to 225 MHz frequency ranges.

Hybrid Junction Techniques are employed to assure superior isolation and minimal insertion loss. VSWR is optimized at all ports.

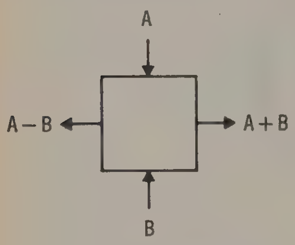
50 and 75 ohm impedances are standard. Other impedances available on special order.

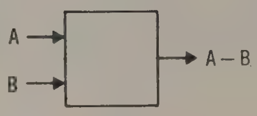
	2-WAY				4-WAY				8-WAY			
Model	50-201RA	75-201RA	50-210RA	75-210RA	50-401RB	75-401RB	50-410RB	75-410RB	50-801SA	75-801SA	50-810SA	75-810SA
Impedance (Ω)	50	75	50	75	50	75	50	75	50	75	50	75
Frequency Range (MHz)	0.2 - 110		30 - 225		0.2 - 110		30 - 225		0.2 - 110		30 - 225	
Insertion Loss (dB)	0.5		1.0		0.5		1.0		1.0		1.5	
Isolation (dB min)	30		30		30		30		30		30	
Amplitude Balance (± dB)	0.5		0.5		0.5		0.5		1.0		0.5	
Phase Balance (± °)	0.5		2.0		1.0		2.0		0.5		2.0	
Input VSWR	1.1		1.25		1.1		1.25		1.1		1.25	
Input Power (watts)	5		3		5		3		5		3	
Case Style	RA		RA		RB		RB		SA		SA	
Weight (gm)	50		50		65		65		160		160	

HYBRID TRANSFORMERS

SUM & DIFFERENCE (4-port)



DIFFERENCE DIVIDER (3-port)



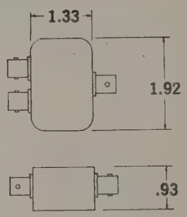
Port Impedance Type	50Ω 50-212RE	75Ω 75-212RE
Frequency Range	0.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Amplitude Balance	±.3 dB	
Phase Balance	1° max	
VSWR	1.20 max	
Power	0.5 watt max	

Port Impedance Type	50Ω 50-221RA	75Ω 75-221RA
Frequency Range	.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Null	40 dB min	
VSWR	1.20 max	
Power	0.5 watt max	

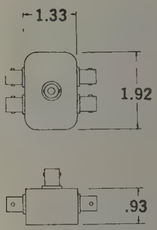
TERMINATIONS

Model	Impedance	Frequency Range	VSWR	Connector
R50-101	50 Ω	DC - 1 GHz	1.06 max.	BNC Male
R75-101	75 Ω	DC - 1 GHz	1.06 max.	BNC Male

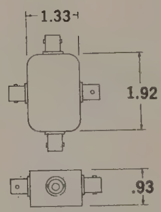
CASE STYLES



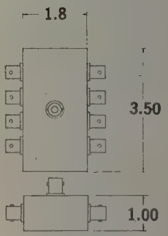
RA



RB



RE



SA

BNC Connectors are standard. Other connectors available on special order. Stud mounting standard.

Different case styles, including printed circuit types with solder terminals, available on special order.

SPECIAL UNITS — 10 Hz to 1 GHz

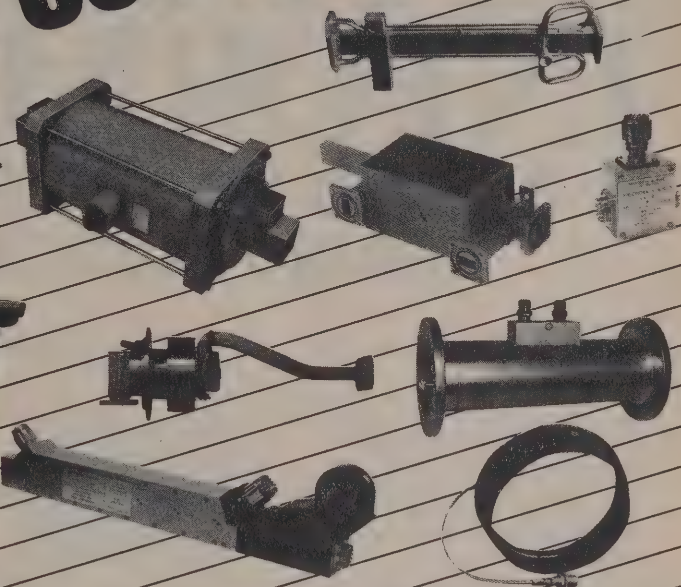
In addition to our standard lines, North Hills custom designs to specific requirements. Examples of these include:

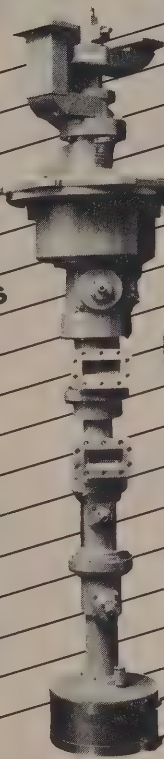
- Active unity – or high-gain power splitters, adders and combiners.
- High power dividers.
- Resistive dividers from dc to 500 MHz
- Power dividers for video applications with response down to 1 kHz.
- Non-standard impedances.

North Hills Electronics, INC.

GLEN COVE, N.Y. 11542 • 516-671-5700

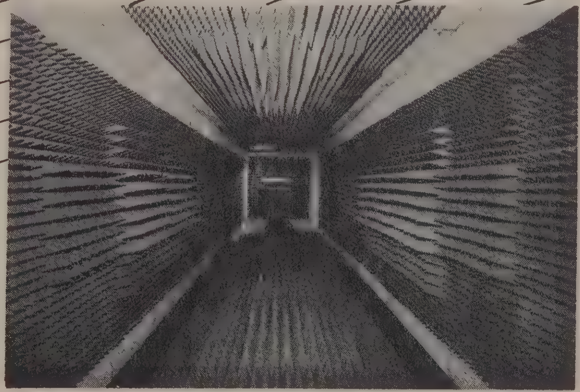
The Premier Source: Microwave Components





- Microwave Front Ends
- Microwave Filters
- Rotary Joints
- Antennas & Feeds
- Ferrite Devices
- Millimeter Components
- Diplexers
- Multiplexers
- Phase Shifters
- Isolators
- Loads
- Directional Couplers
- Hybrids
- Circulators
- Windows
- Attenuators

plus a complete,
computerized Anechoic
Antenna/Component/Sub-System
Test Facility



Premier Microwave Corporation has been serving the Microwave Industry for almost half a century with narrow- and broad-band waveguide, strip and coax components and sub-systems. We design, manufacture and test fixed, variable and dc-controlled products, both active and passive, with emphasis on a superlative ferrite engineering section.

Write for a complete catalog of standard and custom microwave components and sub-systems, or send your specifications for evaluation/price/delivery to:

PMC

PREMIER MICROWAVE CORP.
a subsidiary of Comtech, Inc.
33 New Broad St., Port Chester, NY 10573. (914) 939-8900

Designers and manufacturers of Rotary Joints, Ferrite Devices, Front Ends, Antennas and other microwave system components. Automated-computerized antenna test pattern facility available.

Qualified personnel are invited to send resume and salary requirement to Director of Personnel, Premier Microwave Corp., 33 New Broad Street, Port Chester, N.Y. 10573.

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

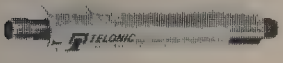
Abbreviations/Acronyms	**1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code	**3**•1103
Batteries, Product Selection Guide	**3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide	**2**•1003
Capacitors, Basic Formulas	**1A**•1093
Capacitors, Miniglossary	**1A**•1069
Capacitors, Product Selection Guide	**1A**•1003
Circuit Boards (Printed), Product Selection Guide	**2**•1089
Coils, Chokes, & Inductors, Product Selection Guide	**1A**•1219
Connectors, Miniglossary	**2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide	**2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**1A**•1309
Delay Lines, Product Selection Guide	**1A**•1445
Discrete Semiconductors, Product Selection Guide	**1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide	**1B**•1021
EBCDIC Code	**3**•1153
Encapsulation, Miniglossary	**2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**2**•1801
Filters, Product Selection Guide	**1A**•1577
Instruments, Graphic Recording, Product Selection Guide	**3**•1381
Instruments, Panel Meters, Product Selection Guide	**3**•1321
Instruments, Test & Measuring, Product Selection Guide	**3**•1182
Interconnection Systems, Product Selection Guide	**2**•1873
Keyboards & Keypads, Product Selection Guide	**1B**•1759
Microwave Components, Product Selection Guide	**1A**•1685
Military Qualified Products Lists	**1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide	**1B**•1121
Opto Semiconductors, Miniglossary	**1B**•1218
Oscilloscopes, Product Selection Guide	**3**•1361
Panel Hardware, Product Selection Guide	**2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**1A**•2017
Power Supplies, Miniglossary	**3**•1455
Power Supplies, AC, Product Selection Guide	**3**•1815
Power Supplies, DC, Product Selection Guide	**3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**1B**•1255
Relay Contact Forms	**1B**•1317
Relays, Electromechanical, Miniglossary	**1•B**1292
Relays, Product Selection Guide	**1B**•1289
Resistor Color Codes	**1A**•1791
Resistors, Product Selection Guide	**1A**•1789
Servo Components, Miniglossary	**3**•1935
Solenoids, Product Selection Guide	**1B**•1481
Switches, Product Selection Guide	**1B**•1499
Thyristors/High Power Diodes, Miniglossary	**1A**•1652
Transducers & Encoders, Product Selection Guide	**1B**•1827
Transformers, Product Selection Guide	**1A**•2115
Wire & Cable, Product Selection Guide	**2**•1935

Microwave Filters and RF Attenuators

TUBULAR LOWPASS FILTERS

Cutoff frequency range: 30 to 2,750 MHz. Available with 2 thru 12 sections and virtually any RF connector.

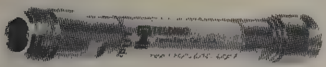
SERIES TLP	SERIES TLA	SERIES TLC
100 to 2,750 MHz	50 to 1,500 MHz	30 to 1,000 MHz
½″ diam.	¾″ diam.	1¼″ diam.
low cost	intermediate loss	low loss
small size	size power	highest power



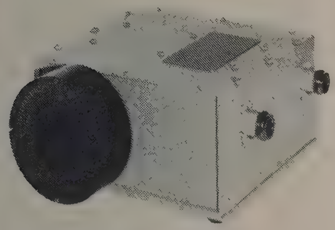
TUBULAR BANDPASS FILTERS

Featuring 0.1 dB Chebyschev design, these cover 30 to 2,400 MHz, 2 to 30% bandwidth, 2 to 12 sections.

SERIES TBP	SERIES TBA	SERIES TBC
100 to 2,400 MHz	50 to 1,000 MHz	30 to 900 MHz
½″ inch diam.	¾″ inch diam.	1¼″ inch diam.
lowest cost	medium loss	lowest loss
most popular	and power	highest power

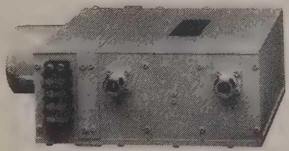


TUNABLE BANDPASS FILTERS



MANUAL VERSION
Iris-coupled, 0.05 dB Chebyschev design. Frequency-Reading Dials, Full Octave Coverage 48 MHz to 4 GHz Range, Individually Calibrated, Vernier Tuning, 3 or 5 sections.

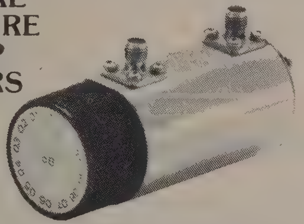
SPECIFICATIONS	TTA 3% & 5 % SERIES	TTF 5% SERIES
VSWR	1.5:1 Maximum	1.5:1 Maximum
Impedance	50 Ohms	50 Ohms
Maximum Input Power	20 Watts	50 Watts
Dial Accuracy —	± 1%	± 1%



COMPUTER-CONTROLLED VERSION
New, digitally-addressable tunable rf filters also available with IEEE 488, RS232 and BCD addressing.

SUBMINIATURE AND MINIATURE ROTARY STEP ATTENUATORS

Available in nine models with ranges from 1 to 100 dB

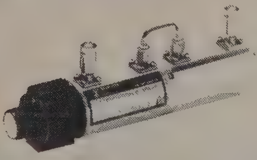


Accuracy to 0.5% available in custom units.

Model No.	dB Range	dB Steps	Frequency Range	Impedance (ohms)	VSWR	Accuracy*
8051	0-60	10	2 GHz	50	1.3:1 max.	3%
8052	0-10	1	2 GHz	50	1.3:1 max.	±0.2 dB or 3%
8120	0-100	10	2 GHz	50	1.3:1 max.	3%
8121	0-60	10	2 GHz	50	1.3:1 max.	3%
8122	0-10	1	2 GHz	50	1.3:1 max.	±0.2 dB or 3%
8123	0-1	0.1	500 MHz	50	1.3:1 max.	±0.2 dB
8131	0-70	10	1 GHz	75	1.3:1 max.	3%
8132	0-10	1	1 GHz	75	1.3:1 max.	±0.2 dB or 3%
8133	0-1	0.1	500 MHz	75	1.3:1 max.	±0.02 dB

TANDEM MOUNTED ROTARY STEP ATTENTUATORS

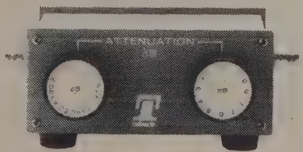
Combinations of step units (described above) in one assembly



Model No.	dB Range	dB Steps	Frequency Range	Impedance (ohms)	VSWR	Accuracy
8107	0-69	1	2 GHz	50	1.3:1 to 1 GHz	±0.2 dB or 3%
8140	0-109	1	2 GHz	50	1.4:1 to 2 GHz	±0.2 dB or 3%
8142	0-69	1	2 GHz	50		±0.2 dB or 3%
8149	0-10.9	0.1	500 MHz	50	dc to 500 MHz 1.3:1 max	±0.2 dB or 3%

BENCH TYPE ROTARY STEP ATTENUATORS

Discrete instruments for electronics lab, production, testing, or quality assurance



Model No.	dB Range	dB Steps	Frequency Range	Impedance (ohms)	VSWR	Accuracy
8128	0-100	10	2 GHz	50		3%
8129	0-10	1	2 GHz	50	1.3:1 to 1 GHz	±0.2 dB or 3%
8143	0-110	1	2 GHz	50	1.4:1 to 2 GHz	±0.2 dB or 3%
8145	0-80	1	1 GHz	75	1.4:1 max.	±0.2 dB or 3%
8148	0-11	0.1	500 MHz	50	1.3:1 max.	

Since 1960, Telonic has been a leading name in precision electronic components. Telonic's approach is to offer an *exceptionally wide* choice of standard filter types that can be delivered promptly—and which meet your specification requirements. Electrical test design data accompanies each order on request—and is your guarantee of quality assurance.

In the early 1960's when Telonic needed a precision step attenuator for one of their newly designed sweep generators, they had to revert to the ultimate supplier—themselves—to get the performance and dependability the instrument engineer demanded. Today, the product line has expanded into a complete series of rotary step, toggle, fixed, programmable, and custom units.

■ Technical assistance ■ Custom designs ■ Competitive prices ■ Outstanding product quality—backed by full warranty ■ Prompt delivery of stock items.

Call toll free for specs, prices and delivery on standard or special orders.

®TELONIC BERKELEY INC.
A SUBSIDIARY OF BERKELEY INDUSTRIES

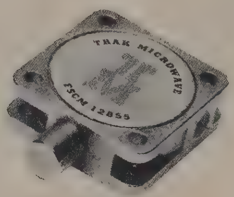
P.O. Box 277, 2825 Laguna Canyon Road,
Laguna Beach, CA 92652
Tel: 800/854-2436, (714/494-9401 in CA),
Telex: 18-2720 Domestic, 47-20277 Foreign

TRAK. MICROWAVE

Circulators & Isolators (Drop-In Type)

TRAK MICROWAVE
FSCM 12855

TRAK MICROWAVE
FSCM 12855



Isolators

FREQ. RANGE (GHz)	MODEL # ISOLATORS	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	POWER RATING PEAK POWER KW	POWER RATING AVERAGE POWER WATTS	HEAT SINK TEMP °C.	SIZE (INCHES NOMINAL) L W H
0.5 -0.7	29*0401	5	20	0.7	1.25	-54 to +95	0.1	1.0	+50	1.00 x 1.00 x 0.30
0.7-1.0	29*0501	7	20	0.6	1.25	-54 to +95	0.1	1.0	+50	1.00 x 1.00 x 0.30
1.0-1.3	29*1401	10	20	0.5	1.25	-54 to +95	0.1	1.0	+50	1.00 x 1.00 x 0.30
1.3-1.65	29*1501	10	20	0.5	1.25	-54 to +95	0.1	1.0	+50	1.00 x 1.00 x 0.30
1.65-2.0	29*1601	5	20	0.5	1.25	-54 to +95	0.1	1.0	+50	0.75 x 0.75 x 0.25
2.0-2.5	29*3401	10	20	0.5	1.25	-54 to +95	0.1	1.0	+50	0.75 x 0.75 x 0.25
2.5-3.7	29*3501	10	20	0.6	1.25	-54 to +95	0.1	1.0	+50	0.75 x 0.75 x 0.25
2.5-3.7	29*3601	5	18	0.6	1.30	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25
3.7-4.6	29*6401	5	18	0.6	1.30	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25
4.6-6.2	29*6501	10	18	0.6	1.30	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25
6.2-8.0	29*6601	10	18	0.6	1.35	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25
8.0-10.0	29*9401	10	18	0.6	1.35	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25
10.0-12.0	29*9501	10	18	0.6	1.35	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25
12.0-15.0	29*2401	10	17	0.6	1.45	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25
15.0-18.0	29*2501	10	17	0.6	1.45	-54 to +95	0.1	1.0	+50	0.50 x 0.50 x 0.25

NOTE: Circulators are also available.

*Specify center frequency when ordering. Model designation will be completed by TRAK.

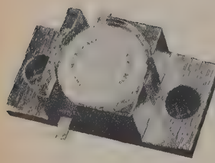
µicropuck® Circulators & Isolators

The Micropuck™ family of circulators and isolators was designed to maximize the use of isolators and circulators in stripline and microstrip applications. They are easy-to-mount devices with magnetic shielding which prevents detuning or changes in performance when operating in magnetic fields or in close proximity to ferrous metals. The round design and tab lead configuration allow installation at a reduced cost, replacing milling operations with a simple drilled hole.

The Micropuck™ isolator is also available in a flange mount similar to the mounting used on some power transistors. This construction has input and output tabs located 180° from each other as opposed to the 120° separation of the round version. This provides an alternative choice for system designers who prefer the screw-down mounting and can allow the extra space it requires.

Specifications for these microminiature ferrite devices are as good as you'll find anywhere. Look at the data and call our ferrite sales group or local representative.

Flange Mount Micropuck™ Isolators



MODEL #	FREQUENCY (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR MAX.	OPERATING TEMP. °C.	PEAK PWR watts	AVG. PWR watts	HEAT SINK TEMP °C.	SIZE L x W x H INCHES
F9*6101	4-8	10	20	0.5	1.25	-54 to +95	50	0.7	50	.62 x .375 x .21
F9*9001	8-12	10	20	0.4	1.25	-54 to +95	50	0.5	50	.50 x .25 x .18
F9*2001	12-18	10	17	0.5	1.35	-54 to +95	50	0.5	50	.50 x .25 x .18
F9A9101	8-12	FULL BAND	16	0.7	1.45	-54 to +95	50	0.7	50	.62 x .375 x .21
F9A2201	12-18	FULL BAND	17	0.7	1.50	-55 to +100	50	0.5	50	.50 x .25 x .18

Micropuck™ Circulators

MODEL #	FREQUENCY (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR MAX.	OPERATING TEMP. °C.	PEAK PWR (W)	AVG. PWR (W)	HEAT SINK TEMP.	SIZE DIA. INCH	SIZE HEIGHT INCH
79*6101	4 - 8	10	18	.5	1.30	-54 to +95	500	25	50	.375	.200
79*9001	8 - 12	10	18	.4	1.30	-54 to +95	50	20	50	.250	.156
79*2001	12 - 18	10	17	.5	1.35	-54 to +95	50	20	50	.250	.156
79A9101	8 - 12	FULL BAND	16	.7	1.45	-54 to +95	50	20	50	.375	.200

Micropuck™ Isolators

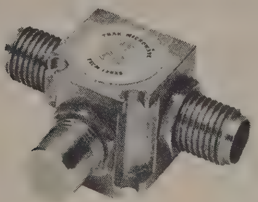
89*6101	4 - 8	10	20	.5	1.25	-54 to +95	50	.7	50	.375	.200
89*9001	8 - 12	10	20	.4	1.25	-54 to +95	50	.5	50	.250	.156
89*2001	12 - 18	10	17	.5	1.35	-54 to +95	50	.5	50	.250	.156
89A2201	12 - 18	FULL BAND	17	.7	1.50	-54 to +100	50	.5	50	.250	.156
89A9101	8 - 12	FULL BAND	16	.7	1.45	-54 to +95	50	.5	50	.375	.200

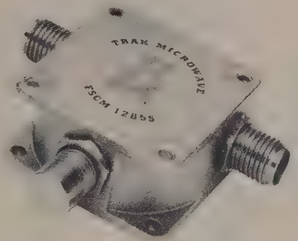
*Specify center frequency when ordering. Model designation will be completed by TRAK.

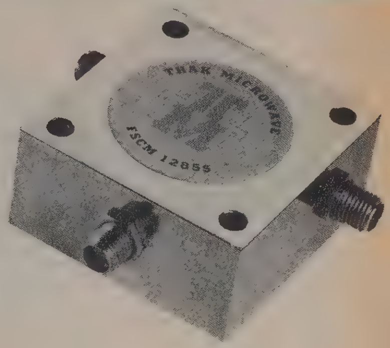
Dept. E-4 4726 Eisenhower Boulevard • Tampa, Florida 33614 • (813) 884-1411 • TLX: 52-827 • TWX: 810-876-9140

TRAK MICROWAVE

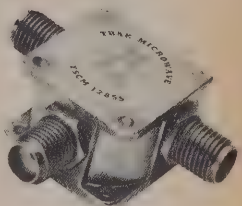
Circulators & Isolators (Octave and Broad Bandwidth Coaxial Type)







Isolators

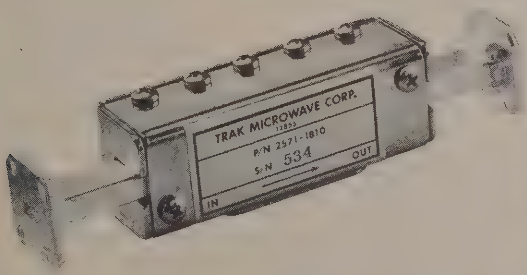


FREQUENCY RANGE (GHz)	MODEL #	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (Inches Nominal) L W H
1.0-2.0	60A1101*	15	0.6	1.40	0 to +50	0.2	1.0	+35	1.60 x 1.60 x 0.75
2.0-4.0	60A3001*	18	0.5	1.30	-10 to +70	0.6	1.0	+40	1.00 x 1.00 x 0.50
2.6-5.2	60A3011*	18	0.5	1.30	-25 to +80	1.0	1.0	+45	1.00 x 1.00 x 0.50
3.0-6.0	60A6301	18	0.5	1.40	-45 to +85	0.1	1.0	+50	0.75 x 0.75 x 0.50
4.0-8.0	60A6001*	18	0.5	1.30	-45 to +95	2.0	1.0	+50	0.75 x 0.75 x 0.50
5.0-10.0	60A6071*	18	0.5	1.30	-55 to +95	0.5	2.0	+50	0.75 x 0.75 x 0.50
6.0-12.0	60A9201*	16	0.7	1.35	-55 to +95	0.1	1.0	+50	0.75 x 0.75 x 0.50
8.0-12.4	20B9201*	20	0.5	1.30	-55 to +110	0.5	3.0	+50	0.50 x 0.50 x 0.50
8.0-16.0	60A2001*	17	0.5	1.35	-40 to +95	0.5	3.0	+50	0.50 x 0.50 x 0.50
7.5-18.0	60C2051	14	0.9	1.50	-54 to +95	0.5	3.0	+50	0.50 x 0.50 x 0.50
12.0-18.0	20B2201*	18	0.5	1.30	-55 to +110	2.0	3.0	+50	0.50 x 0.50 x 0.50
8.0-18.0	60A2051*	14	0.6	1.50	-54 to +95	0.5	3.0	+50	0.50 x 0.50 x 0.50
18.0-22.0	20A8101*	18	0.7	1.30	-54 to +95	0.5	3.0	+50	0.50 x 0.50 x 0.50

NOTE: Circulators are also available.

*These units are normally available from stock.

Waveguide Isolators



EEM
KU110LI
12.4-18.0 GHz
INPUT
OUTPUT

FREQEUNCY GHz	MODEL #	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR BILATERAL max.	POWER KW PEAK	MAX. W. AVE.	LENGTH INCHES	WEIGHT OUNCES NOMINAL	WAVEGUIDE TYPE	FLANGE TYPE
5.85-8.2	XB951LI	30	1.0	1.15	20	20	5.00	32	RG-50/U	UG-344/U
5.85-8.2	XB103LI	30	1.0	1.15	20	20	6.13	56	RG-50/U	UG-344/U
7.05-10.0	XL103LIA	30	1.0	1.15	5	20	6.13	36	RD-51/U	UG-51/U
8.2-12.4	X956LI	30	1.0	1.10	10	40	4.50	24	RG-52/U	UG-39/U
8.2-12.4	X110LIA*	30	1.0	1.10	5	20	5.00	28	RG-52/U	UG-39/U
10.0-15.0	M111LI	30	1.0	1.15	10	10	5.00	32	WR-75	WR-75
12.4-18.0	Ku915LI	30	1.0	1.10	10	20	4.00	24	RG-91/U	UG-419/U
12.4-18.0	Ku110LI*	30	1.0	1.15	10	10	5.00	28	RG-91/U	UG-419/U
18.0-26.5	2561-1810*	25	1.0	1.25	3	3	4.50	6.0	WR-42	UG-595/U
26.5-40.0	2571-1810*	23	1.5	1.15	3	3	4.125	5.5	WR-28	UG-599/U

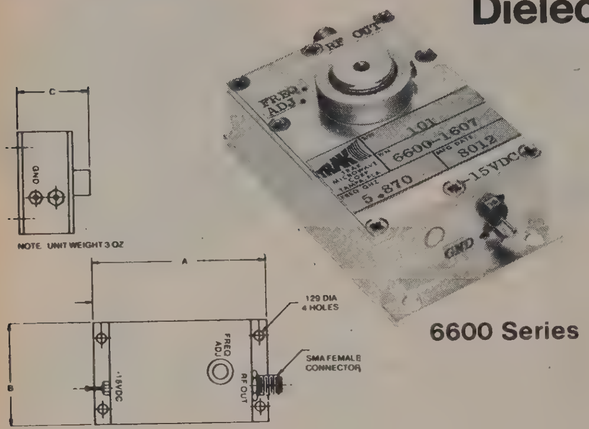
*These units are normally available from stock.

Specifications subject to change without notice.

TRAK MICROWAVE

Oscillators, IF Amplifiers & Power Amplifiers

Dielectrically Stabilized Oscillators (DSO's)



6600 Series

MODEL NUMBER	FREQUENCY RANGE (GHz)	OUTPUT POWER (mw Min.)	SECOND HARMONIC (dBc Min.)	(OUNCES NOMINAL)	SIZE, INCHES NOMINAL, A B C
6600-1300	3.65-4.05	30	25	3.0	2.7 x 1.7 x .1
6600-1610	4.25-4.75	30	25	2.5	2.5 x 1.5 x .9
6600-1611	4.75-5.25	30	25	2.5	2.5 x 1.5 x .9
6600-1612	5.10-5.60	30	25	2.5	2.5 x 1.5 x .9
6600-1613	5.40-5.90	30	25	2.5	2.5 x 1.5 x .9
6600-1614	5.60-6.10	30	25	2.5	2.5 x 1.5 x .9
6600-1615	5.70-6.20	30	25	2.5	2.5 x 1.5 x .9
6600-1616	5.90-6.40	30	25	2.5	2.5 x 1.5 x.9
6600-1617	6.40-6.90	30	25	2.5	2.5 x 1.5 x .9
6600-1618	7.00-7.45	15	25	2.0	2.2 x 1.3 x .9
6600-1910	8.00-8.40	15	25	2.0	2.2 x 1.3 x .9
6600-1911	8.60-9.00	15	25	2.0	2.2 x 1.3 x .9
6600-1912	9.00-9.50	15	25	2.0	2.2 x 1.3 x .9

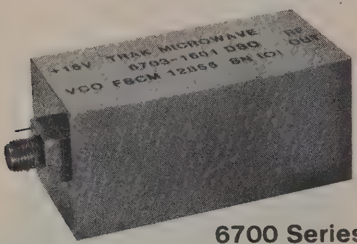
Power Supply:	-15 VDC @ 40 mA nom.
Frequency stability:	10ppm/°C, max. 5ppm/°C, typical
Temperature:	-54 to +95°C.

NOTE: Contact factory regarding improved stability requirements.

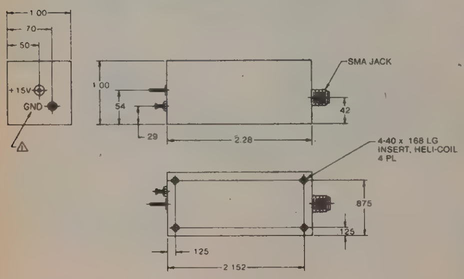
8 - 18 GHz GaAs FET Dielectrically Stabilized Oscillators (DSO's)

ENVIRONMENTAL CONDITIONS

Operating temperature range:	-54 to +115°C.
Storage temperature:	-54 to +125°C.
Shock:	100g, 11ms
Vibration:	20g, 20-2000cps



6700 Series



ELECTRICAL PARAMETERS

Frequency:	Factory set between 8 and 18 GHz
Frequency set accuracy:	±1 MHz
Power output:	+10 dBm minimum
In-band spurious:	None
Stability:	
Frequency vs temperature:	5ppm/°C max., 2.5 ppm/°C typical
Frequency pulling:	1 MHz peak to peak, maximum, into 3:1 load VSWR
Frequency pushing:	2 KHz/volt, typical
Power vs temperature:	±1 dB
Power supply:	+15 VDC @ 80 mA, nominal

MECHANICAL PARAMETERS

Size:	2.28 x 1.0 x 1.0 inches (58 x 25.4 x 25.4 mm) nominal, excluding projections
Weight:	100 grams, nominal
RF connector:	SMA female
DC connections:	Solder terminals

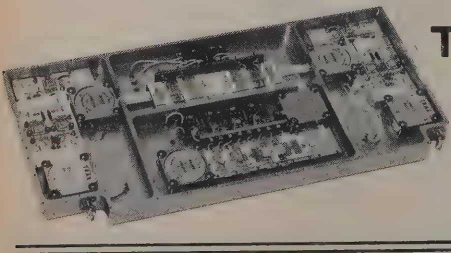
Options: The following components can be added to tailor the oscillator to meet specific system requirements and to obtain the optimum cost-performance tradeoff.

- PIN switch for dual frequency mode.
- Amplifier stages for increased output power.
- RF coupler for RF power monitoring or other functions.
- Power dividers for driving multiple mixers.
- PIN attenuator for external amplitude modulation.
- Varactors for external frequency modulation.
- Heater for increased frequency stability.

In addition to adding other functions, TRAK can provide special models to provide minimal FM under 50g operating vibration. Models with mechanical tuning capability are also available.

Specifications subject to change without notice.

Tacan Band Dual Channel Power Amplifier



Frequency Range:	960 - 1215 MHz	Duty Factor:	20%
Power Output:	165 watts peak per channel	Bandwidth:	255 MHz
Gain:	42 dB		

Dept. E-4 4726 Eisenhower Boulevard • Tampa, Florida 33614 • (813) 884-1411 • TLX: 52-827 • TWX: 810-876-9140

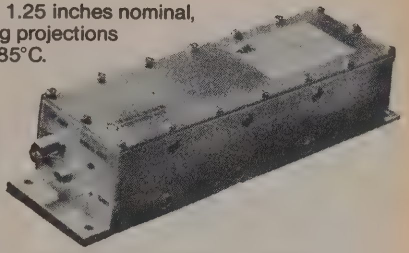
TRAK MICROWAVE

Oscillators, Comb Generators, IF Amplifiers & Power Amplifiers

Ovenized Ku Band Crystal Controlled Oscillators

Frequency:	12, 13, or 14 GHz
Power Output:	+10 dBm minimum
Frequency Stability:	±5ppm (-20°C. to +71°C.)*
Frequency Set Accuracy:	±2ppm (at +25°C.)
Harmonics and Spurs:	>40 dBc
Load VSWR:	1.5:1 maximum
Power Supply:	+15V @ 430 mA steady state (800 mA max. at turn-on)
Warm-up Time to meet 5ppm frequency stability:	120 sec. max.
Size:	5 x 1.5 x 1.25 inches nominal, excluding projections
Temperature Range:	-55 to +85°C.

*Includes heater stabilized.

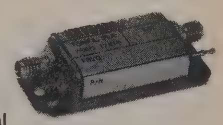


2.5 - 18 GHz Miniature Crystal Controlled Oscillators

ELECTRICAL PARAMETERS (general)
Frequency set accuracy at room temperature: ±0.001%
Freqeuncy stability: ±0.003%
Aging rate: ±0.005% per year
Power variation with temperature: ±2 dB
Power supply: +15 VDC (other voltages optional)
Load VSWR: 1.5:1 maximum
Temperature Range: -55 to +85°C. (to +125°C with degradation)
Contact factor for other frequencies and/or power levels.

MODEL #	FREQUENCY (GHz)	POWER OUTPUT AT +25°C. (dBm min.)	OUTPUT HARMONICS AND SPURIOUS (dBc)	CURRENT (mA nom.)
5044-1311	2.5 - 4.0	+10	>40	100
5044-1611	4.0 - 8.0	+10	>40	110
5045-1911	8.0 - 10.0	+10	>40	120
5045-1913	10.0 - 12.0	+10	>40	140
5045-1240	12.0 - 18.0	+10	>40	150

Wide Dynamic Range Low Noise IF Amplifer
Model 8400-1080



Center Frequency:	Customer specified 20 to 150 MHz
3 dB Bandwidth:	10 MHz, nominal
Bandpass Ripple:	1 dB, typical
Skirt Selectivity:	12 dB/octave, typical
Gain:	70 ± 3 dB
Noise Figure:	3 dB max.
Input Impedance:	50 ohms nominal
1 dB Compression Point:	0 dBm min.
3rd Order Intercept Point:	+10 dBm nominal
Input Dynamic Range (with AGC):	80 dB min.
AGC Range:	60 dB min.
AGC Voltage:	0 to + 5 volts
Size:	1.28 x .71 x 0.5 inches, nominal excluding projections
Temperature Range:	0 to + 50°C (see note)

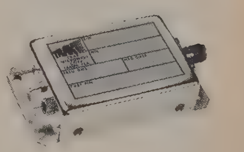
NOTE: Temperature compensation circuits are optionally available for higher stability and/or wider temperature range.

Custom Designed Switched Multiple Output Oscillator

This custom designed unit provides several electrically selectable output frequencies. Output signals can be in various bands and with various power levels. Thin-film hybrid techniques minimize size. Contact TRAK with your needs.

Comb Generators (Harmonic Generators)

MODEL NUMBER	3901-1010	3901-1020	3900-1210	3900-1900	3900-1203	3900-1200
Frequency Range	5-100 MHz	20-500 MHz	.5-18 GHz	.5-12 GHz	.95-13.3 GHz	.1-18 GHz
Comb spacing (MHz)	5	20	500	500	950	100
Frequency stability (ppm)	30	30	30	30	30	30
Power output (dBm)	-13 max., -27 min.	-10 max., -31 min.	-40 min.	+6 max., -22 min.	-20 min.	0 max., -40 min.
Load VSWR (max.)	2:1	2:1	1.5:1	1.5:1	1.5:1	1.5:1
In-band spurious (dBc max.)	60	60	24	30	40	60
Power supply +15 VDC @ (mA max.)	50	100	200	200	150	300
Size: (inches, nominal excluding projections)	1.33 x 1.33 x .49	1.33 x 1.33 x .49	1.9 x 1.33 x .5	1.33 x 1.33 x .5	1.9 x 1.33 x .6	1.9 x 1.33 x .6
Weight: (ounces, nominal)	1	1	3	1	3	3
Temperature range: (°C)	-54 to +85	-54 to +85	-54 to +85	-54 +85	-54 to +85	-54 to +85



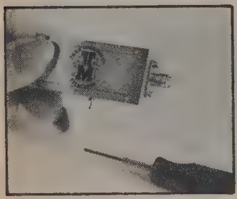
Also Available:
- **Other Oscillators-Cavity Stabilized, Crystal-Controlled, Pulsed-Up To Ka Band**
- **Frequency Multipliers**
- **Microwave Subsystems and Receivers**
- **Custom Designs**

Send Today For Complete Catalog

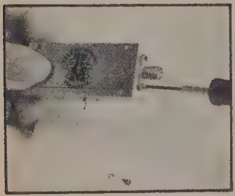
Dept. E-4 4726 Eisenhower Boulevard • Tampa, Florida 33614 • (813) 884-1411 • TLX: 52-827 • TWX: 810-876-9140

TRAK® MICROWAVE

GaAs FET Amplifiers (Drop-In Wide Band Temperature Compensated Type)

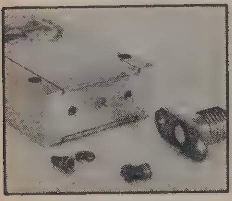


Amplifier is shipped with connector in place to simplify testing.



After test, screws are removed.

Connector is removed. Unit remains hermetically sealed. TRAK PAK™ impedance remains 50 ohms.



Amplifier is ready to drop into microstrip circuit.

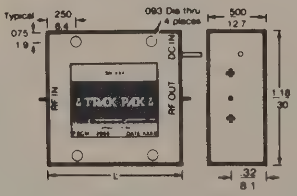
MODEL	FREQUENCY GHz	GAIN (dB) MINIMUM	GAIN (dB) NOMINAL	GAIN (dB) MAXIMUM	MAXIMUM NOISE FIGURE (dB) -54 C	MAXIMUM NOISE FIGURE (dB) +25 C	MAXIMUM NOISE FIGURE (dB) +85 C	MINIMUM POWER OUT (dBm)[4]	3rd ORDER INTERCEPT dBm min.	VSWR[2]	mA max @ +15VDC[2, 3]	PACKAGE OUTLINE
8081-1601	2.0 - 8.0	8.0	9.0	10.0	5.5	6.0	7.0	+12	+22	2.0:1	40	F1
8081-1602	2.0 - 8.0	17.0	18.0	19.0	5.5	6.0	7.0	+12	+22	2.0:1	80	F2
8081-1603	2.0 - 8.0	25.0	27.0	29.0	5.5	6.0	7.0	+12	+22	2.0:1	180	F8
8081-1604	2.0 - 8.0	34.0	36.0	38.0	5.5	6.0	7.0	+12	+22	2.0:1	220	F3
8081-1605	2.0 - 8.0	43.0	45.0	47.0	5.5	6.0	7.0	+12	+22	2.0:1	260	F4
8081-1610	2.0 - 6.0	15.0	16.0	17.0	4.0	4.5	5.5	+14	+24	2.0:1	100	G1
8081-1611	2.0 - 6.0	24.0	25.0	26.0	4.0	4.5	5.5	+14	+24	2.0:1	140	G2
8081-1612	2.0 - 6.0	32.5	34.0	35.5	4.0	4.5	5.5	+14	+24	2.0:1	180	G3
8081-1301	2.0 - 4.0	11.0	12.0	13.0	3.0	3.5	4.5	+ 9	+19	2.0:1	60	F1
8081-1302	2.0 - 4.0	23.0	24.0	25.0	3.0	3.5	4.5	+10	+20	2.0:1	100	F8
8081-1303	2.0 - 4.0	39.0	40.0	41.0	3.0	3.5	4.5	+10	+20	2.0:1	140	F3
8081-1620	4.0 - 8.0	13.0	14.0	15.0	5.0	5.5	6.5	+10	+20	2.0:1	100	F7
8081-1621	4.0 - 8.0	21.0	22.0	23.0	5.0	5.5	6.5	+10	+20	2.0:1	140	F8
8081-1622	4.0 - 8.0	28.5	30.0	31.5	5.0	5.5	6.5	+10	+20	2.0:1	180	F3
8081-1201	6.0 - 18.0	13.0	14.0	15.0	7.5	8.0	9.0	+ 9	+19	2.0:1	180	H3
8081-1202	6.0 - 18.0	16.5	18.0	19.5	7.5	8.0	9.0	+ 9	+19	2.0:1	220	H4
8081-1203	6.0 - 18.0	21.0	23.0	25.0	7.5	8.0	9.0	+ 9	+19	2.0:1	260	H5
8081-1210	8.0 - 18.0	4.0	5.0	6.0	7.5	8.0	9.0	+10	+20	2.0:1	40	H1
8081-1211	8.0 - 18.0	8.0	10.0	12.0	7.5	8.0	9.0	+10	+20	2.0:1	80	H2
8081-1212	8.0 - 18.0	13.0	14.0	15.0	7.5	8.0	9.0	+10	+20	2.0:1	180	H3
8081-1213	8.0 - 18.0	16.5	18.0	19.5	7.5	8.0	9.0	+10	+20	2.0:1	220	H4
8081-1214	8.0 - 18.0	20.0	22.0	24.0	7.5	8.0	9.0	+10	+20	2.0:1	260	H5
8081-1901	8.0 - 12.0	12.0	13.0	14.0	4.5	5.0	6.0	+ 9	+19	2.0:1	140	H6
8081-1902	8.0 - 12.0	16.5	18.0	19.5	4.5	5.0	6.0	+ 9	+19	2.0:1	180	H3
8081-1903	8.0 - 12.0	21.0	23.0	25.0	4.5	5.0	6.0	+ 9	+19	2.0:1	220	H4
8081-1904	8.0 - 12.0	26.0	28.0	30.0	4.5	5.0	6.0	+ 9	+19	2.0:1	260	H5
8081-1220	12.0 - 18.0	12.5	14.0	15.5	6.5	7.0	8.0	+10	+20	2.0:1	180	H3
8081-1221	12.0 - 18.0	16.0	18.0	20.0	6.5	7.0	8.0	+10	+20	2.0:1	220	H4
8081-1222	12.0 - 18.0	19.5	22.0	24.5	6.5	7.0	8.0	+10	+20	2.0:1	260	H5
8081-1223	12.0 - 18.0	23.5	26.0	28.5	6.5	7.0	8.0	+10	+20	2.0:1	300	H7

[1] Gain over temperature and frequency.

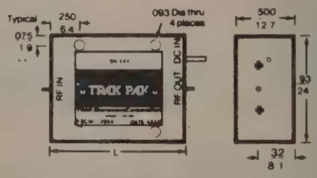
[2] -54°C to +85°C.

[3] Supply voltage may be any value between +12 and +18 VDC.

[4] Power output at 1 dB compression.



Length in/mm	
F1	659/16.7
F2	1 186/30.1
F3	2 497/63.4
F4	3.024/76.8
F5	3.551/90.2
F6	916/23.3
F7	1.443/36.7
F8	1 970/50 0
G1	2.443/62.1
G2	3.470/88.1
G3	4.497/114.2



Length in/mm	
H1	659/16 7
H2	1 186/30 1
H3	2 497/63 4
H4	3 024/76 8
H5	3 551/90 2
H6	1 970/50 0
H7	4 078/103 6

*Refer to photographs on top of next page.

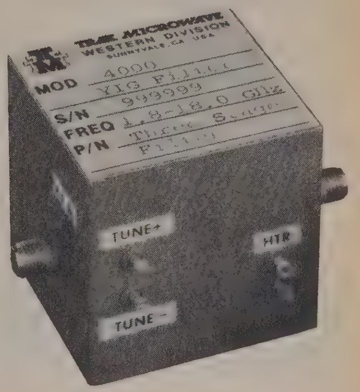
Dept. E-4 4726 Eisenhower Boulevard • Tampa, Florida 33614 • (813) 884-1411 • TLX: 52-827 • TWX: 810-876-9140

TRAK. MICROWAVE WESTERN DIVISION

YIG Components (Military Grade)

TRAK can provide you a wide variety of Military Grade YIG tuned filters, oscillators and harmonic generators, covering frequencies 0.5 - 40 GHz. The following is a sample of our specs for MIL-grade units; however, tighter tolerances for commercial applications are also available. All designs are available with or without integral tuning devices.

TRAK MICROWAVE
WESTERN DIVISION
SUNNYVALE, CA USA
MOD Oscillator
5570-0M01
S/N 01
FREQ 2.0-8.0GHz
P/N Vb= +15.0V



STANDARD BANDPASS FILTERS

MODEL NO.	FREQUENCY RANGE (GHz)	BANDWIDTH 3dB (MHz, min.)	INSERTION LOSS (dB, max.)	OFF-RESONANCE ISOLATION (dB, min.)	OFF-RESONANCE SPURIOUS (dB, max.)	LINEARITY (MHz, max.)	HYSTERESIS (MHz, max.)	FREQUENCY DRIFT (MHz, max.)	PASSBAND RIPPLE & SPURIOUS (dB, max.)	FREQUENCY TRACKING (MHz, max.)	WITHOUT DRIVER: TUNING SENSITIVITY (MHz/mA, nom.)	WITHOUT DRIVER: COIL RESISTANCE (Ω, nom.)	WITHOUT DRIVER: COIL INDUCTANCE (mH, nom.)
TWO-STAGE FILTERS													
5510-2M01	0.5 to 2	12	5	40	25	±3	6	±4	2.5		14	7	70
5510-2M04	2 to 8	20	3	50	25	±6	10	±8	2.5		14	7	70
5510-2M05	8 to 18	30	3	40	30	±12	20	±12	2.5		25	5.5	80
5510-2K01	18 to 26.5	35	4	40	30	±15	20	±15	2.5		28	8	120
THREE-STAGE FILTERS													
5510-3M01	0.5 to 2	12	6	70	35	±2	6	±4	2.0		14	7	70
5510-3M06	2 to 8	20	4	70	40	±5	10	±8	2.0		14	7	70
5510-3M07	8 to 18	25	4	70	40	±10	20	±12	2.5		25	5.5	80
5510-3M02	1 to 18	15	6	70	40	±18	20	±15	2.0		25	5.5	80
5510-3K01	18 to 26.5	35	5	60	40	±15	20	±15	2.5		28	8	120
5510-3A01	26.5 to 40	60	9	50	35	±20	60	±20	2.0		40	17	250
FOUR-STAGE FILTERS													
5510-4M01	0.5 to 2	10	8	70	40	±3	6	±4	2.5		14	7	70
5510-4M06	2 to 8	15	5	70	50	±6	10	±8	2.5		14	7	70
5510-4M07	8 to 18	20	5	70	50	±12	20	±12	2.5		25	5.5	80
5510-4K01	18 to 26.5	30	6	70	50	±15	20	±15	2.5		28	8	120
DUAL TWO-STAGE FILTERS (Composite Specifications)													
5520-2M01	0.5 to 2	10	8	70	50	±3	6	±4	2.5	10	14	7	70
5520-2M02	2 to 8	20	6	70	50	±6	10	±8	2.5	8	14	7	70
5520-2M03	8 to 18	25	5	70	50	±12	20	±12	2.5	10	25	5.5	80
5520-2K01	18 to 26.5	30	8	70	50	±15	20	±15	2.5	10	28	8	110

STANDARD WIDE-BANDWIDTH BANDPASS FILTERS

4 STAGE FILTER

MODEL NO	FREQUENCY RANGE (GHz)	BANDWIDTH 3dB (MHz, min.)	INSERTION LOSS (dB, max.)	LIMITING LEVEL (dBm, min.)	OFF-RESONANCE ISOLATION (dB, min.)	LINEARITY (MHz, max.)	HYSTERESIS (MHz, max.)	FREQUENCY DRIFT (MHz, max.)	PASSBAND RIPPLE & SPURIOUS (dB, max.)	WITHOUT DRIVER: TUNING SENSITIVITY (MHz/mA, nom.)	WITHOUT DRIVER: COIL RESISTANCE (Ω, nom.)	WITHOUT DRIVER: COIL INDUCTANCE (mH, nom.)
5510-4M08	2.0 to 6.0	100	6	-10	65	±10	15	±10	3.0	14	7	70
5510-4M09	6.0 to 18.0	120	5	+10	65	±15	20	±15	2.5	25	5.5	80
5510-4M10	8 to 18	250	5	+10	70	±15	15	±10	2.5	25	5.5	80

STANDARD OSCILLATORS

MODEL NO	FREQUENCY RANGE (GHz)	POWER OUTPUT (dB, min.)	POWER VARIATION vs. FREQUENCY (dB, max.)	FREQUENCY VARIATION: vs. Load 1.5:1 (MHz, max.)	FREQUENCY VARIATION: vs. Temp. (MHz, max.)	FREQUENCY VARIATION: HYSTERESIS (dBc, min.)	SPURIOUS OUTPUTS: 2nd HARMONIC (dBc, min.)	SPURIOUS OUTPUTS: 3rd HARMONIC (dBc, min.)	SPURIOUS OUTPUTS: OTHER (dBc, min.)	FINE TUNING PORT: SENSITIVITY (KHz/mA, nom.)	FINE TUNING PORT: IMPEDANCE (typical)	FINE TUNING PORT: 3dB BANDWIDTH (KHz, min.)	WITHOUT DRIVER: BIAS CURRENT (+18 VDC at mA, max.)	WITHOUT DRIVER: FREQUENCY PUSHING (MHz/V, max.)	WITHOUT DRIVER: COARSE TUNING PORT: COARSE SENSITIVITY (MHz/mA, nom.)	WITHOUT DRIVER: COARSE TUNING PORT: IMPEDANCE
TRANSISTOR OSCILLATORS																
5570-0P03	0.5 to 1	+13	5	0.5	±8	2	15	60	60	150	1Ω/1μH	100	120	1	14	10Ω/60mH
5570-0L04	1 to 2	+13	5	0.5	±10	3	15	60	60	150	1Ω/1μH	100	120	1	14	10Ω/60mH
5570-0M05	0.5 to 2	+13	6	0.5	±12	4	12	60	60	150	1Ω/1μH	100	120	1	14	10Ω/60mH
5570-0S01	2 to 4	+13	4	2	±10	6	15	18	60	300	1Ω/1μH	250	50	0.5	15	10Ω/50mH
5570-0M06	1 to 4	+13	7	0.5	±12	6	15	60	60	150	1Ω/1μH	100	120	1	14	10Ω/50mH
5570-0M01	2 to 8	+12	6	2	±15	9	15	15	60	300	1Ω/1μH	250	50	0.5	15	10Ω/50mH
GUNN DIODE OSCILLATORS																
5580-0X09	8 to 12.4	+17	6	10	±12	10	30	60	60	150	1Ω/10μH	100	+8 to +15V @800 mA, max.	10	20	6Ω/80mH
5580-0U07	12.4 to 18	+17	6	10	±15	15	30	60	60	150	1Ω/10μH	100	+5 to +12V @850 mA, max.	10	20	6Ω/80mH
5580-0M01	8 to 18	+10	6	10	±20	25	30	60	60	150	1Ω/10μH	100	+5 to +15V @900 mA, max.	10	20	6Ω/80mH
5580-0K01	18 to 26.5	+10	6	10	±20	40	20	60	60	150	1Ω/10μH	100	+5 to +12V @1500 mA, max.	15	27	12Ω/150mH
5580-0A01	26.5 to 40	+ 7	8	20	±25	60	20	60	60	150	1Ω/10μH	100	+3 to +8V @1700 mA, max.	20	43	17Ω/150mH

WESTERN DIVISION (YIG Components) Dept E-4 735 Palomar Avenue • Sunnyvale, California 94086 • (408) 735-9660 • TWX: 910-339-9309

WAVETEK

RF AND MICROWAVE COMPONENTS

ULTRAMIN® MINIATURE FILTERS

- 10 to 2000 MHz
- Miniature Packages
- Meet Military Specifications

WAVETEK
B2B4PP
70/1.4
8416
8857
ULTRAMIN
WAVETEK
FILTER

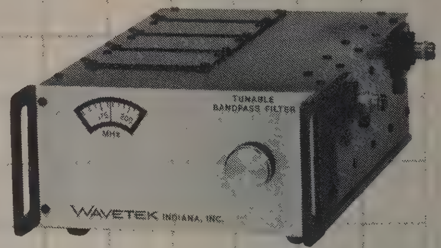
Filters in TO-5 size packages are only 0.36 inches in diameter and weigh less than 0.046 oz. Standard models cover 10 to 2000 MHz frequency range. Other frequencies are available on special order. Bandpass, lowpass, highpass and bandstop filters are available. Models are available that meet MIL-E-5400 and MIL-STD-202. A glass-to-glass hermetic seal is standard on "T" packages.

TUBULAR AND LC FILTERS

- 2 MHz to 10 GHz
- Computer Designed (CAD)
- Nine Series
- Meet Military Specifications

TUNABLE BANDPASS FILTERS

- 30 to 2000 MHz
- Octave Frequency Bands
- 2.2 Typical Form Factor
- ± 1% Accuracy and Resetability
- Gear Drive



MODEL	FREQUENCY RANGE
5201	31 to 62 MHz
5202	62 to 125 MHz
5203	125 to 250 MHz
5204	250 to 500 MHz
5205	500 to 1000 MHz
5206	1 to 2 GHz

SERIES	TYPE	FREQUENCY RANGE (MHz)	NUMBER OF SECTIONS	SIZE (INCH)	AVERAGE POWER (W)
25	Tubular	500 to 10,000	3 to 6	1/4 dia.	1
38	Tubular	100 to 5000	2 to 8	3/8 dia.	5
50	Tubular	50 to 4000	2 to 12	1/2 dia.	25
75	Tubular	25 to 1500	2 to 12	3/4 dia.	60
125	Tubular	10 to 900	2 to 12	1 1/4 dia.	200
A	LC	2 to 500	2 to 12	3/4 x 3/4 x 2 3/16	10
A2	LC	2 to 500	2 to 12	3/8 x 3/4	10
B	LC	5 to 500	2 to 6	3/4 x 3/4 x 1	10
B2	LC	5 to 500	2 to 6	3/8 x 3/4 x 1	10

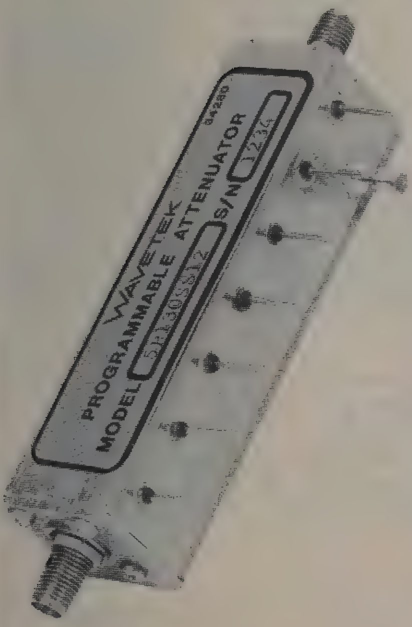
WAVETEK INDIANA INC.·P.O. Box 190·Beech Grove, IN 46107·Tel. (317) 788-5975·TWX (310) 687-6033

WAVETEK

RF AND MICROWAVE COMPONENTS

PROGRAMMABLE ATTENUATORS

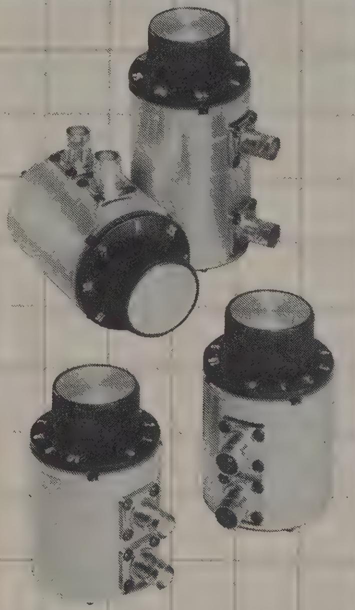
- World's Smallest Design
- Ideal for OEM Systems Applications
- High Volume Delivery
- Custom Design Capability
- Optional TTL Interface



MODEL	ATTENUATION	FREQUENCY
5P70	0 to 70 dB	DC to 2000 MHz
5P127	0 to 127 dB	DC to 1500 MHz
5P130	0 to 130 dB	DC to 1500 MHz

TURRET ATTENUATORS

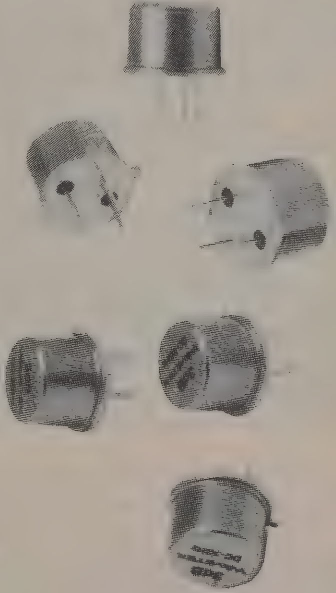
- Broadband Operation
- Low VSWR
- High Repeatable Accuracy
- Ideal for OEM Applications



MODEL	ATTENUATION
5001	1 to 2 dB in 0.1 dB steps
5010	0 to 10 dB in 1 dB steps
5035	0 to 35 dB in 5 dB steps
5070	0 to 70 dB in 10 dB steps
5080	0 to 80 dB in 1 dB steps

MICROPAD SERIES MA5 STRIPLINE/ MICROSTRIP FIXED ATTENUATORS

- DC to 3 GHz
- ±0.2 dB Accuracy to 1 GHz
- 5 Standard Attenuation Values
- Ultraminiature Packaging
- Hermetically Sealed
- Custom Values Available



WAVETEK INDIANA INC.·P.O. Box 190·Beech Grove, IN 46107·Tel. (317) 788-5975·TWX (310) 687-6033

24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
eem
2800
TRW

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

Weinschel RF components . . .

DC-40 GHz

Weinschel Engineering offers the industry's most comprehensive line of high quality microwave components. Covering the frequency spectrum from DC to 40 GHz, these components include fixed, continuously variable, and step attenuators as well as precision terminations, connectors, adapters and power dividers. Consistent performance and virtually flat attenuation versus frequency characteristics are well-known qualitites of Weinschel components. Power ratings from 1 watt to 250 watts are available.

Conservatively rated, Weinschel's high power attenuators handle at least 24% more power than specified. Due to innovative engineering and state-of-the-art manufacturing techniques, our high-power line is continually being improved and expanded. Not only do we offer a 250 watt attenuator but high power attenuators with broadband capabilities are also now available. For example, Weinschel's model 48, rated for 100 watts average, 1 KW peak, operates from DC to 18 GHz. Proprietary film processes produce resistive elements with features such as low temperature coefficients, low aging rates and immunity to overload. By eliminating the need for heat conducting liquids, size can be reduced while reliability is improved.

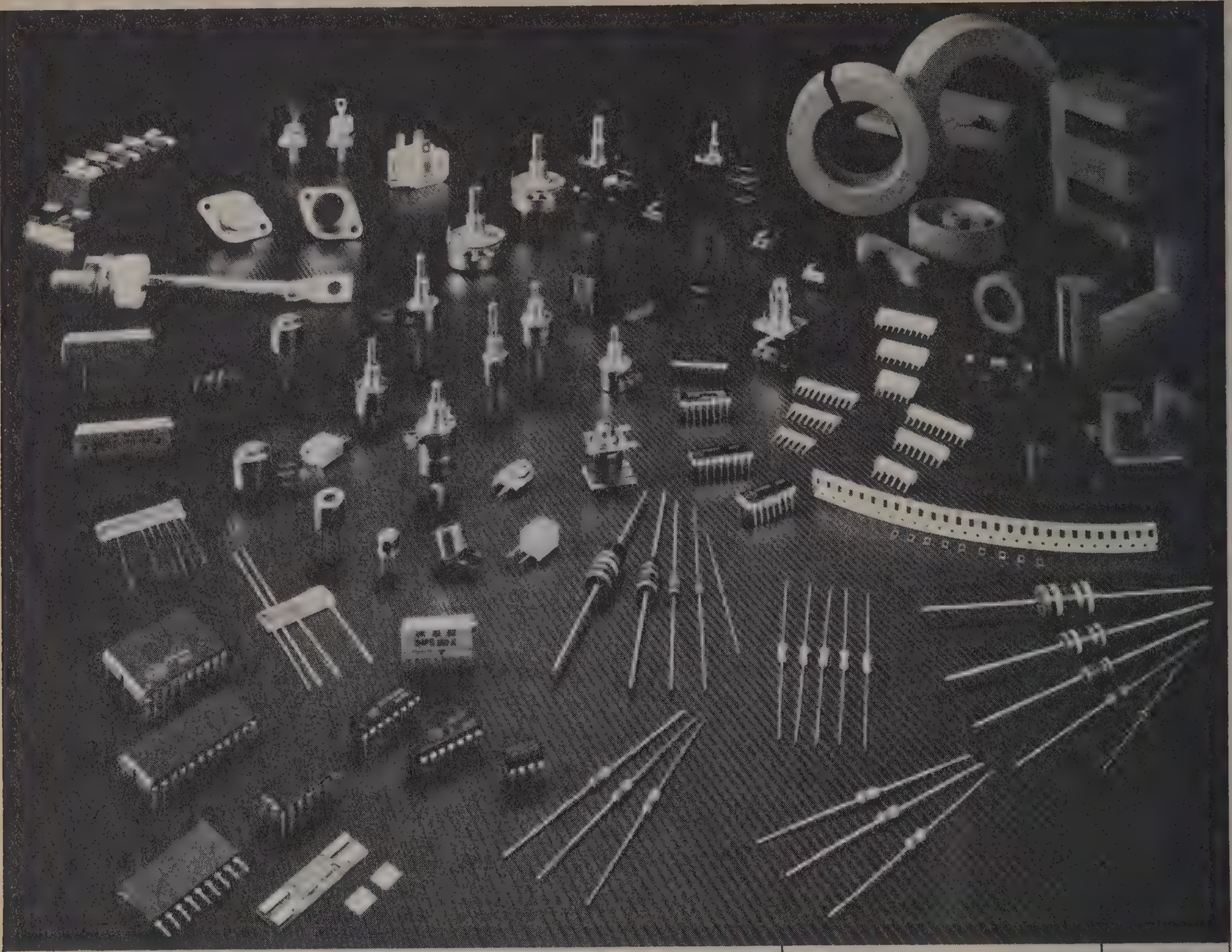
For more information about our component line contact your nearest Weinschel representative or call us toll free.

WEINSCHEL ENGINEERING
STEP BINAR ATTEN
PROGRAMMABLE ATTENUATOR

a long line of excellence.

800-638-2048

Weinschel Engineering
One Weinschel Lane
Gaithersburg, MD 20877
Telephone: (301) 948-3434
Telex: ITT440702 or WU89-8352



COMPONENT DESCRIPTION			TYPE/SERIES	PAGE
FIXED RESISTORS	Hot-Molded Composition		BB, CB, EB, GB, HB, GM, HM	1A•1792
	Metal Film		Types RN, RNK	1A•1793
RESISTOR NETWORKS	Thick Film (Cermet) Networks	Ceramic I-SIP	Series 100,400	1A•1794
		Conformal Coated C-SIP	Series 700	1A•1795
		Ceramic I-DIP	Series 314, 316	1A•1796
		Military DIP	Series 514, 516	1A•1797
	Thin Film (Precision) Networks	Standard DIP	Series F08, F14, F16	1A•1798
		Voltage Divider	Series FNPC207, FNRC399	1A•1799
		Custom	Series FC, FG	1A•1800
LEADLESS RESISTORS	Standard Chip Resistors		Type BC	1A•1802
TRIMMING POTENTIOMETERS	Cermet	Single-turn	Types S, 81, 90	1A•2019
		Multi-turn	Types 85, 94	1A•2019
	Hot-Molded Composition	Single-turn	Types F, Y, BT	1A•2019
		Multi-turn	Types N, R	1A•2019
PANEL POTENTIOMETERS	Cermet		MOD POT, Type SP	1A•2020
	Conductive Plastic		MOD POT, Types M, 2000	1A•2020
	Hot-Molded Composition		MOD POT, Types J, EJ, G, W, WR	1A•2020
POWER TRANSISTOR COMPONENTS (PTC)	High Voltage NPN Darlington Transistors		Various	1A•2088
	High Voltage NPN Transistors		Various	1A•2088
	Fast Recovery Rectifiers		Various	1A•2088
	Power Modules		Various	1A•2088
MAGNETIC PRODUCTS	Soft Ferrite Material		W5, R02, R03	2•1790
	Hard Ferrite Material		M6, M7, M8, M9, M9B, M10	2•1788

ALLEN-BRADLEY
1201 S. Second St.
Milwaukee, Wisconsin

electronic components

RESISTORS

Manufacturer	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Film		Wire-wound	Power			Foil	Fused	Chip	Networks	Precision	Features		
					Metallized & Non-metallized	Carbon		2W<R<5W	5 to 15W	>15W						High Voltage >1000V	Non-inductive	Flame Retardant
Allen-Bradley				1A•1792*	1A•1793*			1A•1792*					1A•1802	1A•1794- 1A•1801*				
Bourns														1A•1804- 1A•1806				
Caddock Electronics					1A•1808- 1A•1817 1A•1822- 1A•1825 1A•1827				1A•1810- 1A•1813	1A•1815				1A•1818- 1A•1821 1A•1826	1A•1808- 1A•1817 1A•1822- 1A•1825 1A•1827	1A•1810 1A•1811	1A•1808- 1A•1817 1A•1822- 1A•1825 1A•1827	
Cal-R							1A•1830* 1A•1831		1A•1831*	1A•1830*			1A•1829	1A•1829 1A•1831	1A•1830 1A•1831			
Capar Comps.					1A•1828	1A•1828		1A•1828						1A•1828				
Carborundum	1A•1832- 1A•1834								1A•1833	1A•1832				1A•1836- 1A•1844			1A•1832- 1A•1834	
Colber							1A•1845			1A•1845		1A•1845						1A•1845
CTS Berne			1A•1836- 1A•1844											1A•1836- 1A•1844				
Dale Electronics					1A•1854- 1A•1858*	1A•1860	1A•1861- 1A•1868*		1A•1859 1A•1862- 1A•1864*	1A•1860 1A•1861* 1A•1864- 1A•1868			1A•1853* 1A•1854	1A•1846- 1A•1852* 1A•1858	1A•1858* 1A•1861- 1A•1863*	1A•1859 1A•1860		1A•1856* 1A•1857*
Electro-Films													1A•1870 1A•1871	1A•1870 1A•1871				
Electronic Precision							1A•1869*		1A•1869*					1A•1869	1A•1869*			
E-Systems							1A•1872			1A•1872								
General Resistance							1A•1873								1A•1873			
HyComp													1A•1874	1A•1874				
International Comps.					1A•1876	1A•1876								1A•1876				1A•1876
Iskra Electronics						1A•1877*						1A•1877*						1A•1877*
Julie Research							1A•1878*		1A•1878*					1A•1878	1A•1878*			1A•1877*
K&M Electronics									1A•1883					1A•1883	1A•1883	1A•1883		
KDI Electronics													1A•1879	1A•1879*		1A•1879		
Kelvin							1A•1880- 1A•1882*	1A•1880*		1A•1881*				1A•1880	1A•1880- 1A•1882*	1A•1881*		
KOA Speer Electronics					1A•1886*	1A•1886*							1A•1888	1A•1886 1A•1887	1A•1886*			
Meissner							1A•1889*		1A•1889*						1A•1889*		1A•1889*	
Mepco/Electra					1A•1890*	1A•1890*							1A•1890*	1A•1891	1A•1890*			

* Mil. Spec.

RESISTORS

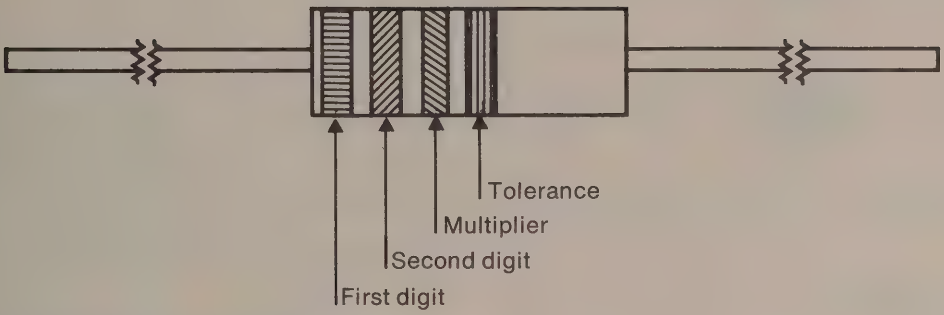
					Film			Power								Features		
Manufacturer	Bulk Ceramic	Ceramic Core	Cermet	Carbon Comp.	Metallized & Non-metallized	Carbon	Wire-wound	2W<R<5W	5 to 15W	>15W	Foil	Fused	Chip	Networks	Precision	High Voltage >1000V	Non-inductive	Flame Retardant
Micro-Ohm					1A•1893	1A•1893	1A•1892			1A•1892 1A•1894				1A•1895	1A•1892 1A•1893		1A•1892	1A•1894
Microplex													1A•1897					
Milwaukee Resistor							1A•1898- 1A•1900*			1A•1898- 1A•1900*							1A•1898*	1A•1898- 1A•1899*
Mini-Systems													1A•1902*	1A•1902*				
Murata Erie														1A•1903		1A•1905		
NIC Components		1A•1906			1A•1906	1A•1906									1A•1906		1A•1906	1A•1906
Nytronics		1A•1907* 1A•1908*					1A•1907- 1A•1909*		1A•1908*	1A•1909*							1A•1907- 1A•1909*	
Ohmite							1A•1910- 1A•1917*		1A•1910- 1A•1913*	1A•1914- 1A•1916					1A•1912*			1A•1910- 1A•1917*
Ohmtek			1A•1920										1A•1919- 1A•1921*	1A•1919- 1A•1921*			1A•1920	
Pacific Resistor							1A•1922 1A•1923	1A•1923	1A•1922						1A•1922		1A•1923	
Precision Resistive					1A•1925*									1A•1925	1A•1925			
Precision Resistor							1A•1926 1A•1927								1A•1926 1A•1927			
RCD Comps.			1A•1929*		1A•1929*	1A•1929*	1A•1929*	1A•1929*	1A•1929*	1A•1929*			1A•1929*	1A•1929*	1A•1929*	1A•1929*	1A•1929*	1A•1929*
RCL/Shallcross							1A•1930- 1A•1935*		1A•1930*	1A•1931* 1A•1932*		1A•1933		1A•1936	1A•1934* 1A•1935*		1A•1930 1A•1931 1A•1933	
Resistors, Inc.							1A•1937			1A•1937							1A•1937	
Res-Net					1A•1938				1A•1938					1A•1938	1A•1938			
Techno Components														1A•1939*				
Tel Labs					1A•1942*		1A•1943*		1A•1943*						1A•1942*			
TRW Resistive Prods.		1A•1944*		1A•1944*	1A•1944*	1A•1944*	1A•1944*	1A•1944*	1A•1944*	1A•1944*			1A•1944*	1A•1944*	1A•1944*	1A•1944*		
Ultronix							1A•1994- 1A•1999*		1A•1995*	1A•1996 1A•1998*	1A•1992* 1A•1993*			1A•1993 1A•1997	1A•1992- 1A•1994*			1A•1998*
Victoreen					1A•2000	1A•2000				1A•2001 1A•2002				1A•2001 1A•2003	1A•2000	1A•2001 1A•2002		
Vishay					1A•2011*		1A•2014 1A•2015			1A•2009				1A•2008 1A•2010	1A•2004- 1A•2007* 1A•2009 1A•2011* 1A•2014 1A•2015			

* Mil. Spec.

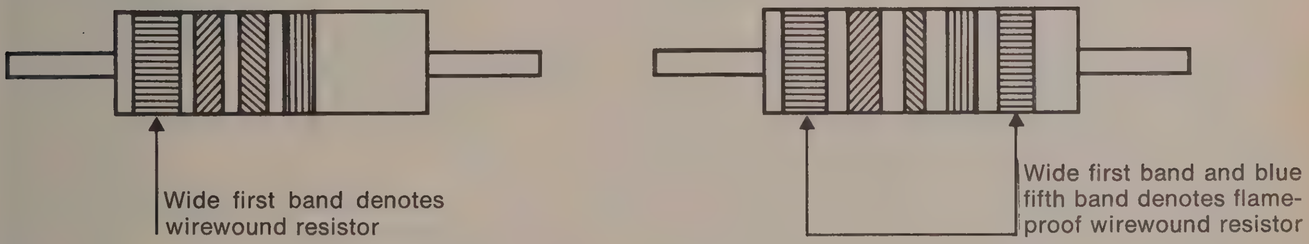
eem

MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes


Tolerance
Multiplier
Second digit
First digit

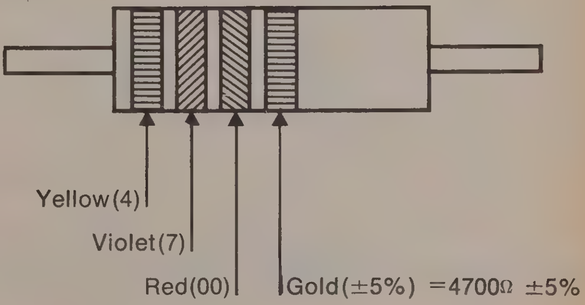
Color code for general-purpose industrial resistors


Wide first band denotes wirewound resistor
Wide first band and blue fifth band denotes flame-proof wirewound resistor

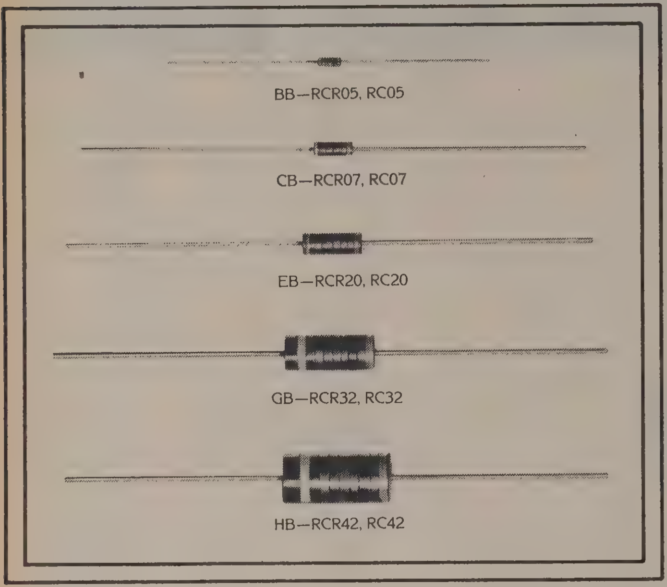
Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:


Yellow(4)
Violet(7)
Red(00)
Gold(±5%) =4700Ω ±5%

Types BB, CB, EB, GB, HB, GM, HM Hot-Molded Fixed Resistors



Allen-Bradley hot-molded composition resistors are high quality units intended for general purpose use in the electronics industry.

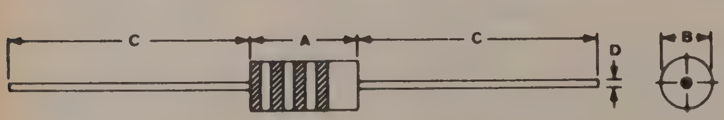
Allen-Bradley Style RCR resistors not only meet all requirements of MIL-R-39008 but also exceed the S level (best level) of Established Reliability of 0.001% failure rate per 1000 hours. And only Allen-Bradley resistors are available in S level reliability in all five wattage sizes over the entire resistance range. The S reliability level is indicated by a yellow 5th color band on the resistor body.

Metal-clad hot-molded resistors (Types GM and HM) are fitted with metal clamps which surround the major portion of the resistor. The metal clamps provide rigid mounting and efficient heat transfer from the resistors to the metal chassis or panels on which they are mounted.

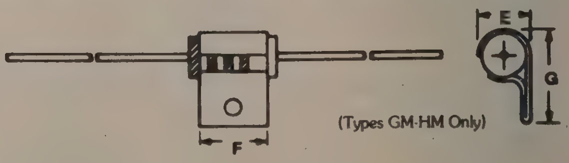
For more information request Publication EC5021-2.1.

SPECIFICATIONS

Type	Power at 70° C	Resistance Range	Tolerance	Voltage Rating (RMS)	Maximum Ambient Temperature	Dimensions in Inches (millimeters) A	B	C	D	E	F	G
BB	1/8 watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	150V	+130° C	0.145 (3.68)	0.062 (1.59)	1.000 (25.40)	0.015 (0.38)			
RCR05		2.7 Ohms to 22 Megohms	±5, 10%									
CB	1/4 watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	250V	+150° C	0.250 (6.35)	0.090 (2.29)	1.500 (38.10)	0.025 (0.64)			
RCR07		2.7 Ohms to 22 Megohms	±5, 10%									
EB	1/2 watt	1.0 Ohm to 100 Megohms	±5, 10, 20%	350V		0.375 (9.52)	0.140 (3.56)	1.500 (38.10)	0.033 (0.84)			
RCR20		1.0 Ohm to 22 Megohms	±5, 10%									
GB	1 watt	1.0 Ohm to 100 Megohms	±5, 10, 20%	500V		0.562 (14.29)	0.225 (5.72)	1.500 (38.10)	0.041 (1.04)			
RCR32		1.0 Ohm to 22 Megohms	±5, 10%									
HB	2 watts	10 Ohms to 100 Megohms	±5, 10, 20%	750V		0.688 (17.46)	0.312 (7.94)	1.500 (38.10)	0.045 (1.14)			
RCR42		10 Ohms to 22 Megohms	±5, 10%	500V								
GM	3 watts	1.0 Ohm to 22 Megohms	±5% ±10%	500V		0.562 (14.29)	0.225 (5.72)	1.500 (38.10)	0.041 (1.04)	0.305 (7.75)	0.438 (11.11)	0.656 (16.67)
HM	4 watts	10 Ohms to 22 Megohms		750V		0.688 (17.46)	0.312 (7.94)	1.500 (38.10)	0.045 (1.14)	0.391 (9.92)	0.562 (14.29)	0.766 (19.45)



(Types BB-CB-EB-GB-HB)



(Types GM-HM Only)

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

Types RN,RNK

Metal Film Fixed Resistors

Type RN

Type RNK

1/4 Watt at 70° C
10 Ohms to 1 Megohm
±1% Tolerance, ±5% Tolerance
±100 PPM/° C, ±200 PPM/° C

FEATURES

- Highly Stable Metal Film
- Tight TCR
- Laser Trimmed Element
- High Quality Performance
- Standard Tape Reel Packaging
- Automatically Insertable

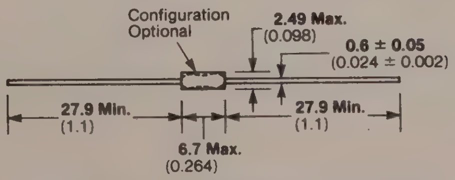
Allen-Bradley metal film resistors are high quality units intended for general purpose use in the electronics industry.

Nichrome resistance element provides stable performance under load, in various environments, and on the shelf. Type RN performance characteristics are better than MIL-R-22684 (RL07) requirements. Type RNK performance characteristics are better than MIL-R-10509 (RN55D) requirements.

For more information request Publication EC5030-2.1 (Type RN) or Publication EC5032-2.1 (Type RNK).

SPECIFICATIONS

Type	Power at 70°C	Resistance Range	Tolerance	RCWV	Maximum Ambient Temperature
RN	¼ Watt	10 Ohms to 1.0 Megohm	± 5, 2%	250V or Less	+ 155°C
RNK	¼ Watt	10 Ohms to 1.0 Megohm	± 1%	250V or Less	+ 155°C

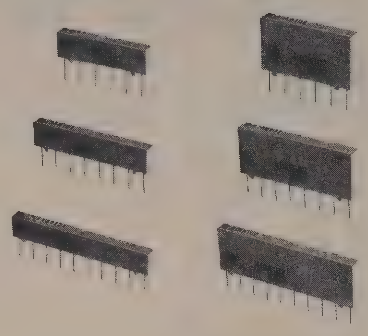


Note: Dimensions in Millimeters (inches).

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

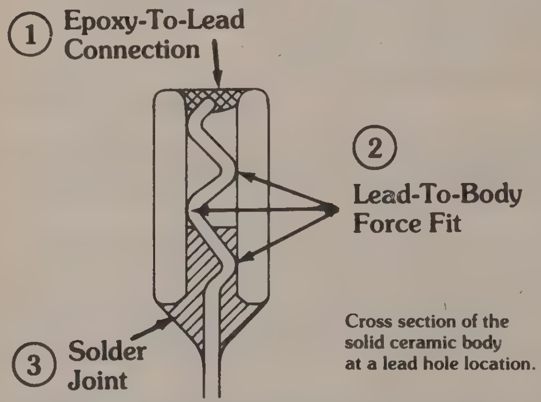
Series 100 400 Cermet Resistor Networks



I-SIP
Single In-Line Package

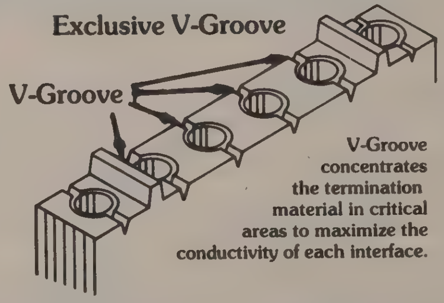
Tough new package

Triple-Strength Leads


①
Epoxy-To-Lead Connection
②
Lead-To-Body Force Fit
③
Solder Joint

Cross section of the solid ceramic body at a lead hole location.

Exclusive V-Groove



V-Groove concentrates the termination material in critical areas to maximize the conductivity of each interface.

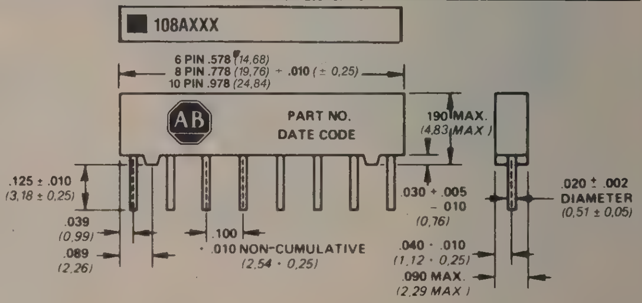
FEATURES

- Solid Ceramic Body, with V-Groove
- Triple-Strength Leads
- 0.100 Inch (2,54mm) Lead Spacing
- Two Package Heights:
  0.190 Inch (4,83mm), 0.350 Inch (8,89mm)
- 6, 8 and 10 Pins
- Automatically Insertable
- Permanent Laser Marking
- Part Markings — Side and Top

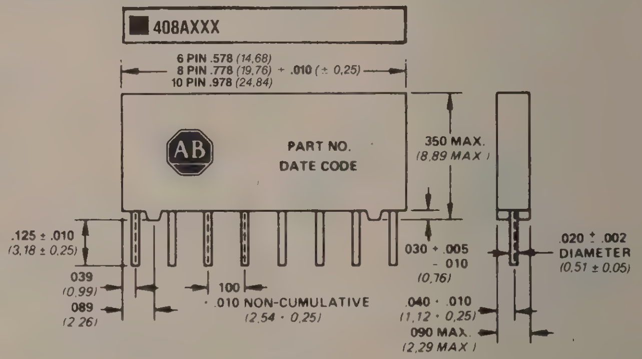
For more information request Publication EC5420-2.1

DIMENSIONS

Low profile 100 series


■ 108AXXX
6 PIN .578 (14,68)
8 PIN .778 (19,76) + .010 (± 0,25)
10 PIN .978 (24,84)
AB
PART NO.
DATE CODE
190 MAX.
(4,83 MAX)
.125 ± .010
(3,18 ± 0,25)
.039
(0,99)
.089
(2,26)
.100
· .010 NON-CUMULATIVE
(2,54 · 0,25)
.030 + .005
− 010
(0,76)
.040 · .010
(1,12 · 0,25)
.090 MAX.
(2,29 MAX)
.020 ± .002
DIAMETER
(0,51 ± 0,05)

High profile 400 series


■ 408AXXX
6 PIN .578 (14,68)
8 PIN .778 (19,76) + .010 (± 0,25)
10 PIN .978 (24,84)
AB
PART NO.
DATE CODE
350 MAX.
(8,89 MAX)
.125 ± .010
(3,18 ± 0,25)
039
(0,99)
089
(2 26)
100
· .010 NON-CUMULATIVE
(2,54 · 0,25)
030 + .005
- 010
(0,76)
.040 · .010
(1,12 · 0,25)
090 MAX.
(2,29 MAX)
.020 ± .002
DIAMETER
(0,51 ± 0.05)

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES

Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5° Except as Specified.

NOT TO SCALE

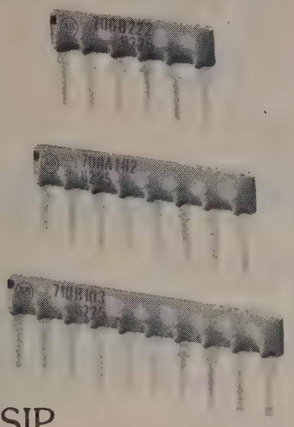
Applications

- — Pull-up and pull-down arrays
- — Transmission line terminators
- — Current limiting resistors
- — ECL terminating networks
- — A wide array of custom designs

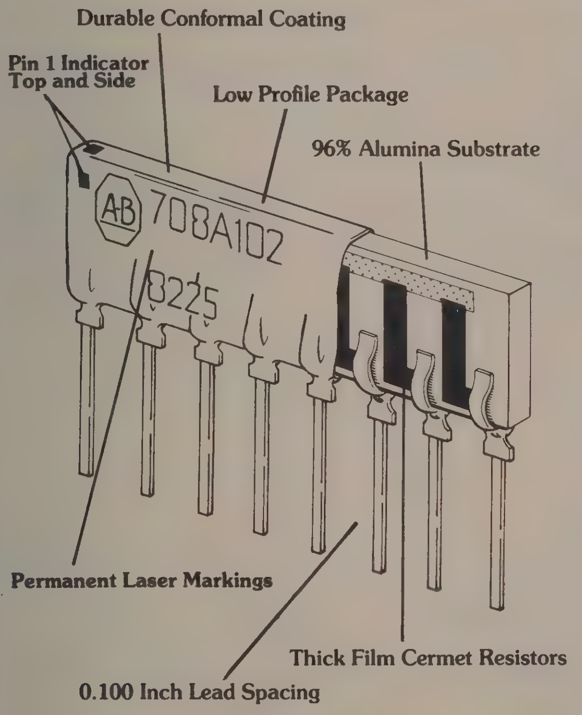
ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

Series 700 Conformal Coated Cermet Resistor Networks



C-SIP
Single In-Line Package


Durable Conformal Coating
Pin 1 Indicator Top and Side
Low Profile Package
96% Alumina Substrate
AB 708A102
8225
Permanent Laser Markings
Thick Film Cermet Resistors
0.100 Inch Lead Spacing

Applications

- Pull-up and pull-down arrays
- Transmission line terminators
- Current limiting resistors
- ECL terminating networks

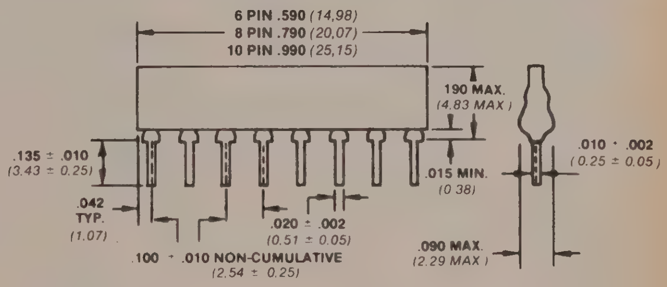
FEATURES

- 96% Alumina Substrate
- Permanently Laser Marked, Top and Side
- 0.100 Inch (2,54mm) Lead Spacing
- Low Package Height 0.190 Inch (4,83mm)
- 6, 8 and 10 Pins
- Durable Conformal Coating
- Standard Circuits
- High Quality

For more information request Publication EC5440-2.1

DIMENSIONS

Low profile 700 series

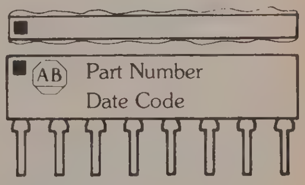

6 PIN .590 (14,98)
8 PIN .790 (20,07)
10 PIN .990 (25,15)
190 MAX. (4,83 MAX)
.135 ± .010 (3.43 ± 0.25)
.015 MIN. (0 38)
.010 ± .002 (0.25 ± 0.05)
.042 TYP. (1.07)
.020 ± .002 (0.51 ± 0.05)
.100 ± .010 NON-CUMULATIVE (2.54 ± 0.25)
.090 MAX. (2.29 MAX)

NOT TO SCALE

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

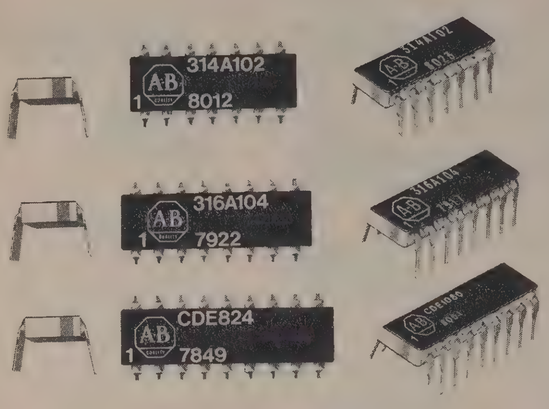
Standard Markings

A-B Logo
A-B Part Number
Date Code
Pin #1 Indicator ■
Top and Side


AB
Part Number
Date Code

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204


314A102
AB
1
8012
316A104
7922
CDE824
7849
314A102
316A104
CDE1080

I-DIP
Dual In-Line Package

Series 314, 316 Cermet Resistor Networks

FEATURES

- Solid Ceramic Body
- Solder Coated Leads
- 0.100 Inch (2,54mm) Lead Spacing
- Low Profile
- 14, 16 and 18 Pin Construction
- Automatically Insertable

For more information request Publication EC5410-2.1.

Standard network applications

NETWORK								
314A 316A	314B 316B	314E 316E	316LR8 316L08 314L10	314M110 314M120 314M125	314M130	316T110	314X101 316X101	314Z
APPLICATIONS								
Pull-Up Resistor Arrays for Unused TTL Gates Parallel High Speed Circuitry Wired OR Configurations Pull-Down Applications TTL-MOS Interfacing Digital Pulse Squaring	Transmission Line Termination Power Gate Pull-Up Current Limiting Logic Level Translation	Digital Line Termination ECL and TTL Applications	8 BIT R/2R Ladder 10 BIT R/2R Ladder Network for D/A and A/D Converter with Bi Polar or CMOS Switches	Complement the 7520 Series of Core Memory Sense Amps	Core-Memory Sense Line Applications with Two 711 Dual Voltage Comparators	TTL to ECL Translator Network	Interconnect Networks Shorting Applications Matrix Interconnections Test Plugs	Fixed Voltage Attenuation with Impedance Matching

DIMENSIONS

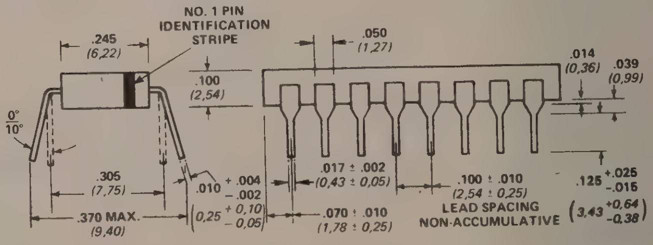
"A" Maximum		Number of Leads
Decimal	Metric	
.745	18,92	14
.845	21,46	16
.945	24,00	18

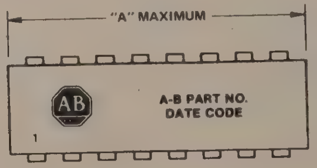
Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES

Dimensional Tolerance ± .005 (0,13)
Angular Tolerance ± 5° Except as Specified.

NOT TO SCALE


NO. 1 PIN IDENTIFICATION STRIPE
.245 (6,22)
.100 (2,54)
.050 (1,27)
.014 (0,36)
.039 (0,99)
0° 10°
.305 (7,75)
.370 MAX. (9,40)
.010 + .004 − .002 (0,25 + 0,10 − 0,05)
.017 ± .002 (0,43 ± 0,05)
.070 ± .010 (1,78 ± 0,25)
.100 ± .010 (2,54 ± 0,25)
LEAD SPACING NON-ACCUMULATIVE
.125 +.025 −.015 (3,43 +0,64 −0,38)

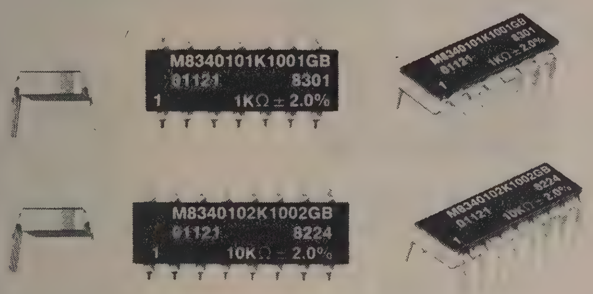

"A" MAXIMUM
AB
A-B PART NO.
DATE CODE
1

Standard Markings

A-B Logo
A-B Part Number
Date Code
Pin #1

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204


M8340101K1001GB
01121 8301
1 1KΩ ± 2.0%
M8340102K1002GB
01121 8224
1 10KΩ ± 2.0%

I-DIP
Dual In-Line Package

Series 514, 516 Military Resistor Networks MIL-R-83401

FEATURES

- Solid Ceramic Body
- Solder Coated Leads
- 100% Screened per MIL-R-83401
- Low Profile
- 14 and 16 Pin Construction
- Automatically Insertable
- MIL-R-83401 Qualified

For more information request Publication EC5430-2.1.

General capabilities

Package Style Number of Pins

M83401	Description
01	14 pin DIP
02	16 pin DIP

Schematic Circuit Layout

M83401	Description
A	Isolated resistors
B	Resistors with a common buss

Characteristic Temperature Coefficient

M83401	Description
K	±100 ppm/°C
M	±300 ppm/°C

Tolerance

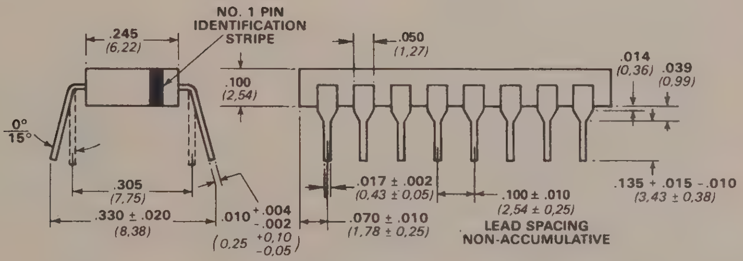
M83401	Description
F	±1%
G	±2%
J	±5%

Resistance Range

33 ohms to 1 megohm

DIMENSIONS

"A" Maximum		Number of Leads
Decimal	Metric	
.745	18,92	14
.845	21,46	16

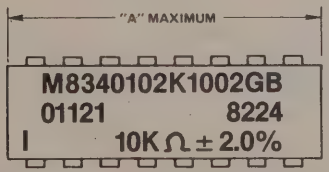

NO. 1 PIN IDENTIFICATION STRIPE
.245 (6,22)
.050 (1,27)
.014 (0,36)
.039 (0,99)
.100 (2,54)
0° 15°
.305 (7,75)
.330 ± .020 (8,38)
.010 +.004 -.002 (0,25 +0,10 -0,05)
.017 ± .002 (0,43 ± 0,05)
.070 ± .010 (1,78 ± 0,25)
.100 ± .010 (2,54 ± 0,25)
LEAD SPACING NON-ACCUMULATIVE
.135 + .015 - .010 (3,43 ± 0,38)

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES

Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5° Except as Specified.

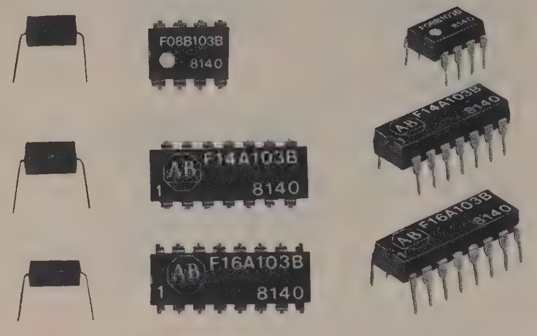
NOT TO SCALE


"A" MAXIMUM
M8340102K1002GB
01121 8224
I 10K Ω ± 2.0%

Standard Markings
Military Part Number
Federal Source Code
Date Code
Pin 1

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204


F08B103B
8140
F14A103B
8140
F16A103B
8140
AB
1

DIP
Dual In-Line Package

Series F08, F14, F16 Thin Film Resistor Networks

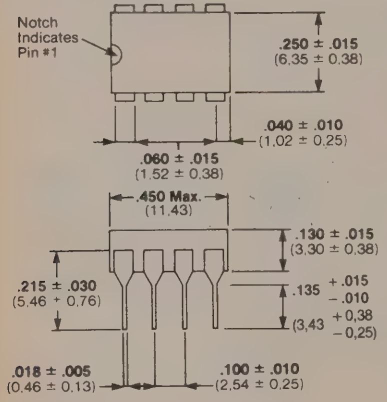
FEATURES

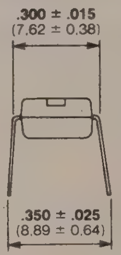
- 99.5% Alumina Substrate
- Molded Epoxy DIP Package
- 0.100 Inch (2,54mm) Lead Spacing
- Low Profile
- 8, 14 and 16 Pin Construction
- Automatically Insertable
- Meets Specifications of Characteristic V of MIL-R-83401

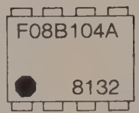
For more information request Publication EC5512-2.1.

DIMENSIONS

Series F08B


Notch Indicates Pin #1
.250 ± .015 (6,35 ± 0.38)
.040 ± .010 (1,02 ± 0,25)
.060 ± .015 (1,52 ± 0.38)
.450 Max. (11,43)
.130 ± .015 (3,30 ± 0,38)
.215 ± .030 (5,46 ± 0,76)
.135 +.015 −.010 (3,43 +0,38 −0,25)
.018 ± .005 (0,46 ± 0.13)
.100 ± .010 (2,54 ± 0,25)


.300 ± .015 (7,62 ± 0.38)
.350 ± .025 (8,89 ± 0.64)


F08B104A
8132

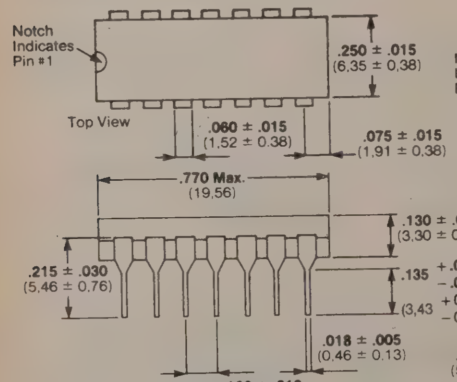
Standard Marking
A-B Part Number
Date Code
Pin #1

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

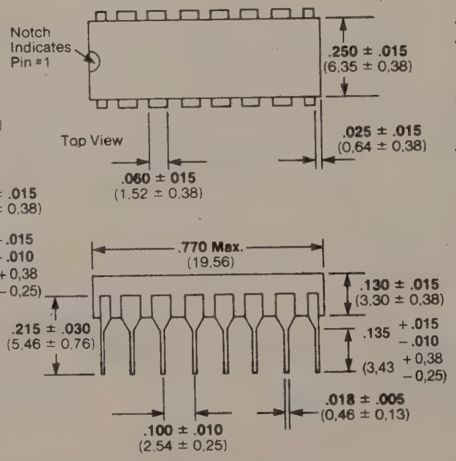
TOLERANCES
Dimensional Tolerance ±.005 (0,13)
Angular Tolerance ±5° Except as Specified.

NOT TO SCALE

Series F14A, F14B, F16A, and F16B


Notch Indicates Pin #1
.250 ± .015 (6,35 ± 0,38)
Top View
.060 ± .015 (1,52 ± 0.38)
.075 ± .015 (1,91 ± 0.38)
.770 Max. (19,56)
.130 ± .015 (3,30 ± 0.38)
.215 ± .030 (5,46 ± 0,76)
.135 +.015 −.010 (3,43 +0,38 −0,25)
.018 ± .005 (0,46 ± 0.13)
.100 ± .010 (2,54 ± 0,25)

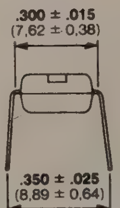
14 Pin Package

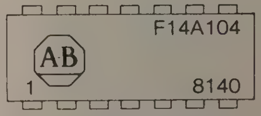

Notch Indicates Pin #1
.250 ± .015 (6,35 ± 0,38)
Top View
.025 ± .015 (0,64 ± 0,38)
.060 ± 015 (1,52 ± 0.38)
.770 Max. (19,56)
.130 ± .015 (3,30 ± 0,38)
.215 ± .030 (5,46 ± 0.76)
.135 +.015 −.010 (3,43 +0,38 −0,25)
.018 ± .005 (0,46 ± 0,13)
.100 ± .010 (2,54 ± 0,25)

16 Pin Package

Standard network applications

NETWORK	
F14A F16A	F08B F14B F16B
APPLICATIONS	
Pull-Up Resistor Arrays for Open TTL Gates Parallel High Speed Circuitry Wired OR Configurations Pull-Down Applications TTL-MOS Interfacing Digital Pulse Squaring	Matched Pairs Current Limiting Transmission Line Termination Power Gate Pull-Up Logic Level Translation


.300 ± .015 (7,62 ± 0,38)
.350 ± .025 (8,89 ± 0,64)


F14A104
AB
1
8140

Standard Marking
A-B Logo
A-B Part Number
Date Code
Pin #1

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

Series **FNPC207** **FNRC399**

Precision Voltage Dividers

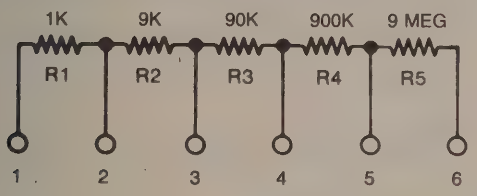
Standard Thin Film Resistor Networks

FEATURES

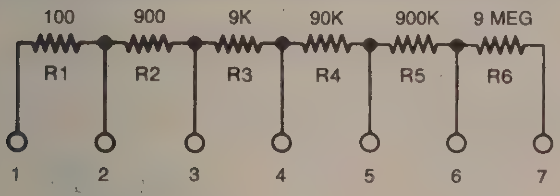
FNPC207	FNRC399
• 10 Megohms Range	• 10 Megohms Range
• 5 Decades Attenuation	• 5 or 6 Decades Attenuation
• .03% Ratios	• .03% Ratios
• 0 to 1000 Volts	• 0 to 1000 Volts
• ±5 ppm/°C Tracking	• ±5 ppm/°C Tracking 1K, 10K, 100K, 1M to 10M
• Operating Temperature — 0°C to +70°C	• Operating Temperature — 0°C to +70°C
• Storage Temperature — -65°C to +175°C	• Storage Temperature — -65°C to +175°C
• Voltage Coefficient — 0.01 ppm/volt or less	• Voltage Coefficient — 0.01 ppm/volt or less

For more information request Publication EC5515-2.2.

Network schematic FNPC207


1K
9K
90K
900K
9 MEG
R1
R2
R3
R4
R5
1
2
3
4
5
6

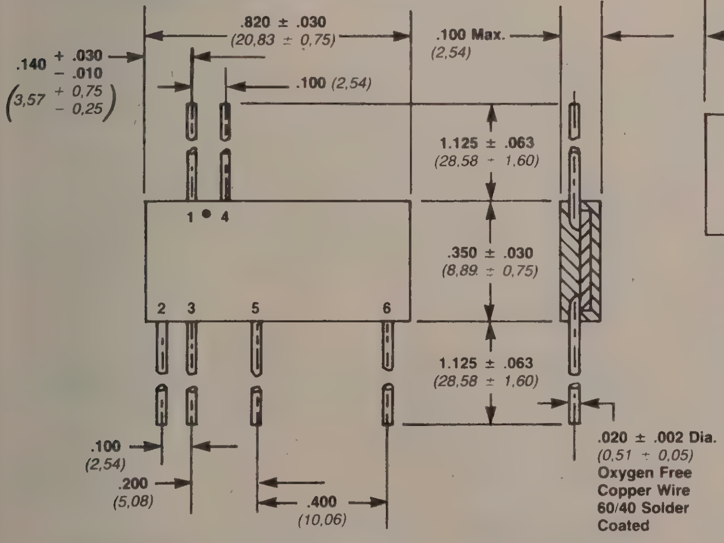
Network schematic FNRC399


100
900
9K
90K
900K
9 MEG
R1
R2
R3
R4
R5
R6
1
2
3
4
5
6
7

DIMENSIONS

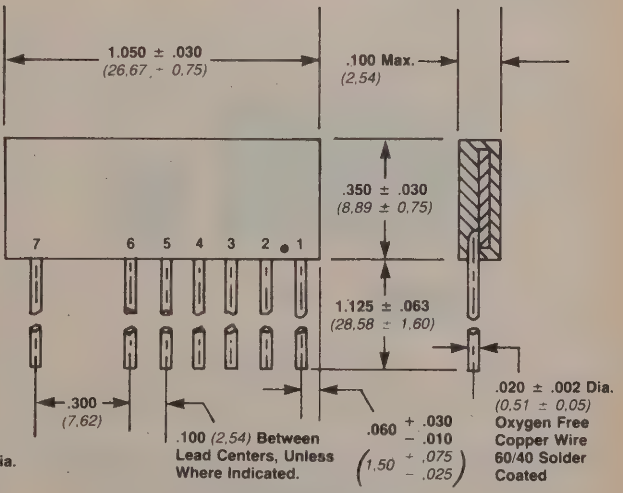
Series FNPC207

Conformally Coated — Similar to FN207


.820 ± .030
(20,83 ± 0,75)
.100 Max.
(2,54)
.140 + .030 − .010
(3,57 + 0,75 − 0,25)
.100 (2,54)
1.125 ± .063
(28,58 ± 1,60)
1 • 4
.350 ± .030
(8,89 ± 0,75)
2 3 5 6
1.125 ± .063
(28,58 ± 1,60)
.100
(2,54)
.200
(5,08)
.400
(10,06)
.020 ± .002 Dia.
(0,51 ± 0,05)
Oxygen Free
Copper Wire
60/40 Solder
Coated

Pin 1 Indicated With Dot.

Series FNRC399


1.050 ± .030
(26,67 ± 0,75)
.100 Max.
(2,54)
.350 ± .030
(8,89 ± 0,75)
7 6 5 4 3 2 • 1
1.125 ± .063
(28,58 ± 1,60)
.300
(7,62)
.100 (2,54) Between
Lead Centers, Unless
Where Indicated.
.060 + .030 − .010
(1,50 + ,075 − ,025)
.020 ± .002 Dia.
(0,51 ± 0,05)
Oxygen Free
Copper Wire
60/40 Solder
Coated

Pin 1 Indicated With Dot.

Basic dimensions in inches.
Dimensions shown in parentheses are in millimeters.

TOLERANCES

Dimensional Tolerance ±.015 (0,38)
Except as Specified.

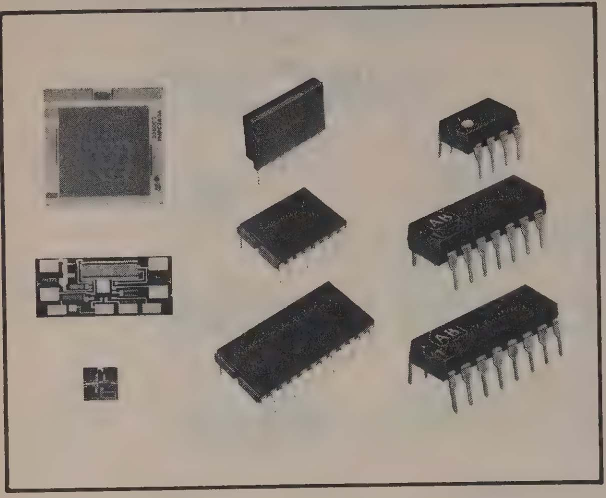
NOT TO SCALE

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

Series FC, FG

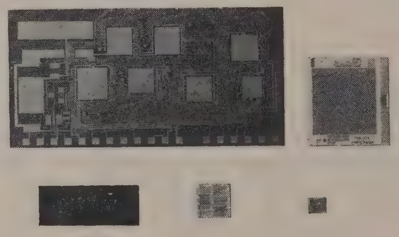
Precision Thin Film Custom Resistor Networks



Applications

These precision networks are ideally suited for use on any electronic equipment requiring close tolerances and/or low temperature coefficient resistors. Some of these applications are listed below.

- Ladder networks
- Digital multimeters
- Current summing applications
- Precision attenuators
- A/D and D/A converters
- Communication equipment
- Precision voltage dividers
- Telemetry equipment
- Coding and decoding circuitry
- Measurement bridges
- Paging systems



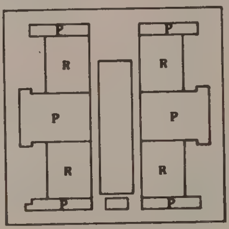
Chip Networks and
Hybrid Network Substrates

Hybrid network substrates — Allen-Bradley hybrid network substrates contain resistors, bonding pads and interconnections used in producing hybrid networks. Allen-Bradley does not manufacture complete hybrid circuits, but does manufacture the basic hybrid network substrates.

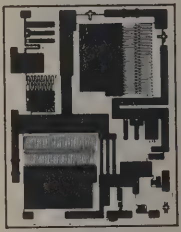
FEATURES

- 1K Ohms to 10 Megohms
- ± 0.015% Tolerance
- ± 0.015% Ratio
- ± 25 ppm/°C TCR
- ± 5 ppm/°C TCR Tracking
- SIP Package (ceramic)
- DIP Packages (molded and ceramic)
- Chip Resistor Networks (alumina or glass)
- Hybrid Network Substrates (alumina or glass)

For more information request Publication EC5510-2.1.



Chip Network



Hybrid Network Substrate

Termination and bonding pad material — Gold, with a minimum thickness of 5000A, is used for all termination pads, bonding pads and interconnections. This material is compatible with ultrasonic and thermocompression bonding methods for attaching gold or aluminum wire, integrated circuit dice, LID's or beam leaded IC's. Chip capacitors can be attached by reflow solder methods.

Substrate material — Glass: Corning 7059 glass (Barium Alumino Silicate - electrically inert [Alkali-free]) .032 ±.005 inch (0,81 ±0,13mm) thick. Ceramic: 99.5% Alumina, .010 ± .001 inch (2,54 ±0,3mm) thick.

User trimmable option — Chip and hybrid network resistors can be trimmed to tolerance by Allen-Bradley or, if needed, resistors can be

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

designed for active trimming by the user during final hybrid assembly operations to meet predetermined functional requirements. The amount of adjustment available is dependent on the initial resistance value, resolution, final value and available substrate area. The active trimming results in a positive resistance change only and can be done by mechanical methods or a laser. These networks are referred to as user trimmable resistor networks.

Standard substrate sizes (in inches) —
.150 x .150 .350 x .150 .200 x .200 .600 x .200
.250 x .150 .450 x .150 .400 x .200 .250 x .250

Bonding pad sizes — 5 mils x 5 mils minimum.

Resistance range — 1K ohms to 10 megohms.

Tolerances — Absolute: as low as ± 0.015% at + 25°C. Ratio: as low as ± 0.015% at + 25°C.

TCR — ± 25 ppm/°C
TCRT — ± 5 ppm/°C

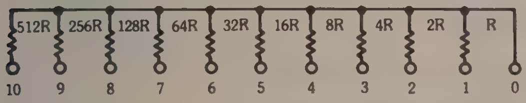
Temperature ranges of operation — –55°C to +125°C or 0°C to +70°C. Other ranges available.

Power rating — Up to 50mw per resistor.

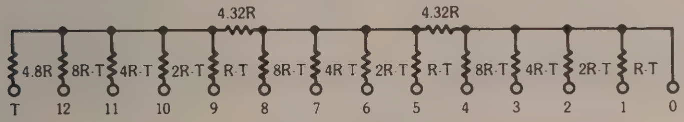
DIAGRAMS

Thin film custom resistor network suggestions

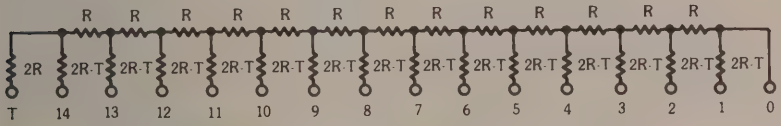
A/D — D/A Converter Networks


512R
256R
128R
64R
32R
16R
8R
4R
2R
R
10
9
8
7
6
5
4
3
2
1
0

Binary Code — Summing Ladder Network

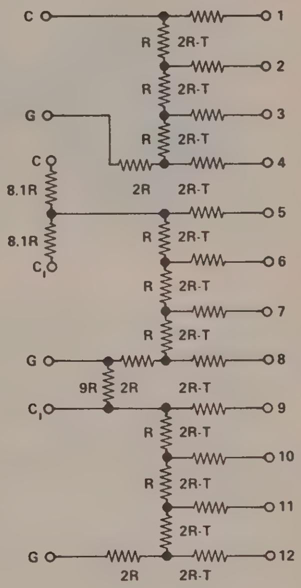

4.32R
4.32R
4.8R
8R·T
4R·T
2R·T
R·T
8R·T
4R·T
2R·T
R·T
8R·T
4R·T
2R·T
R·T
T
12
11
10
9
8
7
6
5
4
3
2
1
0

1-2-4-8 BCD Code Ladder Network

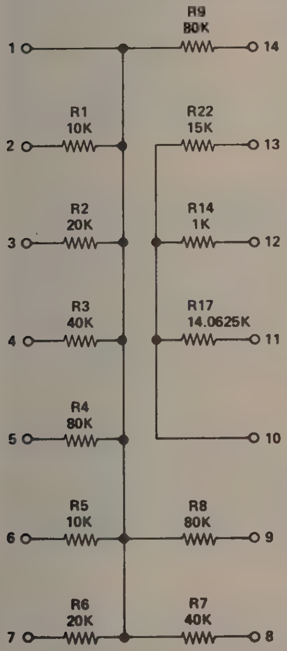

R
R
R
R
R
R
R
R
R
R
R
R
R
2R
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
2R·T
T
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0

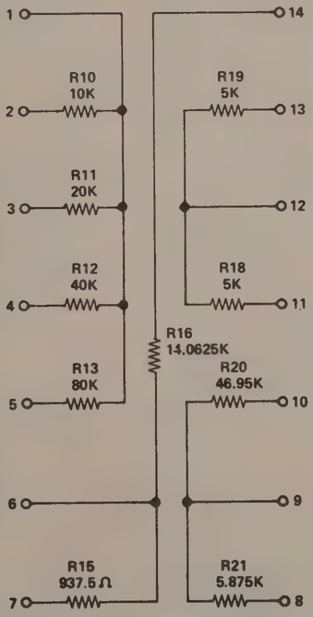
Binary Code — R/2R Voltage Ladder Network

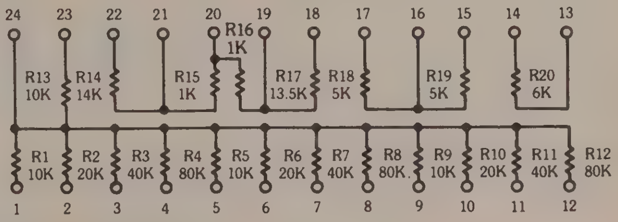
1-2-4-8 BCD Code Ladder Network


C
1
R
2R-T
2
R
2R-T
3
G
R
2R-T
4
C
8.1R
2R
2R-T
5
8.1R
C₁
R
2R-T
6
R
2R-T
7
R
2R-T
G
8
9R
2R
2R-T
C₁
9
R
2R-T
10
R
2R-T
11
2R-T
G
12
2R
2R-T

A/D - D/A Converter Networks for use with integrated circuit quad current switches


R9
80K
1
14
R1
10K
2
R22
15K
13
R2
20K
3
R14
1K
12
R3
40K
4
R17
14.0625K
11
R4
80K
5
10
R5
10K
6
R8
80K
9
R6
20K
7
R7
40K
8


1
14
R10
10K
2
R19
5K
13
R11
20K
3
12
R12
40K
4
R18
5K
11
R16
14.0625K
R13
80K
5
R20
46.95K
10
6
9
R15
937.5Ω
7
R21
5.875K
8

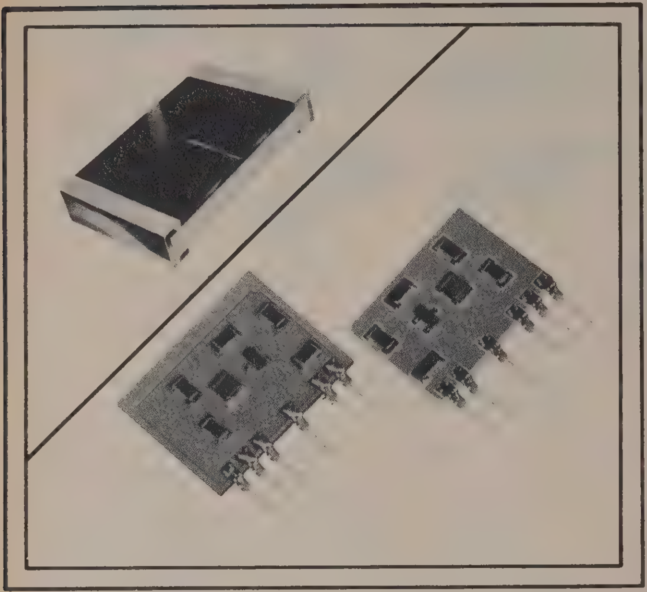

24
23
22
21
20
19
18
17
16
15
14
13
R16
1K
R13
10K
R14
14K
R15
1K
R17
13.5K
R18
5K
R19
5K
R20
6K
R1
10K
R2
20K
R3
40K
R4
80K
R5
10K
R6
20K
R7
40K
R8
80K
R9
10K
R10
20K
R11
40K
R12
80K
1
2
3
4
5
6
7
8
9
10
11
12

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

Type BC Chip Resistor

1/8 Watt at 70° C
±5%, 200 PPM/° C
±1%, 100 PPM/° C
Zero Ohm Jumper



FEATURES

- Thick Film Resistance Element
- High Purity Alumina Substrate
- Glass Passivated
- Tight TCR
- Standard Size, 1.6 x 3.2 x 0.6 mm
- Wrap-around Termination
- Inner Electrode Protection
- Wave or Reflow Solderable
- Surface Attachable

For more information request Publication EC5110-2.1.

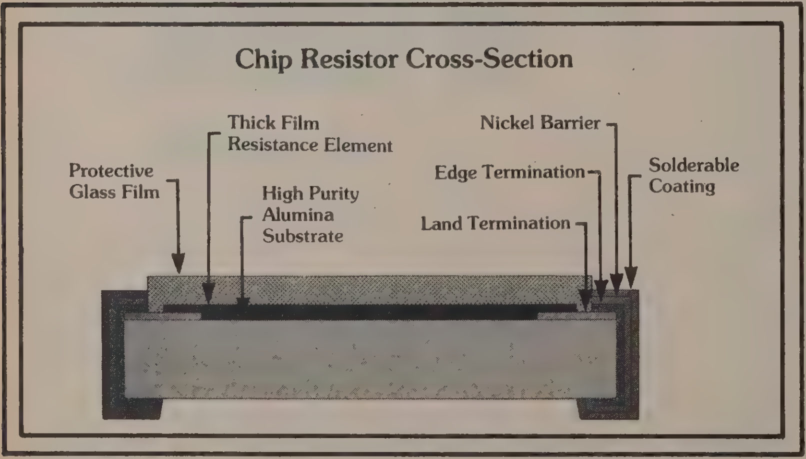
Nominal resistance range -
5% - 10 ohms to 2.2 megohms, E24 series
1% - 49.9 ohms to 2.2 megohms, E96 series.
Higher values available upon request.

Standard Resistance Values — 5% (E24)

10	15	22	33	47	68
11	16	24	36	51	75
12	18	27	39	56	82
13	20	30	43	62	91

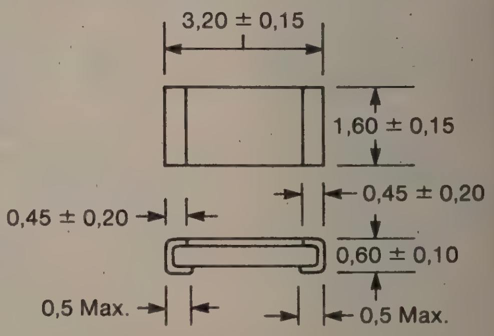
Standard Resistance Values — 1% (E96)

10.0	12.1	14.7	17.8	21.5	26.1	31.6	38.3	46.4	56.2	68.1	82.5
10.2	12.4	15.0	18.2	22.1	26.7	32.4	39.2	47.5	57.6	69.8	84.5
10.5	12.7	15.4	18.7	22.6	27.4	33.2	40.2	48.7	59.0	71.5	86.6
10.7	13.0	15.8	19.1	23.2	28.0	34.0	41.2	49.9	60.4	73.2	88.7
11.0	13.3	16.2	19.6	23.7	28.7	34.8	42.2	51.1	61.9	75.0	90.9
11.3	13.7	16.5	20.0	24.3	29.4	35.7	43.2	52.3	63.4	76.8	93.1
11.5	14.0	16.9	20.5	24.9	30.1	36.5	44.2	53.6	64.9	78.7	95.3
11.8	14.3	17.4	21.0	25.5	30.9	37.4	45.3	54.9	66.5	80.6	97.6


Chip Resistor Cross-Section

Thick Film Resistance Element
Nickel Barrier
Protective Glass Film
High Purity Alumina Substrate
Edge Termination
Solderable Coating
Land Termination

DIMENSIONS


3,20 ± 0,15
1,60 ± 0,15
0,45 ± 0,20
0,45 ± 0,20
0,60 ± 0,10
0,5 Max.
0,5 Max.

Note: All dimensions in millimeters.

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

NETWORKS DIVISION, 1400 North 1000 West, Logan, UT 84321
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 • TEL (714) 781-5050

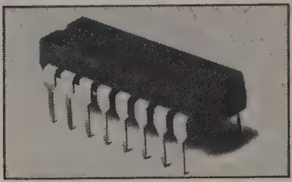
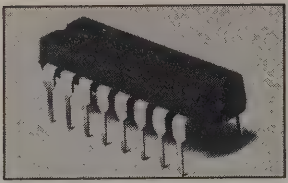
BOURNS® DIP RESISTOR NETWORKS

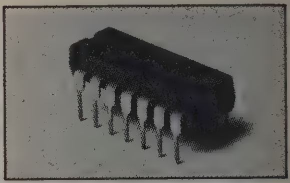
4114R-001
4116R-001
Dual-in-line isolated resistor circuits

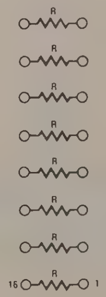
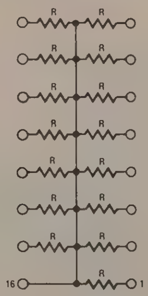
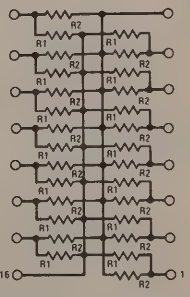
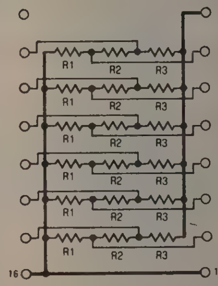
4114R-002
4116R-002
Dual-in-line bussed resistor circuits

4114R-003
4116R-003
Dual-in-line terminator

4114R-008
TTL to ECL translator



Resistance Range	22 ohms to 2.2 megohms	22 ohms to 2.2 megohms	R1 – R2 180 ohms – 390 ohms 220 ohms – 270 ohms 220 ohms – 330 ohms	R1 – R2 – R3 180 ohms – 270 ohms – 820 ohms
Operating Temperature	−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient
Resistance Tolerance	±2% or ±2 ohms	±2% or ±2 ohms	±2% or ±2 ohms	±2% or ±2 ohms
Insulation Resistance	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum
Power Rating @ 75°C	(Derating curve) Package 14 pin - 2 watts 16 pin - 2.25 watts Single resistor - 0.25 watt	Package 14 pin - 2 watts 16 pin - 2.25 watts Single resistor - 0.125 watt	4114R-003 Package - 2 watts Resistor pair - .25 watt 4116R-003 Package - 2.25 watts Resistor pair - .25 watt	Package - 2.0 watts Single resistor - 0.125 watt
Temperature Coefficient	±250ppm/°C	±250ppm/°C	±250ppm/°C	±250ppm/°C
Standard Load Life	±1.0%	±1.0%	±1.0%	±1.0%
Schematic (Highest pin configurations shown)				

Custom Resistor Networks are available in both DIP and SIP configurations. Specifications subject to change without notice.

BOURNS® SIP RESISTOR NETWORKS

4114R-064
4116R-064
Logic memory network

Pass Thru	Pull-Up
*R1	*R2
20 ohms	1K
30 ohms	1K
40 ohms	1K

−55°C to
+125°C ambient

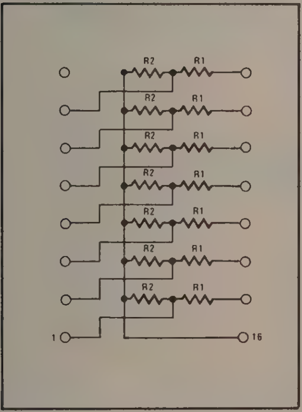
±2% or ±2 ohms

10,000 megohms
minimum

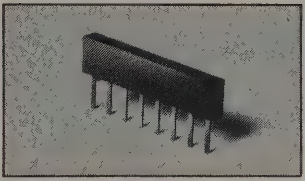
Package
14 pin - 2 watts
16 pin - 2.25 watts
Single resistor -
0.125 watt

±250ppm/°C

±1.0%



4306R-101
4308R-101
4310R-101
Single-in-line bussed



22 ohms to
2.2 megohms

−55°C to
+125°C ambient

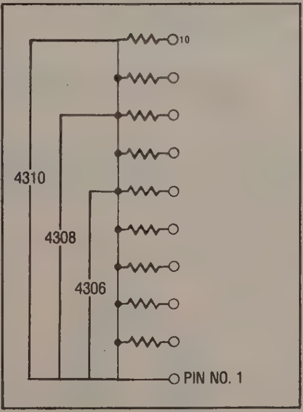
±2% or ±2 ohms

10,000 megohms
minimum

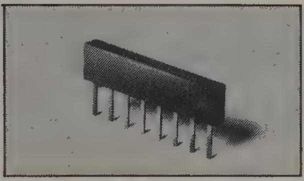
	6	8	10
	watt		
Package	0.75	1.0	1.25
Single resistor	0.2	0.2	0.2

±250ppm/°C

±1.0%



4306R-102
4308R-102
4310R-102
Single-in-line isolated



22 ohms to
2.2 megohms

−55°C to
+125°C ambient

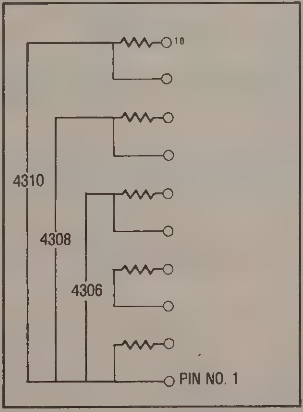
±2% or ±2 ohms

10,000 megohms
minimum

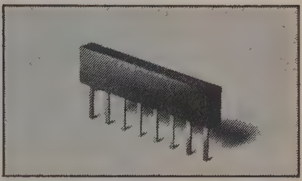
	6	8	10
	watt		
Package	0.75	1.0	1.25
Single resistor	0.3	0.3	0.3

±250ppm/°C

±1.0%



4306R-104
4308R-104
4310R-104
Single-in-line dual terminator



R1	R2
180 ohms	390 ohms
220 ohms	270 ohms
220 ohms	330 ohms
3000 ohms	6200 ohms

−55°C to
+125°C ambient

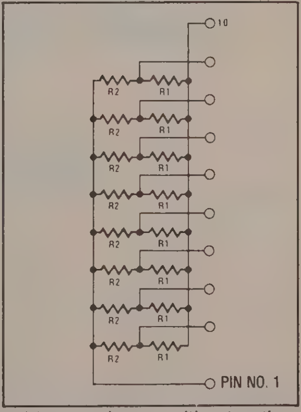
±2% or ±2 ohms

10,000 megohms
minimum

	6	8	10
	watt		
Package	0.75	1.0	1.25
Resistor pair	0.25	0.25	0.25

±250ppm/°C

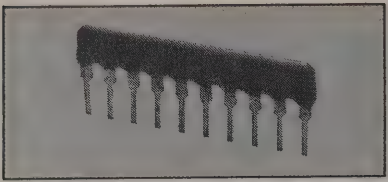
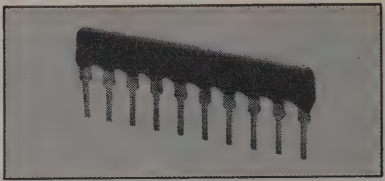
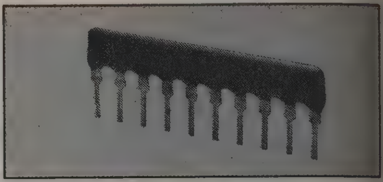
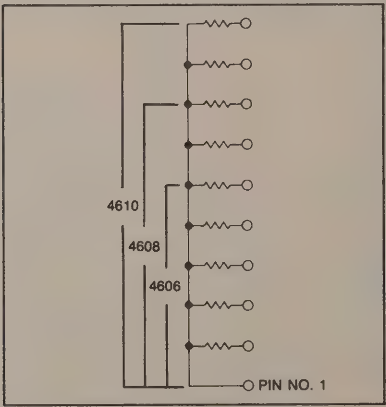
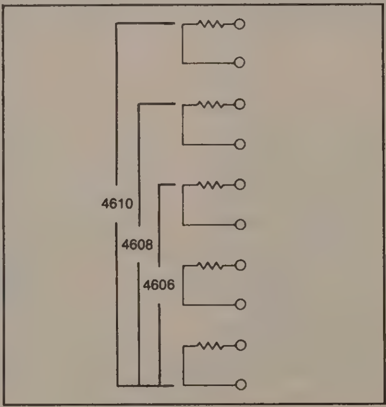
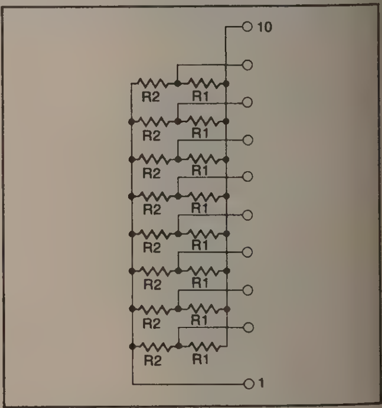
±1.0%



*Other values available.

Specifications subject to change without notice.

BOURNS® MODEL 4600 SERIES CONFORMAL COATED SIP NETWORKS

	4606X-101 **4608X-101** **4610X-101** Single-in-line bussed	**4606X-102** **4608X-102** **4610X-102** Single-in-line isolated	**4606X-104-R1/R2** **4608X-104-R1/R2** **4610X-104-R1/R2** Single-in-line dual terminator
			
Resistance Range	22 ohms to 2.2 megohms	22 ohms to 2.2 megohms	R1 R2 180 ohms 390 ohms 220 ohms 270 ohms 220 ohms 330 ohms 3000 ohms 6200 ohms
Operating Temperature	−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient
Resistance Tolerance	±2% or ±1 ohm	±2% or ±1 ohm	±2% or ±1 ohm
Insulation Resistance	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum
Power Rating @75°C	6 8 10 watt Package 0.75 1.0 1.25 Single resistor 0.2 0.2 0.2	6 8 10 watt Package 0.75 1.0 1.25 Single resistor 0.3 0.3 0.3	6 8 10 watt Package 0.75 1.0 1.25 Resistor pair 0.25 0.25 0.25
Temperature Coefficient	±100ppm/C°	±100ppm/C°	±100ppm/C°
Standard Load Life	±1.0%	±1.0%	±1.0%
Schematics			

BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM

General Radio

CAMDEN, NJ
(609) 964-8560

PENNSYLVANIA
(215) 922-7037

BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM

CAM RPC
ELECTRONICS

PITTSBURGH, PA
(412) 782-3770

HIGHLAND HTS, OH
(216) 461-4700

BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM

SPIRIT of the WEST

ACACIA SALES
A California Corporation

LAKEWOOD, CO
(303) 232-2882

CADDOCK

HIGH PERFORMANCE FILM RESISTORS

High Performance Film Resistors

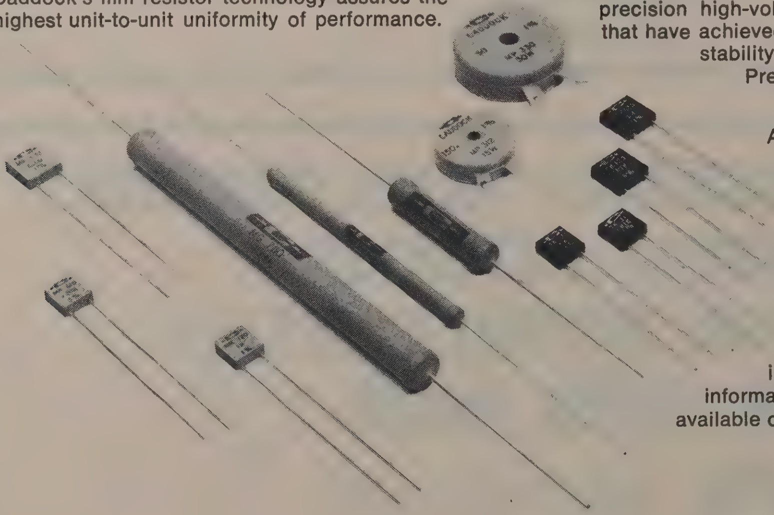
This 20th Edition of the Caddock Electronics General Catalog describes over 150 in-production models of precision discrete resistors and resistors networks that utilize Caddock's high-stability, extended-life Micronox® and Tetrinox™ resistance films. With 20 years of experience and an exceptional record of in-circuit performance and reliabilility, Caddock Electronics continues to lead the industry in the development, production and on-time delivery of high performance film resistors.

Caddock's Advanced Resistor Technology Provides Many Exceptional Performance Advantages:

Caddock's advanced resistor technology began in 1962 with the introduction of Micronox® harsh-environment high-power and high-voltage resistors. The Caddock technology was further extended in 1975 with the development of the Tetrinox™ resistance system that made possible the introduction of low TC, ultra-stable resistors and resistor networks.

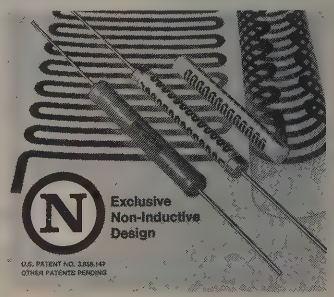
These technological advances have provided the electronics industry with a selection of precision resistor types that achieve many high-performance advantages:

- **Precision** — Tolerances as close as 0.01%.
- **Long-Term Stability** — Better than 0.005% per 1000 hours of operation under full load operating conditions.
- **Higher Power Ratings** — Up to five times higher than other resistor technologies.
- **High Operating Temperatures** — Up to +275°C.
- **Ultra-Low Temperature Coefficients** — Standard to less than 10 PPM/°C and custom values as low as 2 PPM/°C.
- **Unit-to-Unit Uniformity** — The inherent consistency of Caddock's film resistor technology assures the highest unit-to-unit uniformity of performance.



Caddock's Exclusive Non-Inductive Performance Is Available in Both High-Power and High-Voltage Micronox® Film Resistors.

For wide-band, high frequency applications, the advantages of Caddock's Exclusive Non-Inductive Design are available in most models of Micronox® resistors. This special serpentine pattern provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.



The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

The High-Performance Capabilities of Caddock Film Resistors Can Provide Improved Accuracy and Stability to Precision Circuitry:

Because of the special advantages of Caddock's resistance film technology, Caddock High Performance Film Resistors are often specified in the precision circuits that ultimately establish the overall accuracy and stability of the equipment.

Examples of such applications include many types of precision high-voltage supplies and voltage references that have achieved improved accuracy and extended-life stability through the use of Caddock Type MG Precision High-Voltage Resistors and Type T912 Precision Resistor Networks.

Additional examples of the application of this advanced resistor technology include the industry-wide use of Caddock Type 1776 and Type 1787 Precision Decade Divider Resistors in the signal input circuits of laboratory and bench-type digital voltage and current measuring instruments.

An introduction and index to these Caddock resistor technologies is provided on the next page. Additional information and technical assistance is also available directly from our technical staff.

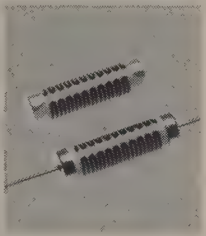
We welcome your call.

CADDOCK
ELECTRONICS, INCORPORATED.

High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Micronox® Resistance Films



For harsh environmental conditions, Caddock Micronox® resistors are truly unsurpassed. Produced by firing complex-oxide Micronox® resistance films onto ceramic core materials at temperatures above +1400°F, these precision resistors can withstand extremes of temperature, thermal shock, overvoltage and input power.

The result is a family of high voltage, high power precision resistors with an exceptional combination of performance advantages:

- **High Power Ratings** — to 30 watts.
- **High Voltage Ratings** — to 30,000 volts.
- **High Stability** — as close as 0.01% per 1000 hours in 50,000 hour extended life.
- **High Operating Temperatures** — up to +275°C.
- **A Wide Range of Resistance Values In Many Sizes** — from 30 ohms to 2000 Megohms.

These performance advantages make Caddock Micronox® film resistors ideal for use in many types of electronic circuitry, including —

- **Voltage Reference Circuits**
- **High Power Density Packaging**
- **Precision Feedback Circuits**
- **Matched TC Resistor Pairs**

Type MG Precision High-Voltage Resistors
Highest stability at continuous operation to 30,000 volts in single-resistor values as high as 2000 Megohms.

Pages **1A**•1810 and **1A**•1811

Type MS and MR Power Film Resistors
Power ratings to 15 watts at 6000 volts in a single axial-lead resistor - plus, Non-Inductive Performance is available.

Pages **1A**•1812 and **1A**•1813

Type ML and MM Precision Film Resistors
Molded case encapsulation to meet high temperature industrial and aerospace requirements.

Page **1A**•1814

Type MP Chassis Mounted Power Film Resistors
High power density in both 15 and 30 watt ratings with center-screw chassis mounting.

Page **1A**•1815

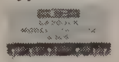
Type MK Low Cost Precision Film Resistors

MK 132
10MEG
0.1%

.75 watt rating at +125° C. Resistance range from 30 ohms to 100 Megohms.

Pages **1A**•1816 and **1A**•1817

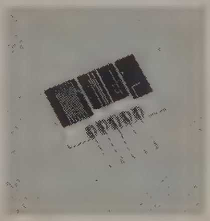
Type 1787 Current Shunt Resistor Networks



2-, 3- and 4-decade input networks for accurate current sensing in multi-range instrumentation.

Pages **1A**•1818 and **1A**•1819

Tetrinox™ Resistance Films



In high-accuracy instrumentation where outstanding circuit performance is required through variations of temperature and through long-term operation, Caddock Tetrinox™ resistance films are the answer.

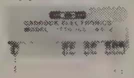
Constructed with advanced technology complex-oxide resistance films that are fired onto ceramic substrates, Caddock Tetrinox™ film resistors provide a unique combination of performance characteristics:

- **Ultra-Low Absolute and Ratio TC** — standard to less than 5 PPM/°C.
- **Ultra-Precision** — tolerances as tight as 0.01%.
- **High Resistance Range** — values to 10 Megohms in a miniature package.
- **Ultra-Stable in Loadlife** — ratio stability to within ±0.01% per 2000 hours.

This special combination of advantages make Caddock Tetrinox™ film resistors the optimum choice in many high stability applications, including —

- **Input Voltage Dividers in Precision Laboratory Instrumentation**
- **Precision Bridge Circuits**
- **Precision Voltage Reference Circuits.**
- **Ultra-Stable Voltage Dividers.**
- **Ultra-Low Power Precision Circuitry.**
- **Decade Resistance Networks.**

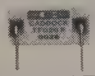
Type 1776 Precision Decade Resistor Voltage Dividers



33 models of decade voltage dividers for accurate voltage-division in multi-range digital instrumentation.

Pages **1A**•1820 and **1A**•1821

Type TF Low TC Ultra-Precision Film Resistors



The cost-effective replacement for precision high-value wire-wound resistors.

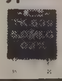
Page **1A**•1822

Type T912 and T914 Precision Resistor Networks

Resistor pairs and quads with ultra-precision ratio characteristics for analog circuits.

Page **1A**•1823

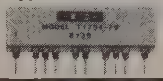
Type TK Temp-Stable Precision Film Resistors.



Temperature coefficients to less than 5 PPM/° C in single resistor values as high as 10 Megohms.

Pages **1A**•1824 and **1A**•1825

Type 1794 Custom Precision SIP Resistor Networks



Resistor networks with custom package size and custom performance.

Page **1A**•1826

If you should need additional information on any type of Caddock resistor, please call or write to our engineering and manufacturing offices in Riverside, California.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK

HIGH PERFORMANCE FILM RESISTORS

Type MG Precision High-Voltage Resistors

Highest Long-Term Stability Combined with Precision Tolerances and TC of 80 PPM/°C.

Caddock's Micronox® resistance films are the source of the Type MG Precision High Voltage Resistors' outstanding combination of performance features:

- Single-resistor values as high as 2000 Megohms.
- Maximum continuous operating voltages as high as 30,000 volts.
- Overvoltage capabilities of 150% of the standard working voltages for all models and values.
- Resistance Tolerances from ± 1.0% to ± 0.1%.
- Standard temperature coefficient of 80 PPM/°C in combination with resistance tolerances as tight as ±0.1%.

– plus

- Typical extended life stability of 0.02% per 1000 hours as demonstrated by reliability testing.

This exceptional performance has been proven through many years of use in equipment that demands the highest reliability and stability, including TWT amplifiers, X-ray systems, geophysical instruments and medical electronics.

Special High-Voltage Pulse Performance

All power ratings and maximum working voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

Maximum working voltages up to 60% higher than the values listed in the table can be achieved through special factory conditioning, provided the power ratings are not exceeded. To specify maximum working voltages above the values listed in the table, add a "–15" to the model number (Example: MG750-15) and identify the overvoltage value with the initial order. (Note that the standard overload and overvoltage ratings do not apply to the "-15" resistors.)

Non-Inductive Performance

Caddock's patented Exclusive Non-Inductive Design uses a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

Most models are available with Caddock's Patented Non-Inductive Design. To specify this performance, add an "N" to the standard model number. (Example: MG750N)

Model No.	Wattage	Max. Continuous Oper. Volt	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions		
						Min.	Max.	A	B	C
MG650	.5	600	225°C	750	80	200Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002
MG655	.5	600	225°C	750	80	200Ω	8 Meg	.313 ±.030	.109 ±.025	.025 ±.002
MG660	.6	1,000	225°C	750	80	400Ω	10 Meg	.500 ±.030	.094 ±.015	.025 ±.002
MG680	.8	2,000	225°C	750	80	600Ω	20 Meg	.750 ±.030	.094 ±.015	.025 ±.002
MG710	1.0	4,000	225°C	750	80	800Ω	50 Meg	1.000 ±.040	.094 ±.015	.025 ±.002
MG712	.6	1,000	225°C	750	80	800Ω	20 Meg	.400 ±.060	.140 ±.030	.025 ±.002
MG714	1.0	1,000	225°C	750	80	200Ω	20 Meg	.562 ±.060	.150 ±.030	.032 ±.002
MG715	1.0	2,000	225°C	750	80	400Ω	50 Meg	.750 ±.060	.140 ±.030	.025 ±.002
MG716	1.5	4,000	225°C	750	80	600Ω	75 Meg	1.000 ±.060	.140 ±.030	.025 ±.002
MG717	1.5	2,000	225°C	750	80	600Ω	75 Meg	.710 ±.050	.240 ±.030	.040 ±.002
MG721	2.0	4,000	225°C	750	80	200Ω	100 Meg	1.000 ±.050	.240 ±.030	.040 ±.002
MG730	3.0	6,000	225°C	1000	80	500Ω	250 Meg	1.500 ±.080	.240 ±.030	.040 ±.002
MG735	3.6	10,000	225°C	1000	80	750Ω	300 Meg	2.000 ±.080	.240 ±.030	.040 ±.002
MG745	5.0	15,000	225°C	1000	80	1K	500 Meg	3.000 ±.100	.240 ±.030	.040 ±.002
MG750	5.0	10,000	225°C	1000	80	400Ω	500 Meg	2.125 ±.060	.315 ±.030	.040 ±.002
MG780	7.5	15,000	225°C	1000	80	600Ω	750 Meg	3.125 ±.060	.315 ±.030	.040 ±.002
MG785	8.0	20,000	225°C	1000	80	800Ω	1000 Meg	4.000 ±.120	.315 ±.030	.040 ±.002
MG810	10.0	25,000	225°C	1000	80	1K	1250 Meg	5.000 ±.120	.315 ±.030	.040 ±.002
MG815	15.0	30,000	225°C	1000	80	1K	2000 Meg	6.000 ±.120	.350 ±.040	.040 ±.002

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Insulation Resistance: 100 megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.8% max.

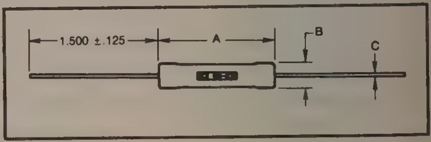
Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.5% max.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.8% max.

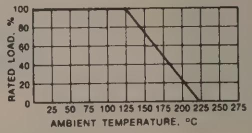
Loadlife: 1000 hours at rated power, ΔR 0.8% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.

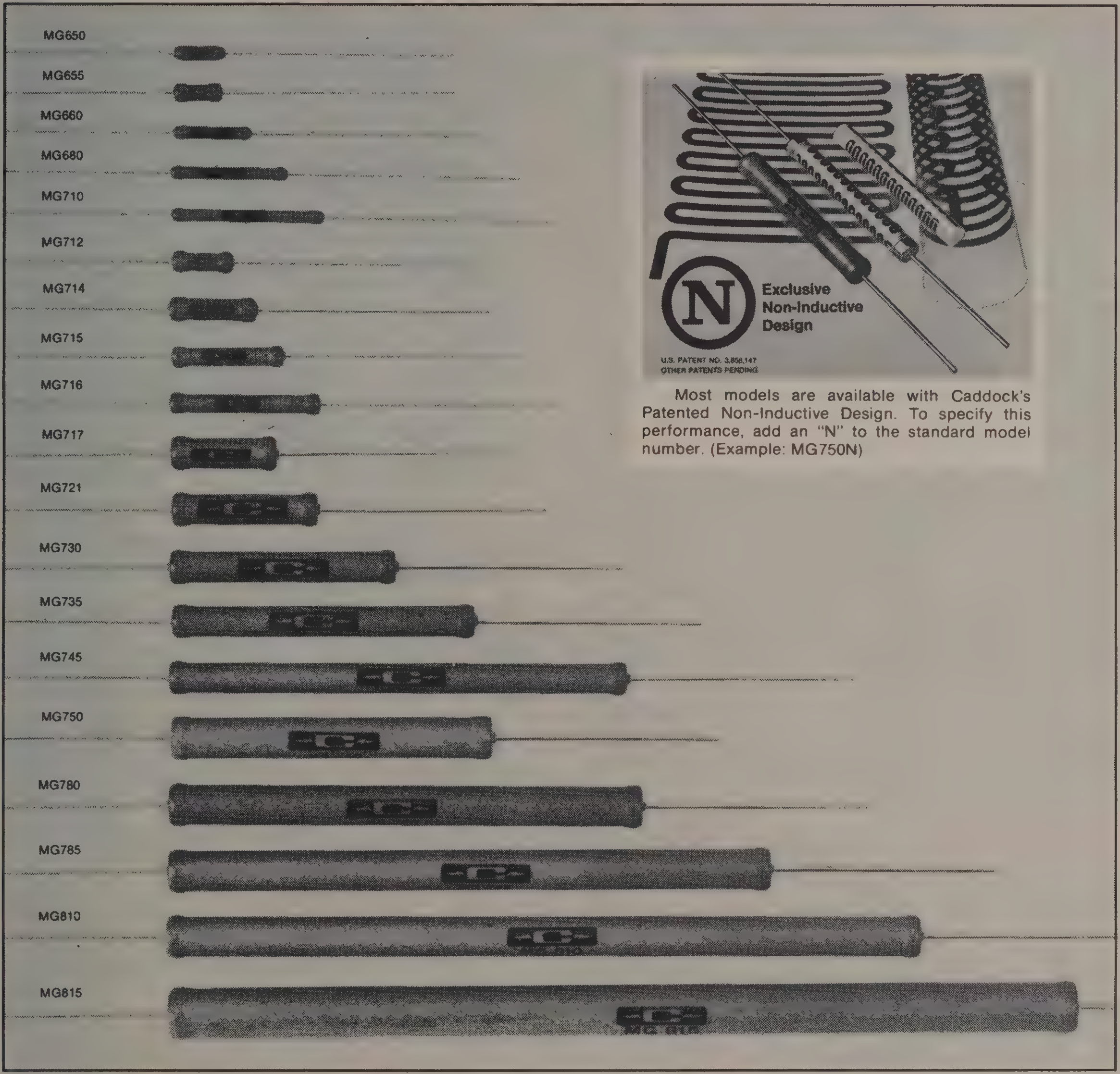


Derating Curve:



Type MG Precision High-Voltage Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS


MG650
MG655
MG660
MG680
MG710
MG712
MG714
MG715
MG716
MG717
MG721
MG730
MG735
MG745
MG750
MG780
MG785
MG810
MG815
N
Exclusive
Non-Inductive
Design
U.S. PATENT NO. 3,858,147
OTHER PATENTS PENDING

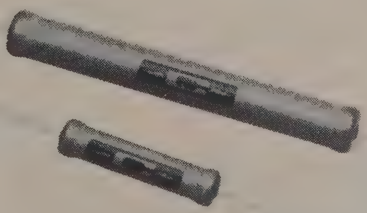
Most models are available with Caddock's Patented Non-Inductive Design. To specify this performance, add an "N" to the standard model number. (Example: MG750N)

Matched Type MG Resistor Sets with Tight Ratio Tolerances and Ratio TC Tracking.

The temperature coefficients of Caddock Micronox® resistance films can be controlled to provide matched sets of Type MG resistors with tight ratio TC from -55° C to +105° C.

For high voltage divider applications, ±2% ratio tolerance and 25 PPM/° C ratio tracking is available.

For low voltage, high resistance applications – such as electrometer circuits or high-gain amplifiers – ±0.1% ratio tolerance and 10 PPM/° C ratio tracking is available.



CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MR & MS Power Film Resistors

Power Film Resistor Family with Wide Resistance Range and +275° C Maximum Temperature.

With power ratings to 15 watts and voltage ratings as high as 6000 volts in an axial-lead resistor with values to 30 Megohms, the Type MS Power Film Resistors deliver the performance capabilities that can simplify circuit design and reduce equipment cost and complexity.

Type MS Power Film Resistors provide all these features in a single resistor:

- Full power and voltage ratings, without derating —
  - for non-inductive performance.
  - for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability. Tests demonstrate typical stability of 0.05% per 1000 hours over extended life.

Micronox® Resistance Films

Type MS performance begins with Micronox® resistance films, the basic element in every Caddock resistor. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for 20 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core, in air, at 1400°F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This unique approach to precision power resistors opens new design possibilities by providing wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.

N
Exclusive
Non-Inductive
Design
U.S. PATENT NO. 3,858,147
OTHER PATENTS PENDING

There's no derating of performance when you specify Caddock's Exclusive Non-Inductive Design.

When non-inductive performance is specified, we produce these power film resistors with a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

Non-inductive construction is available in most models. Specify by adding "N" suffix to Model Number. (Example: MS 310N)

Carefully Controlled Manufacturing and Test Procedures Assure Compliance with Strict Quality Control Requirements

Manufacturing Control

In addition to these procedures, all Type MS Resistors are produced under strict manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

Quality Control

From the certification and testing of all materials to the supervision of manufacturing processes, all Caddock Type MS and MR Power Film Resistors are produced under procedures that have been approved for conformance to the requirements of NASA NHB5300.4(1C) and MIL-I-45208 in many recent surveys.

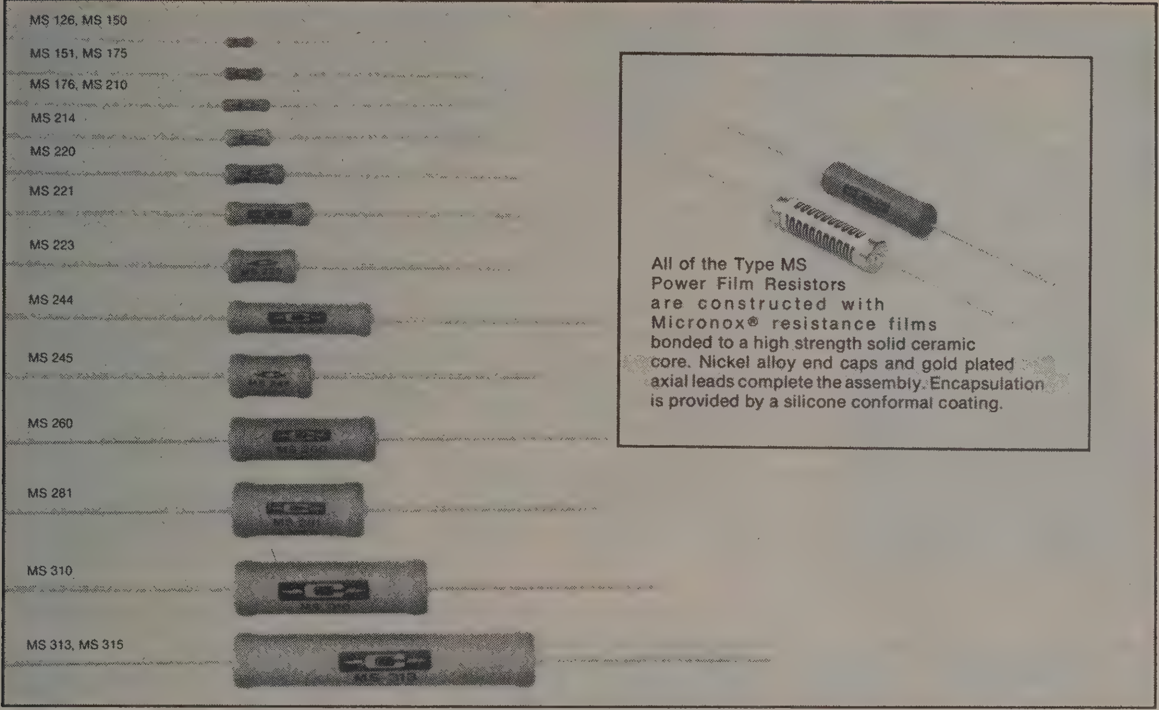
Reliability Verification

Type MS Resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG and MK represent an identical combination of materials—aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type MR & MS Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS



All of the Type MS Power Film Resistors are constructed with Micronox® resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and gold plated axial leads complete the assembly. Encapsulation is provided by a silicone conformal coating.

Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encap-sulation	Leadwire
						Min.	Max.	A	B	C		
MR 129	.25	200	275°C	500	150	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Nickel
MR 154	.40	300	275°C	750	150	50Ω	1 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MR 178	.60	500	275°C	750	150	50Ω	3 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MS 126	.25	200	275°C	500	50	30Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 150	.5	—	275°C	500	50	30Ω	2 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 151	.5	300	275°C	750	50	30Ω	2 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 175	.75	—	275°C	750	50	30Ω	2 K	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 176	.75	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 210	1.0	—	275°C	750	50	45Ω	3 K	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 214	1.0	500	275°C	750	50	45Ω	5 Meg	.313 ±.030	.109 ±.025	.025 ±.002	Silicone Conformal	Gold Plated
MS 220	2.0	1000	275°C	800	50	45Ω	10 Meg	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal	Gold Plated
MS 221	3.0	1000	275°C	800	50	45Ω	10 Meg	.575 ±.050	.165 ±.030	.032 ±.002	Silicone Conformal	Gold Plated
MS 223	3.0	800	275°C	1000	50	30Ω	4 Meg	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 244	4.0	2000	275°C	1000	50	45Ω	15 Meg	.950 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 245	4.0	800	275°C	1000	50	30Ω	6 Meg	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 260	6.0	2000	275°C	1000	50	45Ω	15 Meg	.970 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 281	8.0	2000	275°C	1000	50	45Ω	8 Meg	.910 ±.060	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 310	10.0	4500	275°C	1000	50	45Ω	20 Meg	1.25 ±.070	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 313	12.5	6000	275°C	1000	50	50Ω	30 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 315	15.0	—	275°C	1000	50	50Ω	1 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

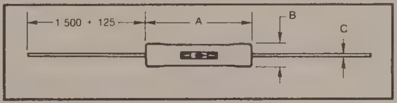
Insulation Resistance: 100 megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

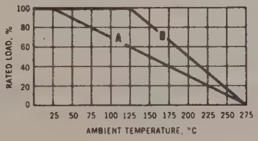
Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, ΔR 0.5% max. or 0.5 ohms max., whichever is greater.



Derating Curve:



A - all MS models except MS 126, MS 151, MS 176.

B - MS 126, MS 151, MS 176, MR 129, MR 154, MR 178.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type ML & MM Precision Film Resistors

High-Temperature Resistors for Geophysical, Aerospace and Industrial Requirements.

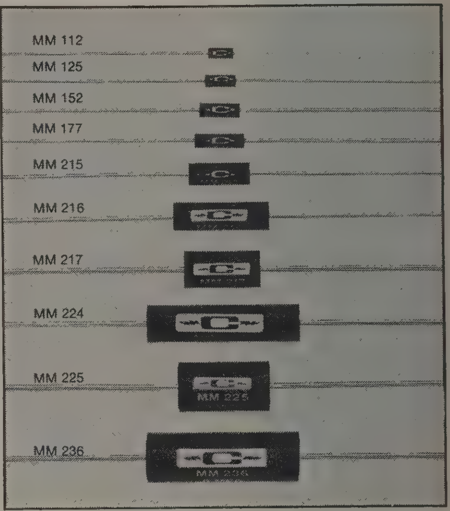
Type MM and ML resistors have a proven performance history in industrial, computer, military and space applications. With power ratings up to 3 watts and resistance values to 15 megohms, these outstanding resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1000 hours.

The Type MM Precision Film Resistors provide a maximum operating temperature range of +275° C and both the Type MM and the Type ML have temperature coefficients of only 50 PPM/° C over the range from −15° C to +105° C.

Exclusive
Non-Inductive
Design
U.S. PATENT NO. 3,858,147
OTHER PATENTS PENDING

Construction includes Micronox® resistance films fired onto a high strength solid ceramic core. End cap construction and a molded case completes the resistor assembly and provides increased resistance to abrasion and solvents.

Caddock's Exclusive Non-Inductive Performance can also be specified for most of these resistors by adding the "N" suffix to the model number. (Example: MM 236N)



Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation
						Min.	Max.	A	B	C	
MM 112	.12	200	275°C	400	50	45Ω	500 K	.160 ±.010	.065 ±.010	.016 ±.002	Black Molded Type
MM 125	.25	200	275°C	500	50	30Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Black Molded Type
MM 152	.4	300	275°C	750	50	30Ω	2 Meg	.250 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 177	.6	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 215	1.0	800	275°C	1000	50	45Ω	10 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Black Molded Type
MM 216	1.5	1000	275°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Black Molded Type
MM 217	1.5	800	275°C	1500	50	30Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 224	2.0	2000	275°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 225	2.0	800	275°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
MM 236	3.0	2000	275°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
ML 104	.08	200	175°C	400	50	50Ω	300 K	.160 ±.010	.065 ±.010	.016 ±.002	Transfer Molded Type
ML 114	.15	200	175°C	500	50	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Transfer Molded Type
ML 124	.25	300	175°C	750	50	50Ω	600 K	.250 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 131	.4	500	175°C	750	50	50Ω	1 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 181	.6	600	175°C	750	50	50Ω	5 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Transfer Molded Type
ML 212	1.0	1000	175°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Transfer Molded Type
ML 213	1.0	800	175°C	1500	50	30Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 218	1.25	2000	175°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 219	1.25	800	175°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type
ML 226	2.0	2000	175°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Insulation Resistance: 100 megohms, minimum.

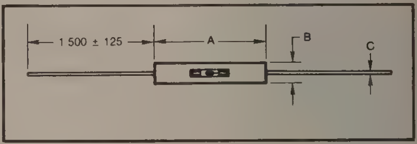
Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Thermal Shock: MIL-STD-202, Method 107, Cond. F, ΔR, 0.2% max. or 0.5 ohms max., whichever is greater.

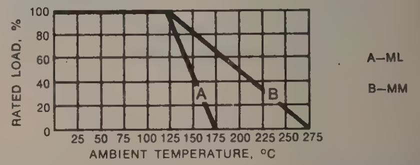
Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, ΔR 0.5% max. or 0.5 ohms max., whichever is greater.

Lead Material: Gold Plated.



Derating Curve:



CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type MP Chassis Mounted Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MP Chassis Mounted Power Film Resistors are made with Micronox® resistance films fired onto a ceramic substrate which is thermally bonded to an anodized aluminum base. By mounting this assembly directly to a metal surface for improved heat transfer, the high power capabilities of these unique resistors can provide increased packaging densities in many types of electronic equipment.

The special performance features of the Type MP Power Film Resistors include:

- Two case sizes that provide 15 watt and 30 watt ratings.
- Single-screw mounting to simplify attachment to the chassis or other heat conducting surface.
- A molded silicone case that encapsulates the resistor assembly to meet stringent environmental specifications.
- Extended-life stability better than 0.01% per 1000 hours has been demonstrated through a 5½ year, 50,000 hour program of continuous load-life testing.

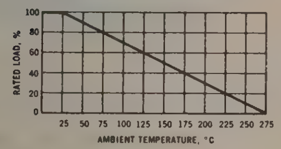
Detailed information on power ratings versus ambient temperature and chassis area has been provided on this page. A detailed report on the results of extended-life stability tests is available from the applications engineering group at Caddock Electronics, Inc.

Model No.	Power Rating†	Max. Voltage	Diel. Str.	High Temp. TC‡	Resistance Range		Dimensions				Terminals
					Min.	Max.	A	B	C	D	
MP312	15 Watts	300	600	50	10Ω	200 K	.600	.188	.185	.092	Gold Plated Solder Lugs
MP330	30 Watts	450	1000	50	10Ω	200 K	.850	.250	.250	.142	Gold Plated Solder Lugs

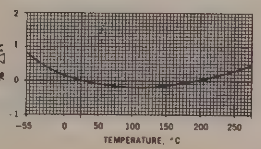
† Power rating based on chassis mounting with MP 312 on a 6″ x 4″ x 2″ x .040″ aluminum chassis and MP 330 on a 5″ x 7″ x 2″ x .040″ aluminum chassis.

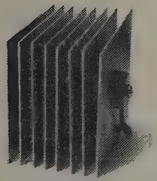
‡ TC: 50 ppm referenced to 25°C, ΔR taken at +150°C and +275°C. (Low temp. TC will be nominally —85 ppm/°C at —55°C. See typical R-T curve.)

DERATING CURVE



TYPICAL R-T CURVE

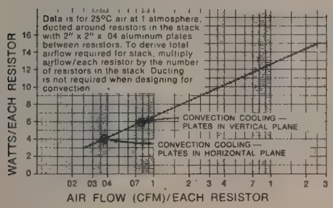




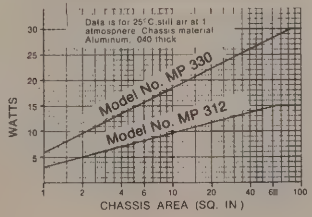
Stacked Type MP assemblies — constructed by bolting resistors between aluminum heat dissipating plates — provide a simple means of further improving packaging densities.

These charts of power ratings versus ambient temperature and chassis area show the high power levels that can be achieved with forced air cooling and with convection cooling in either vertical or horizontal orientation.

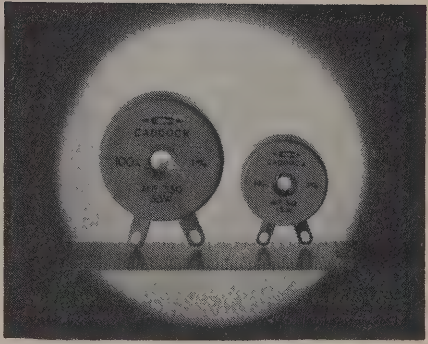
POWER RATING
FOR STACKED MP 312 POWER RESISTORS



POWER RATING
FOR CHASSIS MOUNTED SINGLE RESISTORS



U.S. Patent No's 3,636,493 and 3,649,944 Other patents pending.



SPECIFICATIONS

Resistance Tolerance: ±1% standard (Other tolerances on special order.)

Insulation Resistance: 10,000 Megohms, dry. Method — Mil-R-18546D, para. 4.6.8.

Solderability: Per Mil-R-18546D, para. 3.7, para. 4.6.4.

Terminal Strength: Per Mil-Std-202, Method 211, Cond. A (Pull Test), 5 lbs., and Cond. B (Bend Test). Max. △R, .2% or .2Ω, whichever is greater.

Thermal Shock: Per Mil-R-18546D, para. 4.6.9, max. △R, .5% or .2Ω, whichever is greater.

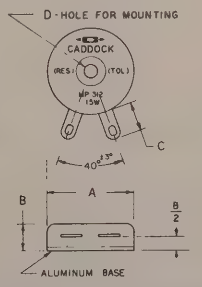
Momentary Overload: 2 times rated power or 1.5 times max. allowable working voltage, whichever gives the lower power, for 5 seconds. Max. △R, .5% or .2Ω, whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106B, less steps 7a and 7b, max. △R, .5% or .2Ω, whichever is greater.

Life: Per Mil-R-18546D, para. 4.6.12, 1,000 hrs., Max. △R, 1% or .2Ω, whichever is greater.

Shock, Medium Impact: 50G, per Mil-Std-202, Method 205, Cond. C.

Vibration, High Frequency: Per Mil-Std-202, Method 204, Cond. B, Max. △R .2% or .2Ω, whichever is greater, through shock and vibration sequence.



CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Low Cost Precision Film Resistors

Radial-Lead Resistors with Resistance Range from 10 ohms to 100 Megohms.

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Film Resistors now cover the entire resistance range from 10 ohms to 100 Megohms.

Constructed with Caddock Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

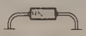
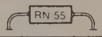
- ±1% resistance tolerance is standard and tolerances to ±0.1% are available on special order.
- Operating temperatures are from -55° C to +175° C.
- Full power rating at +125° C.
- Temperature Coefficient is only 50 PPM/° C up to 10 Megohms and 80 PPM/° C up to 100 Megohms, referenced to 25° C with the ΔR taken at -15° C and +105° C.
- Extended life stability is typically better than 0.1% per 1000 hours.
- Caddock's Non-Inductive Performance provides greater pulse fidelity and wider bandwidths in high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

One size of Type MK resistor can replace many sizes of axial lead resistors.

This table of "RN" style axial lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

Comparison of Type MK and "RN" Ratings and Dimensions

Resistor Type	Power Rating	Maximum Resistance	Mounting Hole Spacing		
MK 120 or MK 620	**.50 WT.**	**40 Megohms**	**.150**	MK 132 5.0K 1% MK120 7.50K 1%	Even the smallest Type MK resistor can replace all of these RN type resistors.
MK 132 or MK 632	**.75 WT.**	**100 Megohms**	**.200**		
RN50	.05 WT	1 Megohm	.400		
RN 55	.10 WT	5 Megohms	.500		
RN60	.125 WT	10 Megohms	.625		
RN65	.25 WT	20 Megohms	.875		
RN70	.50 WT	40 Megohms	1.000		

All outline drawings full size — dimensions in inches.

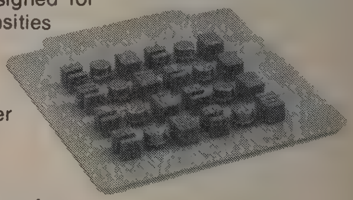
The largest Type MK — rated at .75 watt — requires less board space than even the 1/20th watt RN50.

The smallest Type MK — rated at .5 watt — provides power dissipation **equal** to the RN70 resistor. The RN70 resistor requires a mounting hole spacing of 1" and a side-to-side spacing of .250 inches, resulting in a total mounting area of .25 square inches — **10 times the area required for a .75 watt Type MK resistor!**

MK620
40MEG
1%
MK 63
100 MEG
1%

One standard resistor configuration can simplify board layouts.

With the exceptionally wide range of resistances that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving extra space where resistor value changes can require larger resistors or non-uniform lead spacings.



Standardization of resistor size can speed assembly procedures and reduce procurement costs.

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power rating and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial lead resistors to a single, 'standardized' resistor type, unit prices can be lowered and inventory problems simplified.

Low Quantity Prices — Fast Delivery

Quantity prices for Type MK Precision Film Resistors are low, with many values priced under 60 cents each in medium-to-large production orders.

A pricing schedule for all values and models of Type MK Precision Film Resistors is available upon request. For specific price and delivery information, call or write to the main offices of Caddock Electronics in Riverside, California.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type MK Low Cost Precision Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Film Resistors — Standard Resistance Range

Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions	Encap-sulation	Leadwire
						Min.	Max.			
MK 120	.5	200	175°C	300	50	30 Ω	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 132	.75	400	175 C	400	50	30 Ω	5 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (tolerance to ±.1% on special order).

Operating Temperature: −55°C to 175°C.

Overload: 5 times rated power for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.

Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, shift .2% max., or .2 ohms, max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max., or .2 ohms, whichever is greater.

Loadlife: 1000 hours at rated power, R shift .4% max., or .2 ohms, whichever is greater.

Insulation Resistance: 10,000 Megohms, minimum.

Type MK Precision Film Resistors — Extended Resistance Range

Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions	Encap-sulation	Leadwire
						Min.	Max.			
MK 620	.5	200	175 C	300	80	2 Meg.	40 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 632	.75	400	175°C	400	80	5.1 Meg.	100 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (consult factory for tighter tolerances).

Operating Temperature: −55°C to 175°C.

Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .5% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, R shift .5% max.

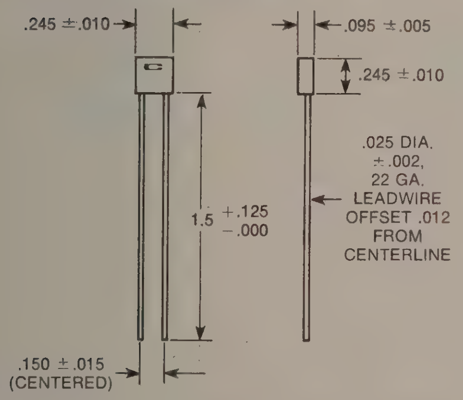
Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max.

Loadlife: 1000 hours at rated power, R shift .5% max.

Insulation Resistance: 10,000 Megohms, minimum.

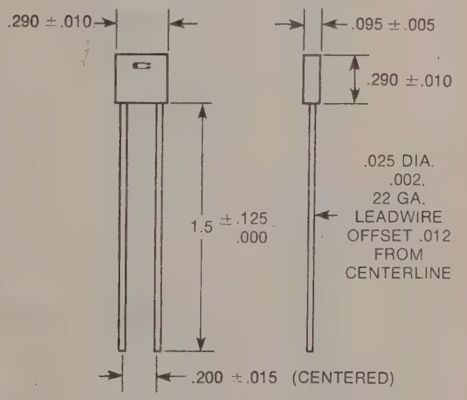
†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Case "A"
Model MK 120 and MK 620

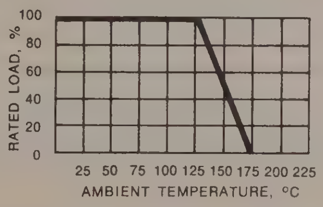


ALL DIMENSIONS IN INCHES

Case "B"
Model MK 132 and MK 632



DERATING CURVE



CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type 1787 Current Shunt Resistor Networks

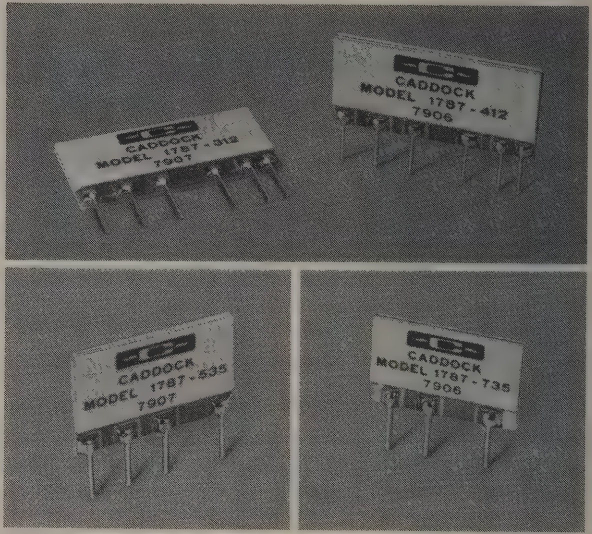
Accurate Current Sensing in Multi-Range Instrumentation

Type 1787 Current Shunt Resistor Networks utilize Caddock's Micronox® resistance films and advanced high thru-put laser manufacturing capabilities to achieve many vital advantages in precision current measurement circuits, including laboratory and bench-type digital instrumentation:

- The thin-profile single-package configuration replaces as many as four discrete current shunt resistors.
- The monolithic construction and standardized lead spacing simplifies installation.
- Caddock Micronox® resistance films provide exceptional stability for improved long-term measurement accuracy.

Eighteen standard models in six network arrangements provide the specific accuracy and resistance values required for a wide range of current measuring instruments and circuits.

Prototype quantities of most models of the Type 1787 Current Shunt Resistor Networks can be delivered from stock to within 6 weeks ARO.


CADDOCK MODEL 1787-312 7907
CADDOCK MODEL 1787-412 7906
CADDOCK MODEL 1787-535 7907
CADDOCK MODEL 1787-735 7906

Model No.	Resistance Values				Power Rating Watts				Max. Power Rating Watts Total Pkg.	Fig.	Absolute Resistance Tolerance % ①	Maximum Absolute TC ppm/°C ②	Absolute Stability Max. % Change In Resistance Value	
	R_A	R_B	R_C	R_D	R_A	R_B	R_C	R_D					Load Life ③	Shelf Life ④
1787—31	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.25	80	0.05	0.03
1787—312	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.10	80	0.03	0.02
1787—41	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.25	80	0.05	0.03
1787—412	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.10	80	0.03	0.02
1787—5	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.25	50	0.04	0.02
1787—53	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.10	50	0.02	0.01
1787—535	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.05	50	0.02	0.01
1787—5352	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.02	50	0.01	0.01
1787—6	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.25	50	0.04	0.02
1787—64	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.10	50	0.02	0.01
1787—645	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.05	50	0.02	0.01
1787—6452	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.02	50	0.01	0.01
1787—7	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.25	50	0.04	0.02
1787—73	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.10	50	0.02	0.01
1787—735	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.05	50	0.02	0.01
1787—7352	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.02	50	0.01	0.01
1787—13	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	6	0.25	100	0.05	0.03
1787—132	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	6	0.10	100	0.03	0.02

① **Absolute Resistance Tolerance:** Tolerance of R_A, R_B, R_C or R_D when measured in accordance with proper Figure No

② **Absolute Temperature Coefficient:** Temperature coefficient of R_A, R_B, R_C or R_D from 0°C to 70°C, referenced to +25°C.

③ **Load Life:** Stability of R_A, R_B, R_C or R_D with full power applied individually for 2000 hours at +70°C.

④ **Shelf Life:** Stability of R_A, R_B, R_C or R_D for six months at shelf conditions.

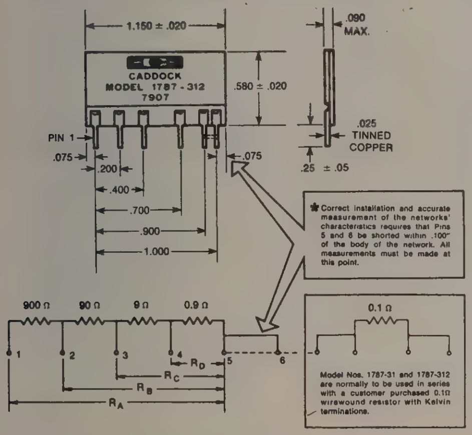
Storage Temperature: −55°C to +105°C.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type 1787 Current Shunt Resistor Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Figure 1 — Model Nos. 1787-31 and 1787-312


1.150 ± .020
.090 MAX.
CADDOCK MODEL 1787-312 7907
.580 ± .020
.025 TINNED COPPER
PIN 1
.075
.200
.400
.700
.900
1.000
.075
.25 ± .05
900 Ω
90 Ω
9 Ω
0.9 Ω
0.1 Ω
1 2 3 4 5 6
R_D
R_C
R_B
R_A

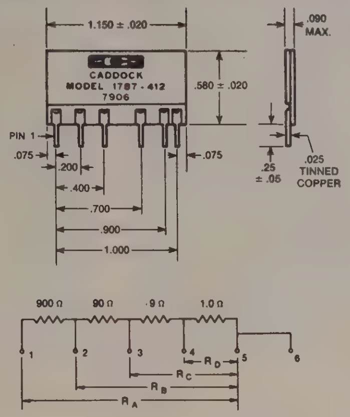
★ Correct installation and accurate measurement of the networks' characteristics requires that Pins 5 and 6 be shorted within .100" of the body of the network. All measurements must be made at this point.

Model Nos. 1787-31 and 1787-312 are normally to be used in series with a customer purchased 0.1Ω wirewound resistor with Kelvin terminations.

Model Nos. 1787-31 and 1787-312 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	999.9 Ω	Pin 1	Pin 1	Pin 5 ★	Pin 6 ★
R_B	99.9 Ω	Pin 1	Pin 2	Pin 5 ★	Pin 6 ★
R_C	9.9 Ω	Pin 1	Pin 3	Pin 5 ★	Pin 6 ★
R_D	0.9 Ω	Pin 1	Pin 4	Pin 5 ★	Pin 6 ★

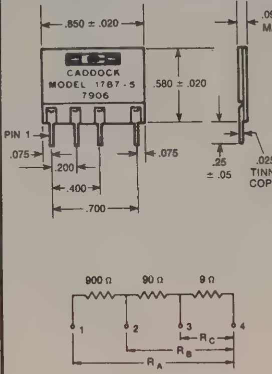
Figure 2 — Model Nos. 1787-41 and 1787-412


1.150 ± .020
.090 MAX.
CADDOCK MODEL 1787-412 7906
.580 ± .020
PIN 1
.075
.200
.400
.700
.900
1.000
.075
.25 ± .05
.025 TINNED COPPER
900 Ω
90 Ω
9 Ω
1.0 Ω
1 2 3 4 5 6
R_D
R_C
R_B
R_A

Model Nos. 1787-41 and 1787-412 Measurement Connections

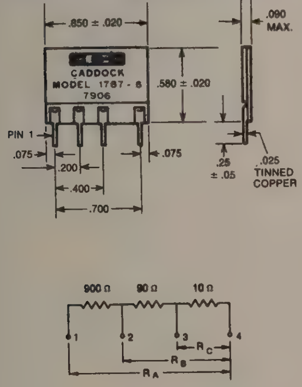
Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	1000 Ω	Pin 1	Pin 1	Pin 5	Pin 6
R_B	100 Ω	Pin 1	Pin 2	Pin 5	Pin 6
R_C	10 Ω	Pin 1	Pin 3	Pin 5	Pin 6
R_D	1 Ω	Pin 1	Pin 4	Pin 5	Pin 6

Figure 3 — Model Nos. 1787-5, 1787-53, 1787-535 and 1787-5352


.850 ± .020
.090 MAX.
CADDOCK MODEL 1787-5 7906
.580 ± .020
PIN 1
.075
.200
.400
.700
.075
.25 ± .05
.025 TINNED COPPER
900 Ω
90 Ω
9 Ω
1 2 3 4
R_C
R_B
R_A

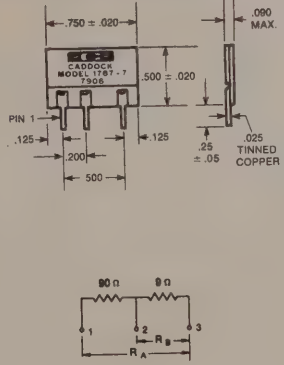
Resistances	
"R"	Total Value
R_A	999 Ω
R_B	99 Ω
R_C	9 Ω

Figure 4 — Model Nos. 1787-6, 1787-64, 1787-645 and 1787-6452


.850 ± .020
.090 MAX.
CADDOCK MODEL 1787-6 7906
.580 ± .020
PIN 1
.075
.200
.400
.700
.075
.25 ± .05
.025 TINNED COPPER
900 Ω
90 Ω
10 Ω
1 2 3 4
R_C
R_B
R_A

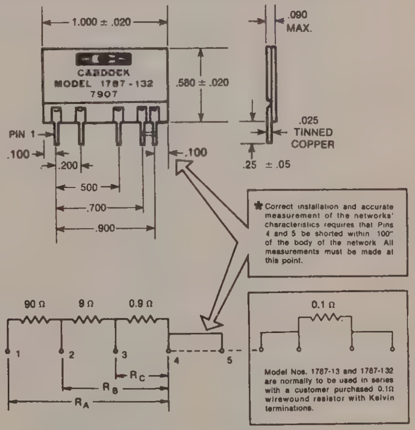
Resistances	
"R"	Total Value
R_A	1000 Ω
R_B	100 Ω
R_C	10 Ω

Figure 5 — Model Nos. 1787-7, 1787-73, 1787-735 and 1787-7352


.750 ± .020
.090 MAX.
CADDOCK MODEL 1787-7 7906
.500 ± .020
PIN 1
.125
.200
500
.125
.25 ± .05
.025 TINNED COPPER
90 Ω
9 Ω
1 2 3
R_B
R_A

Resistances	
"R"	Total Value
R_A	99 Ω
R_B	9 Ω

Figure 6 — Model Nos. 1787-13 and 1787-132


1.000 ± .020
.090 MAX.
CADDOCK MODEL 1787-132 7907
.580 ± .020
.025 TINNED COPPER
PIN 1
.100
.200
500
.700
.900
.100
.25 ± .05
90 Ω
9 Ω
0.9 Ω
0.1 Ω
1 2 3 4 5
R_C
R_B
R_A

★ Correct installation and accurate measurement of the networks' characteristics requires that Pins 4 and 5 be shorted within .100" of the body of the network. All measurements must be made at this point.

Model Nos. 1787-13 and 1787-132 are normally to be used in series with a customer purchased 0.1Ω wirewound resistor with Kelvin terminations.

Model Nos. 1787-13 and 1787-132 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	99.9 Ω	Pin 1	Pin 1	Pin 4 ★	Pin 5 ★
R_B	9.9 Ω	Pin 1	Pin 2	Pin 4 ★	Pin 5 ★
R_C	0.9 Ω	Pin 1	Pin 3	Pin 4 ★	Pin 5 ★

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

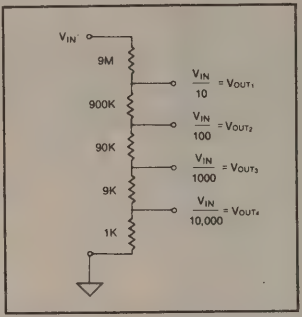
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type 1776 Precision Decade Resistor Voltage Dividers

Input Voltage Dividers for Digital Multimeters and Range-Switching Instruments.

Produced with Caddock Tetrinox® resistance films to achieve an exceptional combination of accuracy, temperature stability and long-term stability, these edge-mount precision decade resistor voltage dividers are now being widely specified for use in the input signal circuits of bench and laboratory digital instruments.

In addition to requiring less board space, these compact resistor networks deliver higher performance than selected discrete resistor sets and thin-film networks.


V_{IN}
9M
900K
90K
9K
1K
$\frac{V_{IN}}{10} = V_{OUT_1}$
$\frac{V_{IN}}{100} = V_{OUT_2}$
$\frac{V_{IN}}{1000} = V_{OUT_3}$
$\frac{V_{IN}}{10,000} = V_{OUT_4}$

The 33 standard models in the expanded 'family' of Type 1776 resistor networks now include —

- 3-, 4- and 5-decade voltage dividers with ratios from 10:1 to 10,000:1
- 1,200 volts continuous ratings and overvoltage to 2,000 volts.
- Many combinations of ratio and absolute tolerances and ratio and absolute TC.

For complete information on quantity price and delivery, call our main offices in Riverside, California.

Model No	Resistance Values					Fig.	Voltage Rating ⑦	Absolute Tolerance %	Ratio Tolerance % ①	Absolute TC ppm/°C	Ratio TC ppm/°C ②	Voltage Coefficient of Ratio ppm/volt ③	Ratio Stability % Change in Ratio		
	R_1	R_2	R_3	R_4	R_5								Load Life ④	Shelf Life ⑤	Over-voltage ⑥
1776 – 9	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776 – 91	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776 – 912	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.02	30	5	0.02	0.01	0.005	0.01
1776 – 82	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.25	30	25	0.3	0.04	0.02	0.04
1776 – 8	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
1776 – 81	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.05	30	25	0.2	0.02	0.01	0.02
1776 – 1	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776 – 14	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776 – 72	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.25	30	30	0.3	0.04	0.02	0.04
1776 – 7	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
1776 – 71	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.05	30	25	0.2	0.02	0.01	0.02
1776 – 10*	9 Meg	900 K	90 K	10 K	—	4	1200	+0 −0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776 – 105*	9 Meg	900 K	90 K	10 K	—	4	1200	+0. −0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776 – 532	900 K	90 K	9 K	900	—	5	300	0.25	0.25	25	25	0.4	0.04	0.02	0.04
1776 – 53	900 K	90 K	9 K	900	—	5	300	0.1	0.1	25	25	0.3	0.02	0.01	0.02
1776 – 542	900 K	90 K	9 K	1 K	—	5	300	0.25	0.25	25	25	0.4	0.04	0.02	0.04
1776 – 54	900 K	90 K	9 K	1 K	—	5	300	0.1	0.1	25	25	0.3	0.02	0.01	0.02
1776 – 63	900 K	90 K	9 K	900	—	6	300	0.1	0.1	25	10	0.3	0.01	0.005	0.01
1776 – 64	900 K	90 K	9 K	1 K	—	6	300	0.1	0.1	25	10	0.3	0.01	0.005	0.01
1776 – 232	9 Meg	900 K	90 K	9 K	900	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776 – 23	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.1	50	50	0.2	0.02	0.01	0.02
1776 – 231	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.05	50	50	0.2	0.02	0.01	0.02
1776 – 242	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776 – 24	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.1	50	50	0.2	0.02	0.01	0.02
1776 – 241	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.05	50	50	0.2	0.02	0.01	0.02
1776 – 732	9 Meg	900 K	90 K	9 K	900	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776 – 73	9 Meg	900 K	90 K	9 K	900	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776 – 742	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.25	0.25	50	50	0.5	0.01	0.02	0.01
1776 – 74	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.25	0.1	50	50	0.5	0.04	0.02	0.04
1776 – 832	9 Meg	900 K	90 K	9 K	900	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776 – 83	9 Meg	900 K	90 K	9 K	900	8	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776 – 842	9 Meg	900 K	90 K	9 K	1 K	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776 – 84	9 Meg	900 K	90 K	9 K	1 K	8	1200	0.25	0.1	50	50	0.5	0.04	0.02	0.04

*Resistors Isolated

① **Ratio Tolerance:** Maximum ratio difference between any two resistors in the network.

② **Ratio Temperature Coefficient:** Ratio track between any two resistors in the network from 0°C to +70°C.

③ **Voltage Coefficient of Ratio (ppm/volt):** R_1 in series with any combination of R_2, R_3, R_4 and R_5, 100 volts to 1200 volts.

④ **Load Life:** Ratio stability of resistance under full load. 1200 volts DC applied to all resistors in series for 2000 hours at +70°C.

⑤ **Shelf Stability of Ratio:** Six months at shelf conditions.

⑥ **Overvoltage:** Maximum voltage of 1.67 times rated DC voltage. Volts DC or peak AC applied to R_1 and any combination of R_2, R_3, R_4, and R_5 in series with R_1 for 10 seconds.

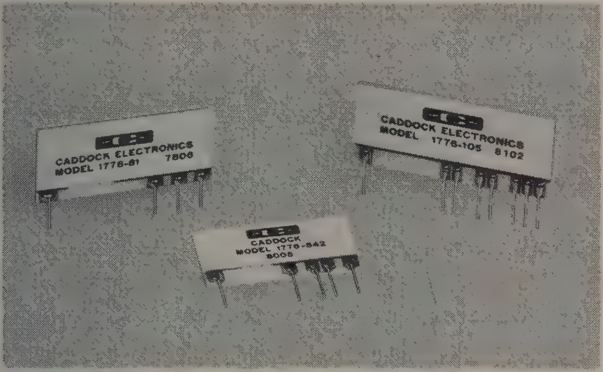
⑦ **Voltage Rating:** DC or RMS AC voltage applied to all resistors in series.

Storage Temperature: −55°C to +85°C.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type 1776 Precision Decade Resistor Voltage Dividers

CADDOCK
HIGH PERFORMANCE FILM RESISTORS


CADDOCK ELECTRONICS
MODEL 1776-81 7806
CADDOCK ELECTRONICS
MODEL 1776-105 8102
CADDOCK
MODEL 1776-542
8005

CADDOCK ELECTRONICS
MODEL 1776-10 8112
CADDOCK ELECTRONICS
MODEL 1776-24 8002

Figure 1

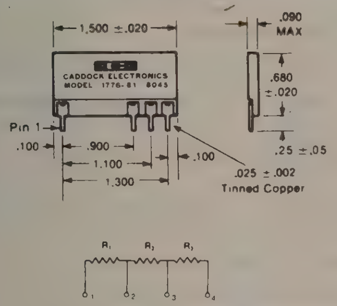

1.500 ±.020
.090 MAX
CADDOCK ELECTRONICS
MODEL 1776-81 8043
.680 ±.020
Pin 1
.25 ±.05
.100
.900
1.100
1.300
.100
.025 ±.002 Tinned Copper
R1 R2 R3
1 2 3 4

Figure 2

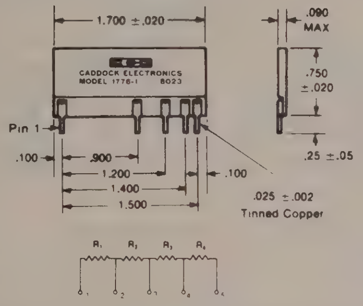

1.700 ±.020
.090 MAX
CADDOCK ELECTRONICS
MODEL 1776-1 8023
.750 ±.020
Pin 1
.25 ±.05
.100
.900
1.200
1.400
1.500
.100
.025 ±.002 Tinned Copper
R1 R2 R3 R4
1 2 3 4 5

Figure 3

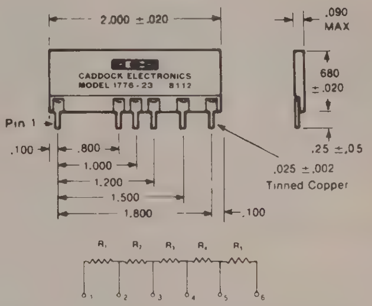

2.000 ±.020
.090 MAX
CADDOCK ELECTRONICS
MODEL 1776-23 8112
.680 ±.020
Pin 1
.25 ±.05
.100
.800
1.000
1.200
1.500
1.800
.100
.025 ±.002 Tinned Copper
R1 R2 R3 R4 R5
1 2 3 4 5 6

Figure 4

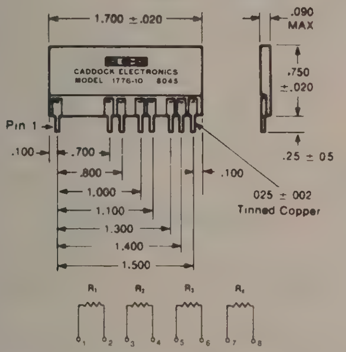

1.700 ±.020
.090 MAX
CADDOCK ELECTRONICS
MODEL 1776-10 8043
.750 ±.020
Pin 1
.25 ±.05
.100
.700
.800
1.000
1.100
1.300
1.400
1.500
.100
.025 ±.002 Tinned Copper
R1 R2 R3 R4
1 2 3 4 5 6 7 8

Figure 5

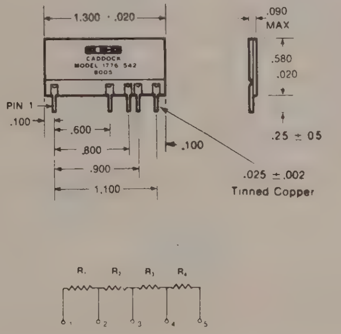

1.300 ±.020
.090 MAX
CADDOCK
MODEL 1776-542
8005
.580 ±.020
PIN 1
.25 ±.05
.100
.600
.800
.900
1.100
.100
.025 ±.002 Tinned Copper
R1 R2 R3 R4
1 2 3 4 5

Figure 6

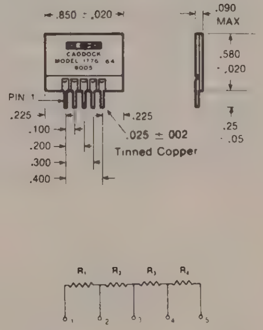

.850 ±.020
.090 MAX
CADDOCK
MODEL 1776-64
8005
.580 ±.020
PIN 1
.225
.100
.200
.300
.400
.225
.025 ±.002 Tinned Copper
.25 ±.05
R1 R2 R3 R4
1 2 3 4 5

Figure 7

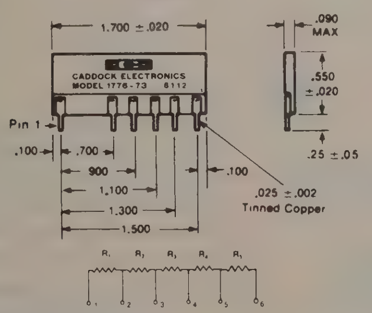
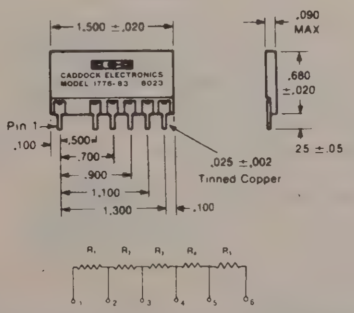

1.700 ±.020
.090 MAX
CADDOCK ELECTRONICS
MODEL 1776-73 8112
.550 ±.020
Pin 1
.25 ±.05
.100
.700
.900
1.100
1.300
1.500
.100
.025 ±.002 Tinned Copper
R1 R2 R3 R4 R5
1 2 3 4 5 6

Figure 8


1.500 ±.020
.090 MAX
CADDOCK ELECTRONICS
MODEL 1776-83 8023
.680 ±.020
Pin 1
.25 ±.05
.100
.500
.700
.900
1.100
1.300
.100
.025 ±.002 Tinned Copper
R1 R2 R3 R4 R5
1 2 3 4 5 6

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

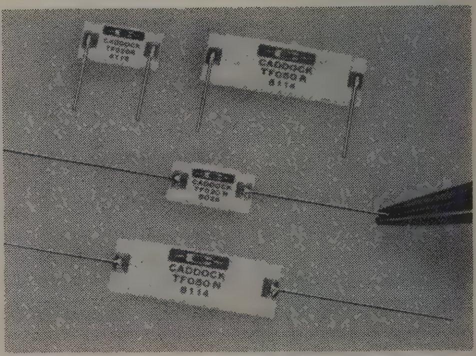
Type TF Low TC Ultra-Precision Film Resistors

Absolute TC to 5 PPM/°C — Values from 1 kohm to 125 Megohms — Absolute Tolerance to ±0.01%.

Type TF precision resistors employ the Caddock Tetrinox® resistance films — the resistance system that sets a new standard for high value, ultra-stable precision resistors that provide an exceptional combination of performance characteristics:

- **Ultra-Precision** – Seven standard resistance tolerances from ±1% to ±0.01%
- **A Wide Range of Resistance Values** – from 1 kohm to 125 Megohms.
- **Low Temperature Coefficients** – 5 PPM/°C, 10 PPM/°C and 15 PPM/°C.
- **Long-Term Stability** – to 0.01% per 1000 hours.

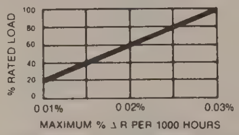
This completely new approach to quantity production of ultra-precision resistors is the result of combining our unique complex-oxide technology with an advanced high thru-put laser manufacturing capability.



Type TF – Standard Resistance Range – 1 kohm to 10 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 020 N	TF 020 R	.33	300	1 K	2 Meg	.75 ±.020	.375 ±.020
TF 050 N	TF 050 R	.75	1400	10 K	10 Meg	1.5 ±.020	.50 ±.020

Load Stability:



Shelf Life: Typically 0.005% per year.

Type TF – Extended Resistance Range – 2 Megohms to 125 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 626 N	TF 626 R	.33	300	2.01 Meg	35 Meg	.75 ±.020	.375 ±.020
TF 656 N	TF 656 R	.75	1400	10.01 Meg	125 Meg	1.5 ±.020	.50 ±.020

Load Stability: 1000 hours at rated voltage at +70° C, maximum ΔR 0.03%.

Shelf Life: Typically 0.010% per year.

Specifications

Apply to all Type TF resistor models

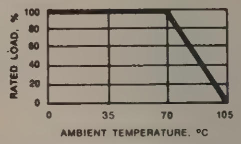
Absolute Temperature Coefficient: 5 PPM/°C, 10 PPM/°C or 15 PPM/°C. Referenced to 25°C, ΔR taken at –15°C and +105°C.

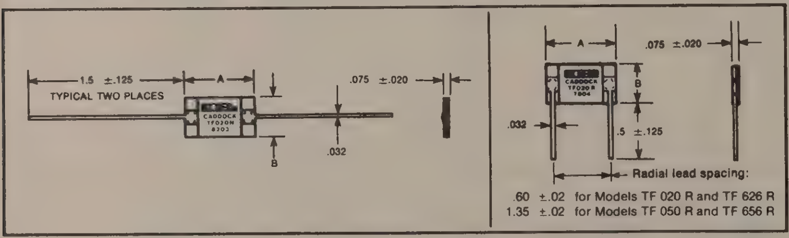
Resistance Tolerance: ±0.01%, ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0%.

Storage Temperature: –55° C to +105° C.

Leadwire: Tinned Copper.

Derating Curve:





Ordering Information

TF050R – 10 Meg – 0.01% – 10 PPM/°C

Model Number

Resistor Value

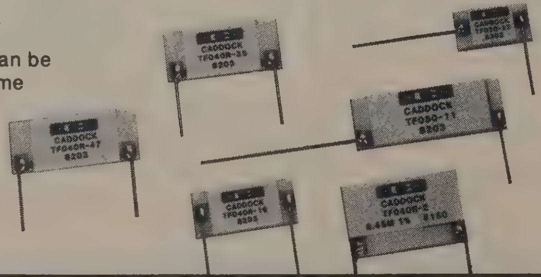
Tolerance

Temperature Coefficient

Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating.
- Power rating.
- Mechanical configuration.
- Ratio matched sets.



And for special requirements, custom Type TF resistors are available with:

- TCs of 5 ppm/°C, 10 ppm/° C 15 ppm/°C or 25 ppm/°C.
- Shelf stability of 0.0025% per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layouts.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type T912 and T914 Precision Resistor Networks

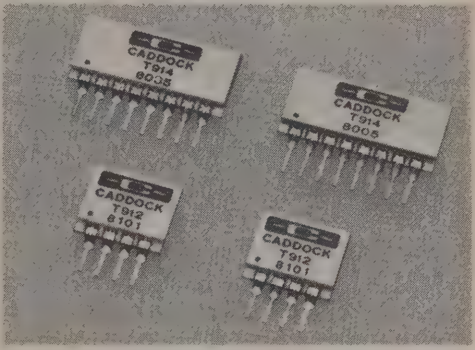
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Resistor Pairs and Quads with Matched Characteristics for Precision Analog Circuits.

Type T912 and T914 Precision Resistor Networks are constructed with Caddock Tetrinox® resistance films to achieve the matched resistor characteristics and stability required by highly accurate amplifier circuits, voltage reference circuits and precision bridge circuits.

- **Ratio Tolerances** – from ±0.1% to ±0.01%.
- **Ratio Temperature Coefficients** – 10 PPM/°C, 5 PPM/°C or 2 PPM/°C.
- **Absolute Temperature Coefficient** – 25 PPM/°C.
- **Ratio Stability of Resistance at Full Load for 2000 hours** – Within ±0.01%.
- **Shelf Life Stability of Ratio for 6 Months** – Within ±0.005%.

Both the T912 and T914 are available in 14 standard resistance values between 1000 ohms and 1 Megohm. Caddock's high thru-put manufacturing capability assures delivery of prototype and large-volume production quantities from stock to within 6 weeks after receipt of order.



Standard Type T912 and T914 Precision Resistor Networks

In addition to the 14 standard **equal value** models of the Type T912 and T914, the Type T912 can also be ordered with —

- **10:1 resistance ratio** — for use with gain-setting amplifiers.
- **9:1 resistance ratio** — for use in voltage reference dividers.

T912 - A 10K - 010 - 02

Model Number

Ratio Code Letter: *

A – T912 with R_1:R_2 where $R_2 = 10R_1$

1K:10K	5K:50K	20K 200K	40K.400K
2K:20K	10K:100K	25K 250K	50K.500K
			100K:1 Megohm

B - T912 with R_1:R_2 where $R_2 = 9R_1$

1K:9K	5K:45K	20K:180K	40K.360K
2K:18K	10K:90K	25K:225K	50K 450K
			100K.900K

No Letter — T912 with $R_1 = R_2$

No Letter — T914 with $R_2 = R_2 = R_3 = R_4$

Ratio Temperature Track:* (0°C to 70°C)
-10 = 10 PPM/°C
-05 = 5 PPM/°C
-02 = 2 PPM/°C

Ratio Tolerance:*
-100 = 0.1%
-020 = 0.02%
-050 = 0.05%
-010 = 0.01%

Standard Resistance Values:* (R_1)

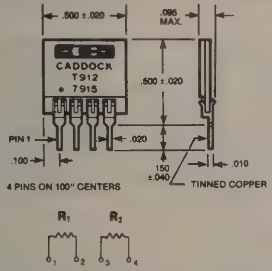
1K	10K	40K	200K	500K
2K	20K	50K	250K	1 Meg
5K	25K	100K	400K	

Special or mixed resistance values are available as custom networks. See the custom section at the bottom of this page.

*(This information appears on the back side of the network)

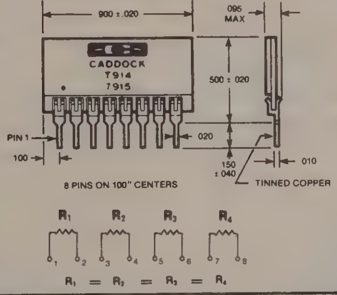
Type T912

Ratios Available: 1:1, 9:1, 10:1 and Custom.



Type T914

Ratios Available: 1:1 and Custom.



Specifications

Absolute Tolerance: 0.1% for all resistors.

Absolute Temperature Coefficient: ±25 PPM/°C. Referenced to 25°C, ΔR taken at 0°C and 70°C.

Voltage Rating: 30 Volts DC or RMS AC applied to R_1, R_2, R_3, or R_4.

Power Rating: 0.10 watt applied to R_1, R_2, R_3, R_4 (not to exceed rated voltage).

Package Power Rating: Type T912, 0.200 watt. Type T914, 0.400 watt.

Storage Temperature: -55°C to +105°C.

Insulation Resistance Between Isolated Pins: Pin 2 to Pin 3, Pin 4 to Pin 5, or Pin 6 to Pin 7, 1000 Megohms, minimum.

Dielectric Strength Between Isolated Pins: 50 volts RMS AC.

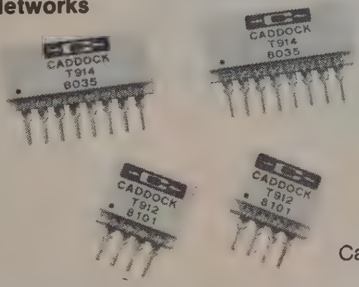
Ratio Stability Under Load: Ratio change between any two resistors in the network under full load for 2000 hours at 70°C, 0.01% maximum.

Shelf Stability of Ratio: Six months at shelf conditions, 50 PPM.

Custom Model T912 and T914 Precision Resistor Networks

For applications requiring non-standard resistance values, the T912 and T914 custom configurations can include these special features:

- Mixed resistance values with a maximum ratio of 250-to-1. (Example: 1.0 Megohm and 4K)
- Absolute TC as low as 15 PPM/°C.
- Ratio TC as low as 2 PPM/°C.
- Custom voltage ratings.
- Matched resistors of any special value between 1K and 2 Megohms.



Identification of the electrical characteristics of each T912 and T914 resistor network is included on the back side of the network.

For performance, price and availability of custom T912 and T914 resistor networks, contact Caddock Electronics' main offices in Riverside, California.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TK Temp-Stable Precision Film Resistors

Small Package with Low TC of 10 PPM/°C and Resistance Range from 1 kohm to 10 Megohms.

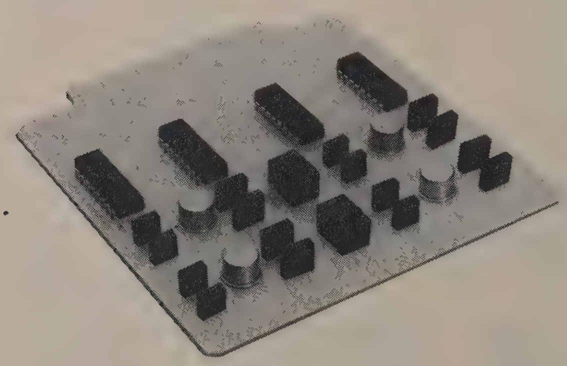
Caddock introduces a new design element for precision electronic circuitry — an advanced technology breakthrough that solves many critical circuit stability problems — the **Type TK Temp-Stable Precision Film Resistors with the Tetrinox® resistance system.**

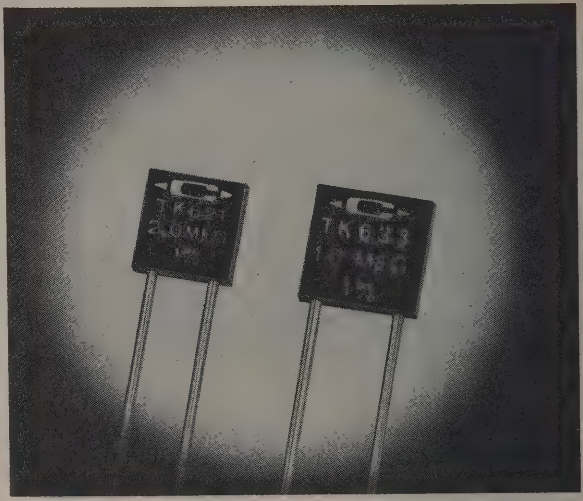
Type TK Temp-Stable Precision Film Resistors provide a combination of performance advantages never before available in a resistive component:

- **Temperature Stability** — better than 10 PPM/°C over the entire temperature range from −55°C to +125°C!
- **Long-Term Absolute Stability** — better than ±0.05% per 2000 hours of operation.
- **Extended Resistance Range** — from 1000 ohms to 10 Megohms.
- **Precision Tolerances** — ±1% is standard, and tolerances as close as ±0.05% are available.
- **Wide Operating Temperature Range**—from −55°C to +175°C.
- **Small Size** — with two miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density** — with power ratings of .2 watt and .3 watt in molded cases, the largest of which is a standard CK 06 package.
- **Highest Performance-to-Cost Ratio** — with many values priced below $2.00 each in 1000 lot quantities.

(Photos show resistors full size)

Building on 20 years of experience with our unique complex-oxide technology, Caddock has perfected the Tetrinox® resistance system — the first high resistance system to provide a TC that is well within 10 PPM/°C and that is also essentially linear over the entire temperature range from −55°C to +125°C.





The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 5 PPM/°C temperature coefficient provides ratio tracking of less than 10 PPM/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 PPM/°C.

Extended Resistance Range Reduces Power Requirements

Because the Type TK resistors provide resistance values as high as 10 Megohms — values that are up to 100 times higher than other types of ultra-low TC resistors — engineers can now design precision circuits with lower current drain and lower power requirements.

High Density Packaging

The radial lead mounting and small rectangular case of Type TK resistors permits high packaging densities in low profile electronic circuitry. And because both models of Type TK resistors are available in an exceptionally wide range of resistances, lead spacing and mounting space can be standardized.

For additional information on the Type TK resistors for your high stability circuits, contact the engineering staff of Caddock Electronics in Riverside, California. They can assist you in determining the exact temperature coefficient and tolerances your application requires, and will provide both evaluation and production quantities of these new resistors on fast-delivery schedules.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

Type TK Temp-Stable Precision Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TK Temp-Stable Precision Film Resistors — Standard Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance		Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encap-sulation	Leadwire
		Min.	Max.						
TK121	5, 10 or 20	1K	500K	.2	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK133	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK139	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +125°C.

Overload:* 6.25 times rated power for 5 seconds at voltages not to exceed 1.5 times maximum rated working voltage, R shift less than 0.05%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.05%.

Low Temperature Operation:* R shift less than 0.02%.

Dielectric Withstanding Voltage:* R shift less than 0.02%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.02%.

Load Life:* 2000 hours at +125°C, R shift less than 0.05%.

Shelf Life (Typical): 25 ppm/year.

Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.01%.

Shock:* R shift less than 0.02%.

*Test methods per specifications and procedures of Mil-R-55182/9.

Type TK Temp-Stable Precision Film Resistors — Extended Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance		Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encap-sulation	Leadwire
		Min.	Max.						
TK621	5, 10 or 20	501K	2 Meg	Limited by Maximum Working Voltage	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK633	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK639	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +105°C.

Overload:* 1.5 times maximum rated working voltage for 5 seconds, R shift less than 0.2%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.1%.

Low Temperature Operation:* R shift less than 0.05%.

Dielectric Withstanding Voltage:* R shift less than 0.05%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.05%.

Load Life:* 2000 hours at +125°C, R shift less than 0.2%.

Shelf Life (Typical): 200 ppm/year.

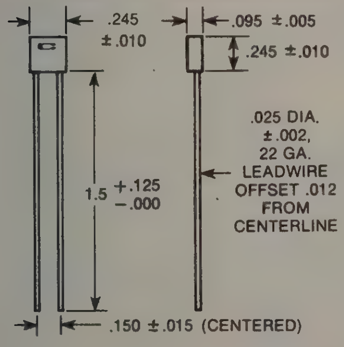
Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.05%.

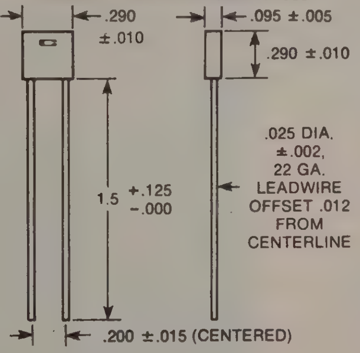
Shock:* R shift less than 0.05%.

*Test methods per specifications and procedures of Mil-R-55182/9.

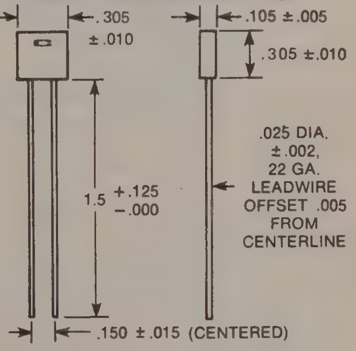
Case "A"
Model TK 121 and Model TK 621



Case "B"
Model TK 133 and Model TK 633



Case "C"
Model TK 139 and Model TK 639

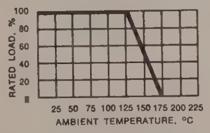


Ordering Information

TK633 – 10 Meg – 0.1% – 10 PPM/°C

Model Number
Resistor Value
Tolerance
Temperature Coefficient

Derating Curve:



APPLIES TO ALL MODELS OF TYPE TK RESISTORS

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CADDOCK

HIGH PERFORMANCE FILM RESISTORS

Type T1794 Custom Precision SIP Resistor Networks

Resistor Networks with Custom Package Size and Custom Performance.

For precision analog designs with special circuit requirements Caddock Type T1794 Custom Precision SIP Resistor Networks can include from 2 to 15 resistors per assembly and are available with performance that includes -

- Absolute tolerances from 1.0% to 0.1% - to as close as 0.025%.
- Ratio tolerances from 1.0% to 0.1% - to as close as 0.025%.
- Resistance tolerances from 500 ohms to 50 Megohms.
- Absolute temperature coefficients of 50 PPM/°C, 25 PPM/°C and 15 PPM/°C.
- Ratio temperature coefficients from 25 PPM/°C to 10 PPM/°C - to as close as 5 PPM/°C.
- Ratio stability of resistance at full load for 2000 hours to within ±0.02%.
- Shelf life stability of ratio for six months to within ±0.005%.
- Custom voltage and power ratings.

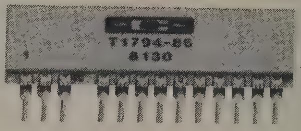
The unique thin-profile, single-in-line edge-mount package design allows the wide range of flexibility necessary to blend the performance of Tetrinox® resistance technology with particular circuit specifications to arrive at the final network package size, pin spacing and pin style.

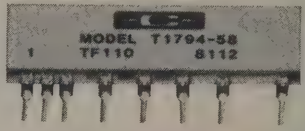
In addition to the normal upright configuration with SIP-socket pin spacing, special low-profile packages with extended leads and right-angle leads are also available.

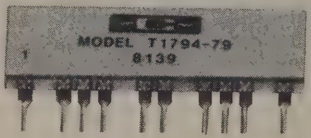
By optimizing both performance and configuration many designers find that these precision networks can achieve savings in both component cost and insertion costs — even in production-lot quantities as low as 1000 units.

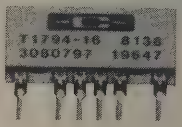
A large part of our high thru-put manufacturing capacity is now committed to the production of these custom precision resistor networks. Custom network designs for requirements that range from 500 networks per year to over 400,000 networks per year are now in production.

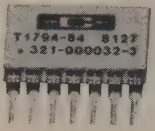
For immediate engineering information on the custom precision resistor network configuration that can best meet your needs, call or write to our Applications Engineering Group in Riverside, California, and we will be pleased to provide both technical performance and pricing information.

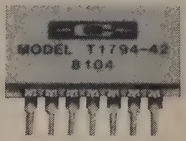


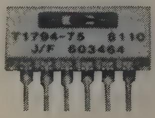




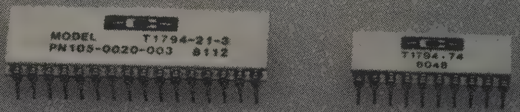




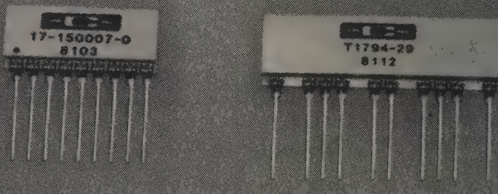




Optional Pin Styles



Low-profile, single-in-line package with one row of right-angle pins.



SIP package with extra-long pin length.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

The outstanding levels of performance and reliability that Caddock resistors provide is maintained through a continuous program of testing and process control that includes every step in the production process.

Manufacturing Control

Our manufacturing controls include processes for power conditioning, over-voltage conditioning and maximum temperature conditioning. We also perform many in-process tests to verify the performance levels and consistency of all of our resistor types, and to screen out defects not detectable by visual inspection.

Quality Control

The Caddock Quality Control System covers every step in the manufacturing process from the examination of incoming raw materials to the final testing and packaging of each resistor.

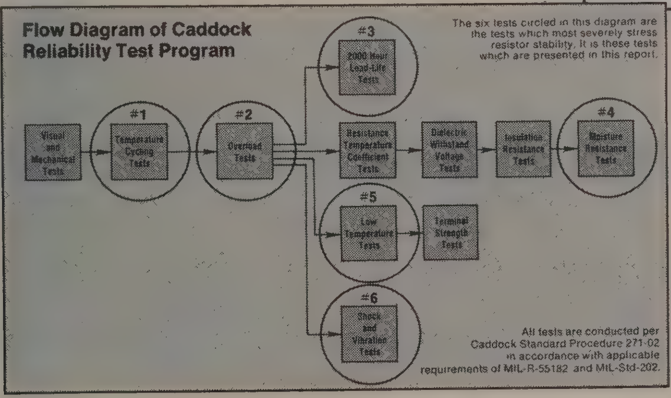
To meet the most stringent QC requirements, Caddock's Quality Control Procedures have been approved as being in conformance to the requirements of NASA NHB5300.4(1C) and MIL-1-45208 in recent surveys.

Reliability Verification

In addition to the tests for tolerance, stability and temperature characteristics that are part of our normal manufacturing procedures, we also perform semi-annual reliability tests to confirm compliance to our exacting product specifications.

The flow diagram of the Caddock Reliability Test Program illustrates the sequence of the eleven tests in this program.

The test procedures in the Caddock Reliability Testing Specification 271-02 generally follow the format of MIL-R-55182 and MIL-Std-202. The results of these tests may be used to qualify Caddock resistors for substitution in existing designs.


Flow Diagram of Caddock Reliability Test Program

The six tests circled in this diagram are the tests which most severely stress resistor stability. It is these tests which are presented in this report.

All tests are conducted per Caddock Standard Procedure 271-02 in accordance with applicable requirements of MIL-R-55182 and MIL-Std-202.

Visual and Mechanical Tests
#1
Temperature Cycling Tests
#2
Overload Tests
#3
2000 Hour Load-Life Tests
Resistance Temperature Coefficient Tests
Dielectric Withstand Voltage Tests
Insulation Resistance Tests
#4
Moisture Resistance Tests
#5
Low Temperature Tests
Terminal Strength Tests
#6
Shock and Vibration Tests

Reliability Test Summary — "Caddock Report No. 1".

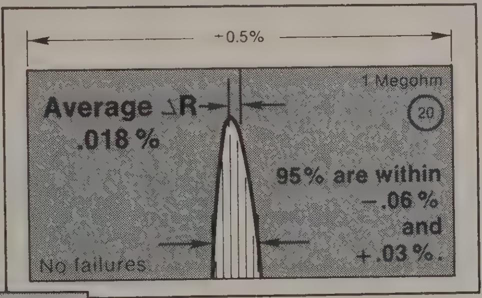
To provide electronic engineers with actual stability data — data that can be used to determine actual improvements in circuit performance — we have compiled test results taken since 1972 from our continuing reliability program.

Of the eleven tests in this program, we have graphically summarized data from the six tests that measure resistor stability under conditions most important to circuit designers:

1 — Temperature Cycling Tests
2 — Overload Tests
3 — 2000 Hour Load-Life Tests
4 — Moisture Resistance Tests
5 — Low Temperature Operation
6 — Shock and Vibration Tests

This stability data appears in a series of 96 graphs that show the actual stability of 740 Caddock High Performance Film Resistors.

The individual and average resistance change is also shown in these graphs for the low, high and 'critical' values, to provide data that can be used to pre-determine actual circuit performance and long-term equipment specifications.



A copy of the 12-page brochure describing the results of these reliability and stability tests is available from the main offices of Caddock Electronics, Inc. in Riverside, California.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

CAPAR COMPONENTS CORPORATION

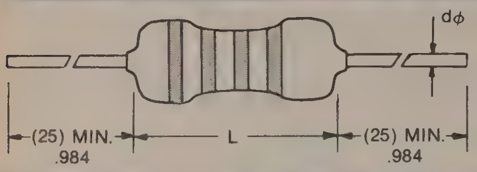
Resistor Products

PRODUCTS LIST

Type	Series Number	Power Rating @70°C	Maximum Working Voltage	Resistance Range	Resistance Tolerance	Temperature Coefficient (ppm/°C)
Carbon Film	CCF16	0.16W	200V	10 ~ 1MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	CCF25	0.25W	300V	1.0 ~ 10MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	CCF50	0.50W	350V	1.0 ~ 10MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	CCF1W	1W	500V	1.0 ~ 5.1MΩ	±2, ±5%	+350—450 ~ 0—1300
Metal Oxide Film	CMO1W	1W	350V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	CMO2W	2W	350V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	CMO3W	3W	500V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Film	CMR25	0.25W	250V	10 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50
Metal Film	CMR50	0.5W	350V	10 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50,
Zero OHM	CZO-25	2.5A	—	.02Ω	—	—
Resistor Network	CRN-SIP	.125W	250V	10 ~ 1MΩ	±2%, ±5%, ±10%	±50, ±100, ±200

Note: Higher and lower resistance values are available upon request.

CCF SERIES CARBON FILM

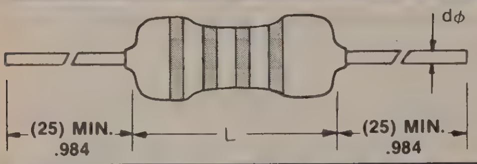


ORDERING SYSTEM

CCF — 25 100K TR

- TR: Packaging
- 100K: Resistance value in ohms
- 25: Power rating (wattage)
- CCF: Type (CCF, CMR, CMO)

CMO SERIES METAL OXIDE

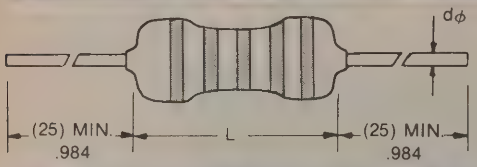


ORDERING SYSTEM

CMO 100 J

- J: Tolerance (2%=G available)
- 100: Resistance value in ohms
- CMO: Type number

CMR SERIES METAL FILM

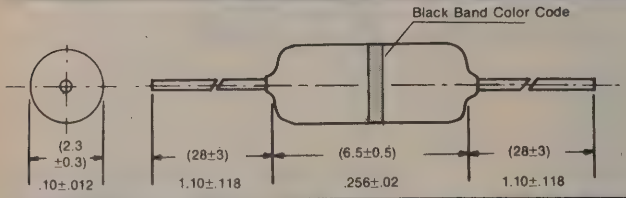


ORDERING SYSTEM

CMR -25 100K TR

- TR: Packing
- 100K: Resistance value in ohms
- -25: Power rating (wattage)
- CMR: Type

CZO SERIES ZERO OHM

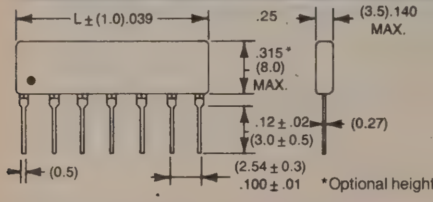


ORDERING SYSTEM

CZO 25 TR

- TR: Packaging
- 25: Power rating
- CZO: Series type

CRN-SIP SERIES NETWORK



*Optional height - .195 must be specified

ORDERING SYSTEM

CRN SIP 5 4 100K

- 100K: Resistance value in ohms
- 4: Number of elements
- 5: Number of pins
- SIP: DIP for dual in-line omit for SIP package
- CRN: Series type

EASTERN DIVISION & HEADQUARTERS
25 Dubon Court
Farmingdale, New York 11735
(516) 454-6390
EAST OF MISSISSIPPI:
TOLL FREE: (800) 645-9626 TELEX: 221794

WESTERN DIVISION
1701 East Edinger Avenue, Unit F2
Santa Ana, California 92705
(714) 547-7034
WEST OF MISSISSIPPI
TOLL FREE: (800) 628-5780 TELEX: 181604

CAPAR COMPONENTS CORPORATION

CAL-R®, INC.

THICK FILM

CERMET CHIP RESISTORS

ELECTRICAL

Resistance Range: 10 ohms to 40 megohms
Tolerance: 1% (F), 2% (G), 5% (J), 10% (K) standard and 20% (M)
Power Rating: 100 Milliwatts CR1, 200 Milliwatts CR2. 250 Milliwatts CR3 & 300 Milliwatts CR4, 350 Milliwatts CR5
Short Time Overload: Less than 0.50% ΔR
Temperature Coefficient of Resistance: ±150 ppm standard thru 1 megohm; ±350 ppm 1.1 megohm thru 10 megohms; ±50 ppm available 100 ohms thru 750K ohms. All TCR ratings as measured from −55°C to +125°C with 25°C reference point.
Standard MIL Decade Values: 10 ohms thru 20 megohms.

ENVIRONMENTAL

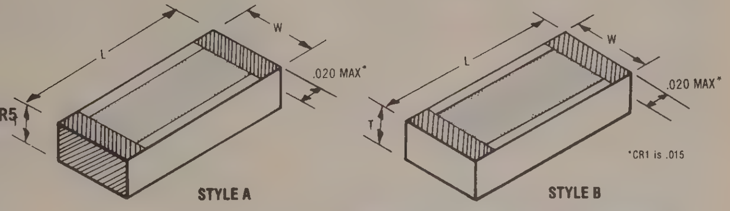
Operating Temperature: −55°C to +125°C.
Moisture Resistance: Less than 1% change when tested per method 106 of MIL-STD 202.
Life: Less than 1% change when tested per method 108D (+85°C) of MIL-STD 202.
MIL Specifications: Designed to meet MIL-R-55342 requirements.

MECHANICAL

Construction: 96% Alumina substrate with proprietary Cermet resistance element and specified termination material.

Terminations:

STYLES	MATERIAL	
A 3 sided wrap-around	A Palladium silver	D Platinum silver
B Top termination	B Platinum gold	E palladium gold
C 5 sided wrap-around	C Gold	Solder termination available S1 — 60/40 S2 — SN62



STYLE A STYLE B

SIZE	LENGTH (L) ±.005	WIDTH (W) ±.005	THICKNESS (T) ±.003
CR1	.050	.040	.012
CR2	.075	.050	.016
CR3	.100	.050	.016
CR4	.150	.050	.016
CR5	.225	.075	.016
CR1010	.100	.100	.029
CR1025	.100	.025	.020
CR2010	.200	.100	.020
CR3535	.035	.035	.015
CR5025	.050	.030	.020
CR5050	.050	.050	.020

CAL-R CHIP NUMBERING SYSTEM

SIZE	TERMINATION		VALUE * (OHMS)	TOLERANCE	TCR
	STYLE	MATERIAL			
CR1	A	A	1002	K	150

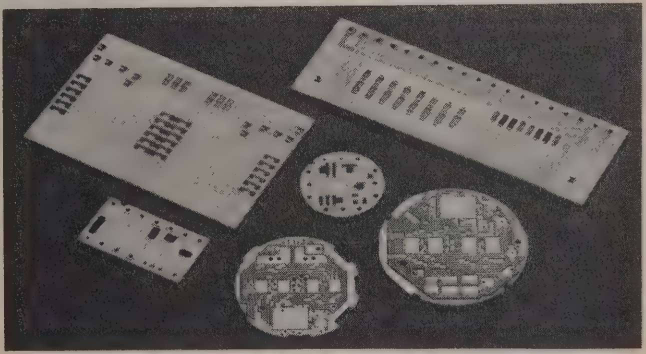
* The first 3 digits represent significant figures; the last digit specifies the number of zeros to follow.
Tolerance code: F —1%, G —2%, J —5%, K —10% & M —20%

PRECISION THICK FILM NETWORKS

Cal-R thick Film Passive Systems develops and produces, to customer requirements, packaged resistor networks including digital to analog A-D binary ladders (through 12 bits), BCD bipolar ladders and custom precision resistor networks.

Cal-R manufactures ceramic substrates for the Digital Watch market and custom R-C networks for hi-rel and commercial applications.

Cal-R thick film resistor compositions fused to a high purity 96% aluminum substrate insure low thermal gradients, high thermal stability and matched electrical characteristics.

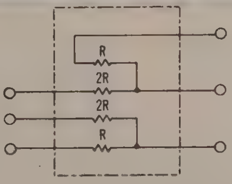


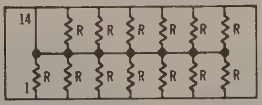
ELECTRICAL SPECIFICATIONS

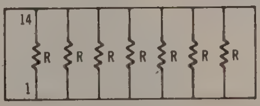
CHARACTERISTICS	DUAL and SINGLE IN-LINE AND FLATPACK RESISTOR NETWORKS	LADDER NETWORKS
Resistance Range	10 ohms to 1 megohm	10 ohms to 1 megohm
Temperature Coefficient	±150 PPM/°C STD ±50 PPM/°C Avail.	±150 PPM/°C STD ±50 PPM/°C Avail.
Tracking to:	15 PPM/°C	5 PPM/°C

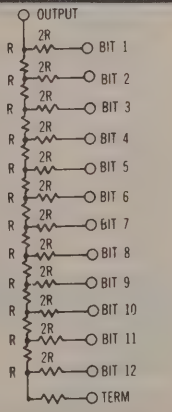
GENERAL SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +150°C
Stability To: 25 PPM/year
Settling To: 50 nSec.
Fast Rise Time
Minimum size for maximum efficiency and quality.
All networks are 100% inspected to applicable requirements (MIL-Specs or inhouse).
All resistance parameters meet or exceed the performance requirements of MIL-R-55342A when applicable.









CAL-R®, INC.
1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966
WIREWOUND RESISTORS • THICK FILM • THERMISTORS

CAL-R, INC. WIRE WOUND RESISTORS

PRECISION POWER RESISTORS

FEATURES

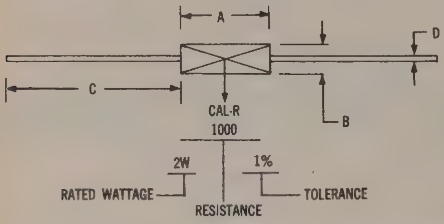
1. Copperweld leads standard. Nickel A or Alloy 180 available.
2. Core-alumina and steatite ceramics.
3. Silicone coating to give maximum wire protection and extra high resistance to moisture.
4. Failure rates of less than .006% per 1000 hours @ +25°C with 60% confidence.

ELECTRICAL CHARACTERISTICS

A. TOLERANCES: 5.0% to .01%. 1% standard for off-shelf delivery. Special matching available to .001% tolerance.
B. TEMPERATURE COEFFICIENT: 20 ppm/degree C standard. Special T.C.'s to 5 ppm/degree C available.
C. Dielectric strength greater than 1000 V.A.C.
D. Special configurations available on request.
E. SA (X) Types Thermal shock proof from 275°C to —55°C.
F. SAV (X) Types Thermal shock proof from 350°C to —55°C.
G. STABILITY: consistent with tolerances, all parts stabilized in production. Less than 0.1% drift in 2000 hours operation at full Cal-R wattage rating for 1% tolerance parts.
H. RESISTANCE RANGES: .05 ohms to 250K ohms.
I. INDUCTIVE TYPES: Single layer space wound with largest wire permissible.
J. Non-inductive Types feature dual balanced windings for minimum inductance.

ENVIRONMENTAL

Meet or exceed applicable paragraphs of MIL-R-26E and MIL-R-39007.



WHEN ORDERING SPECIFY: TYPE, WATTAGE, RESISTANCE AND TOLERANCE.

STANDARD RESISTANCE & TOLERANCE RANGES

*Type		*Type		MIL Equiv. MIL-R-26E & 39007	Dimensions				4 Tolerances & Max. Resistance Based on .0007 Min. Wire Dia.	
SA and SAX (Noninduct)	1 Rated Wattage	SAV and SAVX (Noninduct)	2 Rated Wattage		A ± .062	B ± .032 3	C ± .062	D ± .002	1% & Higher	.5%, .25%, .1% & .05%
SA 01	.4	SAV 03	.5		.250	.078	1½	.020 24 Ga.	1.4KΩ	950Ω
SA 02	.5	SAV 06	.6	RW 81U RWR 81	.250	.085	1½	.020 24 Ga.	2KΩ	1.2KΩ
SA 04	.75	SAV 09	.9		.312	.078	1½	.020 24 Ga.	3KΩ	1.3KΩ
SA 05	.8	SAV 12	1.2		.312	.094	1½	.020 24 Ga.	4.9KΩ	2.4KΩ
SA 10	.9	SAV 22	2.2		.344	.094	1½	.020 24 Ga.	5KΩ	2.5KΩ
SA 15	1.0	SAV 25	2.5	RW 70U RW 80U RWR 80	.406	.094	1½	.020 24 Ga.	7KΩ	3.5KΩ
SA 17	1.0	SAV 26	2.6		.531	.094	1½	.020 24 Ga.	10KΩ	5KΩ
SA 20	2.0	SAV 33	3.0		.500	.156	1½	.032 20 Ga.	15KΩ	7.5KΩ
SA 30	2.5	SAV 41	4.1	RW 69V	.500	.188	2	.032 20 Ga.	20KΩ	10KΩ
SA 31	3.0	SAV 45	4.5	RWR 89 RW 79U	.560	.187	2	.032 20 Ga.	25KΩ	12KΩ
SA 32	2.0	SAV 46	4.6	RWR 71	.812	.188	2	.032 20 Ga.	40KΩ	20KΩ
SA 35	3.0	SAV 52	5.2		.625	.250	2	.040 18 Ga.	35KΩ	17KΩ
SA 50	5.0	SAV 74	7.4	RWR 74 RW 74U RWR 84	.875	.312	2	.040 18 Ga.	60KΩ	30KΩ
SA 55	5.5	SAV 82	8.2	RW 67V	1.00	.313	2	.040 18 Ga.	70KΩ	35KΩ
SA 70	7.0	SAV 96	9.6		1.219	.312	2	.040 18 Ga.	90KΩ	45KΩ
SA 95	9.5	SAV 106	11.0	RW 55V	1.375	.469	1½	.040 18 Ga.	160KΩ	80KΩ
SA 100	10.0	SAV 145	14.5	RWR 78 RW 78U RW 68V	1.781	.375	2	.040 18 Ga.	200KΩ	100KΩ
SA 125	12.5	SAV 150	15.0	RW 56V	2.000	.469	1½	.040 18 Ga.	250KΩ	140KΩ

*—Available in Noninductive (code symbol "X").

1 —Nominal, based on maximum 275°C. Hot spot at 25°C. Ambient. (char. U)

2 —Nominal, based on maximum 350°C. Hot spot at 25°C. Ambient. (char. V).

3 —Tolerance for noninductive types below 150Ω ±.062.

4 —Noninductive maximum resistances are one-half of listed values.

POWER RESISTORS

FOUR STANDARD MC TYPE RESISTOR SPECIFICATIONS IN MIL-R SIZES

OUTSTANDING FEATURES

1. Copperweld leads hot tin dipped for maximum solderability.
2. Completely welded construction terminal to terminal.
3. High density extruded aluminum housing provides superior heat conduction.
4. Housing deep finned for maximum heat dissipation under natural and forced convection.
5. Windings—High uniformity single layer space wound, designed to give maximum core coverage for even heat dissipation. MCX (non-inductive) types have dual balanced windings for minimum inductance.
6. Core—Steatite ceramic, centerless ground for uniformity.
7. Silicone coated resistance element to give maximum wire protection and extra high resistance to moisture.

ELECTRICAL CHARACTERISTICS

Tolerances—5.0% to .05%, 1% standard for off-shelf delivery.

Temperature Coefficient—20 ppm/degree C standard. Special T.C.'s to 5 ppm/degree C available.

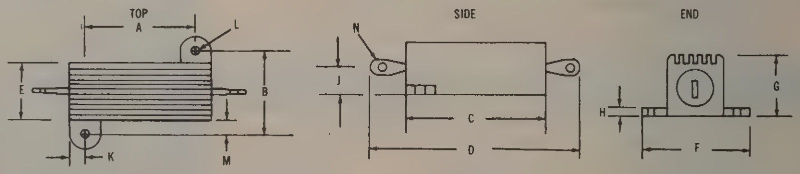
Dielectric strength greater than 1000 V.A.C. on MC-100 and MC-250, and greater than 2000 V.A.C. on MC-500.

Dielectric Test—performed on 100% basis.

Stability—consistent with tolerances, all parts stabilized in production. Less than 0.5% drift in 1000 hours operation at full Cal-R wattage rating for 1% tolerance parts. Resistance ranges—.05 ohms to 210K ohms.

ENVIRONMENTAL

Meet or exceed all requirements of MIL-R-18546D, including "N" characteristic and MIL-R-39009.



DIMENSIONS

Type	A	B	C	D	E	F	G	H	J	K	L	M	N
MC-80	.444	.490	.600	1.125	.334	.646	.317	.075	.139	.078	.093	.078	.050
MC-100	.562	.625	.750	1.375	.438	.873	.408	.094	.172	.093	.093	.094	.086
MC-250	.719	.781	1.063	1.938	.500	1.094	.531	.094	.219	.171	.125	.141	.086
MC-500	1.563	.844	1.969	2.781	.563	1.156	.625	.094	.281	.203	.125	.141	.086
TOL. ±	.005	.005	.016	.063	.031	.031	.031	.016	.031	.010	.005	.016	.015

STANDARD RESISTANCE & TOLERANCE RANGES

Type	Mil Equiv. Mil-R-18546C Mil-R-39009	Cal-R Watts Normal Rating	Watts Mil-R Rating	TOLERANCES AND MAXIMUM RESISTANCES*				
				1% Up	.5%	.25%	.1%	.05%
MC-80 (X)	RE 60 (N), RER 40, RER 60	8	5	.5 Ω to 20 K Ω	1 Ω to 10 K Ω	2.5 Ω to 10 K Ω	3 Ω to 10 K Ω	5 Ω to 10 K Ω
MC-100 (X)	RE 65 (N), RER 45, RER 65	10	10	.5 Ω to 25 K Ω	1 Ω to 10 K Ω	2.5 Ω to 10 K Ω	3 Ω to 10 K Ω	5 Ω to 10 K Ω
MC-250 (X)	RE 70 (N), RER 50, RER 70	25	20	.1 Ω to 70 K Ω	.2 Ω to 30 K Ω	.3 Ω to 30 K Ω	.5 Ω to 30 K Ω	1 Ω to 30 K Ω
MC-500 (X)	RE 75 (N), RER 55, RER 75	50	30	.1 Ω to 200 K Ω	.2 Ω to 80 K Ω	.3 Ω to 80 K Ω	.5 Ω to 80 K Ω	1 Ω to 80 K Ω

Available in Noninductive (code symbol "X"—Cal-R)
(code symbol "N"—Mil)

*Noninductive maximum resistances are one-half of listed values.

CAL-R, INC.
1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966
WIREWOUND RESISTORS • THICK FILM • THERMISTORS

CAL-R®, INC. WIRE WOUND RESISTORS

POWER RESISTORS . . . Cont'd.

T-5 (5 WATTS) OUTSTANDING FEATURES

1. Copperweld leads hot tin dipped — Gold plated DUMET or "A" nickel available.
2. High density extruded aluminum housing provides superior heat conduction.
3. Housing deep finned for maximum heat dissipation.
4. Windings — high uniformity single layer space wound, designed to give maximum core coverage for even heat dissipation. T5X (non-inductive) types have dual balanced windings for minimum inductance.
5. Core — Alumina ceramic, centerless ground for uniformity.

T-3 (3 WATTS) OUTSTANDING FEATURES

1. Windings — Reverse pie wound — all pies filled for maximum heat dissipation.
2. Unique recessed end cap designed to isolate winding termination from all lead stress.
3. Protective overcoating covering entire resistor before molding insures maximum protection and secures winding without introducing stress.
4. Resistor element encased in nonburning epoxy by transfer molding techniques.
5. Copperweld leads hot tin dipped standard — Gold plated DUMET or "A" nickel available.

STANDARD RESISTANCE & TOLERANCE RANGES

Type	Normal Rating	Weight	Tolerances and Maximum Resistances 1% UP	.5%	.25%	.1%	.05%
T5	5 WATTS	.8 gr	1Ω-5K	1Ω-5K	5Ω-3K	10Ω-2.5K	10Ω-2.5K
T3*	3 WATTS	.8 gr	3K-300K	3K-300K	3K-300K	3K-300K	3K-300K

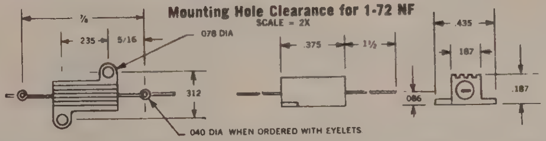
*200 VAC MAX.

T-5 ELECTRICAL CHARACTERISTICS

TOLERANCES: 5.0% to .05%. 1% standard for off-shelf delivery.
TEMPERATURE COEFFICIENT: 30 ppm/°C standard. Special T.C.'s to 5 ppm/°C available.
STABILITY: consistent with tolerances, all parts stabilized in production. Less than 0.5% drift in 1000 hours operation at full CAL-R wattage rating for 1% tolerance parts.
RESISTANCE RANGES: .5 ohms to 3 K ohms.
DIELECTRIC STRENGTH: greater than 500 V.A.C.
DIELECTRIC TEST: performed on 100% basis.

T-3 ELECTRICAL CHARACTERISTICS

TOLERANCE: 1 to .005% absolute. To .002% matching tolerance for matched sets.
TEMPERATURE COEFFICIENT: 10 ppm/°C is standard. Special TCs in ranges from +6000 ppm to 2 ppm/°C available.
STABILITY: consistent with tolerances. All parts stabilized in production, including 1% parts. Components available with stability of .002% per year.
WINDINGS: multiple pie reversed type to minimized inductance. Special windings available to provide fast rise times.
RESISTANCE: Ranges 3 K ohms to 300 K ohms.
MAXIMUM WORKING VOLTAGE: 200V.


Mounting Hole Clearance for 1-72 NF
SCALE = 2X
⅞
235
5/16
078 DIA
312
040 DIA WHEN ORDERED WITH EYELETS
.375
1½
.435
187
.187
.086

PRECISION RESISTORS

OUTSTANDING FEATURES

1. All pies filled for maximum heat dissipation.
2. Unique recessed end cap designed to isolate winding termination from all lead stress.
3. Terminals welded to end cap for maximum strength — will withstand 15 lbs. linear pull.
4. Double slots tangent to mandrel to prevent shorting between pie windings eliminating space-wasting construction features or the need for insulating tape.
5. Protective overcoating covering entire resistor before molding insures maximum moisture protection and secures winding without introducing stress.
6. Standard leads — copperweld hot tin dipped or annealed Dumet gold plated.
7. Special matching available to .001% tolerance.

ELECTRICAL CHARACTERISTICS

TOLERANCE: 1 to .005% absolute. To .002% matching tolerance for matched sets.

TEMPERATURE COEFFICIENT: 10 ppm/°C is standard. Special TCs in ranges from +6000 ppm to 2 ppm/°C available.

STABILITY: consistent with tolerances. All parts stabilized in production, including 1% parts. Components available with stability of .002% per year.

WINDINGS: multiple pie reversed type to minimized inductance (except on Miniature Series). Special windings available to provide low rise times.

RESISTANCE: Ranges 1 ohm to 10 megohms.

PHYSICAL CHARACTERISTICS

MATERIAL: Hi-Temp epoxy with matching coefficient of expansion between core and case. Leads are gold over Dumet.

ENVIRONMENTAL

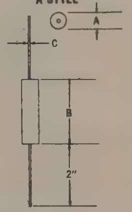
Meet or exceed all requirements of MIL-R-93C and MIL-R-39005.

STANDARD RESISTANCE & TOLERANCE RANGES

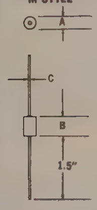
Dimensions CAL-R Part No.	"A" ±.010	"B" ±.010	"C"	Rated Wattage	MIL Equiv. MIL-R-93C MIL-R-39005	Tolerances and Maximum Resistances ±1%	±.5%	±.1%	±.05%	±.01%
M10	.080	.200	.016 #26 AWG	.05		100Ω100K	300Ω-80K	1K-80K	3K-50K	1.0K-25K
M20	.100	.200	.016 #26 AWG	.06		25Ω-150K	50Ω-100K	100Ω-100K	500Ω-80K	2.5K-50K
M30	.125	.250	.020 #24 AWG	.08		10Ω-250K	20Ω-250K	80Ω-250K	300Ω-200K	1.5K-150K
M40 M41*	.125	.375	.020 #24 AWG	.10		10Ω-400K	20Ω-400K	80Ω-400K	300Ω-300K	1.K-200K
A2525	.250	.250	.032 #20 AWG	.2	RBR75	10Ω-750K	20Ω-750K	50Ω750K	200Ω-650K	1.K-500K
A2535	.250	.350	.032	.25	RBR56	10Ω-1MEG	20Ω-1MEG	50Ω-1MEG	200Ω-1MEG	800Ω-800K
A2537	.250	.375	.032	.25	RB56	10Ω-1MEG	20Ω-1MEG	50Ω-1MEG	200Ω-1MEG	800Ω-800K
A2550	.250	.500	.032	.25	RB55 RBR55	10Ω-2.5MEG	20Ω-2.5M	50Ω-2.5M	100Ω-2.5M	500Ω-2.5M
A2575	.250	.750	.032	.35	RB54 RBR54	5Ω-3M	10Ω-3M	50Ω-3M	100Ω-3M	500Ω-3M
A25100	.250	1.00	.032	.4	RB53 RBR53	5Ω-3.5M	10Ω-3.5M	50Ω-3.5M	100Ω-3.5M	500Ω-3.5M
A3775	.375	.750	.032	.5		5Ω-4M	10Ω-4M	50Ω-4M	100Ω-4M	400Ω-3M
A37100	.375	1.00	.032	1.0	RB52 RBR52	2Ω-5.5M	4Ω-5.5M	20Ω-5.5M	50Ω-5.5M	300Ω-4.5M
A5050 A5062	.500 .500	.500 .625	.032 .032	.5 .5		10Ω-4M	20Ω-4M	50Ω-4M	100Ω-4M	400Ω-3M
A5070	.812	.312	.032	.5	RBR76	5Ω-5.5M	10Ω-5.5M	50Ω-5.5M	100Ω-5.5M	400Ω-4.5M
A50100	.500	1.00	.032	1.0	RB57 AFRT14	1Ω-7MEG	5Ω-7M	20Ω-7MEG	50Ω-7MEG	200Ω-5MEG
P2531	.250	.312	.025 #22 AWG	.12		10Ω-1MEG	20Ω-1M	50Ω-1M	100Ω-1M	800Ω-800K
P3750	.375	.500	.025	.35		5Ω-1.5M	10Ω-1.5M	30Ω-1.5M	100Ω-1.5M	800Ω-1.MEG
F10	.250	.250	.032 #20 AWG	.125		10Ω-750K	20Ω-750K	50Ω-750K	200Ω-650K	1.K-500K
F30	.500	.250	.032	.25		10Ω-1M	20Ω-1MEG	50Ω-1M	200Ω-1M	800Ω-800K
F50	.250	.500	.032	.25		5Ω-1.3M	10Ω-1.3M	20Ω-1.3M	100Ω-1.3M	200Ω-1.M

* NON INDUCTIVE

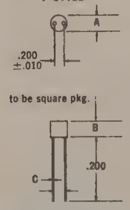
A STYLE



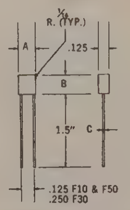
M STYLE



P STYLE



F STYLE

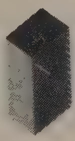


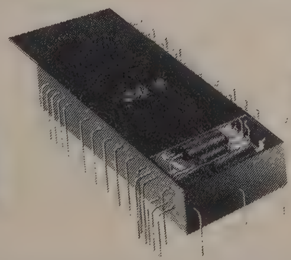
PRECISION RESISTOR NETWORKS

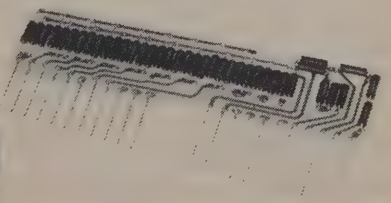
Cal-R engineers, specialists in advanced network design, offer precision assemblies, packaged to meet the most exacting specifications, allowing the circuit designer maximum freedom without costly packaging problems.

GENERAL SPECIFICATIONS

RESISTOR VALUES: From 1 ohm thru 5 megohms
FULL SCALE ACCURACY: to .005%
TEMPERATURE COEFFICIENT TRACKING: to 1 PPM/°C.
TEMPERATURE COEFFICIENT ABSOLUTE: to 2 PPM/°C.
AMBIENT TEMPERATURE RANGE: —55°C to +125°C.
STANDARD TEMPERATURE COEFFICIENT: 0 to ±10 PPM.
STABILITY: to 10 PPM per year.
FAST RECOVERY TIME: to within .02% of final value within 100 ns.







CAL-R®, INC.

1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966
WIREWOUND RESISTORS • THICK FILM • THERMISTORS

CARBORUNDUM NON-INDUCTIVE POWER RESISTORS

Choose Type SP for great A-C power handling capability, whether it be at power frequency or many megahertz.

Choose Type A when high resistance is required in a high power non-inductive resistor.

Choose Type AS for its ability to absorb huge amounts of energy and for its non-inductive property at high voltage.

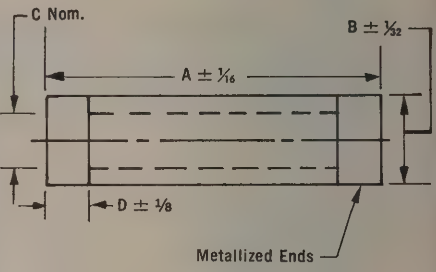
CHARACTERISTICS	Type SP	Type AS	Type A
Maximum Operating Temperature: °C	350	230 150*	230
Temperature Coefficient: Percent per degree C, −55°C to maximum rated temperature	±0.075	−0.075	−0.20
Voltage Coefficient: Maximum percent per kilovolt per inch active length (overall length less termination)	1.0	1.0	—
Short Time Overload: Maximum percent change after 5 cycles 10 times rated power, 5 seconds on, 90 seconds off	2.0	2.0	—
Moisture Resistance: Maximum percent change when tested per MIL-STD-202 method 103	2.5	2.5	2.5

*with epoxy insulation for use in oil

STANDARD SIZES

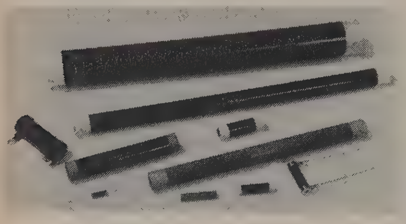
(Special sizes are also available: consult factory.)

Type	A	B	C (SP & AS)	C (A)	D
884 SP	2.0	0.50	0.22	—	0.25
885 SP, AS, & A	2.5	0.75	0.50	0	0.50
886 SP, AS, & A	5.0	0.75	0.50	0	0.62
887 SP, AS, & A	6.0	1.00	0.75	0.5	0.50
888 SP, AS, & A	8.0	1.00	0.75	0.5	0.88
889 SP, AS, & A	12.0	1.00	0.75	0.5	0.88
890 SP, AS, & A	18.0	1.00	0.75	0.5	0.88
891 SP	18.0	2.00	1.50	—	1.00
892 SP	24.0	2.00	1.50	—	1.00



SERIES 800 AND 1000

This general line is available in a wide variety of sizes and terminations. They retain the non-inductive and heavy load characteristics of all Carborundum ceramic resistors. These resistors can handle up to 1000 watts, 165 KJ and 165 KV in resistance values from 1 ohm to 1 megohm.



Parts are specified by the four or five character type number (for example 885SP, 888AS, 890A), the first two digits of the resistance, a single digit to indicate the power of ten multiplier, and a "J" for ±5%, a "K" for ±10%, or an "L" for ±20%. Where the resistance is less than ten ohms, the power of ten multiplier is not used, and an "R" replaces the decimal point. Thus R50 = 0.50 ohm, 7R5 = 7.5 ohm, 220 = 22.0 ohm, 152 = 1500 ohm, etc. *Type AS with a suffix letter to part number denotes optional construction: "D" for dielectric coating; "O" for oil application; "N" for No Arc terminal. Consult Customer Service for additional options and part number detail. A typical part number would be 886AS501KD. This represents a type AS resistor, 5" long x ¾" diameter, 500 ±10% ohms, with dielectric coating.

ELECTRICAL SPECIFICATIONS

Length and Diameter	Type	Resistance Available (ohms) Min.	to Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak Voltage (volts)
2" x ½"	884SP	1.0	200	22.5	250	1,000
2½" x ¾"	885SP	1.0	130	45	250	1,000
	885AS	6.0	1200	15	2,800	4,000
	885AS . . D*	6.0	1200	15	2,800	8,000*
	885A	1500	220K	15	750	3,750
5" x ¾"	886SP	1.0	330	90	500	4,000
	886AS	15.0	3300	30	7,000	10,000
	886AS . . D*	15.0	3300	30	7,000	20,000*
	886A	3900	390K	30	1,500	10,000
6" x 1"	887SP	1.0	330	150	1,600	4,000
	887AS	12.0	3300	50	13,000	15,000
	887AS . . D*	12.0	3300	50	13,000	30,000*
	887A	3900	390K	50	6,000	12,000
6" x 1½"	1026AS	5.0	1200	70	37,000	15,000
	1026AS . . D*	5.0	1200	70	37,000	30,000*
8" x 1"	888SP	1.0	390	190	2,100	6,000
	888AS	15.0	3900	75	16,500	22,500
	888AS . . D*	15.0	3900	75	16,500	45,000*
	888A	4700	470K	60	7,500	15,000
8" x 1½"	1028AS	6.5	1875	100	46,000	22,500
	1028AS . . D*	6.5	1875	100	46,000	45,000*
12" x 1"	889SP	1.0	680	275	3,200	10,000
	889AS	25.00	6800	100	27,000	37,500
	889AS . . D*	25.00	6800	100	27,000	75,000*
	889A	8200	680K	90	12,500	25,000
12" x 1½"	1032AS	9.0	2500	150	75,000	37,500
	1032AS . . D*	9.0	2500	150	75,000	75,000*
18" x 1"	890SP	1.0	1000	375	4,200	16,000
	890AS	40.0	10K	150	43,000	60,000
	890AS . . D*	40.0	10K	150	43,000	120,000*
	890A	12K	1M	125	20,000	40,000
18" x 1½"	1038AS	15.0	3800	225	119,000	60,000
	1038AS . . D*	15.0	3800	225	119,000	120,000*
18" x 2"	891SP	1.0	450	750	15,000	16,000
24" x 2"	892SP	1.0	600	1000	17,500	22,000
24" x 1½"	1044AS	20.0	4800	300	164,000	82,500
	1044AS . . D*	20.0	4800	300	164,000	165,000*

The Carborundum Company
Electric Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302
Tel: (716) 278-2521 • Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

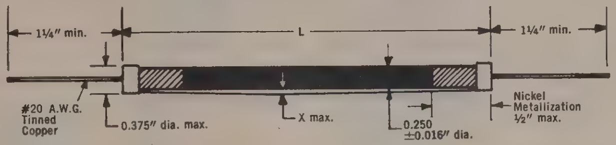
CARBORUNDUM NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

Series 102/104/106/109AS & SP Pencil-type Resistors

These ¼″ diameter resistors are available in a variety of lengths. Pencil shaped resistors offer unique non-inductive and high-voltage properties in a compact, easily-wired configuration.

Type AS for high voltage and energy applications.

Type SP for high AC power handling capabilities.



Length	Type No.	Resistance Available (ohms) Min.	Resistance Available (ohms) Max.	Average Power @ 40°C (watts)	Peak Energy (joules)	Peak Voltage (volts)
2″	102AS 102SP	30 1	9,000 700	5 15	600 50	3,000 1,000
4″	104AS 104SP	55 2	18,000 1,500	9 25	1,200 95	9,000 3,600
6″	106AS 106SP	90 3	30,000 2,400	13 36	1,900 155	15,000 5,000
9″	109AS 109SP	150 4	48,000 3,800	20 55	3,000 250	25,000 8,800

TYPE 234 AND 231 RESISTORS

Carborundum type 234 and 231 resistors are a small size non-inductive bulk type resistor (there are no spirals or windings), capable of dissipating a full 10 watts of power (Type SP) or absorbing **275** Joules of energy (Type AS).

234 — ¼″ x 1″
231 — 5/32″ x ¾″

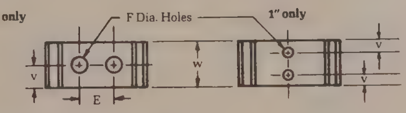
Specifications	234SP	234AS	231SP	231AS
Resistance, ohms ±5%, ±10%, ±20%	1-330	12-5000	1-1000	25-6250
Peak Voltage	500 Volts	2.5kv	375 Volts	1.5kv
Power at 40°C	10 Watts	3 Watts	2.5 Watts	1.5 Watts
Derate Linearly to 0 Watts at	350°C	230°C	350°C	230°C
Max operating temperature	350°C	230°C	350°C	230°C
Peak Energy	30 Joules	**275** Joules	15 Joules	75 Joules

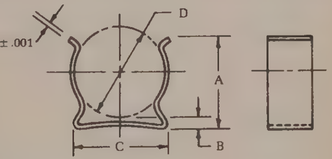
Characteristics	234SP	234AS	231SP	231AS
Short Time Oveload • 10 Cycles of 1000% rated power • 5 sec. on, 90 sec. off	5% max.	1% max.	3.5% max.	1% max.
Life test 1000hr rated power	5% max.	5% max.	5% max.	5% max.
Temperature Coefficient	±0.075% /°C	−0.075% /°C	±0.075% /°C	−0.075% /°C

Termination and Mounting

Electrical connection to the resistive bodies of resistors is made by flame-sprayed metal end bands. The standard metal is aluminum for type SP, nickel for types AS and A. Special terminations of brass or copper overspray or tinned ends are readily available specials. Add "B," "C," or "T" respectively to the part number to designate these special terminations.

In most cases, connections to the resistors may be made by stock clips such as these:





CLIPS DIMENSIONS

Stock No.	Size	Holes	A	B	C	D	E	F	T	V	W
35370	½″	1	0.620	0.090	0.560	0.500		0.093	0.020	0.188	0.375
35267	¾″	1	0.940	0.155	0.830	0.750		0.144	0.020	0.312	0.625
35268	1″	2	1.230	0.170	1.070	1.000		0.128	0.024	0.156	0.625
35371	1½″	2	1.650	0.100	1.650	1.500	0.925	0.103	0.032	0.250	0.500
35269	2″	2	2.375	0.544	1.080	2.000	0.375	0.125	0.043	0.375	0.750

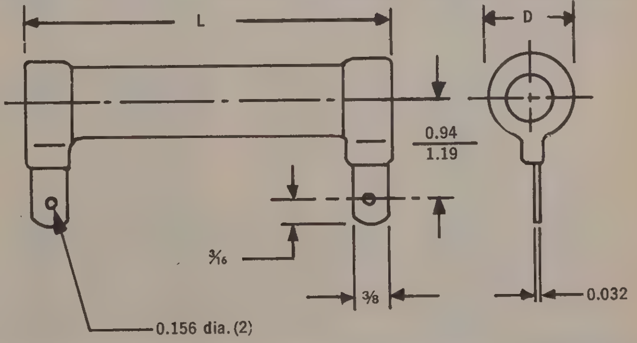
Material: Beryllium Copper
Finish: Electro Tin Plate

TYPE AS EPOXY COATED STYLE

Carborundum Type AS High-Energy Ceramic Resistors are available with an epoxy coating which protects the resistors body from contaminants. It is especially useful where the resistor is employed in an application where it is not protected from a dirty ambient atmosphere or where it is immersed in a cooling or dielectric fluid.

In air the coated resistor can safely dissipate 75% of the power dissipated by an uncoated part. Energy level in oil should not exceed 300 joules/cc.

The overall length, L, of the coated resistor is approximately 0.25″ longer than the uncoated part; the diameter, D, is approximately 0.30″ greater.



The Carborundum Company
Electric Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302
Tel: (716) 278-2521 • Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

CARBORUNDUM NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

TYPE AS DISC AND WASHER STYLES

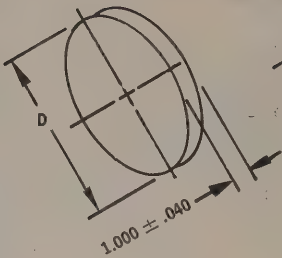
Carborundum Type AS Disc and Washer Ceramic Resistors are a bulk-type low resistance element, and therefore have the ability to absorb instantaneously great surges of energy with virtually zero inductance.

Maximum Peak Voltage: 5000 volts.

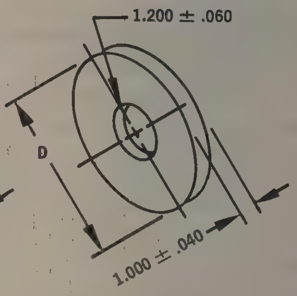
Maximum Temperature: 230°C.

Power Rating: In free air, parts will safely dissipate 2.5 watts per square inch of surface area at 40°C.

Temperature Coefficient of Resistance: −0.1%/°C to 0.0%/°C.



STYLE DS



STYLE WS

Style		Diameter "D" (inches)	Peak Energy (joules)	Available Resistances	
				Minimum	Maximum
911DS	Solid Disc	1.60 ± 0.06	9,000	1.6	800
912DS	Solid Disc	2.37 ± 0.06	21,000	0.7	90
913DS	Solid Disc	3.00 ± 0.08	33,000	0.5	56
914DS	Solid Disc	3.75 ± 0.08	52,500	0.3	36
913WS	Washer	3.00 ± 0.08	27,600	0.5	78
914WS	Washer	3.75 ± 0.08	47,000	0.3	40
915WS	Washer	4.37 ± 0.08	65,500	0.2	28
916WS	Washer	4.75 ± 0.08	79,500	0.2	24

CARBORUNDUM® VARISTORS

Standard varistors described below have a 10% tolerance on voltage. Also available: leadless discs and rods, voltages specified at intermediate values or at other currents, and voltage tolerances of ±15% and ±20%. Available at extra cost: voltage tolerances of ±5% and ±7%, color coding, and special coatings.

Standard rod varistors have a blue epoxy coating. Available at extra cost: formed leads for printed circuit board insertion.

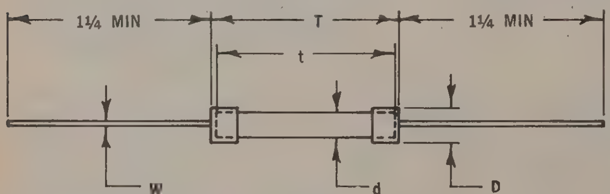


Figure 1

Standard disc varistors have a black flame-retardant PVC coating. Also available: Glyptal coating and kinked leads for printed circuit board insertion.

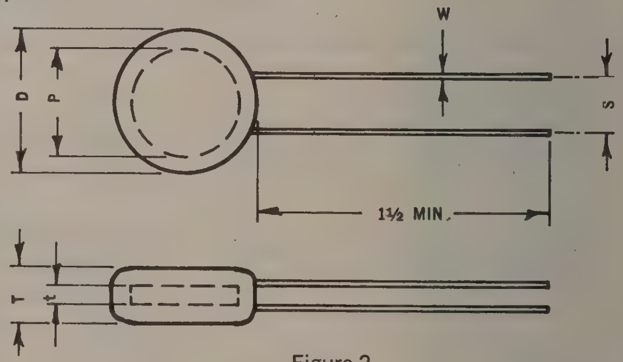


Figure 2

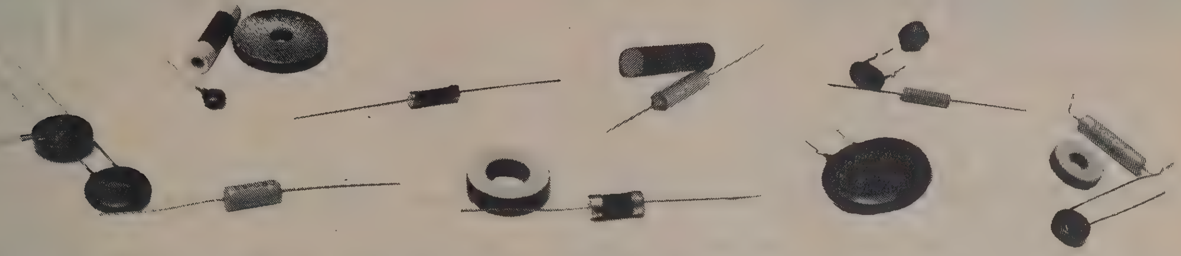
VOLTAGES AVAILABLE

	Carborundum Style Number	Volts ±10% at 1.0 MA	Volts at 1.0 MA Volts at .1 MA	Peak Voltage	Power Watts	d ±.030	t ±.030	D max.	T max.	w nom.	s nom.
ROD STYLES (Figure 1)	231BNR4-	100-750	2.1-1.7	800	0.750	0.156	0.625	0.250	0.812	0.032	—
	233BNR4-	68-710	2.1-1.7	800	1.000	0.250	0.625	0.375	0.812	0.032	—
	234BNR4-	135-1050	2.2-1.7	1500	1.500	0.250	1.000	0.375	1.188	0.032	—
	Carborundum Style Number	**Volts ±10% at 1.0 MA**	**Volts at 1.0 MA Volts at .1 MA**	**Peak Voltage**	**Power Watts**	**d ±.030**	**t ±.030**	**D max.**	**T max.**	**w nom.**	**s nom.**
DISC STYLES' (Figure 2)	551BNR2-	9-88	2.4-1.8	100	0.250	0.250	0.062	0.400	0.350	0.020	0.125
	432BNR2-	6-90	2.9-1.7	100	0.500	0.500	0.062	0.650	0.350	0.032	0.250
	379BNR2-	12-180	2.9-1.7	200	0.500	0.500	0.125	0.650	0.400	0.032	0.250
	328BNR2-	2-80	3.0-1.7	100	0.750	0.750	0.062	0.900	0.350	0.032	0.375
	925BNR2-	12-160	2.4-1.7	150	0.750	0.750	0.100	0.900	0.380	0.032	0.375
	Carborundum Style Number	**Volts ±10% at 5.0 MA**	**Volts at 5.0 MA Volts at .5 MA**	**Peak Voltage**	**Power Watts**	**d ±.030**	**t ±.030**	**D max.**	**T max.**	**w nom.**	**s nom.**
	923BNR2-	13-150	2.2-1.7	150	1.500	1.000	0.100	1.150	0.380	0.040	0.375
	463BNR2-	10-190	2.2-1.7	200	1.500	1.000	0.125	1.150	0.400	0.040	0.375
	927BNR2-	9-140	2.7-1.9	150	2.250	1.250	0.100	1.400	0.380	0.040	0.375

The Carborundum Company
Electric Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302
Tel: (716) 278-2521 • Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

CARBORUNDUM® VARISTORS



Carborundum silicon carbide varistors are voltage-dependent resistors which are offered in a wide variety of configurations, including discs, rods, and washers. In addition to the sizes shown on these pages, rods are available up to 18 inches in length, washers are available up to 3½ inches in diameter. Typical uses include limitation of peak discharges, spike suppression, stabilization of voltages, and generation of non-linear functions.

Varistors are specified by the voltage measured across them, suitably toleranced, at some constant current. The slope of the voltage-current characteristic is most often given by the maximum voltage ratio for two specified currents.

In general the characteristic for a varistor may be approximated by the equation:

$$i = Ke^n$$

where i and e are instantaneous current and voltage respectively, K is a proportionality constant, and n is an exponent applicable in the range in which the varistor is used: most often it is between 3 and 5.

The silicon carbide varistor is a "forgiving" component. When hit by a voltage surge, the energy is absorbed throughout its body, not at a junction. A voltage surge beyond the design level causes substantial increase in current and energy absorption, but not a catastrophic failure.

SMALL DISC VARISTORS

Carborundum Part Number	Volts ±10% @ 1.0 ma.	Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum)
432BNR2-406	6.8	2.70
432BNR2-407	8.2	2.60
432BNR2-408	10.0	2.50
432BNR2-409	12.0	2.35
432BNR2-410	15.0	2.20
432BNR2-411	18.0	2.10
432BNR2-412	22.0	2.00
432BNR2-413	27.0	1.90
432BNR2-414	33.0	1.84
432BNR2-416	47.0	1.80
432BNR2-418	68.0	1.76
432BNR2-420	100.0	1.72
379BNR2-410	15.0	2.50
379BNR2-412	22.0	2.40
379BNR2-414	33.0	2.30
379BNR2-415	39.0	2.20
379BNR2-416	47.0	2.10
379BNR2-417	56.0	2.00
379BNR2-418	68.0	1.95
379BNR2-419	82.0	1.90
379BNR2-420	100.0	1.84
379BNR2-421	120.0	1.78
379BNR2-422	150.0	1.74
379BNR2-423	180.0	1.70
328BNR2-400	2.2	3.60
328BNR2-401	2.7	3.40
328BNR2-402	3.3	3.20
328BNR2-403	3.9	3.00
328BNR2-404	4.7	2.80
328BNR2-405	5.6	2.60
328BNR2-406	6.8	2.50
328BNR2-407	8.2	2.40
328BNR2-408	10.0	2.30
328BNR2-409	12.0	2.20
328BNR2-410	15.0	2.10
328BNR2-411	18.0	2.00
328BNR2-412	22.0	1.95
328BNR2-413	27.0	1.90
328BNR2-414	33.0	1.85
328BNR2-416	47.0	1.76

LARGE DISC VARISTORS

Carborundum Part Number	Volts ±10% @ 5.0 ma.	Volts @ 5.0 ma. ÷ Volts @ 0.5 ma. (maximum)
463BNR2-410	15.0	2.40
463BNR2-412	22.0	2.20
463BNR2-414	33.0	2.10
463BNR2-415	39.0	2.02
463BNR2-416	47.0	1.98
463BNR2-417	56.0	1.94
463BNR2-418	68.0	1.90
463BNR2-419	82.0	1.86
463BNR2-420	100.0	1.82
463BNR2-421	120.0	1.78
463BNR2-422	150.0	1.74
463BNR2-423	180.0	1.70
927BNR2-408	10.0	2.90
927BNR2-409	12.0	2.80
927BNR2-410	15.0	2.70
927BNR2-411	18.0	2.60
927BNR2-412	22.0	2.50
927BNR2-413	27.0	2.40
927BNR2-414	33.0	2.30
927BNR2-416	47.0	2.20

ROD VARISTORS

Carborundum Part Number	Volts ±10% @ 1.0 ma.	Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum)
233BNR4-417	56.0	2.50
233BNR4-418	68.0	2.40
233BNR4-419	82.0	2.30
233BNR4-420	100.0	2.20
233BNR4-421	120.0	2.10
233BNR4-422	150.0	2.00
233BNR4-423	180.0	1.90
233BNR4-424	220.0	1.82
233BNR4-425	270.0	1.78
233BNR4-426	330.0	1.76
233BNR4-428	470.0	1.74
233BNR4-430	680.0	1.70
234BNR4-426	330.0	2.00
234BNR4-427	390.0	1.90
234BNR4-428	470.0	1.80
234BNR4-429	560.0	1.77
234BNR4-430	680.0	1.74
234BNR4-431	820.0	1.70
234BNR4-432	1000.0	1.68

The Carborundum Company
Electric Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302
Tel: (716) 278-2521 • Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

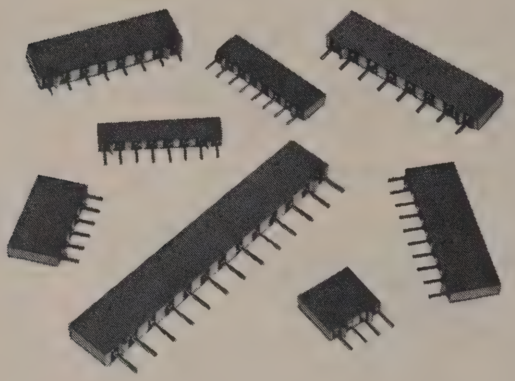
CTS® CORPORATION*
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices)*

CTS . . . Leader in the field of **Low Profile** space-saving Cermet Resistor Modules. Readily recognizable because of the familiar CTS Blue.

As is well illustrated, these modules have been specifically designed to save space.



750 Series

Environmental Performance Characteristics		
For units less than .340″ high, refer to page 8 for performance characteristics. Test	Allowable Resistance Change CTS Max△ R	CTS Avg. △ R
Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C	±0.40%	±0.20%
Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs.	±0.50%	±0.20%
Insulation Resistance: Measured wet after moisture resistance test, 200 VDC	Greater than 1000 megohms	
Low Temperature Exposure: −63°C, 4 hrs.	±0.10%	±0.04%
Thermal Shock: 5 cycles, −63°C to +125°C, no load	±0.10%	±0.03%
Short Time Overload: 2.5 times rated voltage, 5 sec.	±0.25%	±0.05%
Terminal Strength: 5 lb. tensile & compression, 30 sec.	±0.10%	±0.03%
Effect of Soldering: 60/40 solder, 246°C, 2 sec.	±0.10%	±0.05%

So if you want to reduce the size of your design or add more complex circuitry without increasing size, CTS rates top consideration.

Most appealing is the fact that "The Little Blue Brick" is an extensive "Off The Shelf" item with CTS.

FEATURES:

- Compact edge mount modules
- Ultra high stability and reliability
- Automatic insertion capabilities
- Reduced insertion time
- Fewer items to inventory
- Space savings over individual resistors
- Available with capacitors and/or active devices*
- Available with .100″ and .125″ lead centers

ELECTRICAL AND MECHANICAL SPECIFICATIONS:

Description: Cermet thick film single-in-line resistor networks.

Standard Resistance Range: 33Ω through 1 MegΩ.

Special Resistance Range: Below 33Ω and above 1 MegΩ.

Resistance Matching (2 like resistors):
50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ — ±5%

Standard Temperature Coefficient: ±250 ppm/°C.

Special Temperature Coefficient: ±100 ppm/°C.

Temperature Coefficient Tracking: Available to 50 ppm/°C.

Standard Resistance Tolerance: ±5%.

Special Resistance Tolerance: to ±0.5% or ½Ω (whichever is greater).

Substrate Material: Alumina.

Resistor Material: Cermet - thick film.

Insulation Coating: Organic - epoxy phenolic.

Lead Material: Solder coated copper.

Solder: 60/40 Tin/Lead.

Lead Strength: 5# pull.

Wattage Rating @ 70°C (see chart below).

Lead Centers	Ht. of Module (Max.)	Number of Pins										
		2	4	5	6	7	8	9	10	11	12	13
.100	(.250)	—	—	—	.9	—	1.1	1.3	1.5	—	—	—
.100	(.350)	—	.7	—	1.0	—	1.3	—	2.0	2.3	2.5	—
.125	(.350)	.5	1.0	—	1.5	—	2.0	—	2.5	—	3.0	—

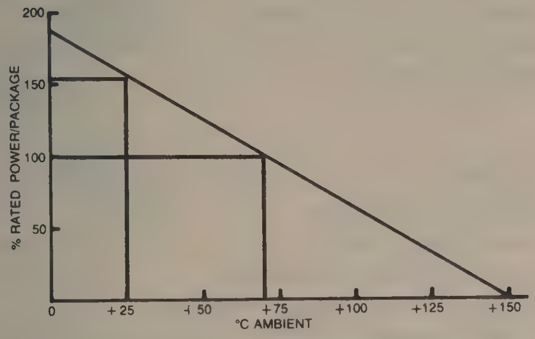
* Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana, dba CTS Electronics Corporation

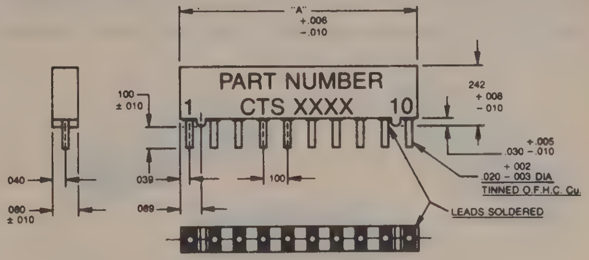
CTS® CORPORATION*
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS



TYPICAL DERATING CURVE FOR CTS 750 SERIES

NO. OF PINS	"A" DIMENSION
6	.578
8	.778
9	.878
10	.978

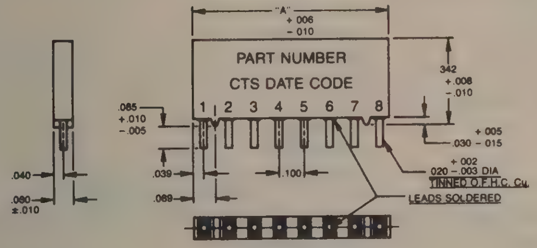


"A"
+.006
-.010
PART NUMBER
CTS XXXX
1
10
100
± 010
242
+ 008
- 010
+.005
.030 -.010
+ 002
.020 - 003 DIA
TINNED O.F.H.C. Cu.
LEADS SOLDERED
040
080
± 010
039
100
089

NOTE:
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY.

GEN. TOL. ±.005

NO. OF PINS	"A" DIMENSION
4	.378
6	.578
8	.778
10	.978
11	1.078
12	1.178

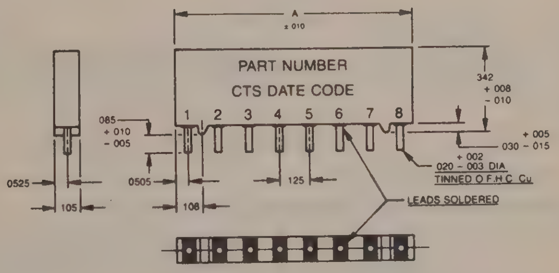


"A"
+ 006
- 010
PART NUMBER
CTS DATE CODE
1 2 3 4 5 6 7 8
.085
+.010
-.005
342
+.008
-.010
+ 005
.030 - 015
+ 002
020 -.003 DIA
TINNED O.F.H.C. Cu.
LEADS SOLDERED
.040
.080
±.010
.039
.100
.089

NOTE:
INSULATION COATING APPLIED
ON THE TWO FACES ONLY.

GEN. TOL. ±.005

NO. OF PINS	"A" DIMENSION
2	.228
4	.478
6	.728
8	.978
10	1.228
12	1.478



A
± 010
PART NUMBER
CTS DATE CODE
1 2 3 4 5 6 7 8
085
+ 010
- 005
342
+ 008
- 010
+ 005
030 - 015
+ 002
020 - 003 DIA
TINNED O F.H C Cu
LEADS SOLDERED
0525
105
0505
108
125

NOTE:
INSULATION COATING APPLIED
ON THE TWO FACES ONLY.

GEN. TOL. ±.005

QUALITY — HOW'S THIS!!

138,000 YEARS OF LIFE TESTING UNSURPASSED IN THE INDUSTRY

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

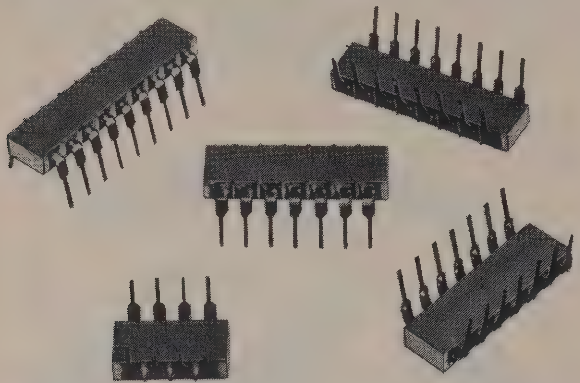
* In Indiana. dba CTS Electronics Corporation

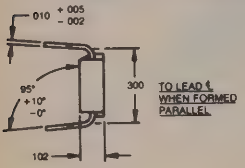
CTS® CORPORATION*
BERNE DIVISION

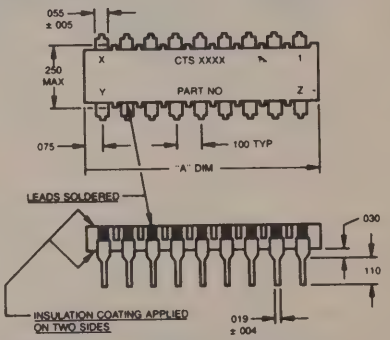
DUAL-IN-LINE CERMET RESISTOR NETWORKS

CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices)*

CTS Series 760 Dual-In-Line cermet resistor networks are available in 8, 14, 16, and 18 lead styles. CTS now offers you a choice of four popular space-saver packages. All are designed to simplify automatic insertion along with IC's and other DIP products for reduced costs. Easy to hand mount, too. Available without cover coat, so you can trim for circuit balance in your own plant. Choose from standard circuits available off-the-shelf for immediate delivery or custom designed to your specifications.







NO OF PINS	"A" DIM	PIN DESIGNATION		
		X	Y	Z
8	450	4	5	8
14	750	7	8	14
16	850	8	9	16
18	950	9	10	18

GEN. TOL ±010

Environmental Performance Characteristics

Test	Allowable Resistance Change CTS Max △ R	CTS Avg. △ R
Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C	±0.50%	±0.20%
Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs.	±0.50%	±0.20%
Insulation Resistance: Measured wet after moisture resistance test, 200 VDC	Greater than 1000 megohms	
Low Temperature Exposure: −63°C, 4 hrs.	±0.25%	±0.10%
Thermal Shock: 5 cycles, −63°C to +125°C, no load	±0.25%	±0.10%
Short Time Overload: 2.5 times rated voltage, 5 sec.	±0.25%	±0.05%
Terminal Strength: 5 lb. tensile & compression, 30 sec.	±0.25%	±0.03%
Effect of Soldering: 60/40 solder, 246°C, 2 sec.	±0.25%	±0.05%

FEATURES:

- Low height profile
- .100″ lead spacing
- High overload capabilities
- 8, 14, 16 & 18 pin constructions
- Compatible with automatic insertion equipment
- 2 watt power capabilities
- Reduced insertion time
- Available with capacitors and/or active devices*

ELECTRICAL AND MECHANICAL SPECIFICATIONS:

Description: 8, 14, 16, and 18 pin dual-in-line modules on .100″ lead centers.

Standard Resistance Range: 22Ω through 1 MegΩ.

Special Resistance Range: Below 22Ω and above 1 MegΩ.

Resistance Matching (2 like resistors):
50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ — ±5%

Wattage Rating @ 70°C per module: 8 pin - .75 watt; 14 pin - 1.5 watts; 16 pin - 1.75 watts; 18 pin - 2.0 watts.

Standard Temperature Coefficient: ±300 ppm/°C.

Special Temperature Coefficient: to ±100 ppm/°C.

Temperature Coefficient Tracking: Available to 50 ppm/°C.

Standard Resistance Tolerance: ±5%.

Special Resistance Tolerance: ±1% or ½Ω (whichever is greater).

Substrate Material: Alumina.

Resistor Material: Cermet - thick film.

Insulation Coating: Organic - epoxy phenolic.

Lead Material: Solder coated copper.

Solder: 60/40 Tin/Lead.

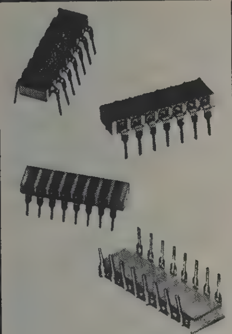
Lead Strength: 5# pull.

* Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.

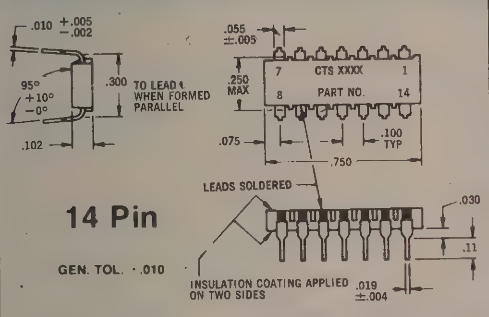
ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION*
BERNE DIVISION

DUAL-IN-LINE CERMET RESISTOR NETWORKS



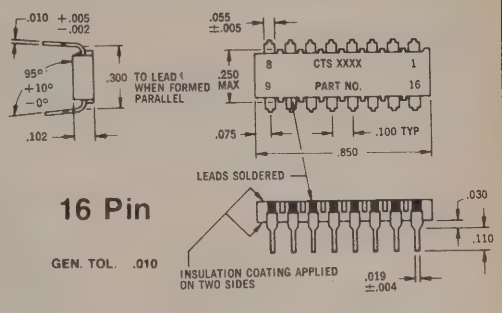
CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	Typical TC	Prices 1-99	Prices 100-499	Prices 500-999
760-3	14 Pin Module on .100″ x .300″ DIP Centers	Cermet	22Ω-220KΩ*±2%	1.5 @ 70°C per module	±100 ppm/°C	$1.15	$ .93	$ .66
760-1						1.20	.95	.68
760-5						2.15	1.75	1.25
761-3	16 Pin Module on .100″ x .300″ DIP Centers	Cermet	68Ω-220KΩ*±2%	1.75 @ 70°C per module	±100 ppm/°C	$1.20	$ .95	$ .68
761-1						1.25	.98	.70
761-5						2.30	1.88	1.34


.010 +.005 −.002
95° +10° −0°
.300 TO LEAD ℄ WHEN FORMED PARALLEL
.102
.055 ±.005
.250 MAX
7 CTS XXXX 1
8 PART NO. 14
.075
.100 TYP
.750
LEADS SOLDERED
.030
.11
INSULATION COATING APPLIED ON TWO SIDES
.019 ±.004

14 Pin

GEN. TOL. ·.010

FEATURES:
- Low cost automatic insertion and handling
- High overload capabilities
- Low height profile
- Package compatibility with monolithic packages
- .100″ lead spacing


.010 +.005 −.002
95° +10° −0°
.300 TO LEAD ℄ WHEN FORMED PARALLEL
.102
.055 ±.005
.250 MAX
8 CTS XXXX 1
9 PART NO. 16
.075
.100 TYP
.850
LEADS SOLDERED
.030
.110
INSULATION COATING APPLIED ON TWO SIDES
.019 ±.004

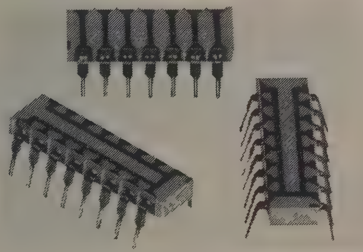
16 Pin

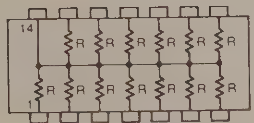
GEN. TOL. .010

CONDUCTOR MODULES

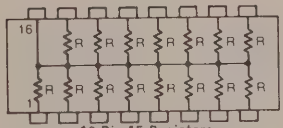
Eliminate time consuming installation of jumper wires.

Density of Jumpers:
Depending on number of pins, screened on both sides of substrate. Built to customer specifications and requirements.



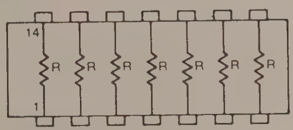


14 Pin-13 Resistors
Part Number 760-1-R+value

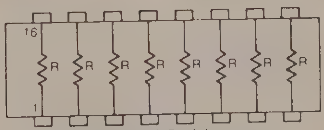


16 Pin-15 Resistors
Part Number 761-1-R+value

APPLICATIONS: MOS/ROM pull-up/pull-down; Open collector pull-up; "Wired OR" pull-up; Power driver pull-up; High speed parallel pull-up; TTL unused gate pull-up; TTL input pull-down; Digital pulse squaring.

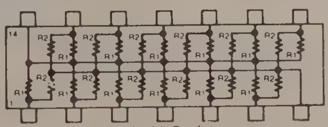


14 Pin-7 Resistors
Part Number 760-3-R+value

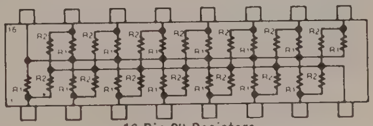


16 Pin-8 Resistors
Part Number 761-3-R+value

APPLICATIONS: "Wired OR" pull-up; Power driver pull-up; Power gate pull-up; Line termination; Long-line impedance balancing; LED current limiting; ECL output pull-down resistors; TTL input pull-down.



14 Pin-24 Resistors
Part Number 760-5-R+values



16 Pin-28 Resistors
Part Number 761-5-R+values

Resistance Values R1/R2	Part Numbers	
220Ω/270Ω	760-5-R220/270	761-5-R220/270
220Ω/330Ω	760-5-R220/330	761-5-R220/330
1.5K/3.3K	760-5-R1.5/3.3K	761-5-R1.5K/3.3K

Other combinations available upon request

Pulse Squaring TTL Terminators

CTS Terminator networks consist of two resistor pairs of the above value combinations. The resistors are connected together in series with a common line for power and a common line for ground. The junction of each pair is brought out to a separate terminal.

CTS® CORPORATION*

BERNE DIVISION

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

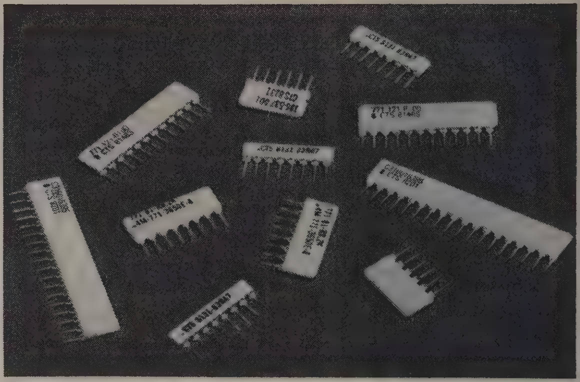
* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION*
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

CONFORMAL COATED SERIES 770-771

These conformal coated networks are supplied in both the 4.95mm/.195 in. max. and 8.89mm/.350 in. max. height. Custom networks can be supplied with special resistor values and resistor combinations and tolerance to meet most customer applications.

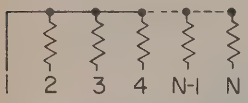


FEATURES:

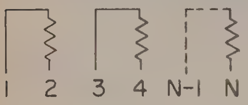
- High reliability cermet resistors
- Space saving over individual resistors
- Available with capacitors
- Available at 4.95mm/.195 in or 8.89mm/.350 in. high; 2.54mm/.100 in. pin spacing
- 770 series available off-the-shelf in many values

TYPICAL CIRCUITS

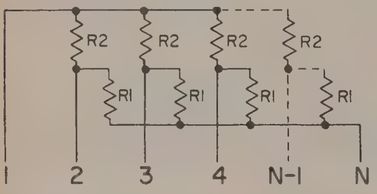
CIRCUIT #1



CIRCUIT #3



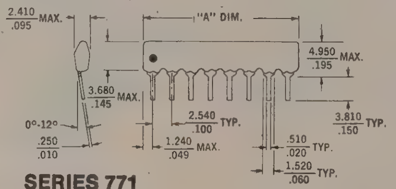
CIRCUIT #5



R2
R2
R2
R2
R1
R1
R1
R1
1
2
3
4
N-1
N

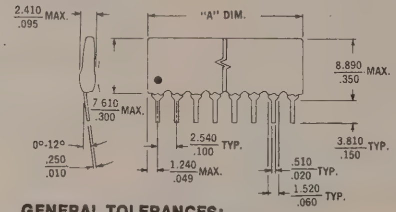
DIMENSIONS

SERIES 770



2.410/.095 MAX.
"A" DIM.
4.950/.195 MAX.
3.680/.145 MAX.
0°-12°
.250/.010
2.540/.100 TYP.
1.240/.049 MAX.
3.810/.150 TYP.
.510/.020 TYP.
1.520/.060 TYP.

SERIES 771

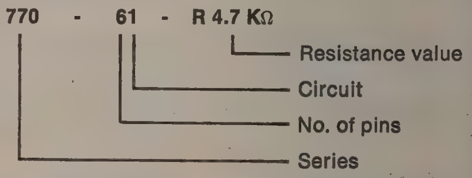


2.410/.095 MAX.
"A" DIM.
8.890/.350 MAX.
7.610/.300 MAX.
0°-12°
.250/.010
2.540/.100 TYP.
1.240/.049 MAX.
3.810/.150 TYP.
.510/.020 TYP.
1.520/.060 TYP.

GENERAL TOLERANCES:
Decimal dimensions ±.25mm/±.010″

NO. OF PINS	"A" DIMENSION
4	10.160/.398 Max
5	12.700/.498 Max
6	15.240/.598 Max
7	17.780/.698 Max
8	20.320/.798 Max
9	22.860/.898 Max
10	25.400/.998 Max
11	27.940/1.098 Max
12	30.480/1.198 Max

CODING SYSTEM



770 - 61 - R 4.7 KΩ
Resistance value
Circuit
No. of pins
Series

***POWER RATING:**

Series	Package	Resistor Power	4	5	6	7	8	9	10	11	12
TOTAL NETWORK POWER @ 25°C											
			Number of Pins								
770	4.95/.195	.20	0.5	0.7	0.8	0.9	1.1	1.2	1.4	1.5	1.6
771	8.89/.350	.375	0.9	1.1	1.4	1.6	1.8	2.0	2.2	2.5	2.7
TOTAL NETWORK POWER @ 70°C											
770	4.95/.195	.125	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
771	8.89/.350	.25	0.6	0.8	0.9	1.0	1.2	1.4	1.5	1.6	1.8

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standards. TCR may be affected by some custom network requirements.

SPECIFICATIONS

***RESISTANCE RANGE:**
Standard 33Ω to 1.0 Meg. Ω

RESISTANCE TOLERANCE:
Standard: ±2%
Special: 0.5% or 0.5Ω (Whichever greater)

***MAXIMUM OPERATING VOLTAGE:**
Series 770: 50V not to exceed rated power
Series 771: 100V not to exceed rated power

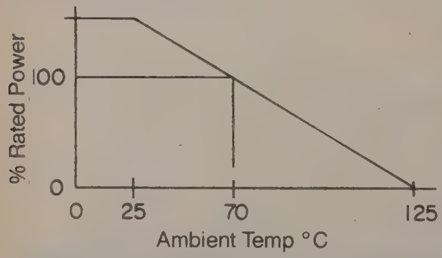
***TEMPERATURE COEFFICIENT:**
±100 PPM @ −55°C to +125°C

***OPERATING TEMP. RANGE:**
−55°C to +125°C

STORAGE TEMP. RANGE:
−55°C to +125°C

DIELECTRIC STRENGTH:
100V

Power Derating Curve



ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

Test	Max. % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.5%	107	B	5 cycles −65°C to +125°C
Short Time Overload	0.5%	—	—	2½ x rated voltage 5 sec. (Series 770: 100V max.) (Series 771: 200V max.)
Moisture Resistance	0.5%	106	—	240 hours .1 rated load −10°C to +65°C 90% RH
Load Humidity	1.0%	—	—	1000 hours .1 rated load 65°C 90-98% RH
High Temp Exposure	1.0%	—	—	240 hours no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C rated load
Resistance to Solder Heat	.25%	210	A	350°C 3 sec dwell
Mechanical Shock	.25%	213	D	500g 1 msec 3/shocks ea plane
Vibration	.25%	204	D	20g 10-2000 Hz 4 hours/plane
Terminal Strength	.25%	—	—	2.0 Kg pull 30 sec two 45° bends
Low Temp Storage	.25%	—	—	24 hours @ −65°C no load
Low Temp Operation	.25%	—	—	1 hour @ −65°C full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC
Solderability		208	—	RMA flux 230°C 5 sec dip 95% coverage

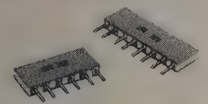
ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION*
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

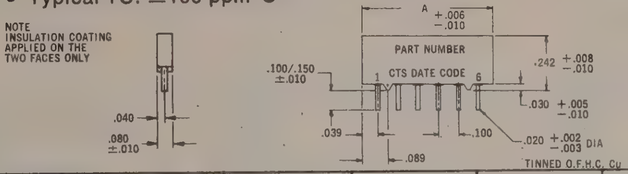
750 SERIES SINGLE-IN-LINE CERMET RESISTOR NETWORKS



FEATURES:

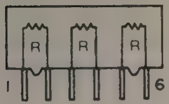
- Low profile construction
- High reliability
- Alumina substrate
- Low cost automatic insertion and handling

- 6, 8 and 10-pin modules on .100″ lead centers
- Resistance: 32Ω - 220 KΩ* ±2% (for 750-85 Series, see table below schematic)
- Power ratings @ 70°C per module: 6 pin .9 watt; 8 pin 1.1 watt; 10 pin 1.5 watt
- Typical TC: ±100 ppm°C

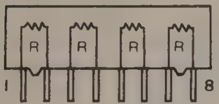


No. of Pins	A
6	.578
8	.778
10	.987

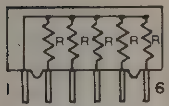
GENERAL TOLERANCES:
Decimal dimensions ±.005″



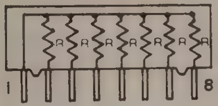
6 PIN — 3 RESISTORS
PART NUMBER
750-63-R (VALUE)



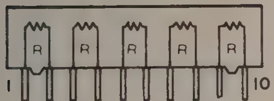
8 PIN — 4 RESISTORS
PART NUMBER
750-83-R-(VALUE)



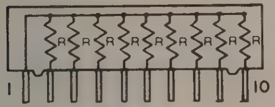
6 PIN — 5 RESISTORS
PART NUMBER
750-61-R (VALUE)



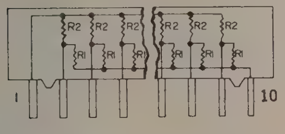
8 PIN — 7 RESISTORS
PART NUMBER
750-81-R (VALUE)



10 PIN — 5 RESISTORS
PART NUMBER 750-103-R (VALUE)



10 PIN — 9 RESISTORS
PART NUMBER 750-101-R (VALUE)



8 PIN — 12 RESISTORS
PART NUMBER 750-85 — 750-85-R (R1/R2)
10 PIN — 16 RESISTORS
PART NUMBER 750-105 — 750-105R (R1/R2)

R1/R2 Ohms	Thevenin Impedance
180/390	123Ω
220/330	132Ω
330/390	180Ω
330/470	195Ω

Resistance Value, Tolerance	6 Pin, 3 Resistor	6 Pin, 5 Resistor	8 Pin, 4 Resistor	8 Pin, 7 Resistor	10 Pin, 5 Resistor	10 Pin, 9 Resistor
33Ω±2%	750-63-R33Ω	750-61-R33Ω	750-83-R33Ω	750-81-R33Ω	750-103-R33Ω	750-101-R33Ω
47Ω±2%	—	—	750-83-R47Ω	—	750-103-R47Ω	750-101-R47Ω
51Ω±2%	—	750-61-R51Ω	—	750-81-R51Ω	—	750-101-R51Ω
56Ω±2%	—	—	750-83-R56Ω	750-81-R56Ω	—	750-101-R56Ω
62Ω±2%	—	—	—	—	—	750-101-R62Ω
68Ω±2%	750-63-R68Ω	750-61-R68Ω	750-83-R68Ω	750-81-R68Ω	750-103-R68Ω	750-101-R68Ω
75Ω±2%	—	—	750-83-R75Ω	750-81-R75Ω	—	—
82Ω±2%	—	750-61-R82Ω	750-83-R82Ω	750-81-R82Ω	—	—
91Ω±2%	—	750-61-R91Ω	—	750-81-R91Ω	—	—
100Ω±2%	750-63-R100Ω	750-61-R100Ω	750-83-R100Ω	750-81-R100Ω	750-103-R100Ω	750-101-R100Ω
110Ω±2%	—	750-61-R110Ω	—	750-81-R110Ω	—	—
120Ω±2%	—	750-61-R120Ω	750-83-R120Ω	750-81-R120Ω	750-103-R120Ω	750-101-R120Ω
150Ω±2%	750-63-R150Ω	750-61-R150Ω	750-83-R150Ω	750-81-R150Ω	—	—
160Ω±2%	—	750-61-R160Ω	—	750-81-R160Ω	—	750-101-R160Ω
180Ω±2%	—	750-61-R180Ω	750-83-R180Ω	750-81-R180Ω	750-103-R180Ω	750-101-R180Ω
200Ω±2%	—	750-61-R200Ω	—	750-81-R200Ω	—	—
220Ω±2%	750-63-R220Ω	750-61-R220Ω	750-83-R220Ω	750-81-R220Ω	750-103-R220Ω	750-101-R220Ω
240Ω±2%	—	750-61-R240Ω	—	—	—	—
270Ω±2%	—	750-61-R270Ω	750-83-R270Ω	750-81-R270Ω	750-103-R270Ω	750-101-R270Ω
330Ω±2%	750-63-R330Ω	750-61-R330Ω	750-83-R330Ω	750-81-R330Ω	750-103-R330Ω	750-101-R330Ω
360Ω±2%	—	750-61-R360Ω	—	—	—	—
390Ω±2%	—	750-61-R390Ω	—	750-81-R390Ω	—	750-101-R390Ω
430Ω±2%	—	750-61-R430Ω	—	750-81-R430Ω	—	—
470Ω±2%	750-63-R470Ω	750-61-R470Ω	750-83-R470Ω	750-81-R470Ω	750-103-R470Ω	750-101-R470Ω
500Ω±2%	—	750-61-R500Ω	—	750-81-R500Ω	—	750-101-R510Ω
510Ω±2%	—	750-61-R510Ω	—	750-81-R510Ω	—	—
560Ω±2%	—	—	—	750-81-R560Ω	750-103-R560Ω	750-101-R560Ω
680Ω±2%	750-63-R680Ω	750-61-R680Ω	750-83-R680Ω	750-81-R680Ω	750-103-R680Ω	750-101-R680Ω
820Ω±2%	—	—	—	750-81-R820Ω	—	750-101-R820Ω
910Ω±2%	—	—	—	750-81-R910Ω	—	—
1KΩ±2%	750-63-R1KΩ	750-61-R1KΩ	750-83-R1KΩ	750-81-R1KΩ	750-103-R1KΩ	750-101-1RKΩ
1.1KΩ±2%	—	—	—	—	—	750-101-R1.1KΩ
1.2KΩ±2%	—	750-61-R1.2KΩ	750-83-R1.2KΩ	750-81-R1.2KΩ	—	750-101-R1.2KΩ
1.33KΩ±2%	—	750-61-R1.33KΩ	—	—	—	—
1.5KΩ±2%	750-63-R1.5KΩ	750-61-R1.5KΩ	750-83-R1.5KΩ	750-81-R1.5KΩ	750-103-R1.5KΩ	750-101-R1.5KΩ
2KΩ±2%	750-63-R2KΩ	750-61-R2KΩ	750-83-R2KΩ	750-81-R2KΩ	—	750-101-R2KΩ
2.2KΩ±2%	750-63-R2.2KΩ	750-61-R2.2KΩ	750-83-R2.2KΩ	750-81-R2.2KΩ	750-103-R2.2KΩ	750-101-R2.2KΩ
2.7KΩ±2%	—	750-61-R2.7KΩ	—	750-81-R2.7KΩ	—	—
3KΩ±2%	—	—	750-83-R3KΩ	750-81-R3KΩ	—	—
3.3KΩ±2%	750-63-R3.3KΩ	750-61-R3.3KΩ	750-83-R3.3KΩ	750-81-R3.3KΩ	750-103-R3.3KΩ	750-101-R3.3KΩ
3.9KΩ±2%	—	—	—	750-81-R3.9KΩ	—	—
4.7KΩ±2%	750-63-R4.7KΩ	750-61-R4.7KΩ	750-83-R4.7KΩ	750-81-R4.7KΩ	750-103-R4.7KΩ	750-101-R4.7KΩ
5.1KΩ±2%	—	750-61-R5.6KΩ	750-83-R5.1KΩ	—	—	—
5.6KΩ±2%	—	—	750-83-R5.6KΩ	750-81-R5.6KΩ	—	750-101-R5.6KΩ
6.8KΩ±2%	750-63-R6.8KΩ	750-61-R6.8KΩ	750-83-R6.8KΩ	750-81-R6.8KΩ	750-103-R6.8KΩ	750-101-R6.8KΩ
10KΩ±2%	750-63-R10KΩ	750-61-R10KΩ	750-83-R10KΩ	750-81-R10KΩ	750-103-R10KΩ	750-101-R10KΩ
12KΩ±2%	—	—	—	—	—	750-101-R12KΩ
15KΩ±2%	750-63-R15KΩ	750-61-R15KΩ	750-83-R15KΩ	750-81-R15KΩ	750-103-R15KΩ	750-101-R15KΩ
16KΩ±2%	—	—	—	—	—	—
18KΩ±2%	—	—	—	750-81-R18KΩ	—	—
20KΩ±2%	—	—	750-83-R20KΩ	—	—	—
22KΩ±2%	750-63-R22KΩ	750-61-R22KΩ	750-83-R22KΩ	750-81-R22KΩ	750-103-R22KΩ	750-101-R22KΩ
33KΩ±2%	750-63-R33KΩ	750-61-R33KΩ	750-83-R33KΩ	750-81-R33KΩ	750-103-R33KΩ	750-101-R33KΩ
47KΩ±2%	750-63-R47KΩ	750-61-R47KΩ	750-83-R47KΩ	750-81-R47KΩ	750-103-R47KΩ	750-101-R47KΩ
56KΩ±2%	—	—	—	750-81-R56KΩ	—	750-101-R56KΩ
68KΩ±2%	750-63-R68KΩ	750-61-R68KΩ	750-83-R68KΩ	750-81-R68KΩ	750-103-R68KΩ	—
100KΩ±2%	750-63-R100KΩ	750-61-R100KΩ	750-83-R100KΩ	750-81-R100KΩ	750-103-R100KΩ	750-101-R100KΩ
120KΩ±2%	—	—	750-83-R120KΩ	—	—	—
150KΩ±2%	750-63-R150KΩ	750-61-R150KΩ	750-83-R150KΩ	750-81-R150KΩ	—	750-101-R150KΩ
220KΩ±2%	750-63-R220KΩ	750-61-R220KΩ	750-83-R220KΩ	750-81-R220KΩ	—	750-101-R220KΩ

NOTE: Additional resistance values are constantly being added. Please contact your local CTS Industrial Distributor to check availability of values not shown above.

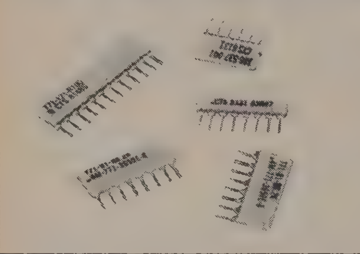
ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION*
BERNE DIVISION

SIP RESISTOR NETWORKS

770 SERIES SINGLE-IN-LINE CONFORMAL COATED CERMET RESISTOR NETWORKS

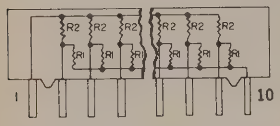
	CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	TC
	770-63	6, 8, and 10 Pin Single In-Line Conformal Coated Network on .100" Lead Centers	Cermet	33Ω-220 KΩ* ±2%	6 Pin .5 Watt 8 Pin .7 Watt 10 Pin .9 Watt @ 70°C per module	±100 ppm/°C typical
	770-61					
	770-83					
	770-81					
	770-103					
	770-101					

FEATURES

- High reliability cermet resistors
- Low-Profile construction
- .100" lead spacing
- High reliability
- Alumina substrate

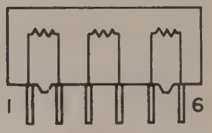
NO. OF PINS	"A" DIMENSION
6	15.240/.598 Max.
8	20.320/.798 Max.
10	25.400/.998 Max.

General Tolerances: ±.25mm/±.010 decimal dimensions.

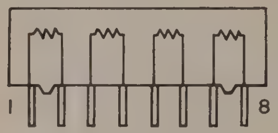


8 PIN — 12 RESISTORS
PART NUMBER 750-85 — 750-85-R (R1/R2)
10 PIN — 16 RESISTORS
PART NUMBER 750-105 — 750-105R (R1/R2)

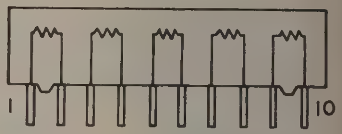
R1/R2 Ohms	Thevenin Impedance
180/390	123Ω
220/330	132Ω
330/390	180Ω
330/470	195Ω



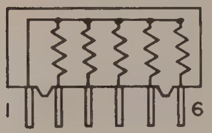
6 Pin-3 Resistors Conformal Coated
Part Number 770-63-R (value)



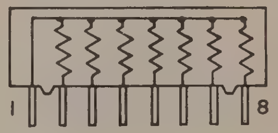
8 Pin-4 Resistors Conformal Coated
Part Numer 770-83-R (value)



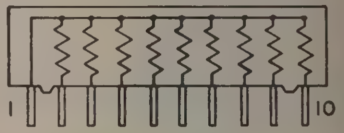
10 Pin-5 Resistors Conformal Coated
Part number 770-103-R (value)



6 Pin-5 Resistors Conformal Coated
Part Number 770-61-R (value)



8 Pin-7 Resistors Conformal Coated
Part Number 770-81-R (value)



10 Pin-9 Resistors Conformal Coated
Part Number 770-101-R (value)

STANDARD "OFF THE SHELF" PART NUMBERS*

Resistance Value, ±2% Tolerance	6 Pin, 3 Resistor	6 Pin, 5 Resistor	8 Pin 4 Resistor	8 Pin, 7 Resistor	10 Pin, 5 Resistor	10 Pin, 9 Resistor
33Ω	—	—	770-83-R33Ω	770-81-R33Ω	—	—
47Ω	—	—	770-83-R47Ω	—	—	770-101-R47Ω
56Ω	—	—	770-83-R56Ω	770-81-R56Ω	—	770-101-R56Ω
100Ω	770-63-R100Ω	770-61-R100Ω	770-83-R100Ω	770-81-R100Ω	770-103-R100Ω	770-101-R100Ω
150Ω	—	770-61-R150Ω	770-83-R150Ω	770-81-R150Ω	—	—
180Ω	—	—	770-83-R180Ω	770-81-R180Ω	—	—
220Ω	770-63-R220Ω	770-61-R220Ω	770-83-R220Ω	770-81-R220Ω	770-103-R220Ω	770-101-R220Ω
270Ω	—	—	—	770-81-R270Ω	—	—
330Ω	770-63-R330Ω	770-61-R330Ω	770-83-R330Ω	770-81-R330Ω	770-103-R330Ω	770-101-R330Ω
390Ω	—	770-61-R390Ω	—	770-81-R390Ω	—	—
470Ω	770-63-R470Ω	770-61-R470Ω	770-83-R470Ω	770-81-R470Ω	770-103-R470Ω	770-101-R470Ω
510Ω	—	—	—	770-81-R510Ω	—	—
560Ω	—	—	—	770-81-R560Ω	—	—
680Ω	770-63-R680Ω	770-61-R680Ω	770-83-R680Ω	770-81-R680Ω	—	770-101-R680Ω
1KΩ	770-63-R1KΩ	770-61-R1KΩ	770-83-R1KΩ	770-81-R1KΩ	770-103-R1KΩ	770-101-R1KΩ
1.5KΩ	—	770-61-R1.5KΩ	—	770-81-R1.5KΩ	—	770-101-R1.5KΩ
2.2KΩ	770-63-R2.2KΩ	770-61-R2.2KΩ	770-83-R2.2KΩ	770-81-R2.2KΩ	—	770-101-R2.2KΩ
3.3KΩ	770-63-R3.3KΩ	770-61-R3.3KΩ	770-83-R3.3KΩ	770-81-R3.3KΩ	770-103-R3.3KΩ	770-101-R3.3KΩ
4.7KΩ	770-63-R4.7KΩ	770-61-R4.7KΩ	770-83-R4.7KΩ	770-81-R4.7KΩ	—	770-101-R4.7KΩ
5.6KΩ	—	—	—	—	—	770-101-R5.6KΩ
6.8KΩ	—	770-61-R6.8KΩ	—	770-81-R6.8KΩ	—	770-101-R6.8KΩ
10KΩ	770-63-R10KΩ	770-61-R10KΩ	770-83-R10KΩ	770-81-R10KΩ	770-103-R10KΩ	770-101-R10KΩ
15KΩ	—	770-61-R15KΩ	—	—	—	—
22KΩ	770-63-R22KΩ	—	770-83-R22KΩ	770-81-R22KΩ	770-103-R22KΩ	770-101-R22KΩ
33KΩ	—	770-61-R33KΩ	—	770-81-R33KΩ	—	—
47KΩ	770-63-R47KΩ	770-61-R47KΩ	770-83-R47KΩ	770-81-R47KΩ	770-103-R47KΩ	770-101-R47KΩ
100KΩ	770-63-R100KΩ	770-61-R100KΩ	770-83-R100KΩ	770-81-R100KΩ	770-103-R100KΩ	770-101-R100KΩ
220KΩ	—	—	770-83-R220KΩ	770-81-R220KΩ	—	—

* NOTE: Additional resistance values are constantly being added. Please contact your local CTS Industrial Distributor to check availability of values not shown above.

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION*
BERNE DIVISION

NEW FOR 85

SMD RESISTOR NETWORKS DEVELOPMENT ENGINEER'S KIT

10 PIECES EACH STYLE RANDOM VALUES

.100" CENTERS REG. $79.95
INTRODUCTORY AT ONLY $49.95
MAXIMUM 3 KITS/ENGINEER

.050" CENTERS REG. $99.95
INTRODUCTORY AT ONLY $69.95
MAXIMUM 3 KITS/ENGINEER

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION*
BERNE DIVISION

SURFACE MOUNT RESISTOR NETWORKS

SPECIFICATIONS

***Resistance Range**	Standard 33 ohm to 1.0 Megohm
Resistance Tolerance:	Standard: ±2%
***Max. Operating Voltage:**	Special: 0.5% or 0.5 ohm (whichever greater)
***Temp. Coefficient:**	50V not to exceed rated power
***Operating Temp. Range:**	±100 PPM @ −55°C to +125°C
Storage Temp. Range:	−55°C to +125°C
Dielectric Strength:	−55°C to +125°C
***Power Rating:**	100V

	Resistor Power	Total Network Power			
		8P	14P	16P	18P
@ 70°C	.07	.25w	.4w	.5w	.62
@ 25°C	.1	.38w	.6w	.75	.9w

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standards. TCR may be affected by some custom network requirements.

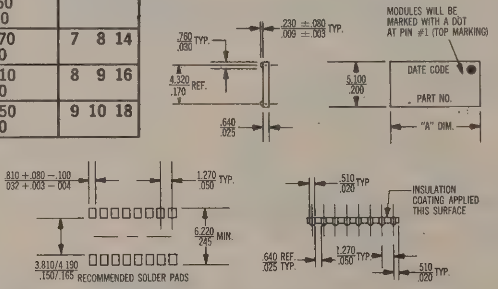
ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

Test	Max. % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.5%	107	B	5 cycles −65°C to +125°C
Short Time Overload	0.5%	—	—	2½ x rated voltage 5 sec. (Series 770: 100V max.)
Moisture Resistance	0.5%	106	—	240 hours .1 rated load −10°C to +65°C 90% RH
Load Humidity	1.0%	—	—	1000 hours .1 rated load 65°C 90-98% RH
High Temp Exposure	1.0%	—	—	240 hours no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C rated load
Resistance to Solder Heat	.25%	210	A	350°C sec dwell
Mechanical Shock	.25%	213	D	500g 1 msec 3/shocks ea plane
Vibration	.25%	204	D	20g 10-2000 Hz 4 hours/ plane
Terminal Strength	.25%	—	—	2.0 Kg pull 30 sec two 45° bends
Low Temp Storage	.25%	—	—	24 hours @ −65°C no load
Low Temp Operation	.25%	—	—	1 hour @ −65°C full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC
Solderability		208	—	RMA flux 230°C 5 sec dip 95% coverage

FLAT MOUNTED PACK TYPE 4M-760-3790-2
ALUMINA SUBSTRATE

NO. PINS	"A" DIM ±.125 ±.005	MARKING X	Y	Z
8	9.650 .380			
14	17.270 .680	7	8	14
16	17.810 .780	8	9	16
18	22.350 .880	9	10	18

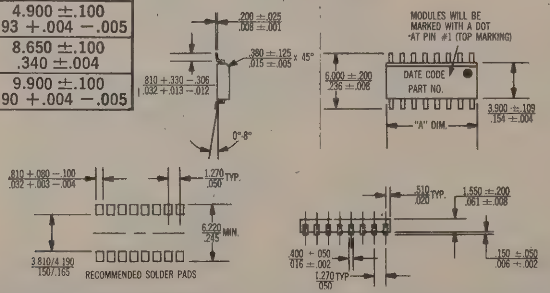
NOTE: 16 PIN ILLUSTRATED


.230 ±.080 / .009 ±.003 TYP.
.760 / .030 TYP.
4.320 / .170 REF.
.640 / .025
MODULES WILL BE MARKED WITH A DOT AT PIN #1 (TOP MARKING)
DATE CODE
PART NO.
5.100 / .200
"A" DIM.
.810 +.080 −.100 / .032 +.003 −.004
1.270 / .050 TYP.
6.220 / .245 MIN.
3.810/4.190 / .150/.165
RECOMMENDED SOLDER PADS
.510 / .020 TYP
INSULATION COATING APPLIED THIS SURFACE
.640 REF. / .025 TYP.
1.270 / .050 TYP.
.510 / .020 TYP.

FLAT MOUNTED PACK TYPE 4M-760-3790-3 (SO PAC)
ALUMINA SUBSTRATE

NO. PINS	"A" DIM.
8	4.900 ±.100 .193 +.004 −.005
14	8.650 ±.100 .340 ±.004
16	9.900 ±.100 .390 +.004 −.005

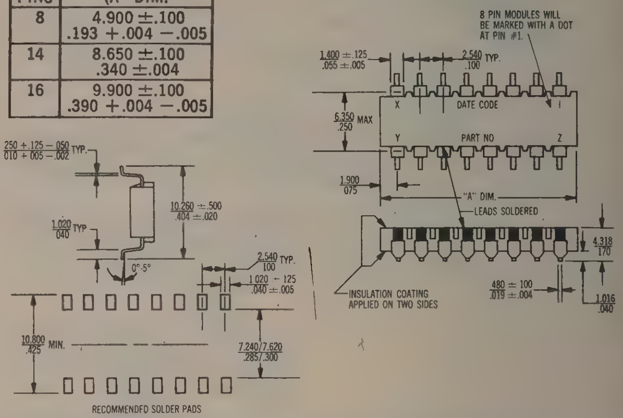
NOTE: 16 PIN ILLUSTRATED


.200 ±.025 / .008 ±.001
.380 ±.125 / .015 ±.005 x 45°
.810 +.330 −.306 / .032 +.013 −.012
0°-8°
MODULES WILL BE MARKED WITH A DOT AT PIN #1 (TOP MARKING)
6.000 ±.200 / .236 ±.008
DATE CODE
PART NO.
3.900 ±.109 / .154 ±.004
"A" DIM.
.810 +.080 −.100 / .032 +.003 −.004
1.270 / .050 TYP.
6.220 / .245 MIN.
3.810/4.190 / .150/.165
RECOMMENDED SOLDER PADS
.510 / .020 TYP.
1.550 ±.200 / .061 ±.008
.400 ±.050 / .016 ±.002
1.270 / .050 TYP
.150 ±.050 / .006 ±.002

FLAT MOUNTED PACK TYPE 4M-760-3790

NO. PINS	"(A" DIM.
8	4.900 ±.100 .193 +.004 −.005
14	8.650 ±.100 .340 ±.004
16	9.900 ±.100 .390 +.004 −.005

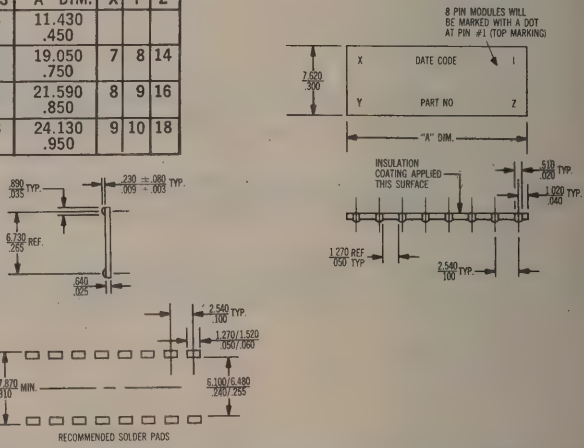
NOTE: 16 PIN ILLUSTRATED


8 PIN MODULES WILL BE MARKED WITH A DOT AT PIN #1.
1.400 ±.125 / .055 ±.005
2.540 / .100 TYP.
6.350 / .250 MAX
X
DATE CODE
Y
PART NO
Z
1.900 / .075
"A" DIM.
LEADS SOLDERED
4.318 / .170
INSULATION COATING APPLIED ON TWO SIDES
.480 ±.100 / .019 ±.004
1.016 / .040
.250 +.125 −.050 / .010 +.005 −.002 TYP.
1.020 / .040 TYP
10.260 ±.500 / .404 ±.020
0°-5°
2.540 / .100 TYP.
1.020 ±.125 / .040 ±.005
10.800 / .425 MIN.
7.240/7.620 / .285/.300
RECOMMENDED SOLDER PADS

DUAL IN-LINE FLAT PACK TYPE 4M-760-3790-1
ALUMINA SUBSTRATE
CERMET RESISTORS

NO. PINS	"A" DIM.	MARKING X	Y	Z
8	11.430 .450			
14	19.050 .750	7	8	14
16	21.590 .850	8	9	16
18	24.130 .950	9	10	18

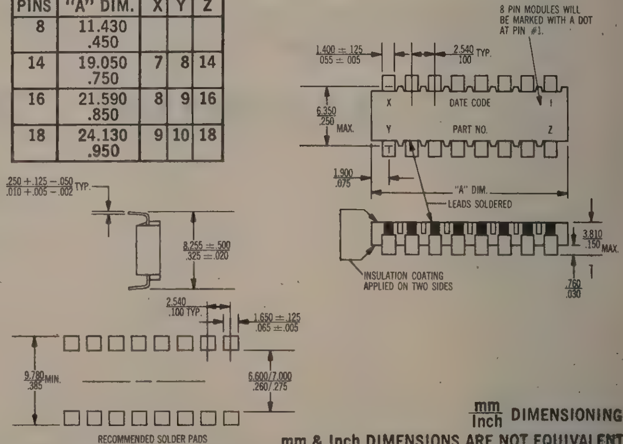
NOTE: 16 PIN ILLUSTRATED


8 PIN MODULES WILL BE MARKED WITH A DOT AT PIN #1 (TOP MARKING)
7.620 / .300
X
DATE CODE
Y
PART NO
Z
"A" DIM.
INSULATION COATING APPLIED THIS SURFACE
.518 / .020 TYP.
1.020 / .040 TYP.
1.270 REF / .050 TYP
2.540 / .100 TYP.
.890 / .035 TYP.
.230 ±.080 / .009 ±.003 TYP.
6.730 / .265 REF.
.640 / .025
2.540 / .100 TYP.
1.270/1.520 / .050/.060
7.870 / .310 MIN.
6.100/6.480 / .240/.255
RECOMMENDED SOLDER PADS

DUAL IN-LINE FLAT PACK TYPE 4M-760-3790-4
ALUMINA SUBSTRATE
CERMET RESISTORS

NO. PINS	"A" DIM.	MARKING X	Y	Z
8	11.430 .450			
14	19.050 .750	7	8	14
16	21.590 .850	8	9	16
18	24.130 .950	9	10	18

NOTE: 16 PIN ILLUSTRATED


8 PIN MODULES WILL BE MARKED WITH A DOT AT PIN #1.
1.400 ±.125 / .055 ±.005
2.540 / .100 TYP.
6.350 / .250 MAX.
X
DATE CODE
Y
PART NO.
Z
1.900 / .075
"A" DIM.
LEADS SOLDERED
3.810 / .150 MAX.
INSULATION COATING APPLIED ON TWO SIDES
.760 / .030
.250 +.125 −.050 / .010 +.005 −.002 TYP.
8.255 ±.500 / .325 ±.020
2.540 / .100 TYP.
1.650 ±.125 / .065 ±.005
9.780 / .385 MIN.
6.600/7.000 / .260/.275
RECOMMENDED SOLDER PADS

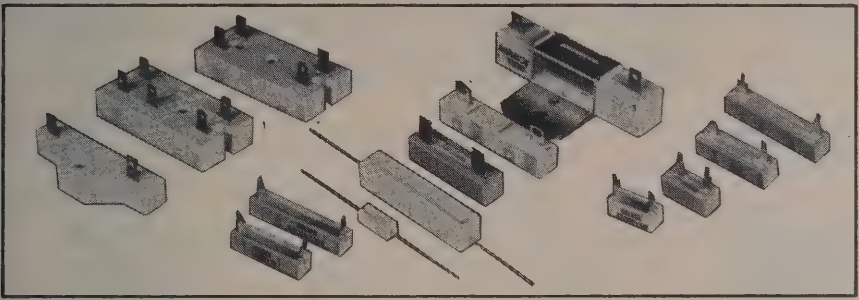
$\frac{\text{mm}}{\text{Inch}}$ DIMENSIONING
mm & Inch DIMENSIONS ARE NOT EQUIVALENT

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana. dba CTS Electronics Corporation

COLBER RESISTORS

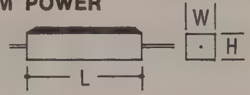
WIRE WOUND / TEMPERATURE SENSITIVE / CERAMIC ENCAPSULATED / FUSISTORS (FUSEABLE RESISTORS)



The resistance elements of the Colber resistors are uniformly and tightly wound on glass fiber cores using premium quality wires. Tinned steel or brass terminals are secured to the element by automatic assembly equipment. The high degree of automation used in manufacturing this resistor allows you to use a high quality wire wound unit at a cost of approximately two cents.

RESISTORS
FIXED WIRE WOUND

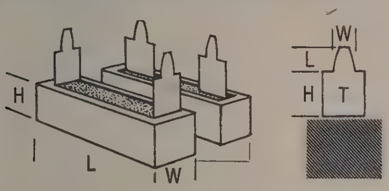
MEDIUM POWER



Part No.	Wattage Rating	L± 1/16″	H± 1/32″	W± 1/32″	Resist. Ranges (OHMS) Standard Temp. Coefficients .06%/°C	.03%/°C
CW2	2	45/64	1/4	1/4	.07-.2	.22-1.5k
CW3	3	7/8	5/16	5/16	.1-.27	.3-2.5k
CW5	5	7/8	3/8	3/8	.1-.27	.3-2.5k
CW7	7	1 25/64	11/32	3/8	.22-.7	.75-6k
CW10	10	1 7/8	11/32	3/8	.35-.9	1-8k
CW15	15	1 7/8	1/2	1/2	.35-.9	1-8k
CW20	20	2 1/2	1/2	1/2	.5-1.35	1.5-13k
CW25	25	2 1/2	5/8	5/8	—	4-400

Consult Factory for Lower Values and Special Temperature Coefficients.

ENCAPSULATED RESISTORS



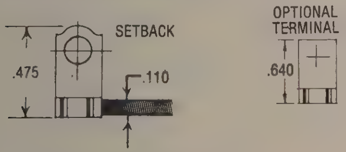
1. **Terminals** — Brass, tin plated, Parallel or perpendicular to the case.
2. **Body**—Ceramic Case, Inorganic, Fireproof Fill.
3. **Resistive Element** — High quality Colber type as in all our resistors.
4. **Tolerance** — 10% Standard, 5% Available.

TERMINAL DIMENSIONS

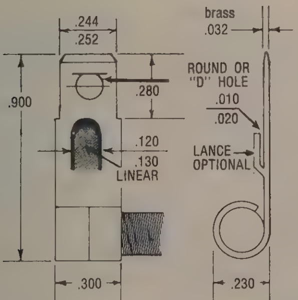
T	H	L	W
.150	.040 Ref.	.120	.055
.150	.250 Ref.	.180	.055
.150	.280 Ref.	.180	.055

STANDARD COLBER RESISTORS

Approximately 4 watts per inch

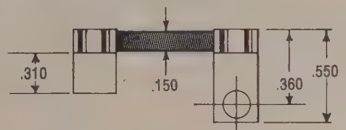

SETBACK
.475
.110
OPTIONAL TERMINAL
.640

QUICK CONNECTION


.244
.252
brass
.032
ROUND OR "D" HOLE
.010
.020
.900
.280
.120
.130
LINEAR
LANCE OPTIONAL
.300
.230

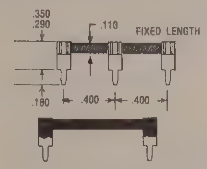
INTERMEDIATE COLBER RESISTORS

Approximately 5 watts per inch

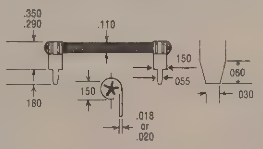

.310
.150
.360
.550

PRINTED CIRCUIT COLBER RESISTORS

Approximately 4 watts per inch


.350
.290
.110
FIXED LENGTH
.180
.400
.400

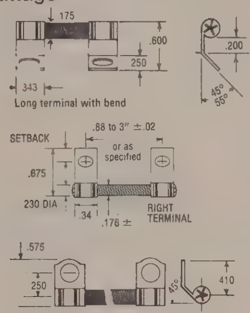
EPOXY COATED OR UNCOATED


.350
.290
.110
150
060
055
150
180
030
.018
or
.020

SHORTER AND LONGER TERMINALS AVAILABLE

HIGH WATTAGE COLBER RESISTORS

Approximately 6 watts per inch high wattage


175
.600
250
343
Long terminal with bend
.200
45°
55°
.88 to 3″ ±.02
SETBACK
or as specified
.675
230 DIA
.34
.176 ±
RIGHT TERMINAL
.575
250
45°
410

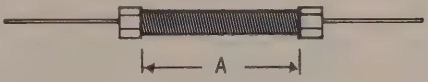
WITH OR WITHOUT BEND

Setback	Left Mounting Hole	Right Mounting Hole
.115	.155 X 1.31	.155 X .131
.125	.125 Dia.	.125 Dia.
.155	.200 X .220	.200 X .220
.155	.135	No Hole
.250	.200 X .225	.200 X .225
	.155 X .131	.155 X .131
.317	.135 X .160	.135 Dia.
.317	.200 X .225	.200 X .225
.317	.131 Dia.	.131 Dia.

Note: Any hole combination available with additional minor tooling.

AXIAL LEAD COLBER RESISTORS

TYPE AL — WIRE WOUND



LEAD SIZES AVAILABLE:
.032 X 1⅜ Tinned Copper
.032 X 1½ Tinned Copper
.032 X 1 11/16 Tinned Copper
.036 X 1 11/16 Tinned Copper
.040 X 1 11/16 Tinned Copperweld
.040 X 1⅞ Tinned Copperweld

LEAD MATERIAL:
Copper — Oxygen free, dead soft, Tinned Copperweld — Steel core, copper clad, Tinned.

CORE MATERIAL:
Silicone impregnated, braided fiberglas.

RESISTANCE TOLERANCE:
±10% Standard
±5% Available

STANDARD SIZES
(alternate sizes available):

"A" Dimension	Wattage Rating	Resistance Ranges (OHMS) Standard Temperature Coefficients .06%/°C	.03%/°C
AL-2 .280″ (min.)	1.1	.07-.2	.22-1.5k
AL-5 .400″	1.6	.1-.27	.3-2.5k
AL-6 .650″	2.6	.16-.44	.45-4k
AL-7 .925″	3.7	.22-.7	.75-6k
AL-10 1.400″	5.6	.35-.9	1-8k
AL-20 2.000″ (max.)	8.	.5-1.35	1.5-13k

the Colber Corporation

Quality and Service with Competitive Pricing Since 1950

FOR ORDERS ONLY
DEPT. EM, 26 BUFFINGTON ST. • IRVINGTON, NJ 07111 • (201) 371-9500 • TWX 710 995 4416 • TOLL FREE 800-221-0647

DALE®

SERIES CSC
Thick Film SIP Resistor Network

SPECIFICATIONS

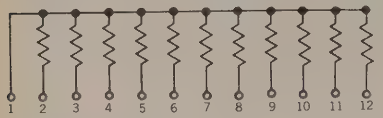
Resistance Range: 10Ω to 3.3 Megohms

Resistance Tolerance: ±2% standard.
±1%, ±5%, ±10% and ±20% available

Resistance Temperature Coefficient:
±100 PPM/°C (−55°C to +125°C) typical

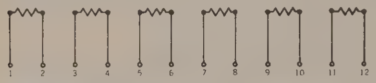
Terminals: Tin plated copper alloy

Body: High alumina. Resistors epoxy coated


1
2
3
4
5
6
7
8
9
10
11
12

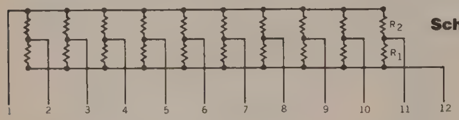
Schematic 01

(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12 pin package)


1
2
3
4
5
6
7
8
9
10
11
12

Schematic 03

(Available in 4, 6, 8, 10 or 12 pin package)

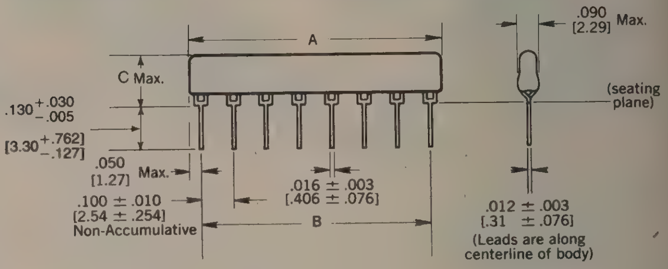

R2
R1
1
2
3
4
5
6
7
8
9
10
11
12

Schematic 05

(Available in 4, 5, 6, 7, 8, 9, 10, 11 or 12 pin package)

Choice of: .195″ [4.95] "A" and .350″ [8.89] "C" maximum seated heights.

DIMENSIONAL AND TERMINAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

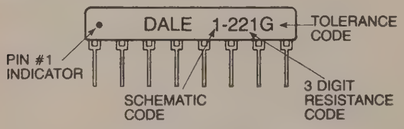

A
.090 [2.29] Max.
C Max.
.130 +.030 −.005
[3.30 +.762 −.127]
(seating plane)
.050 [1.27] Max.
.016 ± .003 [.406 ± .076]
.100 ± .010 [2.54 ± .254] Non-Accumulative
B
.012 ± .003 [.31 ± .076]
(Leads are along centerline of body)

TYPE	A (Max.)	B	C (Max.)
CSC04	.390 [9.91]	.300 [7.62]	"A" Profile = .195 [4.95] "C" Profile = .350 [8.89]
CSC05	.490 [12.45]	.400 [10.16]	
CSC06	.590 [14.99]	.500 [12.70]	
CSC07	.690 [17.54]	.600 [15.24]	
CSC08	.790 [20.07]	.700 [17.78]	
CSC09	.890 [22.61]	.800 [20.32]	
CSC10	.990 [25.15]	.900 [22.86]	
CSC11	1.090 [27.69]	1.000 [25.40]	
CSC12	1.190 [30.23]	1.100 [27.94]	

01 and 03 SCHEMATIC STOCKED RESISTANCE VALUES IN OHMS ("G" Tolerance)

56	180	510	2K	4.7K	15K	47K
100	220	560	2.2K	6.8K	18K	100K
120	330	1K	2.7K	10K	22K	220K
150	470	1.5K	3.3K	12K	27K	1 Meg.

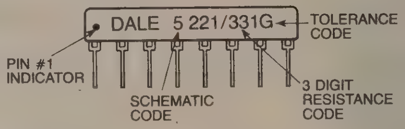
MARKING (Minimum Information)


DALE 1-221G
TOLERANCE CODE
PIN #1 INDICATOR
SCHEMATIC CODE
3 DIGIT RESISTANCE CODE

05 SCHEMATIC STOCKED RESISTANCE VALUES IN OHMS ("G" Tolerance)

R_1/R_2	Zo	R_1/R_2	Zo	R_1/R_2	Zo
220/270	121	330/390	179	1.5K/3.3K	1031
180/390	123	330/470	194		
220/330	132	330/680	222		

MARKING (Minimum Information)


DALE 5 221/331G
TOLERANCE CODE
PIN #1 INDICATOR
SCHEMATIC CODE
3 DIGIT RESISTANCE CODE

HOW TO ORDER

01 and 03 SCHEMATIC

CSC	08	A	01	-101	G
SERIES	NUMBER OF PINS	PACKAGE CODE	SCHEMATIC	RESISTANCE VALUE	TOLERANCE
		A = .195″ [4.95] height; .100″ [2.54] lead spacing. **C** = .350″ [8.89] height; .100″ [2.54] lead spacing.		First two digits (3 for "F" tolerance) are significant. Last digit specifies the number of zeros.	**F** = ±1% **G** = ±2%* **J** = ±5%* **K** = ±10% **M** = ±20%

*NOTE: 05 Schematic limited to "G" and "J" tolerances.

05 SCHEMATIC

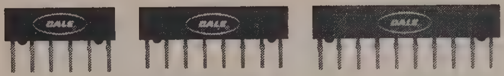
CSC	08	A	05	-221	/ 331	G
SERIES	NUMBER OF PINS	PACKAGE CODE	SCHEMATIC	RESISTANCE VALUE R_1	RESISTANCE VALUE R_2	TOLERANCE
		A = .195″ [4.95] height; .100″ [2.54] lead spacing. **C** = .350″ [8.89] height; .100″ [2.54] lead spacing.		First two digits are significant figures. The third digit specifies the number of zeros to follow.		**G** = ±2% **J** = ±5%

For complete information, write or phone
DALE ELECTRONICS. INC.. Box 26950. El Paso. TX 79926 • Phone 915-592-3253

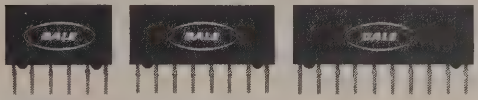
DALE®

DALE SERIES MSP

Thick Film SIP Resistor Network



MSPXXA, .195″ [4.95] above board



MSPXXC, .350″ [8.89] above board

SPECIFICATIONS

ELECTRICAL

Resistance Range: 10Ω to 3.3 Megohms

Resistance Tolerances: ±2% standard. ±1%, ±5%, ±10%, ±20% available.

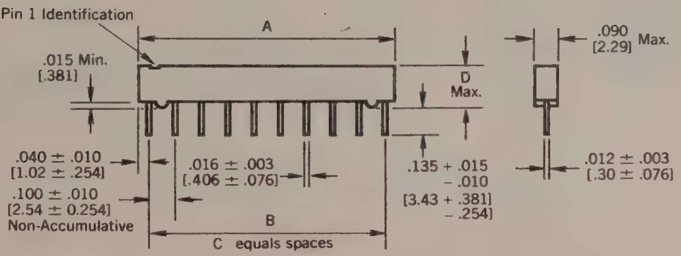
Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) standard

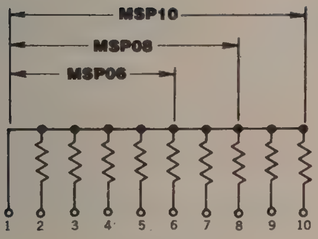
Terminals: Tin plated copper alloy

DIMENSIONAL AND TERMINAL CONFIGURATIONS

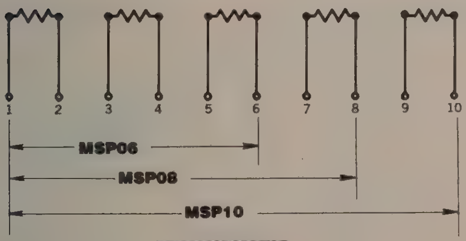
[Numbers in brackets indicate millimeters]

TYPE	A (Max.)	B	C	D
MSP06	.590 [14.99]	.500 [12.70]	5	.195″ [4.95] for MSPXXA
MSP08	.790 [20.07]	.700 [17.78]	7	.350″ [8.89] for MSPXXC
MSP10	.990 [25.15]	.900 [22.86]	9	


Pin 1 Identification
A
.015 Min.
[.381]
D
Max.
.090
[2.29]
Max.
.040 ± .010
[1.02 ± .254]
.016 ± .003
[.406 ± .076]
.135 + .015
− .010
[3.43 + .381]
− .254]
.012 ± .003
[.30 ± .076]
.100 ± .010
[2.54 ± 0.254]
Non-Accumulative
B
C equals spaces


MSP10
MSP08
MSP06
1
2
3
4
5
6
7
8
9
10

01 SCHEMATIC


1
2
3
4
5
6
7
8
9
10
MSP06
MSP08
MSP10

03 SCHEMATIC

STOCK VALUES

(2% tolerance)

*22Ω	120Ω	560Ω	2.7KΩ	12KΩ	68KΩ
33Ω	150Ω	680Ω	3.3KΩ	15KΩ	82KΩ
39Ω	180Ω	820Ω	3.9KΩ	18KΩ	100KΩ
47Ω	220Ω	1KΩ	4.7KΩ	22KΩ	*120KΩ
56Ω	270Ω	1.2KΩ	5.6KΩ	27KΩ	*150KΩ
68Ω	330Ω	1.5KΩ	*6.0KΩ	33KΩ	*180KΩ
82Ω	390Ω	1.8KΩ	6.8KΩ	39KΩ	220KΩ
100Ω	470Ω	2.0KΩ	8.2KΩ	47KΩ	330KΩ
*110Ω	510Ω	2.2KΩ	10KΩ	56KΩ	*470KΩ
					1 Meg.

*MSPXXA only

HOW TO ORDER

MSP	08	A	01	-101	G
SERIES	NUMBER OF PINS	PACKAGE CODE	SCHEMATIC	RESISTANCE VALUE	TOLERANCE

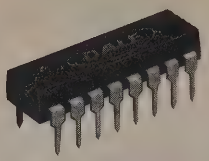
A = .195″ [4.95] height; .100″ [2.54] lead spacing.
C = .350″ [8.89] height; .100″ [2.54] lead spacing.

First two digits are significant. (3 for "F" tolerance.) Last digit specifies the number of zeros.

F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%

For complete information, write or phone
DALE ELECTRONICS, INC., Box 26950, El Paso, TX 79926 • Phone 915-592-3253

DALE®



SERIES MDP
Thick Film DIP Resistor Network

SPECIFICATIONS
ELECTRICAL

Resistance Range: 10Ω to 3.3 Megohms

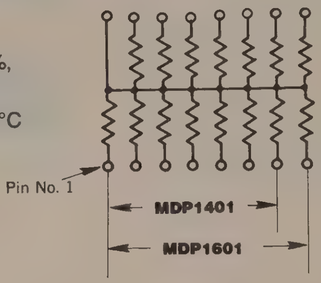
Resistance Tolerance: ±2% standard. ±1%, ±5%, ±10%, ±20% available.

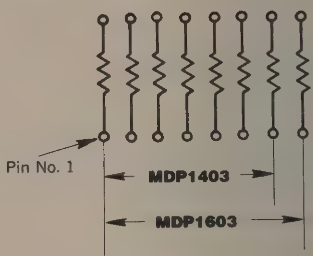
Resistance Temperature Coefficient: ±100 PPM/°C (−55°C to +125°C) standard

Terminals: Tin plated copper alloy

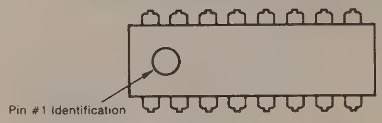
Body: Molded epoxy

STANDARD SCHEMATICS


Pin No. 1
MDP1401
MDP1601

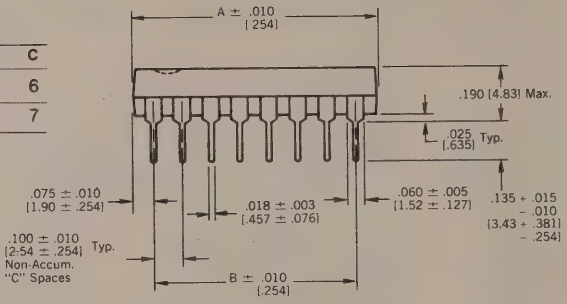

Pin No. 1
MDP1403
MDP1603

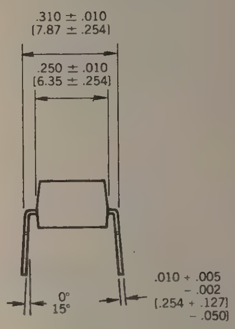
DIMENSIONS AND TERMINAL CONFIGURATIONS


Pin #1 identification

[Numbers in brackets indicate millimeters]

TYPE	A	B	C
MDP14	.750 [19.05]	.600 [15.24]	6
MDP16	.850 [21.59]	.700 [17.78]	7


A ± .010 [.254]
.190 [4.83] Max.
.025 [.635] Typ.
.075 ± .010 [1.90 ± .254]
.018 ± .003 [.457 ± .076]
.060 ± .005 [1.52 ± .127]
.135 + .015 − .010 [3.43 + .381 − .254]
.100 ± .010 [2.54 ± .254] Typ. Non-Accum. "C" Spaces
B ± .010 [.254]


.310 ± .010 [7.87 ± .254]
.250 ± .010 [6.35 ± .254]
0°
15°
.010 + .005 − .002 [.254 + .127 − .050]

STOCKED RESISTANCE VALUES IN OHMS
("G" Tolerance)
Other Values from 10Ω to 1 Megohm Available

MODEL MDP1401 and MDP1403

22	51	120	300	680	1.6K	3.9K	8.2K	20K	100K
24	56	130	330	750	1.8K	4.3K	9.1K	22K	120K
27	62	150	360	820	2.0K	4.7K	10K	27K	150K
30	68	160	390	910	2.2K	5.1K	11K	33K	180K
33	75	180	430	1K	2.4K	5.6K	12K	39K	220K
36	82	200	470	1.1K	2.7K	6.0K	13K	47K	330K
39	91	220	510	1.2K	3.0K	6.2K	15K	56K	470K
43	100	240	560	1.3K	3.3K	6.8K	16K	68K	1 Meg.
47	110	270	620	1.5K	3.6K	7.5K	18K	82K	

MODEL MDP1601 and MDP1603

		510	2.2K	12K	82K
22	110	560	2.7K	15K	100K
33	120	680	3.3K	18K	120K
39	150	820	3.9K	22K	150K
47	180	1K	4.7K	27K	180K
56	220	1.2K	5.6K	33K	220K
62	270	1.5K	6.0K	39K	330K
68	330	1.8K	6.8K	47K	470K
82	390	2.0K	8.2K	56K	680K
100	470		10K	68K	1 Meg.

HOW TO ORDER

MDP	14	03	−101	G
SERIES	NUMBER OF PINS	SCHEMATIC	RESISTANCE VALUE	TOLERANCE
			First 2 digits (3 for "F" tolerance) are significant figures, last digit specifies number of zeros to follow.	F = ±1% K = ±10% G = ±2% M = ±20% J = ±5%

EXAMPLE:
MDP1403-101G = A dual-in-line thick film resistor network with 14 pins on .100 [2.54] centers, 03 schematic, resistance of 100 ohms and tolerance of ±2%.

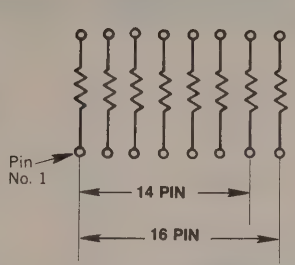
For complete information, write or phone
DALE ELECTRONICS, INC., Box 26950, El Paso, TX 79926 • Phone 915-592-3253

DALE®

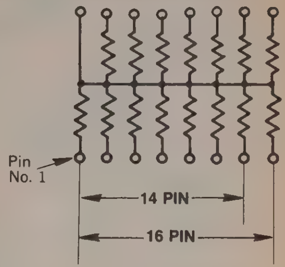
MIL-R-83401, STYLE RZ

MILITARY QUALIFIED
Thick Film Resistor Networks

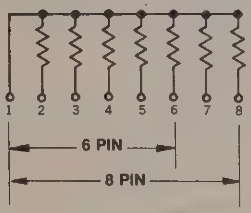
APPROVED SCHEMATIC ALTERNATIVES


Pin No. 1
14 PIN
16 PIN

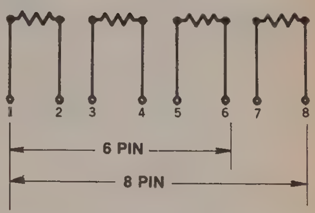
SCHEMATIC "A"


Pin No. 1
14 PIN
16 PIN

SCHEMATIC "B"


1
2
3
4
5
6
7
8
6 PIN
8 PIN

SCHEMATIC "C"


1
2
3
4
5
6
7
8
6 PIN
8 PIN

SCHEMATIC "G"

SPECIFICATIONS (Applicable to all styles)

ELECTRICAL

Resistance Range: 10Ω to 1 Megohm standard.

Resistance Tolerances: ±1%, ±2%, ±5%

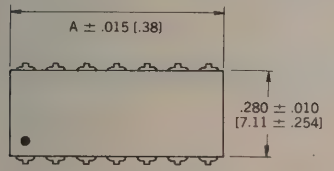
Temperature Coefficient: "M" = ±300 PPM/°C; "K" = ±100 PPM/°C over the temperature range of −55°C to +125°C (+25°C reference).

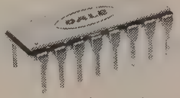
DUAL IN LINE

M8340101 = 14 PIN
M8340102 = 16 PIN

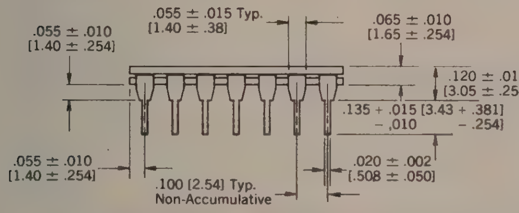
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340101 M XXXXX A	RZ010	SDM14-01 MDM14-03	10Ω-1 Meg. 10Ω-100K
M8340101 K XXXXX A	RZ010	SDM14-01	10Ω-1 Meg.
M8340101 M XXXXX B	RZ010	SDM14-02 MDM14-01	10Ω-1 Meg. 10Ω-100K
M8340101 K XXXXX B	RZ010	SDM14-02	10Ω-1 Meg.
M8340102 M XXXXX A	RZ020	SDM16-01 MDM16-03	10Ω-1 Meg. 10Ω-100K
M8340102 K XXXXX A	RZ020	SDM16-01	10Ω-1 Meg.
M8340102 M XXXXX B	RZ020	SDM16-02 MDM16-01	10Ω-1 Meg. 10Ω-100K
M8340102 K XXXXX B	RZ020	SDM16-02	10Ω-1 Meg.

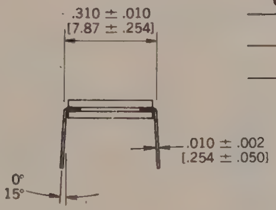
DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]


A ± .015 [.38]
.280 ± .010
[7.11 ± .254]



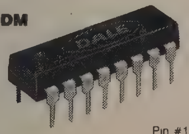
Type SDM

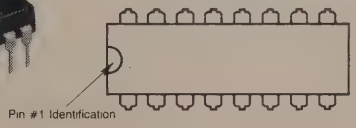

.055 ± .010
[1.40 ± .254]
.055 ± .015 Typ.
[1.40 ± .38]
.065 ± .010
[1.65 ± .254]
.120 ± .010
[3.05 ± .254]
.135 + .015 [3.43 + .381]
− .010 − .254]
.055 ± .010
[1.40 ± .254]
.020 ± .002
[.508 ± .050]
.100 [2.54] Typ.
Non-Accumulative

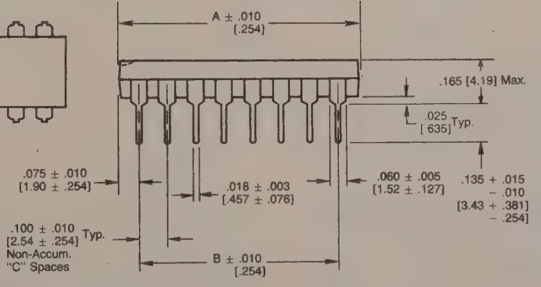

.310 ± .010
[7.87 ± .254]
.010 ± .002
[.254 ± .050]
0°
15°

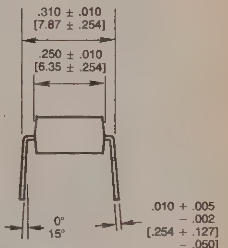
NO. OF PINS	A
14	.710 [18.0]
16	.810 [20.6]

Type MDM




Pin #1 Identification


A ± .010
[.254]
.165 [4.19] Max.
.025
[.635] Typ.
.075 ± .010
[1.90 ± .254]
.018 ± .003
[.457 ± .076]
.060 ± .005
[1.52 ± .127]
.135 + .015
− .010
[3.43 + .381]
− .254]
.100 ± .010
[2.54 ± .254] Typ.
Non-Accum.
"C" Spaces
B ± .010
[.254]


.310 ± .010
[7.87 ± .254]
.250 ± .010
[6.35 ± .254]
0°
15°
.010 + .005
− .002
[.254 + .127]
− .050]

NO. OF PINS	A	B	C
14	.750 [19.05]	.600 [15.24]	6
16	.850 [21.59]	.700 [17.78]	7

STOCK VALUES

Available from stock in these standard values (±2% tolerance A and B schematic)
Characteristic "M" (±300 PPM/°C) Type MDM not available in 470K and 1 Meg.

39Ω	100Ω	220Ω	510Ω	2.2K	5.1K	20K	470K
51Ω	120Ω	270Ω	680Ω	3.0K	5.6K	22K	1 Meg.
56Ω	150Ω	330Ω	1.0K	3.3K	6.8K	30K	
68Ω	180Ω	390Ω	1.5K	3.9K	10K	47K	
75Ω	200Ω	470Ω	2.0K	4.7K	15K	100K	

For complete information, write or phone
DALE ELECTRONICS, INC., Box 26950, El Paso, TX 79926 • Phone 915-592-3253

DALE® FLAT PACK M8340103 = 14 PIN

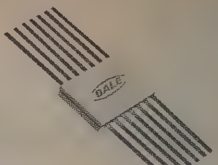
MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5%
M8340103 M XXXXX A	RZ030	DFM14-01 DFM14-11	10Ω-1 Meg. 10Ω-1 Meg.
M8340103 K XXXXX A	RZ030	DFM14-01 DFM14-11	10Ω-1 Meg. 10Ω-1 Meg.
M8340103 M XXXXX B	RZ030	DFM14-02 DFM14-12	10Ω-1 Meg. 10Ω-1 Meg.
M8340103 K XXXXX B	RZ030	DFM14-02 DFM14-12	10Ω-1 Meg. 10Ω-1 Meg.

Leads: -01, -02 = gold plated; -11, -12, = tin lead plated

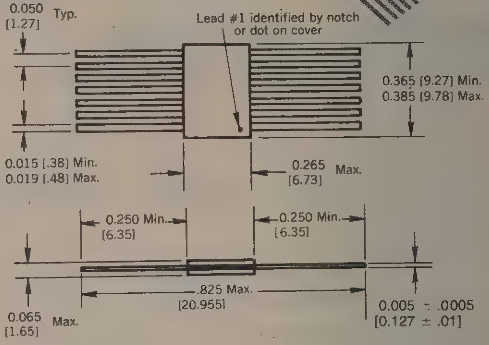
STOCK VALUES

Available from stock in these standard values (±2% tolerance, A and B schematics, Characteristic "M", ±300 PPM/°C):

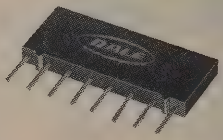
100Ω	330Ω	510Ω	1.0K	2.0K	3.0K	4.7K	6.8K	22K
200Ω	470Ω	680Ω	1.5K	2.2K	3.3K	5.1K	10K	100K



DIMENSIONAL AND TERMINAL CONFIGURATIONS


0.050 [1.27] Typ.
Lead #1 identified by notch or dot on cover
0.365 [9.27] Min.
0.385 [9.78] Max.
0.015 [.38] Min.
0.019 [.48] Max.
0.265 [6.73] Max.
0.250 Min. [6.35]
0.250 Min. [6.35]
.825 Max. [20.955]
0.065 [1.65] Max.
0.005 ± .0005 [0.127 ± .01]

SINGLE IN LINE M8340105 = 8 PIN M8340104 = 6 PIN



MIL P/N	MIL. STYLE	DALE TYPE	MILITARY RES. RANGE TOLERANCE ±1%,±2%, ±5%
M8340104 M XXXXX C	RZ040	MSM06C-01	10Ω-1 Meg.
M8340104 K XXXXX C	RZ040	MSM06C-01	10Ω-1 Meg.
M8340104 M XXXXX G	RZ040	MSM06C-03	10Ω-1 Meg.
M8340104 K XXXXX G	RZ040	MSM06C-03	10Ω-1 Meg.
M8340105 M XXXXX C	RZ050	MSM08C-01	10Ω-1 Meg.
M8340105 K XXXXX C	RZ050	MSM08C-01	10Ω-1 Meg.
M8340105 M XXXXX G	RZ050	MSM08C-03	10Ω-1 Meg.
M8340105 K XXXXX G	RZ050	MSM08C-03	10Ω-1 Meg.

Note: Dale will be supplying MIL-R-83401/6, /7, /8, /9 effective September 1, 1983.

STOCK VALUES

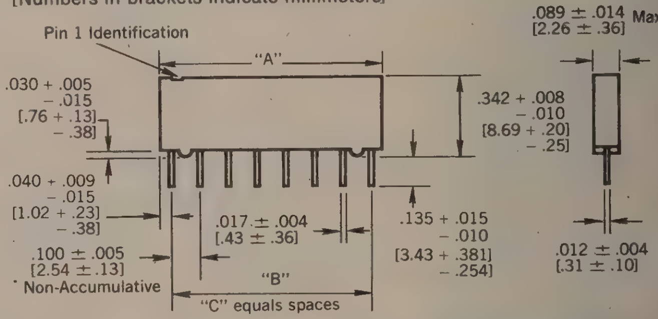
Available from stock in these standard values (±2% tolerance, C and G schematics, Characteristic "M", ±300 PPM/°C):

33Ω	330Ω	2.0K	22K
39Ω	470Ω	2.2K	47K
47Ω	510Ω	3.3K	56K
68Ω	560Ω	4.7K	82K
82Ω	680Ω	5.6K	100K
100Ω	820Ω	6.8K	220K
150Ω	1.0K	8.2K	470K
220Ω	1.5K	10K	1 Meg.

NO. OF PINS	A	B	C
6	.583 ± .015 [14.81 ± .38]	.500 [12.70]	5
8	.783 ± .015 [19.89 ± .38]	.700 [17.78]	7

DIMENSIONAL AND TERMINAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]


Pin 1 Identification
"A"
.089 ± .014 [2.26 ± .36] Max.
.030 + .005 − .015 [.76 + .13 − .38]
.342 + .008 − .010 [8.69 + .20 − .25]
.040 + .009 − .015 [1.02 + .23 − .38]
.017 ± .004 [.43 ± .36]
.135 + .015 − .010 [3.43 + .381 − .254]
.012 ± .004 [.31 ± .10]
.100 ± .005 [2.54 ± .13]
* Non-Accumulative
"B"
"C" equals spaces

HOW TO ORDER—Military Part Number

M8340104	K	1003	G	G
DETAIL SPEC. NO.	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE	SCHEMATIC
M8340103 = 14 Pin DIP RZ030 **M8340104** = 6 Pin SIP RZ040 **M8340105** = 8 Pin SIP RZ050	**"K"** = ±100 PPM/°C **"M"** = ±300 PPM/°C	The first three digits are significant figures and the last digit specifies the number of zeros to follow.	**F** = ±1% **G** = ±2% **J** = ±5%	

EXAMPLE:

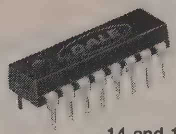
M8340104K1003GG = A single-in-line resistor network with 6 pins and a T.C.R. of ±100 PPM/°C, resistance value of 100K ohms, tolerance of 2% and "G" schematic.

For complete information, write or phone
DALE ELECTRONICS, INC., Box 26950, El Paso, TX 79926 • Phone 915-592-3253

DALE®

DUAL & SINGLE-IN-LINE PACKAGES
RESISTOR/CAPACITOR NETWORKS

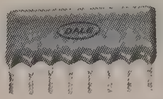
R/C Networks



14 and 16 Pin
Molded DIP styles

FEATURES

- Ideal where repetitive circuits are required.
- Wide range of R/C values for special applications.
- High density packaging for reduced assembly costs, improved performance and simplified board layout.
- Utilize same thick film circuit materials as those qualified to MIL-R-83401.
- Capacitors available to EIA RS 198 or MIL-C-55681.



4 thru 12 Pin
Coated SIP styles

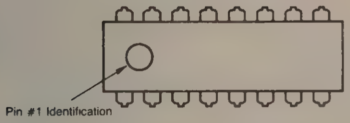
GENERAL SPECIFICATIONS

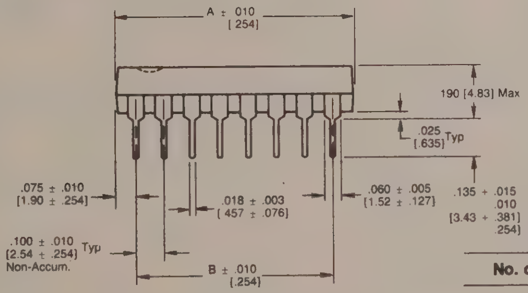
	RESISTORS	*CAPACITORS		
		NPO	BX	X7R
Value Range (SIP)	10Ω-3.3 meg	100pf-4700pf	500pf-0.1μf	500pf-0.1μf
Value Range (DIP)	10Ω-3.3 meg	100pf-2700pf	500pf-0.1μf	500pf-0.1μf
Tolerances	±2% standard, ±1%, ±5%, ±10%, ±20% available	±5% & ±10%	±10% & ±20%	±10% & ±20%
Temperature Characteristics (−55°C to +125°C)	±100ppm/°C Typical	±30ppm/°C	±15% @ OVDC & +15%, −25% @ rated VDC	±15%
Voltage Rating	100VDC	50VDC	50VDC	50VDC
Dissipation Factor (1 VRMS @ 1 KHZ)	N/A	0.1% max	2.5% max	3.0% max
Operating Temperature Range	−55°C to +125°C			

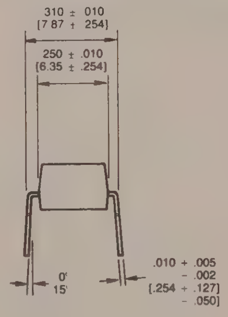
*Capacitors tested at 1 VRMS @ 1 KHZ @ 25°C

STANDARD PACKAGE CONFIGURATIONS
DIMENSIONAL AND TERMINAL CONFIGURATIONS: [Numbers in brackets indicate millimeters]

DUAL-IN-LINE

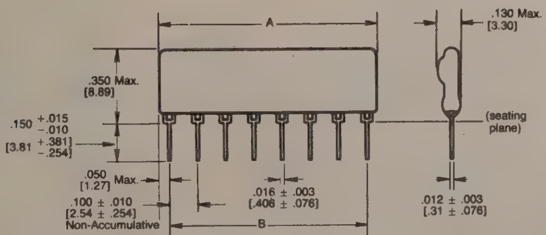

Pin #1 Identification


A ± 010
[254]
190 [4.83] Max
.025
[.635] Typ
.075 ± .010
[1.90 ± .254]
.018 ± .003
[457 ± .076]
.060 ± .005
[1.52 ± .127]
.135 + .015
.010
[3.43 + .381]
.254]
.100 ± .010
[2.54 ± .254] Typ
Non-Accum.
B ± .010
[.254]


310 ± 010
[7 87 ± 254]
250 ± .010
[6.35 ± .254]
0'
15'
.010 + .005
− .002
[.254 + .127]
− .050]

No. of Pins	A	B
14	.750 [19.05]	.600 [15.24]
16	.850 [21.59]	.700 [17.78]

SINGLE-IN-LINE

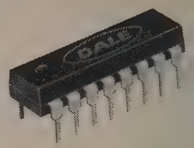

A
.350 Max.
[8.89]
.150 +.015
−.010
[3.81 +.381]
−.254]
.050
[1.27] Max.
.100 ± .010
[2.54 ± .254]
Non-Accumulative
B
.016 ± .003
[.406 ± .076]
.130 Max.
[3.30]
(seating plane)
.012 ± .003
[.31 ± .076]

No. of Pins	A (Max.)	B
4	.390 [9.91]	.300 [7.62]
5	.490 [12.45]	.400 [10.16]
6	.590 [14.99]	.500 [12.70]
7	.690 [17.54]	.600 [15.24]
8	.790 [20.07]	.700 [17.78]
9	.890 [22.61]	.800 [20.32]
10	.990 [25.15]	.900 [22.86]
11	1.090 [27.69]	1.000 [25.40]
12	1.190 [30.23]	1.100 [27.94]

For complete information, write or phone
DALE ELECTRONICS, INC., Box 26950, El Paso, TX 79926 • Phone 915-592-3253

DALE® THIN FILM RESISTOR NETWORKS

SERIES TDP: 14 and 16 pin DIP models



SPECIFICATIONS

Resistance Range: 100Ω to 100KΩ

Resistance Tolerance: 1%, .5%, .1%

Ratio Match: .05%, .1%, .5%

Resistance Temperature Coefficient: ±25 PPM/°C; ±10 PPM/°C available (−55°C to +125°C)

Resistor Power Rating:
01 Circuit = .05 watt/resistor at 25°C
03 Circuit = .1 watt/resistor at 25°C

Package Power Rating: .7 watt/package at 25°C

Maximum Operating Voltage: 100 VDC

Voltage Coefficient of Resistance: < 5 PPM/V typical

T.C. Tracking: ±5 PPM/°C (−55°C to +125°C)

Operating Temperature Range: −55°C to +125°C

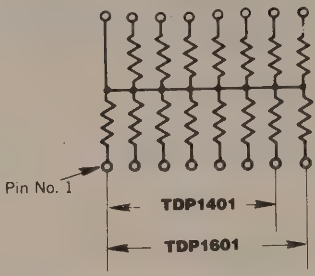
Storage Temperature Range: −55°C to +150°C

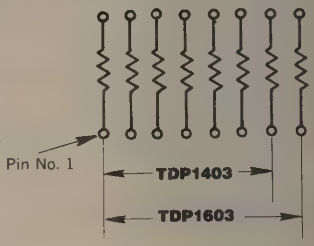
Terminals: Solder Coated Copper Alloy

Body: Molded Epoxy

Resistive Material: Nichrome film

STANDARD SCHEMATICS


Pin No. 1
TDP1401
TDP1601

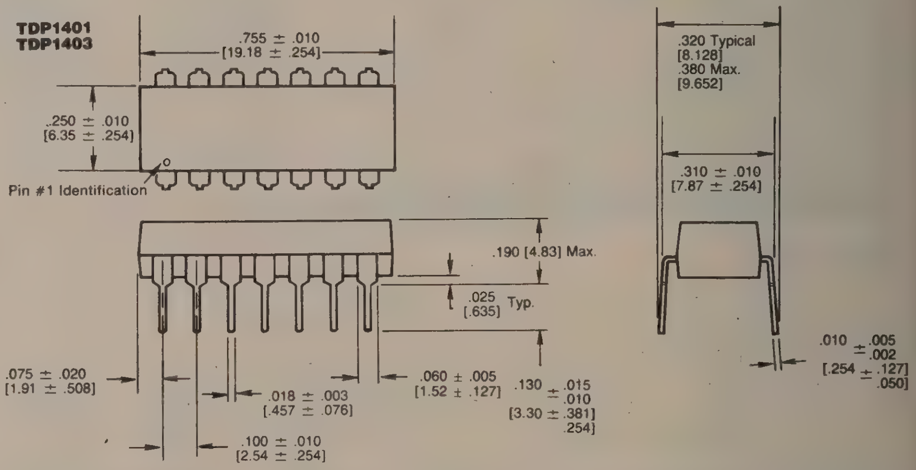

Pin No. 1
TDP1403
TDP1603

APPLICATIONS

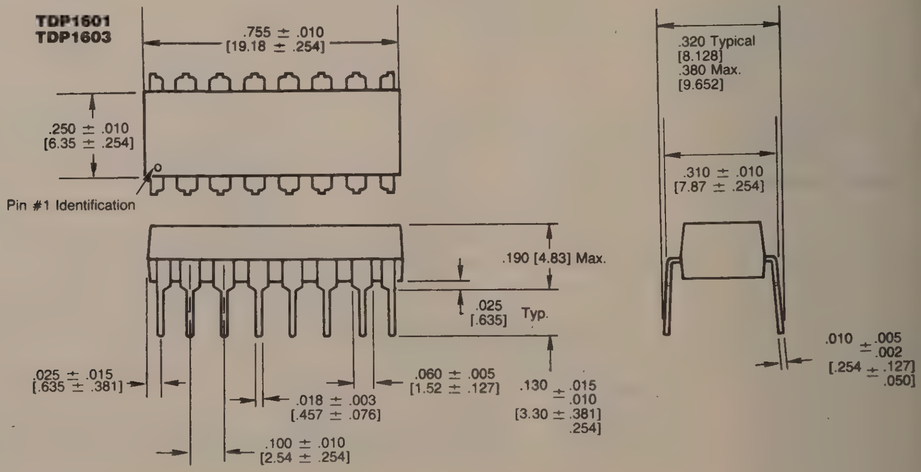
- Precision voltage/current dividers
- Differential, instrumentation and summing amplifiers
- Converter ladder, scaling and range setting
- Oscillators and active filters

DIMENSIONS |Numbers in brackets indicate millimeters|

TDP1401
TDP1403


.755 ± .010 [19.18 ± .254]
.250 ± .010 [6.35 ± .254]
Pin #1 Identification
.190 [4.83] Max.
.025 [.635] Typ.
.075 ± .020 [1.91 ± .508]
.018 ± .003 [.457 ± .076]
.060 ± .005 [1.52 ± .127]
.130 ± .015/.010 [3.30 ± .381/.254]
.100 ± .010 [2.54 ± .254]
.320 Typical [8.128] .380 Max. [9.652]
.310 ± .010 [7.87 ± .254]
.010 ± .005/.002 [.254 ± .127/.050]

TDP1601
TDP1603


.755 ± .010 [19.18 ± .254]
.250 ± .010 [6.35 ± .254]
Pin #1 Identification
.190 [4.83] Max.
.025 [.635] Typ.
.025 ± .015 [.635 ± .381]
.018 ± .003 [.457 ± .076]
.060 ± .005 [1.52 ± .127]
.130 ± .015/.010 [3.30 ± .381/.254]
.100 ± .010 [2.54 ± .254]
.320 Typical [8.128] .380 Max. [9.652]
.310 ± .010 [7.87 ± .254]
.010 ± .005/.002 [.254 ± .127/.050]

NOTE:
Other Dale thin film products include thin film chips, including styles compatible with chip carrier and custom packages. Consult factory.

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE® THICK FILM CHIP RESISTORS

Series RCM and RCWM
Established Reliability
Military Qualification MIL-R-55342/2, /3, /4, /6

FEATURES

- Allows wide design flexibility for use with hybrid circuitry
- One-surface and wrap-around teminations
- Choices of sizes and power ratings
- Dale has complete capability to develop specific reliability programs designed to customer requirements
- Custom sizes can be designed for special applications

RCM and RCWM SPECIFICATIONS

ELECTRICAL

Resistance and Tolerance Range:
RCM/RCWM550: 10Ω to 500K, ±1%, 2%, 5% and 10%
10Ω to 500K, ±5% and 10%
RCM/RCWM575 and 5100:
10Ω to 1 Meg., ±1%, 2%, 5% and 10%
10Ω to 1 Meg., ±5% and 10%
RCM/RCWM5150 10Ω to 1 Meg., ±1%, 2%, 5% and 10%

Resistance Temperature Coefficient:
(−55°C to +125°C) "M" = ± 300 PPM/°C
"K" = ± 100 PPM/°C

Power Rating: Maximum at +70°C
RCM/RCWM550 = 50 MW
RCM/RCWM575 = 100 MW
RCM/RCWM5100 = 100 MW
RCM/RCWM5150 = 150 MW

RC and RCW SPECIFICATIONS

ELECTRICAL

Resistance Range:
RC/RCW550: 5Ω to 2 Meg.
RC/RCW575: 5Ω to 5 Meg.
RC/RCW5100: 10Ω to 10 Meg.
RC/RCW5150: 10Ω to 15 Meg.
RC/RCW1100: 5Ω to 5 Meg.
RC/RCW7225: 10Ω to 15 Meg.
RC/RCW2010: 10Ω to 15 Meg.
RC/RCW2512: 10Ω to 15 Meg.
RC/RCW1206: 10Ω to 10 Meg.

Resistance Tolerance: ±1%, ±2%, ±5%, ±10%, ±20%

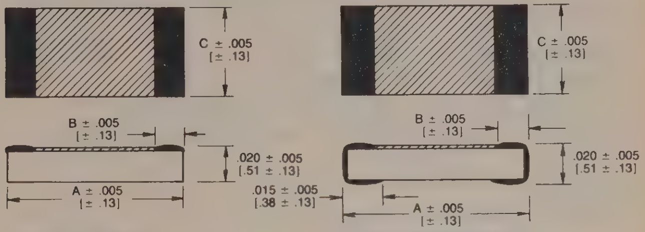
Resistance Temperature Coefficient:
(−55°C to +125°C) ±200 PPM/°C

Power Rating (@ 70°C) and Maximum Operating Voltage:
RC/RCW550 = 100 MW, 50 VDC
RC/RCW575 = 150 MW, 70 VDC
RC/RCW5100 = 200 MW, 100 VDC
RC/RCW5150 = 350 MW, 125 VDC
RC/RCW1100 = 400 MW, 100 VDC
RC/RCW7225 = 600 MW, 200 VDC
RC/RCW2010 = 800 MW, 200 VDC
RC/RCW2512 = 1000 MW, 200 VDC
RC/RCW1206 = 250 MW, 100 VDC

Operating Temperature Range: −55°C to +125°C

Series RC and RCW
Commercial

DIMENSIONAL AND TERMINAL CONFIGURATIONS
[Numbers in brackets indicate millimeters.]



RC and RCM
(One-surface termination)

RCW and RCWM
(Wrap-around termination)

MILITARY STYLE	DALE TYPE	A (Length)	B	C (Width)
RM0505	RCM550	.050 [1.27]	.010 [.25]	.050 [1.27]
	RCWM550	.055 [1.40]		
RM0705	RCM575	.075 [1.91]	.015 [.38]	.050 [1.27]
	RCWM575	.080 [2.03]		
RM1005	RCM5100	.100 [2.54]	.015 [.38]	.050 [1.27]
	RCWM5100	.105 [2.67]		
RM1505	RCM5150	.150 [3.81]	.015 [.38]	.050 [1.27]
	RCWM5150	.155 [3.94]		

Type	A (length)	B	C (Width)
RC550	.050 [1.27]	.010 [.25]	.050 [1.27]
RCW550	.055 [1.40]	.010 [.25]	.050 [1.27]
RC575	.075 [1.91]	.015 [.38]	.050 [1.27]
RCW575	.080 [2.03]	.015 [.38]	.050 [1.27]
RC5100	.100 [2.54]	.015 [.38]	.050 [1.27]
RCW5100	.105 [2.67]	.015 [.38]	.050 [1.27]
RC5150	.150 [3.81]	.015 [.38]	.050 [1.27]
RCW5150	.155 [3.94]	.015 [.38]	.050 [1.27]
RC1100	.100 [2.54]	.015 [.38]	.100 [2.54]
RCW1100	.105 [2.67]	.015 [.38]	.100 [2.54]
RC7225	.225 [5.72]	.015 [.38]	.075 [1.91]
RCW7225	.230 [5.84]	.015 [.38]	.075 [1.91]
RC2010	.200 [5.08]	.015 [.38]	.100 [2.54]
RCW2010	.205 [5.21]	.015 [.38]	.100 [2.54]
RC2512	.250 [6.35]	.015 [.38]	.125 [3.18]
RCW2512	.255 [6.48]	.015 [.38]	.125 [3.18]
RC1206	.120 [3.05]	.015 [.38]	.060 [1.53]
RCW1206	.125 [3.18]	.015 [.38]	.060 [1.53]

HOW TO ORDER—Military Part Number

M55342/2	M	1003	F	S	M
DETAIL SPEC. NO.	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE	TERMINATION	FAILURE RATE
M55342/2 = RM0505 M55342/6 = RM0705 M55342/3 = RM1005 M55342/4 = RM1505	**M** = ±300 PPM/°C **K** = ±100 PPM/°C	The first two digits (three for "F" tolerance) are significant figures and the last digit specifies the number of zeros to follow.	**F** = ±1% **G** = ±2% **J** = ±5% **K** = ±10%	**S** = Pre-tinned one-surface. **R** = Pre-tinned wrap-around. **T** = Untinned one-surface. **U** = Untinned wrap-around.	**M** = 1%/1000 hours **P** = 0.1%/1000 hours **R** = 0.01%/1000 hours

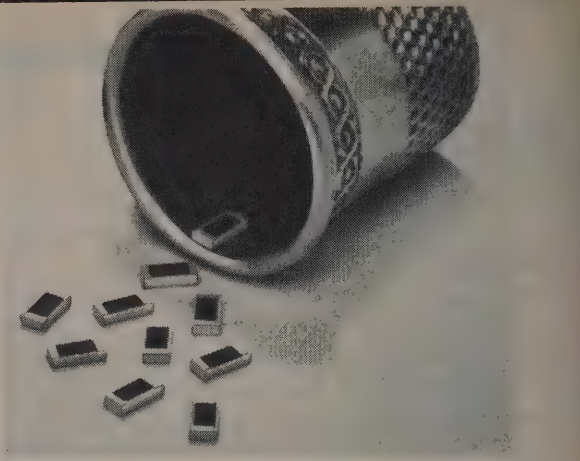
HOW TO ORDER: RC and RCW—Commercial Styles

RC	5100	103	G	41
STYLE	SIZE	RESISTANCE CODE	TOLERANCE	TERMINATION CODE
RC = One-surface termination. **RCW** = Wrap-around termination	550 5150 2010 575 1100 2512 5100 7225 1206	The first two digits (three for "F" tolerance) are significant figures and the last digit specifies the number of zeros to follow.	**F** = ±1% **G** = ±2% **J** = ±5% **K** = ±10% **M** = ±20%	No Code = Solder Pre-tinned (standard) **20** = Gold (RC only) **40** = Platinum Gold **41** = Platinum Silver **42** = Palladium Silver

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE®

COMMERCIAL
THICK FILM CHIP RESISTORS



DALE SERIES CRC

FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Flow solderable • Thick film resistance element
- Wraparound termination • Inner electrode protection

ELECTRICAL SPECIFICATIONS

Resistance Range: 10Ω to 2.2 Meg. (±2%, ±5%)
20Ω to 300K (±1%)
Zero ohm jumper (0.05Ω Max., 2 amp Max.)

Standard Tolerance: ±1%, ±2%, ±5%

Power Rating: 1/8 Watt @ 70°C

Maximum Abient Temperature: 125°C

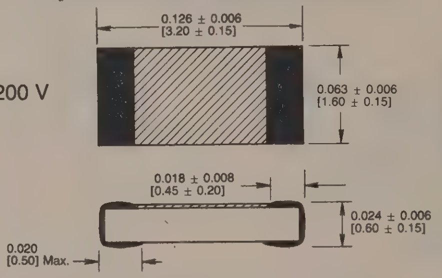
Rated Continuous Working Voltage: $\sqrt{0.125 \times R}$ or 200 V whichever is less (r = nominal resistance value)

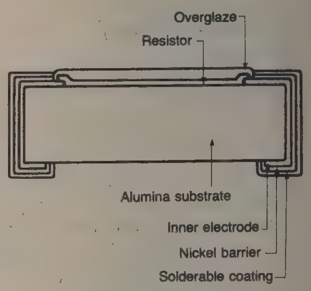
Temperature Range: −55°C to +125°C)

Temperature Coefficient: (−55°C to +125°C)
±1%, tolerance: ±100PPM/°C
±2%, ±5% tolerance: ±200PPM/°C

DIMENSIONAL SPECIFICATIONS:

[Numbers in brackets indicate millimeters]





HOW TO ORDER

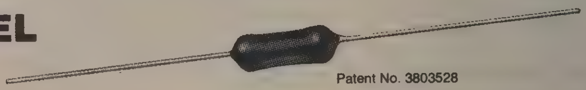
CRC	W	1206	182	G	B
SERIES	STYLE	SIZE	RESISTANCE VALUE	TOLERANCE	PACKAGING
	W = Wraparound termination		First two digits (3 for "F" tolerance) are significant; last digit is the multiplier (1800Ω is illustrated).	**F** = ±1% **G** = ±2% **J** = ±5%	**T** = Standard 8mm reel **B** = Standard bulk

---

DALE®

ESTABLISHED RELIABILITY
HERMETICALLY SEALED METAL FILM RESISTORS

MIL-R-55182, TYPE RNR, S LEVEL
DALE TYPE SE



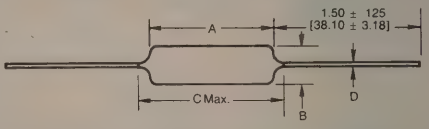
Patent No. 3803528

FEATURES

• Meets requirements of MIL-R-55182 • Verified Failure Rate • Very low noise • Controlled temperature coefficient of resistance • Excellent high frequency characteristics • Ceramic-to-metal sealed construction • Final protective coat of special epoxy provides a smooth, non-porous envelope • Leads are OFHC tinned copper • 100% stabilization and screening tests. Group A testing, if desired, to customer requirements • Traceability of materials and processing • Monthly acceptance testing • Dale has complete capability to develop specific reliability programs designed to customer requirements • Extensive stocking program at distributors and factory

STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL. TYPE	125°C RATING	MAX. WEIGHT (Grams)	MAX. WORKING VOLTAGE	RESISTANCE RANGE
SE-1/10	RNR55	1/10W	.498	200	24.9 to 200K
SE-1/8	RNR60	1/8W	.552	250	24.9 to 499K
SE-1/4	RNR65	1/4W	1.370	300	24.9 to 1.0 Meg.



TEMPERATURE COEFFICIENT CODE

MIL. CODE	SE TYPE CODE	TEMPERATURE COEFFICIENT
E	C-3	0±25ppm/°C
C	C-2	0±50ppm/°C

TOLERANCE CODES

B	0.1%
D	0.5%
F	1.0%

PHYSICAL CONFIGURATIONS

DALE TYPE	DIM. A	DIM. B	DIM. C MAX.	DIM. D
SE-1/10	.261±.020 [6.63±.51]	.130±.010 [3.30±.254]	.345 [8.76]	.025 (22 Awg) [.635]
SE-1/8	.360±.020 [9.14±.51]	.140±.015 [3.56±.331]	.437 [11.1]	.025 (22 Awg) [.635]
SE-1/4	.636±.020 [16.15±.51]	.215±.020 [5.46±.51]	.750 [19.05]	.025 (22 Awg) [.635]

For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701 • Phone 402-371-0080

DALE® MIL-R-55182, TYPE RNC

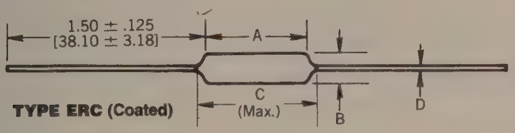
DALE TYPE ERC and EMF

Established Reliability Metal Film—Coated and Molded

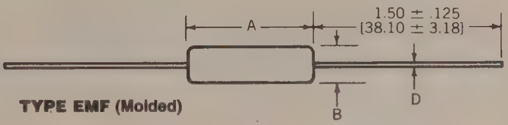
STANDARD ELECTRICAL SPECIFICATIONS RNC Types in Stock (S Level)

	DALE TYPE	MIL. TYPE*	70°C RATING	125°C RATING	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	RESISTANCE RANGE (Ohms)** T-1(K)	T-2(H)	T-9(J)
Coated	ERC 50	RNC50	1/10 W	1/20 W	.11	200	10-796K	10-796K	10-796K
	ERC 55	RNC55	1/8 W	1/10 W	.35	200	10-2 Meg.	10-2 Meg.	10-2 Meg.
	ERC 60	RNC60	1/4 W	1/8 W	.75	250	10Ω-3.01 Meg.	10Ω-3.01 Meg.	10Ω-3.01 Meg.
Molded	EMF 50	RNC50	1/10 W	1/20 W	.11	200	10 to 796K	10 to 796K	10 to 796K
	EMF 55	RNC55	1/8 W	1/10 W	.35	200	10 to 1.21 Meg.	10 to 1.21 Meg.	10 to 1.21 Meg.
	EMF 60	RNC60	1/4 W	1/8 W	.45	250	10 to 3.01 Meg.	10 to 3.01 Meg.	10 to 3.01 Meg.
	EMF 65	RNC65	1/2 W	1/4 W	.84	300	30.1 to 3.01 Meg.	49.9 to 3.01 Meg.	49.9 to 3.01 Meg.
	EMF 70	RNC70	3/4 W	1/2 W	1.6	350	49.9 to 2.49 Meg.	49.9 to 2.49 Meg.	49.9 to 2.49 Meg.
	EMF 75	—	—	1 W	4.4	500	24.9 to 4.02 Meg.	49.9 to 2.61 Meg.	49.9 to 2.61 Meg.

*ERC and EMF include RNR, RNN and RNC Mil. Types. Standard Resistance Tolerances: .1%(B), .5%(D) and 1%(F). .1% not applicable to characteristic K.
**Consult factory for values on QPL.



TYPE ERC (Coated)



TYPE EMF (Molded)

PHYSICAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

TYPE	DIM. A	DIM. B	DIM. C (Max.)	DIM. D
ERC 50	.150 ± .020 [3.81 ± .51]	.070 ± .010 [1.78 ± .25]	.244 [6.20]	.016 Dia. [.406]
ERC 55	$.250 {}^{+.031}_{-.046}$ [6.35 $^{+.79}_{-1.17}$]	.091 ± .009 [2.31 ± .23]	.325 [8.26]	.025 Dia. [.635]
ERC 60	.375 ± .062 [9.53 ± 1.57]	.145 ± .016 [3.68 ± .41]	.475 [12.07]	.025 Dia. [.635]
EMF 50	.150 ± .020 [3.81 ± .508]	.070 ± .010 [1.78 ± .254]	—	.016 [.406]
EMF 55	.260 ± .010 [6.60 ± .254]	.097 ± .005 [2.46 ± .127]	—	.025 [.635]
EMF 60	.406 ± .015 [10.31 ± .381]	.135 ± .010 [3.43 ± .254]	—	.025 [.635]
EMF 65	.593 ± .015 [15.06 ± .381]	.203 ± .015 [5.16 ± .381]	—	.025 [.635]
EMF 70	.730 ± .020 [18.54 ± .508]	.250 ± .015 [6.35 ± .381]	—	.032 [.813]
EMF 75	1.093 ± .020 [27.76 ± .508]	.375 ± .015 [9.53 ± .381]	—	.032 [.813]

DALE® MIL-R-39017, TYPE RLR
S LEVEL

DALE TYPE ERL

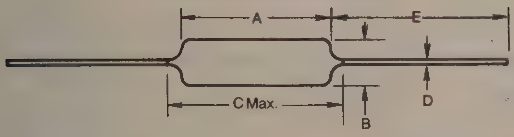
Established Reliability Metal Film

STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL. TYPE	70°C RATING	MAX. WEIGHT (Grams)	MAX. WORKING VOLTAGE	RES. RANGE* T-1 (100 PPM)
ERL-05	RLR-05	1/8 W	.11	200	4.7Ω to 300K
ERL-07	RLR-07	1/4 W	.35	250	10 to 10 Meg.
ERL-20	RLR-20	1/2 W	.75	350	4.3 to 3.01 Meg.

*Consult factory for values on QPL. Standard Resistance Tolerances: 1%(F), 2%(G), 5%(J).

COATED CONSTRUCTION



PHYSICAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

TYPE	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E
ERL-05	.150 ± .020 [3.81 ± .508]	.066 ± .008 [1.68 ± .20]	.187 [4.75] Max.	.016 [.406]	1.25 ± .266 [31.75 ± 6.76]
ERL-07	.250 ± $^{.031}_{.046}$ [6.35 ± $^{.79}_{1.17}$]	.090 ± .008 [2.29 ± .20]	.300 [7.62] Max.	.025 [.635]	1.50 ± .125 [38.10 ± 3.18]
ERL-20	.375 ± .041 [9.53 ± 1.04]	.138 ± .023 [3.51 ± .58]	.450 [11.43] Max.	.032 [.813]	1.50 ± .125 [38.10 ± 3.18]

Termination: Standard lead material is solder-coated copper. (Solderable and weldable per MIL-STD-1276, Type C.)

For complete information, write or phone

DALE ELECTRONICS. INC.. 2300 Riverside Blvd.. Norfolk. Nebraska 68701 • Phone 402-371-0080

MIL-R-10509, TYPE RN } Higher Commercial
MIL-R-22684, TYPE RL } Ratings (See Chart)
DALE TYPE CMF COATED METAL FILM RESISTORS

FEATURES

- Higher commercial wattage ratings
- Very low noise
- Very low voltage coefficient
- Controlled temperature coefficient
- Close tracking of temperature coefficient
- Excellent high frequency characteristics
- Flame retardant epoxy coating

STANDARD ELECTRICAL SPECIFICATIONS

WATTAGE	MILITARY QUALIFIED			COMMERCIAL**	
	MIL-R-10509 70°C (D)	MIL-R-10509 125°C (C & E)	MIL-R-22684 70°C	70°C	125°C
1/20	—	CMF-50 (RN-50)	—	CMF-50	CMF-50
1/10	—	CMF-55 (RN-55)	—	CMF-50, 55	CMF-50, 55
1/8	CMF-55 (RN-55)	CMF-60 (RN-60)	—	CMF-50, 55, 60	CMF-50, 55, 60
1/4	CMF-60 (RN-60)	CMF-65 (RN-65)	CMF-07 (RL-07)	CMF-55, 60, 65, 07	CMF-55, 60, 65
1/2	CMF-65 (RN-65)	—	CMF-20 (RL-20)	CMF-55, 60, 65, 20	CMF-60, 65
3/4	—	—	—	CMF-60*, 65*	CMF-65*
1	—	—	—	CMF-65*	—

*.032 [.813] Lead. **Derate all commercial ratings linearly to zero power at 165°C.

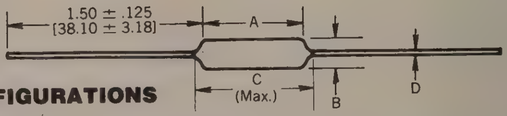
TEMPERATURE COEFFICIENT CODE

COMMERCIAL T.C. CODE	10509 MIL. CHAR.	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE
T-1	D	0 ± 100 PPM/°C	–55°C to +175°C
T-2	C	0 ± 50 PPM/°C	–55°C to +175°C
T-9	E	0 ± 25 PPM/°C	–55°C to +175°C
T-00	MIL-R-22684	0 ± 200 PPM/°C	–55°C to +150°C

TOLERANCE:
CMF-50, 55, 60 and 65 types are available in the following standard tolerances: Tolerances of ±1%(F) and ±0.5%(D) are available over the entire ohmic range. Tolerances of ±0.25% and ±0.1% are available only in T-2 and T-9 temperature coefficients and over the ohmic range specified in the T-9 column. CMF-07 and CMF-20 are available in 2% or 5% only.

ELECTRICAL SPECIFICATIONS

DALE TYPE	MAXIMUM WORKING VOLTAGE	DALE MILITARY APPROVED VALUE RANGE				DALE COMMERCIAL VALUE RANGE			
		MIL-R-10509 CHAR. D	MIL-R-10509 CHAR. C	MIL-R-10509 CHAR. E	MIL-R-22684	T-0	T-1	T-2	T-9
CMF-50	200	—	10Ω-100KΩ	10Ω-100KΩ	—	10Ω-1 Meg.	10Ω-1 Meg.	10Ω-500KΩ	10Ω-500KΩ
CMF-55	250	10Ω-301K	49.9Ω-100KΩ	49.9Ω-100KΩ	—	1Ω-15 Meg.	5Ω-15 Meg.	10Ω-10 Meg.	24.9Ω-2.5 Meg.
CMF-07	250	—	—	—	51Ω-150KΩ	1Ω-15 Meg.	5Ω-15 Meg.	—	—
CMF-60	300	10Ω-1 Meg.	49.9Ω-499KΩ	49.9Ω-499KΩ	—	1Ω-15 Meg.	5Ω-15 Meg.	10Ω-10 Meg.	24.9Ω-2.5 Meg.
CMF-20	350	—	—	—	4.3Ω-470KΩ	1Ω-15 Meg.	5Ω-15 Meg.	—	—
CMF-65	350	10Ω-2 Meg.	49.9Ω-1 Meg.	49.9Ω-1 Meg.	—	1Ω-15 Meg.	5Ω-15 Meg.	10Ω-10 Meg.	24.9Ω-2.5 Meg.



PHYSICAL CONFIGURATIONS

TYPE	DIM. A	DIM. B	DIM. C (Max.)	DIM. D
CMF-50	.150 ± .020 [3.81 ± .508]	.065 ± .015 [1.65 ± .381]	.244 [6.20]	.016 ± .002 [.406 ± .051]
CMF-55	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]	.025 ± .002 [.635 ± .051]
CMF-60	.344 ± .031 [8.74 ± .787]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	*.025 ± .002 [.635 ± .051]
CMF-65	.562 ± .031 [14.27 ± .787]	.180 ± .015 [4.57 ± .381]	.687 [17.45]	*.025 ± .002 [.635 ± .051]
CMF-07	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]	.025 ± .002 [.635 ± .051]
CMF-20	.375 ± .040 [9.53 ± 1.02]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	.032 ± .002 [.813 ± .051]

*Available with .032 [.813] lead.

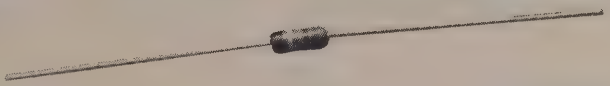
For complete information, write or phone
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE®

DALE TYPE CCF-07 and CCF-55 METAL FILM RESISTORS

Coated, Commercial, 1%, 2% Tolerance

TAPE AND REEL PACKAGING



FEATURES

- 1/4 watt at 70°C power rating
- CCF-07 = 2% tolerance, CCF-55 = 1% tolerance
- 100 PPM/°C temperature coefficient
- Superior electrical performance. CCF-55 meets or exceeds MIL-R-22684 (RL07) and MIL-R-10509 (RN55D). CCF-07 meets electrical requirements of MIL-R-22684 (RL07)
- Flame retardant epoxy conformal coating
- Color band marking for ease of identification after mounting

SPECIFICATIONS

ELECTRICAL

Resistance Range: 10Ω to 1 Megohm

Resistance Tolerance: ±1% (CCF-55) ±2% (CCF-07)

Resistance Temperature Coefficient: ±100 PPM/°C (CCF-07 = −65°C to +150°C; CCF-55 = −65°C to +165°C)

Resistor Power Rating: 1/4 watt at +70°C

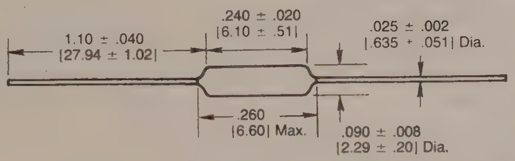
Maximum Working Voltage: 250 VRMS

Insulation Resistance: 10,000 Megohms

Operating Temperature Range: CCF-07 = −65°C to +150°C; CCF-55 = −65°C to +165°C

PHYSICAL CONFIGURATION

[Numbers in brackets indicate millimeters]



RESISTANCE VALUES

The **Dale CCF-07** is available in the standard 24 resistance values per decade. The **Dale CCF-55** is available in the standard 96 resistance values per decade. Values are obtained from the appropriate decade table by multiplying by powers of 10. Example: 24 = 24 ohms, 240 ohms, 2.4K, 24K or 240K.

CCF-07

10	22	47
11	24	51
12	27	56
13	30	62
15	33	68
16	36	75
18	39	82
20	43	91

CCF-55

10.0	12.1	14.7	17.8	21.5	26.1	31.6	38.3	46.4	56.2	68.1	82.5
10.2	12.4	15.0	18.2	22.1	26.7	32.4	39.2	47.5	57.6	69.8	84.5
10.5	12.7	15.4	18.7	22.6	27.4	33.2	40.2	48.7	59.0	71.5	86.6
10.7	13.0	15.8	19.1	23.2	28.0	34.0	41.2	49.9	60.4	73.2	88.7
11.0	13.3	16.2	19.6	23.7	28.7	34.8	42.2	51.1	61.9	75.0	90.9
11.3	13.7	16.5	20.0	24.3	29.4	35.7	43.2	52.3	63.4	76.8	93.1
11.5	14.0	16.9	20.5	24.9	30.1	36.5	44.2	53.6	64.9	78.7	95.3
11.8	14.3	17.4	21.0	25.5	30.9	37.4	45.3	54.9	66.5	80.6	97.6

HOW TO ORDER

CCF-07 CCF-55	241 3010	G F
MODEL NUMBER	RESISTANCE VALUE	TOLERANCE
	First two digits are significant for CCF-07; first three digits for CCF-55. Last digit specifies the number of zeros.	**F** = ±1% **G** = ±2%

EXAMPLE: **CCF-07 241G** = A 1/4 watt metal film resistor with ±100 PPM/°C T.C., resistance of 240 ohms and tolerance of ±2%.

CCF-55 3010F = A 1/4 watt metal film resistor with ±100 PPM/°C T.C., resistance of 301 ohms and tolerance of ±1%.

For complete information, write or phone

DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, Nebraska 68701 • Phone 402-371-0080

DALE®

DALE TYPE PTF COATED PRECISION THIN FILM

Low T.C.—Tight Tolerance

FEATURES

- Performance exceeds MIL-R-55182 requirements
- Extremely low temperature coefficients of resistance
- Very low noise and voltage coefficient
- Wide precision resistance range in small package
- 100% laser spiralled
- Very good high frequency characteristics
- Proprietary epoxy coating provides superior moisture protection
- Acceptance testing available
- Can replace wirewound bobbins

MATERIAL

Element: Precision deposited nickel-chrome alloy with controlled annealing

Core: Fire-cleaned high purity ceramic

Encapsulant: Specially formulated epoxy compounds. Coated construction.

Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type C.

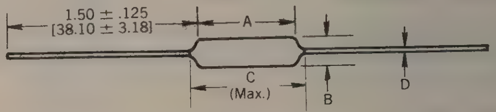
STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	85°C RATING	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	RESISTANCE RANGE
PTF 51	1/20 W	.11	200	50 Ω to 100K
PTF 56	1/8 W	.35	300	50 Ω to 499K
PTF 65	1/4 W	.75	500	50 Ω to 1 Meg.

Standard tolerances from 1% to .01%.

PHYSICAL CONFIGURATIONS

TYPE	DIM. A	DIM. B.	DIM. C (MAX.)	DIM. D
PTF 51	.150 ± .020 [3.81 ± .51]	.070 ± .010 [1.78 ± .25]	.200 [5.08]	.016 [.406]
PTF 56	.250 + .031 − .046 [6.35 + .79] − 1.17]	.091 ± .009 [2.31 ± .23]	.300 [7.62]	.025 [.635]
PTF 65	.375 ± .062 [9.53 ± 1.57]	.145 ± .016 [3.68 ± .41]	.475 [12.07]	.025 [.635]



TEMPERATURE COEFFICIENT CODE

−20° to +85°C

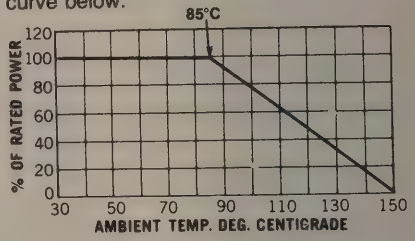
T.C. CODE	TEMPERATURE COEFFICIENT
T-10	0 ± 15 PPM/°C
T-13	0 ± 10 PPM/°C
T-16	0 ± 5 PPM/°C

PERFORMANCE DATA

TEST per MIL-R-55182 (Exceptions Noted)	MAX. ΔR (Typical Test Lots)	SPECIFICATION
Thermal Shock (−55°C to +85°C)	0.02%	MIL-STD-202, Method 107
Moisture	0.08%	MIL-STD-202, Method 106
Resistance to Solder Heat	0.02%	MIL-STD-202, Method 210
Dielectric Withstanding	0.01%	MIL-STD-202, Method 301 & 105
Short Time Overload	0.01%	MIL-R-10509, Para. 4.6.6
Damp Heat	0.08%	IEC Publication #68-2-3 (56 days)
Low Temperature Operation	0.02%	MIL-R-55182, Para. 4.7.9
Life (1000 hours rated power @ 85°C)	0.04%	MIL-R-55182, Para. 4.7.17

DERATING

Dale PTF resistors have an operating temperature range of −55°C to +150°C. They must be derated according to the curve below.



MATCHED SETS — NETWORKS

Dale's many years of experience in matching resistors for sets and networks, combined with the superb performance of the PTF product, provide the best and most economical solution to your precision resistor requirements. Why? Because most applications for precision resistors depend on two or more discretes having an initial tolerance ratio and a resistance tracking capability over temperature rather than each discrete resistor meeting the absolute requirements of the application.

Cost savings approaching 50% can be realized when relatively tight matching requirements are specified while permitting the absolute parameters of the discrete resistors to have more relaxed specifications.

Dale application engineers are available to assist you in specifying your requirements in the most economical way possible.

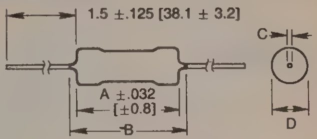
For complete information, write or phone

DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701 • Phone 402-371-0080

DALE® METAL OXIDE HIGH VOLTAGE RESISTORS

RNX and ROX SERIES

Numbers in Brackets Indicate Millimeters



FEATURES

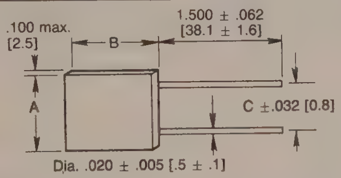
- Silicone coating (Epoxy available) • RNX Ratings to 2W, 6KV • ROX Ratings to 10W, 45KV
- Low TC: ±200 PPM/°C Standard, ±50 PPM/°C, ±100 PPM/°C available

PRECISION TYPES (±1%, ±2%, ±5%, ±10%)

DALE TYPE *	Power (watts) @ 125°C	Voltage Rating	RESISTANCE (Ohms) Min.	Max.	DIMENSIONS A Max.	B Max.	C	D
RNX-1/4	0.25	0.75KV	1K	100M	0.270 [6.9]	0.320 [8.1]	.025 [0.64]	.135 ± .015 [3.43 ± 0.38]
RNX-3/8	0.5	1.5KV	1K	500M	0.400 [10.2]	0.470 [11.9]	.025 [0.64]	.135 ± .015 [3.43 ± 0.38]
RNX-1/2	0.6	1.5KV	1K	1.5G	0.525 [13.3]	0.595 [15.1]	.025 [0.64]	.135 ± .015 [3.43 ± 0.38]
RNX-3/4	1.0	2.0KV	1.2K	2.5G	0.775 [19.7]	0.845 [21.5]	.025 [0.64]	.135 ± .015 [3.43 ± 0.38]
RNX-1	1.25	4.0KV	1.5K	3G	1.025 [26.0]	1.095 [27.8]	.025 [0.64]	.135 ± .015 [3.43 ± 0.38]
RNX-1-1/4	1.5	5.0KV	1.7K	4G	1.275 [32.4]	1.345 [34.2]	.025 [0.64]	.135 ± .015 [3.43 ± 0.38]
RNX-1-1/2	2.0	6.0KV	2K	5G	1.525 [38.7]	1.595 [40.5]	.025 [0.64]	.135 ± .015 [3.43 ± 0.38]
ROX-3/4	1.5	5.0KV	1K	4G	0.800 [20.3]	0.884 [22.5]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]
ROX-1	2.0	7.5KV	1K	5G	1.050 [26.7]	1.134 [28.8]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]
ROX-1-1/2	2.5	11.0KV	1.5K	7.5G	1.550 [39.4]	1.634 [41.5]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]
ROX-2	3.0	15.0KV	2K	10G	2.050 [52.1]	2.134 [54.2]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]
ROX-3	5.0	22.5KV	3K	15G	3.050 [77.5]	3.134 [79.6]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]
ROX-4	6.0	30.0KV	4K	20G	4.050 [102.9]	4.134 [105.0]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]
ROX-5	8.0	37.5KV	5K	25G	5.050 [128.3]	5.134 [130.4]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]
ROX-6	10.0	45.0KV	6K	30G	6.050 [153.7]	6.134 [155.8]	.032 [0.81]	.270 ± .015 [6.86 ± 0.38]

*Leads are OFHC tinned copper.

FLAT STYLE, FHV & RFX SERIES



FEATURES

- Epoxy Coating • Ratings to 5W, 25KV
- Low TC: ±200 PPM/°C Standard, ±100 PPM/°C available

PRECISION TYPES (±1%, ±2%, ±5%, ±10%)

DALE TYPE*	Power (watts) @ 25°C	Voltage Rating	RESISTANCE (Ohms) Min.	Max.	DIMENSIONS A Max.	B Max.	C
FHV-1/2	0.5	1.5KV	10K	500M	0.350 [8.9]	0.350 [8.9]	0.200 [5.1]
FHV-1	1.6	3.5KV	10K	2G	0.520 [13.2]	0.520 [13.2]	0.360 [9.1]
FHV-2	4.0	7.5KV	20K	10G	1.020 [25.9]	0.520 [13.2]	0.860 [21.8]
FHV-3	5.0	25KV	30K	10G	2.070 [52.6]	0.750 [19.1]	1.880 [47.8]
RFX-1/2	0.25	3.75KV	100	10G	0.570 [14.5]	0.210 [5.3]	0.415 [10.5]
RFX-1	0.8	7.5KV	100	2G	1.070 [27.2]	0.280 [7.1]	0.890 [22.6]
RFX-1-1/2	1.5	11.25KV	100	5G	1.570 [39.9]	0.330 [8.4]	1.390 [35.3]
RFX-2	2.0	15.0KV	100	8G	2.070 [52.6]	0.330 [8.4]	1.880 [47.8]

*Leads are OFHC tinned copper. FHV Series terminals are tinned brass (.020 x 0.10 x 0.250).

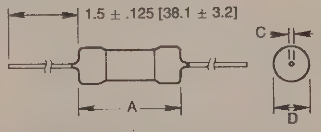
DALE® METAL ALLOY HIGH VOLTAGE RESISTORS

HVW, MVW and HVX SERIES

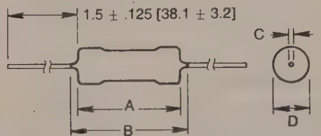
FEATURES

- HVW and MVW = Uncoated; HVX = Silicone coated
- HVW & MVW Ratings to 2.6W, 15KV, ±5%; HVX Ratings, to 5W, 15KV, ±5%
- Axial leads—HVW and HVX = tinned copper MVW = Copperweld

HVW/MVW Uncoated



HVX Coated



HVW/MVW (Uncoated) **SEMI-PRECISION TYPES*** (±5%, ±10%, ±20%)

DALE TYPE	Power (watts) @ 200°C	Voltage Rating	RESISTANCE (Ohms) Min.	Max.	DIMENSIONS A Max.	C	D Max.
HVW-1/2	0.5	3.5KV	500	25M	0.631 [16.0]	.032 [0.81]	0.155 [3.94]
MVW-1/2	0.5	3.5KV	500	25M	0.631 [16.0]	.032 [0.81]	0.155 [3.94]
HVW-3/4	1.0	7.5KV	1K	50M	0.968 [24.6]	.032 [0.81]	0.155 [3.94]
MVW-3/4	1.0	7.5KV	1K	50M	0.968 [24.6]	.032 [0.81]	0.155 [3.94]
HVW-1	1.2	7.5KV	1K	100M	0.968 [24.6]	.032 [0.81]	0.275 [6.99]
HVW-2	2.6	15.0KV	1K	200M	2.090 [53.1]	.032 [0.81]	0.275 [6.99]

HVX (Silicone Coated)

DALE TYPE	Power (watts) @ 70°C	Voltage Rating	RESISTANCE (Ohms) Min.	Max.	DIMENSIONS A Max.	B Max.	C	D Max.
HVX-1/2	1.0	3.5KV	500	25M	0.631 [16.0]	0.680 [17.3]	.032 [0.81]	0.180 [4.57]
HVX-3/4	1.5	7.5KV	1K	50M	0.968 [24.6]	1.062 [27.0]	.032 [0.81]	0.180 [4.57]
HVX-1	2.5	7.5KV	1K	100M	0.968 [24.6]	1.062 [27.0]	.032 [0.81]	0.310 [7.87]
HVX-2	5.0	15.0KV	1K	200M	2.090 [53.1]	2.200 [55.9]	.032 [0.81]	0.310 [7.87]

*Consult factory for closer tolerance. Leads are OFHC tinned copper.

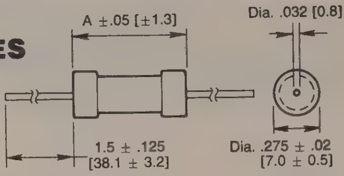
For complete information, write or phone

DALE ELECTRONICS, INC., P.O. Box 1179, Robbinsville, NC 28771 • Phone 704-479-6451

DALE® CARBON FILM HIGH VOLTAGE RESISTORS

Numbers in Brackets Indicate Millimeters

T SERIES



FEATURES

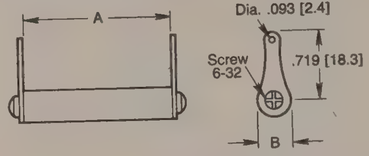
- Low cost, cap and lead type
- Ratings to 3W, 15KV, ±5%
- Supplied with mylar protective sleeve .002″ [.05] thick

GENERAL PURPOSE TYPES (±5%, ±10%, ±15%, ±20%)

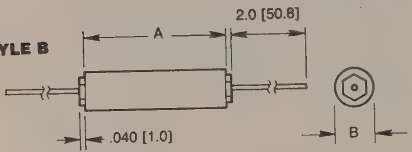
DALE TYPE	Power (watts) @ 25°C	Voltage Rating	RESISTANCE (Ohms) Min.	Max.	DIMENSION A
TAEW	0.5	3.0KV	1M	1G	0.80 [20.3]
TAFW	1.0	5.0KV	1M	1G	1.05 [26.7]
TAKW	1.5	7.5KV	1M	1G	1.55 [39.4]
TAOW	2.0	10.0KV	1M	1G	2.05 [52.1]
TAQW	2.5	12.5KV	1M	1G	2.55 [64.8]
TARW	3.0	15.0KV	1M	1G	3.05 [77.5]

B, E, F, H SERIES*

STYLE A



STYLE B



FEATURES

- Single units to 10W, 40KV, ±3%
- Matched pairs (BP) to 20W, 80KV, ±1%
- Radial lug or axial lead
- Supplied with mylar protective sleeve .002″ [.05] thick
- Series B is general purpose. Also available encapsulated (Series E); non-inductive, varnish coated (Series F); high megohm, varnish coated (Series H).

Style B axial leads are #20 AWG tinned copper. Dimensional tolerances are ±.016″ [.4] or ±1%, whichever is greater.

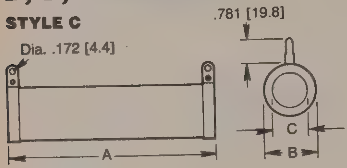
GENERAL PURPOSE TYPES (±3%, ±5%, ±10%, ±15%)

DALE* TYPE	Power (watts) @ 25°C	Voltage Rating	RESISTANCE (Ohms) Min.	Max.	Style	DIMENSIONS A	B
( ) AEW	0.5	2.5KV	20	1T	B	0.75 [19.1]	0.250 [6.4]
( ) AKW	1.0	5.0KV	25	5T	B	1.50 [38.1]	0.250 [6.4]
( ) BF	1.0	3.5KV	20	25T	A	1.00 [25.4]	0.313 [8.0]
( ) BFW	1.0	3.5KV	20	25T	B	1.00 [25.4]	0.313 [8.0]
( ) BM	2.0	7.5KV	25	50T	A	1.75 [44.5]	0.313 [8.0]
( ) BMW	2.0	7.5KV	25	50T	B	1.75 [44.5]	0.313 [8.0]
( ) BR	3.0	15.0KV	35	100T	A	3.00 [76.2]	0.313 [8.0]
( ) BRW	3.0	15.0KV	35	100T	B	3.00 [76.2]	0.313 [8.0]
( ) BV	5.0	30.0KV	60	100T	A	5.50 [139.7]	0.313 [8.0]
( ) FQ	4.0	15.0KV	20	100T	A	2.50 [63.5]	0.563 [14.3]
( ) FT	6.0	25.0KV	25	100T	A	4.00 [101.6]	0.563 [14.3]
( ) FW	10.0	40.0KV	40	100T	A	6.50 [165.1]	0.563 [14.3]

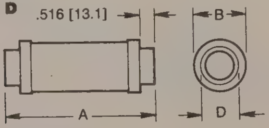
*(First letter of nomenclature is variable: B, E, F or H)

D, E, G SERIES*

STYLE C



STYLE D



FEATURES

- Ratings to 100W, 125KV, ±3%
- Radial bands or ferrule terminals
- Standard models varnish coated; vinyl protective sleeve available.
- Series D is general purpose. Also available encapsulated (Series E) or in non-inductive, varnish coated (Series G) styles.

Consult factory for complete information including other series to meet your needs.

GENERAL PURPOSE TYPES (±3%, ±5%, ±10%, ±15%)

DALE* TYPE	Power (Watts) @ 25°C	Voltage Rating	RESISTANCE (Ohms) Min.	Max.	Style	DIMENSIONS A	B	C	D
( ) JU	10	25KV	20	100G	C	4.500 [114.3]	.750 [19.1]	0.500 [12.7]	N/A
( ) PW	20	35KV	20	100G	C	6.500 [165.1]	1.125 [28.6]	0.750 [19.1]	N/A
( ) PW-1	20	35KV	20	100G	D	7.687 [195.2]	1.125 [28.6]	N/A	0.812 [20.6]
( ) PX	30	65KV	30	100G	C	10.500 [266.7]	1.125 [28.6]	0.750 [19.1]	N/A
( ) PX-1	30	65KV	30	100G	D	11.687 [296.8]	1.125 [28.6]	N/A	0.812 [20.6]
( ) VY	60	90KV	35	100G	C	14.500 [368.3]	1.500 [38.1]	1.250 [28.6]	N/A
( ) VY-1	60	90KV	35	100G	D	15.687 [398.4]	1.500 [38.1]	N/A	1.141 [29.0]
( ) ZW	35	40KV	20	100G	C	6.500 [165.1]	2.000 [50.8]	1.563 [39.7]	N/A
( ) ZW-1	35	40KV	20	100G	D	7.687 [195.2]	2.000 [50.8]	N/A	1.141 [29.0]
( ) ZZ	100	125KV	30	100G	C	18.500 [469.9]	2.000 [50.8]	1.563 [39.7]	N/A
( ) ZZ-1	100	125KV	30	100G	D	19.687 [500.0]	2.000 [50.8]	N/A	1.141 [29.0]

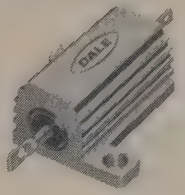
Dimensional tolerances are ±.016″ [.4] or ±1%, whichever is greater. *(First letter of nomenclature is variable: D, E, G)

For complete information, write or phone
DALE ELECTRONICS, INC., P.O. Box 1179, Robbinsville, NC 28771 • Phone 704-479-6451

DALE® PRECISION POWER WIREWOUND RESISTORS

MIL-R-18546, TYPE RE

DALE TYPE RH, ALUMINUM HOUSED
Chassis Mount



STANDARD ELECTRICAL SPECIFICATIONS

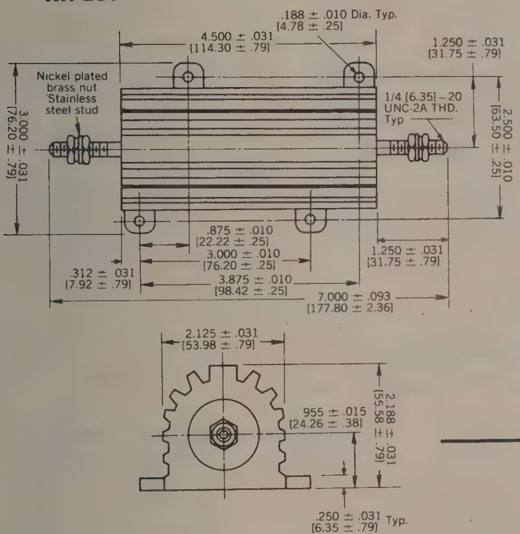
DALE TYPE	MIL-R-18546 TYPE	POWER RATING (Watts)		RESISTANCE RANGE (Ohms) MIL. Range shown in bold face		MAX. WORKING VOLTAGE	MAX. WEIGHT (Grams)	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms) *		
		DALE	MIL	.05%, .1%, .25%	.5%, 1%, 3%			±50 PPM	±30 PPM	±20 PPM
RH-5	**RE60G**	7.5 (5)	5	1 to 6.5K	.1 to 24.5K **.1 to 3.32K**	160	3	1 to 9.9	10 to 49	50 to 24.5K
RH-10	**RE65G**	12.5 (10)	10	1 to 12.7K	.008 to 47.1K **.1 to 5.62K**	265	6	1 to 9.9	10 to 79	80 to 47.1K
RH-25	**RE70G**	25	20	.5 to 25.7K	.01 to 95.2K **.1 to 12.1K**	550	13	1 to 9.9	10 to 169	170 to 95.2K
RH-50	**RE75G**	50	30	.5 to 73.4K	.01 to 273K **.1 to 39.2K**	1250	28	1 to 9.9	10 to 469	470 to 273K
RH-100	**RE77G**	100	75	.3 to 50K	.05 to 59K **.05 to 29.4K**	1900	400	1 to 99	100 to 949	950 to 50K
RH-250	**RE80G**	250	120	.3 to 75K	.1 to 75K **.1 to 35.7K**	2300	800	1 to 99	100 to 999	1K to 75K

*1Ω to .99Ω = ±100 PPM; .01Ω to .099Ω = ±150 PPM.

These resistors are also available in non-inductive (NH) styles. Several modifications of housing and terminals are available.

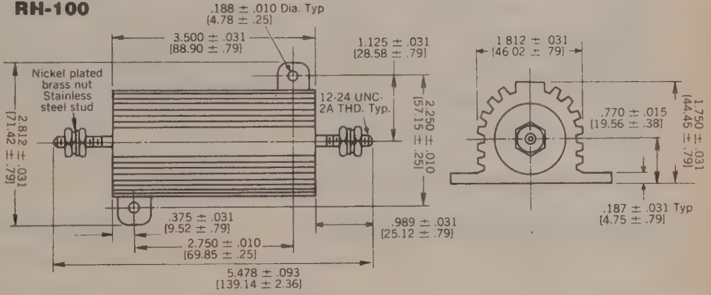
NOTE: All resistance ranges shown conform to military specifications unless otherwise indicated.

RH-250



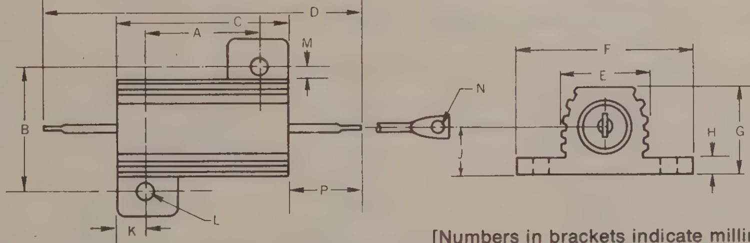
.188 ± .010 Dia. Typ.
[4.78 ± .25]
4.500 ± .031
[114.30 ± .79]
1.250 ± .031
[31.75 ± .79]
Nickel plated brass nut Stainless steel stud
1/4 [6.35] – 20 UNC-2A THD. Typ
3.000 ± .031
[76.20 ± .79]
2.500 ± .010
[63.50 ± .25]
.875 ± .010
[22.22 ± .25]
3.000 ± .010
[76.20 ± .25]
1.250 ± .031
[31.75 ± .79]
.312 ± .031
[7.92 ± .79]
3.875 ± .010
[98.42 ± .25]
7.000 ± .093
[177.80 ± 2.36]
2.125 ± .031
[53.98 ± .79]
.955 ± .015
[24.26 ± .38]
2.188 ± .031
[55.58 ± .79]
.250 ± .031 Typ.
[6.35 ± .79]

RH-100



.188 ± .010 Dia. Typ
[4.78 ± .25]
3.500 ± .031
[88.90 ± .79]
1.125 ± .031
[28.58 ± .79]
Nickel plated brass nut Stainless steel stud
12-24 UNC-2A THD. Typ.
2.812 ± .031
[71.42 ± .79]
2.250 ± .010
[57.15 ± .25]
.375 ± .031
[9.52 ± .79]
2.750 ± .010
[69.85 ± .25]
.989 ± .031
[25.12 ± .79]
5.478 ± .093
[139.14 ± 2.36]
1.812 ± .031
[46.02 ± .79]
.770 ± .015
[19.56 ± .38]
1.750 ± .031
[44.45 ± .79]
.187 ± .031 Typ
[4.75 ± .79]

RH-5 thru RH-50



D
C
A
M
B
N
F
E
H
G
J
P
K
L

DIMENSIONS

[Numbers in brackets indicate millimeters]

TYPE	A	B	C	D	E	F	G	H	J	K	L	M	N	P
RH-5	.444 ± .005 [11.28 ± .127]	.490 ± .005 [12.45 ± .127]	.600 ± .031 [15.24 ± .787]	1.125 ± .062 [28.58 ±1.58]	.334 ± .015 [8.48 ± .381]	.646 ± .015 [16.41 ± .381]	.320 ± .015 [8.13 ± .381]	.065 ± .010 [1.65 ± .254]	.133 ± .010 [3.38 ± .254]	.078 ± .010 [1.98 ± .254]	.093 ± .005 [2.36 ± .127]	.078 ± .015 [1.98 ± .381]	.050 ± .005 [1.27 ± .127]	.262 ± .062 [6.65 ±1.58]
RH-10	.562 ± .005 [14.27 ± .127]	.625 ± .005 [15.88 ± .127]	.750 ± .031 [19.05 ± .787]	1.375 ± .062 [34.93 ± 1.58]	.420 ± .015 [10.67 ± .381]	.800 ± .015 [20.32 ± .381]	.390 ± .015 [9.91 ± .381]	.075 ± .010 [1.90 ± .254]	.165 ± .010 [4.19 ± .254]	.093 ± .010 [2.36 ± .254]	.093 ± .005 [2.36 ± .127]	.102 ± .015 [2.59 ± .381]	.086 ± .005 [2.18 ± .127]	.312 ± .062 [7.92 ± 1.58]
RH-25	.719 ± .005 [18.26 ± .127]	.781 ± .005 [19.84 ± .127]	1.062 ± .031 [26.97 ± .787]	1.938 ± .062 [49.23 ± 1.58]	.550 ± .015 [13.97 ± .381]	1.080 ± .015 [27.43 ± .381]	.546 ± .015 [13.87 ± .381]	.088 ± .010 [2.24 ± .254]	.231 ± .010 [5.87 ± .254]	.172 ± .010 [4.37 ± .254]	.125 ± .005 [3.18 ± .127]	.115 ± .015 [2.92 ± .381]	.086 ± .005 [2.18 ± .127]	.438 ± .062 [11.13 ± 1.58]
RH-50	1.563 ± .005 [39.70 ± .127]	.844 ± .005 [21.44 ± .127]	1.968 ± .031 [49.99 ± .787]	2.781 ± .062 [70.64 ± 1.58]	.630 ± .015 [16.00 ± .381]	1.140 ± .015 [28.96 ± .381]	.610 ± .015 [15.49 ± .381]	.088 ± .010 [2.24 ± .254]	.260 ± .010 [6.60 ± .254]	.196 ± .010 [4.98 ± .254]	.125 ± .005 [3.18 ± .127]	.107 ± .015 [2.72 ± .381]	.086 ± .005 [2.18 ± .127]	.406 ± .062 [10.31 ± 1.58]

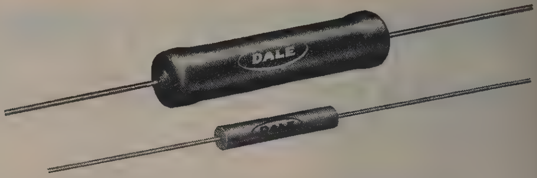
For complete information, write or phone

DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE® PRECISION POWER WIREWOUND RESISTORS

MIL-R-26, TYPE RW

DALE TYPE RS, AXIAL LEAD
Silicone Coated and Molded



STANDARD ELECTRICAL SPECIFICATIONS

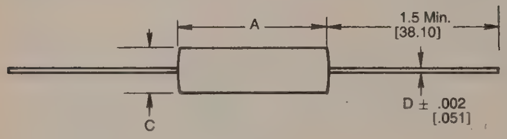
DALE TYPE	MIL-R-26 TYPE	DALE RATING U .05% thru 5%	DALE RATING V 3% & 5%	RESISTANCE RANGE (Ohms) MIL. Range shown in bold face .05%	.1%	.25%	.5%, 1%, 3%, 5%	MAX.* WORKING VOLTAGE U	MAX.* WORKING VOLTAGE V	MAX. WT. GRAMS
RS-1/4	—	.4 W	—	1-1K	.499-1K	.499-3.4K	.1-3.4K	20	—	.21
RS-1/2	—	.75 W	—	1-1.3K	.499-1.3K	.499-4.9K	.1-4.9K	29	—	.23
RS-1A	**RW-70**	1.0 W 1.0 W	—	1-2.74K	.499-2.74K **.499-2.74K**	.499-10.4K **.499-2.74K**	.1-10.4K **.1-2.74K**	52	—	.34
RS-2	—	4.0 W	5.5 W	.499-12.7K	.499-12.7K	.1-47.1K	.1-47.1K	210	250	2.1
RS-2B	**RW-79**	3.0 W 3.0 W	3.75 W	.499-6.5K	.499-6.5K **.499-6.49K**	.1-24.5K **.1-6.49K**	.1-24.5K **.1-6.49K**	140	157	.70
RS-2C	—	2.5 W	3.25 W	.499-8.6K	.499-8.6K	.1-32.3K	.1-32.3K	138	157	1.6
RS-2C-17	—	2.5 W	3.25 W	.499-8.6K	.499-8.6K	.1-32.3K	.1-32.3K	138	157	1.6
RS-5	—	5.0 W	6.5 W	.499-25.7K	.499-25.7K	.1-95.2K	.1-95.2K	360	410	4.2
RS-5-69	**RW-74**	5.0 W 5.0 W	6.5 W	.499-24.5K	.499-24.5K **.499-24.3K**	.1-91.0K **.1-24.3K**	.1-91.0K **.1-24.3K**	350	400	4.2
RS-7	—	7.0 W	9.0 W	.499-41.4K	.499-41.4K	.1-154K	.1-154K	504	576	4.7
RS-10	—	10 W	13W	.499-73.4K	.499-73.4K	.1-273K	.1-273K	858	978	9.0
RS-10-38	**RW-78**	10 W 10 W	13 W	.499-71.5K	.499-71.5K **.499-71.5K**	.1-265K **.1-71.5K**	.1-265K **.1-71.5K**	846	966	9.0

*Max. working voltage determined at .0008 dia. wire resistance values.

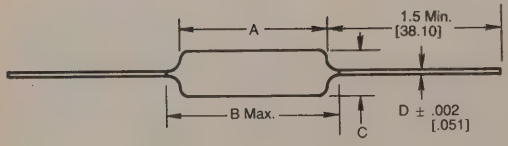
NOTE: All resistance ranges shown conform to military specifications unless otherwise indicated.

PHYSICAL CONFIGURATIONS

MOLDED MODEL



COATED MODEL



DIMENSIONAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]

	TYPE	DIM. A	DIM. B	DIM. C	DIM. D
MOLDED MODELS	RS-1/4	.250 ± .015 [6.35 ± .381]	—	.078 ± .015 [1.98 ± .381]	.020 [.508]
	RS-1/2	.312 ± .015 [7.92 ± .381]	—	.078 ± .015 [1.98 ± .381]	.020 [.508]
	RS-1A	.422 ± .015 [10.72 ± .381]	—	.110 ± .015 [2.79 ± .381]	.020 [.508]
COATED MODELS	RS-2	.625 ± .062 [15.88 ± 1.58]	.765 [19.43]	.250 ± .031 [6.35 ± .787]	.040 [1.02]
	RS-2B	.560 ± .062 [14.22 ± 1.58]	.622 [15.80]	.187 ± .031 [4.75 ± .787]	.032 [.813]
	RS-2C	.500 ± .062 [12.7 ± 1.58]	.593 [15.06]	.218 ± .031 [5.54 ± .787]	.040 [1.02]
	RS-2C-17	.500 ± .062 [12.7 ± 1.58]	.593 [15.06]	.218 ± .031 [5.54 ± .787]	.032 [.813]
	RS-5	.875 ± .062 [22.23 ± 1.58]	1.000 [25.4]	.312 ± .031 [7.92 ± .787]	.040 [1.02]
	RS-5-69	.875 ± .062 [22.23 ± 1.58]	.937 [23.80]	.312 ± .031 [7.92 ± .787]	.040 [1.02]
	RS-7	1.218 ± .062 [30.94 ± .158]	1.281 [30.94]	.312 ± .031 [7.92 ± .787]	.040 [1.02]
	RS-10	1.780 ± .062 [45.21 ± 1.58]	1.875 [47.63]	.375 ± .031 [9.53 ± .78]	.040 [1.02]
	RS-10-38	1.780 ± .062 [45.21 ± 1.58]	1.842 [46.79]	.375 ± .031 [9.53 ± .78]	.040 [1.02]

For complete information, write or phone

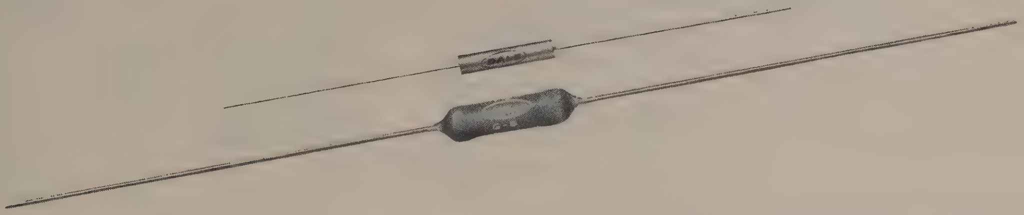
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE® PRECISION POWER WIREWOUND RESISTORS

MIL-R-26, TYPE RW

DALE TYPE G, AXIAL LEAD

Silicone Coated and Molded



STANDARD ELECTRICAL SPECIFICATIONS

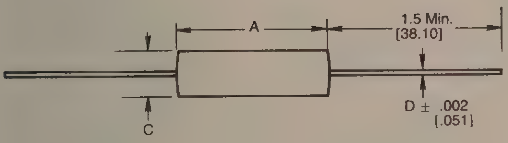
DALE TYPE	MIL-R-26 TYPE	DALE RATING		RESISTANCE RANGE (Ohms) MIL. Range shown in bold face				MAX.* WORKING VOLTAGE		MAX. WT. GRAMS
		U .05% thru 5%	V 3% & 5%	.05%	.1%	.25%	.5%, 1%, 3%, 5%	U	V	
G-1-80		1.0 W	—	1-1K	.499-1K	.499-3.4K	.1-3.4K	33	—	.20
	RW-81	1.0 W	—		**.499-1K**	**.499-1K**	**.1-1K**	33	—	.20
G-2	—	1.5 W	—	1-1.3K	.499-1.3K	.499-4.9K	.1-4.9K	42	—	.21
G-3-80		2.0 W	—	1-2.74K	.499-2.74K	.499-10.4K	.1-10.4K	80	—	.34
	RW-80	2.0 W	—		**.499-2.74K**	**.499-2.74K**	**.1-2.74K**	80	—	.34
G-5	—	4.0 W	5 W	.499-6.5K	.499-6.5K	.1-24.5K	.1-24.5K	162	184	.80
G-5C	—	5 W	7 W	.499-8.6K	.499-8.6K	.1-32.3K	.1-32.3K	194	230	1.2
G-10	—	7 W	10 W	.499-25.7K	.499-25.7K	.1-95.2K	.1-95.2K	425	508	3.6

*Maximum Working Voltage determined at .0008 dia. wire resistance values.

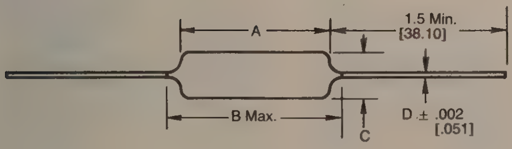
PHYSICAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

MOLDED MODEL



COATED MODEL



	TYPE	DIM. A	DIM. B	DIM. C	DIM. D
MOLDED MODELS	G-1-80	.250 ± .015 [6.35 ± .381]	—	.078 ± .015 [1.98 ± .381]	.020 [.508]
	G-2	.312 ± .015 [7.92 ± .381]	—	.078 ± .015 [1.98 ± .381]	.020 [.508]
	G-3-80	.422 ± .015 [10.72 ± .381]	—	.110 ± .015 [2.79 ± .381]	.020 [.508]
COATED MODELS	G-5	.562 ± .062 [14.27 ± 1.58]	.640 [16.26]	.188 ± .032 [4.78 ± .813]	.032 [.813]
	G-5C	.500 ± .062 [12.7 ± 1.58]	.593 [15.06]	.218 ± .032 [5.54 ± .813]	.040 [1.02]
	G-10	.875 ± .062 [22.23 ± 1.58]	1.000 [25.4]	.312 ± .032 [7.92 ± .813]	.040 [1.02]

NOTE: All resistance ranges shown conform to military specifications unless otherwise indicated.

For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE®

INDUSTRIAL POWER WIREWOUND RESISTORS

DALE TYPE HL, TUBULAR

For inexpensively dissipating larger amounts of power in DC or low frequency AC circuits.

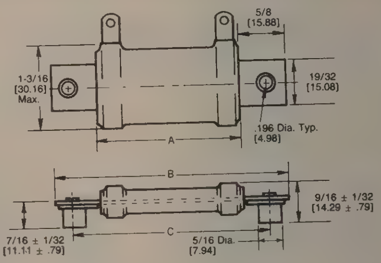
Applications include:

- Grid resistor
- Voltage dropping resistor
- High voltage bleeder resistors in power supplies
- Bias supply resistor
- Voltage divider networks
- Filament dropping resistor
- Load resistor
- Shunt resistor

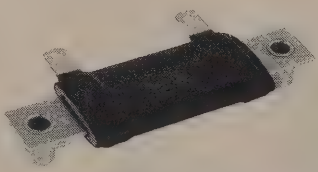
STANDARD TYPE SPECIFICATIONS

TYPE	WATTAGE RATING	DALE MAX.* RESISTANCE	MAX. WORKING VOLTAGE	TERMINAL SETBACK ±1/32 [.79]	CORE DIMENSIONS LENGTH ±1/16 [1.59]	O.D.	I.D. ±1/32 [.79]	STANDARD TERMINAL** DESIGNATION	MOUNTING HARDWARE OPTIONS
HL-12	12	70K	500	3/32 [2.38]	1-3/4 [44.45]	5/16 [7.94]	3/16 [4.76]	05	101, 204, 301
HL-20	20	120K	880	3/32 [2.38]	2 [50.80]	7/16 [11.11]	5/16 [7.94]	02	101, 203, 301
HL-25	25	155K	1.3K	3/32 [2.38]	2 [50.80]	9/16 [14.29]	5/16 [7.94]	06	101, 203, 301
HL-50	50	385K	1.9K	3/32 [2.38]	4 [101.60]	9/16 [14.29]	5/16 [7.94]	06	101, 203, 301
HL-100	100	870K	2.5K	1/8 [3.18]	6-1/2 [165.10]	3/4 [19.05]	1/2 [12.70]	06	102, 206, 303
HL-175	175	1.7 Meg.	5.2K	7/32 [5.56]	8-1/2 [215.90]	1-1/8 [28.58]	3/4 [19.05]	07	103, 205, 303
HL-225	225	2.1 Meg.	6.1K	7/32 [5.56]	10-1/2 [266.70]	1-1/8 [28.58]	3/4 [19.05]	07	103, 205, 303

*Minimum resistance is .1 ohm for all models.
**Contact factory for optional, non-standard terminals, including quick disconnect types.



DALE TYPE HL, FLAT



FLAT TYPE SPECIFICATIONS

TYPE	WATTAGE RATING	MAX.* RESISTANCE	MAX. WORKING VOLTAGE	TERMINAL SETBACK ±1/32 [.79]	DIMENSIONS A ±1/16 [1.59]	B ±1/16 [1.59]	C ±1/32 [.79]	STANDARD TERMINAL** DESIGNATION
HL-24	30	55K	800	5/64 [1.98]	1-1/4 [31.75]	2-1/2 [63.50]	2 [50.80]	09
HL-35	40	135K	1.4KV	5/64 [1.98]	2 [50.80]	3-1/4 [82.55]	2-3/4 [69.85]	09
HL-55	55	300K	1.8KV	5/64 [1.98]	3-1/2 [88.90]	4-3/4 [120.65]	4-1/4 [107.95]	09
HL-95	95	550K	2.6KV	5/64 [1.98]	6 [152.40]	7-1/4 [184.15]	6-3/4 [171.45]	09

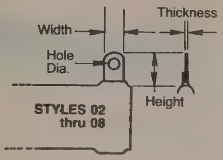
*Minimum resistance is .1 ohm for all models.
**Contact factory for optional, non-standard terminals, including quick disconnect types.

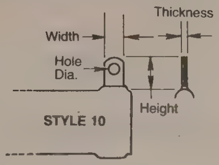
For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE®

TERMINAL SPECIFICATIONS

Terminals for HL, HLM and HLW Power Wirewound Resistors


Width
Thickness
Hole Dia.
Height
STYLES 02 thru 08


Width
Thickness
Hole Dia.
Height
STYLE 10

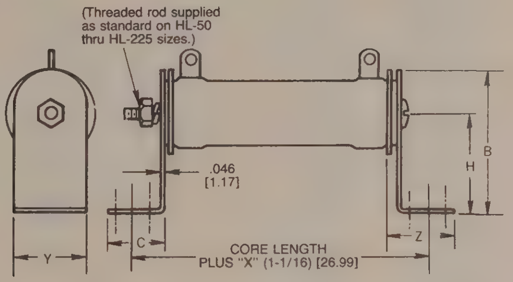
All terminals will be supplied in tinned finish (Z) unless otherwise specified. Optional finishes are nickel plated (N) for HL's, bare alloy 180 (W) for HLW lead styles. Specify proper suffix in part number designation when ordering.

TERMINAL DIMENSIONS

TERMINAL DESIGNATION	02	05	06	07	09	10	A1, R1	A2, R2
WIDTH	3/16 [4.76]	3/16 [4.76]	1/4 [6.35]	3/8 [9.52]	3/16 [4.76]	1/8 [3.18]	1-1/2″ [38.10] 18 AWG Lead	1-1/2″ [38.10] 20 AWG Lead
HEIGHT	13/32 [10.32]	7/16 [11.11]	9/16 [14.29]	5/8 [15.88]	1/2 [12.70]	3/16 [4.76]		
HOLE DIA.	.093 [2.36]	.104 [2.64]	.166 [4.22]	.173 [4.39]	.104 [2.64]	.063 [1.60]		
THICKNESS	.020 [.51]	.020 [.51]	.020 [.51]	.020 [.51]	.020 [.51]	.030 [.76]		

MOUNTING SPECIFICATIONS

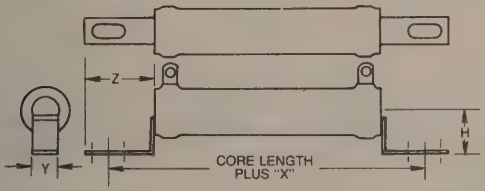
HORIZONTAL THRU-BOLT


(Threaded rod supplied as standard on HL-50 thru HL-225 sizes.)
.046 [1.17]
B
H
C
Z
Y
CORE LENGTH PLUS "X" (1-1/16) [26.99]

Note: Flat washers are supplied on resistor cores through 9/16 [14.29] diameter.

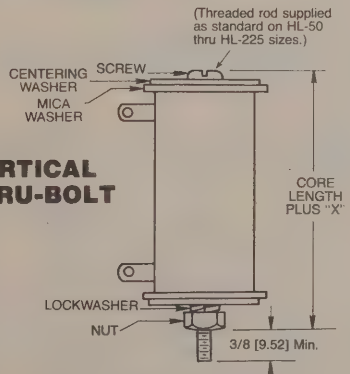
BRACKET TYPE	X	Y	Z	H	MOUNTING SLOT	C	B
101	1-1/16 [26.99]	1/2 [12.70]	55/64 [21.83]	1 [25.40]	7/32 x 7/16 [5.56 x 11.11]	3/4 [19.05]	1-3/8 [34.92]
102	1-1/16 [26.99]	3/4 [19.05]	55/64 [21.83]	1-1/4 [31.75]	7/32 x 7/16 [5.56 x 11.11]	3/4 [19.05]	1-3/4 [44.45]
103	1-1/16 [26.99]	1-1/4 [31.75]	1 [25.40]	1-1/2 [38.10]	9/32 x 9/16 [7.14 x 14.29]	7/8 [22.22]	2-1/8 [53.98]

PUSH-IN


Z
H
Y
CORE LENGTH PLUS "X"

BRACKET TYPE	X	H	Y	Z	HOLE
203	5/8 [15.88]	43/64 [17.06]	1/4 [6.35]	15/32 [11.91]	.161 Dia. [4.09]
204	3/8 [9.52]	9/32 [7.14]	1/4 [6.35]	11/32 [8.73]	.144 Dia. [3.66]
205	13/16 [20.64]	1-25/64 [35.32]	1/2 [12.70]	11/16 [17.46]	.196 x .260 [4.98 x 6.60]
206	23/32 [18.26]	31/32 [24.61]	3/8 [9.52]	5/8 [15.88]	.196 x .375 [4.98 x 9.52]

VERTICAL THRU-BOLT


(Threaded rod supplied as standard on HL-50 thru HL-225 sizes.)
CENTERING WASHER
SCREW
MICA WASHER
CORE LENGTH PLUS "X"
LOCKWASHER
NUT
3/8 [9.52] Min.

Note: Flat washers are supplied on resistor cores through 9/16 [14.29] diameter.

BRACKET TYPE	X (Approximate)	THREAD
301	7/16 [11.11]	8-32
303	1/4 [6.35]	10-32

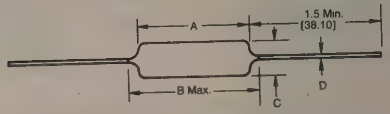
[Numbers in brackets indicate millimeters]

For complete information, write or phone

DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE® INDUSTRIAL POWER WIREWOUND RESISTORS

DALE TYPE CW, COATED, AXIAL LEAD



STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL. TYPE	POWER RATING (Max. Hot Spot) 275°C	POWER RATING (Max. Hot Spot) 350°C	MIL.	RESISTANCE RANGE (Mil. Range shown in bold face)	MAX. WT. (Grams)	MAX.* WORKING VOLTAGE 275°C	MAX.* WORKING VOLTAGE 350°C
CW-2	—	4.0	5.5	—	.1Ω to 22K	2.1	200	235
CW-2B	—	3.0	3.75	—	.1Ω to 11K	.70	125	140
CW-2C	—	2.5	3,25	—	.1Ω to 15K	1.6	130	150
CW-2C-1	**RW-69**	2.5	3.25	3.0	.1Ω to 15K **.1Ω to 2K**	1.6	130	150
CW-2C-14	—	2.5	3.25	—	.1Ω to 15K	1.6	130	150
CW-5	—	5.0	6.5	—	.1Ω to 45K	4.2	320	365
CW-5-2	—	4.0	5.0	—	.1Ω to 30K	4.2	240	265
CW-5-3	—	5.0	6.5	—	.1Ω to 45K	4.2	320	365
CW-5-5	**RW-67**	5.0	6.5	6.5	.1Ω to 45K **.1Ω to 8.2K**	4.2	320	365
CW-7	—	7.0	9.0	—	.1Ω to 75K	4.7	460	520
CW-10	—	10.0	13.0	—	.1Ω to 130K	9.0	765	875
CW-10-3	—	10.0	13.0	—	.1Ω to 130K	9.0	765	875
CW-10-4	**RW-68**	10.0	13.0	11.0	.1Ω to 130K **.1Ω to 20K**	9.0	765	875

*Maximum working voltage determined at .0008" diameter wire resistance values.

Tolerance: Standard tolerance is ±5% 1 ohm and above, ±10% below 1 ohm, ±3% available.

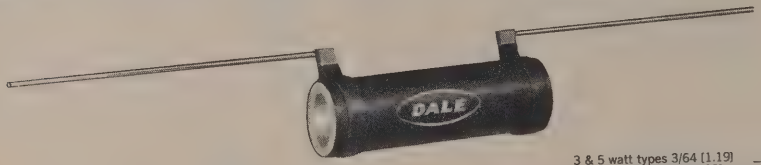
Temperature Coefficient: ±90 PPM/°C below 1Ω; ±50 PPM/°C 1Ω to 9.9Ω; ±30 PPM/°C 10Ω and above.

Lead Material: Standard material is tinned copperweld

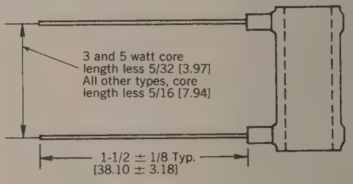
DIMENSIONAL SPECIFICATIONS

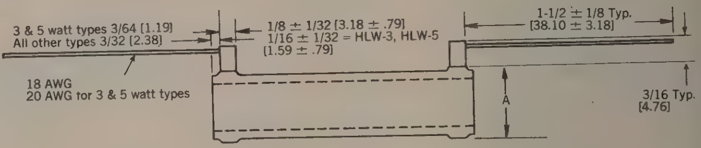
DALE TYPE	A ±.062 [1.57]	B (Max.)	C ±.032 [.81]	D ±.002 [.051]
CW-2	.625 [15.88]	.765 [19.43]	.250 [6.35]	.040 [1.02]
CW-2B	.562 [14.27]	.622 [15.80]	.188 [4.78]	.032 [.81]
CW-2C	.500 [12.70]	.593 [15.06]	.218 [5.54]	.040 [1.02]
CW-2C-1	.500 [12.70]	.593 [15.06]	.218 [5.54]	.032 [.81]
CW-2C-14	.500 [12.70]	.593 [15.06]	.218 [5.54]	.032 [.81]
CW-5	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.040 [1.02]
CW-5-2	.875 [22.22]	1.000 [25.40]	.250 [6.35]	.032 [.81]
CW-5-3	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.032 [.81]
CW-5-5	.875 [22.22]	1.000 [25.40]	.312 [7.92]	.040 [1.02]
CW-7	1.218 [30.94]	1.281 [32.54]	.312 [7.92]	.040 [1.02]
CW-10	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.040 [1.02]
CW-10-3	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.032 [.81]
CW-10-4	1.781 [45.24]	1.875 [47.62]	.375 [9.52]	.040 [1.02]

DALE TYPE HLW, TUBULAR, AXIAL LEAD



Lug-attached leads to facilitate direct electrical connection by soldering.


3 and 5 watt core length less 5/32 [3.97] All other types, core length less 5/16 [7.94]
1-1/2 ± 1/8 Typ. [38.10 ± 3.18]


3 & 5 watt types 3/64 [1.19]
All other types 3/32 [2.38]
1/8 ± 1/32 [3.18 ± .79]
1/16 ± 1/32 = HLW-3, HLW-5 [1.59 ± .79]
1-1/2 ± 1/8 Typ. [38.10 ± 3.18]
18 AWG
20 AWG for 3 & 5 watt types
A
3/16 Typ. [4.76]

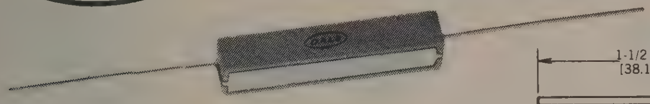
STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	WATTAGE RATING	MAX. RESISTANCE*	LENGTH ±1/16 [1.59]	CORE O.D.	CORE I.D. ± 1/32 [.79]	A (Max.)	AXIAL TERMINAL DESIGNATION	RADIAL TERMINAL DESIGNATION	MOUNTING HARDWARE
HLW-3	3	6K	7/16 [11.11]	13/64 [5.16]	1/8 [3.18]	19/64 [7.54]	A2	R2	—
HLW-5	5-1/4	15K	5/8 [15.88]	1/4 [6.35]	1/8 [3.18]	11/32 [8.73]	A2	R2	—
HLW-6	8	25K	1 [25.40]	5/16 [7.94]	3/16 [4.76]	13/32 [10.32]	A1	R1	101, 204, 301
HLW-12	12	70K	1-3/4 [44.45]	5/16 [7.94]	3/16 [4.76]	13/32 [10.32]	A1	R1	101, 204, 301
HLW-20	20	120K	2 [50.80]	7/16 [11.11]	5/16 [7.94]	9/16 [14.29]	A1	R1	101, 203, 301

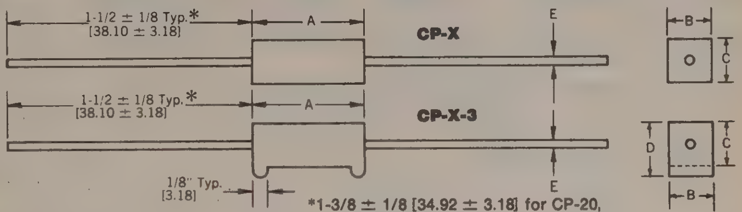
*Minimum resistance is .1 ohm for all models. Consult factory for higher values.

For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue. Columbus, Nebraska 68601 • Phone 402-564-3131

DALE® COMMERCIAL POWER WIREWOUND RESISTORS



DALE TYPE CP, AXIAL LEAD


1-1/2 ± 1/8 Typ.*
[38.10 ± 3.18]
A
E
CP-X
B
C
1-1/2 ± 1/8 Typ.*
[38.10 ± 3.18]
A
CP-X-3
D
C
1/8" Typ.
[3.18]
E
B

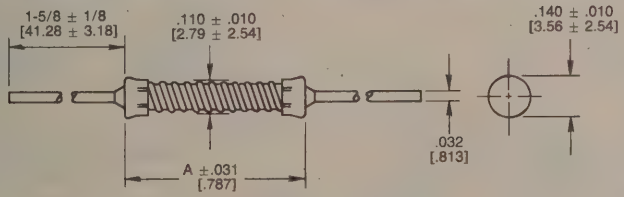
*1-3/8 ± 1/8 [34.92 ± 3.18] for CP-20, CP-20-3, CP-22, CP-22-3.

CP SERIES AXIAL LEAD TYPE

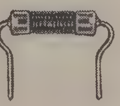
DALE TYPE	WATTAGE RATING	EIA STANDARD RS-344 TYPE	RESISTANCE	MAX. WORKING VOLTAGE	DIMENSIONS A ± 1/32 [.79]	B ± 1/32 [.79]	C ± 1/32 [.79]	D ± 1/32 [.79]	E ± .001 [.02]
CP-2	2	CRU2A	.1 to 2.4K	65	11/16 [17.46]	1/4 [6.35]	1/4 [6.35]	–	.032 [.81]
CP-2-3	2	–	.1 to 2.4K	65	11/16 [17.46]	1/4 [6.35]	1/4 [6.35]	5/16 [7.94]	.032 [.81]
CP-3	3	CRU3	.1 to 7.5K	150	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]	–	.036 [.91]
CP-3-3	3	–	.1 to 7.5K	150	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]	3/8 [9.52]	.036 [.91]
CP-5	5	CRU5	.1 to 8.5K	200	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	–	.036 [.91]
CP-5-3	5	–	.1 to 8.5K	200	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	13/32 [10.32]	.036 [.91]
CP-7	7	CRU7	.12 to 18K	350	1-25/64 [35.32]	3/8 [9.52]	11/32 [8.73]	–	.036 [.91]
CP-7-3	7	–	.12 to 18K	350	1-25/64 [35.32]	3.8 [9.52]	11/32 [8.73]	15/32 [11.91]	.036 [.91]
CP-10	10	CRU10	.18 to 30K	540	1-7/8 [47.62]	3/8 [9.52]	11/32 [8.73]	–	.036 [.91]
CP-10-3	10	–	.18 to 30K	540	1-7/8 [47.62]	3/8 [9.52]	11/32 [8.73]	15/32 [11.91]	.036 [.91]
CP-15	15	CRU15	.18 to 30K	670	1-7/8 [47.62]	1/2 [12.70]	1/2 [12.70]	–	.036 [.91]
CP-15-3	15	–	.18 to 30K	670	1-7/8 [47.62]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.91]
CP-20	20	–	.29 to 30K	770	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	–	.036 [.91]
CP-20-3	20	–	.29 to 30K	770	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.91]
CP-22	22	–	.52 to 30K	815	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	–	.036 [.91]
CP-22-3	22	–	.52 to 30K	815	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.91]

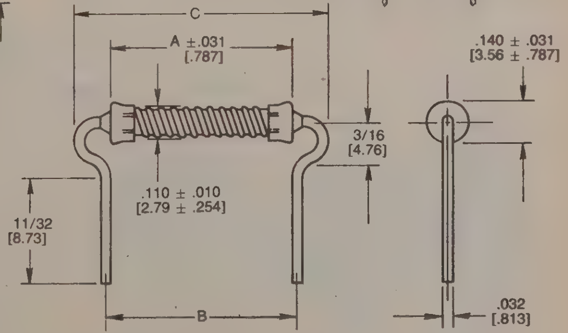
DALE TYPE CA & CR

CA-4000


1-5/8 ± 1/8
[41.28 ± 3.18]
.110 ± .010
[2.79 ± 2.54]
.140 ± .010
[3.56 ± 2.54]
.032
[.813]
A ±.031
[.787]

CR-4000




C
A ±.031
[.787]
.140 ± .031
[3.56 ± .787]
3/16
[4.76]
.110 ± .010
[2.79 ± .254]
11/32
[8.73]
B
.032
[.813]

DIMENSIONAL AND POWER SPECIFICATIONS

DALE TYPE	DIM. A MIN.	MAX.	DIM. B ±1/32 [.79]	DIM. C ±1/32 [.79]
CA-4000	.6 [15.24]	2.0 [50.8]	N/A	N/A
CR-4000	.6 [15.24]	2.0 [50.8]	A + 3/32 [2.38]	A + 7/32 [5.56]

Resistance Range: .1Ω minimum to 7K, dependent on resistor core length. **Tolerance:** ±10% standard, ±5% also available.

For complete information, write or phone

DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE® ESTABLISHED RELIABILITY WIREWOUND RESISTORS

MIL-R-39007, TYPE RWR, R LEVEL

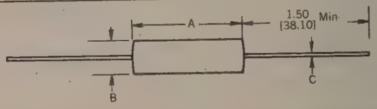
DALE TYPE ESS, ESW, EGS, EGW, ESN & EGN
Silicone Coated and Molded

STANDARD ELECTRICAL SPECIFICATIONS

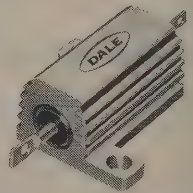
DALE TYPE	MIL-R-39007 TYPE	POWER RATING (Watts)	MILITARY RANGE		DIMENSIONS		
			.1%	.5% & 1%	DIM. A	DIM. B	DIM. C
EGS-1-80*	RWR-81S	1	.499-1000	.1-1000	.250 ± .015 [6.35 ± .381]	.078 ± .015 [1.98 ± .381]	.020 ± .0015 [.508 ± .038]
EGW-1*	RWR-81W	1	.499-1000	.1-1000	.250 ± .015 [6.35 ± .381]	.078 ± .015 [1.98 ± .381]	.020 ± .0015 [.508 ± .038]
EGN-1-80*	RWR-81N	1	10-499	10-499	.250 ± .015 [6.35 ± .381]	.078 ± .015 [1.98 ± .381]	.020 ± .0015 [.508 ± .038]
EGN-1-10*	RWR-81Z	1	10-499	10-499	.250 ± .015 [6.35 ± .381]	.078 ± .015 [1.98 ± .381]	.020 ± .0015 [.508 ± .038]
EGS-2*	RWR-82S	1.5	.499-1300	.1-1300	.312 ± .015 [7.92 ± .381]	.078 ± .015 [1.98 ± .381]	.020 ± .0015 [.508 ± .038]
EGW-2*	RWR-82W	1.5	.499-1300	.1-1300	.312 ± .015 [7.92 ± .381]	.078 ± .015 [1.98 ± .381]	.020 ± .0015 [.508 ± .038]
EGS-3-80*	RWR-80S	2	.499-3160	.1-3160	.422 ± .015 [10.72 ± .381]	.110 ± .015 [2.79 ± .381]	.020 ± .0015 [.508 ± .038]
EGW-3*	RWR-80W	2	.499-3160	.1-3160	.422 ± .015 [10.72 ± .381]	.110 ± .015 [2.79 ± .381]	.020 ± .0015 [.508 ± .038]
EGN-3-80*	RWR-80N	2	10-1580	10-1580	.422 ± .015 [10.72 ± .381]	.110 ± .015 [2.79 ± .381]	.020 ± .0015 [.508 ± .038]
EGN-3-10*	RWR-80Z	2	10-1580	10-1580	.422 ± .015 [10.72 ± .381]	.110 ± .015 [.279 ± .381]	.020 ± .0015 [.508 ± .038]
ESS-2A	RWR-71S	2	.499-12.1K	.1-12.1K	.812 ± .062 [20.62 ± 1.57]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESW-2A	RWR-71W	2	.499-12.1K	.1-12.1K	.812 ± .062 [20.62 ± 1.57]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESN-2A	RWR-71N	2	10-6.04K	10-6.04K	.812 ± .062 [20.62 ± 1.57]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESN-2A-10	RWR-71Z	2	10-6.04K	10-6.04K	.812 ± .062 [20.62 ± 1.57]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESS-2B	RWR-89S	3	.499-4120	.1-4120	.560 ± .062 [14.22 ± 1.58]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESW-2B	RWR-89W	3	.499-4120	.1-4120	.560 ± .062 [14.22 ± 1.58]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESN-2B	RWR-89N	3	10-2050	10-2050	.560 ± .062 [14.22 ± 1.58]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESN-2B-10	RWR-89Z	3	10-2050	10-2050	.560 ± .062 [14.22 ± 1.58]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
ESS-5	RWR-74S	5	.499-12,100	.1-12,100	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
ESW-5	RWR-74W	5	.499-12,100	.1-12,100	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
ESN-5	RWR-74N	5	10-6040	10-6040	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
ESN-5-10	RWR-74Z	5	10-6040	10-6040	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
EGS-10-80	RWR-84S	7	.499-12,400	.1-12,400	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
EGW-10	RWR-84W	7	.499-12,400	.1-12,400	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
EGN-10-80	RWR-84N	7	10-6190	10-6190	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
EGN-10-10	RWR-84Z	7	10-6190	10-6190	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
ESS-10	RWR-78S	10	.499-39,200	.1-39,200	1.780 ± .062 [45.21 ± 1.58]	.375 ± .031 [9.52 ± .787]	.040 ± .002 [1.02 ± .051]
ESW-10	RWR-78W	10	.499-39,200	.1-39,200	1.780 ± .062 [45.21 ± 1.58]	.375 ± .031 [9.52 ± .787]	.040 ± .002 [1.02 ± .051]
ESN-10	RWR-78N	10	10-19,600	10-19,600	1.780 ± .062 [45.21 ± 1.58]	.375 ± .031 [9.52 ± .787]	.040 ± .002 [1.02 ± .051]
ESN-10-10	RWR-78Z	10	10-19,600	10-19,600	1.780 ± .062 [45.21 ± 1.58]	.375 ± .031 [9.52 ± .787]	.040 ± .002 [1.02 ± .051]

*Molded models. All others have conformal coating.

All styles available in non-Mil models with extended resistance ranges. Consult factory.



DALE® MIL-R-39009, TYPE RER, R LEVEL



DALE TYPE ERH & ENH
Aluminum Housed Established Reliability

STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL-R-39009 TYPE	POWER RATING (Watts)		MILITARY RESISTANCE RANGE (Ohms) 1%	MAX. WORKING VOLTAGE	MAX. WEIGHT (Grams)	MIL-R-39009 STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms)		
		MOUNTED	FREE AIR				±100 PPM	±50 PPM	±30 PPM
ENH-5	RER-40	5	3	1 to 1.65K	128.9	3.3	—	1 to 19.9	20 to 1.65K
ENH-10	RER-45	10	6	1 to 2.8K	190	8.8	—	1 to 19.9	20 to 2.8K
ENH-25	RER-50	20	8	1 to 6.04K	390	16.5	—	1 to 19.9	20 to 6.04K
ENH-50	RER-55	30	10	1 to 19.6K	890	35.0	—	1 to 19.9	20 to 19.6K
ERH-5	RER-60	5	3	0.10 to 3.32K	160	3	.1 to .99	1 to 19.9	20 to 3.32K
ERH-10	RER-65	10	6	0.10 to 5.62K	265	6	.1 to .99	1 to 19.9	20 to 5.62K
ERH-25	RER-70	20	8	0.10 to 12.1K	550	13	.1 to .99	1 to 19.9	20 to 12.1K
ERH-50	RER-75	30	10	0.10 to 39.2K	1250	28	.1 to .99	1 to 19.9	20 to 39.2K

Standard Terminals: Tinned copperweld for all models. **Standard Tolerance:** ±1% **Dimensions:** Identical to Dale RH Resistors shown in this section.

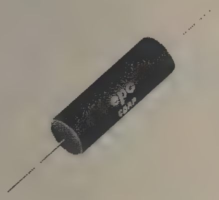
For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

epc CORPORATION

MANUFACTURERS OF PRECISION WIRE-WOUND RESISTORS ● RESISTOR NETWORKS CURRENT SHUNTS AND HIGH VOLTAGE DIVIDERS ● NO ORDER TOO SMALL OR LARGE

EPC DEVICES — *DESCRIPTION* — Mil Equiv. — *CONDENSED SPECIFICATIONS*

TYPE CA



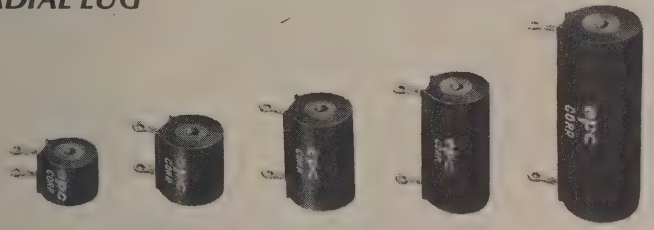
Encapsulated precision wire-wound resistors offering exceptional resistance stability, T.C. 5 ppm std. and low thermal EMF's. Designed to meet MIL-R-93/MIL-R-39005. Group encapsulization, Radial-lug four terminal and special physical configurations available.

Request CA Brochure

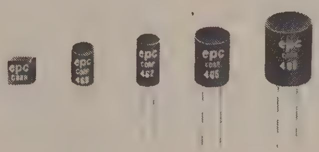
MIL	EPC
RBR-08	610
RBR-16	630
RBR-17	640
RBR-18	650
RBR-19	660
RBR-56	680
RBR-55	690
RBR-54	710
RBR-53	750
RBR-52	760
RBR-71	460
RBR-70	465

Power: .02 to 2.5W
Range: 1Ω to 20MΩ depending on size
Tolerance: .005%, .01%, .025%, .05%, .1% and 1%
Temp. Coef.: 5 PPM/°C std. on values over 100Ω
Stability: ±35ppm/YR

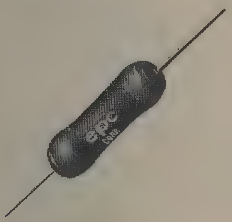
RADIAL LUG



PRINTED CIRCUIT



TYPE SP



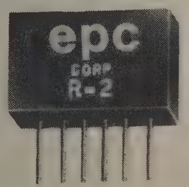
Silicone coated precision wire-wound power resistors, offering exceptional stability and performance under severe environmental conditions of MIL-R-26/MIL-R-39007. Also available utilizing Beryllium oxide cores. For greater power-size ratio and stability.

Request SP Bulletin

MIL	EPC
RWR-70	SP-1
RWR-69	SP-2A
RWR-70	SP-5
RWR-74	SP-6
RWR-55	SP-7A
RWR-78	SP-10A
RWR-68	SP-10B
RWR-56	SP-12

Power: .25W to 12.5W
Range: .1Ω to 275KΩ depending on size
Tolerance: 1% is std. Available to .01%
Temp. Coef.: 20 PPM/°C. Slightly higher for lower values. Special T.C.'s available

NETWORKS



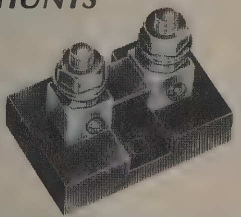
RC NETWORKS OUR SPECIALITY

Resistor networks to customer specification utilizing ultra precision wire-wound, metal film, carbon film, or wire-wound power resistors. All networks assembled on printed circuit boards.

FAST DELIVERY ON PROTOTYPE AND LARGE ORDERS

Power: .1W to 10W
Range: .1Ω to 5MΩ
Nominal Resistance Tolerance: To ±.005% D.C. W-W
Resistance Ratio Tolerance: To .001% D.C. W-W
Long Term Stability: .001%
Response Time: 100MS

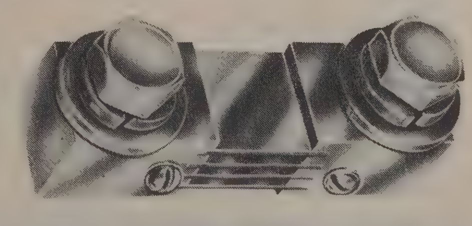
LIGHTWEIGHT SHUNTS



Standard D.C. current shunts from .001Ω to 1Ω. Accuracy ±.25%, available to .01%. Also external portable and switchboard shunts for use with D.C. Ammeters. 1 to 200 amp. with a 50MV or 100MV drop. Accuracy ±1%.

SPECIAL OEM CURRENT SHUNT RANGING FOR PANEL METERS

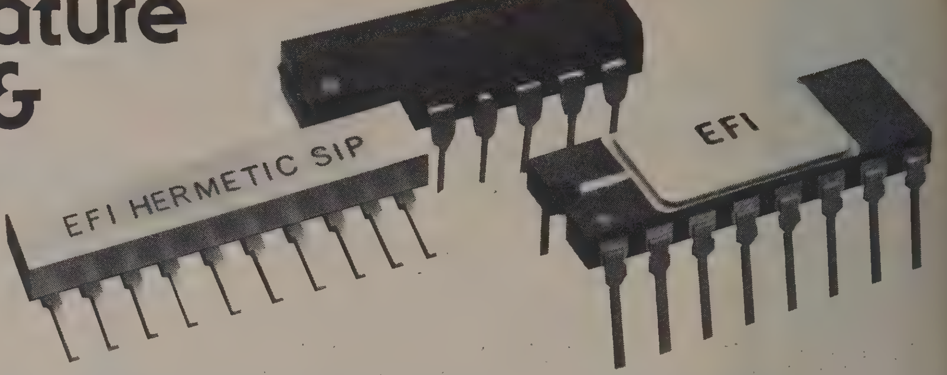
METER SHUNTS



ELECTRONIC PRECISION COMPONENTS CORPORATION

11 SANDFORD BLVD. ● MOUNT VERNON, N.Y. 10550 ● TELEPHONE: (914) 664-2333

Microminiature Resistors & Networks



RESISTOR NETWORKS

PACKAGE TYPE	PINS/LEADS/ TERMINALS	RESISTANCE RANGES	DISSIPATION	TOLERANCES	NETWORK TYPES/CONFIGURATION
SIP	2—10	20Ω—1MΩ	125mW/Res.	Absolute: ±1% to ±0.05% Ratio: ±0.1% to ±0.005%	Common connection to all resistors (S1) Series connection (S2)
Hermetically sealed SIP	10	20Ω—1MΩ	100mW/Res. 1.0W/Pkg.		Common connection (S1) Series connection (S2)
Molded DIP (P) Epoxy-coated DIP (E) Hermetic DIP (C)	8, 14, 16 4—24 even # 8, 14, 16, 18, 24	20Ω—1MΩ 20Ω—1MΩ	125mW/Res. 1.2W/Pkg.		Common connection (D1) Series connection (D2) Single resistor connection (D4)
TRIM-PAK® * Laser-Trimmable DIP	8, 14, 16, 18, 24	20Ω—1MΩ	125mW/Res. 1.2W/Pkg.	Absolute: ±1% to ±0.01% Ratio: ±0.1% to ±0.005%	Common connection (D1) Series connection (D2) Single resistor connection (D4)
Hermetically sealed Chip-carrier	16, 18, 20, 28 32, 42, 64	20Ω—1MΩ	100mW/Res. 1.0W/Pkg.	Same as TRIM-PAK	Single-layer (epoxy sealed) Multi-layer (epoxy or alloy sealed)
Flip-chip	14, 16, 24 (other on request)	20Ω—1MΩ	125mW/Res. 1.0W/Pkg.	Same as SIP & DIP, above	Common connection (D1) Series connection (D2) Single resistor connection (D4)

*Patent Pending

LADDER NETWORKS

PACKAGE TYPE	MODEL NO.	CONFIGURATION	RESOLUTION	ACCURACY	OPERATING TEMPERATURE RANGE	MAXIMUM CUMULATIVE ERROR
16-pin ceramic DIP	D355	R-2R	10-bit or 12-bit	± ½LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±0.05%
24-pin hermetically sealed DIP	D350 D351	BCD	8, 10, or 12-bit	± ½LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% (±0.03%)**
14-pin hermetically sealed DIP	D352 D353	BCD				10 Bits: ±0.05% (±0.12%)**
14-lead hermetically sealed flatpack	F352 F353	Binary				8 Bits: ±0.2%
16-pin hermetic chip carrier	C355	R-2R	10-bit or 12-bit	± ½LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ± .05%
24-pin hermetic chip carrier	C350	BCD	8, 10 or 12-bit	± ½LSB	0 to 70°C or −55°C to +125°C	12 Bits: ±0.012% 10 Bits: ±0.05% 8 Bits: ±0.2%

**D351 only.

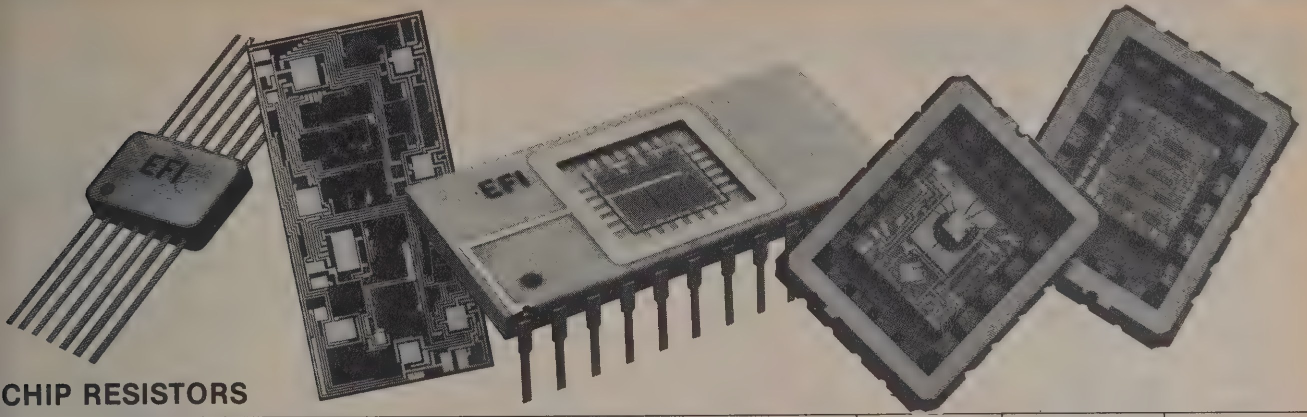
METALLIZED CERAMIC SUBSTRATES (Conductor-only and Resistor-conductor)

SUBSTRATE	METALLIZATION	RESISTORS*
Composition: 99.5% Al_2O_3 Surface Finish: 3—4 µin. typ. 1—2 µin. (polished) Size: .1″ × .1″ thru 4.5″ × 3.75″ Thickness: .010″ — .025″ Dimensional Tolerances: T — ±.002%, ±.001″ L — ±.003″ W — ±.003″ Camber: .004″/in. Dielectric Constant: 9.8 typ. @ 25°C—1MHz Loss Factor: .0004 typ @ 25°C—10GHz	**SPUTTERED** Ni/Cr, Ni, Au; Cr, Ni, Au; Cr, Au; Ta; Mo, Ni, Au; Cr, Cu, Au; Cr, Cu; Ti-W; Ti Other combinations of above metals. **ELECTROPLATED** Au: 100 µin. (Std.) — 300 µin. 24K: High ductility Cu: 100 µin.—300 µin. Resistivity: 10 ohms/square-200 ohms/square or 400 ohms/square	Range: to 1M Absolute Tolerance: to 0.01% Ratio Tolerance: to 0.01% Absolute TCR: ±50 ppm, ±25 ppm Ratio Tracking 100R/R**: 1 ppm/°C 1000R/R: 3 ppm/°C Time Stability Absolute: 0.05%/1000 hrs. @ 125°C Ratio: 0.005%/1000 hrs. @ 125°C Frequency: to >18 GHz

*For resistor-conductor pattern. **R >1000 ohms

ELECTRO-FILMS INCORPORATED

111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886



CHIP RESISTORS

CHIP SIZE (±.003″)				TERMINATIONS				TOLERANCE	STABILITY	TCR
Type	Length	Width	Thickness	Width	Length	Resistance	Power*			
1.	.040″	.020″	.010″	.007″	.015″	20Ω— 24KΩ	15— 30mW	Standard: 5% and 1% Special: .5% — .1% & tighter	0.05%/1000 hrs. @ 125°C (Dependent on range)	Standard: ±50 PPM/°C Special: ±25 PPM/°C ±10 PPM/°C
2.	.030″	.030″	.010″	.004″	.006″	250Ω— 40KΩ	18— 35mW			
3.	.050″	.050″	.010″	.0075″	.045″	20Ω— 125KΩ	50—100mW			
4.	.100″	.050″	.010″	.015″	.045″	40Ω— 400KΩ	85—175mW			
5.	.100″	.100″	.010″	.015″	.095″	20Ω—1000KΩ	200—400mW			
6.	.045″	.030″	.010″	.010″	.025″	40Ω— 59KΩ	30— 60mW			
7.**	.030″	.030″	.010″	.007″	.025″	20Ω— 30KΩ	18— 35mW			

SUBSTRATES	METALLIZATION
Composition — 99.5% Al_2O_3 Surface — 3—4 microinches (Standard) Thickness — .010″ ±.002″ (Standard) ±.001″ (Special) Passivation: Optional, thermo-plastic recommended for solder applications.	Resistive Material: Cr/Ni/X, 100—200Å (R.F. Sputtered) Conductor Base: Nickel — 5—8 μin. (R.F. Sputtered) Terminations: A. Gold — 100 μin. (Electroplated) B. Nickel & Solder (62/32/2) Microwave versions available.

*When bonded to substrate, value dependent. **Center-tapped.

New Surface Mounted Resistor Networks

RATIO TOLERANCES TO 0.01%
ANY COMBINATION OF RESISTOR VALUES FROM 20Ω TO 250 KΩ

HERMETIC CHIP CARRIERS — standard JEDEC hermetic chip carries to full MIL STD 883B specifications. Available with from 16 to 64 terminals.

ECONO-CHIP* — Low-cost replacements, in non-military applications, for hermetic chip-carrier networks. Bonding pad locations are equivalent to configurations of standard JEDEC cariers.

* Patent Pending.

FLIP CHIPS — solder bumped; coated, multi-resistor substrates for face down attachment. Suitable for reflow soldering assembly. Low cost and fast production in custom networks.

VERSA-CHIP — New low-cost, surface-mounted packaging design for precision resistor networks. Provides pin-for-pin equivalency with chip carriers, and versatility for many alternate configurations. Laser-trimmable by customer after mounting.

Microwave Components

METALIZED PLATES — metalized on 1, 2 or 6 sides; as fired or polished substrates, in house laser hole drilling and contouring, through hole metalization. Metalizations — see metalized ceramic substrates.

MICROWAVE ATTENUATOR CHIPS — (3rd Quarter) attenuation of 1, 2, 3, 4, 5, 6, 8, 10, 16, and 20 dB; frequency to 18 GHz.

Other New Products

R.C. NETWORKS — Precision RC Networks are now available in standard SIP and DIP packages.

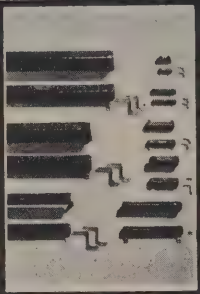
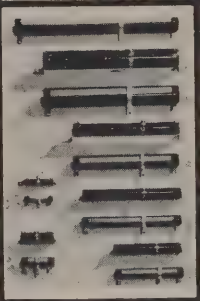
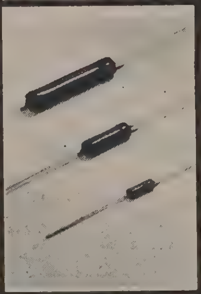
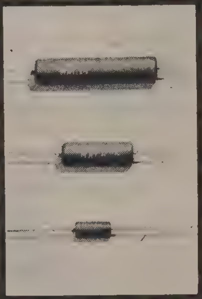
SILICON CHIP RESISTORS — (3rd Quarter) Standard and center-tapped chip resistors to compliment EFI's alumina-substrate chip resistors, Ta or NiCr, passivated.

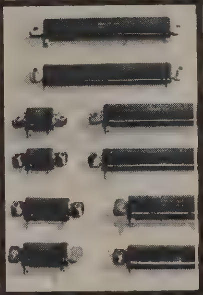
ELECTRO-FILMS INCORPORATED

111 GILBANE ST., WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886

E-SYSTEMS INC.
Memcor Division

WIRE WOUND RESISTORS

Type		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
TYPE FR VITREOUS ENAMEL FIXED TUBULAR WITH TABS		5 10 20 25 50 100 160 200	25K 50K 100K 100K 250K 100K 100K 100K	1 x 5/16 1¾ x 5/16 2 x 7/16 2 x 9/16 4 x 9/16 6½ x ¾ 8½ x 1⅛ 10½ x 1⅛
TYPE AR VITREOUS ENAMEL ADJUSTABLE TUBULAR WITH TABS		10 25 50 75 100 160 200	10K 25K 50K 50K 100K 100K 100K	1¾ x 5/16 2 x 9/16 4 x 9/16 6 x 9/16 6½ x ¾ 8½ x 1⅛ 10½ x 1⅛
TYPE VL VITREOUS ENAMEL AXIAL LEADS		3 5 10	10K 25K 50K	7/32 x 17/32 5/16 x 1 1/64 3/8 x 1 25/32
TYPE ML MOLDED SILICONE AXIAL LEADS		1 2 3 6.5 11	2500 3500 10K 80.6K 200K	.125 x .437 .205 x .590 .242 x .525 .375 x .917 .375 x 1.828

Type		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
TYPE FR w/LEADS VITREOUS ENAMEL FIXED TUBULAR		5-8 10-12 20	25K 50K 100K	1 x 5/16 1¾ x 5/16 2 x 7/16
TYPE MZ VITREOUS ENAMEL MIDGET OVALS WITH TABS		10 20	5000 25K	3/8 x 5/32 3/8 x 5/32
TYPE ZR VITREOUS ENAMEL OVALS TAB TERMINAL		30 40 55	10K 15K 25K	5/16 x 1 5/16 x 1 5/16 x 1
TYPE RR VITREOUS ENAMEL EDGEWOUND WITH TABS		40 90 100 160 150 300 500 750 1500	1.8 3 2.5 5.5 6.0 13 36 40 100	2 x 9/16 4 x 9/16 3½ x ¾ 6 x ¾ 5 x 1 8½ x 1⅛ 10½ x 1⅝ 12 x 2½ 20 x 2½

MEMCOR Components represent the cumulative design and production knowledge gained during 30 years experience in the industry.

Let MEMCOR sales engineers aid you with your special design and application requirements.

For price, quality, and delivery look to MEMCOR Components. Immediate delivery on stock value resistors. Typical 3-5 week delivery on other standard values and special requirements. These products are available from MEMCOR's Nationwide Authorized Distributor Network.

Write for FREE Catalog.

E-SYSTEMS
Memcor Division

DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

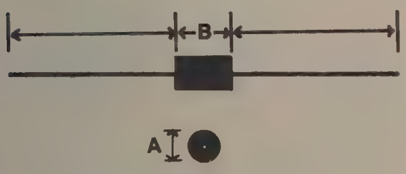
PRECISION WIREWOUND RESISTORS

For thirty years we have been deeply involved in the refinement and manufacture of precision wirewound resistors meeting the exacting requirements of military specifications such as MIL-R-93/MIL-R-39005 (RB & RBR styles).

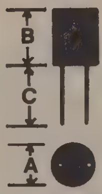
Many form factors are available, including axial and PC mounting types, in resistance values and accuracies to fill most requirements. "Standard" values and accuracies in our more popular types are usually available from stock. Orders for extremely large quantities and non-standard values are put on-line for prompt delivery.

Type		Basic Resistance Range	Standard Accuracies	Stability	Tempco	Power△ Rating ±0.1%@ +85°C	Max. Voltage	Encapsulation	A Dia.	B Length	C Length of Wire	D† Wire Gauge
ECONISTOR (Axial-Leads)	8E16	1Ω to 1.1 Meg	±0.01% ±0.025% ±0.1% (others available)	±35ppm/ year	±5ppm/ °C max. −55°C to +125°C (others available)	8E16, 0.33W	200VDC or AC pk.	Molded Epoxy	1/4" 6.4 mm	1/2" 12.7 mm	1-1/2" typ. 38 mm	22 AWG 0.6 mm
	8E24					8E24, 0.40W			1/4" 6.4 mm	3/4" 19.1 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
SQUARISTOR (PC Mounting)	GR102	1Ω to 100K				0.30W	150VDC or AC pk.		N/A	0.32" 8.1 mm	1" typ. 25 mm	22 AWG 0.6 mm
MAXI-OHM (Axial-Leads)	12E32	1Ω to 3.5M				12E32, 0.75W	600VDC or AC pk.		3/8" 9.5 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
	16E32	1Ω to 5M				16E32, 1.00W			1/2" 12.7 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
PLUGISTOR (PC Mounting)	8P13	1Ω to 200K				0.30W	150VDC or AC pk.		1/4" 6.4 mm	13/32" 10.3 mm	1" typ. 25mm	22 AWG 0.6 mm
MINI-OHM (Axial Leads)	5E10	1Ω to 80K		±50ppm/ year		0.2W	175VDC or AC pk.		5/32" 4 mm	5/16" 0.5 mm	1-1/2" typ. 38 mm	24 AWG 0.4 mm
CURRISTOR	8C24	0.01Ω to 100Ω			±10ppm/ °C std. (others available)	0.50W*			1/4" 6.4 mm	3/4" 19.1 mm	1" 25 mm	22 or 20 AWG 0.6 or 0.8 mm
	12C20					0.75W*			3/8" 9.5 mm	5/8" 15.9 mm	1" 25 mm	20 AWG 0.8 mm
	16C32					1.50W*			1/2" 12.7 mm	1" 25.4 mm	1" 25 mm	20 AWG or Terminals
	16C64					2.50W*			1/2" 12.7 mm	2" 51 mm	1" 25 mm	20 AWG or Terminals
	32C64					6.00W*			1" 25.4 mm	2" 51 mm	N/A	Terminals

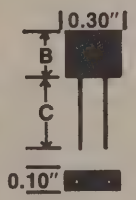
△For other tolerances consult factory
* Power ratings for Curristor are at +100°C
† All leads are tinned copper



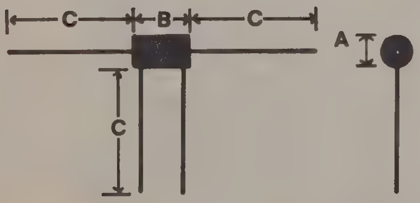
ECONISTOR, MINI-OHM, AND MAXI-OHM



PLUGISTOR



SQUARISTOR



CURRISTOR

GENERAL RESISTANCE, INC.
Twin Lakes Road • P.O. Box 185
North Branford, CT 06471
(203) 481-5721 • TWX 710-452-3092

GENERAL RESISTANCE
COMPONENTS

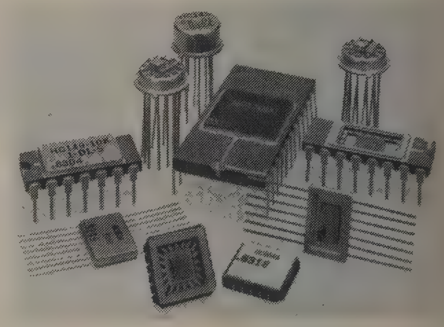
A PRIME TECHNOLOGY COMPANY

Today's New HyComp Delivers Advanced Thin-Film Products.

Precision, Standard and Custom
RESISTOR NETWORKS

FEATURES:

- Hundreds of standard networks or your unique design
- Your choice of package: **SIP, DIP, JEDEC, LCC** (surface mount device)
- Either industrial (−25° to +85°C) or military (−55° to +125°C) temperature range
- Screening to MIL R-83401D or 883C
- Outstanding tolerances:
  - — Ratio matching to .005%
  - — Ratio tracking to ±0.5 ppm/°C
  - — Absolute tolerance to 0.05%
  - — Absolute TCR to ±10 ppm/°C
- Proprietary Nichrome mix resulting in high stability over time and temperature
- Passivated, hermetically-sealed, low moisture

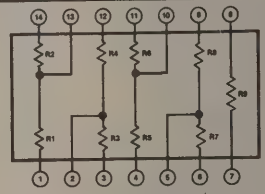


A SAMPLING OF PACKAGED NETWORKS

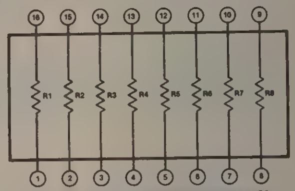
SERIES → / PARAMETERS	HC-149 Quad Divider Network (Equal R's)	HC-150 8 Equal Isolated Resistors	HC-170 12 Equal Isolated Resistors	HC-180 Binary Weighted Divider
Resistance Range	10K-100KΩ	2K-100KΩ	2K-100KΩ	5K-100KΩ
Tolerance Absolute Ratio	Standard: ±5% ±0.01% Custom: To 0.05% To 0.005%			
Thermal Stability Absolute (TCR) Standard Custom Tracking (TCRT) Standard Custom	±25ppm/°C To ±10ppm/°C ±5ppm/°C To 0.5ppm/°C			±25ppm/°C To ±5ppm/°C ±5ppm/°C To ±1ppm/°C
Power Dissipation Package Total LCC, JEDEC LCC, DIP, Flatpak Per Resistor	1W max. 500mW max. 100mW, max.	1W max. 500mW max. 100mW, max.	1.5W max. 1W max. 80mW, max.	1W max. — 50mW, max.
Package[1] Styles	14-Lead, DIP or Flatpak; 20-Lead JEDEC LCC	16-Lead DIP, or Flatpak; 20-Lead JEDEC LCC	24-Lead DIP, or Flatpak; 28-Lead JEDEC LCC	14-Lead DIP, or Flatpak; 20-Lead JEDEC LCC

NOTES:

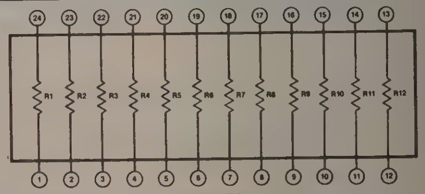
1. LCC denotes leadless chip carrier packages that are available in JEDEC and non-JEDEC versions.


14
13
12
11
10
9
8
R2
R4
R6
R8
R9
R1
R3
R5
R7
1
2
3
4
5
6
7

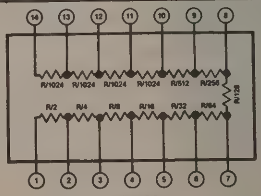
HC-149


16
15
14
13
12
11
10
9
R1
R2
R3
R4
R5
R6
R7
R8
1
2
3
4
5
6
7
8

HC-150 (MIL – R-83401 SCHEM A)


24
23
22
21
20
19
18
17
16
15
14
13
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
1
2
3
4
5
6
7
8
9
10
11
12

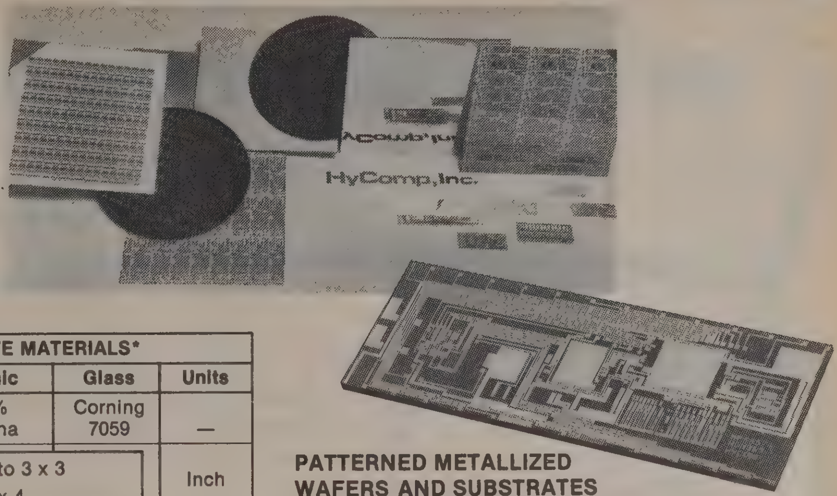
HC-170


14
13
12
11
10
9
8
R/1024
R/1024
R/1024
R/1024
R/512
R/256
R/128
R/2
R/4
R/8
R/16
R/32
R/64
1
2
3
4
5
6
7

HC-180

Metallized WAFERS & SUBSTRATES

With or without pattern



METALLIZED WAFERS

SUBSTRATE CHARACTERISTICS	SUBSTRATE MATERIALS* Silicon	Ceramic	Glass	Units
Formulation	100% Pure	99.6% Alumina	Corning 7059	—
Dimensions Length x Width	Standard: 2 x 2 to 3 x 3 Optional: To 4 x 4			Inch
Thickness	0.012	0.010-0.025	0.022	Inch
Finish (As-Fired)	NA	4-6, 2-3 opt.	NA	μinch
Surfaces Coated	1 or 2	1 or 2	1 or 2	—
DEPOSITIONS	**METALLIZATION**			
Resistance Layer Material Thickness	Nichrome (Vacuum-deposited on substrate) Typically 100-200Å			
Diffusion Barrier Material Thickness	Nickel (Vacuum-deposited on Nichrome) Typically 1000-3000Å			
Bonding Layer Material	High ductility 24K gold (Vacuum-deposited on Nickel)			
Thickness	Typically 1200Å; Electroplated to a minumum of 40 microinches, a maximum to customer specification			

* Sapphire and Berrylia substrates are available on request.

PATTERNED METALLIZED WAFERS AND SUBSTRATES

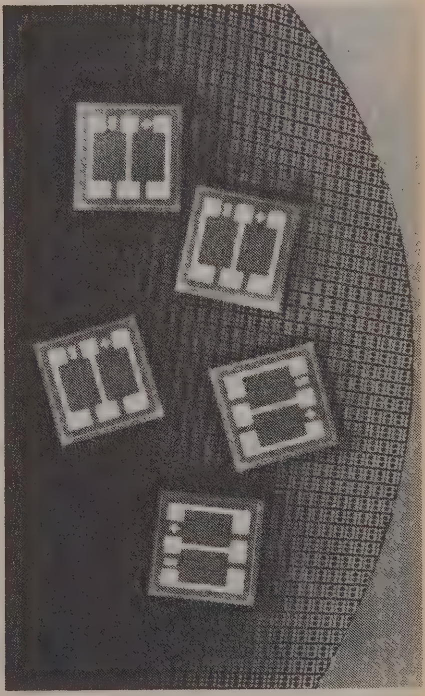
PATTERN PARAMETER	PARAMETER RANGE
MECHANICAL	
Lines and Spaces	Standard: Down to 1 mil Optional: Down to 0.25 mil
Form Factor	Wafers or individual substrates
Bonding Methods	HyComp's standard gold bonds are compatible with ultrasonic, thermocompression ball and wedge, and thermosonic bonding techniques.
ELECTRICAL	
Sheet Resistivity	50 to 300 Ohms per square
Absolute TCR	10 to 50ppm/°C
Levels of Fabrication	HyComp will attach active or passive devices on request.

Nichrome CHIP RESISTORS

STANDARD CHIP RESISTOR PRODUCTS

SERIES	HC30CT		HC20C		HC20BC
PARAMETERS					
Package	Top-Contact Center-Tapped		Top-Contact Non-Tapped		Top and Back Contact Non-Tapped
Substrate	Silicon	Ceramic	Silicon	Ceramic	Silicon
Resistance[1]	10Ω-1.2MΩ		10Ω-1.2MΩ	10Ω-510KΩ	10Ω-1.2MΩ
Tolerance Absolute	0.1%, 0.5%, 1%, 2%, 5%, 10%, 20%				1, 2, 5, 10, 20%
Ratio	0.1%, 0.05% 0.025%, 0.01%		—		—
Temperature TCR	± 10ppm/°C typ. ± 50ppm/°C max.				± 25ppm/°C typ. ± 50ppm/°C max.
TCRT	± 1ppm/°C typ. ± 2ppm/°C max.		—		—
Dimensions (L x W) Thickness	30 x 30 mils 10 ± 3 mils		20 x 20 mils 10 ± 3 mils		20 x 20 mils 10 ± 3 mils
Power, max.	250mW		250mW	100mW	100mW

1. Available in standard RETMA values. Other values available on request.



HyComp specializes in solutions to thin-film problems. Call us today.

HyComp, Inc.

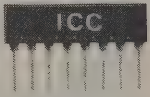
Union Ave., Sudbury, MA 01776-0377
Tel: (617) 443-4631 • TWX: 710-347-0385

INTEROHM RESISTORS

by International

RESISTOR	Type	Power Rating @70°C	Resistance Tolerance	Resistance Range	Voltage Rating	Temperature Coefficient
Carbon Film	CF 25	0.25W	±2%, ±5%	1.0 ohm — 10 megohms	250V	From 200 PPM/°C
	CF 50	0.50W	±2%, ±5%	1.0 ohm — 10 megohms	350V	From 200 PPM/°C
Metal Film	MF 25	0.25W	±1%, ±2%, ±5%	1 ohm — 1.0 megohm	250V	100 PPM/°C
	MF 50	0.50W	±1%, ±2%, ±5%	1 ohm — 1.0 megohm	350V	100 PPM/°C
Metal Oxide (Flame Proof)	MO-1	1.0W	±2%, ±5%, ±10%	0.5 ohm — 100K ohms	350V	350 PPM/°C
	MO-2	2.0W	±2%, ±5%, ±10%,	0.5 ohm — 100K ohms	350V	350 PPM/°C

RESISTOR NETWORKS — SIP



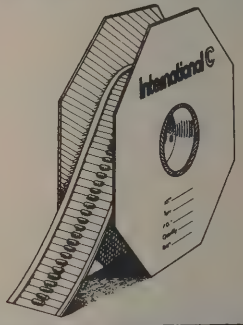
Pins	5-14
Resistance Range	22 ohms—2.2 megohms
Resistance Tolerance	±2%, ±5%, ±10%, ±20%
Element Power Rating	0.125W @70°C
Package Power Rating	0.35W — 1W @70°C
Temperature Coefficient	±150 PPM/°C, ±300 PPM/°C
Maximum Voltage	200V
Operating Temperature	−55°C to +130°C

ZERO OHM JUMPERS

1/4W Size Insulated Construction

PACKAGING

- Tape & Reel
- Magazine Pack
- Cut & Form (to specification)
- Bulk (100 Bag)



CALL TOLL FREE
800-645-9154

IN N.Y. STATE
516-293-1500

INTEROHM
International
International Components Corporation

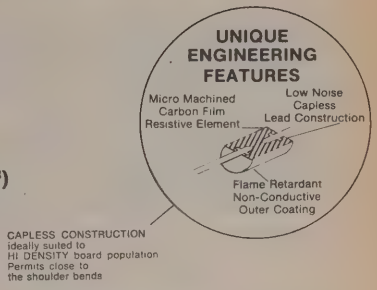
105 Maxess Road
Melville, New York 11747
(516) 293-1500
TELEX # 221576

ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

5%, 2% AND 1% CARBON FILM RESISTORS

FUSE ACTION—NON-FLAMMABLE


UNIQUE ENGINEERING FEATURES
Micro Machined Carbon Film Resistive Element
Low Noise Capless Lead Construction
Flame Retardant Non-Conductive Outer Coating
CAPLESS CONSTRUCTION ideally suited to HI DENSITY board population Permits close to the shoulder bends

- △ **High Stability**
- △ **Lowest Noise**
- △ **Smallest Dimensions**
- △ **Capless Design**
- △ **Meets MIL Specifications**
- △ **Extremely Long Life**
- △ **Produced And Checked By Automatic Equipment**

- △ **Failure Rate Less Than 10^8/Hour (MTTF More Than 10^8)**
- △ **Solderability as per MIL-STD-202**
- △ **Insulation Resistance Higher Than 10^9 Ohms**
- △ **Terminal Strength > 8 Lbs.**
- △ **Equivalents: MIL R-10509, MIL R-39, MIL R-11**
- △ **Color Code: MIL-STD-129**
- △ **Available With Weldable Leads**
- △ **Available in Bulk Pack or Taped and Reeled**

TYPE	A	b	a	L_1	L_4	d	D	L
UPM ¼ W (INCHES)	3.35-0.039	0.236	0.197 ± 0.08	0.236 + 0.039	1.457 ± 0.039	0.024	0.091 ± 0.08	$3.15^{+0.118}_{-0.079}$
UPM ¼ W (MM)	85-1	6	5 ± 0.2	6 + 1	37 ± 1	0.6	2.3 ± 0.2	80^{+3}_{-2}
UPM ½ W (INCHES)	3.35-0.039	0.236	0.197 ± 0.08	0.315 + 0.039	1.457 ± 0.039	0.027	0.111 ± 0.08	$3.15^{+0.118}_{-0.079}$
UPM ½ W (MM)	85-1	6	5 ± 0.2	8 + 1	36 ± 1	0.7	2.8 ± 0.2	80^{+3}_{-2}

INCLUDE RESISTANCE RANGES

Wattage	Tolerance	Range
¼	5%	4.7Ω — 1 MegΩ
	2%	10Ω — 300KΩ
½	5%	4.7Ω — 4.7 MegΩ
	2%	10Ω — 1 MegΩ

MIL R-11 EQUIVALENT	MIL R-10509 EQUIVALENT
RC 07 and RC 12	RN 65 cat. b,d
RC 20 and RC 22	RN 70 cat. b,d

	MAX. △ RES.
Humidity (Steady State)	± 1.00%
Life	± 1.00
Short Time Overload	± 0.50
After Soldering	± 0.25
Thermal Shock	± 0.25
Twist	± 0.25
Vibration	± 0.25

Also Available 1% Metal Film Resistors
¼ Watt 50 PPM & 100 PPM

ISKRA ELECTRONICS INC.
8 GREENFIELD RD., SYOSSET, NY 11791 • (516) 364-2616

JRL JULIE RESEARCH LABORATORIES INCORPORATED

PRECISION WIREWOUND RESISTORS

PRECISION RESISTORS FOR EVERY APPLICATION

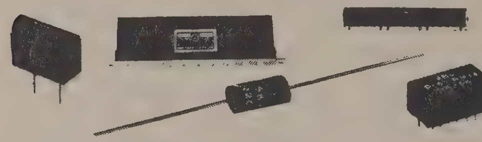
Precision Resistors for every application imaginable; high quality, low priced precision resistors are available for your every design need and at delivery schedules (1-2 weeks) even distributors can't beat!! JULIE RESEARCH resistors are guaranteed for a lifetime performance in almost every value, tolerance and stability.

Available as individual, ratio or network assemblies, these expertly manufactured and trimmed resistors assist you in eliminating countless hours of Production Test time from your design. In addition, the use of these very stable resistors contribute to reliable design and reduced component count. Specify a Julie Resistor. Better yet, call us and we will assist in helping you get the best price-performance unit your application and budget will allow.

JUST A FEW OF THE PROVEN APPLICATIONS FOR THESE LOW REACTANCE HIGH PERFORMANCE RESISTORS ARE:

- Transducer Calibrating Networks
- Current Metering
- Gyro Torquing
- AC and DC Precision Bridge Elements
- Amplifier Summing Elements
- D/A Converters
- Reference Divider
- Precision Multiplier
- Resistive Divider Networks
- Shunting
- AC or DC Ratio
- High Performance MIL Spec
- Zener Trimming Networks

RESISTOR STYLES



SPECIFICATIONS

The DIP resistor is available with up to 7 resistance values in a 14 pin DIP or 8 resistance values in a 16 pin DIP.

Range: 100Ω to 100 KΩ per resistor.

Ratio Accuracy: To .001% for ratio 1:1.

Stability: Network .002% for standard ranges.

Temperature Coefficient: 1 ppm/°C to 20 ppm/°C.

Delivery: 3-4 weeks.

Custom designs available — contact factory with your specific applications.

SPECIFICATIONS

Range: Individual Resistors, 0.1 ohm to 5 megohms. Ratio Sets, 1:1 to 10^6:1 depending on total resistance required.

Accuracy: Standard accuracy of resistors, 0.005% for values from 1000 ohms to 5 megohm. Standard accuracy of ratio sets, 0.0025% for ratios near 1:1. Accuracies from 0.002% to 0.1% are available (at corresponding prices) on special order.

Stability: Resistors, 0.002% per year for standard ranges.

Accuracy Over Military Temperature Range: ±0.02% from −45°C to +85°C.

Matching Over Military Temperature Range: ±0.005% from −45°C to +85°C.

Retrace Over Military Environmental Conditions: 0.002%.

Temperature Coefficient: Resistors, 5 ppm/°C standard. (Available as low as 1.0 ppm/°C). Ratio sets, 2.5 ppm/°C standard. (Available as low as 0.7 ppm/°C).

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

Thermal Transients: All thermal-induced transient effects, e.g.: self-heating, Seebeck and Peltier effects, are less than 0.0015% at rated power dissipation. Self-heating and time constants of thermal transients are reduced to 10% of normal values in air.

Current Capability: To 2 amperes.

Voltage: Between Terminals, 300 volts maximum, Terminals to Case, 500 volts maximum.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 10 megohms. Ratios, 1:1 to 10^6:1, depending on total resistance required.

Accuracy: Standard accuracy of resistors, 0.01%, for values from 100 ohms to 5 megohm. Standard accuracy of ratios, 0.005%, for ratios near 1:1. Intermediate accuracies of 0.05% and up and higher accuracies to .0025% are available on special order.

Stability: Resistors 0.003% per year for standard ranges.

Accuracy Over Military Temperature Range: 0.02% from −30°C to +85°C.

Retrace Over Military Environmental Conditions: 0.003%.

Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 1.0 ppm/°C). Ratios, 2.5 ppm/°C standard, (available as low as 0.7 ppm/°C).

Note: Temperature Coefficient can be altered, in manufacture, over over wide ranges.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 100 ohms.

Accuracy: Standard accuracy of resistors, 0.01%, for values from 1.0 ohm to 100 ohms. (R_1xG) .005% (CH).

Stability: Resistors 0.003% per year for standard ranges.

Accuracy Over Military Temperature Range: 0.02% fom −30°C to +85°C.

Retrace Over Military Environmental Conditions: 0.003%.

Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 2.5 ppm/°C).

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

Voltage and Power Ratings: See chart.

Construction: See charts.

Group Encapsulation: Special techniquies permit group encapsulation of high-accuracy units on a high-yield basis, enabling better accuracies at competitive costs. (See JRL Bulletin B-11.)

HIGH LOAD-LIFE STABILITY, PRECISION NETWORKS

Type	Construction Dual In-Line	Resistor Configuration	Dimensions (Inches) L x W x H	Max Res Per Resistor	Max Volt. Per Resistor	Max Power Per Resistor
RNX-14	14 pin	7 max.	.740 x .39 x .27	100K	125V	1/10W
RNX-14	14 pin	13 max.	.740 x .39 x .51	100K	125V	1/10W
RNX-16	16 pin	8 max.	.840 x .39 x .27	100K	125V	1/10W
RNX-16	16 pin	15 max.	.840 x .39 x .51	100K	125V	1/10W

LOWEST, LOW REACTANCE OIL FILLED AND ENCAPSULATED THA-H, CH, HCH, RESISTORS AXIAL WIRE LEAD CONSTRUCTION

Style	Size		AWG Leads	Max. Res.	Volt	Power	MIL R-93
	Inches	MM					
H-32	⅜ x ½	9.5 x 12.7	20	250 K	250	½ W	—
H-33	⅜ x ¾	9.5 x 19.1	20	350 K	450	½ W	RB 53
H-34	⅜ x 1	9.5 x 25.4	20	500 K	500	½ W	RB 52
H-42	½ x ½	12.7 x 12.7	18	750 K	250	½ W	—
H-44	½ x 1	12.7 x 25.4	18	2 Meg	500	1 W	RB 57
H-46	½ x ½	12.7 x 38.1	18	3 Meg	750	1½	RB 58
H-48	½ x 2	12.7 x 50.8	18	5 Meg	1000	2 W	RB 59
HCH-32	⅜ x ½	9.5 x 12.7	20	150 K	—	¾ W*	—
HCH-33	⅜ x ¾	9.5 x 19.1	20	250 K	—	1 W*	—
HCH-34	⅜ x 1	9.5 x 25.4	20	350 K	—	1.5 W*	—
HCH-35	⅜ x 1¼	9.5 x 31.8	20	500 K	—	1.8 W*	—
HCH-42	½ x ½	12.7 x 12.7	18	375 K	—	1.5 W*	—
HCH-44	½ x 1	12.7 x 25.4	18	750 K	—	3 W*	—
HCH-46	½ x 1½	12.7 x 38.1	18	1 M	—	4.5 W*	—
HCH-48	½ x 2	12.7 x 50.8	18	1.5 M	—	6 W*	—
CH-32	⅜ x ½	9.5 x 12.7	20	300 K	—	¾*	—
CH-33	⅜ x ¾	9.5 x 19.1	20	500 K	—	1 W*	—
CH-34	⅜ x 1	9.5 x 25.4	20	700 K	—	1.5*	—
CH-35	⅜ x 1¼	9.5 x 31.8	20	1 Meg	—	1.8*	—
CH-42	½ x ½	12.7 x 12.7	18	750 K	—	1.5*	—
CH-44	½ x 1	12.7 x 25.4	18	1.5 M	—	3.0*	—
CH-46	½ x 1½	12.7 x 38.1	18	2 M	—	4.5*	—
CH-48	½ x 2	12.7 x 50.8	18	5 M	—	6 W*	—
THA-36	⅜ x ½	9.5 x 12.7	18	1 M	100	—	RB 53
THA-38	⅜ x ¾	9.5 x 19.1	18	1 M	100	—	RB 53

* When mounted on heat sink.

SUPER ACCURATE, SUPER STABLE ENCAPSULATED, MINIATURE PRECISION R, XG, RS, L, GL RESISTORS

TYPE R AND C — AXIAL WIRE LEAD-CONSTRUCTION

C-21X	3/16 x ⅜		24	100 K	125	1/10 W	
R-22	¼ x 9/16	6.4 x 14.3	22	500 K	125	⅛ W	—
R-23	¼ x ¾	6.4 x 19.1	22	750 K	125	⅙ W	RB 54
R-24	5/16 x 1	7.9 x 25.4	22	1 Meg	350	¼ W	—
R-32	⅜ x ½	9.5 x 12.7	22	750 K	125	¼ W	—
R-33	⅜ x ¾	9.5 x 19.1	20	1 Meg	125	⅓ W	RB 53
R-34	⅜ x 1	9.5 x 25.4	20	1.5 Meg	250	½ W	RB 52
R-35	⅜ x 1¼	9.5 x 31.8	20	2 Meg	250	⅝ W	—
R-42	½ x ½	12.7 x 12.7	18	1.5 Meg	125	½ W	—
R-44	½ x 1	12.7 x 25.4	18	4 Meg	250	1 W	RB 57
R-46	½ x 1½	12.7 x 38.1	18	7.5 Meg	250	1½ W	RB 58
R-48	½ x 2	12.7 x 50.8	18	10 Meg	250	2 W	RB 59

TYPE L AND RB — RADIAL LUG CONSTRUCTION

L-10A	⅝ x 9/16	15.9 x 14.3	Solder Lug	1.5 Meg	125	½ W	RB 16
L-HB	⅝ x 1¼	15.9 x 31.8	Solder Lug	4 Meg	250	1 W	RB 18
RB-19	1 x 2 1/32	25.4 x 51.6	Solder Lug	10 Meg	300	2 W	RB 19
RB-17	½ x 1	12 7 x 25.4	Solder Lug	1.5 Meg	125	¾ W	RB 17

TYPE XG — RADIAL WIRE LEAD CONSTRUCTION

R-32XG	⅜ x 9/16	9.5 x 14.3	22	500 K	125	¼ W	—
R-42XG	½ x 9/16	12.7 x 14.3	20	1 Meg	125	½ W	—
R-44XG	½ x 1 5/32	12.7 x 29.3	20	3.5 Meg	250	1 W	—
R-46XG	½ x 1⅜	12.7 x 34.9	20	5 Meg	250	1½ W	—
R-48XG	½ x 2 1/16	12.7 x 52.4	20	10 Meg	250	2 W	—
R-52XG	⅝ x 19/32	15.9 x 15.1	20	1 Meg	125	¾ W	—

TYPE RS — TOP HAT CONSTRUCTION

RS-36	11/32 x ½	10.3 x 12.7	22	750 K	125	¼ W	—
RS-26	9/32 x ½	7.1 x 12.7	22	250 K	125	⅛ W	—

LOW OHM, LONG TERM STABILITY, OIL FILLED AND ENCAPSULATED 4-TERMINAL CH46-T4, R-46-T4, R46xG-T4 AXIAL AND RADIAL CONSTRUCTION

Style	Size	MM	AWG Leads	Max. Res.	Current	Power
R-46T4	½ x 1½	12.7 x 38.1	18	100 Ohms	2 Amps	1½ W
R-46XG-T4	½ x 1½	12.7 x 38.1	20	100 Ohms	2 Amps	1½ W
CH-46T4	½ x 1½	12.7 x 38.1	18	100 Ohms	2 Amps	3 W*

* When mounted on heat sink.

JULIE RESEARCH LABORATORIES, INC. • 211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

J35215-8/82 Printed in U.S.A. All rights reserved.

THICK AND THIN FILM ELECTRONIC COMPONENTS

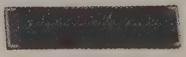
DIP RESISTOR NETWORKS

MIL-R-83401

Thick film epoxy molded DIP resistor networks are available in both Commercial and M-83401 Mil-approved configurations. 14 and 16 Pin. A and B Schematics in standard resistance values are available from stock. Custom designed circuits for your unique requirements are a specialty.

WRITE FOR BULLETIN MD 2/80
WRITE FOR BULLETIN PD 1/80

THICK FILM CAPACITOR ARRAYS



Thick Film Capacitor Arrays offer considerable cost advantages and reliability improvements for multiple capacitor circuits. The standard capacitance range is 10 pf to 200 pf. These circuits are available in virtually any customer required configurations. The capacitor elements exhibit NPO - type characteristics. Tolerances to 5% and voltage rating to 200 volts are available. Capacitors on a substrate may be matched to 2.5% on request. Dissipation factor is typically 1% and insulation resistance is greater than 10^{11} ohms.

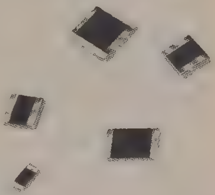
WRITE FOR BULLETIN CA 3/82

FLATSO

KDI Pyrofilm offers seven "FLATSO" resistors with voltage ratings to 20 KV and power ratings from .25 watts to 5 watts. Resistance values from 50Ω to 5,000 Meg and temperature coefficients to ±100 PPM/°C are available depending on value. Custom Flatso Networks and non-standard values will be quoted upon request.

WRITE FOR BULLETIN FL1-80

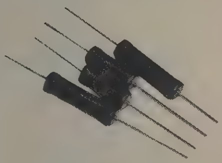
THICK FILM CHIP RESISTORS



A complete line of Thick Film Chip Resistors are available in eight sizes. These chips feature both single-sided and wrap-around terminations. They are available with platinum gold, gold, and solder coated terminations. The resistance range is from 5.1 ohms to 4 megohms. Tolerances from 1% to 20% are standard as are temperature coefficients from 100 PPM/°C to 250 PPM/°C. Power capabilities range from 50 mW to 0.5 Watts. These chip resistors offer high rel design and construction and environmental testing is available.

WRITE FOR BULLETIN PC 10/81

HIGH VOLTAGE



Axial lead thick film resistors for both high voltage and high resistance can be supplied in voltage ratings to 40 KV and resistance values to 1,000 Meg. Fired at over 900°C, these resistors are unmatched in performance with proven load life stability.

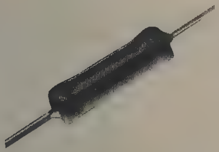
WRITE FOR BULLETIN PVC 2/80

HIGH VOLTAGE THICK FILM NETWORKS

Voltage dividers and other networks are available with ratings up to 60 KV. Divider Networks have tolerances to 1% with TC tracking to 25 PPM/°C. They can be manufactured with a resistance range from 10 ohm to 1,000 megohm. These networks are available in leaded and unleaded styles, in both standard and custom configurations.

WRITE FOR BULLETIN #FN 3/80

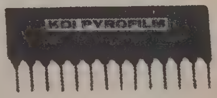
METAL FILM



Conformal coated high precision metal film resistors offer superior stability and reliability at a reasonable cost. Features include: small size, impervious to moisture, low noise, low T.C. and resistance range of 10 ohms to 70 Megohms. Surpasses MIL-R-10509 and MIL-R-55182. In-plant testing facilities as well as matched networks are available. Standard T.C.: ±10, ±25, ±50, and ±100 ppm/°C.

WRITE FOR BULLETIN #PME 2-80

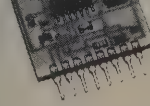
THICK FILM RESISTOR CAPACITOR NETWORKS



Custom Resistor and Resistor Capacitor Networks can be supplied to virtually any customer requirement. The resistance range is from 10 ohms to 10 megohms with absolute tolerances to 0.5%, and ratios to 0.1%. Temperature coefficient of 100 PPM/°C is available. The capacitance range is determined by the type of dielectric material chosen. RC Time Constant Calibration is available to 0.5%. Complete environmental testing can be performed.

WRITE FOR BULLETIN RC 2/82

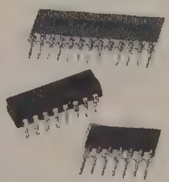
THICK FILM HYBRID CIRCUITS



Custom Thick Film Hybrid circuits are produced using any type of surface mountable semiconductor and chip component. Both Single-in-Line and Dual-in-Line styles are available and custom packaging formats can be accommodated also. Circuits can utilize any combination of semiconductors, capacitors, resistors and chip inductors. Full functional and parametric testing is available as well as any required environmental tests. All the features of Thick Film resistor networks, such as tight tolerances and ratio tracking, as well as low TC are inherent in hybrid circuits.

For additional information call factory

CHIPLESS™ RESISTOR/ CAPACITOR NETWORKS AND CAPACITOR ARRAYS



These standard and custom circuits are available in both Dual-in-Line and Single-in-Line formats and offer cost effective alternatives to discrete designs. These circuits and arrays utilize our Thick Film Capacitor technology and therefore require no "add on" chips. Capacitor elements are available with NPO or X7R characteristics. Values range up to several thousand picofarads with tolerances to 5% and matching to 2.5%. Resistor elements range from 10 ohms to 10 meg ohm with tolerance to 0.5%, TC to 100 ppm and matching to 0.1%.

Write for Bulletin DCRC-184 and CRC184

KDI
ELECTRONICS, INC.

PYROFILM & ENGELMANN DIVISIONS

60 SOUTH JEFFERSON ROAD, WHIPPANY, N.J. 07981
201-887-8100 • TWX (710) 986-8220

KELVIN

Precision Wire-wound Resistors, Power Resistors & Resistor Networks

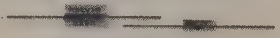
Kelvin is a pioneer in the field of very high stability, close tolerance, precision wire-wound resistors. Resistors shown represent only part of the broad Kelvin line. Complete catalog data is available on request.

HIGH RELIABILITY "HRL" SERIES

Kelvin's "HRL" Series was generated after years of experience on the Polaris, Gemini, Apollo and other important high reliability missile and space programs. Kelvin has combined the many and varied parameters of these programs into a single resistor series, designed to meet the stringent high reliability requirements of many of today's military and commercial systems.

Kelvin's reliability goal, through the design and controls of the "HRL" Series resistor and the use of acceptance inspection procedures, was to produce precision wire-wound resistors having failure rates better than .0005%/1000 hours at a 90% confidence level. Present level is .00064%/1000 hours at a 60% confidence level.

All "HRL" resistors have a documented history. This includes traceability from the spool analysis of the resistance wire, through each phase of the production operation to the finished product. Each resistor is screened to eliminate INFANT MORTALITY. This consists of a 100 hour burn in at full rated power at 125°C and a short time overload at twice the rated power. Other tests are conducted as outlined in Bulletin HR 02449, which presents the complete procedure and methods approach for production of "HRL" resistors.



KELVIN TYPE	WATTAGE*	RESISTANCE MAXIMUM**	DIA. ± .015	LENGTH ± .032	MAXIMUM VOLTS	LEAD DIA.	MIL-R-39005
HRL-20	.08	25K	.187	.375	150 V	#22	
HRL-991	.125	150K	.250	.312	150 V	#22	RBR-71
HRL-1009	.125	316K	.250	.295	150 V	#22	RBR-75
HRL-1097	.125	90K	.193†	.500	150 V	#22	RBR-74
HRL-417	.125	220K	.250	.343	150 V	#20	RBR-56
HRL-467	.150	332K	.250	.500	200 V	#20	RBR-55
HRL-334	.200	500K	.375	.500	300 V	#20	
HRL-812	.250	562K	.250	.750	300 V	#20	RBR-54
HRL-815	.333	1.1 meg	.375	.750	300 V	#20	RBR-53
HRL-1100	.500	600K	.312	.812	300 V	#20	RBR-76
HRL-254	.500	1.21 meg	.375	1.000	600 V	#20	RBR-52
HRL-27	.750	6.42 meg	.500	1.000	600 V	#20	RBR-57

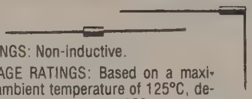
† ± .010 Tolerance

SUB-MINIATURE TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.



WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

COMBINATION AXIAL-RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
315-PAR	.05	100K	.080	.375	100	#24
303-PAR	.05	100K	.125	.250	100	#24
162-PAR	.10	200K	.125	.375	100	#22
158-PAR	.15	700K	.187	.375	100	#22

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-00	.05	100K	.080	.375	100	#24
1788-P	.04	50K	.100	.225	75	#24
460-P	.06	100K	.100	.281	100	#24
301-P	.05	175K	.125	.250	100	#24
EP-01	.10	200K	125	.375	100	#22
470-P	.10	.500K	.160	.500	100	#24
EP-20	.15	700K	.187	.375	200	#22
304-P	.15	500K	.250	.250	100	#22
430-P	.15	600K	.250	.312	100	#20
417-P	.20	700K	250	.343	100	#20

PRINTED CIRCUIT TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

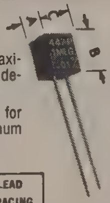
TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.



-HIGH DENSITY PACKAGING

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	SIZE ±.020			MAX. VOLTS	LEAD DIA.	LEAD SPACING
			A	B	C			
446-P	.250	2 Meg.	.140"	.270"	.500"	100	#20	.250
447-P	.125	1 Meg.	.140"	270"	.250"	100	#20	.125

STANDARD PRINTED CIRCUIT

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.	LEAD SPACING
252-P	.15	375K	.250	.250	100	#22	.150
176-P	.15	450K	.250	.312	100	#22	.150
178-P	.20	650K	.250	.400	200	#22	.150
277-P	.20	700K	.250	.437	200	#22	.150
471-P	.25	750K	.250	.500	300	#22	.150
177-P	.30	850K	.312	.500	400	#22	.200
179-P	.30	1.1M	.375	.500	400	#22	.200
155-P	.50	3.0M	.500	.625	400	#20	.250

HIGH STABILITY SERIES

LONG TERM STABILITY: .003% resistance change per year maximum under conditions involving normal equipment and room temperature variations.

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±10 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

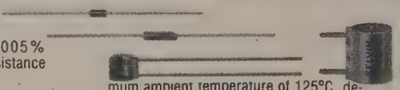
*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
OA	.15	560K	.187	.375	300	#22
OB	.25	1.2 Meg.	.250	.500	300	#22
OC	.33	2.2 Meg.	.250	.750	400	#22
OD	.33	2.4 Meg.	.375	.500	300	#20
OE	.50	3.6 Meg.	.375	.828	400	#20
OF	.60	5.2 Meg.	.375	1.000	400	#20
OG	.50	4.0 Meg.	.500	.500	400	#20
OH	.60	6.4 Meg.	.500	.625	400	#20
OJ	1.00	8.0 Meg.	.500	1.000	800	#20
OK	1.50	10.0 Meg.	.500	1.500	900	#20
OL	1.75	10.5 Meg.	.500	1.750	900	#20
OM	2.00	13.0 Meg.	.500	2.000	1200	#20

STANDARD TYPES



TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

*All Lug Types available with #20 gauge radial leads (except EP-22) by specifying letter "R" after type number.

LUG and RADIAL LEAD

KELVIN [illegible]	COMMERCIAL WATTAGE*	[illegible] MAX.**	DIA. · 1/32	LENGTH 1/32	MAX. VOLTS	TERMINAL TYPE*	MOUNTING HOLE
EP-22	.10	350K	312	.250	100	#24 x 2 (Wire Lead)	#2
346 P	25	1 0M	375	.440	150	Lug	#4
264 P	33	1 5M	375	.500	300	Lug	#4
EP 09	50	4 0M	500	.500	400	Lug	#6
263 P	50	4 0M	.625	.500	400	Lug	#6
EP-15	.60	5.0M	.500	.625	400	Lug	#6
EP-16	1.00	6.5M	.500	1.000	800	Lug	#6
EP-30	1.50	10.0M	500	1 500	900	Lug	#6

AXIAL-WIRE LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-21	.25	1.5 Meg.	.250	.500	400	#22
467-P	.25	1.5 Meg.	.250	.500	400	#20
EP-23	.33	2.75 Meg.	.250	.750	400	#22
812-P	.33	2.75 Meg.	.250	.750	400	#20
363-P	.40	3.0 Meg.	.250	1.000	400	#22
334-P	.33	3.0 Meg.	.375	.500	300	#20
815-P	.50	4.5 Meg.	.375	.750	600	#20
EP-24	.50	4.5 Meg.	.375	.828	600	#20
EP-25	.50	5.0 Meg.	.500	.500	400	#20
254-P	.60	6.5 Meg.	.375	1.000	800	#20
EP-26	.60	8.0 Meg.	.500	.625	400	#20
EP-27	1.00	10.0 Meg.	.500	1.000	800	#20
EP-28	1.50	12.0 Meg.	.500	1.500	900	#20
366-P	1.75	13.0 Meg.	.500	1.750	900	#20
EP-29	2.00	15.0 Meg.	.500	2.000	1200	#20

CATALOG #763 COVERS ALL PRODUCTS SHOWN ON THIS PAGE

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 TELEPHONE (818) 782-6662

FAST RISE TIME APPLICATIONS

''RT'' style resistors provide exceptionally high frequency performance, in addition to the other recognized advantages of wire-wound resistors. ''RT'' resistors can be supplied with rise times as low as 100 nanoseconds (from 10% to 90% of peak pulse amplitude at 100 KC), depending on resistance values and physical configurations. See Catalog #763

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

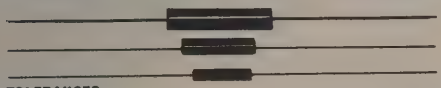
*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. · 1/64	LENGTH · 1/32	MAX. VOLTS	LEAD DIA.
RTA	15	560 K	187	375	300	#22
RTB	25	1 2 Meg	250	500	400	#22
RTC	33	2 2 Meg	250	750	400	#22
RTD	.33	2 4 Meg	375	500	300	#20
RTE	50	3 6 Meg	375	828	400	#20
RTF	60	5 2 Meg	375	1 000	400	#20
RTG	50	4 0 Meg	500	500	400	#20
RTH	60	6 4 Meg	500	625	400	#20
RTJ	1 00	8 0 Meg	500	1 000	800	#20
RTK	1 50	10 0 Meg.	500	1.500	900	#20
RTL	1 75	10 5 Meg	.500	1.750	900	#20
RTM	2 00	13 0 Meg	500	2 000	1200	#20

SERIES KM MOLDED, POWER RESISTORS



Series KM are general purpose, reliable power resistors designed to be used where heat sinks are not available or not desired. These resistors are extremely stable for their size as compared to film types. Series KM are considered to have the lowest dollar per watt cost of precision resistors. Send for Bulletin K-1.

TOLERANCES:

KM025, KM050, KM100—.1% thru 5%
KM200 thru KM1000—.05% thru 5%

TEMPERATURE COEFFICIENT:
(Per Degree Centigrade)

±20 PPM (170 ohms and above)
±30 PPM (10 to 170 ohms)
±50 PPM (1 to 9.99 ohms)
Below one ohm—contact factory

T.C.s to 5 PPM/°C available depending on size and value.

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add ''N'' to part number. Example: KMN025.

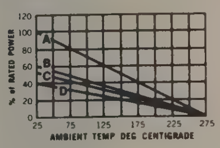
KELVIN PART NUMBER	WATTAGE @ 25° C	DC Working Voltage	Maximum Resistance	SIZE and TOLERANCES Length	Diameter	Lead Length (±0.125)	Lead Diameter (AWG)	Equivalent Military Styles MIL-R-26E
KM025	0.40	35	12.5K	0.250±.015	0.078±.015	1.5 in.	24	
KM050	0.75	50	3.9K	0.312±.015	0.078±.015	1.5 in.	24	
KM100	1.0	75	7.3K	0.422±.015	0.093±.015	1.5 in.	24	RW70
KM200	2.0	200	12K	0.490±.015	0.150±.015	1.5 in.	22	
KM250	2.5	200	16K	0.500±.031	0.218±.015	1.5 in.	20	
KM300	3.0	150	18K	0.560±.031	0.187±.015	1.5 in.	20	RW79
KM350	4.0	200	29K	0.625±.031	0.250±.015	2.0 in.	18	
KM500	5.0	400	62K	0.875±.031	0.312±.031	2.0 in.	18	RW74
KM700	7.0	600	98K	1.218±.031	0.312±.031	2.0 in.	18	
KM1000	10.0	1000	16K	1.780±.031	0.375±.031	2.0 in.	18	RW78

SERIES KC CHASSIS MOUNT POWER RESISTORS

DERATING CURVES

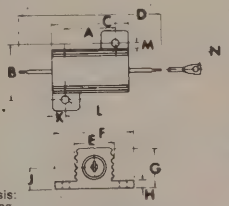
Derating is required for reduced chassis mounting area and high ambient temperatures.

Curves



A — When mounted on proper aluminum chassis:
48 sq. inches 0.040 aluminum for KC500 and KC1000
70 sq. inches 0.040 aluminum for KC2500
144 sq. inches 0.040 aluminum for KC5000

B — Unmounted KC500 and KC1000
C — Unmounted KC2500
D — Unmounted KC5000



Designed to provide maximum heat dissipation through heat sink and finned case configuration. Ideally suited where large amounts of power must be dissipated and small size is important. Capable of maintaining their precision tolerance in wattage ratings up to 50 watts. Send for Bulletin K-3.

TOLERANCES: 0.05% through 5.0%.

TEMPERATURE COEFFICIENT:
(Per Degree Centigrade)

TC	KC500	KC1000	KC2500	KC5000
±50PPM	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω	1 Ω to 9.9 Ω
±30PPM	10 Ω to 25 Ω	10 Ω to 99 Ω	10 Ω to 170 Ω	10 Ω to 500 Ω
±20PPM	26 Ω to 20K	100 Ω to 30K	171 Ω to 75K	501 Ω to 200K

Below one ohm—contact factory.

T.C.s to 5 PPM/°C available depending on size and value.

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add ''N'' to part number. Example: KCN500.

KELVIN PART NUMBER	Watts	DC Working Voltage	Max. Res	SIZE and TOLERANCES A ± 005	B ± 005	C ± 031	D ± 062	E ± 015	F ± 015	G ± 015	H ± 010	J ± 010	K ±0 10	L ± 005	M ± 015	N ± 005	Mtg. Screw Size	MIL-R-18546
KC500	7 0	165	20K	0 444	0 190	0 600	1 125	0 334	0 646	0 320	0 065	0 133	0 078	0 093	0 078	0 050	#2	RE60
KC1000	12	275	30K	0 562	0 625	0 750	1 375	0 425	0 812	0 400	0 075	0 190	0 093	0 093	0 093	0 086	#2	RE65
KC2500	25	560	75K	0 719	0 781	1 062	1 938	0 525	1 080	0 550	0 088	0 280	0 171	0 125	0 115	0 086	#4	RE70
KC5000	50	1300	200K	1 563	0 844	1 969	2 781	0 615	1 150	0 615	0 085	0 307	0 203	0 125	0 115	0 086	#4	RE75

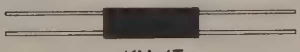
SERIES KM-4T & KC-4T POWER RESISTORS

KELVIN FOUR TERMINAL POWER RESISTORS provide low resistance and close tolerance capabilities to users who require accurate measurements in tightly designed circuits. The two voltage (sense) leads will yield a very precise measurement at the points where they join the current leads. Lead resistance, which plays a predominant role in low ohm resistors, is virtually eliminated.

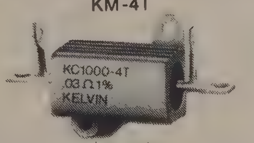
GENERAL FEATURES

TOLERANCES:	1% through 10%
RESISTANCE RANGE:	.001 ohms and up
TEMPERATURE COEFFICIENT:	.1Ω to 1Ω ±90 PPM/°C .05Ω to <.1Ω ± 150 PPM/°C Below .05 ohm—Check Factory
TEMPERATURE RANGE:	−55°C to +275°C
DIELECTRIC STRENGTH:	1000 VRMS all styles except KC5000-4T at 2500 VRMS
LEADS:	Tinned copperweld

See KM & KC Series this page for additional specifications.



KM-4T



KC-4T

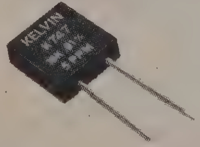
KELVIN PART NUMBER	WATTAGE RATING	DC WORKING VOLTAGE	MINIMUM RESISTANCE IN OHMS 10%	5%	3%	1%
KM300-4T	3W	150	.003	.005	.01	.02
KM500-4T	5W	400	.002	.003	.0075	.015
KC1000-4T	12W	275	.003	.005	.01	.02
KC2500-4T	25W	560	.002	.003	.0075	.015
KC5000-4T	50W	1300	.001	.002	.005	.01

K747 WIREWOUND RESISTOR

Lead Size:	#22 (.025) solder-coated brass
Lead Spacing ℄ to ℄:	.150" (±.010)
Wattage:	.3 watts
Voltage:	200 volts
Resistance Range:	.5Ω to 400K
Resistance Tolerance:	1% thru .005%
Temperature Coefficient:	±5 PPM standard (0–85"C)
TC Tracking:	±3PPM/°C Typical—Available to ±1PPM/°C (Value dependent)
Stability:	25PPM/year
Rise Time:	25 nanoseconds (value dependent)
Noise:	Not measureable on commercially available equipment
Environmental:	Exceeds all requirements of MIL-R-39005

Designed specifically to interchange with film resistors of same physical configuration. Performance characteristics show the K747 series to be superior in almost all instances. Send for Bulletin K747.

For closer tolerances to .005% and temperature coefficients to 1 PPM (0 to 60°C referenced to 25°C), request Bulletin K746.



SIZE: 320±.020 H,
.295±.010 L,
.100±.015 W.
Or .100±.010W (specify K746)

Kelvin pioneered the close tolerance, close temperature coefficient and excellent long term stability wire-wound resistor. State-of-the-art manufacturing techniques and superior testing capabilities yield the ultimate in quality at a competitive price. Please contact your nearest Kelvin representative or the factory direct for further details.

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 (818) 782-6662, TELEX: 651417

KELVIN

Precision Wire-wound Resistors, Power Resistors & Resistor Networks

Kelvin is a pioneer in the field of very high stability, close tolerance, precision wire wound resistors. Resistors shown represent only part of the broad Kelvin line. Complete catalog data is available on request.

Series G HERMETICALLY SEALED RESISTORS

DESCRIPTION

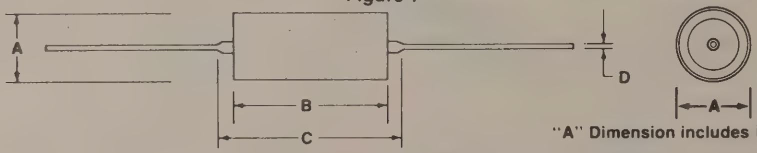
- The Kelvin "G" Series are true hermetically sealed resistors where the resistive element is contained in its own stable environment within an insulated, non-magnetic metal shell with Kovar glass-to-metal end seals.
- By providing a true hermetic seal, plus closely controlled production techniques, guaranteed shelf life stabilities of less than 5 PPM per year are now made commercially available. Stability plots conducted over an extended period show deviations of less than 5PPM after the first year and 10PPM over a three year period.
- In order to achieve these high accuracies of stability, special handling in a controlled environment and attention to finite Engineering, Production and Quality details is a prerequisite.
- Kelvin has developed special winding techniques wherein repeatability of winding tension from lot to lot is controllable within a finite degree. This repeatability of tension results in consistency of stability and temperature coefficient. For example: TC's of 1PPM are available (value dependent) from 0°C to 85°C referenced to 25°C.

ELECTRICAL SPECIFICATIONS: "G" SERIES

1. Resistance Range:	See Table 1
2. Standard Resistance Tolerances:	0.1% to .0025%*
3. Resistance Ratios:	To .001%*
4. Temperature Coefficient:	±5PPM/°C from −55°C to +125°C Available to ±1PPM* 0 to 85°C TC's referenced to 25°C
5. Stability: (Storage Life)	5PPM/Year 10PPM/3 Years
6. Environmental:	Conforms to MIL-R-39005
7. Wattage:	See Table 1
8. Maximum Voltage:	See Table 1
9. Mechanical Dimensions:	See Table 1
10. Leads:	Solderable, 1½ inch minimum length. See Table 1

*Value Dependent

Figure 1



"A" Dimension includes insulating sleeve.

TABLE 1

KELVIN PART NUMBER	WATTAGE @ 85°C (1)	MAXIMUM VOLTAGE	RESISTANCE MAX. (2)	A ±.015	B ±.031	C MAX.	D AWG
G-19	.1	100	200K	.261	.500	.750	#22
G-20	.1	100	200K	.194	.600	.850	#22
G-21	.2	100	500K	.261	.700	.950	#22
G-23	.3	200	800K	.261	.970	1.250	#22
G-24	.4	300	1.8 MEG	.375	1.000	1.250	#20
G-27	.5	500	3.0 MEG	.520	1.000	1.250	#20
G-28	1.0	600	5.0 MEG	.520	1.500	1.500	#20
G-29	1.5	600	8.0 MEG	.520	2.000	2.000	#20

(1) Derated to Zero Watts See Figure 3

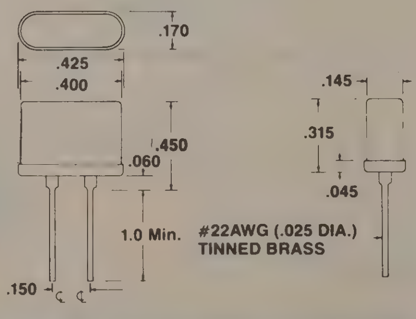
(2) Check Factory for minimum value vs electrical tolerance and physical size.

ELECTRICAL SPECIFICATIONS: SERIES G-747

1. Resistance Max:	375K
2. Tolerance:	.1% to .005%*
3. Resistance Ratios:	To .001%*
4. Temperature Coefficient:	±5PPM/°C from −55°C to +125°C Available to ±1PPM* 0 to 85°C TC's referenced to 25°C
5. Stability (Storage Life):	5PPM/year 10PPM/3 year
6. Environmental:	Conforms to MIL R 39005
7. Wattage:	0.1W at 85°C(1)
8. Maximum voltage:	200 volts

*Value dependent

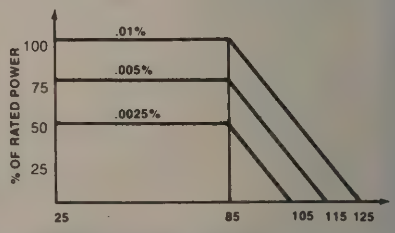
Figure 2



.xxx ±.015

Figure 3

DERATING CURVES RELATED TO RESISTOR TOLERANCE

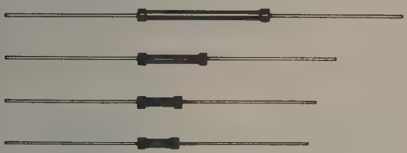


KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 (818) 782-6662, TELEX: 651417

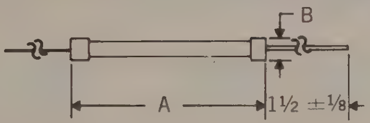
K AND M electronics • inc

HIGH VOLTAGE
• PRECISION RESISTORS
• DIODE ARRAY

SERIES I RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE RESISTORS



FEATURES
- Tinned copper leads .020″ or .032″ standard. Other lead materials available
- Conformal epoxy coated
- Glass overglaze for vacuum applications



NOTES
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid resistance values
- Burn in and other preconditioning options available
- Tolerance to ½% on request

TYPES —

Type	Resistance Ohms		Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max Surface Temp.	Dimensions Max Inches	
	Min	Max					A	B
K01040	1 Meg	5K Meg	.75	2000V	1, 2 & 5%	220°C	.460	.145
K01243	1 Meg	10K Meg	1.0	2500V	1, 2 & 5%	220°C	.500	.170
K01268	1 Meg	20K Meg	1.5	5000V	1, 2 & 5%	220°C	.750	.170
K01213	1 Meg	100K Meg	2.0	10,000V	1, 2 & 5%	220°C	1.500	.170

TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	K01040 Megohms	K01243 Megohms	K01268 Megohms	K01213 Megohms
±100 PPM/°C	1-100	1-100	1-200	1-400
±200 PPM/°C	100-3K	100-3K	200-6K	400-15K
±1000 PPM/°C	3K-5K	3K-10K	6K-20K	15K-100K

SERIES II RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE POWER RESISTORS

FEATURES
- Tinned copper leads .020″ or .032″ standard. Other lead materials available
- Conformal epoxy coated

NOTES
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid resistance values
- Burn in and other preconditioning options available
- Tolerance to ½% on request

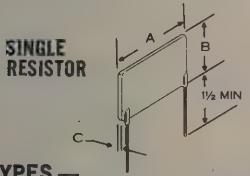
TYPES —

Type	Ohms Resistance		Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max Surface Temp.	Dimensions Max Inches	
	Min	Max					A	B
K02510	1 Meg	5K Meg	4	8,000V	1, 2 & 5%	220°C	1.125	.325
K02520	1 Meg	10K Meg	7	16,000V	1, 2 & 5%	220°C	2.125	.325
K02530	1 Meg	15K Meg	10	24,000V	1, 2 & 5%	220°C	3.125	.325
K02540	1 Meg	20K Meg	12	32,000V	1, 2 & 5%	220°C	4.125	.325

TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	K02510 Megohms	K02520 Megohms	K02530 Megohms	K02540 Megohms
±100 PPM/°C	1-500	1-1000	1-1500	1-2000
±200 PPM/°C	500-5K	1000-10K	1500-15K	2000-20K

SERIES III RESISTORS
PRECISION HIGH OHMAGE HIGH VOLTAGE FLAT RESISTORS, VOLTAGE DIVIDERS AND NETWORKS



TYPICAL VOLTAGE DIVIDER NETWORK

TYPES —

Type	Resistance Ohms		Max Power @ 70°C	Max Operating Voltage	Max Surface Temp.	Dimensions Max Inches		
	Min	Max				A	B	C
KF315	1 Meg	5K Meg	2	12,000V	150°C	1.550	.350	.110
KF510	1 Meg	5K Meg	2	10,000V	150°C	1.050	.550	.110
KF520	1 Meg	5K Meg	4	20,000V	150°C	2.050	.550	.110
KF1020	1 Meg	10K Meg	6	30,000V	150°C	2.050	1.050	.110

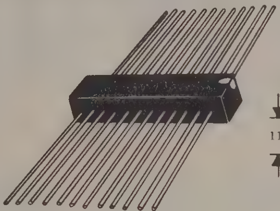
FEATURES
- Tolerances: 1%, 2%, 5%, 10%, 15%
- Conformal epoxy coated
- .032 tinned copper leads or nickel ribbon leads for welding
- Available without leads with solderable termination pads
- VCR less than 5 PPM/V
- Voltage dividers and networks designed to your specifications resistor ratios to 10,000:1 (size dependent).
- TCR tracking 25 PPM/°C
- Ratios to 1%

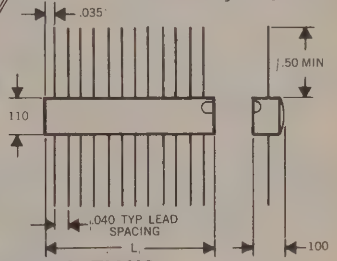
TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KF315 Megohms	KF510 Megohms	KF520 Megohms	KF1020 Megohms
±100 PPM/°C	1-500	1-500	1-500	1-1000
±250 PPM/°C	500-5,000	500-5,000	500-5,000	1,000-10,000

MINIATURE HIGH VOLTAGE DIODE ARRAY

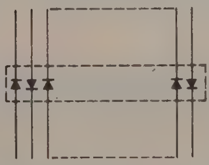
FEATURES
- Low reverse leakage current
- Fast recovery
- Small sizes





MECHANICAL
- Lead Diameter .015 max
- Lead Material—Silver
- Encapsulant—Epoxy

APPLICATIONS
- Typical applications are power supplies which generate the high voltage required for image intensifiers photo-multipliers and CRTS.



SPECIFICATIONS:

K & M Part No.	No. of Diodes	DIM L
107-031-12	12	.510
107-032-10	10	.430
107-033- 8	8	.350
107-034- 6	6	.270
107-035- 4	4	.190
107-036- 2	2	.110

ELECTRICAL
- P1V = 1200 VDC
- IR @ 23°C 500 VDC 10 nano amps Max
- Junction Capacitance @ 23° Max 0.35 pf Max @ 500 VDC
- Recovery Time @ 23°C 1.5 micro Sec. @ If = 10 ma
- Recovery Time @ 23°C 0.5 micro Sec. .040 Max
- Operating Temp +55°C to −54°C
- Storage Temp +85°C to −70°C

K AND M electronics • inc
MINIATURE HIGH VOLTAGE POWER SUPPLIES & COMPONENTS
123 Interstate Drive • West Springfield • Mass • 01089 • (413) 781-1350 • TWX 710-350-6463

EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

KOA
Metal Films
Carbon Films
MSDs
SIPs

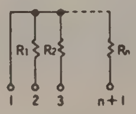
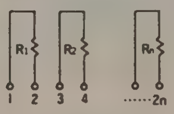
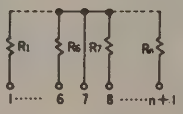
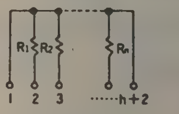
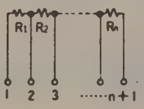
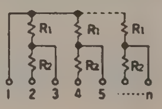
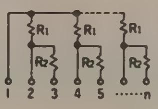
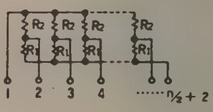
KOA SPEER ELECTRONICS, INC.

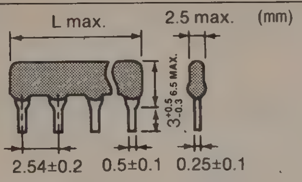
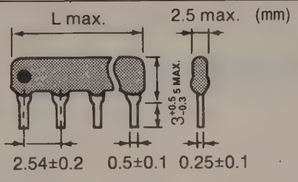
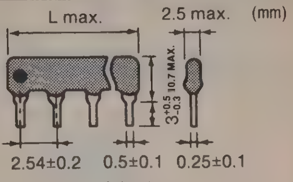
You Can't Resist KOA!

Fixed Resistors

Parameter	Metal Film					Low Power		Carbon Film	
	Precision	Semi-Precision	Ultra Precision	MIL	Multi-Rated				
Type Designation	MF	ML	H	RN	SN2C	MO	SPR	CF	RDS2
Wattage	1/8-1	1/8-1/2	1/10-1/2	1/8-1/4	1/8-1/4	1-3	1-5	1/8-1	1/8-1/4
Temp. Coefficient	25-100	200	5-25	50 & 100	50 & 100	200	150-600	—	—
Resist. Toler. (%)	0.5 & 1.0	2.0 & 5.0	0.05-1.0	0.5 & 1.0	1.0	2.0 & 5.0	2.0 & 5.0	2.0 & 5.0	2.0 & 5.0
Oper. Temp. Range	−55/+155°C	−55/+155°C	−55/+155°C	−55/+165°C	−55/+155°C	−55/+225°C	−55/+200°C	−55/+155°C	−55/+155°C
Short Time Overload (%)	0.3	0.5	0.06	0.05(C) 0.1(D)	0.05	0.5	1.0	0.4	0.2
Temp. Cycling	0.3	0.5	0.04	0.1	0.15	0.5	1.0	0.5	.15
Load Life (%)	1.0	1.5	0.3	0.5(C) 1.0(D)	1.0	2.0	3.0	2.0	1.5
Moisture Resistance	1.0	1.5	0.4	0.3(C) 1.0(D)	1.0	2.0	3.0	2.0	1.0
Voltage Coefficient	5ppm/V	10ppm/V	5ppm/V	5ppm/V	5ppm/V	10ppm/V	10ppm/V	15ppm/V	15ppm/V
Failure Rate/1000 Hrs.	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-5}$	$<10^{-3}$	$<10^{-3}$	$<10^{-4}$	$<10^{-4}$
Marking	Clr. Band (5)	Clr. Band (4)	Alpha	Alpha	Clr. Band (5)	Clr. Band (4)	Clr. & Alpha	Clr. Band (4)	Clr. Band (4)

Resistor Networks

CIRCUIT SYMBOL		NON MARKING	S	C	D
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 $R_1=R_2\cdots+Rn$ (n=2 to 7)	 $R_1=R_2\cdots+Rn$ (n=4 to 12)	 $R_1=R_2\cdots=Rn$ (n=3 to 12)
MARKING	RKC	10KΩJ	$\boxed{4}$S10KΩJ	10KΩJ ●	10KΩJ
	RKL	103J	S103J	C103J	D103J
	RKH	103J	$\boxed{4}$S103J	$\boxed{6}$C103J	$\boxed{6}$D103J
CIRCUIT SYMBOL		**A**	**T**	**E**	**R**
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 R1 R1 R1 R2 R2 R2 1 2 3 4 5 ……n (n=4 to 12)	 R1 R1 R1 R2 R2 R2 1 2 3 4 5 ……n (n=4 to 12)	 R2 R2 R2 R2 R1 R1 R1 R1 1 2 3 4 ……n/2+2 (n=6 to 18)
MARKING	RKC	$\boxed{8}$A103J	$\boxed{8}$T472/103J	$\boxed{8}$E472/103J	$\boxed{8}$R221/331J
	RKL	A103J	T472/103J	E472/103J	R221/331J
	RKH	$\boxed{8}$A103J	$\boxed{8}$T472/103J	$\boxed{8}$E472/103J	$\boxed{8}$R221/331J

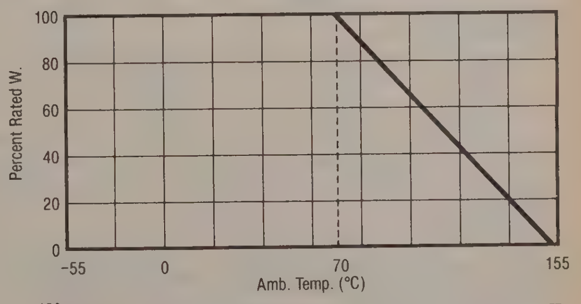
TYPE	RKC		RKL	RKH
DIMENSIONS	 L max. 2.5 max. (mm) $3^{+0.5}_{-0.3}$ 6.5 MAX. 2.54±0.2 0.5±0.1 0.25±0.1		 L max. 2.5 max. (mm) $3^{+0.5}_{-0.3}$ 5 MAX. 2.54±0.2 0.5±0.1 0.25±0.1	 L max. 2.5 max. (mm) $3^{+0.5}_{-0.3}$ 10.7 MAX. 2.54±0.2 0.5±0.1 0.25±0.1
NO. of pins	L (mm)	L (mm)	L (mm)	L (mm)
4	10.8	10.16	—	10.8
5	13.2	12.7	12.7	13.2
6	15.8	15.24	15.24	15.8
7	18.3	17.78	17.78	18.3
8	20.9	20.32	20.32	20.9
9	23.4	22.86	22.86	23.4
10	25.9	25.4	25.4	25.9
11	28.5	—	27.94	—
12	31.0	—	—	—
13	33.6	—	—	—
14	36.1	—	—	—

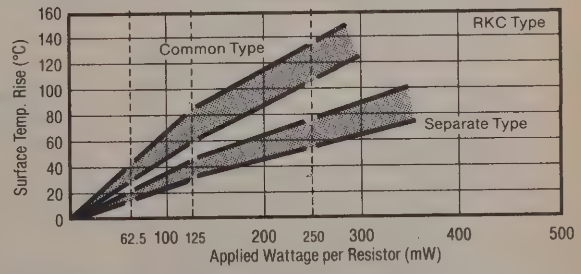
Thick Film Resistor Networks

	CIRCUIT	ONE ELEMENT	MAX. POWER IN ONE PACKAGE											MAX. WORKING V.	MAX. OVERLOAD V.	RATING AMBIENT TEMP.	RESISTANCE RANGE	RESISTANCE TOLERANCE
			4 PIN	5 PIN	6 PIN	7 PIN	8 PIN	9 PIN	10 PIN	11 PIN	12 PIN	13 PIN	14 PIN					G SERIES
RKC POWER RATING (W)	Bn	0.125	0.375	0.5	0.625	0.75	0.875	1	1.05	1.15	1.25	1.35	1.45	200V	280V	70°C	22Ω~ 10MΩ	G – J
	nA																	
	nR		—		—		—		—		—	—	—					
	BnC											1.35						
	nE																	
	nT																	
	BnD			0.375	0.5	0.625	0.75	0.875	1	1.125	1.25		1.45					
	BnS	0.25	0.5	—	0.75	—	1	—	1.05	—		—						
RKL POWER RATING (W)	Bn	0.1	—	0.4		0.6	0.7	0.8	0.84	0.92	—			150V	200V	70°C	22Ω~ 1MΩ	G – J
	nA																	
	nR																	
	BnC				—		—		—									
	nE																	
	nT																	
	BnD			0.3	0.4	0.5	0.6	0.7	0.8	0.9								
	BnS	0.11		—	0.33	—	0.44	—	0.55	—								
RKH POWER RATING (W)	Bn	0.25	0.525	0.7	0.875	1.05	1.25	1.4	1.5	—				250V	350V	70°C	56Ω~ 10MΩ	G – J
	nA		—															
	nR																	
	BnC				—		—		—									
	nE																	
	nT																	
	BnD				0.875		1.25		1.5									
	BnS	0.5	0.7	—	1.05	—	1.4	—										

Characteristics

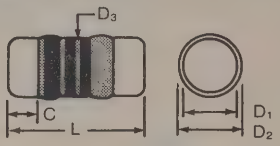
Requirements			Characteristics
Max. Resistance Changes	Operating Temp. Range		-55°C ~ +155°C
	Temp. Coefficient		±200ppm/°C
	Short Time Overload		±(0.5%+0.05Ω)
	Insulation Resistance		Over 10^4MΩ
	Dielectric Withstanding V.		±(0.5%+0.05Ω)
	Terminal Strength	Pull Test	±(0.5%+0.05Ω)
		Bend Test	3 Cycle and Over
	Resistance to Soldering Heat		±(0.5%+0.05Ω)
	Solderability		Over ¾
	Life (at Elevated Ambient Temp.)		±(3 %+0.05Ω)
	Temperature Cycling		±(0.5%+0.05Ω)
	Moisture Resistance		±(1%+0.05Ω)≦100KΩ
	Load Life		±2% >100KΩ
Resistance To Solvents	Solvents	Freon TE Tri-chloroethylene 1-1-1 Tri-chloroethylene	No evidence of mechanical damage





MELF

Appearance – Dimension



Coating Color RD - Ivory
RN - Blue
CC - Brown

Style	Dimension mm				
	L	C	D_1	D_2	D_3
RD41B2B RN41C2B CC12	3.5±0.2	0.5min.	1.45±0.1	1.55max.	0.1max.
RD41B2E RN41C2E CC25	5.9±0.2	0.5min.	2.2±0.1	$2.2^{+0.2}_{-0.1}$	0.15max.

Rating

Style	Power Rating	Max. Working V.	Max. Overload V.	Tolerance	Resistance Range	Rating Ambient Temp.
RD41B2B	0.125W	200V	400V	J (E 24)	2.2Ω~ 1MΩ	70°C
RN41C2B		150V	300V	F (E 96)	10 Ω~510KΩ	
RD41B2E	0.25W	300V	600V	J (E 24)	1 Ω~ 2.2MΩ	
RN41C2E		250V	500V	F (E 96)	10 Ω~510KΩ	

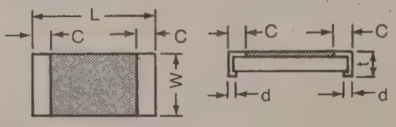
Style	Max. Current	Resistance	Rating Ambient Temp.
CC12	2A	less than 10mΩ	70°C
CC25	5A		

Characteristics

Requirements		Characteristics						
		RD						RN41C2E
Operating Temp. Range		-55~155°C						
Temp. Coefficient (ppm/°C)		Style / T.C.R.	+350~0	0~-450	0~-700	0~-1000	0~-1300	±50
		RD41B2B	2.2Ω~10Ω	11Ω~47KΩ	51KΩ~100KΩ	110KΩ~330KΩ	360KΩ~1MΩ	
		RD41B2E	1Ω~2Ω	2.2Ω~100KΩ	110KΩ~330KΩ	360KΩ~1MΩ	1.1MΩ~2.2MΩ	
	Short Time Overload	±(1%+0.05Ω)						±(0.5%+0.05Ω)
	Resistance to Soldering Heat	±(1%+0.05Ω)						±(0.5%+0.05Ω)
	Temperature Cycling	±(1%+0.05Ω)						±(0.5%+0.05Ω)
	Moisture Resistance	±5%						±(1 %+0.05Ω)
	Load Life	±2%						±(1 %+0.05Ω)
	Resistance to Solvents	No evidence of mechanical damage.						

RM Flat Chip Resistor

Appearance – Dimension



Style	Dimension mm				
	L	W	C	d	t
RM73B2B	$3.2^{+0.05}_{-0.25}$	$1.6^{+0.05}_{-0.15}$	0.5±0.3	0.15±0.15	0.57±0.08
RM73B2A	2±0.2	1.25±0.2	0.35±0.2	0~0.25	0.45±0.1

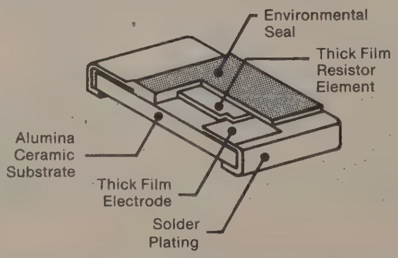
Rating

Style	Power Rating	Max. Working V.	Max. Overload V.	Operating Temp. Range	Resistance Range	Resistance Tolerance
RM73B2B	0.125W	200V	400V	-55°C~125°C	10Ω~1MΩ	G-J
RM73B2A	0.1W	150V	300V	-55°C~125°C		

Style	Current Rating	Max. Surge Current	Resistance	Operating Temp. Range
RM73B2B-Z RM73B2A-Z	2A	10A	50mΩ	-55°C~125°C

Characteristics — Structure – Material

Requirements	Characteristics
Temp. Coefficient	±250 ppm/°C
Terminal Strength	±(1%+0.1Ω)
	over 1kg/mm²
Resistance to Soldering Heat	±(1%+0.05Ω)
Short Time Overload	±(2%+0.05Ω)
Intermittent Overload	±(2%+0.01Ω)
Temperature Cycling	±(1%+0.2Ω)
Load Life	±(3%+0.1Ω)
Moisture Resistance	±(3%+0.1Ω)
Electrode Solderability	95%



KOA SPEER ELECTRONICS, INC.

Advanced capabilities for the 80's...and beyond.

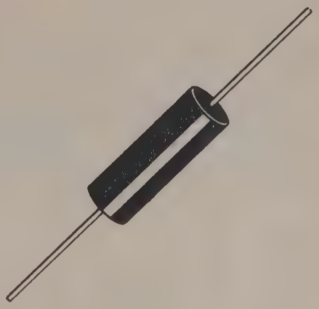
KOA Speer Electronics, Inc.,
P.O. Box 547, Dept A, Bradford, PA 16701
(814) 362-5536 • TLX: 914-404
TWX: 510-695-5921 • FAX: 814-362-8883
Direct Line to Sales Dept: (814) 362-8810

KOA Speer Electronics, Inc.,
1613 E. Edinger Avenue, Santa Ana,
CA 92705 (714) 558-0268
TWX: 910-595-1125

ULTRA PRECISION / FASTEST DELIVERY **MEISSNER**

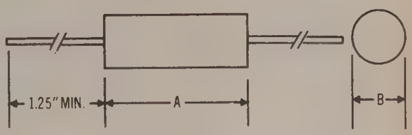
ULTRA PRECISION WIREWOUND RESISTORS

STYLE	MIL R 93 STYLE	WATTAGE	NOMINAL DIMENSIONS A ± .062	NOMINAL DIMENSIONS B ± .062	MAX OHMS
AX-01		.1	.188	.093	75 K
AX-1		.1	.250	.125	150 K
AX-1A		.1	.312	.150	175 K
AX-2		.2	.375	.150	200 K
AX-2F		.2	.375	.187	250 K
AX-4	RB 56	.25	.312	.250	400 K
AX-5	RB 55	.33	.500	.250	500 K
AX-6		.33	.625	.250	650 K
AX-7	RB 54	.5	.750	.250	1 MEG
AX-8	RB 53	.75	.750	.375	2 MEG
AX-9	RB 52	1.0	1.000	.375	3 MEG
AX-10	RB 57	1.25	1.000	.500	5 MEG
AX-11	RB 58	1.5	1.500	.500	7.5 MEG
AX-12	RB 59	2.0	2.000	.500	10 MEG



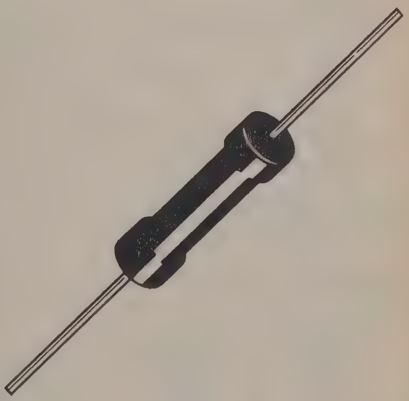
SPECIFICATIONS

TOLERANCE:	.1% to .001%
WATTAGE:	.1 Watt to 2.0 Watts
STABILITY:	.0005% per year
TEMPERATURE COEFFICIENT:	±2 ppm/°C above 10 Ω ±15 ppm/°C below 10 Ω
WINDINGS:	Non inductive
CONSTRUCTION:	Encapsulated Epoxy
ADDITIONAL FEATURES:	Tracking T.C. ±.5 ppm/°C. Shunts as low as .001 Ω. Special T.C. 0 to +6000 ppm/°C. Low capacitance ±1 pF Hermetic sealing available



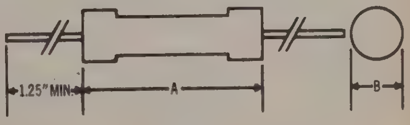
SILICONE COATED POWER WIREWOUND RESISTORS

STYLE	MIL R 26 TYPE	WATTAGE RATING U 275°C	WATTAGE RATING V 350°C	NOMINAL DIMENSIONS A ± .062	NOMINAL DIMENSIONS B ± .031	MAX OHMS
MI-1A	RW 70	1.0	1.25	.406	.094	10 K
MI-1B		1.1	1.3	.531	.094	15 K
MI-2		4.0	5.5	.625	.250	47 K
MI-2A		3.0	3.75	.812	.188	42 K
MI-2B	RW 79	3.0	3.75	.560	.188	24 K
MI-2C	RW 69	3.0	3.75	.500	.218	32 K
MI-5	RW 74	5.0	6.5	.875	.312	95 K
MI-7		7.0	9.0	1.185	.312	154 K
MI-10	RW 78	10.0	13.0	1.780	.375	273 K



SPECIFICATIONS

TOLERANCE:	5%, 1% closer tolerances available to .05%
WATTAGE:	1 Watt to 13 Watts
STANDARD RESISTANCE VALUES:	From .1 Ω to maximum values as stated in table. Values as low as .001 Ω and 4 terminal construction available
COATING:	Special silicone coating withstands moisture, salt water immersion and cleaning solvents. It will withstand operation from −65°C up to 400°C
LEADS:	Tinned copperweld. Length 1.25" minimum
TEMPERATURE COEFFICIENT:	±20 ppm/°C 500 Ω up
CONSTRUCTION:	Welded Terminations
ADDITIONAL FEATURES:	Non inductive windings. Other sizes and wattages. Special Temperature Coefficients up to +6000 ppm/°C



MEISSNER

MEISSNER INDUSTRIES
DEPT. EM, 551 ROUTE 10 / DOVER, NEW JERSEY 07801/(201) 366-1700

Mepco//Electra

A NORTH AMERICAN PHILIPS COMPANY

Reliability across the board™

FILM RESISTORS

General Purpose, Carbon Film, SFR, Precision Film, Mil-R-10509 (RN),
Mil-R-22684 (RL), Mil-R-39017 (RLR), UPR, Mil-R-55182 (RNC)
P.O. Box 760, Mineral Wells, TX 76067 (817) 325-7871 TWX: 910-890-5855

Established reliability metal film, Mil-R-55182 style RNR
Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437

INDUSTRIAL/CONSUMER GROUP

Mepco/ Electra Series	Category	Body Type	Resistance Range (ohms)	Tolerance Range (±%)	Temperature Coefficient Range (PPM/°C)	Power Range @ 70°C (watts)	Max. Voltage Range (watts)
SPACE MISER	GENERAL PURPOSE	METAL FILM Conformal-Coated	.22Ω-5.1 Meg	5% 1%	±100	⅓	200
CR	GENERAL PURPOSE	CARBON FILM Conformal-Coated	1Ω-1 Meg	5%	−200 to +500, ±300	¼ ½	250-350
SFR	GENERAL PURPOSE	METAL FILM Conformal-Coated	1Ω-10 Meg	1%-2% 5%	±200 and ±100	¼ ½	250-350
SPR	STANDARD PRECISION	METAL FILM Conformal-Coated	10Ω-250 Meg	0.5%-1.0%	±50 to ±150	¼-1	350-500
UPR & MATCHED SETS	ULTRA PRECISION	METAL FILM Conformal-Coated	51.1Ω-499K	.025%-1%	±2 to ±25	@ 85°C $^{1}/_{20}$ ⅛-¼ ⅓	200-300
MIL Style	**MIL Specs**	**INDUSTRIAL/STANDARD MILITARY**					
RL	MIL-R-22684	METAL FILM Conformal-Coated	4.3Ω-470K	2% 5%	±100	¼-½	250-350
RN	MIL-R-10509	METAL FILM Conformal-Coated	10Ω-4M	0.1%-1%	±25 to ±100	$^{1}/_{10}$-½	200-350
		ESTABLISHED RELIABILITY (MIL)					
RLR	MIL-R-39017	METAL FILM Conformal-Coated	4.2Ω-1.33M	1%-2%	±100	¼-½	250-350
RNC	MIL-R-55182	METAL FILM Conformal-Coated	10Ω-3.01M	0.1%-1%	±25 to ±100	@ +125°C $^{1}/_{20}$-¼	200-300
RNR Hermetic	MIL-R-55182	METAL FILM Hermetic Seal	10Ω-1M	0.1%-1%	±25 to ±50	@ +125°C $^{1}/_{10}$-½	200-350

CHIP RESISTORS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437

SERIES 9C COMMERCIAL CHIP RESISTORS

Mepco/ Electra Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (mm)		
						Length	Width	Thickness
9C1206	10Ω-100MΩ	±1% ±5%	±100 ±200	⅛ Watt	200V (R.M.S.)	3.2 ±0.15	1.6 ±0.15	0.6 ±10

SERIES RM ESTABLISHED RELIABILITY CHIP RESISTORS (MIL-R-55342)

Mil-Part Part Number Style	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (Inches)		
						Length	Width	Thickness
M55342/2 RM0505	100Ω-300KΩ 100Ω-500KΩ 100Ω-500KΩ	±1% ±5% ±10%	±100 ±300 ±300	50mw	40VDC	.050 +.025 −.005	.050 +.010 −.005	.010 Min. .040 Max.
M55342/6 RM0705	100Ω-500Ω 100Ω-1MΩ 100Ω-1MΩ	±1% ±5% ±10%	±100 ±300 ±300	100mw	50VDC	.075 +.025 −.005	.050 +.010 −.005	.010 Min. .040 Max.
M55342/3 RM1005	100Ω-500KΩ 100Ω-1MΩ 100Ω-1MΩ	±1% ±5% ±10%	±100 ±300 ±300	100mw	40VDC	.100 +.025 −.005	.050 +.010 −.005	.010 Min. .040 Max.
M55342/4 RM1505	100Ω-1MΩ 100Ω-1MΩ 100Ω-1MΩ	±1% ±5% ±10%	±100 ±300 ±300	150mw	40VDC	.150 +.025 −.005	.050 +.010 −.005	.010 Min. .040 Max.

Mepco//Electra

A NORTH AMERICAN PHILIPS COMPANY

Reliability across the board™

NETWORKS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437

SERIES 9S FIXED RESISTOR NETWORKS SINGLE IN LINE PACKAGE

Mepco/Electra Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available
9S06, 08, 10	22Ω-1MΩ	±2% ±1%*	±200 ±100*	Terminator Pull Up/Pull Down	6, 8, and 10 Single in Line
9S06, 08, 10	22Ω-1MΩ	±2% ±1%* ±5%*	±200	Dual Terminator Circuit	6, 8, and 10 Single in Line

SERIES RZ040,† RZ050,† RZ030 MILITARY STYLE (MIL-R-83401) RESISTOR NETWORKS

Military Part Number	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Pin Styles Available
M8340104 RZ040†	47.5Ω-1MΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	6 Pin Single in Line
M8340105 RZ050†	47.5Ω-1MΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	8 Pin Single in Line
M8340103 RZ030	100Ω-100KΩ	±1% ±2% ±5%	±100 ±300	Terminator Pull Up	14 Pin Flat Pack

† Recent qualification/06, 07, 08, 09 — consult QPL listing for characteristic, tolerance and resistance ranges.

10K AND 100K ECL TERMINATORS

Mepco/Electra Series	Standard Resistance Values	Tolerance	Temperature Coefficient (ppm/°C)	Circuits Available	Capacitors	Pin Styles Available
9N08	68Ω, 100Ω,** 150Ω	±5%	±200	For 10K	.01µf Z5U 25VDC	8 Pin Single in Line
9N10	50Ω, 68Ω,** 100Ω	±5%	±200	For 100K	.01µf Z5U 25VDC	10 Pin Single in Line

* These characteristics available upon request. ** Others available upon request.

NON-LINEAR RESISTORS

Columbia Road, Morristown, NJ 07960 (201) 539-2000 TWX: 710-986-7437

PTC/NTC THERMISTORS

Mepco/Electra Series	Category	Body Type	Resistance Range	Tolerance	Temperature Coefficient Range (ppm/°C)	Power Range @ 70°C (watts)	Ma. Voltage Range (volts)
NTC	Non Linear	Conformal Coated Disc	15Ω-330KΩ	±5% ±10% ±20%	8%-98%/°C	¼-1	N.A.
PTC			30Ω-250Ω		5%-75%/°C	N.A.	15-265V

VOLTAGE DEPENDENT RESISTORS (ZnO VARISTORS)

Mepco/Electra Series	Style & Size Range Inches (mm)	R.M.S. Working Voltage	Temperature Coefficient @ 1mA. +25°C to +85°C	Max. Avg. Dissipation (Including Transients)	Max. Non-Repetitive Transient Current
VZ, VW, VY, VV	.276 — .630 O.D. (7 — 16) O.D.	60 — 460 All types	−0.065%/K All Types	100mW — 600mW	400A — 4500A

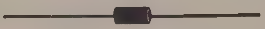
For information on Mepco/Electra's CAPACITORS/POTENTIOMETERS/MILITARY COMPONENTS, see pages 1A•1134-1136, 1B•1012-1013 and 1A•2046.

MICRO-OHM
CORPORATION

4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

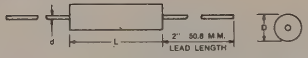
QUALITY PRECISION RESISTORS

AXIAL LEAD



Series 100

Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive

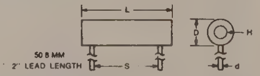


MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.015	Diameter (D) mm ±.30	Lead (d) AWG	Lead (d) mm	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0004 Wire)
133		.500	12.70	.200	5.08	22	.64	.30	300	600K
139		.700	17.78	.200	5.08	22	.64	.40	300	1.2M
144		.250	6.35	.250	6.35	22	.64	.25	150	400K
115		.312	7.92	.250	6.35	22	.64	.25	200	1M
156	RB56	.375	9.52	.250	6.35	20	.81	.25	200	700K
143	RB55	.500	12.70	.250	6.35	20	.81	.30	300	900K
137	RB54	.750	19.05	.250	6.35	20	.81	.50	300	1.2M
136		.610	15.49	.375	9.52	20	.81	.50	400	3M
132	RB53	.750	19.05	.375	9.52	20	.81	.66	500	3M
138	RB52	1.00	25.40	.375	9.52	20	.81	1.0	750	5M
134		.500	12.70	.500	12.70	20	.81	.66	300	3M
170		.625	15.88	.500	12.70	20	.81	.75	400	3M
146	RB57	1.00	25.40	.500	12.70	20	.81	1.5	750	7M
180	RB58	1.50	38.10	.500	12.70	20	.81	2.0	1000	15M
190	RB59	2.00	50.80	.500	12.70	20	.81	2.5	1200	20M
SUBMINIATURES										
140		.250	6.35	.125	3.18	24	.51	.10	100	150K
112		.375	9.52	.125	3.18	24	.51	.125	200	125K
113		.312	7.92	.160	4.06	22	.64	.15	150	300K
150		.500	12.70	.160	4.06	22	.64	.20	200	400K
114		.312	7.92	.187	4.75	22	.64	.20	200	300K
135		.375	9.52	.187	4.75	22	.64	.25	300	300K
160		.625	15.88	.187	4.75	20	.81	.30	300	600K
MICRO-MINIATURES										
XP101		.375	9.52	.050	1.27	30	.25	.02	50	10K
100		.110	2.79	.070	1.78	30	.25	.03	50	11K
105		.155	3.94	.075	1.91	30	.25	.04	50	11K
110		.200	5.08	.093	2.36	28	.32	.05	75	30K
130		.312	7.92	.093	2.36	28	.32	.06	100	60K
142		.185	4.70	.120	3.05	28	.32	.06	100	30K
141		.180	4.06	.125	3.18	28	.32	.06	100	30K

RADIAL LEAD

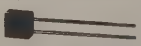
Series 200 & 600 (Lugs)

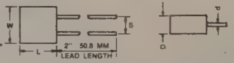
Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive



MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Dia. (D) Inch ±0.15	Dia. (D) mm ±.38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.032	Lead Spacing (S) mm ±.81	Mounting Hole (H) Inch ±.010	Mounting Hole (H) mm ±.35	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
221		.490	12.45	.365	9.27	24	.51	.390	9.91	.140	3.56	.50	300	2.5M
211		.325	8.26	.375	9.52	24	.51	.245	6.22	.120	3.05	.50	300	1.5M
226		1.000	25.40	.375	9.52	20	.81	.855	21.72	.089	2.26	1.00	600	5M
222		.668	17.48	.420	10.69	20	.81	.555	14.10	None		1.00	600	3M
236		1.125	28.59	.435	11.05	20	.81	.960	24.38	None		1.25	600	5M
220	RB17	1.000	25.40	.500	12.70	20	.81	.845	21.46	.140	3.56	1.00	600	10M
228	RB73	2.000	50.80	.500	12.70	20	.81	1.750	44.45	.140	3.56	2.00	1200	20M
227	RB08	.500	12.70	.550	13.97	20	.81	.235	5.97	.140	3.56	.50	300	1M
224	RB16	.612	15.54	.550	13.97	20	.81	.475	12.06	.140	3.56	.50	300	12M
230	RB18	1.250	31.75	.750	19.05	20	.81	1.125	28.59	.140	3.56	2.00	600	20M
SUBMINIATURES														
225		.500	12.70	.160	4.06	24	.51	.385	9.78	None		.20	200	500K
202		.250	6.35	.312	7.92	24	.51	.180	4.57	.089	2.26	.25	200	500K
243		.500	12.70	.250	6.35	22	.64	.290	7.37	None		.25	300	300K
MICRO-MINIATURES														
206		.200	5.08	.105	2.67	30	.25	.100	2.54	None		.30	100	30K
210		.250	6.35	.100	2.54	28	.32	.200	5.08	None		.05	100	30K
205		.165	4.19	.075	1.90	30	.25	.150	5.81	None		.04	50	11K

PRINTED CIRCUIT LEAD





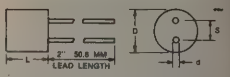
RECTANGULAR

MO Style	Length (L) Inch ±.032	Length (L) mm ±.81	Width (W) Inch ±.015	Width (W) mm ±.38	Depth (D) Inch ±.015	Depth (D) mm ±.38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.0-0	Lead Spacing (S) mm ±.25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
450	.250	6.35	.250	6.35	.125	3.18	20	.81	.125	3.18	.125	100	1M
460	.250	6.35	.500	12.70	.125	3.18	20	.81	.250	6.35	.250	100	2M

PRINTER CIRCUIT LEAD

Series 400

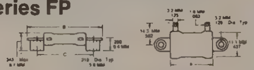
Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive



MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.032	Diameter (D) mm ±.81	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.010	Lead Spacing (S) mm ±.25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
440		.250	6.35	.125	3.18	24	.51	.050	1.27	.10	100	120K
412		.375	9.52	.125	3.18	24	.51	.050	1.27	.125	200	55K
413		.312	7.92	.160	4.06	24	.51	.080	2.03	.15	150	300K
414		.312	7.92	.187	4.75	22	.64	.100	2.54	.20	200	300K
435		.375	9.52	.187	4.75	22	.64	.100	2.54	.25	300	300K
415	RB71	.312	7.92	.250	6.35	22	.64	.200	5.08	.25	300	500K
416		.375	9.52	.250	6.35	22	.64	.200	5.08	.25	300	800K
443		.500	12.70	.250	6.35	22	.64	.125	3.18	.30	300	1M
437		.750	19.05	.250	6.35	22	.64	.125	3.18	.50	300	1M
417	RB70	.500	12.70	.375	9.52	20	.81	.200	5.08	.50	300	1.5M
436		.610	15.49	.375	9.52	20	.81	.250	6.35	.50	450	3M
438		1.00	2.54	.375	9.52	20	.81	.250	6.35	1.00	750	5M
434		.500	12.70	.500	12.70	20	.81	.300	7.62	.50	300	3M
MICRO-MINIATURES												
405		.155	3.94	.075	1.91	30	.25	.030	.76	.04	50	11K
430		.312	7.92	.093	2.36	28	.32	.040	1.02	.05	100	50K
401		.175	4.44	.105	2.67	28	.32	.040	1.02	.05	75	30K
442		.185	4.70	.120	3.05	28	.32	.050	1.27	.05	100	30K
441		.160	4.06	.125	3.18	28	.32	.050	1.27	.05	100	30K

POWER RESISTORS

Series FP

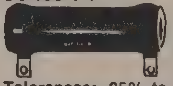


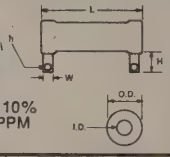
Tolerances: .05% to 10%

T.Cs: PPM/°C	Resistance
20	10Ω & over
30	1Ω — 10Ω
90	under 1Ω

MO Style	Core Length (A) Inch ±.032	Core Length (A) mm ±.01	Length Inch Hdwe. (D) Inch ±.015	Length Inch Hdwe. (D) mm ±.38	Mtg. Hole Spacing (C) Inch ±.015	Mtg. Hole Spacing (C) mm ±.38	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
FP-10	.750	19.05	1.218	30.94	1.00	25.4	10	300	.1-15K
FP-20	2.062	52.37	2.625	66.68	2.313	58.75	20	1000	.1-15K

Series TL





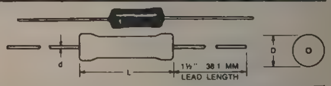
Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM depending on value

TERMINAL DIMENSIONS

M.O. Series	TL-5 Inch	TL-5 mm	TL-10 25 & 30 Inch	TL-10 25 & 30 mm	TL-60 & 100 Inch	TL-60 & 100 mm
Width (W)	.125	3.2	.187	4.8	.250	6.4
Height (H)	.250	6.4	.406	10.3	.750	19.1
Hole Dia. (h)	.062	1.57	.093	2.4	.154	3.9

No. Style	Length (L) Inch ±.062	Length (L) mm ±1.57	Diameter O.D. Inch ±.032	Diameter O.D. mm ±.81	Diameter I.D. Inch ±.032	Diameter I.D. mm ±.81	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
TL-6	1.00	25.40	.250	6.35	.156	3.96	5	230	.1-12K
TL-10	1.00	25.40	.438	11.12	.312	7.92	10	400	.1-22K
TL-25	2.00	50.80	.563	14.30	.312	7.92	25	1300	.1-100K
TL-50	4.00	101.60	.563	14.30	.312	7.92	50	1900	.1-250K
TL-60	4.00	101.60	.750	19.05	.500	12.70	60	2100	.1-350K
TL-100	6.50	165.10	.750	19.05	.500	12.70	100	2500	.1-550K

Series R



Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM depending on value

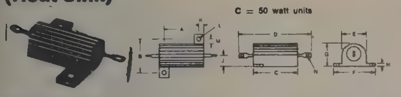
MO Style	Mil R-26 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.032	Diameter (D) mm ±.81	Lead (d) AWG	Lead (d) mm	Wattage U	Wattage V	Max. Working Voltage U	Max. Working Voltage V	Resistance Ranges (ohms) .05% .1% .25%	Resistance Ranges (ohms) .5% 1% 3% 5%
R-¼		.250	6.35	.078	1.98	24	.51	.40		20		10-950	.1-3.4K
R-½		.312	7.92	.078	1.98	24	.51	.75		29		10-1.3K	.1-4.9K
R-1A	RW70	.406	10.31	.093	2.36	22	.64	1.00		52		1-2.7K	.1-10.4K
R-1		.531	13.49	.093	2.36	22	.64	1.10		62		1-4.0K	.1-15K
R-2½	RW69	.500	12.70	.210	5.33	20	.81	2.50	3.25	138	157	1-8.6K	.01-32.2K
R-3A	RW79	.562	14.27	.210	5.33	20	.81	3.00	3.75	135	148	1-6.5K	.01-34.5K
R-3		.812	20.62	.210	5.33	20	1.02	3.25	4.75	185	220	1-11.4K	.01-42.1K
R-4		.625	15.88	.300	7.62	18	1.02	4.00	5.50	210	250	1-12.7K	.01-47.1K
R-5	RW67 RW74	.875	22.22	.300	7.62	18	1.02	5.00	6.50	330	376	.5-24.5K	.01-91.0K
R-7		1.218	30.94	.375	9.52	18	1.02	7.00	9.00	504	576	.5-41.4K	.01-154K
R-10	RW68 RW78	1.780	45.21	.375	9.52	18	1.02	10.00	13.00	799	911	.5-71.3K	.01-265K

MICRO-OHM
CORPORATION

4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

QUALITY PRECISION RESISTORS

POWER RESISTORS
SERIES HS
(Heat Sink)



Tolerances: .05% to 10%

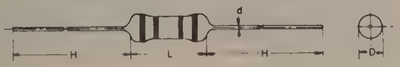
T.Cs: PPM/°C	Resistance
20	10Ω & over
30	1Ω — 10Ω
90	under 1Ω

MO Style	Mil-R 18546	Com'l Watt	Max. Work. Volt.	Max. Res.	A Inch ± .005	A mm ± .013	B Inch ± .005	B mm ± .013	C Inch ± .032	C mm ± .81
HS-5	RE60	5	160	20K	.444	11.28	.490	12.45	.600	15.24
HS-10	RE65	10	265	30K	.562	14.27	.625	15.88	7.50	19.05
HS-25	RE70	25	550	75K	.719	18.26	.781	19.84	1.062	26.97
HS-50	RE75	50	1234	200K	1.563	39.70	.844	21.44	1.968	49.99

Style	D Inch ± .062	D mm ± 1.57	E Inch ± .015	E mm ± .38	F Inch ± .015	F mm ± .38	G Inch ± .015	G mm ± .38	H Inch ± .010	H mm ± .25
HS-5	1.125	28.58	.334	8.48	.646	16.41	.317	8.05	.075	1.91
HS-10	1.375	34.93	.438	11.13	.812	20.62	.406	10.31	.100	2.54
HS-25	1.938	49.23	.500	12.70	1.094	27.79	.563	14.30	.094	2.39
HS-50	2.781	70.64	.625	15.88	1.156	29.36	.625	15.88	.094	2.39

MO Style	J Inch ± .010	J mm ± .25	K Inch ± .010	K mm ± .25	L Inch ± .005	L mm ± .013	M Inch ± .015	M mm ± .38	N Inch ± .005	N mm ± .013	Mtg. Hole Size
HS-5	.145	3.68	.078	1.98	.093	2.36	.078	1.98	.050	1.27	#2
HS-10	.203	5.16	.093	2.36	.093	2.36	.094	2.39	.086	2.18	#2
HS-25	.250	6.35	.171	4.34	.125	3.18	.125	3.18	.086	2.18	#2
HS-50	.281	7.14	.196	4.98	.125	3.18	.125	3.18	.086	2.18	#4

DEPOSIT CARBON FILM
Fixed Resistors
Type
M 50, 25, 12

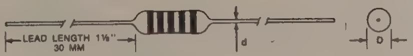


SPECIFICATIONS

Type	M-50	M-25	M-12
Wattage Rating at 70°C	0.5W	0.25W	0.125W
Max. Working Voltage	350V	250V	150V
Max. Over Load Voltage	700V	500V	300V
Resistance Tolerance	±2% (G), ±5% (J)	±2% (G) ±5% (J)	±5% (J)
Resistance Range 5% 2%	1Ω to 10 MΩ 10Ω to 910K	1Ω to 13 MΩ 10Ω to 910K	1Ω to 5 MΩ 51Ω to 220K
Temperatuge Range	−55°C to +155°C	−55°C to +155°C	−55° to +155°C

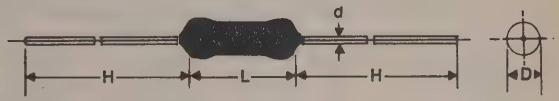
Type	Body Length (L)		Body Diameter (D)		Leadwire Length (H)		Leadwire Diameter (d)		Net Weight
M-50	inch .350 ±.020	mm 8.9 ±0.5	inch .146 ±.008	mm 3.7 ±0.2	inch 1.125 ±.1	mm 30 ±3	inch .031±.001	mm 0.8 ±0.03	500 grms (1.1 lb.)
M-25	inch .245 +.020 −.010	mm 6.7 max.	inch .098 max.	mm 2.5 max.	inch 1.125 ±.1	mm 30 ±3	inch .024 ±.005	mm 0.6 ±0.05	200 grms (.44 lb.)
M-12	inch .160 +.020 −.010	mm 4.6 max.	inch .068 max.	mm 1.7 max.	inch 1.125 ±.1	mm 30 ±3	inch .020 ±.005	mm 0.5 ±0.05	135 grms (.30 lb.)

METAL FILM RESISTORS
Type RN 25
T.Cs: 25, 50 & 100 PPM
Tolerances: 0.1% to 1%
RN55 Size: ¼W rating



MO Style	Length (L) Inch ±0.39	Length (L) mm ±1.0	Diameter (D) Inch ±.02	Diameter (D) mm ±0.5	Lead(d) Tin Cu. AWG	Lead(d) Tin Cu. mm	Wattage @ 70°C	Max. Working Voltage	Max. Overload Voltage	Resistance Range (Ω)
RN25	.25	6.4	.09	2.3	22	0.5	¼	250	500	1-10 Meg.

HIGH STABILITY LINEAR POSITIVE T.C. RESISTORS
Type LPTC-8 Metal Film



Max. Power Rating @ 70°C	L ±.020	D ±.020	1	d
⅛W	.250	.090	1.0	22 ga.

Resistance Range: 10 ohm — 20K ohm (T1 and T2)
10 ohm — 1K ohm (T3 and T4)
Resistance Tolerance: ±2% (G) and ±5% (J)
Resistance Temperature Coefficient: T1 (±2500 PPM)
T2 (±3000 PPM)
T3 (±3500 PPM)
T4 (±4000 PPM)

Features: a) Linear resistance change vs. temperature, which cannot be obtained in a semiconductor or thermister.
b) Positive temperature coefficient

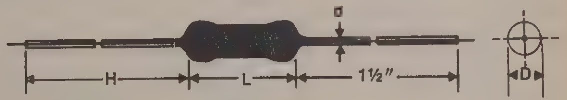
Application: Temperature compensation, temperature indication, temperature control, temperature protection and liquid level detection.

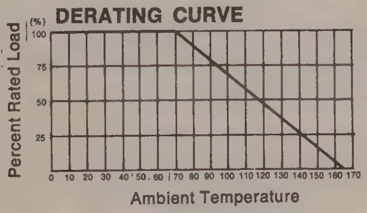
Markings: First two bands are significant digits, third band the multiplier, and the fourth and fifth bands are first two digits of T.C.R.

SPECIFICATIONS FOR MG SERIES METAL GLAZE RESISTORS

This high resistance component has been developed to be used as a precision or power resistor for X-ray equipment, measuring equipment and statistic electric equipment. It has high reliability in its shelf life, T.C.R. and other characteristics.

CHARACTERISTICS:
T.C.R.: 100 PPM
Load life: 3000 Hrs. ±1%
Anti moisture load life: ±1% after 250 Hrs. at 40°C 90-95% RH
Voltage coefficient: 0.00002 — 0.0005% /V
Shelf life: ±1% after 10,000 Hrs. at room temp.
Max. Temperature: 220°C
Temperature range: −55°C — +165°C




DERATING CURVE

Style	Rated Wattage (W)	Max. Working Voltage (KV)	Pulse Voltage (KV)	Resistance Range	Dimensions (Inches) D ±.04	Dimensions (Inches) L ±.06	Dimensions (Inches) d ±.004
MG-25	0.25	0.10	0.30	1 Meg- 100 Meg	.09	.256	.025
MG-50	0.50	0.25	0.70	1 Meg- 200 Meg	.126	.393	.028
MG-1	1.0	1.00	1.00	1 Meg-1000 Meg	.165	.472	.032
MG-2	2.0	5.00	7.50	1 Meg-2000 Meg	.217	.630	.032

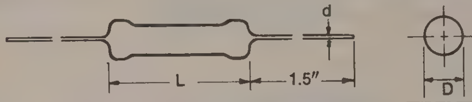
Resistance Tolerance: F = ±1%, G = ±2%, J = ±5%. Markings: EIA color coding system or Digital marking.

MICRO-OHM CORPORATION

4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

QUALITY PRECISION RESISTORS

FLAME-PROOF METAL OXIDE POWER RESISTORS



Style	Dimension (inches)		
	L ±.02	D ±.02	d (nominal)
RSF-½B	.35	.12	.028
RSF-1B	.46	.16	.028
RSF-2B	.61	.23	.032
RSF-3B	.98	.33	.032
RSF-5B	1.60	.33	.032

Style	Power Rating @ 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	Resistance Tolerance
RSF-½B	0.5W	250V	400V	500V	0.2 -100 KΩ	
RSF-1B	1W	500V	1,000V	700V	0.2 -100 KΩ	
RSF-2B	2W	500V	1,000V	700V	0.2 -120 KΩ	G*
RSF-3B	3W	750V	1,000V	1,000V	0.2 -150 KΩ	J
RSF-5B	5W	750V	1,000V	1,500V	0.47-240 KΩ	

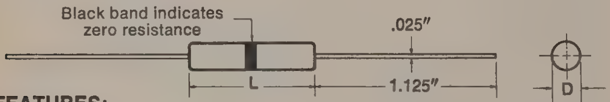
* G 5.1Ω and over

CHARACTERISTICS

Requirements		Characteristics	Test Method	
			JIS C 5202	MIL-R-22684B
Operating Temperature Range		−55°C to +275°C		
Temperature Coefficient (ppm C)		±200	5.2	4 6 11
Max. Resistance Change	Short Time Overload	±(0.5% +0.05Ω)	5.5	4 6 5
	Effect of Soldering	±(0.5% +0.05Ω)	6.4 350°C 3 sec	4 6 9
	Temperature Cycling	±(0.5% +0.05Ω)	7.4 −55°C/85°C	4 6 3
	Moisture Resistance	±5%	7.9 1,000 hr	4 6 10
	Load Life	±5%	7.10 1,000 hr	4 6 12
Dielectric Withstanding Voltage		±(0.5% +0.05Ω)	5.7	4 6 7
Insulation Resistance		over 10^4 MΩ	5.6	4 6 8
Non-Combustibility		The resistor shall withstand Overload test in accordance with Article UL492, 213 without producing a fire hazard.		
Resistance to Solvents		The resistor shall withstand Solvents test in accordance with Article MIL-STD-202 E 215 without producing any mechanical or electrical damage.		

JUMPER WIRE ZERO OHM RESISTORS

Type 104, 106, 108



FEATURES:

- Sizes equal to ⅛, ¼ and ½W carbon film
- Economical
- Straight-through zero ohm continuity
- Conformal multilayer epoxy coating
- Welded cap and lead construction
- Packing: Tape & reeled or bulk

Type	Equivalent Wattage	Body	
		inch Length (L) ±.010	inch Diameter (D) +.005
104	⅛	.150	.080
106	¼	.245	.085
108	½	.500	.095

SPECIFICATIONS:

Maximum Resistance: 0.0025 ohm
Lead Material: Leads are copperclad steel with 30/70 solder coatings to allow both welding and soldering operations.
Body material: Epoxy coated metal body
Minimum Insulation Resistance: Dry, 10,000 megohm; Wet, 100 megohm
Minimum Dielectric Withstanding Voltage: Atmospheric, 500V RMS; Reduced, 325V RMS
Insulation Flammability: Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed.
Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C
Reel Capacity: 5000 pcs

APPLICATIONS

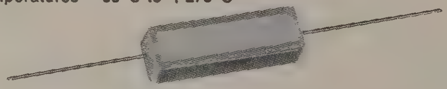
Jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a PC board.
Generally they are used for the following reasons:

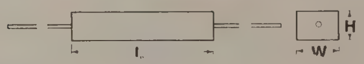
- Inability to connect two points on a PC board due to other circuit paths which must be crossed over.
- An after-the-fact design change that requires new point connections.
- Circuit tuning by changing point connections.

BATHTUB TYPE RESISTORS

CW SERIES

√ Economical
√ 1 watt to 50 watt
√ 5 & 10% Tolerances
√ Fireproof
√ Operating temperatures −55°C to +275°C





CONSTRUCTION

Premium grade resistance wire is wound on a woven fiberglass core. Tinned copper terminals are tightly crimped or welded (depending on resistance value) to the banded core. The wound unit is potted in a high quality Steatite Ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package, highly resistant to solvents and impervious to moisture.

Stand off or feet type available in sizes 3 Watt and larger. Specify by inserting letter "F" after type number. Example: CW5F

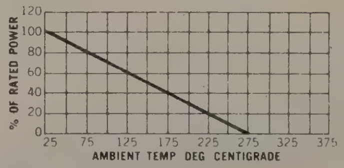
- Temperature coefficients (Typical) Below 1Ω 0 ±800 ppm; Over 1Ω 0 ±400 ppm
- Applicable specification to EIA Standard RS-344 Type
- Fuse type available
- Terminal strength: 5 lbs minimum
- Non-Inductive types available

CW SERIES - AXIAL LEAD

Type	Wattage	DIMENSIONS (inches)				Maximum Working Voltage	Resistance Range (Ω)
		Length (L)	Width (W)	Height (H)	Lead (d)		
CW1	1	.594	.219	.250	.032	60	.01-.27
CW2	2	.688	.250	.250	.032	65	.01-.35
CW3	3	.875	.312	.312	.032	150	.01-10K
CW5	5	.875	.375	.375	.032	200	.01-10K
CW7	7	1.406	.375	.343	.032	350	.01-27K
CW10	10	1.875	.375	.343	.032	540	.01-30K
CW15	15	1.875	.500	.500	.036	670	.01-30K
CW20	20	1.875	.500	.500	.036	740	.01-40K
CW25	25	2.531	.625	.625	.036	890	.01-40K
*CW50F	50	3.500	.500	.500	.040	940	.01-45K

* Available with stand off feet only.

DERATING



HOW TO ORDER:

CW5 10 ohms 5%
TOLERANCE
RESISTANCE VALUE
TYPE & WATTAGE

MICRO-OHM
CORPORATION

4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

QUALITY PRECISION RESISTORS

THICK FILM RESISTOR NETWORKS

Single-In-Line SIP Resistors

INTRODUCTION

These conformal coated single-in-line (SIP) resistor networks are designed to meet a variety of application requirements in a compact, highly reliable package.

All SIP networks are quality tested for both resistance and tolerance before shipping.

Applications for resistor networks include: pull up and pull down resistors, TTL & ECL line terminating resistors, LED current limiting resistors and telecommunication networks.

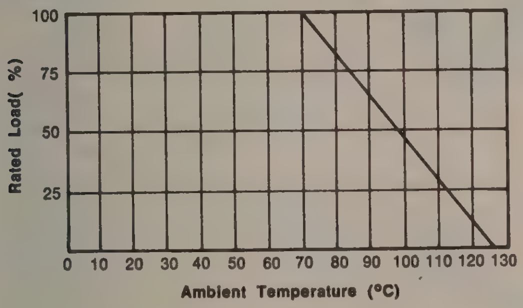
FEATURES

- Substrate Material — 96% alumina provides superior thermal properties and cooler operation.
- Resistors and Conductors — thick film materials with proven reliable performance.
- Lead Pull Strength: 5 lbs.
- Lead Material: Tinned plated copper alloy.
- Provides high electrical conductivity and thermal transfer.
- Encapsulation: Conformal coating ensure reliable performance.

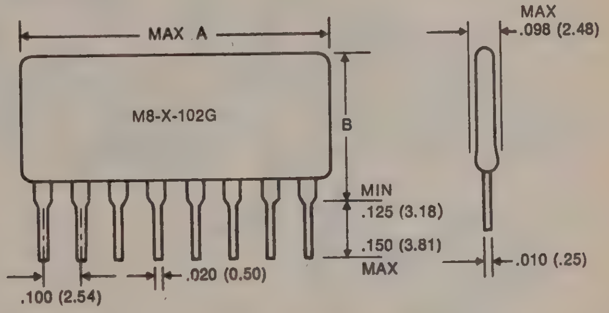
PERFORMANCE SPECIFICATIONS

Temperature Coefficient:	±250 PPM Std., ±100 PPM avail.
TCR Tracking:	50 PPM Max.
Operating Temperature:	−55°C to +125°C
Max. Working Voltage:	200V
Thermal Shock:	±.5% Max.
Moisture Resistance:	±.5% Max.
Terminal Strength:	±.25% Max.
Resis. to Soldering Heat:	±1.0% Max.
Load Life (1000 hours):	±3.0% Max.
Temperature Cycling:	±1.0% Max.
Shock and Vibration:	±.25% Max.
Solvent Resistance:	Resists industrial cleaning agents per MIL-STD-202E
Lead Solderability:	Meets MIL-STD-202 Method 208

DERATING CURVE

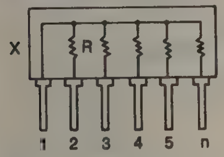


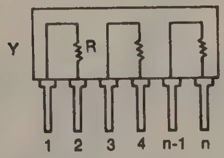
DIMENSIONS

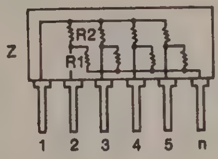


	No. Pins	STD Circuit X	STD Circuit Y	STD Circuit Z	Dimensions mm	Dimensions in.
A	5	4	—	—	13.5	.531
	6	5	—	8	16.0	.630
	7	6	—	—	18.5	.728
	8	7	4	12	21.0	.827
	9	8	—	14	23.5	.925
	10	9	5	16	26.5	1.04
	11	10	—	—	29.0	1.14
	12	11	6	—	31.5	1.24
	13	12	—	—	34.0	1.34
B	Low Profile				5.08	.200
	Medium Profile				6.35	.250
	High Profile				8.90	.350

STANDARD CIRCUITS







POWER RATING

Profile	Circuit: X Parallel	Circuit: Y Discrete	Circuit: Z Double Termination
Low	.125W	.200W	.200W ($R_1 + R_2$)
Medium	.150W	.250W	.250W ($R_1 + R_2$)
High	.250W	.350W	.350W ($R_1 + R_2$)

STANDARD RESISTANCE (Ω)

33	220	1K	5.6K	47K
47	270	1.2K	6.0K	68K
56	330	1.5K	6.8K	82K
68	390	1.8K	8.2K	100K
82	470	2.2K	10K	220K
100	510	2.7K	12K	390K
120	560	3.3K	15K	470K
150	680	3.9K	22K	680K
180	820	4.7K	33K	1M

DOUBLE TERMINATION (R1/R2) (Ω)

81/130
120/195
160/260
220/270
180/390
220/330
330/390
330/470
3K/6.2K

PART NUMBERING

M 8 X 102 G

SINGLE IN-LINE RESISTOR NETWORK
L = Low profile
M = Medium profile
H = High Profile

NO. OF PINS

CIRCUIT TYPE
X = Parallel Y = Discrete
Z = Double Termination

RESISTANCE CODE
First two digits are significant.
Last digit specifies number of zeros.

RESISTANCE TOLERANCE
G = ±2% J = ±5% K = ±10% M = ±20%

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

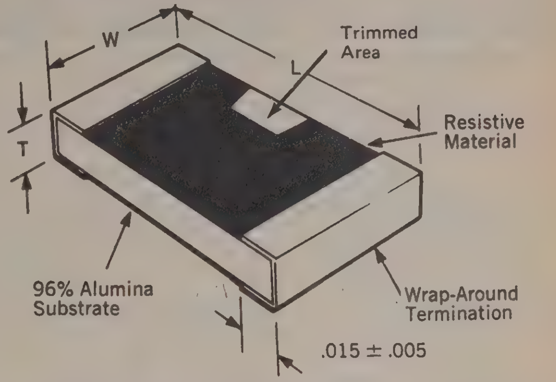
CHIP RESISTORS (THICK FILM)

FEATURES

- Eliminates expensive multiple screenings
- Provides very low to very hgh resistance values (trimmed to your specific order)
- Wrap-around terminations provide assembly ease and reliability
- Allows high density packaging
- Offers uniform tolerances — to .1%
- Can be wave-soldered directly to the back of a P.C. board
- Can be color-coded for identification
- High reliability-manufactured to meet MIL-R-55342C standards (see chart)
- High purity alumina substrate
- Precision performance-resulting from tight TCR, close tracking and excellent environmental performance
- Backside metalization available on request.

TOP-ONLY TERMINATIONS
(on request)

WRAP-AROUND TERMINATIONS



- Technical information and samples available without obligation.
- Laser trimmed for better accuracy and stability.

SIZES

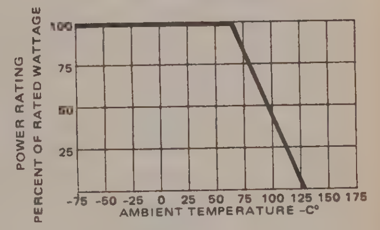
Style*	Resistance Range	Power Rating at 25°C	Length (L) ± .005" (.13)		Width (W) ± .005" (.13)		Thickness (T) ±.005" (.13)	
Ec	5 Ω - 50 meg	75 mw	.050"	(1.27)	.030"	(.76)	.020"	(.5)
A	1 Ω - 50 meg	125 mw	.050"	(1.27)	.050"	(1.27)	.020"	(.5)
B	1 Ω - 50 meg	200 mw	.075"	(1.91)	.050"	(1.27)	.020"	(.5)
C	5 Ω - 100 meg	250 mw	.100"	(2.54)	.050"	(1.27)	.020"	(.5)
D	5 Ω - 100 meg	700 mw	.150"	(3.81)	.050"	(1.27)	.020"	(.5)
E	5 Ω - 100 meg	1 w	.100"	(2.54)	.100"	(2.54)	.020"	(.5)
F	5 Ω - 100 meg	2 w	.200"	(5.08)	.100"	(2.54)	.020"	(.5)
G	5 Ω - 100 meg	500 mw	.225"	(5.7)	.075"	(1.9)	.020"	(.5)
H	5 Ω - 100 meg	300 mw	.125"	(3.2)	.060"	(1.6)	.020"	(.6)

*Other values and sizes available on special orders.
* Always specify method of attachment to determine proper termination material.

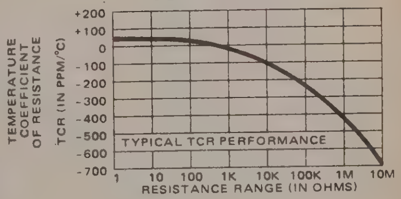
PERFORMANCE CHARACTERISTICS

CHARACTERISTIC	TEST METHOD	REQUIREMENT
Temperature Coefficient of Resistance (see chart)	MIL-STD-202F, Method 304 – 55°C to + 125°C	± 200 PPM/°C (± 50 PPM/°C available)
Thermal Shock	MIL-STD-202F, Method 107 5 cycles, −65°C to +150°C	± 0.5% max.
Low Temperature Operation	MIL-R-55342C, Para. 4.7.4 & 3.9 One hour at – 65°C followed by 45 minutes RCWV	± 0.5% max.
Short Time Overload	MIL-R-55342C, Para. 4.7.5 & 3.10 2.5 times RCWV for 5 sec at 25°C not exceeding 80 volts	± 0.5% max.
High Temperature Exposure	MIL-R-55342C, Para. 4.7.6 & 3.11 125°C for 100 hours	± 1.0% max.
Resistance to Bonding Exposure	MIL-R-55342C, Para. 4.7.7 & 3.12 Soldered to test board at 260°C for 10 seconds	± 0.25% max.
Moisture Resistance	MIL-STD-202F, Method 106 10 cycles, total 240 hours	± 0.5% max.
Life	MIL-STD-202F, Method 108A 2000 hours at 70°C, RCWV intermittent	± 2.0% max.
Solderability	MIL-STD-202F, Method 208 230°C for 5 seconds	95% min. coverage
Termination Adhesion	MIL-R-55342C, Para. 4.7.12 15 gram pull for 30 seconds	15 gram minimum
Maximum Operating Voltage		100 WVDC (Not to exceed maximum power)
TCR Tracking		± 5 PPM/°C (From same lot)

DERATING CURVE



TCR CHART



MICROPLEX, inc.

1977 State College Blvd., Anaheim, California 92806 • (714) 634-1535

CUSTOM BUILT OR STANDARD...........
.... MRC MEETS YOUR EXACT SPECS

MRC MILWAUKEE RESISTOR CORPORATION
704 W. VIRGINIA ST. • MILWAUKEE, WI 53204 • (414) 271-9900

Custom Roundwire Power Resistors

ALTHOUGH MILWAUKEE RESISTOR ALSO MANUFACTURES INDUSTRY **STANDARD** VITREOUS ENAMEL RESISTORS, OUR SPECIALTY IS SOLVING DESIGN PROBLEMS THROUGH CUSTOM INNOVATION. SOME OF THE CUSTOM POSSIBILITIES ARE SHOWN ON THIS PAGE.

AVAILABLE WATTAGE RATINGS by core size.
Ratings based on 325°C above 25°C ambient.

	Core Size	Ohmic Range				
Watts	O.D.xI.D.xL.	Fixed †		Adjustable †		Part No.*
		MinΩ	MaxΩ	MinΩ	MaxΩ	
8 (5) †	5/16X3/16X1	.70	13.5K	N.A.	N.A.	5-16-Ω
12 (10)†	5/16X3/16X1 3/4	.12	66K	0.27	15.2K	5-28-Ω
11 (8)	7/16X5/16X1	6.15	3.1K	N.A.	N.A.	7-16-Ω
15 (10)	7/16X5/16X1 1/2	.19	21K	N.A.	N.A.	7-24-Ω
20 (15)†	7/16X5/16X2	.11	63K	N.A.	N.A.	7-32-Ω
26	7/16X5/16X3	.11	110K	N.A.	N.A.	7-48-Ω
25 (20)†	9/16X5/16X2	.22	35K	0.47	28K	9-32-Ω
31 (25)	9/16X5/16X2 1/2	.11	55K	0.68	40K	9-40-Ω
50 (35)†	9/16X5/16X4	.21	119K	1.31	78K	9-64-Ω
75	9/16X5/16X6	.33	207K	2.15	128K	9-96-Ω
24	3/4X1/2X1 1/2	.33	13K	N.A.	N.A.	12-24-Ω
30 (25)	3/4X1/2X2	.28	29K	0.62	26K	12-32-Ω
45 (35)	3/4X1/2X3	.18	63K	1.17	59K	12-48-Ω
51 (40)	3/4X1/2X3 1/2	.22	83K	1.44	79K	12-56-Ω
61 (45)	3/4X1/2X4	.27	97K	1.72	93K	12-64-Ω
65 (50)	3/4X1/2X4 1/2	.31	122K	2.0	117K	12-72-Ω
75 (60)	3/4X1/2X5	.35	134K	2.27	129K	12-80-Ω
90	3/4X1/2X6	.43	172K	2.82	167K	12-96-Ω
100†	3/4X1/2X6 1/2	.47	186K	3.1	181K	12-104-Ω
52	1X3/4X3	.15	43K	0.49	38K	16-48-Ω
70	1X3/4X4	.12	72K	0.75	66K	16-64-Ω
85	1X3/4X5	.16	106K	1.02	99K	16-80-Ω
105	1X3/4X6	.20	134K	1.29	127K	16-96-Ω
40 (33)	1 1/8X3/4X2	.48	7.9K	N.A.	N.A.	18-32-Ω
80	1 1/8X3/4X4	.12	53K	0.77	48K	18-64-Ω
95	1 1/8X3/4X5	.17	83K	1.07	79K	18-80-Ω
120	1 1/8X3/4X6	.21	106K	1.37	100K	18-96-Ω
130 (115)	1 1/8X3/4X6 1/2	.23	119K	1.51	114K	18-104-Ω
160	1 1/8X3/4X8	.31	160K	1.96	154K	18-128-Ω
175 (160) †	1 1/8X3/4X8 1/2	.32	169K	2.11	163K	18-136-Ω
225†	1 1/8X3/4X10 1/2	.41	214K	2.71	208K	18-168-Ω
235	1 1/8X3/4X11 1/4	.45	239K	2.94	230K	18-180-Ω
251	1 1/8X3/4X12	.48	259K	3.16	250K	18-192-Ω
220	1 5/8X1 1/8X8 1/2	.41	100K	2.69	98K	26-136-Ω
275	1 5/8X1 1/8X10 1/2	.55	131K	3.54	129K	26-168-Ω
300	1 5/8X1 1/8X11 3/4	.62	151K	4.10	149K	26-188-Ω
500‡	2 1/2X1 3/4X12	.98	58K	6.4	58K	40-192-Ω C
750‡	2 1/2X1 3/4X15	1.30	75K	8.4	75K	40-240-Ω C
1000‡	2 1/2X1 3/4X20	1.80	105K	11.6	104K	40-320-Ω C
850‡	3 1/4X1 3/4X15	1.65	50K	10.8	50K	52-240-Ω C
1150‡	3 1/4X1 3/4X20	2.30	69K	15.0	69K	52-320-Ω C

- Wattages shown in parenthesis are Navy ratings per Mil-R-15109.

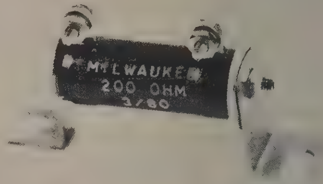
† Resistors shown are standard wattages

* Add "A" after part number for adjustable types.

† For resistance values outside the limits shown, consult M.R.C.

‡ Cement coating standard — Silicone available.

- Unable to find what you need above? The same cores can be wound with ribbon wire for higher wattage capability



M.R.C. can build a resistor to your specifications on any of the basic cores shown here. (If these do not suit your need, contact M.R.C. for engineering assistance, as 32 additional cores are also available.)

When contemplating a custom resistor, consider the following options to meet your exact requirement(s):

- **SPECIAL APPLICATIONS**
- **SIZE LIMITATIONS**
- **MIL–R–15109**

SPECIAL TOLERANCE–
- Resistance tolerance to ±1% can be manufactured in many cases.

SPECIAL COATINGS–
- Silicone
- Cement
- Sand & Cement

SPECIAL TAPS–
- Taps can be provided to your specifications.

SPECIAL T.C.–
- Temperature coefficient to 20 ppm/°C.

SPECIAL WINDINGS–
- Ayrton-Perry (Non-inductive, round wire only)
- Bilfilar (Non-inductive)

SPECIAL TERMINALS–
- Single and double ¼" quick-connect
- Metal sleeve ferrule
- Live-bracket

HARDWARE–
- Terminal hardware
- L–Bracket mounting
- Spring clip mounting
- Vertical mounting hardware

LOAD BANKS–
- M.R.C. will custom design and build load banks to your requirements.

CUSTOM BUILT or STANDARD............
.........MRC MEETS YOUR EXACT SPECS

MRC MILWAUKEE RESISTOR CORPORATION
DEPT. EM, 704 W. VIRGINIA ST. MILWAUKEE, WI 53204 414-271-9900

UNIQUE HI-OHM RIBWOUNDS ....
.........................SAVE SPACE

MRC MILWAUKEE RESISTOR CORPORATION
704 W. VIRGINIA ST. • MILWAUKEE, WI 53204 • (414) 271-9900

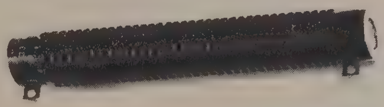
Vitreous Enamel Ribwound Resistors

APPLICATIONS

Particularly useful where high energy is to be dissipated in the lower ohmic ranges. Due to its ability to operate at higher temperatures and dissipate greater heat, the ribwound resistor is almost one-half the physical size of the equivalently rated round-wire style resistor. Ribwound wattage ratings are based on a temperature rise of 375°C above an ambient of 40°C. They may be mounted with spring clips (thru 1 1/8" dia.); thrubolt mounting hardware, individual or multiple-stacked bracket assemblies or live-bracket mountings.

BASIC CONSTRUCTION

Crimped ribbon resistance wire is edgewound and then locked to the ceramic core with vitreous enamel. Resistance wire is spot-welded to the terminal bands. Ribwound resistors can be furnished in fixed, adjustable, or tapped styles and are also available with cement coating.



OHMS	OHMS	OHMS
0.1	1.0	6.0
0.15	1.25	8.0
0.2	1.5	10.0
0.25	2.0	12.0
0.4	2.5	15.0
0.5	3.0	20.0
0.6	4.0	25.0
0.75	5.0	33.0

Many 300 watt units are stocked in both fixed and adjustable styles. Listed are the more popular 300 watt ohmic values. All other wattage ratings and styles are made to order.

HI–OHM RIBS

Exclusively from M.R.C.

You may note on the adjacent chart that maximum ohmic values shown for each wattage are three or more times that normally available.

This development is the result of the installation of precision rib winding machines designed and manufactured by M.R.C.

Unique in the industry, these precision machines produce a winding with extreme uniformity, as close inspection of M.R.C. ribwound resistors will reveal. The uniform winding allows turns to be applied much closer to each other and consequently significantly higher resistances are achieved.

This means that lower ohmic value round wire power resistors may feasibly be replaced by HI–OHM RIBS with a significant saving in size. (For a given wattage rating, ribwounds are considerably smaller physically.)

WATTS	CORE SIZE	OHMIC RANGE#		PART NUMBER	
	O.D. X I.D. X L.	FIXED	ADJ.	FIXED	ADJ.
40	9/16X5/16X2	.010-9.4	N.A.	9-32-Ω R	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R".
50	3/4X1/2X2	.010-6.1	N.A.	12-32-Ω R	
60	3/4X1/2X2 1/2	.010-12.2	N.A.	12-40-Ω R	
75	3/4X1/2X3	.010-18.3	N.A.	12-48-Ω R	
90	9/16X5/16X4	.016-28.0	.014-25.0	9-64-Ω R	
100	3/4X1/2X3 1/2	.013-24.0	.011-20.0	12-56-Ω R	
110	3/4X1/2X4	.016-30.0	.014-26.0	12-64-Ω R	
120 (110)	3/4X1/2X4 1/2	.020-36.0	.018-32.0	12-72-Ω R	
135	3/4X1/2X5	.022-42.0	.020-39.0	12-80-Ω R	
150	1 1/8X3/4X4	.023-44.0	.020-39.0	18-64-Ω R	
160	3/4X1/2X6	.029-55.0	.027-51.0	12-96-Ω R	
160 (155)	1 1/8X3/4X4 1/4	.025-49.0	.022-43.0	18-68-Ω R	
175	1 1/8X3/4X4 1/2	.027-53.0	.024-48.0	18-72-Ω R	
180	3/4X1/2X6 1/2	.032-61.0	.030-57.0	12-104-Ω R	
220	1 1/8X3/4X6	.041-80.0	.038-74.0	18-96-Ω R	
225 (220)	1 1/8X3/4X6 1/8	.040-82.0	.035-77.0	18-98-Ω R	
240 (240)	1 1/8X3/4X6 1/2	.041-89.0	.038-83.0	18-104-Ω R	
300 (300) †	1 1/8X3/4X8 1/2	.057-125	.055-119	18-136-Ω R	
375	1 1/8X3/4X10 1/2	.074-161	.071-155	18-168-Ω R	
400	1 1/8X3/4X11 1/4	.080-174	.077-168	18-180-Ω R	
400 (400)	1 5/8X1 1/8X8 1/2	.066-159	.062-149	26-136-Ω R	
420	1 1/8X3/4X11 3/4	.084-183	.081-177	18-188-Ω R	
500 (500)	1 5/8X1 1/8X10 1/2	.087-200	.083-200	26-168-Ω R	
550 (550)	1 5/8X1 1/8X11 3/4	.100-240	.096-230	26-188-Ω R	
750‡	2 1/2X1 3/4X12	.140-166	.130-157	40-192-Ω RC	
1000‡	2 1/2X1 3/4X15	.183-210	.176-200	40-240-Ω RC	
1500‡	2 1/2X1 3/4X20	.250-300	.240-290	40-320-Ω RC	
2000‡	3 1/4X1 3/4X20	.300-390	.290-380	52-320-Ω RC	

Standard resistance tolerance is ±10% - closer on request.
† Stock wattage - see stock list this page.
‡ Cement coating is standard rather than vitreous enamel.
Wattages in parenthesis are Navy ratings per Mil-R-15109, Form EW.

UNIQUE HI-OHM RIBWOUNDS ....
.........................SAVE SPACE

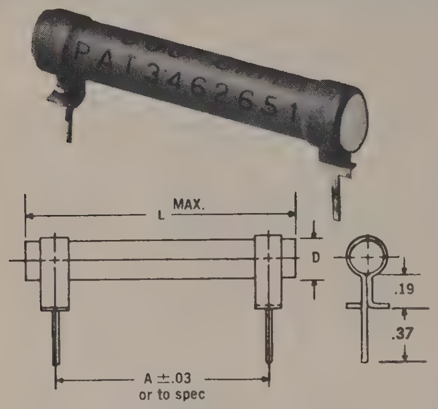
MRC MILWAUKEE RESISTOR CORPORATION
DEPT. EM, 704 W. VIRGINIA ST. MILWAUKEE, WI 53204 414-271-9900

MRC MILWAUKEE RESISTOR CORPORATION

ON TIME DELIVERIES....................
............DATE GUARANTEED when required

704 W. VIRGINIA ST. MILWAUKEE, WI.53204 414-271-9900

PCB Printed Circuit Board Resistors *



FIXED PCB'S

WATTS	L	A	D	MAX. OHMS
3	1	0.6	13/64	20,000
5	1 1/4	0.9	13/64	38,000
7	1 5/8	1.3	13/64	69,000
10	2.1	1.7	13/64	86,000
15	2.1	1.7	5/16	85,000
20	2 1/2	2.2	5/16	113,000

ADJUSTABLE PCB'S

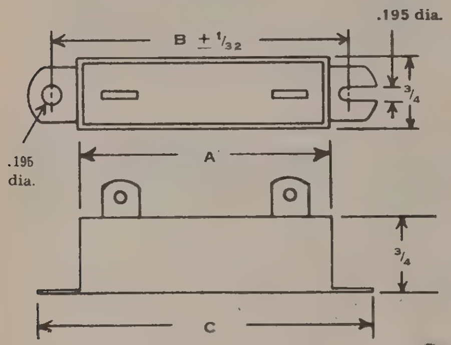
WATTS	L	A	D	MAX. OHMS
15	2.1	1.7	5/16	2,000 ‡
20	2 1/2	2.2	5/16	3,000 ‡

‡=FOR HIGHER OHMS, CONSULT FACTORY

FEATURES

- Built-in standoff keeps board cool.
- Mounting feet prevent rocking.
- Power ratings 3 to 20 watts.
- Complete OHM range.
- One-piece, welded terminals
- Rectangular leads .020 x .040 in.
- Silicon base coating. Vitreous enamel coating available.
- Standard tolerance ±5%.
- 20 PPM upon request.

* Patent #3,462,651



TERMINALS TO CUSTOMER SPECIFICATIONS—Screw Lug,Quick-Connect.

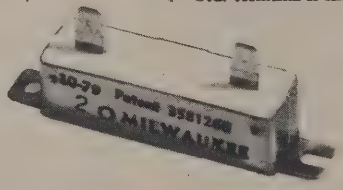
WATTS Ratings at 275°C rise showing benefit of mounting flush for full heat sink.††		DIMENSIONS			PART NUMBER
Without Heat Sink	With Heat Sink	A	B	C	(Specify Terminal)
20	45	1	1 7/16	1 7/8	12M16-Ω †
40	70	2 1/2	3	3 3/8	12M40-Ω ‡
50	100	3 11/16	4 1/8	4 9/16	12M59-Ω ‡

†† Ratings based on mounting on steel panel 10" x 10" x .040"; (heat transfer to heat sink is improved by the use of thermal conductive grease or epoxy).

† Std. terminal is 3/16" wide with hole, Type AB.

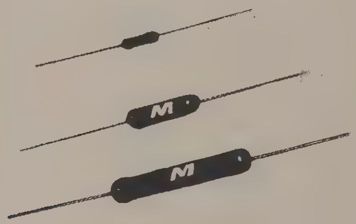
‡ Std. terminal is single quick connect, Type H.

Metal Case



High Heat Sink—flush mounting dissipates heat.
20 to 100 Watts — higher on Specials
Quick Connect or Screw Terminals
Save: Space -First Cost- Assembly Cost
Patent #3,581,266
WRITE FOR ADDITIONAL INFORMATION

Axials



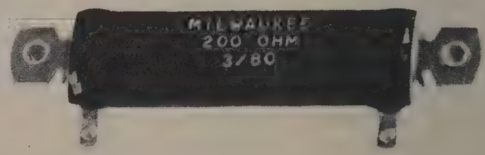
APPLICATIONS

- Electronic Circuitry
- Printed Circuits
- Radio, Television and Sound Reproduction
- Miniature Controls

FEATURES

- Rugged yet small.
- Highly stable.
- Matched expansion in core caps and coating for temperature stability.
- Standard 5% tolerance over 1 ohm, available in close tolerances on request.
- Wattage ratings based on 325°C rise at 25°C ambient.
- Standard Sizes—3, 6.5, 11 watts.
- Leads Hot Tin Dipped.

Ovals



OVAL RESISTORS are for use where space saving is desired and where the use of the 'Heat Sink' function of the metal chassis, rack or panel may be employed. Resistance tolerance of ±5% is standard except on low resistance and multi-tapped units. COATINGS of vitreous enamel or silicone base are offered.

OVALS are available in regular or miniature sizes; an original development of MILWAUKEE Resistor.

MRC MILWAUKEE RESISTOR CORPORATION

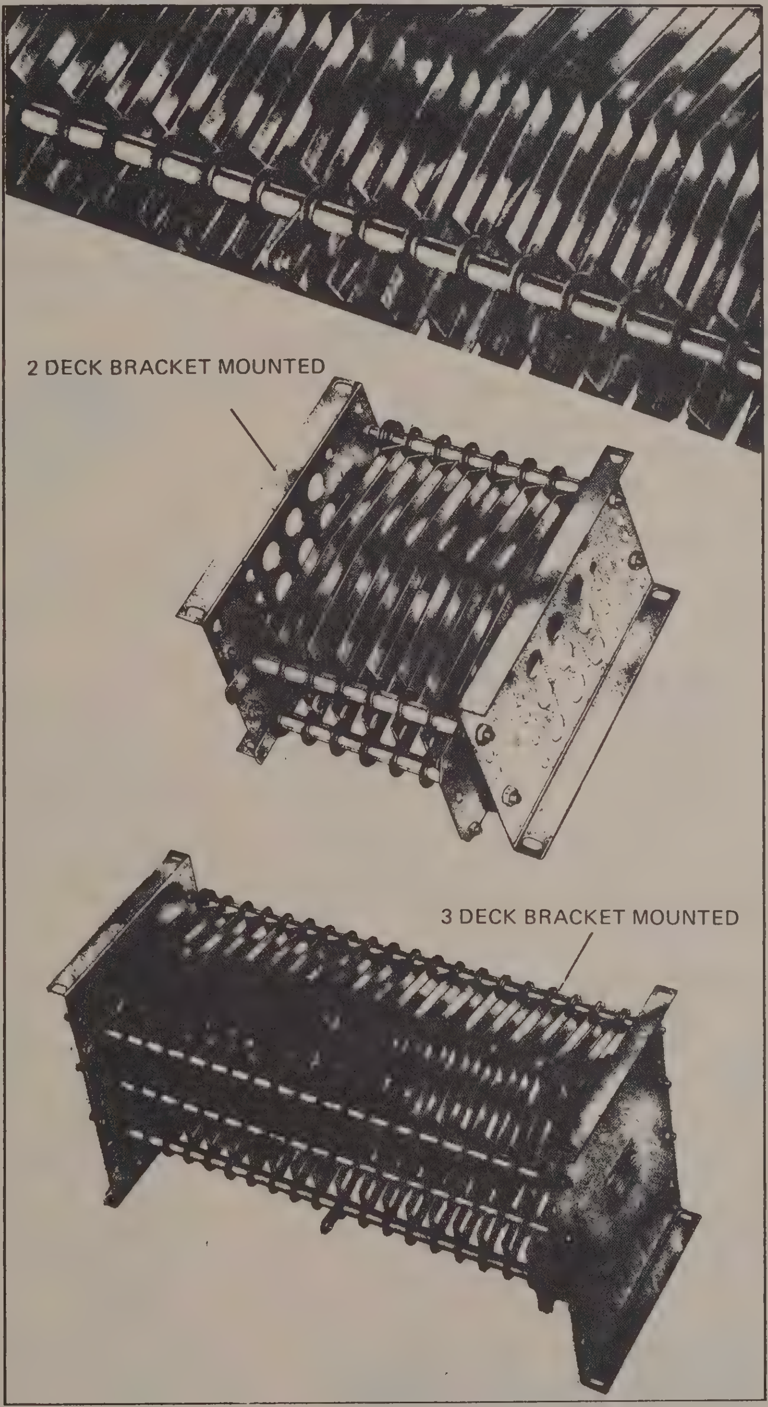
704 W. VIRGINIA ST. • MILWAUKEE, WI 53204 • (414) 271-9900

EXCLUSIVE PATENTED*, PRE-FORMED..........
........GRID ELIMINATES WARPING PROBLEMS

Grid Resistors *

For High Current and High Power Circuits

COMPUTER AIDED DESIGN – All Milwaukee Grids are designed for the specific application involved at no extra cost. Without the constraints of standard resistance and current ratings, Milwaukee can offer a grid for your exact need, often at a considerable saving in cost.



APPLICATIONS WHERE RUGGED MILWAUKEE GRIDS ARE IN USE............

- Motor Starting
- Speed Control
- Braking
- Power Systems
- Heaters
- Crane Controls
- Dummy Loads
- Grounding Resistors
- Feedback Resistors

* Patent 3,212,045

MRC MILWAUKEE RESISTOR CORPORATION

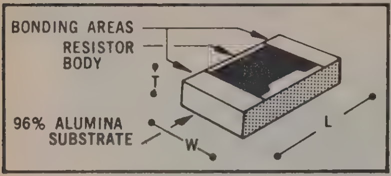
EXCLUSIVE, PATENTED*, PRE-FORMED ....
......GRID ELIMINATES WARPING PROBLEMS

DEPT. EM, 704 W. VIRGINIA ST. MILWAUKEE, WI 53204 414-271-9900

PRECISION THICK/THIN FILM CHIP RESISTORS

MINI-SYSTEMS, INC

20 David Road, P.O. Box 69, North Attleboro, MA 02761
TELEPHONE: (617) 695-0203 • TWX NO. 710-348-0564



MINI-SYSTEMS, INC., thick/thin film chip resistor components are ideally suited for the fabrication of microelectronic circuits where tight resistance tolerance, wide range of resistance values, or short production runs make the conventional screening and firing of thick/thin film resistance networks too costly. MINI-SYSTEMS, INC., chip resistors are made from a carefully engineered selection of materials. Geometries are mechanically precise and uniform. Careful testing and inspection result in the highest quality resistors.

STANDARD "MSR" SERIES

- Sizes Available: .035″ x .035″ up to .661″ x .494″.
- PDIS Rating (25°C free air): 40 mW to 15 W.
- Resistors manufactured with palladium silver or platinum gold.
- Tolerances available: ±.5%, 1%, 2%, 5%, 10%, and 20% for most resistance values.
- All types available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metalization available upon request.
- "Flip-Chip" resistors are solder tinned (SN-62).
- Wire bond resistors have gold metalization optimized for wire bonding.
- Sandwich metalization standard on all wrap-around resistors.

***Wrap-Around Terminations**

WA-	Size (L x W)	PDIS Rating 25°C (Milliwatts)	Ohmic Range
10	.040 x .037	35	1Ω to 75MΩ
4	.057 x .052	250	1Ω to 100MΩ
13	.083 x .052	400	1Ω to 100MΩ
9	.110 x .052	500	1Ω to 100MΩ
7	.110 x .102	1000	1Ω to 100MΩ
24	.160 x .052	600	1Ω to 100MΩ

* Other standard sizes available.
Write for free literature with detailed resistor chart.

ESTABLISHED RELIABILITY QPL MIL-R-55342 CHIP RESISTORS FOR ALL CRITICAL APPLICATIONS

- Sizes 55342/1 through /6
- Terminations Available: S, R, W, T, U
- Tolerances Available: F, G, J, K
- Meet or exceed Characteristic M
- Delivery: Typically 4 weeks ARO

NEW LOW COST "JR" SERIES COMPUTER/INDUSTRIAL GRADE WRAP AROUND CHIP RESISTOR

TYPE #JR13 — .075(L) x .050(W) x .017(T)

- Resistance Range: 10Ω to 10MΩ to standard EIA/MIL/IEC resistance decade values.
- PDIS Rating (25°C free air): 200 milliwatts.
- Untinned for either epoxy or solder attachment.
- Delivery typically 2 weeks ARO.

THIN FILM

MSTF-2 SERIES

(.020″ x .020″)

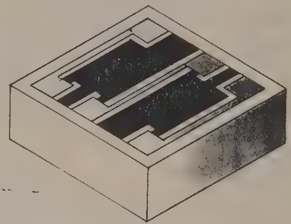
MSTF-3 SERIES

(.030″ x .030″)

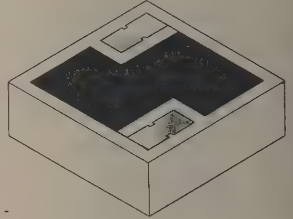
MSTF-4 SERIES

(.040″ x .040″)

CUSTOM NETWORKS



MSTF-3 FORMAT A



MSTF-3 FORMAT B

- Nichrome or Tantalum Nitride
- Choice of Substrates:
  - a) Oxidized Silicon — .010″ ±.003″ Oxide Thickness — 10,000 Å min.
  - b) Ceramic, 99.6% — .010″ ±.001″
- Values range through the RETMA Series from 1Ω up to 10 megohm, depending on chip size.
- Tolerances: ±20%, 10%, 5%, 2%, 1%, 0.5% and 0.1% for most values.
- Backside gold available (3,000 Å typ.) on request.
- MSTF-3 series includes standard center tap dual resistor pattern.
- Visual requirements designed to meet MIL-STD-883 Method 2010.6 with full lot traceability of material and processing.
- Bond pad size: .005″ x .005″ minimum. Bond pad conductor material: Gold (20,000 Å typ.) standard. Bondable with normal wire bonding methods, such as thermocompression, thermosonic, or ultrasonic.
- Nichrome resistors passivated with silicon dioxide (5,000 Å typ.) for moisture protection and reliability. TCR (absolute) can be provided from 0-25 ppm. Special TCR's available on request.
- Noise: −30 to −35 dB typical for most values.
- Stability: 0.05% max. 0.02% typical. ± .003% typical Ratio. (After 1000 hours @ + 125°C.)
- Trimmable: Designed for later active trimming with Xenon or YAG Laser.
- Chip or Packaged

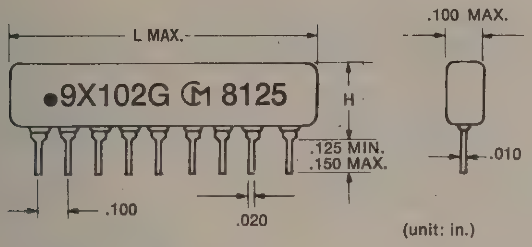
FOR ANY CUSTOM REQUIREMENTS, CONTACT FACTORY

THICK/THIN MULTILAYER SUBSTRATES/ HYBRID MICROCIRCUITS

MINI-SYSTEMS, INC. has the latest materials technology processing capabilities for thick film multilayer substrates/monolithic thick film substrates, and custom resistor networks coupled with complete facilities for hybrid assembly, packaging, and testing. Fully automatic wire bonders and fully automatic laser trim systems give substantial production quantity capabilities.

sip
resistor networks

muRata ERiE
MURATA ERIE NORTH AMERICA, INC.



⅛ Watt H = .200
⅛ Watt H = .250
¼ Watt H = .336 (Except RSC__Y—.250)

X-CIRCUIT

No. Pins	No. of Elements	L
4	3	0.395
5	4	0.495
6	5	0.595
7	6	0.695
8	7	0.795
9	8	0.895
10	9	1.024
11	10	1.100
12	11	1.200
13	12	1.300

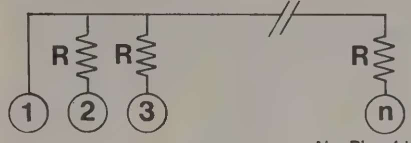
Y-CIRCUIT

No. Pins	No. of Elements	L
6	3	0.595
8	4	0.795
10	5	1.024
12	6	1.200

Z-CIRCUIT

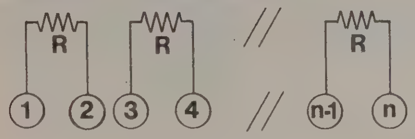
No. Pins	No. of Elements	L
6	8	0.595
8	12	0.795
9	14	0.895
10	16	1.024

X-Circuit — Parallel



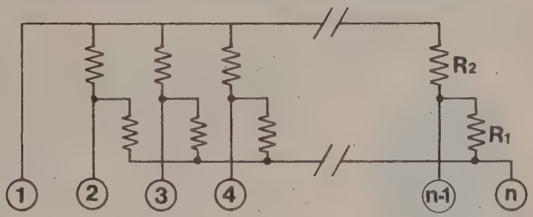
12 Elements Max. N = Pins 4 through 13

Y-Circuit — Discrete



6 Elements Max. N = 6, 8, 10 and 12 Pins

Z-Circuit — Double Termination



16 Elements Max. N = 6, 8, 9 and 10 Pins

SPECIFICATIONS

Electrical

Temp. Range: −55°C to +125°C

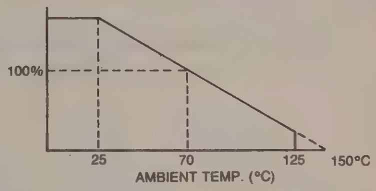
Resistance Range: 47Ω to 750KΩ
(22Ω to 1MΩ available on special request)

Resistance Tolerance: ±2% (G), ±5% (J), ±10% (K), ±20% (M)

Temp. Coefficient: ±200 ppm/°C max.
(±100 ppm/°C max. on special order)

Power: RSC-125 mW max./resistor or 1.5W max./package (whichever is smaller)
RSH-250 mW max/resistor or 2.5W max./package (whichever is smaller)

Power Derating Characteristics:



Mechanical

Substrate Material: Alumina

Resistor Material: Cermet, thick film

Lead Pull Strength: 2 lbs.

Lead Material: Tinned Copper Alloy

STANDARD RESISTANCES

Res. (ohms)	Code	Res. (ohms)	Code	Res. (ohms)	Code	Res. (ohms)	Code
100	101	1K	102	10K	103	100K	104
150	151	1.5K	152	15K	153	150K	154
220	221	2.2K	222	22K	223	220K	224
330	331	3.3K	332	33K	333	330K	334
470	471	4.7K	472	47K	473	470K	474
680	681	6.8K	682	68K	683	680K	684

TYPICAL RESISTANCE COMBINATIONS*

R_1/R_2	R_1/R_2	R_1/R_2
160/240	330/390	330/390
180/390	330/470	1.5K/3.3K
220/330	330/680	3K/6.2K

* **Note 1:** In addition to $R_1 = R_2$ resistance combinations, the typical resistor combinations shown in the chart are available on special order.

2: RC networks also available. Contact Murata Erie for technical details.

MARKING: Pin 1 Location
No. of Pins
Circuit Type
Res. Value
Tolerance
4 = RSH ¼ W only

PART NUMBERING SYSTEM

RSC 6 X 102 G

SINGLE IN-LINE RESISTOR NETWORK
RSC = ⅛ W
RSH = ¼ W

NO. OF PINS

CIRCUIT TYPE
X = Parallel
Y = Discrete
Z = Double Termination

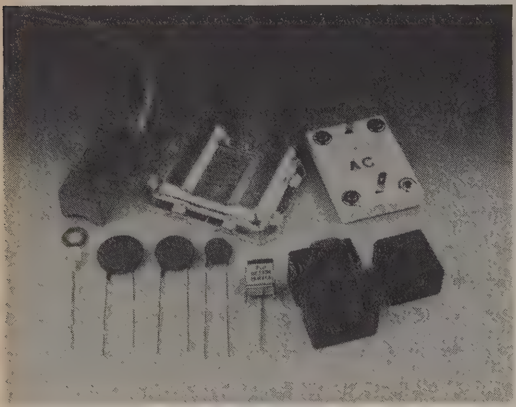
RESISTANCE CODE
First two digits are significant. Last indicates number of zeros.

RESISTANCE TOLERANCE
G = ±2% K = ±10%
J = ±5% M = ±20%

muRata ERiE
MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

posistor® positive temperature coefficient resistors

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.

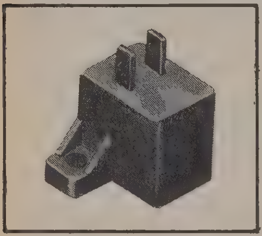


Murata Erie Posistors are basically positive temperature coefficient resistors with a very well defined resistance-temperature "knee" and the unique ability to "switch" relatively large amounts of power. They may also be used as self-regulating heating devices at useful power levels and as control devices for high power heaters. Applications include temperature sensing, over temperature and over current protection and motor starting to name a few.

Products utilizing Positors are extremely safe and reliable and offer all of the design, manufacturing, repair and sales advantages of solid state technology.

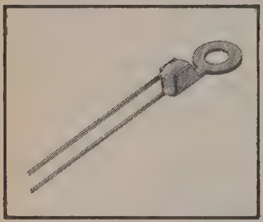
- Compact
- Reduced component count
- Extremely reliable
- "Stepless" temperature control
- Simple repair or replacement
- Long term reliability
- Shock and vibration immunity
- Nonflammable case and insulation available
- No electrical or acoustical noise
- No electrical contacts

FOR MOTOR STARTING



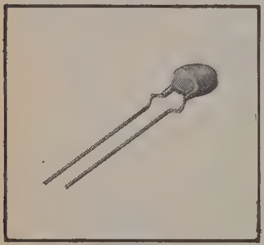
Provides a smooth, solid state electronic starting device for single phase motors utilizing a split-phase starting winding or for PSC motors as a direct replacement for starting capacitors and switches.

FOR SEMICONDUCTOR OVERLOAD PROTECTION



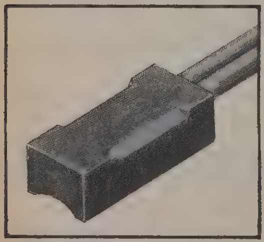
Senses the case temperature of high power semiconductors and appropriately reduces the power dissipation when dangerous power or current levels are reached by switching to a high resistance state and reducing base bias current.

FOR CIRCUIT PROTECTION



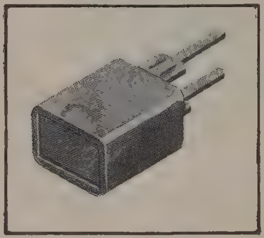
Provides overcurrent protection in a variety of applications. When connected in series with the protected device, Posistors limit the circuit current to a predetermined value — above that value they switch to a high resistance state and limit the current to a safe level.

FOR FREEZE PROTECTION



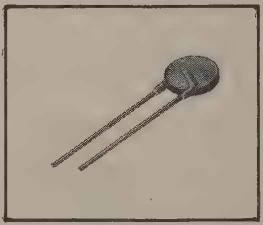
Designed for water filled pipe freeze-protection. Self-temperature regulating. As temperature decreases the Posistor power dissipation increases creating more heat that is conducted to the pipe (approximately 25 watts @ −20°C).

FOR DEGAUSING



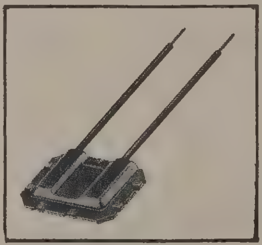
Used in series with CRT degausing coils, the Posistor functions as an automatic switch that goes to a high resistance state in a fixed time period after power is applied, effectively eliminating the current that flows through the degausing coil.

FOR TRANSFORMER PROTECTION



These devices are connected mechanically to the transformer core and electrically in series with the transformer primary. If core temperature exceeds temperature specs, the Posistor switches to a high resistance state and limits input current. It resets automatically when temperature returns to normal.

FOR HIGH POWER HEATING



Posistors for heating are self-temperature regulating with fast thermal response and power ratings to 170 watts.

PELLET HEATERS

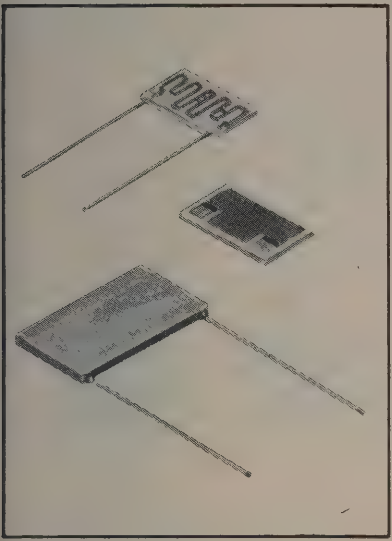
Basic Posistor elements are available in a variety of shapes and electrical characteristics to meet custom application requirements.

muRata ERIE

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

high voltage resistors

MURATA ERIE NORTH AMERICA, INC.



HV resistors

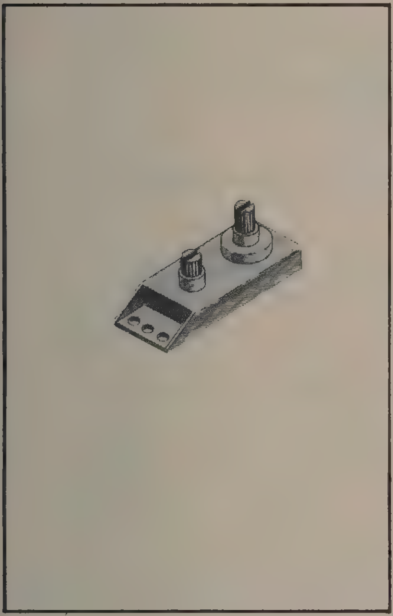
Murata Erie's line of high voltage resistors are designed to replace high voltage carbon film resistors and feature an extremely rigid alumina substrate with a deposited *thick film* resistance element for maximum electrical and mechanical stability.

Three models are offered — the *P Series* is for subassemblies that will be encapsulated in epoxy resin after assembly, the *D Series* which is supplied completely encapsulated and the *F Series* which is supplied encapsulated but without leads.

Murata Erie's application engineers are available to aid in the selection of exactly the right high voltage resistor to meet specific application requirements.

SPECIFICATIONS

Voltage Range	10 to 35 KV
Resistance Range	1 to 5000 Megohms
Power Rating	3 to 5 Watts at −70°C
Operating Temperature Range	−25°C to +130°C
Temperature Coefficient	±150 ppm/°C
Tolerance	±2% to ±20%



focus adjusting resistors

Murata Erie's focus adjusting resistors are designed to meet the stringent demands of high voltage CRT power supply applications. They are offered in a variety of configurations including those with integral capacitors and multiple taps such that most application requirements can be easily met.

TYPICAL CHARACTERISTICS

Item	Condition	Performance
Rated Power	Ambient Temperature: −20°C to +70°C	3W Max.
Temperature Coefficient	Ambient Temperature: −20°C to +120°C	±300 ppm/°C
Voltage Coefficient	Impressed Voltage: 1/10 Rated Voltage (to rated Voltage)	±3 ppm/Volt
Load Life	Ambient Temperature: 70°C; Impressed Voltage: Rated Voltage; Impressed Time: 1000 hours (90 minutes ON, 30 minutes OFF)	△R ≦ ±5% △N ≦ ±3%
Humidity Characteristics	Ambient Temperature: 40°C; Relative Humidity: 95%; Shelf Time: 1000 hours	△R ≦ ±5% △N ≦ ±3%
Thermal Shock Characteristics	1 cycle is −30°C (1 hour) to +130°C (1 hour) — Repeat 10 cycles	△R ≦ ±3% △N ≦ ±2%
Withstanding Voltage	Impressed Voltage: 1½ Rated Voltage; Impressed Time: 1 minute	△R ≦ ±3% No failure

△R denotes variation of resistance value. △N denotes variation of tapped resistance ratio.

NIC COMPONENTS CORPORATION FIXED RESISTORS

RESISTORS GENERAL SPECIFICATIONS AND PRODUCT LIST

I. PRODUCTS LIST

Type	Series Number	Power Rating @70°C	Maximum Working Voltage	Resistance Range	Resistance Tolerance	Temperature Coefficient (ppm/°C)
Carbon Film	NCF16	0.16W	200V	10 ~ 1MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	NCF25	0.25W	300V	1.0 ~ 10MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	NCF50	0.50W	350V	1.0 ~ 10MΩ	±2, ±5%	+350—450 ~ 0—1300
Carbon Film	NCF1W	1W	500V	1.0 ~ 5.1MΩ	±2, ±5%	+350—450 ~ 0—1300
Metal Oxide Film	NMO1W	1W	350V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	NMO2W	2W	350V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	NMO3W	3W	500V	1.0 ~ 100KΩ	±2, ±5%	±350
Metal Oxide Film	NMO5W	5W	750V	5.1 ~ 240KΩ	±2, ±5%	±350
Metal Oxide Film	NMO7W	7W	750V	5.1 ~ 240KΩ	±2, ±5%	±350
Metal Film	NMR25	0.25W	250V	10 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50, ±100
Metal Film	NMR50	0.5W	350V	10 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50, ±100
Metal Film	NMR1W	1W	500V	20 ~ 1MΩ	±0.5, ±1, ±2%	±25, ±50, ±100
ZERO OHM	NZ025	JUMPER TYPE INSULATED RESISTORS				

Note: Higher and lower resistance values are available upon request.

II. GENERAL SPECIFICATIONS

A. ELECTRICAL CHARACTERISTICS

1. POWER
The power rating is the maximum power which can be applied to the resistor continuously at the specified ambient temperature.

2. RATED WORKING VOLTAGE
The rated working voltage is the maximum DC voltage or RMS value of AC voltage which can be applied to the resistor at the specified ambient temperature, and will be calculated by the following formula:

$$\text{RATED WORKING VOLTAGE} = \sqrt{\text{POWER RATING (W)} \times \text{NOM. RESISTANCE } (\Omega)}$$

However, the resistor can not be used over the specified MAXIMUM WORKING VOLTAGE.

3. MAXIMUM WORKING VOLTAGE
The maximum working voltage is the maximum limit of DC voltage or RMS value of AC voltage which can be applied to the resistor at the specified ambient temperature.

4. OVERLOAD VOLTAGE
The overload voltage is 2.5 times of rated working voltage which can be applied on the resistor in a period of 5 seconds at the specified ambient temperature. However, the resistor can not be used over the specified MAXIMUM OVERLOAD VOLTAGE even for a short period.

5. PULSE LOAD VOLTAGE
The pulse load voltage is the maximum pulse voltage specified in JIS C5202, 5.11 which can be applied on the resistor at the specified ambient temperature, and will be calculated by the following formula:

$$E_P = \text{POWER RATING (W)} \times \text{RESISTANCE } (\Omega) \frac{1}{t \times f} \quad \text{(t: time of pulse, f: test frequency)}$$

However, the resistor can not be used over the specified MAXIMUM PULSE VOLTAGE.

B. MECHANICAL CHARACTERISTICS

1. LEAD PULL TEST
The lead wire shall withstand steady pull of the following weight applied axially to the lead wire for the minimum period of 10 seconds without any breakage or damage:

Nom. Lead Diameter	0.4ϕmm	0.5ϕmm	0.6ϕmm	0.7ϕmm	0.8ϕmm & over
Steady Weight	1.0Kgs.	1.0Kgs.	1.5Kgs.	2.0Kgs.	2.5Kgs.

2. LEAD BEND TEST
The lead wire shall withstand minimum 4 bends of 90° rotation without any breakage or damage, when the resistor is placed in a vertical position and is applied with a weight of 0.5Kgs for 0.4—0.5ϕmm or 1.1Kgs for 0.6ϕmm and over lead wire.

3. SOLDERABILITY
The lead wire is immersed into 10% methanol or isopropyl alcohol of rosin by weight for a period of 2±0.5 seconds. Then, it shall be dipped into molten solder (60% Sn & 40% Pb) melted at 230±5°C for a period of 5±1 seconds approximately 1.5mm from the body of the resistor. A new adhering coating of solder shall cover minimum 95% of the surface being dipped into solder.

4. RESISTANCE TO CLEANING SOLVENTS
Color coating or marking shall remain legible after cleaning by solvents such as isopropyl alcohol, trichloroethylene, freon TF/TAC, xyliene etc., in form of liquid or gas.

NIC COMPONENTS CORP. 238 Route 109, Farmingdale, New York 11735 • (516) 694-0060 • (800) 645-9333, 9222

NORTH AMERICAN OPERATIONS NIPPON INDUSTRIES COMPANY LTD.

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE 100S - 1900S RESISTORS

TYPE S RESISTOR ITEM DESCRIPTION

Sage Part Number identification consists of a combination of numerals and letters according to the following guide. This is the nomenclature ordinarily marked on resistors and it fully serves the purpose of purchased item description except for limited cases of special testing. Note that grouping of characters is not constant, but varies to fit descriptive need of a given part.

STYLE DESIGNATION

1500 **S NS** **B** **2740** **1**

Nominal Value, Ohms (decimal symbol, as required, is used in both nominal value and tolerance)

±% tolerance

If applicable

Core Material and Process Classification:
Blank entry indicates regular steatite core, commercial processing
A = alumina core, commercial processing **P** = alumina core, High Rel processing
B = beryllia core, commercial processing **M** = beryllia core, High Rel processing

S = single layer wound; **NS** = non-inductively wound

Body type, size, lead details per catalog chart

SAGE CLIPPER
2600 C

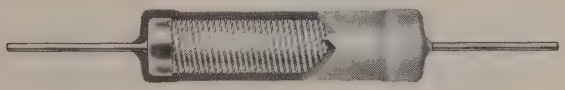
TYPE C

TYPE S

TYPE S CONSTRUCTION

Showing ceramic core, spaced single layer winding, welded to stainless steel cap, and multiple layer coating.

Copperweld leads 60/40 Hot Solder Dip. Lead Length 2″ ±1/16* is supplied on all sizes unless otherwise specified on purchase order.



*Except 250S and 500S Styles, which are 1½″ minimum.

TYPE C METAL SHEATHED RESISTORS

Similar in all respects to Type S, fully insulated plus addition of metal sleeve for heat sink mounting in spring clip holders.
Full heat sink rating.

STYLE	Rating Watts Full heat sink rating	SAGE BODY STYLE NO.	WATTAGE DATA (25°C AMBIENT) IND. STD.	SAGE CAPABILITY CHAR. G OR U 275°C	SAGE CAPABILITY CHAR: V 350°C	PHYSICAL DATA LEAD WIRE AWG NO.	PHYSICAL DATA BODY LENGTH INCHES	PHYSICAL DATA BODY DIAMETER INCHES	BODY DIELECTRIC STRENGTH VOLT rms	STD. RESISTANCE RANGE REGULAR WINDING MIN.	REGULAR WINDING MAX.	NON-INDUCTIVE MIN.	NON-INDUCTIVE MAX.
		100S	1	1.2	1.7	24-.020	.400 Nom.*	.094±.031	500	0.1	8400	10	3000
		200S	2	2.1	3	24-.020	.400 Nom.*	.125±.031	500	0.1	11,000	10	3900
		250S	.25	.6	1	24-.020	.250±.031	.078±.016	500	0.1	3800	10	1350
		300S	3	3	3.6	24-.020	.400 Nom.*	.187±.031	500	0.1	15,000	10	5300
		500S	.5	.9	1.2	24-.020	.312±.031	.078±.016	500	0.1	5000	10	1750
		1000S	1	1.2	1.7	24-.020	.406±.031	.094±.031	750	0.1	8400	10	3000
		1100S	2	2.3	3.4	20-.032	.500±.062	.125±.031	1000	0.1	15,000	10	5500
2200C	6	1200S	2, 3	3	4	20-.032	.500±.062	.187±.031	1000	0.1	20,000	10	7000
		1240S	3	3.2	4.2	20-.032	.562±.062	.187±.031	1000	0.1	24,000	10	8400
2250C	6	1250S	2, 3	3.5	5	20-.032	.812±.062	.187±.031	1000	0.1	40,000	10	14,000
		1300S	3	4.2	5.5	18-.040	.625±.062	.250±.031	1000	0.1	30,000	10	10,500
2400C	7	1400S	3, 4	4.3	5.6	18-.040	.750±.062	.250±.031	1000	0.1	42,000	10	15,000
		1500S	5	5.3	7.5	18-.040	.875±.062	.312±.031	1000	0.1	71,000	10	25,000
2550C	11	1550S	5	6	8	18-.040	1.000±.062	.312±.031	1000	0.1	88,000	10	31,000
2600C	14	1600S	7	7	9	18-.040	1.219±.062	.312±.031	1000	0.1	114,000	10	40,000
		1700S	10	10	12	18-.040	1.781±.062	.375±.031	1000	0.1	230,000	10	80,000
		1900S	7	10	12	18-.040	1.375±.062	.431±.031	1000	0.1	210,000	10	73,000
		1950S	10	11	15	18-.040	1.937±.062	.431±.031	1000	0.1	314,000	10	110,000

Body dia. may exceed that of 1100NS and smaller sizes, also values less than 0.1Ω.

* Clean lead to clean lead = .450 Max.

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

TYPE RWR
MIL-R-39007
RESISTORS

INDUSTRY'S FINEST RESISTORS

MIL-R-39007
ESTABLISHED RELIABILITY
FAILURE RATES M, P, AND R .01%/1000 HRS.
RESISTANCE TOLERANCE ±1%
TEMPERATURE COEFFICIENT
±20 PPM/°C MAX. 10Ω AND HIGHER
±50 PPM/°C MAX. 1Ω TO 10Ω
±90 PPM/°C MAX. .1Ω TO 1Ω

ALL STYLES AVAILABLE WITH SOLDERABLE (S) OR WELDABLE (W) TERMINALS

ALSO: NON-INDUCTIVELY WOUND (N)

TYPE DESIGNATIONS

MIL STYLE	DETAIL SPEC. NO.	SAGE STYLE	MIL WATTS @ 25°C	AVAILABLE RESISTANCE RANGE
RWR80S RWR80W	/8E /8E	1009SM 1007SM	2	.10Ω to 2.67K
RWR81S RWR81W	/9C /9C	259SM 257SM	1	.10Ω to 1.0K
RWR89S RWR89W	/11C /11C	1249SM 1247SM	3	.10Ω to 4.12K
RWR84S RWR84W	/10C /10C	1509SM 1507SM	7	.10Ω to 12.4K
RWR71S RWR71W	/5D /5D	1259SP 1257SP	2	.10Ω to 16.2K
RWR74S RWR74W	/6C /6C	1509SP 1507SP	5	.10Ω to 12.1K
RWR78S RWR78W	/7C /7C	1709SP 1707SP	10	.10Ω to 39.2K

EXAMPLE PART DESIGNATION:

RWR-74 S 49R9 F R

Body style — RWR-74

Terminals — S
S — Solderable
W — Weldable
N — Non-inductive

Nominal res., Ω. Three significant digits plus fourth indicating number of zeroes. Below 100Ω, R-decimal and following digits are significant. — 49R9

Tolerance ±1% — F

Life failure rate — R

MIL-R-26E TYPE DESIGNATIONS

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE Single layer wound .00175 min. wire dia.	DEFINED OHMIC RANGE .001 min. wire dia.
RW55V	1900S	7	.1—5100	
RW56V	1950S	14	.1—9100	
RW67V	1550S	6.5	.1—3600	.1—8200
RW68V	1700S	11	.1—8200	.1—20K
RW69V	1200S	3	.1—910	.1—2K

EXAMPLE: RW69 V 471

Body Style — RW69

Characteristic, V only (350° C max.) — V

Nominal resistance, Ω. Two significant digits plus third indicating number of zeros. Below 10ΩR = decimal and last digit is significant. — 471

TOLERANCE: ±5% for values 1Ω and up; ±10% below 1Ω. TC: ±260 ppm/°C 20Ω and up; 400 ppm/° below 20Ω.

MIL STYLE	SAGE STYLE	MIL WATTS	VOLTAGE Max.	DEFINED OHMIC RANGE Min.	DEFINED OHMIC RANGE Max. for .001" wire (Navy)	DEFINED OHMIC RANGE Max. for .0008" wire(all other)
RW70U	1000S	1	—	.1	1210	3160
RW74U	1500S	5	300	.1	12100	38300
RW78U	1700S	10	720	.1	40200	90900
RW79U	1240S	3	135	.1	3570	10500
RW80U	1000SB	2	—	.1	1240	3160
RW81U	250SB	1	25	.1	649	—

EXAMPLE: RW70 U 49R9 F

Body Style — RW70

Characteristic, U only (275°C max) — U

Nominal resistance, Ω. Three significant digits plus fourth indicating number of zeros. Below 10CΩR decimal and following digits are significant. — 49R9

Tolerance ± % — F
F = 1.0%
B = .1%
D = .5%

TC: ±30 ppm/°C 10Ω and above/±50 ppm/°C 1Ω to 10Ω/±90 ppm/°C below 1Ω.

SAGE SILICONE COATED fixed wirewound units are not ordinary power resistors. They provide remarkable miniaturization vs. required wattage performance. Sage has pioneered the area of power handling capacity combined with precision and stability features ordinarily associated with Mil-R-93 resistors.

TYPE SB & NSB HIGH WATTAGE COMMERCIAL BERYLLIA CORE RESISTORS

Standard Solderable Leads	Rated Watts G	Rated Watts V	Approx. Grams Weight
250SB	1	1.5	.18
500SB	1.5	2	.28
1000SB	2.25	2.75	.32
1200SB	3.5	4.5	1.0
1240SB	4	5	1.1
1250SB	4.5	6	1.2
1300SB	6	8	1.8
1500SB	7	9	3.6
1600SB	9	12	4.2
1700SB	14	18	7.3

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

SAGE TYPE M item identification is as follows:

3225 M B 360 — 1

- **1**: ±% tolerance
- **360**: Nominal value, Ohms. Decimal symbol, as required, is used in both nominal value and tolerance.
- **B** (If applicable): Core Material & Process Classification. Blank entry indicates regular alumina core and commercial processing.
  - **B** = beryllia core, commercial processing
  - **P** = alumina core, High Rel processing
  - **M** = beryllia core, High Rel processing
- **M**: **M** for regular single layer winding; **NM** for non-inductive winding
- **3225**: Body style

STYLE		RATED WATTS 25°C AMBIENT					DIELECTRIC TEST VOLTS rms	WORK-VOLTS MAX. DC or rms	STD. RESISTANCE RANGE, OHMS		MIL-R-18546, OHMS	
		SAGE			MIL-R-18546							
		ON CHASSIS										
SAGE	MIL-R 18546	STD	HI REL	FREE AIR	ON CHASSIS	FREE AIR			MIN.	MAX.	MIN.	MAX.
3105M	RE60G	8	6	4	5	3	1000	440	.1	24,000	.1	3320
3105NM	RE60N	8	6	4	5	3	1000	260	1.0	8400	1.0	1650
3010M	RE65G	14	10	6	10	6	1000	650	.1	30,000	.1	5620
3010NM	RE65N	14	10	6	10	6	1000	380	1.0	10,500	1.0	2800
3225M	RE70G	25	20	12	20	8	1500	1000	.1	71,000	.1	12,000
3225NM	RE70N	25	20	12	20	8	1500	790	1.0	25,000	1.0	6040
3550M	RE75G	50	40	16	30	10	2000	1500	.1	230,000	.1	39,200
3550NM	RE75N	50	40	16	30	10	2000	1500	1.0	80,000	1.0	19,600

OUTLINE DIMENSIONS

STYLE Dimensions: inches	3105 M NM	3010 M NM	3225 M NM	3550 M NM
A ± .062	1.125	1.375	1.937	2.781
B ± .005	.490	.625	.781	.844
C ± .010	.078	.094	.172	.172
D ± .005	.444	.562	.719	1.562
E ± .016	.600	.750	1.062	1.906
F ± .062	.250	.312	.437	.437
G ± .015	.334	.406	.500	.562
H ± .015	.245	.312	.390	.422
J ± .015	.646	.812	1.094	1.156
K ± .005	.093	.093	.125	.125
L ± .015	.317	.422	.562	.625
M ± .015	.145	.219	.312	.344
N ± .010	.075	.078	.078	.094
P ± .015	.156	.187	.344	.344
R ± .015	.078	.094	.172	.172
Mount Screw	#2	#2	#4	#4
Terminal ± .005 Punched Holes	.050	.085	.085	.085

TYPE 3105M - 3550M RESISTORS

TYPE MB HIGH WATTAGE

BERYLLIUM OXIDE CORES

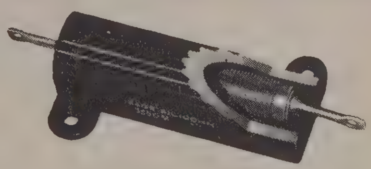
STYLE	RATED WATTS 25°C ambient	
	chassis mounted	free air
3105 MB NMB	15	6
3010 MB NMB	20	8
3225 MB NMB	35	14
3550 MB NMB	50	20

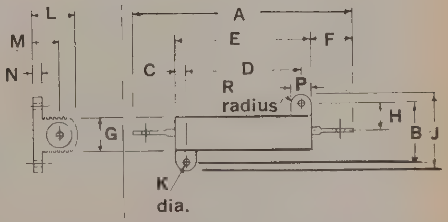
MB suffic designates regular single layer wind, NMB non-inductive wind.

RE65	G	1001
Style	Characteristic, 275°C Max. G for regular inductive winding. N for non-inductive winding.	Nominal resistance, Ω. ±1% only. Three significant digits plus fourth indicating number of zeros. Below 100Ω R = decimal and following digits are significant.

T.C. ±30 ppm/°C 2000Ω and above
±50 ppm/°C under 2000Ω

TYPE M — METAL CLAD CHASSIS MOUNT RESISTORS





Leads: Copperweld, 60-40 Solder Coated
Body: Black Anodized Aluminum

OHMITE® Series 22 5% tolerance

conformal vitreous enamel axial lead wirewound resistors

OHMITE
20J10R

FEATURES

- **Rugged Vitreous Enamel Coating Withstands Severe Humidity and Temperature Cycling**
- **Economical**
- **All Welded Construction**
- **Ideal for Machine Insertion**

Advanced conformal vitreous enamel coating protects resistors, even in environments of high heat. These rugged, economical wirewound resistors are recommended for industrial applications where quality construction and reliable operation are prime specifying parameters.

The items listed in the chart are standard stock items. Other values and wattages are also available in accordance with the following applications.

SPECIFICATIONS

Tolerance: ±5% std. ±1% to ±10% available.

Temperature Coefficient:
0 ±30 ppm/°C 10 ohms and above
0 ±50 ppm/°C 1 to 9.99 ohms
0 ±90 ppm/°C below 1 ohm.

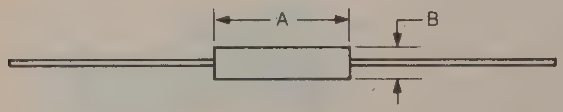
Dielectric Withstanding Voltage:
1000 VAC. (500 VAC for 1 watt type.)

Overload: 10X rated wattage for 5 sec. for 5 watt size and larger. 5X rated wattage for 5 sec. under 5 watt size.

Inductance: Standard units have single layer inductive winding. Low inductance windings available.

Core: Steatite ceramic.

Coating: Conformal vitreous enamel.



Watts	Type	Resistance Range Min.-Max.	Body Dimensions				Leads 1.5" (38.1mm) Ga.
			Max. Lgth.—A		Max. Dia.—B		
			In.	MM	In.	MM	
1	221	.1—6.1K	.406	10.3	.156	4.0	22
2	222	.1—8.7K	.406	10.3	.219	5.6	20
3	223	.1—22K	.562	14.3	.250	6.4	20
5	225	.1—54K	1.000	25.4	.250	6.4	20
6	226	.1—89K	1.031	26.2	.343	8.7	20
7	227	.1—118K	1.250	31.8	.343	8.7	20
10	220	.1—190K	1.797	45.6	.343	8.7	20
12.5	220P	.1—21K	1.812	46.0	.406	10.3	18

Resistance Ohms	Catalog Numbers				
	1 Watt	3 Watt	5 Watt	7 Watt	10 Watt
1.0	21J1R0	23J1R0	25J1R0	27J1R0	20J1R0
1.5	21J1R5	23J1R5	25J1R5	(27J1R5)	20J1R5
2.0	21J2R0	23J2R0	25J2R0	(27J2R0)	20J2R0
2.2	21J2R2	23J2R2	25J2R2	(27J2R2)	20J2R2
3.0	21J3R0	23J3R0	25J3R0	27J3R0	20J3R0
4.0	21J4R0	23J4R0	25J4R0	(27J4R0)	20J4R0
5.0	21J5R0	23J5R0	25J5R0	27J5R0	20J5R0
7.5	21J7R5	23J7R5	25J7R5	(27J7R5)	20J7R5
10.0	21J10R	23J10R	25J10R	27J10R	20J10R
12.0	21J12R	23J12R	25J12R	(27J12R)	20J12R
15.0	21J15R	23J15R	25J15R	27J15R	20J15R
18.0	21J18R	23J18R	25J18R	(27J18R)	20J18R
20.0	21J20R	23J20R	25J20R	(27J20R)	20J20R
22.0	21J22R	23J22R	25J22R	27J22R	20J22R
25.0	21J25R	23J25R	25J25R	(27J25R)	20J25R
27.0	21J27R	23J27R	25J27R	(27J27R)	20J27R
30.0	21J30R	23J30R	25J30R	(27J30R)	20J30R
33.0	21J33R	23J33R	25J33R	(27J33R)	20J33R
35.0	21J35R	23J35R	25J35R	(27J35R)	20J35R
39.0	21J39R	23J39R	25J39R	(27J39R)	(20J39R)
40.0	21J40R	23J40R	25J40R	27J40R	20J40R
47.0	21J47R	23J47R	25J47R	(27J47R)	20J47R
50.0	21J50R	23J50R	25J50R	27J50R	20J50R
56.0	21J56R	23J56R	25J56R	(27J56R)	20J56R
62.0	21J62R	23J62R	25J62R	(27J62R)	(20J62R)
68.0	21J68R	23J68R	25J68R	(27J68R)	
75.0	21J75R	23J75R	25J75R	27J75R	20J75R
82.0	21J82R	23J82R	25J82R	(27J82R)	20J82R
100	21J100	23J100	25J100	27J100	20J100
120	21J120	23J120	5J120	(27J120)	(20J120)
125	(21J125)	23J125	25J125	(27J125)	20J125
150	21J150	23J150	25J150	(27J150)	20J150
180	21J180	23J180	25J180	27J180	20J180
200	(21J200)	23J200	25J200	27J200	20J200
220	(21J220)	23J220	25J220	(27J220)	20J220
225	21J225	23J225	25J225	(27J225)	(20J225)
250	21J250	23J250	25J250	(27J250)	20J250
270	21J270	23J270	25J270	(27J270)	(20J270)
300	21J300	23J300	25J300	(27J300)	20J300
330	21J330	23J330	25J330	(27J330)	20J330
350	21J350	(23J350)	25J350	(27J350)	20J350
390	21J390	23J390	25J390	(27J390)	(20J390)
400	21J400	23J400	25J400	(27J400)	20J400
450	21J450	23J450	25J450	(27J450)	20J450
470	21J470	23J470	25J470	(27J470)	20J470
500	21J500	23J500	25J500	27J500	20J500
560	21J560	23J560	25J560	(27J560)	20J560
600	21J600	23J600	25J600	27J600	20J600
680	21J680	23J680	25J680	(27J680)	20J680
750	21J750	23J750	25J750	(27J750)	20J750
800	21J800	23J800	25J800	(27J800)	20J800
820	21J820	23J820	(25J820	(27J820)	20J820
900	21J900	23J900	25J900	(27J900)	20J900
1000	(21J1K0)	23J1K0	25J1K0	(27J1K0)	20J1K0
1100	(21J1K1)	23J1K1	25J1K1	(27J1K1)	(20J1K1)
1200	(21J1K2)	23J1K2	25J1K2	27J1K2	20J1K2
1500	(21J1K5)	23J1K5	25J1K5	(27J1K5)	(20J1K5)
1800	(21J1K8)	(23J1K8)	(25J1K8)	(27J1K8)	(20J1K8)
2000	(21J2K0)	23J2K0	25J2K0	(27J2K0)	20J2K0
2200	(21J2K2)	23J2K2	25J2K2	(27J2K2)	20J2K2
2500	(21J2K5)	23J2K5	25J2K5	(27J2K5)	20J2K5
2700	(21J2K7)	23J2K7	(25J2K7)	(27J2K7)	20J2K7
3000	(21J3K0)	23J3K0	25J3K0	(27J3K0)	20J3K0
3300		23J3K3	25J3K3	(27J3K3)	20J3K3
3500		23J3K5	25J3K5	(27J3K5)	20J3K5
3900		23J3K9	25J3K9	(27J3K9)	20J3K9
4000		23J4K0	25J4K0	(27J4K0)	20J4K0
4500		23J4K5	25J4K5	(27J4K5)	20J4K5
4700		23J4K7	25J4K7	(27J4K7)	20J4K7
5000		23J5K0	25J5K0	(27J5K0)	20J5K0
6000		23J6K0	25J6K0	(27J6K0)	20J6K0
6800		23J6K8	25J6K8	(27J6K8)	(20J6K8)
7000		23J7K0	25J7K0	(27J7K0)	20J7K0
7500		23J7K5	25J7K5	(27J7K5)	20J7K5
8000		23J8K0	25J8K0	(27J8K0)	(20J8K0)
9000		23J9K0	(25J9K0)	(27J9K0)	(20J9K0)
10,000		23J10K	25J10K	27J10K	20J10K
12,000			25J12K	(27J12K)	20J12K
13,000				(27J13K)	20J13K
15,000			25J15K	(27J15K)	20J15K
17,000				(27J17K)	(20J17K)
20,000			25J20K	27J20K	20J20K
22,000			25J22K	(27J22K)	20J22K
25,000			25J25K	(27J25K)	20J25K
30,000					20J30K
33,000					(20J33K)
35,000					20J35K
40,000					20J40K
50,000					20J50K

OHMITE® type 995 MOLDED axial lead vitreous enameled resistors

FEATURES

- **Unique Molded Construction Provides Consistent Shape & Size**
- **Exceeds MIL-R-26 Moisture Requirements**
- **Endures Heat Up to 1500 F**
- **All Welded Construction**
- **Ideal for Machine Insertion and High Density Circuits**

Series 99 molded vitreous wirewound resistors are high performance components designed for precision instrumentation, medical equipment and other applications demanding high reliability and stable operation. MIL-R-26 approved units are available for Military Application.

The items listed below are standard stock items. In addition items in accordance with the specifications shown are available on special order.

SPECIFICATIONS

Tolerance: ±5% std. ±.25% to ±10% available. 2 ohm minimum for tolerances closer than ±1%.

Temperature Coefficient: 0 ± 30 ppm/°C 10 ohms and above 0 ±100 ppm/°C 1 to 10 ohms 0 ±200 ppm/°C below 1 ohm.

Dielectric Withstanding Voltage: 1000 VAC. 500 VAC for 1 watt size.

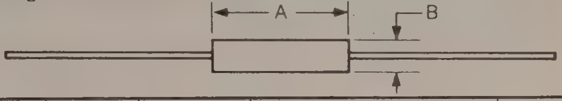
Overload: 10X rated wattage for 5 sec. for 5 watt size and larger. 5X rated wattage for 5 sec. under 5 watt size.

Wattage Rating: May be increased by using metal mounting clips as a heat sink.

Inductance: Standard units have single layer inductive winding. Non-inductive (Aryton Perry or limited inductance) windings available.

Core: Steatite ceramic.

Coating: Molded vitreous enamel.



Watts	Type	Resistance Range Min.-Max.	Body Dimensions Max. Lgth.—A In.	MM	Max. Dia.—B In.	MM	Leads 1.5″ (38.1mm) Ga.
1.5	995-1A	.1—6.65K	.437	11.1	.140	3.6	24
2.25	995-2A	.1—6.49K	.390	9.9	.219	5.6	20
3.25	995-3A	.1—22.1K	.562	14.3	.234	5.9	20
5	995-5B	.1—53.6K	.953	24.2	.234	5.9	20
6.5	995-5A	.1—80.6K	.937	23.8	.343	8.7	20
9	995-7A	.1—118K	1.233	31.3	.343	8.7	20
11	995-10A	.1—187K	1.796	45.6	.343	8.7	20
15	995-15A	.1—243K	2.015	51.2	.425	10.8	20

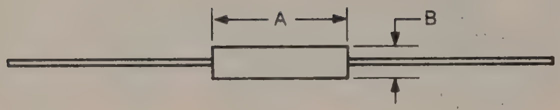
	1½ WATT .422″ x .125″ Dia. Style 995-1A Avg. Wt., .0009 lb.		2¼ WATT .375″ x .188″ Dia. Style 995-2A Avg. Wt., .0018 lb.		3¼ WATT .547″ x .203″ Dia. Style 995-3A Avg. Wt., .003 lb.		5 WATT .938″ x .203″ Dia. Style 995-5B Avg. Wt., .004 lb.		11 WATT 1.781″ x .312″ Dia. Style 995-10A Avg. Wt., .015 lb.	
Ohms	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.
1.0	4030	91J1R0	3860	92J1R0	4330	93J1R0	4530	95J1R0	4730	90J1R0
1.1	4031	91J1R1	(3861)	92J1R1	(4331)	93J1R1	(4531)	95J1R1	(4731)	90J1R1
1.2	4032	91J1R2	3862	92J1R2	4332	93J1R2	(4532)	95J1R2	4732	90J1R2
1.3	4033	91J1R3	3863	92J1R3	(4333)	93J1R3	(4533)	95J1R3	(4733)	90J1R3
1.5	4034	91J1R5	3864	92J1R5	4334	93J1R5	4534	94J1R5	4734	90J1R5
1.6	4035	91J1R6	(3865)	92J1R6	(4335)	93J1R6	(4535)	95J1R6	(4735)	90J1R6
1.8	4036	91J1R8	(3866)	92J1R8	4336	93J1R8	(4536)	95J1R8	4736	90J1R8
2.0	4037	91J2R0	3867	92J2R0	4337	93J2R0	4537	95J2R0	4737	90J2R0
2.2	4038	91J2R2	3868	92J2R2	4338	93J2R2	4538	95J2R2	4738	90J2R2
2.4	4039	91J2R4	3869	92J2R4	4339	93J2R4	4539	95J2R4	4739	90J2R4
2.7	4041	91J2R7	(3871)	92J2R7	4341	93J2R7	4541	95J2R7	(4741)	90J2R7
3.0	4042	91J3R0	3872	92J3R0	4342	93J3R0	4542	95J3R0	4742	90J3R0
3.3	4043	91J3R3	3873	92J3R3	4343	93J3R3	4543	95J3R3	4743	90J3R3
3.6	4044	91J3R6	(3874)	92J3R6	(4344)	93J3R6	(4544)	95J3R6	(4744)	90J3R6
3.9	4045	91J3R9	(3875)	92J3R9	4345	93J3R9	4545	95J3R9	(4745)	90J3R9
4.0	4046	91J4R0	3876	92J4R0	4346	93J4R0	4546	95J4R0	4746	90J4R0
4.3	4047	91J4R3	(3877)	92J4R3	(4347)	93J4R3	(4547)	95J4R3	(4747)	90J4R3
4.7	4048	91J4R7	3878	92J4R7	4348	93J4R7	4548	95J4R7	4748	90J4R7
5.0	4049	91J5R0	3879	92J5R0	4349	93J5R0	4549	95J5R0	4749	90J5R0
5.1	(4050)	91J5R1	(3880)	92J5R1	4350	93J5R1	(4550)	95J5R1	(4750)	90J5R1
5.6	4051	91J5R6	3881	92J5R6	4351	93J5R6	4551	95J5R6	4751	90J5R6
6.2	4053	91J6R2	3883	92J6R2	4353	93J6R2	4553	95J6R2	4753	90J6R2
6.8	4054	91J6R8	3884	92J6R8	4354	93J6R8	4554	95J6R8	4754	90J6R8
7.5	4056	91J7R5	3886	92J7R5	4356	93J7R5	4556	95J7R5	4756	90J7R5
8.2	(4058)	91J8R2	3888	92J8R2	4358	93J8R2	4558	95J8R2	4758	90J8R2
9.1	(4060)	91J9R1	(3890)	92J9R1	(4360)	93J9R1	4560	95J9R1	(4760)	90J9R1
10	4061	91J10R	3891	92J10R	4361	93J10R	4561	95J10R	4761	90J10R
11	(4062)	91J11R	(3892)	92J11R	(4362)	93J11R	(4562)	95J11R	4762	90J11R
12	4063	91J12R	3893	92J12R	4363	93J12R	4563	95J12R	4763	90J12R
13	(4064)	91J13R	(3894)	92J13R	(4364)	93J13R	(4564)	95J13R	(4764)	90J13R
15	(4065)	91J15R	3895	92J15R	4365	93J15R	4565	95J15R	4765	90J15R
16	4066	91J16R	(3896)	92J16R	(4366)	93J16R	4566	95J16R	4766	90J16R
18	4067	91J18R	3897	92J18R	4367	93J18R	4567	95J18R	4767	90J18R
20	4068	91J20R	3898	92J20R	4568	93J20R	4568	95J20R	4768	90J20R
22	4069	91J22R	3899	92J22R	4369	93J22R	4569	95J22R	4769	90J22R
24	(4070)	91J24R	(3900)	92J24R	(4370)	93J24R	4570	95J24R	4770	90J24R
25	4071	91J25R	(3901)	92J25R	4371	93J25R	4571	95J25R	4771	90J25R
27	4072	91J27R	3902	92J27R	4372	93J27R	4572	95J27R	4772	90J27R
30	4073	91J30R	3903	92J30R	4373	93J30R	4573	95J30R	4773	90J30R
33	4074	91J33R	(3904)	92J33R	4374	93J33R	4574	95J33R	4774	90J33R
35	(4074A)	91J35R	(3905)	92J35R	4374A	93J35R	4574A	95J35R	4774A	90J35R
36	4075	91J36R	(3906)	92J36R	(4375)	93J36R	4575	95J36R	4775	90J36R
39	4076	91J39R	3907	92J39R	4376	93J39R	4576	95J39R	4776	90J39R
40	(4077)	91J40R	(3908)	92J40R	(4377)	93J40R	4577	95J40R	4777	90J40R
43	(4078)	91J43R	(3909)	92J43R	4378	93J43R	4578	95J43R	(4778)	90J43R
47	4079	91J47R	3910	92J47R	4379	93J47R	4579	95J47R	4779	90J47R
50	4080	91J50R	3911	92J50R	4380	93J50R	4580	95J50R	4780	90J50R
51	4081	91J51R	3912	92J51R	4381	93J51R	4581	95J51R	(4781)	90J51R
56	4082	91J56R	(3913)	92J56R	4382	93J56R	4582	95J56R	4782	90J56R
62	4084	91J62R	(3915)	92J62R	4384	93J62R	4584	95J62R	4784	90J62R
68	4085	91J68R	3916	92J68R	4385	93J68R	4585	95J68R	4785	90J68R
75	4087	91J75R	3918	92J75R	4387	93J75R	4587	95J75R	4787	90J75R
82	4089	91J82R	(3920)	92J82R	4389	93J82R	4589	95J82R	4789	90J82R
91	4091	91J91R	3922	92J91R	4391	93J91R	4591	95J91R	4791	90J91R
100	4092	91J100	3923	92J100	4392	93J100	4592	95J100	4792	90J100
110	(4093)	91J110	(3924)	92J110	4393	93J110	4593	95J110	(4793)	90J110
120	4094	91J120	3925	92J120	4394	93J120	4594	95J120	4794	90J120
130	(4095)	91J130	3926	92J130	4395	93J130	4595	95J130	4795	90J130
150	4096	91J150	3927	92J150	4396	93J150	4596	95J150	4796	90J150
160	(4097)	91J160	3928	92J160	4397	93J160	4597	95J160	4797	90J160
180	4098	91J180	3929	92J180	4398	93J180	4598	95J180	4798	90J180
200	4099	91J200	3930	92J200	4399	93J200	4599	95J200	4799	90J200
220	4100	91J220	3931	92J220	4400	93J220	4600	95J200	4800	90J220
240	4101	91J240	(3932)	92J240	4401	93J240	4601	95J240	4801	90J240
250	4102	91J250	3933	92J250	4402	93J250	4602	95J250	4802	90J250
270	4103	91J270	3934	92J270	4403	93J270	4603	95J270	4803	90J270
300	4104	91J300	3935	92J300	4404	93J300	4604	95J300	4804	90J300
330	4105	91J330	3936	92J330	4405	93J330	4605	95J330	4805	90J330
350	(4105A)	91J350	3937	92J350	4405A	93J350	4605A	95J350	4805A	90J350
360	4106	91J360	3938	92J360	4406	93J360	4606	95J360	(4806)	90J360
390	4107	91J390	3939	92J390	4407	93J390	4607	95J390	4807	90J390
400	4108	91J400	3940	92J400	4408	93J400	4608	95J400	4808	90J400
430	4109	91J430	3941	92J430	4409	93J430	4609	95J430	4809	90J430
450	4109A	91J450	(3942)	92J450	4409A	93J450	4609A	95J450	(4809A)	90J450
470	4110	91J470	3943	92J470	4410	93J470	4610	95J470	4810	90J470
500	4111	91J500	3944	92J500	4411	93J500	4611	95J500	4811	90J500
510	4112	91J510	3945	92J510	4412	93J510	4612	95J510	(4812)	90J510
560	4113	91J560	3946	92J560	4413	93J560	4613	95J560	4813	90J560
600	4114	91J600	3947	92J600	4414	93J600	4614	95J600	4814	90J600
620	4115	91J620	3948	92J620	4415	93J620	(4615)	95J620	(4815)	90J620
680	(4116)	91J680	3949	92J680	4416	93J680	4616	95J680	4816	90J680
700	4117	91J700	(3950)	92J700	4417	93J700	4617	95J700	(4817)	90J700
750	4118	91J750	3951	92J750	4418	93J750	4618	95J750	4818	90J750
800	4119	91J800	(3952)	92J800	4419	93J800	4619	95J800	4819	90J800
820	4120	91J820	3953	92J820	4420	93J820	4620	95J820	4820	90J820
900	(4121)	91J900	(3954)	92J900	4421	93J900	(4621)	95J900	(4821)	90J900
910	4122	91J910	(3955)	92J910	4422	93J910	(4622)	95J910	(4822)	90J910
1000	4123	91J1K0	3956	92J1K0	4423	93J1K0	4623	95J1K0	4823	90J1K0
1100	(4124)	91J1K1	3957	92J1K1	(4424)	93J1K1	(4624)	95J1K1	4824	90J1K1
1200	4125	91J1K2	3958	92J1K2	4425	93J1K2	4625	95J1K2	4825	90J1K2
1300	4126	91J1K3	(3959)	92J1K3	4426	93J1K3	(4626)	95J1K3	4826	90J1K3
1400	4126A	91J1K4	(3960)	92J1K4	(4426A)	93J1K4	(4626A)	95J1K4	4826A	90J1K4
1500	4127	91J1K5	3961	92J1K5	4427	93J1K5	4627	95J1K5	4827	90J1K5
1600	(4128)	91J1K6	(3962)	92J1K6	4428	93J1K6	4628	95J1K6	4828	90J1K6
1800	4129	91J1K8	(3963)	92J1K8	4429	93J1K8	4629	95J1K8	4829	90J1K8
2000	4130	91J2K0	3964	92J2K0	4430	93J2K0	4630	95J2K0	4830	90J2K0
2200	4131	91J2K2	3965	92J2K2	4431	93J2K2	4631	95J2K2	4831	90J2K2
2400	4132	91J2K4	(3966)	92J2K4	4432	93J2K4	4632	95J2K4	(4832)	90J2K4
2500	4133	91J2K5	3967	92J2K5	4433	93J2K5	4633	95J2K5	4833	90J2K5
2700	(4134)	91J2K7	(3968)	92J2K7	4434	93J2K7	4634	95J2K7	4834	90J2K7
3000	4135	91J3K0	3969	92J3K0	4435	93J3K0	4635	95J3K0	4835	90J3K0
3300					4436	93J3K3	4636	95J3K3	4836	90J3K3
3500					4436A	93J3K5	4636A	95J3K5	4836A	90J3K5
3600					4437	93J3K6	4637	95J3K6	4837	90J3K6
3900					4438	93J3K9	4638	95J3K9	4838	90J3K9
4000					4439	93J4K0	4639	95J4K0	4839	90J4K0
4300					(4440)	93J4K3	(4640)	95J4K3	4840	90J4K3
4500					4440A	93J4K5	4640A	95J4K5	4840A	90J4K5
4700					4441	93J4K7	4641	95J4K7	4841	90J4K7
5000					4442	93J5K0	4642	95J5K0	4842	90J5K0
5100					4443	93J5K1	4643	95J5K1	4843	90J5K1
5600					4444	93J5K6	4644	95J5K6	4844	90J5K6
6000					4445	93J6K0	4645	95J6K0	4845	90J6K0
6200					4446	93J6K2	4646	95J6K2	4846	90J6K2
6800					4447	93J6K8	4647	95J6K8	4847	90J6K8
7000					4448	93J7K0	4648	95J7K0	(4848)	90J7K0
7500					4449	93J7K5	4649	95J7K5	4849	90J7K5
8000					4450	93J8K0	4650	95J8K0	4850	90J8K0
8200					4451	93J8K2	4651	95J8K2	4851	90J8K2
9000					(4452)	93J9K0	4652	95J9K0	4852	90J9K0
9100					(4453)	93J9K1	(4653)	95J9K1	4853	90J9K1
10000					4454	93J10K	4654	95J10K	4854	90J10K
11000							4655	95J11K	(4855)	90J11K
12000							4656	95J12K	4856	90J12K
13000							(4657)	95J13K	4857	90J13K
14000							(4657A)	95J14K	(4857B)	90J14K
15000							4658	95J15K	4858	90J15K
16000							4659	95J16K	(4859A)	90J16K
17000							4659B	95J17K	(4859C)	90J17K
18000							4660	95J18K	4860	90J18K
20000							4661	95J20K	4861	90J20K
22000							4662	95J22K	(4862)	90J22K
24000							4663	95J24K	(4863)	90J24K
25000							4664	95J25K	4864	90J25K
27000									4865	90J27K
30000									4866	90J32K
33000									4867	90J33K
35000									4867A	90J35K
36000									(4868)	90J36K
39000									4869	90J39K
40000									4870	90J40K
43000									4871	90J43K
45000									(4871A)	90J45K
47000									4872	90J47K
50000									4873	90J50K
51000									4874	90J51K

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Series 44 OHMICONE® 5% tolerance

MIL-R-26 Axial Lead Resistors

IN ACCORDANCE WITH RW-67V — RW-68V — RW-69V



DIMENSIONS: Inches (mm)

Ohmite Series	41J___	42J___	43J___	45J___	40J___
MIL-R-26 Designation	None	None	RW69V___	RW67V___	RW68V___
Wattage	1	2	3	5	10
(A) Max. Lgth.	.437″ (11.1mm)	.406″ (10.3mm)	.563″ (14.3mm)	.937″ (23.8mm)	1.843″ (46.8mm)
(B) Max. Dia.	.125″ (3.2mm)	.219″ (5.6mm)	.250″ (6.4mm)	.343″ (8.7mm)	.406″ (10.3mm)
Lead 1½″	22 GA	20 GA	20 GA	18 GA	18 GA

conformal silicone ceramic axial lead wirewound resistors

Series 44 Ohmicone® conformal silicone ceramic power resistors are designed for a wide range of commercial, industrial and communications equipment and systems. Resistors feature low, stable T.C.; all welded construction; and operation under high temperature conditions.

ELECTRICAL:

Tolerance: ±5%.

Temperature Coefficient: <1Ω — ±90 ppm/°C; 1 to 10Ω — 0 ±50 ppm/°C; 10Ω & greater — 0±20 ppm/°C.

Dielectric Withstanding Voltage: 1000 VAC for 3-5-10 Watt sizes, 500 VAC for 2 Watt and 250 VAC for 1 Watt size.

Overload, Short Time: 10X rated wattage for 5 seconds (5W and larger); 5X rated wattage for 5 seconds (3W and smaller).

Wattage: 1, 2, 3, 5, and 10 Watt sizes.

Inductance: Varies with no. of turns and wire size. Standard units have single layer winding.

Non-inductive (ARYTON-PERRY) windings available.

MATERIALS:

Core: Ceramic, resistant to thermal shock and wide variations in temperature.

Resistance Element: High grade resistance alloy wire, single layer winding. Leads and resistance elements welded to metal end caps.

Coating: High performance conformal silicone ceramic.

Leads: Solder coated.

DERATING

Wattage is based on 25°C Free Air Rating. For high temperature operation, derate linearly from 100% @ +25°C to 0% @ 275°C.

	CATALOG NUMBERS				
			RW69	RW67	RW68
OHMS	1 Watt	2 Watts	3 Watts	5 Watts	10 Watts
.1	41JR10	42JR10	43JR10	45JR10	40JR10
.15	41JR15	42JR15	43JR15	45JR15	40JR15
.2	41JR20	42JR20	43JR20	45JR20	40JR20
.3	41JR30	42JR30	43JR30	45JR30	40JR30
.4	41JR40	42JR40	43JR40	45JR40	40JR40
.5	41JR50	42JR50	43JR50	45JR50	40JR50
.75	41JR75	42JR75	43JR75	45JR75	40JR75
1.0	41J1R0	42J1R0	43J1R0	45J1R0	40J1R0
1.5	41J1R5	42J1R5	43J1R5	45J1R5	40J1R5
2.0	41J2R0	42J2R0	43J2R0	45J2R0	40J2R0
2.2	41J2R2	42J2R2	43J2R2	45J2R2	40J2R2
3.0	41J3R0	42J3R0	43J3R0	45J3R0	40J3R0
4.0	41J4R0	42J4R0	43J4R0	(45J4R0)	40J4R0
5.0	41J5R0	42J5R0	43J5R0	45J5R0	40J5R0
7.5	41J7R5	42J7R5	43J7R5	45J7R5	40J7R5
10.0	41J10R	42J10R	43J10R	45J10R	40J10R
12.0	41J12R	42J12R	43J12R	45J12R	40J12R
15.0	41J15R	42J15R	43J15R	45J15R	40J15R
18.0	41J18R	42J18R	43J18R	(45J18R)	40J18R
20.0	41J20R	42J20R	43J20R	(45J20R)	40J20R
22.0	41J22R	42J22R	43J22R	(45J22R)	40J22R
25.0	41J25R	42J25R	43J25R	45J25R	40J25R
27.0	41J27R	42J27R	43J27R	45J27R	(40J27R)
30.0	41J30R	42J30R	43J30R	45J30R	40J30R
33.0	41J33R	(42J33R)	43J33R	45J33R	(40J33R)
35.0	41J35R	(42J35R)	(43J35R)	(45J35R)	(40J35R)
39.0	41J39R	42J39R	43J39R	45J39R	40J39R
40.0	41J40R	42J40R	(43J40R)	45J40R	40J40R
47.0	41J47R	42J47R	43J47R	(45J47R)	40J47R
50.0	41J50R	42J50R	43J50R	45J50R	40J50R
56.0	41J56R	42J56R	43J56R	(45J56R)	(40J56R)
62.0	41J62R	42J62R	(43J62R)	(45J62R)	40J62R
68.0	41J68R	42J68R	43J68R	45J68R	40J68R
75.0	41J75R	42J75R	(43J75R)	45J75R	40J75R
82.0	41J82R	42J82R	43J82R	45J82R	40J82R
100	41J100	42J100	43J100	45J100	40J100
120	41J120	42J120	43J120	(45J120)	40J120
125	(41J125)	(42J125)	(43J125)	45J125	40J125
150	41J150	42J150	43J150	45J150	40J150
180	41J180	42J180	43J180	(45J180)	40J180
200	41J200	42J200	43J200	45J200	40J200
220	41J220	42J220	43J220	(45J220)	(40J220)
225	(41J225)	(42J225)	43J225	(45J225)	40J225
250	41J250	42J250	43J250	45J250	40J250
270	41J270	42J270	43J270	45J270	40J270
300	41J300	42J300	43J300	45J300	40J300
330	41J330	42J330	43J330	45J330	40J330
350	(41J350)	42J350	(43J350)	(45J350)	(40J350)
390	41J390	42J390	43J390	45J390	40J390
400	41J400	42J400	43J400	45J400	40J400
450	(45J450)	(42J450)	(43J450)	45J450	40J450
470	41J470	42J470	43J470	45J470	40J470
500	41J500	42J500	43J500	45J500	40J500
560	(41J560)	42J560	43J560	(45J560)	40J560
600	41J600	42J600	43J600	45J600	40J600
680	41J680	42J680	43J680	45J680	(40J680)
750	41J750	42J750	43J750	45J750	40J750
800	41J800	42J800	43J800	(45J800)	40J800
820	41J820	42J820	43J820	(45J820)	40J820
900	41J900	(42J900)	43J900	(45J900)	40J900
1000	41J1K0	42J1K0	43J1K0	(45J1K0)	40J1K0
1100	41J1K1	(42J1K1)	43J1K1	(45J1K1)	40J1K1
1200	41J1K2	—	43J1K2	(45J1K2)	40J1K2
1500	41J1K5	42J1K5	43J1K5	(45J1K5)	40J1K5
1800	41J1K8	—	43J1K8	(45J1K8)	(40J1K8)
2000	41J2K0	—	43J2K0	45J2K0	40J2K0
2200	41J2K2	—	43J2K2	45J2K2	40J2K2
2500	41J2K5	—	43J2K5	(45J2K5)	40J2K5
2700	(41J2K7)	—	43J2K7	(45J2K7)	(40J2K7)
3000	41J3K0	42J3K0	43J3K0	45J3K0	40J3K0
3300	—	—	43J3K3	45J3K3	40J3K3
3500	—	—	(43J3K5)	(45J3K5)	(40J3K5)
3900	—	—	43J3K9	45J3K9	40J3K9
4000	—	—	(43J4K0)	(45J4K0)	(40J4K0)
4500	—	—	43J4K5	(45J4K5)	(40J4K5)
4700	—	—	43J4K7	(45J4K7)	40J4K7
5000	—	—	43J5K0	(45J5K0)	40J5K0
6000	—	—	43J6K0	(45J6K0)	40J6K0
6800	—	—	43J6K8	(45J6K8)	40J6K8
7000	—	—	(43J7K0)	(45J7K0)	40J7K0
7500	—	—	43J7K5	45J7K5	40J7K5
8000	—	—	43J8K0	(45J8K0)	(40J8K0)
9000	—	—	43J9K0	(45J9K0)	(40J9K0)
10,000	—	—	43J10K	45J10K	40J10K

Please Note**. The values listed are those normally maintained in stock. The other values in the E 24 sequence are also available as special items.

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® Series 80 OHMICONE® 1% tolerance

MIL-R-26 Axial Lead Resistors

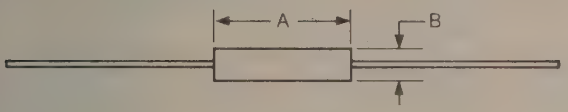
conformal OHMICONE® precision resistors

IN ACCORDANCE WITH RW70U — RW74U — RW78U — RW79U. SERIES 80 RESISTORS ARE DESIGNED FOR HIGH STABILITY, PRECISION POWER APPLICATIONS.

LOW TEMPERATURE COEFFICIENT, 20 PPM/°C FOR 10 OHMS AND ABOVE.

DIELECTRIC WITHSTANDING VOLTAGE 1000 VAC

1% TOLERANCE STANDARD, LOWER TOLERANCES AVAILABLE ON SPECIAL ORDER.



DIMENSIONS: Inches (mm)

Ohmite Series	81F___	83F___	85F___	80F___
MIL-R-26 Designations	RW70U___F	RW79U___F	RW74U___	RW78U___F
Wattage	1	3	5	10
(A) Max. Lgth.	.437″ (11.1mm)	.597″ (15.2mm)	.937″ (23.8mm)	1.842″ (46.8mm)
(B) Max. Dia.	.125″ (3.2mm)	.218″ (5.5mm)	.343″ (8.7mm)	.406″ (10.3mm)
Leads 1½″	22 GA	20 GA	18 GA	18 GA

SPECIFICATIONS

Tolerance: ± 1% std.

Temperature Coefficient:
±20 ppm/°C 10 ohms and above
±50 ppm/°C 1 to 9.99 ohms
±90 ppm/°C below 1 ohm

Dielectric Withstanding Voltage: 1000 VAC for 3-5-10 Watt sizes, 500 VAC for 1 Watt size.

Overload: 10X rated wattage for 5 sec. for 5 Watt size and larger. 5X rated wattage for 5 sec. under 5 Watt size.

Stability: Load life delta R of 0.5% for 2000 hours.

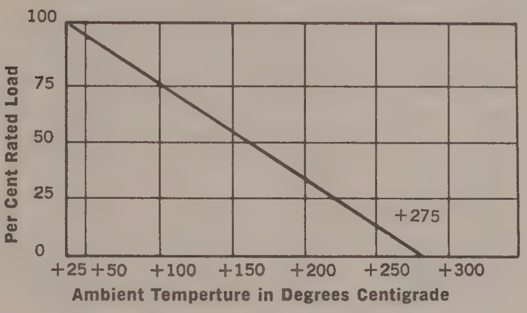
Inductance: Standard units have single layer inductive winding.

Core: Steatite ceramic.

Coating: Silicone ceramic.

DERATING

Wattage ratings are based on 25°C Free Air Rating. For higher ambient temperatures, use derating chart.

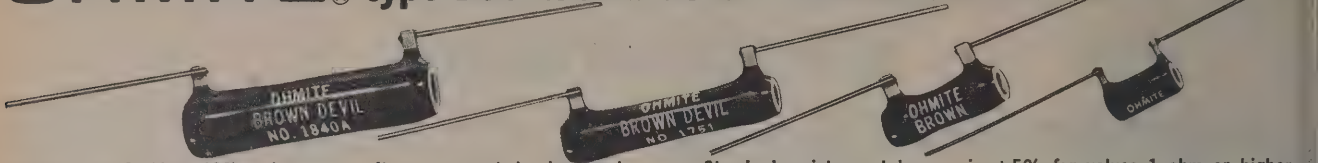


	CATALOG NUMBERS			
	1 Watt	3 Watts	5 Watts	10 Watts
OHMS	RW70U	RW79U	RW74U	RW78U
.100	81FR10	83FR10	85FR10	80FR10
.121		83FR121	85FR121	80FR121
.150	81FR15	83FR15	85FR15	80FR15
.200	81FR20	83FR20	85FR20	80FR20
.221		83FR221	85FR221	80FR221
.249		83FR249	85FR249	80FR249
.274		83FR274	85FR274	80FR274
.392	81FR392	83FR392	85FR392	80FR392
.475		83FR475	85FR475	80FR475
.499	81FR499	83FR499	85FR499	80FR499
.681		83FR681	85FR681	80FR681
.750	81FR75	83FR75	85FR75	80FR75
.825		83FR829	85FR329	80FR829
1.00	81F1R0	83F1R0	85F1R0	80F1R0
1.10		83F1R1	85F1R1	80F1R1
1.21		83F1R21	85F1R21	80F1R21
1.43		83F1R43	85F1R43	80F1R43
1.50	81F1R5	83F1R5	85F1R5	80F1R5
1.82		83F1R82	85F1R82	80F1R82
2.00	81F2R0	83F2R0	85F2R0	80F2R0
2.49		83F2R49	85F2R49	80F2R49
2.74		83F2R74	85F2R74	80F2R74
3.01	81F3R01	83F3R01	85F3R01	80F2R01
3.32		83F3R32	85F3R32	80F3R32
4.02	81F4R02	83F4R02	85F4R02	80F4R02
4.53		83F4R53	85F4R53	80F4R53
4.99	81F4R99	83F4R99	85F4R99	80F4R99
5.11		83F5R11	85F5R11	80F5R11
6.19		83F6R19	85F6R19	80F6R19
6.81		83F6R81	85F6R81	80F6R81
7.50	81F7R5	83F7R5	85F7R5	80F7R5
8.06		83F8R06	85F8R06	80F8R06
9.09		83F9R09	85F9R09	80F9R09
10.0	81F10R	83F10R	85F10R	80F10R
11.0		83F11R	85F11R	80F11R
12.1	81F12R1	83F12R1	85F12R1	80F12R1
13.0		83F13R	85F13R	80F13R
14.0		83F14R	85F14R	80F14R
15.0	81F15R	83F15R	85F15R	80F15R
18.2	81F18R2	83F18R2	85F18R2	80F18R2
20.0	81F20R	83F20R	85F20R	80F20R
22.1	81F22R1	83F22R1	85F22R1	80F22R1
24.3		83F24R3	85F24R3	80F24R3
24.9	81F24R9	83F24R9	85F24R9	80F24R9
27.4	81F27R4	83F27R4	85F27R4	80F27R4
30.1	81F30R1	83F30R1	85F30R1	80F30R1
33.2	81F33R2	83F33R2	85F33R2	80F33R2
34.8	81F34R8	83F34R8	85F34R8	80F34R8
39.2	81F39R2	83F39R2	85F39R2	80F39R2
40.2	81F40R2	83F40R2	85F40R2	80F40R2
43.2		83F42R3	85F43R2	80F43R2
47.5	81F47R5	83F47R5	85F47R5	80F47R5
49.9	81F49R9	83F49R9	85F49R9	80F49R9
51.1		83F51R1	85F51R1	80F51R1
56.2	81F56R2	83F56R2	85F56R2	80F56R2
59.0		83F59R	85F59R	80F59R
60.0		83F60R4	85F60R4	80F60R4
61.9	81F61R9	83F61R9	85F61R9	80F61R9
68.1	81F68R1	83F68R1	85F68R1	80F68R1
75.0	81F75R	83F75R	85F75R	80F75R
82.5	81F82R5	83F82R5	85F82R5	80F82R5
88.7		83F88R7	85F88R7	80F88R7
90.9		83F90R9	85F90R9	80F90R9
100	81F100	83F100	85F100	80F100
115		83F115	85F115	80F115
121	81F121	83F121	85F121	80F121
130		83F130	85F130	80F130
150	81F150	83F150	85F150	80F150
162		83F162	85F162	80F162
169		83F169	85F169	80F169
174		83F174	85F174	80F174
178		83F178	85F178	80F178
182	81F182	83F182	85F182	80F182
200	81F200	83F200	85F200	80F200
205		83F205	85F205	80F205
215		83F215	85F215	80F215
221	81F221	83F221	85F221	80F221
249	81F249	83F249	85F249	80F249
255		83F255	85F255	80F255
274	81F274	83F274	85F274	80F274
301	81F301	83F301	85F301	80F301
332	81F332	83F332	85F332	80F332
365		83F365	85F365	80F365
374		83F374	85F374	80F374
383		83F383	85F383	
392	81F392	83F392	85F392	
402	81F402	83F402	85F402	80F402
432		83F432	85F432	80F432
453	81F453	83F453	85F453	80F453
475	81F475	83F475	85F475	80F475
499	81F499	83F499	85F499	80F499
511		83F511	85F511	80F511
562	81F562	83F562	85F562	80F562
604	81F604	83F604	85F604	80F604
619		83F619	85F619	80F619
681	81F681	83F681	85F681	80F681
715		83F715	85F715	80F715
750	81F750	83F750	85F750	80F750
806	81F806	83F806	85F806	80F806
825	81F825	83F825	85F825	80F825
909	81F909	83F909	85F909	80F909
1000	81F1K0	83F1K0	85F1K0	80F1K0
1180	81F1K18	83F1K18	85F1K18	80F1K18
1300		83F1K3	85F1K3	80F1K3
1470		83F1K47	85F1K47	80F1K47
1500	81F1K5	83F1K5	85F1K5	80F1K5
1620		83F1K62	85F1K62	80F1K62
1780		83F1K78	85F1K78	80F1K78
2000	81F2K0	83F2K0	85F2K0	80F2K0
2210	81F2K21	83F2K21	85F2K21	80F2K21
2260		83F2K26	85F2K26	80F2K26
2430		83F2K43	85F2K43	80F2K43
2490	81F2K49	83F2K49	85F2K49	80F2K49
2740	81F2K74	83F2K74	85F2K74	80F2K74
2940		83F2K94	85F2K94	80F2K94
3010	81F3K01	83F3K01	85F3K01	80F3K01
3160		83F3K16	85F3K16	80F3K16
3320		83F3K32	85F3K32	80F3K32
3480		83F3K48	85F3K48	80F3K48
4020		83F4K02	85F4K02	80F4K02
4750		83F4K75	85F4K75	80F4K75
4870		83F4K87	85F4K87	80F4K87
4990		83F4K99	85F4K99	80F4K99
5110		83F5K11	85F5K11	80F5K11
5620		83F5K62	85F5K62	80F5K62
6040		83F6K04	85F6K04	80F6K04
6190		83F6K19	85F6K19	80F6K19
6650		83F6K65	85F6K65	80F6K65
6810		83F6K81	85F6K81	80F6K81
6980		83F6K98	85F6K98	80F6K98
8060		83F8K06	85F8K06	80F8K06
10,000		83F10K	85F10K	80F10K
15,000		83F15K	85F15K	80F15K
20,000		83F20K	85F20K	80F20K
20,500		83F20K5		
22,100			85F22K1	80F22K1
23,700			85F23K7	80F23K7
24,900			85F24K9	80F24K9
25,500			85F25K5	80F25K5
27,400			85F27K4	80F27K4
30,100			85F30K1	80F30K1
34,000			85F34K	80F34K
36,500			85F36K5	80F36K5
40,200			85F40K2	80F40K2
43,200			85F43K2	80F43K2
47,500			85F47K5	80F47K5
49,900			85F49K9	80F49K9
51,100			85F51K5	80F51K5
80,600			85F80K6	80F80K6
82,500				80F82K5
90,900				80F90K9
100,000				80F100K
150,000				80F150K
174,000				80F174K
200,000				80F200K

Please Note**. The values listed are those normally maintained in stock. Any of the other values in Table III of MIL-R-26/5B may also be obtained as a special item.

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® type 200 *brown devil*® fixed resistors



BROWN DEVIL™ (Type 200) resistors, are vitreous enameled, wirewound units long famous for ruggedness and durability in small power resistors. With the emphasis toward miniaturization and the current industry trend toward high operating temperatures, Ohmite has been able to increase the ratings on two Brown Devil sizes. The 5 watt size is now rated 8 watts and the 10 watt size is now rated 12 watts. The 20 watt unit retains the same rating.

Available on special order in 3 watt size and in values other than those listed as standard. Also available on special order with radial leads for P-C board mounting.

Standard resistance tolerance is ±5% for values 1 ohm or higher; ±10% for values below 1 ohm. Tinned leads 1½" long: 3 and 5¼ watt, 20 AWG; 8, 12 and 20 watt, 18 AWG.

DIMENSIONS & WEIGHTS

Rating	5¼W	8W	12W	20W
Core Dimen.	⅝x¼D	1x5⁄16D	1¾x5⁄16D	2x7⁄16D
Weight (lbs.)	.005	.01	.015	.03

	5¼ WATT		8 WATT		12 WATT		20 WATT	
Ohms	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.
0.5					1700A	B12JR50	1800A	B20JR50
1.0	2822	B5J1R0	1500	B8J1R0	1701	B12J1R0	1802A	B20J1R0
1.1	(2823)	B5J1R1						
1.2	(2824)	B5J1R2						
1.3	(2825)	B5J1R3						
1.5	2826	B5J1R5	1500B	B8J1R5	1704	B12J1R5		
1.6	(2827)	B5J1R6						
1.8	2828	B5J1R8						
2.0	2829	B5J2R0	1501	B8J2R0	1705	B12J2R0	1802B	B20J2R0
2.2	2830	B5J2R2						
2.4	2831	B5J2R4						
2.7	(2832)	B5J2R7						
3.0	2833	B5J3R0	1502	B8J3R0	1706	B12J3R0	1802C	B20J3R0
3.3	2834	B5J3R3						
3.6	(2835)	B5J3R6						
3.9	2836	B5J3R9						
4.0			1503	B8J4R0	1707	B12J4R0	1802D	B20J4R0
4.3	2837	B5J4R3						
4.7	2838	B5J4R7						
5.0			1504	B8J5R0	1708	B12J5R0	1803	B20J5R0
5.1	2839	B5J5R1						
5.6	(2840)	B5J5R6						
6.2	2841	B5J6R2						
6.8	(2842)	B5J6R8						
7.5	2843	B5J7R5	1505	B8J7R5	1709	B12J7R5		
8.2	2844	B5J8R2						
9.1	(2845)	B5J9R1						
10	2846	B5J10R	1506	B8J10R	1710	B12J10R	1804	B20J10R
11	(2847)	B5J11R						
12	2848	B5J12R	1507	B8J12R	1711	B12J12R		
13	(2849)	B5J13R						
15	2850	B5J15R	1508	B8J15R	1712	B12J15R		
16	(2851)	B5J16R						
18	2852	B5J18R						
20	2853	B5J20R	1509	B8J20R	1713	B12J20R		
22	2854	B5J22R						
24	2855	B5J24R						
25			1510	B8J25R	1714	B12J25R	1805	B20J25R
27	2856	B5J27R						
30	2857	B5J30R	1511	B8J30R	1715	B12J30R		
33	2858	B5J33R						
35			1512	B8J35R	1716	B12J35R		
36	2859	B5J36R						
39	2860	B5J39R						
40			1513	B8J40R	1717	B12J40R		B20J40R
43	2861	B5J43R						
47	2862	B5J47R						
50			1514	B8J50R	1718	B12J50R	1806	B20J50R
51	2863	B5J51R						
56	2864	B5J56R						
62	2865	B5J62R						
68	2866	B5J68R						
75	2867	B5J75R	1515	B8J75R	1719	B12J75R	1807	B20J75R
82	2868	B5J82R						
91	2869	B5J91R						
100	2870	B5J100	1516	B8J100	1720	B12J100	1808	B20J100
110	(2871)	B5J110						
120	2872	B5J120						
125			1517	B8J125	1721	B12J125		B20J125
130	2873	B5J130						
150	2874	B5J150	1518	B8J150	1722	B12F150	1809	B20J150
160	2875	B5J160						
180	2876	B5J180						
200	2877	B5J200	1519	B8J200	1723	B12J200	1810	B20J200
220	2878	B5J220						
225			1520	B8J225	1724	B12J225		
240	2879	B5J240						
250			1521	B8J250	1725	B12J250	1811	B20J250
270	2880	B5J270						
300	2881	B5J300	1522	B8J300	1726	B12J300	1812	B20J300
330	2882	B5J330						
350			1523	B8J350	1727	B12J350	1813	B20J350
360	2883	B5J360						
390	2884	B5J390						
400			1524	B8J400	1728	B12J400	1814	B20J400
430	2885	B5J430						
450			1525	B8J450	1729	B12J450		
470	2886	B5J470						

	5¼ WATT		8 WATT		12 WATT		20 WATT	
Ohms	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.
500			1526	B8J500	1730	B12J500	1815	B20J500
510	2887	B5J510						
560	2888	B5J560						
600			1527	B8J600	1731	B12J600		
620	2889	B5J620						
650							1816	B20J650
680	2890	B5J680						
700			1528	B8J700	1732	B12J700	1817	B20J700
750	2891	B5J750	(1529)	B8J750	1733	B12J750	1818	B20J750
800			1530	B8J800	1734	B12J800	1819	B20J800
820	2892	B5J820						
900			1531	B8J900	1735	B12J900	(1820A)	B20J900
910	2893	B5J910						
1000	2894	B5J1K0	1532	B8J1K0	1736	B12J1K0	1821	B20J1K0
1100	(2895)	B5J1K1	(1533)	B8J1K1	(1737)	B12J1K1		
1200	2896	B5J1K2	1534	B8J1K2	1738	B12J1K2	1822	B20J1K2
1250			1535	B8J1K25	1739	B12J1K25	1823	B20J1K25
1300	2897	B5J1K3						
1500	2898	B5J1K5	1536	B8J1K5	1740	B12J1K5	1824	B20J1K5
1600	(2899)	B5J1K6						
1750			1537	B8J1K75	1741	B12J1K75	1825	B20J1K75
1800	2900	B5J1K8						
2000	2901	B5J2K0	1538	B8J2K0	1742	B12J1K0	1827	B20J1K0
2200	2902	B5J2K2						
2250			1539	B8J2K25	1743	B12J2K25	(1828)	B20J2K25
2400	2903	B5J2K4						
2500			1540	B8J2K5	1744	B12J2K5	1830	B20J2K5
2700	2904	B5J2K7						
2750							1831	B20J2K75
3000	2905	B5J3K0	1541	B8J3K0	1745	B12J3K0	1832	B20J3K0
3300	2906	B5J3K3						
3500			1542	B8J3K5	1746	B12J3K5	1833	B20J3K5
3600	2907	B5J3K6						
3900	2908	B5J3K9						
4000			1543	B8J4K0	1747	B12J4K0	1834	B20J4K0
4300	(2909)	B5J4K3						
4500			1544	B8J4K5	1748	B12J4K5	1835	B20J4K5
4700	2910	B5J4K7						
5000			1545	B8J5K0	1749	B12J5K0	1836	B20J5K0
5100	2911	B5J5K1						
5600	2912	B5J5K6						
6000			1546	B8J6K0	1750	B12J6K0	1837	B20J6K0
6200	2913	B5J6K2						
6800	2914	B5J6K8						
7000			1547	B8J7K0	1751	B12J7K0	1838	B20J7K0
7500	2915	B5J7K5	1548	B8J7K5	1752	B12J7K5	1839	B20J7K5
8000			1549	B8J8K0	1753	B12J8K0	1840	B20J8K0
8200	2916	B5J8K2						
8500					(1754)	B12J8K5		
9000			1550	B8J9K0	(1754A)	B12J9K0	(1840A)	B20J9K0
9100	(2917)	B5J9K1						
10K	2918	B5J10K	1551	B8J10K	1755	B12J10K	1841	B20J10K
11K	(2919)	B5J11K			(1756)	B12J11K		
12K	2920	B5J12K			1757	B12J12K		
12.5K			1552	B8J12K5	1758	B12J12K5	1842	B20J12K5
13K	2921	B5J13K						
13.5K					(1759)	B12J13K5		
15K	2922	B5J15K	1553	B8J15K	1761	B12J15K	1843	B20J15K
16K	2923	B5J16K			(1762)	B12J16K		
17.5K			(1554)	B8J17K5	(1763)	B12J17K5		
18K	2924	B5J18K			1764	B12J18K		
20K	2925	B5J20K	1555	B8J20K	1765	B12J20K	1844	B20J20K
22.5K			(1556)	B8J22K5	1766	B12J22K5		
25K			1557	B8J25K	1767	B12J25K	1845	B20J25K
30K					1768	B12J30K	1846	B20J30K
35K					1769	B12J35K	(1847)	B20J35K
40K					1770	B12J40K	1848	B20J40K
45K					1771	B12J45K	(1849)	B20J45K
50K					1772	B12J50K	1850	B20J50K
55K							(1851)	B20J55K
60K							(1852)	B20J60K
65K							(1853)	B20J65K
70K							(1854)	B20J70K
75K							(1855)	B20J75K
80K							1856	B20J80K
85K							(1857)	B20J85K
90K							(1858)	B20J90K
95K							(1859)	B20J95K
100K							1860	B20J100K

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, IL 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® type 270 vitreous enameled fixed resistors

These lug type resistors are wire-wound on high quality ceramic cores, protected and insulated by Ohmite vitreous enamel — the time-proved standard covering that is the best conductor of heat for a material which must also be a good electrical insulator.

Resistance tolerance is ±5% for values 1 ohm or higher; ±10% below 1 ohm.

Wattage ratings are for use in free air. When resistors are mounted in closed spaces or where the circulation of air is restricted, they should not be used at more than one-half rating. Currents and voltages for reduced ratings can be obtained by multiplying full rating by the following factors: 75% load = .86, 66% = .81, 50% = .71, 33% = .57, 25% = .50.

Higher wattage resistors are available on a custom manufactured basis, for information, request copy of catalog 101.

These items are also available on special order, with non-inductive windings, (Aryton Perry).

The resistors listed below are standard stock items only. The 270 resistors are also available, on special order, in wattages from 3 through 1,000 with many intermediate values. Resistance values can also be supplied to meet your specific requirements. Contact our field representatives or our application engineers for assistance.

12 WATT Free air rating to 5600 Ohms Core: 1-3/4" x 5/16" Mtg. Ctr: 2 3/16" —Av. Wt. .02 lb. Std. Mtg. Brkt.: Cat. No. 5		
Resist. Ohms	Catalog Numbers Old	New
.51	3723	L12JR51
1.0	3730	L12J1R0
1.5	3734	L12J1R5
2.2	3738	L12J2R2
3.3	3742	L12J3R3
4.7	3746	L12J4R7
6.8	3750	L12J6R8
10	3754	L12J10R
12	3756	L12J12R
15	3758	L12J15R
18	3760	L12J18R
22	3762	L12J22R
27	3764	L12J27R
33	3766	L12J33R
39	3768	L12J39R
47	3770	L12J47R
56	3772	L12J56R
68	3774	L12J68R
82	3776	L12J82R
100	3778	L12J100
120	3780	L12J120
150	3782	L12J150
180	3784	L12J180
220	3786	L12J220
270	3788	L12J270
330	3790	L12J330
390	3792	L12J390
470	3794	L12J470
560	3796	L12J560
680	3798	L12J680
820	3800	L12J820
1,000	3802	L12J1K0
1,200	3804	L12J1K2
1,500	3806	L12J1K5
1,800	3808	L12J1K8
2,200	3810	L12J2K2
2,700	3812	L12J2K7
3,300	3814	L12J3K3
3,900	3816	L12J3K9
4,700	3818	L12J4K7
5,600	3820	L12J5K6
6,800	3822	L12J6K8
8,200	3824	L12J8K2
10,000	3826	L12J10K
12,000	3828	L12J12K
15,000	3830	L12J15K
18,000	3832	L12J18K
22,000	3834	L12J22K
27,000	3836	L12J27K
33,000	3838	L12J33K
39,000	3840	L12J39K
47,000	3842	L12J47K
51,000	3843	L12J51K

	25 WATT Free air rating to 12,000 Ohms. Core: 2" x 9/16" Mfg. Ctr: 2¾" — Av. Wt. .05 lb. Std. Mtg. Brkt.: No. 9		**50 WATT** Free air rating to 25,000 Ohms. Core: 4" x 9/16" Mtg. Ctr: 4¾" — Av. Wt. .09 lb. Std. Mtg. Brkt.: No. 9		**100 WATT** Free air rating to 60,000 Ohms. Core: 6½" x ¾" Mtg. Ctr: 7⅜" — Av. Wt. .20 lb. Std. Mtg. Brkt.: No. 12		**175 WATT** Free air rating for All Values Core: 8½" x 1⅛" Mtg. Ctr: 9⅜" — Av. Wt. .50 lb. Std. Mtg. Brkt.: No. 18		**225 WATT** Free air rating for All Values Core: 10½" x 1⅛" Mtg. Ctr: 11⅜" — Av. Wt. .62 lb. Std. Mtg. Brkt.: No. 18	
Ohms Res.	Catalog Numbers Old	New	Catalog Numbers Old	New	Catalog Numbers Old	New	Catalog Numbers Old	New	Catalog Numbers Old	New
1	0200J	L25J1R0	0400J	L50J1R0	0600C	L100J1R0	0700C	L175J1R0	0900C	L225J1R0
2	0200K	L25J2R0	0400K	L50J2R0	0600D	L100J2R0	0700D	L175J2R0	0900D	L225J2R0
3	0200	L25J3R0	0400L	L50J3R0	0600E	L100J3R0	0700E	L175J3R0	0900E	L225J3R0
4	0200N	L25J4R0	0400N	L50J4R0	0600F	L100J4R0	0700F	L175J4R0	0900F	L225J4R0
5	0200A	L25J5R0	0400A	L50J5R0	0600A	L100J5R0	0700A	L175J5R0	0900A	L225J5R0
10	0200B	L25J10R	0400B	L50J10R	0600B	L100J10R	0700B	L175J10R	0900B	L225J10R
15	0200R	L25J15R								
25	0200C	L25J25R	0400C	L50J25R	0601	L100J25R	0701	L175J25R	0901	L225J25R
50	0200D	L25J50R	0400D	L50J50R	0602	L100J50R	0702	L175J50R	0902	L225J50R
75	0200E	L25J75R	0400E	L50J75R	0603	L100J75R	0703	L175J75R	0903	L225J75R
100	0200F	L25J100	0400F	L50J100	0604	L100J100	0704	L175J100	0904	L225J100
125					0604B	L100J125	0704B	L175J125		
150	0200G	L25J150	0400G	L50J150	0605	L100J150	0705	L175J150	0905	L225J150
200	0200H	L25J200	0400H	L50J200						
250	0201	L25J250	0401	L50J250	0606	L100J250	0706	L175J250	0906	L225J250
500	0202	L25J500	0402	L50J500	0607	L100J500	0707	L175J500	0907	L225J500
750	0203	L25J750	0403	L50J750	0608	L100J750	(0708)	L175J750	0908	L225J750
800	0204	L25J800	0404	L50J800						
1,000	0205	L25J1K0	0405	L50J1K0	0609	L100J1K0	0709	L175J1K0	0909	L225J1K0
1,500	0206	L25J1K5	0406	L50J1K5	0610	L100J1K5	0710	L175J1K5	0910	L225J1K5
2,000	0207	L25J2K0	0407	L50J2K0	0611	L100J2K0	0711	L175J2K0	0911	L225J2K0
2,500	0208	L25J2K5	0408	L50J2K5	0612	L100J2K5	0712	L175J2K5	0912	L225J2K5
3,000	0209	L25J3K0	0409	L50J3K0	0613	L100J3K0	0713	L175J3K0	0913	L225J3K0
3,500	0210	L25J3K5								
4,000	0211	L25J4K0	0410	L50J4K0						
5,000	0212	L25J5K0	0411	L50J5K0	0614	L100J5K0	0714	L175J5K0	0914	L225J5K0
6,000	0213	L25J6K0								
7,500	0214	L25J7K5	0412	L50J7K5	0615	L100J7K5	0715	L175J7K5	0915	L225J7K5
8,000			0413	L50J8K0						
10,000	0215	L25J10K	0414	L50J10K	0616	L100J10K	0716	L175J10K	0916	L225J10K
12,000	0216	L25J12K	0415	L50J12K						
15,000	0217	L25J15K	0416	L50J15K	0617	L100J15K	0717	L175J15K	0917	L225J15K
20,000	0218	L25J20K	0417	L50J20K	0618	L100J20K	0718	L175J20K	0918	L225J20K
25,000	0219	L25J25K	0418	L50J25K	0619	L100J25K	0719	L175J25K	0919	L225J25K
30,000	0220	L25J30K			0620	L100J30K	0720	L175J30K	0920	L225J30K
35,000	0221	L25J35K	0419	L50J35K						
40,000	0222	L25J40K			(0621)	L100J40K	0721	L175J40K	0921	L225J40K
50,000	0224	L25J50K	0420	L50J50K	0622	L100J50K	0722	L175J50K	0922	L225J50K
60,000	0225	L25J60K			0623	L100J60K	0723	L175J60K	0923	L225J60K
70,000	0226	L25J70K								
75,000			0421	L50J75K	0624	L100J75K	0724	L175J75K	0924	L225J75K
80,000	0227	L25J80K								
100,000	0229	L25J100K	0422	L50J100K	0625	L100J100K	0725	L175J100K	0925	L225J100K
125,000			0423	L50J125K						
150,000			0424	L50J150K						
175,000			0425	L50J175K						
200,000			0426	L50J200K						
250,000			0428	L50J250K						

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, IL 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® dividohm® type 210 adjustable vitreous enameled resistors

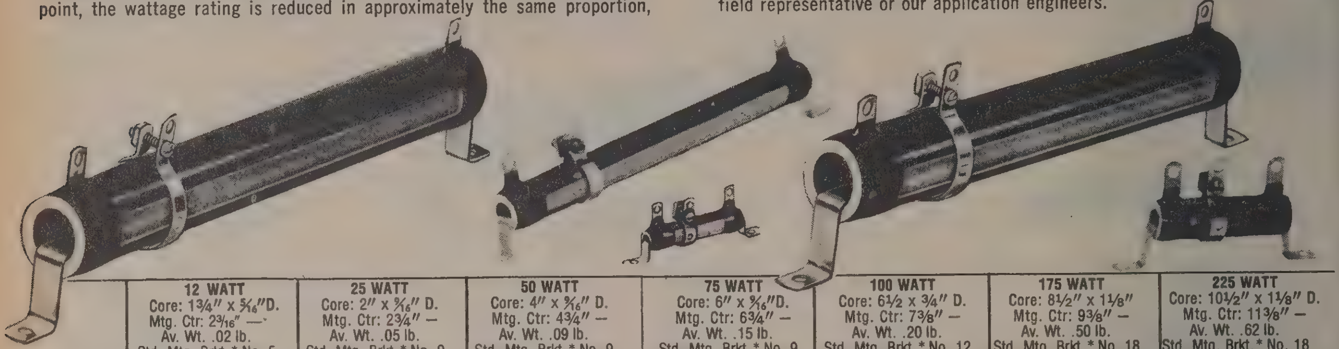
"Dividohm" resistors make ideal voltage dividers for original equipment and replacement in transmitters, rectifiers and other apparatus. Such tapped "bleeders" are made by using one or more adjustable lugs, as required. "Dividohms" are also handy for obtaining odd resistance values, for adjusting circuits, and for use on equipment which must be set to meet various line voltages.

"Dividohm" resistors are vitreous enameled resistors on which a narrow strip has been left uncovered to expose a portion of each turn. Contact to any wire in this strip is made by an embossed contact on the adjustable lug (supplied).

WATT RATING: The stated wattage rating applies only when the entire resistance is in the circuit. When the adjustable lug is set at an intermediate point, the wattage rating is reduced in approximately the same proportion, i.e., if the lug is set at half the resistance, the wattage is reduced by one-half. A safe rule to follow is to make sure that the maximum rated current is not exceeded. This should be carefully checked particularly if the resistor will be used as a voltage divider with several adjustable lugs. Resistance tolerance is ±10% for the total resistance value.

The items listed in the chart below, are those items that have proven to be the most popular based on usage. "Dividohm" style resistors are available on special order in resistance values other than those shown and in a wattage range of 12 Watts through 1000 Watts. In addition to the vitreous enamel standard coating, these items are also available with an Ohmicone silicone ceramic coating.

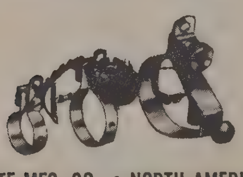
For any variable or adjustable resistor requirement, contact your Ohmite field representative or our application engineers.



	12 WATT Core: 1¾" x 5⁄16"D. Mtg. Ctr: 23⁄16" — Av. Wt. .02 lb. Std. Mtg. Brkt.* No. 5		25 WATT Core: 2" x 9⁄16" D. Mtg. Ctr: 2¾" — Av. Wt. .05 lb. Std. Mtg. Brkt.* No. 9		50 WATT Core: 4" x 9⁄16" D. Mtg. Ctr: 4¾" — Av. Wt. .09 lb. Std. Mtg. Brkt.* No. 9		75 WATT Core: 6" x 9⁄16"D. Mtg. Ctr: 6¾" — Av. Wt. .15 lb. Std. Mtg. Brkt.* No. 9		100 WATT Core: 6½ x ¾" D. Mtg. Ctr: 7⅜" — Av. Wt. .20 lb. Std. Mtg. Brkt.* No. 12		175 WATT Core: 8½" x 1⅛" Mtg. Ctr: 9⅜" — Av. Wt. .50 lb. Std. Mtg. Brkt.* No. 18		225 WATT Core: 10½" x 1⅛" D. Mtg. Ctr: 11⅜" — Av. Wt. .62 lb. Std. Mtg. Brkt.* No. 18	
Resist. Ohms	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.	Old Cat. No.	New Cat. No.
1	1001	D12K1R0	0360	D25K1R0	0560A	D50K1R0	0769A	D75K1R0	0956A	D100K1R0	1156A	D175K1R0	1356A	D225K1R0
2	1002	D12K2R0	0360B	D25K2R0	0560B	D50K2R0	0769B	D75K2R0	0956B	D100K2R0	1156B	D175K2R0	1356B	D225K2R0
3	1003	D12K3R0	0361	D25K3R0	0560C	D50K3R0	0769C	D75K3R0	0956C	D100K3R0	1156C	D175K3R0	1356C	D225K3R0
4					0560D	D50K4R0	(0769D)	D75K4R0	0956D	D100K4R0	1156D	D175K4R0	1356D	D225K4R0
5	1004	D12K5R0	0362	D25K5R0	0560	D50K5R0	0769	D75K5R0	0956	D100K5R0	1156	D175K5R0	1356	D225K5R0
7.5	1005	D12K7R5	0362B	D25K7R5										
10	1006	D12K10R	0363	D25K10R	0561	D50K10R	0770	D75K10R	0957	D100K10R	1157	D175K10R	1357	D225K10R
15	1007	D12K15R	0364	D25K15R			0771	D75K15R						
20	1008	D12K20R	0364B	D25K20R										
25	1009	D12K25R	0365	D25K25R	0562	D50K25R	0772	D75K25R	0958	D100K25R	1158	D175K25R	1358	D225K25R
50	1010	D12K50R	0366	D25K50R	0563	D50K50R	0773	D75K50R	0959	D100K50R	1159	D175K50R	1359	D225K50R
75	1011	D12K75R	0367	D25K75R	0564	D50K75R								
100	1012	D12K100	0368	D25K100	0565	D50K100	0774	D75K100	0960	D100K100	1160	D175K100	1360	D225K100
150	1013	D12K150	0369	D25K150	0566	D50K150								
200	1014	D12K200	0370	D25K200	0567	D50K200	0774B	D75K200						
250	1015	D12K250	0371	D25K250	0568	D50K250	0775	D75K250	0960B	D100K250	1160B	D175K250	1360B	D225K250
300	1016	D12K300	0371B	D25K300	0568B	D50K300	0775B	D75K300						
350	(1017)	D12K350												
400	1018	D12K400	0371C	D25K400	0568C	D50K400	0775C	D75K400						
500	1019	D12K500	0372	D25K500	0569	D50K500	0776	D75K500	0961	D100K500	1161	D175K500	1361	D225K500
600	(1020)	D12K600												
750	1021	D12K750	0373	D25K750	0570	D50K750	0777	D75K750						
800	(1022)	D12K800	0374	D25K800	0571	D50K800	(0777B)	D75K800						
1000	1023	D12K1K0	0375	D25K1K0	0572	D50K1K0	0778	D75K1K0	0962	D100K1K0	1162	D175K1K0	1362	D225K1K0
1250	1024	D12K1K25	0375B	D25K1K25	0572B	D50K1K25	0778B)	D75K1K25						
1500	1025	D12K1K5	0376	D25K1K5	0573	D50K1K5	(0779)	D75K1K5	0962B	D100K1K5	1162B	D175K1K5	1362B	D225K1K5
2000	1026	D12K2K0	0377	D25K2K0	0574	D50K2K0	(0780)	D75K2K0						
2250	(1027)	D12K2K25	0377B	D25K2K25	(0574B)	D50K2K25	(0780B)	D75K2K25						
2500	1028	D12K2K5	0378	D25K2K5	0575	D50K2K5	(0781)	D75K2K5	0963	D100K2K5	1163	D175K2K5	1363	D225K2K5
3000	1029	D12K3K0	0379	D25K3K0	0576	D50K3K0	(0781B)	D75K3K0						
3500	(1030)	D12K3K5	0380	D25K3K5	0576B	D50K3K5	(0782)	D75K3K5						
4000	1031	D12K4K0	(0381)	D25K4K0	0577	D50K4K0	(0782B)	D75K4K0						
4500	(1032)	D12K4K5	0381B	D25K4K5	(0577B)	D50K4K5	(0782C)	D75K4K5						
5000	1033	D12K5K0	0382	D25K5K0	0578	D50K5K0	(0783)	D75K5K0	0964	D100K5K0	1164	D175K5K0	1364	D225K5K0
6000	1034	D12K6K0	0383	D25K6K0	(0578B)	D50K6K0	(0783B)	D75K6K0						
7000	1035	D12K7K0	0383B	D25K7K0	0578C	D50K7K0	(0783C)	D75K7K0						
7500	1036	D12K7K5	0384	D25K7K5	0579	D50K7K5	(0784)	D75K7K5						
8000	(1037)	D12K8K0	(0384B)	D25K8K0	(0580)	D50K8K0	(0784B)	D75K8K0						
8500	(1038)	D12K8K5												
9000	(1039)	D12K9K0	(0384C)	D25K9K0	0580B	D50K9K0	(0784C)	D75K9K0						
10000	1040	D12K10K	0385	D25K10K	0581	D50K10K	(0785)	D75K10K	0965	D100K10K	1165	D175K10K	1365	D225K10K
12000			(0386)	D25K12K	(0582)	D50K12K	0785B	D75K12K						
15000			0387	D25K15K	0583	D50K15K	(0786)	D75K15K	(0966)	D100K15K	(1166)	D175K15K	1366	D225K15K
20000			0388	D25K20K	0584	D50K20K	0787	D75K20K	(0967)	D100K20K	(1167)	D175K20K	1367	D225K20K
25000			0389	D25K25K	0585	D50K25K	(0788)	D75K25K	(0968)	D100K25K	(1168)	D175K25K	1368	D225K25K
30000					0586	D50K30K	(0789)	D75K30K	(0969)	D100K30K	(1169)	D175K30K	(1369)	D225K30K
35000							0790	D75K35K						
40000					0587	D50K40K	(0791)	D75K40K	(0970)	D100K40K	(1170)	D175K40K	(1370)	D225K40K
45000							(0792)	D75K45K						
50000					0588	D50K50K	(0793)	D75K50K	0971	D100K50K	(1171)	D175K50K	1371	D225K50K
60000					(0589)	D50K60K	(0794)	D75K60K						
75000									(0972)	D100K75K	(1172)	D175K75K	1372	D225K75K
80000					(0590)	D50K80K	(0795)	D75K80K						
100000					0591	D50K100K	(0796)	D75K100K	0973	D100K100K	(1173)	D175K100K	1373	D225K100K

adjustable lugs

One "Screw Driver Type Adjustable Lug" is supplied with each unit. Lugs with a silver contact button can be ordered from the table below. MOVING THE LUGS: Lugs always should be loosened completely before moving and not moved except while the current is off, in order to protect the exposed wire from mechanical or electrical injury and to protect the operator from dangerous voltages.



DOUBLE THUMB SCREW ADJUSTABLE LUG

This adjustable lug, which is illustrated at left, features two advantages — ease of adjustment and less chance of damaging the resistance wire while moving lugs. Available for 1⅛" cores.
Catalog No. **2160**

STANDARD

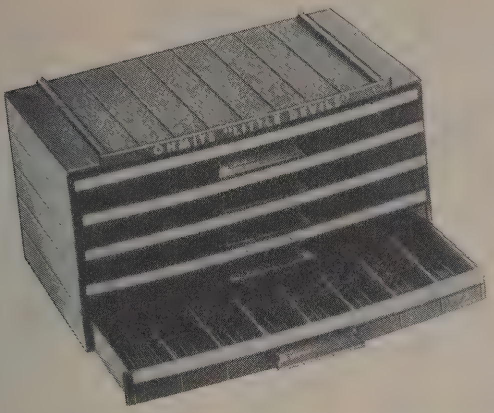
Core Diam. Inches	Screw Driver Type New Cat. No.	Screw Driver Type Old Cat. No.	Bakelite Knob Type New Cat. No.	Bakelite Knob Type Old Cat. No.
5⁄16	2115	1058	—	—
9⁄16	2121	0358	2122	0359
¾	2125	1958	2126	1959
1⅛	2133	2158	2134	2159

With SILVER CONTACT BUTTONS

Core Diam. Inches	Screw Driver Type New Cat. No.	Screw Driver Type Old Cat. No.	Bakelite Knob Type New Cat. No.	Bakelite Knob Type Old Cat. No.
5⁄16	2116	2161	—	—
9⁄16	2123	2164	2124	2165
¾	2127	2166	2128	2167
1⅛	2135	2170	2136	2171

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, IL 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® cabinet resistor assortments



Perfect for R & D and prototype labs.
All popular values included.
8 wattage sizes to choose from.
Contents clearly marked on front of each drawer segment.

Always have the right style, wattage, and resistance value on hand. Thwart Murphey's Law which states; "The resistance value needed will not be available."

Ohmite cabinet assortments come in four different resistor styles and 8 different wattages. The resistors used to make up these assortments are the most popular resistance values as determined by national usage.

The handy compact plastic cabinets are packed in accordance with the tables below, which state the quantities, number of values, and the resistance range of each assortment. Each drawer segment is individually labeled. Dovetail tops and bottoms of each cabinet facilitate stacking. Individual cabinet dimensions are: 9″ long by 4¾″ high by 5¼″ deep.

For specific information regarding any of the cabinet assortments, ask your Ohmite Distributor for the latest cabinet brochure.

Style of Resistor	Watts	Cat. No.	Tolerance	Quantity	No. of Values	No. of Cab. in Assortment	Resistance Range
WIREWOUND SEE PAGES 5 AND 6 FOR DIMENSIONS AND CHARACTERISTICS							
Conformal Vitreous Enamel	1	CAB-221	5%	167	40	1	1Ω - 3KΩ
Conformal Vitreous Enamel	3	CAB-223	5%	325	71	2	1Ω - 10KΩ
Conformal Vitreous Enamel	5	CAB-225	5%	357	77	2	1Ω - 25KΩ
Conformal Vitreous Enamel	10	CAB-220	5%	185	40	1	1Ω - 50KΩ
Conformal Ohmicone®	1	CAB-441	5%	120	40	1	.1Ω - 3KΩ
Conformal Ohmicone®	3	CAB-443	5%	120	40	1	.1Ω - 5KΩ
Conformal Ohmicone®	5	CAB-445	5%	120	40	1	.1Ω - 10KΩ
Conformal Ohmicone®	10	CAB-440	5%	120	40	1	.1Ω - 15KΩ
LITTLE DEVIL®							
Carbon Composition	1/8	CAB-21	5%	500	80	2	2.7Ω - 22 MEGΩ
Carbon Composition	1/8	CAB-45	5%	1000	160	4	2.7Ω - 22 MEGΩ
Carbon Composition	1/4	CAB-54	5%	124	37	1	47Ω - 10MΩ
Carbon Composition	1/4	CAB-525	5%	800	80	2	2.7Ω - 22MΩ
Carbon Composition	1/4	CAB-46	5%	1500	160	4	2.7Ω - 22MΩ
Carbon Composition	1/2	CAB-510	5%	120	40	1	10Ω - 10MΩ
Carbon Composition	1/2	CAB-526	5%	800	80	2	2.7Ω - 22MΩ
Carbon Composition	1/2	CAB-47	5%	1500	160	4	2.7Ω - 22MΩ
Carbon Composition	1	CAB-52	5%	100	40	1	10Ω - 10MΩ
Carbon Composition	1	CAB-527	5%	480	80	2	2.7Ω - 22MΩ
Carbon Composition	1	CAB-48	5%	900	160	4	2.7Ω - 22MΩ
Carbon Composition	2	CAB-53	5%	100	40	1	10Ω - 10MΩ
LITTLE REBEL®							
Carbon Film	1/8	CAB-5F	5%	150	31	1	10Ω to 22MΩ
Carbon Film	1/8	CAB-22F	5%	500	52	2	10Ω to 22MΩ
Carbon Film	1/8	CAB-34F	5%	1000	104	3	10Ω to 22MΩ
Carbon Film	1/4	CAB-6F	5%	150	36	1	1Ω to 1MΩ
Carbon Film	1/4	CAB-23F	5%	500	75	2	1Ω to 1MΩ
Carbon Film	1/4	CAB-43F	5%	1500	137	4	1Ω to 1MΩ
Carbon Film	1/2	CAB-7F	5%	150	36	1	1Ω to 1MΩ
Carbon Film	1/2	CAB-24F	5%	500	75	2	1Ω to 1MΩ
Carbon Film	1/2	CAB-44F	5%	1500	137	4	1Ω to 1MΩ
METAL DEVIL®							
Metal Film	1/4	CAB-8M	1%	250	40	1	10Ω to 301KΩ
Metal Film	1/4	CAB-28M	1%	500	80	2	10Ω to 301KΩ
Metal Film	1/4	CAB-31M	1%	1000	120	3	10Ω to 301KΩ
Metal Film	1/2	CAB-9M	1%	250	40	1	10Ω to 1MΩ
Metal Film	1/2	CAB-29M	1%	500	80	2	10Ω to 1MΩ
Metal Film	1/2	CAB-32M	1%	1000	120	3	10Ω to 1MΩ

DEC-RANGER™

OHMITE MFG. CO.
SKOKIE, ILL.
U.S.A.
dec-ranger
0.1% PRECISION RESISTANCE
BOX CAT. NO. 3416

0.1% ACCURACY PRECISION DECADE RESISTANCE BOX NO. 3416

SPECIFICATIONS:

ACCURACY: ±0.1% (PLUS 0.03Ω MAXIMUM CONTACT AND CIRCUIT RESISTANCE)

NUMBER OF DECADES: 6

SELECTION: ROTARY TAP SWITCHES, CONTINUOUS ROTATION IN EITHER DIRECTION

READ OUT: DIGITAL, IN LINE, THROUGH "WINDOWS" IN PANEL

SWITCH LIFE: IN EXCESS OF 50,000 OPERATIONS

DIMENSIONS: 10½″ LONG x 3¾″ HIGH x 4⅝″ DEEP

CAP-RANGER®

ECONOMICAL, PORTABLE CAPACITANCE SELECTOR

OHMITE
cap-ranger

100 picofarads to 11.111 microfarads in 100 picofarad steps with ±2% accuracy. Three binding posts, one to ground the metal case. Compact size. Big performance. Simple operation. Solves your troubleshooting, breadboarding and circuit design problems using simple sliding switches. Dimensions 4″ x 6″ x 1″.

Catalog No. 3430A

OHM-RANGER®

ECONOMICAL, PORTABLE RESISTANCE SELECTOR

- **Over 11 million ohms in one-ohm increments**
- **1% accuracy***
- **Easy slide switch operation**
- **Handy slimline size**
- **Rugged metal construction**

OHMITE
ohmranger

1 to 11,111,110 ohms, in one-ohm steps — with accuracy assured by half-watt 1% tolerance resistors! Has three binding posts, one to ground case. Small enough to take anywhere in your pocket, the handy easy-to-use OHM-RANGER is ideal for lab use, schools and service technicians. Dimensions 4″ x 6″ x 1″.

* 10 ohms and above

Catalog No. 3420

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, IL 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES:

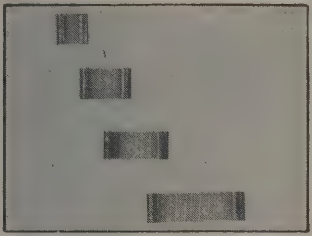
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms ..... **1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code ..... **3**•1103
Batteries, Product Selection Guide ..... **3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **2**•1003
Capacitors, Basic Formulas ..... **1A**•1093
Capacitors, Miniglossary ..... **1A**•1069
Capacitors, Product Selection Guide ..... **1A**•1003
Circuit Boards (Printed), Product Selection Guide ..... **2**•1089
Coils, Chokes, & Inductors, Product Selection Guide ..... **1A**•1219
Connectors, Miniglossary ..... **2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide ..... **2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **1A**•1309
Delay Lines, Product Selection Guide ..... **1A**•1445
Discrete Semiconductors, Product Selection Guide ..... **1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **1B**•1021
EBCDIC Code ..... **3**•1153
Encapsulation, Miniglossary ..... **2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **2**•1801
Filters, Product Selection Guide ..... **1A**•1577
Instruments, Graphic Recording, Product Selection Guide ..... **3**•1381
Instruments, Panel Meters, Product Selection Guide ..... **3**•1321
Instruments, Test & Measuring, Product Selection Guide ..... **3**•1182
Interconnection Systems, Product Selection Guide ..... **2**•1873
Keyboards & Keypads, Product Selection Guide ..... **1B**•1759
Microwave Components, Product Selection Guide ..... **1A**•1685
Military Qualified Products Lists ..... **1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **1B**•1121
Opto Semiconductors, Miniglossary ..... **1B**•1218
Oscilloscopes, Product Selection Guide ..... **3**•1361
Panel Hardware, Product Selection Guide ..... **2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **1A**•2017
Power Supplies, Miniglossary ..... **3**•1455
Power Supplies, AC, Product Selection Guide ..... **3**•1815
Power Supplies, DC, Product Selection Guide ..... **3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **1B**•1255
Relay Contact Forms ..... **1B**•1317
Relays, Electromechanical, Miniglossary ..... **1•B**1292
Relays, Product Selection Guide ..... **1B**•1289
Resistor Color Codes ..... **1A**•1791
Resistors, Product Selection Guide ..... **1A**•1789
Servo Components, Miniglossary ..... **3**•1935
Solenoids, Product Selection Guide ..... **1B**•1481
Switches, Product Selection Guide ..... **1B**•1499
Thyristors/High Power Diodes, Miniglossary ..... **1A**•1652
Transducers & Encoders, Product Selection Guide ..... **1B**•1827
Transformers, Product Selection Guide ..... **1A**•2115
Wire & Cable, Product Selection Guide ..... **2**•1935

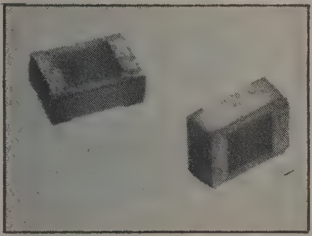
OHMTEK Chip Resistors

SOLDERABLE



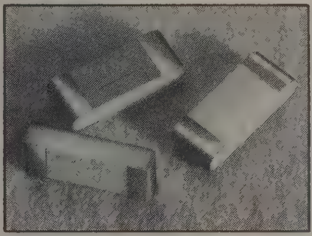
GENERAL PURPOSE

Cermet thick film wraparound terminations; resistance range 10 ohms – 100 megohms; tolerances 1, 2, 5, 10%; sizes (mils) 50x40, 50x50, 50x75, 50x100, 50x150, 100x100; solder coated with Ni barrier.



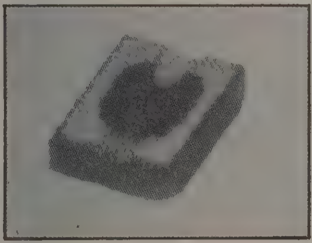
PRECISION THIN FILM WRAPAROUND

Resistance range 10 ohms – 200K; size 50x75 mils; tolerances .1, .5, 1, 2, 5%.



ULTRA-LOW VALUE

Resistance range .1 ohm – 10 ohms; tolerances 1, 2, 3, 5, 10%; size 60x160 mils; solder coated with Ni barrier.



FLIP CHIP

Cermet one-sided resistor for low cost reflow applications; sizes 50x50, 50x75, 50x100, 50x150 mils; resistance range 10 ohms – 100 megohms; tolerances 1, 2, 5, 10, 20%.

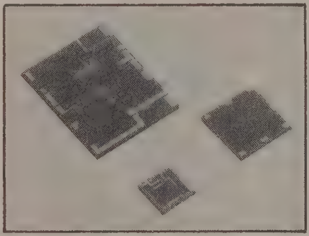
WIRE BONDABLE

THIN FILM ON SILICON

Sizes 30 mil² and 20 mil²; center tapped or single value; resistance range 4.7 ohms – 250k ohms; tolerances .1, .5, 1, 2, 5, 10%.

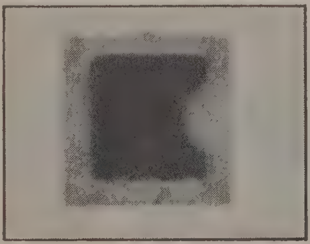
THIN FILM ON ALUMINA

Size 30 mil²; single value or center tapped for high frequency applications; resistance range 4.7 ohms – 500k ohms; tolerances .05, .1, .5, 1, 2, 5, 10%.



THIN FILM CUSTOM ARRAYS

Exceptional stability, tracking, and reliability; available in MIL-R-55342 characteristics; special chip array designs available on ceramic or silicon for active trimming.



TOPSIDE TERMINATION ON ALUMINA

Cermet thick film chip with Au wire bondable terminations; sizes 50x50 and 40x20 mils standard; resistance range 10 ohms – 5 megohms; tolerances 1, 2, 5, 10%.

Features:

- Standard chips for military and commercial applications.
- Custom chip arrays as required for demanding applications.
- Nichrome or Tantalum-based thin film.
- Ruthenium-based cermet thick film.
- Wide variety standard or versatile custom arrays.
- Rugged construction provides dependable performance and low cost.
- Chip network reliability greater than discrete resistor arrays.

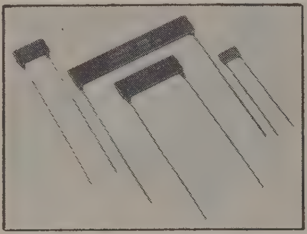
Performance/Design Characteristics:

- Tolerances: .05%, .1%, .5%, 1%, 5%, 10%.
- Resistance values: .1 ohm to 100 megohms.
- Low TCR: 25 ppm/°C; 50 ppm/°C; 100 ppm/°C.
- Tracking less than 1 ppm (arrays).
- Operating temperature range: –55°C to +125°C.
- Low noise: –35db.
- Stability: ΔR less than 200 ppm/70°C/10,000 hrs.
- Full Mil-spec screening available in-house.

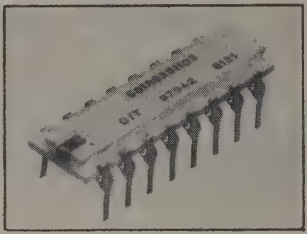
ohmtek INC.

2160 LIBERTY DRIVE,
NIAGARA FALLS, NY 14304
PHONE: 716/283-4025 EASYLINK 62343910

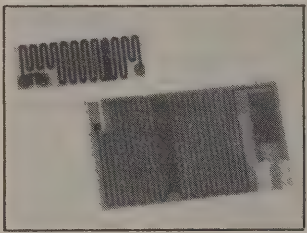
OHMTEK Cermet Resistors, Dividers and Networks



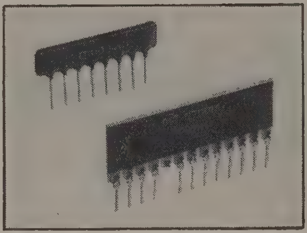
RADIAL LEAD RESISTORS
High voltage, low inductance applications; ¼, ½, 1, and 2 watt sizes; standard 10 ohms to 500 megohms 1%, 2%, 5%, 10% tolerances.



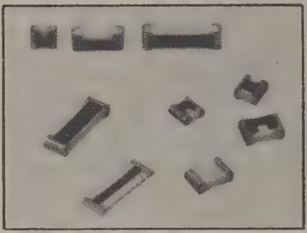
DUAL-IN-LINE
Resistor and R-C networks in standard DIL style "A" and "B" schematics; 100 ohms to 1 megohm; 1%, 5%, 10% tolerances. Testing to Group A of MIL-R-83401.



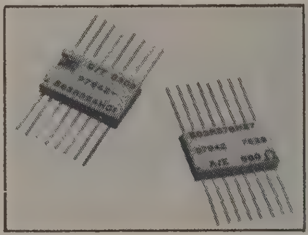
HIGH VOLTAGE DIVIDERS
Broad application to both military and commercial power supplies. Many standards to choose from, or custom made.



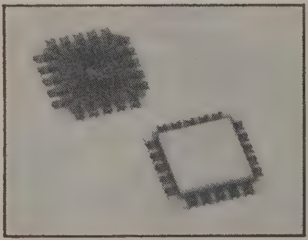
SINGLE-IN LINE CONFORMAL
Isolated resistors or common lead configurations. Low profile or high profile conserve P-C board space. Conformal epoxy coated or single-sided screened coatings.



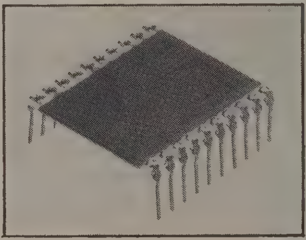
CHIP RESISTORS
General purpose solder-coated wraparounds and flipchips for reflow applications; gold topside terminations for wire bonding, ultra low to high megohm values; 1%, 2%, 5%, 10% tolerances.



FLAT PACKS
Application to high density packaging in airborne computers. Standard "A" and "B" schematics available as well as R-C networks tested to Group A of MIL-R-83401.



LEADLESS CHIP NETWORKS
Standard "A" or "B" schematic in single-layer ceramic with glazed overcoat or with ceramic cover; 100 ohms to 1 megohm; 1%, 5%, 10% tolerances.



CUSTOM NETWORKS
Custom sizes as well as networks including binary, R-2R, and decade configurations. Laser or abrasive trimmed as required to meet tolerancing demands.

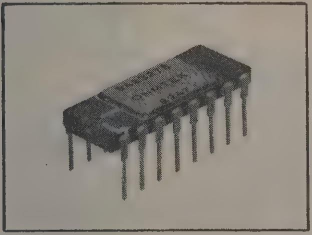
Features:
- Standard circuits for military and commercial applications.
- Custom circuits to meet demanding or unique applications.
- Ruthenium-based screened films.
- Pt/Au or Pd/Ag terminations as required.
- Broad packaging sizes and styles – Standard DIL's, 3-13 pin SIL's, oversize .600 centers or greater DIL's.
- Rugged ceramic-based construction yields dependable performance and low cost.
- Discrete performance with space saving and greater reliability of networks.

Performance/Design Characteristics
- Tolerances: .1% – 20%.
- Resistance values: .1 ohm to 1 gigaohm.
- TCR's: 100 & 250 ppm standard; 50 ppm available.
- Operating temperature range: – 55° C to +125° C.
- Tracking: 10 to 25 ppm.
- Testing to full MIL-spec requirements available.

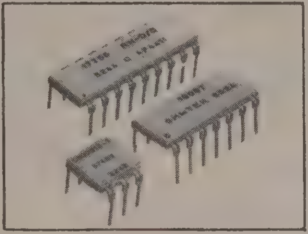
ohmtek INC.
2160 LIBERTY DRIVE,
NIAGARA FALLS, NY 14304
PHONE: 716/283-4025 EASYLINK 62343910

OHMTEK Precision Resistor Networks

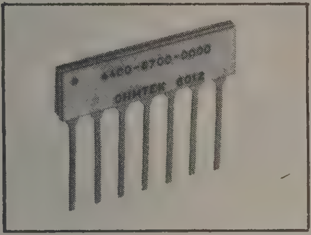
Wirewound Performance in Contemporary Packages



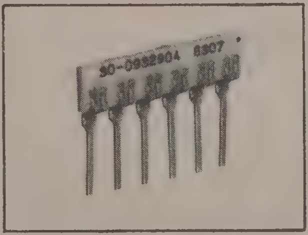
DUAL-IN-LINE HERMETIC
Meets Mil-R-83401 Characteristic "C" for military and other environmental extremes. Available 8, 14, 16 and 18 leads.



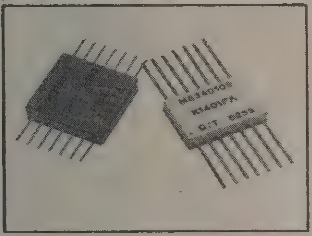
DUAL-IN-LINE CERAMIC SANDWICH
Meets Mil-R-83401 Characteristic "V". Packages of 4-22 leads in rugged monolithic inexpensive construction with highest precision in the industry.



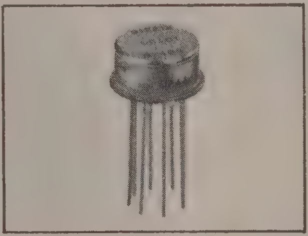
SINGLE-IN-LINE MIL-GRADE
Meets Mil-R-83401 Characteristic "V". 3-13 lead ceramic sandwich construction in high and low profile versions.



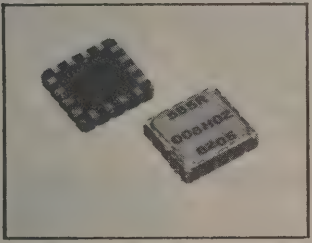
SINGLE-IN-LINE CONFORMAL
3-13 lead packages available. Designed for a wide range of tolerances and values at minimum cost.



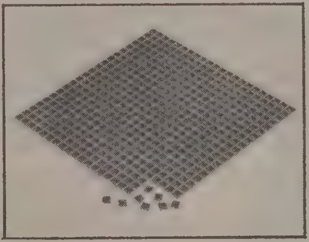
FLATPACKS
Hermetic or non-hermetic meet Mil-R-83401 Characteristic "C", "V" or "K". Available in 14 through 28 lead packages.



TO-STYLE HERMETIC
Available for custom precision applications requiring very low TCR and tight tracking.



LEADLESS CHIP CARRIERS
Hermetic or ceramic sandwich JEDEC packages. Standard and custom schematics available.



CHIP RESISTORS AND ARRAYS
Exceptional stability and reliability. Available in general purpose, 30-Mil square Mil-R-55342 characteristics and custom circuit arrays on ceramic or silicon.

Features:

- Standard circuits for military and commercial applications.
- Custom circuits as required for demanding applications.
- Nichrome or Tantalum based films optional.
- Wide packaging styles – standard hermetic or versatile custom pin counts with ceramic sandwich and conformal coated styles.
- Full Mil-spec screening available in-house.
- Rugged construction provides dependable performance at minimum cost.
- Network reliability greater than discrete resistor arrays.

Performance/Design Characteristics:

- Tolerances: .005% – 1%
- Resistance values: 10 ohms to 10 Megohm.
- Low TCR: 25 ppm/°C Std.
- Ultra low TCR: 10 and 5 ppm/°C available.
- Tracking less than 1 ppm.
- Operating temperature range: –55°C to +125°C
- Low noise: –35 db
- Stability: Δ R less than 200 ppm/70°C/ 10,000 hrs.

ohmtek INC.

2160 LIBERTY DRIVE,
NIAGARA FALLS, NY 14304
PHONE: 716/283-4025 EASYLINK 62343910

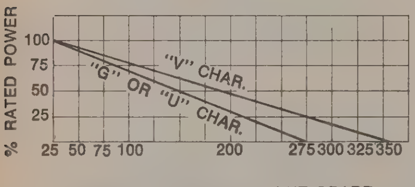
PRECISION POWER RESISTORS
Sub-Miniature Wire Wound V-Coated for 350° C

TYPE A MOLDED
.4 to 14 watts

TYPE B MOLDED
1 watt to 10 watts Beryllium or Alumina Oxide Core

ELECTRICAL SPECIFICATIONS

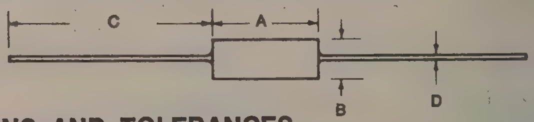
1. **Tolerances** — 5%, 3%, 1%, .5%, .25%, .1%, .05%, .02%.
2. **Dielectric Strength** — 500 VAC for 04A, 05A, 15A; B1, B3. Bal. 1000 VAC, circular foil wrap method or V-block.
3. **Life** — Maximum 0.5% resistance change after 1000 hour load life cycling 1½ hours on, ½ hour off, full load at 25°C).
4. **Temperature Coefficient** — Below 1 ohm = 90 PPM, Below 10 ohms = 50 PPM, Below 50 ohms = 30 PPM, All above = 20 PPM.



AMBIENT TEMP. DEG. CENTIGRADE

GENERAL SPECIFICATIONS

1. **Molded Type A** axial-lead resistors, molded for uniformity and minimum size for today's space age requirements.
2. Completely welded construction.
3. Meet or exceed requirements of Mil-R26, characteristic U.
4. Leads are tinned copperweld. Other materials available on request.
5. High temperature silicone molded coating.
6. **Molded Type B** beryllium oxide or alumina with power ratings 1.4 to 4 times higher than conventional ceramic resistors of the same size.

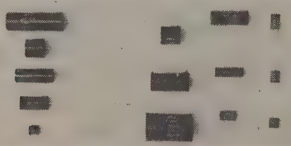


DIMENSIONS AND TOLERANCES

PRC Type	DIMENSIONS AND TOLERANCES A	B	C	D	Wattages G 275°	V 350°	Max. Res. Value	Working Voltage	MIL-R26 E Equiv.
04A	.250 ±.010	.090 ±.010	1.5	#24	.4	.75	3.4K	30	
05A	.330 ±.010	.110 ±.010	1.5	#24	.5	1.0	6K	50	
*15A	.412 ±.010	.115 ±.010	1.5	#24	1.25	2.0	7.5K	75	
20A	.550 ±.010	.115 ±.010	1.5	#24	1.25	2.0	10K	100	
S1A	.490 ±.010	.162 ±.010	1.5	#22	1.75	2.5	15K	150	
1A	.610 ±.010	.210 ±.010	1.5	#20	3.0	3.75	20K	200	
**N1A	.535 ±.010	.220 ±.010	1.5	#20	3.0	3.75	20K	200	
25A	.890 ±.010	.210 ±.010	1.5	#20	3.0	4.5	28K	200	
2A	.535 ±.010	.270 ±.010	2.0	#18	3.0	4.25	20K	200	
3A	.656 ±.010	.270 ±.010	2.0	#18	3.25	5.2	30K	200	
***5A	.900 ±.010	.312 ±.010	2.0	#18	5.5	7.5	75K	400	
7A	1.187 ±.010	.312 ±.010	2.0	#18	7.0	9.0	100K	600	
****10A	1.825 ±.010	.405 ±.010	2.0	#18	10.0	14.0	200K	1000	
B1	.250 ±.010	.090 ±.010	1.5	.020	1.0w	1.5w	3.4K	35	RW 81
B2	.325 ±.010	.090 ±.010	1.5	.020	1.5	2.0	4.9K	48	
B3	.412 ±.010	.115 ±.010	1.5	.020	2.25	3.0	10.4K	85	RW 80
B5	.610 ±.010	.210 ±.010	1.5	.032	4.0	5.0	24.5K	172	
B5C	.540 ±.010	.240 ±.010	2.0	.040	5.0	7.0	32.3K	260	
B6	.656 ±.010	.270 ±.010	2.0	.040	6.0	8.0	47.1K	300	
B10	.900 ±.010	.312 ±.010	2.0	.040	7.0	10.0	96 K	470	

* RW 70 ** RW 59/69/79 *** RW 57/67/74 **** RW 58/68/78
For Non-Inductive Winding add Suffix "N" to Callout.

MOLDED PRECISION WIRE WOUND RESISTORS



All are non-inductively, reverse Pi wound at minimum wire tension for maximum long life stability. All production is aged before calibration for insurance of minimum long-term load-life drift. Due to advance winding techniques and design they have extremely low rise time characteristics approaching film type resistors. Through matching of materials, resistance changes from temperature expansion rates is eliminated. Zero voltage coefficient and low noise characteristics. Leads are solderable or weldable. TC of 15 PPM/°C standard. TC of 2 PPM/°C to 6000 PPM/°C available. All bridges and other instrumentation used in calibration are periodically checked against National Bureau Primary Standards. Designs exceed Mil-R-93 and Mil-R-9444. Distinct capabilities for: Special Networks; Matched Sets; Voltage Dividers; Molded and encapsulated Modules.

TYPE AP: AXIAL PRECISION
TYPE LP: LUG PRECISION
TYPE RP: RADIAL PRECISION
TYPE RPC: RECTANGULAR PRINTED CIRCUIT
TYPE PC: PRINTED CIRCUIT

DIMENSIONS TABLE

New Type		Comm. Watts	Max. Res.	Max. Dia.	Max. Length	Max. Volt.	Lead Spacing	Lead Gauge	Hole Size
118AP		.08	250K	.128	.263	100		#24	
122AP		.10	500K	.128	.380	100		#24	
130AP		.13	1.2M	.190	.300	100		#22	
134AP		.15	1.3M	.190	.380	100		#22	
142AP		.15	750K	.260	.260	150		#20	
152AP	RB56	.20	2.0M	.260	.385	100		#20	
156AP		.25	2.5M	.260	.510	150		#22	
160AP	RB55	.25	2.5M	.260	.510	150		#20	
164AP	RB54	.35	4.5M	.260	.760	300		#20	
168AP	RB53	.50	8.0M	.385	.760	400		#20	
172AP		.50	4.0M	.385	.510	300		#20	
176AP		.50	8.0M	.510	.510	400		#20	
180AP		.60	9.0M	.510	.635	400		#20	
184AP	RB52	.60	9.0M	.385	1.010	400		#20	
188AP	RB57	1.00	18.0M	.510	1.010	800		#20	
192AP	RB58	1.50	30.0M	.510	1.510	900		#20	
202RP		.25	500K	.260	.285	100	.200	#22	N.H.
214RP		.25	1.0M	.260	.447	150	.277	#22	#2
324LP	RB08	.50	4.0M	.510	.510	400	.325	Lug	#6
372LP	RB18	2.00	10.0M	.760	1.260	1000	1.000	Lug	#6
400RPC		.125	500K	.145 x .260 x .260		150	.125	#20	
500PC		.25	500K	.260	.320	150	.200	#22	
512PC		.20	700K	.260	.410	150	.150	#20	

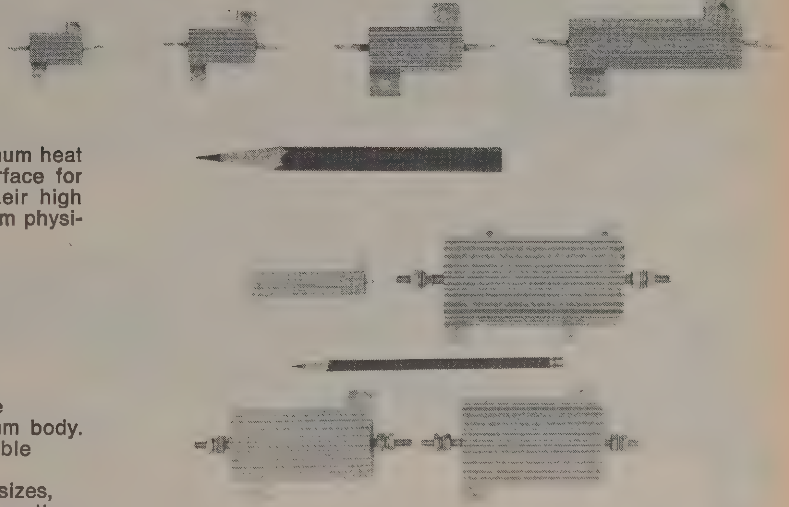
PACIFIC RESISTOR CO.

18300 OXNARD STREET, TARZANA, CA 91356 • (818) 345-7811 - (818) 873-4574 • Inside CA: 800-835-3355 • Outside CA: 800-367-6677

PRECISION POWER RESISTORS Aluminum-Finned Heat Sink

TYPE CH CHASSIS MOUNT
5 through 250 watts

TYPE BCH CHASSIS MOUNT
15 through 35 watts
Beryllium Oxide or Alumina Core



Chassis Mount, Type CH units are designed for maximum heat dissipation by mounting solidly to metal chassis surface for maximum heat transfer. They are outstanding for their high power dissipation with precision tolerances in minimum physical sizes.

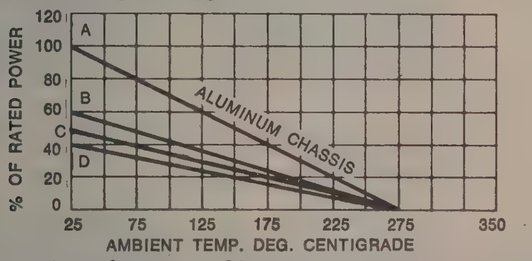
ELECTRICAL SPECIFICATIONS

1. Resistance Range — .05 ohms to 275K ohms.
2. Tolerance — 5%, 3%, 1%, .5%, .25%, .1%, .05%.
3. Temperature Coefficient — ±20 PPM to 90 PPM

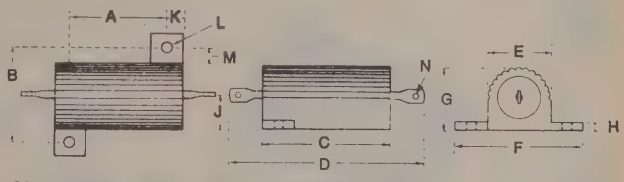
GENERAL SPECIFICATIONS

1. Lower hot spot ratings due to exclusive complete encapsulation of element within anodized aluminum body.
2. Welded construction throughout assures long stable load life.
3. Heavy spade lug type leads on 5 through 70 watt sizes, threaded heavy stud terminals on 100 through 250 watts.
4. 1000 VAC minimum dielectric strength on 5CH, 10CH, B5CH and B10CH; 2500 VAC on 25CH, 50CH, 100CH, and B25CH; 5500 VAC on all others.
5. Temperature Range — −55°C to +275°C.
6. Eight standard sizes.

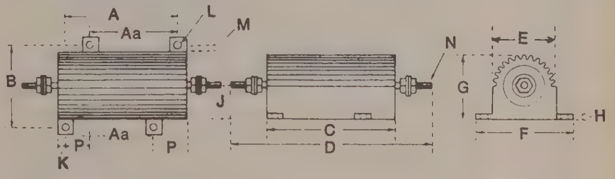
DERATING CURVES



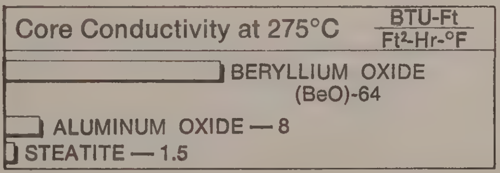
Temp. of −55°C to +275°C. Derating is required for reduced chassis mounting area and high ambient temp.
Curves:
A — When mounted on proper alum.
Chassis:
4x6x2x.040 alum. chassis = 5CH & 10CH.
5x7x2x.040 alum. chassis = 25CH, B25CH, & B50CH.
12x12x.059 alum. panel = 50CH & 100CH.
12x12x.125 alum. panel = 110CH, 180CH, and 250CH.
B — Unmounted 5CH, 10CH, B5CH, B10CH.
C — Unmounted 25CH, 100CH, B25CH, and 110CH.
D — Unmounted 50CH, 180CH, and 250CH.



5CH, 10CH, 25CH, 50CH, 100CH, B5CH, B10CH, B25CH



110CH, 180CH, 250CH

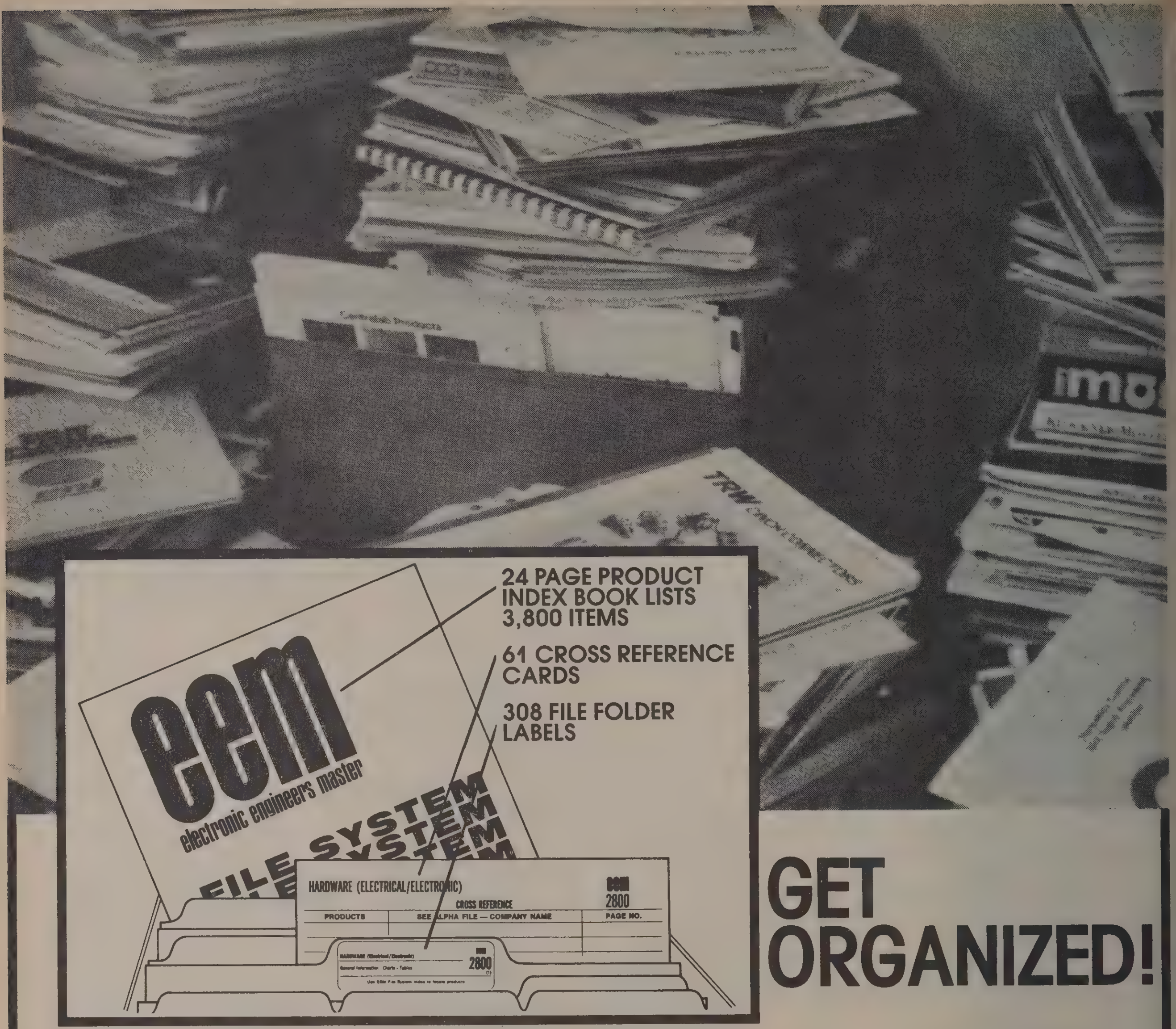


DIMENSIONS TABLE

PRC Type	Mil-R 18546	Com. Watts	Max. Res.	A	Aa	B	C	D	E	F	G	H	J	K	L	M	N	P	No. Mtg. Screw Size
5CH	RE60	5	20K	.444	–	.490	.500	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050		2-#2
10CH	RE65	10	30K	.562	–	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086		2-#2
25CH	RE70	25	75K	.719	–	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086		2-#2
50CH	RE75	50	200K	1.563	–	.844	1.968	2.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086		2-#4
100CH	–	70	275K	2.625	–	.844	2.968	3.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086		2-#4
B5CH	RE60	15	20K	.444	–	.490	.600	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050		2-#2
B10CH	RE65	20	30K	.562	–	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086		2-#2
B25CH	RE70	35	75K	.719	–	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086		2-#2
TOL.	–	–	–	±.005	–	±.005	±.031	±.063	±.031	±.031	±.031	±.016	±.016	±.01	±.005	±.016	±.005 thd	–	–
110CH	RE77	100	50K	2.750	–	2.250	3.500	5.478	1.80	2.813	1.750	.188	.800	.375	.188	.250	12/24 thd		2-#8
180CH	–	180	50K	2.770	–	2.500	3.500	5.478	2.125	3.000	2.188	.250	.950	.375	.188	.200	12/24 thd		2-#8
250CH	RE80	250	45K	3.875	3.00	2.500	4.500	7.000	2.125	3.000	2.188	.250	1.00	.312	.188	.200	¼/20	.875	4-#8
TOL.	–	–	–	±.01	‡.01	±.01	±.094	±.094	REF.	±.031	±.031	±.016	REF.	±.031	±.010	REF.	–	±.01	–

‡ For Non-Inductive Winding add Suffix "N" to Callout.

PACIFIC RESISTOR CO.
18300 OXNARD STREET, TARZANA, CA 91356 • (818) 345-7811 - (818) 873-4574 • Inside CA: 800-835-3355 • Outside CA: 800-367-6677


24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
eem
2800
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
2800
TRW
imo

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

PRECISION RESISTIVE PRODUCTS, INC.

HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637 (319) 394-9131

PR-SERIES ULTRA PRECISION METAL FILM RESISTORS

- **Low Temperature Coefficients**
- **Tight Tolerances**
- **High Stability**
- **Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
PR1/10	.280	.102	.300	AWG #22
PR1/8	.400	.150	.450	AWG #22
PR1/4	.600	.200	.685	AWG #22

SPECIFICATIONS

Style	Resistance Range (Ohms)	Wattage Rating @ 85°C	Voltage Rating
PR1/10	10-500K	1/10	300
PR1/8	10-1M	1/8	400
PR1/4	10-1M	1/4	500

TYPICAL PERFORMANCE

	%ΔR
1000 Hr. Load Life 85°C	0.02
Humidity	0.04
Temperature Cycling	<0.01
Short Time Overload	<0.01
Dielectric Withstanding	<0.01
Noise	<−30dB
Insulation Resistance	>10000 M. Ohm
Shelf Life	<50 PPM/YR.

TEMPERATURE COEFFICIENTS

TC25 = 0 ±25 PPM/°C −20 to +85°C
TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC5 = 0 ± 5 PPM/°C −20 to +85°C

RESISTANCE TOLERANCES

±1.0%, ±0.5%, ±.25% & ±0.1%, ±0.5%, ±.02%, ±.01%

LEAD MATERIAL

OFHC with 60/40 Tin/Lead Coating

RL-SERIES ULTRA PRECISION METAL FILM RESISTORS

- **Radial Leads**
- **Small Size**
- **Low TC**
- **High Stability**

DIMENSIONS (INCHES)

H	Height	.365
L	Length	.260
W	Width	.140
LS	Lead Spacing Lead Gage #22	.150

SPECIFICATIONS

Style	Temperature Coefficient	Resistance Range (Ohms)	Standard Tolerance	Wattage @ 85°C
RL 1	20 PPM/°C 15 10 5	20 thru 100K	1%, 5%, .25%, .10%, .05%, & .02% .01%	.1
RL 3	20 PPM/°C 15 10 5	20 thru 100K	1%, .5%, .25%, .1% .05% & .02% .01%	.3

TEMPERATURE COEFFICIENTS

TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC5 = 0 ± 5 PPM/°C −20 to +85°C

TYPICAL ENVIRONMENTAL PERFORMANCE

	%ΔR
1000 Hr. Load Life	±0.02%
Humidity	±0.04%
Temperature Cycling	±0.01%
Short Time Overload	±0.01%
Insulation Resistance	>1000 Megohms
Noise Index	<−30dB
Voltage Coefficient	<0.05 PPM/Volt
1 Year Shelf Life	±50 PPM

MATCHED SETS AND NETWORKS

Customized resistance and temperature coefficient matching is available.

Resistance matching to .01% and T. C. tracking of 1 PPM/°C are standard.

Please consult the factory for details on your requirements.

GP-SERIES GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- **Economical**
- **High Performance**
- **Very Stable**
- **Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
GP¼	.280	.102	.325	AWG #22
GP½	.400	.150	.450	AWG #22
GP¾	.600	.200	.685	AWG #22
GP1	.600	.200	.685	AWG #20

SPECIFICATIONS

PRP Style	Mil. Style	Resist. Range (Ohms)	Wattage Rating @ 70°C	Wattage Rating @ 125°C	Voltage Rating
GP¼	RN55	2.5—500K	¼	1/10	300
GP½	RN60	2.5—1 M	½	⅛	500
GP¾	RN65	10—1.5M	¾	¼	500
GP1	RN70	10—1.5M	1	½	500

TYPICAL PERFORMANCE

	%ΔR
Temperature Cycling	0.05
Low Temperature Operation	0.03
Terminal Strength, 5 Lb. Load	0.02
Resistance To Soldering Heat	0.02
Dielectric Withstanding Voltage	0.02
Short Time Overload	0.05
Moisture Resistance	0.20
1000 Hour Load Life @ 125°C	0.15

TEMPERATURE COEFFICIENTS

TC25 = 0 ±25 PPM/°C −20 to +85°C
TC50 = 0 ±50 PPM/°C −20 to +85°C
T100 = 0 ±100 PPM/°C −20 to +85°C
T250 = 0 ±250 PPM/°C −20 to +85°C

RESISTANCE TOLERANCES

±5.0%, ±2.0%, ±1.0%, ±0.5%, ±.25%, & ±0.1%

LEAD MATERIAL

OFHC with 60/40 Tin/Lead Coating

NOTE: The GP-Series of resistors is conformally coated and fully protected against moisture by a multi-paint coat system and a hard epoxy outer coating.

Marking is alpha-numeric and meets the most demanding marking requirements. Special marking is available upon request.

Consult the factory concerning failsafe, flameproof, and fusing requirements.

LCR¼-SERIES GENERAL PURPOSE METAL FILM RESISTORS

- **Low Cost**
- **Taped and Reel Package**
- **Color Band Marking**
- **Exceeds Mil-R-22684B & Mil-R-10509F Performance Requirements**

DIMENSIONS

Max. L	Max. Dia.	Lead L.	Lead Dia.
.270″	.098″	1¼″	.025

GENERAL SPECIFICATIONS

Resist. Tolerance	Resist. Range	Temp. Coef. of Resist.	Power Rating	Max. Volt.
1% 2% 5%	10Ω through 1M	50 & 100 PPM/°C	¼ W (70°C)	250 VRMS

Performance Characteristics		PRP	Mil-R-22684B	Mil-R-10509F
Type No. (Style)		LCR¼	RL07	RN55D
Size: inch	Body Length	.270 Max.	.243 ±.038	.250 ±.031
	Body Diameter	.098 Max.	.090 ±.008	.109 ±.031
	Lead Diameter	.024 ±.002	0.23 ±.004	.025 ±.002
Power Rating		0.25W at 70°C 0.125W at 125°C	0.25W at 70°C 0.078W at 125°C	0.125W at 70°C 0.0625W at 25°C
Max. Rated Continuous Working Voltage		250V	250V	200V
Max. Ambient Temperature		165°C	150°C	165°C
TCR		±50 & ±100 PPM/°C	±200 PPM/°C	+200 −500 PPM/°C
Nominal Resistance Range		10Ω to 1MΩ	47Ω to 150kΩ	10Ω to 301kΩ
Standard Tolerances		1%, 2% & 5%	5% & 2%	1%
Dielectric Withstanding Voltage	ΔR	0.25%	0.5%	0.5%
Insulation Resistance		10,000 MΩ	1,000 MΩ	10,000 MΩ
Temperature Cycling	ΔR	0.25%	1.0%	0.5%
Short-Time Overload	ΔR	0.25%	0.5%	0.5%
Moisture Resistance	ΔR	0.5%	1.5%	1.5%
Load Life	ΔR	1.0%	2.0%	1.0%
Terminal Strength	ΔR	0.2%	0.5%	0.2%
Resistance to Soldering Heat	ΔR	0.5%	0.5%	0.5%
Shock	ΔR	0.2%	0.5%	0.5%
Vibration	ΔR	0.2%	0.5%	0.5%
Low Temperature Operation	ΔR	0.25%	0.5%	0.5%
Shelf Life	ΔR	0.2%	0.2%	N.A.

PRECISION WIREWOUND RESISTORS

TYPE SM-(4)

FOUR (4) TERMINAL SHUNTS

	PRC Type	Max. Power Rating	Body Dimensions ±.787mm (.031") Length mm	(ins.)	Diameter mm	(ins.)	Std. Space	1.5"L. Std. Lead Diam. (±.001")	Min. Res. @ Max. Watts Ω W	Min. Res. @ Derated Power Ω W
	SM186-4	2½W	16.5	(.650")	6.35	(.250")	.110"	.0285"	.025 @ 2½W	.005 @ .5W
	SM228-4	3W	19.69	(.775")	7.11	(.280")	.110"	.0285"	.03 @ 3W	.005 @ .5W
	SM2812-4	5W	26.04	(1.025")	8.71	(.343")	.118"	.032"	.02 @ 5W	.005 @ 1.125W
	SM3724-4	7½W	45.72	(1.800")	11.10	(.437")	.243"	.032"	.03 @ 7½W	.005 @ 1.125W

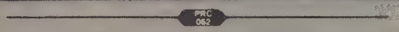
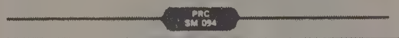
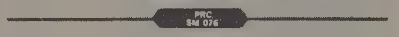
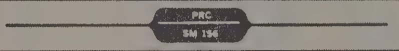
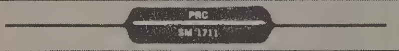
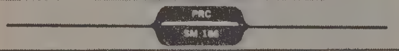
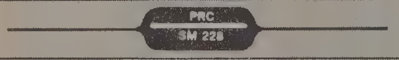
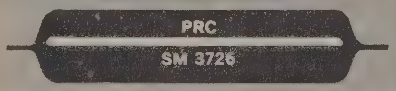
ALL DRAWINGS ILLUSTRATE ACTUAL SIZE

Precise low-value repeatability. Eliminates lead-out and contact resistance. "Single Joint" design makes lead identification academic.

TYPE SM

TWO (2) TERMINAL PRECISION "POWER" AXIAL LEAD

For higher resistance values (at max. rated voltage) decrease max. power rating ($P = E^2/R$)
For lower resistance values (at max. rated power) decrease max. voltage rating ($E = \sqrt{PR}$)

	PRC Type	RW Styles MIL-R-26	Max. Power Rating (Watts)	*Min. Allowable Resist. (Ohms)	Resist. Values Based Upon Max. Power & Max. Voltage ($R=E^2/P$)	*Max. Allowable Resist. (Ohms)	Max. Voltage Rating	Body Dimensions ±.787mm (.031") Length mm	(ins.)	Diameter mm	(ins.)	1.5"L. Lead Diam. Tinned Copper
	SM062	—	¼W	1.0	17K	30K	65V	6.35	(.250")	2.03	(.080")	.020"
	SM063	—	½W	0.1	24K	50K	110V	7.92	(.312")	2.03	(.080")	.020"
	SM094	RW70	1W	0.1	40K	80K	200V	10.31	(.406")	2.92	(.115")	.025"
	SM076	—	1⅛W	0.1	53K	180K	245V	12.7	(.500")	2.29	(.090")	.020"
	SM156	—	1½W	0.1	90K	400K	375V	13.49	(.531")	4.47	(.176")	.028"
	SM1711	—	2W	0.1	225K	900K	670V	20.62	(.812")	4.83	(.190")	.028"
	SM186	RW69	3W	*0.025	80K	480K	500V	12.7	(.500")	5.26	(.207")	.028"
	SM177	RW79	3W	0.1	80K	540K	500V	14.27	(.562")	4.83	(.190")	.028"
	SM228	—	3W	*0.02	120K	720K	600V	15.88	(.625")	6.10	(.240")	.032"
	SM2812	RW74	5W	*0.02	200K	1 MEG	1000V	22.23	(.875")	7.92	(.312")	.032"
	SM3114	RW67	6½W	0.1	154K	1.5 MEG	1000V	25.4	(1.000")	7.92	(.312")	.032"
	SM3726	RW78	10W	*0.07	156K	4 MEG	1250V	45.21	(1.780")	10.03	(.395")	.032"

* 0.02 ohm to 0.1 ohm and maximum resistance values available in non-standard physical sizes −0 +.062". All low value 2-terminal designs are calibrated and tested at mid-point on lead unless otherwise specified.

CONSIDER THESE INNOVATIVE FEATURES:

1 WIDE RESISTANCE RANGE

"Widest in the industry" any ohmic value or decimal part of an ohm from 0.005 ohm to 4 megohms.

2 DEPENDABLE TOLERANCES

Small quantity lots, as well as, competitive high volume production quantities are accurately checked 100% to assure specified limits . . . ±1% (Std.), ±0.5%, ±0.25%, ±0.1% and ±0.05% resistance tolerances.

3 STABILITY VS. TEMPERATURE CHARACTERISTICS

Carefully selected materials/processes & quality control procedures insure low temperature (TCR) and power coefficients. Standard: Zero ±5 ppm/°C to zero ±20 ppm/°C. Special to ±2 ppm/°C.

4 HIGH VOLTAGE RATINGS

(D.C. Voltage or Peak Voltage)
Precision's high operating voltage winding patterns also eliminate dangerous crossovers and potential problems of standard mandrel style resistors. To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

5 PRECISION POWER RATINGS

All (Std.) Type SM 1% tolerance resistors are designed for continuous full load operation at 25°C. Derate to zero power at +275°C.

6 SOLVENT RESISTANT COATING

All Type SM resistors are sealed in a tough solvent resistant — high temperature silicone coating . . . with indelible marking.

PRC **PRECISION RESISTOR CO., INC.**
109 U.S. HIGHWAY #22 • HILLSIDE, NJ 07205 U.S.A. • TEL: (201) 926-3036 • TELEX: 13-6479 (413)

PRECISION WIREWOUND RESISTORS

TYPE HR

ULTRA HIGH PRECISION AXIAL LEAD

PRC Types	RB Styles Meets or Exceeds Environmental Conditions of: MIL-		Max. Watts 1% Res. Tol.	Max. Volts	Body Dimensions ±.787mm (.031″)				2″L. Leads Diam. Max.	Resistance (Ohms) Min. 0.1 Max.
	R-39005	R-93			Length mm	Length (ins.)	Diameter mm	Diameter (ins.)		
HR175N	—	—	.2W	100V	7.92	(.312″)	3.96	(.156″)	.020″	100K
HR186N	—	—	.2W	150V	9.53	(.375″)	4.75	(.187″)	.025″	150K
HR188N	RBR74	—	.25W	150V	12.7	(.500″)	4.9	(.193″)	.025″	200K
HR255N	RBR75	—	.25W	150V	7.49	(.295″)	6.35	(.250″)	.025″	316K
HR256N	RBR56	RB56	.25W	200V	9.53	(.375″)	6.35	(.250″)	.032″	200K
HR258N	RBR55	RB55	.33W	300V	12.7	(.500″)	6.35	(.250″)	.032″	500K
HR2512N	RBR54	RB54	.5W	300V	19.05	(.750″)	6.35	(.250″)	.032″	1 MEG
HR3114N	RBR76	—	.5W	300V	20.62	(.812″)	7.92	(.312″)	.032″	1.5 MEG
HR3712N	RBR53	RB53	.66W	300V	19.05	(.750″)	9.53	(.375″)	.032″	2 MEG
HR3716N	RBR52	RB52	1W	600V	25.4	(1.000″)	9.53	(.375″)	.032″	3 MEG
HR5016N	RBR57	RB57	1.5W	600V	25.4	(1.000″)	12.7	(.500″)	.032″	5 MEG
HR5024N	—	RB58	2W	900V	38.1	(1.500″)	12.7	(.500″)	.032″	7.5 MEG
HR5032N	—	RB59	2.5W	1200V	50.8	(2.000″)	12.7	(.500″)	.032″	10 MEG

THE ULTIMATE IN PRECISION AND VALUE:

1 RESISTANCE RANGE AND TOLERANCE
Standard: Any ohmic value or decimal part of an ohm desired from 0.1 ohm to 10 megohms with tolerances to ±0.001%, (±0.01% Std.)

2 TEMPERATURE COEFFICIENT OF RESISTANCE
Standard: Zero ±5 ppm/°C (100 ohms and above). Zero ±15 ppm/°C (values below 100 ohms). Special: To ±1 ppm/°C.

3 STABILITY VS. TIME CHARACTERISTICS
To ±0.001%/year @ 25°C. e.g. 10% of tolerance: ±0.01% = 0.001%/year.

TYPE SX

HIGH PRECISION AXIAL LEAD

PRC Types	$P = \frac{E^2}{R}$ Max. Watts	$E = \sqrt{PR}$ Max. Volts	Body Dimensions ±.787mm (.031″)				1.5″L. Leads Max. Diam.	Resistance (Ohms)		
			Length mm	Length (ins.)	Diameter mm	Diameter (ins.)		Min.	Max. Standard	Max. Special
SX062	.04W	35V	6.86	(.270″)	2.03	(.080″)	.020″	1.0	17K	30K
SX063	.05W	50V	8.43	(.332″)	2.03	(.080″)	.020″	0.1	20K	50K
SX072	.06W	45V	6.86	(.270″)	2.29	(.090″)	.020″	0.1	25K	35K
SX073	.07W	65V	8.43	(.332″)	2.29	(.090″)	.020″	0.1	30K	65K
SX093	.1W	85V	8.43	(.332″)	2.92	(.115″)	.025″	0.1	35K	75K
SX094	.1W	100V	10.03	(.395″)	2.92	(.115″)	.025″	0.1	50K	100K
SX095	.125W	125V	11.61	(.457″)	2.92	(.115″)	.025″	0.1	60K	180K
SX105	.166W	165V	11.61	(.457″)	3.3	(.130″)	.025″	0.1	75K	210K
SX123	.166W	165V	8.43	(.332″)	3.68	(.145″)	.025″	0.1	40K	120K
SX106	.2W	200V	13.21	(.520″)	3.3	(.130″)	.025″	0.1	100K	280K
SX124	.2W	200V	10.03	(.395″)	3.68	(.145″)	.025″	0.1	50K	160K
SX143	.2W	200V	8.43	(.332″)	4.06	(.160″)	.028″	0.1	50K	130K
SX154	.25W	250V	10.03	(.395″)	4.47	(.176″)	.028″	0.1	100K	200K
SX155	.25W	250V	11.61	(.457″)	4.47	(.176″)	.028″	0.1	100K	300K
SX156	.33W	330V	13.21	(.520″)	4.47	(.176″)	.028″	0.1	140K	400K
SX174	.33W	330V	10.03	(.395″)	4.83	(.190″)	.028″	0.1	130K	220K
SX175	.33W	330V	11.61	(.457″)	4.83	(.190″)	.028″	0.1	135K	350K
SX158	.5W	500V	16.38	(.645″)	4.47	(.176″)	.028″	0.1	450K	600K
SX177	.5W	500V	14.78	(.582″)	4.83	(.190″)	.028″	0.1	400K	540K
SX185	.5W	500V	11.61	(.457″)	5.26	(.207″)	.028″	*0.01	135K	360K
SX186	.5W	500V	13.21	(.520″)	5.26	(.207″)	.028″	*0.01	150K	480K
SX188	.6W	600V	16.38	(.645″)	5.26	(.207″)	.028″	*0.01	450K	720K
SX2210	.8W	800V	19.56	(.770″)	6.10	(.240″)	.032″	0.1	511K	1.1 MEG
SX3110	1W	1000V	19.56	(.770″)	8.43	(.332″)	.032″	0.1	750K	1.6 MEG
SX2812	1.25W	1000V	22.73	(.895″)	7.62	(.300″)	.032″	0.1	1 MEG	1.8 MEG
SX3114	1.33W	1000V	25.91	(1.020″)	8.43	(.332″)	.032″	0.1	1.25 MEG	2 MEG
SX3712	1.5W	1000V	22.73	(.895″)	11.1	(.437″)	.032″	0.25	1.5 MEG	2.5 MEG
SX3716	2W	1250V	29.08	(1.145″)	11.1	(.437″)	.032″	0.5	2 MEG	3.5 MEG
SX3724	3W	1250V	41.78	(1.645″)	11.1	(.437″)	.032″	0.5	3 MEG	5 MEG
SX3730	5W	1500V	51.31	(2.020″)	11.1	(4.37″)	.032″	0.5	4 MEG	6 MEG

REASONS FOR SPECIFYING TYPE SX RESISTORS:

1 RESISTANCE RANGE AND TOLERANCE
"Repeatable (part-to-part)". any ohmic value desired with tolerances of ±1% (Std.), ±½%, ±¼%, ±1/10% and ±1/20%.

2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)
Zero ±10 ppm/°C (standard).

3 INDUCTIVE VS. NON-INDUCTIVE
The standard Type SX resistors are inductively wound. Add suffix letter "N" in part number for standard non-inductive resistors. Special non-inductive winding patterns are available for evaluation.

4 STABILITY VS. TIME CHARACTERISTICS
"Long Life"
To ±0.005%/year at 25°C (no load).

5 POWER RATINGS VS. AMBIENT TEMPERATURE AND RESISTANCE TOLERANCE
Full power ratings to +125°C, are based upon standard ±1% resistance tolerance. Derating is required for higher temperatures and closer resistance tolerances.

6 TERMINALS
Solderable "hot-tinned" copper wire leads act as an excellent wetting agent and provide long shelf life. Low EMF construction reduces thermal effects.

7 PROTECTIVE COATINGS
Type SX: New solvent resistant silicone-epoxy-seal.

TYPE PT

TEMPERATURE-SENSITIVE SPECIFICATIONS

PRC Types	Power Rating	Body Dimensions ±.787mm (.031″)				1.5″L. Lead Diam. Tinned Copper	Maximum Resistance Values for Partial Listing of Popular +(TCR) Characteristics				
		Length mm	Length (ins.)	Diameter mm	Diameter (ins.)		+400 ppm/°C	+1400 ppm/°C	+3930 ppm/°C	+4500 ppm/°C	+6000 ppm/°C
PT094	0—.1W	10.03	(.395″)	3.18	(.125″)	.025″	7K	6K	100	1500	500
PT156	0—.25W	13.21	(.520″)	4.75	(.187″)	.028″	27K	20K	500	5K	2K
PT158	0—.5W	16.38	(.645″)	4.75	(.187″)	.028″	45K	40K	800	10K	3500

PRECISION'S linear (+) TCR thermal tracking resistors function as **economical temperature sensing** devices or used as **compensators** for voltage stabilization.

Maximum Resistance values based upon .001″ wire size. Hundreds of additional physical sizes and TCR combinations are available.

PURCHASING INFORMATION
Please specify: Quantity, type, resistance value, resistance tolerance and special features which may apply.

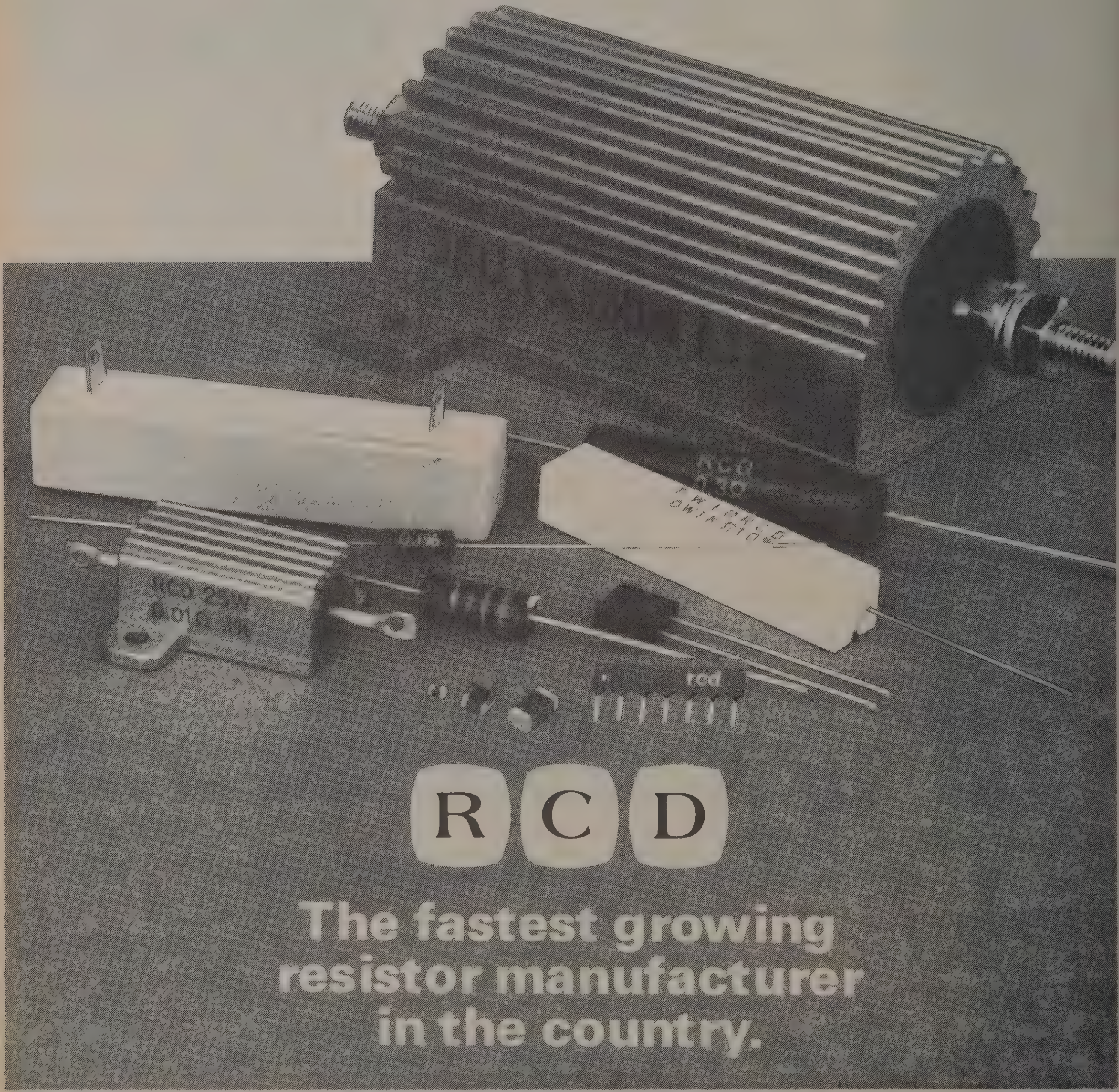
PRODUCTION CAPACITY
Small quantity lots delivered quickly . . . No minimums. Also PRECISION has competitive high volume general purpose resistor capabilities.

50 YEARS EXPERIENCE
Request our "easy to specify" brochure and select exactly what you need. Let our experience in resistor design and manufacturing work for you.

PRC PRECISION RESISTOR CO., INC.
109 U.S. HIGHWAY #22 • HILLSIDE, NJ 07205 U.S.A. • TEL: (201) 926-3036 • TELEX: 13-6479 (413)

It's simple.

If we can't save you money on resistors, then we don't deserve your business.

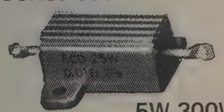
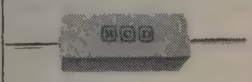


R C D

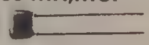
The fastest growing
resistor manufacturer
in the country.

RCD Quick Reference Guide

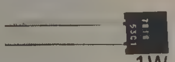
POWER WIREWOUND RESISTORS

STOCK	**Series 100*** ¼W-20W	Silicone coated, all-welded, per MIL-R-26(RW), MIL-R-39007 (RWR). .001Ω to 300KΩ, tolerances to ±0.01%, TCR to 5PPM. 100X — non-inductive 100BEO — increased power 100R — radial leads 100F — flameproof coating
	Series 600*  5W-300W	Silicone molded in an aluminum housing. High wattage capability with chassis mounting, per MIL-R-18546(RE), MIL-R-39009(RER). .005Ω to 200KΩ, tolerances to ±0.01%, TCR to 5PPM. 600X — non-inductive 600BEO — increased power
STOCK	**Series PW***  2W-50W	Low cost general purpose wirewounds. Ceramic encased, completely flameproof. PWX — non-inductive PWA — standoffs PWR — radial leads PWF — failsafe fusible PWS — miniature sizes
	Series RW 1W -3W	Low cost epoxy molded or conformal coated wirewounds offer savings over carbon comps. RW-1 (1-watt) is the size of a ½-W carbon comp. RW-2(2W) and RW-3(3W) are both the size of a 1W comp. RWF — Flameproof fusible
	Series ULV,LVF* 1W-25W	Series ULV utilizes a newly-developed manufacturing technique to obtain very low values (to 0.002Ω), with precision accuracy at lowest cost. LVF — four terminal construct.

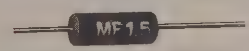
THICK FILM RESISTORS

STOCK	**Series RSF,BW** ¼W-9W	**METAL OXIDE RESISTORS** Flameproof, thick complex-oxide construction results in performance and size of wirewounds, at significant price reductions. Non-inductive, high-surge capability. 0.1Ω to 240K stocked. BW Series is fusible.
	RG, UHV ¼W-4W	**HIGH VOLTAGE/HIGH MEGOHM** Voltage capability to 50KV. Resistance to 10,000 Gig. Tolerances to 0.5%, TCR to 50PPM.
	Series MG ½W- 1W	**SPACE SAVER RESISTORS—** Miniature resistors! ½-watt is ⅛W size, 1-watt is ¼-watt size. Improved dissipation due to thick cermet glaze. 6.2 ohm to 1 Meg, TCR to 50 PPM, tolerances to 1.0%.
	Series MC, MCR 1/16-1.0W	**THICK FILM CHIPS—12 SIZES** High-stability thick film chip resistors. 4.7Ω to 2000 Meg. Wraparound termination available. Tolerances to 0.25%, TCR to 50PPM.
	Series MR,MCF 	**WORLD'S SMALLEST!** Cermet micro-resistors offer highest performance in smallest possible size. Under 0.1" long! 4.7Ω to 8.2 Meg. Axial or radial leads.
STOCK	**DIP,SIP ***	**THIN FILM/THICK FILM—** RCD resistor networks offer premium performance per MIL-R-83401. SIP packages are 4 to 12 pin. DIP's are 14 or 16 pin. Variety of standard and custom configurations, hybrids available.

PRECISION WIREWOUND RESISTORS

Series SA,MA* .1W-2W	Epoxy encapsulated, non-inductive precision bobbin wirewounds per MIL-R-93(RB), MIL-R-39005 (RBR). 0.1Ω to 25 Meg, tolerances to ±0.005%, TCR from ±1PPM to +6700PPM
Series PC*  .1W-1W	Same as Series SA, MA but feature radial leads for easy PCB insertion and space savings per MIL-R-93, MIL-R-39005. PC451 (rectangular) is direct low-cost replacement for ultra-precision films.
Series Q* .1W-1W	Wirewound substitutes for precision metal film's RN55, RN60, RN65, RN70, RN75. Better stability, lower price. TCR as low as ±2PPM. Tolerances to ±0.01%.

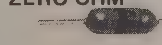
THIN FILM RESISTORS

	Series MF* .1W-1W	Precision metal film per MIL-R-10509, RN55,60,65,70,75 and MIL-R-55182(RNR,RNC). 10Ω to 5.1 Meg, tolerances to ±0.05%. Outstanding TC's to 5PPM.
STOCK	**Series GP–Metal Film** .1W-1W	Commercial metal film with MIL-spec performance at half the price! Exceeds MIL-R-10509(RN),-22684 (RL),-39017(RLR). Values to 22.1 Meg, TC's to 25PPM, tolerances to ±0.5%.
STOCK	**Series CF -Carbon Film** 1/8W-2W	General purpose carbon fim feature highest grade core for extended life stability and overload dissipation. 1ohm to 22 Meg, 7 standard sizes. Series CFF is flameproof.

TEMPERATURE SENSORS

LP 1/4 +150°C	Low cost metal film with linear positive TCR. 33Ω to 30K, tolerances to ±1.0%. Available in any T.C. up to +5000PPM (.5%/°C). Only ¼" long.
ATB,PTB,ATS,ATC * +375°C	Precision wirewound, axial or radial. Interchangeable TCR, 1Ω to 1 Meg, tolerances to ±0.05%. Available in any T.C. up to +6720 PPM.
PTC,PTS * +600°C	Ceramic encased RTD elements or stainless steel RTD probles. Platinum, Nickel, Nife elements stocked. Tolerances to +0.1%.

SPECIALTY PRODUCTS

	FUSE RESISTORS 1/8W-10W	Standard and Custom fusing curves to provide precisely controlled circuit protection. Fusing time to 5μS at 0.1A and up.
	SURGE RESISTORS * 1W-50W	Withstand high energy dissipation and absorb surges up to 75 joules with minor resistance shift Standard and Custom designs.
STOCK	**ZERO OHM**  ¼W	Insulated jumpers come in 1/4W size and are suited for automatic insertion. Resistance is .02 ohm or less. Chip jumpers available.

INDUCTORS

STOCK	**Series AL**	Low cost color banded inductors per MIL-C15305. Special core results in high Q and SFR, low DCR. .22μH to 56000μH. Axial or radial leads. Shielded type available.

CUSTOM

RCD manufactures a series of custom coil products including toroids, transformers, and shielded chokes. RCD also offers custom Res/cap, Res/Diode hybrid networks and voltage dividers.

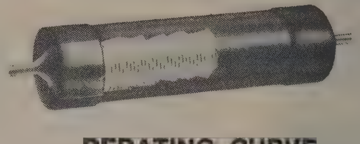
* Don't forget our **'SWIFT'** service (**S**hip **W**ith **I**n **F**ifty **T**wo hours) when you require fast delivery of a non-stock item!

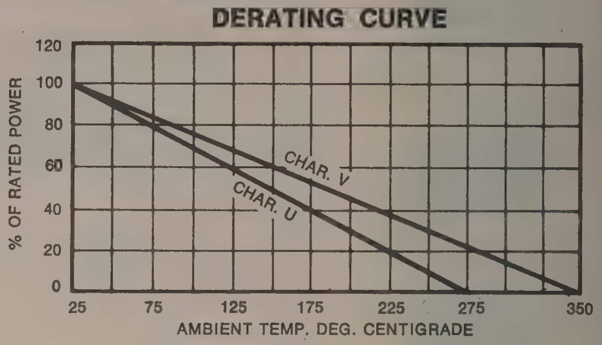
RCD Components Inc. • 330 Bedford Street, Manchester, NH 03101 • (603) 669-0054 Tlx: 943512

RCL:Shallcross POWER WIREWOUND RESISTORS

MIL-R-26, TYPE RW

T Series, Silicone Coated





GENERAL SPECIFICATIONS

Wattage Range: 25 styles to choose from ranging from .4 to 14 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table. For values below 0.1 ohm, use RCL-Shallcross Low Ω Metal Element Resistors.

Power Rating: Two power ratings, depending on operating temperature and stability requirements:

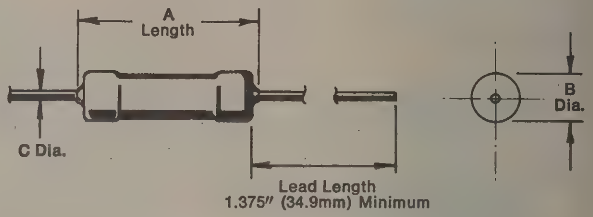
- Characteristic U: 275°C maximum hotspot temperature.
- Characteristic V: 350°C maximum hotspot temperature.

Derating: Wattage Ratings based on operation at 25°C. For higher ambient temperatures, derate per derating curve.

Tolerance: ±1.0% is standard. Closer tolerances are available.

Temperature Range: From −65°C to +275°C (Characteristic U) or +350°C (Characteristic V).

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 500Ω and up, ±30 PPM/°C = 10Ω to 499Ω, ±50 PPM/°C = 1Ω to 9.99Ω, ±90 PPM/°C = 0.1Ω to 0.99Ω, ±400 PPM/°C = 0.025Ω to 0.099Ω, ±650 PPM/°C = 0.01Ω to 0.024Ω.



ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Metric Dimensions

RCL[1] Style	MIL-R-26[1] Style	Wattage Rating U	Wattage Rating V	Dimensions Clean lead to clean lead Length A	Dimensions Clean lead to clean lead Diameter B	Resistance[2] RCL Style	Resistance[2] MIL-R-26 Style	Lead[2] Diam. C AWG	Dimensions Clean lead to clean lead Length A mm	Dimensions Clean lead to clean lead Diameter B mm	Lead Diam. mm
T-½-A	—	0.4		.220 ±.062	.078 ±.031	2K	—	#24	5.6 ±1.6	2.0 ±0.8	0.5
T½	—	0.75	—	.330 ±.062	.078 ±.031	4K		#24	8.4 ±1.6	2.0 ±0.8	0.5
T-½-A81	RW81	1.0	—	.250 ±.032	.085 ±.020	2K	1K	#24	6.4 ±0.8	2.2 ±0.8	0.5
T-1-80	RW80	2.0		.406 ±.032	.094 ±.032	10K	3.16K	#24	10.3 ±0.8	2.4 ±0.5	0.5
T-1A	—	1.0	1.25	.406 ±.062	.093 ±.032	6.5K	—	#24	10.3 ±1.6	2.4 ±0.8	0.5
T-1A-70	RW70	1.0		.406 ±.031	.094 ±.031	6.5K	3.16K	#24	10.3 ±0.8	2.4 ±0.8	0.5
T-1B	—	1.1	1.30	.530 ±.062	.093 ±.031	8.2K	—	#24	13.5 ±1.6	2.4 ±0.8	0.5
T-1C	—	1.0	—	.280 ±.062	.093 ±.031	3.4K	—	#24	7.1 ±1.6	2.4 ±0.8	0.5
T-2	—	1.5	—	.343 ±.062	.156 ±.031	8K	—	#20	8.7 ±1.6	4.0 ±0.8	0.8
T-2A	—	3.0	3.75	.500 ±.062	.187 ±.031	12K	—	#20	12.7 ±1.6	4.8 ±0.8	0.8
T-2A-69	RW69	—	3.00	.500 ±.063	.188 ±.063	18K	2K	#20	12.7 ±1.6	4.8 ±1.6	0.8
T-2B	—	3.0	3.75	.812 ±.062	.188 ±.031	34K	—	#20	20.0 ±1.6	4.8 ±0.8	0.8
T-2B-79	RW79	3.0		.560 ±.062	.187 ±.031	22K	10.5K	#20	14.2 ±1.6	4.8 ±0.8	0.8
T-2C	—	3.0	3.25	.500 ±.062	.250 ±.031	18K	—	#18	12.7 ±1.6	6.3 ±0.8	1.0
T-3	—	4.0	5.5	.625 ±.062	.250 ±.031	25K	—	#18	15.8 ±1.6	6.3 ±0.8	1.0
T-5	—	5.0	6.5	.875 ±.062	.312 ±.031	45K	—	#18	22.2 ±1.6	8.0 ±0.8	1.0
T-5-74	RW74	5.0	—	.875 ±.062	.312 ±.031	45K	38.3K	#18	22.2 ±1.6	8.0 ±0.8	1.0
T-6	—	6.0	7.5	1.00 ±.062	.312 ±.031	65K	—	#18	25.4 ±1.6	8.0 ±0.8	1.0
T-6-67	RW67	—	6.5	1.00 ±.094	.313 ±.063	65K	8.2K	#20	25.4 ±2.4	8.0 ±1.6	0.8
T-7	—	7.0	9.0	1.185 ±.062	.312 ±.031	75K	—	#18	30.0 ±1.6	8.0 ±0.8	1.0
T-7A-55	RW55	—	7.0	1.375 ±.094	.469 ±.094	120K	5.1K	#20	35.0 ±2.4	12.0 ±2.4	0.8
T-10	—	10.0	13.0	1.812 ±.062	.375 ±.031	150K	—	#18	46.0 ±1.6	9.5 ±0.8	1.0
T-10-78	RW78	10.0	—	1.780 ±.062	.375 ±.031	150K	90.9K	#18	45.2 ±1.6	9.5 ±0.8	1.0
T-10-68	RW68	—	11.0	1.875 $^{+.063}_{-.125}$	.344 ±.094	150K	20K	#20	22.2 $^{+1.6}_{-3.2}$	8.7 ±2.4	0.8
T-10-A-56	RW56	—	14.0	2.00 ±.094	.469 ±.094	200K	9.1K	#20	50.8 ±2.4	12.0 ±2.4	0.8

[1] Aryton Perry Winding available for non-inductive requirements. (Divide Max. Resistance Value by 2).

[2] Contact factory for lead diameter, ohmic values or temperature coefficients not listed as standard.

NON-INDUCTIVE WINDINGS, RADIAL LEADS, EXTENDED HEAT DISSIPATION and other SPECIAL FEATURES are available.

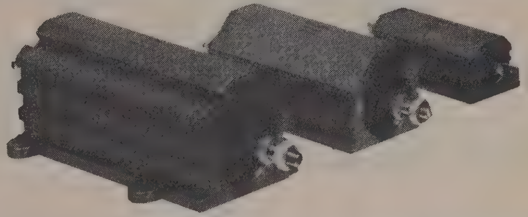
Call or write factory for complete information

RCL ELECTRONICS, INC., 195 McGregor Street, Manchester, NH 03102 • (603) 627-3831
SHALLCROSS, INC., U.S. 70 East, Smithfield, NC 27577 • (919) 934-5181

RCL·Shallcross POWER WIREWOUND RESISTORS

MIL-R-18546, TYPE RE

AL Series, Aluminum Housed Chassis Mount



GENERAL SPECIFICATIONS

Wattage Range: 7 styles to choose from ranging from 5 to 250 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table.

Power Rating: 275°C maximum hotspot at 25°C ambient. 1% maximum ΔR in 1000 hour load life.

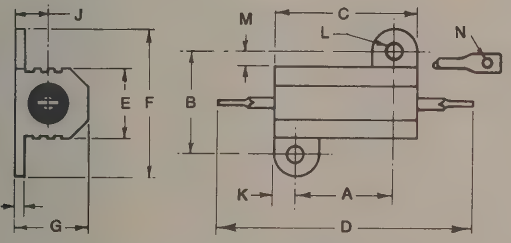
Derating: Wattage ratings based on operation at 25°C. For higher ambient temperatures, derate per derating curve.

Tolerance: ±1.0% is standard.

Temperature Range: From −55°C to +275°C.

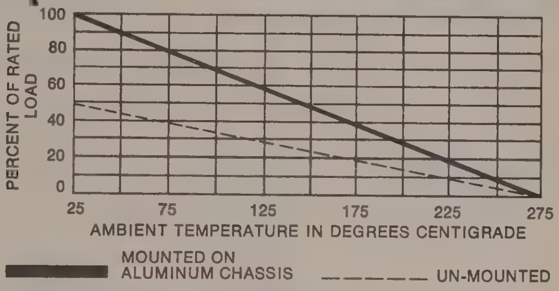
Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 10Ω and up, ±50 PPM/°C = 1Ω to 9.99Ω, ±90 PPM/°C = below 1Ω.

DIMENSIONS — 5 THRU 75 WATTS

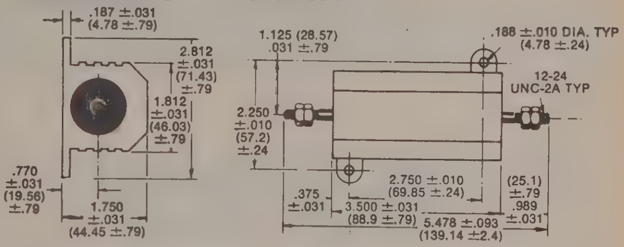

J
M
C
L
N
E
F
B
K
A
D
H
G

(METRIC DIMENSIONS ARE IN PARENTHESIS)

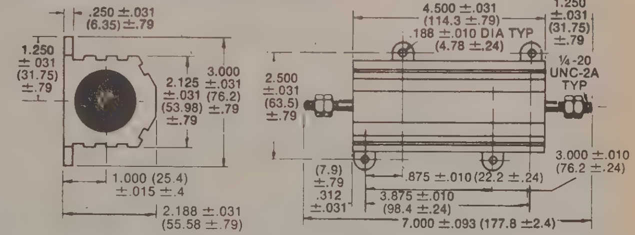
WATTAGE VS. AMBIENT TEMP. DERATING



DIMENSIONS — 100 WATT


.187 ±.031 (4.78 ±.79)
2.812 ±.031 (71.43) ±.79
1.812 ±.031 (46.03) ±.79
.770 ±.031 (19.56) ±.79
1.750 ±.031 (44.45 ±.79)
1.125 (28.57) .031 ±.79
.188 ±.010 DIA. TYP (4.78 ±.24)
12-24 UNC-2A TYP
2.250 ±.010 (57.2) ±.24
.375 ±.031
2.750 ±.010 (69.85 ±.24)
3.500 ±.031 (88.9 ±.79)
(25.1) ±.79 .989 ±.031
5.478 ±.093 (139.14 ±2.4)

DIMENSIONS — 250 WATT


.250 ±.031 (6.35) ±.79
1.250 ±.031 (31.75) ±.79
2.125 ±.031 (53.98) ±.79
3.000 ±.031 (76.2) ±.79
1.000 (25.4) ±.015 ±.4
2.188 ±.031 (55.58 ±.79)
4.500 ±.031 (114.3 ±.79)
.188 ±.010 DIA TYP (4.78 ±.24)
1.250 ±.031 (31.75) ±.79
¼-20 UNC-2A TYP
2.500 ±.031 (63.5) ±.79
(7.9) ±.79 .312 ±.031
.875 ±.010 (22.2 ±.24)
3.000 ±.010 (76.2 ±.24)
3.875 ±.010 (98.4 ±.24)
7.000 ±.093 (177.8 ±2.4)

ELECTRICAL SPECIFICATIONS

RCL** Style	MIL Style	Power Rating (Watts)*		Resistance Range			Max. Weight
		RCL	MIL	Min.	Max.	Max. MIL	Grams
AL-5	RE-60G	5	5	.1	16K	3.32K	3
AL-10	RE-65G	10	10	.1	25K	5.62K	7
AL-25	RE-70G	25	20	.1	55K	12.1K	14
AL-50	RE-75G	50	30	.1	180K	39.2K	29
AL-75		75		.1	75K		120
AL-100	RE-77G †	100	75	.1	50K		400
AL-250	RE-80G †	250	120	.1	75K		800

* AL resistors have an operating temperature range of −55°C to +275°C. Derating is required for reduced chassis mounting area and or for high ambient temperatures.

** To order non-inductive styles add suffix N. (e.g.: ALN-5, RE-60N) (Divide Max. Res. Values by 2).

† For reference only

DIMENSIONAL SPECIFICATIONS

Style	A	B	C	D	E	F	G	H	J	K	L	M	N
Tol.	±.005	±.005	±.031	±.062	±.015	±.015	±.015	±.010	±.010	±.010	±.005	±.015	±.005
Tol. (metric)	±0.1	±0.1	±0.8	±1.6	±0.4	±0.4	±0.4	±0.25	±0.25	±0.25	±0.1	±0.1	±0.1
AL-5	.444 (11.28)	.490 (12.45)	.600 (15.24)	1.125 (28.58)	.334 (8.48)	.646 (16.41)	.320 (8.13)	.065 (1.65)	.140 (3.56)	.078 (1.98)	.093 (2.36)	.078 (1.98)	.050 (1.27)
AL-10	.562 (14.27)	.625 (15.88)	.750 (19.1)	1.375 (34.93)	.430 (10.92)	.800 (20.3)	.400 (10.2)	.075 (1.91)	.190 (4.83)	.093 (2.4)	.093 (2.4)	.102 (2.59)	.086 (2.18)
AL-25	.719 (18.26)	.781 (19.84)	1.062 (26.97)	1.938 (49.23)	.530 (13.46)	1.080 (27.43)	.560 (14.22)	.085 (2.16)	.260 (6.6)	.172 (4.37)	.125 (3.18)	.115 (2.92)	.086 (2.18)
AL-50	1.563 (39.7)	.844 (21.44)	1.968 (49.99)	2.781 (70.64)	.615 (15.62)	1.140 (28.96)	.615 (15.62)	.085 (2.16)	.300 (7.62)	.196 (4.97)	.125 (3.18)	.107 (2.71)	.086 (2.18)
Tol.	±.010	±.010	±.031	±.093	±.031	±.031	±.031	±.015	±.015	±.015	±.005	±.015	±.005
Tol. (metric)	±0.25	±0.25	±0.8	±2.4	±0.8	±0.8	±0.8	±0.4	±0.4	±0.4	±0.1	±0.4	±0.1
AL-75	2.125 (53.98)	1.500 (38.1)	2.500 (63.5)	3.750 (95.25)	1.125 (28.58)	1.875 (47.62)	1.125 (28.58)	.125 (3.18)	.625 (15.89)	.187 (4.75)	.172 (4.37)	.187 (4.75)	.095 (2.4)

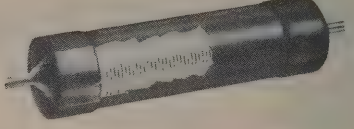
NON-INDUCTIVE WINDINGS, SPECIAL LEADS and EXTENDED HEAT DISSIPATION versions are available.

Call or write factory for complete information.

RCL ELECTRONICS, INC., 195 McGregor Street, Manchester, NH 03102 • (603) 627-3831

RCL·Shallcross ESTABLISHED RELIABILITY POWER WIREWOUND RESISTORS

MIL-R-39007, TYPE RWR, S LEVEL PR Series, Silicone Coated



GENERAL SPECIFICATIONS

Wattage Range: 15 styles to choose from ranging from 1 to 15 watts.

Resistance Values: From 0.1 ohm to maximum values as stated in table.

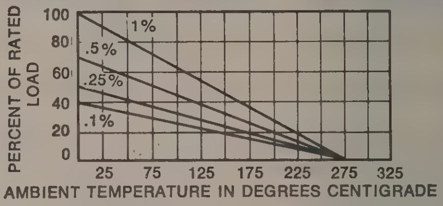
Power Rating: 275°C maximum hotspot at 25°C ambient.

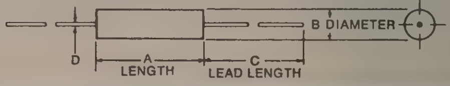
Tolerance: ±1.0% is standard. ±0.1%, ±0.25%, ±0.5%, ±3%, ±5% and ±10% are available.

Temperature Range: −55°C to +275°C.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 10Ω and up, ±50 PPM/°C = 1Ω to 10Ω, ±400 PPM/°C = 0.499Ω to 1Ω, ±650 PPM/°C = 0.1Ω to 0.499Ω.

WATTAGE VS. AMBIENT TEMP. DERATING





ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross Style	MIL-R-39007[1,2,3] Style	Power Rating (Watts) 275°	Resistance Value Min. Tol. 0.1%	Resistance Value Min. Tol. 1.0%	Resistance Value Max. All Tol.	Maximum Weight (Grams)	Dimensions A	Dimensions B	Dimensions C	Dimensions D
PR13		6	10	0.1	10K	2.25	.625 ±.062	.250 ±.032	1.500	.040
PR17		5	10	0.1	7K	1.5	.500 ±.062	.218 ±.032	1.500	.040
PR33		15	10	0.1	80K	8.5	1.780 ±.062	.375 ±.032	1.500	.040
PR433	RWR78	10	0.499	0.1	80K	8.5	1.780 ±.062	.375 ±.032	1.500	.040
PR246	RWR84	7	0.499	0.1	25K	4.0	.875 ±.062	.312 ±.032	1.500	.040
PR446	RWR74	5	0.499	0.1	25K	4.0	.875 ±.062	.312 ±.032	1.500	.040
PR49	RWR80	2	0.499	0.1	3.16K	.35	.406 ±.032	.094 ±.032	1.500	.020
PR449		1	10	0.1	3.16K	.35	.406 ±.032	.094 ±.032	1.500	.020
PR60		10	10	0.1	45K	4.7	1.218 ±.062	.312 ±.032	1.500	.040
PR61	RWR89	4	0.499	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR261	RWR89	3	0.499	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR461		3	10	0.1	4.12K	1.0	.560 ±.062	.187 ±.032	1.500	.032
PR62		4.5	10	0.1	14K	1.25	.812 ±.062	.187 ±.032	1.500	.032
PR462	RWR71	3.25	0.499	0.1	16.2K	1.25	.812 ±.062	.187 ±.032	1.500	.032
PR66	RWR82	1.5	0.499	0.1	1.3K	.30	.312 ±.032	.085 ±.015	1.500	.020
PR68	RWR81	1	0.499	0.1	1K	.25	.250 ±.032	.085 ±.015	1.500	.020
PR268	RWR81	1	0.499	0.1	1K	.25	.250 ±.032	.085 ±.015	1.500	.020

[1] MIL-R-39007 Approved. To Life Failure Rate M, P, R, & S.

[2] Tolerances F (1%), D (.5%) and B (.1%) available at Life Failure Rate M, P, R, & S.

[3] Ayrton Perry Winding available for Non-Inductive requirements.

MIL-R-39009, TYPE RER, R LEVEL

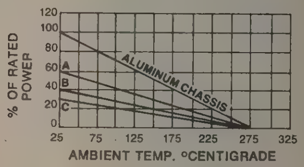
AL-ER Series, Aluminum Housed Chassis Mount

GENERAL SPECIFICATIONS

Wattage Range: 4 styles to choose from ranging from 5 to 50 watts.

Power Rating: 275°C maximum hotspot at 25°C ambient. 1% maximum ΔR in 2000 hour load life.

Derating: AL-ER chassis mount resistors have an operating temperature range of −55°C to +275°C. For higher ambient temperatures, use derating curve which applies to operation of unmounted resistors (A = AL5ER and AL10ER, B = AL25ER and C = AL50ER).



Tolerance: ±1% is standard.

Temperature Coefficient of Resistance: Standard T.C.: ±20 PPM/°C = 20Ω and up, ±50 PPM/°C = 1Ω to 19.6Ω, ±100 PPM/°C = below 1Ω.

Dimensional Specifications: Identical to AL Series on previous page.

ELECTRICAL SPECIFICATIONS

RCL Style Refer to Note #1	MIL-R-39009 Style	Power Rating* (Watts) RCL	Power Rating* (Watts) MIL	Minimum Resistance	Maximum Resistance	Maximum Working Voltage	Maximum Weight (Grams)
ALN5 ER	RER-40	7.5	5	1.0Ω	1.65K	90.8	3.3
AL5 ER	RER-60	7.5	5	0.1Ω	3.32K	128.9	3.0
ALN10 ER	RER-45	12.5	10	1.0Ω	2.80K	167.3	8.8
AL10 ER	RER-65	12.5	10	0.1Ω	5.62K	237.1	8.0
ALN25 ER	RER-50	25.0	20	1.0Ω	6.04K	347.6	16.5
AL25 ER	RER-70	25.0	20	0.1Ω	12.1K	550.0	15.0
ALN50 ER	RER-55	50.0	30	1.0Ω	19.6K	766.8	35.0
AL50 ER	RER-75	50.0	30	0.1Ω	39.2K	1085.0	32.0

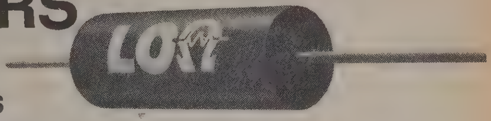
* Rating based on chassis mounting at +25°C ambient.

Call or write factory for complete information

RCL ELECTRONICS, INC., 195 McGregor Street, Manchester, NH 03102 • (603) 627-3831
SHALLCROSS, INC., U.S. 70 East, Smithfield, NC 27577 • (919) 934-5181

RCL·Shallcross

LOΩ® METAL ELEMENT RESISTORS



Low Ohmic Value At An Affordable Price

GENERAL SPECIFICATIONS

Wattage Range: 3 and 5 watts.

Resistance Values: 0.005, 0.01, 0.015, 0.02, 0.025, 0.03, 0.04, 0.05, 0.07, 0.08, 0.1, 0.2 ohms.

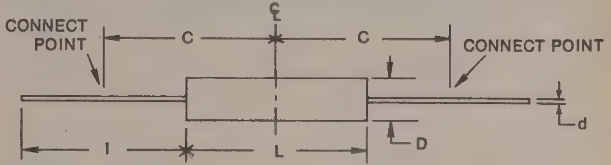
Derating: Lo Ω Metal Element Resistors are derated linearly from room temperature at full power to 0 power at 275°C.

Tolerance: 5% — All styles and values, 3% — All styles and values, 0.5% available above 0.005 ohms.

Construction: Tinned copper leads are welded directly to a low temperature coefficient of resistance element by a highly mechanized proprietary process. Resistors are encapsulated in a special formulated compound.

FEATURES

- Ultra Low Resistance Valves
- High Stability Over Life
- Low Temperature Coefficient of Resistance
- Inherently Non-Inductive



DIMENSION SPECIFICATIONS

Dimensions — Inches (Millimeters)

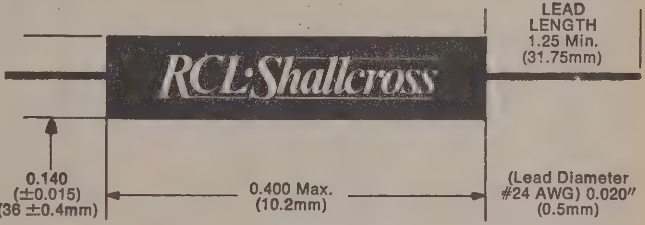
Style	L	D	C	l	d
LO-3	0.560 ±0.010 (14.224 ±0.254)	0.210 ±0.010 (5.334 ±0.254)	0.655 (16.64)	1.375 ±0.125 (34.925 ±3.175)	0.032 ±0.002 (0.813 ±0.051)
LO-5	0.920 ±0.010 (23.368 ±0.254)	0.330 ±0.010 (8.382 ±0.254)	0.835 (21.209)	1.250 ±0.125 (31.750 ±3.175)	0.040 ±0.002 (1.016 ±0.051)

DUAL FUNCTION FUSE RESISTORS

A Dual Purpose Device That Acts As Both A Wirewound Resistor and Fuse

GENERAL SPECIFICATIONS

Resistance Range: 0.2Ω to 200Ω.
Resistance Tolerance: 10% is standard, 5% and 2% definition.
Blow Characteristics: Per table — 2 pt. definition.
Operating Temperature: −55°C to +150°C
Temperature Coefficient: ±50 PPM/°C Max.


LEAD LENGTH 1.25 Min. (31.75mm)
RCL·Shallcross
0.140 (±0.015) (36 ±0.4mm)
0.400 Max. (10.2mm)
(Lead Diameter #24 AWG) 0.020" (0.5mm)

FEATURES

- Affords protection for semiconductor devices
- Eliminates fire hazard and circuit board damage to overheated components
- Eliminates unnecessary blowing due to transient conditions
- Reduces the number of discrete components required.

ELECTRICAL SPECIFICATIONS

RCL Style	Res (Ω)	Steady-State		Blow Condition I			Blow Condition II		
			W (Power Dissipation in Watts)		W (Power Dissipation in Watts)	T (Max.) Max. Fuse Blow Time		W (Power Dissipation in Watts)	T (Max.) Max. Fuse Blow Time
F501	0.2	2.2A	1.0W	10A	20W	500ms	25A	125W	50ms
F502	0.2	2.2A	1.0W	10A	20W	300ms	25A	125W	30ms
F503	0.5	1.4A	1.0W	6A	18W	10sec	15A	112W	100ms
F504	0.5	1.4A	1.0W	6A	18W	500ms	15A	112W	50ms
F505	0.5	1.4A	1.0W	6A	18W	50ms	15A	112W	10ms
F506	1.0	1.0A	1.0W	4A	16W	10sec	10A	100W	100ms
F507	1.0	1.0A	1.0W	4A	16W	500ms	10A	100W	50ms
F508	1.0	1.0A	1.0W	4A	16W	50ms	10A	100W	10ms
F509	2.0	700ma	1.0W	3A	18W	10sec	7A	98W	50ms
F510	2.0	700ma	1.0W	3A	18W	200ms	7A	98W	50ms
F511	2.0	700ma	1.0W	3A	18W	50ms	7A	98W	10ms
F512	5.0	450ma	1.0W	2A	20W	200ms	4.5A	101W	50ms
F513	5.0	400ma	0.8W	1.5A	10W	50ms	4.0A	80W	10ms
F514	5.0	350ma	0.6W	1.0A	5W	100ms	1.4A	10W	20ms
F515	10	300ma	0.9W	1.2A	14W	200ms	3.0A	90W	10ms
F516	10	300ma	0.9W	1.0A	10W	100ms	1.3A	17W	50ms
F517	10	200ma	0.4W	600ma	3.6W	100ms	900ma	8W	50ms
F518	20	220ma	1.0W	600ma	7.2W	10sec	900ma	8W	100ms
F519	20	220ma	1.0W	600ma	7.2W	100ms	900ma	8W	50ms
F520	20	150ma	0.4W	350ma	2.4W	500ms	450ma	4W	50ms
F521	50	140ma	1.0W	400ma	8.0W	500ms	600ma	18W	50ms
F522	50	130ma	0.8W	350ma	6.1W	100ms	450ma	10W	50ms
F523	50	80ma	0.3W	200ma	2.0W	200ms	240ma	2.9W	50ms
F524	100	100ma	1.0W	250ma	6.2W	10sec	300ma	9.0W	100ms
F525	100	80ma	0.6W	200ma	4.0W	200ms	250ma	6.2W	250ms
F526	100	60ma	0.4W	140ma	1.4W	10sec	180ma	2.0W	200ms
F527	200	70ma	1.0W	200ma	8.0W	10sec	250ma	12.5W	100ms
F528	200	60ma	0.8W	150ma	4.0W	100ms	250ma	12.5W	10ms

Call or write factory for complete information

RCL ELECTRONICS, INC., 195 McGregor Street, Manchester, NH 03102 • (603) 627-3831

RCL·Shallcross PRECISION WIREWOUND RESISTORS

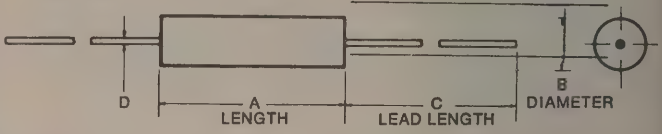
MIL-R-93, RB TYPE

VA, SP and 7000 Series, Axial Lead

ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross VA Style	MIL-R-93²	Dimensions A ±.032	Dimensions B ±.015	Dimensions C	Dimensions D Awg.	Watts MIL 125°C	Watts Commercial¹ 85°C	Max. Volt. DC	Approx. Weight Grams	Max. Resistance
• 10	RB56	.343	.250	2.0	20	.125	.250	200	1.0	350K
• 11		.295	.250	1.5	22	.125	.250	150	.3	250K
• 12	RB55	.500	.250	2.0	20	.150	.300	300	1.0	525K
13		.625	.250	1.5	20	.200	.400	500	1.5	800K
• 14	RB54	.750	.250	2.0	20	.250	.500	300	2.0	850K
16		1.0	.250	1.5	20	.500	1.0	750	3.0	1.25Meg
19		.812	.312	1.5	20	.500	1.0	300	3.5	5.0Meg
30		.343	.375	1.5	20	.125	.250	300	2.0	1.0Meg
• 32		.500	.375	1.5	20	.250	.500	300	3.5	1.5Meg
• 34	RB53	.750	.375	2.0	20	.330	.660	500	4.5	2.0Meg
• 36	RB52	1.0	.375	2.0	20	.500	1.0	750	6.0	2.5Meg
38		1.5	.375	1.5	20	.750	1.500	1000	7.5	3.5Meg
39		2.0	.375	1.5	20	1.250	2.500	1200	10.0	4.0Meg
52		.500	.500	1.5	20	.330	.660	300	5.5	2.0Meg
• 54		.750	.500	1.5	20	.500	1.0	500	7.0	3.0Meg
• 56		1.0	.500	1.5	20	.750	1.5	750	8.5	4.0Meg
• 58		1.5	.500	1.5	20	1.0	2.0	1000	11.5	5.0Meg
• 59		2.0	.500	1.5	20	1.250	2.5	1200	12.5	10.0Meg
SP Style	SUBMINIATURES									
• 20		.250	.187	1.5	22	.100	.200	150	.3	125K
• 21		.375	.187	1.5	22	.125	.250	300	.3	200K
• 22		.500	.187	1.5	22	.150	.300	300	.3	300K
23		.625	.187	1.5	22	.175	.350	600	1.0	400K
26		1.0	.187	1.5	22	.250	.500	1000	1.5	500K
40		.500	.160	1.5	22	.100	.200	300	.3	500K
• 41		.250	.125	1.5	22	.050	.100	100	.2	125K
• 42		.375	.125	1.5	22	.065	.125	200	.2	200K
• 43		.500	.125	1.5	22	.075	.150	200	.3	300K
47		.187	.100	1.5	24	.025	.050	75	.1	50K
• 48		.312	.100	1.5	24	.030	.060	100	.1	100K
49		.437	.100	1.5	24	.040	.075	100	.2	150K
• 68		.250	.085	1.5	24	.020	.040	100	.1	50K
69		.375	.085	1.5	24	.025	.050	100	.1	100K

• Standard Style ¹ Commercial ratings may be applied at 125°C provided 175°C max. operating temperature is permissible. ² MIL-R-93 Approved.



RCL Style	MIL-R-93 Style	Dia. ±.015	Lgth. ±.032	RCL Max. Watts	MIL Max. Watts	MIL Style Max. Res. 0.001 (.0254)	RCL Style 0.0005 (.0127)	Non-Inductive Winding	Lead Dia. AWG D	Metric Dimensions Dia. ±.4 mm	Metric Dimensions Lgth. ±.8 mm	Metric Dimensions Lead Dia. D mm
7002		.110	.220	.1			100K	NO	#24	2.8	5.6	0.5
7003		.100	.260	.05			150K	NO	#24	2.5	6.6	0.5
7004		.100	.300	.05			250K	YES	#24	2.5	7.6	0.5
7005		.125	.250	.1			300K	YES	#22	3.2	6.3	0.6
7006		.125	.3125	.1			350K	YES	#22	3.2	7.9	0.6
7007		.1875	.375	.125			700K	YES	#22	4.8	9.5	0.6
7008		.250	.250	.150			1Meg	YES	#22	6.3	6.3	0.6
7009	RB-56	.250	.343	.25	.125	127K	1.4Meg	YES	#20	6.3	8.7	0.8
7010	RB-55	.250	.500	.33	.15	226K	3Meg	YES	#20	6.3	12.7	0.8
7020	RB-54	.250	.750	.50	.25	511K	4.4Meg	YES	#20	6.3	19.0	0.8
7030	RB-53	.375	.750	.60	.33	750K	8Meg	YES	#20	9.5	19.0	0.8
7040	RB-52	.375	1.000	1.00	.50	1.5Meg	12Meg	YES	#20	9.5	25.4	0.8
7044		.500	.500	.50			7Meg	YES	#20	12.7	12.7	0.8
7045		.500	.625	.60			8Meg	YES	#20	12.7	15.9	0.8
7045A		.437	.625	.60			9Meg	YES	#20	11.1	15.9	0.8
7050	†RB-57	.500	1.00	1.25	.75	2Meg	14Meg	YES	#20	12.7	25.4	0.8
7050A		.437	1.00	1.25			13Meg	YES	#20	11.1	25.4	0.8
7060	†RB-58	.500	1.50	1.50	1.0	3Meg	20Meg	YES	#20	12.7	38.1	0.8
7070	†RB-59	.500	2.00	2.00	1.25	5Meg	30Meg	YES	#20	12.7	50.8	0.8

† For reference only

PC and 4000 Series

Printed Circuit Board Style

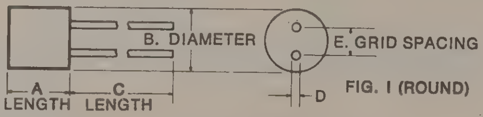


FIG. I (ROUND)

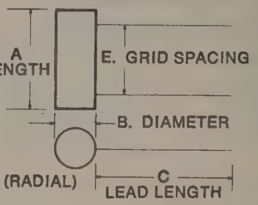
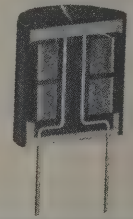


FIG. II (RADIAL)



ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross PC Style	PC Style MIL-R-93	Fig.	Dimensions A ±.032	Dimensions B ±.015	Dimensions C 1″ Min.	Dimensions D Awg.	Dimensions E ±.010	Watts MIL 125°C	Watts Commercial¹ 85°C	Maximum Voltage DC	Approx. Weight Grams	Maximum Resistance
1		I	.250	.250	1.0	22	.200	.100	.200	150	.3	150K
3		I	.359	.265	1.0	22	.200	.125	.250	150	1.0	250K
4		I	.375	.375	1.0	20	.200	.250	.500	300	2.5	500K
8	RB71	I	.312	.250	1.0	22	.200	.125	.250	300	.3	150K
340		II	.500	.160	1.0	22	.406	.100	.200	300	.3	500K

¹ Commercial ratings may be applied at 125°C provided 175°C max. operating temperature is permissible.

RCL Style	MIL-R-93 Style	Fig. I Length (A)	Fig. I Diameter (B)	MIL..Style Max. R Using .001 (25.4 μ)	RCL Style* Max. R Using .0006 (15.2 μ)	RCL Style** Max. Wattage	Standard Lead Spacing (±0.010)	Lead Diameter (AWG)	Metric Dimensions Length (mm)	Metric Dimensions Diameter (mm)	Metric Dimensions Standard Lead Spacing (mm ±0.25)	Metric Dimensions Lead Diameter (mm)
4060	RB-71	.312 ±.032	.250 ±.025	100K	500K	.250**	.200	#22	7.9 ±0.8	6.3 ±0.6	5.08	0.6
4061		.375 ±.032	.250 ±.025	160K	800K	.250	.200	#22	9.5 ±0.8	6.3 ±0.6	5.08	0.6
4062		.437 ±.032	.250 ±.025	160K	800K	.250	.200	#22	11.1 ±0.8	6.3 ±0.6	5.08	0.6
4063		.375 ±.032	.375 ±.015	185K	1Meg	.333	.200	#20	9.5 ±0.8	9.5 ±0.4	5.08	0.8
4064		.437 ±.032	.375 ±.015	250K	1.3Meg	.333	.200	#20	11.1 ±0.8	9.5 ±0.4	5.08	0.8
4065	RB-70	.500 ±.032	.375 ±.015	301K	1.5Meg	.333**	.200	#20	12.7 ±0.8	9.5 ±0.4	5.08	0.8
4066		.375 ±.032	.437 ±.015	450K	2Meg	.400	.300	#20	9.5 ±0.8	11.1 ±0.4	7.62	0.8
4067		.437 ±.032	.437 ±.015	600K	3Meg	.400	.300	#20	11.1 ±0.8	11.1 ±0.4	7.62	0.8
4068		.500 ±.032	.437 ±.015	700K	3.5Meg	.400	.300	#20	12.7 ±0.8	11.1 ±0.4	7.62	0.8

* Not applicable for MIL Styles (RB). ** Max. Wattage for MIL-R-93 Styles is 0.125 for RB-71 and 0.250 for RB-70.
Lead length 1½″ (38.1 mm) Minimum. Tinned, weldable leads. RB-70 and RB-71, Lead length 1″ ±⅛″ (25.4 ±3.18 mm).

Call or write factory for complete information

RCL ELECTRONICS, INC., 195 McGregor Street, Manchester, NH 03102 • (603) 627-3831
SHALLCROSS, INC., U.S. 70 East, Smithfield, NC 27577 • (919) 934-5181

RCL·Shallcross ESTABLISHED RELIABILITY PRECISION WIREWOUND RESISTORS

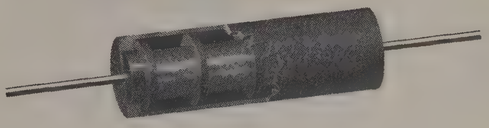
MIL-R-39005, TYPE RBR, R LEVEL

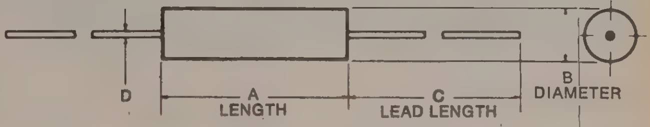
HR Series

Mil Tolerance Range For HR & ER Series:

RBR	Value	Tol. Minimum
52, 53, 55, 56, & 71	≧ 10Ω ≧ 0.1Ω	±.01% ±1%
54	≧ 4.99Ω ≧ 0.1Ω	±.01% ±1%
80 & 81	≧ 1000Ω ≧ 100Ω ≧ 10Ω	±0.01% ±0.02% ±0.10%

±1.0% (F); ±0.1% (B); ±0.5% (D); ±0.05% (A); ±0.02% (Q); ±0.01% (T).





ELECTRICAL AND DIMENSIONAL SPECIFICATIONS

Shallcross HR Style	HR Style MIL-R-39005	Dimensions A ±.032	Dimensions B ±.015	Dimensions C Min.	Dimensions D Awg.	Watts MIL 125°C	Watts Commercial[1] 85°C	Maximum DC Voltage	Approx. Weight Grams	Maximum Resistance
1		.250	.250	1.0	22	.100	.200	150	.3	150K
3		.359	.265	1.0	22	.125	.200	150	1.0	250K
4		.375	.375	1.0	20	.250	.500	300	2.5	500K
• 5 [2]		.500	.250	1.0	22	.250	.500	300	1.0	500K
6		.375	.250	1.0	22	.125	.250	300	1.0	300K
7		.500	.375	1.0	20	.330	.660	300	3.0	600K
• 8	RBR71[3,4]	.312	.250	1.0	22	.125	.250	300	.3	150K
9		.750	.375	1.0	20	.500	1.0	600	4.5	1.0Meg
• 10	RBR56[3,4]	.343	.250	1.5	20	.125	.250	200	1.0	350K
11	RBR75	.295	.250	1.5	22	.125	.250	150	.3	250K
• 12	RBR55[3,4]	.500	.250	1.5	20	.150	.300	300	1.0	525K
13		.625	.250	1.5	20	.200	.400	500	1.5	800K
• 14	RBR54[3,4]	.750	.250	1.5	20	.250	.500	500	2.0	850K
16		1.0	.250	1.5	20	.500	1.0	750	3.0	1.25Meg
19	RBR76	.812	.312	1.5	20	.500	1.0	500	3.5	5.0Meg
• 20		.250	.187	1.5	22	.100	.200	150	.3	125K
• 21		.375	.187	1.5	22	.125	.250	300	.3	200K
• 22	RBR74	.500	.187	1.5	22	.125	.300	300	.3	300K
23		.625	.187	1.5	22	.175	.350	600	1.0	400K
26		1.0	.187	1.5	22	.250	.500	1000	1.5	500K
30		.343	.375	1.5	20	.125	.250	300	2.0	1.0Meg
• 32		.500	.375	1.5	20	.250	.500	300	3.5	1.5Meg
• 34	RBR53[3,4]	.750	.375	1.5	20	.330	.660	500	4.5	2.0Meg
• 36	RBR52[3,4]	1.0	.375	1.5	20	.500	1.0	750	6.0	2.5Meg
38		1.50	.375	1.5	20	.750	1.5	1000	7.5	3.5Meg
39		2.00	.375	1.5	20	1.250	2.5	1200	10.0	4.0Meg
40		.500	.160	1.5	22	.100	.200	300	.3	500K
• 41		.250	.125	1.5	22	.050	.100	100	.2	125K
• 42		.375	.125	1.5	22	.065	.125	200	.2	200K
43		.500	.125	1.5	22	.075	.150	200	.3	300K
47		.187	.100	1.5	24	.025	.050	75	.1	50K
• 48		.312	.100	1.5	24	.030	.060	100	.1	100K
49		.437	.100	1.5	24	.040	.075	100	.2	150K
52		.500	.500	1.5	20	.330	.660	300	5.5	2.0Meg
54		.750	.500	1.5	20	.500	1.0	500	7.0	3.0Meg
• 56	RBR57	1.0	.500	1.5	20	.750	1.5	750	8.5	4.0Meg
• 68		.250	.085	1.5	24	.020	.040	100	.1	50K
69		.375	.085	1.5	24	.025	.050	100	.1	100K
340 [5]	RBR81	.500 Max.	.160 Max.	1.0	24	.100	.200	300	.55	175K
341 [5]	RBR80	.325 Max.	.160 Max.	1.0	24	.100	.200	150	.40	50K

• **Standard Style**....[1] Commercial ratings may be applied at 125°C max. provided 175°C max. operating temperature is permissible. [2] Printed Circuit Style — See previous page for dimension diagram. Standard grid spacing 200″. [3] Available in failure rate levels M, P and R. [4] MIL-R-39005 Approved. [5] Printed Circuit Style — See pevious page, Figure II for dimension diagram. Standard grid spacing for HR 340 is .400″ ±.005″ and for HR 341 is .225″ ±.005″.

2000 ER, 4000 ER & 7000 ER Series

FIG. "A" — AXIAL LEAD

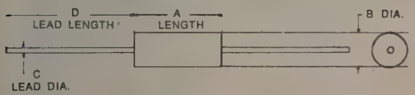


FIG "B" — PLUG-IN

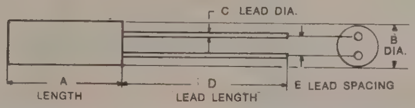
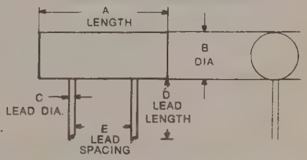


FIG. "C" — RADIAL LEAD



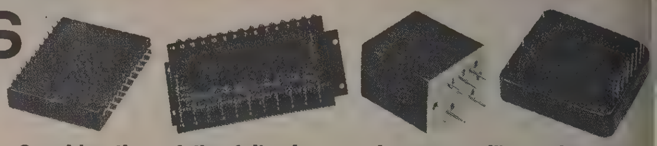
RCL Style	Military Style	MIL Resistance Range (Ohms)	Power Rating (Watts)	Fig.	Maximum Dimensions Length A	Maximum Dimensions Diam. B	Maximum Dimensions Lead Diam. C	Maximum Dimensions Min. Lead Length D	Lead Spacing E ±0.005	Approx. Weight (Grams)	Style
7040-ER	RBR 52	0.1-1,200,000	0.5	A	1.020 (25.91)	0.39 (9.9)	0.034 (0.86)	1.5 (38.1)	N.A.	6.0	Axial
7030-ER	RBR 53	0.1-1,100,000	0.33	A	0.770 (19.6)	0.39 (9.9)	0.034 (0.86)	1.5 (38.1)	N.A.	4.5	Axial
7020-ER	RBR 54	0.1-562,000	0.25	A	0.770 (19.6)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	2.0	Axial
7010-ER	RBR 55	0.1-332,000	0.15	A	0.520 (13.21)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	1.0	Axial
7009-ER	RBR 56	0.1-220,000	0.125	A	0.364 (9.2)	0.265 (6.7)	0.034 (0.86)	1.5 (38.1)	N.A.	1.0	Axial
4060-ER	RBR 71	0.1-150,000	0.125	B	0.343 (8.7)	0.281 (7.1)	0.027 (0.69)	0.875 (22.2)	0.200 (5.1)*	0.3	Plug-In
R2407-ER	RBR 80	10.0-120,000	0.1	C	0.325 (8.3)	0.160 (4.06)	0.022 (0.56)	1.0 (25.4)	0.225 (5.7)	6.0	Radial
R2408-ER	RBR 81	10.0-250,000	0.1	C	0.50 (12.7)	0.160 (4.06)	0.022 (0.56)	1.0 (25.4)	0.400 (10.2)	6.0	Radial

(Metric dimensions in mm are in parenthesis) *±0.010 (±0.254)

Call or write factory for complete information

RCL ELECTRONICS, INC., 195 McGregor Street, Manchester, NH 03102 • (603) 627-3831
SHALLCROSS, INC., U.S. 70 East, Smithfield, NC 27577 • (919) 934-5181

RCL·Shallcross DISCRETE RESISTOR NETWORKS & MATCHED SETS



NETWORKS

Network quality is determined by the qualities of its individual resistors and the packaging and mounting expertise of its assembler. RCL/Shallcross offers a unique background of experience, data, manufacturing and testing skills for its wirewound resistor networks. PARAMETERS: (1) Resistance ratios to .001%, (2) Resistor tolerances to ±.005% (at ambient), (3) Ratio tolerances as close as .01% (over a range of temperatures), (4) Stability to ±.001% per year.

MATCHED SETS

Two or more resistors can be matched with relative tolerance much higher than each one's individual tolerance. Characteristics most often matched are: (1) DC Resistance at one or more temperatures, (2) AC and DC Voltage ratios, (3) Temperate Coefficients and (4) Phase Shifts. Principle advantages of matched sets are: (a) Very tight relative tolerances, (b) Lower cost than networks of comparable accuracy and (c) Flexibility in locating components during design and packaging. An engineering staff at RCL/Shallcross is ready to assist you in specifying your matched set requirements.

Consideration of the following requirements will provide our engineering staff with adequate information to complete your specification and quotation:

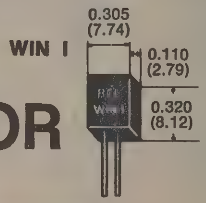
A. CIRCUIT

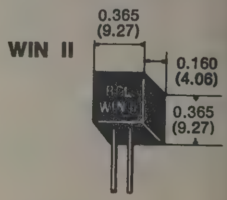
Resistance values ....
Resistance tolerances ....
Ratio/Ratios ....
Ratio tolerance (Ambient) ....
(over operating temperature range) ....
Wattage dissipation .... per resistor .... total
Frequency in Hz if AC ....
Ambient Temperature .... °C
Operating temperature range − .... °C to + ... °C
Maximum applied voltage ....
Schematic ....

B. CASE

Maximum volume .... cu. in.
Case dimensions
.... length, ... width, ... height, ... diameter
Mounting: lugs .... studs ....
screw holes (recessed) .... other ....
Lead material .... gauge .... lead length
.... special spacing ....

RCL·Shallcross WIN HIGH DENSITY MODULAR RESISTOR





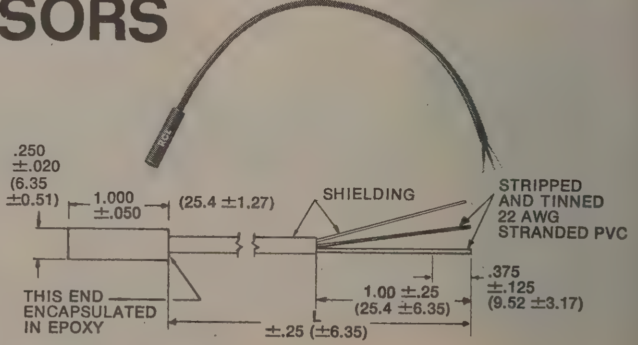
SPECIFICATIONS

	Tolerance Avail.		T.C. Avail. PPM/°C (0°C to +85°C)	
Resistance Range	Win I	Win II	Win I	Win II
0.1Ω to .99Ω	Consult Factory	±10%	Consult Factory	±90 PPM
1.0Ω to 24.9Ω	Consult Factory	±3%	Consult Factory	±30 PPM
25Ω to 99.9Ω	±0.25%	±0.25%	±5 PPM	±5 PPM
100Ω to 199Ω	±0.1%	±0.1%	±5 PPM	±5 PPM
200Ω to 499Ω	±0.1%	±0.05%	±3 PPM	±3 PPM
500Ω to 699Ω	±0.05%	±0.02%	±3 PPM	±3 PPM
700Ω to 999.9Ω	±0.02%	±0.01%	±3 PPM	±3 PPM
1K to 125K	±0.02%	±0.01%	±2 PPM	±2 PPM
125K to 500K	N.A.	±0.01%	N.A.	±2 PPM

Wattage	0.3W at 85°C
Voltage	200 VDC
Resistance Range	Win I 0.1Ω to 125K Win II 0.1Ω to 500K
T.C. Tracking	To ±2PPM/°C
Stability	25 PPM/Year
Rise Time	Up to 25 nSec. Avail. Consult Factory
Noise	Negligible
Lead Spacing	S = 0.150 ±0.010 (3.81 ±0.254)
Size (Maximum) Win I	H ± 0.320 (8.12) L = 0.305 (7.74) W = 0.110 (2.79)
Size (Maximum) Win II	H ± 0.365 (9.27) L = 0.365 (9.27) W = 0.160 (4.06)

RCL·Shallcross MOLDED TEMPERATURE SENSORS

RCL offers a standard line of epoxy encapsulated sensing resistors for temperature compensating applications. The standard resistance tolerance ±5% with tighter tolerances available on special order. Cable lengths from 2.0″ to 48.0″ (50.80 to 1219.2 mm) are available with 6.0″ (152.40 mm) standard. Operating temperature range is −55°C to +105°C. Repeatability of tempco within a given lot is ±100 PPM.

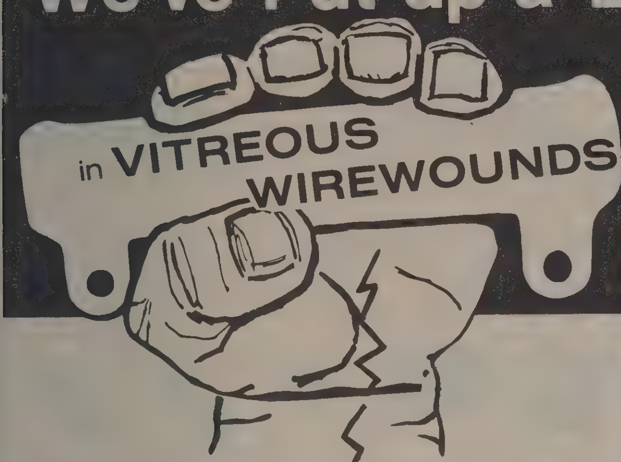


RCL Style	Resistance Range	PPM/°C Average Tempco 0°C — 100°C
TC35	10Ω — 50KΩ	3500 ±350
TC45	10Ω — 10KΩ	4500 ±450
TC55	10Ω — 5KΩ	5500 ±550

Call or write factory for complete information

RCL ELECTRONICS, INC., 195 McGregor Street, Manchester, NH 03102 • (603) 627-3831
SHALLCROSS, INC., U.S. 70 East, Smithfield, NC 27577 • (919) 934-5181

We've Put up a LOT of Resistance...



Reliable Performance *Wherever* Needed!

For More Than 30 Years Our Famous, *Versatile* Ohmic Capabilities have met the rigid demands of smart buyers with unerring consistency — saving time, tempers and money.

Against this enviable background our engineers envision even greater challenges in solving future OEM and industrial resistor application problems. For prompt, practical answers to your requirements, send us your prints or specs.

AXIAL LEAD

No.	Watts	Resistance Min. Max.	Dimensions O.D. x Lgth.
3 AX	3	0.1- 10,000	¼ max. x 9⁄16
5 AX	5	0.1- 30,000	11⁄32 max. x 11⁄16
10 AX	10	0.1- 50,000	13⁄32 max. x 15⁄16

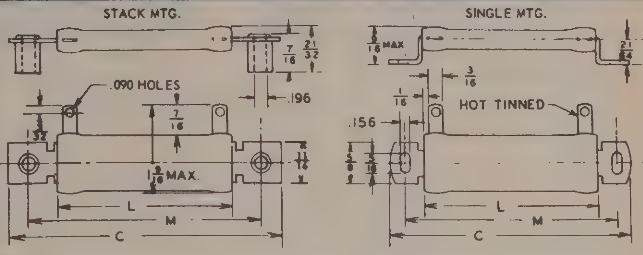
FIXED LUG

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 M	5	0.1- 11,000	5⁄16 x 1
1¾ M	10	0.1- 50,000	5⁄16 x 1¾
2 E	20	0.25-100,000	7⁄16 x 2
2 B	25	0.25-100,000	9⁄16 x 2
4 B	50	0.5-175,000	9⁄16 x 4
6½ C	100	1.0-300,000	¾ x 6½
8½ R	160	1.0-300,000	1⅛ x 8½
10½ R	200	1.0-400,000	1⅛ x 10½

ADJUSTABLE

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1¾ MA	10	1.0- 10,000	5⁄16 x 1¾
2 BA	25	1.0- 25,000	9⁄16 x 2
4 BA	50	1.0-100,000	9⁄16 x 4
6 BA	75	1.0-100,000	9⁄16 x 6
6½ CA	100	1.0-100,000	¾ x 6½
8½ RA	160	1.0-100,000	1⅛ x 8½
10½ RA	200	1.0-100,000	1⅛ x 10½

FLAT OVAL



Watts* Free Air	Core—L	Min. Ohms	Max. Ohms	Mounting	C	M
30	1¼	0.1	10K	Single Stack	2⅛ 2½	1¾ 2
40	2	0.2	30K	Single Stack	2⅞ 3¼	2½ 2¾
55	3½	0.3	60K	Single Stack	4⅜ 4¾	4 4¼
65	4¾	0.4	85K	Single Stack	5⅝ 6	5¼ 5½
75	6	0.5	100K	Single Stack	6⅞ 7¼	6½ 6¾

* Ratings of flat oval resistors based on mounting on steel panel 10″ x 10″ x .040″. When mounted on non-metallic surface, reduce wattage approximately 15%.

RIBBON-WOUND RESISTORS

Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.	Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.
400	1⅛	11¼	0.24	18.00	135	¾	5	0.06	4.25
375	1⅛	10½	0.22	16.50	105	¾	4	0.04	3.00
300	1⅛	8½	0.17	13.00	100	¾	3½	0.03	2.40
240	1⅛	6½	0.11	8.20	135	9⁄16	6	0.06	5.50
185	1⅛	5	0.09	6.40	105	9⁄16	5	0.05	3.65
180	¾	6½	0.08	6.00	90	9⁄16	4	0.04	2.75

Available with adjustable tap bands or with tapped windings.

NON-INDUCTIVE RESISTORS: for high frequency power circuits. Available in all fixed-lug types, 10 watts and larger. Standard tolerances: ±10%.

RESISTANCE TOLERANCES: Standard: ±5%, 1.0 ohm and over. Special: down to ±1%.

Write For Complete Catalog

resistors, inc.

CUSTOM DESIGNING,
ENGINEERING, MANUFACTURING

5226 West 26th Street, Chicago, Illinois 60650
Long Distance Phone: (312) 652-7555
Chicago Phones: 242-1539 • 242-1540

RESΩNET®

ULTRA PRECISION METAL FILM RESISTORS & NETWORKS

RESISTANCE TOLERANCES — 0.005% to 1%

TEMPERATURE COEFFICIENT — 1, 2, 5, or 10ppm/°C

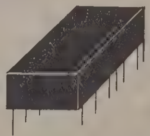
FEATURES

Long Term Stability: 25ppm/year
Noise Factor: Below 30db
Inductance: Approx. .05 microhenry
Capacitance: Below 0.5 picofarad
Voltage Coefficient: < 2ppm/volt
Rise Time: Less than 1ns without ringing

PERFORMANCE MEETS OR EXCEEDS REQUIREMENTS OF MIL-R-55182

	S-50	S-100	X-100	S-120	S-300	S-302	C-200	C-201	C-202
Resistance Range and Wattage	1 ohm to 50K .125 watt	1 ohm to 150K .3 watt	1 ohm to 150K .3 watt	20 ohms to 700K .3 watt	50 ohms to 1 Meg. .5 watt	75 ohms to 1.5 Meg. .75 watt	1 ohm to 50K .100 watt	1 ohm to 75K .100 watt	1 ohm to 200K .25 watt
Size	H .200 ± .020 L .295 ± .010 W .100 ± .010	H .320 ± .020 L .295 ± .010 W .100 ± .010	H .320 ± .020 L .295 ± .010 W .100 ± .010	H .320 ± .020 L .565 ± .020 W .150 ± .010	H .520 ± .020 L .565 ± .020 W .150 ± .010	H .520 ± .020 L .810 ± .010 W .150 ± .010	L .250 ± .10 D .125 ± .010	L .300 ± .01 D .125 ± .01	L .500 ± .020 D .250 ± .010
Lead Spacing	.150 ± .010	.150 ± .010	Center	.400 ± .020	.400 ± .020	.650 ± .020	Center	Center	Center

CUSTOM RESISTOR NETWORKS



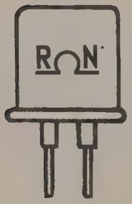
DUAL-IN-LINE (DIP)
SINGLE-IN-LINE (SIP)

MATCHING & TRACKING
AS GOOD AS .005% 1 PPM/°C
PER CUSTOMER SPECIFICATIONS

Other Packages Available

Complete Custom
Packaging Capability

ULTRA-PRECISION HERMETIC SEAL METAL FILM HS-100



Resistance to 150K
Tolerance to .005%
TC to 1PPM/°C

PRECISION HERMETIC SEAL METAL FILM POWER RESISTOR P-300

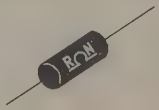
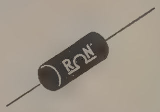
Power: 10 Watts (Heat Sink)
3 Watts (Free Air)
Tolerance to ±.01%
TC to 10ppm/°C
Standard TO-3 Package

FILMET®

NEW ECONOMY SERIES / HIGH PRECISION METAL FILM RESISTORS

COST COMPETITIVE WITH WIRE-WOUND

TC = 10ppm/°C Tolerance to .01%

STYLE	OUTLINE DWG.	MAX. DIMENSIONS	RESISTANCE RANGE
EP-50		H = .200 L = .320 W = .120 LS = .150	10Ω — 50K .125 Watt
EP-100		H = .345 L = .320 W = .120 LS = .150	10Ω — 150K .3 Watt
EP-200		L = .250 D = .125	10Ω — 50K .100 Watt
EP-202		L = .500 D = .250	10Ω — 200K .3 Watt

Call or Write for Complete Brochure

RΩN®

RES-NET CORPORATION

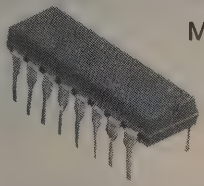
110 ROUTE 10, WHIPPANY, NEW JERSEY 07981
(201) 887-2260 • TOLL FREE (800) 526-0704 EXCEPT N.J.

TECHNO

a subsidiary of OAK INDUSTRIES, INC.

RESISTOR NETWORKS

MOLDED DIP



FEATURES/SPECIFICATIONS

QPL to MIL-R-83401
Oper. Temp.: -55° to +125° C
Resis. Range: 10 Ohm to 1meg Ohm
Resis. Tol.: ±1, 2, 5%
Temp. Coeff.: ±300 PPM/°C
±100 PPM/°C
100% Burn-in (MIL)
Solderable leads
Insul. Resis.: 10k meg Ohms (min.)
Two standard configurations (14 & 16 pin) in two basic schematics "A" or "B" as seen below. Techno can supply special network schematics and meet special testing and quality standards. Designed for automatic insertion.

HOW TO ORDER

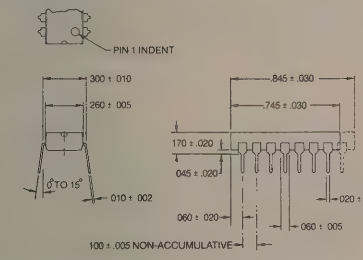
MIL-R-83401

M83401 02 M 1003 F B
① ② ③ ④ ⑤ ⑥

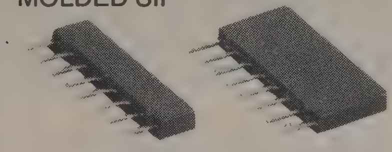
① Basic MIL #.
② 01 = 14 pin DIP 04 = 6 pin std. profile SIP
02 = 16 pin DIP 05 = 8 pin std. profile SIP
07 = 6 pin low profile SIP 08 = 8 pin low profile SIP
09 = 10 pin low profile SIP
③ TC, M = ±300ppm/°C
K = ±100ppm/°C
④ R Value: First 3 digits significant. Last digit = number of zeros. Letter "R" represents decimal point for values less than 100 ohms
1003 = 100,000 Ohms
37RO = 37 Ohms
⑤ Resistance Tolerance: F = ±1%, G = ±2%, J = ±5%
⑥ Schematic—A, B, C, or G

DIMENSIONS

14, 16 PIN DIP


PIN 1 INDENT
300 ± 010
260 ± 005
0° TO 15°
010 ± 002
.845 ± .030
.745 ± .030
170 ± .020
045 ± .020
020 ± 002
060 ± 020
060 ± 005
100 ± .005 NON-ACCUMULATIVE

MOLDED SIP



FEATURES/SPECIFICATIONS

QPL to MIL-R-83401
Available in two heights. The standard profile height is 0.335. The low profile height is 0.187. Both are available in MIL and commercial types. Same basic specifications as DIP types except with three configurations (6 & 8 pin. 10 pin also available in Low Profile). Schematics "C," "G," or Custom

Molded SIP networks have standoffs to facilitate PC board washing. Designed for automatic insertion.

HOW TO ORDER

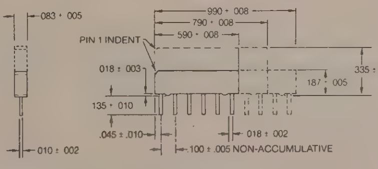
Techno Part No.

16 D M 1003 F B
① ② ③ ④ ⑤ ⑥

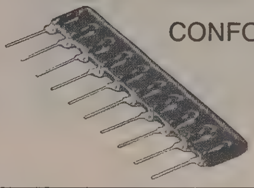
① 16 = # pins
② D = DIP. S = Std. Profile SIP
L = Low profile SIP
③-⑥ Same as MIL

DIMENSIONS

6, 8 PIN STANDARD PROFILE
6, 8, 10 PIN LOW PROFILE


083 ± 005
990 ± 008
790 ± 008
590 ± 008
PIN 1 INDENT
018 ± 003
335 ± 005
187 ± 005
135 ± 010
.045 ± .010
018 ± 002
010 ± 002
.100 ± .005 NON-ACCUMULATIVE

CONFORMAL SIP



FEATURES/SPECIFICATIONS

These low cost conformally coated SIP resistor networks are made to the same high standards as the molded types. They are available in two standard schematics "C" and "G" and special designs. Choose from 5 to 11 pins depending on circuit.

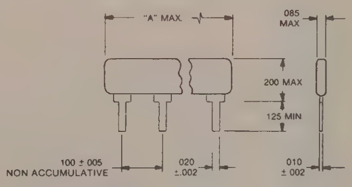
Resis. range: 10 Ohms to 1meg Ohms.
Resis: Tol.: ±2%
TC: ±200 PPM/°C
Oper. Temp.: -55° to +125°C
Oper. Volts: 250 (max.)
Insul. Resis.: 10k meg Ohms
Power Rating: 250 mW @ 25° C
125 mW @ 70° C

HOW TO ORDER

8 C L 1003 G C
① ② ③ ④ ⑤ ⑥

① 8 = # pins (5 to 11)
② C = Conformal coated low profile
③ L = TC (±200ppm/°C)
④ 1003 = 100,000 Ohms (See description to left)
⑤ G = Tol. (±2%)
⑥ Schematic (C or G)

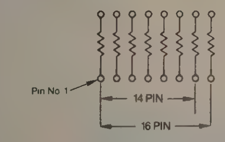
DIMENSIONS


"A" MAX.
085 MAX
200 MAX
125 MIN
100 ± 005 NON ACCUMULATIVE
020 ±.002
010 ± 002

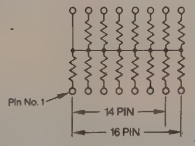
No. of Pins	"A" Dimension
5	.490
6	590
7	690
8	790
9	890
10	990
11	1 090

NETWORK SCHEMATICS

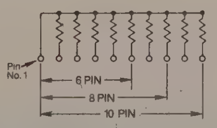
A


Pin No 1
14 PIN
16 PIN

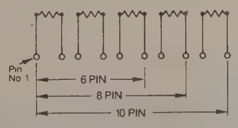
B


Pin No. 1
14 PIN
16 PIN

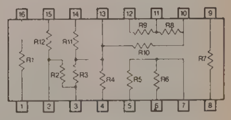
C


Pin No. 1
6 PIN
8 PIN
10 PIN

G


Pin No 1
6 PIN
8 PIN
10 PIN

SPECIALS


16
15
14
13
12
11
10
9
R9
R8
R12
R11
R10
R1
R7
R2
R3
R4
R5
R6
1
2
3
4
5
6
7
8

TECHNO-COMPONENTS CORP., 7803 Lemona Ave., Van Nuys, CA 91405 (818) 781-1642, TWX: 910-495-2015

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

Quality fixed wire-wound & Precision metal film resistors.

For over thirty years, Tel Labs has been establishing the standard of quality for the design and manufacture of fixed wire-wound resistors. We are now also producing a complete line of precision metal film resistors in our new 10,000 square foot plant, utilizing the same unsurpassed quality control upon which our reputation was built.

We encourage your comparison between our American manufactured products and any other resistor on the market today.

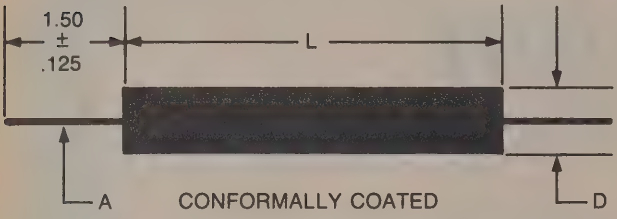
Demand quality. Specify Tel Labs.

TEL LABS, inc.

154 Harvey Road, PO Box 375, Londonderry, N.H. 03053
TWX 710-220-1844 Tel. (603) 625-8994

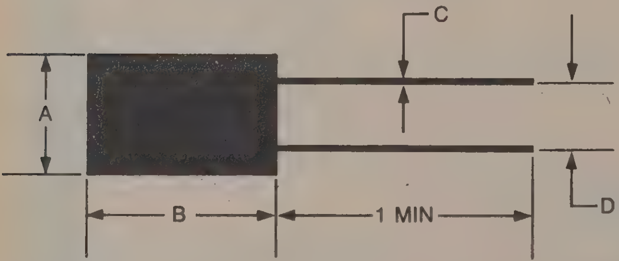
Demand Quality.

PRECISION METAL FILM RESISTORS



Tel Labs Style	Mil R	RR	W	VR	BL(L)	BD(D)	LD(A)
LA45	N/A	10-25K	1/40	100	.130 ±.005	.047 ±.005	.016(#26)
LA50	RNC50	10-200K	1/20	200	.150 ±.020	.070 ±.010	.016(#26)
LA55	RNC55	10-604K	1/10	200	.250 ±.020	.080 ±.015	.025(#22)
LA60	RNC60	10-1.0M	1/8	250	.375 ±.060	.100 ±.015	.025(#22)
LA65	RNC65	10-3.0M	1/4	300	.562 ±.031	.180 ±.015	.025(#22)
LA70	RNC70	10-4.02M	1/2	350	.640 ±.031	.210 ±.015	.032(#20)
LA75	RNC75	10-5M	1	750	1.000 ±.031	.340 ±.015	.032(#20)
LA80	N/A	10-10M	2	750	2.062 ±.031	.275 ±.015	.032(#20)

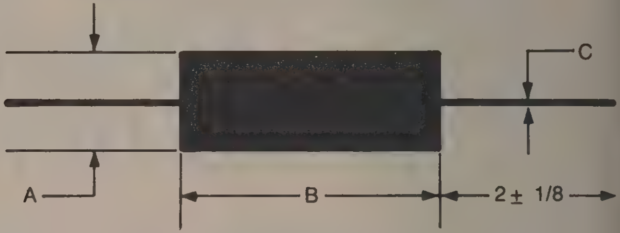
TYPE PW SERIES



Mil R93D Desig.	Tel Labs Style	A ± .015	B ± .032	C	D ± .015	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. V. Mil.	MAX. V. Comm.
RB71	PW1	.250	.312	.025	.200	100K	125K	.125W	.15W		300
	PW2	.250	.406	.025	.200		175K		.2W		600
RB70	PW20	.375	.500	.032	.200,.250	301K	375K	.250W	.33W	150	600
	PW40	.468	.625	.032	.250,.300		500K		.3W		600
	PW31	.500	.625	.032	.250,.300		1.75 Meg		.6W		600
	PW10	.406	1.250	.032	.250,.300		1.0 Meg		1.0W		1200
	PW50	.531	1.000	.032	.250,.300		3.0 Meg		1.0W		1200

TYPE SA EPOXY

Meets or exceeds MIL-R-93D



Tel Labs Style	Mil R93D Desig.	Diam. A ± .015	Length B ± .031	Lead Diam. C.	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. VOLTAGE Mil.	MAX. VOLTAGE Comm.
SA1	RB55	.250	.500	.032	226 K	1.1 Meg	.15W	.3W	400	400
SA2	RB54	.250	.750	.032	448 K	2 Meg	.25W	.4W	300	400
SA3	RB53	.375	.750	.032	750 K	8 Meg	.333W	.5W	300	400
SA4	RB52	.375	1.000	.032	1.5 Meg	10 Meg	.5W	.75W	600	800
SA5	RB57	.500	1.000	.032	2 Meg	16 Meg	.75W	1.0W	800	1000
SA6	RB58	.500	1.531	.032	3 Meg	24 Meg	1.0W	1.5W	900	1200
SA7	RB59	.500	2.031	.032	5.11 Meg	24 Meg	1.25W	2.0W	1200	1800
SA11		.250	.625	.032		400 K		.33W		800
SA13		.312	.937	.032		1.2 Meg		.5W		800
SA16	RB56	.250	.375	.032	127 K	205 K	.125W	.25W	200	200
SA19		.250	.250	.032		500 K		.2W		200
SA18		.500	.500	.032		3 Meg		.5W		500

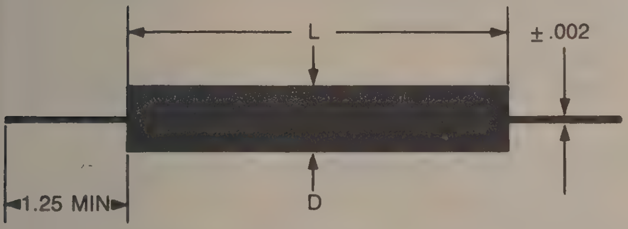
SUBMINIATURES

Tel Labs Style	Diameter A ± .015	Length B ± .031	Lead Diam. C.	Maximum Value	Maximum Wattage	Maximum Voltage
SA9	.135	.312	.025	400K	.08W	100
SA10	.185	.500	.025	500K	.2W	100
SA20	.165	.500	.025	400K	.150W	100,200
SA21	.187	.375	.025	500K	.125W	100,200
SA22	.150	.400	.025	190K	.07W	100
SA24	.125	.250	.020	75K	.05W	100
SA25	.110	.300	.020	85K	.05W	100
SA26	.125	.375	.025	140K	.05W	100
SA29	.100	.300	.025	80K	.05W	100
SA30	.200	.405	.025	550K	.13W	100
SA31	.100	.220	.020	70K	.04W	100

Specify Tel Labs.

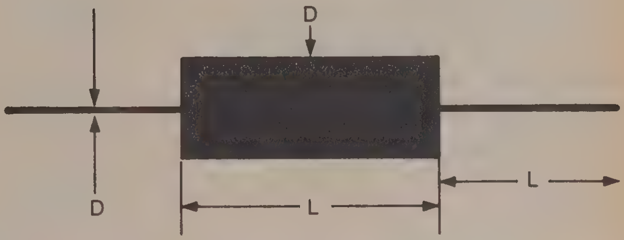
TYPE EL SILICONE POWER

Meets or exceeds MIL-R-26



Tel Labs Style	Mil Desig RW	Wattage		Dimensions — Inches		Max Res.		Lead Dia. IN.
		U 275°	V 350°	Dia.	LN	.05% to .05%	1% to 5%	
EL¼		.5W	1.0W	.090 ± .031	.215 ± .031	500Ω	500Ω	.020
EL½		.75W	1.0W	.094 ± .031	.280 ± .031	1K	1.5K	.020
EL1A	RW70	1.0W	1.25W	.094 ± .031	.406 ± .031	2K	6K	.020
EL1B		1.0W	1.50W	.094 ± .031	.530 ± .031	4K	9K	.020
EL1C		1.0W	2.0W	.135 ± .031	.335 ± .031	2K	4.4K	.025
EL2F		2.5W	3.0W	.188 ± .031	.500 ± .062	4K	12K	.032
EL2H		2.5W	3.0W	.188 ± .031	.385 ± .062	2K	5.7K	.032
EL2G		2.5W	3.0W	.188 ± .031	.430 ± .062	2K	8K	.032
EL2B		3.0W	3.5W	.188 ± .031	.625 ± .062	8K	16K	.032
EL2A		3.25W	4.5W	.188 ± .031	.825 ± .062	10K	28K	.032
EL2E	RW59	2.5W	3.5W	.195 ± .031	.500 ± .062	8K	15.4K	.032
EL2E	RW69	2.5W	3.5W	.195 ± .031	.500 ± .062	8K	15.4K	.032
EL2I	RW79	3.0W	3.5W	.195 ± .031	.560 ± .062	8K	19K	.032
EL2D		3.0W	4.0W	.250 ± .031	.500 ± .062	7.5K	19K	.032,.040
EL2C		3.0W	4.0W	.250 ± .031	.562 ± .062	8K	22K	.032,.040
EL2		3.5W	4.5W	.250 ± .031	.625 ± .062	12K	31K	.032,.040
EL3		3.5W	5.0W	.295 ± .031	.500 ± .062	8.3K	23K	.032,.040
EL5	RW74	5.0W	7.0W	.290 ± .062	.925 ± .093	22K	56K	.032,.040
EL7		6.0W	8.0W	.290 ± .062	1.200 ± .093	35K	90K	.032,.040
EL5A	RW57	5.0W	6.5W	.350 ± .062	1.000 ± .093	35K	90K	.040
EL5A	RW67	5.0W	6.5W	.350 ± .062	1.000 ± .093	35K	90K	.040
EL7A		7.0W	9.0W	.350 ± .062	1.360 ± .093	45K	100K	.040
EL10A	RW58	10W	11W	.350 ± .062	1.815 ± .093	75K	175K	.040
EL10A	RW68	10W	11W	.350 ± .062	1.815 ± .093	75K	175K	.040
EL12	RW56	12W	14W	.469 ± .062	2.00 ± .093	90K	235K	.040

ULTRA LOW OHM POWER RESISTORS



Tel Labs Style	LENGTH	DIAMETER	Lead L	Lead D	Resistance Measurement Points from body
TL01	.406 ± .015	.094 ± .015	1.5 Min.	.025 ± .002	.375 each side
TL03	.560 ± .015	.210 ± .015	1.5 Min.	.032 ± .002	.375 each side
TL05	.920 ± .015	.330 ± .015	1.5 Min.	.040 ± .002	.375 each side

Send for our new catalog covering our complete line of fixed wire wound resistors.

Additional items include:
TYPE VR - Vitreous Coated
TYPE EH - Aluminum Housed
TYPE BL - Beryllium Oxide
TYPE PR - Subminiature Printed Circuit
TYPE Q81 - Special Temperature Compensation
TYPE Q239 – Special 4-Terminal Device

TEL LABS, inc.

154 Harvey Road, PO Box 375, Londonderry, N.H. 03053
TWX 710-220-1844 Tel. (603) 625-8994

TRW

CONTENTS

GENERAL-PURPOSE RESISTORS

Carbon Composition IBT Series 2

Carbon Film CR Series 3, 4

Metal Film GP¼ Series 5

SEMIPRECISION/PRECISION RESISTORS

Metal Film GP55 Series 6

MIL-Qualified Thick Film RG Series 7, 8, 9

Thick Film RG Chip Resistors 10

Radial-Lead Thick Film RGU Series 11

High-Voltage CGH Series 12

Low-TC Industrial CM Series 13

ULTRAPRECISION RESISTORS

Tailored-T.C. MTR Series 14

Metal Film MAR Series 15

Radial-Lead MAR40 Series 16

MAR Matched Sets 17

THIN FILM RESISTOR NETWORKS

Conformal-Coated SIP Networks 18

MIL-R-83401 DIP Networks 19

MIL-R-83401 Flat-Pack Networks 20

20-Pin DIP R-2R Ladders 21

Subminiature Dual-Resistor Networks 22

Chip Carriers 23

THICK FILM RESISTOR NETWORKS

Conformal-Coated .256-inch SIP Networks 24

Conformal-Coated .200-inch SIP Networks 25

Molded .350-Inch SIP Networks 26

Molded .195-Inch SIP Networks 27

Molded 14- and 16-Pin DIP Networks 28

SCREEN-PRINTED RESISTIVE PRODUCTS

High-Voltage Divider RD Series 29

High-Voltage RB Series 30

Focus Controls 31

Custom Thick Film Circuits 32

WIREWOUND RESISTORS

Low-Power Molded BW Series 33

Failsafe Molded BWF Series 34

General-Purpose Power PW Series 35

Printed Circuit Board PC and PCX Series 36

Semiprecision Power AS Series 37

Pulse and Surge PPW Series 38

Extremely-Low-Resistance LPW Series 39

Four-Terminal Current-Sensing 4LPW Series 40

Automotive and Appliance AW Series 41

High-Power Fixed, Adjustable and Tapped PWW Series 42

SPECIAL-PURPOSE RESISTORS

Wirewound Temperature-Sensing BWG Series 43

Thin Film Temperature-Sensing TD Series 44

Thick Film Temperature-Sensing RGT Series 45

High-Voltage, High-Resistance MV Series 46

Zerohm Jumper Wires 47

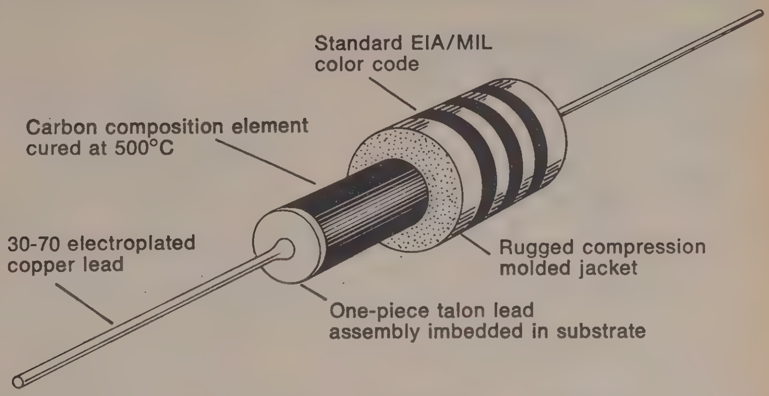
TRW Sales Offices 48

TRW

GENERAL-PURPOSE CARBON COMPOSITION RESISTORS

IBT SERIES*

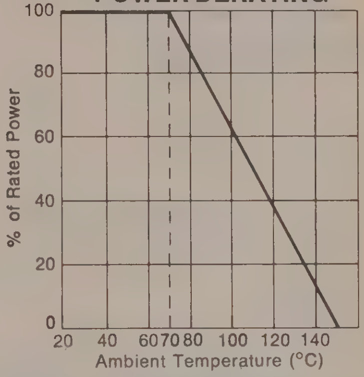
- ☐ ¼ watt to 1 watt
- ☐ 10 ohms to 22 megohms
- ☐ ±5% tolerance
- ☐ Excellent high-frequency response
- ☐ Exceptional long-term load life performance


Standard EIA/MIL color code
Carbon composition element cured at 500°C
30-70 electroplated copper lead
Rugged compression molded jacket
One-piece talon lead assembly imbedded in substrate

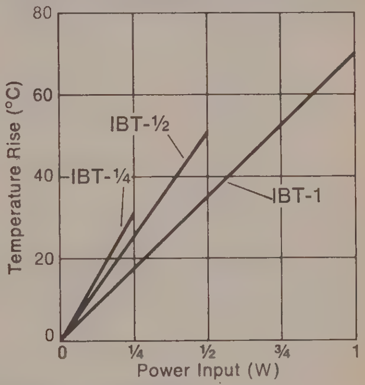
SPECIFICATIONS

Electrical Characteristics	IBT-¼	IBT-½	IBT-1
MIL-R-11 Style	RC07	RC20	RC32
Resistance Range	10Ω to 1MΩ	10Ω to 22MΩ	10Ω to 10MΩ
Tolerance	±5% (Series E24)	±5% (Series E24)	±5% (Series E24)
Rated Power	0.25W @ 70°C	0.50W @ 70°C	1W @ 70°C
Max. Continuous Working Voltage	250V	350V	500V
Surface Temperature Rise	32°C @ 0.25W	50°C @ 0.5W	70°C @ 1W
Average Shunt Capacitance	0.15 pF	0.175 pF	0.30 pF
Dielectric Withstanding Voltage			
— Atmospheric Pressure	500V RMS, min.	700V RMS, min.	1000V RMS, min.
— At 87mm of Mercury	325V RMS, min.	450V RMS, min.	625V RMS, min.
Insulation Resistance — Dry	10^4MΩ min.	10^4MΩ min.	10^4MΩ min.
Wet	10^2MΩ min.	10^2MΩ min.	10^2MΩ min.
Performance Characteristics (Typical % △R for the entire ohmic range)			
Operating Temperature Range	−55°C to +150°C	−55°C to +150°C	−55°C to +150°C
Voltage Coefficient	−0.035%/V max.	−0.025%/V max.	−0.020%/V max.
Life (Method 108, MIL-STD-202, Cond. D)	±2.50%	±5%	±5%
Short Time Overload (6.25 x Rated Power, 5 sec.)	±1%	±1.50%	±1.50%
Moisture Resistance (Method 106, MIL-STD-202)	±8%	±3%	±3%
Temperature Cycling (Method 102, MIL-STD-202, Cond. D)	±1%	±0.75%	±1%
Low Temperature Operation (MIL-R-11, Para 4.6.7; −65°C)	±0.75%	±0.50%	±1%
Terminal Strength (Method 211, MIL-STD-202, Cond. A, D)	±0.30%	±0.50%	±0.50%
Resistance to Soldering (Method 210, MIL-STD-202, Cond. A)	±2%	±1.50%	±2%
Shock, Medium Impact (Method 205, MIL-STD-202, Cond. C)	±1%	±0.50%	±0.50%
Vibration, High Frequency (Method 204, MIL-STD-202, Cond. D)	±1%	±0.50%	±0.50%

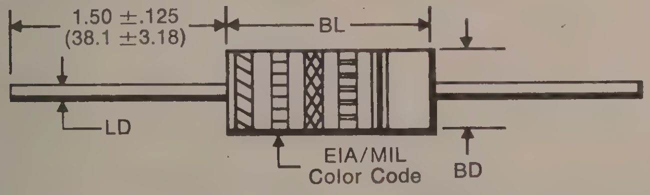
POWER DERATING



SURFACE TEMPERATURE RISE



DIMENSIONS — IN. AND (mm)



TRW Type	Body Length BL	Body Diameter BD	Lead Diameter LD
IBT-¼	.250 ±.015 (6.35 ±.30)	.090 ±.008 (2.29 ±.20)	.025 ±.001 (.635 ±.03)
IBT-½	.390 ±.010 (9.91 ±.30)	.140 ±.008 (3.56 ±.20)	.031 ±.001 (.787 ±.03)
IBT-1	.562 ±.010 (14.3 ±.30)	.225 ±.008 (5.72 ±.20)	.040 ±.001 (1.02 ±.03)

* Manufactured in Italy

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

HOW TO ORDER

Sample Part No.:

IBT - ½ - 680k - 5%

Type

Power Rating at 70°C
¼, ½ or 1 watt

Resistance
Standard EIA/MIL values for carbon composition resistors.
See specification table for range.

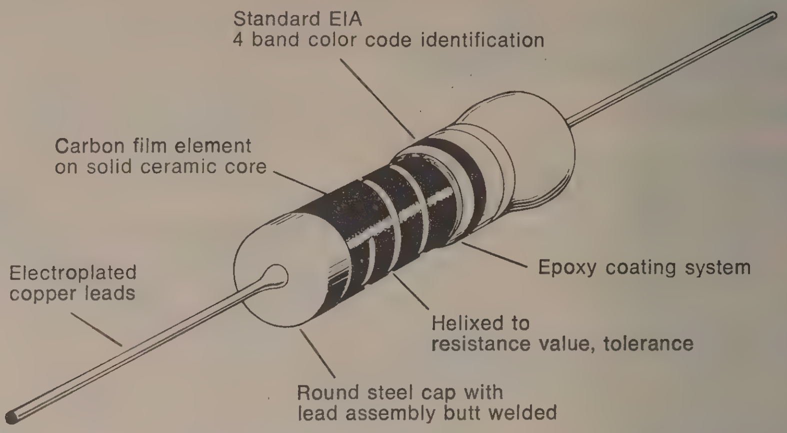
±5% Tol.	±5% Tol.	±5% Tol.	±5% Tol.
1.0	1.8	3.3	5.6
1.1	2.0	3.6	6.2
1.2	2.2	3.9	6.8
1.3	2.4	4.3	7.5
1.5	2.7	4.7	8.2
1.6	3.0	5.1	9.1

Tolerance
±5%

GENERAL-PURPOSE CARBON FILM RESISTORS

C F SERIES*

- ☐ ⅛ watt to 2 watt
- ☐ 1 ohm to 10.0 megohms
- ☐ ±5% tolerance


Standard EIA
4 band color code identification
Carbon film element
on solid ceramic core
Electroplated
copper leads
Epoxy coating system
Helixed to
resistance value, tolerance
Round steel cap with
lead assembly butt welded

SPECIFICATIONS

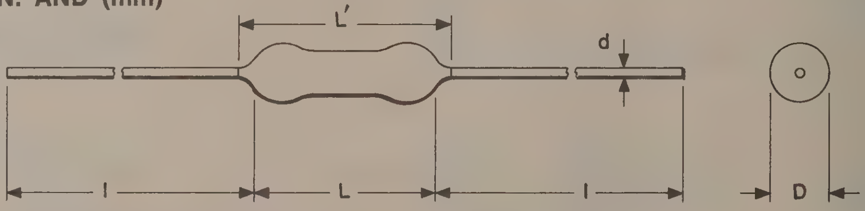
Type	CF-⅛	CF-¼	CF-½	CF-1	CF-2
Resistance, Standard	1Ω to 1MΩ	1Ω to 10MΩ	1Ω to 10MΩ	1Ω to 10MΩ	1Ω to 10MΩ
Tolerances, Standard	±5%	±5%	±5%	±5%	±5%
Power Rating	⅛ watt @ 70°C	¼ watt @ 70°C	½ watt @ 70°C	1 watt @ 70°C	2 watts @ 70°C
Maximum Continuous Working Voltage	150 volts	250 volts	350 volts	500 volts	500 volts
Minimum Insulating Resistance—Dry	100MΩ	1000MΩ	1000MΩ	1000MΩ	1000MΩ
Minimum Dielectric Withstanding Voltage—Atmospheric	300 volts	500 volts	500 volts	500 volts	500 volts
Load Life—Typical ΔR Less Than	±3%	±3%	±3%	±3%	±3%

RESISTANCE-TEMPERATURE CHARACTERISTICS

Nominal Resistance (ohms)	Typical Temperature Coefficient (ppm/°C)				
	CF-⅛	CF-¼	CF-½	CF-1	CF-2
1.0Ω to 91.0Ω	±50 to ±250	±50 to ±250	±50 to ±250	±50 to ±250	±50 to ±250
100Ω to 10kΩ	−100 to −400	−100 to −400	−150 to −350	−150 to −350	−150 to −350
11KΩ to 100kΩ	−150 to −600	−150 to −600	−200 to −500	−200 to −500	−200 to −500
110KΩ to 1.0MΩ	−200 to −1200	−250 to −1000	−250 to −800	−250 to −800	−250 to −800
1.1MΩ to 10.0MΩ	—	−300 to −1800	−300 to −1800	−300 to −1800	−300 to −1800

The carbon film resistors contact caps are pressed on the rods and a helical grove cut through the film to give the required resistance value. Connecting wire of lead-tin coated electrolytic copper are welded to the end caps. Finally the resistors are coated with multiple layers of insulating lacquer. This process gives every resistor the better characteristics in respect to the mechanical and electrical such as Loading Temperature coefficient, current Noise and etc.

DIMENSIONS — IN. AND (mm)



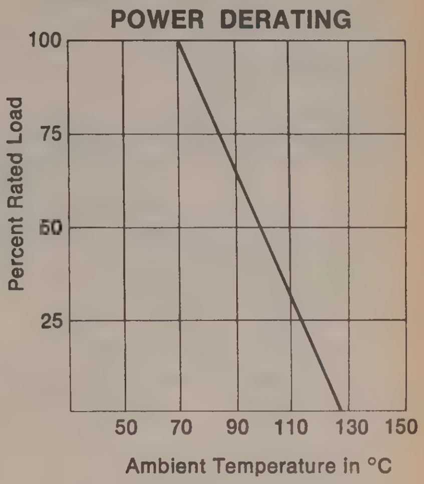
Type	Clead Lead to Clean Lead L	Body Length L	Body Diameter D	Lead Length l	Lead d
CF-⅛	4.6 Max. (.18 Max.)	3.8 ±.2 (.15 ±.008)	1.5 ±.2 (.06 ±.008)	28 ±1 (1.1 ±.04)	.5 (.02)
CF-¼	8.5 Max. (.33 Max.)	6.5 ±.5 (.26 ±.02)	2.5 ±.2 (.1 ±.008)	28 ±1 (1.1 ±.04)	.6 (.024)
CF-½	11 Max. (.43 Max.)	9.5 ±.5 (.37 ±.02)	3.5 ±.5 (.14 ±.02)	28 ±1 (1.1 ±.04)	.7 (.028)
CF-1	14.2 Max. (.56 Max.)	13 ±1 (.51 ±.04)	4.8 ±1 (.19 ±.04)	38 ±2 (1.5 ±.08)	.7 (.028)
CF-2	20 Max. (.79 Max.)	18 ±1 (.71 ±.04)	6.5 ±1 (.26 ±.04)	38 ±2 (1.5 ±.08)	.7 (.028)

* Made in Far East

CHARACTERISTICS

Requirements	Carbon Film Resistors				
Operating Temp. Range	−25 to +125°C				
Current Noise (μv/v)	**Noise Style**	0.1	0.3	0.6	1.0
	CF-⅛ CF-¼	Under 10kΩ	11kΩ −100kΩ	110kΩ −1.3MΩ	Over 1.5MΩ
	CF-½	Under 10kΩ	11kΩ −270kΩ	300kΩ −4.7MΩ	Over 5.1MΩ
Dielectric Withstanding Voltage	No evidence of flashover, breakdown				
Short Time Overload	±(1% + 0.05Ω)				
Vibration	±(1% + 0.05Ω)				
Temp. Cycling	±(0.75% +0.05Ω)				
Effect of Soldering	±(1% + 0.05Ω)				
Moisture Resistance	< 100kΩ ±3% ≥ 100kΩ ±5%				
Load Life	±5%				

These characteristics are tested by our factory's quality control department to conform to DIN 44061, MIL-R-10509F (Char. D & C) and MIL-R-22684 and are determined under the following conditions.



1. **Short-Time Overload Tests**
   100 samples of each value (high 10K ohm and over and low 1k ohm below were taken for each test). There are altogether 12 tests formed by various combinations of the 4 loading conditions (1½, 2, 2½, 3 times rated voltage) and the 3 loading durations (1, 2, 5 sec.) The initial resistance values (before overloading) were compared with the final resistance values (after loading) after a recovery period of more than 2 hours.

2. **Vibration (Low frequency)**
   Resistors shall be mounted on appropriate jig fixtures and supported by their leads at the distance of 9.5 mm from the body and subjected to a single vibration having an amplitude of 0.8 mm for 2 hours in each direction for a total of 6 hours. The vibration frequency shall be varied uniformly 10 to 55 Hz and return to 10 Hz shall be traversed n 1 minutes.

3. **Temperature Cycling**
   Resistance change after 5 cycles for duty cycle as follows;

Step	Temperature	Time
1	-55^{+0}_{-3}C	30 minutes
2	25^{+10}_{-5}	10 to 15 minutes
3	85^{+3}_{-0}	30 minutes
4	25^{+10}_{-5}	10 to 15 minutes

4. **Solderability (When tested per MIL-R-202D method 208)**
   100 samples were also taken for this test. The resistors under test were dipped up to 2-3 mm from the roots of the main bodies into a solder tank of temperature 350°C ±10°C for 3 ±0.5 sec.

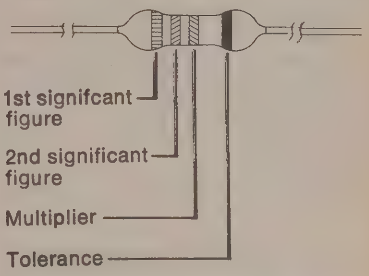
5. **Moisture Resistance (Long term)**
   Resistance change after 500 hours operating at rated continuous working voltage at 40 ±2°C and 90 to 95% relative humidity for duty cycle of 1.5 hour "on," 0.5 hour "off."

6. **Load Life**
   Resistance change after 1,000 hours operating at rated continuous working voltage at 70 ±3°C for duty cycle 1.5 hour "on," 0.5 hour "off."

7. **Noise**
   The noise voltage per volt produced in dividing the noise voltage by load voltage which generates from resistors when the rated voltage was added to the Resistors.

COLOR CODING

The resistance value and tolerance are indicated by a four-band color code:



HOW TO ORDER

Sample Part No.: **CF - ¼ - 47Ω - 5%**

TRW Type

Power Rating at 70°C
¼, ½ or 1 watt

Resistance
Standard Resistance Value
Multipliers:

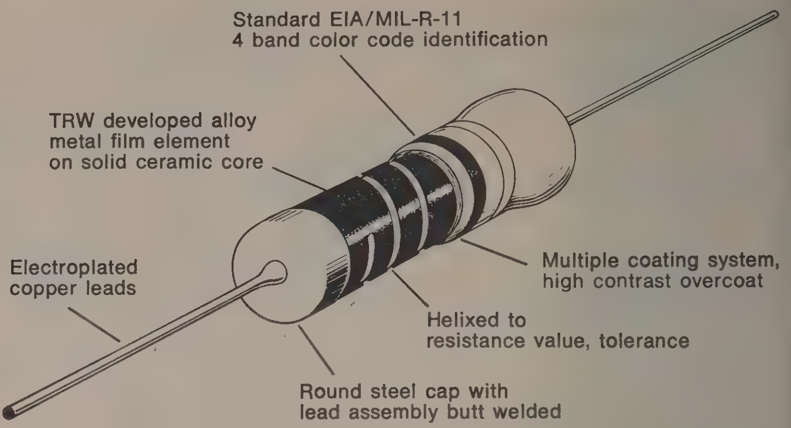
±5% Tol.	±5% Tol.	±5% Tol.	±5% Tol.
1.0	1.8	3.3	5.6
1.1	2.0	3.6	6.2
1.2	2.2	3.9	6.8
1.3	2.4	4.3	7.5
1.5	2.7	4.7	8.2
1.6	3.0	5.1	9.1

Tolerance
±5%

GENERAL-PURPOSE METAL FILM RESISTORS

GP¼ SERIES

- ☐ Dual rating for ¼ watt and ½ watt applications
- ☐ Metal film environmental performance
- ☐ 10 ohms to 1 megohm
- ☐ ±2% or ±5% tolerance
- ☐ ±200 ppm/°C temperature coefficient
- ☐ Low noise


Standard EIA/MIL-R-11
4 band color code identification
TRW developed alloy metal film element on solid ceramic core
Electroplated copper leads
Multiple coating system, high contrast overcoat
Helixed to resistance value, tolerance
Round steel cap with lead assembly butt welded

SPECIFICATIONS

Resistance Values: 10Ω through 1.0 Meg

Resistance Tolerance: ¼W application ±2%, ±5% — ½W application ±5%

Power Rating @ 70°C: ¼W, ½W

Temperature Coefficient of Resistance: ±200 ppm

Temperature Range: −55°C to +155°C

Continuous Working Voltage: 250V

Insulation Resistance: 1000 Megohms

Noise: −5 dB to −30 dB

Lead Material: Electroplated Copper

Construction: TRW developed alloy metal film on solid ceramic core

PERFORMANCE DATA (MAX ΔR)

Shock, Medium Impact & Vibration High Frequency: .5% +.05Ω

Load Life 100% Power @ 70% 2% +.5Ω

Short Time Overload: .5% +.05Ω @ 2.5 x Rated Voltage for 5 sec.

High Temperature Exposure: 2% +.5Ω @ 155°C

Low Temperature Operation: .5% +.05Ω

Hot Spot Surface Temperature Rise: ¼W 20°C, ½W 40°C

Temperature Cycling: .5% +.05Ω

Moisture Resistance: ¼W 2% - 1.5% +.05Ω
¼W 5% - 2% +.05Ω —
½W 5% - 3% +.05Ω

Solder Heat: .5% +.05Ω

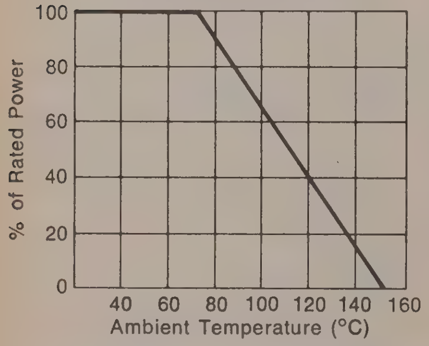
Terminal Strength: .5% +.05Ω

The GP¼ is a superior dual rated, general purpose metal film resistor. Available as either a 5% general purpose or a 2% semi precision resistor, this conformally coated device exhibits a temperature coefficient of ±200 ppm/°C — far superior to the industry average.

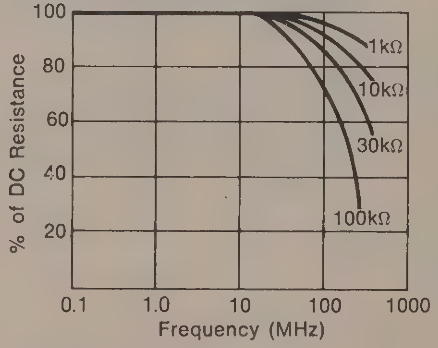
Since it can perform in ¼W and ½W applications, the compact GP¼ saves valuable "real estate" in circuit boards while offering versatility for inventory purposes. This space saving capability coupled with the GP¼'s compatibility with automatic insertion equipment makes it the ideal alternative to carbon composition and carbon film resistors for computer, telecommunications, instrumentation, and many automotive applications.

All the quality and reliability exhibited by TRW Resistive Products for several decades are manufactured into the GP¼. The same sturdy ceramic end cap construction and quality materials have been combined with an automated assembly technique that results in TRW quality at a lower price.

POWER DERATING



HIGH FREQUENCY CHARACTERISTICS



HOW TO ORDER

Sample Part No.:

GP¼ - 47Ω - 2%

TRW Type

Resistance Value
10Ω to 1.0 Meg in the following standard EIA/MIL decade values:

±2% and ±5% tolerance			
10.0	18.0	33.0	56.0
11.0	20.0	36.0	62.0
12.0	22.0	39.0	68.0
13.0	24.0	43.0	75.0
15.0	27.0	47.0	82.0
16.0	30.0	51.0	91.0

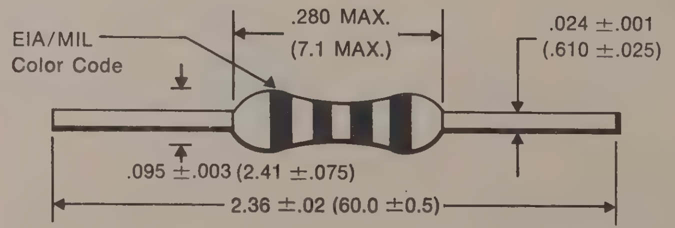
Tolerance
±2% or ±5%

Standard Packaging:

EIA RS-296D-Class 1-Tape and Reel. 5000 pieces per value per reel.
2500 pc. reels, 1000 pc. bulk pack, 2000 pc. pack or vertical insertion available; consult factory.

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

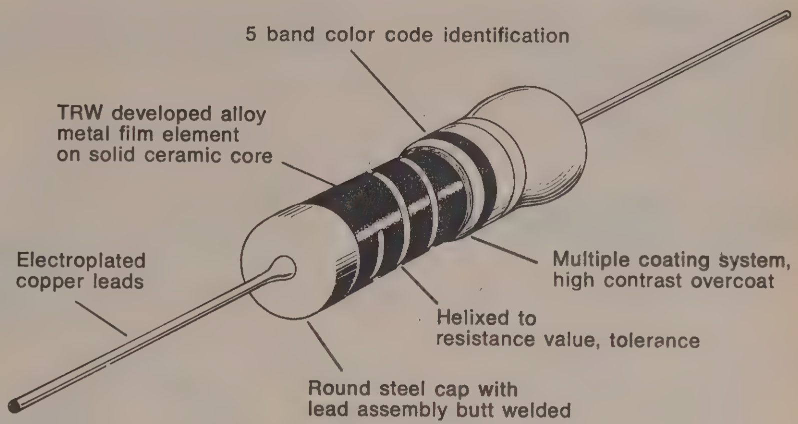
DIMENSIONS — IN. AND (mm)


EIA/MIL Color Code
.280 MAX.
(7.1 MAX.)
.024 ±.001
(.610 ±.025)
.095 ±.003 (2.41 ±.075)
2.36 ±.02 (60.0 ±0.5)

RN55DXXXF EQUIVALENT METAL FILM

GP55 SERIES

- ☐ Metal film stability
- ☐ ±1% tolerance
- ☐ ±100 ppm/°C temperature coefficient
- ☐ 10 ohm to 1 megohm
- ☐ Meets or exceeds MIL-R-10509 and R-22684
- ☐ E.I.A. (5 color band) standard


5 band color code identification
TRW developed alloy metal film element on solid ceramic core
Electroplated copper leads
Multiple coating system, high contrast overcoat
Helixed to resistance value, tolerance
Round steel cap with lead assembly butt welded

SPECIFICATIONS

Resistance Values: 10Ω through 1.0 Meg; higher values available; consult factory.

Resistance Tolerance: ¼W application ±1%
½W application ±1%

Power Rating @ 70°C: ¼W

Temperature Coefficient of Resistance: ±100 ppm

Temperature Range: −55°C to 155°C

Continuous Working Voltage: 250 V

Insulation Resistance: 1000 Megohms

Noise: −5 dB to −30 dB

Lead Material: Electroplated Copper

Construction: TRW developed alloy metal film on solid ceramic core

The GP55 is a quality, metal film resistor which is intended to help component engineers and circuit designers upgrade or replace carbon composition and carbon film resistors in most circuit applications. The standard unit comes in a 1% absolute tolerance and a temperature coefficient of ±100 ppm.

GP55 meets or exceeds all parameters of MIL-R-10509 (RN55) and MIL-R-22684 (RL07) and has been lab and field tested with many hours of proven reliability. RS-296D, Class I tape and reel is standard, making the GP55 ideal for high volume, automatic insertion applications.

E.I.A. color banding (5 band) is also standard facilitating identification on printed circuit boards.

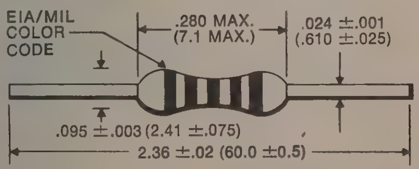
GP55 is approved and in use by many leading companies in the telecommunications, computer, automotive and instrumentation industries. Improve your cost effectiveness by converting to GP55.

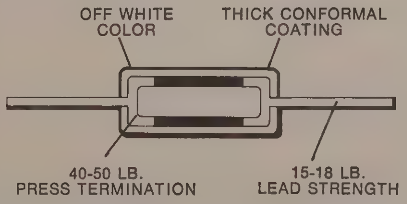
PERFORMANCE DATA*

Test	Typical ΔR GP55 (1%)	MIL-R-10509	MIL-R-22684	MIL-R-39017
Temperature Coefficient (ppm)	±100	+200 −500	±200	±100
Load Life 70°C @ ¼W - 1000 Hrs.	0.5%	1.0%	2.0%	2.0%
Hi-Temperature Exposure (155°C) (No Load)	0.5%	N.A.	N.A.	2.0%
Moisture Resistance	0.5%	1.5%	1.5%	1.0%
Temperature Cycling −55°C to 155°C	0.1%	0.5%	1.0%	0.25%
Low Temperature Operation - 65°C	0.1%	0.5%	0.5%	0.25%
Short Time Overload	0.25%	0.5%	0.5%	0.5%
Terminal Strength	0.1%	0.2%	0.5%	0.25%
Resistance to Solder Heat (350°C)	0.05%	0.5%	0.5%	0.25%
Shock	0.05%	0.5%	0.5%	0.25%
Vibration	0.05%	0.5%	0.5%	0.5%
Rated Voltage (RMS)	250	200	200	200
Resistance Range	10Ω-1 megΩ	10Ω-301KΩ	10Ω-1 megΩ	10Ω-1 megΩ

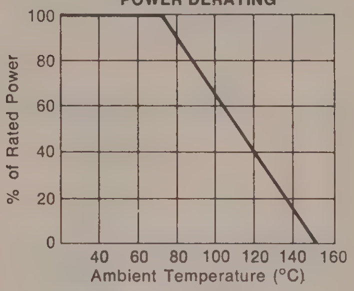
* NOTE: Above table shows typical GP55 performance compared to military specifications.

DIMENSIONS — IN. AND (mm)

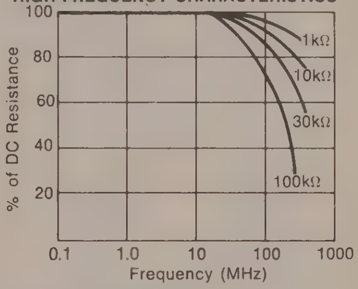

EIA/MIL COLOR CODE
.280 MAX. (7.1 MAX.)
.024 ±.001 (.610 ±.025)
.095 ±.003 (2.41 ±.075)
2.36 ±.02 (60.0 ±0.5)


OFF WHITE COLOR
THICK CONFORMAL COATING
40-50 LB. PRESS TERMINATION
15-18 LB. LEAD STRENGTH

POWER DERATING



HIGH FREQUENCY CHARACTERISTICS



HOW TO ORDER

Sample Part No.: **GP55 - XXXX - ±1%**

TRW Type

Resistance Value
Standard MIL resistance code
10Ω to 1.0 Meg in the following standard EIA/MIL decade values:

±1% tol.	±1% tol.	±1% tol.	±1% tol.	±1% tol.	±1% tol.
1.00	1.47	2.15	3.16	4.64	6.81
1.02	1.50	2.21	3.24	4.75	6.98
1.05	1.54	2.26	3.32	4.87	7.15
1.07	1.58	2.32	3.40	4.99	7.32
1.10	1.62	2.37	3.48	5.11	7.50
1.13	1.65	2.43	3.57	5.23	7.68
1.15	1.69	2.49	3.65	5.36	7.87
1.18	1.74	2.55	3.74	5.49	8.06
1.21	1.78	2.61	3.83	5.62	8.25
1.24	1.82	2.67	3.92	5.76	8.45
1.27	1.87	2.74	4.02	5.90	8.66
1.30	1.91	2.80	4.12	6.04	8.87
1.33	1.96	2.87	4.22	6.19	9.09
1.37	2.00	2.94	4.32	6.34	9.31
1.40	2.05	3.01	4.42	6.49	9.53
1.43	2.10	3.09	4.53	6.65	9.76

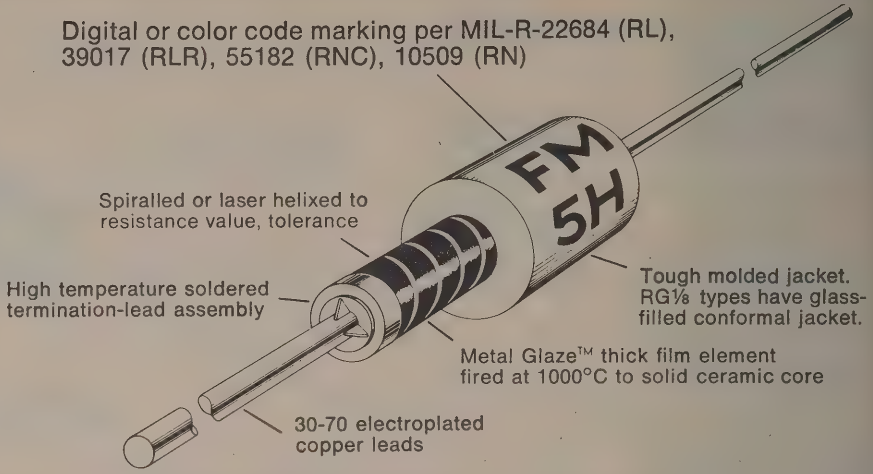
Tolerance

2500 pc. or 5000 pc. reels standard.
1000 pc. bulk pack, 2000 pc. pack, or vertical insertion available; consult factory.

PRECISION MIL-QUALIFIED METAL GLAZE™ RESISTORS

RG SERIES

- ☐ ⅛ watt to 3 watts
- ☐ 1 ohm to 3 megohms
- ☐ 0.5% to 5% tolerance; 0.1% in selected ranges
- ☐ ±25 ppm/°C to ±200 ppm/°C


Digital or color code marking per MIL-R-22684 (RL), 39017 (RLR), 55182 (RNC), 10509 (RN)
FM
5H
Spiralled or laser helixed to resistance value, tolerance
High temperature soldered termination-lead assembly
Tough molded jacket. RG⅛ types have glass-filled conformal jacket.
Metal Glaze™ thick film element fired at 1000°C to solid ceramic core
30-70 electroplated copper leads

SPECIFICATIONS

TRW Type	MIL Type	Marking	Tolerance (±%)	T.C. (ppm/°C)	TRW Power Rating (watts)	MIL Power Rating (watts)	Volt Rating	TRW Resistance Range	MIL Approved Resistance Range	Nominal Size
RG⅛(1)	—	Band	2, 5	200	¼ @ 70°C	—	200	10Ω to 1.5MΩ	—	⅛ W
RG¼	—	Band	5	200	½ @ 70°C	¼ @ 70°C	250	10Ω to 3MΩ	—	¼ W
RG½	—	Band	5	200	1 @ 70°C	—	350	10Ω to 3MΩ	—	½ W
RG1	—	Band	5	200	1 @ 70°C	—	500	4.3Ω to 3MΩ	—	1W
GS-3 (Replaces RG2, RG42)	—	Stamp	1, 2, 5	50, 100	3 @ 25°C 2 @ 70°C	—	1000	10Ω to 2MΩ	—	1W
T0-50(1)	—	Stamp	1	100	¼ @ 70°C	—	200	10Ω to 800KΩ	—	⅛ W
T2-50(1)	—	Stamp	1	50	⅛ @ 70°C	—	200	10Ω to 800KΩ	—	⅛ W
TF07	—	Band/Stamp	1, 2, 5	100	½ @ 70°C	—	250	1Ω to 9.9Ω	—	¼ W
TF20	—	Band/Stamp	1, 2, 5	100	1 @ 70°C	—	350	1Ω to 9.9Ω	—	½ W
GF-55(4)	(Flame Resistant)	Stamp	1	100	½ @ 70°C	—	200	10Ω to 2MΩ	—	¼ W
GF-07(4)	(Flame Resistant)	Stamp	2, 5	100	½ @ 70°C	—	250	10Ω to 2MΩ	—	¼ W
GF-60(4)	(Flame Resistant)	Stamp	1	100	1 @ 70°C	—	300	10Ω to 2MΩ	—	½ W
GF-20(4)	(Flame Resistant)	Stamp	2, 5	100	1 @ 70°C	—	350	10Ω to 2MΩ	—	½ W
GF-3(4)	(Flame Resistant)	Stamp	1, 2, 5	200	3 @ 25°C 2 @ 70°C	—	500	10Ω to 2MΩ	—	1W
RG07	RL07	Band	2, 5	200	½ @ 70°C	¼ @ 70°C	250	4.3Ω to 3MΩ	51Ω to 150KΩ	¼ W
RG20	RL20	Band	2, 5	200	1 @ 70°C	½ @ 70°C	350	4.3Ω to 3MΩ	4.3Ω to 470KΩ	½ W
RG32	RL32	Band	2, 5	200	1 @ 70°C	1 @ 70°C	500	4.3Ω to 3MΩ	10Ω to 1MΩ	1W
RGR05(1)	RLR05/S(2)	Stamp	1, 2	100	⅛ @ 70°C	⅛ @ 70°C	200	10Ω to 300KΩ	10Ω to 300KΩ	⅛ W
RGR07	RLR07/S(2)	Stamp	1, 2	100	¼ @ 70°C	¼ @ 70°C	250	10Ω to 3.0MΩ	10Ω to 3.0MΩ	¼ W
RGR20	RLR20/S(2)	Stamp	1, 2	100	½ @ 70°C	½ @ 70°C	350	4.3Ω to 3.01MΩ	4.3Ω to 3.01MΩ	½ W
RGR32	RLR32/S(2)	Stamp	1, 2	100	1 @ 70°C	1 @ 70°C	500	10Ω to 2.7MΩ	10Ω to 2.7MΩ	1W
T0-55	RN55D	Stamp	.5, 1(3)	100	½ @ 70°C	⅛ @ 70°C	200	10Ω to 3MΩ	10Ω to 301KΩ	¼ W
T2-55	RN55C	Stamp	.5, 1(3)	50	¼ @ 70°C	1/10 @ 125°C	200	10Ω to 3MΩ	49.9Ω to 100KΩ	¼ W
T9-55	RN55E	Stamp	.5, 1(3)	25	¼ @ 70°C	1/10 @ 125°C	200	10Ω to 3MΩ	49.9Ω to 100KΩ	¼ W
T0-60	RN60D	Stamp	.5, 1(3)	100	¾ @ 70°C	¼ @ 70°C	300	10Ω to 3MΩ	10Ω to 1MΩ	½ W
T2-60	RN60C	Stamp	.5, 1(3)	50	½ @ 70°C	⅛ @ 125°C	250	10Ω to 3MΩ	49.9Ω to 499KΩ	½ W
T9-60	RN60E	Stamp	.5, 1(3)	25	½ @ 70°C	⅛ @ 125°C	250	10Ω to 3MΩ	49.9Ω to 499KΩ	½ W
T0-65	RN65D	Stamp	.5, 1(3)	100	1 @ 70°C	½ @ 70°C	350	10Ω to 3MΩ	10Ω to 1MΩ	1W
T2-65	RN65C	Stamp	.5, 1(3)	50	½ @ 70°C	¼ @ 125°C	300	10Ω to 3MΩ	49.9Ω to 1MΩ	1W
T9-65	RN65E	Stamp	.5, 1(3)	25	½ @ 70°C	¼ @ 125°C	300	10Ω to 3MΩ	49.9Ω to 1MΩ	1W
TH55	RNC55H/S(2)	Stamp	.5, 1(3)	50	1/10 @ 125°C	1/10 @ 125°C	200	10Ω to 2MΩ	10Ω to 2MΩ	¼ W
TK55	RNC55K/S(2)	Stamp	.5, 1(3)	100	1/10 @ 125°C	1/10 @ 125°C	200	10Ω to 2MΩ	10Ω to 2MΩ	¼ W
TJ55	RNC55J/S(2)	Stamp	.5, 1(3)	25	1/10 @ 125°C	1/10 @ 125°C	200	10Ω to 2MΩ	10Ω to 2MΩ	¼ W
TH60	RNC60H/S(2)	Stamp	.5, 1(3)	50	⅛ @ 125°C	⅛ @ 125°C	250	10Ω to 3MΩ	10Ω to 3MΩ	½ W
TK60	RNC60K/S(2)	Stamp	.5, 1(3)	100	⅛ @ 125°C	⅛ @ 125°C	250	10Ω to 3MΩ	10Ω to 3MΩ	½ W
TJ60	RNC60J/S(2)	Stamp	.5, 1(3)	25	⅛ @ 125°C	⅛ @ 125°C	250	10Ω to 3MΩ	10Ω to 3MΩ	½ W
TH65	RNC65H/S(2)	Stamp	.5, 1(3)	50	¼ @ 125°C	¼ @ 125°C	300	49.9Ω to 3MΩ	49.9Ω to 3MΩ	1W
TK65	RNC65K/S(2)	Stamp	.5, 1(3)	100	¼ @ 125°C	¼ @ 125°C	300	49.9Ω to 3MΩ	49.9Ω to 3MΩ	1W
TJ65	RNC65J/S(2)	Stamp	.5, 1(3)	25	¼ @ 125°C	¼ @ 125°C	300	49.9Ω to 3MΩ	49.9Ω to 3MΩ	1W

NOTES:

(1) Conformally coated construction on all ⅛ W nominal size resistors
(2) Failure rate symbol; R = .01%/1000 Hours at 60% Conf. Level, S = .001%
(3) .1% tolerance available
(4) Contact factory for details of flame-resistant specifications

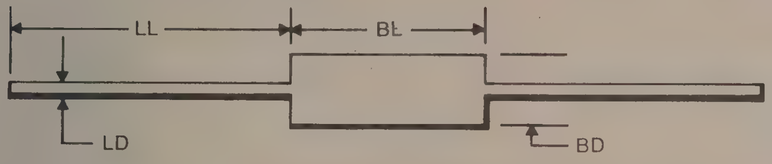
AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

ESTABLISHED RELIABILITY MIL SPECIFICATIONS

RLR and RNC products listed above are qualified to the appropriate established reliability MIL Specification.

RG SERIES

DIMENSIONS — IN. and (mm)



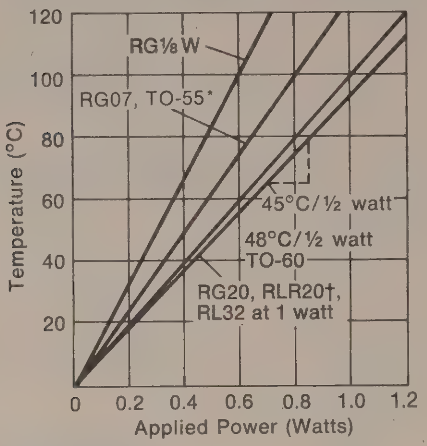
Nominal Size	Body Length BL	Body Diameter BD	Lead Length LL	Lead Diameter LD	Clean Lead
⅛ watt RLR05	0.150 ±0.020 (3.8 ±0.3)	0.066 ±0.008 (1.7 ±0.2)	1.00 ±0.125 (25.4 ±3.2)	0.016 (0.41)	0.244 0.187
¼ watt RLR07	0.250 ±0.015 (6.4 ±0.4)	0.090 ±0.008 (2.3 ±0.2)	1.50 ±0.125 (38.1 ±3.2)	0.025 (0.64)	0.310 0.300
½ watt RLR20	0.390 ±0.010 (9.9 ±0.3)	0.140 ±0.008 (3.6 ±0.2)	1.50 ±0.125 (38.1 ±3.2)	0.025/0.032 (0.64/0.81)	0.450 0.450
1 watt RLR32	0.562 ±0.031 (14.3 ±0.8)	0.190 ±0.008 (4.8 ±0.2)	1.50 ±0.125 (38.1 ±3.2)	0.025/0.040 (0.64/1.02)	0.682 0.625
GS-3	0.515 ±0.010 (13.1 ±0.3)	0.225 ±0.008 (5.7 ±0.2)	1.50 ±0.125 (38.1 ±3.2)	0.032 (0.81)	0.575

Mil Type	TRW Approved Range	TRW Approved	Failure Rate
RNC55 H (50 ppm)	10 ohm - 1 meg 1.01 meg - 2 meg	B,D,F, F only	S
RNC55 J (25 ppm)	10 ohm - 1 meg 1.01 meg - 2 meg	B,D,F, F only	S
RNC55 K (100 ppm)	10 ohm - 1 meg 1.01 meg - 2 meg	D,F F only	S
RNC60 H (50 ppm)	10 ohm - 2 meg 2.01 meg - 3 meg	B,D,F, F only	S
RNC60 J (25 ppm)	10 ohm - 2 meg 2.01 meg - 3 meg	B,D,F, F only	S
RNC60 K (100 ppm)	10 ohm - 2 meg 2.01 meg - 3 meg	D,F F only	S
RNC65 H (50 ppm)	10 ohm - 49.8 ohm 49.9 ohm - 2 meg 2.01 meg - 3 meg	F only B,D,F, F only	S
RNC65 J (25 ppm)	10 ohm - 49.8 ohm 49.9 ohm - 2 meg 2.01 meg - 3 meg	F only B,D,F, F only	S
RNC65 K (100 ppm)	10 ohm - 49.8 ohm 49.9 ohm - 2 meg 2.01 meg - 3 meg	F only D,F F only	S

Mil Type	TRW Approved Range	TRW Approved	Failure Rate
RLR05 (100 ppm)	10 ohm - 300K	F,G	S
RLR07 (100 ppm)	10 ohm - 3.01 meg	F,G	S
RLR20 (100 ppm)	4.3 ohm - 3.01 meg	F,G	S
RLR32 (100 ppm)	10 ohm - 2.7 meg	F,G	S
RN55C (50 ppm)	49.9 ohm - 100K	B,C,D,F	—
RN55D (100 ppm)	10 ohm - 301K	F	—
RN55E (25 ppm)	49.9 ohm - 100K	B,C,D,F	—
RN60C (50 ppm)	43.9 ohm - 499K	B,C,D,F	—
RN60D (100 ppm)	10 ohm - 1 meg	F	—
RN60E (25 ppm)	49.9 ohm - 499K	B,C,D,F	—
RN65C (50 ppm)	49.9 ohm - 1 meg	B,C,D,F	—
RN65D (100 ppm)	10 ohm - 1 meg	F	—
RN65E (25 ppm)	49.9 ohm - 1 meg	B,C,D,F	—

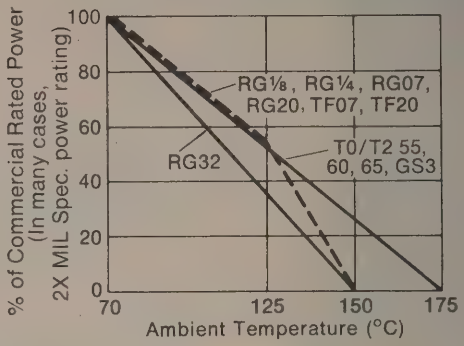
Tolerance: B = ±.1%, D = ±.5% F = ±1%, G = ±2%

RG, "TO" FILM TEMPERATURE RISE

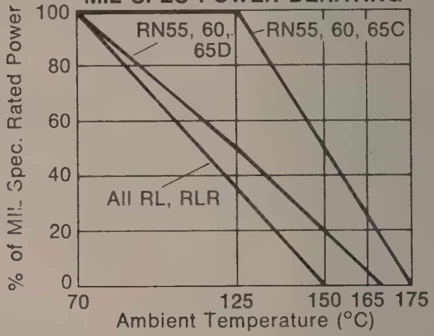


* .025-in. leads
† .032-in. leads

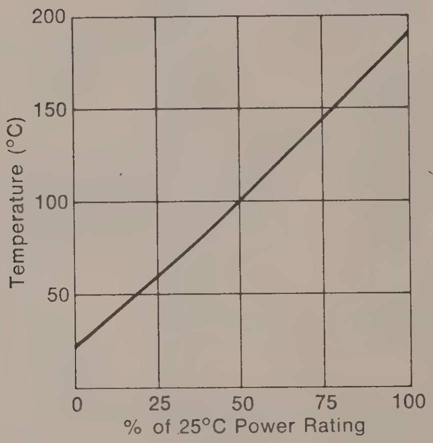
COMMERCIAL POWER DERATING



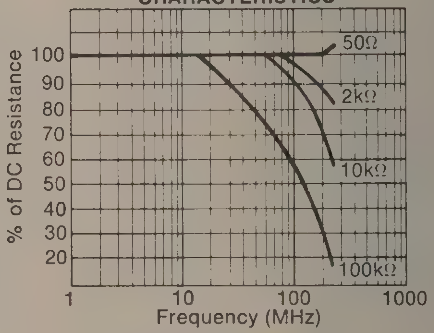
MIL SPEC POWER DERATING



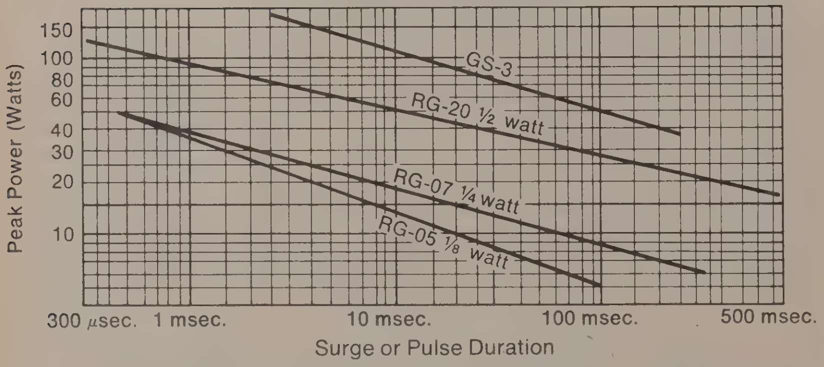
GS-3 SURFACE TEMPERATURE RISE



RG¼ HIGH-FREQUENCY CHARACTERISTICS



SURGE CAPABILITY



Note: Average power dissipation is not to exceed the component power rating at 70°C.

HOW TO ORDER

Sample Part Nos.

RLR 32-C-1001-FS

TO 55 - 2202 - J

TRW Type
See specification table for types available.

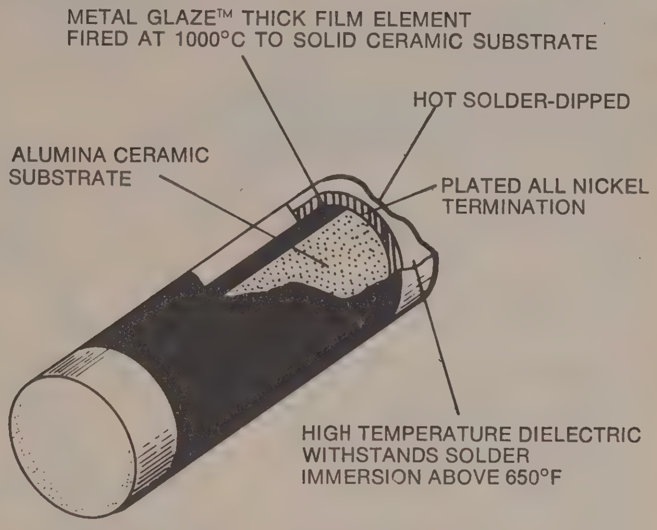
Resistance
Standard EIA/MIL resistance values for metal film resistors. See specification table for range.

Tolerance
±0.1% to ±5%
See specification table for availability.

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

RG CHIP RESISTORS

- ☐ Metal Glaze™ Technology from TRW's RG resistor line. Proven reliability for over 15 years
- ☐ Low TCR — All < 100 ppm/°C
- ☐ Standard size 3.2 x 1.5mm (0.126″ x 0.057″). Compatible with chip placement equipment from Panasonic, Universal, and others
- ☐ Hot solder-dipped nickel contacts withstand prolonged (>60 sec.) immersion in solder with no de-wetting of contacts
- ☐ Bonds to circuit boards with standard techniques using adhesives or solder paste
- ☐ Color band marking available
- ☐ Packaging in bulk or 8 mm tape reels, taping per EIA —RS481


METAL GLAZE™ THICK FILM ELEMENT FIRED AT 1000°C TO SOLID CERAMIC SUBSTRATE
HOT SOLDER-DIPPED
ALUMINA CERAMIC SUBSTRATE
PLATED ALL NICKEL TERMINATION
HIGH TEMPERATURE DIELECTRIC WITHSTANDS SOLDER IMMERSION ABOVE 650°F

SPECIFICATIONS

Resistance Range: 3Ω to 1 meg*, plus zero-ohm jumpers
Tolerances: 1%, 2% & 5%
Temperature Coefficient: <100 ppm/°C for all tolerances*
Rated Wattage: ⅛ W @ 70°C†
Rated Continuous Working Voltage: √.125 x R or 200V, whichever is less
Commercial RCWV: √.25 x R or 200V, whichever is less
Maximum Overload Voltage: 400V
Temperature Range: −55°C to +150°C
Insulation Resistance: 10,000 Meg min.

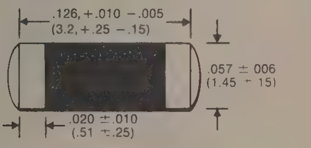
* Contact factory for other resistance values and other temperature coefficients, or for color banding.

† CHP⅛ may safely be double-rated to ¼ W operation @ 70°C under normal conditions. Derate to zero at 150°C.

COMPARISON WITH MELF CHIP RESISTORS

RG chips are smaller in size than MELF chips, use thick-film technology rather than carbon films, and have plated nickel terminations, not pressed-on end caps. This also eliminates the typical "dogbone" outline seen on MELF's. Unlike MELF's, RG chips are available in standard 8mm tape.

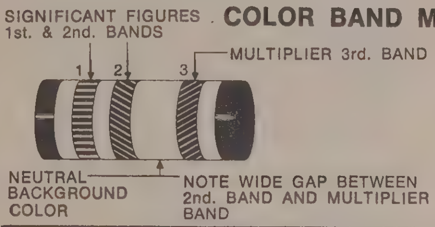
DIMENSIONS — IN. AND (mm)

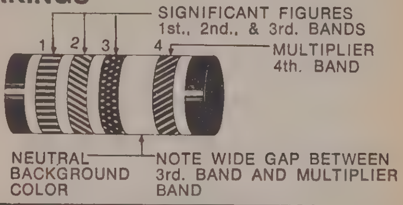

.126, +.010 −.005
(3.2, +.25 −.15)
.057 ± 006
(1.45 ± 15)
.020 ± .010
(.51 ±.25)

ACTUAL SIZE

8 mm Tape Packaging

COLOR BAND MARKINGS


SIGNIFICANT FIGURES 1st. & 2nd. BANDS
MULTIPLIER 3rd. BAND
1
2
3
NEUTRAL BACKGROUND COLOR
NOTE WIDE GAP BETWEEN 2nd. BAND AND MULTIPLIER BAND


SIGNIFICANT FIGURES 1st., 2nd., & 3rd. BANDS
MULTIPLIER 4th. BAND
1
2
3
4
NEUTRAL BACKGROUND COLOR
NOTE WIDE GAP BETWEEN 3rd. BAND AND MULTIPLIER BAND

Color	Significant digit	Multiplier	Color	Significant digit	Multiplier
Black	0	1	Violet	7	10,000,00
Brown	1	10	Gray	8	—
Red	2	100	White	9	—
Orange	3	1000	Gold	—	0.1
Yellow	4	10,000	Silver	—	0.01
Green	5	100,000	No color	—	—
Blue	6	1,000,000			

PERFORMANCE DATA (Maximum △R)

Temperature Coefficient:	0 ±100 ppm/°C
Thermal Shock:	±0.5%
Low-Temperature Operation:	±0.25%
Short-Time Overload	±1% (±.25% for R ≤ 100K ohm or E ≤ 100V)
Commercial Short-Time Overload:	±2.5%
High-Temperature Exposure:	±0.5%
Resistance to Bonding Exposure:	±0.25%
Resistance to Solder Immersion:	±2% 60 sec at 325°C
Solderability:	95% min. coverage 60 sec at 325°C
Moisture Resistance:	±0.5%
Life Test:	±0.5%
Commercial Life:	±2%
Terminal Adhesion Strength:	±1%, No mechanical damage
Resistance to Board Bending:	±1%, No mechanical damage

HOW TO ORDER

Sample Part No.

CHP⅛ - 100 - 2203 - F - BLK

TRW Type

Temperature Coefficient

Resistance
1st 3 significant figures plus
4th digit multiplier
Examples: 2203 = 220,000 ohms
51R0 = 51.0 ohms
Available in STD EIA values

Packaging Code
BLK for bulk, CST for tape.

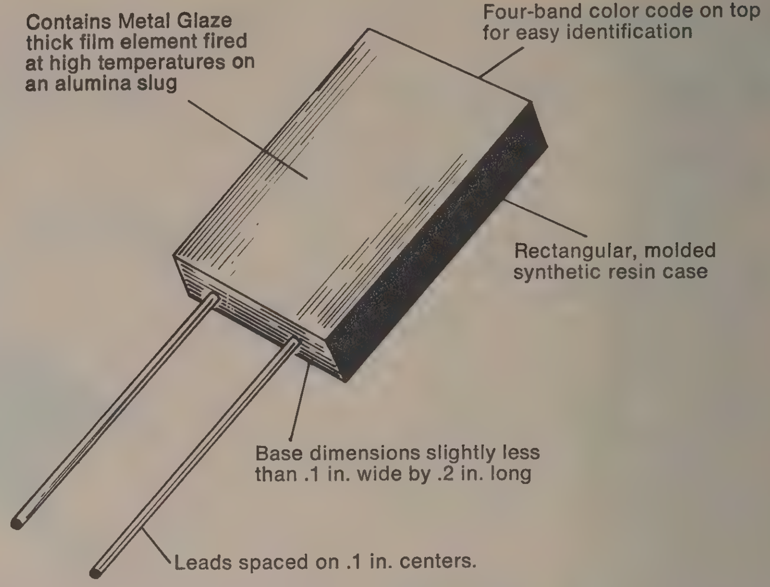
Tolerance
F = 1%, G = 2%, J = 5%

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, P.O. BOX 1860, BOONE, NC 28607 • (704) 264-8861

RADIAL LEAD MOLDED METAL GLAZE RESISTORS

RGU SERIES*

- ☐ Take up half the PC board area of comparably rated axial-lead resistors
- ☐ Project 0.39 in. from the board surface when installed
- ☐ Can be placed individually, or grouped in rows, in any direction on standard predrilled PC boards
- ☐ Available on carrier tape and are auto-insertable with existing equipment


Contains Metal Glaze thick film element fired at high temperatures on an alumina slug
Four-band color code on top for easy identification
Rectangular, molded synthetic resin case
Base dimensions slightly less than .1 in. wide by .2 in. long
Leads spaced on .1 in. centers.

SPECIFICATIONS

Resistance Range: 10 ohms to 1 megohm

Tolerance (E96, E24): ±1%, ±2%, ±5%

Temperature Coefficient: ±50, ±100 ppm/°C

Voltage Coefficient: Less than 30 ppm/V

Maximum Continuous Working Voltage: 350V RMS

Dielectric Withstanding Voltage: 1000V RMS min.

Insulation Resistance: Greater than 10^4 Megohms, except top surface

STANDARDS

Electrical properties according to MIL-R 22684

Power Rating: ½ watt at 70°C

Temperature Range: −55°C to +155°C for 56 days, −65°C to +175°C

Stability 70°C, 5000 h: ±0.5%

Damp Heat Steady State (40°C, 90 to 95% R.H., 56 days, 5 VDC): 1.0%

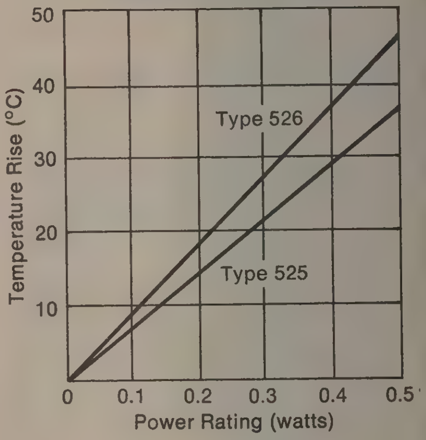
Failure Rate (V_o=155°C): $<5 \times 10^{-9}$/h

HOW TO ORDER

5 25-0 **XXXX** **TOL**

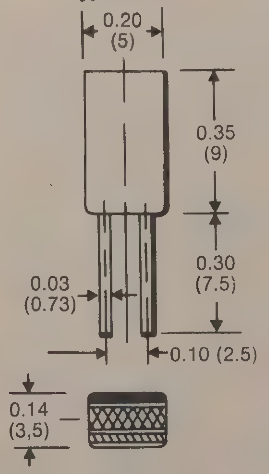
Style **Range** —

TEMPERATURE RISE

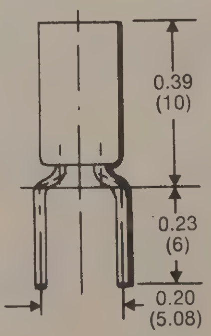


DIMENSIONS — IN. AND (mm)

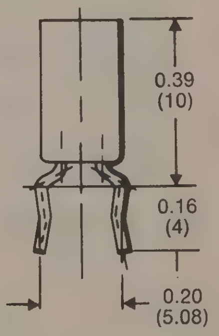
Type 525-0


0.20
(5)
0.35
(9)
0.30
(7.5)
0.03
(0.73)
0.10 (2.5)
0.14
(3,5)

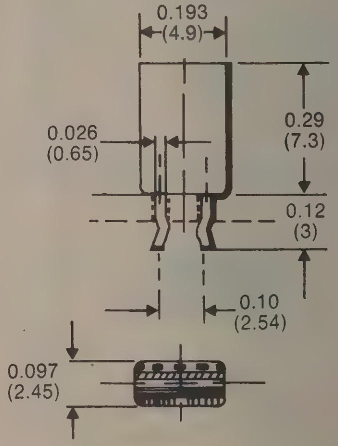
Type 525-6


0.39
(10)
0.23
(6)
0.20
(5.08)

Type 525-7


0.39
(10)
0.16
(4)
0.20
(5.08)

Type 526-0


0.193
(4.9)
0.026
(0.65)
0.29
(7.3)
0.12
(3)
0.10
(2.54)
0.097
(2.45)

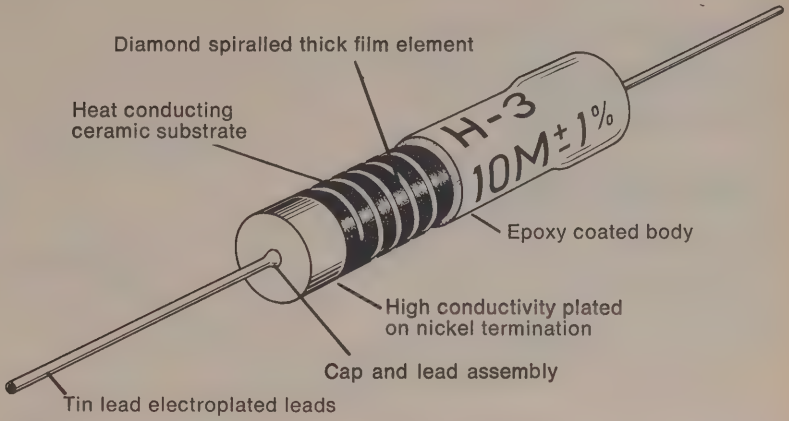
---

* Manufactured in West Germany

PRECISION, HIGH-VOLTAGE THICK FILM RESISTORS

CGH SERIES

- ☐ ¼ watt to 15 watts
- ☐ 100K to 500 megohm range
- ☐ ±0.5%, ±1%, ±2% or ±5% tolerance
- ☐ TC or ±50 ppm/°C or ±100 ppm/°C


Diamond spiralled thick film element
Heat conducting ceramic substrate
H-3
10M±1%
Epoxy coated body
High conductivity plated on nickel termination
Cap and lead assembly
Tin lead electroplated leads

SPECIFICATIONS

TRW Type	Power Rating at 70°C (watts)(1)	Voltage Rating (volts)(2)	Resistance Range (ohms)	Tolerance (±%)	Maximum TCR (±ppm/°C)	VCR (ppm/V)
CGH-¼	¼	750	100KΩ to 50MΩ	.5, 1, 2, 5	50, 100	0 to −5
CGH-½	½	1,500	100KΩ to 100MΩ	.5, 1, 2, 5	50, 100	0 to −5
CGH-1	1	3,000	500KΩ to 100MΩ	.5, 1, 2, 5	50, 100	0 to −5
CGH-2	2	5,000	1MΩ to 200MΩ	.5, 1, 2, 5	50, 100	0 to −5
CGH-3	3	10,000	1MΩ to 300MΩ	.5, 1, 2, 5	50, 100	0 to −5
CGH-5	5	20,000	1MΩ to 500MΩ	.5, 1, 2, 5	50, 100	0 to −5

NOTES:
(1) Other wattage ratings available on request. Consult factory. For power rating above 70°C, see derating curve.
(2) Voltage rating shown is the rated DC continuous working voltage or the sine-wave RMS absolute maximum voltage at commercial line frequency. For DC applications the absolute maximum permissible voltage is 1.5 times the value shown for low repetition short-time-overload or pulse conditions of 10 seconds or less duration.
(3) Typical voltage coefficient of resistance is -1 to -2 ppm/V measured at full rated voltage and 10% rated voltage.

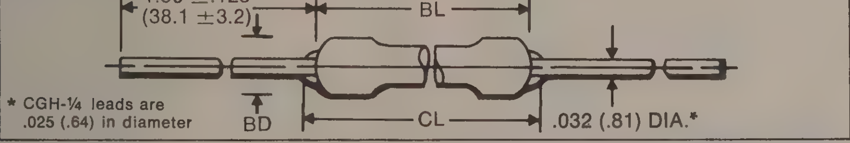
CGH-7.5 thru -15 contact factory for specifications and higher or lower resistance values.

ENVIRONMENTAL PERFORMANCE

Test Condition(1)	Maximum ΔR (±3σ)	Typical(2) ΔR
Temperature Shock	±0.25%	±0.10%
Short-Time Overload (1.5 times rated V for 10 sec.)	±0.20%	±0.10%
Solder Effect	±0.15%	±0.05%
Terminal Strength	±0.20%	±0.05%
Moisture Resistance (no load or polar)	±0.50%	±0.20%
Load Life (1000 Hours at 70°C)	±1.0%	±0.25%
Shelf Life (1 year at 25°C)	±0.10%	±0.03%
High-Temperature Exposure		
(150°C for 2000 Hours)	±0.75%	±0.03%
(175°C for 2000 Hours)	±1.0%	±0.40%
Dielectric Breakdown(3)		
(¼ and ½ watt size)	2000 VDC, 1500 VAC	
(1-watt through 5-watt size)	3500 VDC, 2500 VAC	
Dielectric Strength(4)	±0.15%	±0.05%
Insulation Resistance at 500 VDC	10^9 ohms min.	10^{11} ohms typ.

NOTES:
(1) Test method per MIL-STD-202 unless otherwise indicated.
(2) Typical defined as that percent change which will include a minimum of 50% of the measured changes in resistance from a variety of lots representing various unit sizes and ranges.
(3) Values shown are the maximum safe dielectric voltage applied from a V block or foil wrapping which extends the complete body length of the resistor under test.
(4) Percent change after the maximum safe dielectric voltage is applied for 1 minute.

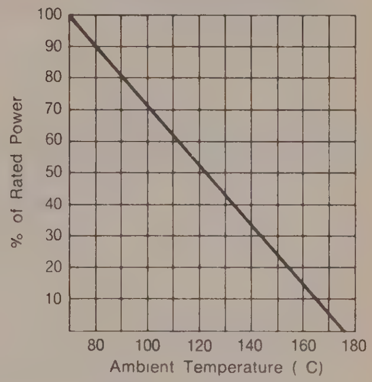
DIMENSIONS — IN. AND (mm)



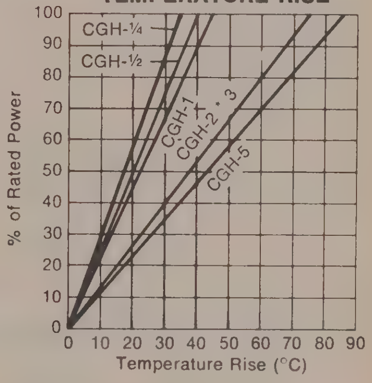
* CGH-¼ leads are .025 (.64) in diameter

TRW Type	Body Length BL	Body Diameter BD	Clean Lead to Clead Lead CL
CGH-¼	0.275 ±0.031 (6.98 ±0.79)	0.088 ±0.010 (2.22 ±0.25)	0.400 (10.16)
CGH-½	0.400 ±0.031 (10.16 ±0.79)	0.138 ±0.016 (3.51 ±0.41)	0.525 (13.34)
CGH-1	0.690 ±0.062 (17.53 ±1.57)	0.297 ±0.031 (7.54 ±0.79)	0.900 (22.86)
CGH-2	1.062 ±0.062 (26.97 ±1.57)	0.297 ±0.031 (7.54 ±0.79)	1.250 (31.75)
CGH-3	2.062 ±0.062 (52.37 ±1.57)	0.297 ±0.031 (7.54 ±0.79)	2.250 (57.15)
CGH-5	3.062 ±0.062 (77.77 ±1.57)	0.297 ±0.031 (7.54 ±0.79)	3.250 (82.55)

POWER DERATING



TEMPERATURE RISE



HOW TO ORDER

Sample Part No.:

CGH-3 - 50 ppm/°C - 22M - 1%

TRW Type
CGH-¼, CGH-½, CHG-1, CGH-2, CGH-3 or CGH-5

Temperature Coefficient
±100 ppm/°C, ±50 ppm/°C

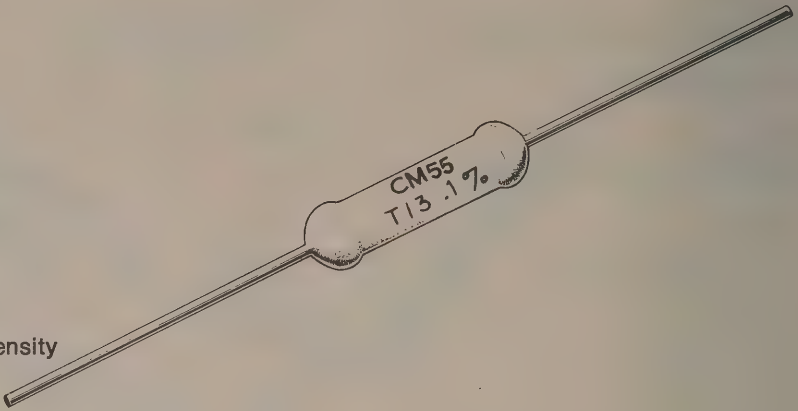
Resistance
Standard EIA/MIL values for metal film resistors. See specificaiton chart for range

Tolerance
±0.5%, ±1%, ±2%, ±5%

LOW TC INDUSTRIAL PRECISION METAL FILM RESISTOR

CM SERIES

- ☐ Cost effective
- ☐ Proven conformal coating system
- ☐ Proven TRW metal film stability
- ☐ High volume production capacity
- ☐ Reduced size for greater board density



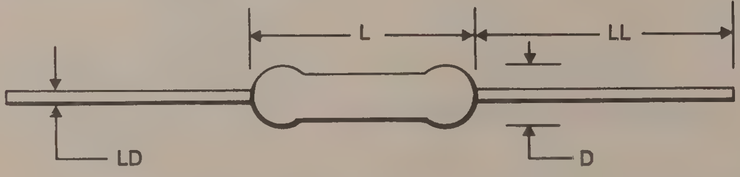
SPECIFICATIONS

TRW Model	Resistance Range	Power Rating @ 85°C (watts)	Voltage Rating (volts)	Tolerances	Temperature Coefficients (0° to 85°C)	Insulation Resistance	Noise Index	Voltage Coefficients
CM50	10Ω to 150KΩ	1/20	200	.05%, .1%, .25%, .5%	5 ppm, 10 ppm 15 ppm	>10,000 megohm	<-30 db	<.05 ppm/volt
CM55	10Ω to 350KΩ	1/10	250	.05%, .1%, .25%, .5%	5 ppm, 10 ppm 15 ppm	>10,000 megohm	<-30 db	<.05 ppm/volt
CM60	10Ω to 700KΩ	1/8	300	.05%, .1%, .25%, .5%	5 ppm, 10 ppm 15 ppm	>10,000 megohm	<-30 db	<.05 ppm/volt
CM65	10Ω to 1.5MΩ	1/4	500	.05%, .1%, .25%, .5%	5 ppm, 10 ppm 15 ppm	>10,000 megohm	<-30 db	<.05 ppm/volt

PERFORMANCE DATA

Test Conditions per MIL-R-55182, except where noted	Typical% ΔR
100 Hour Load Life (rated power at 85°C)	±.02
Humidity	±.04
Thermal Shock	±.01
Effect of Solder	±.01
Dielectric Withstanding	±.01
Shock and Vibration	±.01
Short Time Overload	±.01
1 Year Shelf Life	±30 ppm

DIMENSIONS — IN. AND (mm)



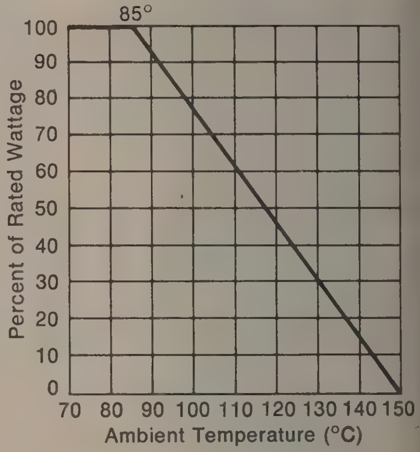
TRW Style	L Length	D Diameter	LL Lead Length	LD Lead Diameter
CM50	.180±.010	.065±.015	1.570±.100	.016±.001
CM55	.250±.031	.088±.010	1.500±.125	.025±.002
CM60	.390±.040	.130±.020	1.500±.125	.025±.002
CM65	.594±.031	.180±.020	1.500±.125	.025±.002

The new cost effective CM Series of resistors is a result of proven TWR ultra precision resistive technology combined with state of the art high speed production equipment. Our conformal coatting has proven its reliability with extensive environmental testing.

The series utilizes an improved sputtered film system and mechanically superior cap and lead construction. CMs offer the most cost effective solution to ultra stable circuit needs. This product line covers virtually all tolerances, temperature coefficients, and power ratings required for precision resistor applications.

Matched sets of CM Series resistors provide the ultimate in resistor matching and temperature coefficient tracking. Sets with ±.005% ratio tolerance and ±2 ppm/°C temperature coefficient tracking are available in matched sets. Consult factory for details.

POWER DERATING



PACKAGING

Bulk Package: 250/Pack

Lead Tape & Reel: Per EIA Spec RS-296D

Special lead tape & reel and anti static packaging available; consult factory.

HOW TO ORDER

Sample Part No.:

CM T13 0.1% 150K

Trw Type
CM50
CM55
CM60
CM65

Temperature Coefficient
T16 (5 ppm), T13 (10 ppm), and T10 (15 ppm)
(all models)

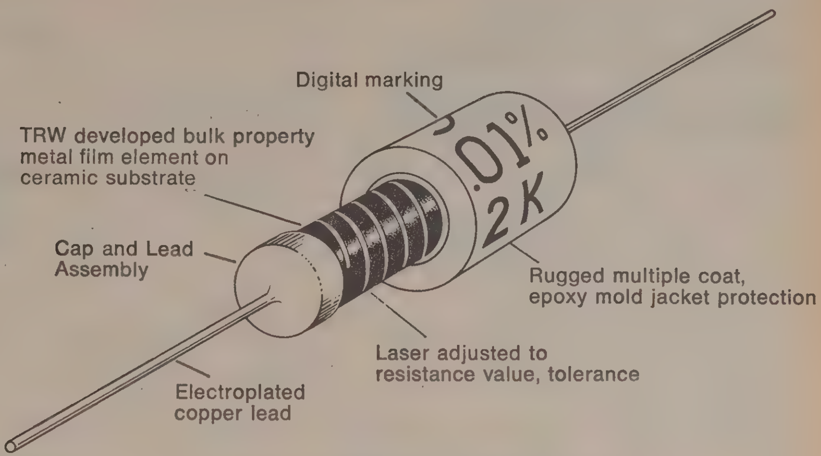
Tolerance
.05%, .1%, .25%, .5%
(all models)

Resistance
10Ω thru 150KΩ
10Ω thru 350KΩ
10Ω thru 700KΩ
10Ω thru 1.5MΩ

ULTRA-PRECISION TAILORED-T.C. METAL FILM RESISTORS

MTR SERIES

- ☐ 1/20 watt to 1/4 watt
- ☐ 50 ohms to 1.0 megohm
- ☐ Any TC from −100 to +150 ppm/°C
- ☐ Tolerances from ±1.0% to ±0.01%


Digital marking
TRW developed bulk property metal film element on ceramic substrate
Cap and Lead Assembly
.01%
2K
Rugged multiple coat, epoxy mold jacket protection
Laser adjusted to resistance value, tolerance
Electroplated copper lead

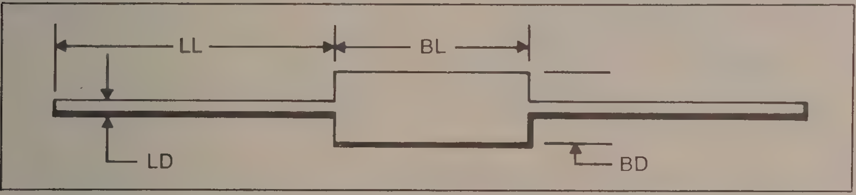
SPECIFICATIONS

TRW Type	Resistance Range* (ohms)	Temperature Coefficients† −20°C to +85°C (± ppm/°C)	Tolerances (±%)	Power Rating at 85° (watts)	Voltage Rating (volts)
MTR3	50Ω to 100kΩ	Any T.C. from −100 to +150	1.0, 0.5, 0.25, 0.1, 0.05, 0.02, 0.01	1/20	200
MTR5	50Ω to 250kΩ	Any T.C. from −100 to +150	1.0, 0.5, 0.25, 0.1, 0.05, 0.02, 0.01	1/10	250
MTR6	50Ω to 500kΩ	Any T.C. from −100 to +150	1.0, 0.5, 0.25, 0.1, 0.05, 0.02, 0.01	⅛	300
MTR7	50Ω to 1.0MΩ	Any T.C. from −100 to +150	1.0, 0.5, 0.25, 0.1, 0.05, 0.02, 0.01	¼	500

* Wider ranges are available. Consult the TRW plant in Corpus Christi or your nearest TRW sales office.

† T.C. tolerances available to ±5 ppm/°C.

DIMENSIONS — IN. and (mm)



TRW/IRC Type	Body Length BL	Body Diameter BD	Lead Length LL	Lead Diameter LD
MTR3	.191 (4.85)	.082 (2.08)	1.00 ±.062 (25.4 ±1.57)	.016 (.406)
MTR5	.281 (7.14)	.102 (2.59)	1.50 ±.125 (38.1 ±3.18)	.025 (.635)
MTR6	.425 (10.8)	.155 (3.94)	1.50 ±.125 (38.1 ±3.18)	.025 (.635)
MTR7	.650 (16.5)	.195 (4.95)	1.50 ±.125 (38.1 ±3.18)	.025 (.635)

For precision circuits where a high degree of temperature stability is required, MTR Series metal film resistors can be used to reduce the temperature effects of other components.

One common application is compensating for capacitors in RC filters and other RC circuits. By using an MTR resistor with a T.C. of the same magnitude but opposite slope, capacitor temperature coefficients from −100 to +150 ppm/°C can be effectively compensated to zero.

These resistors are also effective for improving the characteristics of amplifiers.

HOW TO ORDER

Sample Part No.:

MTR5-+50 ppm/°C-100k-0.25%

TRW Type
MTR3, MTR5, MTR6 or MTR7. See specification table for power rating.

Temperature Coefficient
Any T.C. from −100 pmm/°C to +150 ppm/°C

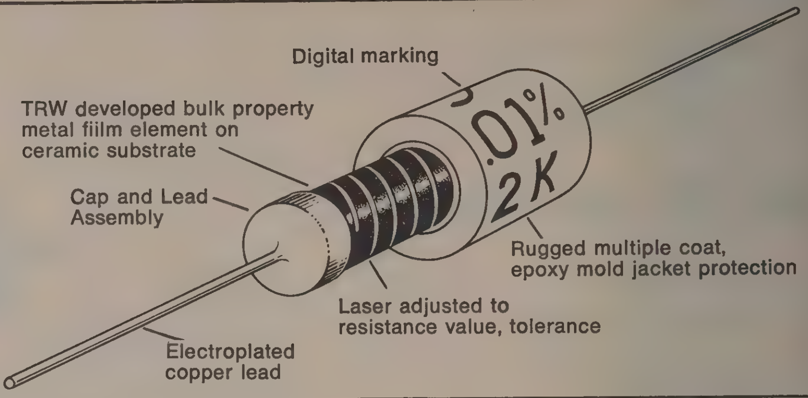
Resistance
Standard EIA/MIL values for metal film resistors. See specification table for range.

Tolerance
±1.0% to ±0.01%. See specification table for availability.

ULTRA-PRECISION METAL FILM RESISTOR

MAR SERIES

- ☐ High reliability
- ☐ Ultra low temperature coefficient
- ☐ Non-measurable noise
- ☐ Superior moisture performance
- ☐ Tailored or standard values
- ☐ Highest stability metal film available
- ☐ Matched sets and networks


Digital marking
TRW developed bulk property metal fiilm element on ceramic substrate
Cap and Lead Assembly
.01%
2K
Rugged multiple coat, epoxy mold jacket protection
Laser adjusted to resistance value, tolerance
Electroplated copper lead

SPECIFICATIONS

TRW Model	Resistance Range by Tolerance (ohms)					Resistance Range by TC (ohms)			Power Rating @ 85°C (Watts)	Voltage Rating (Volts)
	.5%	.25%	.1%	.02 & .05%	.01%	T-10	T-13	T-16		
MAR3	10-250K	10-250K	10-250K	10-150K	10-150K	10-250K	10-150K	10-125K	1/20	200
MAR5*	10-500K	10-500K	10-500K	10-250K	10-250K	10-500K	10-350K	10-300K	1/10	250
MAR6	10-1 Meg	10-1 Meg	10-1 Meg	10-500K	10-500K	10-1 Meg	10-700K	10-500K	1/8	300
MAR7	10-3 Meg	10-3 Meg	10-3 Meg	10-700K	10-700K	10-3 Meg	10-1.5 Meg	10-1 Meg	1/4	500

* The MAR5 resistor is qualified to Characteristic J (25 ppm/°C) and to Tolerance B (1%) of MIL-55182(E). Approved resistance range is 49.9Ω to 150Ω.

MAR resistors are ultra precision metal film resistors with the superior performance characteristics of high reliability, low inductance, and small size for a given power rating. The proprietary coatings and epoxy mold jacket provide a virtual hermetic seal in those applications where stability is critical regardless of the environmental conditions.

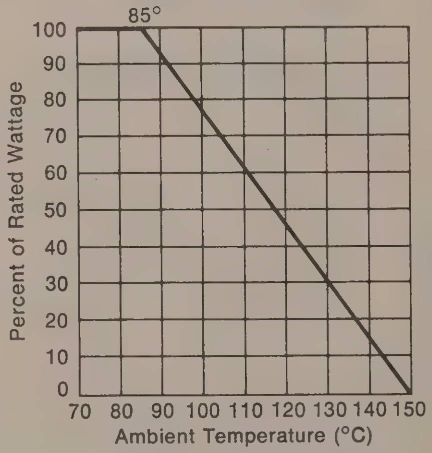
These superior benefits are demonstrated by the MAR5's qualification to the RNC55 size of MIL-R-55182. The MAR has successfully solved application problems in the following circuit configurations: data conversion, precision reference, input decade division, and data transmission in the instrumentation, telecommunications, aircraft and missile, and computer industries.

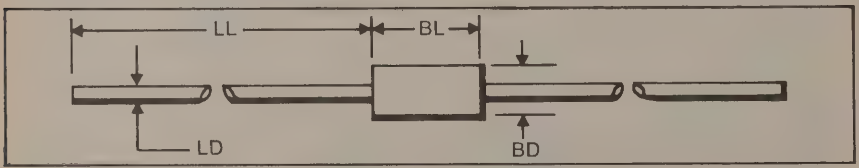
The utilization of MAR resistors in matched sets provides the ultimate in ratio tolerance and temperature coefficient tracking, with resistance ratio tolerance matching to ±.005% and temperature coefficient tracking as low as ±1 ppm/°C.

PERFORMANCE DATA

Test Conditions Per MIL-R-55182, Except Where Noted	Typical ΔR%
1,000 Hour Loadlife (rated power @ 85°C)	±0.02
Humidity	±0.04
Thermal Shock (tested per method 107, MIL-STD 202, Condition F)	±0.01
Effect of Solder (tested per method 210, MIL-STD 202)	±0.01
Dielectric Withstanding	±0.01
Shock and Vibration	+0.01
Short Time Overload	+0.01
Insulation Resistance	>10,000 Meg
Noise Index	<−30 dB
Voltage Coefficient	<0.05 ppm/Volt
1-Year Shelf Life	±30 ppm

DERATING CURVE





DIMENSIONS — IN. and (mm)

TRW/IRC Type	Body Length BL	Body Diameter BD	Lead Length LL	Lead Diameter LD
MAR3	.191 (4.85)	.082 (2.08)	1.00 ±.062 (25.4 ±1.57)	.016 (.406)
MAR5	.281 (7.14)	.102 (2.59)	1.50 ±.125 (38.1 ±3.18)	.025 (.635)
MAR6	.425 (10.8)	.155 (3.94)	1.50 ±.125 (38.1 ±3.18)	.025 (.635)
MAR7	.650 (16.5)	.195 (4.95)	1.50 ±.125 (38.1 ±3.18)	.025 (.635)

HOW TO ORDER

Sample Part No.:

MAR6 - T16 - 15K - 0.02%

TRW
MAR3 (1/20 watt at 85°C), MAR5 (1/10 watt at 85°C), MAR6 (⅛ watt at 85°C) or MAR7 (¼ watt at 85°C).

Temperature Coefficient
T16 (±5 ppm/°C), T13 (±10 ppm/°C) or T10 (±15 ppm/°C). See specification table for availability.

Resistance
Standard EIA/MIL values for metal film resistors. See specification table for range.

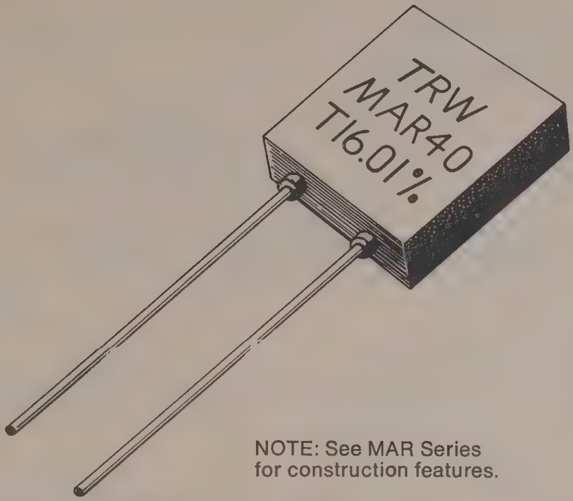
Tolerance
±0.01%, ±0.02%, ±0.05%, ±0.1%, ±0.25% or ±0.5%. See specification table for availability.

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 4222 S. STAPLES STREET, CORPUS CHRISTI, TX 78411 • (512) 922-7900

ULTRA-PRECISION METAL FILM RESISTORS

MAR40

- ☐ High power ultra-precision resistor
- ☐ Tight temperature coefficient (to ±2ppm)
- ☐ High reliability construction
- ☐ Tolerance to ±0.005%
- ☐ Rugged solid epoxy encapsulation
- ☐ Custom reliability screening available
- ☐ Matched sets



NOTE: See MAR Series for construction features.

SPECIFICATIONS

TRW Type	TC Code	Standard Temperature Coefficient		Standard Resistance Range (ohms)	Resistance Tolerance	Power Rating @ 85°C(watts)	Voltage Rating (volts)
MAR40	T16	0 ±5 ppm/°C 0 ±10 ppm/°C	0 to 60°C −55° to 125°C	20-250K (Below 50Ω not available in 0.01% Tol.)	0.005, 0.01, 0.02, 0.05, 0.1, 0.25, 0.5, 1.0	0.3	250
MAR40	T18	0 ±2 ppm/°C 0 ±5 ppm/°C	0 to 60°C −55° to 125°C	50-250K		0.3	250

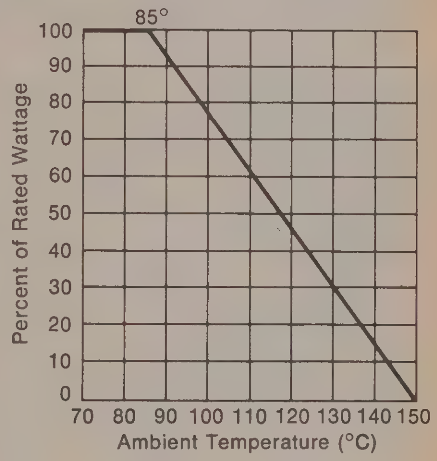
The MAR40 ultra precision resistor combines the benefits of proven TRW metal film reliability, non-measurable noise, and superior frequency response with very low linear temperature coefficient characteristics, convenient radial lead design, and efficient use of printed circuit board "real estate."

The shelf and load life stability characteristics are derived from our precision metal film system. The physical size meets the military standard RNC90 dimensions. The internal construction utilizes the high reliability "end cap" technology of the MAR. The MAR40 is an effective step toward product reliability and long service free life.

The MAR40 may be specified to any custom value needed and purchased in matched sets with extremely tight ratio tolerance and close temperature tracking.

The MAR40 is a cost effective solution to ultra precision resistor circuit requirements.

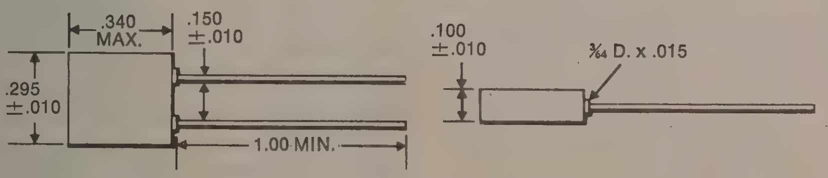
POWER DERATING



PERFORMANCE DATA

Test Conditions Per MIL-R-55182, Except Where Noted	Typical ΔR%
1000 Hour Loadlife (Rated Power At 85°C)	±0.02
Humidity	±0.04
Thermal Shock (Tested Per Method 107, MIL-STD 202, Condition F)	±0.01
Effect of Solder (Tested Per Method 210, MIL-STD 202)	±0.01
Dielectric Withstanding Voltage	±0.01
Shock and Vibration	±0.01
Short Time Overload	±0.01
Insulation Resistance	>10,000 Meg
Noise Index	<−30 dB
Voltage Coefficient	<0.05 ppm/Volt
1-Year Shelf Life	±30 ppm

DIMENSIONS — INCHES



HOW TO ORDER

Sample Part No.:

MAR40 - T16 - 91K - 0.02%

TRW Type

Temperature Coefficient
T16 (±5 ppm),
T18 (±2 ppm)

Resistance Ranges
See table above

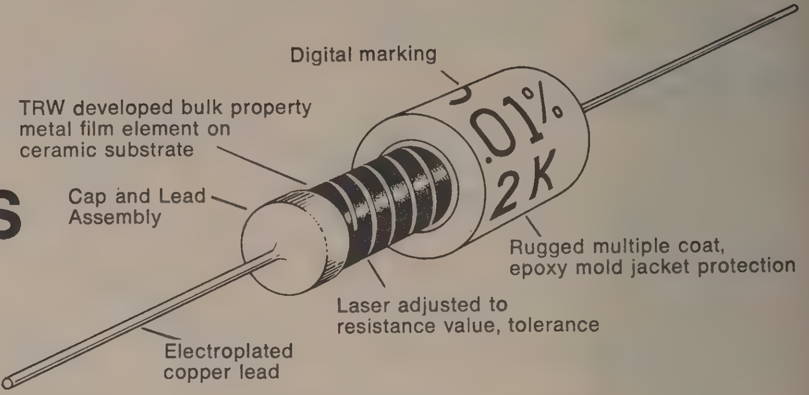
Tolerance
±1%, ±.5%, ±.25%, ±.1%
±.05%, ±.02%, ±.01%, ±.005% *

* ±.005% tolerance available; consult factory.

ULTRA-PRECISION THIN FILM DISCRETE RESISTOR

MAR MATCHED SETS

- ☐ 1/20 watt to 1/4 watt
- ☐ 10 ohms to 3 megohms
- ☐ Tolerances from ±0.01% to ±1.0%; Ratios to 0.005%
- ☐ TCs of ±5, ±10 and ±15 ppm/°C; Tracking to 1 ppm/°C


Digital marking
TRW developed bulk property metal film element on ceramic substrate
Cap and Lead Assembly
.01%
2K
Rugged multiple coat, epoxy mold jacket protection
Laser adjusted to resistance value, tolerance
Electroplated copper lead

DISCRETE RESISTOR SPECIFICATIONS

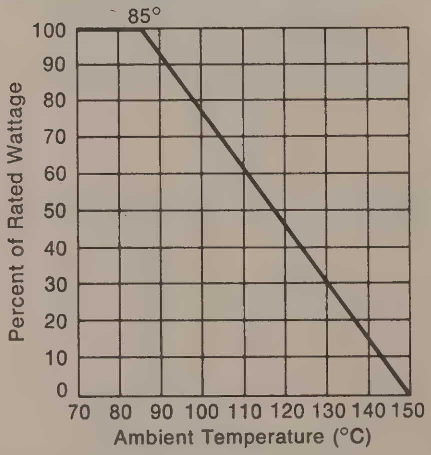
TRW Type	Discrete Resistance Range by Tolerance by Size (ohms)					Discrete Resistance Range by TC (ohms)			Power Rating @ 85°C (Watts)	Voltage Rating (Volts)
	.5%	.25%	.1%	.02 & .05%	.01%	T-10	T-13	T-16		
MAR3	10-250K	10-250K	10-250K	10-150K	10-150K	10-250K	10-150K	10-125K	1/20	200
MAR5*	10-500K	10-500K	10-500K	10-250K	10-250K	10-500K	10-350K	10-300K	1/10	250
MAR6	10-1 Meg	10-1 Meg	10-1 Meg	10-500K	10-500K	10-1 Meg	10-700K	10-500K	1/8	300
MAR7	10-3 Meg	10-3 Meg	10-3 Meg	10-700K	10-700K	10-3 Meg	10-1.5 Meg	10-1 Meg	1/4	500

* The MAR5 resistor is qualified to Characteristic J (25 ppm/°C) and to Tolerance B(1%) of MIL-R-55182(E). Approved resistance range is 49.9Ω to 150Ω.

ENVIRONMENTAL PERFORMANCE

Test Conditions per MIL-R-55182, except where noted	Typical ΔR%
1,000-Hour Load Life (Rated Power at 85°C)	±0.02
Humidity	±0.04
Thermal Shock (tested per Method 107 MIL-STD 202, Condition F)	±0.01
Effect of Solder (Tested per Method 210, MIL-STD-202)	±0.01
Dielectric Withstanding	±0.01
Shock and Vibration	+0.01
Short-Time Overload	+0.01
Insulation Resistance	>10000 MegΩ
Noise Index	<−30 dB
Voltage Coefficient	<0.05 ppm/volt
1-Year Shelf Life	±30 ppm

DERATING CURVE



RATIO ACCURACY AND TC TRACKING SPECIFIATIONS

Ratio to Master	TC Track 0° to 70°C	Resistance Ratio Accuracy
1:1	1 ppm	.005%
10:1	1 ppm	.01%
100:1	2 ppm	.01%
1000:1	3 ppm	.02%

The performance of most precision resistor circuits requires that the relationship of all the resistors used be held to exacting tolerances in relation to each other. This tight tolerance relationship can be accomplished in two ways. One is to specify absolute tolerances so that no resistor can deviate from any other resistor by more than twice this tolerance. The other is to specify matched sets of resistors where the relationship between resistors, rather than absolute tolerances, is tightly controlled in many designs, the absolute values are not so critical as the maintenance of a precise relationship among the set during changing ambients.

Matched resistor sets using the MAR series of resistors provide a decade or greater improvement in performance at significantly less cost than individually specified resistors. While others of our resistor products can be specified as matched sets, the MAR Series is recommended for most critical applications.

Specifying matched resistor sets requires that the resistance ratio tolerance be specified along with allowable absolute tolerance; and the temperature coefficient tracking tolerance be specified with the basic TC.

Two examples of specifying matched sets are shown below. Other design considerations permitting, it is more economical to specify ratios to a reference resistor than to each other. However, if required, the MAR series offers the inherent precision and stability for either method.

A knowledge of the availability of these two ways to achieve extreme stability offers options to the designer which may prevent overspecifying, with attendant economic considerations.

SPECIFICATION EXAMPLES

Example No. 1

Resistor	Ohms	Watts	Absolute Tolerance %	Absolute TC (ppm/°C)	Ratio Tolerance Referenced To R_1 (%)	TC Tracking Referenced To R_1 (ppm/°C)
R_1	1K	⅛	±1	±25	—	—
R_2	2K	⅛	±1	±25	0.02	5
R_3	4K	⅛	±1	±25	0.04	10
R_4	8K	⅛	±1	±25	0.08	20

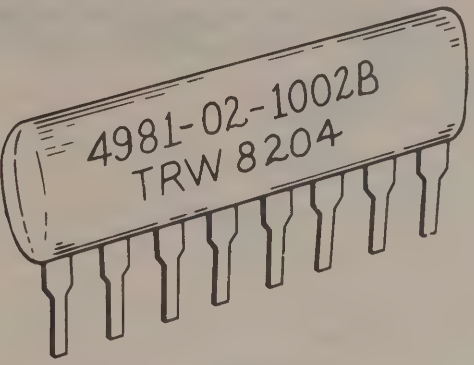
Example No. 2

Resistor	Ohms	Watts	Absolute Tolerance %	Absolute TC (ppm/°C)
R_1	10K	.25	±.1	±15
R_2	100K	.25	±.1	±15
R_3	1M	.125	±.25	±15

TaNFilm® CONFORMALLY COATED

SIP NETWORKS

- ☐ High precision
- ☐ Low profile
- ☐ High component density
- ☐ Superior TCR tracking
- ☐ 3 standard sizes
- ☐ Proven reliability



SPECIFICATIONS

Resistance Ranges:
Schematic C: 49.9Ω to 50KΩ
Schematic F: 20Ω to 50KΩ
Schematic G: 20Ω to 100KΩ
Higher resistance values available

Resistance Tolerances: ±.1%, ±.25%, ±.5%, ±1%, ±2%

Temperature Coefficient of Resistance: ±25 ppm°C, ±50 ppm/°C, ±100 ppm/°C, −100 ±50 ppm/°C

TCR Tracking: 5 ppm/°C, except Schematic C below 500Ω (20 ppm/°C)

Temperature Range: −55°C to +150°C

Noise: Less than −25 dB

Power Rating @ 70°C:

	Wattage			
		Network		
Schematic	Resistor	6 Pin	8 Pin	10 Pin
C, F	.12	.60	.84	1.08
G	.12	.36	.48	.60

Lead Material: Gold plated copper

Substrate Material: 99.5% pure alumina ceramic

Construction: Epoxy conformal coating

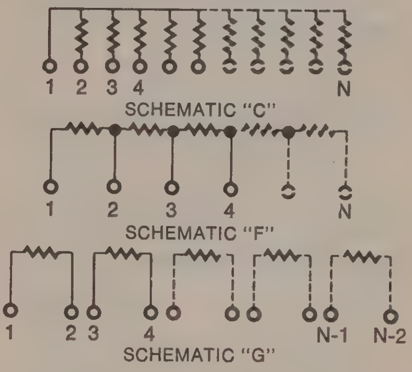
Custom circuits and special testing available

Contact factory for any special features required.

PERFORMANCE DATA

Test Per MIL-R-83401	MIL-R-83401 Limits (ΔR%) M	K	H	TaNFilm Test Data (ΔR%) Maximum	Typical
Thermal Shock and Power Conditioning	.7	.7	.5	.1	.02
Low Temperature Operation	.5	.25	.1	.1	.02
Short Time Overload	.5	.25	.1	.05	.02
Terminal Strength	.25	.25	.25	.1	.02
Resistance to Soldering Heat	.25	.25	.1	.1	.02
Moisture Resistance	.5	.5	.4	.1	.03
Shock	.25	.25	.25	.1	.02
Vibration	.25	.25	.25	.1	.02
Life	2.0	.5	.5	.1	.05
High Temperature Exposure	1.0	.5	.2	.1	.05
Low Temperature Storage	.5	.25	.1	.1	.05
25°C Double Load	2.0	.5	.5	.05	.03

STANDARD CIRCUITS

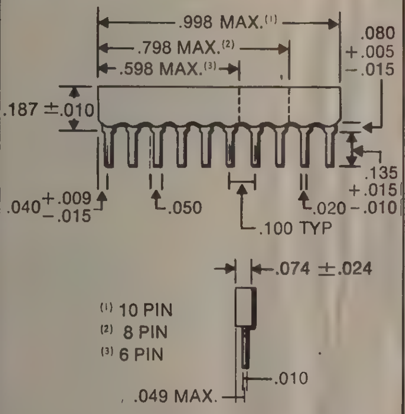


Where precision as well as long term reliability and stabiltiy are required in a small amount of space, the conformally coated SIP is the answer. This low profile SIP resistor network exhibits all the outstanding performance characteristics inherent in TaNFilm products.

Our TaNFilm manufacturing process of sputtering Tantalum Nitride on to ceramic substrates ensures uniform temperature characteristics of all the resistors in the networks. The resistance film is then anodically passivated to improve its stability and to make it virtually impervious to environmental elements.

When you need high precision and ultimate reliability in a limited space, the TaNFilm SIP is the solution. The conformally coated SIP network can be tailored to meet special circuit configurations with multiple resistance values.

DIMENSIONS — INCHES



HOW TO ORDER

Sample Part No.:

4981 — 03 — 1001 — B

Model

4901	9-resistor, 10 pin SIP, one common lead (Schematic C)
4981	7-resistor, 8 pin SIP, one common lead (Schematic C)
4961	5-resistor, 6 pin SIP, one common lead (Schematic C)
4908	9-resistor, 10 pin SIP, series resistors (Schematic F)
4988	7-resistor, 8 pin SIP, series resistors (Schematic F)
4968	5-resistor, 6 pin SIP, series resistors (Schematic F)
4909	5-resistor, 10 pin SIP, Isolated (Schematic G)
4989	4-resistor, 8 pin SIP, Isolated (Schematic G)
4969	3-resistor, 6 pin SIP, Isolated (Schematic G)

Tolerance
Standard MIL tolerance code:
B=±.1%, C=±.25%, D=±.5%, F=±1%, G=±2%

Resistance
Standard MIL resistance code
Example: 1001=1000Ω

Characteristic

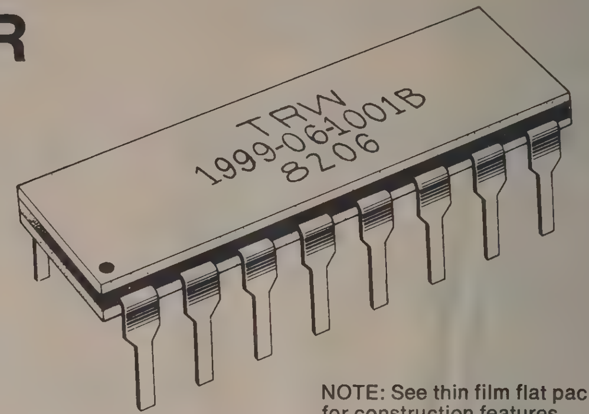
Code	Classification	TCR (ppm/°C)
00	Commercial grade	−100±50
01	Commercial grade	±100
02	Commercial grade	±50
03	Commercial grade	±25

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 4222 S. STAPLES STREET, CORPUS CHRISTI, TX 78411 • (512) 922-7900

TRW

TaNFilm® DIP RESISTOR NETWORKS

- ☐ MIL qualifiied to both MIL-R-83401/01 and MIL-R-83401/02
- ☐ Tightest qualified tolerance available: ±0.1%
- ☐ Best qualified TC: ±50 ppm/°C; available to ±25 ppm/°C
- ☐ Superior TCR tracking to 5 ppm/°C
- ☐ Ratios available to 0.03%
- ☐ Special mechanical and electrical configurations available with military screening



NOTE: See thin film flat pack for construction features.

SPECIFICATIONS

MIL Qualified Resistance Values:
Schematic A: 100Ω to 100KΩ
Schematic B: 100Ω to 70KΩ
Higher and lower resistance values available

Resistance Tolerances: ±.1%, ±.25%, ±.5%, ±1%, ±2%

Temperature Coefficient of Resistance: ±50 ppm/°C, ±100 ppm/°C, ±300 ppm/°C, −100 ±50 ppm

TCR Tracking: 5 ppm/°C, except Models 1987 & 1998 below 500Ω (20 ppm/°C)

Temperature Range: −55°C to +150°C

Power Rating @ 70°C:

Model	Wattage Resistor	Wattage Network
1987	.1	1.3
1998	.1	1.5
1989	.2	1.4
1999	.2	1.6

Noise: Less than −25 dB

Lead Material: Gold plated copper

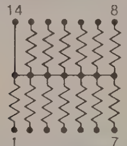
Substrate Material: 99.5% pure alumina ceramic

Construction: Ceramic sandwich epoxy encapsulant

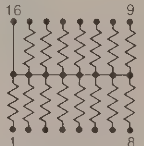
Custom Circuit and Special Testing Available

Contact factory for any special features required

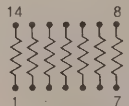
STANDARD CIRCUITS



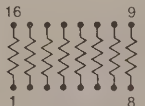
Model 1987



Model 1998



Model 1989



Model 1999

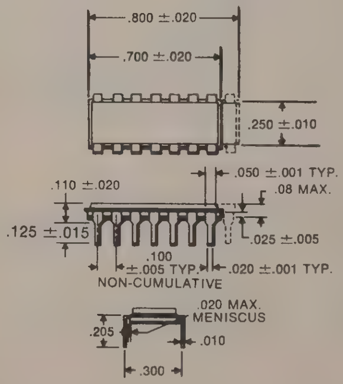
PERFORMANCE DATA

Test Per MIL-R-83401	MIL-R-83401 Limits (ΔR%) M	K	H	TaNFilm Test Data (ΔR%) Maximum	Typical
Thermal Shock and Power Conditioning	.7	.7	.5	.1	.02
Low Temperature Operation	.5	.25	.1	.1	.02
Short Time Overload	.5	.25	.1	.05	.02
Terminal Strength	.25	.25	.25	.1	.02
Resistance to Soldering Heat	.25	.25	.1	.1	.02
Moisture Resistance	.5	.5	.4	.1	.03
Shock	.25	.25	.25	.1	.02
Vibration	.25	.25	.25	.1	.02
Life	2.0	.5	.5	.1	.05
High Temperature Exposure	1.0	.5	.2	.1	.05
Low Temperature Storage	.5	.25	.1	.1	.05
25°C Double Load	2.0	.5	.5	.05	.03

TaNFilm resistor networks are designed for use in applications requiring a high degree of reliability, stability, tight tolerance, close TCR tracking, and low noise. Our continuous feed, high vacuum sputtering process insures uniform properties from network to network. Precise state-of-the-art laser trimming enables us to easily zero in the tightest ratios. Gold-plated copper leads are thermal pulse bonded to large-area gold conductor pads on the ceramic substrate assuring the most relaible termination and long-term stability. Anodically passivated Tantalum Nitride resistor material offers performance far superior to military specifications and excellent environmental protection. Over 40 billion continuous resistor operating hours in the field without a defect-related failure clearly demonstrates the reliability of our TaNFilm product.

The versatile nature of our photo-etch process makes it readily adaptable to meet special customer requirements. Custom circuit designs and special mechanical configurations can be easily achieved with a modest set up charge. Full military screening is also available with all units.

DIMENSIONS — INCHES



HOW TO ORDER

Sample Part No.:

1999 — 06 — 1001 — B

Model

Model	Description
1989	7-resistor 14 Pin DIP, straight thru (MIL-R-83401-01, schematic A)
1999	8-resistor 16 Pin DIP, straight thru (MIL-R-83401-02, schematic A)
1987	13-resistor, 14 Pin DIP, one common lead (MIL-R-83401-01, schematic B)
1998	15-resistor, 16 Pin DIP, one common lead (MIL-R-83401-02, schematic B)

Tolerance
Standard MIL tolerance code:
B=±.1%, C=±.25%, D=±.5%, F=±1%, G=±2%

Resistance
Standard MIL resistance code
Example: 1001=1000Ω

Characteristic

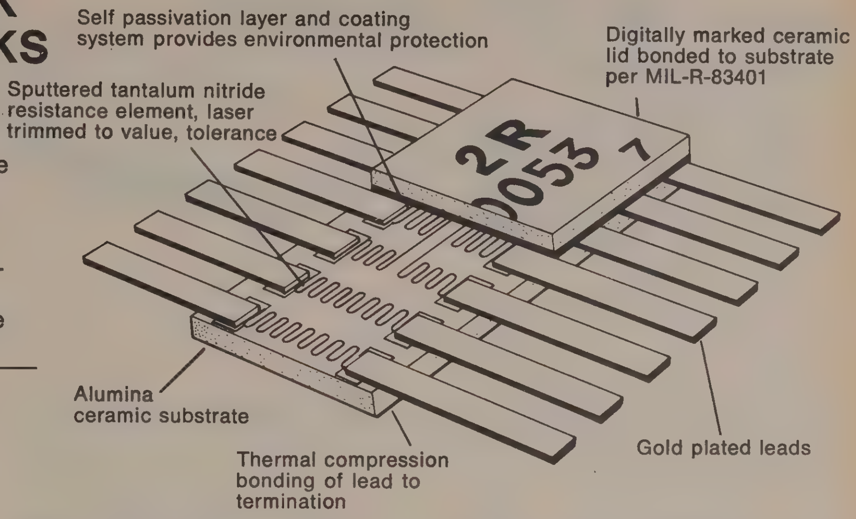
Code	Classification	TCR (ppm/°C)
00	Commercial grade	−100±50
01	Commercial grade	±100
02	Commercial grade	±50
03	Commercial grade	±25
04	MIL-R-83401M	±300
05	MIL-R-83401K	±100
06	MIL-R-83401H	±50
07	MIL-R-83401H	±25

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 4222 S. STAPLES STREET, CORPUS CHRISTI, TX 78411 • (512) 922-7900

TaNFilm® FLAT-PACK RESISTOR NETWORKS

- ☐ Qualified to MIL-R-83401/03, Characteristic H
- ☐ Available with custom testing
- ☐ Ultra precision — Absolute tolerance to ±0.1% — Ratios to 0.03%
- ☐ Superior temperature performance Absolute T.C. to ±25 ppm/°C T.C. tracking: 5 ppm/°C standard — 3 ppm/°C available
- ☐ Custom schematics readily available
- ☐ Special mechanical configurations


Self passivation layer and coating system provides environmental protection
Digitally marked ceramic lid bonded to substrate per MIL-R-83401
Sputtered tantalum nitride resistance element, laser trimmed to value, tolerance
2R
0053 7
Alumina ceramic substrate
Thermal compression bonding of lead to termination
Gold plated leads

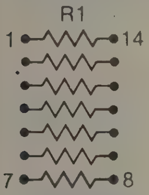
SPECIFICATIONS

Mil Qualified Resistance Ranges:
Schematic A: 49.9Ω to 100K
Schematic B: 49.9Ω to 56K
Higher resistance values available
Resistance Tolerances: ±.1%, ±.25%, ±.5%, ±1%, ±2%
Temperature Coefficient of Resistance: ±25 ppm°C, ±50 ppm/°C, ±100 ppm/°C, −100 ±50 ppm/°C
TCR Tracking: Referenced to R1, is ±5 ppm/°C except Model 8987 below 500 ohm, which is ±20 ppm/°C
Temperature Range: −55° to +150°C
Noise: Less than −25 dB
Power Ratings: .1 watt per resistor, .5 watt per network at 70°C
1.0 watt per network at 25°C
Ratio Tolerance: to ±.03%
Lead Material: Gold plated copper alloy
Substrate Material: High alumina ceramic
Construction: Ceramic sandwich package
Custom Circuits: R-2R, BCD
Custom Screening Procedures
Packages: up to 20 leads

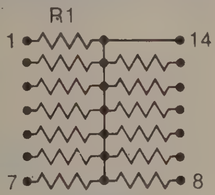
Contact factory for all custom packages and circuits

STANDARD CIRCUITS

Both "A" and "B" schematics of MIL-R-83401 — RZ 030 are available as standard. Contact factory for custom packages and circuits.

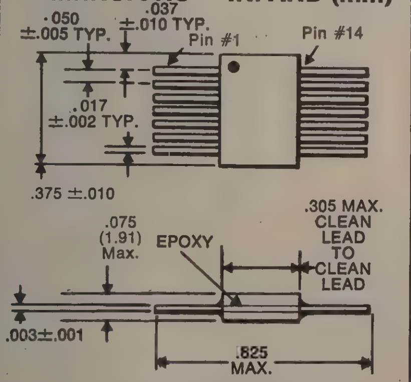


Model 8989
MIL-R-83401
Schematic A



Model 8987
MIL-R-83401
Schematic B

DIMENSIONS — IN. AND (mm)


.050 ±.005 TYP.
.037 ±.010 TYP.
Pin #1
Pin #14
.017 ±.002 TYP.
.375 ±.010
.075 (1.91) Max.
EPOXY
.305 MAX. CLEAN LEAD TO CLEAN LEAD
.003±.001
.825 MAX.

Dimensional tolerances unless otherwise specified ±.005 (.127)

TaNFilm resistor networks are designed for use in applications requiring a high degree of reliability, stability, tight tolerance, close TCR tracking, and low noise. The sputtering process for resistor formation has been perfected to allow a continuous feed production line under high vacuum conditions, thus, insuring uniformity of properties between networks. Precise state of the art laser trimming makes tight ratios easily achievable. The gold plated copper leads are thermal pulse bonded to large area gold conductor pads on the ceramic substrate assuring the most reliable termination and long term stability. The Tantalum Nitride resistor material is anodically passivated for excellent environmental protection and performance far superior to military specifications. Reliability has been demonstrated in field usage with over 40 billion continuous resistor operating hours without a defect related failure.

Our TaNFilm process enables us to manufacture networks containing different resistance values and still maintain the tight tolerances and tracking characteristics of networks containing only a single resistance value. The nature of our photo-etch process makes it readily adaptable to meet each individual customer's needs. Custom circuit designs and special mechanical configurations can be easily achieved with a modest set up charge while maintaining our high standards of precision and reliability.

PERFORMANCE DATA

Test Per MIL-R-83401	MIL-R-83401 Limits (ΔR%)			TaNFilm Test Data (ΔR%)	
	M	K	H	Maximum	Typical
Thermal Shock and Power Conditioning	.7	.7	.5	.1	.02
Low Temperature Operation	.5	.25	.1	.1	.01
Short Time Overload	.5	.25	.1	.05	.01
Terminal Strength	.25	.25	.25	.1	.01
Resistance to Soldering Heat	.25	.25	.1	.1	.02
Moisture Resistance	.5	.5	.4	.1	.03
Shock	.25	.25	.25	.1	.03
Vibration	.25	.25	.25	.1	.03
Life	2.0	.5	.5	.1	.05
High Temperature Exposure	1.0	.5	.2	.1	.05
Low Temperature Storage	.5	.25	.1	.1	.02
25°C Double Load	2.0	.5	.5	.05	.03

HOW TO ORDER

Sample Part No.:

8987 — 05 — 1001 — B

Model

Model	Network Schematic
8989	7-resistors (MIL-R-83401-03, Schematic A)
8987	13-resistors (MIL-R-83401-03, Schematic B)

Characteristic

Code	Classification	TCR (ppm/°C)
00	Commercial grade	−100 ±50
01	Commercial grade	±100
02	Commercial grade	±50
03	Commercial grade	±25
04	MIL-R-83401M	±300
05	MIL-R-83401K	±100
06	MIL-R-83401H	±50
07	MIL-R-83401H	±25

Tolerance
Standard MIL tolerance code:
B=±.1%, C=±.25%,
D=±.5%, F=±1%, G=±2%,
J = ±5%

Resistance
Standard MIL resistance code
Example: 1001=1000Ω

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

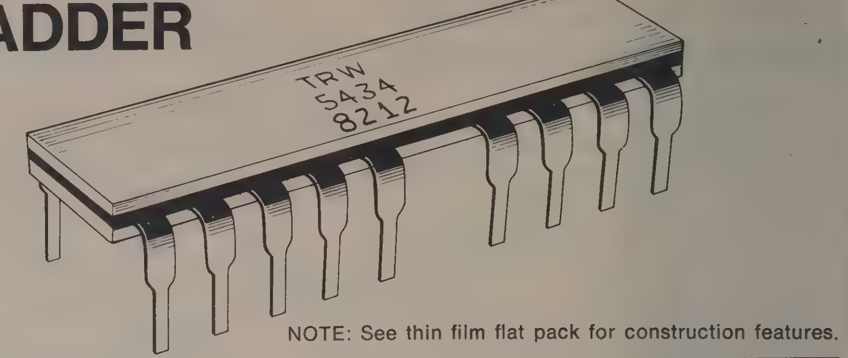
See MIL-R-83401 for Military numbering system

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 4222 S. STAPLES STREET, CORPUS CHRISTI, TX 78411 • (512) 922-7900

TaNFilm® R-2R LADDER

12-BIT, 20-PIN DIP

- ☐ Proven reliability
- ☐ 12 bit, ±½ LSB accuracy over 10,000 hour life
- ☐ Passivated TaNFilm for superior environmental performance
- ☐ ±122 ppm ladder accuracy over −55°C to +125°C
- ☐ Standard DIP package
- ☐ 5 standard R values



NOTE: See thin film flat pack for construction features.

The 5430 series R-2R ladder utilizes the unique characteristics of the TaNFilm process to provide the ±½ LSB, 12 bit accuracy required for precision data conversion. Our continuous sputtering process deposits Tantalum Nitride resistance film over an entire substrate of 99.5% pure alumina, ensuring virtually identical resistance temperature characteristics of all resistors in the ladder. This guarantees no degradation in ladder accuracy over the full military temperature range of −55°C to +125°C.

Anodic passivation of the resistance film results in outstanding environmental performance. More importantly, since the aging process of this film results in a slight continuation of this passivation, all resistors change at the same rate. Consequently, voltage ratios required for ladder accuracy are very stable over long term, 10,000 hour load and temperature conditions.

Large area thermocompression bonding of gold plated leads eliminates the need for fine wire bonds and provides the ultimate in strength and reliability. In addition the combination of high alumina substrate for thermal conductivity and 1.5 mil minimum resistor line width enhances reliability for the most severe applications. Reliability and stability of TaNFilm networks are proven with years of MIL-R-83401 testing and qualification.

SPECIFICATIONS

Ladder Resistance Values (R): 5K, 10K, 20K, 25K, 50K

Ladder Resistance Tolerance: ±5%

Maximum Input Voltage: 20V

Settling Time (to 0.1% of final value): 100n sec.

Temperature Range: −55°C to +125°C

External Switch Compensation (Note 1):
Models 5431-5434 — 5Ω
Model 5435 — 500Ω

Ladder Voltage Accuracy: ±122 ppm

Application Resistor Tolerance Ratio (Note 2): 0.04%

Lead Material: Gold plated copper alloy

STABILITY

TaNFilm 12 bit ladders exhibit ±122 ppm maximum voltage ratio error after the following tests (per MIL-R-83401 except as noted):

Operating Life: 1000 Hrs. Full Load 100°C
Short Time Overload: 10 Sec. 2.5 x Rated Voltage
Thermal Shock: 10 cycles −65°C to +150°C
High Temperature Exposure: 100 Hrs. @ 125°C
Moisture Cycle, Load: 10 Days
Soldering Heat: 10 Sec. @ 260°C
Shock: 100 g's for 6 Milliseconds
Vibration: 20 g's
Terminal Strength: 4.5 Lbs.

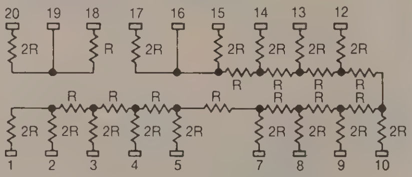
Note 1 — Consult factory for other switch compensation.

Note 2 — Ratio matching of each application resistor to ladder output resistance. Consult factory for other accuracy requirements.

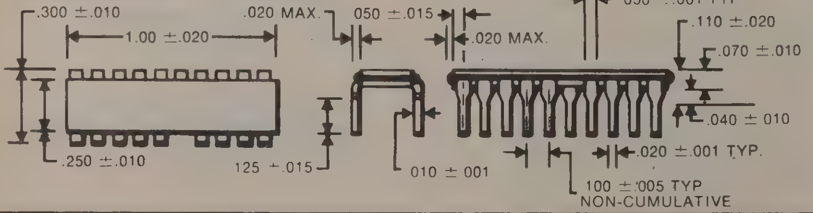
HOW TO ORDER

Model	Description
5431	5/10K, 12 bit, 20 pin DIP, R-2R ladder
5432	10/20K, 12 bit, 20 pin DIP, R-2R ladder
5433	20/40K, 12 bit, 20 pin DIP, R-2R ladder
5434	25/50K. 12 bit, 20 pin DIP, R-2R ladder
5435	50/100K, 12 bit, 20 pin DIP, R-2R ladder

STANDARD CIRCUIT



DIMENSIONS — INCHES



Testing R-2R Ladder Networks

Conversion Accuracy Testing

TRW tests its R-2R ladders functionally by comparing the output of the DUT (device under test) with the output of a standard ladder having an accuracy of 1 ppm. The ladder networks are activated one bit at a time, starting with bit one and continuing to the LSB (least significant bit). See Figure 1. A calculator controlled scanner having low thermal mercury relays is used for the switching. The reference voltage being applied to the corresponding bit of each ladder (standard and DUT) is 10 volts. The output voltage error is measured using a calculator control DVM and is stored in the calculator memory. After all bits have been read, the plus and minus sums are found by adding the appropriate errors of all bits. Normally each of these sums must be less than one half the output of a perfect ladder with only its least significant bit energized. This is 122 ppm for 12 bit ladders. This procedure guarantees monotonicity and a worst case accuracy of less than ½ LSB.

Output Resistance Testing

The output resistance is determined by making a single measurement. All bits are connected to common and the resistance between the "OUT" terminal and common is measured. The value will be the R value of the ladder. When switch compensation is accounted for, the output reistance is ±5% of the nominal value of R.

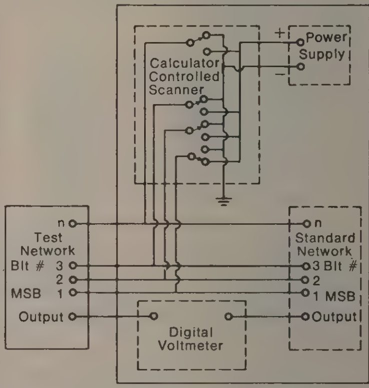
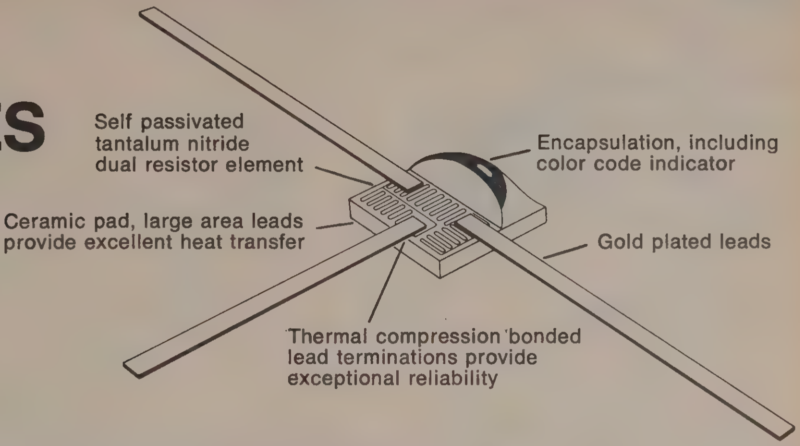


Figure 1. Conversion Accuracy Tester

TaNFilm® SUBMINIATURE DUAL NETWORK

TaNTee SERIES

- ☐ Subminiature (0.075" x 0.075")
- ☐ Dual resistor, center lead common
- ☐ Available with custom testing
- ☐ Ultra precision — Absolute tolerance to ±1% — Ratios to: 0.1%
- ☐ Superior temperature performance Absolute T.C. to ±25 ppm/°C — T.C. tracking: 5 ppm/°C standard
- ☐ High frequency operation


Self passivated tantalum nitride dual resistor element
Encapsulation, including color code indicator
Ceramic pad, large area leads provide excellent heat transfer
Gold plated leads
Thermal compression bonded lead terminations provide exceptional reliability

SPECIFICATIONS

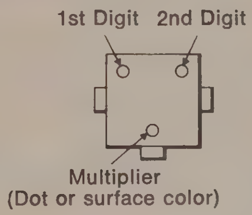
Resistance Range, each R: 10Ω to 10KΩ
(See chart and schematic below)
Power Rating: ¼W @ 85°C
(sum of power in both resistors)
Resistor Tolerance:
Absolute Tolerance — ±5% standard, ±1% available
Ratio Tolerance — To .1%
Moisture Resistance, ΔR: ±0.4% max.
Thermal Shock, ΔR: ±0.25% max.
(5 cycles, −65°C to +125°C)
Temperature Coefficient:
Absolute — To ±25 ppm/°C
Tracking — To 5 ppm
Load Life, ΔR: ±.5% max.
(1000 hrs. @ 70°C @ Rated Load)
Noise: −20 db max.
Short Time Overload, ΔR: ±0.1% max.
(2.5 x rated voltage for 5 seconds)

NOTE: TaNTee resistors meet the performance requirements of MIL-R-83401, characteristic H

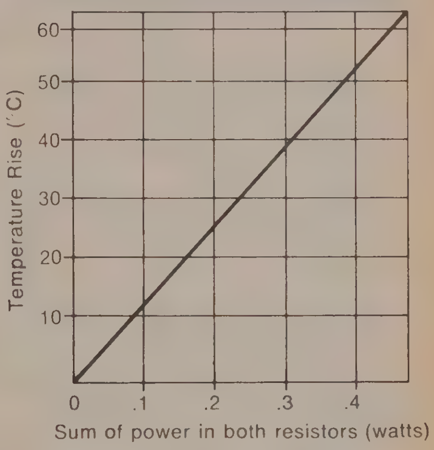
The TaNTee Series of TaNFilm resistor networks provide a miniature, two-resistor network adaptable to many circuit requirements. The tanalum nitride film resistors are deposited on a 25 mil thick ceramic chip .075" x .075", and are protected by a rugged epoxy coating. Gold plated copper leads are bonded to termination pads on the ceramic chip, resulting in a strong, reliable lead connection.

Tantalum nitride is an extremely stable metal film resistor material capable of high operating power levels and also exceptional environmental performance. The TaNTee dual resistor's physical size and construction make it ideally suited for high frequency applications. The excellent TC tracking of the two resistors on the chip provides a very stable voltage ratio, which is critical in many applications.

COLOR CODING

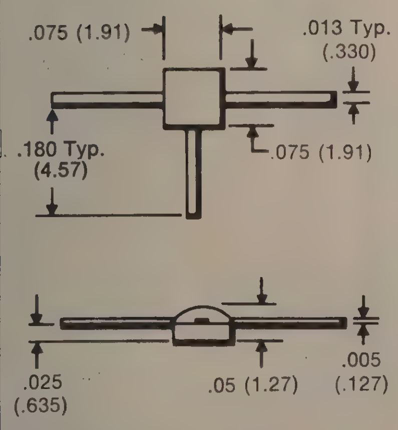

1st Digit
2nd Digit
Multiplier
(Dot or surface color)

TEMPERATURE RISE ABOVE AMBIENT

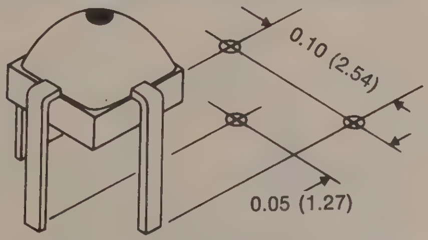


Standard Resistances					1st and 2nd Digit		Multiplier
10	16	27	43	68	Black = 0	Green = 5	Black = X1
11	18	30	47	75	Brown = 1	Blue = 6	Brown = X10
12	20	33	51	82	Red = 2	Violet = 7	Red = X100
13	22	36	56	91	Orange = 3	Grey = 8	Orange = X1000
15	24	39	62		Yellow = 4	White = 9	
5% EIA Values							

DIMENSIONS — IN. AND (mm)

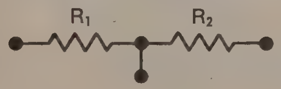

.075 (1.91)
.013 Typ. (.330)
.180 Typ. (4.57)
.075 (1.91)
.025 (.635)
.05 (1.27)
.005 (.127)

SUGGESTED HOLE SPACING


0.10 (2.54)
0.05 (1.27)

NOTE: TaNTee Dual Resistors are supplied only with non-formed leads.

STANDARD CIRCUIT



HOW TO ORDER

Sample Part No.:

TaNTee 2-X X X

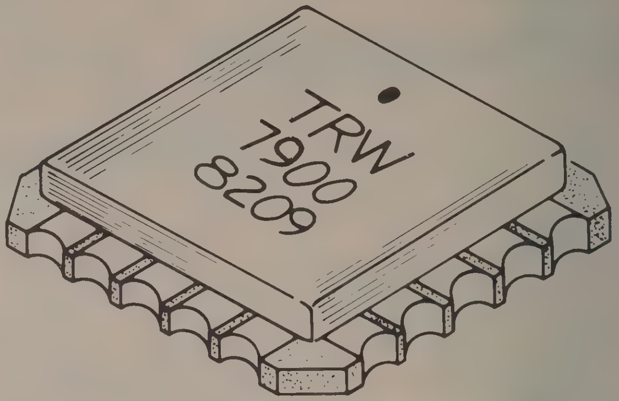
Product Family
Resistance Value When $R_1 = R_2$*
(* When R_1 does not equal R_2, consult factory.)
First Digit
Second Digit
Multiplier
(Number of Zeros)

Example: 2100 = 10Ω
2101 = 100Ω
2103 = 10,000Ω

TRW

TaNFilm® CHIP CARRIER RESISTOR NETWORKS

- ☐ Increased component density
- ☐ Ideal for vapor phase reflow soldering
- ☐ Best tolerances: 0.1% absolute — 0.02% ratio
- ☐ Superior temperature performances: Absolute T.C. to ±25 ppm/°C — Tracking 5 ppm/°C standard
- ☐ Custom schematics readily available
- ☐ Meets JEDEC standard for Type 'C' package



SPECIFICATIONS

Resistance Values: 50Ω to 50KΩ standard; up to 100KΩ on special order

Resistance Tolerances: ±.1%, ±.5%, ±1%, ±2%, ±5%

Temperature Coefficient of Resistance: ±25 ppm/°C, ±50 ppm/°C, ±100 ppm/°C, ±300 ppm/°C

TCR Tracking: 5 ppm/°C

Temperature Range: −55°C to +150°C

Noise: Less than −25 dB

Power Rating @ 70°C: .1 watt/resistor, .5 watt/network

Meets JEDEC standard for type 'C' package

Terminations: Gold over nickel over copper

Substrate Material: 99.5% pure alumina ceramic

Construction: Ceramic sandwich/epoxy encapsulant

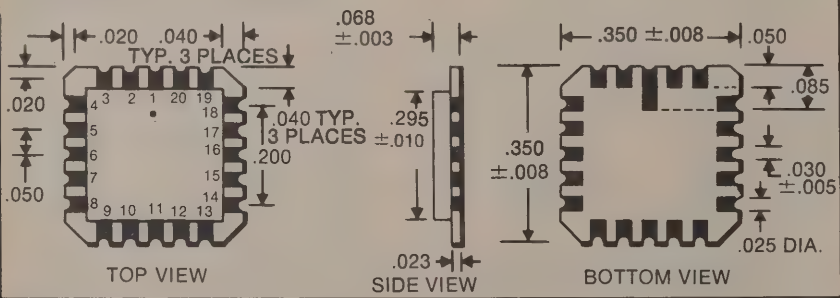
Custom circuits and special testing available

Contact factory for any special features required.

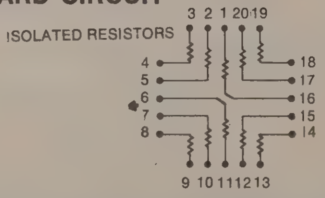
PERFORMANCE DATA

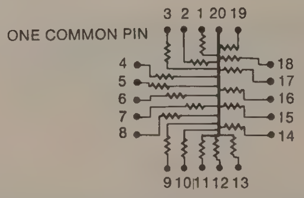
	MIL-R-83401 Limits (ΔR%)			TaNFilm Test Data (ΔR)	
Test Per MIL-R-83401	M	K	H	Maximum	Typical
Thermal Shock and Power Conditioning	.7	.7	.5	.1	.05
Low Temperature Operation	.5	.25	.1	.1	.02
Short Time Overload	.5	.25	.1	.05	.02
Terminal Strength	.25	.25	.25	.1	.05
Resistance to Soldering Heat	.25	.25	.1	.1	.02
Moisture Resistance	.5	.5	.4	.1	.03
Shock	.25	.25	.25	.1	.03
Vibration	.25	.25	.25	.1	.03
Life	2.0	.5	.5	.1	.05
High Temperature Exposure	1.0	.5	.2	.1	.05
Low Temperature Storage	.5	.25	.1	.1	.05
25°C Double Load	2.0	.5	.5	.05	.03

DIMENSIONS — INCHES



STANDARD CIRCUIT





The TRW TaNFilm chip carrier network offers higher lead density, increased component count, lower installed resistor cost, better reliability, and is ideal for use with the latest production technique — vapor phase reflow solder process. In addition, the TaNFilm leadless chip carrier network provides all the unique qualities of our other TaNFilm package configurations. Testing has demonstrated performance exceeding MIL-R-83401 Characteristic H.

The proven TaNFilm manufacturing process enhances reliability through elimination of wire bonds. Precise state-of-the-art laser trimming provides close tolerances and tight ratios. The TaNFilm process enables us to manufacture custom circuit configurations and multiple resistance values without sacrificing the tightest tolerance and tracking characteristics of precision networks. The Tantalum Nitride resistor material is passivated for environmental protection surpassing military requirements and guaranteeing exceptional ratio stability over the full range of military environments.

For applications requiring a high degree of reliability, stability, accuracy and low noise, plus advantages of new resistor packing, specify the TRW leadless chip carrier configuration resistor network.

HOW TO ORDER

Sample Part No.:

7900 - 01 - 1001 - B

Model

7900 19-resistor, pin #20 common, min. 50Ω, max. 20K

7909 10-resistor, isolated resistors, min. 50Ω, max. 50K

Characteristic

Code	TCR (ppm/°C)
00	−100 ±50
01	±100
02	±50
03	±25

Resistance

Standard MIL resistance code

Example: 1001 = 1000Ω

Tolerance

Standard MIL tolerance code

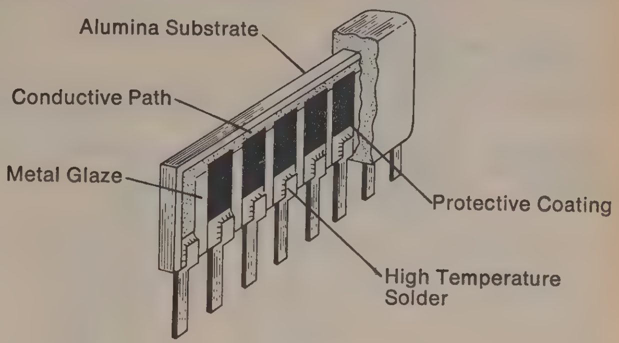
B = ±.1%, C = ±.25%, D = ±.5%, F = ±1%, G = ±2%, J = ±5%

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 4222 S. STAPLES STREET, CORPUS CHRISTI, TX 78411 • (512) 922-7900

TRW

THICK FILM
CONFORMAL COATED
SIP NETWORKS *

- ☐ 4 through 14-pin packages
- ☐ Project .256 in. from circuit board
- ☐ Circuits -1, -3 and -5 are standard
- ☐ Other circuits available on request


Alumina Substrate
Conductive Path
Metal Glaze
Protective Coating
High Temperature Solder

SPECIFICATIONS

ELECTRICAL

Resistance Range: 22Ω to 1.0 MegΩ
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±200 ppm/°C
Max. Continuous Working Voltage: 50V
Operating Temp.: −40°C to +150°C

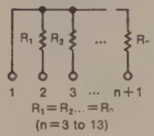
PHYSICAL

Element: Fused thick-film composition
Substrate: 96% Alumina
Body: Conformal Coated
Terminals: Solder Plated Steel
Lead Pull: 2.2 pounds
Lead Solderability: MIL-STD-202, Method 208
Resistance to Soldering Heat: MIL-STD-202E, Method 210A, Cond. A
Marking Resistance to Solvents: MIL-STD-202, Method 215

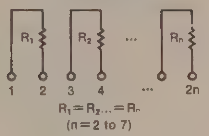
ENVIRONMENTAL PER MIL-R-83401

Short Time Overload: ±.5%
Terminal Strength: ±.5%
Resistance to Solder Heat: ±.5%
Moisture Resistance: ±2%
Load Life: ±2%
Temperature Cycling: ±.5%

CIRCUIT 1

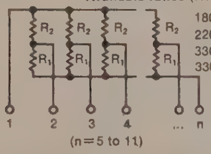

R₁
R₂
...
Rₙ
1
2
3
...
n+1
R₁=R₂...=Rₙ
(n=3 to 13)

CIRCUIT 3


R₁
R₂
...
Rₙ
1
2
3
4
...
2n
R₁=R₂...=Rₙ
(n=2 to 7)

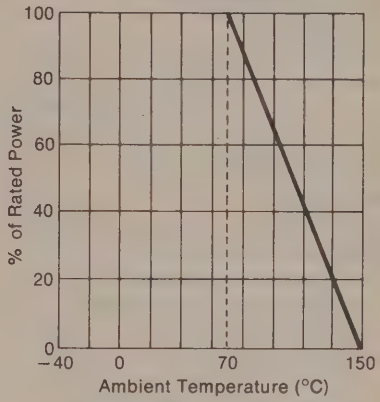
CIRCUIT 5

Available ratios (R1/R2):
180/390
220/330
330/390
330/470

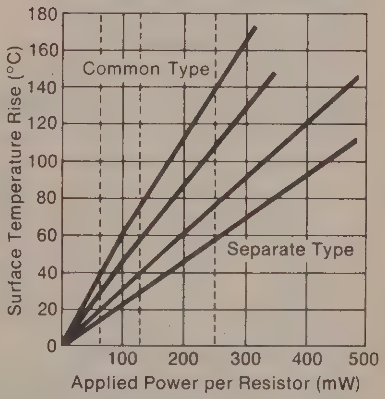

R₂
R₁
1
2
3
4
...
n
(n=5 to 11)

STANDARD CIRCUITS

POWER DERATING



SURFACE TEMPERATURE RISE



STANDARD RESISTANCE (OHMS)

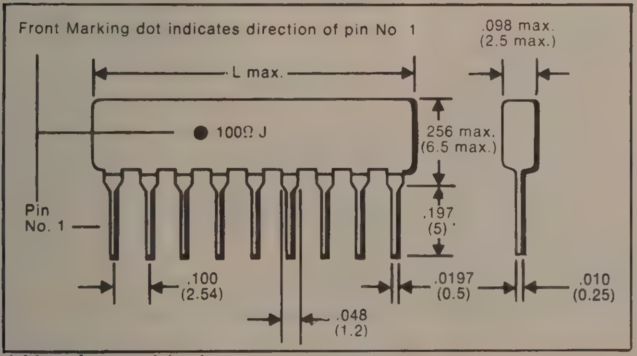
22	82	(330)	1.2K	(4.7K)	18K	68K	270K
27	(100)	390	1.5K	5.6K	(22K)	82K	330K
(33)	120	(470)	1.8K	(6.8K)	27K	(100K)	390K
39	(150)	560	(2.2K)	8.2K	33K	120K	470K
(47)	180	(680)	2.7K	(10K)	39K	150K	560K
(56)	(220)	820	(3.3K)	12K	(47K)	180K	680K
68	(270)	(1K)	3.9K	(15K)	56K	220K	820K
							1M

(*) Preferred standard resistance values available immediately from stock.

POWER RATING AT 70°C

Circuit Type	One Element	MAX. POWER IN ONE NETWORK (WATTS)										
		4-PIN	5-PIN	6-PIN	7-PIN	8-PIN	9-PIN	10-PIN	11-PIN	12-PIN	13-PIN	14-PIN
—1	.125	.375	.5	.625	.75	.875	1	1.05	1.15	1.25	1.35	1.45
—3	.25	.50	—	.75	—	1	—	1.05	—	1.25	—	1.45
—5	.125	—	.5	.625	.75	.875	1	1.05	1.15	1.25	1.35	1.45

DIMENSIONS — IN. AND (mm)


Front Marking dot indicates direction of pin No 1
.098 max.
(2.5 max.)
L max.
100Ω J
256 max.
(6.5 max.)
.197
(5)
Pin
No. 1
.100
(2.54)
.0197
(0.5)
.010
(0.25)
.048
(1.2)

No. of Pins	L max inches (mm)
4	0.43 (10.66)
5	0.53 (13.2)
6	0.63 (15.8)
7	0.73 (18.3)
8	0.83 (20.9)
9	0.93 (23.4)
10	1.03 (25.9)
11	1.13 (28.5)
12	1.23 (31.0)
13	1.33 (33.6)
14	1.43 (36.1)

* Manufactured in Japan

HOW TO ORDER

Sample Part No.: C 10 - 3 - 223 - G

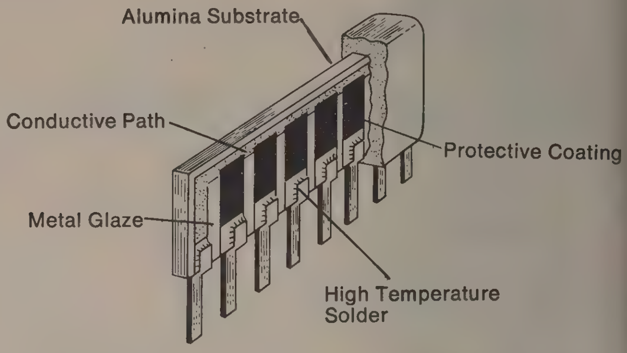
Product Family (C = .256 SIP)
Number of Pins (4 through 14)
Circuit Type (1, 3 or 5)
For Circuits 1 or 3, 2 Digit Range and Digit Multiplier
For Circuit 5, ratio of R1/R2
Tolerance (G = 2%, J = 5%)

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, P.O. BOX 1860, BOONE, NC 28607 • (704) 264-8861

THICK FILM
CONFORMAL COATED LOW PROFILE
SIP NETWORKS *

- ☐ 5 through 11-pin packages
- ☐ Project .20 in. from circuit board
- ☐ Circuits −1, −3 are standard
- ☐ Other circuits available on request


Alumina Substrate
Conductive Path
Protective Coating
Metal Glaze
High Temperature Solder

SPECIFICATIONS

ELECTRICAL

Resistance Range: 22Ω to 1.0 MegΩ
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±200 ppm/°C
Max. Continuous Working voltage: 150V
Operating Temp.: −40°C to +155°C

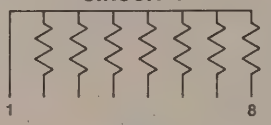
PHYSICAL

Element: Fused thick-film composition
Substrate: 96% Alumina
Body: Conformal Coated
Terminals: Solder Plated Steel
Lead Pull: 2.2 pounds
Lead Solderability: MIL-STD-202E, Method 210A, Cond. A
Resistance to Soldering Heat: MIL-STD-202 E, Method 210A, Cond. A
Markings Resistance to Solvents: MIL-STD-202, Method 215

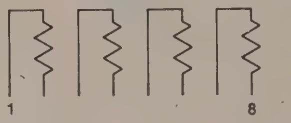
ENVIRONMENTAL PER MIL-R-83401

Short Time Overload: ±.5%
Terminal Strength: ±.5%
Resistance to Solder Heat: ±.5%
Moisture Resistance: ±2%
Load Life: ±2%
Temperature Cycling: ±.5%

CIRCUIT 1

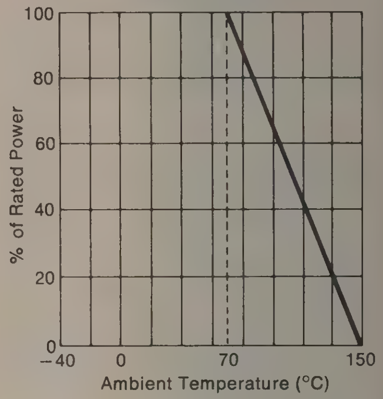


CIRCUIT 3



STANDARD CIRCUITS

POWER DERATING



STANDARD RESISTANCE (OHMS)

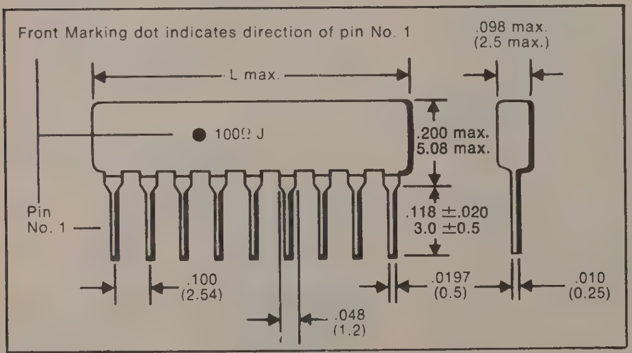
22
27
(33)
39
(47)
(56)
68
82
(100)
120
(150)
180
(220)
(270)
(330)
290
(470)
560
(680)
820
(1K)
1.2K
1.5K
1.8K
(2.2K)
2.7K
(3.3K)
3.9K
(4.7K)
5.6K
(6.8K)
8.2K
(10K)
12K
(15K)
18K
(22K)
27K
33K
39K
(47K)
56K
68K
82K
(100K)
120K
150K
180K
220K
270K
330K
390K
470K
560K
680K
820K
1M

(*) Preferred standard resistance values available immediately from stock

POWER RATING AT 70°C

Circuit Type	One Element	MAX. POWER IN ONE NETWORK (WATTS)						
		5-PIN	6-PIN	7-PIN	8-PIN	9-PIN	10-PIN	11-PIN
−1	.1	0.4	0.5	0.6	0.7	0.8	0.84	0.92
−3	.11							

(THE -3 CIRCUITS WILL BE MARKED WITH A LETTER 'S' PRECEDING THE RESISTANCE VALUE)


Front Marking dot indicates direction of pin No. 1
.098 max.
(2.5 max.)
L max.
100Ω J
.200 max.
5.08 max.
Pin
No. 1
.118 ±.020
3.0 ±0.5
.100
(2.54)
.0197
(0.5)
.010
(0.25)
.048
(1.2)

No. of Pins	L max inches (mm)
5	0.5 (12.7)
6	0.6 (15.24)
7	0.7 (17.78)
8	0.8 (20.32)
9	0.9 (22.86)
10	1.0 (25.40)
11	1.1 (27.90)

HOW TO ORDER

Sample Part No.: **CL 10 - 3 - 223 - G**

Product Family

Number of Pins (5 through 11)

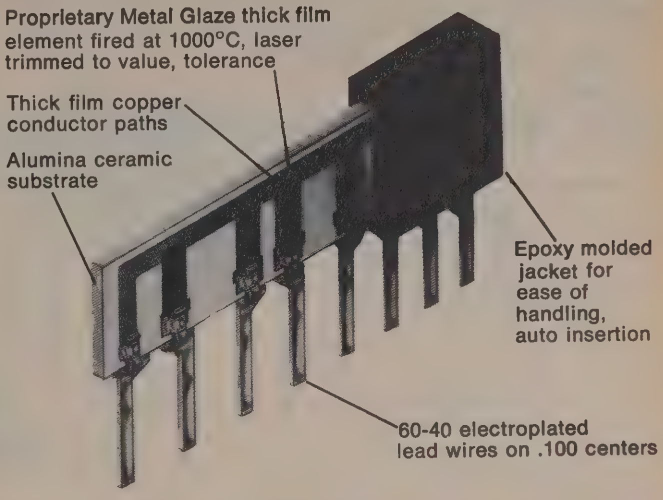
Circuit Type (1, 3)

For Circuits 1 or 3, 2 Digit Range and Digit Multiplier

Tolerance (G = 2%, J = 5%)

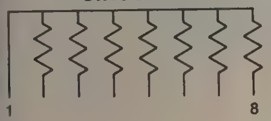
* Manufactured in Japan

THICK FILM MOLDED 6-, 8- AND 10-PIN, .350-IN. SIP NETWORKS

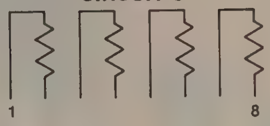

Proprietary Metal Glaze thick film element fired at 1000°C, laser trimmed to value, tolerance
Thick film copper conductor paths
Alumina ceramic substrate
Epoxy molded jacket for ease of handling, auto insertion
60-40 electroplated lead wires on .100 centers

STANDARD CIRCUITS

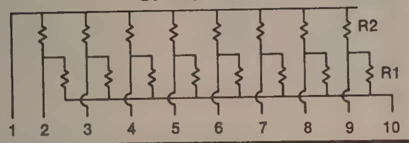
CIRCUIT 1



CIRCUIT 3



CIRCUIT 5


R2
R1
1
2
3
4
5
6
7
8
9
10

SPECIFICATIONS

ELECTRICAL

Resistance Range: 22Ω to 1 Meg
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±150 ppm/°C
TC Tracking: 50 ppm/°C typical
Max. Continuous Working Voltage: 50V
Operating Temperature: −55°C to 150°C

PHYSICAL

Element: Fused thick-film composition
Substrate: 96% Alumina
Body: Molded epoxy
Terminals: Tinned copper
Lead Pull: 4.5 pounds
Lead Solderability: MIL-STD-202, Method 208, and MIL-STD-883, Method 2003
Resistance to Soldering Heat: MIL-STD-202E, Method 210A, Cond. C
Marking Resistance to Solvents: MIL-STD-202, Method 215

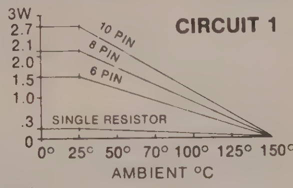
ENVIRONMENTAL PER MIL-R-83401

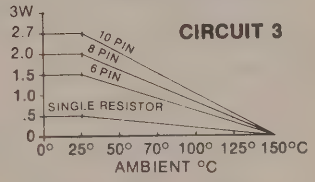
TCR: ±150 PPM/°C
Thermal Shock: ±.50%
Power Conditioning: ±.50%
Low Temperature Operation: ±.25%
Short Time Overload: ±.25%
Terminal Strength: ±.25%
Resistance to Solder Heat: ±.25%
Moisture Resistance: ±.50%
Shock: ±.25%
Vibration, High Frequency: ±.25%
Life: ±1.0%
25°C Power Rating: ±1.0%
High Temperature Exposure: ±.50%
Low Temperature Storage: ±.25%
Insulation Resistance: 10,000 Megohms

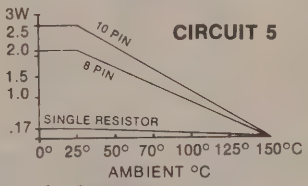
POWER RATING

	6 PIN	8 PIN	10 PIN
Circuit 1—Total package	1.5W	2.1W	2.7W
Single resistor	.3W	.3W	.3W
Circuit 3—Total package	1.5W	2.0W	2.5W
Single resistor	.5W	.5W	.5W
Circuit 5—Total package	—	2.0W	2.7W
Single resistor	—	.17W	.17W

(Rating @ 70°C is 67% or 25° rating)





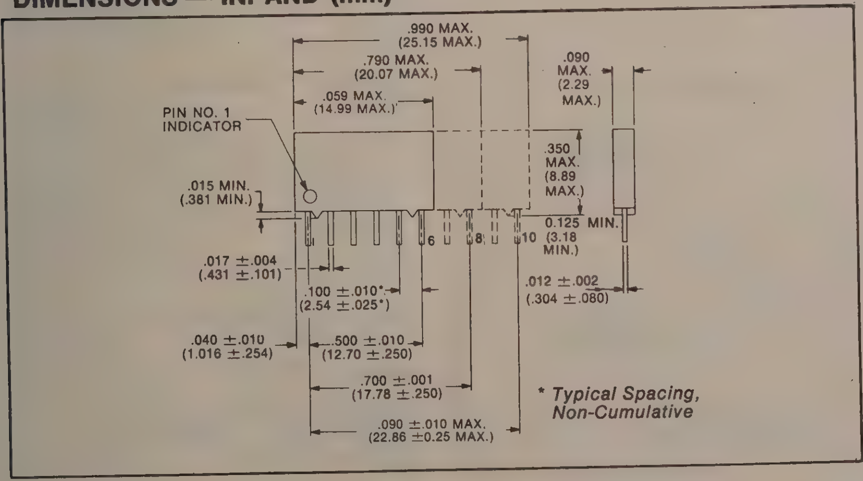


STANDARD RESISTANCE VALUES (OHMS)

22	82	330	1.0K	3.3K	10K	33K	100K	330K
27	100	390	1.2K	3.9K	12K	39K	120K	390K
33	120	470	1.5K	4.7K	15K	47K	150K	470K
39	150	560	1.8K	5.6K	18K	56K	180K	560K
47	180	680	2.2K	6.8K	22K	68K	220K	680K
56	220	820	2.7K	8.2K	27K	82K	270K	820K
68	270							1 MEG

* R2/R1 ratio = 1.2 (minimum) to 2.2 (maximum). R1 Minimum = 50 Ohm; R2 Maximum = 1000 Ohm.

DIMENSIONS — IN. AND (mm)


.990 MAX.
(25.15 MAX.)
.790 MAX.
(20.07 MAX.)
.059 MAX.
(14.99 MAX.)
.090
MAX.
(2.29
MAX.)
PIN NO. 1
INDICATOR
.350
MAX.
(8.89
MAX.)
.015 MIN.
(.381 MIN.)
6
8
10
0.125 MIN.
(3.18
MIN.)
.017 ±.004
(.431 ±.101)
.100 ±.010*
(2.54 ±.025*)
.012 ±.002
(.304 ±.080)
.040 ±.010
(1.016 ±.254)
.500 ±.010
(12.70 ±.250)
.700 ±.001
(17.78 ±.250)
.090 ±.010 MAX.
(22.86 ±0.25 MAX.)

* *Typical Spacing, Non-Cumulative*

HOW TO ORDER

8 10 - 3 - 223 - G

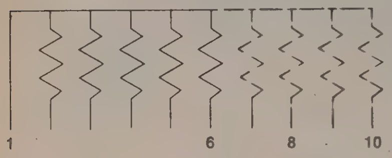
Product Family (8 = .350″ SIP)
No. of Pins
Circuit Type (1 = N-1) (3 = N/2) (5 = Terminator)
2 Digit Range and Digit Multiplier or, for Circuit 5, R_1/R_2
Tolerance (G = 2%, J = 5%)

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

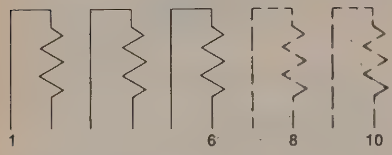
THICK FILM MOLDED 8- AND 10-PIN, .195-IN. SIP NETWORKS

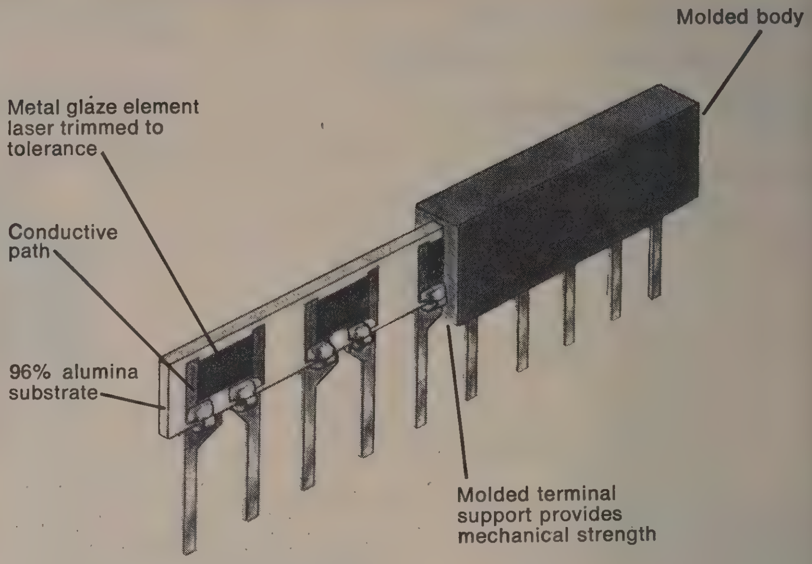
STANDARD CIRCUITS

CIRCUIT 1



CIRCUIT 3




Molded body
Metal glaze element laser trimmed to tolerance
Conductive path
96% alumina substrate
Molded terminal support provides mechanical strength

SPECIFICATIONS

ELECTRICAL

Resistance Range: 22Ω to 150K
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±150 ppm/°C
TC Tracking: 50 ppm/°C typical
Max. Continuous Working Voltage: 50V
Operating Temperature: −55°C to 150°C

PHYSICAL

Element: Fused thick-film composition
Substrate: 96% Alumina
Body: Molded epoxy
Terminals: Tinned copper
Lead Pull: 4.5 pounds
Lead Solderability: MIL-STD-202, Method 208, and MIL-STD-883, Method 2003
Resistance to Soldering Heat: MIL-STD-202E, Method 210A, Cond. C
Marking Resistance to Solvents: MIL-STD-202, Method 215

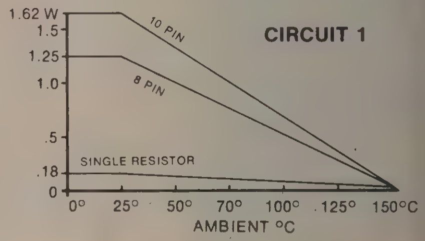
ENVIRONMENTAL PER MIL-R-83401

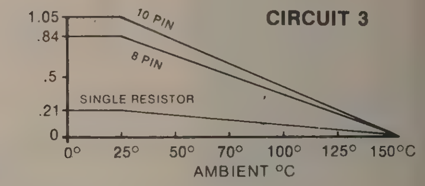
TCR: ±150 PPM/°C
Thermal Shock: ±.50%
Power Conditioning: ±.50%
Low Temperature Operation: ±.25%
Short Time Overload: ±.25%
Terminal Strength: ±.25%
Resistance to Solder Heat: ±.25%
Moisture Resistance: ±.50%
Shock: ±.25%
Vibration, High Frequency: ±.25%
Life: ±1.0%
25°C Power Rating: ±1.0%
High Temperature Exposure: ±.50%
Low Temperature Storage: ±.25%
Insulation Resistance: 10,000 Megohms

POWER RATING

	8 PIN	10 PIN
Circuit 1—Total package	1.25W	1.62W
Single resistor	.18W	.18W
Circuit 3—Total package	.84W	1.05W
Single resistor	.21W	.21W

(Rating @ 70°C is 67% of 25° rating)

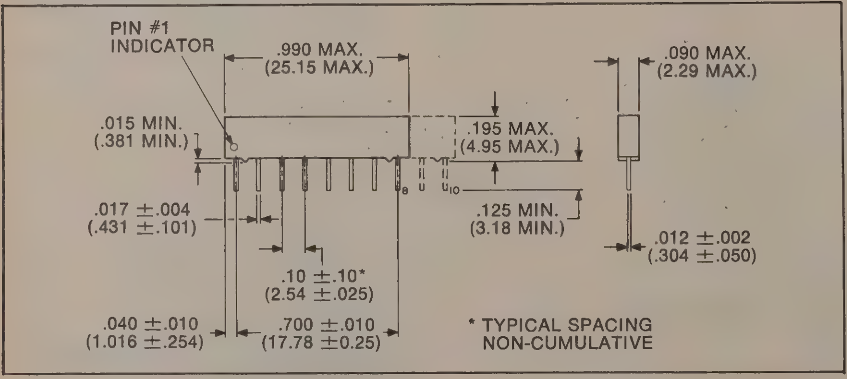




STANDARD RESISTANCE VALUES (OHMS)

22	82	330	1.0K	3.3K	10K	33K	100K
27	100	390	1.2K	3.9K	12K	39K	120K
33	120	470	1.5K	4.7K	15K	47K	150K
39	150	560	1.8K	5.6K	18K	56K	
47	180	680	2.2K	6.8K	22K	68K	
56	220	820	2.7K	8.2K	27K	82K	
68	270						

DIMENSIONS — IN. AND (mm)


PIN #1 INDICATOR
.990 MAX. (25.15 MAX.)
.090 MAX. (2.29 MAX.)
.015 MIN. (.381 MIN.)
.195 MAX. (4.95 MAX.)
8
10
.017 ±.004 (.431 ±.101)
.125 MIN. (3.18 MIN.)
.012 ±.002 (.304 ±.050)
.10 ±.10* (2.54 ±.025)
.040 ±.010 (1.016 ±.254)
.700 ±.010 (17.78 ±0.25)

* TYPICAL SPACING NON-CUMULATIVE

HOW TO ORDER

6 08 - 1 - 223 - G

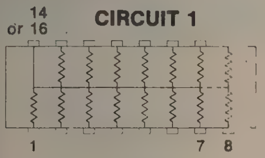
Product Family (6 = .195″ SIP)
No. of Pins
Circuit Type (1 = N-1)
(3 = N/2)
2 Digit Range and Digit Multiplier
Tolerance (G = 2%, J = 5%)

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

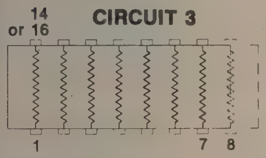
THICK FILM MOLDED 14- AND 16-PIN DIP NETWORKS

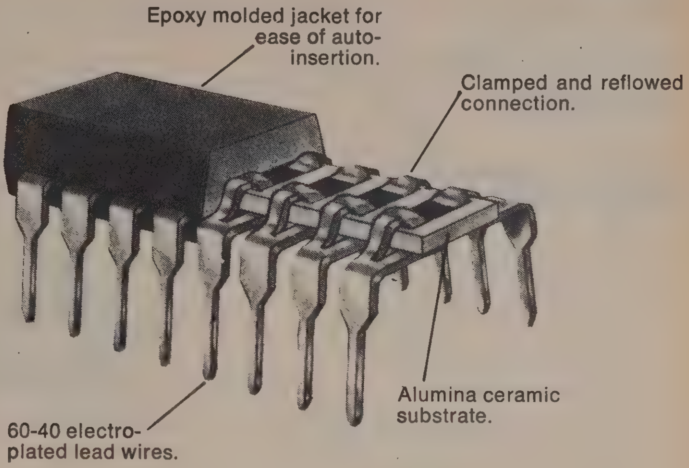
STANDARD CIRCUITS

CIRCUIT 1



CIRCUIT 3




Epoxy molded jacket for ease of auto-insertion.
Clamped and reflowed connection.
Alumina ceramic substrate.
60-40 electro-plated lead wires.

SPECIFICATIONS

ELECTRICAL

Resistance Range: 22Ω to 1 Meg
Resistance Tolerance: ±2% and ±5%
Temperature Coefficient: ±150 ppm/°C
TC Tracking: 50 ppm/°C typical
Max. Continuous Working Voltage: 100V
Operating Temperature: −55°C to 150°C

PHYSICAL

Element: Fused thick-film composition
Substrate: 96% Alumina
Body: Molded epoxy
Terminals: Tinned copper
Lead Pull: 4.5 pounds
Lead Solderability: MIL-STD-202, Method 208, and MIL-STD-883, Method 2003
Resistance to Soldering Heat: MIL-STD-202E, Method 210A, Cond. C
Marking Resistance to Solvents: MIL-STD-202, Method 215

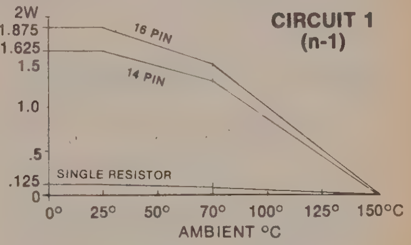
ENVIRONMENTAL PER MIL-R-83401

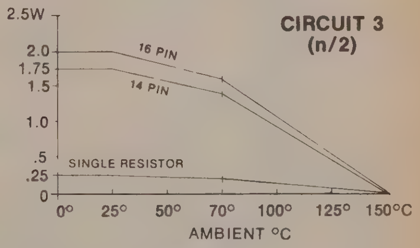
TCR: ±150 PPM/°C
Thermal Shock: ±.50%
Power Conditioning: ±.50%
Low Temperature Operation: ±.25%
Short Time Overload: ±.25%
Terminal Strength: ±.25%
Resistance to Solder Heat: ±.25%
Moisture Resistance: ±.50%
Shock: ±.25%
Vibration, High Frequency: ±.25%
Life: ±1.0%
25°C Power Rating: ±1.0%
High Temperature Exposure: ±.50%
Low Temperature Storage: ±.25%
Insulation Resistance: 10,000 Megohms

POWER RATING

	14 PIN	16 PIN
Circuit 1—Total package	1.625W	1.875W
Single resistor	.125W	.125W
Circuit 3—Total package	1.75W	2.00W
Single resistor	.25W	.25W

(Rating @ 70°C is 80% of 25° rating)

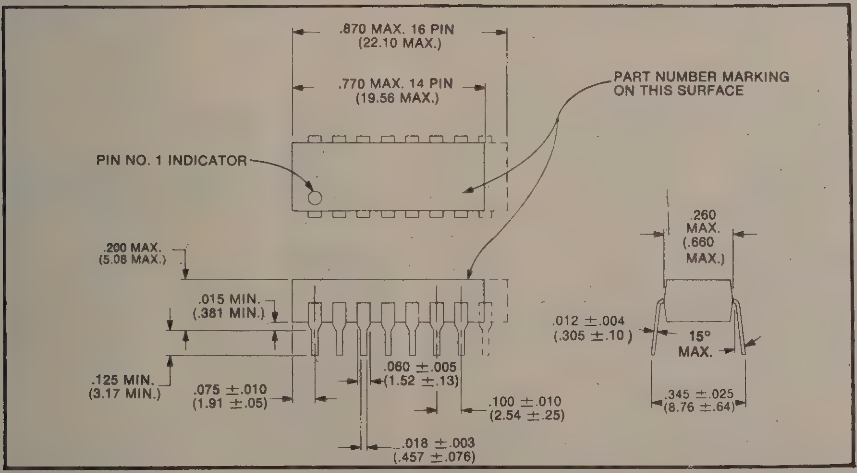




STANDARD RESISTANCE VALUES (OHMS)

22	82	330	1.0K	3.3K	10K	33K	100K	330K
27	100	390	1.2K	3.9K	12K	39K	120K	390K
33	120	470	1.5K	4.7K	15K	47K	150K	470K
39	150	560	1.8K	5.6K	18K	56K	180K	560K
47	180	680	2.2K	6.8K	22K	68K	220K	680K
56	220	820	2.7K	8.2K	27K	82K	270K	820K
68	270							1 MEG

DIMENSIONS — IN. AND (mm)


.870 MAX. 16 PIN
(22.10 MAX.)
.770 MAX. 14 PIN
(19.56 MAX.)
PART NUMBER MARKING
ON THIS SURFACE
PIN NO. 1 INDICATOR
.200 MAX.
(5.08 MAX.)
.015 MIN.
(.381 MIN.)
.125 MIN.
(3.17 MIN.)
.075 ±.010
(1.91 ±.05)
.060 ±.005
(1.52 ±.13)
.100 ±.010
(2.54 ±.25)
.018 ±.003
(.457 ±.076)
.260
MAX.
(.660
MAX.)
.012 ±.004
(.305 ±.10)
15°
MAX.
.345 ±.025
(8.76 ±.64)

HOW TO ORDER

5 14 - 1 - 223 - G

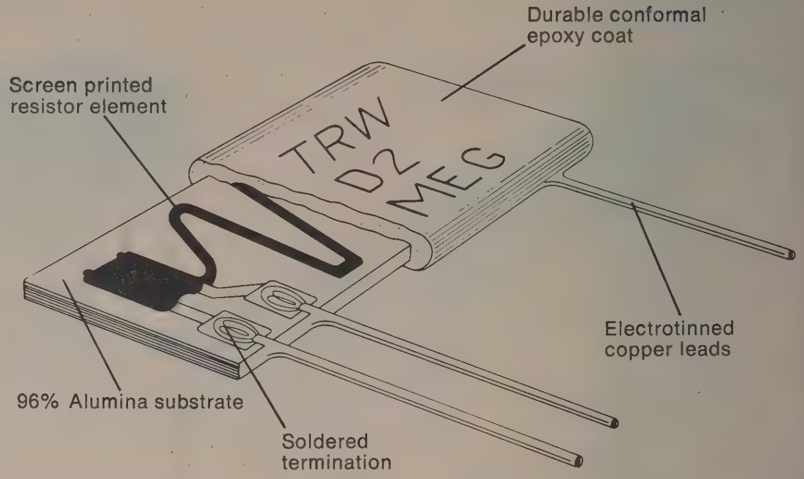
Product Family (5 = DIP)
No. of Pins
Circuit Type (1 = N-1)
(3 = N/2)
2 Digit Range and Digit Multiplier
Tolerance (G = 2%, J = 5%)

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

THICK FILM HIGH VOLTAGE DIVIDERS

RD SERIES

- ☐ TRW proprietary thick film materials and technology
- ☐ Space-saving thin body design
- ☐ PC board compatible
- ☐ High voltage stability
- ☐ Wide resistance and ratio selection
- ☐ For use in CRT circuits, voltage multipliers, power supplies, voltage readout sensing


Durable conformal epoxy coat
Screen printed resistor element
TRW
D2
MEG
Electrotinned copper leads
96% Alumina substrate
Soldered termination

SPECIFICATIONS

Power Rating: 3 to 7 watts

Resistance Range: 1MΩ to 500MΩ

Max. DC Voltage: 10 kV to 20 kV

Resistance Tolerance: 10%, 20%

Ratios: 1:1 to 2000:1

Ratio Tolerance: 3% to 5%

Ratio Tracking: ±50 ppm/°C

Temperature Coefficient: ±200 ppm/°C overall, ±50 ppm/°C ratio

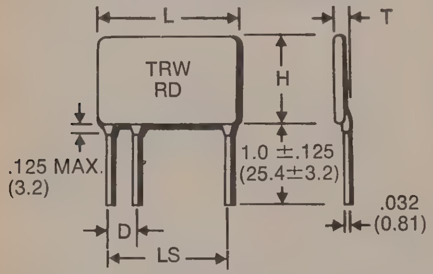
Voltage Coefficient: 5 ppm/V overall, 5 ppm/V ratio

1000 Hour 25°C Load Life ΔR: 2% overall, 1% ratio

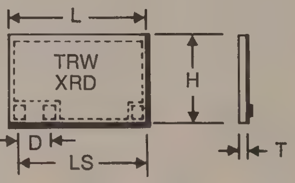
Moisture Resistance: 1% overall, 0.5% ratio

Operating Temp.: −55°C to +150°C

STANDARD CONFIGURATION



ALTERNATE CONFIGURATION



TRW Type	25°C Power Rating	Max.* DC Voltage	Physical Dimensions† — In. and (mm) L ±.062 (1.57)	H ±.062 (1.57)	LS ±.062 (1.57)	T Max.
RD-2	3 watts	10KV	1.03 (26.16)	1.03 (26.16)	0.90 (22.86)	.150 (3.81)
RD-3	4 watts	15KV	1.53 (38.86)	1.03 (26.16)	1.40 (35.56)	.150 (3.81)
RD-5	7 watts	20KV	2.03 (51.56)	1.03 (26.16)	1.80 (45.72)	.150 (3.81)
XRD-2	3 watts	10KV	1.00 (25.40)	1.00 (25.40)	0.90 (22.86)	.05 (1.27)
XRD-3	4 watts	15KV	1.50 (38.10)	1.00 (25.40)	1.40 (35.56)	.05 (1.27)
XRD-5	7 watts	20KV	2.00 (50.80)	1.00 (25.40)	1.80 (45.72)	.065 (1.65)

* Power and voltage rating can be higher for potted applications. Consult factory for overrating information

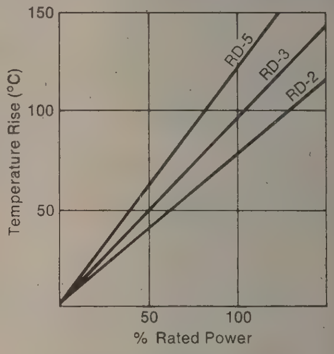
† Tolerance for XRD dimensions L, H, LS, and D is ±.01″ (±.254mm)

NOTE: The XRD is an RD unit without leads. It is provided with screen printed epoxy overcoat and exposed soldered termination pads, and is designed for use in potted assembly applications.

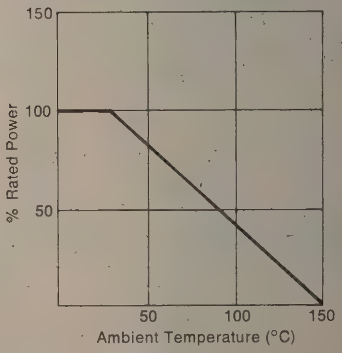
D — TYPICAL NOMINAL DIMENSION

TRW Type	R1/R2 Ratio Range Up to 1:1	2:1 to 5:1	6:1 to 25:1	25:1 to 99:1	100:1 & Up
RD-2 XRD-2	.40 (10.2)	.30 (7.6)	.30 (7.6)	.30 (7.6)	.20 (5.1)
RD-3 XRD-3	.70 (17.8)	.40 (10.2)	.30 (7.6)	.20 (5.1)	.20 (5.1)
RD-5 XRD-5	.70 (17.8)	.40 (10.2)	.40 (10.2)	.20 (5.1)	.20 (5.1)

HOT SPOT TEMPERATURE RISE



POWER DERATING



HOW TO ORDER

Sample Part No.:

RD-3 - 10M ±10% - 25:1 - ±5%

TRW Type

Resistance Value (megohms)
See specification table for values available

Resistance Tolerance
(±10%, ±20%)

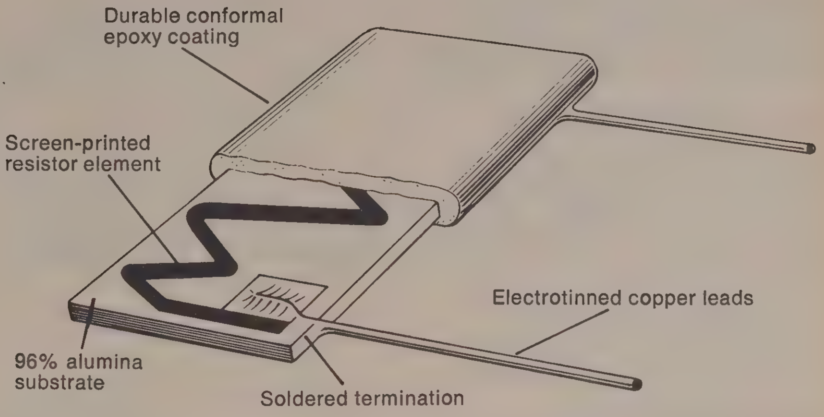
Divider Ratio (R1/R2)

Ratio Tolerance

HIGH VOLTAGE THICK FILM RESISTORS

RB SERIES

- ☐ 1 watt to 5 watts
- ☐ 1 ohm to 500 megohms
- ☐ 10 KV to 25 KV
- ☐ 5% to 20% tolerance
- ☐ TCR of ±200 ppm/°C


Durable conformal epoxy coating
Screen-printed resistor element
Electrotinned copper leads
96% alumina substrate
Soldered termination

FEATURES

- ☐ TRW proprietary non-noble thick film technology
- ☐ Space saving thin body design
- ☐ PC board compatible
- ☐ High voltage stability
- ☐ Low inductance design
- ☐ Backed by TRW high volume production capability

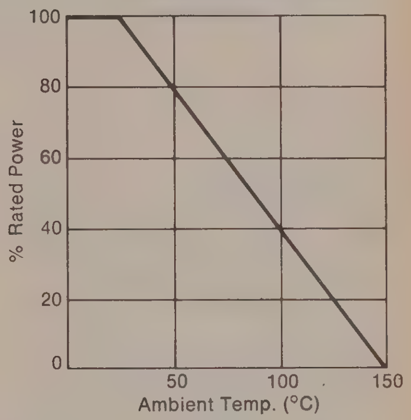
APPLICATIONS

- ☐ High voltage power resistors for use in:
  - Power supplies
  - Voltage multipliers
  - Electrostatic equipment
  - Copiers
- ☐ Low resistance - low inductance power resistors

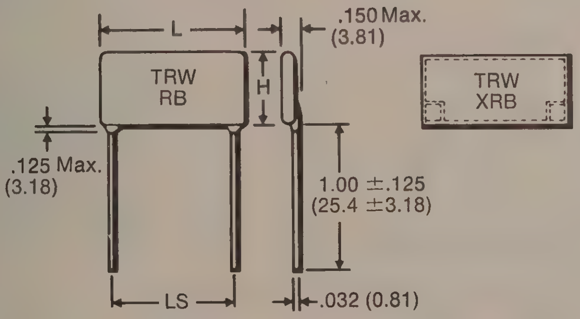
TYPICAL PERFORMANCE CHARACTERISTICS

Temperature Coefficient	±200 ppm/°C
Voltage Coefficient	±5 ppm/V
1000 hr 25°C Load Life	2%
Moisture Resistance	1%
Thermal Shock	0.5%
Operating Temperature	−55 to +150°C

POWER DERATING



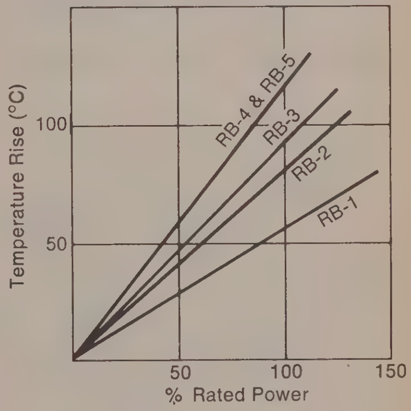
DIMENSIONS — IN. and (mm)


L
.150 Max.
(3.81)
TRW
RB
H
TRW
XRB
.125 Max.
(3.18)
1.00 ±.125
(25.4 ±3.18)
LS
.032 (0.81)

TRW Type†	25°C Power Rating	Max. DC Voltage	Physical Dimensions L ±.062 (±1.57)	H ±.062 (±1.57)	LS ±.062 (±1.57)
RB-1	1 watt	10KV	1.03 (26.16)	.28 (7.11)	.90 (22.86)
RB-2	2 watts	10KV	1.03 (26.16)	.53 (13.46)	.90 (22.86)
RB-3	3 watts	15KV	1.53 (38.86)	.53 (13.46)	1.40 (35.56)
RB-4	4 watts	20KV	2.03 (51.56)	.53 (13.46)	1.90 (48.26)
RB-5	5 watts	25KV	2.53 (64.26)	.53 (13.46)	2.40 (60.96)

† All RB sizes are available in XRB style. The XRB is an RB unit without leads. It is provided with screen printed epoxy overcoat and exposed soldered termination pads. Designed for use in potted assembly applications.

HOT SPOT TEMPERATURE RISE



HOW TO ORDER

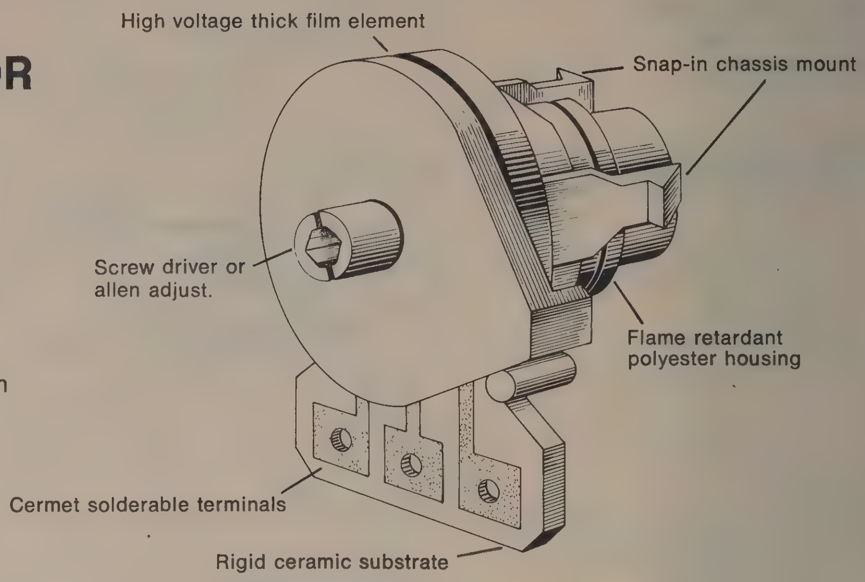
Sample Part No.:

RB - 3 - 100 MegΩ - 5%

TRW Type — RB - 3
Resistance Value — 100 MegΩ
Tolerance — 5%

HIGH-VOLTAGE FOCUS RESISTOR

- ☐ 3 kV voltage rating
- ☐ Resistance ranges from 1 megohm to 100 megohms
- ☐ Rated 1 w at 65°C, derated to 0 at 105°C
- ☐ Potential applications include electrostatic copiers, CRT displays, computer terminals, video games and instrumentation
- ☐ Metal Glaze™ element


High voltage thick film element
Snap-in chassis mount
Screw driver or allen adjust.
Flame retardant polyester housing
Cermet solderable terminals
Rigid ceramic substrate

SPECIFICATIONS

Resistance Tolerance: Standard: ±20%; Special: ±10%

Voltage Rating: Across end terminals: 3000 VDC; Mounting plate to terminals: 7500 VDC

Tapers Available: Linear only ±20%

Terminal Minimum Resistance (Both Ends of Rotation): 10% of total resistance maximum

Temperature Coefficient (−55° to +105°C) ±400 ppm/°C

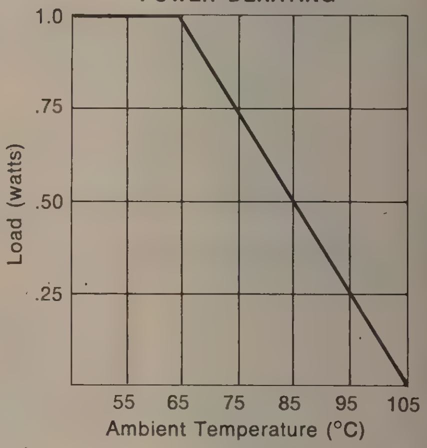
Voltage Coefficient: Less than 10 ppm/V

Rotational Torque: 1 - 8 in. oz.

Molded Materials: SE-O Rated

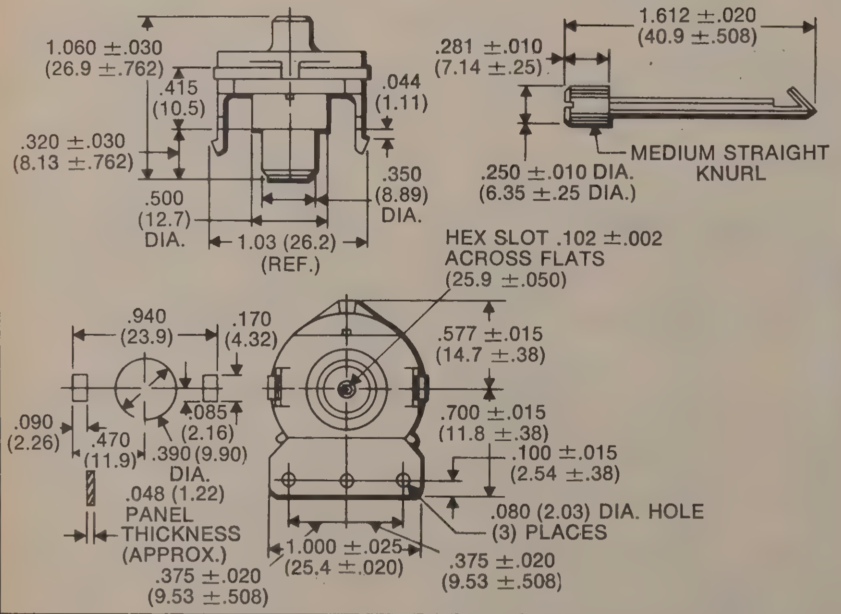
Environmental Performance:
- Load Life: Maximum △R after 1000 hours at 65°C ±5%
- Rotational Life (No Load): Maximum △R (after 500 cycles) ±10%
- Humidity (No Load): Maximum △R (after 240 hours at 40°C and 90 - 95% R.H.) ±5%

POWER DERATING



Note: Available with leads for PC board mounting.

DIMENSIONS — IN. AND (mm)

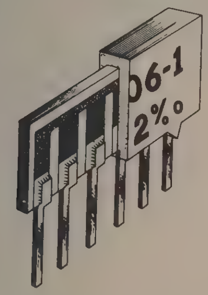

1.060 ±.030 (26.9 ±.762)
.415 (10.5)
.044 (1.11)
.320 ±.030 (8.13 ±.762)
.350 (8.89) DIA.
.500 (12.7) DIA.
1.03 (26.2) (REF.)
.281 ±.010 (7.14 ±.25)
1.612 ±.020 (40.9 ±.508)
.250 ±.010 DIA. (6.35 ±.25 DIA.)
MEDIUM STRAIGHT KNURL
HEX SLOT .102 ±.002 ACROSS FLATS (25.9 ±.050)
.940 (23.9)
.170 (4.32)
.577 ±.015 (14.7 ±.38)
.090 (2.26)
.085 (2.16)
.470 (11.9)
.390 (9.90) DIA.
.700 ±.015 (11.8 ±.38)
.100 ±.015 (2.54 ±.38)
.048 (1.22) PANEL THICKNESS (APPROX.)
.080 (2.03) DIA. HOLE (3) PLACES
1.000 ±.025 (25.4 ±.020)
.375 ±.020 (9.53 ±.508)
.375 ±.020 (9.53 ±.508)

TRW

CUSTOM THICK FILM CIRCUITS

- ☐ High reliability
- ☐ Major size reduction compared to discrete components
- ☐ Cost effective in large quantities

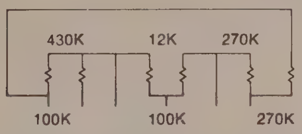
RESISTOR-ONLY CIRCUITS

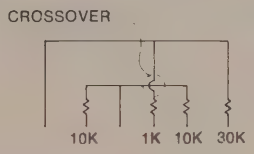


.350-in. SIP

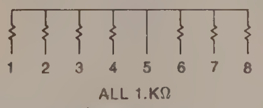
CIRCUIT VARIATIONS:

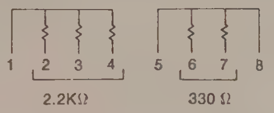
Overall the .350-in. SIP is the best choice for custom network requirements. A wide variety of circuits is possible with the extra "real estate" available on this size, including circuits requiring crossovers. Remember, however, that crossovers add significantly to the manufacturing cost of a network.

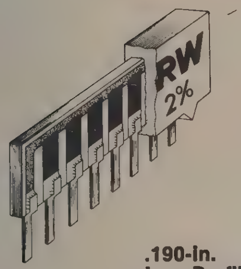

430K
12K
270K
100K
100K
270K


CROSSOVER
10K
1K
10K
30K

Straightforward variations to standard circuits of the .195-in. SIP are feasible, such as different common location(s), missing resistors, and multiple resistances.


1 2 3 4 5 6 7 8
ALL 1.KΩ

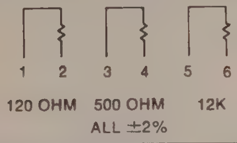

1 2 3 4 5 6 7 8
2.2KΩ
330 Ω

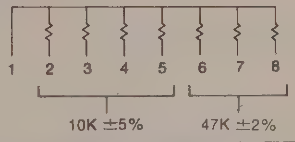


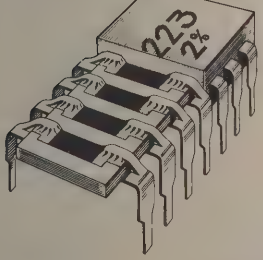
.190-in. Low-Profile SIP

MULTIPLE RESISTANCES:

Multi-value networks are available for both types. Values from 22 ohm to 1 Megohm, and multiple tolerances of ±2% and ±5% are also possible.


1 2 3 4 5 6
120 OHM
500 OHM
12K
ALL ±2%

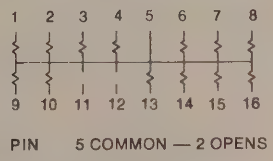

1 2 3 4 5 6 7 8
10K ±5%
47K ±2%

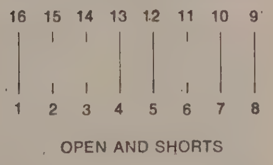


14- and 16-pin DIP

CIRCUIT VARIATIONS:

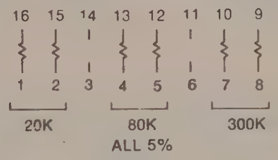
The position of the common pin can be varied, and open or shorted pins incorporated.

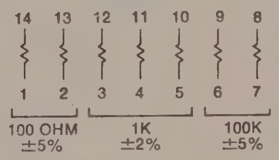

1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
PIN 5 COMMON — 2 OPENS


16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8
OPEN AND SHORTS

MULTIPLE RESISTANCES:

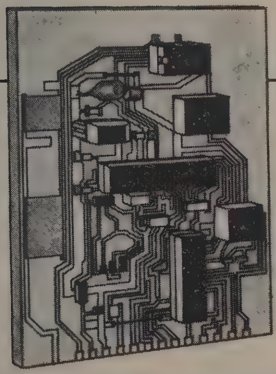
Values from 22 ohm to 1 Megohm are available, as are multiple tolerances of ±2% and ±5%.


16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8
20K
80K
300K
ALL 5%


14 13 12 11 10 9 8
1 2 3 4 5 6 7
100 OHM ±5%
1K ±2%
100K ±5%

ADDITIONAL FEATURES:

- Top Stamping — to customer specification; one 8-character line
- Missing Pins—removed external to SIP molded package, but within standoff profile
- TCR — ±150PPM
- Ratio Matching — ±2% between specified resistor pairs — ratios not to exceed 20:1



COMPLEX CUSTOM FUNCTIONAL CIRCUITS

Custom functional circuits are most applicable where size reduction and reliability are prime factors. Generally, outboard components (diodes, transistors, ICs and capacitors) are surface mounted. Resistors and conductors are screen printed and fired at 900 to 1000°C directly to the ceramic substrate.

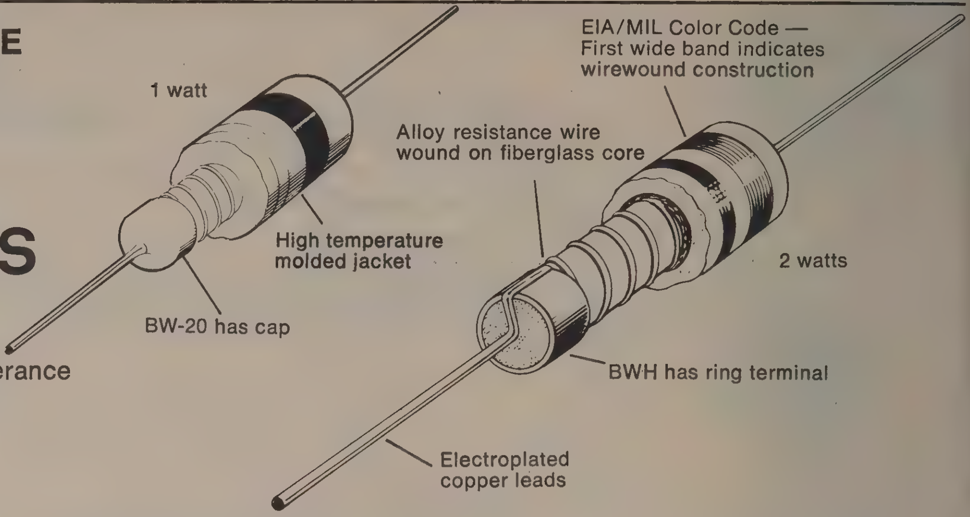
TRW circuit features include:

- High-conductivity, leach-resistant copper conductors
- 10-ohm to 10-megohm/square resistors
- Stability characteristics as in R-only circuits above
- Cost effectivity of non-noble Metal Glaze™ thick film

GENERAL-PURPOSE LOW-POWER MOLDED WIREWOUNDS

BW SERIES

- ☐ 1 watt, 2 watts
- ☐ ±2%, ±5%, ±10% tolerance
- ☐ 0.05 ohm to 2400 ohms
- ☐ TCs as low as ±150 ppm/°C


1 watt
High temperature molded jacket
BW-20 has cap
EIA/MIL Color Code — First wide band indicates wirewound construction
Alloy resistance wire wound on fiberglass core
2 watts
BWH has ring terminal
Electroplated copper leads

SPECIFICATIONS

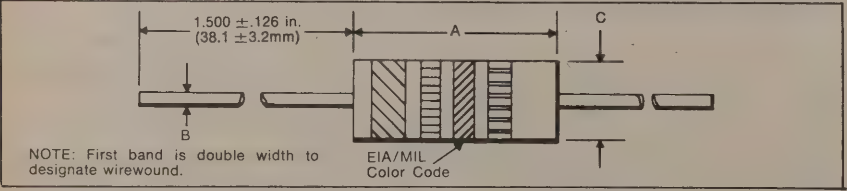
TRW Type	BW-20	BWH
EIA RS-344 Style	CRU1	CRU2
MIL-R-11 Style Equivalent	RC20/RC32	RC32/RC42
Resistance - Standard	0.10 Ohms thru 1200 Ohms	0.05 Ohms thru 2400 Ohms
Tolerance - Standard	±2%, ±5%, ±10%	±5%, ±10%
Power Rating	1-watt @ 50°C ¾-watt @ 70°C ½-watt @ 100°C, derating to 0 @ 160°C	2-watts @ 70°C 1-watt @ 115°C ½-watt @ 137°C, derating to 0 @ 160°C
Load Life Stability, Max ΔR	1 watt @ 50°C: ±5%	2-watts @ 70°C: ±10%
Max. Continuous Working Voltage	$\sqrt{PR}$	$\sqrt{PR}$
Min. Insulation Resistance — Dry	10,000 Megohms	10,000 Megohms
Min. Insulation Resistance — Wet	100 Megohms	100 Megohms
Min. Dielectric Withstanding Voltage		
Atmospheric Pressure	700 Volts, RMS	1000 Volts, RMS
Reduced Pressure	450 Volts, RMS	625 Volts, RMS
Hot Spot Temperature Rise	100°C @ 1 watt	115°C @ 2 watts
Current Noise	Negligible	Negligible
Marking	Standard EIA/MIL Color Code (double width first band)	Standard EIA/MIL Color Code (double width first band)

TEMPERATURE COEFFICIENT

TRW Type	Power Rating	Resistance Range	Temperature Coefficient Maximum ΔR
BW-20	1-watt	0.10Ω-0.15Ω 0.16Ω-0.62Ω 0.68Ω-1200Ω	+600 ppm or +0.06%/°C +300 ppm or +0.03%/°C ±150 ppm or ±0.015%/°C
BWH	2-watts	0.05Ω-0.16Ω 0.18Ω-0.68Ω 0.75Ω-2400Ω	+1000 ppm or +0.10%/°C +800 ppm or +0.08%/°C ±400 ppm or ±0.04%/°C

DIMENSIONS — IN. AND (mm)

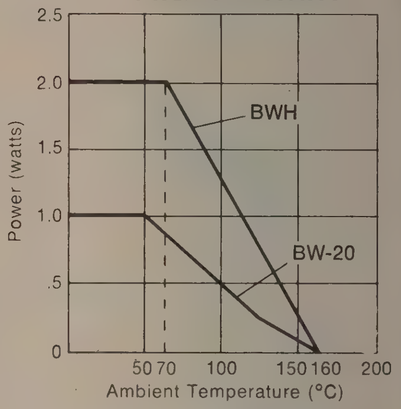
TRW Type	A ±.010 (.25)	B ±.001 (.03)	C ±.008 (.20)
BW-20	.390 (9.91)	.032 (.813)	.140 (3.56)
BWH	.562 (14.3)	.040 (1.02)	.225 (5.72)


1.500 ±.126 in. (38.1 ±3.2mm)
A
C
B
EIA/MIL Color Code

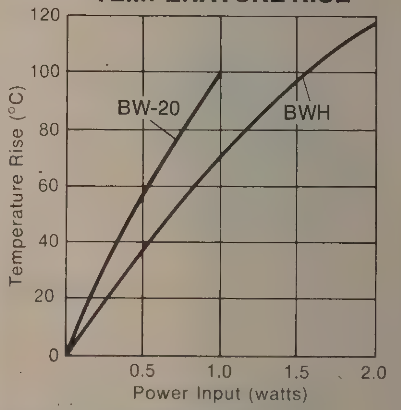
NOTE: First band is double width to designate wirewound.

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

POWER DERATING



TEMPERATURE RISE



HOW TO ORDER

Sample Part No.:

BWH — 1k — 5%

TRW Type
BW-20=1-watt
BWH=2-watts

Resistance Range
Expressed in ohms.
(Standard EIA/MIL Values)

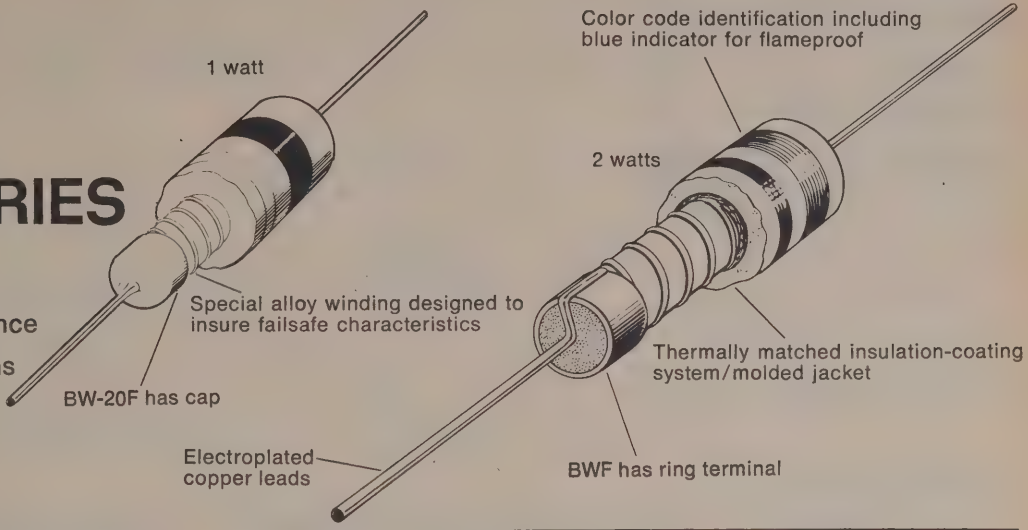
Tolerance
±2%, ±5%, ±10%

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, P.O. BOX 1860, BOONE, NC 28607 • (704) 264-8861

FAILSAFE MOLDED WIREWOUNDS

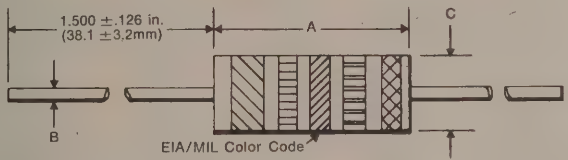
BWF SERIES

- ☐ 1 watt, 2 watts
- ☐ ±5% , ±10% tolerance
- ☐ 0.1 ohm to 1000 ohms
- ☐ TCs as low as ±150 ppm/°C


1 watt
2 watts
Color code identification including blue indicator for flameproof
Special alloy winding designed to insure failsafe characteristics
BW-20F has cap
Thermally matched insulation-coating system/molded jacket
Electroplated copper leads
BWF has ring terminal

SPECIFICATIONS

TRW Type	BW-20F	BWF
EIA RS-334 Style	CRU-1	CRU2
MIL-R-11 Style Equiv.	RC20/RC32	RC32/RC42
Resistance Standard	0.10Ω thru 1000Ω	0.10Ω thru 1000Ω
Tolerance Standard	±5%, ±10%	±5%, ±10%
Power Rating	1-watt @ 50°C ¾-watt @ 70°C, derating to 0 @ 160°C	2-watt @ 70°C ½-watt @ 137°C, derating to 0 @ 150°C
Max. Continuous Working Voltage	$\sqrt{PR}$	$\sqrt{PR}$
Min. Insulation Resistance — Dry Wet	10,000 Megohms 100 Megohms	10,000 Megohms 100 Megohms
Min. Dielectric Withstanding Voltage Atmospheric Pressure Reduced Pressure	 700 Volts R.M.S. 450 Volts R.M.S.	 1000 Volts R.M.S. 625 Volts R.M.S.
Current Noise	Negligible	Negligible
Load Life Stability — Max. ΔR	1-watt @ 50°C — ±5%	2-watt @ 70°C — ±10%
Temperature Coefficient — Max. ΔR	For 0.1Ω, +1000 ppm or +0.10%/°C For 0.11Ω to 0.18Ω, +600 ppm or +0.06%/°C For 0.20Ω to 0.68Ω, +300 ppm or +0.03%/°C For 0.75Ω to 1000Ω, ±150 ppm or ±0.015%/°C	For 0.10Ω, +1500 ppm or +0.15%/°C For 0.11Ω to 0.16Ω, +1000 ppm or +0.10%/°C For 0.18Ω to 0.68Ω, +800 ppm or +0.08%/°C For 0.75Ω to 1000Ω, ±400 ppm or ±0.04%/°C

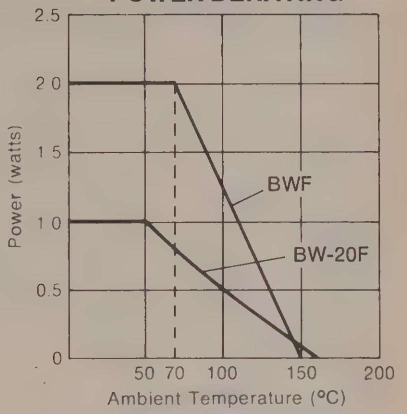

1.500 ±.126 in.
(38.1 ±3.2mm)
A
C
B
EIA/MIL Color Code

NOTE: First band is double width to designate wirewound.
Fifth blue band designates flameproof on BWF and BW-20F.

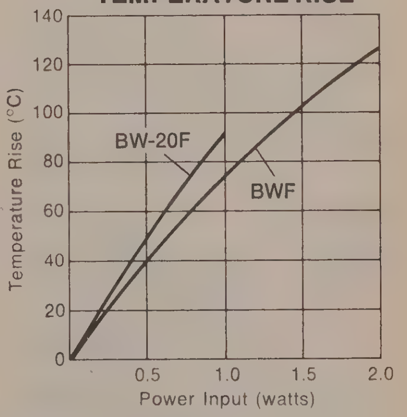
DIMENSIONS — IN. AND (mm)

TRW Type	A ±.010 (.25)	B ±.001 (.03)	C ±.008 (.20)
BW-20F	.390 (9.91)	.032 (.813)	.140 (3.56)
BWF	.562 (14.3)	.040 (1.02)	.225 (5.72)

POWER DERATING



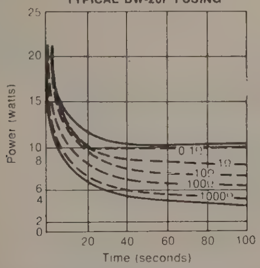
TEMPERATURE RISE



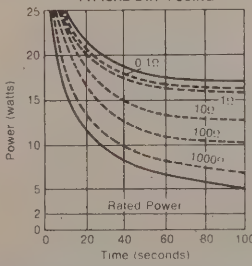
SPECIAL APPLICATIONS

A wide selection of special fusing times, temperature coefficients and very low resistances can be custom designed to your specific applications. Contact the factory for information.

TYPICAL BW-20F FUSING



TYPICAL BWF FUSING



HOW TO ORDER

Sample Part No.:

BW-20F - 1k - 5%

TRW Type
BW-20F = 1W
BWF = 2W

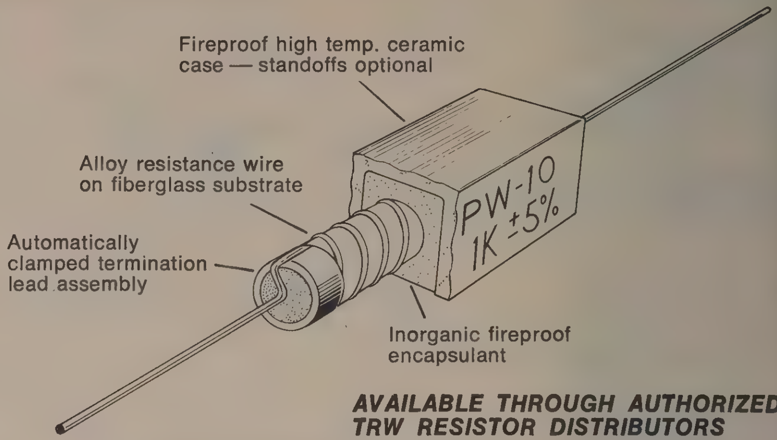
Resistance Value
Expressed in ohms

Tolerance
±5%, 10%

GENERAL-PURPOSE POWER WIREWOUNDS

PW SERIES

- ☐ 3 watts to 50 watts
- ☐ ±10%, ±5% tolerance
- ☐ 0.18 ohms to 30k ohms
- ☐ TCs from 300 ppm/°C to +5500 ppm/°C


Fireproof high temp. ceramic case — standoffs optional
Alloy resistance wire on fiberglass substrate
Automatically clamped termination lead assembly
Inorganic fireproof encapsulant
PW-10
1K ±5%

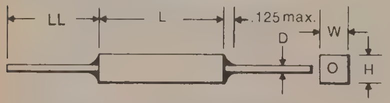
AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

SPECIFICATIONS

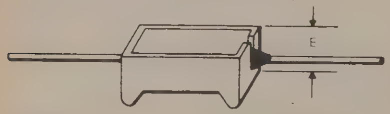
TRW Type	Power Rating at 25°C (watts)	Standard Resistance Range (ohms)	Standard Temperature Coefficients 0.06%/°C over R range of	Standard Temperature Coefficients 0.03%/°C over R range of	Special Temperature Coefficients +0.55%/°C over R range of	Special Temperature Coefficients +0.45%/°C over R range of	Special Temperature Coefficients +0.26%/°C over R range of
PW-1	1	0.18 to 2.0K	0.18 to 0.62	0.68 to 2K	0.1 to 27	0.24 to 100	1.0 to 10
PW-2	2	0.18 to 2.4K	0.18 to 0.62	0.68 to 2.4K	0.1 to 30	0.24 to 130	1.0 to 10
PW-3	3	0.1 to 7.5K	0.1 to 0.27	0.30 to 7.5K	0.1 to 86	0.1 to 270	0.24 to 20
PW-5	5	0.1 to 8.5K	0.1 to 0.36	0.39 to 8.5K	0.1 to 68	0.1 to 300	0.27 to 22
PW-7	7	0.1 to 18K	0.1 to 0.56	0.62 to 18K	0.1 to 150	0.15 to 680	0.62 to 51
PW-10	10	0.18 to 30K	0.18 to 0.91	1.0 to 30K	0.1 to 240	0.24 to 1100	1.0 to 82
PW-15	15	0.18 to 30K	0.18 to 0.91	1.0 to 30K	0.1 to 240	0.24 to 1100	1.0 to 82
PW-18	18	0.18 to 22K	0.18 to 0.91	1.0 to 22K	0.1 to 200	0.24 to 1000	1.0 to 70
PW-22	22	0.27 to 12K	0.27 to 1.3	1.5 to 12K	0.15 to 360	0.36 to 1800	1.5 to 120
PW-25	25	0.27 to 10K	0.27 to 1.3	1.5 to 10K	0.15 to 300	0.36 to 1200	1.5 to 100
PW-30	30	0.5 to 1.2K	*	*	*	*	*
PW-40	40	0.65 to 1.5K	*	*	*	*	*
PW-50E	50	0.8 to 1.8K	*	*	*	*	*

* Consult Factory

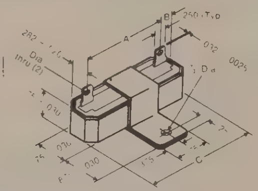
PW-1 TO PW-25
STANDARD CONFIGURATION



ALTERNATE CONFIGURATION



PW-30 TO PW-50E



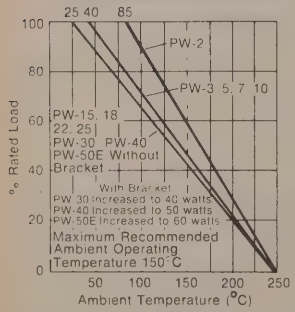
DIMENSIONS — IN. AND (mm)

TRW Type	L ±.03 (.8)	W ±.03 (.8)	H ±.03 (.8)	D-Dia. ±.002	E ±.03 (.8)	LL min.
PW-1	.58 (14.7)	.25 (6.35)	.25 (6.35)	.032 (.8)	—	1.44 (36.6)
PW-2	.69 (17.5)	.25 (6,35)	.25 (6.35)	.032 (.8)	.31 (7.87)	1.44 (36.6)
PW-3	.88 (22.4)	.31 (7.87)	.31 (7.87)	.036 (.9)	.38 (9.65)	1.44 (36.6)
PW-5	.88 (22.4)	.38 (9.65)	.34 (8.89)	.036 (.9)	.41 (10.4)	1.50 (38.1)
PW-7	1.39 (35.3)	.38 (9.65)	.34 (8.89)	.036 (.9)	.47 (11.9)	1.50 (38.1)
PW-10	1.88 (47.8)	.38 (9.65)	.34 (8.89)	.036 (.9)	.47 (11.9)	1.50 (38.1)
PW-15	1.88 (47.8)	.50 (12.7)	.50 (12.7)	.036 (.9)	.63 (16.0)	1.50 (38.1)
PW-18	1.88 (47.8)	.50 (12.7)	.50 (12.7)	.036 (.9)	.63 (16.0)	1.50 (38.1)
PW-22	2.50 (63.5)	.50 (12.7)	.50 (12.7)	.040 (1.0)	.63 (16.0)	1.50 (38.1)
PW-25	2.50 (63.5)	.50 (12.7)	.50 (12.7)	.040 (1.0)	.63 (16.0)	1.50 (38.1)

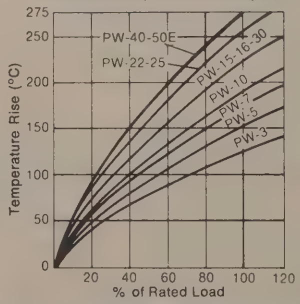
DIMENSIONS — IN. AND (mm)

TRW Type	A ±.02 (.5)	B ±.04 (1.0)	C ±.06 (1.5)
PW-30	2.00 (50.8)	.275 (7.0)	2.55 (64.8)
PW-40	2.45 (62.2)	.275 (7.0)	3.00 (76.2)
PW-50E	3.075 (78.1)	.275 (7.0)	3.625 (92.1)

POWER DERATING



TEMPERATURE RISE



HOW TO ORDER

Sample Part No.:

PW - 18 - 12k - 10%

TRW Type
PW

Power
18 = 18 watts
(See specification chart for other power ratings)

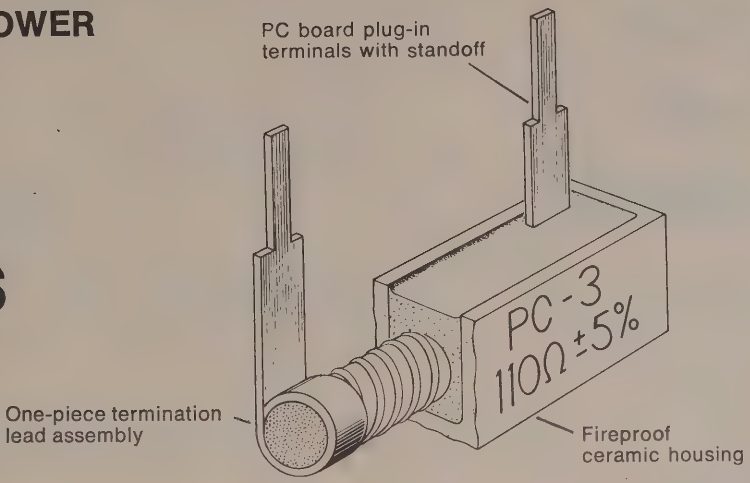
Resistance Value
Expressed in ohms
(Standard EIA/MIL Values)

Tolerance
±10%, ±5% Standard

GENERAL-PURPOSE POWER WIREWOUNDS FOR PC BOARD APPLICATIONS

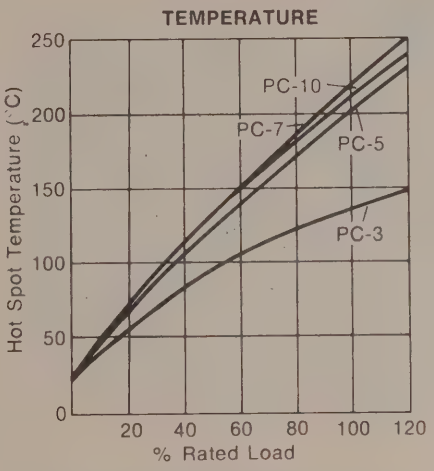
PC AND PCX SERIES

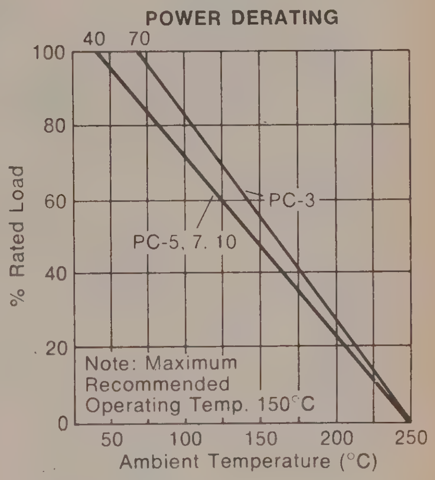
- ☐ 3 watts to 10 watts
- ☐ ±10%, ±5% tolerance
- ☐ 1 ohm to 1200 ohms
- ☐ ±400 ppm/°C TC

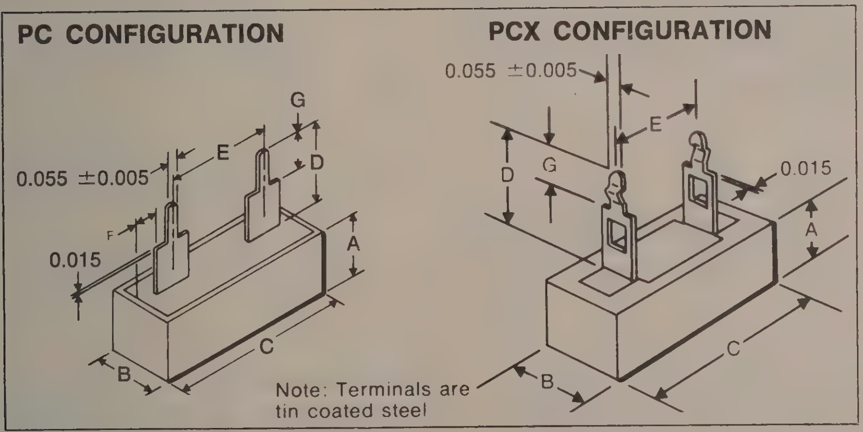

PC board plug-in terminals with standoff
PC-3
110Ω ±5%
One-piece termination lead assembly
Fireproof ceramic housing

SPECIFICATIONS

TRW Type	Power at 25°C (watts)	Resistance Range (ohms)
PC-3	3	1 to 400
PC-5, PCX-5	5	1 to 400
PC-7, PCX-7	7	1 to 1000
PC-10, PCX-10	10	1 to 1200


TEMPERATURE


POWER DERATING


PC CONFIGURATION

PCX CONFIGURATION

G
E
D
0.055 ±0.005
F
0.015
A
C
B
0.055 ±0.005
E
D
G
0.015
A
C
B

Note: Terminals are tin coated steel

HOW TO ORDER

Sample Part No.:

PC - 7 - 560Ω - 5%

TRW Type

Power
7 = 7 watts (See specification chart for other power ratings

Resistance Value
Expressed in ohms
(Standard EIA/MIL Values)

Tolerance
±10%, ±5% standard

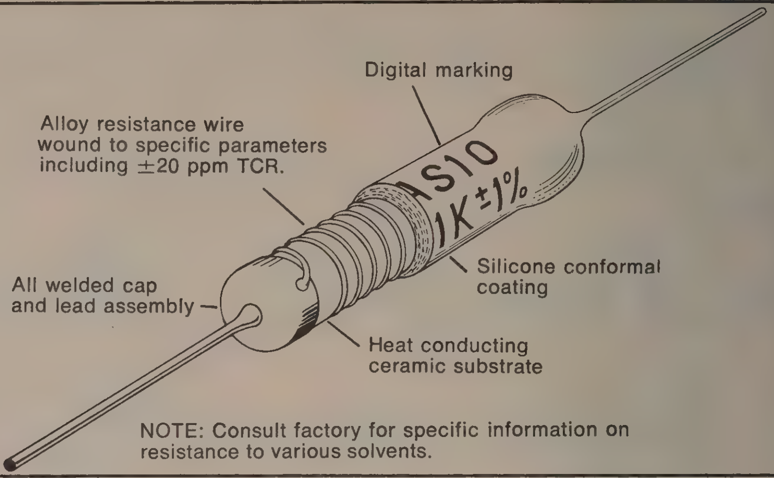
DIMENSIONS — IN. AND (mm)

TRW Type	A ±0.03 (0.8)	B ±0.03 (0.8)	C ±0.05 (1.2)	D ±0.03 (0.8)	E ±0.02 (0.51)	F	G ±0.01 (0.25)
PC-3	0.312 (7.92)	0.312 (7.92)	0.875 (22.2)	0.460 (11.7)	0.450 (11.4)	0.120 (3.05)	0.180 (4.57)
PC-5	0.343 (8.71)	0.375 (9.52)	0.875 (22.2)	0.445 (11.3)	0.450 (11.4)	0.120 (3.05)	0.180 (4.57)
PC-7	0.343 (8.71)	0.375 (9.52)	1.390 (35.3)	0.445 (11.3)	0.950 (24.1)	0.120 (3.05)	0.180 (4.57)
PC-10	0.343 (8.71)	0.375 (9.52)	1.875 (47.6)	0.445 (11.3)	1.450 (36.8)	0.120 (3.05)	0.180 (4.57)
PCX-5	0.343 (8.71)	0.375 (9.52)	0.875 (22.2)	0.445 (11.3)	0.450 (11.4)	—	0.180 (4.57)
PCX-7	0.343 (8.71)	0.375 (9.52)	1.390 (35.3)	0.445 (11.3)	0.950 (24.1)	—	0.180 (4.57)
PCX-10	0.343 (8.71)	0.375 (9.52)	1.875 (47.6)	0.445 (11.3)	1.450 (36.8)	—	0.180 (4.57)

SEMI-PRECISION POWER WIREWOUNDS

AS SERIES

- ☐ ½ watt to 10 watts
- ☐ ±5%, ±3%, ±1%, ±.5%, ±.25%, ±.1% tolerance
- ☐ 0.1 ohm to 175k ohms
- ☐ ±20 ppm/°C


Digital marking
Alloy resistance wire wound to specific parameters including ±20 ppm TCR.
AS10
1K±1%
Silicone conformal coating
All welded cap and lead assembly
Heat conducting ceramic substrate

NOTE: Consult factory for specific information on resistance to various solvents.

SPECIFICATIONS

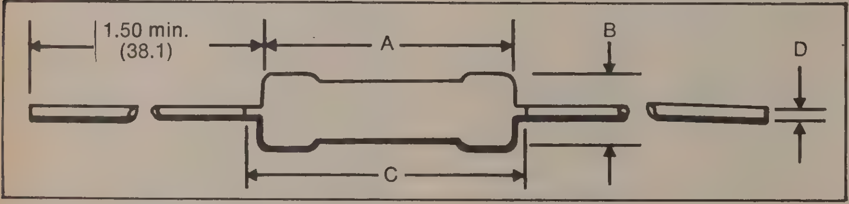
TRW Type	Equivalent MIL-R-26 Style	TRW Power Rating 275°C Max. Hot Spot (watts)		Commercial Range (ohms)		Voltage Rating (volts)	Non-Inductive Range† (ohms)		Available Resistance (ohms)‡			
		125°C	25°C	Min.	Max.		Min.	Max.	0.1% Tol.	0.25% Tol.	0.5%, 1% Tol.	3%, 5% Tol.
AS-½		0.5	1	0.1	6K	100	*	*	5-2K	2.5-2K	1-6K	0.1-6K
AS-1	RW70U	1	2	0.1	7.5K	130	0.1	3.8K	5-3K	2.5-3K	1-7.5K	0.1-7.5K
AS-2	RW69V/ RW79U	2	3	0.1	20K	140	0.5	10K	5-4.2K	2.5-4.2K	1.20K	0.1-20K
AS-2B		3	4	0.1	24K	185	0.5	12K	5-4.5K	2.5-4.5K	1-24K	0.1-24K
AS-2C		2	3	0.1	18K	160	0.2	7.5K	5-4.2K	2.5-4.2K	1-18K	0.1-18K
AS-3		3	5	0.1	30K	200	0.5	15K	5-6.5K	2.5-6.5K	1-30K	0.1-30K
AS-5	RW74U/ RW67V	5	7	0.1	60K	400	0.8	30K	5-15.5K	2.5-15.5K	1-60K	0.1-60K
AS-7		7	9	0.1	90K	600	1.0	45K	5-22K	2.5-22K	1-90K	0.1-90K
AS-10	RW68V/ RW78U	10	14	0.1	175K	1000	3.0	50K	5-55K	2.5-55K	1-175K	0.1-175K

* Inductance on AS-½ is less than 1 μH at 1 MHz.
† To order non-inductive types, add the prefix "N". Example: NAS-1, NAS-2C, etc.
‡ Lower values available upon request.

ENVIRONMENTAL TESTING

Test Condition	Max. ΔR
Load Life 1000 Hours	1.0%
Moisture Resistance	1.0%
Temperature Cycle	0.5%
Short Time Overload	0.5%

Test Condition	Max. ΔR
Low Temperature Operation	0.5%
Solder Heat	0.25%
Shock	0.5%
Vibration	0.5%

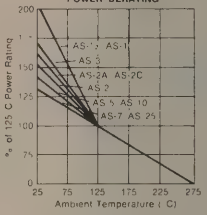


DIMENSIONS — IN. AND (mm)

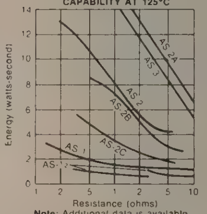
TRW Type	Dim. A ±.032	Dim. B (Max.)	Dim. C (Max.)	Dim. D (Lead Dia.)
AS-½	.312 (.79)	.094 (2.4)	.375 (9.6)	.020 (.5)
AS-1	.375 (9.6)	.125 (3.2)	.450 (11.4)	.020 (.5)
AS-2	.500 (12.7)	.250 (6.35)	.625 (15.9)	.032 (.8)
AS-2B	.562 (14.3)	.219 (5.6)	.687 (17.5)	.032 (.8)
AS-2C	.469 (11.9)	.157 (4.0)	.562 (14.3)	.032 (.8)
AS-3	.687 (17.5)	.282 (7.2)	.812 (20.6)	.040 (1.0)
AS-5	.875 (22.2)	.344 (8.8)	1.000 (25.4)	.040 (1.0)
AS-7	1.250 (31.8)	.344 (8.8)	1.375 (35.0)	.040 (1.0)
AS-10	1.812 (46.0)	.407 (10.4)	1.937 (49.2)	.040 (1.0)

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

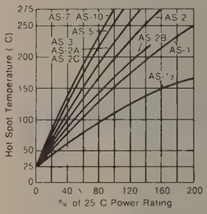
POWER DERATING

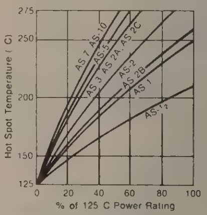


SELECTED PULSE-HANDLING CAPABILITY AT 125°C



Note· Additional data is available





HOW TO ORDER

Sample Part No.:

AS - 3 - 27Ω - .25%

TRW Type

Power
3=3 watts (See specification chart for other power ratings)

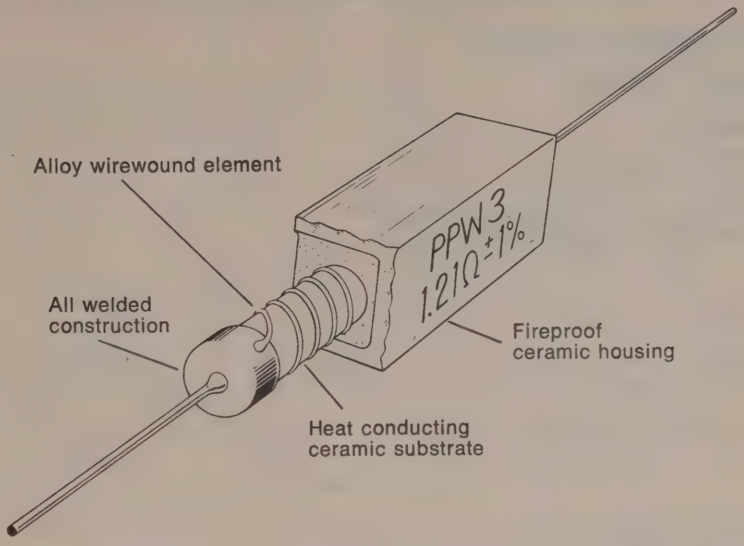
Resistance Value
Expressed in ohms
(Standard EIA/MIL Values)

Tolerance
±5%, ±3%, ±1%,
±.5, ±.25, ±.1% standard

SEMI-PRECISION POWER WIREWOUNDS FOR PULSE AND SURGE APPLICATIONS

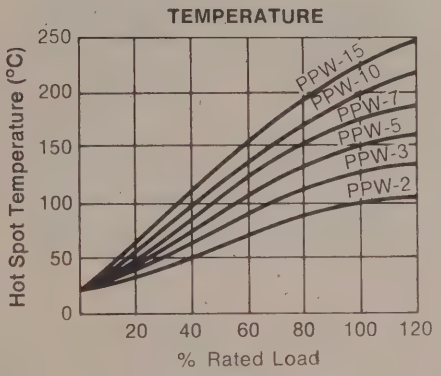
PPW SERIES

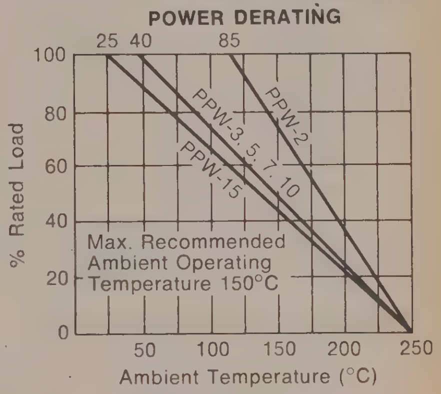
- ☐ 2 watts to 15 watts
- ☐ ±3%, ±2%, ±1% tolerance
- ☐ 1 ohm to 5000 ohms
- ☐ ±20 ppm/°C TC


Alloy wirewound element
All welded construction
Fireproof ceramic housing
Heat conducting ceramic substrate
PPW 3
1.21Ω ±1%

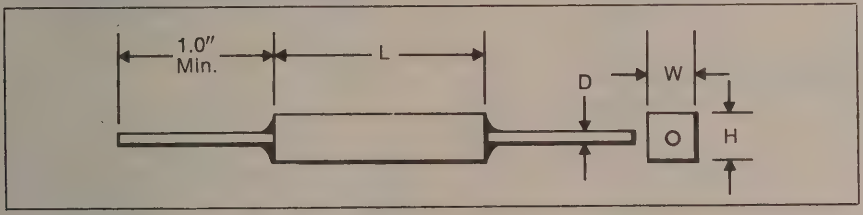
SPECIFICATIONS

TRW Type	Power at 25°C (watts)	Resistance Range (ohms)
PPW-2	2	1 to 1600
PPW-3	3	1 to 1600
PPW-5	5	1 to 1600
PPW-7	7	1 to 2500
PPW-10	10	1 to 5000
PPW-15	15	1 to 5000

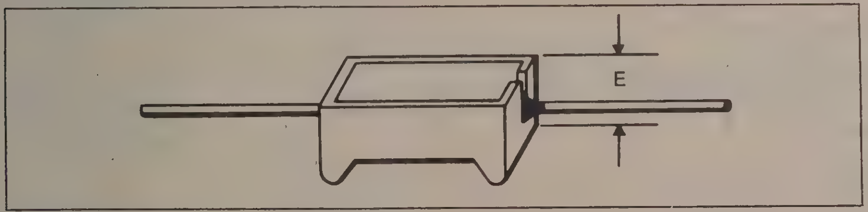




STANDARD CONFIGURATION



ALTERNATE CONFIGURATION



DIMENSIONS — IN. AND (mm)

TRW Type	L ±.03 (.8)	W ±.03 (.8)	H ±.03 (.8)	D Diameter	E ±.03 (.8)
PPW-2	.69 (17.5)	.25 (6.35)	.25 (6.35)	.032 (.8)	.31 (7.87)
PPW-3	.88 (22.3)	.31 (7.87)	.31 (7.87)	.032 (.8)	.38 (9.65)
PPW-5	.88 (22.3)	.38 (9.65)	.35 (8.89)	.032 (.8)	.41 (10.4)
PPW-7	1.39 (35.3)	.38 (9.65)	.35 (8.89)	.032 (.8)	.47 (11.9)
PPW-10	1.88 (47.7)	.38 (9.65)	.35 (8.89)	.032 (.8)	.47 (11.9)
PPW-15	1.88 (47.7)	.50 (12.7)	.50 (12.7)	.032 (.8)	.50 (12.7)

HOW TO ORDER

Sample Part No.:

PPW - 10 - 15Ω - 2%

TRW/IRC Type

Power
10 = 10 watts (See specification chart for other power ratings)

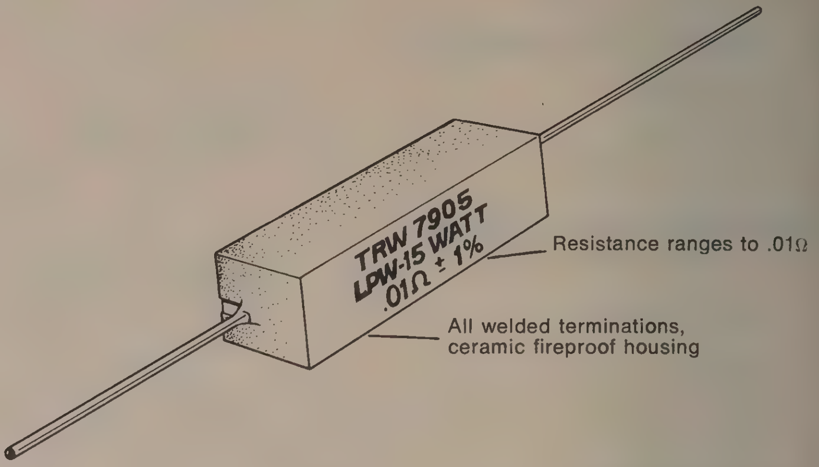
Resistance Value
Expressed in ohms (Standard EIA/MIL Values)

Tolerance
±3%, ±2%, ±1% standard

EXTREMELY-LOW-RESISTANCE POWER WIREWOUNDS

LPW SERIES

- ☐ 3 watts to 15 watts
- ☐ ±1%, ±2%, ±3%, ±5% tolerance
- ☐ .01 ohm to 1.0 ohm

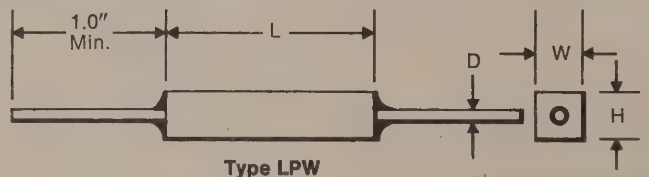

TRW 7905
LPW-15 WATT
.01Ω ± 1%
Resistance ranges to .01Ω
All welded terminations, ceramic fireproof housing

SPECIFICATIONS

TRW Type	Power at 25°C (watts)	Max. Current (amps)	Resistance Range (ohms)
LPW-3	3	10	.01 to 1.0
LPW-5	5	10	.01 to 1.0
LPW-7	7	20	.01 to 1.0
LPW-10	10	20	.01 to 1.0
LPW-15	15	20	.01 to 1.0

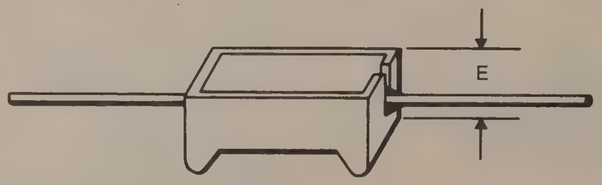
Note: Test points for LPW-3 and LPW-5 are 1.750 in. (44.45mm); test points for LPW-7, LPW-10 and LPW-15 are 2.500 in. (63.50mm).

STANDARD CONFIGURATION



Type LPW

ALTERNATE CONFIGURATION



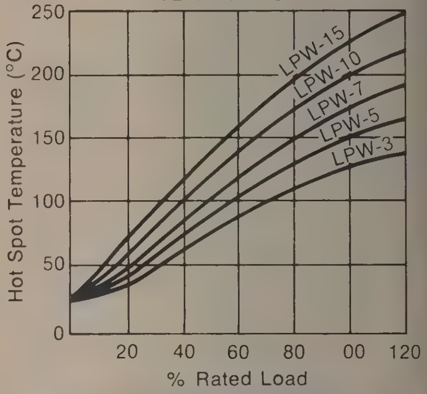
Type LPW-A

DIMENSIONS — IN. AND (mm)

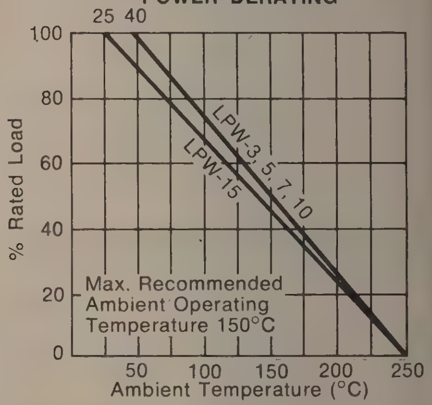
TRW Type	L +1/16, −1/32	W ±.03 (.8)	H ±.03 (.8)	D Diameter	E ±.03 (.8)
LPW-3	.88 (22.4)	.31 (7.87)	.31 (7.87)	.032*(.8)	.38 (9.65)
LPW-5	.88 (22.4)	.38 (9.65)	.35 (8.89)	.036*(.9)	.41 (10.4)
LPW-7	1.39 (35.3)	.38 (9.65)	.35 (8.89)	.036*(.9)	.47 (11.9)
LPW-10	1.88 (47.8)	.38 (9.65)	.35 (8.89)	.036*(.9)	.47 (11.9)
LPW-15	1.88 (47.8)	.50 (12.7)	.50 (12.7)	.036*(.9)	.50 (12.7)

* For resistances above .05 ohms, diameter D is .032 in. (.8mm)

TEMPERATURE



POWER DERATING



HOW TO ORDER

Sample Part No.:

LPW - 5 - .02Ω - 3%

TRW Type

Power
5 = 5 watts (See specification chart for other power ratings)

Resistance Value
Expressed in ohms
(Standard EIA/MIL Values)

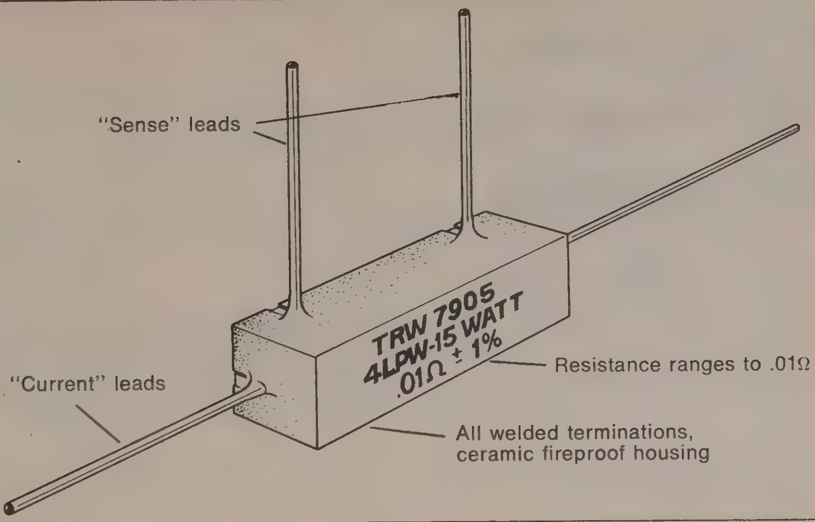
Tolerance
±1%, ±2%, ±3%,
±5%, ±10% standard

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, P.O. BOX 1860, BOONE, NC 28607 • (704) 264-8861

FOUR-TERMINAL CURRENT-SENSING WIREWOUNDS

4LPW SERIES

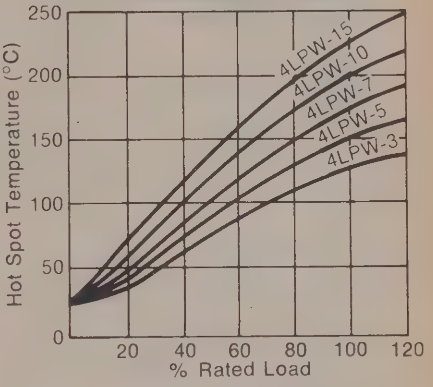
- ☐ 3 watts to 15 watts
- ☐ ±1%, ±2% ±3%, ±5%, ±10% tolerance
- ☐ .01 ohm to 1.0 ohm


"Sense" leads
"Current" leads
TRW 7905
4LPW-15 WATT
.01Ω ± 1%
Resistance ranges to .01Ω
All welded terminations, ceramic fireproof housing

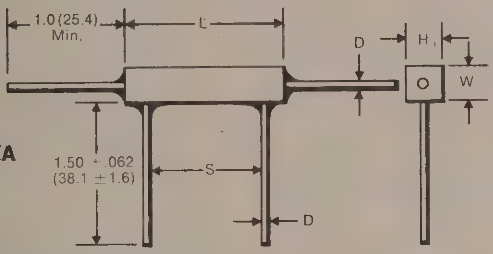
SPECIFICATIONS

TRW Type	Power at 25°C (watts)	Max. Current (amps)	Resistance Range (ohms)
4LPW-3	3	10	.01 to 1.0
4LPW-5	5	10	.01 to 1.0
4LPW-7	7	20	.01 to 1.0
4LPW-10	10	20	.01 to 1.0
4LPW-15	15	20	.01 to 1.0

TEMPERATURE RISE

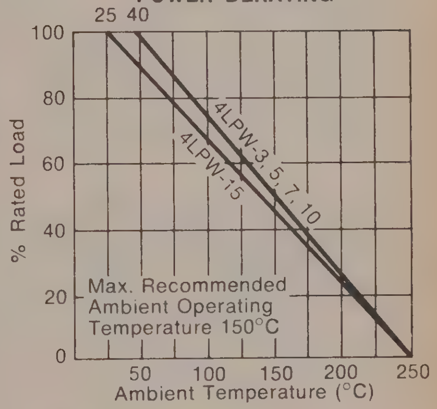


STANDARD CONFIGURATION

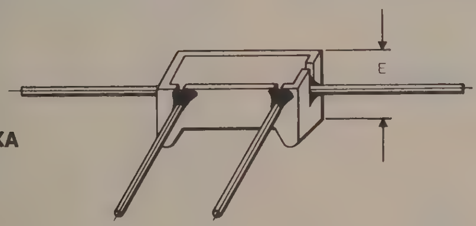

1.0 (25.4) Min.
L
D
H
W
1.50 ±.062 (38.1 ±1.6)
S
D

Type 4LPW-XA

POWER DERATING



ALTERNATE CONFIGURATION



Type 4LPW-XA

DIMENSIONS — IN. AND (mm)

TRW Type	L $+\frac{1}{16}, -\frac{1}{32}$	W ±.03 (.8)	H ±.03 (.8)	S ±.062 (1.6)	D Diameter	E ±.03 (.8)
4LPW-3	.88 (22.4)	.31 (7.87)	.31 (7.87)	.563 (14.3)	.036* (.9)	.38 (9.65)
4LPW-5	.88 (22.4)	.38 (9.65)	.35 (8.89)	.563 (14.3)	.036* (.9)	.41 (10.4)
4LPW-7	1.39 (35.3)	.38 (9.65)	.35 (8.89)	1.013 (25.7)	.036* (.9)	.47 (11.9)
4LPW-10	1.88 (47.8)	.38 (9.65)	.35 (8.89)	1.388 (35.3)	.036* (.9)	.47 (11.9)
4LPW-15	1.88 (47.8)	.50 (12.7)	.50 (12.7)	1.388 (35.3)	.036* (.9)	.50 (12.7)

* For resistances above .05 ohms, diameter D is .032 in. (.8mm)

HOW TO ORDER

Sample Part No.:

4LPW - 15 - .01Ω - 1%

TRW

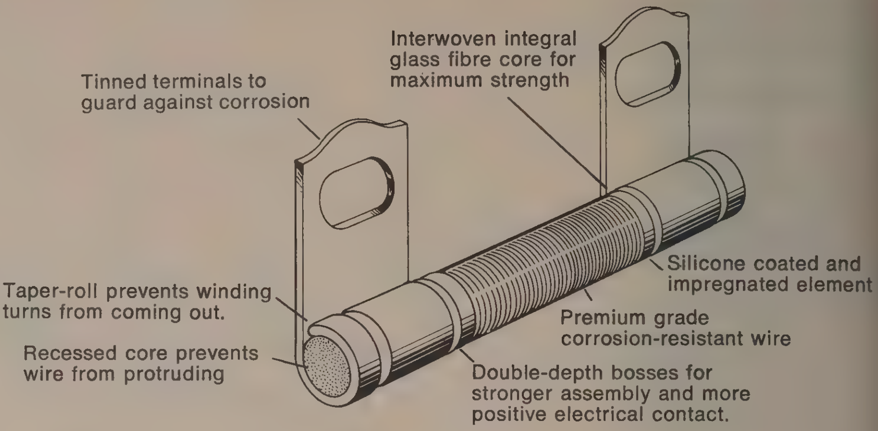
Power
15 = 15 watts (See specification chart for other power ratings)

Resistance Value
Expressed in ohms
(Standard EIA/MIL Values)

Tolerance
±1%, ±2%, ±3%,
±5%, ±10% standard

AUTOMOTIVE AND APPLIANCE POWER WIREWOUNDS

AW SERIES


Tinned terminals to guard against corrosion
Interwoven integral glass fibre core for maximum strength
Taper-roll prevents winding turns from coming out.
Recessed core prevents wire from protruding
Silicone coated and impregnated element
Premium grade corrosion-resistant wire
Double-depth bosses for stronger assembly and more positive electrical contact.

- ☐ Appliance applications include food mixers, coffee makers, electric and electronic ranges, electric blankets, actuating heaters for bi-metal switches, toasters and deep fryers
- ☐ Automotive applications include horns, voltage regulators, ignition ballasts, instrument gauges, spark suppressors and windshield wipers

SPECIFICATIONS

RESISTANCE RANGE

0.1 ohm minimum to 1000 ohms/in. of active length, or inside terminal dimension.

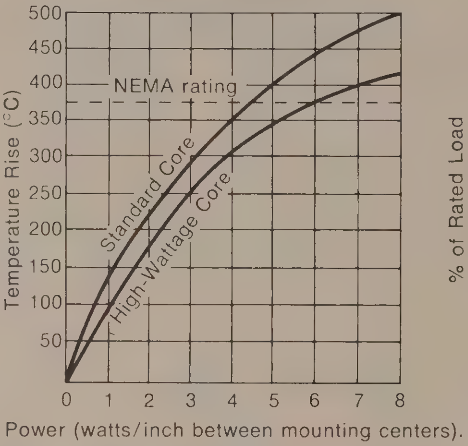
POWER RATINGS

4.5 watts/in. between mounting centers on the standard AW, and 6 watts/in. between mounting centers on the high-wattage AW resistor. Higher wattages are available on low resistance values with special windings.

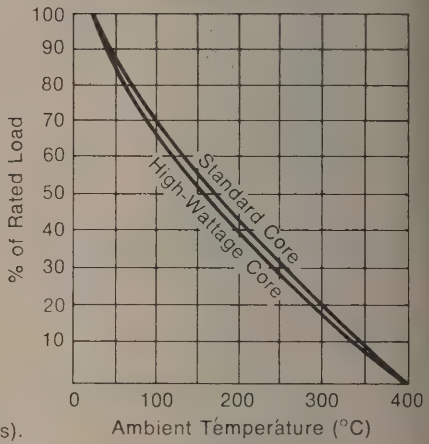
TOLERANCE

±10% tolerance is standard. Other tolerances are available on special orders.

TEMPERATURE RISE

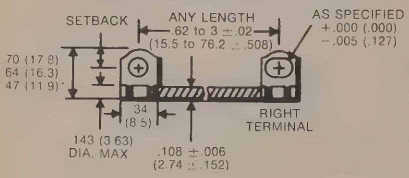


POWER DERATING

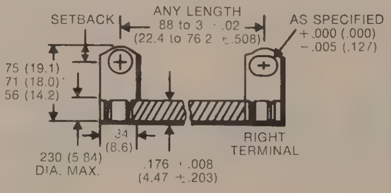


HOW TO ORDER: Consult Factory

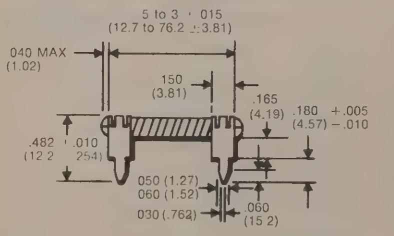
STANDARD CONFIGURATION


SETBACK
ANY LENGTH
.62 to 3 ±.02
(15.5 to 76.2 ±.508)
AS SPECIFIED
+.000 (.000)
−.005 (.127)
70 (17 8)
64 (16.3)
47 (11 9)
34
(8 5)
143 (3 63)
DIA. MAX
.108 ±.006
(2.74 ±.152)
RIGHT TERMINAL

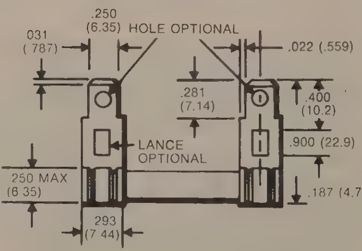
HIGH-WATTAGE CONFIGURATION


SETBACK
ANY LENGTH
88 to 3 ±.02
(22.4 to 76 2 ±.508)
AS SPECIFIED
+.000 (.000)
−.005 (.127)
75 (19.1)
71 (18.0)
56 (14.2)
34
(8.6)
230 (5 84)
DIA. MAX.
.176 ±.008
(4.47 ±.203)
RIGHT TERMINAL

PRINTED CIRCUIT TERMINALS


5 to 3 ±015
(12.7 to 76.2 ±3.81)
040 MAX
(1.02)
150
(3.81)
.165
(4.19)
.180 +.005
(4.57) −.010
.482 ±.010
(12 2 ±254)
050 (1.27)
060 (1.52)
030 (.762)
.060
(15 2)

HIGH-WATTAGE QUICK DISCONNECT TERMINALS


.250
(6.35)
HOLE OPTIONAL
031
(787)
.022 (.559)
.281
(7.14)
.400
(10.2)
LANCE OPTIONAL
.900 (22.9)
250 MAX
(6 35)
.187 (4.75)
293
(7 44)

DESIGN AND CONSTRUCTION

The resistance elements of AW resistors are uniformly and tightly wound on glass fiber cores using premium quality wire. Tinned steel or tinned brass terminals are secured to the element by automatic assembly equipment. The high degree of automation used in manufacturing this resistor allows you to use a high-quality wirewound unit at low cost.

TERMINALS

Standard AW resistor terminals are 11/32 in. x .015 in. tinned steel or tinned brass. High-wattage AW resistor terminals are 11/32 in. x .020 in. tinned steel or tinned brass.

Over 50 styles of terminal mounting holes are tooled and immediately available. Any of these can be furnished with one or both mounting holes omitted and in any resistor length, within limits shown, from standard tooling. Other mounting hole sizes or terminal configurations can be made to your specification at a nominal cost.

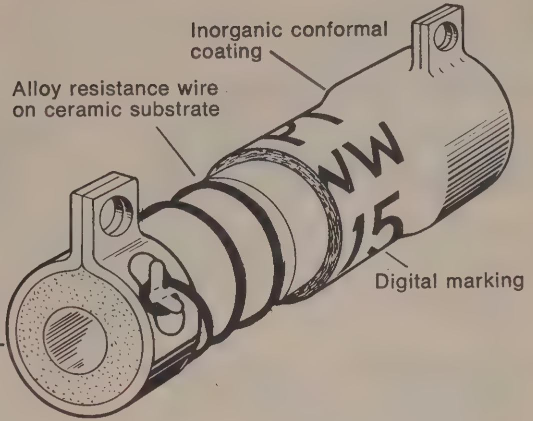
STAMPING

Resistance value is stamped on both sides of the left terminal in large numbers.

FIXED, ADJUSTABLE AND TAPPED HIGH POWER WIREWOUNDS

PWW SERIES

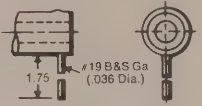
- ☐ 4 watts to 225 watts
- ☐ ±10%, ±5% tolerance
- ☐ 0.1 ohm to 175k ohms
- ☐ TCs from ±50 ppm/°C to ±400 ppm/°C


Inorganic conformal coating
Alloy resistance wire on ceramic substrate
Digital marking
Lugs, lead wires, other terminal configurations, depending on specifications
PWW 15

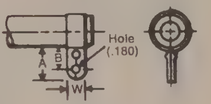
TUBULAR STYLE — FIXED

TRW Type	Power Rating at 25°C (Watts)	MIL Equivalent		Core Dimension			Terminals		Min. Resistance (ohms) **	Maximum Resistance (ohms)		
		MIL Style	MIL Power Rating (Watts)	Length Inches (mm)	O.D. Inches (mm)	I.D. Inches (mm)	Standard	Special		.0025 Wire	.00175 Wire	.0008 Wire
1A	5	—	—	1.00 (25.4)	.31 (7.9)	.19 (4.8)	13A	1†, 12A	0.10	530	1,550	15K
1¾ A	12	RW29	11	1.75 (44.5)	.31 (7.9)	.19 (4.8)	13A‡	1, 12A	0.10	2,500	5,600	50K
1C	12	RW30	11	1.00 (25.4)	.44 (11.2)	.27 (6.9)	12A	1, 13A	0.10	900	2,500	20K
1½ C	15	RW31	14	1.50 (38.1)	.44 (11.2)	.27 (6.9)	12A	1, 13A	0.10	2,000	6,300	50K
2C	20	RW32	17	2.00 (50.8)	.44 (11.2)	.27 (6.9)	13A‡	1, 12A	0.10	4,000	10K	80K
2D	25	—	—	2.00 (50.8)	.56 (14.2)	.38 (9.7)	12A	1, 4A, 13A	0.10	4,500	12K	100K
3C	26	RW33	26	3.00 (76.2)	.44 (11.2)	.27 (6.9)	12A	1, 13A	0.10	8,000	18K	150K
3D	35	—	—	3.00 (76.2)	.56 (14.2)	.38 (9.7)	12A	1, 4A, 13A	0.10	8,250	23.8K	200K
4D	50	—	—	4.00 (101.6)	.56 (14.2)	.38 (9.7)	12A	1, 4A, 13A	0.20	12K	35K	300K
4H	80	RW36	78	4.00 (101.6)	1.12 (28.4)	.75 (19.1)	4A	—	0.30	23K	68.5K	525K
6H	120	RW37	113	6.00 (152.4)	1.12 (28.4)	.75 (19.1)	4A	—	0.47	38K	112.5K	850K
6½ H	130	—	—	6.50 (165.1)	1.12 (28.4)	.75 (19.1)	4A	—	0.56	41.5K	120K	900K
8H	160	RW38	159	8.00 (203.2)	1.12 (28.4)	.75 (19.1)	4A	—	0.68	54K	156K	1.15M
8½ H	175	—	—	8.50 (215.9)	1.12 (28.4)	.75 (19.1)	4A	—	0.75	57K	167K	1.25M
10½ H	225	RW47	210	10.50 (266.7)	1.12 (28.4)	.75 (19.1)	4A	—	0.91	72K	210K	1.5M

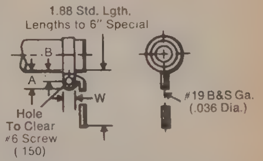
* 6 Watts † 8 watts ‡ 12A standard on adjustable type ** Except #1 terminal


1.75
#19 B&S Ga (.036 Dia.)

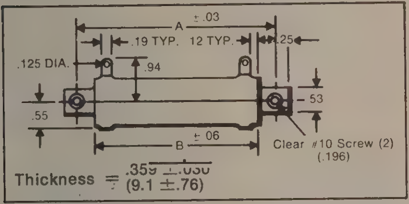
TERMINAL STYLE 1


Hole (.180)
A
B
W

TERMINAL STYLE 4A


1.88 Std. Lgth.
Lengths to 6" Special
B
A
W
Hole To Clear #6 Screw (.150)
#19 B&S Ga. (.036 Dia.)

TERMINAL STYLE 12A (NO LEAD) AND 13A (WITH LEAD)


A ±.03
.19 TYP.
12 TYP.
.25
.125 DIA.
.94
.55
.53
B ±.06
Clear #10 Screw (2) (.196)
Thickness .359 ±.030 (9.1 ±.76)

FLAT STYLE — FIXED

TRW Type	Power Rating at 25°C (watts)	MIL Equivalent		Dimensions in Inches (mm)		Min. Resistance (ohms)	Maximum Resistance (ohms)		
		MIL Style	MIL Power Rating (watts)	Mounting Center A	Core Length B		.0025 Wire	.00175 Wire	.0014 Wire
FRW-20	30	RW20	21	2.00 (50.8)	1.25 (31.8)	0.10	2.75K	8K	15K
FRW-21	40	RW21	31	2.75 (69.9)	2.00 (50.8)	0.10	6K	18K	35K
FRW-22	55	RW22	53	4.25 (108)	3.50 (88.9)	0.20	13K	38K	75K
FRW-23	70	RW23	68	5.50 (140)	4.75 (121)	0.25	19K	56K	110K
FRW-24	95	RW24	91	6.75 (172)	6.00 (152)	0.35	25K	75K	140K

TUBULAR STYLE – ADJUSTABLE

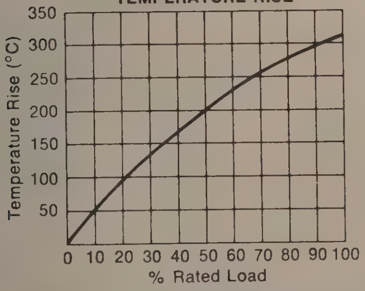
TRW Type	Power Rating at 25°C (watts)	Maximum Resistance (ohms)		
		.0025 Wire	.00175 Wire	.0014 Wire
1¾ AA	12	2.5K	5.6K	10K
2CA	20	3K	9.5K	10K
2DA	25	4.5K	12K	20K
3CA	26	6K	18K	31K
3DA	35	8.25K	23.8K	40K
4DA	50	12K	35K	60K
4EA	60	16K	45K	75K
4HA	80	23K	68.5K	110K
6HA	120	38K	112.5K	180K
6½ HA	130	41.5K	120K	220K
8HA	160	54K	156K	280K
8½ HA	175	57K	167K	300K
10½ HA	225	72K	210K	350K

FLAT STYLE — ADJUSTABLE

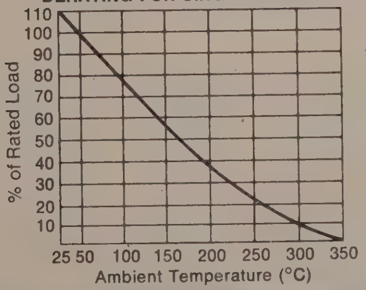
TRW Type	Power Rating at 25°C (watts)	Dimensions in Inches (mm)		Minimum Resistance (ohms)	Maximum Resistance (ohms)		
		Mounting Center A	Core Length B		.0025 Wire	.00175 Wire	.0014 Wire
FRWA-21	40	2.75 (69.9)	2.00 (50.8)	0.1	6K	18K	35K
FRWA-22	55	4.25 (108)	3.50 (88.9)	0.2	13K	38K	75K
FRWA-23	70	5.50 (140)	4.75 (121)	0.25	19K	56K	110K
FRWA-24	95	6.75 (172)	6.00 (152)	0.35	25K	75K	140K

* Adjustable resistors are identified by adding the letter "A" to the designation of standard resistors.

TEMPERATURE RISE



DERATING FOR SINGLE RESISTORS



HOW TO ORDER

Sample Part No.:

2D - 12A - 4707 - 5%
FRWA - 23 - 470K - 10%

TRW Type
A = Adjustable

Power
23 = 70 watts (See specification chart for other power ratings)

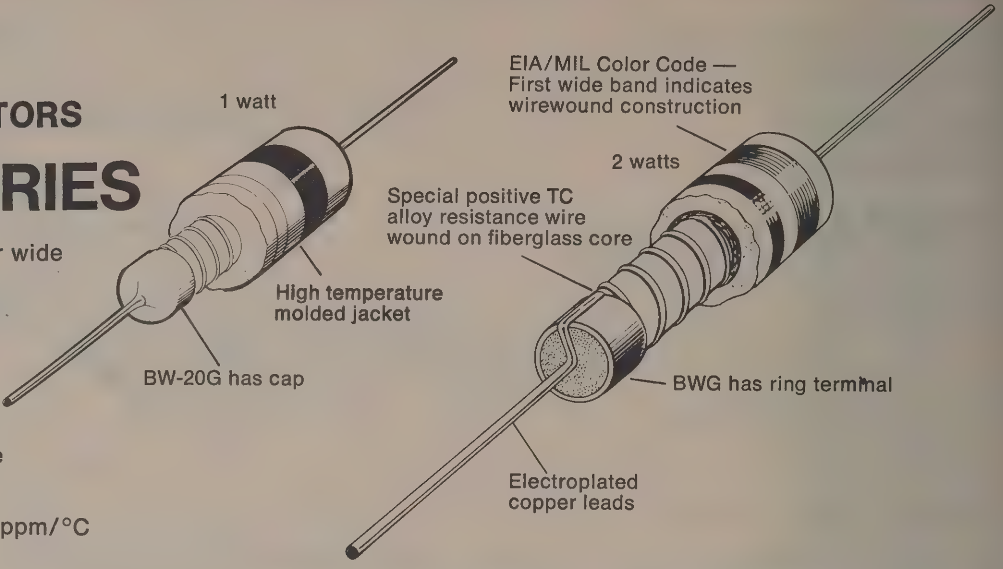
Resistance Value
Expressed in ohms
(Standard EIA/MIL values)

Tolerance
±5% standard for fixed resistors,
±10% standard for adjustable and tapped

WIREWOUND TEMPERATURE SENSING RESISTORS

BWG SERIES

- ☐ Excellent linearity over wide temperature span
- ☐ Fast response time
- ☐ Small size
- ☐ Economical cost
- ☐ 1 watt, 2 watts
- ☐ ±5%, ±10% tolerance
- ☐ 0.1 ohm to 300 ohms
- ☐ TCs as high as +5500 ppm/°C


1 watt
EIA/MIL Color Code — First wide band indicates wirewound construction
2 watts
Special positive TC alloy resistance wire wound on fiberglass core
High temperature molded jacket
BW-20G has cap
BWG has ring terminal
Electroplated copper leads

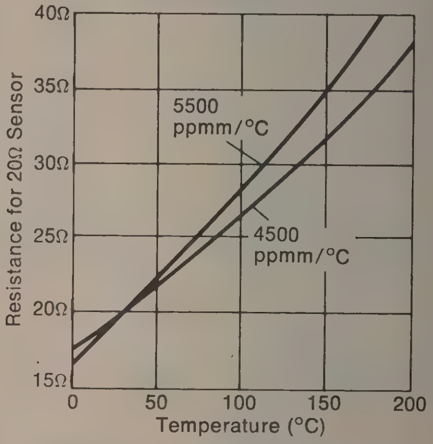
SPECIFICATIONS

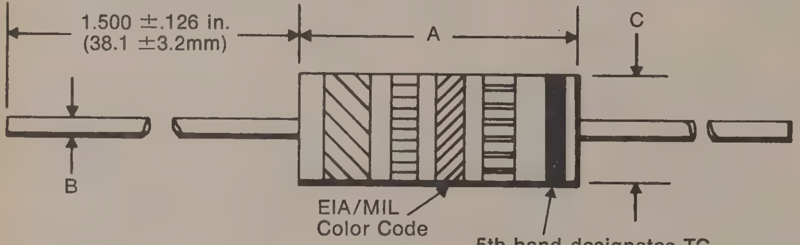
Temperature Coefficient		Available Resistance in Ohms*	
PPM/°C	%/°C	BW-20G (1 watt)	BW (2 watts)
4500	0.45	0.10 to 100	0.20 to 300
5500	0.55	0.10 to 43	0.10 to 110

* As supplied "cold" resistance values — measured at room ambient temperature.

Temperature Range: −55°C to +150°
Power Rating: 1 watt @ 50°C for BW-20G, 2 watts @ 70°C for BWG
Standard Tolerance: ±5%, ±10%
Maximum Continuous Working Voltage: $E = \sqrt{PR}$
Minimum Dielectric Withstanding Voltage: 700V for BW-20G, 1000V for BWG
Minimum Insulation Resistance: 10,000 Meg Ω when dry, 100 Meg Ω when wet
Size Equivalent to RS344: CRU1 for BW-20G, CRU2 for BWG
Size Equivalent to MIL-R-11: RC-20 for BW-20G, RC-32 for BWG

LINEARITY




1.500 ±.126 in. (38.1 ±3.2mm)
A
C
B
EIA/MIL Color Code

NOTE: First band is double width to designate wirewound

5th band designates TC
Green = +4500 ppm/°C
Grey = +5500 ppm/°C

DIMENSIONS — IN. AND (mm)

TRW Type	A ±.010 (.25)	B ±.001 (.03)	C ±.008 (.20)
BW-20G	.390 (9.91)	.032 (.813)	.140 (3.56)
BWG	.562 (14.3)	.040 (1.02)	.225 (5.72)

HOW TO ORDER

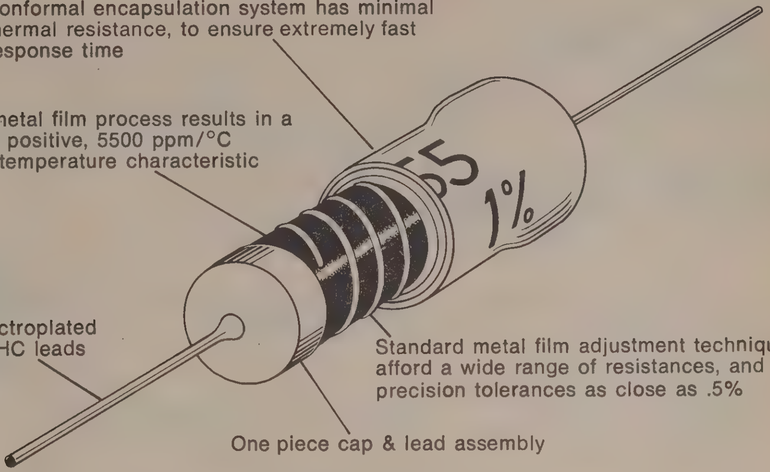
Consult factory.

RESISTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, P.O. BOX 1860, BOONE, NC 28607 • (704) 264-8861

THIN FILM RESISTANCE TEMPERATURE SENSING ELEMENT

TD SERIES

- ☐ Proven metal film reliability
- ☐ Fast thermal response
- ☐ Positive temperature coefficient
- ☐ Close tolerance
- ☐ Superior linearity
- ☐ Ultra miniature



Conformal encapsulation system has minimal thermal resistance, to ensure extremely fast response time

Exclusive metal film process results in a very linear, positive, 5500 ppm/°C resistance temperature characteristic

Electroplated OFHC leads

Standard metal film adjustment techniques afford a wide range of resistances, and precision tolerances as close as .5%

One piece cap & lead assembly

SPECIFICATIONS

Resistance Range at 25°C: TD50 - 100Ω to 2KΩ, TD55 - 100Ω to 3KΩ

Temperature Coefficient: +5000 ±100 ppm/°C at 25°C; +6000 ±120 ppm/°C at 100°C

Tolerance at 25°C: ±.5%, ±1% or ±2%

Oper. Temp. Range: −55°C to +175°C

Interchangeability Accuracy: ±.9°C @ 25°C for .5% tolerance — ±1.8°C @ 25°C for 1% tolerance — ±3.6°C @ 25°C for 2% tolerance

Accuracy Limits: ±1.5°C for .5% tolerance (−50°C to +100°C) — ±3°C for 1% tolerance (−50°C to +100°C) ±6°C for 2% tolerance (−50°C to +100°C)

Retracking Error: <.05% of nominal (−55°C to +175°C)

Resistance Ratio: R @ 125°C/R @ 25°C =1.57

Linearity: <1.2% maximum deviation from best straight line fit over any 100°C interval between −55°C and +175°C

Thermal Time Constant: TD50 - 3.7 sec. maximum, TD55 - 5.5 sec maximum. (Time to achieve 63.2% of an applied step change in still air)

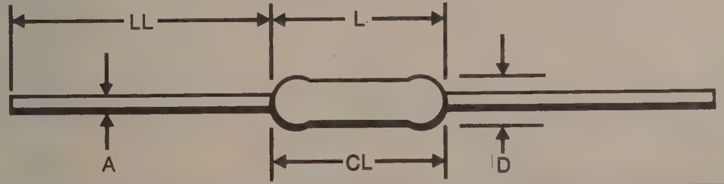
Dissipation Constants: TD50 - 4.1 mW/°C, TD55 - 6.2 mW/°C (Power required to raise sensor temperature 1°C in still air at 25°C)

ENVIRONMENTAL PERFORMANCE

Type of Test	Maximum ΔR	Typical ΔR
Thermal Shock (5 Cycles, −55°C to +175°C)	.068%	.040%
Effect of Solder	.15%	.02%
Moisture Resistance	.50%	.15%
Load Life (2,000 hours @ +125°C)	.25%	.15%
High Temperature Exposure (2,000 hours @ +175°C)	.50%	.25%
Low Temperature Exposure (−65°C)	—	.05%
Dielectric Strength	.30%	.20%
Insulation Resistance	>100MΩ	—
Terminal Strength	.07%	.03%
Shock	.058%	.020%
High Frequency Vibration	.066%	.035%
Short Time Overload (1 watt, 1 minute)	.062%	.031%
Noise	—	−35 dB

Note: Testing per MIL-R-55182, except noise.

DIMENSIONS — IN. AND (mm)



TRW Type	Body Length L	Body Diameter D	Max. Clean Lead Length CL	Lead Length LL	Lead Gauge A
TD50	.152 ±.020 (3.86 ±0.51)	.065 ±.015 (1.65 ±0.38)	.200 (5.08)	1.00 (25.4)	#26 .016 (0.41)
TD55	.250 ±.031 (6.35 ±0.79)	.088 ±.010 (2.24 ±0.25)	.325 (8.26)	1.50 (38.1)	#22 .0253 (0.64)

TEMPERATURE VS. RESISTANCE

Degrees C	R in Ohms*	Degrees C	R in Ohms*	Degrees C	R in Ohms*
−55	633	+25	1000	+105	1442
−50	661	+30	1021	+110	1471
−45	682	+35	1044	+115	1504
−40	704	+40	1071	+120	1533
−35	726	+45	1099	+125	1568
−30	747	+50	1124	+130	1600
−25	769	+55	1150	+135	1634
−20	789	+60	1178	+140	1667
−15	811	+65	1206	+145	1701
−10	833	+70	1234	+150	1729
−5	857	+75	1264	+155	1769
0	882	+80	1292	+160	1803
+5	907	+85	1321	+165	1839
+10	924	+90	1350	+170	1873
+15	941	+95	1381	+175	1910
+20	968	+100	1411		

* Based on actual measurements of 1% tolerance TD Sensors that were 1000 ohms at 25°C

HOW TO ORDER

Sample Part No.:

TD50 - 100 ppm/°C - 2KΩ - 1%

TRW Type
TD50 = ⅛ watt @ 70°C, $^1/_{20}$ watt @ 125°C
TD55 = ⅛ watt @ 70°C, $^1/_{10}$ watt @ 125°C

Temperature Coefficient*
+5000 ±100 ppm/°C @ 25°C
+6000 ±120 ppm/°C @ 100°C

Resistance*
Standard Resistances at 25°C
TD50 = 100Ω to 1 KΩ
TD55 = 100Ω to 2 KΩ

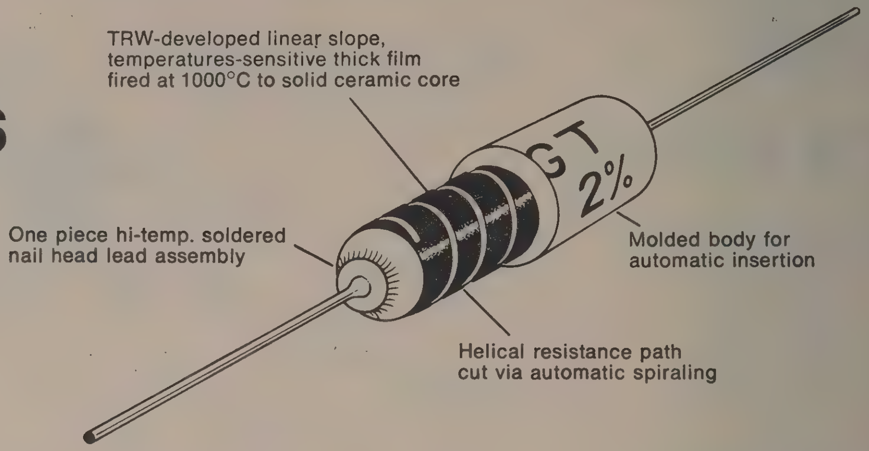
Tolerance
±.5%, ±1% or ±2%

* Contact factory for non-standard T.C., tolerance and resistance requirements.

THICK FILM TEMPERATURE SENSING RESISTORS

RGT SERIES

- ☐ Excellent linearity over wide temperature span
- ☐ Fast response time
- ☐ Small size
- ☐ Economical cost



TRW-developed linear slope, temperatures-sensitive thick film fired at 1000°C to solid ceramic core

One piece hi-temp. soldered nail head lead assembly

Molded body for automatic insertion

Helical resistance path cut via automatic spiraling

SPECIFICATIONS

Linearity: Typically less than 1.2% deviation/100°C

Time Constant: 2.9 seconds in still air for Type 2 sensor, 7.4 seconds for Type 1

Operating Temperature −55° to +175°C (−67° to +347°F)

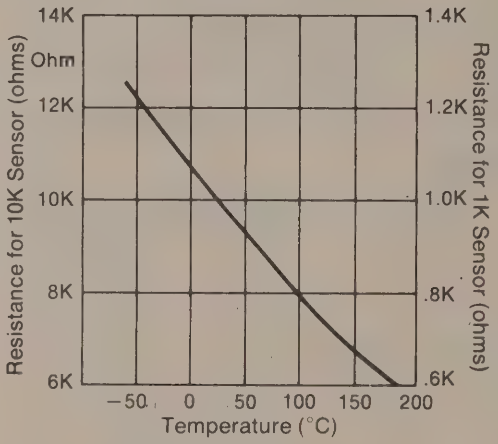
Negative TC of ≅ .3%/°C

Stable Metal Glaze™ Element: New family of glazes. Standard glaze-on-ceramic construction

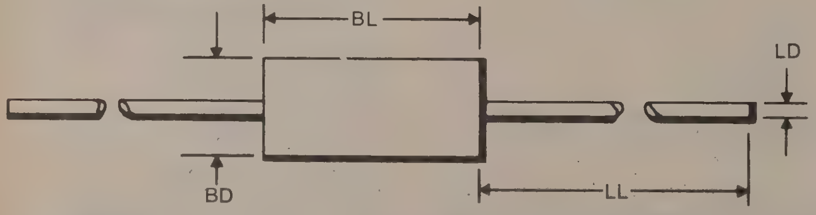
Nominal 1K and 10K Resistance Values at 25°C: In 10%, 5%, 2% tolerances (Other values available for sufficient volume)

Proven Manufacturing Line: Now in 18th year. Glazes produced in TRW's own facility

LINEARITY



DIMENSIONS — IN. AND (mm)



TRW/IRC Type	Length BL	Body Diameter BD	Lead Diameter LD	Lead Length LL
Type 2	.150 (3.81)	.063 (1.60)	.016 (0.41)	1.0 (25.4)
Type 1	.250 (6.35)	.090 (2.29)	.025 (0.64)	1.5 (38.1)

Note: Sensor housings also available for volume applications.

HOW TO ORDER

Sample Part No.:

RGT - 2 - 10K - 2%

TRW/IRC Type

Size

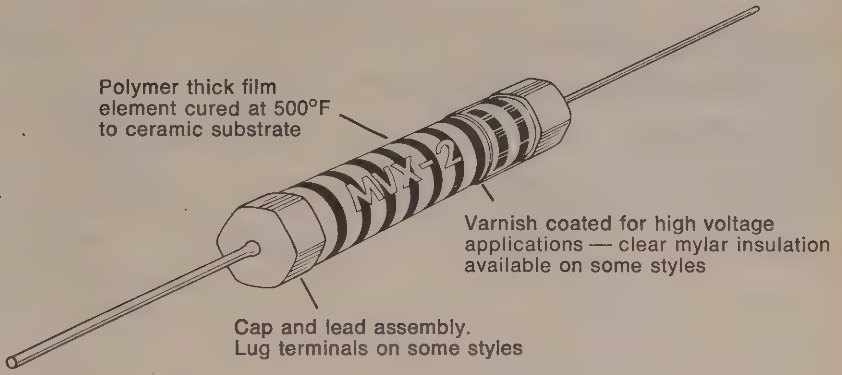
Resistance Value
(1K or 10K)

Tolerance
(±10%, ±5% or ±2%)

GENERAL-PURPOSE HIGH-VOLTAGE FILM RESISTORS

MV SERIES

- ☐ ½ watt to 90 watts
- ☐ 10k to 1000 megohm range
- ☐ ±5%, ±10%, or ±20% tolerance


Polymer thick film element cured at 500°F to ceramic substrate
MVX-2
Varnish coated for high voltage applications — clear mylar insulation available on some styles
Cap and lead assembly. Lug terminals on some styles

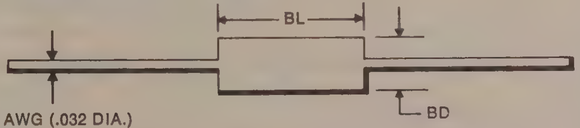
SPECIFICATIONS—LUG TERMINALS OR COLLODIAL SILVER TERMINALS

TRW Type	Standard Terminal Type	Special Terminals Available	Power Rating (Watts)	Peak Voltage Rating (KV)*	Minimum Available Resistance ±10% or ±20% Tolerance	Minimum Available Resistance ±5% Tolerance	Maximum Available Resistance (Megs)	Dimensions in Inches: Resistor Body Length BL	Resistor Body Diameter BD	Ceramic Inside Diameter	Width of Silver Bands #15 Term.
MVC-1	‡	Axial Leads	1	3.5	10K	100K	1,000	1.00 ±.03	.31 ±.03	THD #6-32	——
MVC-2	‡	Axial Leads	2	7.5	25K	100K	1,000	1.75 ±.03	.31 ±.03	THD #6-32	——
MVC-3	‡	Axial Leads	3	15.0	100K	100K	1,000	3.00 ±.03	.31 ±.03	THD #6-32	——
MVC-5	‡	Axial Leads	5	30.0	100K	200K	1,000	5.50 ±.06	.31 ±.03	THD #6-32	——
MVX-1	Axial Leads	——	1	3.5	100K	100K	1,000	1.00 ±.03	.25 ±.03	——	——
MVX-2	Axial Leads	——	2	10.0	100K	100K	1,000	2.00 ±.03	.25 ±.03	——	——
MVX-3	Axial Leads	——	3	15.0	100K	100K	1,000	3.00 ±.06	.25 ±.03	——	——
MVH-2	‡	——	4	15.0	100K	150K	1,000	2.50 ±.05	.56 ±.03	THD #6-32	——
MVH-4	‡	——	6	25.0	100K	400K	1,000	4.00 ±.06	.56 ±.03	THD #6-32	——
MVL	‡	——	5	30.0	100K	100K	1,000	4.50 ±.06	.50 ±.03	THD #10-32	——
MVF	#15	#12	2	5.0	100K	25K	1,000	1.75 ±.03	.31 ±.03	.19 ±.03	.38 ±.03
MVG	#15	#12, 16, 17	4	7.5	100K	100K	1,000	2.00 ±.03	.56 ±.03	.38 ±.03	.56 ±.06
MVK	#15	#12, 16, 17	10	20.0	100K	200K	1,000	5.00 ±.06	.56 ±.03	.38 ±.03	.56 ±.06
MVJ	#15	#12, 16, 17	5	10.0	100K	200K	1,000	3.00 ±.03	.56 ±.03	.38 ±.03	.56 ±.06
MVP	#15	#12, 16, 17	10	15.0	100K	400K	1,000	4.50 ±.06	.75 ±.03	.50 ±.03	.56 ±.06
MVA	#15	#16, 17	20	25.0	200K	1.0 Meg	1,000	6.50 ±.06	1.12 ±.03	.75 ±.03	.56 ±.06
MVO	#15	#16, 17	30	50.0	400K	2.0 Meg	1,000	10.50 ±.06	1.12 ±.03	.75 ±.03	.56 ±.06
MVQ	#15	#17	50	50.0	500K	3.5 Meg	1,000	10.50 ±.12	2.00 ±.05	1.56 ±.05	.88 ±.06
MVR	#15	#17	90	100.0	1 Meg	7.0 Meg	1,000	18.5 ±.12	2.00 ±.05	1.56 ±.05	.88 ±.06

‡ Solder lug or screw mounted

* Rated continuous working voltage determined by $E = \sqrt{PR}$ E should not exceed value listed in column above

DIMENSIONS — IN. and (mm)



20 AWG (.032 DIA.)

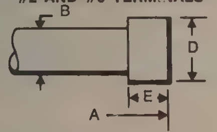
FERRULE TERMINALS

TRW Type	Power Rating at 25°C Ambient (watts)	(KV) Rating* Voltage Peak	Type Terminal	"A" (Max.) Length Overall	Dimensions in Inches: Nominal Diameter "B"	Ferrule Spacing "C"	Ferrule Diameter "D"	Ferrule Length "E"
MVP-2	10	15.0	#2	4.56	.75 ±.03	—	.91 ±.03	.50 ±.06
MVO-7	30	50.0	#7	12.00	1.12 ±.03	10.81 ±.06	.81 ±.03	.50 ±.06
MVO-8	30	50.0	#8	12.00	1.12 ±.03	10.81 ±.06	1.12 ±.03	.50 ±.06
MVQ-8	50	50.0	#8	11.72	2.00 ±.05	10.56 ±.16	1.12 ±.03	.56 ±.03
MVR-8	90	100.0	#8	19.94	2.00 ±.05	18.56 ±.16	1.12 ±.03	.56 ±.03

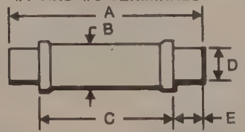
* Rated continuous working voltage determined by $E = \sqrt{PR}$ E should not exceed value listed in column above

STANDARD TERMINALS

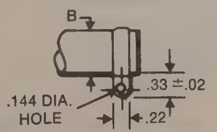
#2 AND #6 TERMINALS



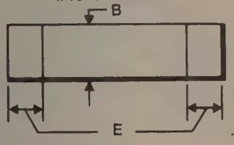
#7 AND #8 TERMINALS



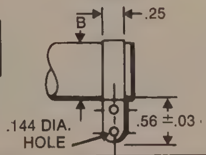
#12 TERMINAL


B
.144 DIA. HOLE
.33 ±.02
.22

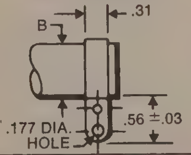
#15 TERMINAL



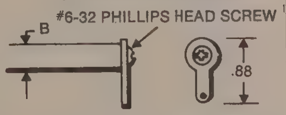
#16 TERMINAL


B
.25
.144 DIA. HOLE
.56 ±.03

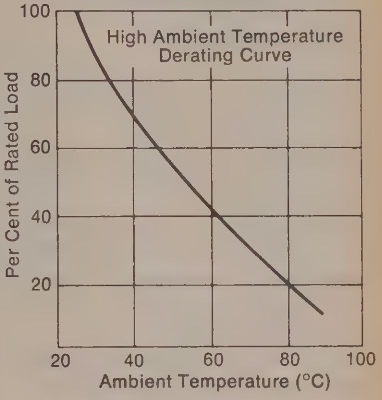
#17 TERMINAL


B
.31
.177 DIA. HOLE
.56 ±.03

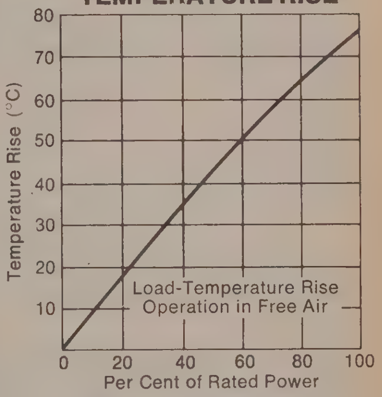
SOLDER LUG TERMINAL


#6-32 PHILLIPS HEAD SCREW
B
.88

POWER DERATING



TEMPERATURE RISE



HOW TO ORDER

Sample Part No.:

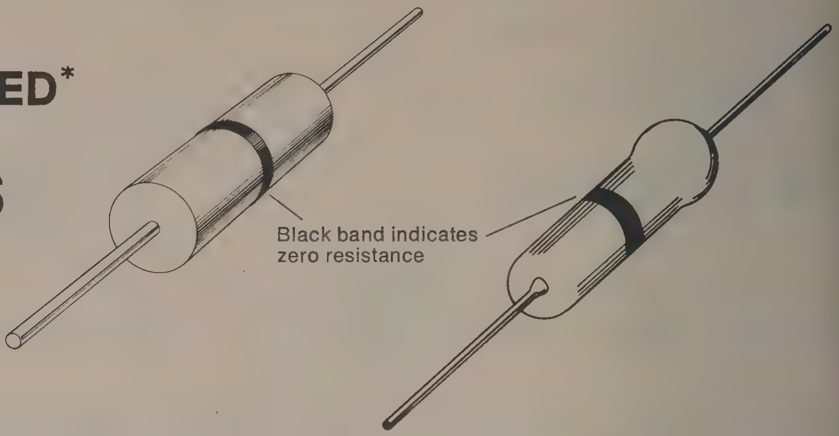
MVX1 - 510M - 10%

TRW Type — See specification table for types and power ratings available.

Resistance — 10K ohms to 1000M ohms in standard EIA/MIL values. See specification table for exact range.

Tolerance — ±20%, ±10% or ±5%. See specification table for availability.

MOLDED AND CONFORMAL COATED* ZEROHM JUMPER WIRES



- ☐ Standard ¼-watt size
- ☐ Supplied on lead tape and reel for automatic insertion
- ☐ Less than 0.01 Ohm

SPECIFICATIONS

Maximum Resistance: 0.01 ohm

Lead Material: Leads are copper with solder alloy coating

Body Material: Electrical grade, high performance, coating and molding compounds

Minimum Insulation Resistance: Dry, 10,000 megohm; Wet, 100 megohm

Minimum Dielectric Withstanding Voltage: Atmospheric, 500V RMS; Reduced, 325V RMS

Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C

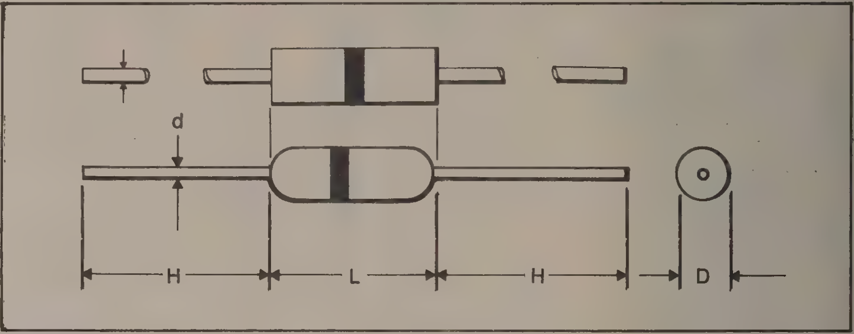
APPLICATIONS

Jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a PC board.

Generally they are used for the following reasons:

- Inability to connect two points on a PC board due to other circuit paths which must be crossed over.
- An after-the-fact design change that requires new point connections.
- Circuit tuning by changing point connections.

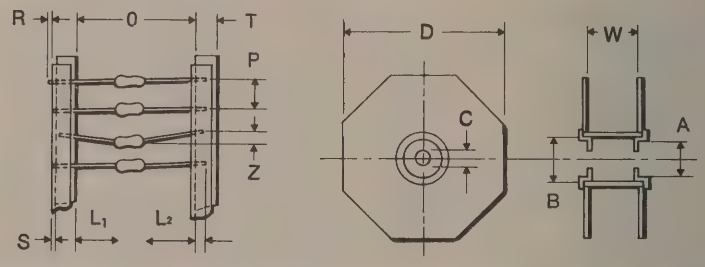
TRW's jumper wires offer a quick simple solution to these problems. They are especially suited for automatic machine insertion on lead tape, and are available in all packaging styles including pre-cut and formed leads for manual insertion.



DIMENSIONS — in. and (mm)

Unit	Body Length L	Body Diameter D	Lead Length H	Lead Diameter d
Molded	.250 ±.015 (6.35 ±.381)	.090 ±.008 (2.3 ±0.2)	1.50 ±.125 (38.1 ±3.2)	.025 nom. (0.63 nom.)
Coated	.256 ±.012 (6.5 ±0.30)	.090 ±.008 (2.3 ±0.2)	1.10 ±.08 (28.0 ±2.0)	.022 nom. (.056 nom.)

TAPING AND PACKAGING DIMENSIONS



TAPING DIMENSIONS

Unit	0	P	$L_1 - L_2$	T	Z	R	t	S
mm	52 ± 1	5 ± 0.4	1 max	6 ± 1	1 max	0	4 min	0.5 max
Inches	2.05 ± .04	.200 ± .016	.04 max	.236 ± .04	.04 max	0	.16 min	.02 max

PACKAGING DIMENSIONS

Unit	Q'TY	A	B	C	D	W
mm	5,000pcs/reel	65 ± 2	70 ± 2	15 ± 1	280 ± 5	70 ± 2
Inches		2.56 ± .08	2.76 ± .08	.59 ± .04	11.02 ± .20	2.76 ± .08

*Leader tape of 910 ± 50 mm (36 inches) shall be provided after the last component in the reel.

AVAILABLE THROUGH AUTHORIZED TRW RESISTOR DISTRIBUTORS

* Made in Far East

TRW SALES OFFICES

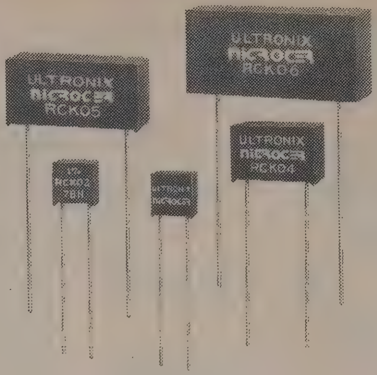
ALABAMA	HUNTSVILLE	TRW/ECG	205-533-7600
ARIZONA	SCOTTSDALE	TRW/ECG	602-994-0441
CALIFORNIA	LOS ANGELES	Integrated Sales	213-478-0183
	MOUNTAIN VIEW	Straube Associates	415-969-6060
	SANTA ANA	Integrated Sales	714-973-2162
	SAN DIEGO	Integrated Sales	619-571-1455
	WOODLAND HILLS	Integrated Sales	213-883-7130
COLORADO	WESTMINSTER	Straube Associates	303-426-0890
CONNECTICUT	ROWAYTON	TRW/ECG	203-853-4466
FLORIDA	FORT LAUDERDALE	TRW/ECG	305-772-3000
	ORLANDO	TRW/ECG	305-857-3650
GEORGIA	NORCROSS	TRW/ECG	404-447-6154
ILLINOIS	CHICAGO	TRW/ECG	312-693-7730
INDIANA	FORT WAYNE	R.O. Whitesell Assoc.	219-432-5591
	INDIANAPOLIS	R.O. Whitesell Assoc.	317-359-9283
	KOKOMO	R.O. Whitesell Assoc.	317-457-9127
IOWA	CEDAR RAPIDS	C.H. Horn & Associates	319-393-8703
KANSAS	DeSOTO	Midtec Associates Inc.	913-441-6565
KENTUCKY	LOUISVILLE	R.O. Whitesell Assoc.	502-426-7696
MARYLAND	COLUMBIA	TRW/ECG	301-964-9110
MASSACHUSETTS	FRAMINGHAM	TRW/ECG	617-620-0625
MICHIGAN	GRAND RAPIDS	R.O. Whitesell Assoc.	616-942-5420
	ST. JOSEPH	R.O. Whitesell Assoc.	616-983-7337
	SOUTHFIELD	R.O. Whitesell Assoc.	313-559-5454
MINNESOTA	MINNEAPOLIS	TRW/ECG	612-854-6616
MISSOURI	ST. LOUIS	John G. Macke Co.	314-432-2830
NEW JERSEY	ROWAYTON, CONN.	TRW/ECG	203-853-4466
NEW MEXICO	EL PASO	S.W. Sales	915-594-8259
NEW YORK	Upstate: FAIRPORT	TRW/ECG	716-425-3775
	Metropolitan Area: ROWAYTON, CONN.	TRW/ECG	203-853-4466
NORTH CAROLINA	GREENSBORO	TRW/ECG	919-852-4676
OHIO	CINCINNATI	R.O. Whitesell Assoc.	513-521-2290
	CLEVELAND	R.O. Whitesell Assoc.	216-447-9020
	COLUMBUS	R.O. Whitesell Assoc.	614-888-9396
	DAYTON	R.O. Whitesell Assoc.	513-298-9546
OREGON	PORTLAND	TRW/ECG	503-620-5032
PENNSYLVANIA	BALA CYNWYD	TRW/ECG	215-667-3400
	PITTSBURGH	R.O. Whitesell Assoc.	412-963-6161
TENNESSEE	GREENEVILLE	R.O. Whitesell Assoc.	615-639-6154
TEXAS	AUSTIN	Technology Sales Co.	512-345-2331
	DALLAS	TRW/ECG	214-248-8000
	EL PASO	S.W. Sales	915-594-8259
	HOUSTON	TRW/ECG	713-772-5541
UTAH	SALT LAKE CITY	Straube Associates	801-263-2640
VIRGINIA	RICHMOND	TRW/ECG	804-288-8334
WASHINGTON	BELLEVUE	TRW/ECG	206-641-9996
WISCONSIN	BROOKFIELD	TRW/ECG	414-784-7773
CANADA	TORONTO, ONTARIO	Renmark Electronic Ltd.	416-494-5445
	CARLETON PLACE, ONTARIO,	Renmark Electronic Ltd.	613-257-1490
PUERTO RICO	RIO PIEDRAS	Electronic Sales Assoc.	809-769-2911

For manufacturers' sales offices, see yellow pages

ULTRONIX inc SFERNICE

P.O. Box 1090
Grand Junction
Colorado 81502

(303) 242-0810



metal foil resistor NICROCER® process

very high precision and stability

MIL QUALIFICATION TO MIL–R–55182/9 (RNC90Y)

FEATURES

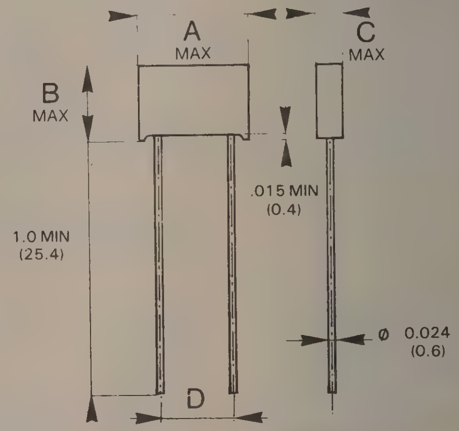
- VERY TIGHT TOLERANCES ±0.005% to ±1% – Matching to 0.002%
- VERY LOW TEMPERATURE COEFFICIENT
  typical < ±3 ppm/°C (−55°C to +155°C) ± 1 ppm (0°C to + 60°C)
  tracking to 0.5 ppm/°C
- VERY HIGH STABILITY < 25 ppm/year or *< 50 ppm/3 years (shelf life)*
- *NEGLIGIBLE RISE TIME approx. 1 X* 10^{-9} sec.

STANDARD ELECTRICAL SPECIFICATIONS

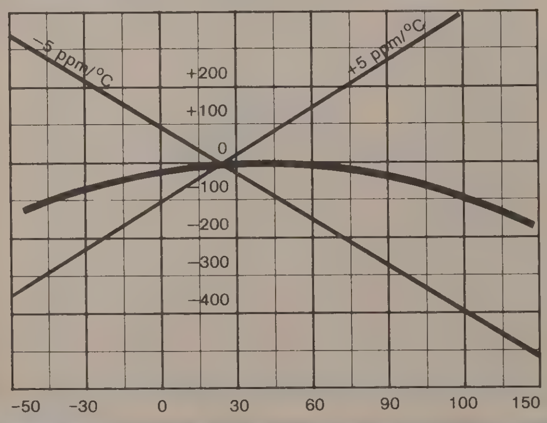
ULTRONIX TYPE	MIL TYPE	70°C RATING	125°C RATING	MAX. WORKING VOLTAGE	RESISTANCE RANGE (OHMS) ±0.005%	±0.02% ±0.01%	±0.05%	±0.1%, ±0.2% ±0.5%, ±1%
RCK02A	RNC90Y	0.5W	0.33W	300V	50Ω-200K	25Ω-200K	10Ω-200K	1Ω-200K
RCK04	–	1.0W	0.6W	350V	50Ω-400K	25Ω-400K	10Ω-400K	2Ω-400K
RCK05/05A	–	1.2W	0.9W	500V	150Ω-600K	75Ω-600K	30Ω-600K	3Ω-600K
RCK06	–	1.5W	1.2W	650V	200Ω-800K	100Ω-800K	40Ω-800K	4Ω-800K

PHYSICAL CONFIGURATIONS

Type	Dim. A	Dim. B	Dim. C	Dim. D
RNC90Y	.320 (8.13)	.375 (9.52)	.120 (3.05)	.150 (3.81)
RCK02A	.312 (7.92)	.330 (8.38)	.115 (2.92)	.150 (3.81)
RCK04	.591 (15)	.413 (10.5)	.138 (3.5)	.400 (10.16)
RCK05	.890 (22.6)	.413 (10.5)	.138 (3.5)	.700 (17.78)
RCK05A	.890 (22.6)	.413 (10.5)	.138 (3.5)	.650 (16.51)
RCK06	1.200 (30.5)	.531 (13.5)	.256 (6.5)	.900 (22.86)



TEMPERATURE COEFFICIENT $\frac{\Delta R}{R}$ ppm



The T.C. of RCK resistors is always better than ± 5 ppm/°C in the temperature range −55°C to +155°C.

More generally, the T.C. is positive towards the very low temperatures, typical values +2.2 ± 2 ppm/°C for −55°C to +25°C.

It is negative towards the high temperatures, typical value −1.8 ± 2 ppm/°C for +25°C to +125°C.

For temperature variations of about 20 to 30°C from the 25°C ambient temperature, the T.C. is very low.

In the temperature range 0°C to +60°C it can be reduced to a value below ± 1 ppm/°C.

For a group of resistors, T.C. matching can be made to better than ± 0.5 ppm/°C.

Consult **ULTRONIX.**

ULTRONIX SFERNICE

ULTRONIX inc SFERNICE
P.O. Box 1090
Grand Junction
Colorado 81502

(303) 242–0810

metal foil resistor NICROCER® process

SPECIFICATIONS

ELECTRICAL

RESISTANCE RANGE	1Ω to 800K
RESISTANCE TOLERANCE	±0.005% to ±1%
POWER RATING	0.5W to 1.5W at 70°C depending on configuration
T.C. LIMIT	±5 ppm/°C
DIELECTRIC VOLTAGE	750 V RMS
INSULATION RESISTANCE	> 10^6M
THERMAL RESISTANCE	0.14°C/mW
THERMO-ELECTRIC EFFECT	0.5 μV for 1°C of difference between leads

MECHANICAL

MECHANICAL	insulated case
RESISTIVE ELEMENT	nickel-chromium
TERMINAL LEADS	tinned copper or UE6P weldable solderable type C MIL-STD 1276
UNIT WEIGHT	0.3—1—2—4g

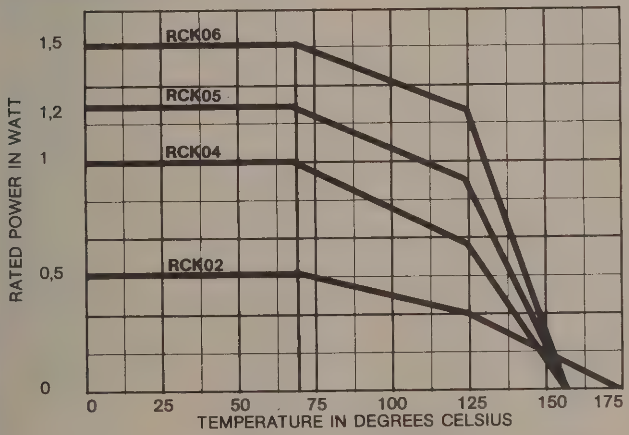
ENVIRONMENTAL

TEMPERATURE LIMITS	−55°C +175°C

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

TESTS	REQUIREMENTS MIL–R–55182E	TYPICAL DRIFTS
OVERLOAD	±0.05%	±0.002%
TEMPERATURE CYCLING	±0.05%	±0.002
TERMINAL STRENGTH	±0.02%	±0.001%
RESISTANCE TO SOLDERING HEAT	±0.02%	±0.002%
VIBRATIONS (LIFE TEST)	±0.02%	±0.002%
MOISTURE RESISTANCE	±0.05% Insulation R. > 10^2MΩ	±0.003% Insulation R. > 10^4MΩ
LOAD LIFE	±0.05% ±0.05% @ 175°C	±0.005% ±0.01%
HIGH TEMPERATURE EXPOSURE	–	±0.005%
HUMIDITY (STEADY STATE) 56 DAYS	–	±0.003% Insulation R. > 10^4MΩ

POWER DERATING CHART

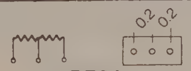


POWER DERATING

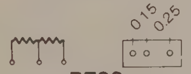
The power ratings listed in the tables are based upon achieving the specified stabilities at maximum ambient temperatures of 70°C. If a resistor is to be used at higher ambient temperature, the power should be derated linearly to zero per the chart. To insure maximum stability, this power curve should be derated by 25% for tolerances to 0.05%, by 50% for tolerances to 0.01% and by 75% for tolerances of 0.005%.

RESISTOR NETWORKS

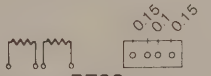
IN "04" PACKAGE SIZE



★RE21

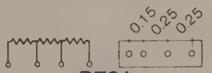


RE22

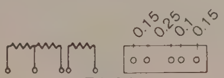


RE23

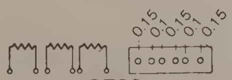
IN "05" PACKAGE SIZE



RE31

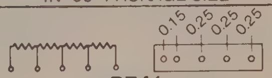


RE32

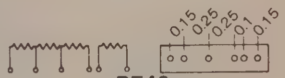


RE33

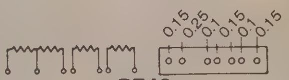
IN "06" PACKAGE SIZE



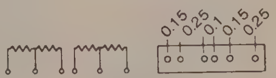
RE41



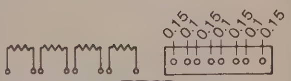
RE42



RE43



RE44



RE45

★Available in "02" Package, Lead Spacings of 0.1. Order RE11.

ULTRONIX SFERNICE

ULTRONIX
205A
39K Ω
0.5%

wirewound resistors

very high precision and stability

ULTRONIX INC SFERNICE
P.O. Box 1090
Grand Junction
Colorado 81502

(303) 242–0810

MIL QUALIFICATION TO MIL–R–39005 AND MIL–R–93

SPECIFICATIONS

MINIMUM VALUES

Generally 0.1Ω for 1% and 0.5% and 10Ω for 0.1% and tighter.

TOLERANCES (±)

Standards are 0.005%, 0.01%, 0.02%, 0.05%, 0.1%, 0.5% and 1% depending on style and value.

TEMPERATURE COEFFICIENTS

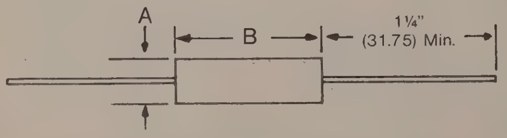
± 5 ppm/°C standard for 10Ω and above. Higher T.C.'s on low ohmic values.
±1 ppm/°C available. TC match to ±0.5 ppm/°C.
High T.C.'s up to + 6000 ppm/°C are available.

MILITARY QUALIFIED

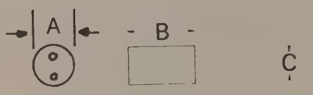
MIL STYLE			MAXIMUM VALUE Ω		POWER RATING AT 125°C (WATTS)		DIMENSIONS · 020 (51)			ϕ LEADS		
MIL-R 93	MIL-R 39005	ULTRONIX TYPE	MIL-R 93	MIL-R 39005		MAX VOLTS	A	B	C	AWG	inch	mm
—	RBR74	185A	—	6 52K	0.125	300	188 (4.78)	.500 (12.70)	—	22	026	0 60
RB56	RBR75	202A	42K	150K	0 125	200	250 (6 35)	310 (7.87)	—	20	032	0 81
RB56	RBR56	203A	42K	220K	0 125	200	250 (6 35)	343 (8.71)	—	20	032	0 81
RB71	RBR71	203PA	100K	150K	0 125	150	270 (6.86)	320 (8.13)	.200(5.08)	22	.026	0.60
RB55	RBR55	205A	80K	332K	0.15	400	250 (6.35)	500 (12.70)		20	032	0 81
RB54	RBR54	207A	170K	562K	0.25	800	.250 (6.35)	750 (19.05)	—	20	032	0 81
—	RBR76	308A	—	—	—	800	312 (7.92)	.810 (20.57)	—	20	032	0.81
RB53	RBR53	307A	320K	1 1M	0 33	800	375 (9 53)	750 (19 05)	—	20	032	0 81
RB52	RBR52	310A	610K	1 21M	0 50	800	375 (9.53)	1.00 (25.40)	—	20	032	0 81
RB57	RBR57	510A	830K	1 37M	0 75	800	500 (12.70)	1.00 (25.40)	—	20	032	0 81

COMMERCIAL

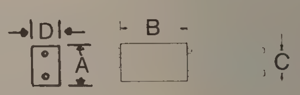
ULTRONIX TYPE	MAX VALUE Ω	POWER RATING AT 125°C (WATTS)	MAX VOLTS	DIMENSIONS · 020 (.51)				ϕ LEADS		
				A	B	C	D	AWG	inch	mm
123A	111K	0 05	150	100 (2 54)	230 (5 84)	—	—	24	.020	.511
118A	192K	0.05	150	130 (3 30)	180 (4 57)	—	-	26	.016	.404
122A	199K	0 05	150	123 (3 12)	218 (5 54)	—	—	24	.020	.511
102A	334K	0 10	150	110 (2 79)	250 (6 35)	—	—	24	.020	.511
101A	410K	0 10	300	130 (3 30)	375 (9 53)	—	-	22	.026	0.60
101P	453K	0 12	150	300 (7 62)	320 (8 13)	150 (3 81)	.110 (2 79)	22	.026	0.60
103A	633K	0 10	150	150 (3 81)	300 (7 62)	—	—	22	.026	0.60
105A	468K	0 125	300	160 (4.06)	500 (12.7)	—	—	22	.026	0.60
102P	821K	0 12	150	250 (6 35)	250 (6 35)	125 (3 18)	125 (3 18)	22	.026	0 60
184A	817K	0 125	300	187 (4 75)	375 (9 53)	—	—	22	.026	0.60
185A	961K	0 125	300	188 (4.78)	.500 (12.70)	—	—	22	026	0 60
202A	968K	0 25	200	250 (6 35)	310 (7.87)	—	—	20	032	0.81
203A	1.7M	0 25	200	250 (6.35)	.343 (8.71)	—	—	20	032	0 81
203PA	1 48M	0.25	150	270 (6.86)	320 (8.13)	200 (5 08)	—	22	026	0 60
205A	1 93M	0 33	400	.250 (6.35)	500 (12.70)	-	—	20	032	0 81
207A	3 0M	0 50	800	250 (6 35)	750 (19 05)	-		20	032	0 81
308A	3 0M	0 60	800	312 (7 92)	810 (20 57)	—	—	20	.032	0.81
210A	4 10M	0.50	800	250 (6.35)	1.00 (25.40)	—	-	20	032	0 81
307A	5.63M	0.60	800	375 (9.53)	.750 (19.05)	—	—	20	032	0 81
310A	7 68M	1 00	800	375 (9 53)	1 00 (25.40)	—	—	20	032	0.81
510A	24M	1.25	800	500 (12.70)	1.00 (25.40)	—	—	20	.032	0 81
515A	35M	1.50	1200	500 (12.70)	1.50 (38.10)	—	—	20	032	0 81
517A	43M	1 75	1200	500 (12.70)	1.75 (44.45)	—	—	20	032	0 81
520A	43M	2 00	1200	.500 (12.70)	2 00 (50.80)	—	—	20	032	0 81



STYLES XXXA



STYLES XXX PA/PC

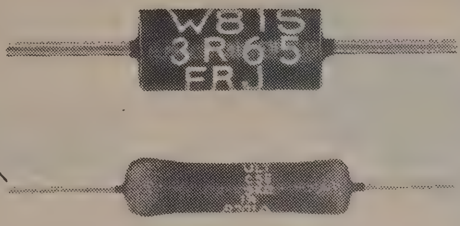


STYLES XXX P

ULTRONIX SFERNICE

ULTRONIX inc STERNICE
P.O. Box 1090
Grand Junction
Colorado 81502

(303) 242–0810

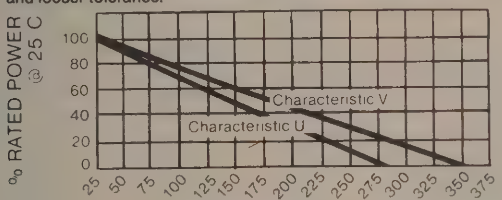


wirewound resistors axial leaded power

MIL QUALIFICATION TO MIL–R–39007 and MIL–R–26

POWER RATING

The chart below shows this operating for characteristic U resistors of 1% tolerance and characteristic V resistors of 3% and looser tolerance.



SPECIFICATIONS

MINIMUM RESISTANCE

0.1Ω for solenoid winding depending on tolerance
10Ω for non-inductive winding

TOLERANCES AVAILABLE

±0.1%, 0.25%, 0.5%, 1%, 3%, 5%, & 10%

TEMPERATURE COEFFICIENTS

Standard ± 90PPM/°C R<1Ω
± 50PPM/°C 1Ω≤R<10Ω
± 20PPM/ C R≥10
Special to + 6000PPM/ C

NON INDUCTIVE WINDING-ADD PREFIX N

Divide maximum resistance by two.
Multiply maximum working voltage by 0.707
Where possible, specify maximum inductance or capacitance allowable at a specific frequency

PRODUCT SELECTION			POWER RATING AT 25°C/MAXIMUM VALUE				DIMENSIONS						
ULTRONIX	MIL R 26	MIL R 39007	COMMERCIAL	MIL R 26 CHAR U	MIL-R 26 CHAR V	MIL-R-39007	Φ DIAMETER INCH	Φ DIAMETER MM	LENGTH INCH	LENGTH MM	AWG	Φ LEAD inch	Φ LEAD mm
MS101			1W 1 5K				093 max	2 4 max	343 max	8 7 max	24	020	0 51
MS1	RW81	RWR81	1W/1 25K	1W/1K		1W/1 00K	085 ± 020	2 16 ± 0.51	250 ± 031	6.35 ± 0 79	24	.020	0.51
MS2	RW70		2W/3 16K	1W/3 16K	-		094 ± 031	2 39 ± 0 79	406 ± 031	10 31 ± 0 79	24	020	0 51
MS2	RW80	RWR80	2W 3 16K	2W 2 67K		2W 3 16K	094 ± 031	2 39 ± 0 79	406 ± 031	10 31 ± 0 79	24	020	0 51
MS25 CS3	RW69		3W 10K		3W 2K		200 ± 031	5 08 ± 0 79	500 ± 062	12 70 ± 1 57	20	032	0 81
MS3/CS4	RW79	RWR89	3W/11K	3W/10 5K		3W/4 12K	187 ± 031	4 75 ± 0 79	560 ± 062	14 22 ± 1 57	20	032	0 81
CS5			4W/20K				187 ± 031	4 75 ± 079	812 ± 062	20 62 ± 1 57	20	032	0 81
CS6	RW74	RWR74	5W/38K	5W 12 1K		5W/12 1K	312 ± 031	7 92 ± 0 79	875 ± 062	22 22 ± 1 57	18	040	1 02
CS7	RW67		6 5W/45K	-	6 5W/8 2K		312 ± 031	7 92 ± 079	1 000 ± 062	25.40 ± 1 57	20	032	1 02
CS6		RWR84	7W/38K			7W/12 4K	312 ± 031	7 92 ± 0 79	875 ± 062	22 22 ± 1 57	18	040	1 02
CS8			8W 84K				469 ± 031	11 91 ± 0 79	1 375 ± 062	34 92 ± 1 57	18	040	1 02
CS10	RW78	RWR78	10W/115K	10W 39 2K		10W/39 2K	375 ± 031	9 52 ± 0 79	1 780 ± 062	45 21 ± 1 57	18	040	1 02
CS11	RW68		11W/115K		11W/20K		375 ± 031	9 52 ± 0 79	1 780 ± 062	45 21 ± 1 57	18	040	1 02

VERY LOW OHM, ULTRA PRECISION FOUR TERMINAL RESISTORS

STANDARD OHMIC VALUES & WATTAGES AVAILABLE

OHMIC VALUE	PRODUCT TYPE FT1	FT2	FT3	FT5	FT7
00167			3 watts		
.003		2 watts	3 watts		
00455		2 watts	3 watts		
.005		2 watts	3 watts		
.010	1 watt	2 watts	3 watts		
.0139		2 watts	3 watts		
025	1 watt	2 watts	3 watts		
.050	1 watt	2 watts			
1.0				5 watts	7 watts
2.0				5 watts	7 watts
5.0				5 watts	7 watts

Derate to 0 at 175°C.

Ultronix manufactures a large variety of four-terminal resistors and networks for specialized applications. These are used in requirements of lower value where high precision and low temperature coefficient is required.

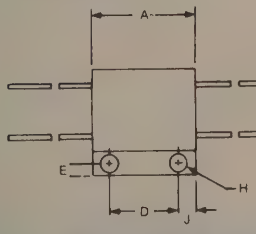
Tolerances available 1.0% or greater.

Temperature Coefficient for the FT1, FT2, and FT3 is 100 ppm/°C from +25°C to +125°C. FT5 and FT7. T.C. is 10 ppm/°C from +25°C to +125°C.

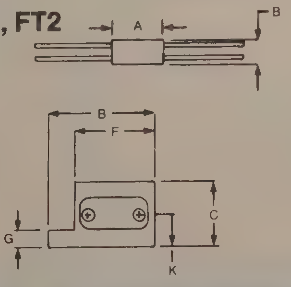
SPECIFICATIONS Dimensional Tolerances ±.02 (.508)

	A	B	C	D	E	F	G	H	I	J	[illegible]	LEAD LENGTH	Φ LEADS AWG	Φ LEADS inch	Φ LEADS mm
FT1	.625 (15 87)	312 (7 92)	—	—	—	—	—	—	20 (5.08)	—	—	1.00 typ (25.4)	18	.040	1.012
FT2	.750 (19 05)	.375 (9.52)	—	—	—	—	—	—	.20 (5.08)	—	—	1.00 typ (25.4)	18	.040	1.012
FT3	750 (19.05)	780 (19.81)	.50 (12 7)	40 (10 16)	.093 (2.36)	.590 (14.98)	120 (3.05)	.120 (3.05)	.20 (5.08)	.125 (3.17)	.25 (6.35)	1.00 typ. (25.4)	16	.051	1.29
FT5	625 (15 87)	.312 (7 92)	.450 (11.43)	40 (10.16)	112 (2.84)	—	—	.125 (3.17)	—	.112 (2.84)	.296 (7.51)	voltage 1.0 typ. (25.4) current 1.0 typ. (25.4)	voltage 26 current 20	voltage .016 current .032	voltage 0.404 current 0.813
FT7	1 000 (25.4)	.312 (7.92)	450 (11 43)	781 (19.83)	.110 (2.79)	—	—	.125 (3.17)	—	.110 (2.79)	.29 (7.36)	voltage 1.0 typ. (25.4) current 1.0 typ. (25.4)	voltage 26 current 20	voltage .016 current .032	voltage 0.404 current 0.813

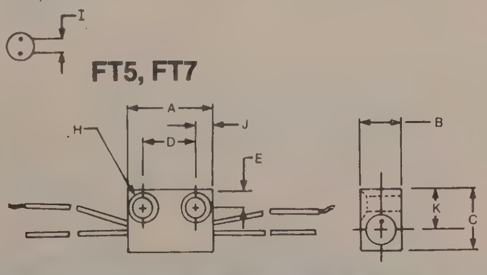
FT3



FT1, FT2



FT5, FT7



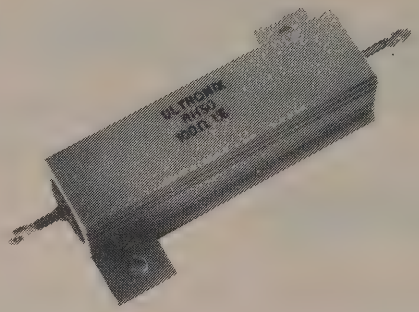
wirewound resistors

10 TO 50 WATTS

ALUMINUM HOUSED — CHASSIS MOUNT

ULTRONIX inc STERNICE
P.O. Box 1090
Grand Junction
Colorado 81502

(303) 242–0810



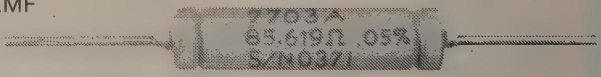
The RH Series provides high dissipation, light weight and small volume, complete environmental protection, electrical insulation 10^7 MΩ, mechanical strength, easy mounting, high stability <0.05%/year, low temperature coefficient, low ohmic values.

Ultronix Type	Power Rating at 25°C	Max. Rated Voltage	Max. Value (ohms)	Minimum Value (ohms) vs. Tolerance 0.1%	0.5%	1%	2%	5%	10%	Length ±.02 (.5)	Height Max.
RH5	10W	160V	3.32K	9.4	1.2	0.6	0.3	0.1	0.01	.64 (16.3)	.35 (8.9)
RH10	12.5W	250V	5.62K	9.4	1.2	0.6	0.3	0.1	0.009	.75 (19)	.43 (11)
RH25	25W	550V	12.1K	2.8	0.15	0.06	0.03	0.015	0.0075	1.10 (28)	.59 (15)
RH50	50W	1285V	39.2K	2.8	0.15	0.06	0.03	0.015	0.0075	1.97 (50)	.59 (15)

Power Rating based on proper heat sinking: 413cm^2 for RH5 and RH10, 536cm^2 for RH25 and RH50

HERMETICALLY SEALED – ULTRA-HIGH STABILITY

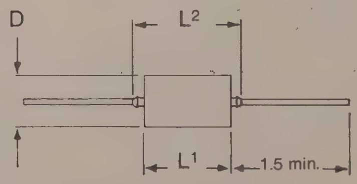
- Accuracy to 25 ppm absolute
- Shelf life to 10 ppm/year
- Temperature coefficient to ±1 ppm/°C
- Zero voltage coefficient
- Noise free
- Low thermal EMF



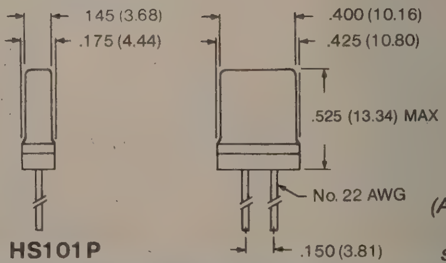
SPECIFICATIONS

Style	Max Value (Ω)	Power rating at 25° C* (W)	Max Volts	Dimensions D ±.01 (.25) inch	D mm	L1 ±.02 (.51) inch	L1 mm	L2 ±.03 (.76) inch	L2 mm	ϕ Leads AWG	ϕ Leads inch	ϕ Leads mm
HS185A	817 KΩ	0.125	300	.187	4.76	.500	12.70	.625	15.88	22	.026	.60
HS205A	1.93 MΩ	0.25	300	.250	6.35	.500	12.70	.562	14.27	20	.032	.81
HS207A	2.3 MΩ	0.4	600	.250	6.35	.750	19.05	.812	20.62	20	.032	.81
HS210A	4.10 MΩ	0.5	600	.250	6.35	1.000	25.40	1.063	27.00	20	.032	.81
HS307A	4.10 MΩ	0.6	600	.375	9.53	.750	19.05	.850	21.59	20	.032	.81
HS310A	5.63 MΩ	0.8	600	.375	9.53	1.000	25.40	1.060	26.92	20	.032	.81
HS510A	24 MΩ	1.	600	.500	12.70	1.050	26.67	1.120	28.45	20	.032	.81
HS520A	43 MΩ	1.8	900	.500	12.70	2.000	50.80	2.160	54.86	20	.032	.81
HS101P	450 KΩ	0.3 *	300	See HS101P drawing						22	.026	.60

*HS101P Power Rating is at 125°C



HSXXXA



HS101P

(Available without standoff)

ULTRONIX STERNICE

ULTRONIX INC STERNICE

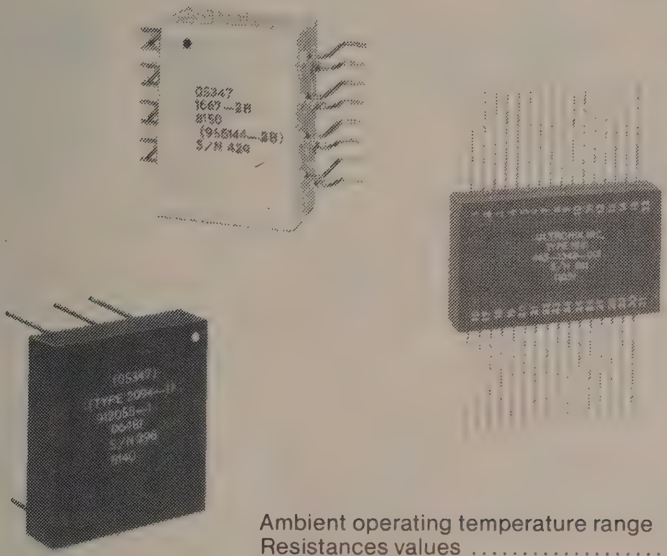
P.O. Box 1090
Grand Junction
Colorado 81502

(303) 242-0810

wirewound networks and custom requirements

CALL FOR OUR APPLICATIONS ENGINEERS TO ASSIST YOU WITH YOUR DESIGN REQUIREMENTS

CUSTOM DESIGNED NETWORKS AND MATCHED SETS



Network quality is determined by the precision of its individual resistors plus packaging and mounting techniques. **ULTRONIX** offers a unique background of experience, reliability, data, manufacturing and testing skills for wirewound resistor networks. For a sample of this ability, submit your next network requirement for evaluation by **ULTRONIX** engineers.

Matched resistor sets and custom designed networks are available from Ultronix for equipment design requiring close ratio matching and temperature tracking of resistors.

Our networks are used in a wide variety of applications such as communications satellites, precision instrumentation, aircraft controls, etc.

GENERAL SPECIFICATIONS AVAILABLE

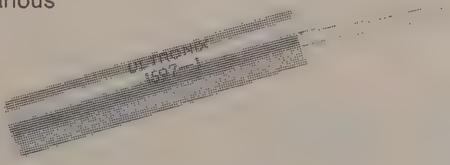
Ambient operating temperature range	−55°C to125°C
Resistances values	0.1 ohm to 40M ohm
Absolute resistor tolerances	to ±0.005%
Matched resistance ratios	to ±0.001%
Temperature coefficient match and tracking between resistors within	±1 ppm from 0°C to +85°C

Low reactance and rise times as low as 0.02 microseconds.
AC resistance match at frequence determined by user.

CUSTOM WIREWOUND TEMPERATURE SENSORS

Ultronix temperature sensors are available with temperature coefficients from −50 to +6000 PPM/°C. Various alloys and metals are used to obtain the required range of resistance change with temperature for trimming, tracking, compensation and matching. These units may be in metal housings such as brass, aluminum, or stainless steel, or molded in various epoxies or silicone.

TCR PPM/°C		TCR PPM/°C	
25°C to 125°C	-55°C to 25°C	25°C to 125°C	-55°C to 25°C
80 ± 20	80 ± 20	1400 ± 200	1500 ± 200
100 ± 20	100 ± 20	2600 ± 200	2600 ± 200
140 ± 30	140 ± 30	3000 ± 150	3000 ± 150
180 ± 30	180 ± 30	3200 ± 300	3200 ± 300
290 ± 30	290 ± 30	3500 ± 300	3500 ± 300
400 ± 40	380 ± 40	4500 ± 400	3900 ± 300
700 ± 200	700 ± 200	5000 ± 500	4000 ± 500
850 ± 80	850 ± 80	6000 ± 300	5000 ± 300
1000 ± 100	1000 ± 100		



The accompanying table lists standard TCR's for readily available alloys and metals. Most alloys show some non-linearity as can be noted by the TCR differences above and below 25°C. However, all alloys can be considered linear over narrow spectrums.

ULTRONIX STERNICE

enameled wirewound power resistors

ULTRONIX inc SFERNICE

P.O. Box 1090
Grand Junction
Colorado 81502

(303) 242–0810

As a result of more than 40 years of experience and continuous improvements the RWM Series of resistors features proven reliability either in direct or alternating current.

The high quality of the RWM results primarily from the use of a proprietary Sfernice enamel fired at high temperature and which is free from any compound that would corrode the resistive wire.

- **HIGH SPECIFIC DISSIPATION**
- **HIGH RELIABILITY LEVEL**
  - **Fire proof**
  - **Excellent endurance**
  - **Conformal vitreous enamel**
  - **Great mechanical strength**
  - **Good environmental protection**
  - **All welded construction**
- **LOW OHMIC VALUES**

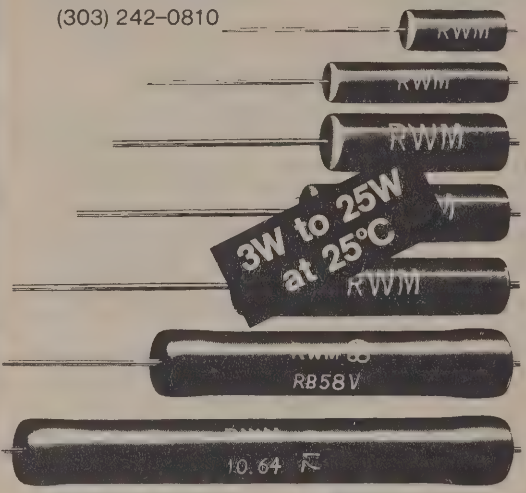
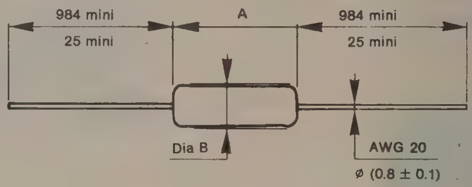


Table 1

Style	4 x 10	4 x 22	6 x 22	5 x 26	6 x 34	8 x 45	10 x 64
A	.472±.02 (12±.5)	.870±.035 (22.1±.9)	.854±.02 (21.7±.5)	.972±.02 (24.7±.5)	1.327±.02 (33.7±.5)	1.803±.024 (45.8±.6)	2.512±.028 (63.8±.7)
Dia B	.217±.02 (5.5±.5)	.217±.02 (5.5±.5)	.291±.024 (7.4±.6)	.291±.024 (7.4±.6)	.291±.024 (7.4±.6)	.370±.024 (9.4±.6)	.370±.024 (9.4±.6)
Weight: grams	1	2	2,5	3	4	8	14



inches
(mm)

FEATURES

Table 2

SFERNICE STYLES		4 x 10	4 x 22	6 x 22	5 x 26	6 x 34	8 x 45	10 x 64
MIL-R-26 E STYLES		RW 69	–	–	RW 67	–	RW 68	–
CECC 40201-001	(alternate marking)	RB 59	RB 61	RB 57	RB 57	RB 60	RB 58	–
BS - CECC 40201-002	(alternate marking)	JB	HB	KB	–	–	–	–
POWER RATING	Rated at 70°C	2.6 W	4.3 W	6 W	5.6 W	6.9 W	9.5 W	21 W
	at 25°C	3 W	5 W	7 W	6.5 W	8 W	11 W	25 W
	with surface temp. ≦ 400°C	5.5 W	7 W	10 W	10 W	12 W	20 W	25 W
OHMIC RANGE IN RELATION TO TOLERANCE	E 12 ± 10%	.1 Ω < 1 Ω	.15 Ω < 1 Ω	.15 Ω < 1 Ω	.15 Ω < 1 Ω	.33 Ω < 1.5 Ω	.47 Ω < 1.8 Ω	.68 Ω < 3.3 Ω
	E 12 ± 5%	1 Ω 6.8 KΩ	1 Ω 16 KΩ	1 Ω 27 KΩ	1 Ω 27 KΩ	1.5 Ω 36 KΩ	1.8 Ω 62 KΩ	3.3 Ω 100 KΩ
LIMITING ELEMENT VOLTAGE		120 V	300 V	350 V	350 V	500 V	650 V	800 V
CRITICAL RESISTANCE		4.8 KΩ	–	17.5 KΩ	18.8 KΩ	31 KΩ	38 KΩ	25.6 KΩ

MARKING

SFERNICE Trade mark, SFERNICE series and style, CEEC style, if applicable, (except for the smallest model due to lack of space 4 x 10 or RB 59), ohmic value (in Ω), resistance tolerance (in %), manufacturing date.

SPECIFICATIONS

Tolerance: ± 5% standard. ± 1% to ± 10% on request.
Temperature coefficient: + 75 ppm/ °C typical.
Dielectric withstanding voltage: 1000 V RMS.
Inductance: non inductive (Ayrton-Perry) winding available.

ORDERING PROCEDURE

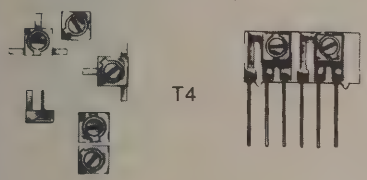
SERIES	STYLE	NON INDUCTIVE WINDING	OHMIC VALUE	TOLERANCE
RWM	8x45	NI	1,6 KΩ	±5%

ULTRONIX sfernice

trimmers and potentiometers

ULTRONIX inc SFERNICE
P.O. Box 1090
Grand Junction
Colorado 81502
(303) 242-0810

All models of trimmers utilize a quality cermet track contained within sealed plastic cases that will withstand normal board cleaning processes, (the miniature T4 requires a protective cap).
The product line exhibits high performance and proven reliability yet competitively priced to fit existing applications.


T4

T386C
T386X

T386F
T386P
T386T

T262W

TM6X

T7

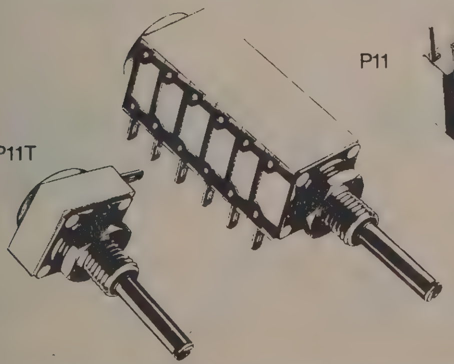
T262X

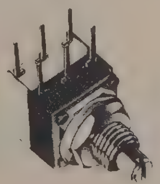
TM6Y

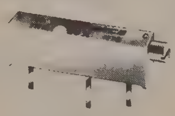
FEATURES

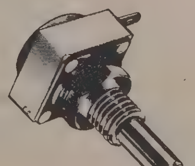
Table 1

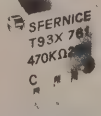
Series	Resistance element and adjustment turns	Resistance range	Tolerance ± %	Power	Load life stability (typical)	T.C.	Operating temperature range	Case dimensions in inches (millimeters)	Enclosure
T4	Cermet single turn	10Ω ... 1MΩ	20 - 10	0.15 W at +70°C	2% 1000 Hrs at + 70°C	±100 ppm/ °C	−65°C+155°C	.117x.117x0.94 (4.5x4.5x2.4)	Open frame
T7 T386 (TX, TY)	Cermet single turn	10Ω ... 1MΩ	10	0.5 W at +85°C	3% 1000 Hrs at + 45°C	−55°C+125°C	−55°C+125°C	T7 Ø.275 (7) TX.323x.275x.209 (8.2x7x5,3) TY.275x.263x.255 (7x6.7x6.5)	Enables cleaning
T262 (T63)	Cermet multiturn	10Ω ... 1MΩ	10	0.25 W at +85°C	1% 1000 Hrs at + 85°C	−65°C+155°C	−65°C+155°C	.260x.268x.185 (6.6x6.8x4.7)	Enables cleaning
T299 (T93)	Cermet multiturn	10Ω ... 2.2MΩ	10	0.5 W at +70°C	2% 1000 Hrs at + 70°C	−55°C+125°C	−55°C+125°C	.374x.374x.197 (9.5x9.5x5)	Enables cleaning
T006P (T18)	Cermet multiturn	10Ω ... 1MΩ	10	0.75 W at +70°C	1% 1000 Hrs at + 70°C	±100 ppm/ °C	−55°C+125°C	.748x.252x.185 (19x6.4x4.7)	Enables cleaning
ULTRA HIGH PRECISION AND STABILITY TM6 (RJR 26 style)	Metal foil multiturn	22Ω ... 4.7KΩ	10 - 5	0.25 W at +70°C	0.5% 2000 Hrs at + 85°C	±10 ppm/ °C	−55°C+155°C	.260x.268x.185 (6.6x6.8x4.7)	Fully sealed container
MODULAR POTENTIOMETERS P11 SWITCH AVAILABLE	Cermet single turn	22Ω ... 4.7MΩ	20 - 10 - 5	1 W at +70°C	1% 1000 Hrs at + 70°C	±100 ppm/ °C	−55°C+125°C	.492x.492x.354 (12.5x12.5x9)	Enables cleaning


P11T

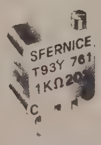

P11


T006P

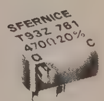

P11Q



T299X
T299Z



T299W
T299Y



T299P

ULTRONIX SFERNICE

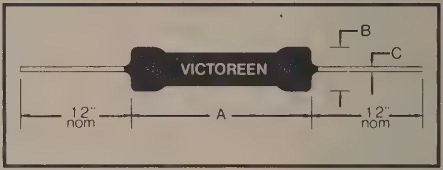
VICTOREEN Carbon & Metal Film Resistors

From general purpose thru extreme precision, Victoreen now offers low-priced Carbon and Metal Film Resistors.

In addition to our broad based stock, custom stocking plans are available to fit your needs.

VCF-125,250,500 (Carbon Film)

- Wide resistance range: 1 ohm to 10M ohm
- Tolerances available: 1, 2 & 5%
- Packaging variety: Bulk, Tape & Reel, Ammo Pack
- Cut and form leads available as required
- Custom stocking plans available
- Epoxy conformal coated

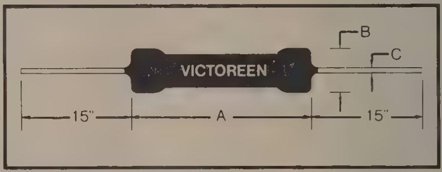


Dimensions (in inches)

Type	A Max Length	B Max O.D.	C Nominal
VCF-125	0.150	0.080	0.020
VCF-250	0.270	0.110	0.024
VCF-200	0.410	0.160	0.024
VCF-1000	0.512	0.189	0.028
VCF-2000	0.709	0.256	0.028

VMF-55,60 (Metal Film)

- Wide Temperature Coefficient range: 25, 50, 100PPM/°C
- Tolerances available: 0.25%, 0.5%, 1%, 2%, 5%
- Packaging variety: Bulk, Tape & Reel, Ammo Pack
- Cut and form leads available as required
- Custom stocking plans available
- Epoxy conformal coated



Dimensions (in inches)

Type	A Max Length	B Max O.D.	C Nominal
VMF-55	0.275	0.105	0.024
VMF-60	0.400	0.155	0.028
VMF-65	0.492	0.177	0.028

Capabilities

Type	Resistance Range (Ohm)	Power Rating (@ 70 C)	Voltage Rating
VCF-125	1-1M	1/8W	200V
VCF-250	1-10M	1/4W	250V
VCF-500	1-10M	1/2W	350V
VCF-1000	1-10M	1W	500V
VCF-2000	1-10M	2W	500V
VMF-55	10-1M	1/4W	250V
VMF-60	10-1M	1/2W	500V
VMF-65	10-1M	1W	500V

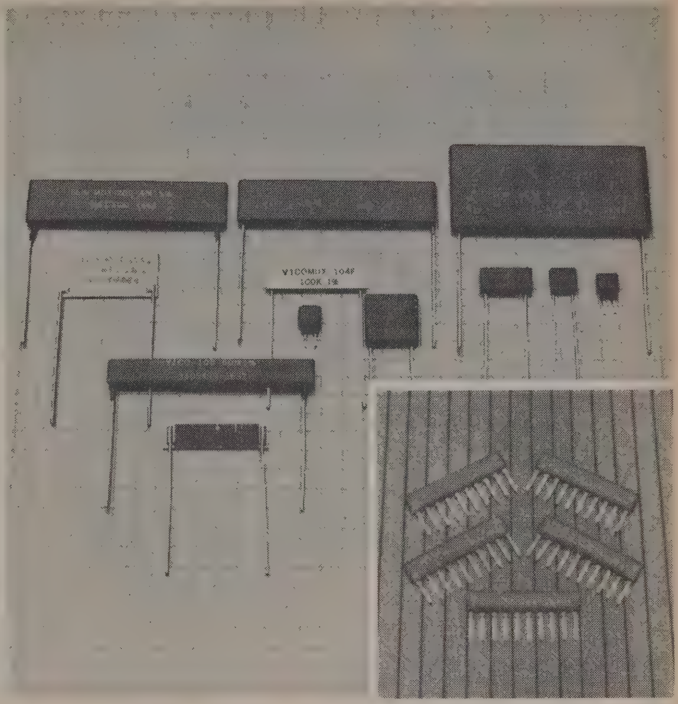
VICTOREEN

Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN Slim-Mox and S.I.P. Networks

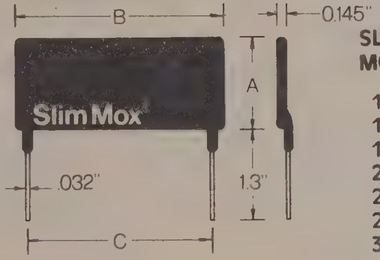
Slim-Mox Resistors are ideal for applications where high voltage/high impedance or high density packaging are benefits to the designer.

S.I.P. Networks are available from 47 ohm to 2.2 megs, with stocking plans available to fit your needs.



Slim-Mox

- Stocking values available
- Wide resistance range to 50,000 Meg ohm
- Voltage capability to 18 KV
- Power rating to 5 Watts
- Tolerances from 0.5 to 20%
- Epoxy conformal coated



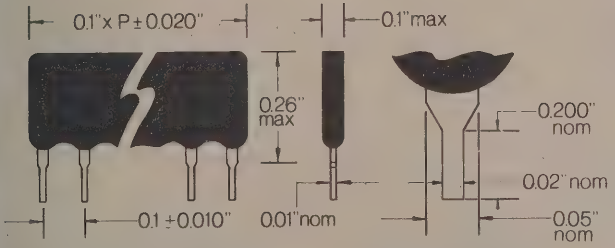
SLIM-MOX	A Max. Length	B Max. O.D.	C Nominal
102	0.34	0.58	0.4
104	0.34	1.08	0.9
108	0.34	2.08	1.9
202	0.59	0.58	0.4
204	0.59	1.08	0.9
208	0.59	2.08	1.9
308	0.84	2.08	1.9

Capabilities

Type	Resistance Range (ohm)	Power Rating (@ 70°C.)	Voltage Rating
SLIM MOX-102	1K-10,000M	0 5W	2500V
SLIM MOX-104	1K-50,000M	1 0W	5000V
SLIM MOX-108	1K-50,000M	2 0W	10,000V
SLIM MOX-202	1K-30,000M	1 0W	5000V
SLIM MOX-204	1K-50,000M	2 0W	10,000V
SLIM MOX-208	1K-50,000M	4.0W	15,000V
SLIM MOX-308	1K-50,000M	5 0W	18,000V

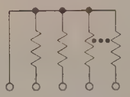
VNK-1V,2V

- Wide resistance range: 47 ohm to 2.2 Meg ohm
- Tolerances available: 2, 5, 10 & 20%
- Bulk package
- Custom stocking plans available
- Epoxy conformal coated
- 5 to 14 pin configurations available

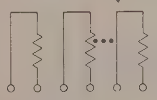


Capabilities

Code	Temperature Coefficient (PPM/°C)	Resistance Range (ohm)	Tolerance (%)
A	150	47 2 2M	2, 5
B	200	100 - 2.2M	5, 10, 20



Type 1V
Pin One Common



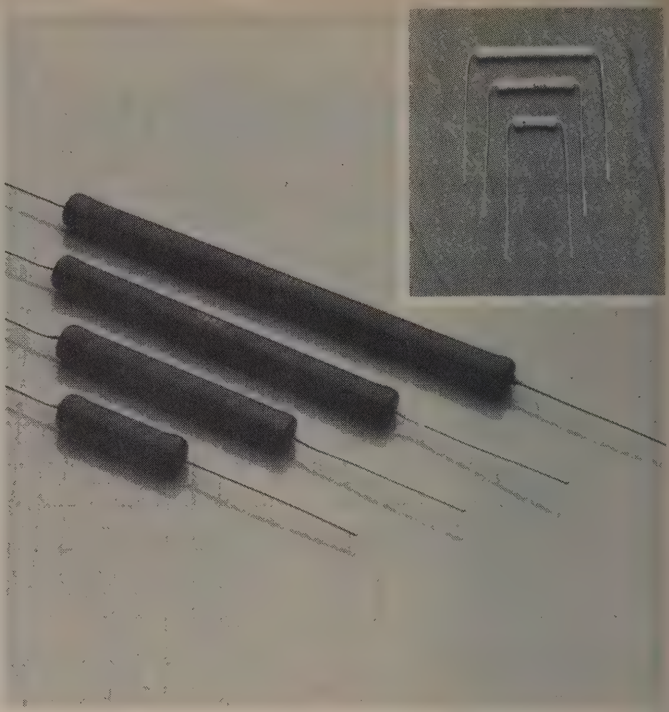
Type 2V
Isolated Elements

Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN

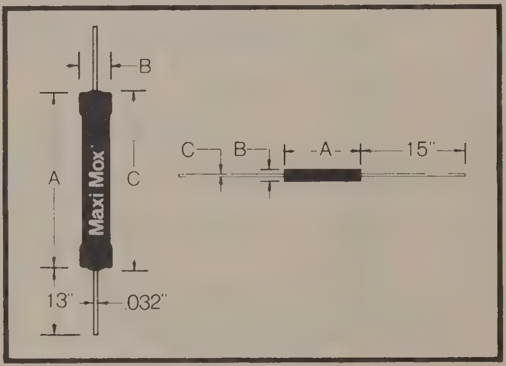
VICTOREEN High Voltage Mini and Maxi Mox Resistors

Mini and Maxi Mox Resistors have historically been custom-manufactured resistors.
NOW AVAILABLE FROM STOCK.



Mini-Mox/ Maxi-Mox

- Stocking values available
- Wide resistance range to 50,000 Meg ohm
- Voltage capability to 37.5 KV
- Power rating to 12.5 Watts
- Tolerances from 0.5 to 15%
- Epoxy conformal coated



Dimensions (in inches)

		A Max. Length	B Max. O.D.	C Nominal
MINI-MOX	200	0.275	0.105	0.024
	300	0.435	0.145	0.028
	400-24	0.500	0.150	0.020
	750-24	0.840	0.150	0.020
	1125-24	1.235	0.150	0.020
MAXI-MOX	1-13	1.140	0.345	1.2
	2-13	2.140	0.345	2.2
	3-13	3.140	0.345	3.2
	4-13	4.140	0.345	4.2
	5-13	5.140	0.345	5.2

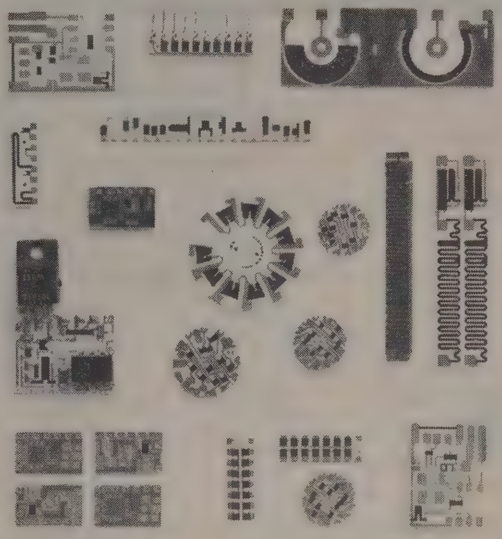
Capabilities

Type	Resistance Range (ohm)	Power Rating (@ 70° C)	Voltage Rating
MOX-200	1M-1000M	.25W	500V
MOX-300	1M-1000M	.50W	1000V
MOX-400-24	1K-20,000M	.25W	1000V
MOX-750-24	1K-30,000M	.50W	2000V
MOX-1125-24	1K-50,000M	1.00W	5000V
MOX-1-13	10K-20,000M	1.5W	7500V
MOX-2-13	20K-30,000M	3.0W	15,000V
MOX-3-13	30K-30,000M	4.5W	22,500V
MOX-4-13	40K-50,000M	6.0W	30,000V
MOX-5-13	50K-50,000M	7.5W	37,500V

Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN

VICTOREEN
Micro Circuits



General

- **Resistance Range: .1 ohm to 50,000 Megohm**
- **Termination Materials: PdAg, PdAu, PtAg, PtAu, Ag, Au**
- **Minimum Line Resistance: .020 ohm/□**
- **Line Definition: .005″ Min. line width .005″ Min. spacing between adjacent lines**

Electrical Options

Ratio Matching to ± .1%
Absolute Tolerances to ± .1%
Temperature Coefficient Tracking to ± 10PPM/°C
Power Ratings of up to 50 Watts/In.^{2}

Mechanical Options

Any Size to a Preferred Maximum of 3″ × 3″
Electrical Crossovers, Multi-Layer Printing
Double Sided Printing of Resistive and Conductive Paths
Through Hole Plating on Internal Holes (vias)
Wrap Around Plating

Victoreen, Inc.
A Sheller-Globe Corporation Subsidiary
10101 Woodland Avenue
Cleveland, Ohio 44104
(216) 795-8200

VICTOREEN

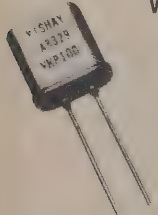
VISHAY RESISTIVE SYSTEMS GROUP

FIXED RESISTORS

Hermetically Sealed Resistors — Metrology and Laboratory Groups

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) Length x Diameter	Shelf-Life Stability (Max.△R)[3]	Load-Life Stability (Max.△R)[3]	Temperature Coefficient of Resistance
VHA412	5-100K 101K-250K	±0.001%	0.3W 0.2W	250	0.625 x 0.375 (15.88) x (9.53)	5ppm after 1 year and 10ppm after 3 years	0.002% 2000 hours 0.1W @60°C	Nominal[2] / Standard Spread[2] 0°C to +25°C: +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C: -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C: +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C: -1.8ppm/°C ±2.0ppm/°C
VHA414	5-200K 201K-500K	±0.001%	0.5W 0.3W	350	1.000 x 0.375 (25.4) x (9.53)			
VHA512*	5-300K 301K-750K	±0.001%	0.75W 0.4W	350	0.625 x 0.375 (15.88) x (9.53)			
VHA516-4*	5-400K 401K-1M	±0.001%	1.0W 0.5W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA516-5*	5-500K 501K-1.25M	±0.001%	1.25W 0.6W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA516-6*	5-600K 601K-1.5M	±0.001%	1.5W 0.7W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA518-7*	5-700K 701K-1.75M	±0.001%	1.75W 0.8W	600	1.000 x 0.500 (25.4) x (12.7)			
VHA518-8*	5-800K 801K-2.0M	±0.001%	2.0W 0.9W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-9*	5-900K 901K-2.25M	±0.001%	2.25W 1.0W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-10*	5-1M >1M-2.5M	±0.001%	2.5W 1.1W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-11*	5-1.1M >1M-3.3.M	±0.001%	2.5W 1.2W	600	1.500 x 0.500 (38.1) x (12.7)			
VHP202	5-100K 101K-250K	±0.001%	0.3W 0.2W	300	W x L x H (max) 0.195 x 0.445 x 0.430** (4.95) x (11.30) x (10.92) Lead Spacing 0.150 (3.81) nom. †			

Hermetically Sealed "0" TCR Resistor



Model Number	Resistance (Ohms)	Tolerance[1] @+25°C	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (2000h) (Max.△R)[3]	Load-Life Stability (Max.△R)[3]	Temperature Coefficient of Resistance
VHP100	100-150K	To ±0.005%	.3W	.15W	300V	W 0.185 ±.020 (4.70 ±0.51) L 0.435 ±.020 (11.05 ±0.51) H 0.430**±.020 (10.92 ±0.51) Lead Spacing 0.150 (3.81) nom. †	5ppm after 1 year and 10ppm after 3 years	0.02% max R 0.3W @ 70°C and 0.02% max△R 0.15W @ 125°C	-55°C to +125°C < 1ppm/°C

* Number of chips is designated after dash i.e., VHA516-4 (4 chips). ** .375H (9.53mm) available on special order † 0.200 (5.08mm) lead spacing available

Also available in a four terminal lead.

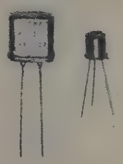
VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY RESISTIVE SYSTEMS GROUP

FIXED RESISTORS

Hermetically Sealed Resistors — Industrial and Aerospace Group



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance
VHS555[4]*	1-250K	±0.005%	0.6W	0.3W	300	0.195 x 0.445 x 0.430 (4.95) x (11.30) x (10.92) Lead spacing 0.150 (3.81) Nom.	5ppm after 1 year and 10ppm after 3 years	0.0025% 2000 hrs. 0.1W @ 60°C 0.015% 2000 hrs. 0.3W @ 125°C 0.01% 10,000 hrs. 0.05W @ 125°C	Nominal[2] Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
VHS102	1-250K	±0.005%	0.6W	0.3W	300	0.195 x 0.445 x 0.430** (4.95) x (11.30) x (10.92) Lead spacing 0.150 (3.81) Nom.†			
VHM-1	5-33K	±0.01%	0.2W	0.1W	45	Height x Diameter 0.210 x 0.230 (5.33) x (5.84) Standard TO-18 Case			

Established Reliability Resistors — MIL Style RNC90Y (MIL-R-55182/9, Char. Y)

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance
RNC90Y[4]	4.99-100K	±0.005%	0.6W	0.3W	300	0.105 x 0.310 x 0.326 (2.67) x (7.87) x (8.28) Lead spacing 0.150 (3.81) Nom. Dim. Tol. ±0.010 (0.25)	25ppm after 1 year and 50ppm after 3 years	0.015% 2000 hrs. 0.3W @ 125°C	Nominal[2] Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
S555	1-100K 101K-150K	±0.005%	0.6W	0.3W 0.2W	300	0.105 x 0.310 x 0.326 (2.67) x (7.87) x (8.28) Lead spacing 0.150 (3.80) Nom. Dim. Tol. ±0.010 (0.25)			

* Within the resistance range of 4.99 Ω to 100KΩ, this unit contains an RNC90Y inside the hermetically-sealed unit.
** .375H (9.53mm) available on special order
† .200 (5.08mm) lead spacing available

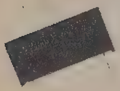
VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY RESISTIVE SYSTEMS GROUP

FIXED RESISTORS

Precision Resistors — High Performance Industrial & Aerospace Group

	Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)	Temperature Coefficient of Resistance
	S102C™[4]	1-100K 101K-250K	±0.005%	0.6W	0.3W 0.2W	300	0.105 x 0.302 x 0.326 (2.67) x (7.67) x (8.28) Dim. Tol. ±0.010 (0.25) Lead Spacing 0.150 (3.81) Nom.	25ppm after 1 year and 50ppm after 3 years	0.005% 2000 hrs. 0.1W @70°C	Nominal[2] / Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
	S104D	1-200K 201K-500K	±0.005%	1.0W	0.5W 0.3W	350	0.160 x 0.575 x 0.530 max* (4.06) x (14.61) x (13.46) Lead Spacing 0.400 (10.16) Nom.		0.015% 2000 hrs. 0.3W @125°C	
	S105D	1-300K 301K-750K	±0.005%	1.5W	0.75W 0.4W	350	0.160 x 0.820 x 0.530 max* (4.06) x (20.83) x (13.46) Lead Spacing 0.650 (16.51) Nom.		0.05% 10,000 hrs. 0.3W @125°C	
	**S106D**	.5-400K 401K-1M	±0.005%	2.0W	1.0W 0.5W	500	0.260 x 1.190 x 0.530 max* (6.60) x (30.23) x (13.46) Lead Spacing 0.900 (22.86) Nom.			

Value Engineered and Standard Stock Precision Resistors

	Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance (Limits)
	VSR4	1-200K 201K-500K	.005%	.5	0.4W 0.2W	350	0.160 x 0.575 x 0.530 max* (4.06) x (14.61) x (13.46) Lead Spacing 0.400 (10.16) Nom.	25ppm after 1 year	—	0°C to +60°C ±4ppm/°C -55°C to +125°C ±8ppm/°C
	VSR5	1-300K 301K-750K	.005%	.75	0.6W 0.3W	350	0.160 x 0.820 x 0.530 max* (4.06) x (20.83) x (13.46) Lead Spacing 0.650 (16.51) Nom.			
	VSR6	.5-400K 401K-1M	.005%	1.0	0.8W 0.4W	500	0.260 x 1.190 x 0.530 max* (6.60) x (30.23) x (13.46) Lead Spacing 0.900 (22.86) Nom.			

* .413H (10.49mm) available on request

VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY RESISTIVE SYSTEMS GROUP

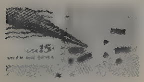
FIXED AXIAL LEAD RESISTORS

Value Engineered and Standard Stock Axial Lead Precision Resistors

	Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) L × D	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance (Limits)
	VTA52 (RBR52)	5-750K 25-750K	±.1 ±.01	1.0W	.5W	300	1.00 x 3.75 (25.4) x (9.53)	25ppm after 1 year	0.05% 2000 hrs. @ 125°C	0°C to +60°C ±4ppm/°C -55°C to +25°C ±8ppm/°C
	VTA53 (RBR53)	5-500K 25-500K	±.1 ±.01	.66W	.33W	300	.750 x .375 (19.05) x (9.53)			
	VTA54 (RBR54)	5-500K 25-500K	±.1 ±.01	.5W	.25W	300	.750 x .260 (19.05) x (6.60)			
	(VTA55) (RBR55)	5-250K 25-250K	±.1 ±.01	.3W	.15W	300	.500 x .260 (12.70) x (6.60)			
	VTA56 (RBR56)	5-250K 25-250K	±.1 ±.01	.25W	.125W	300	.356 x .260 (9.04) x (6.60)			
	VMTA55 (RNC55)	5-30K 50-30K	±.1 ±.01	.2W	.1W	200	.270 x .120 (6.86) x (3.05)			
	VMTA60 (RNC60)	5-30K 50-30K	±.1 ±.01	.25W	.125W	250	.375 x .125 (9.53) x (3.18)			
	VMTB60 (RNC60)	5-60K 50-60K	±.1 ±.01	.25W	.125W	250	.375 x .160 (9.53) x (4.07)			
	VSA100	5-250K 50-250K	±.1 ±.01	.6W	.3W	300	.305 (7.75) max T. .102 (3.60) max H. .250 (6.40) max			

CHIPS

Microchip (V5X5) and Minichip (V15X5) Resistors for Hybrid Microcircuits

	Model Number	Resistance* (Ohms)	Trim Range	Tolerance[1] To	Power at 70°C	Max. Work. Voltage	Nominal Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Nominal TCR[2]	Standard TCR Spread from Nominal[2]
	V5X5	5-10K	0 To 1.2x the nominal prevalue	±0.02% or ±0.005%[5]	0.05W	40	0.050 x 0.050 x 0.020 (1.27) x (1.27) x (0.508)	0.005%/Yr. 0.0005%/Yr. Hermetically Packaged	0.05% 2000 Hrs. @70°C	0°C to +25°C +0.6ppm/°C +25°C to +60°C -0.6ppm/°C -55°C to +25°C +2.2ppm/°C +25°C to +125°C -1.8ppm/°C	±1.5ppm/°C ±1.5ppm/°C ±2.0ppm/°C ±2.0ppm/°C
	V15X5	5-30K	0 To 1.3x the nominal prevalue	±0.02% or ±0.005%[5]	0.1W	40	0.150 x 0.050 x 0.020 (3.81) x (1.27) x (0.508)				

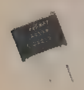
* Higher resistance ranges and larger size chips available

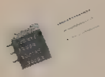
VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY RESISTIVE SYSTEMS GROUP

UNITIZED RESISTOR NETWORKS AND VOLTAGE DIVIDERS





Model Number[9]	No. of Resistors	R. Value of Each Individual Resistor[10] (Ohms)	Tolerance Ratio Between Resistors at 25°C To	Maximum Dimensions (Excluding Leads) W x L x H x Inch (mm)	TCR Ratio Between Resistors (Tracking) (Ref. @ 25°C)
300190 300191	2	100-250K	.005%	0.160 x 0.575 x .413 (4.06) x (14.61) x (10.49)	0° to +60°C -55°C to +125°C (Standard Spread) ±1.5ppm/°C ±2.0ppm/°C (Maximum Spread) ±2.5ppm/°C ±2.3ppm/°C (Available to) 0.5ppm/°C 0.5ppm/°C
300192 300193 300194	3	100-250K	.005%	0.160 x 0.820 x .413 (4.06) x (20.83) x (10.49)	
300195 300196 300197 300198 300199	4	100-250K	.005%	0.260 x 1.190 x .413 (6.60) x (30.23) x (10.49)	
300210	3	100-250K	.005%	0.160 x 0.820 x .413 (4.06) x (20.83) x (10.49)	
300211 300212	4	100-250K	.005%	0.260 x 1.190 x .413 (6.60) x (30.23) x (10.49)	
300144	2	100-20K[11]	.005%	.105 x .302 x .320 (2.67) x (7.67) x (8.128)	−55°C to +125°C (Maximum Spread) 1.0ppm/°C (Available to) 0.1ppm/°C
300145	4	100-20K[11]	.005%	0.375 x 0.375 x 0.200 (9.525) x (9.525) x (5.080) Nom.	
VSR144	2	Any value from 100Ω-20KΩ with some derating of power	.005%	.105 x .302 x .320 (2.67) x (7.67) x (8.128)	To 3.0ppm/°C (absolute TCR to 5.0ppm/°C

Hermetically-Sealed Miniature Voltage Dividers

Model Number[9]	No. of Resistors	R. Value of Each Individual Resistor[10] (Ohms)	Tolerance Ratio Between Resistors at 25°C To	Maximum Dimensions (Excluding Leads) W x L x H x Inch (mm)	TCR Ratio Between Resistors (Tracking) (Ref. @ 25°C)
VHD200	1	100-20K	.005%	.195 x .445 x .430 (4.95) x (11.30) x (10.92)	To 0.1ppm/°C (absolute TCR to 0.6ppm/°C)
VHD144	2	Any value from 100Ω-20KΩ with some derating of power	.005%	.195 x .445 x .430 (4.95) x (11.30) x (10.92)	To 0.5ppm/°C (absolute TCR to 2.0ppm/°C)

VISHAY
...to be precise®

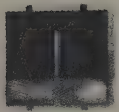
63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY RESISTIVE SYSTEMS GROUP

POWER RESISTORS AND PLATES

Precision Power Plate Resistors for Current Sensing and Power Surge Applications

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Max. Work. Voltage	Maximum Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max.ΔR)[3]	Standard TCR Spread from Nominal
VPR-5	1-100K	.01%	5W	300	.450 x .625 x .312 (11.43) x (15.88) x (7.93)	25ppm	Above 10 ohms ±5ppm/°C
VPR-7	1-100K	.01%	7W	300	.450 x 1.030 x .312 (11.43) x (26.16) x (7.93)		Below 10 ohms ±10ppm/°C



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C[6]	Nominal Plate Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Resistance Element Area Sq. In. (mm)	Nominal TCR[2]
V3PR-300589	10-5K	±0.005%[5]	3W in air; 10W on heat sink	1.000 x 1.000 x .025 (25.4) x (25.4) x (0.635)	25ppm after 1 year	0.03% 2000 hrs @ 125°C	100 (25.40) 0.98 (24.89) 0.658 (16.71) 11.20 (284.48)	±2ppm/°C
V3PR-300586 (2 R's)	0.25	±0.25%	25W*	1.600 x 1.700 x 0.025 (40.64) x (43.18) x (0.635)	25ppm after 1 year	0.03% 2000 hrs @ 125°C	100 (25.40) 0.98 (24.89) 0.658 (16.71) 11.20 (284.48)	±10ppm/°C
V3PR-300338	0.5	±0.25%	25W*					
V3PR-300571	1.0	±0.25%	20W*	1.750 x 1.20 x 0.025 (44.45) x (28.45) x (0.635)				
V3PR-300572	2.0	±0.25%	20W*	1.750 x 1.20 x 0.025 (44.45) x (28.45) x (0.635)				
V3PR-300610 (4 R's)[7]	2.0	±0.25	>100W*	4.000 x 5.000 x 0.025 (101.6) x (127.0) x (0.635)				

* Power is 10W/sq. in. when a heat sink, which keeps the foil temperature below 100°C, is used.

Hermetically Sealed Precision Power and Current Sensing Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C*	Max. Work. Voltage	Nominal Plate Dimensions Inch (mm) L x W x T	Load-Life Stability (Max.ΔR)[3]	Shelf-Life Stability (Max.ΔR)[3]	Nominal TCR[2]
VHP-3	1-400K	±0.01%	3W in air; 10 W on heat sink (3A max)	750	0.346 x 1.530 x 1.000 (8.79) x (38.86) x (25.4) (Standard TO-3 Case)	0.05% 2000 hrs @ 25°C	5ppm after 1 year	0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
VHP-4**	1-400K							

* Below 5 ohms, TCR is ±15ppm/°C (-55°C to +125°C), ** 4 terminal model

VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY RESISTIVE SYSTEMS GROUP

NETWORKS

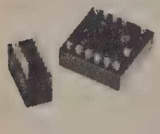
Hermetically Sealed Miniature Precision Resistor Networks in DIP, TO and Other Packages

Model Number	Type Package	Max. No. of V5 x 5 Resistor	R Value of each Individual Resistor	Tolerance Ratio Between Resistors @25°C To	Maximum Dimensions (Excluding leads) Inch (mm) H x D - pin circle	TCR Ratio Between Resistors (Ref. @25°C)
1403	4 pin TO-18	5 1	10K or 30K	.005%	0.200 x 0.212 - 0.100 (5.08) x (5.38) - (2.54)	0° to +60°C -55°C to +125°C (Standard Spread) ±1.5ppm/°C +2.0ppm/°C (Maximum Spread) ±2.5ppm/°C ±2.3ppm/°C (Available To) 0.5ppm/°C 0.5ppm/°C
1413	8 pin TO-5	9	30K	.005%	0.200 x 0.370 - 0.200 (5.08) x (9.40) - (5.08)	
1417	8 pin TO-5	12	30K	.005%	0.200 x 0.362 - 0.230 (5.08) x (9.19) - (5.84)	
1419	10 pin TO-5	12	30K	.005%	0.200 x 0.362 - 0.230 (5.08) x (9.19) - (5.84)	
1421	12 pin TO-8	49	30K	.005%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	
1422	16 pin TO-8	49	30K	.005%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	
					H x L x W	
1442	8 pin DIP	12	30K	.005%	0.10 x 0.53 x 0.32 - 0.300 (2.55) x (13.47) x (8.16) - (7.62)	
1445	14 pin DIP	30	30K	.005%	0.100 x 0.778 x 0.296 - 0.300 (2.54) x (20.54) x (7.52) - (7.62)	
1446	16 pin DIP	36	30K	.005%	0.100 x 0.81 x 0.298 - 0.300 (2.54) x (20.57) x (7.57) - (7.62)	
1457	18 pin DIP	80	30K	.005%	0.150 x 1.007 x 0.5 - 0.300 (3.81) x (25.58) x (12.7) - (7.62)	
1460	20 pin 1'' x 1'' Plug-in	221	30K	.005%	0.220 x 1.01 x 0.90 - 0.900 (5.59) x (25.65) x (22.85) - (22.86)	
1476	30 pin 1'' x 1'' flat pack	225	30K	.005%	0.125 x 1.148 x 0.950 - 0.06** (3.17) x (29.16) x (24.13) - (1.52)**	
1485	16 pin leadless chip carrier	12†	10K	.005%		

* pin square ** axial lead pin spacing † 12 (5x5 chips) or 4 (15x5) chips

STANDARD AND CUSTOM RESISTANCE NETWORKS

Binary Networks and BCD Ladders



Besides designing completely custom precision networks to your most demanding specifications, Vishay offers standard binary R-2R ladder networks in 4-bit to 16-bit configurations (voltage-fed) with resistance values from 1 ohm to 50KΩ; 2R to 100K . Three basic package styles (nominal dimensions): **Profile 500,** 0.750'' (19.05 mm) W x 0.500'' (12.70 mm) H. **Profile 375,** 1.230'' (31.24 mm) W x 0.365'' (9.27 mm) H. Lengths dependent on number of bits: min. 0.700'' (17.78 mm) for 4-bit Profile 500 to 2.14'' (54.35 mm) for 16-bit ladder; min. 0.730'' (18.54 mm) for Profile 375 to 2.59'' (65.78 mm) for 15-bit package. **Profile 200,** 1.0'' (25.4 mm) W x 1.0'' (25.4 mm) L x 0.200'' (5.08 mm) H only.

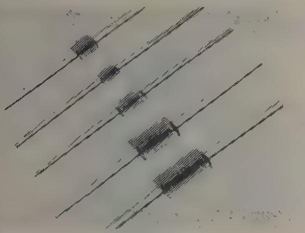
VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY-ANGSTROHM

METAL FILM RESISTORS

Hermetically Sealed per MIL-R-55182 Characteristics C and E
Hermetic Glass-to-Metal Seal — Failure Rates M (1%) thru S (0.001%)



FEATURES

- High stability
- Hermetic enclosure
- Inert gas environment
- In accordance with MIL-R-55182, Styles RNR and RNN
- Extended life and reliability
- 1/10, ⅛, ¼, ½ watt sizes (5 case sizes)

APPLICATIONS

Aerospace, military, oceanography . . . wherever the application or environment demands the ultimate in resistor reliability, Angstrohm's hermetically sealed metal film resistors are unquestionably first-choice. The HN glass-to-metal hermetic seal protects the resistance element from virtually any adverse environmental influence, and will withstand in excess of 3,000 p.s.i. external pressure without leakage.

SPECIFICATIONS

MIL-Specifications: RNR/RNN style resistors are designed to exceed the requirements of MIL-R-55182 for characteristics C and E.

Power Rating: All RNR/RNN resistors are based on full rated load at an ambient of 125°C.

Resistance Tolerances: The standard resistance tolerances are ±1.0% (F), ±.5% (D), and ±.1% (B) per Q.P.L. 55182. Consult factory for tighter tolerances and special matching.

Resistance Values: See Table 1 for range of resistance values.

Derating: For ambients above 125°C, units derate linearly to zero at 175°C.

Applied voltage shall not exceed $\sqrt{PR}$. See Table 1.

RATINGS AND DIMENSIONS

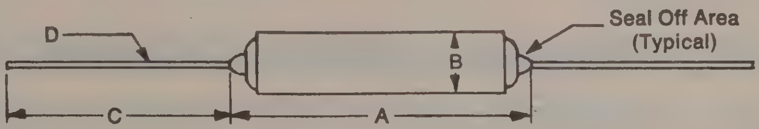
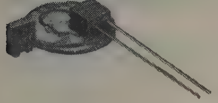


TABLE 1

Designations		Watt Rating @125°C	Volts Max.	Resistance Range in Ohms†		Approx. Dimensions (in inches)				Weight GMS (approx.)
MIL-55182 Style*	Angstrohm Style			Min.	Max.	A Max.	B Dia. Max.	C Nom.	D AWG	
RNR/RNN55	HN55	1/10	200	10	1.21 Meg.	.281	.112	1.50	#22	.314
RNR/RNN57	HN57	⅛	200	49.9	200K	.325	.150	1.25	#24	.317
RNR/RNN60	HN60	⅛	250	10	2.49 Meg.	.437	.150	1.50	#22	.485
RNR/RNN65	HN65	¼	300	24.9	4.99 Meg.	.655	.250	1.50	#22	.950
RNR/RNN70	HN70	½	350	24.9	7.50 Meg.	.796	.250	1.50	#20	1.300

† Consult Factory for extended ranges.

Series AF-102 Precision Metal Foil Resistors to MIL-R-55182-RNC90Y



Angstrohm's new Series AF-102 metal foil resistors provide a new standard of performance in the precision resistor field. They are designed to meet the most stringent environmental specifications without any degradation of performance, and feature a proprietary new lead termination anchor design that has proved to be the most rugged in the industry.

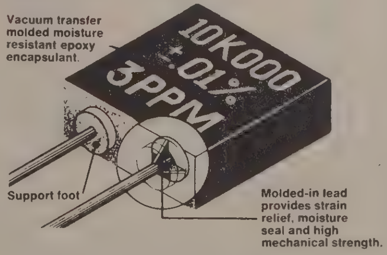
Electrical performance meets or exceeds the requirements of MIL-R-55182 while providing much 'flatter' temperature coefficient characteristics than comparable resistors. Exceptionally low thermal E.M.F.'s are a result of the AF-102's unique lead configuration which also results in low distributed capacitance and inductance. The molded-in stand-off feet protect the resistor element from high soldering temperatures.

SPECIFICATIONS

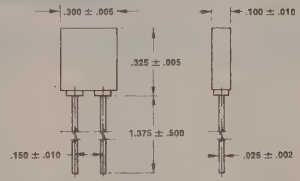
Power Rating	.3 Watt @ 125°C .6 Watt @ 70°C
Voltage	300 VDCW max.
Operating Temperature	−65°C to +175°C
Resistance Range	1Ω to 100KΩ*
Resistance Tolerance	To ± .005%
Temperature Coefficients (TCR)	±5ppm/°C ±3ppm/°C ±2ppm/°C
TCR Tracking	To ½ ppm/°C
Shunt Capacitance	<0.5pF
Inductance	<.08μH
Typ. Rise Time	1nS @ 1KΩ
Thermal EMF	<.3μV/°C
Voltage Coefficient	<±.0001%/VoltΔR
Weight	.6 gm

*1Ω to 20KΩ standard. 20KΩ to 100KΩ on special order.

CONSTRUCTION


Vacuum transfer molded moisture resistant epoxy encapsulant.
10K000
±.01%
3PPM
Support foot
Molded-in lead provides strain relief, moisture seal and high mechanical strength.

DIMENSIONS



ORDERING INFORMATION

AF-102	10K 101	T-20	T
CASE SIZE	RESISTANCE	TEMP. COEFF.	TOLERANCE

RESISTANCE

DESIGNATION	RESISTANCE (ohms)
1R0000 to 9R9900 incl	1 to 9.99 incl
10R000 to 99R999 incl	10 to 99.999 incl
100R00 to 999R99 incl	100 to 999.99 incl
1K0000 to 9K9999 incl	1,000 to 9999.9 incl
10K000 to 99K999 incl	10,000 to 99,999 incl
100K00 incl	100Kohms incl

TEMP. COEFF.

T-20	±5ppm/°C
T-23	±3ppm/°C
T-27	±2ppm/°C

TOLERANCE

	PERCENT
V	±.005
T	±.01
Q	±.02
A	±.05
B	±.1
C	±.25
D	±.5
F	±1.0

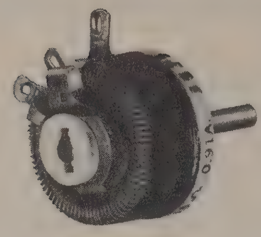
VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY-ANGSTROHM

Vitreous Enameled Power Rheostats

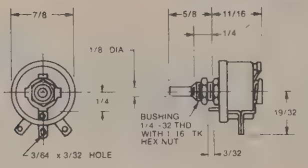
TYPE MP06 12.5 WATT



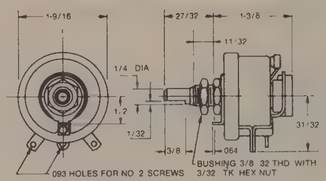
TYPE MP10 25 WATT

TYPE MP15 50 WATT

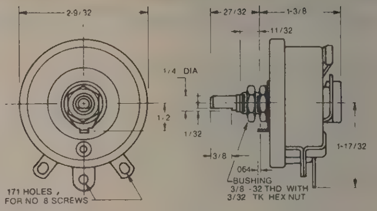
DIMENSIONS


7/8
5/8
11/16
1/4
1/8 DIA
1/4
BUSHING 1/4 -32 THD WITH 1 16 TK HEX NUT
19/32
3/64 x 3/32 HOLE
3/32

Diameter 7/8" . . . Depth behind panel 11/16" . . . Shaft 1/8" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/8" by means of 1/4"-32 bushing and hex nut . . . Non-turn lugs require 1/8" hole 1/4" below center of shaft (Type "A" shaft). WEIGHT: .037 lb., 17 Gms.


1-9/16
27/32
1-3/8
11/32
1/4 DIA
1/2
1/32
31/32
3/8
064
093 HOLES FOR NO 2 SCREWS
BUSHING 3/8 32 THD WITH 3/32 TK HEX NUT

Diameter 1 9/16" . . . Depth behind panel 1 3/8" . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require 3/16" hole 1/2" below center of shaft. (Type "A" shaft). WEIGHT: .180 lb., 82 Gms.


2-9/32
27/32
1-3/8
11/32
1/4 DIA
1/2
1/32
3/8
064
1-17/32
171 HOLES, FOR NO 8 SCREWS
BUSHING 3/8 -32 THD WITH 3/32 TK HEX NUT

Diameter 2 9/32". . . Depth behind panel 1 3/8 . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require 3/16" hole 1/2" below center of shaft. (Type "A" shaft). WEIGHT: .321 lb., 145 Gms.

RESISTANCE VALUES

Total Ohms	Max. Amps.	Approx. Steps
1.0	3.53	29
2.0	2.50	42
2.5	2.24	38
3.0	2.04	44
5.0	1.58	40
6.0	1.44	48
8.0	1.25	51
10	1.12	51
15	0.91	51
25	0.71	73
35	0.60	75
50	0.50	86
75	0.41	103
100	0.35	108
125	0.32	128
150	0.29	128
175	0.27	148
200	0.25	130
250	0.22	166
350	0.19	185
500	0.16	215
750	0.13	255
1000	0.11	260
1500	0.091	310
2500	0.071	321
3500	0.060	378
5000	0.050	430

Total Ohms	Max. Amps	Approx. Steps
1.0	5.00	28
2.0	3.54	31
3.0	2.89	48
6.0	2.04	51
8.0	1.77	54
10	1.58	54
15	1.29	64
25	1.00	86
35	0.85	105
50	0.71	115
75	0.58	135
100	0.50	152
125	0.45	143
175	0.38	160
250	0.32	185
350	0.27	205
500	0.22	230
750	0.18	270
1000	0.16	292
1500	0.13	353
2500	0.10	358
3500	0.08	392
5000	0.07	440

Total Ohms	Max. Amps	Approx. Steps
0.5	10.00	24
1.0	7.07	46
2.0	5.00	50
4.0	3.54	44
6.0	2.89	74
8.0	2.50	85
12	2.04	108
16	1.76	108
22	1.50	123
35	1.19	148
50	1.00	113
80	0.79	147
125	0.63	178
150	0.58	173
225	0.47	203
300	0.41	214
500	0.32	290
800	0.25	365
1000	0.22	358
1600	0.18	367
2500	0.14	460
3500	0.12	505
5000	0.10	565
8000	0.08	695
10000	0.07	693

All other intermediate resistance values are available and can be manufactured on normal delivery cycle.

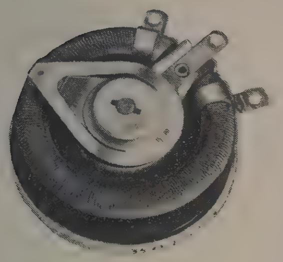
VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY-ANGSTROHM

Angstrohm's broad line of vitreous enameled power rheostats is designed to provide exceptional reliability through the application of the most modern manufacturing techniques and sophisticated materials. These same techniques have resulted in a line of power rheostats that feature a very compact size for their dissipation rating. Furthermore, many standard value rheostats are available for off-the-shelf delivery while special devices are available with short delivery cycles. Rheostats are also available in tapered windings, in tandem assemblies, with off positions and with special shaft assemblies.

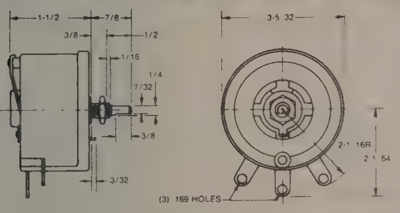
TYPE MP25 100 WATT



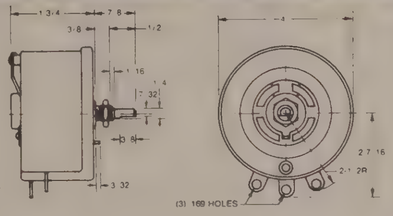
TYPE MP30 150 WATT

TYPE MP40 300 WATT

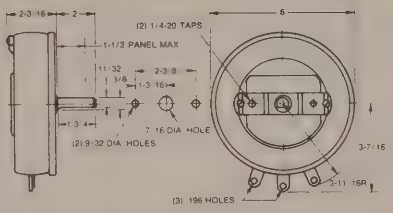
DIMENSIONS



Diameter 3 5/32". . . Depth behind panel 1 1/2" . . .Shaft 1/4" diameter . . . Rotation 300°, ±5°. . . Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require a 3/16" hole 1/2" below center of shaft. (Type "A" shaft) WEIGHT: .594 lbs., 268 Gms.



Diameter 4" . . . Depth behind panel 1 3/4" . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. . . Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require a 3/16" hole 1/2" below center of shaft. (Type "A" shaft) WEIGHT: 1.014 lbs., 460 Gms.



Diameter 6". . . Depth behind panel 2 3/16". . . Shaft 3/8" diameter . . . Rotation 315°, ±5°. . . Mounts on panels up to 1 1/4" by means of mounting bracket with two 1/4"-20 flat head screws. (Type "A" shaft) WEIGHT: 2.625 lbs., 1.191 Kg.

RESISTANCE VALUES

Total Ohms	Max. Amps.	Approx. Steps
.5	14.140	30
1	10.000	30
2	7.071	56
3	5.774	66
5	4.472	56
7.5	3.652	66
10	3.162	104
15	2.582	113
25	2.000	144
50	1.414	180
75	1.155	180
100	1.000	216
200	.707	252
300	.577	252
400	.500	252
500	.447	324
750	.365	396
1000	.316	410
2000	.224	410
2500	.200	410
5000	.141	685
7500	.115	820
10000	.100	820
—	—	—
—	—	—

Total Ohms	Max. Amps	Approx. Steps
.5	17.350	35
1	12.247	39
2	8.660	39
3	7.071	70
5	5.477	73
7.5	4.472	70
10	3.873	70
15	3.162	120
25	2.449	152
50	1.732	190
75	1.414	228
100	1.225	228
200	.866	265
300	.707	303
400	.612	342
500	.548	342
750	.447	418
1000	.387	432
2000	.274	575
2500	.244	456
5000	.173	865
7500	.141	1000
10000	.122	1000
—	—	—
—	—	—

Total Ohms	Max. Amps	Approx. Steps
1	17.320	40
1.5	14.142	58
2	12.247	78
2.5	10.954	78
3	10.000	73
4	8.660	78
5	7.745	78
7.5	6.324	148
10	5.477	154
15	4.472	147
25	3.464	155
35	2.927	231
50	2.449	267
75	2.000	308
100	1.732	326
150	1.414	270
200	1.224	308
300	1.000	340
400	.866	370
500	.774	455
750	.632	514
1000	.547	578
1500	.447	675
2500	.346	720

VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY-MANN

PRECISION WIREWOUND RESISTORS

PART NUMBER:	MX				AX					PX					PC				
	100	125	250	500	125*	175*	250	350	400	125*	175*	250	350	400	125*	175*	250	350	400
Dimensions (inches) length	.236	.354	.374	.472	.378	.378	.591	.429	.654	—	.378	.591	.429	.654	.343	.378	.591	.429	.654
Dimensions (inches) diameter	.118	.118	.185	.236	.25	.25	.25	.410	.410	—	.250	.250	.410	.410	.250	.250	.250	.410	.410
Terminations (inches) length	.984	.984	.984	.984	1.50	1.50	1.50	1.50	1.50	—	1.50	1.50	1.50	1.50	1.0	1.50	1.50	1.50	1.50
Terminations (inches) diameter	.020	.020	.020	.020	.020	.020	.020	.024	.024	—	.020	.020	.024	.024	.020	.020	.020	.024	.024
Lead spacing (inches)	—				—						0.15	0.15	0.3	0.3	0.2	0.2	0.2	0.4	0.4
Maximum Ohmic Value (in Ohms)	125K	250K	400K	1.1M	500K	650K	1.3M	2.5M	5M	500K	650K	1.3M	2.5M	5M	500K	650K	1.3M	2.5M	5M
Minimum Ohmic Value (in Ohms)																			
Tolerance 1% & above	5	5	—	—															
0.5%	5	5	—	—															
0.2%	5	5	—	—															
0.1%	5	5	2	—	10	2	2	5	5	10	2	2	5	5	10	2	2	2	2
0.05%	50	10	10	5	10	10	5	5	5	10	10	5	5	5	10	10	5	5	5
0.02%	100	50	50	50	50	50	50	50	10	50	50	50	50	10	50	50	50	50	10
0.01%	1000	100	100	100	80	80	80	80	50	80	80	80	80	50	80	80	80	80	50
0.005%						500	500	—	100	—	500	500	—	100	—	500	500	—	100
Rated Dissipation in mW	—				125					125					125				
Recommended Power in mW at 20°C	100	125	250	500	—	350	500	700	850	—	350	500	700	850	350	350	500	700	850
Recommended Power in mW at 70°C	45	70	80	250	—	200	300	400	500	—	200	300	400	500	200	200	300	400	500
Maximum Power in mW at 20°C	180	250	350	650	—	800	1W	1	1.1W	—	800	1W	1W	1.1W	800	800	1W	1W	1.1W
Maximum Power in mW at 70°C	100	150	200	350	—	450	550	600	650	—	450	550	600	650	450	450	550	600	650
Maximum Body Temperature	135°C				135°C					135°C					135°C				
Temperature Rise °C/W	600	400	300	200	140	140	120	110	100	140	140	120	110	100	140	140	120	110	100
Voltage Rating at 70°C	70	80	150	250	250	250	400	400	500	250	250	400	400	500	250	250	400	400	500
Temperature Coefficient Standard	< 10ppm/°C				< 10ppm/°C					< 10ppm/°C					< 10ppm/°C				
Suffix B	< 5ppm/°C				< 5ppm/°C					< 5ppm/°C					< 5ppm/°C				
Suffix C	< 3ppm/°C				< 3ppm/°C					< 3ppm/°C					< 3ppm/°C				
Thermal EMF** (in Ohms)	above				above					above					above				
< 0.2 μV/°C	150	510	1.4K	2.2K	1.2K	1.2K	2.4K	8K	16K	1.2K	1.2K	2.4K	8K	16K	1.2K	1.2K	2.4K	8K	16K
< 0.4 μV/°C (optional)	not available				—	500 to 1.2K	1K to 2.4K	2.4K to 8K	4K to 16K	—	500 to 1.2K	1K to 2.4K	2.4K to 8K	4K to 16K	—	500 to 1.2K	1K to 2.4K	2.4K to 8K	4K to 16K
	below				below					below					below				
< 1.8 μV/°C	150	510	1.4K	2.2K	1.2K	500	1K	2.4K	4K	1.2K	500	1K	2.4K	4K	1.2K	500	1K	2.4K	4K
Inductance	—				For low Inductance specify suffix T					For low Inductance specify suffix T					For low Inductance specify suffix T				
Maximum Rise Time	130ns				—					—					—				
Long Term Drift (at 70°C at recommended power)	< 0.005%/ √yr.				< 0.002%/ √yr.					< 0.002%/ √yr.					< 0.002%/ √yr.				
Shelf Life Drift (under storage conditions -30°C to +60°C)	< 0.003%/ √yr.				< 0.0015%/ √yr.					< 0.0015%/ √yr.					< 0.0015%/ √yr.				

VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

VISHAY-MANN

PART NUMBER:	LT			UP			LR			ML	
	450	500	600	175	400	500	450	500	600	175	250
Dimensions (inches) **length**	.736	1.16	1.28	.630	.921	1.61	.736	1.16	1.28	—	
diameter	.543	.543	.823	.280	.441	.532	.543	.543	.823		
Terminations (inches) **length**	1.50	1.50	1.50	.984	.984	.984	1.50	1.50	1.50	—	
diameter	.039	.039	.039	.020	.024	.035	0.39	0.39	0.39		
Maximum Ohmic Value (in Ohms)	2.5M	5M	10M	650K	5M	6M	10	10	10	2	5
Minimum Ohmic Value (in Ohms)											
Tolerance 1% & above	1	1	—								
0.5%	2	2	1								
0.2%	2	2	2							0.1	0.1
0.1%	2	2	2	5	5	2		.01		1.0	1.0
0.05%	2	2	5	10	10	5		.05			
0.02%	5	5	5	50	10	5		.1			
0.01%	10	10	10	80	50	10		.5			
0.005%	100	100	100	500	100	100		—			
0.002%	1K - 1M	1K - 1M	—	—	1K - 1M	1K- 1M		—			
Recommended Power in mW at 20°C	800	1W	1.2W	350	850	1W	800	1W	1.2W	350	500
at 70°C	500	600	800	200	500	600	500	600	800	200	300
Maximum Power in mW at 20°C	1.2W	1.7W	2.2W	800	1.1W	1.1W	1.2W	1.7W	2.2W	800	1W
at 70°C	800	1.1W	1.4W	450	650	650	800	1.1W	1.4W	450	550
Maximum Body Temperature	135°C			135°C			135°C			135°C	
Temperature Rise °C/W	90	65	50	120	100	45	90	65	50	140	120
Voltage Rating at 70°C	750	1000	1500	250	500	1000	—			—	
Temperature Coefficient											
Standard	10ppm/°C			5ppm/°C			10ppm/°C			10ppm/°C	
Suffix B	5ppm/°C						5ppm/°C			5ppm/°C	
Suffix C	3ppm/°C			3ppm/°C			3ppm/°C				
Suffix D				2ppm/°C							
Suffix F				1ppm/°C							
Thermal EMF** (in Ohms)	above										
<0.2 μV/°C	16K	32K	64K	all ohmic values			—	—	—	—	—
<0.4 μV/°C	5K	10K	20K								
(optional)	to	to	to	—	—	—	—	—	—	—	—
	16K	32K	64K								
	below										
<1.8 μV/°C	5K	10K	20K	—	—	—	all ohmic values			all ohmic values	
Inductance	For low Inductance specify suffix T			—			U	U	U	—	
Long Term Drift (at 70°C at recommended power)	<0.002%/√yr.			Note A <0.0015%/√yr.			<0.016%/√yr.			<0.01%/√yr.	
Shelf Life Drift (under storage conditions -30°C to +60°C)	<0.0015%/√yr.			Note A <0.001%/√yr.			<0.006%/√yr.			<0.002%/√yr.	

*AX125 AX175 PC125 PC175 BSC ECC 40301/00 J + K approval BSC ECC 40301/004 J + K approval

U These components have four section bobbins wound in opposition. Inductance may be further reduced by use of bifilar winding. Order as Suffix U.

**All resistors have Thermal EMF of 1.8 μV/°C with respect to copper at 0°C unless specified otherwise in this chart.

Note A: For certain ohmic values, drift rates are considerably lower than specified. Please contact the Applications Engineering Department for complete information.

Other features available include tolerance matching to 0.01% on MX and LR series, 0.002% on other ranges.
Temperature Coefficient matching to 1ppm°C.
Inductance can be reduced by reversal of winding at half turns point. Order as Suffix T on types AX, PX, PC and LT.
Types AX125 and PC125 are type approved to BSC ECC 40 301-001 and -004 respectively.
All Dimensions in inches.

VISHAY
...to be precise

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

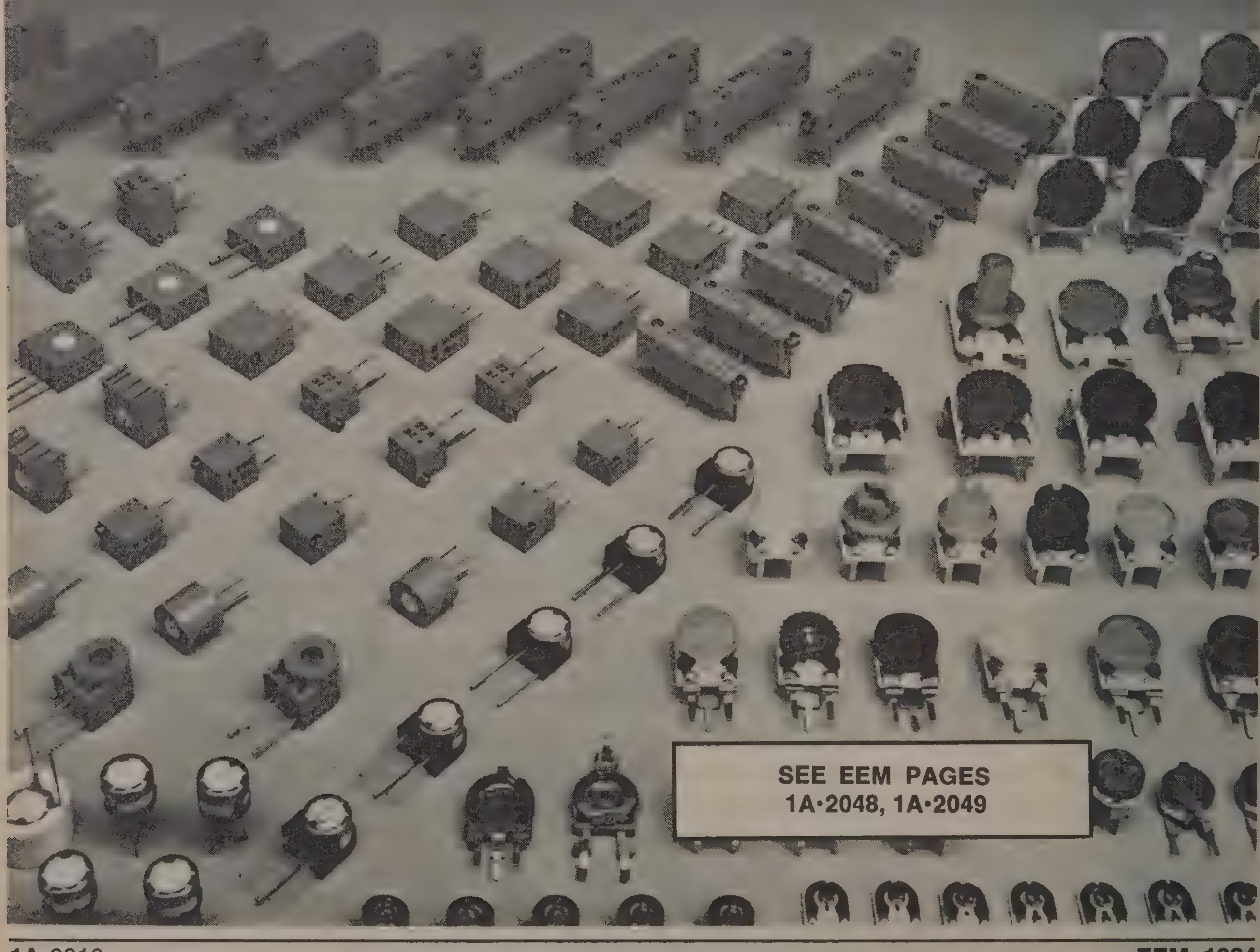
POTENTIOMETER
CAPITAL OF THE WORLD

FROM LOW-COST CARBON SINGLE-TURNS TO SEALED PRECISION MULTI-TURNS . . . MURATA ERIE HAS THEM ALL!

Murata Erie manufactures one of the broadest potentiometer lines in the world. For commercial and industrial applications—single-turn trimmers in carbon, cermet and conductive plastic in all popular resistances, mounting configurations and power ratings from 1/10 watt to 3/4 watt. For instrumentation and other precision applications—single- and multi-turn trimmers with from 1 to 25 turns full range, ¼ watt to 1 watt ratings and standard square, rectangular and circular configurations.

For complete technical details write to
Murata Erie North America, Inc.,
1148 Franklin Road, SE,
Marietta, Georgia 30067 or call
404-952-9777.

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.



SEE EEM PAGES
1A•2048, 1A•2049

POTENTIOMETERS/RHEOSTATS†

Manufacturer	EEM Starting Page No.	Resistance Element Material						Features											Other Features
								Mechanical Adjustment						Mounting					
		Carbon Film	Carbon Comp.	Cermet	Conductive Plastic	Hybrid	Wirewound	Single Turn	Multi-turn	Linear Motion	Non-linear Tapers	High Power	Precision	Thru Panel	Servo	Switch	Multi-section	PC Board	
Allen-Bradley	1A•2021		●	●	●			●						●	●	●	●		
Bourns	1A•2032				●	●	●	●	●				●	●	●				
	1A•2033				●			●			●		●	●		●	●		
CTS Berne	1A•2036			●				●										●	Slotted; shaft lock
E-Systems	1A•2037						●	●			●	●		●					Rheostats†
ETI	1A•2038				●	●	●		●	●			●			●			Motor control
Iskra Elctrns.	1A•2039	●		●				●						●				●	
JDK Controls	1A•2040*				●			●			●		●		●	●			Gear heads
Maurey Instrument	1A•2041				●		●	●		●			●	●	●				Heavy duty
	1A•2042				●		●			●									Light duty
	1A•2043				●		●			●									
	1A•2044				●			●					●	●	●				
	1A•2045						●	●	●				●				●		Motorized
Mura	1A•2047		●					●		●	●					●	●		
Ohmite Mfg.	1A•2050						●					●		●					Rheostats†
	1A•2051*		●					●						●			●		Shaft lock
Precision Electronic	1A•2052*		●					●						●			●		
Samarius	1A•2053				●		●	●			●		●	●	●	●	●		
Shogyo	1A•2055							●		●	●						●		
Spectrol	1A•2057			●	●			●						●					
	1A•2058			●	●		●	●	●				●	●	●				
Vernitech	1A•2066				●			●	●				●	●	●				
VRN International	1A•2089						●	●	●				●	●	●				

† A rheostat is a two-terminal variable resistor. When both ends of the resistance element and the slider contact (three terminals) are used, it's called a potentiometer. By tradition, nevertheless, power variable resistors are often referred to as rheostats, no matter how used.

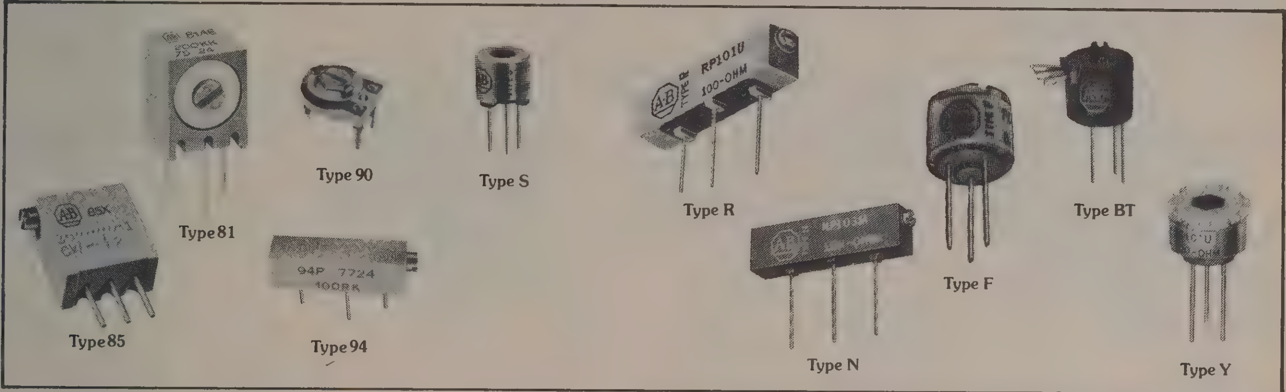
* Mil. Spec.

TRIMMERS

Manufacturer	EEM Starting Page No.	Resistance Element Material					Features							Other Features
							Mechanical Adjustment				Mounting			
		Carbon Film	Carbon Comp.	Cermet	Conductive Plastic	Wirewound	Single Turn	Multi-turn	Linear Motion	Precision	Thru Panel	Multisection	PC Board	
Allen-Bradley	1A•2019		●	●	●		●	●					●	
Bourns	1A•2022*			●		●		●					●	Industrial grade
	1A•2026			●		●	●						●	Industrial grade
	1A•2028			●							●	●	●	Attenuators
CTS Berne	1A•2036			●			●						●	
Iskra Elctrns.	1A•2039	●		●					●				●	
Mepco/Electra	1A•2046*			●			●	●					●	
Murata Erie	1A•2048	●		●			●						●	
	1A•2049*			●				●		●			●	
Spectrol	1A•2056			●			●	●					●	
	1A•2057					●	●	●					●	
Techno-Components	1A•2064*			●				●					●	
	1A•2065*					●		●		●			●	
Vishay	1A•2070							●		●			●	
VRN International	1A•2088			●		●	●	●					●	
Weston Controls	1A•2072												●	Plus resistor network
	1A•2074			●			●	●					●	
	1A•2075					●	●	●					●	
	1A•2076*					●	●	●					●	
	1A•2077*					●		●		●			●	
	1A•2079			●			●	●					●	Low cost

* Mil. Spec.

Types 81, 85, 90, 94, S, N, R, F, BT, Y Trimming Potentiometers



Type 81 Type 90 Type S Type R Type BT Type F Type 85 Type 94 Type N Type Y

SPECIFICATIONS

Type	Publication Number	Resistance Element and Adjustment Turns	Resistance Range and Tolerance	Power	Voltage Rating (RMS or DC)	Operating Temperature Range	Terminal Types	Case Dimensions in Inches (millimeters)	Enclosure
81	EC5731-2.1	Cermet Single Turn	10 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt at 70°C	300V	−55°C to +125°C	Pin	0.25 (6.35) Diameter by 0.25 (6.35)	Immersion Sealed
85	EC5735-2.1	Cermet Multi-Turn	10 Ohms to 2 Megohms ±10%, ±20%	0.5 Watt at 70°C	300V	−55°C to +125°C		L 0.4 (10) H 0.42 (10.7) W 0.21 (5.3)	
90	EC5770-2.1	Cermet Single Turn	100 Ohms to 2 Megohms ±20%	0.5 Watt at 70°C 1.0 Watt at 40°C	200V	−55°C +125°C		L 0.466 (11.9) W 0.393 (10.0) D 0.228 (5.8)	Open Frame
94	EC5774-2.1	Cermet Multi-Turn	10 Ohms to 2 Megohms ±10%, ±20%	0.5 Watt at 70°C 0.75 Watt at 25°C	300V	−55°C +125°C		L 0.76 (19.3) H 0.45 (11.55) W 0.2 (5.08)	Immersion Sealed
S	EC5720-2.1	Cermet Single Turn	50 Ohms to 1 Megohm ±10%	0.5 Watt at 85°C		−65°C +150°C		0.375 (9.52) Diameter by 0.375 (9.52)	
N	EC5815-2.1	Composition Multi-Turn	100 Ohms to 2.5 Megohms ±10%, ±20%	0.33 Watt at 50°C		−55°C to +100°C		L 1.250 (31.75) H 0.359 (9.13) W 0.250 (6.35)	
R	EC5820-2.1			0.25 Watt at 70°C		−55°C to +125°C	Pin or Solder Lug		
F	EC5806-2.1	Composition Single Turn	100 Ohms to 5 Megohms ±10%, ±20%	0.25 Watt at 70°C	350V	−55°C to +120°C	Pin or Solder Lug	0.500 (12.70) Diameter by 0.531 (13.49)	
BT	EC5920-2.1			Consult Factory		−40°C to +120°C	Front: 3 Lugs Rear: 3 Pins or Front: 2 Pins Rear: 2 Pins	0.500 (12.70) Diameter by 0.535 (13.59)	Dust and Splash Resistant
Y	EC5828-2.1			0.25 Watt at 50°C	350V	−55°C to +100°C	Pin or Solder Lug	0.500 (12.70) Diameter by 0.359 (9.13)	Dust and Splash Resistant

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

Conductive Plastic, Cermet and Hot-Molded Carbon Composition Panel Potentiometers

SPECIFICATIONS

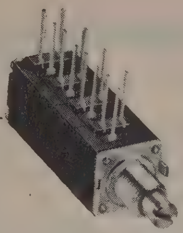
Type	Publication Number	Resistance Element	Resistance Range and Tolerance	Power Rating (Linear Taper)	Voltage Rating (RMS or DC)	Operating Temperature Range	Number of Sections Available	Case Dimensions in Inches (millimeters)	Enclosure
Series 70	EC5670-2.1	Cermet	100 Ohms to 5 Megohms ±10%	2.0 Watts @ 70° C	350V	−55° C to +150° C	1, 2, 3 or 4	0.625 (15.88) Square Lug terminals: 0.594 (15.08) Deep Pin terminals: 0.625 (15.88) Deep (Single Section)	Dust and Splash Resistant
		Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	1.0 Watt @ 70° C		−55° C to +120° C			
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70° C					
Series 72	EC5670-2.1	Cermet	100 Ohms to 5 Megohms ±10%	1.0 Watt @ 70° C		−55° C to +100° C	1 or 2		
		Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	0.5 Watt @ 70° C					
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.25 Watt @ 70° C					
Series 73	EC5670-2.1	Cermet	100 Ohms to 5 Megohms ±10%	2.0 Watts @ 70° C		−55° C to +120° C	1, 2, 3 or 4		
		Hot-Molded Composition	50 Ohms to 10 Megohms ±10%, ±20%	1.0 Watt @ 70° C					
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70° C					
J(RV4)	EC5607-2.1	Hot-Molded Composition	50 Ohms to 5 Megohms ±10%, ±20%	2.25 Watts @ 70° C	500V	−55° C to +120° C	1, 2 or 3	0.625 (15.88) Deep by 1.156 (29.36) Diameter (Single Section) [1]	
EJ	EC5620-2.1			2.25 Watts @ 70° C			1 or 2		
G(RV6)	EC5605-2.1		100 Ohms to 5 Megohms ±10%, ±20%	0.5 Watt @ 70° C	350V	−55° C to +120° C	1	For G and W 0.469 (11.91) Deep For WR 0.422 (10.72) Deep by 0.500 (12.70) Diameter Above dimensions for types G and WR do not include the available switch option [1]	Immersion Sealed
W(RV6) WP	EC5612-2.1			0.5 Watt @ 70° C		−55° C to +120° C	1		
WR	EC5650-2.1			0.5 Watt @ 70° C					Dust and Splash Resistant
SP	EC5640-2.1	Cermet	50 Ohms to 1 Megohm ±10% (5% available)	1.0 Watt @ 70° C	300V	−65° C to +150° C		0.438 (11.11) Deep by 0.375 (9.52) Diameter	Immersion Sealed
M	EC5610-2.1	Conductive Plastic	100 Ohms to 1 Megohm ±20%	0.1 Watt @ 40° C	90V	−25° C to +100° C	1 or 2	0.394 (10.0) Cubed All Versions	Dust and Splash Resistant
2000	EC5680-2.1		250 Ohms to 1 Megohm ±20%	0.5 Watt @ 70° C	350V	−55° C to +125° C	1	0.625 (15.88) Square	Sealed for Board Washing

[1] All depth dimensions are maximum.

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

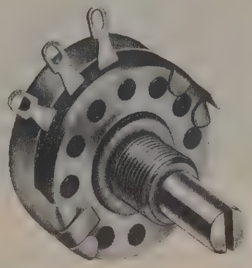
Series 70 MOD POT® – Modular design innovated by Allen-Bradley offers almost unlimited combinations: single, dual, triple or quadruple sections. Options include PC or solder lug terminals, variety of switches, vernier drives, concentric shafts, hot-molded composition, cermet or conductive plastic resistance elements.



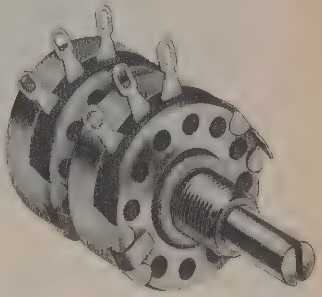
Series 72 MOD POT® – Similar to Series 70, except the bushing and shaft are non-metallic. Available in single or dual combination only.

Series 73 MOD POT® – Similar to Series 70, except the bushing is of a more economical design. Available in single, dual, triple or quadruple sections.

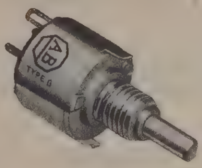
Type J (RV4) — Standard of the industry for quality. Hot-molded composition, 50 ohms to 5 megs, ±10% and ±20% (special values to 1000 megs available), 2.25W at 70° C, single, dual, triple sections available. Switch for single or dual sections.



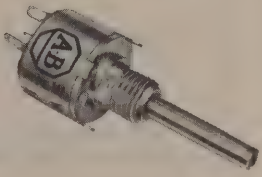
Type EJ – Extra long life version of the Type J with rotational life exceeding one million rotations, single or dual configurations. Slip clutch available.



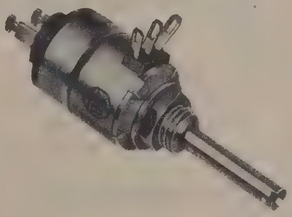
Type G (RV6) – Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70° C, single section available with or without SPST switch.



Type W (RV6) – Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70° C, single section.

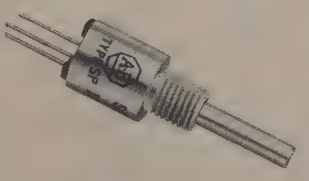


Type WR – Radial-lead version of Type W. Available with or without switch. Switch versions offer contacts that close at start of clockwise rotation (TYPE WRS) or with switch with contacts that close at start of counter-clockwise rotation (TYPE WRH).

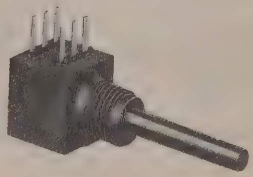


Type WP – Pin-terminal version of Type W. Suited for printed circuit board mounting.

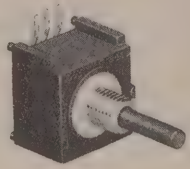
Type SP – Cermet, 50 ohms to 1 meg, ±10%, 1.0W at 70° C, single section. Only 3/8 inch diameter.



Type M – Miniature conductive plastic. 100 ohms to 1 meg., ±20%, 0.1W at 40° C, single and dual sections available. Switches optional. 5 terminal options. Non-metallic case, bushing and shaft.



Type 2000 – Designed cost-effective in conductive plastic. 250 ohms to 1 meg, ±20%, 0.5W at 70° C single section. 3 terminal options. Sealed for board washing. Non-metallic case and shaft. Choice of bushing.



Standard options for most types include linear and non-linear tapers, a variety of shafts, bushings, shaft endings, shaft lengths, and hardware.

Types J and the multi-section MOD POT® with composition tracks are well suited for attenuator applications.

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

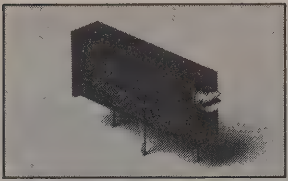
TRIMPOT DIVISION, 1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 • TEL (714) 781-5050

BOURNS® RECTANGULAR MULTITURN TRIMMERS

TRIMPOT® TRIMMING POTENTIOMETERS

3005P

3/4" long, 0.16" wide, 0.31" high
Industrial grade

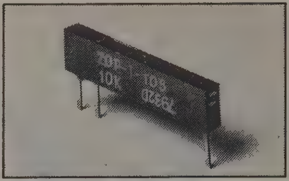


3057

1-1/4" long, 0.19" wide, 0.315" high
Industrial & Military grade (RT12, RTR12)

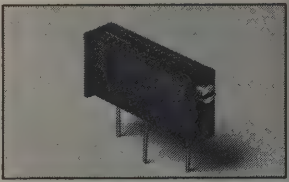
20

0.787" long, 0.080" wide, 0.185" high
Industrial grade
SIP type



3006

3/4" long, 0.19" wide, 0.25" high
Industrial grade



	3005P	3057	20	3006
	Wirewound		**Cermet**	
Resistance Range	10 to 50,000 ohms	10 to 100,000 ohms	10 ohms to 5 megohms	10 ohms to 2 megohms
Resistance Tolerance*	±10% standard	±5% standard	±10% standard	±10% standard
Contact Resistance Variation	N/A	N/A	1.0% or 1 ohm (whichever is greater)	1.0% or 1 ohm (whichever is greater)
Adjustability	Within resolution	Within resolution	0.01% V.R.	0.01% V.R.
Insulation Resistance 500 VDC	100 megohms minimum	1000 megohms minimum	100 megohms minimum	100 megohms minimum
Power Rating	1.0 watt @ 40°C	1.0 watt @ 70°C	0.25 watt @ 70°C (250 volt maximum)	0.75 watt @ 70°C (400 volt maximum)
Temperature Range	−65°C to +125°C	−55°C to +150°C	−55°C to +125°C	−55°C to +125°C
Temperature Coefficient	±50ppm/°C maximum	±50ppm/°C maximum	±100ppm/°C maximum (50 ohms and up)	±100ppm/°C maximum
Seal	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
Load Life (1000 hrs.)	1.0 watt @ 40°C	1.0 watt @ 70°C	0.25 watt @ 70°C	0.75 watt @ 70°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Mechanical Adjustment	20 turns nominal	22 turns nominal	15 turns nominal	15 turns nominal
Mechanical Stops	Wiper idles	Wiper idles	Wiper idles	Wiper idles
Terminals	1 PC pin (shown)	2 PC pin styles 1 solder lug 1 flexible leads	1 PC pin (shown)	3 PC pin styles

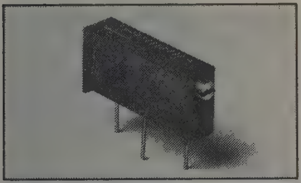
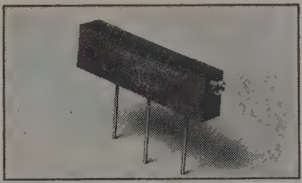
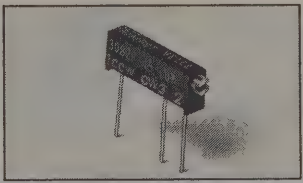
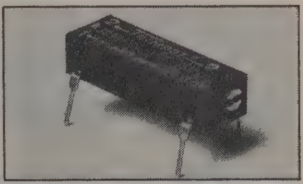
*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice.

BOURNS® RECTANGULAR MULTITURN TRIMMERS

TRIMPOT® TRIMMING POTENTIOMETERS

3009	**3059**	**3082**	**3099**
3/4" long, 0.19" wide, 0.35" high Industrial grade	1-1/4" long, 0.19" wide, 0.315" high Industrial & Military grade (RJ12, RJR12)	1/2" long, 0.10" wide, 0.15" high Industrial & Military grade (RJR28)	3/4" long, 0.25" wide, 0.19" high Industrial & Military grade (RJR32) DIP style
			
Cermet			
10 ohms to 2 megohms	10 ohms to 2 megohms	10 ohms to 2 megohms	10 ohms to 5 megohms
± 10% standard	± 10% standard	± 10% standard	± 10% standard
1.0% or 1 ohm (whichever is greater)	1.0% or 1 ohm (whichever is greater)	3.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater)
0.01% V.R.	0.01% V.R.	0.03% V.R.	0.01% V.R.
100 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
0.75 watt @ 70°C (400 volt maximum)	1.0 watt @ 70°C (400 volt maximum)	0.6 watt @ 25°C (400 volt maximum)	1.0 watt @ 70°C (400 volt maximum)
−55°C to +125°C	−55°C to +150°C	−65°C to +150°C	−55°C to +150°C
± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum
85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
0.75 watt @ 70°C	1.0 watt @ 70°C	0.6 watt @ 25°C	1.0 watt @ 70°C
200 cycles	200 cycles	200 cycles	200 cycles
15 turns nominal	22 turns nominal	10 turns nominal	20 turns nominal
Wiper idles	Wiper idles	Wiper idles	Wiper idles
2 PC pin styles	2 PC pin styles 1 solder lug 1 flexible leads	1 PC pin (shown)	1 PC pin (shown)

*Closer tolerances available.

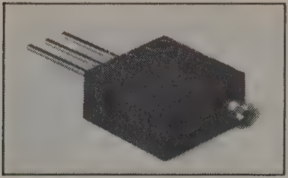
**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice.

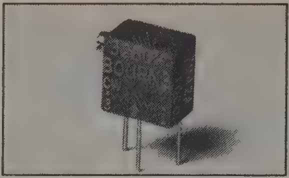
BOURNS® SQUARE MULTITURN TRIMMERS

TRIMPOT® TRIMMING POTENTIOMETERS

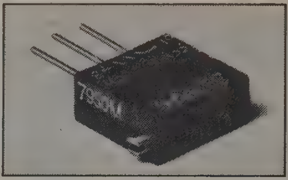
3250
1/2'' square
0.23'' thick maximum
Industrial & Military grade
(RT22, RTR22)



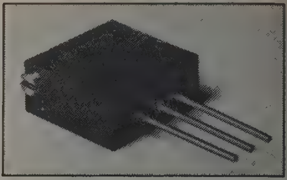
3260
1/4'' square
0.185'' thick maximum
Industrial & Military grade
(RT26)



3290
3/8'' square
0.16'' thick maximum
Industrial & Military grade
(RT24, RTR24)



3252
1/2'' square
0.23'' thick maximum
Industrial & Military grade
(RJ22)



	3250	3260	3290	3252
	Wirewound			Cermet
Resistance Range	10 to 50,000 ohms	10 to 25,000 ohms	10 to 50,000 ohms	10 ohms to 2 megohms
Resistance Tolerance*	± 5% standard	± 5% standard	± 5% standard	± 10% standard
Contact Resistance Variation	N/A	N/A	N/A	2.0% or 2 ohms (whichever is greater)
Adjustability	Within resolution	Within resolution	Within resolution	0.01% V.R.
Insulation Resistance 500 VDC	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
Power Rating	1.0 watt @ 70°C	0.25 watt @ 85°C	1.0 watt @ 70°C	1.0 watt @ 70°C (400 volt maximum)
Temperature Range	−65°C to +150°C	−65°C to +150°C	−65°C to +150°C	−65°C to +150°C
Temperature Coefficient	± 50ppm/°C maximum	± 50ppm/°C maximum	± 50ppm/°C maximum	± 100ppm/°C maximum
Seal	85°C Fluorinert** (pin styles only)	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert** (pin styles only)
Load Life (1000 hrs.)	1.0 watt @ 70°C	0.25 watt @ 85°C	1.0 watt @ 70°C	1.0 watt @ 70°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Mechanical Adjustment	25 turns nominal	11 turns nominal	25 turns nominal	22 turns nominal
Mechanical Stops	Wiper idles	Wiper idles	Wiper idles	Wiper idles
Terminals	3 PC pin styles 1 flexible leads	2 PC pin styles	3 PC pin styles	3 PC pin styles 1 flexible leads

*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

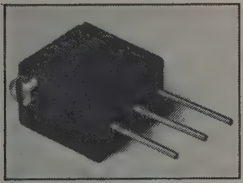
Specifications subject to change without notice.

BOURNS® SQUARE MULTITURN TRIMMERS

TRIMPOT® TRIMMING POTENTIOMETERS

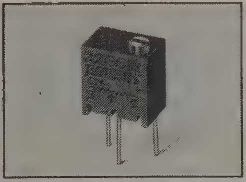
3262

1/4" square
0.185" thick maximum
Industrial & Military grade
(RJ26, RJR26)



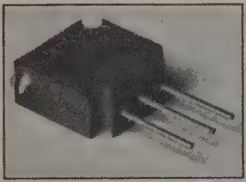
3266

1/4" square
0.185" thick maximum
Industrial grade



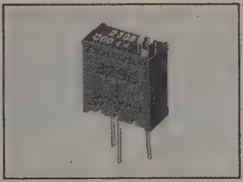
3292

3/8" square
0.16" thick maximum
Industrial & Military grade
(RJ24, RJR24)



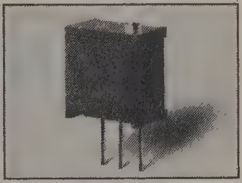
3296

3/8" square
0.202" thick maximum
Industrial grade



3299

3/8" square
0.25" thick maximum
Industrial grade



[redacted]

3262	3266	3292	3296	3299
10 ohms to 1 megohm	10 to 500,000 ohms	10 ohms to 1 megohm	10 ohms to 5 megohms	10 ohms to 5 megohms
± 10% standard	± 10% standard (no optional tolerance)	± 10% standard	± 10% standard	± 10% standard
3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)
0.02% V.R.	0.02% V.R.	0.01% V.R.	0.01% V.R.	0.01% V.R.
1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
0.25 watt @ 85°C (300 volt maximum)	0.25 watt @ 85°C (300 volt maximum)	0.5 watt @ 85°C (400 volt maximum)	0.5 watt @ 70°C (300 volt maximum)	0.5 watt @ 70°C (300 volt maximum)
−65°C to +150°C	−55°C to +125°C	−65°C to +150°C	−55°C to +125°C	−55°C to +125°C
± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum
85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
0.25 watt @ 85°C	0.25 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 70°C	0.5 watt @ 70°C
200 cycles	200 cycles	200 cycles	200 cycles	200 cycles
12 turns nominal	12 turns nominal	22 turns nominal	25 turns nominal	25 turns nominal
Wiper idles	Wiper idles	Wiper idles	Wiper idles	Wiper idles
3 PC pin styles	2 PC pin styles	3 PC pin styles 1 flexible leads	5 PC pin styles	5 PC pin styles

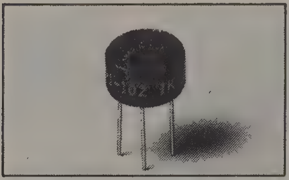
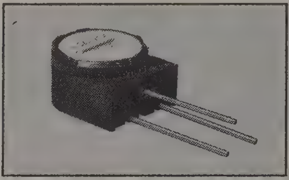
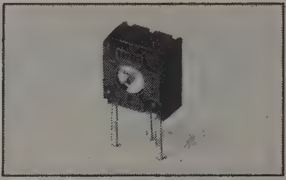
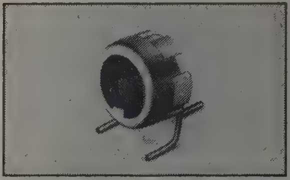
*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice.

BOURNS® SINGLE TURN TRIMMERS

TRIMPOT® and ℬ® TRIMMING POTENTIOMETERS

	3305	**3345**	**3323**	**3325**
	5/16" diameter 0.195" high maximum (top adjustment) Industrial grade	1/2" diameter 0.25" high maximum (top adjustment) Industrial grade	1/4" square 0.22" high maximum (top adjustment) Industrial grade	1/4" diameter 0.23" high maximum (top adjustment) Surface Mounted Trimmer (SMT) Industrial grade
				
	Wirewound		**Cermet**	
Resistance Range	10 to 25,000 ohms	10 to 50,000 ohms	20 ohms to 2 megohms	10 ohms to 1 megohm
Resistance Tolerance*	±5% standard	±5% standard	±20% standard	±10% standard
Contact Resistance Variation	N/A	N/A	1.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)
Adjustability	Within resolution	Within resolution	0.05% V.R.	0.05% V.R.
Insulation Resistance 500 VDC	500 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
Power Rating	0.5 watt @ 70°C	1.0 watt @ 70°C	0.5 watt @ 70°C (300 volt maximum)	0.5 watt @ 85°C (300 volt maximum)
Temperature Range	−55°C to +125°C	−55°C to +150°C	−55°C to +125°C	−55°C to +150°C (operating) +215°C/3 minutes (processing)
Temperature Coefficient	±70ppm/°C maximum (200 ohms and up)	±50ppm/°C maximum (100 ohms and up)	±100ppm/°C maximum	±100ppm/°C maximum
Seal	Dustproof, splashproof ①	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
Load Life (1000 hrs.)	0.5 watt @ 70°C	1.0 watt @ 70°C	0.5 watt @ 70°C	0.5 watt @ 85°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Adjustment Angle	280° nominal	300° nominal	240° nominal	240° nominal
Mechanical Angle	300° nominal	310° nominal	275° nominal	260° nominal
Terminals	2 PC pin styles	2 PC pin styles 2 thumbwheel types	5 PC pin styles	1 top adjustment style 2 side adjustment styles

*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

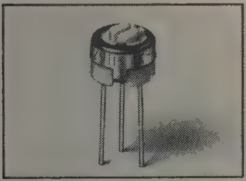
① Performance not guaranteed after exposure to printed circuit board cleaning procedures.

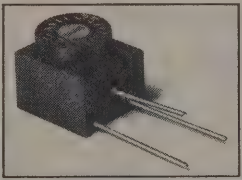
Specifications subject to change without notice.

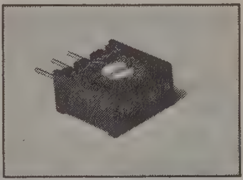
BOURNS® SINGLE TURN TRIMMERS

TRIMPOT® and ℬ® TRIMMING POTENTIOMETERS

3329	3339	3352	3359	3386
1/4" diameter 0.25" high maximum (top adjustment) Industrial & Military grade (RJ50, RJR50)	5/16" diameter 0.26" high maximum (top adjustment) Industrial grade	3/8" diameter 0.39" high maximum (side adjustment) Industrial grade	3/8" diameter 0.5" high maximum (side adjustment) Industrial grade	3/8" square 0.2" thick maximum Industrial grade







Cermet

10 ohms to 1 megohm	10 ohms to 1 megohm	10 ohms to 5 megohms	10 ohms to 2 megohms	10 ohms to 2 megohms
±10% standard	±10% standard	±20% standard	±20% standard	±10% standard
3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater)	2.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater)
0.05% V.R.	0.03% V.R.	0.1% V.R.	0.1% V.R.	0.05% V.R.
1,000 megohms minimum	1,000 megohms minimum	10 megohms minimum	N/A	1,000 megohms minimum
0.5 watt @ 85°C (300 volt maximum)	0.5 watt @ 85°C (300 volt maximum)	0.75 watt @ 40°C (250 volt maximum)	0.75 watt @ 40°C (250 volt maximum)	0.5 watt @ 85°C (300 volt maximum)
−55°C to +150°C	−55°C to +150°C	−55°C to +125°C	−65°C to +125°C	−55°C to +125°C
±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum	±100ppm/°C maximum
85°C Fluorinert**	85°C Fluorinert**	No ①	No ①	85°C Fluorinert**
0.5 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 70°C	0.5 watt @ 85°C
200 cycles	200 cycles	200 cycles	500 cycles	200 cycles
240° nominal	4 turns nominal	205° nominal	230° nominal	280° nominal
260° nominal	Wiper idles	225° nominal	270° nominal	310° nominal
5 PC pin styles	3 PC pin styles	7 PC pin styles	2 PC pin styles	12 PC pin styles

*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

① Performance not guaranteed after exposure to printed circuit board cleaning procedures.

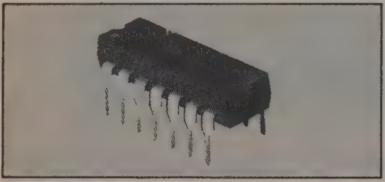
Specifications subject to change without notice.

BOURNS® ATTENUATORS

Bourns offers an extensive line of fixed, variable and switchable attenuators. All Bourns attenuators are available in both standard and custom configurations. Our Engineering Departments can custom design special attenuators for your special applications.

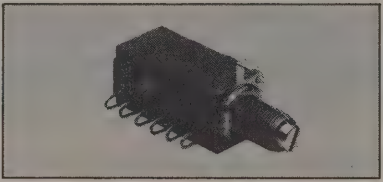
Fixed Attenuators

Models
4114R-033-001
O-Pad Configurations



Variable Attenuator

Models 81/82, 91/92
Straight T-Pad



Switchable Attenuators

Model
3100
T and O-Pad Configurations

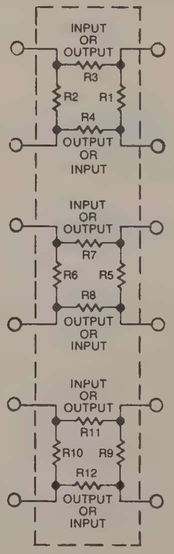
NETWORKS DIVISION

Pre-assembled 14 pin DIPs contain balanced or unbalanced attenuator pads. Available in 1/2 dB steps to 36 dB

Features include temperature coefficient of ±100ppm/°C operating temperature −55°C to +125°C

Attenuation tolerance (dB) of ±1%

Flat response through 1MHz


INPUT OR OUTPUT
R3
R2
R1
R4
OUTPUT OR INPUT
INPUT OR OUTPUT
R7
R6
R5
R8
OUTPUT OR INPUT
INPUT OR OUTPUT
R11
R10
R9
R12
OUTPUT OR INPUT

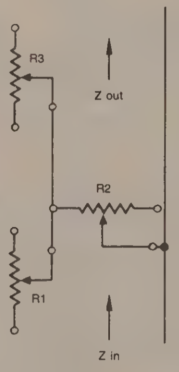
O-Pad

PRECISION CONTROLS DIVISION

Thick film cermet elements achieve infinite resolutions and setting stability

Straight T is available with 10% to 20% impedance tolerances

Minimum attenuation loss 0.2 dB all models with flat response through complete audio range


R3
Z out
R2
R1
Z in

Straight T-Pad

TRIMPOT DIVISION

Bourns Model 3100 switchable attenuators incorporate both switching and attenuator network functions in a single integrated package resulting in reduced component count, assembly costs and PC board space

Sealed to avoid switch contamination and PCB cleaning procedures

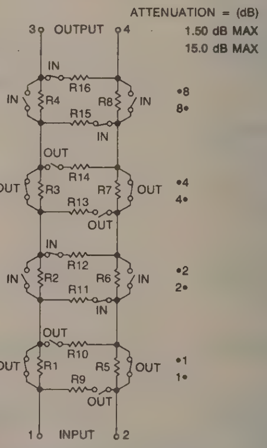
Precious metal switch contacts assure low insertion loss and long term operating stability

Impedance: 600 ohms ±2% (balanced or unbalanced)
75 ohms ±5% (unbalanced)

Standard attenuation ranges:
0-1.5, 0-15, and 0-24 dB

Binary Weighted Switching, 0.1 dB minimum step

Consult factory for details or additional values.


ATTENUATION = (dB)
1.50 dB MAX
15.0 dB MAX
3
OUTPUT
4
IN
R16
IN
R4
R8
IN
R15
IN
•8
8•
OUT
R14
OUT
R3
R7
OUT
R13
OUT
•4
4•
IN
R12
IN
R2
R6
IN
R11
IN
•2
2•
OUT
R10
OUT
R1
R5
OUT
R9
OUT
•1
1•
1
INPUT
2

O-Pad

Specifications subject to change without notice.

BOURNS® TRIM BIN™ KIT

H-800

TRIM BIN
BOURNS

A complete assortment of the most popular Trimpot® trimmers in one convenient package. The kit contains 126 parts representing 50 varieties of resistances and pin styles plus adjustment tools, and product literature.

Single-turn and Multiturn trimmers with wirewound or cermet resistance elements in various configurations (rectangular, square or round) are all included in this kit.

Select the size, shape, type of element and method of adjustment to suit your applications.

PARTS LIST

Model	Description	Resistance Code	-501	-102	-502	-103	-203	-503	-104
		Resistance Value (ohms)	500	1,000	5,000	10,000	20,000	50,000	100,000
20P-1	Multiturn, Cermet, SIP			2		4		2	
3005P-1	Multiturn, Wirewound				2	2			
3006P-1	Multiturn, Cermet			2		4		2	2
3266W-1						2			
3099P-1	Multiturn, Cermet, DIP			2		4			
3290W-1	Multiturn, Wirewound, Square			2	2				
3290P-1				2	2				
3296P-1	Multiturn, Cermet, Square					2			
3296W-1						4			
3296X-1						2			
3323P-1	Single-turn, Cermet, Square			2		4			2
3323W-1					2		2		
3323X-1						2		2	
3329H-1	Single-turn, Cermet			2		4		2	
3329W-1				2		4			
3339P-1	Four-turn, Cermet			2		4		2	
3345P-1	Single-turn, Wirewound				2				
3352P-1	Single-turn, Cermet			2		4		2	
3352W-1				2		4		2	
3352T-1			2			4		2	
3386P-1	Single-turn, Cermet			2		4		2	
3386W-1				2		4		2	
H-90	Adjustment Tool (1)								
H-91	Adjustment Tool (1)								
	Product Literature								

BOURNS® TRIMMERS PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

Pioneer

NORCROSS, GA
(404) 448-1711

AUSTIN, TX
(512) 835-4000

VESTAL, NY
(607) 748-8211

CHARLOTTE, NC
(704) 527-8188

ELK GROVE VILLAGE, IL
(312) 437-0680

CLEVELAND, OH
(216) 587-3600

NORWALK, CT
(203) 853-1515

DALLAS, TX
(214) 386-7300

DAYTON, OH
(513) 236-9900

HORSHAM, PA
(215) 674-4000

ALTAMONTE SPRNGS,FL
(305) 834-9090

FORT LAUDERDALE, FL
(305) 771-7520

HOUSTON, TX
(713) 988-5555

HUNTSVILLE, AL
(205) 837-9300

INDIANAPOLIS, IN
(317) 849-7300

LEXINGTON, MA
(617) 861-9200

LIVONIA, MI
(313) 525-1800

PINE BROOK, NJ
(201) 575-3510

PITTSBURGH, PA
(412) 782-2300

FAIRPORT, NY
(716) 381-7070

MINNETONKA, MN
(612) 935-5444

GAITHERSBURG, MD
(301) 921-0660

WOODBURY, NY
(516) 921-8700

BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM

ADVACOM, INC.
McKean, PA
(814) 476-7774

BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM

HARRISON
Harrison Equipment Co., Inc.

HOUSTON
(713) 879-2727
TX (800) 392-2680

DALLAS
(214) 239-2750
TX (800) 442-1811
NAT'L (800) 527-0900

AUSTIN
(512) 458-3555
TX (800) 252-9992

BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM

E P Electronic Parts Co.

ALBUQUERQUE, NM
(505) 293-6161

LAS CRUCES, NM
(505) 523-4578

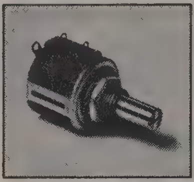
PHOENIX, AZ
(602) 277-7281

PRECISION CONTROLS DIVISION, 2533 North 1500 West, Ogden, UT 84404
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 • TEL (714) 781-5050

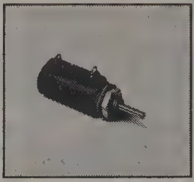
BOURNS® MULTITURN PRECISION POTENTIOMETERS

3543
3-Turn
Wirewound

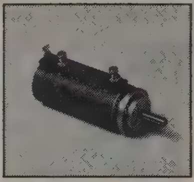
3545
5-Turn
Wirewound



3700/3701
10-Turn
Wirewound/Hybrid

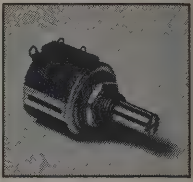


3750/3751
10-Turn
Wirewound/Hybrid



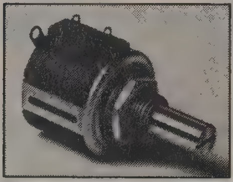
3500/3501
10-Turn
Wirewound/Hybrid

3540
10-Turn
Wirewound

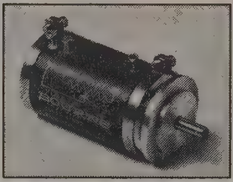


	3543	3545	3700/3701	3750/3751	3500/3501	3540
Resistance	20 to 50k ohms	50 to 50k ohms	**3700** 100 to 100k ohms **3701** 1k to 100k ohms	**3750** 100 to 100k ohms **3751** 1k to 100k ohms	**3500** 50 to 200k ohms **3501** 1k to 100k ohms	100 to 100k ohms
Power Rating @ 70°C	1.0 watt	1.5 watts	1.0 watt	1.0 watt	2.0 watts	2.0 watts
Independent Linearity	±0.25%	±0.25%	±0.25%	±0.25%	±0.2%	±0.25%
Rotational Life	0.3×10^6 revolutions	0.5×10^6 revolutions	**3700** 1×10^6 revolutions **3701** 4×10^6 revolutions	**3750** 1×10^6 revolutions **3751** 4×10^6 revolutions	**3500** 2×10^6 revolutions **3501** 4×10^6 revolutions	1×10^6 revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 3/4"	1/2" diameter x 1"	1/2" diameter x 1"	7/8" diameter x 1"	7/8" diameter x 3/4"

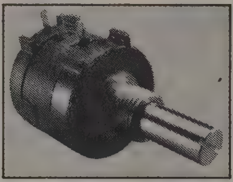
3541
10-Turn
Hybrid



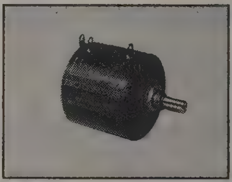
3550/3551
10-Turn
Wirewound/Hybrid



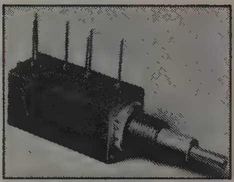
3590
10-Turn
Wirewound



3400
10-Turn
Wirewound



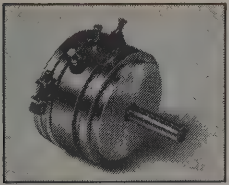
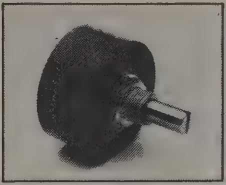
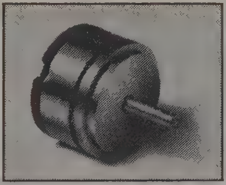
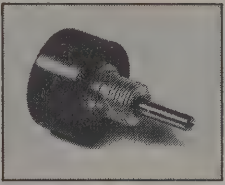
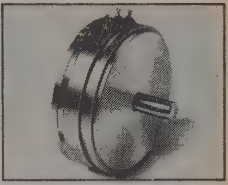
83/84
10-Turn
Wirewound/Hybrid



	3541	3550/3551	3590	3400	83/84
Resistance	1k to 100k ohms	**3550** 100 to 200k ohms **3551** 1k to 100k ohms	200 to 100k ohms	100 to 500k ohms	**Wirewound** 200 to 100k ohms **Hybrid** 1k to 100k ohms
Power Rating @ 70°C	2.0 watts	2.5 watts	2.0 watts @ 40°C 0 watts @ 125°C	5.0 watts @ 40°C	1.0 watt
Independent Linearity	±0.25%	±0.2%	±0.25%	±0.15%	±0.25%
Rotational Life	4×10^6 revolutions	**3550** 2×10^6 revolutions **3551** 4×10^6 revolutions	1×10^6 revolutions	2×10^6 revolutions	**Wirewound** 1×10^6 revolutions **Hybrid** 4×10^6 revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 1-9/16"	7/8" diameter x 3/4"	1-13/16" diameter x 1-3/4"	5/8" square x 3/4"

Specifications subject to change without notice.

BOURNS® SINGLE-TURN PRECISION POTENTIOMETERS

6534/6634	**6637/6638**	**6538**	**6657**	**6574/6674**
Conductive Plastic Servo Mount/ Bushing Mount	Conductive Plastic Bushing Mount	Conductive Plastic Servo Mount	Conductive Plastic Bushing Mount	Conductive Plastic Servo Mount/ Bushing Mount
				

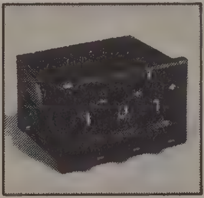
[redacted]

	6534/6634	6637/6638	6538	6657	6574/6674
Resistance	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms
Power Rating @ 70°C	1.0 watt	1.0 watt	1.0 watt	1.5 watts	2.0 watts
Independent Linearity	±0.5%	±1.0%	±1.0%	±1.0%	±.25%
Rotational Life	25x10⁶ revolutions	10x10⁶ revolutions	20x10⁶ revolutions	10x10⁶ revolutions	25x10⁶ revolutions
Size	7/8" diameter x 15/32"	7/8" diameter x 7/16"	7/8" diameter x 15/32"	1-5/16" diameter x 5/8"	2" diameter x 3/5"

BOURNS® DIALS, KNOBPOTS®, AND PUSH-BUTTON POTENTIOMETERS

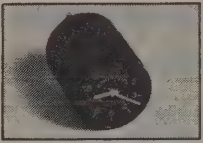
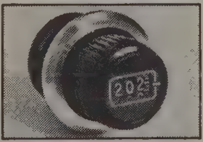
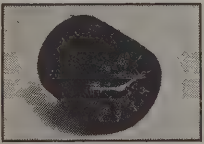
PUSH-BUTTON POTENTIOMETERS

3680 Series
Cermet

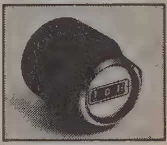
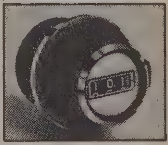


Decades	Model	Resistance	Resolution
1	3681	10 to 100k ohms	10%
2	3682	100 to 100k ohms	1.0%
3	3683	1k to 1 megohm	0.1%
4	3684	10k to 1 megohm	0.01%
5	3685	100k to 1 megohm	0.001%

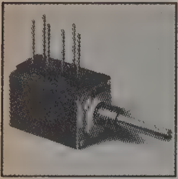
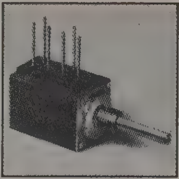
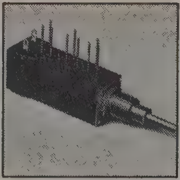
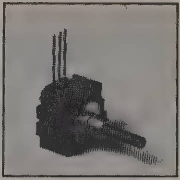
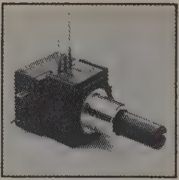
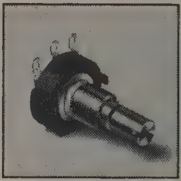
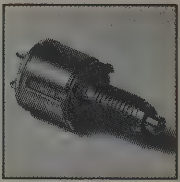
KNOBPOTS®

		Resistance	Power Rating	Diameter
3600 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	3/4"
3610 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	7/8"
3640 Wirewound		100 to 250k ohms	2.5 watts @ 25°C	1-1/4"
3650 Wirewound		100 to 250k ohms	2.5 watts @ 25°C	1-1/4"

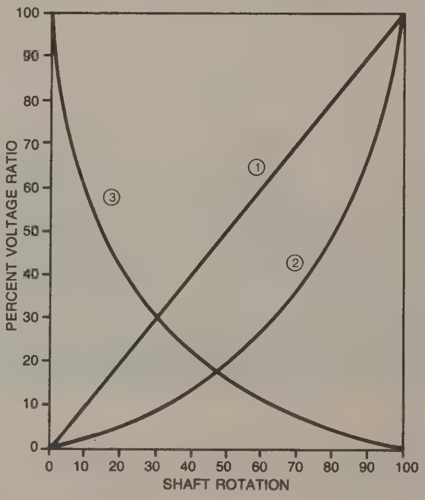
DIALS

H-507-6 7/8" diameter	
H-490 1" diameter	
CT23 1-1/16" diameter	
CT26 1-1/4" diameter	

BOURNS® PANEL CONTROL POTENTIOMETERS

81/82	87/88	85/86*	91/92/93/ 94/95	97/98/99	3851/3852	3862
						
•5/8" square	•5/8" square	•5/8" square	•5/8" square	•5/8" square	•3/4" diameter	•1/2" diameter
•Modular construction	•Modular construction	•Modular construction	•Modular construction	•Modular construction	•1/4" depth	•Rear terminals
•Single or multiple sections	•Single or multiple sections	•Multiple sections	•Single or dual sections		•Single section	•Single section
•Linear or audio tapers	•Semi-precision linear tapers	•DPST and DPDT rotary switches*	•Linear or audio tapers	•DPST and DPDT rotary switches	•Linear or audio tapers	•Linear taper
•Concentric or single shafts	•Concentric or single shafts	•Concentric or single shafts	•Single plastic shaft	•Single shaft	•Single shaft	•1/8" diameter single shaft
•Cermet	•Cermet	•Cermet	•Cermet	•Cermet	•Cermet	•Cermet
•Conductive plastic	•Conductive plastic	•Conductive plastic	•Conductive plastic	•Conductive plastic	•Conductive plastic	

Resistance Range
50
100
250
500
1k
2.5k
5k
10k
25k
50k
100k
250k
500k
1 megohm
2.5 megohms
5.0 megohms



Audio tapers available from 1k to 2.5 megohms only.

Taper Code	Description	Linearity	Tol.	Fig. Ref.
A	Linear-Cermet	±5% Ind.	±10%	1
B	Linear-Conductive plastic	±5% Ind.	±20%	1
C	CW Audio-Cermet	N/A	±10%	2
D	CW Audio-Conductive plastic	N/A	±20%	2
E	Linear-Conductive plastic	±5% Ind.	±10%	1
F	CCW Audio-Cermet	N/A	±10%	3
G	CCW Audio-Conductive plastic	N/A	±20%	3
H	Linear-Cermet	±5% Ind.	±5%	1
L	Linear-Conductive plastic	±2% Z.B.Ⓐ	±5%	1
M	Linear-Cermet	±2.5% Z.B.Ⓐ	±3%	1
N	Linear-Conductive plastic	±1% Z.B.Ⓐ	±5%	1
P	Linear-Cermet	±1.5% Z.B.Ⓐ	±3%	1
S	CW Audio-Conductive plastic	N/A	±10%	2
T	CCW Audio-Conductive plastic	N/A	±10%	3

SWITCH TYPE

Type	Detent	Contacts
DPST	CW	Open/Closed Open/Open Closed/ Closed
	CCW	Open/Closed Open/Open Closed/Closed
DPDT	CW	Open/Closed
	CCW	Open/Closed

*Switch/potentiometer combinations only.

Ⓐ Zero base linearity.

Resistance values and tapers vary from model to model. See individual model specifications in the PCD catalog.

**BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM**

Almo Electronics Corporation

PHILADELPHIA, PA
(215) 698-4000

PITTSBURGH, PA
(412) 931-5990

HAMDEN, CT
(203) 288-6556

NY, NJ, DE
(800) 523-3155

ROCKVILLE, MD
(301) 792-9197

CANTON, MA
(617) 821-1450

**BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM**

**IDEAL
INDUSTRIAL
ELECTRONIC SUPPLY, INC.**

EL PASO, TX
(915) 779-6647

**BOURNS® TRIMMERS · PANEL CONTROLS
RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM**

RS ELECTRONICS
A Subsidiary of Chelsea Industries

LIVONIA, MI
(313) 525-1155

KALAMAZOO, MI
(616) 381-5470

ROSEVILLE, MI
(313) 779-2450

MAUMEE, OH
(419) 893-0721

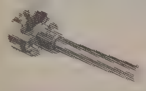
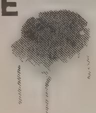
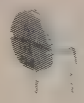
GRAND RAPIDS, MI
(616) 241-3483

WYANDOTTE, MI
(313) AV2-5880

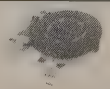
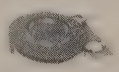
FLINT, MI
(313) 762-5800

CTS® CORPORATION*
BERNE DIVISION

INDUSTRIAL CERMET POTS & TRIMMERS

CTS Series	Description	Data Sheet	Resistance Range	CTS Series	Description	Data Sheet	Resistance Range
550R	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ dia. Bushing: ⅜″ FMS Shaft: ⅞″ FMS x .250″ dia., slotted	3550 E	50Ω- 1 MEGΩ	**375S**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing	3375	50Ω- 1 MEGΩ
550S 	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ Dia. Bushing: ⅜″ FMS Shaft: 2″ FMS x .250″ dia.	3550 E	50Ω- 1 MEGΩ	**375T**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x 150″ .100″ lead spacing	3375	50Ω- 1 MEGΩ
550LT	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim: ¾″ Dia. Bushing: ½″ FMS, locking Shaft: ⅝″ FMS x .250″ dia., slotted	3550 E	50Ω- 1 MEGΩ	**375X**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ 100″ lead spacing TO-5 lead spacing	3375	50Ω- 1 MEGΩ
375E 	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing Cent. Term: .400″	3375	50Ω- 1 MEGΩ	**375Y**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing TO-5 lead spacing	3375	50Ω- 1 MEGΩ
375V 	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .350″ dia. x .150″ .172″ lead spacing Cent. Term: .156″	3375	50Ω- 1 MEGΩ	**375Z**	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing TO-5 lead spacing	3375	50Ω- 1 MEGΩ

INDUSTRIAL CARBON POTS & TRIMMERS

	CTS Series	Description	Resistance Range & Tol.	Power Rating (Watts)	Max. Op. Temp.	No. of Turns
	VA-45 (Vernier Adjust)	15/16″ Panel Mount Shaft: ¼″ dia. x 1″ FMS. Slotted	100Ω- 1 Meg ±10%	½ to 10K ⅓ Above 10K to 100K ¼ Above 100K @ 55°C	85°C	10¼
	**U201**	19/32″ Knob. Dia. Snap-in self-supporting mounting, parallel to PC board	100Ω- 1 Meg ±20%	¼ to 5K @ 40°C ¼ 5K & Up @ 55°C	85°C 100°C	1
	**X201**	19/32″ Knob. Dia. Snap-in self-supporting mounting, perpendicular to PC board	100Ω- 1 Meg ±20%	¼ to 5K @ 40°C ¼ 5K & Up @ 55°C	85°C 100°C	1
	U260	10 mm (.394″) Dia. Mounts horizontally, knob parallel to PC board	500Ω- 1 Meg ±20%	.2 @ 55°C	100°C	1
	X260	10 mm (.394″) Dia. Mounts vertically, knob perpendicular to PC board	500Ω- 1 Meg ±20%	.2 @ 55°C	100°C	1

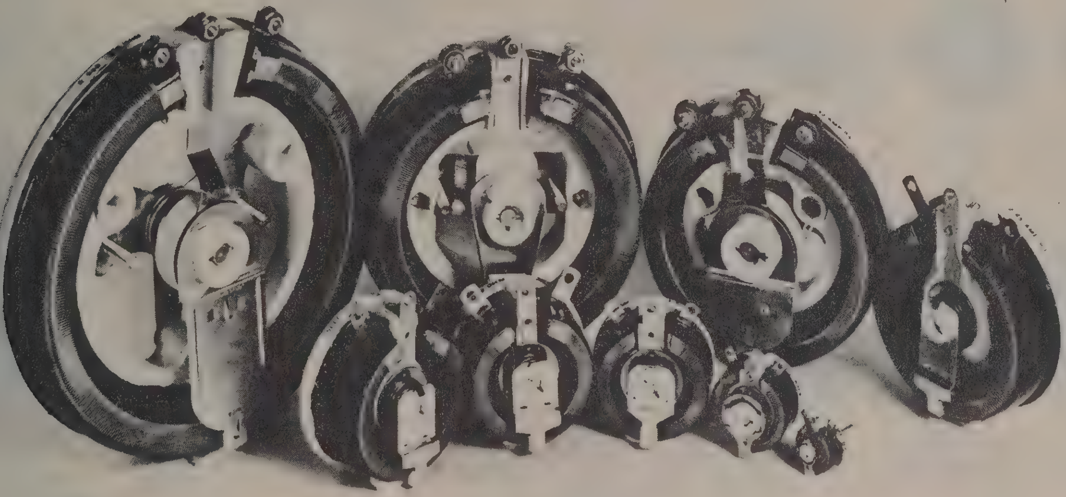
ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana, dba CTS Electronics Corporation

E-SYSTEMS
Memcor Division

POWER RHEOSTATS

MEET THE MEMCOR FAMILY OF HIGH QUALITY WIRE-WOUND POWER RHEOSTATS



All MEMCOR Power Rheostats are vitreous enamel coated. The core and base are bonded together with vitreous enamel, thereby contributing markedly to the heat dissipation.

Standard tolerance: ±10%, ±5% available as a special.

TYPE	POWER (Watts)	RESISTANCE RANGE	DIAMETER	WEIGHT
R12½	12½ Watt	1 - 5000 Ohms	⅞″	.035 Lbs.
R25	25 Watt	1 - 5000 Ohms	1 9/16″	0.23 Lbs.
R50	50 Watt	0.5 - 10,000 Ohms	2 15/16″	0.45 Lbs.
R75	75 Watt	0.5 - 10,000 Ohms	2¾″	0.60 Lbs.
R100	100 Watt	0.5 - 10,000 Ohms	3⅛″	0.72 Lbs.
R150	150 Watt	0.5 - 10,000 Ohms	4″	1.50 Lbs.
R225	225 Watt	1 - 2500 Ohms	5″	2.18 Lbs.
R300	300 Watt	1 - 2500 Ohms	6″	3.0 Lbs.
R500	500 Watt	1 - 2500 Ohms	8″	3.75 Lbs.
R1000	1000 Watt	1 - 2000 Ohms	12″	10.0 Lbs.

Special Rheostats with Tapered Sections, Locking Devices, Off Positions, Tandem Mountings, Special Shafts on Bushing, and many other variations can be supplied.

Write for FREE Catalog.

E-SYSTEMS
Memcor Division

DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

ETI
SYSTEMS

MULTI-TURN POTENTIOMETERS TURNS COUNTING DIALS

MR22

MW10

MW12

MW20

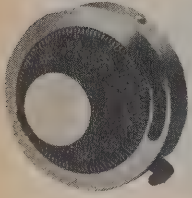
MW46

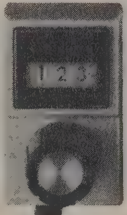
MR46

MG22
7/8″ DIA.

MB25
1″ DIA.

CA20
7/8″ DIA.


MF46
1 13/16″ DIA.

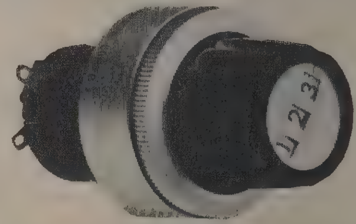

DB10
1″ x 1.75″

DB100
1″ x 1.75″

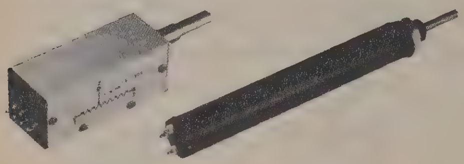
Model	No. of Turns	Size Dia.x Length	Resistance Range	Resistance Tolerance	Linearity, Independent	Power Rating	Mechanical Life (Rev.)	Shaft Dia. †
MR22	10	.875x.750	10Ω-100KΩ	±5%	±.25%	2 watts	500,000	¼″
MW10-10	10	.400x1.00	20Ω-100KΩ	±5%	<5K = ±.4% >5K = ±.25%	1.5 watts	200,000	⅛″
MW12-10	10	.500x1.00	20Ω-150KΩ	±3%	<5K = ±.3% >5K = ±.25%	1 watt	1,000,000	⅛″
MW22-10	10	.875x.750	100Ω-100KΩ	±5%	±.25%	2 watts	500,000	¼″
MW20-10	10	.790x1.00	20Ω-200KΩ	±3%	±.25%	5 watts	2,000,000	¼″
MW25-10	10	.980x1.476	20Ω-200KΩ	±3%	±.25%	5 watts	2,000,000	⅛″
MW46-10	10	1.812x2.00	5Ω-500KΩ	±3%	±.25%	10 watts	2,000,000	¼″
MW46-20	20	1.812x3.13	10Ω-1 Meg.	±3%	±.25%	20 watts	2,000,000	¼″
MR46-10	10	1.812x2.20	0.5Ω-500KΩ	±5%	±.25%	10 watts	2,000,000	¼″
MR46-20	20	1.812x3.74	10Ω-1 Meg.	±3%	±.25%	20 watts	2,000,000	¼″
SMR46	10	Same as MR46-10 except with limit switches at ends. (Snap action)						
M046-10	10	2.500x3.187	Same specs as MR46-10 except oil-filled.					

COMBO® 3

Pre-assembled and phased to ±.25% absolute readout accuracy. Mounts in a 1.187″ dia. panel hole. Available with seven potentiometers above.



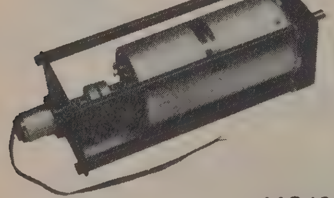
LINEAR MOTION



- Full line of precision linear motion potentiometers. Strokes from 0.433″ to 40″. Available in wirewound, conductive plastic or hybrid elements. Please contact ETI Systems for complete specifications.

MOTOR CONTROLLED POTENTIOMETERS

(MULTI-TURN AND SINGLE-TURN)


MC46-2

ETI Systems offers for the first time a complete line of motor-controlled potentiometers with motor operating currents low enough to respond accurately from operational amplifier outputs.

All ETI Systems rotary potentiometers may be motorized for your applications.

PRECISION POTENTIOMETER, 2,000,000 TURNS LIFE.

GEAR RATIOS: 41:1 TO 235,000:1 WITH DUAL ADJUSTABLE CLUTCHING COUPLER.

PRECISION FRACTIONAL H/P MOTORS IN 6 OR 12 VDC, RPM'S FROM 6,000 to 20,000. A.C. MOTORPOTS NOW AVAILABLE.

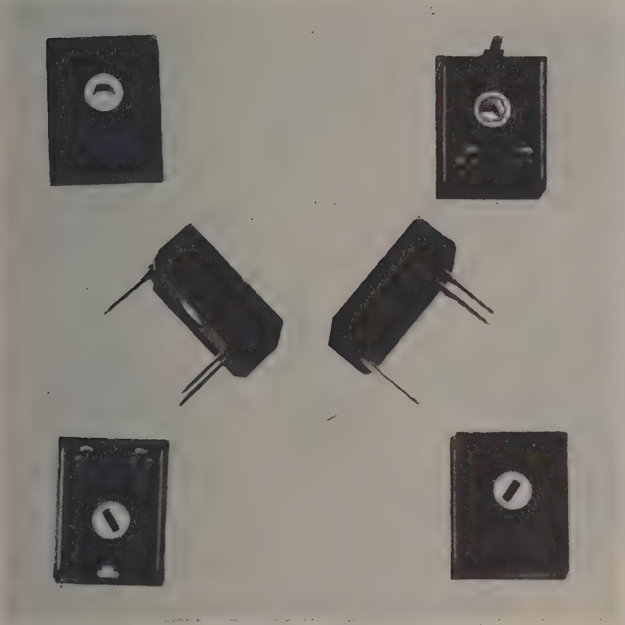
See Section 3500, Motors and Drives for full information.

ETI SYSTEMS
DEPT. EM, 215 VIA DEL NORTE • OCEANSIDE, CA 92054
TEL: (619) 757-7770 • TWX: 910-322-1396
DIV: POLARIS ENTERPRISES, INC.

ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

POTENTIOMETERS



Color of protecting housing
PNZ type — black
PNKZ type — green
PNCZ type — red

For the requirements of modern electronic equipment ISKRA has designed a new series of trimmer potentiometers PNZ 10, which feature a number of improvements.
Some of them are:

- △ Miniature rectangular design
- △ Horizontal and vertical mounting
- △ Three types of resistive layers:
  - carbon layer on phenolic
  - carbon layer on ceramic
  - cermet layer on ceramic
- △ With hex slot suitable for automatic adjustment
- △ Dual wiper design reduces contact resistance and electrical noise
- △ Enclosed body protects against dust and short circuits
- △ Non-inflammable plastic according to UL-94-VO

'POTS'

PNZ Series	Wattage	Resistance	T.C.
(Miniature and enclosed trimmer potentiometers)	.2W, .5W	25 ohms - 5 meg ohms	100 ppm/°C 2000 ppm/°C

PNZ Series available in Carbon on Phenolic, Carbon on Ceramic and Cermet Horizontal and vertical mount configurations (standard industry spacing) available with Screw Driver Slot, Hex Slot, Thumbwheel and Spindle Shift.

Open construction trimmers, from 8mm thru 18mm diameters available on order. Custom controls, slider and focus potentiometers also available.

Rated resistance range

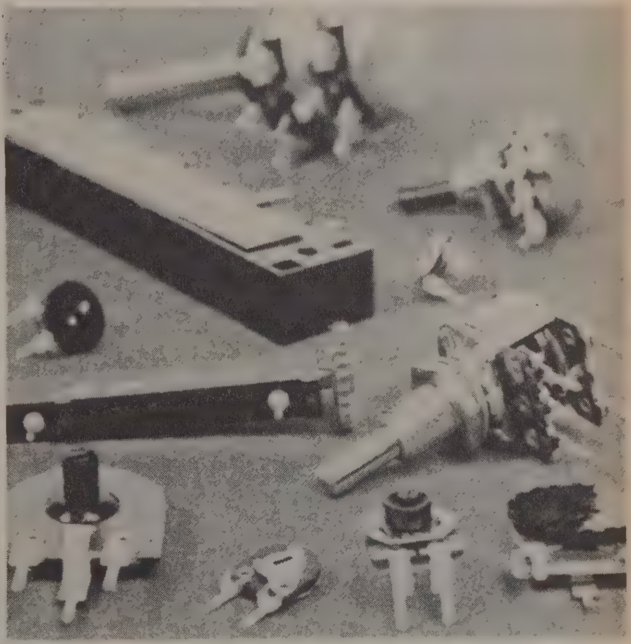
—	1 kΩ	100 kΩ	10 MΩ
25 Ω	2.5 kΩ	250 kΩ	—
50 Ω	5 kΩ	500 kΩ	—
100 Ω	10 kΩ	1 MΩ	—
250 Ω	25 kΩ	2.5 MΩ	—
500 Ω	50 kΩ	5 MΩ	—

CERAMIC BASED PRE-SET POTENTIOMETERS

With the development of modern electronics and miniaturization the technical needs have also increased and consequently pre-set potentiometrs have to be adapted accordingly. The main requirements are:

- △ High electrical loading
- △ Higher operating temperature
- △ Climatic influences
- △ Requirements according to long term stability

Pre-set potentiometers have been developed on alumina ceramics, open version. Several potentiometers are available with dust-proof casing.



ISKRA ELECTRONICS INC.
8 GREENFIELD RD., SYOSSET, NY 11791 • (516) 364-2616

JDK Controls, Inc.

PRECISION CO-MOLDED CONDUCTIVE PLASTIC POTENTIOMETERS & ASSEMBLIES

JDK Controls manufactures one type of potentiometer element — co-molded conductive plastic — because to a serious user, there are very few reasons to use any other type of resistive element technology. In the JDK process, the termination and resist materials are molded under temperature to a plastic substrate. The result is a very hard, smooth surface which promotes ultra-long life and excellent electrical characteristics. This process is superior in reliability to other conductive plastic processes such as film and screening, as well as other element types including cermet, hybrid, and wirewound.

JDK FEATURES

- ULTRA-LONG ROTATIONAL LIFE
  50 Million Cycles — Minimum
- EXCELLENT OUTPUT SMOOTHNESS
  Always under .1%
- LINEAR AND NON-LINEAR
  Functions Available
- OUTSTANDING VALUE
  $\frac{\text{Unit Price}}{\text{Performance}}$
- 18 MONTH WARRANTY
  For most applications —
  because JDK believes in what it manufactures

QUALITY ASSURANCE

All JDK precision co-molded conductive plastic potentiometers are designed and manufactured to meet or exceed the requirements of:

MIL-R-39023A

Our Quality Assurance System meets the requirements of:

MIL-Q-9858A
MIL-I-45208A

MARKETS

JDK precision co-molded conductive plastic potentiometers are used in a variety of commercial, industrial, and military applications.

STANDARD ROTARY SINGLE-TURN SIZES

Model No.	Dia. Inches	Res. Range	Standard* Elect. Travel	Standard* Ind. Lin.	Mounting Styles
6005	.500	1K-50K	325°	1.0%	Servo/Bushing
6008	.750	1K-50K	340°	.5%	Servo/Bushing
6009	.875	1K-50K	340°	.5%	Servo/Bushing
6011	1.062	1K-50K	340°	.5%	Servo/Bushing
6015	1.437	1K-50K	340°	.5%	Servo/Bushing
6018	1.750	1K-50K	350°	.5%	Servo/Bushing
6020	2.000	1K-50K	350°	.5%	Servo/Bushing

* Specials Available

CUSTOM REQUIREMENTS AND ASSEMBLIES

JDK specializes in custom requirements for potentiometers in the sizes listed above as well as the following:

- ELEMENTS
  .578″ to 3.0″ outside diameter
  Rotor/Wiper assemblies available
- DC MOTOR POTENTIOMETER ASSEMBLIES
  16 or 22 mm
  Gearheads also available
- NEXT ASSEMBLIES
  JDK will add to its potentiometers —
  brackets, connectors, switches,
  wire harnesses, etc.

For a complete product catalog, call or write:

JDK Controls, Inc.
2630 Lavery Court, Suite F, Newbury Park, California 91320-1593 Telephone 805/499-7779

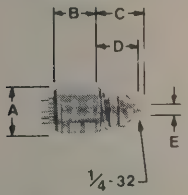
MAUREY
INSTRUMENT CORP.

Potentiometers

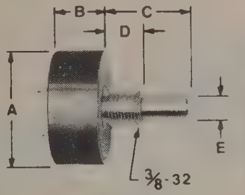
Rotary and Linear Motion Transducers

WIREWOUND These precision potentiometers were developed for military use over a period of 27 years. They are widely used in instrumentation and automation where precise electrical and mechanical requirements are specified. Low resistance tolerance and TCR; close electrical angle tolerance. Custom designs are available.

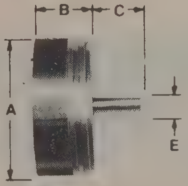
CONDUCTIVE PLASTIC Our raised molded track will withstand 200,000,000 cycles of high dynamic velocities (10″ per second). The infinite resolution and low noise make these units particularly suitable for servo feedback applications. 100 g shock, 100—20,000 Hz at 50 g. Impervious to most gases and oils.



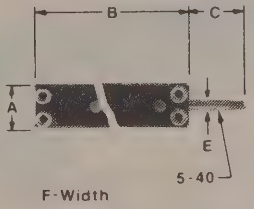
TRIMMER



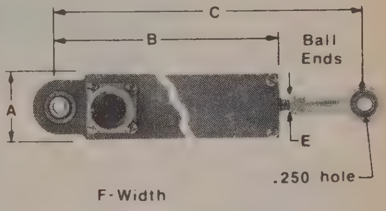
BUSHING



SERVO**



LINEAR MOTION (LMA)



LINEAR MOTION (LMB)

	Part No.	Type	A	B	C	D	E	F	OHMS Range	OHMS ± %	Lin. ± %	Elect. Travel	Mech. Travel	Watts @ 40°C	Torque OZ-IN
Wirewound	50-M123	TRIMMER	.50	.50	.50	.44	.125	—	50Ω-50K	5	3.0	325°	325°	2	1-8
	50-M125	BUSH'G	.50	.50	.62	.25	.125	—	50Ω-25K	5	1.0-0.5	325°	325°	2	0.5
	87-M44	SERVO**	.87	.68	.50	—	.125	—	100Ω-25K	5	1.0-0.2	353°	360°	2	0.1
	131-M3	BUSH'G	1.31	.50	.87	.38	.250	—	100Ω-50K	5	1.0-0.3	320°	330°	3	0.1
	200-M167	SERVO**	2.00	.80	.75	—	.250	—	100Ω-50K	5	1.0-0.1	356°	360°	5	0.5
	200-M493	BUSH'G	2.00	1.00	87	.38	.250	—	100Ω-100K	5	1.0-0.4	320°	360°	4	0.6
	300-M74	SERVO**	3.00	.80	.75	—	.250	—	500Ω-100K	5	0.2-0.05	358°	360°	7	0.6
	M1326-1	LMA ‡	.50	2.00	.75	—	.125	.38	50Ω-20K	5	3.0-0.3	1.00″ ‡	1.10″	1	4*
	M1326-4	LMA ‡	.50	.500	.75	—	.125	.38	250Ω-50K	5	0.3-0.1	4.00″ ‡	4.10″	4	4*
	M1326-12	LMA ‡	.50	13.00	.75	—	.125	.38	5K-100K	5	0.1-0.05	12.0″ ‡	12.10″	12	4*
	M2028-5	LMB ‡	1.25	10.50	**13.20**	—	.250	.76	1K-100K	5	0.2-0.03	5.0″ ‡	5.25″	5	4*
	M2028-10	LMB ‡	1.25	15.80	**18.50**	—	.250	.76	2K-200K	5	0.1-0.02	10.0″ ‡	10.25″	10	4*
	M2028-15	LMB ‡	1.25	21.00	**23.70**	—	.250	.76	5K-200K	5	0.1-0.01	15.0″ ‡	15.25″	15	4*
Conductive Plastic	87-P82	BUSH'G	.87	.53	.87	.38	.250	—	500Ω-50K	20	2.0	340°	360°	1	1
	87-P83	SERVO**	.87	.59	.50	—	.125	—	500Ω-50K	10	0.5	340°	360°	1	0.5
	106-P249	SERVO**	1.06	.65	.50	—	.125	—	500Ω-100K	10	0.5	340°	360°	1.5	0.5
	112-P16	BUSH'G	1.12	.53	.87	.38	.250	—	500Ω-100K	20	2.0	340°	360°	1.5	1
	112-P19	SERVO**	1.12	.65	.50	—	.125	—	500Ω-100K	10	0.5	340°	360°	1.5	0.5
	200-P445	BUSH'G	2.00	.53	.87	.38	.250	—	1K-100K	20	1.0	340°	360°	3	1
	200-P446	SERVO**	2.00	.80	.75	—	.250	—	1K-100K	10	0.5	340°	360°	3	0.5
	P1613-1	LMA ‡	.50	2.00	.75	—	.125	.38	1K-5K	20	2.0	1.0″ ‡	1.1″	0.5	4*
	P1613-4	LMA ‡	.50	5.00	.75	—	.125	.38	4K-10K	20	0.5	4.0″ ‡	4.1″	2	4*
	P1991-5	LMB ‡	1.25	10.50	**13.20**	—	.250	.76	5K-20K	20	0.5	5.0″ ‡	5.25″	2.5	4*
	P1991-10	LMB ‡	1.25	15.80	**18.50**	—	.250	.76	10K-25K	20	0.5	10.0″ ‡	10.25″	5	4*
	P1991-15	LMB ‡	1.25	21.00	**23.70**	—	.250	.76	15K-50K	20	0.5	15.0″ ‡	15.25″	7	4*

* Frictional force in ounces shown for linear motion units.
** Servo dimensions to MIL-R12934C and MIL-R39023A. Custom deviations to the above units are available.
‡ Available travel in one inch increments.

MAUREY
INSTRUMENT CORPORATION
4557 West 60th Street, Chicago, IL 60629 · PHONE (312) 581-4555 · TWX 910-221-6025

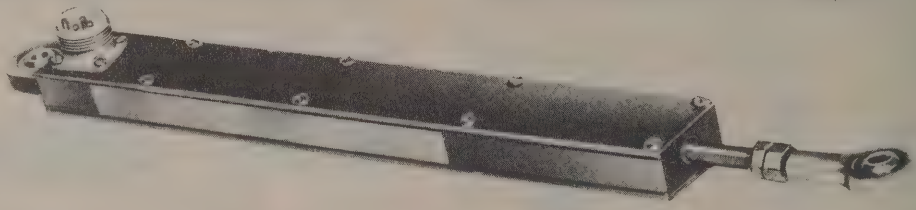
MAUREY
INSTRUMENT CORP.

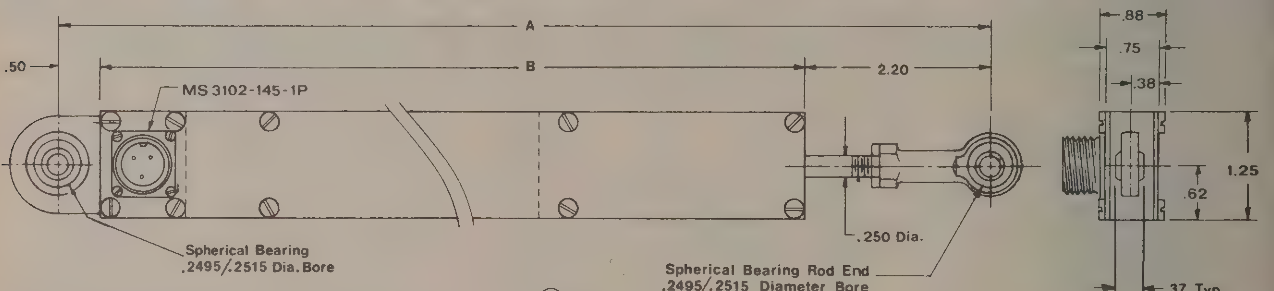
HEAVY DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC

HDL

WIREWOUND M2028 This transducer combines the inherent accuracy and reliability of a wirewound potentiometer with the physical ruggedness required in industrial applications. They are used with hydraulic and mechanical actuators to measure and control linear motion. The self-aligning spherical ball ends and MS connector simplifies installation. High duty bearings give the ¼ inch shaft stability in the extended position.

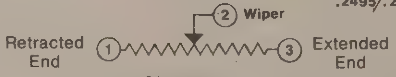
CONDUCTIVE PLASTIC P1991 Where severe environmental conditions exist as in mills, factories and power generating plants, this linear motion transducer is practically indestructible. The unit is impervious to dust, oil and moisture. The molded, raised conductive track and graphite composition contacts provide for years of maintenance free service. As with the M2028, the self-aligning spherical ball ends and MS connector allows for ease in installation.





(1/2 Scale)

TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMALS .XX ±.010
.XXX ±.005



SCHEMATIC

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M2028 WIREWOUND	P1991 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	See Charts II & III	See Note 5
Total Resistance Tolerance	±5%	±20%
Theoretical Resolution	See Chart III	.001 inch
Independent Linearity	See Note 6	±0.5%
Theoretical Elect. Travel (inches)	See Chart I	See Chart I
Theoretical Elect. Travel Tolerance (inches)	±.010	±.025
Total Mechanical Travel (inches)	See Chart I	See Chart I
Temperature Coefficient	50 PPM/°C	500 PPM/°C
Operating Temperature Range	−55 to 125°C	−55° to 105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750 volts, RMS	750 volts, RMS
Terminals	3	3
Taps	1/2 inch spacing	1/2 inch spacing
Tap Tolerance (inches)	±.010	±.030
Life Expectancy (Cycles at 60 in./min.)	500,000	50,000,000
Shaft Frictional Force	4 ounces	4 ounces
Weight (ounces)	See Chart I	See Chart I
Bearings	Nylon	Nylon

Notes:
1. Mating connector supplied.
2. Stainless steel shaft.
3. Anodized aluminum housing.
4. Terminals available on special request.
5. Ohms per inch for P1991: 500, 1K, 2K, 5K, 10K.
7. Independent linearity for M2028: (100% ÷ Total Turns x 2)
6. With modification, this type is available in strokes greater than 15 inches.

CHART I

Dash No.	Elect. Travel	Mech. Travel	A	B	Wt. Ozs.
1	1 00	1 25	**13.20**	10 50	10
−2	2 00	2 25	**13.20**	10 50	10
−3	3.00	3 25	**13.20**	10 50	10
4	4 00	4 25	**13.20**	10 50	10
−5	5.00	5 25	**13.20**	10.50	10
−6	6 00	6.25	**18.50**	15.80	15
−7	7.00	7.25	**18.50**	15 80	15
−8	8 00	8 25	**18.50**	15.80	15
−9	9 00	9 25	**18.50**	15 80	15
−10	10.00	10.25	**18.50**	15 80	15
−11	11.00	11.25	**23.70**	21.00	20
−12	12.00	12.25	**23.70**	21.00	20
13	13 00	13 25	**23.70**	21.00	20
−14	14.00	14.25	**23.70**	21.00	20
15	15.00	15 25	**23.70**	21 00	20

CHART II

DASH NO.	TOTAL RESISTANCE
102	1,000
202	2,000
502	5,000
103	10,000
203	20,000
503	50,000
104	100,000

CHART III

OHMS PER INCH	NUMBER OF TURNS PER INCH
500	270
1,000	370
2,000	415
2,500	450
5,000	550
10,000	660
20,000	1000

PART NUMBER DESIGNATION (EXAMPLE)
M2028-5-502
TOTAL RESISTANCE (5000 Ω)
ELECTRICAL TRAVEL (5.00 INCHES)
BASIC TYPE

MAUREY
INSTRUMENT CORPORATION
4555 West 60th Street, Chicago, IL 60629
PHONE (312) 581-4555
TWX 910-221-6025

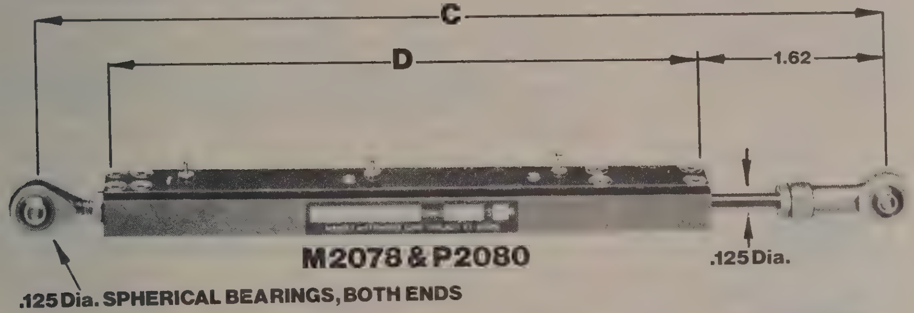
MAUREY
INSTRUMENT CORP.

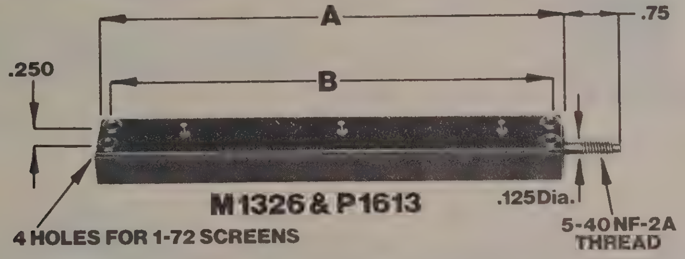
LIGHT DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC

LDL

WIREWOUND (M-Series) These miniature transducers combine the best electrical characteristics in the smallest size at the lowest cost. The units were designed for use in laboratory test equipment, light industrial applications and automation where great accuracy of electrical output is essential. The spherical ball ends add flexibility to mounting. These wirewound, linear motion potentiometers will meet the requirement in the majority of applications.

CONDUCTIVE PLASTIC (P-Series) Where long life in a hostile environment is required, these linear motion transducers with molded, raised tracks and graphite composition contacts have no equal. They are practically impervious to dust, water and oil. The high contact pressure resists the effects of severe vibration and shock. The units are being used in factories and mills where maintenance-free operation is essential.





Stroke (Inches)	M1326 / P1613		M2078 / P2080	
	A	B	C	D
1	2.00	1.800	5.12	3.00
2	3.00	2.800	6.12	4.00
3	4.00	3.800	7.12	5.00
4	5.00	4.800	8.12	6.00
5	6.00	5.800	9.12	7.00
6	7.00	6.800	10.12	8.00
7	8.00	7.800		
8	9.00	8.800		
9	10.00	9.800		
10	11.00	10.800		
11	12.00	11.800		
12	13.00	12.800		

Shaft shown in fully retracted position
Shaft is free to rotate.
Body: ½ wide on terminal side x ⅜ deep.

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M1326 WIREWOUND	P1613 CONDUCTIVE PLASTIC	M2078 WIREWOUND	P2080 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	25 Ω to 20K/inch	250 Ω to 10K/inch	25 Ω to 20K/inch	250 Ω to 10K/inch
Total Resistance Tolerance	±5%	±20%	±5%	±20%
Theoretical Resolution (inch)	.006 to .001	.001	.006 to .001	.001
Independent Linearity	±1.2% to ±0.1%	±2% to ±0.5%	±1.2% to ±0.1%	±2% to ±0.5%
Theoretical Electrical Travel (inches)	1.000 to 12.000	1.00 to 5.00	1.000 to 6.000	1.00 to 5.00
Theoretical Elect. Travel Tolerance (inches)	±.010	±.050	±.010	±.050
Total Mechanical Travel (inches)	1.10 to 12.10	1.10 to 5.10	1.10 to 6.11	1.10 to 5.10
Temperature Coefficient (PPM/°C)	50	500	50	500
Operating Temperature Range	−55°to125°C	−55°to105°C	−55°to125°C	−55°to105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750	750	750	750
Terminals	3	3	3	3
Taps	4 taps/inch	4 taps/inch	4 taps/inch	4 taps/inch
Tap Tolerance (inches)	±.010	±.050	±.010	±.050
Life Expectancy (cycles at 60 in./min.)	500,000	50,000,000	500,000	50,000,000
Shaft Frictional Force (ounces, max.)	4 oz.	4 oz.	4 oz.	4 oz.
Bearings	Nylon	Nylon	Nylon	Nylon

Standard Resistance Values, Ohms / inch: 250Ω, 500Ω, 1K, 2K, 2.5K, 10K, 20K

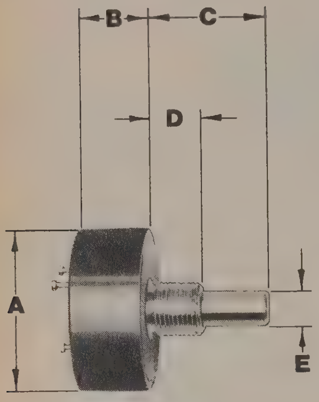
MAUREY
INSTRUMENT CORPORATION
4555 West 60th Street, Chicago, IL 60629 · PHONE (312) 581-4555 · TWX 910-221-6025

MAUREY
INSTRUMENT CORP.

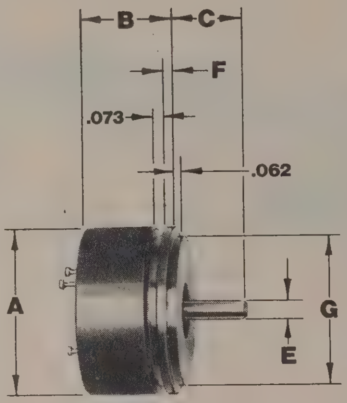
PRECISION CONDUCTIVE-PLASTIC SINGLE TURN POTENTIOMETERS

PST

These conductive plastic potentiometers have been specially designed for severe environmental conditions in mill-factory operations as well as in critical military applications. The molded, raised track maintains itself free from contamination of foreign particles, oil or water. The high gram pressure of the graphite composition contact on the raised track gives excellent resistance to contact bounce under punishing vibration or shock, as well as an exceptional rotational life. Such units are particularly suited for applications where trouble-free maintenance is required.



BUSHING



SERVO

	TYPE	A	B	C	D	E	F	G
87-P82	BUSHING	.87	.53	.87	.38	.250	—	—
87-P83	SERVO	.87	.59	.50	—	.125	.062	.750
106-P249	SERVO	1.06	.57	.50	—	.125	.062	.968
112-P16	BUSHING	1.12	.50	.87	.38	.250	—	—
112-P19	SERVO	1.12	.57	.50	—	.125	.062	1.000
143-P93	SERVO	1.43	.63	.75	—	.250	.093	1.312
200-P445	BUSHING	2.00	.50	.87	.38	.250	—	—
200-P446	SERVO	2.00	.75	.75	—	.250	.093	1.875

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	87-P82 BUSHING	87-P83 SERVO	106-P249 SERVO	112-P16 BUSHING	112-P19 SERVO	143-P SERVO	200-P445 BUSHING	200-P446 SERVO
Total Resistance (Ohms)	500 Ω - 50K	500 Ω - 50K	500 Ω - 100K	500 Ω - 100K	500 Ω - 100K	1K - 100K	1K - 100K	1K - 100K
Total Resistance Tolerance	±20%	±10%	±10%	±20%	±10%	±10%	±20%	±10%
Theoretical Resolution	.001%	.001%	.001%	.001%	.001%	.001%	.001%	.001%
Independent Linearity	±2%	±0.5%	±0.5%	±2%	±0.5%	±0.5%	±2%	±0.5%
Theoretical Electrical Travel (Degrees)	340°	340°	340°	340°	340°	340°	340°	340°
Theoretical Elect. Travel Tolerance (Degrees)	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Total Mechanical Travel (Degrees)	360°	360°	360°	360°	360°	360°	360°	360°
Temperature Coefficient (PPM/°C)	400	400	400	400	400	400	400	400
Operating Temperature Range (°C)	−55° to 105°C	−55° to 105°C	−55° to 105°C	−55° to 105°C	−55° to 105°C	−55° to 105°C	−55° to 105°C	−55° to 105°C
Power Rating (Watts at 40°C)	1	1	1.5	1.5	1.5	2	3	3
Dielectric Strength (Volts, RMS for 60 Sec)	1000	1000	1000	1000	1000	1000	1000	1000
Terminals, Standard	3	3	3	3	3	3	3	3
Taps, Maximum Available	4	4	6	6	6	9	9	9
Tap Tolerance	±5°	±3°	±2°	±5°	±2°	±2°	±5°	±2°
Life Expectancy (Revolutions at 500RPM)	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000
Moment of Inertia (gm-cm^2)	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5
Starting Torque (ounce-inches)	*0.6	0.5	0.5	*0.6	0.5	0.3	*0.6	0.3
Running Torque (ounce-inches)	*0.5	0.4	0.4	*0.5	0.4	0.2	*0.5	0.2
Weight (ounces)	0.5 oz.	0.6 oz.	0.6 oz.	0.6 oz.	0.6 oz.	1.7 oz.	2 oz.	4 oz.
*Stop Strength (pound-inches)	**2 lb.-in.	—	—	*2 lb.-in.	—	—	*3 lb.-in.	—
Bearings	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.

* Add one ounce-inch for O-ring seal
** For units with mechanical stops.
Conforms to MIL - R - 39023 A

Standard Resistance Values Within Range Indicated.
500 Ω , 1K, 2K, 5K, 10K, 20K, 50K, 100K

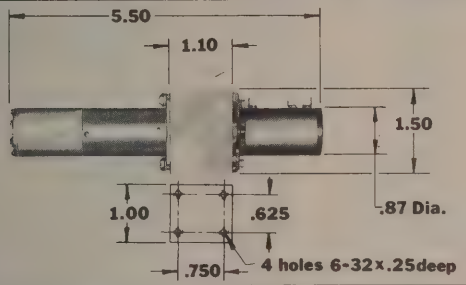
MAUREY
INSTRUMENT CORPORATION
4555 West 60th Street, Chicago, IL 60629 · PHONE (312) 581-4555 · TWX 910-221-6025

MAUREY INSTRUMENT CORP. MOTORIZED POTENTIOMETERS AND SWITCHES

MPS

General Description & Applications

A family of single turn and multiturn, motor driven potentiometers and switches has been developed for industrial servo applications. They are used for such applications as variable speed controls on power generating sets, electrical-mechanical remote control, and readouts. They provide excellent accuracy at an economical price. These integrated motor-potentiometers are the result of years of Maurey experience in the manufacture of precision potentiometers and motor assemblies. The potentiometers, gear head, clutch, and motor are precisely matched to perform to exacting specifications. Motor-clutch-pot units are available in a wide range of specifications. A motor of selected speed and voltage may be matched with single, 3, 5, or 10 turn potentiometers, either wirewound or conductive plastic. When multiple voltages are required, single cups may be conveniently ganged with or without clutches. In addition, Maurey engineers can provide multi-tap potentiometers, special shafts and mountings, and a wide range of AC or DC motors to your specification.



87-H477

87-H477 DC Motorized Multiturn Potentiometer

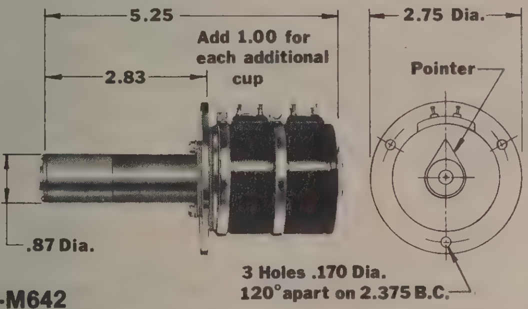
A compact, motor driven, 10 turn ⅞" diameter precision potentiometer. A slip clutch between the motor and the potentiometer protects the stops at the end of mechanical travel. The precision machined, square aluminum housing provides mounting holes for the device.

Sealed from dust and normal industrial environment.

Potentiometer independent linearity: ±0.25% or better

Power rating: 2.5 watts at 60°C

Resistances available: 500 Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.


5.25
Add 1.00 for each additional cup
2.83
2.75 Dia.
Pointer
.87 Dia.
3 Holes .170 Dia. 120° apart on 2.375 B.C.

200-M642

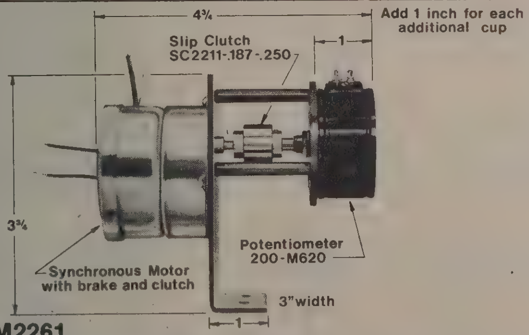
200-M642 DC Motorized Single Turn Potentiometer

A versatile motor, switch, potentiometer assembly. This model may use multi-pole, single throw switch cups, and with up to six precision potentiometers of various resistance values. All components are easily assembled or changed. Proven design for factory or mill environments. A pointer indicates position of wiper or percentage of voltage. A mounting flange simplifies installation on a panel or bracket.

Potentiometers have 320°electrical angle, linearity: ±0.5%

Power: 5 watts at 85°C.

Resistances available: 100 Ω, 250 Ω, 500 Ω, 1K, 2K, 2.5K, 5K, 10K, 20K, 25K, 50K, 100K.


4¾
Add 1 inch for each additional cup
Slip Clutch SC2211-.187-.250
1
3¾
Potentiometer 200-M620
Synchronous Motor with brake and clutch
3"width
1

M2261

M2261 AC Motorized Single Turn Potentiometers

A compact AC motor driven wirewound potentiometer with mechanical stops. A slip clutch provides positive protection to the mechanical stops in the potentiometer. The slip clutch can be eliminated for continuous rotation potentiometers. Also available with single throw switches.

Potentiometer: ±0.5% independent linearity; 4 watts, standard resistances of 250, 500, 1K, 2K, 2.5K, 5K, 10K, 20K, 50K, 100K.

Motor: 115 Volts, A.C. 60 Hz; synchronous continuous duty with positive clutch and instantaneous brake; standard RPM: 1, 2, 4, 6, 10, 12, 30, 60.

Standard DC Motor Data:

Speed: (See chart)
Voltage: (See chart)
Current: (See chart)
Torque at 24 volts: 50 oz-in.
Break away voltage: 10 volts DC
Other requirements on request

Voltage VDC	ma	Speed RPM
12	49	6.0
24	50	16.0
28	51	21.2
35	53	24.5

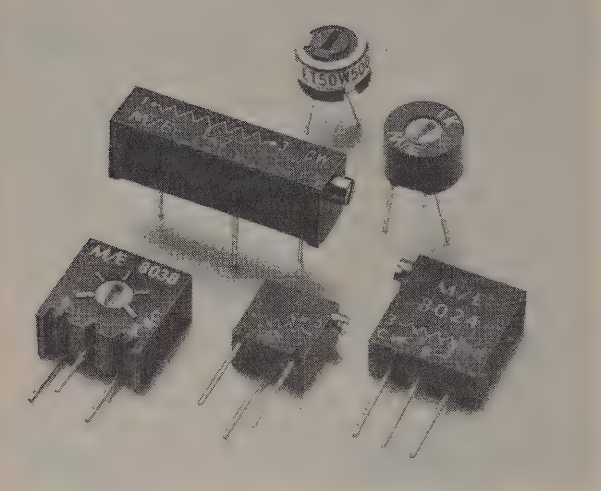
Special Requirements

The types shown here are representative of a wide range of motor driven mechanisms manufactured by Maurey. AC or DC motors may be used. Single and multicup carbon, wirewound, or conductive plastic potentiometers may be specified, with or without slip clutches or switches. Write or phone for a solution to your requirement.

MAUREY
INSTRUMENT CORPORATION
4557 West 60th Street, Chicago, IL 60629 · PHONE (312) 581-4555 · TWX 910-221-6025

Mepco//Electra
A NORTH AMERICAN PHILIPS COMPANY

Reliability across the board™



CERMET TRIMMER SPECIFICATIONS

Temperature Coefficient: ±100 ppm/°C, standard
Contact Resistance Variation (CRV): 3%
End Resistance: 1% maximum or 2Ω, whichever is greater.
Resolution: Essentially infinite.
Operating Range:
−25°C to +125°C for Models 8014, 8038.
−55°C to +125°C for Model 8035.
−65°C to +150°C for Models 8024, 8026, 8050.
Torque: 3 to 5 inch-ounces maximum, depending on model.
Sealed to allow wave solder and immersion cleaning.
Stops: Clutch at both ends for multiturn; positive at both ends for single turn models.

RESISTANCE VALUES AND CODES

OHMS	CODE	OHMS	CODE
10	100	10K	103
20	200	20K	203
50	500	50K	503
100	101	100K	104
200	201	200K	204
500	501	500K	504
1K	102	1MEG	105
2K	202	2MEG	205
5K	502	5MEG	505

TRIMMERS

11468 Sorrento Valley Rd., San Diego, CA 92121 (619) 453-0332 TWX: 910-337-1120

INDUSTRIAL CERMET TRIMMERS

	8014	8024	8026	8035	8038
Description	¼″ Round Single Turn	⅜″ Square Multiturn	¼″ Square Multiturn	¾″ Rectangular Multiturn	⅜″ Square Single Turn
Standard Resistances	100Ω to 1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ
Resistance Tolerance (%)	±20% ±10%	±10%	±10%	±10%	±10%
Dimensions H x W x L (In.)	.250 dia. x .175 (Pin styles W, P) .320 x .250 x .225 (Pin style X)	.375 x .375 x .150	.250 x .250 x .165	.250 x .195 x .750	.375 x .375 x .200
Power Rating (Watts)	0.5 @ 25°C	1.0 @ 70°C	0.25 @ 85°C	0.75 @ 70°C	0.5 @ 85°C
Adjustment	1 Turn	25 Turns	12 Turns	15 Turns	1 Turn
Pin Styles	Side/Top Adjust	Side/Top Adjust	Side/Top Adjust	Side Adjust	Side/Top Adjust

MILITARY CERMET TRIMMERS

MIL-R-22097	RJ24	RJ26	RJ50
Pin Styles	P, W, X	P, W, X	P
Characteristic	C, F	C, F	C, F
Std. Resistance Range	100Ω-1 MΩ	100Ω-1 MΩ	100Ω-1 MΩ

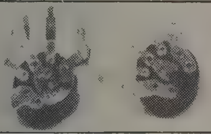
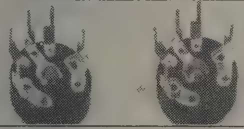
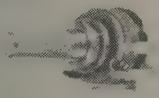
MIL-R-39035	RJR24	RJR26
Pin Styles	P, W, X	P, W, X
Characteristic	C, F, H	F, H
Std. Resistance Range	100Ω-1 MΩ 20KΩ-1 MΩ for "H" Char.	100Ω-1 MΩ 20KΩ-1 MΩ for "H" Char.

For information on Mepco/Electra's CAPACITORS/RESISTORS/MILITARY COMPONENTS, see pages 1A•1134-1136, 1B•1012-1013 and 1A•1890-1891.

MURA®
CORPORATION

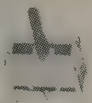
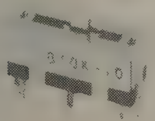
177 CANTIAGUE ROCK ROAD, WESTBURY, N.Y. 11590 / (516) 935-3640 Telex: 967 879

ROTARY
SLIDE
TRIMMING
CARBON COMPOSITION

SERIES	DIAMETER IN/MM	RESISTANCE RANGE (KΩ)(+/-20%)	POWER RATING (WATTS)	SHAFT TYPE	SWITCH TYPE	SWITCH RATING	TERMINAL TYPE P-PCB, S-SOLDER	ANGLE OF ROTATION (+/-10%)
12 	½/12	.5-500	0.1	N/A	ROTARY SPST	12VDC/1A	P/S	230°
16 	⅝/16	.5-1000	0.1	N A	ROTARY SPST	12VDC/1A	P/S	260°
17 	43/64 17	.5-1000	0.1	S,R,F,H,E	ROTARY SPST	12VDC/1A	P S	260°
18	21/32/16.8	.5-1000 AVAILABLE WITH DUAL ELEMENT	0.2	S,F,R,M,H	ROTARY SPST SPST	12VDC/1A 125 VAC/1A	P S	300°
24	15/16/24	.1-3000 AVAILABLE WITH DUAL ELEMENT AND DUAL ELEMENT WITH SWITCH.	0.5	S,F,R,M,H	ROTARY SPST SPST SPDT DPST DPDT PUSH-PULL	125VAC/1A 125VAC/3A 125VAC/1A 125VAC/3A 125VAC/1A 250VAC/3A	P/S	300°

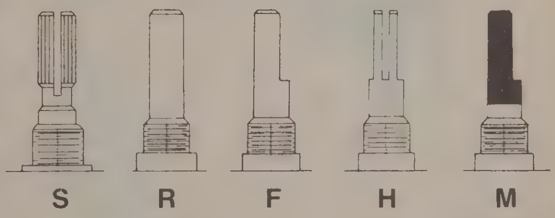
ROTARY POTS:
DETENTS–SERIES 18 AND 24
CENTER,11, 41

SLIDE POTS:
CENTER DETENT-10, 15, 30, 45
11 DETENTS-60

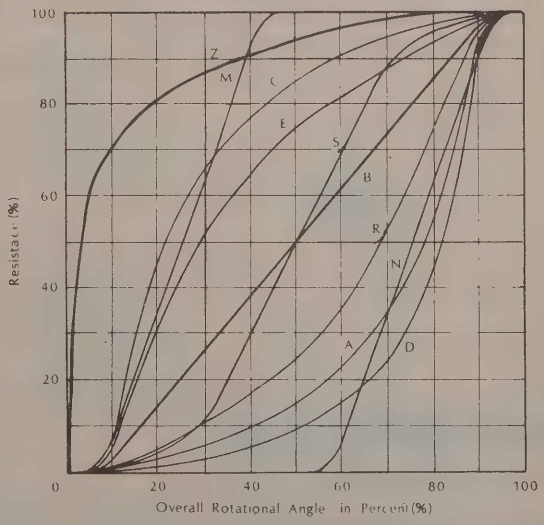
SLIDE POTS	TRAVEL (MM)	TERMINAL TYPE P-PCB. S-SOLDER	DUAL AVAIL.
SV10 	10	P	**YES**
SV15 	15	S	**YES**
SV20	20	S	**YES**
SV30	30	P S	**YES** **YES**
SV45	45	P S	**YES** **YES**
SV60	60	P S	NO

RESISTANCE RANGE: 500Ω-2MΩ

SHAFT TYPES



RESISTENCE TAPERS



single turn, low cost trimming potentiometers

muRata ERiE
MURATA ERIE NORTH AMERICA, INC.

1/10 Watt, Carbon—RVA0607

Resistance Range:	200 ohms to 2 Megohms
Tolerance:	±30%
Residual Resistance:	200 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	0.1W (at 70°C) Derated to 0 watts at 125°C
Max. Working Voltage:	50 VDC
Torque:	.27 to 2.8 oz. in. (20 to 200 g cm)
Terminal Strength:	35.27 oz. (1.0 kg) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	Approx. 220°

1/10 Watt, Carbon—RVF

Resistance Range:	200 ohms to 1 Megohm
Tolerance:	±25%
Residual Resistance:	Less than 5% of nominal rated resistance
Taper:	Linear
Power Rating:	0.1W (at 70°C) Derated to 0 watts at 100°C
Max. Working Voltage:	150 VDC
Torque:	.42 to 4.2 oz. in. (2.9-29.4 mNm)
Terminal Strength:	35.27 oz. (98 mNm) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	270° ±10°

1/5 to 3/4 Watt, Carbon, Cond. Plastic & Cermet—0911/1214

Characteristic	RVA (Carbon) RVX (Cond. Plastic)		RVG (Cermet)	
	0911	1214	0911	1214
Resistance Range:	200 — 5 Megohms*		200 — 1 Megohm	
Tolerance:	±20%			
Residual Resistance:	Less than 500Ω. 5Ω maximum 500Ω and up, less than 1% of nominal rated resistance			
Taper:	Linear			
Power Rating**:	1/5 W (70°C)	⅓ W (70°C)	½ W (70°C)	¾ W (70°C)
Max. Working Voltage***:	250 VDC	350 VDC	350 VDC	500 VDC
Torque:	0.56-4.86 in. oz.	0.83-6.0 in. oz.	0.56-4.86 in. oz.	0.83-6.0 in. oz.
Terminal Strength:	35.27 oz.			
Effective Rotation: Elec.	240°	250°	240°	250°
Mech.	260° ±10°	280° ±10°	260° ±10°	280° ±10°
Stop Strength:	13.9 oz.			

* 100 ohms available in RVA ** Derated to 0 watts at 125°C
*** Max working V varies with resistance value. $V_{max} = \sqrt{\text{Resistance} \times \text{Power}}$

1/3 Watt, Cermet—RVS0707

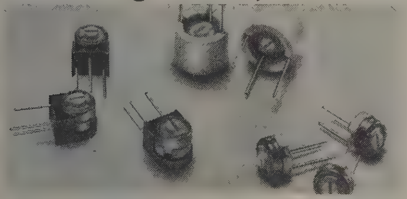
Resistance Range:	100 ohms to 1 Megohm
Tolerance:	±20%
Temperature Coefficient:	100ppm/°C
Residual Resistance:	100 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	⅓ W (at 70°C) Derated to 0 Watts at 125°C
Max. Working Voltage:	100 VDC
Torque:	.27 to 2.8 oz. in. (20 to 200 g cm)
Terminal Strength:	12.35 oz. (350 gr) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	200° ±10°

muRata ERiE
MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E. Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

sealed precision cermet trimming potentiometers—±100 ppm/°c

muRata ERIE
MURATA ERIE NORTH AMERICA, INC.

3321 Single Turn, 1/2 Watt



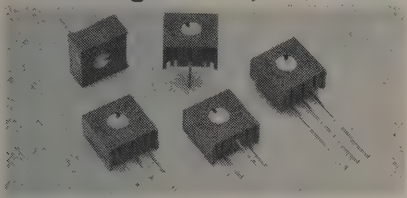
FEATURES

- Flame retardant rotor meets UL94V-0 requirements
- Extremely small size — .260″D. x .181″
- Sealed to withstand wave soldering and immersion cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±20%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +150°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3104 Single Turn, 1/2 Watt



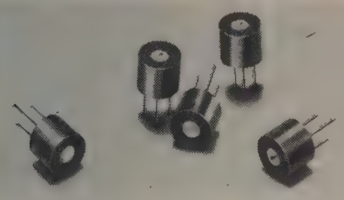
FEATURES

- Low cost
- ⅜″ square

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	2 ohms max.
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	1% or 1 ohm max. whichever is greater

1102, 4-Turn, 1/2 Watt



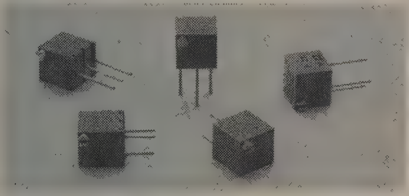
FEATURES

- Unique planetary drive provides the precise setting capability of a multi-turn unit in a small single-turn package
- Just .299″D x .260″
- Sealed to withstand wave soldering and immersion cleaning process

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3103, 12-Turn, 1/4 Watt



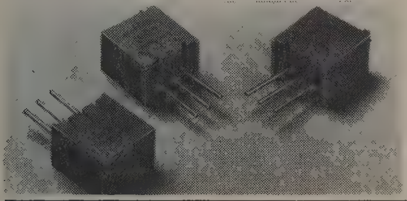
FEATURES

- ¼″ square
- Sealed to MIL-R-22097 standards

SPECIFICATIONS

Resistance Range	10 ohms to 1 Megohm
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.25W at 70°C. Derated to 0W at +125°C
Working Voltage	200 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3102, 25-Turn, 1/2 Watt



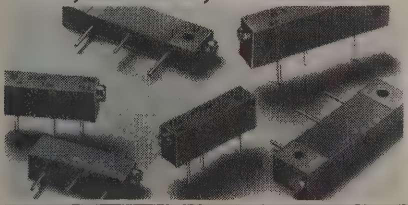
FEATURES

- Small size — .374″ x .394″ x .240″
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2101, 15-Turn, 3/4 Watt



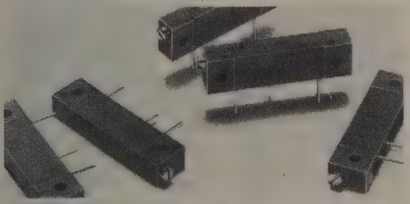
FEATURES

- Small size — .181″ x .252″ x .752″ for close board spacing
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	3% or 1 ohm max. whichever is greater
Power Rating	0.75W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2102, 22-Turn, 1 Watt



FEATURES

- 22 turn mechanism provides extremely fine adjustment capability
- High power dissipation: 1.0W at 70°C
- Sealed to withstand wave soldering and immersion cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	1W at 70°C. Derated to 0W at +150°C
Max. Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

muRata ERIE

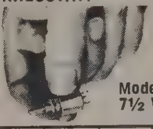
MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

OHMITE® vitreous enameled rheostats (potentiometers)

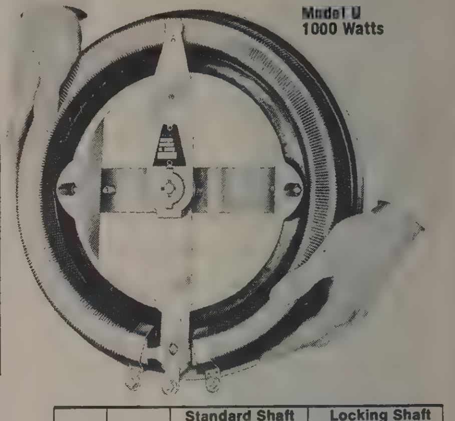
Now, Ohmite offers TWELVE sizes in its line of famous rheostats.

In all Ohmite rheostats, the resistance wire is wound on a solid ceramic core. The turns are locked in place with tough, protective vitreous enamel or Ohmicone® silicone ceramic. Pivoted, universal action mounting of the brush, assures perfect contact. Metal-graphite contact brushes, varied to fit current and resistance, insure good contact with negligible wear of the wire. Terminals at each end of the winding permit connection of the unit as a potentiometer.

INDUSTRY'S SMALLEST NOW, FOR IT'S RATING, RHEOSTAT!



Model C
7½ Watts



Model U
1000 Watts

Dimensions and Other Parameters	Mod. C Encl.	Model E Unencl.	Model E Encl.	Model H	Model J	Model G	Model K	Model L	Model P	Model N	Model R	Model T	Model U
Rated Watts	7½	12½		25	50	75	100	150	225	300	500	750	1000
Resistance Range - Ohms	10 to 5,000	1 to 15,000		1 to 25,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	1 to 30,000	1 to 50,000	1 to 20,000	1 to 15,000	1 to 20,000
Overall Diameter	.515	⅞	1 3/64	1 9/16	2 5/16	2¾	3⅛	4	5	6	8	10	12
Overall Depth Behind Panel	⅞	11/16	1 5/32	1⅜	1⅜	1¾	1¾	2	2⅛	2⅜	2⅛	3	3
Weight - Lbs.	.017	.037	.053	0.19	0.32	0.52	0.64	1.1	2	2.6	4	7.6	10
Mtg. Centers (Dimension "M")	(Single-Hole Mounting)								⅞	1 3/16	1½	1⅞	3

MODEL C — 7½ WATT* — STANDARD & LOCKING SHAFT

Ohms	Amps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New
10	.86	4908	RCS10R	4948	RCL10R
15	.71	4909	RCS15R	4949	RCL15R
25	.55	4910	RCS25R	4950	RCL25R
35	.46	4911	RCS35R	4951	RCL35R
50	.39	4912	RCS50R	4952	RCL50R
75	.32	4913	RCS75R	4953	RCL75R
100	.27	4914	RCS100	4954	RCL100
150	.22	4915	RCS150	4955	RCL150
200	.19	4916	RCS200	4956	RCL200
250	.17	4917	RCS250	4957	RCL250
350	.15	4918	RCS350	4958	RCL350
500	.12	4919	RCS500	4959	RCL500
750	.10	4920	RCS750	4960	RCL750
1000	.086	4921	RCS1K0	4961	RCL1K0
1500	.071	4922	RCS1K5	4962	RCL1K5
2500	.055	4923	RCS2K5	4963	RCL2K5
3500	.046	4924	RCS3K5	4964	RCL3K5
5000	.039	4925	RCS5K0	4965	RCL5K0

* Rating on metal panel — unit is silicone-ceramic coated.

MODEL "E" — 12½ WATT* — UNENCLOSED & ENCLOSED

Total Ohms	Max. Amps	Appr. Steps	Unenclosed Standard Shaft Catalog No. Old	Unenclosed Standard Shaft Catalog No. New	Unenclosed Locking Shaft Catalog No. Old	Unenclosed Locking Shaft Catalog No. New	Enclosed Standard Shaft Catalog No. Old	Enclosed Standard Shaft Catalog No. New
1	3.53	32	0101	RES1R0	L0101	REL1R0	W0101	REE1R0
2	2.50	28	0102	RES2R0	L0102	REL2R0	W0102	REE2R0
2.5	2.24	31	0102A	RES2R5	L0102A	REL2R5	W0102A	REE2R5
3	2.04	33	0103	RES3R0	L0103	REL3R0	W0103	REE3R0
5	1.58	61	0103A	RES5R0	L0103A	REL5R0	W0103A	REE5R0
6	1.44	58	0104	RES6R0	L0104	REL6R0	W0104	REE6R0
8	1.25	61	0105	RES8R0	L0105	REL8R0	W0105	REE8R0
10	1.12	76	0106	RES10R	L0106	REL10R	W0106	REE10R
15	.91	64	0107	RES15R	L0107	REL15R	W0107	REE15R
25	.71	67	0108	RES25R	L0108	REL25R	W0108	REE25R
35	.60	73	0109	RES35R	L0109	REL35R	W0109	REE35R
50	.50	83	0110	RES50R	L0110	REL50R	W0110	REE50R
75	.41	101	0111	RES75R	L0111	REL75R	W0111	REE75R
100	.35	106	0112	RES100	L0112	REL100	W0112	REE100
125	.32	132	0113	RES125	L0113	REL125	W0113	REE125
150	.29	125	0113A	RES150	L0113A	REL150	W0113A	REE150
175	.27	145	0114	RES175	L0114	REL175	W0114	REE175
200	.25	132	0114A	RES200	L0114A	REL200	W0114A	REE200
250	.22	128	0115	RES250	L0115	REL250	W0115	REE250
350	.19	149	0116	RES350	L0116	REL350	W0116	REE350
500	.16	213	0117	RES500	L0117	REL500	W0117	REE500
750	.13	193	0118	RES750	L0118	REL750	W0118	REE750
1000	.11	257	0119	RES1K0	L0119	REL1K0	W0119	REE1K0
1500	.091	255	0120	RES1K5	L0120	REL1K5	W0120	REE1K5
2500	.071	277	0121	RES2K5	L0121	REL2K5	W0121	REE2K5
3500	.060	313	0122	RES3K5	L0122	REL3K5	W0122	REE3K5
5000	.050	255	0123	RES5K0	L0123	REL5K0	W0123	REE5K0
7500	.041	299	4190	RES7K5	L4190	REL7K5	W4190	REE7K5
10,000	.035	398	4191	RES10K	L4191	REL10K	W4191	REE10K
12,500	.031	434	4192	RES12K5	L4192	REL12K5	W4192	REE12K5
15,000	.029	521	4193	RES15K	L4193	REL15K	W4193	REE15K

* Rating on metal panel — unit is silicone-ceramic coated.

25 WATT MODEL "H" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New	Locking Shaft Catalog No. Old	Locking Shaft Catalog No. New
1	5.0	30	0140	RHS1R0	L0140	RHL1R0
2	3.54	30	0141	RHS2R0	L0141	RHL2R0
3	2.88	31	0142	RHS3R0	L0142	RHL3R0
6	2.04	50	0143	RHS6R0	L0143	RHL6R0
8	1.77	53	0144	RHS8R0	L0144	RHL8R0
10	1.58	52	0145	RHS10R	L0145	RHL10R
15	1.29	67	0146	RHS15R	L0146	RHL15R
25	1.0	89	0147	RHS25R	L0147	RHL25R
35	.845	98	0148	RHS35R	L0148	RHL35R
50	.707	80	0149	RHS50R	L0149	RHL50R
75	.575	107	0150	RHS75R	L0150	RHL75R
100	.50	142	0151	RHS100	L0151	RHL100
125	.445	139	0152	RHS125	L0152	RHL125
175	.373	154	0153	RHS175	L0153	RHL175
250	.316	177	0154	RHS250	L0154	RHL250
350	.267	197	0155	RHS350	L0155	RHL350
500	.222	220	0156	RHS500	L0156	RHL500
750	.182	261	0157	RHS750	L0157	RHL750
1000	.155	278	0158	RHS1K0	L0158	RHL1K0
1500	.129	267	0159	RHS1K5	L0159	RHL1K5
2500	.10	341	0160	RHS2K5	L0160	RHL2K5
3500	.084	315	0161	RHS3K5	L0161	RHL3K5
5000	.070	355	0162	RHS5K0	L0162	RHL5K0
7500	.058	439	4200	RHS7K5	L4200	RHL7K5
10,000	.050	476	4201	RHS10K	L4201	RHL10K
15,000	.041	431	4202	RHS15K	L4202	RHL15K
20,000	.035	422	4203	RHS20K	L4203	RHL20K
25,000	.032	527	4204	RHS25K	L4204	RHL25K

50 WATT
MODEL "J" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	10.0	24	0308	RJSR50
1	7.07	44	0309	RJS1R0
2	5.00	43	0310	RJS2R0
4	3.53	42	0311	RJS4R0
6	2.88	45	0312	RJS6R0
8	2.50	43	0313	RJS8R0
12	2.04	86	0314	RJS12R
16	1.76	91	0315	RJS16R
22	1.50	100	0316	RJS22R
35	1.19	125	0317	RJS35R
50	1.00	112	0318	RJS50R
80	.79	143	0319	RJS80R
125	.63	176	0320	RJS125
150	.575	170	0321	RJS150
225	.470	199	0322	RJS225
300	.408	211	0323	RJS300
500	.316	284	0324	RJS500
800	.250	282	0325	RJS800
1000	.224	352	0326	RJS1K0
1600	.176	355	0327	RJS1K6
2500	.141	449	0328	RJS2K5
3500	.119	496	0329	RJS3K5
5000	.100	459	0330	RJS5K0
8000	.079	576	0331	RJS8K0
10,000	.070	565	0332	RJS10K
15,000	.058	568	4210	RJS15K
20,000	.050	599	4211	RJS20K
25,000	.045	573	4212	RJS25K
30,000	.041	688	4213	RJS30K
40,000	.035	673	4214	RJS40K
50,000	.032	842	4215	RJS50K

75 WATT
MODEL "G" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	12.3	27	1100	RGSR50
1	8.66	27	1101	RGS1R0
2	6.12	30	1102	RGS2R0
3	5.0	28	1103	RGS3R0
5	3.88	53	1104	RGS5R0
7.5	3.16	50	1105	RGS7R5
10	2.74	53	1106	RGS10R
16	2.17	91	1107	RGS16R
25	1.73	113	1108	RGS25R
50	1.23	142	1109	RGS50R
75	1.0	134	1110	RGS75R
100	.866	178	1111	RGS100
200	.612	180	1112	RGS200
300	.50	211	1113	RGS300
400	.433	223	1114	RGS400
500	.388	279	1115	RGS1K0
750	.316	338	1116	RGS750
1000	.274	356	1117	RGS1K0
1500	.224	420	1118	RGS1K5
2000	.194	443	1119	RGS2K0
2500	.173	441	1120	RGS2K5
5000	.123	564	1121	RGS5K0
7500	.100	547	1122	RGS7K5
10,000	.087	572	1123	RGS10K

100 WATT
MODEL "K" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	14.1	33	0440	RKSR50
1	10	33	0441	RKS1R0
2	7.07	32	0442	RKS2R0
3	5.75	39	0443	RKS3R0
5	4.47	57	0444	RKS5R0
7.5	3.65	60	0445	RKS7R5
10	3.16	57	0446	RKS10R
16	2.50	88	0447	RKS16R
25	2.0	109	0448	RKS25R
50	1.41	137	0449	RKS50R
75	1.15	163	0450	RKS75R
100	1.00	172	0451	RKS100
200	.707	216	0452	RKS200
300	.575	261	0453	RKS300
400	.500	272	0454	RKS400
500	.447	269	0455	RKS500
750	.365	325	0456	RKS750
1000	.316	343	0457	RKS1K0
1500	.258	404	0458	RKS1K5
2000	.224	426	0459	RKS2K0
2500	.200	426	0460	RK52K5
5000	.141	543	0461	RKS5K0
7500	.115	528	0462	RKS7K5
10,000	.100	704	0463	RKS10K

150 WATT
MODEL "L" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	Standard Shaft Catalog No. New
0.5	17.3	29	0524	RLSR50
1	12.3	41	0525	RLS1R0
2	8.65	40	0526	RLS2R0
3	7.07	42	0527	RLS3R0
5	5.48	44	0528	RLS5R0
7.5	4.47	75	0529	RLS7R5
10	3.88	79	0530	RLS10R
15	3.16	75	0531	RLS15R
25	2.45	120	0532	RLS25R
35	2.07	133	0533	RLS35R
50	1.74	151	0534	RLS50R
75	1.42	179	0535	RLS75R
100	1.23	190	0536	RLS100
150	1.00	225	0537	RLS150
200	.865	239	0538	RLS200
250	.775	236	0539	RLS250
350	.655	265	0540	RLS350
500	.548	296	0541	RLS500
750	.447	362	0542	RLS750
1250	.346	473	0543	RLS1K25
1800	.288	537	0544	RLS1K8
2250	.259	529	0545	RLS2K25
3000	.224	558	0546	RLS3K0
4000	.182	667	0547	RLS4K0
7500	.141	714	0548	RLS7K5
10,000	.122	952	0549	RLS10K

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® vitreous enameled rheostats (potentiometers)

225 WATT MODEL "P" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	15	42	1250	RPS1R0
2	10.6	41	1251	RPS2R0
3	8.66	61	1252	RPS3R0
4	7.50	58	1253	RPS4R0
5	6.71	57	1254	RPS5R0
7.5	5.49	60	1255	RPS7R5
10	4.74	115	1256	RPS10R
15	3.87	108	1257	RPS15R
25	3.00	114	1258	RPS25R
50	2.12	218	1259	RPS50R
75	1.73	206	1260	RPS75R
100	1.50	275	1261	RPS100
150	1.22	259	1262	RPS150
200	1.06	345	1263	RPS200
300	.866	326	1264	RPS300
400	.750	342	1265	RPS400
700	.567	483	1266	RPS700
900	.500	484	1267	RPS900
1200	.433	513	1268	RPS1K2
1500	.387	641	1269	RPS1K5
1750	.358	603	1270	RPS1K75
2000	.336	690	1270A	RPS2K0
2500	.300	679	1271	RPS2K5

300 WATT MODEL "N" — UL Listed

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	17.32	56	0650	RNS1R0
2	12.24	51	0651	RNS2R0
3	10.00	51	0652	RNS3R0
4	8.66	77	0653	RNS4R0
5	7.75	76	0654	RNS5R0
7.5	6.32	72	0655	RNS7R5
10	5.48	76	0656	RNS10R
15	4.47	144	0657	RNS15R
25	3.46	134	0658	RNS25R
50	2.45	230	0659	RNS50R
75	2.00	275	0660	RNS75R
100	1.73	288	0661	RNS100
150	1.41	345	0662	RNS150
200	1.22	364	0663	RNS200
300	1.00	433	0664	RNS300
400	.866	456	0665	RNS400
700	.655	500	0666	RNS700
900	.578	517	0667	RNS900
1200	.500	541	0668	RNS1K2
1500	.447	676	0669	RNS1K5
1750	.414	625	0670	RNS1K75
2000	.387	714	0670A	RNS2K0
2500	.346	720	0671	RNS2K5

500 WATT MODEL "R"

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	22.3	56	0849	RRS1R0
1.5	18.2	71	0850	RRS1R5
2	15.8	75	0851	RRS2R0
2.5	14.1	78	0852	RRS2R5
3	12.9	79	0853	RRS3R0
4	11.2	74	0854	RRS4R0
5	10.0	104	0855	RRS5R0
8	7.9	104	0856	RRS8R0
12.5	6.3	115	0857	RRS12R5
16	5.6	186	0858	RRS16R
25	4.47	205	0859	RRS25R
40	3.54	206	0860	RRS40R
50	3.16	205	0872	RRS50R
80	2.52	316	0861	RRS80R
125	2.0	388	0862	RRS125
175	1.69	434	0863	RRS175
250	1.41	490	0864	RRS250
325	1.24	505	0865	RRS325
500	1.00	614	0866	RRS500
750	.817	735	0867	RRS750
1000	.707	769	0868	RRS1K0
1500	.577	932	0869	RRS1K5
2000	.50	971	0870	RRS2K0
2500	.447	962	0871	RRS2K5

750 WATT MODEL "T"

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	27.4	72	1300	RTS1R0
1.5	22.3	72	1301	RTS1R5
2	19.4	96	1302	RTS2R0
2.5	17.3	101	1303	RTS2R5
3	15.8	96	1304	RTS3R0
4	13.6	94	1305	RTS4R0
5	12.2	104	1306	RTS5R0
8	9.65	100	1307	RTS8R0
10	8.65	139	1308	RTS10R
12.5	7.75	138	1309	RTS12R5
16	6.82	139	1310	RTS16R
25	5.47	137	1311	RTS25R
50	3.87	246	1312	RTS50R
80	3.06	381	1313	RTS80R
100	2.74	376	1314	RTS100
160	2.17	476	1315	RTS160
200	1.94	469	1316	RTS200
300	1.58	562	1317	RTS300
400	1.37	593	1318	RTS400
600	1.18	705	1319	RTS600
750	1.00	694	1320	RTS750
1200	.791	889	1321	RTS1K2
1800	.646	1050	1322	RTS1K8
2000	.610	935	1322A	RTS2K0
2500	.547	1170	1323	RTS2K5

1000 WATT MODEL "U"

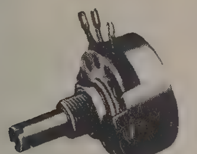
Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
1	31.6	91	1450	RUS1R0
1.5	25.8	90	1451	RUS1R5
2	22.4	90	1452	RUS2R0
2.5	20.0	127	1453	RUS2R5
3	18.3	114	1454	RUS3R0
4	15.8	120	1455	RUS4R0
5	14.1	124	1456	RUS5R0
8	11.2	118	1457	RUS8R0

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
10	16.0	117	1458	RUS10R
12.5	8.95	163	1459	RUS12R5
16	7.90	166	1460	RUS16R
25	6.33	162	1461	RUS25R
50	4.47	327	1462	RUS50R
75	3.65	307	1463	RUS75R
100	3.16	446	1464	RUS100
175	2.39	490	1465	RUS175

Total Ohms	Max. Amps	Appr. Steps	Standard Shaft Catalog No. Old	New
225	2.11	630	1466	RUS225
300	1.83	661	1467	RUS300
400	1.58	704	1468	RUS400
500	1.41	695	1469	RUS500
750	1.15	828	1470	RUS750
1000	1.00	870	1471	RUS1K0
1500	.816	1040	1472	RUS1K5
2500	.633	1100	1473	RUS2K5

OHMITE® molded composition potentiometers

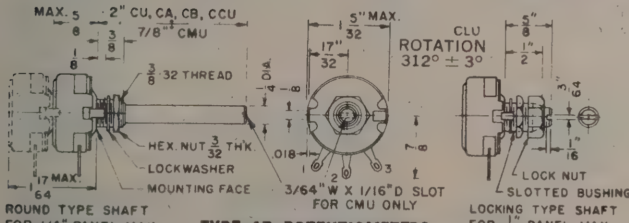
STYLE CMU
MIL STYLE
RV4N



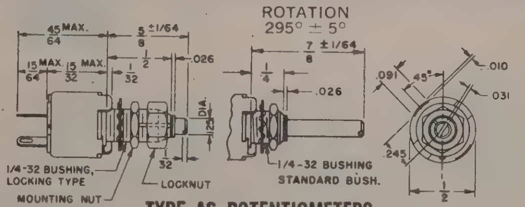
Ohmite molded composition potentiometers (Type AB) provide high quality and dependable performance.

Because the resistance element is a thick, solid-molded ring, longer life and smoother operation are obtained. This is due also to the molded composition contact. Units are dust and splash proof, fungus and corrosion resistant and meet the requirements of military specification MIL-R-94.

Resistance Ohms Except As Noted Tol. ±10% except * ±20%	Type AB (1⁵⁄₃₂" Dia.) Rated 2 Watts[1]						Type AS (1½" Dia.) Rated ½ Watt[1]	
	Single Unit ⅞" Shaft Style CMU Linear	Single Unit 2" Shaft			Locking Style CLU Linear	Dual Style CCU Linear	Miniature Locking Style AS Linear	Miniature ⅞" Shaft Style ASM Linear
		Style CU Linear	Style CA CW log	Style CB CCW log				
50	CMU5001	CU5001			CLU5001			
100	CMU1011	CU1011			CLU1011		AS3601	ASM6661
150	CMU1511	CU1511			CLU1511			
250	CMU2511	CU2511			CLU2511		AS3602	ASM6662
350	CMU3511	CU3511			CLU3511			
500	CMU5011	CU5011			CLU5011		AS3603	ASM6663
750	CMU7511	CU7511			CLU7511			
1000	CMU1021	CU1021			CLU1021	Resistance Shown is for Each Unit	AS3604	ASM6664
1500	CMU1521	CU1521			CLU1521			
2500	CMU2521	CU2521			CLU2521		AS3605	ASM6665
3500	CMU3521	CU3521			CLU3521			
5000	CMU5021	CU5021			CLU5021		AS3606	ASM6666
7500	CMU7521	CU7521			CLU7521			
10,000	CMU1031	CU1031		CB1031	CLU1031	CCU1031	AS3607	ASM6667
15,000	CMU1531	CU1531			CLU1531			
25,000	CMU2531	CU2531		CB2531	CLU2531	CCU2531	AS3608	ASM6668
35,000	CMU3531	CU3531			CLU3531			
50,000	CMU5031	CU5031		CB5031	CLU5031	CCU5031	AS3609	ASM6669
75,000	CMU7531	CU7531			CLU7531			
.1 meg.	CMU1041	CU1041	CA1041		CLU1041	CCU1041	AS3610	ASM6670
.15 meg.	CMU1541	CU1541			CLU1541			
25 meg.	CMU2541	CU2541	CA2541		CLU2541	CCU2541	AS3611	ASM6671
.35 meg.	CMU3541	CU3541			CLU3541			
.5 meg.	CMU5041	CU5041	CA5041		CLU5041	CCU5041	AS3612	ASM6672
.75 meg.*	CMU7542	CU7542			CLU7542			
1.0 meg.*	CMU1052	CU1052	CA1052		CLU1052	CCU1052	AS3613	ASM6673
1.5 meg.*	CMU1552	CU1552			CLU1552			
2.0 meg.*	CMU2052	CU2052			CLU2052		AS3684	ASM6674
2.5 meg.*	CMU2552	CU2552	CA2552		CLU2552		AS3614	ASM6675
3.5 meg.*	CMU3552	CU3552			CLU3552			
5.0 meg.*	CMU5052	CU5052			CLU5052		AS3615	ASM6676
Weight	.064 lb.	.084 lb.			.070 lb.	.123 lb.	.017 lb.	017 lb.



TYPE AB POTENTIOMETERS



TYPE AS POTENTIOMETERS

FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX

OHMITE MFG. CO., a NORTH AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

PRECISION ELECTRONIC COMPONENTS LTD.

19 Hafis Road, Toronto, Ontario Canada M6M 2V6 • Tel. (416) 249-7103 • Telex: 06-969671

Manufacturers of Industrial & Military-Type Potentiometers - Since 1951

YOUR QUALITY EQUIPMENT NEEDS OUR RELIABLE POTS

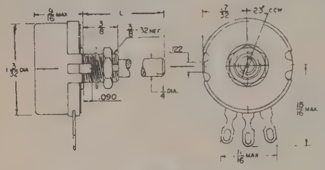
GROUP 1

PANEL MOUNTED POTENTIOMETERS

3/8" BUSHING, 1/4" DIAMETER SHAFT — HOT MOLDED

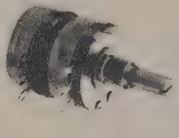
PEC TYPE K

MIL DESIGNATION
RV4

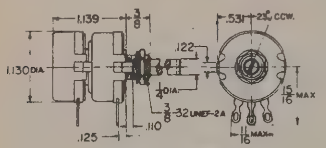


L
3/8-32 NEF
.122
.090
1/4 DIA.
23° CCW

PEC TYPE KK

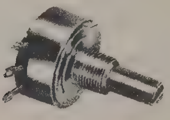


MIL DESIGNATION
2RV7

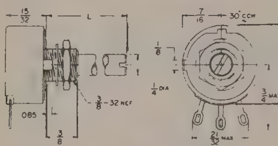


1.139
3/8
1.130 DIA
.531
23° CCW
.122
1/4 DIA.
3/8-32 UNEF-2A
.110
.125
15/16 MAX
11/16 MAX.

PEC TYPE N

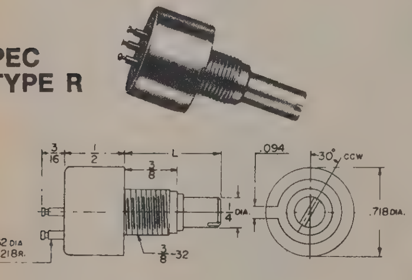


MIL DESIGNATION
RV2



15/32
L
7/16
30° CCW
1/4 DIA
3/8-32 NEF
.085
3/8
29/32

PEC TYPE R



3/16
1/2
L
3/8
.094
30° CCW
1/4 DIA.
.718 DIA.
.062 DIA ON .218 R.
3/8-32

SPECIFICATIONS

	K/KK	N	R
Rotational Angle	314°	300°	300°
Power Rating	2	1	0.75
Operating Voltage	500	500	500

Resistance Range (Ohms)	50-5 Meg.
Resistance Tolerance	10% & 20%
Resistance Taper	Lin & Log
Ambient Temp. Range °C	−65 to +125

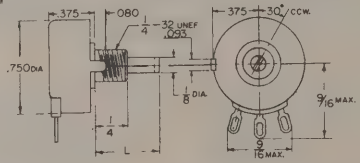
GROUP 2

PANEL MOUNTED POTENTIOMETERS

1/4" BUSHING, 1/8" DIAMETER SHAFT — HOT MOLDED

PEC TYPE T

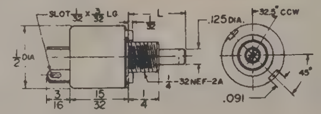
MIL DESIGNATION
RV5



.375
.080
1/4-32 UNEF
.093
.750 DIA
.375
30° CCW
1/8 DIA
9/16 MAX.
1/4
L
9/16 MAX.

PEC TYPE S

MIL DESIGNATION
RV6



SLOT 1/32 x 3/32 LG
L
.125 DIA.
32.5° CCW
1/2 DIA
3/16
15/32
1/4
1/4-32 NEF-2A
.091
45°

SPECIFICATIONS

	T	S
Rotational Angle	300°	295°
Power Rating	0.5	0.5
Operating Voltage	350	350

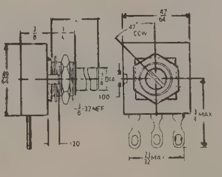
Resistance Range (Ohms)	100-5 Meg.
Resistance Tolerance	10% & 20%
Resistance Taper	Lin & Log
Ambient Temp. Range °C	−65 to +125

GROUP 4

PANEL & PCB MOUNTED POTENTIOMETERS

3/8" BUSHING, 1/4" DIAMETER SHAFT — CERMET

PEC TYPE V



47°
CCW
3/8-32 NEF
.10
.100

Rotational Angle	274°
Power Rating (Watts)	2
Operating Voltage	500
Rotational Life	100,000 cyc.

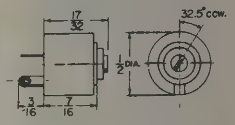
Resistance Range (Ohms)	100-1 Meg.
Resistance Tolerance	10% & 20%
Resistance Taper	Lin
Ambient Temp. Range °C	−55 to +120

GROUP 3

SINGLE TURN TRIMMER POTENTIOMETERS

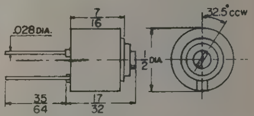
BOARD MOUNTING — HOT MOLDED

PEC TYPE P



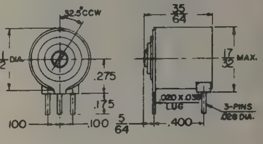
17/32
32.5° CCW
1/2 DIA.
3/16
7/16

PEC TYPE PR



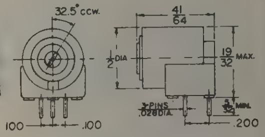
.028 DIA.
7/16
32.5° CCW
1/2 DIA.
35/64
17/32

PEC TYPE L



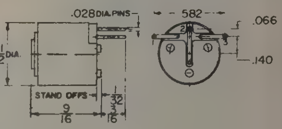
32.5° CCW
1/2 DIA.
.275
.175
.100
.100
5/64
35/64
17/32 MAX.
.020 X .032 LUG
3-PINS .028 DIA.
.400

PEC TYPE LZ



32.5° CCW
1/2 DIA
.100
.100
41/64
19/32 MAX.
3-PINS .028 DIA.
.200

PEC TYPE PZ



.028 DIA PINS
.582
.066
.140
1/2 DIA.
STAND OFFS
9/16
3/32

Rotational Angle	295°
Power Rating (Watts)	0.35
Operating Voltage	350

Resistance Range (Ohms)	100-5 Meg.
Resistance Tolerance	10% & 20%
Resistance Taper	Lin & Log
Ambient Temp. Range °C	− 65 to +125

FULLY QUALIFIED TO
RV4 - RV5

STANDARD RESISTANCE VALUES IN OHMS:
100, 250, 500, 1000, 2500, 5000, 10K, 25K, 50K, 100K, 250K, 500K, 1 MEG., 2.5 MEG.

STANDARD SHAFT LENGTHS, GROUPS 1, 2, 3

NON-LOCKING		LOCKING		
SHAFT LENGTH	BUSHING LENGTH	SHAFT LENGTH	BUSHING LENGTH	TYPE
1/2" (B) 7/8" (D) 2" (J)	3/8" 3/8" 3/8"	5/8" (A) 5/8" (A) 5/8" (A)	1/2" 1/2" 1/2"	RV2 RV4
3/8" (L)	1/4"	1/2" (B)	3/8"	RV5
7/8" (D)	1/4"	5/8" (A)	1/2"	RV6
7/8"	3/8"			R

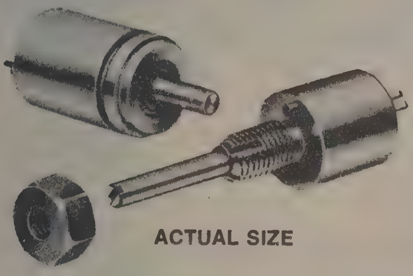
- Tapers: Linear, modified or exact log and reverse log are standard.
- Bushings: Water sealed (panel & shafts) locking.
- Try us for your special requirements for shafts, bushings and tapers.

SAMARIUS INC.

300 SEYMOUR AVENUE, DERBY, CONN. 06418 (203) 735-7405 • TWX: 710-451-2495

PRECISION POTENTIOMETERS

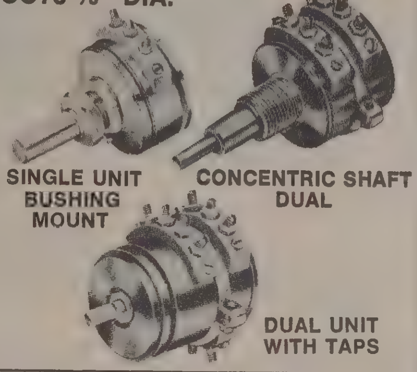
C-050 ½″ DIA.



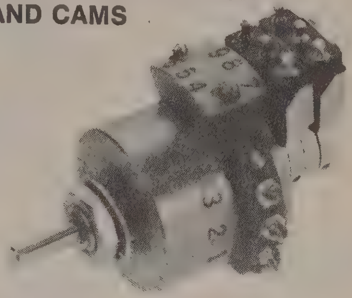
ACTUAL SIZE

Available in resistance values to 500K. Dual Gang Units available both Bushing & Servo Mt.

CO78 ⅞″ DIA.



CO78 - WITH SWITCH AND CAMS



Designed for aircraft and commercial applications.

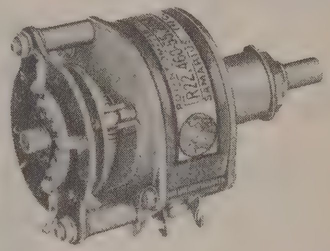
BC200 - C200P 2″ DIA.

Most versatile unit-all resistance values. Taps economically supplied. Gangable and available in both Bushing & Servo Mount.

M300, M301, M400 INSTRUMENT POTENTIOMETERS

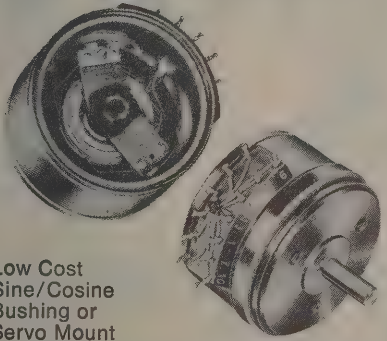
Low Inductance
Low Capacitance

MODEL L140 LOOP CONTROL



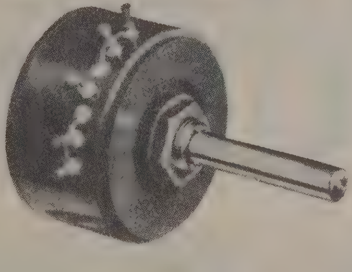
Spring return to center with or without switch and center tap. Used in Satellite and Radar Antennas. Also Medical, Robot and Comparators.

BC200 - C200P SINE/COSINE



Low Cost
Sine/Cosine
Bushing or
Servo Mount

M158 - CP158 1⅝″



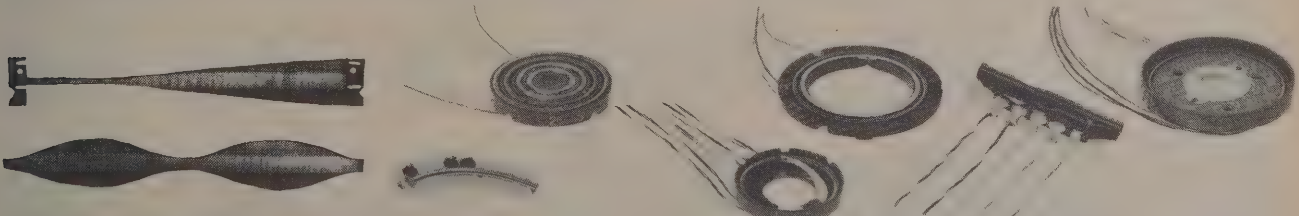
Low Cost Industrial Wirewound & Conductive Plastic Units

SERIES HP-200, HP-300, HP-500 2″, 3″, 5″ HIGH RESOLUTION

Ideal for Tight Linearity Long Elect Angles

HIGH PRECISION POTENTIOMETER AND RESISTOR ASSEMBLY

Samarius, Inc. furnish their clients with a custom winding service for wire wound potentiometer elements in card and mandrel types. Linear or functional requirements are achieved through cooperative R & D with customers. Card profiles are ground with exact duplication from master templates on our own engineered and built machines to tolerances to meet all specifications. We can supply card windings for ¼″ miniature potentiometers to cards 12 feet long and 4 inches wide. Mandrel windings are available up to 16 feet long in any type of wire needed. Over 30 years' experience in supplying high precision potentiometer windings to the field. Call on our engineering staff for their help in solving your winding or potentiometer problems.

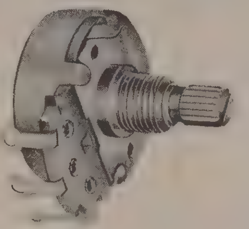


EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

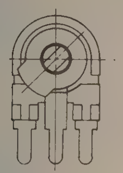
DEPT. EM, 287 NORTHERN BOULEVARD
GREAT NECK, NEW YORK 11021
(516) 466-0911
CABLE: "SHOGYONEWYORK"
TELEX: 12218 + 4758024

SHOGYO
INTERNATIONAL CORPORATION



ROTARY

Angle of Rotation Ranges: 260° ±5° through 300° ±5°
Resistance Range: 500Ω through 2MΩ
Power Rating: .05W through .25W
Voltage Rating: 150V through 500V
Torque: 200 through 350g—cm
For Switch, Gang Error and Electrical Tap Specifications please consult Shogyo directly.



SEMI-FIXED

Resistance Range: 100Ω through 2KΩ
Resistance Tolerance: ±20%
Taper: Linear
Rated Power: 0.1W
Maximum Operating Voltage: 100V
Rotating Angle: 260 ±15%
Rotating Torque: 40 — 250g—cm
Rotating Life: Maximum 10% resistance change @ 50 rotations

Temperature Characteristic: +5 — 20% resistance change after 5 hours at 70°C
Load Characteristic: ±5% resistance change after 5 hours @ normal temperature
Moisture Characteristic: 7 — 15% resistance change after 5 hours at 95% humidity, 40°C

SLIDE & VARIABLE RESISTORS

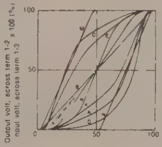
The products illustrated and listed are only a small representation of the full range of items available.

Travel: 20 ±0.5(mm) through 60 ±0.5(mm)
Mounting Pitch: 65(mm) — 31 ±0.3(mm) through 85(mm)
Resistance Range: 500Ω — 1MΩ, 5KΩ through 1MΩ
Power Rating: 0.1W through 0.5W
Voltage Rating: 150V through 500V
Sliding Force: 50 — 350g
Single and Double Types available.

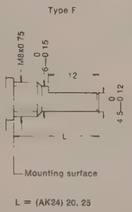
RESISTANCE CHARACTERISTICS

TAPER	CHECK POINT	$\frac{V1\text{-}2}{V1\text{-}3}$ x 100 (%)	$\frac{V2\text{-}3}{V1\text{-}3}$ x 100 (%)
A	60%	15 ~ 30%	
B	50%	40 ~ 60%	
C	60%		15 ~ 30%
D	50%	2 ~ 15%	
E	50%		15 ~ 35%
M	25% 50%	40 ~ 60% 98 ~ 100%	
N	50% 75%	0 ~ 2% 40 ~ 60%	
W	30% 50% 70%	5 ~ 15% 40 ~ 60% 85 ~ 95%	

ILLUSTRATION OF SHAFT

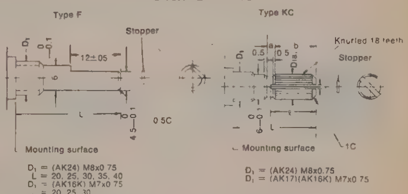


Insulated Shafts



L = (AK24) 20, 25

Metal Shafts



D₁ = (AK24) M8x0 75
L = 20, 25, 30, 35, 40
D₁ = (AK16K) M7x0 75
L = 20 25 30

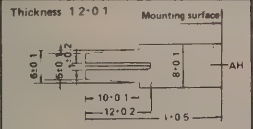
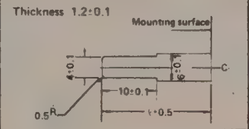
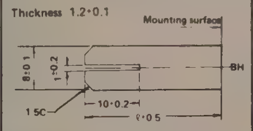
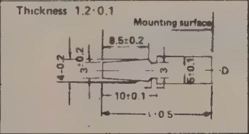
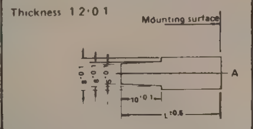
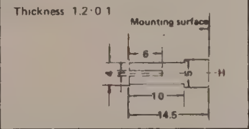
D₁ = (AK24) M8x0.75
D₁ = (AK17)(AK16K) M7x0 75

L	15	20	25	30	35	40 △	60 △
a	1.5	2	4	4	4	4	4.5
b	6	10	12	12	12	12	21
L	7	11	14	14	14	14	14

△ AK24 only

Any special taper as customers required available on request

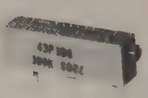
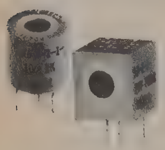
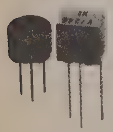
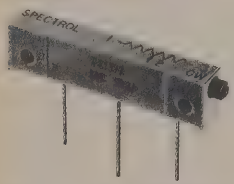
STANDARD LEVERS FOR SLIDE VARIABLE RESISTOR

LEVER DESIGNATION	LEVER SHAPE	LENGTH	APPLICABLE TYPES	LEVER DESIGNATION	LEVER SHAPE	LENGTH	APPLICABLE TYPES
AH	 Thickness 1 2·0 1	L = 20, 25, 30mm	AK-451 AK-452 AK-601 AK-602 AK-701 AK-702	C	 Thickness 1.2±0.1	L = 15, 20, 25mm	AK-305 AK-306 AK-451 AK-452 AK-601 AK-602
BH	 Thickness 1.2·0.1	L = 20, 25, 30mm	AK-451 AK-452 AK-601 AK-602 AK-701 AK-702	D	 Thickness 1.2·0.1	L = 15, 20, 25mm	AK-305 AK-306 AK-451 AK-452 AK-601 AK-602
A	 Thickness 1 2·0 1	L = 20, 25, 30mm	AK-451 AK-452 AK-601 AK-602 AK-701 AK-702	H	 Thickness 1.2·0 1	L = 15, 20, 25mm	AK-201 AK-202 AK-301 AK-302 AK-305 AK-306

SEE OUR OTHER CATALOG PAGES IN EEM SECTIONS 1300/2100/2450/2950/5600/6000

Spectrol

CERMET TRIMMING POTENTIOMETERS

Actual size	MODEL NO.	NOMINAL SIZE (INCHES)	NOM. ADJ. TURNS	TERMINAL[1] STYLE	RESISTANCE TOLERANCE	MAXIMUM POWER RATING (WATTS)	TEMPCO (PPM/°C)	STANDARD RESISTANCE RANGE (OHMS)
	▶ 43	0.75 Long	20	PC	±10%	0.75 @ 70° C	±100 (100 Ω–2 Meg) +200 −100 (10, 20 & 50 Ω)	10 Ω–2 Meg.
	▶ 53	0.34 Dia. Top Adjust 0.31 x 0.36 Side Adjust	240°	PC	±20% (±10% Available)	0.5 @ 85° C	±100 (100 Ω – 1 Meg) 0 to +400 (10, 20 & 50 Ω)	10 Ω – 1 Meg.
	▶ 62	0.25 Dia. Top Adjust .025 Square Side Adjust	215°	PC	±20% (±10% Available)	0.5 @ 70° C	±100 (100 Ω – 1 Meg) 0 to +450 (10, 20 & 50 Ω)	10 Ω – 1 Meg.
	▶ 63	0.38 Square	270°	PC	±20% (± 10% Available)	0.5 @ 70° C	±100 (100 Ω –2 Meg) 0 to +250 (10, 20, 50 Ω)	10 Ω–2 Meg.
	▶ 64	0.38 Square	25	PC	± 10%	0.5 @ 85° C	± 100 (100Ω–2 Meg) 0 to +250 (10, 20, 50Ω)	10 Ω–2 Meg.
	▶ 70	1.25 Long	20	L, PC, SH	± 10%	1.0 @ 85° C	±100 (100 Ω –2 Meg) −100 to + 200 (10, 20 & 50 Ω)	10 Ω-2 Meg.

TRIMMER ADJUSTMENT TOOL

½ actual size

▶ 8

5.0 Long

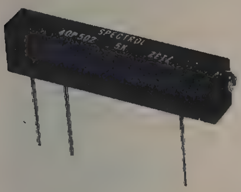
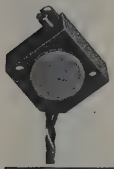
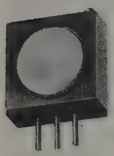
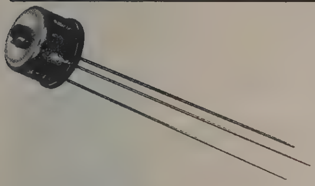
This Adjustment Tool is designed to adjust trimmers of all sizes and has an extended as well as recessed blade for critical adjustments.

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

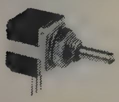
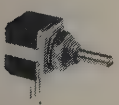
WIREWOUND TRIMMING POTENTIOMETERS

Actual size

MODEL NO.	NOMINAL SIZE (INCHES)	NOM. ADJ. TURNS	TERMINAL[1] STYLE	RESISTANCE TOLERANCE	MAXIMUM POWER RATING (WATTS)	TEMPCO (PPM/° C)	STANDARD RESISTANCE RANGE (OHMS)
 ▶ **40** (RT 12 Available)	1.25 Long	22	L,PC,SH	±5%	1.0 @ 70° C	±50	10Ω–10K 20K 50K 100K
 ▶ **50** (RT 24 Available)	0.38 Square	23	L,PC	±5%	0.75 @ 85° C	±50	10Ω–10K 20K 50K
 ▶ **55** (RT 22 Available)	0.50 Square	23	L,PC	±5%	1.5 @ 70° C	±50	10Ω–10K 20K 50K
 **80**	0.35 Dia.	310°	PC	5%	1.0 @ 50° C	±50	10Ω–10K 20K 50K
 ▶ **84**	0.50 Dia. (Base)	300°	PC,SH	±5%	1.5 @ 70° C	±50	Screw Driver 10Ω–10K 20K Knob 10Ω–10K 20K Panel Mt. 10Ω–10K 20K
 85	0.55 x 0.54 Side Adjust	300°	PC	±5%	1.5 @ 70° C	±50	Screw Driver 10Ω–10K 20K

PANEL CONTROL POTENTIOMETERS

Units shown 1/2 actual size

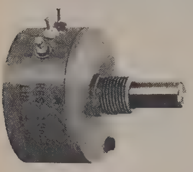
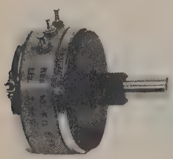
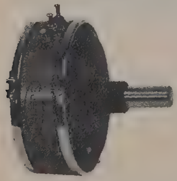
MODEL NO.	SIZE	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE	MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
 ▶ **148** (Conductive Plastic)	0.500 Square	100 to 1 Meg.	±20%	±5%	0.5 @ 70°C	Bushing
 ▶ **149** (Cermet)	0.500 Square	100 to 2 Meg.	±10%	±5%	1.0 @ 85°C	Bushing

[1] TERMINATIONS: L – COLOR CODED LEAD WIRES, SH – SOLDER HOOKS, PC – PRINTED CIRCUIT PINS

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

SINGLE-TURN WIREWOUND PRECISION POTENTIOMETERS

All units shown ½ actual size	MODEL NO.	NOMINAL DIA.² (INCHES)	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE		MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
					STANDARD	BEST PRACTICAL¹		
	**100**	1.312	5 to 35K	± 3% (± 5% below 50Ω)	5Ω to 100Ω ±1.0% 100Ω to 35KΩ ± 0.5%	±.15%	2.75 @ 40° C	Bushing Servo
	122 (Style RR 1100 Available)	1.062	5 to 20K	± 3% (±5% below 20Ω)	5Ω to 200Ω ± 1.0% 200Ω to 20KΩ ± 0.5%	±.20%	1.5 @ 70° C	Bushing Servo
	▶ **132**	1.312	5 to 35K	± 3% (± 5% below 50Ω)	5Ω to 200Ω ± 1.0% 200Ω to 35KΩ ± 0.5%	±.25%	2.75 @ 40° C	Bushing
	▶ **140**	.500	50 to 50K	± 5%	± 1.0%	±.50%	2.0 @ 40° C	Bushing
	142	.500	50 to 50K	±5%	±1.0%	±.50%	2.0 @ 40°C	Servo
	152	.875	5 to 40K	± 3% (±5% below 50Ω)	5Ω to 500Ω ±1.0% 500Ω and above ±0.5%	±.35%	2.0 @ 40° C	Bushing Servo
	**172** (Style RR1300 Available)	1.438	5 to 40K	±3% (±5% below 50Ω)	5Ω to 200Ω ±1.00% 200Ω to 2KΩ ± 0.5% 2K to 50KΩ ±.25%	±.15%	2.0 @ 70°C	Bushing Servo
	182	.750	5 to 30K	±3% (±5% below 20Ω)	5Ω to 2KΩ ±1.0% 2KΩ to 30KΩ ±0.5%	±.25%	1.5 @ 70°C	Servo
	**202**	1.750	5 to 65K	± 3% (± 5% below 50Ω)	5Ω to 50Ω ± 1.0% 50Ω to 500Ω ±0.5% 500Ω to 65KΩ ±.25%	±.15%	3.5 @ 70° C	Bushing Servo

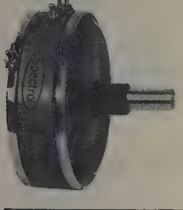
[1] BEST PRACTICAL LINEARITY FIGURES SHOWN FOR THE VARIOUS MODELS APPLY TO HIGHER RESISTANCE UNITS. CONSULT FACTORY WITH SPECIFIC REQUIREMENTS.

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

[2] SIZES SHOWN ARE FOR THE BUSHING MOUNT VERSIONS. SHAFT DIA. .125" FOR MODELS 122, 140, 142, 502, 552, 702, AND CW05; .094" FOR MODELS 162 AND 164; .250" FOR ALL OTHER MODELS.

Spectrol

SINGLE-TURN WIREWOUND PRECISION POTENTIOMETERS

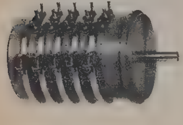
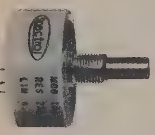
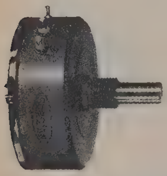
All units shown ½ actual size	MODEL NO.	NOMINAL DIA.[2] (INCHES)	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE		MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
					STANDARD	BEST PRACTICAL[1]		
	**302** (Style RR 2000 Available)	2.000	5 to 85K	± 3% (± 5% below 50 Ω)	5 Ω to 50 Ω ± 1.0% 50 Ω to 200 Ω ±0.5% 200 Ω to 85K Ω ± .25%	±.10%	4.0 @ 70° C	Bushing Servo
	402 (Style RR 3000 Available)	3.000	10 to 150K	± 3% (± 5% below 100 Ω)	10 Ω to 200 Ω ±0.5% 200 Ω to 150K Ω ± .25%	±.075%	6.0 @ 70° C	Bushing Servo
	452 SIN/COS	3.000	250 to 25K per quad	±3%	250 Ω to 2.5K Ω ±0.5% (PK To PK) 2.5K Ω and above ±0.3% (PK To PK)		6.0 @ 70°C	Servo
	702 (Style RR 2100 Available)	.875	5 to 100K	± 3% (± 5% below 20 Ω)	5 Ω to 500 Ω ± 1.0% 500 Ω to 20K Ω ± 0.5%	±.25%	1.25 @ 70° C	Bushing Servo
	MW	.906	5 to 50K	±10%	±5%	±2%	1 @ 20°C	Bushing

[1] BEST PRACTICAL LINEARITY FIGURES SHOWN FOR THE VARIOUS MODELS APPLY TO HIGHER RESISTANCE UNITS. CONSULT FACTORY WITH SPECIFIC REQUIREMENTS.

[2] SIZES SHOWN ARE FOR THE BUSHING MOUNT VERSIONS. SHAFT DIA. .125" FOR MODELS 122, 140, 142, 502, 552, 702, AND CW05; .094" FOR MODELS 162 AND 164; .250" FOR ALL OTHER MODELS

Spectrol

SINGLE-TURN CONDUCTIVE PLASTIC AND CERMET POTENTIOMETERS

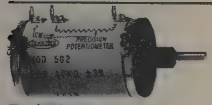
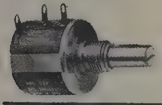
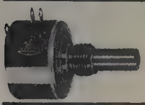
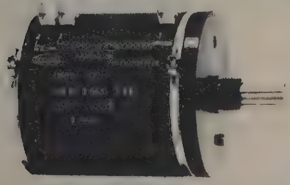
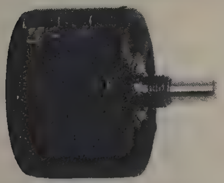
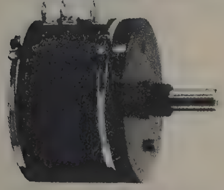
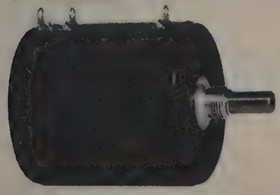
All units shown ½ actual size	MODEL NO.	NOMINAL DIA. (INCHES)	RESISTANCE RANGE (OHMS)	RESISTANCE TOLERANCE	LINEARITY	MAXIMUM POWER RATING (WATTS)	OUTPUT SMOOTHNESS	TEMPCO (PPM/° C)	MOUNTING AVAILABLE
	**126** (Conductive Plastic)	1.062	500 to 50K	±10% (Special to ± 5%)	± 0.5% (Special to ±.15%)	0.6 @ 70° C	0.1% Max.	±400	Servo
	128 (Conductive Plastic)	1.062	500 to 50K	±10% (Special to ± 5%)	± 0.5% (Special to ± .15%)	1.25 @ 70° C	0.1% Max.	±400	Bushing Servo
	**138** (Conductive Plastic)	1.312	1K to 50K	±10% (Special to ±5%)	± 0.5% (Special to ±.25%)	2.0 @ 40° C	0.1% Max.	±500	Bushing
	139 (Cermet)	1.312	500 to 2 Meg.	± 20% (Special to ±5%)	± 0.5% (Special to ±0.25%)	5.0 @ 40° C	0.1% Max.	±100	Bushing
	158 (Conductive Plastic)	.875	500 to 50K	±10% (Special to ±5%)	± 0.5% (Special to ±0.25%)	1.0 @ 40° C	0.1% Max.	±400	Bushing* Servo
	159 (Cermet)	.875	500 to 2 Meg.	±20% (Special to ± 5%)	± 0.2% (Special to ±0.5%)	3.5 @ 40° C	0.1% Max.	±100	Bushing Servo
	**208** (Conductive Plastic)	1.750	500 to 50K	± 10% (Special to± 5%)	± 0.3% (Special to ±0.1%)	1.75 @ 70° C	0.1% Max.	±400	Bushing Servo
	308 (Conductive Plastic)	2.000	500 to 100K	± 10% (Special to ± 5%)	± .25% (Special to ± .05%)	2.0 @ 70° C	0.1% Max.	±400	Bushing Servo
	708 (Conductive Plastic)	.875	500 to 50K	±10% (Special to ± 5%)	± 0.5% (Special to ± 0.2%)	1.0 @ 70° C	0.1% Max.	±400	Bushing Servo

*CONSULT FACTORY FOR NEW LOW-COST VERSION

Spectrol

MULTI-TURN WIREWOUND PRECISION POTENTIOMETERS

All units shown ½ actual size

MODEL NO.	NOMINAL DIA.[2] (INCHES)	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE		MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE
				STANDARD	BEST PRACTICAL[1]		
(10 Turn) ▶ **162/164**	.500	100 to 115K	± 5%	±.30%	±.1%	2.0 @ 40° C	162 Bushing 164 Servo
 (Style RR 1000 Available) **502** (10 Turn)	.875	15 to 150K	± 3% (± 5% below 100 Ω)	±.25%	±.05%	2.0 @ 70° C	Bushing Servo
▶ **533** (3 Turn)	.875	50 to 20K	± 5%	±.25%	±.15%	1.0 @ 70° C	Bushing Servo
▶ **534** (10 Turn)	.875	100 to 100K	± 5%	±.25%	±.075%	2.0 @ 70° C	Bushing Servo
▶ **535** (5 Turn)	.875	50 to 50K	± 5%	±.25%	±.10%	1.5 @ 70° C	Bushing Servo
 ▶ **536** (10 Turn)	.875	100 to 100K	± 5%	±.25%	±.10%	2.0 @ 70° C	Bushing
 **537** (3 Turn)	.875 (.590 Length)	5 to 60K	± 5%	±.25%	±.10%	1.0 @ 70° C	Bushing Servo
552 (3 Turn)	.875	5 to 45K	± 3% (± 5% below 50 Ω)	±.25%	±.125%	1.0 @ 70° C	Bushing Servo
 **802** (10 Turn) (Style RR 2100 Available)	1.812	20 to 500K	± 3% (± 5% below 200 Ω)	±.25%	±.025%	5.0 @ 70° C	Bushing Servo
 ▶ **830** (3 Turn)	1.812	15 to 150K	± 3% (± 5% below 100 Ω)	±.25%	±.05%	3.0 @ 40° C	Bushing
 **852** (3 Turn)	1.812	15 to 150K	± 3% (± 5% below 100 Ω)	±.25%	±.05%	2.0 @ 70° C	Bushing Servo
 ▶ **860** (10 Turn)	1.812	20 to 500K	± 3% (± 5% below 200 Ω)	±.25%	±.025%	8.0 @ 40° C	Bushing

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

SWITCHES AND MULTIDIALS

SUBMINIATURE SWITCHES

All units shown actual size

	MODEL NO.	NOMINAL DIA. (INCHES)	SWITCH ACTION	CONTACT CURRENT RATING	LIFE AT RATED CURRENT	CONTACT RESISTANCE (OHMS)	DESCRIPTION
	▶ 87-11-XX†	.500	Positive Detent, 36° Indexing, Stops	250MA @ 28VDC	4,000 Switching Operations, Per Position	.05 Maximum	Screwdriver Adjust
	▶ 87-21-XX†	.550	Positive Detent, 36° Indexing, Stops	250MA @ 28VDC	4,000 Switching Operations, Per Position	.05 Maximum	Knob Adjust
	▶ 87-31-XX†	.500	Positive Detent, 36° Indexing, Stops	250MA @ 28 VDC	4,000 Switching Operations, Per Position	.05 Maximum	Bushing Panel Mounting
	97	.360	Positive Detent, 45° Indexing, Stops	250MA @ 28VDC	10,000Switching Operations, Per Position	.05 Maximum	Screwdriver Adjust

NUMBER OF POLES AND ACTIVE POSITIONS – MODEL 87

NUMBER OF POLES	ACTIVE POSITIONS	ACTIVE TERMINAL PIN NUMBERS	BASIC PART NUMBER
SINGLE-POLE	1	1 (ON–OFF)	87-XX-11
	2	1 and 2	87-XX-12
	3	1 thru 3	87-XX-13
	4	1 thru 4	87-XX-14
	5	1 thru 5	87-XX-15
	6	1 thru 6	87-XX-16
	7	1 thru 7	87-XX-17
	8	1 thru 8	87-XX-18
	9	1 thru 9	87-XX-19
	10	1 thru 10	87-XX-10

NUMBER OF POLES	ACTIVE POSITIONS	ACTIVE TERMINAL PIN NUMBERS	BASIC PART NUMBER
TWO-POLE	1	3 and 8 (ON–OFF)	87-XX-21
	2	2, 3, 7, and 8	87-XX-22
	3	2, 3, 4, 7, 8, and 9	87-XX-23
	4	1 thru 4, 6 thru 9	87-XX-24
	5	1 thru 10	87-XX-25
THREE POLE	1	1, 4, and 8 (ON–OFF)	87 XX-31
	2	1, 2, 4, 5, 8, and 9	87-XX-32
	3	1 thru 6, 8 thru 10	87-XX-33

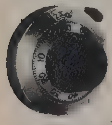
†LAST TWO DIGITS DENOTE POLE/POSITION.

TYPICAL SWITCH APPLICATIONS

● Logic switching. ● Internal switching device for optional equipment add-ons. ● Test point switching. ● Adapting main-frame computers to peripheral equipment. ● Standardizing printed circuit boards. ● Selecting operational voltages. ● Selecting calibration resistors.

MULTIDIALS

All units shown 1/3 actual size.

	MODEL NO.	NOMINAL DIA. (INCHES)	NUMBER OF TURNS	MINOR SCALE DIVISION	SHAFT BORE ■ (INCHES)	FINISH ■
	▶ 11-1-11	1.000	11	1/50 Turn	.250	Satin Chrome
	▶ 15-1-11	H 1.750 W 1.000	10 (3 Digit)	1/500 Turn	.250	Satin Chrome
	▶ 15-2-11	H 1.750 W 1.000	100 (4 Digit)	1/500 Turn	.250	Satin Chrome
	▶ 16-1-11	.875	15	1/50 Turn	.250	Clear Anodized
	▶ 21-1-11	1.812	15	1/100 Turn	.250	Satin Chrome

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

■ OTHER SHAFT BORE SIZES AND FINISHES AVAILABL

Spectrol Electronics P.O. Box 1220, City of Industry, Calif., 91749, U.S.A. (818) 964-6565 · TWX (910) 584-1314

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

TECHNO

a Subsidiary of OAK INDUSTRIES INC.

CERMET TRIMMERS

FEATURES

- Infinite resolution
- Over 20 turns even on 1/4″ size
- Board washable
- Withstands thermal stress environments
- Easy adjustability
- Established reliability to MIL-R-39035

SPECIFICATIONS

ELECTRICAL

Resistance Values: 10 Ohms to 1 meg Ohms
Standard Resistance Tolerance' ±10%
End Resistance: 2 Ohms or 2% of R whichever is greater (0.2 Ohms typical).
Noise (CRV): 3% of R or 3 Ohms whichever is greater (0.5% typical)
Insulation Resistance: >100,000 meg Ohms (500 Vdc)
Dielectric (DWV): 1000Vac @ Ambient temp.

MECHANICAL

Rotation: Clutch stop, wiper assembly idles
Adjustment turns: 22±2 = RJ/RJR 26, 25±2 = RJ/RJR 24
Rotational life: 200 cycles (minimum)
Torque: 3.0 ounce-inches (maximum)

MATERIALS

Case: High temperature plastic
Wiper: Multifinger
Adjustment screw: Corrosion resistant metal
Leads: Solderable

ENVIRONMENTAL

Power rating: 0.25W @ 85° C derated to 0.0W @ 150° C (RJ/RJR26) 0.50W @ 85° C derated to 0.0W @ 150°C (RJ/RJR24)
Oper. Temp.: -55° to +150°C
Temp. Coeff.: ±100PPM/°C (max.)
±50PPM/°C available
Load Life: 2000 hrs per MIL-R-39035 thermal shock, vibration, shock, salt spray, and moisture resistance: per MIL-STD-202
Immersion: per MIL-R-22097 and MIL-R-39035

HOW TO ORDER

MIL—

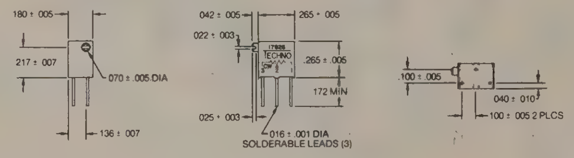
RJR	24	F	P	501	P
①	②	③	④	⑤	⑥

TECHNO—

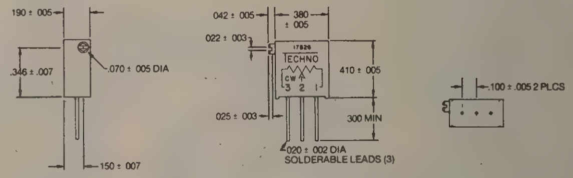
C	24	F	P	501
①	②	③	④	⑤

① Element
MIL: RJ = Non-wirewound
RJR = Establ. Rel, Non-wirewound
Techno: C = Cermet
② Size: 24 = 3/8″ square
26 = 1/4″ square
③ Temp. Coef.: C = ±250ppm/°C
F = ±100ppm/°C
H = ± 50ppm/°C
④ Lead style: P = PC mount
W = Top screw
X = Side screw
⑤ R Value: First 2 digits significant. Last digit = # zeros
⑥ RJR failure rate per 1000 hours: M = 1.0%, P = 0.1%, R = 0.01%

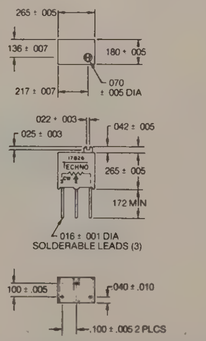
1/4″ SQUARE: C26, RJ26, RJR26
X STYLE


180 ± 005
217 ± 007
070 ± .005 DIA
136 ± 007
042 ± 005
265 ± 005
022 ± 003
17826
TECHNO
.265 ± .005
172 MIN
025 ± 003
016 ± .001 DIA
SOLDERABLE LEADS (3)
.100 ± .005
040 ± 010
100 ± 005 2 PLCS

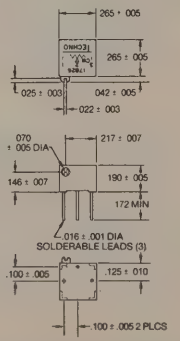
3/8″ SQUARE: C24, RJ24, RJR24
X STYLE


190 ± 005
.346 ± .007
.070 ± 005 DIA
150 ± 007
042 ± 005
380 ± 005
022 ± 003
17826
TECHNO
CW
3 2 1
410 ± 005
025 ± 003
300 MIN
020 ± 002 DIA
SOLDERABLE LEADS (3)
.100 ± .005 2 PLCS

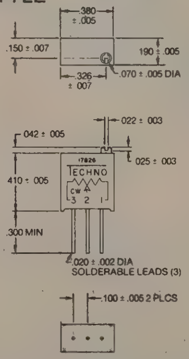
W STYLE


265 ± 005
136 ± 007
180 ± 005
217 ± 007
070
± 005 DIA
022 ± 003
025 ± 003
042 ± 005
17826
TECHNO
265 ± 005
172 MIN
016 ± 001 DIA
SOLDERABLE LEADS (3)
100 ± .005
040 ± .010
.100 ± .005 2 PLCS

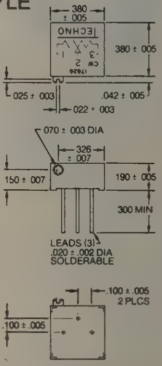
P STYLE


265 ± 005
TECHNO
265 ± 005
025 ± 003
042 ± 005
022 ± 003
070
± 005 DIA
217 ± 007
146 ± 007
190 ± 005
172 MIN
.016 ± .001 DIA
SOLDERABLE LEADS (3)
.100 ± .005
.125 ± 010
.100 ± .005 2 PLCS

W STYLE


.380
± .005
.150 ± .007
190 ± .005
.326
± 007
.070 ± .005 DIA
022 ± 003
042 ± 005
025 ± 003
17826
TECHNO
CW
3 2 1
410 ± 005
.300 MIN
.020 ± .002 DIA
SOLDERABLE LEADS (3)
.100 ± .005 2 PLCS

P STYLE

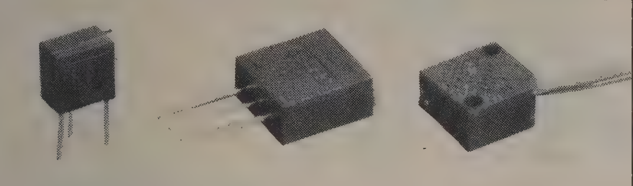

380
± 005
TECHNO
380 ± 005
025 ± 003
.042 ± 005
022 ± 003
070 ± 003 DIA
326
± 007
150 ± 007
190 ± 005
300 MIN
LEADS (3)
.020 ± .002 DIA
SOLDERABLE
.100 ± .005
2 PLCS
.100 ± .005

TECHNO-COMPONENTS CORP., 7803 Lemona Ave., Van Nuys, CA 91405 (818) 781-1642, TWX: 910-495-2015

TECHNO

a Subsidiary of OAK INDUSTRIES INC.

WIREWOUND TRIMMERS



FEATURES

- Precious metal wiper
- Established reliability to 0.01%/1,000 hours, R level per MIL-R-39015
- Special configurations available
- Military quality at affordable prices

SPECIFICATIONS

ELECTRICAL

Resistance Values: 10 to 50k Ohms (RT/RTR24 Type)
10 to 25k Ohms (RT26 Type)
Std. Resis. Tol.: ±5% (closer tolerances available)
End Resistance: 2% or 1 Ohm (whichever is greater) (0.2 Ohms typical).
Noise (ENR): 100 Ohms (Max.) (MIL-R-27208 & MIL-R-39015)
Insulation Resis.: >100,000 meg Ohms (500 Vdc)
Dielectric (DWV): 1000Vac @ Ambient temp.

MECHANICAL

Rotation: Clutch stop
Adjustment turns: 22±4
Rotational life: 200 cycles (min.)
Torque: 5 ounce-inches (max.)

MATERIALS

Case: High temperature plastic
Wiper: Precious metal
Adj. Screw: Corrosion resistant metal
Leads: Solderable

ENVIRONMENTAL

Power rating: 0.50W @ 85° C derated to 0.0W @ 150° C (RT26)
1.0W @ 85°C derated to 0.0W @ 150°C (RT/RTR24)
Oper. Temp.: -65 to +150°C
Temp. Coeff.: ±50PPM/°C (max.)
Load Life: per MIL-R-27208 and MIL-R-39015 thermal shock, vibration, shock, salt spray, and moisture resistance: per MIL-STD-202
Immersion: per MIL-R-27208 and MIL-R-39015

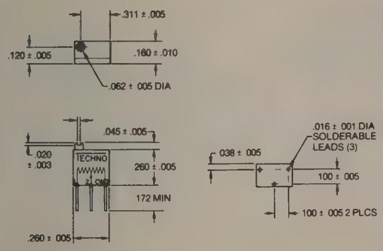
HOW TO ORDER

MIL—
RTR 24 D P 501 P
① ② ③ ④ ⑤ ⑥

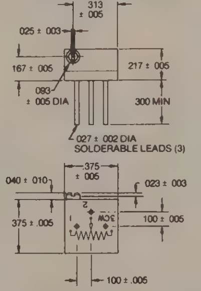
TECHNO—
W 24 D P 501
① ② ③ ④ ⑤

① Element
MIL: RT = Wirewound
RTR = Establ. Rel. wirewound
Techno: W = Wirewound
② Size: 24 = 3/8″ square
26 = 1/4″ square
③ Temp. Coef.: C2 = ±50ppm/°C (RT only)
D = ±50ppm/°C (RTR24 only)
④ Lead style: P = PC mount
W = Top screw
X = Side screw
L = Teflon leads
⑤ R Value: First 2 digits significant. Last digit = # zeros
⑥ RTR failure rate per 1000 hours:
M = 1.0%, P = 0.1%, R = 0.01%

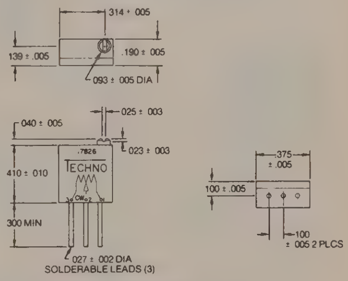
1/4″ SQUARE: W26, RT26
W STYLE


.311 ± .005
.120 ± .005
.160 ± .010
.062 ± 005 DIA
.045 ± .005
.020 ± .003
TECHNO
2
CW
260 ± .005
172 MIN
.260 ± 005
.016 ± 001 DIA SOLDERABLE LEADS (3)
038 ± 005
100 ± 005
100 ± 005 2 PLCS

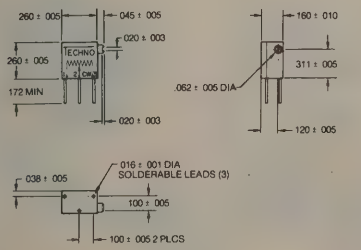
3/8″ SQUARE: W24, RT24, RTR24
P STYLE


313 ± 005
025 ± 003
167 ± 005
217 ± 005
093 ± 005 DIA
300 MIN
027 ± 002 DIA SOLDERABLE LEADS (3)
.375 ± 005
040 ± 010
023 ± 003
375 ± .005
1
2
3CW
100 ± 005
100 ± .005

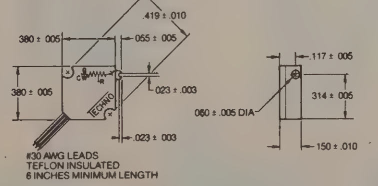
W STYLE


314 ± 005
139 ± .005
.190 ± 005
093 ± 005 DIA
025 ± 003
040 ± 005
023 ± 003
.7826
TECHNO
CW
2
410 ± 010
300 MIN
027 ± 002 DIA SOLDERABLE LEADS (3)
.375 ± .005
100 ± .005
100 ± 005 2 PLCS

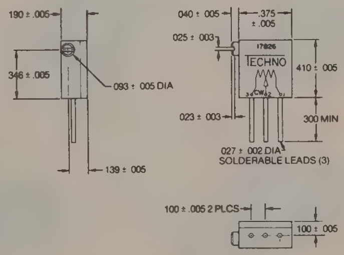
X STYLE


260 ± 005
045 ± 005
020 ± 003
TECHNO
2
CW
260 ± 005
172 MIN
020 ± 003
160 ± 010
311 ± 005
.062 ± 005 DIA
120 ± 005
016 ± 001 DIA SOLDERABLE LEADS (3)
038 ± 005
100 ± 005
100 ± 005 2 PLCS

L STYLE

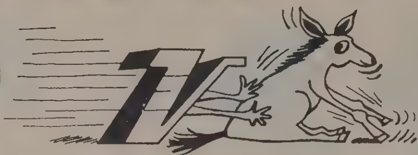

.419 ± .010
380 ± 005
055 ± 005
380 ± 005
CW
R
023 ± .003
ECHNO
.023 ± 003
#30 AWG LEADS TEFLON INSULATED 6 INCHES MINIMUM LENGTH
.117 ± 005
314 ± 005
060 ± .005 DIA
150 ± .010

X STYLE

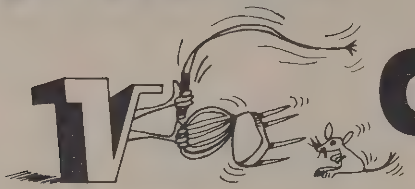

190 ± .005
346 ± .005
093 ± 005 DIA
139 ± 005
040 ± 005
.375 ± .005
025 ± 003
17826
TECHNO
CW
2
410 ± 005
023 ± 003
300 MIN
027 ± 002 DIA SOLDERABLE LEADS (3)
100 ± .005 2 PLCS
100 ± 005

TECHNO-COMPONENTS CORP., 7803 Lemona Ave., Van Nuys, CA 91405 (818) 781-1642, TWX: 910-495-2015

If you want to move it



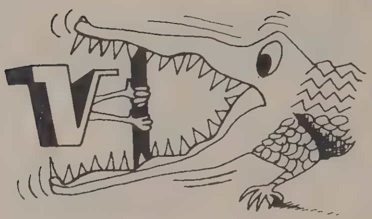
,



control it,

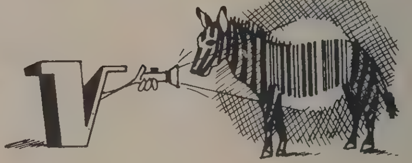
sense it

,



stop it,

or scan it

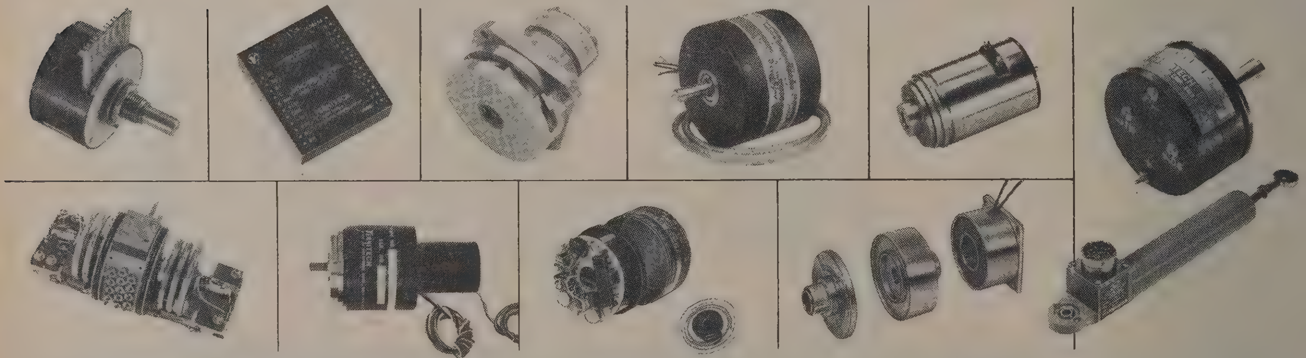


,

call Vernitech.

That is, if you're looking for instrument motors, optical and contacting shaft angle encoders, rotary and linear potentiometers, potentiometric pressure transducers, industrial precision brakes or clutches, or laser scanning motors, we'll probably have just what you're looking for. Just look on the opposite page. And if you *don't* find what you want, call Vernitech, give us the particulars, and we'll make it for you.

VERNITECH



VERNITECH, a division of Vernitron Corp., 300 Marcus Blvd., Deer Park, NY 11729 • 516-586-5100 • TWX 510-227-6089

POTENTIOMETERS

employing Vernitech's unique conductive film and precious metal wipers...respond to wiper motions as small as .000005".

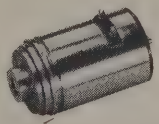
Rotary Single Turn
Linear, non-linear, sine/cosine available.
Sizes 0.5", L 0.5" to Dia 5.0", L 1.880".
Linearity or conformity ±2% to 0.025%.
Resistance range 1KΩ to –250KΩ.

Rotary Multi-Turn
10 to 100 turns available.
Sizes Dia 0.5", L 1.5" to Dia 2.0", L 2.625".
Linearity or conformity ±0.5% to 0.015%.
Resistance range 1KΩ to 500KΩ.

Linear Motion
Electrical stroke lengths 1" to 60".
Linearity or conformity ±0.2% to 0.01%.
Resistance range 250Ω/in to 250KΩ/in.

CLUTCHES AND BRAKES

(electromagnetic)



hundreds of models and sizes available from stock.

Precision Instrument Type
Sizes 5, 8, 11, 13, 15, and 18.
Standard length and wafer types. Spring and magnetic.
Meet MIL-E-5272C. Zero backlash.
Torque 5 to 150 oz. in. Response time 5 to 142 ms.

Industrial Types — open frame
Sizes 8, 12, 17, 22, 26. Torque to 75 in. lb.
Response time 6-30 ms at rated voltage.

Industrial Types — enclosed frame
Hybrid or special units designed for particular applications when MIL-SPECS and close tolerances are not essential, but where having a complete "self-contained" unit is desirable: cassette tape decks, analog devices actuators, etc.

Fail Safe
Braking action occurs 10 ms after coil is de-energized or power fails. Sizes 8, 17, 30, and 45.
Torque up to 50 in. lb. Zero backlash. Adjustable to compensate for wear.

PRESSURE TRANSDUCERS

potentiometer type,

featuring infinite resolution, long life, and high reliability through the use of conductive film resistance elements, multiple wipers, and direct coupling of pressure sensing element to potentiometer wipers.

Pressure ranges from 0.1 to 10,000 psi in gage, absolute and differential types. Also available with high overpressure capability.

Linearity to ±0.3%. Air speed, altitude and low cost types available.

VERNITECH

MOTORS

Over 1500 Standard Designs or Custom Designed to your requirements.

Synchronous — for laser scanning
Sizes 5, 8, 11, 15, 18, 20, 25, 35.
Speeds 100 to 48,000 rpm.
5 through 1600 Hz. 2, 4, 8, 12 poles.

Servo
Viscous damped — sizes 8, 10, 11, 15, 18.
Speeds 3000 to 10,000 rpm.
Inertially damped — sizes 8, 11, 15, 18.
Speeds 3000 to 9500 rpm.

Stepper
Sizes 5, 8, 11, 15. Stepping angles 7.5°, 15°, 45°, 90°.
Stepping rates 100, 110, 125, 130, 175, 180, 225, 240, 260, 400, 725, 800, 1000 pps.

Precision Motor Generators Sizes 8, 10, 11, 15, 18, 23.

Integrating and Computer Motor Tachometers
Sizes 8, 10, 11, 15, 18, 23.

SHAFT ANGLE ENCODERS

featuring precision chrome on glass discs for highest accuracy.

Optical Incremental
VOE 005 — Dia. 0.500", 0.510" L. To 256 pulses (modular)
VOE 05 — Dia. 0.500", 0.820" L. To 256 pulses
VOE 11 — Dia. 1.062", L. 1.80". To 1024 pulses
VOE 015 — Dia. 1.510", L. 0.88". To 1024 pulses (modular)
VOE M15 "Dial Coder" — panel mounted, 1.500" dia., L. 1.08" 127-256 pulses
VOE 023 — Dia. 2.25", L. 80". To 1250 pulses (modular)
VOE 23 — Dia. 2.250", L. 1.875". To 1250 pulses (available sealed)
VOE L23 "Thrift-Line" Dia. 2.250" L. 1.875". To 600 pulses
VOE 25 — Dia. 2.500", L. 2.500". To 3000 pulses (available sealed)

Optical Absolute
VOE 23: Binary, Gray or BCD to 512 counts per turn. Counting speed: 3000 rpm.
VOE 30: Single or multi-turn; Binary, Gray or BCD. To 1024 counts per turn. Max count (2^{19}) in 512 turns. Counting Speed: 30KHz.

Contacting Absolute
Sizes 11, 18, 23, & 31. Binary, Gray, and BCD. Single or multi-turn. Max count (2^{19}) in 2048 turns. 64 to 1024 counts per turn. Operating speed 200 rpm max.

SYNCHRO CONVERTER MODULES

Tracking Synchro-to-Digital and Resolver-to-Digital Converters
Economy Series VSD/VRD. Precision Series VSDH/VRDH Compact, solid state, high performance converters employing type 11 servo loops for lag free tracking at rates to 3600°/sec. Resolution 10 bits, 12 bits, or 14 bits.

Digital-to-Synchro and Digital-to-Resolver Converters Series VDS/VDR:Accept shaft angle data in digital form for conversion to analog at accuracies up to ±4'.

Tracking Synchro-to-Linear DC Converter Module
Series VSDCH/VRDCH:Accept 3-wire synchro or 4-wire resolver input data, convert it to DC analog voltage proportional to synchro angle of input. Accuracy ±6' (typ.).

Tracking Angle Position Indicator
VNST-104: Tracking Synchro-to-Digital Converter, can also be used as a control element. Four decade 0.8" red LED display. Display accuracy ±6' arc (typical). Tracking rate 3600°/sec max. Parallel binary or BDC output.
Self contained line operated power supply.

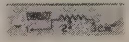
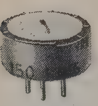
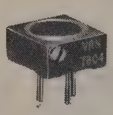
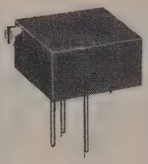
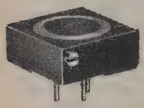
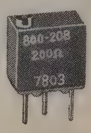
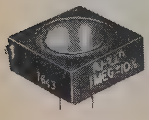
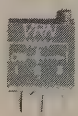
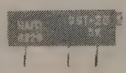
Custom designs available to your specifications.

VERNITECH, a division of Vernitron Corp., 300 Marcus Blvd., Deer Park, NY 11729 • 516-586-5100 • TWX 510-227-6089

VRN INTERNATIONAL

A DIVISION OF VERNITRON CORPORATION

CONTACT FACTORY OR LOCAL SALES OFFICE FOR MORE DETAILS

MODEL	DESCRIPTION	MODEL	DESCRIPTION
 100	**½″ Round Wirewound Single-Turn Trimmer** **Power rating:** 1W @ 70°C **Standard resistance range:** 20Ω to 20KΩ **Resistance tolerance:** ±5% std. **Temperature coefficient:** ±50ppm/°C max. **Noise during adjustment:** 100Ω max. **End resistance:** 1Ω or 2% (W.I.G.) **Dielectric strength:** 1500VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** .25% or 1Ω (W.I.G.)	 450	**1¼″ Rectangular Cermet Multi-Turn Trimmer** **Power rating:** 1W @ 70°C (300V max.) **Standard resistance range:** 10Ω to 2MΩ **Resistance tolerance:** ±10% std. **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 2Ω max.
 150	**½″ Round Cermet Single-Turn Trimmer** **Power rating:** 0.75W @ 85°C (300V max.) **Standard resistance range:** 50Ω to 2MΩ **Resistance tolerance:** ±10% std. **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 20Ω or 3% (W.I.G.) **End resistance:** 5Ω max. or 2% (W.I.G.) **Dielectric strength:** 1500VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1Ω or .25% (W.I.G.)	 700	**⅜″ Square Wirewound Multi-Turn Trimmer** **Power rating:** 0.75W @ 70°C **Standard resistance range:** 10Ω to 20KΩ **Resistance tolerance:** ±5% std. **Temperature coefficient:** ±50ppm/°C max. **Noise during adjustment:** 100Ω max. **End resistance:** 1Ω or 2% (W.I.G.) **Dielectric strength:** 1000VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1Ω or 0.25% (W.I.G.)
 170	**¼″ Round Cermet Single-Turn Trimmer** **Power rating:** 0.5W @ 85° (300V max.) **Standard resistance range:** 10Ω to 2 MΩ **Resistance tolerance:** ±10% 100Ω to 2MΩ (±20% below 100Ω) **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω max. or 2% (W.I.G.) **Dielectric strength:** 400VAC **Insulation resistance:** 100MΩ **Absolute minimum resistance:** 2Ω or 1% (W.I.G.)	 752	**⅜″ Square Cermet Multi-Turn Trimmer** **Power rating:** 0.5W @ 85°C (300V max.) **Standard resistance range:** 20Ω to 2MΩ **Resistance tolerance:** ±10% 100Ω to 2MΩ (±20% below 100Ω) **Temperature coefficient:** ±100ppm/°C max. **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ min. **Absolute minimum resistance:** 1Ω
 180	**¼″ Square Cermet Single-Turn Trimmer** **Power rating:** 0.5W @ 85°C (300V max.) **Standard resistance range:** 10Ω to 2MΩ **Resistance tolerance:** ±10% 100Ω to 2MΩ (±20% below 100Ω) **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 2Ω or 1% (W.I.G.)	 780	**⅜″ Square Cermet Single-Turn Trimmer** **Power rating:** 0.5W @ 85°C (300V max.) **Standard resistance range:** 10Ω to 2MΩ **Resistance tolerance:** ±10% 100Ω to 2MΩ (±20% below 100Ω) **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 2Ω max.
 205	**½″ Square Wirewound Multi-Turn Trimmer** **Power rating:** 1W @ 70°C **Standard resistance range:** 10Ω to 20KΩ **Resistance tolerance:** ±5% std. **Temperature coefficient:** ±50ppm/°C max. **Noise during adjustment:** 100Ω max. **End resistance:** 2Ω max. or 2% (W.I.G.) **Dielectric strength:** 1000VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1% or 1Ω (W.I.G.)	 800	**5⁄16″ Square Wirewound Multi-Turn Trimmer** **Power rating:** 0.6W @ 70°C **Standard resistance range:** 10Ω to 20KΩ **Resistance tolerance:** ±5% std. **Temperature coefficient:** ±50ppm/°C max. **Noise during adjustment:** 100Ω max. **End resistance:** 1Ω or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1Ω or 0.25% (W.I.G.)
 255	**½″ Square Cermet Multi-Turn Trimmer** **Power rating:** 1.0W @ 70°C **Standard resistance range:** 20Ω to 2MΩ **Resistance tolerance:** ±10% std. **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1Ω or 3% (W.I.G.)	 850	**5⁄16″ Square Cermet Multi-Turn Trimmer** **Power rating:** 0.3W @ 70°C (300V max.) **Standard resistance range:** 20Ω to 2MΩ **Resistance tolerance:** ±10% std. **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω max. or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1Ω
 260	**¼″ Square Cermet Multi-Turn Trimmer** **Power rating:** ¼W at 70°C derate to zero at 125°C **Standard resistance range:** 10Ω to 1MΩ **Resistance tolerance:** ±10% standard **Temperature coefficient of resistance of potentiometer:** ±100 ppm/°C (±50 ppm/°C available consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **Insulation resistance:** 1000 meg ohms at 500VDC **Dielectric strength:** 900VAC	 910	**¾″ Rectangular Wirewound Multi-Turn Trimmer** **Power rating:** 1W 40°C **Standard resistance range:** 10Ω to 20KΩ **Resistance tolerance:** ±10% std. **Temperature coefficient:** ±50 ppm/°C nominal **Noise during adjustment:** 100Ω max. **End resistance:** 1Ω or 2% (W.I.G.) **Dielectric strength:** 1000VAC **Insulation resistance:** 100MΩ **Absolute minimum resistance:** 1Ω or .5% (W.I.G.)
 400	**1¼″ Rectangular Wirewound Multi-Turn Trimmer** **Power rating:** 1W @ 70°C **Standard resistance range:** 10Ω to 20KΩ **Resistance tolerance:** ±5% std. **Temperature coefficient:** ±50ppm/°C max. **Noise during adjustment:** 100Ω max. **End resistance:** 1Ω or 2% (W.I.G.) **Dielectric strength:** 900VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1Ω or .25% (W.I.G.)	 960	**¾″ Rectangular Cermet Multi-Turn Trimmer** **Power rating:** 0.75W @ 70°C (300V max.) **Standard resistance range:** 10Ω to 2MΩ **Resistance tolerance:** ±10% std. **Temperature coefficient:** ±100ppm/°C max. (±50ppm/°C available — consult factory) **Contact resistance variation:** 3Ω or 3% (W.I.G.) **End resistance:** 2Ω or 2% (W.I.G.) **Dielectric strength:** 1000VAC **Insulation resistance:** 1000MΩ **Absolute minimum resistance:** 1Ω or 3% (W.I.G.)

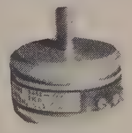
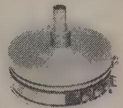
VRN INTERNATIONAL P.O. Box 44000, St. Petersburg, FL 33743 • Tel. (813) 347-2181/TWX: 810-863-0357/TELEX 68105306

VRN INTERNATIONAL
A DIVISION OF VERNITRON CORPORATION

PRECISION POTENTIOMETERS

MODEL	DESCRIPTION
 5001	**½″ Diameter Single-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 10Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 320° ±5°
 5000	**½″ Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 1W (5000) 1.5W (5005) **Standard resistance range:** 100Ω to 100KΩ (5000) 50Ω to 50KΩ (5005) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% std. (closer upon request) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (5000) 1800° +6° −0 (5005) **Electrical rotation:** Same as mechanical
 7501	**¾″ Diameter Single-Turn Wirewound** **Power rating:** 2.25W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±1% **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** Continuous **Electrical rotation:** 320° ±5°
 7561	**¾″ Single-Turn Conductive Plastic** **Power rating:** 1W @ 70°C **Standard resistance range:** 100Ω to 200KΩ **Resistance tolerance:** ±20% **Temperature coefficient:** ±500ppm/°C **Linearity (Ind.):** ±1% std. (closer available) **Output smoothness:** .5% std. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** Continuous **Electrical rotation:** 340° ±5°
 7400/ 7500	**¾″ Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (7400) 2W (7405) **Standard resistance range:** 100Ω to 100KΩ (7400) 100Ω to 50KΩ (7405) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** .25% (7400) .5% (7405) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +6° −0 (7400) 1800° +6° −0 (7405) **Electrical rotation:** Same as mechanical
 0871	**⅞″ Diameter Single-Turn Wirewound** **Power rating:** 1.25W @ 70°C **Standard resistance range:** 100Ω to 10KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 8400/ 8500	**⅞″ Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (8400/8500) 2W (8403-05/8503-05) **Standard resistance range:** 100Ω to 100KΩ (8400/8500) 50Ω to 50KΩ (8403-05/8503-05) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (8400/8500) ±.5% (8403-05/8503-05) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 125°C **Mechanical rotation:** 3600° +10° −0 (8400/8500) 1800° +10° −0 (8405-8505); 1080° +10° −0 (8403/8503) **Electrical rotation:** Same as mechanical

Most singleturn models are available with cermet or conductive plastic elements. All styles are supplied with linear taper as standard. Many are available with non-linear tapers. All styles are available in a bushing mount. Many are available in a servo mount option.

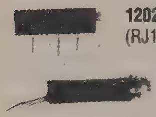
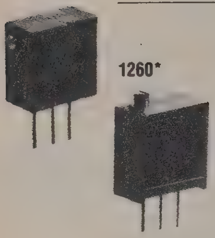
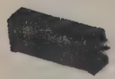
MODEL	DESCRIPTION
 7800	**⅞″ Diameter Multi-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 100Ω to 50KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 105°C **Mechanical rotation:** 3600° +10° −0 **Electrical rotation:** Same as mechanical
 1000/ 1220	**1″ Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 3W (1000) 2W (1005) 4W (1215) 5W (1220) **Standard resistance range:** 500Ω to 250KΩ (1000) 250Ω to 100KΩ (1005) 500Ω to 450KΩ (1215) 1KΩ to 600KΩ (1220) **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% (1000/1005) ±.1% (1215/1220) **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 125°C **Mechanical rotation:** 3600° +4° −0 (1000) 1800° +4° −0 (1005) 5400° +4° −0 (1215) 7200° +4° −0 (1220) **Electrical rotation:** Same as mechanical
 1061	**1 1/16″ Diameter Single-Turn Wirewound** **Power rating:** 1.5W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 **1441**	**1 7/16″ Diameter Single-Turn Wirewound** **Power rating:** 2W @ 40°C **Standard resistance range:** 100Ω to 40KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 151	**1½″ Diameter Single-Turn Wirewound** **Power rating:** 3.5W @ 40°C **Standard resistance range:** 100Ω to 100KΩ **Resistance tolerance:** ±5% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.5% **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±5°
 HD150	**1½″ Diameter Multi-Turn Wirewound** **Power rating:** @ 40°C 5W (HD150) 3W (HD153) 4W (HD155) **Standard resistance range:** 500Ω to 500KΩ (HD150) 200Ω to 250KΩ (HD153) 200Ω to 500KΩ (HD155) **Resistance tolerance:** ±3% (HD150) ±5% (HD153/155) **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% (HD150) ±.5% (HD153/155) **Noise (ENR):** 100Ω max. **Operating temperature range:** −55 to 100°C **Mechanical rotation:** 3600° +4° −0 (HD150) 1080° +4° −0 (HD153) 1800° +4° −0 (HD155) **Electrical rotation:** Same as mechanical
1751	**1¾″ Diameter Single-Turn Wirewound** **Power rating:** 2.5W @ 40°C **Standard resistance range:** 50Ω to 50KΩ **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°
 **2000/ 3000**	**2″ and 3″ Diameter Single-Turn Wirewound** **Power rating:** @ 40°C 4W (2000) 6W (3000) **Standard resistance range:** 100Ω to 60KΩ (2000) 200Ω to 100KΩ (3000) **Resistance tolerance:** ±3% **Temperature coefficient:** ±20ppm/°C **Linearity (Ind.):** ±.25% **Noise (ENR):** 100Ω max. **Operating temperature range:** −65 to 150°C **Mechanical rotation:** Continuous **Electrical rotation:** 350° ±2°

VRN INTERNATIONAL P.O. Box 44000, St. Petersburg, FL 33743 • Tel. (813) 347-2181/TWX: 810-863-0357/TELEX 68105306

VISHAY RESISTIVE SYSTEMS GROUP

TRIMMERS

Precision Trimming Potentiometers

	Model Number	Resistance (Ohms)	Tolerance	Power	No. of Adj. Turns	Nominal Dimensions (Excluding Leads) H x L x W Inch (mm) and Termination Styles	Load-Life Stability (Max.△R)[2]	TCR (End-to-End)[3]
	**1202*** (RJ12 Style)	2, 5, 10 20, 50, 100, 200, 500, 1K 2K, 5K, 10K, 20K	±10%, ±20%, ±5%, ±10%	0.5W @ 85°C	25 ±2	0.35 x 1.250 x 0.195 (8.255) x (31.750) x (4.953) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads	1% 2,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
 	1240* (RJR26 Sty	5, 10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K,	±10% ±5%	0.25W @ 85°C	21 ±2	0.250 x 0.250 x 0.175 (6.350) x (6.350) x (4.445) Type X: Edge-mount, side-adjust Type W: Edge-mount, top-adjust	1% 10,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	1242 (RJ26)	50, 100, 200, 500, 1K, 2K 5K	±10%	25W @ 85°C	21 ±2	0.175 x 0.250 x 0.250 (4.445) x (6.350) x (6.350) Type P: Flat-mount, side adjust	2% 1,000 hrs. @ 85°C	
	**1260***	5, 10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K	±10 ±5	.25W @ 85°C	21 ±2	0.420 x 0.375 x 0.170 (10.67) x (9.52) x (4.32) Type W: Edge-mount, top-adjust Type X: Edge-mount, side adjust	1.0% 10,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	1280*	10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) (Panel mount available)	0.5% 2,000 hrs. @ 25°C	-55°C to +25°C +15ppm/°C +25°C to +125°C -15ppm/°C
	**1285***	10 20, 50 100, 200, 500 1K, 2K, 5K, 10K, 20K	±10% ±5%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (8.86) x (19.06) x (4.83) (Panel mount available)		−55°C to +25°C +5ppm/°C +25°C to +125°C −5ppm/°C

* Screening for low noise (CRV) is available.

VISHAY
...to be precise®

63 Lincoln Highway, Malvern, PA 19355 • Tel: (215) 644-1300 • TWX 510-668-8944

WESTON

WESTON CONTROLS
Archbald, Pennsylvania 18403
Telephone: (717) 876-1500
Telex: 83-1873
TWX: 510-656-2902

FAIRCHILD WESTON
Schlumberger

SALES REPRESENTATIVES FOR POTENTIOMETERS

ALABAMA
DTM, Inc.
6290-C McDonough Dr.
Norcross, Ga. 30093
Phone: 404 447-6832

ARIZONA
Sanford Sales Assoc., Inc.
2150 E. Highland Ave., Suite 205
P.O. Box 10659
Phoenix, Arizona 85064
Phone: 602 957-3570

CALIFORNIA
ADDEM/San Diego
923 Daisy Avenue
Carlsbad, California 92008
Phone: 619 729-9216

Westmark Associates
2557 Wyandotte Street
Mountain View, Calif. 94040
Phone: 415 969-1700

WES-K Associates
5917 Noble Avenue
Van Nuys, Calif. 91411
Phone: 213 989-3070

COLORADO
Quorum 3 Sales Group
8000 E. Girard Avenue
Suite 609
Denver, Colorado 80231
Phone: 303 696-8480

CONNECTICUT
Phoenix Sales Company
389 Main Street
Ridgefield, Conn. 06877
Phone: 203 438-9644

FLORIDA
Perrott Associates, Inc.
473 East Shore Drive
Clearwater Beach, Fla. 33515
Phone: 813 443-5214
813 443-5414

Perrott Associates, Inc.
1371 Sunset Strip
Sunrise, Florida 33313
Phone: 305 792-2211

Perrott Associates, Inc.
7725 N. Orange Blossom Trail
Orlando, Florida 32310
Phone: 305 298-7748

GEORGIA
DTM, Inc.
6290-C McDonough Dr.
Norcross, Ga. 30093
Phone: 404 447-6832

ILLINOIS
Marcon Associates, Inc.
4836 Main Street
Skokie, Illinois 60077
Phone: 312 675-6450

IOWA
Rush & West Associates, Inc.
107 N. Chester
Olathe, Kansas 66061
Phone: 913 764-2700

KANSAS
REPCO
5567 Delaware Street
Wichita, Kansas 67204
Phone: 316 263-4238

MARYLAND
Bernard White & Co., Inc.
7 Church Lane
Baltimore, Maryland 21208
Phone: 301 484-5400

MASSACHUSETTS
TODAY
Component Sales Corp.
P.O. Box 257
35 Wedgewood Road
Stow, Mass. 01775
Phone: 617 897-7500

MICHIGAN
DEM Electronic Sales
30833 Hoover Road
Warren, Michigan 48093
Phone: 313 575-9444

MINNESOTA
REPCO
2515 Wabash Avenue
St. Paul, Minnesota 55114
Phone: 612 642-2828

MISSISSIPPI
DTM, Inc.
6290-C McDonough Dr.
Norcross, Ga. 30093
Phone: 404 447-6832

MISSOURI (Except Kansas City, Mo.)
Rush & West Associates, Inc.
Suite 211
720 Manchester Road
Ballwin, Missouri 63011
Phone: 314 394-7271

MISSOURI (Kansas City, Mo. only)
REPCO
3121B South Dodgion
Independence, Missouri 64055
Phone: 816 254-3410

NEW JERSEY (Northern)
ADDEM Sales, Inc.
387 Passaic Avenue
Fairfield, N.J. 07006
Phone: 201 882-0993

NEW JERSEY (Southern)
ESPY Sales Company, Inc.
Box 27
108 Rydal West
The Fairway
Rydal, Pa. 19046
Phone: 215 576-0780

NEW MEXICO
Sanford Sales Assoc., Inc.
P.O. Box 10659
2150 E. Highland Ave., Suite 205
Phoenix, Arizona 85064
Phone: 602 957-3570

NEW YORK (Northern)
Reagan/Compar, Albany, Inc.
P.O. Box 5208
6 Highland Avenue
Albany, New York 12205
Phone: 518 489-4777

Reagan/Compar
P.O. Box 135
Endwell, New York 13760
Phone: 607 723-8743
607 648-8838

Reagan/Compar
400 Hooper Road
Endwell, New York 13760
Phone: 607 754-8946
607 723-8743

Reagan/Compar
42 Winding Brook Drive
Fairport, New York 14450
Phone: 716 271-2230

Reagan/Compar
41 Woodberry Road
New Hartford, New York 13413
Phone: 315 732-3775

NEW YORK (Southern)
ADDEM Sales, Inc.
387 Passaic Avenue
Fairfield, New Jersey 07006
Phone: 201 882-0993

NORTH CAROLINA
DTM, Inc.
6290-C McDonough Dr.
Norcross, Ga. 30093
Phone: 404 447-6832

OHIO
J.C. Hofstetter Co.
5244 Springboro Heights
Dayton, Ohio 45439
Phone: 513 296-1010

J.C. Hofstetter Co.
7014 River Styx Road
Medina, Ohio 44256
Phone: 216 241-4880
216 725-4477

OKLAHOMA
Delta Components Inc.
312 Glendale Avenue
Seagoville, Texas 75159
Phone: 214 287-6333

OREGON
LD Electronics
P.O. Box 626
17895 S.W. TV Highway
Beaverton, Oregon 97006
Phone: 503 649-6177
503 649-8556

PENNSYLVANIA (Eastern)
ESPY Sales Company, Inc.
Box 27
108 Rydal West
The Fairway
Rydal, Pa. 19046
Phone: 215 576-0780

PENNSYLVANIA (Western)
J.C. Hofstetter Co.
P.O. Box 101
Hickory, Pa. 15340
Phone: 412 356-2305

TEXAS
Delta Components, Inc.
312 Glendale Avenue
Seagoville, Texas 75159
Phone: 214 287-6333

Delta Components, Inc.
P.O. Box 10067
Northwest Station
Austin, Texas 78766
Phone: 512 458-4288

UTAH
Quorum 3 Sales Group
7427 Parkcrest Court
Salt Lake City, Utah 84121
Phone: 801 943-9227

WASHINGTON
LD Electronics
P.O. Box 14586
Spokane, Washington 99214
Phone: 509 922-4883

LD Electronics
7410 77th Avenue, S.E.
Snohomish, Washington 98290
Phone: 206 568-0511

CANADA
Cartwright Southall Assoc., Inc.
Suite 801, 20 Hughson Street S.
Hamilton, Ontario L8N2A1
Phone: 416 528-0294

McIntyre Agencies
3600 Barclay Avenue
STE 340
Montreal 251, Quebec H35-1K5
Phone: 514 731-9617
514 731-9618

OVERSEAS

ARGENTINA
Fotovolt S.A.
Paez 3229
Buenos Aires, Argentina
Phone: 69-3067
Telex 22335

AUSTRIA
Transistor Vertriebsges
MBH & Co. KG
Auhofstr 41A, A-1130
Vienna, Austria
Phone: (02 22) 829451
(02 22) 829404
Telex 133738

BELGIUM
Sotronic
Rue Pere De Deken 14
Pater De Dekenstraat 14
1040 Brussels, Belgium
Phone: 02/736/1007
Telex 25141

BRAZIL
Electro-Radio Ltda.
Rua DoSeminario 199
1 A.S /Loja, Conu, 02
01034 Sao Paulo (SP) Brazil
Phone: (011) 227-0297
Telex 996412

DENMARK
Ditz Schweitzer A-S
Vallensbaekvej 41
DK-2600 Glostrup
Denmark
Phone: 02 45 30 44
Telex 33251

ENGLAND
Macro Marketing Ltd.
Burnham Lane
Berkshire, England
Phone: Slough 06286-4422
Telex 841945

FRANCE
Eurofarad
93 Rue Oberkampf
Paris X1, France
Phone: 355 39 13
Telex 210493

GERMANY (WEST)
Panel Electronic Vertriebs GMBH
Hermann-Oberth-Str. 7
8011 Putzbrunn
West Germany
Phone: 089-464024
Telex 841 05-529238

ISRAEL
Professional Electronics 1983 Ltd.
7 Kehilat Saloniki Street
Neot Afeka
Tel-Aviv, Israel 69204
Phone: 03-482241
03-483124
03-482492
Telex 341270

ITALY
Fast Electronics, S.R.L.
20159 Milano, Italy
Via: Taormina, 36
Phone: (02) 68.36.81 - 68.05.77
Telex 843-313312

JAPAN
Jepico Corporation
Shinjuku Dai-ichi Seimei Bldg.
P.O. Box 5016
Nishi-Shinjuku 2-7-1
Shinjuku-Ku, Tokyo
Japan 160
Phone: (03) 348-0611
Telex (0) 232-3167

NORWAY
RIFA-Hoyem A/S
Tollbodgt 6
Oslo 1, Norway
Phone: 41 37 55
Telex 16611

PUERTO RICO
Distributronics, Inc.
Comercio 56
Playa, Ponce, Puerto Rico 00731
Phone: 809 843-3321

SPAIN
Angel Saenz Components Electronicos
Casa Mirasol, 1-ATO Miracruz
San Sebastian, Spain
Phone: 943-395931
Telex 36041

SWEDEN
AB Gosta Backstrom
Alstromergatan 22
Box 12009
S-102 21 Stockholm 12, Sweden
Phone: 08/54 10 80
Telex 10135

SWITZERLAND
Primotec AG
Täfernstrasse 37
5404 Baden-Dättwill, Switzerland
Phone: 056 84 01 71
Telex 58949

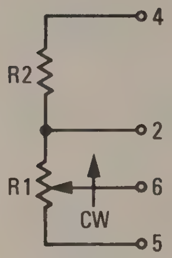
TAIWAN
Jatronics Co., Ltd.
Yosun Industrial Corp.
Room 805, Everspring Bldg.
8F-3, No. 217, Chien-Kuo N Road
Taipei, Taiwan R.O.C.
Phone: (02) 501 0700
Telex 785-26777

WESTON

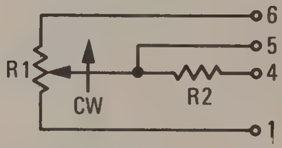
WESTON NETRIM®
TRIMMER RESISTOR NETWORK

FAIRCHILD WESTON
Schlumberger

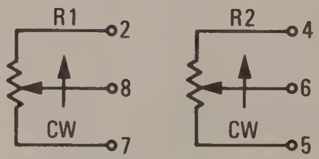
SERIES 0605A
6-PIN DIP



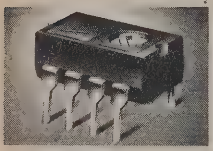
SERIES 0608A
6-PIN DIP

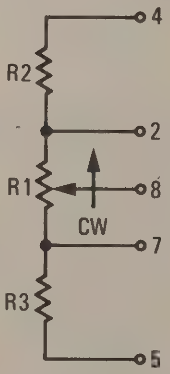


SERIES 0802B
8-PIN DIP

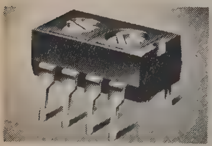


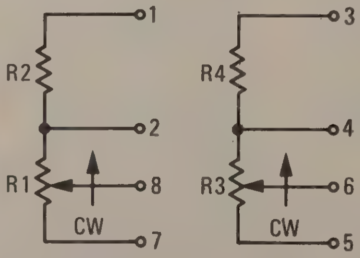
SERIES 0806B
8-PIN DIP





SERIES 0825B
8-PIN DIP





Model Numbers	Resistance Values (Ohms) R1	R2	R3	R4
0605A-102-502	1K	4K	—	—
0605A-102-103	2K	8K	—	—
0605A-102-504	100K	400K	—	—
0605A-105-102	500	500	—	—
0605A-105-103	5K	5K	—	—
0605A-105-503	25K	25K	—	—
0605A-105-104	50K	50K	—	—
0605A-107-503	35K	15K	—	—
0605A-108-502	4K	1K	—	—
0605A-108-504	400K	100K	—	—
0605A-109-103	9K	1K	—	—
0605A-109-104	90K	10K	—	—
0608A-101-104	100K	100K	—	—
0608A-105-502	5K	25K	—	—
0608A-105-103	10K	50K	—	—
0802B-210-101	100	100	—	—
0802B-210-102	1K	1K	—	—
0802B-210-103	10K	10K	—	—
0802B-210-104	100K	100K	—	—
0802B-210-504	500K	500K	—	—
0802B-211-103	10K	20K	—	—
0802B-211-104	100K	200K	—	—
0802B-212-102	1K	10K	—	—
0802B-212-103	10K	100K	—	—
0806B-119-103	8K	1K	1K	—
0806B-127-503	25K	15K	10K	—
0806B-137-503	20K	15K	15K	—
0806B-137-504	200K	150K	150K	—
0806B-146-102	200	400	400	—
0806B-146-104	20K	40K	40K	—
0806B-145-103	1K	5K	4K	—
0806B-157-104	20K	30K	50K	—
0825B-201-502	500	4.5K	500	4.5K
0825B-201-503	5K	45K	5K	45K
0825B-203-503	15K	35K	15K	35K
0825B-207-502	3.5K	1.5K	3.5K	1.5K
0825B-207-103	7K	3K	7K	3K
0825B-207-503	35K	15K	35K	15K
0825B-209-104	90K	10K	90K	10K

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

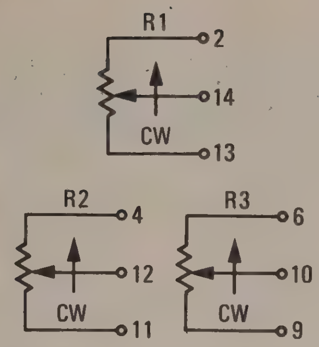
FAIRCHILD WESTON
Schlumberger

WESTON NETRIM®
TRIMMER RESISTOR NETWORK

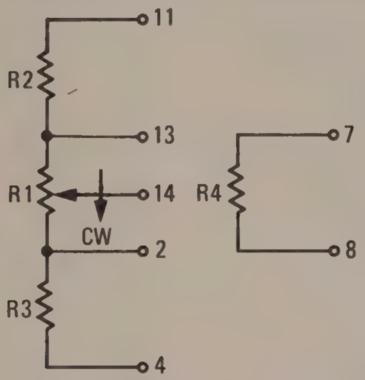
WESTON

Model Numbers	Resistance Values (Ohms)					
	R1	R2	R3	R4	R5	R6
1403C-310-102	1K	1K	1K	—	—	—
1403C-310-103	10K	10K	10K	—	—	—
1403C-310-104	100K	100K	100K	—	—	—
1403C-312-103	10K	20K	20K	—	—	—
1403C-314-102	1K	10K	2K	—	—	—
1403C-314-103	10K	100K	20K	—	—	—
1407C-111-104	1.7K	90K	8.3K	7.6K	—	—
1407C-112-104	200	90K	9.8K	8.8K	—	—
1426C-237-503	20K	15K	15K	20K	15K	15K
1426C-245-103	1K	5K	4K	1K	5K	4K
1604D-410-101	100	100	100	100	—	—
1604D-410-102	1K	1K	1K	1K	—	—
1604D-410-103	10K	10K	10K	10K	—	—
1604D-410-104	100K	100K	100K	100K	—	—
1604D-410-504	500K	500K	500K	500K	—	—
1604D-419-103	10K	20K	20K	20K	—	—
1604D-420-103	10K	100K	20K	20K	—	—
1604D-423-103	10K	100K	10K	100K	—	—

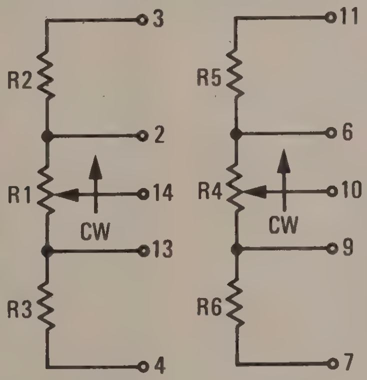
SERIES 1403C
14-PIN DIP


R1
2
14
CW
13
R2
4
12
CW
11
R3
6
10
CW
9

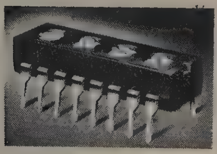
SERIES 1407C
14-PIN DIP

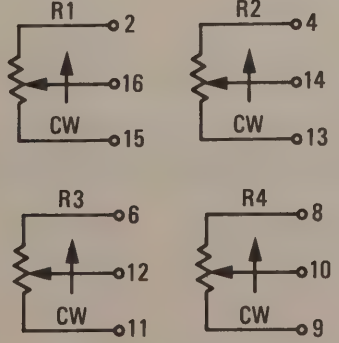

11
R2
13
R1
14
CW
2
R3
4
7
R4
8

SERIES 1426C
14-PIN DIP


3
R2
2
R1
14
CW
13
R3
4
11
R5
6
R4
10
CW
9
R6
7

SERIES 1604D
16-PIN DIP



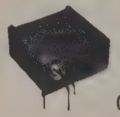
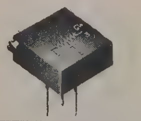

R1
2
16
CW
15
R2
4
14
CW
13
R3
6
12
CW
11
R4
8
10
CW
9

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

WESTON

GENERAL PURPOSE WIREWOUND POTENTIOMETERS SQUARE, RECTANGULAR AND ROUND COMMERCIAL

FAIRCHILD WESTON
Schlumberger

	Model	Terminal Type	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp.°C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
3/4" RECTANGULAR	830P	P	12	.75 x .25 x .19	Wiper Idles	.75 @ 70°C	125	100	10% (*)	10Ω - 2 Meg.
	830W 830Y	W Y								10Ω - 2 Meg.
3/8" SQUARE	840P 840X	P X	1	.375 x .375 x .187	Solid	.50 @ 70°C	125	100	10% (*)	10Ω - 2 Meg.
3/8" SQUARE	850P 850W 850X	P W X	22	.375 x .375 x .187	Wiper Idles	1 @ 50°C	125	100	10% (*)	10Ω - 2 Meg.
		Other Models Available. Consult Factory.								
1/4" SQUARE	860W 860X	W X	16	.250 x .250 x .185	Wiper Idles	.5 @ 85°C	150	100	10% (*)	100Ω - 1 Meg.
		Other Models Available. Consult Factory.								
3/8" SQUARE  (NEW)	950P 950W 950X	P W X	22	.375 x .375 x .187	Wiper Idles	1 @ 50°C	150	100	10% (*)	100Ω - 2 Meg
1/2" RECTANGULAR	522-00HS	P	10	.50 x .17 x .10	Wiper Idles	.30 @ 85°C	150	100	10% (*)	10Ω - 1 Meg.
3/8" SQUARE 	546-00HS	L	25	.375 x .375 x .150	Wiper Idles	.50 @ 85°C	150	100	10% (*)	10Ω - 1 Meg.
	547-00HS 548-00HS 548-72HS	P W X		.375 x .375 x .170 .417 x .375 x .165 .417 x .375 x .165						10Ω - 1 Meg.
1/4" ROUND	566-00HS 567-00HS	P P	1	.270 Dia. x .215	Solid	.50 @ 70°C	150	100	10% (*)	10Ω - 1 Meg.

Humidity: (All Models) MIL-STD-202, Method 106

Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

Specifications Subject to Change Without Notice.

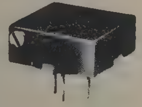
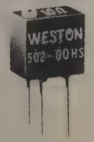
*Note: Resistance Tolerance for 10Ω, 20Ω ±20%

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

FAIRCHILD WESTON
Schlumberger

GENERAL PURPOSE WIREWOUND POTENTIOMETERS SQUARE, RECTANGULAR AND ROUND COMMERCIAL

WESTON

	Model	Terminal Type	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp. °C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
1/2" ROUND WESTON 1000	1000-00HS	P	1	.500 Dia. x .315	Solid	1 @ 70°C	150	50	5%	10Ω - 50K
	1000-67HS	P		.500 Dia. x .250						10Ω - 50K
	1000-68HS	X		.562 x .500 x .312						10Ω - 50K
	Other Models Available. Consult Factory.									
1 1/4" RECTANGULAR	534-00HS	L	24	1.25 x .315 x .190	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
	535-00HS	P		1.25 x .315 x .190						
	539-00HS	Y		1.25 x .325 x .195						
3/8" SQUARE	543-00HS	L	25	.375 x .375 x .160	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
	544-00HS	P		.375 x .375 x .170						10Ω - 50K
	545-00HS	W		.417 x .375 x .170						
	545-72HS	X		.417 x .375 x .170						
1/2" SQUARE	553-00HS	L	35	.500 x .500 x .187	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
	555-00HS	W		.535 x .500 x .220						10Ω. 50K
	555-72HS	X		.535 x .500 x .220						
1/2" SQUARE 	701-00HS	P	37	.500 x .500 x .230	Wiper Idles	1 @ 70°C	150	50	5%	10Ω - 50K
1/4" SQUARE	561-00HS	P	13	.170 x .250 x .250	Wiper Idles	.25 @ 70°C	150	50	5%	10Ω - 25K
	562-00HS	W		.250 x .250 x .170						10Ω - 25K
	562-72HS	X		.250 x .250 x .170						
5/16" SQUARE 	501-00HS	P	15	.175 x .312 x .312	Wiper Idles	.6 @ 70°C	150	70	5%	10Ω - 20K
	502-00HS	W		.312 x .312 x .175						10Ω - 20K
	502-72HS	X		.312 x .312 x .175						

Humidity: (All Models) MIL-STD-202, Method 106

Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

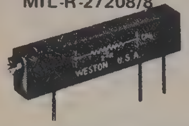
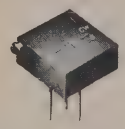
Specifications Subject to Change Without Notice.

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

WESTON

MILITARY APPROVED POTENTIOMETERS WIREWOUND - MIL-R-27208 NON-WIREWOUND - MIL-R-22097

FAIRCHILD WESTON
Schlumberger

	Model	Terminal Type	Military Designation	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp. °C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
MIL-R-27208/8  1 1/4" RECTANGULAR	534-118HS	L	RT12C2L	24	1.25 x .315 x .190	Wiper Idles	.75 @ 85°C	150	50	5%	10Ω - 20K
	535-105HS	P	RT12C2P		1.25 x .315 x .190						
	539-105HS	Y	RT12C2Y		1.25 x .325 x .195						
MIL-R-27208/9 3/8" SQUARE	543-118HS	L	RT24C2L	25	.375 x .375 x .160	Wiper Idles	.75 @ 85°C	150	50	5%	10Ω - 10K
	544-105HS	P	RT24C2P		.375 x .375 x .170						10Ω - 10K
	545-101HS	W	RT24C2W		.417 x .375 x .170						
	545-102HS	X	RT24C2X		.417 x .375 x .170						
MIL-R-27208/4 1/2" SQUARE	553-118HS	L	RT22C2L	35	.500 x .500 x .187	Wiper Idles	.75 @ 85°C	150	50	5%	50Ω - 20K
	555-101HS	W	RT22C2W	35	.535 x .500 x .220						50Ω - 20K
	555-102HS	X	RT22C2X	35	.535 x .500 x .220						
	701-105HS	P	RT22C2P	37	.500 x .500 x .230						10Ω - 20K
MIL-R-27208/10 1/4" SQUARE	561-105HS	P	RT26C2P	13	.170 x .250 x .250	Wiper Idles	.25 @ 85°C	150	50	5%	10Ω - 5K
	562-101HS	W	RT26C2W		.250 x .250 x .170						10Ω - 5K
	562-102HS	X	RT26C2X		.250 x .250 x .170						
MIL-R-22097/4  3/8" SQUARE	546-118HS	L	RJ24FL	25	.375 x .375 x .160	Wiper Idles	.50 @ 85°C	150	100	10%	50Ω - 1 Meg.
	547-105HS	P	RJ24FP		.375 x .375 x .170						50Ω - 1 Meg.
	548-101HS	W	RJ24FW		.417 x .375 x .170						
	548-102HS	X	RJ24FX		.417 x .375 x .170						
	870-105HS	P	RJ24FP	22	.375 x .375 x .187					10%	100Ω - 100K
	870-101HS	W	RJ24FW								
	870-102HS	X	RJ24FX								
		Also available: Characteristic "C" (250 PPM/°C)									
MIL-R-22097/5 1/4" SQUARE	860-101HS	W	RJ26FW	16	.250 x .250 x .185	Wiper Idles	.25 @ 85°C	150	100	10%	100Ω - 1 Meg.
	860-102HS	X	RJ26FX								
		Also available: Characteristic "C" (250 PPM/°C)									
MIL-R-22097/6 1/4" ROUND	567-105HS	P	RJ50CP	1	.270 Dia. x .215	Solid	.25 @ 85°C	150	250	10%	100Ω - 1 Meg

Humidity: (All Models) MIL-STD-202, Method 106

Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

Specifications Subject To Change Without Notice.

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

FAIRCHILD WESTON
Schlumberger

MILITARY APPROVED POTENTIOMETERS HI-RELIABILITY - WIREWOUND - MIL-R-39015 HI-RELIABILITY - NON-WIREWOUND - MIL-R-39035

WESTON

	Model	Terminal Type	Military Designation	Turns	Size L W T	Stops	Power Rating (W)	Max. Oper. Temp. °C	T.C. ±PPM/°C	Res. Tol. %	Resistance Range
MIL-R-39015/1 **1 1/4" RECTANGULAR**	534-160HS 535-160HS 539-160HS	L P Y	RTR12DL RTR12DP RTR12DY	24	1.25 x .315 x .190 1.25 x .315 x .190 1.25 x .325 x .195	Wiper Idles	.75 @ 85°C	150	50	5%	100Ω - 20K
		RTR12DL - "M" & "P" Failure Rate Level; RTR12DP and RTR12DY-"M" Failure Rate Level									
MIL-R-39015/2 **1/2" SQUARE**	553-160HS 555-160HS 555-161HS 701-160HS	L W X P	RTR22DL RTR22DW RTR22DX RTR22DP	35 35 35 37	.500 x .500 x .187 .535 x .500 x .220 .535 x .500 x .220 .500 x .500 x .230	Wiper Idles	.75 @ 85°C	150	50	5%	100Ω - 20K 100Ω - 20K 100Ω - 20K 10Ω - 20K
		RTR22DL & RTR22DP - "M" & "P" Failure Level; RTR22DW & RTR22DX - "M" Failure Level									
MIL-R-39015/3 **3/8" SQUARE**	543-160HS	L	RTR24DL	25	.375 x .375 x .150	Wiper Idles	.75 @ 85°C	150	50	5%	200Ω - 10K
		"M" Failure Rate Level									
MIL-R-39035/2 **3/8" SQUARE**	870-160HS 870-161HS 870-162HS	P W X	RJR24FP RJR24FW RJR24FX	22	.375 x .375 x .187	Wiper Idles	.50 @ 85°C	150	100	10%	100Ω - 100K
		Also available: Characteristic "C" (250 PPM/°C) "M" Failure Rate Level									
MIL-R-39035/3 **1/4" SQUARE**	860-160HS 860-161HS	W X	RJR26FW RJR26FX	16	.250 x .250 x .185	Wiper Idles	.25 @ 85°C	150	100	10%	100Ω - 1 Meg.
		"M" & "P" Failure Rate Level									

Humidity: (All Models) MIL-STD-202, Method 106

Terminals: L, Insulated Flexible Leads; P, Printed Circuit Pins Base Mounted; W, Printed Circuit Pins Edge Mounted 180° from Screw; X, Printed Circuit Pins Edge Mounted 90° from Screw; Y, Printed Circuit Pins Base Mounted.

Failure Rate Designation: In percent/1000 Hours M=1.0, P = 0.1, R = 0.01, S = 0.001

Specifications Subject to Change Without Notice.

Military Part Number: Consists of the document number and a dash number with letters which signify - Terminal Type and Failure Rate.

Example: M39015/1 - 001 L M

- M39015/1 — Document number
- 001 — Dash number from table
- L — Terminal type
- M — Failure rate level

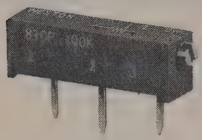
RTR12 D L 101 M

- RTR12 — Style
- D — Characteristics
- L — Terminals
- 101 — Resistance Mil-Code
- M — Failure rate level

WESTON

SERIES 830
POTENTIOMETERS
¾" LOW PROFILE CERMET

FAIRCHILD WESTON
Schlumberger



830P

- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning
- Weston hi-stability cermet element
- Wide resistance range, 10 ohms to 2 megohm
- Resistance tolerance ± 10%
- Resolution, essentially infinite
- Adjustability — 12 turns of adjustment screw
- Mechanical protection — stops and slip clutch
- High power — 0.75 watt at 70°C
- Wide operating temperature range -55°C to + 125°C
- Temperature coefficient ± 100 PPM/°C max.
- Weldable and solderable terminal pins
- Wide variety of lead configurations available

SPECIFICATIONS

ELECTRICAL

Standard Resistance Range: 10 ohms to 2 megohm

Resistance Tolerance: ± 10%

End Resistance: 2 ohms maximum

Contact Resistance Variation: 3% or 20 ohms, whichever is greater

Temperature Coefficient: ± 100 PPM/°C max.

Power Rating: 0.75 watt (in still ajr) at 70°C

Insulation Resistance: 1000 megohms minimum (500 V.D.C.)

Dielectric Strength: 900 V.A.C., Room conditions

Maximum Working Voltage: 300 V.D.C. (RMS) or within power rating, whichever is less

Continuity: Maintained for full mechanical range

Resolution: Essentially infinite

MECHANICAL

Decimal Tolerance: .XX = ±.010

Unless Otherwise Specified: .XXX = ±.005

Mechanical Protection: Stops, wiper idles

Mechanical Adjustment: 12 turns nominal

Rotational Life: 200 cycles min. with no discontinuity

Torque: 5 oz. in. maximum

Weight: 1 gram maximum

ENVIRONMENTAL

Operating Temperature Range: -55°C to + 125°C

Moisture Resistance: MIL-R-22097, MIL-STD-202, Method 106 2%*

Shock: 100 G's per MIL-R-22097 1%*

Vibration: 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D 1%*

Load Life: 1000 hrs. @ rated power per MIL-R-22097 3%*

High Temperature Exposure: MIL-R-22097, except 125°C 3%*

Low Temperature Operation: MIL-R-22097(2%*)

*ALLOWABLE RESISTANCE CHANGE

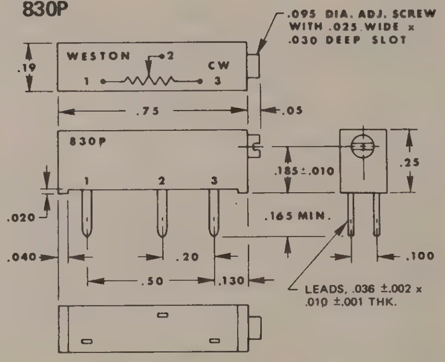
Evaluation samples available upon request.

RESISTANCE OHMS

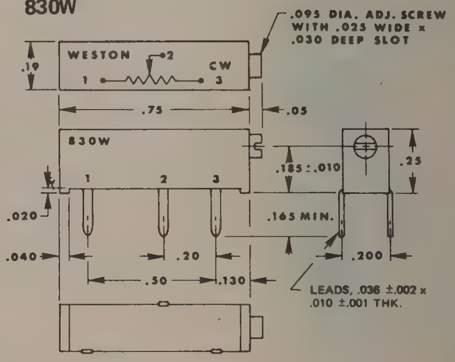
10	10K
20	20K
50	25K
100	50K
200	100K
500	200K
1K	250K
2K	500K
5K	1 MEG
	2 MEG*

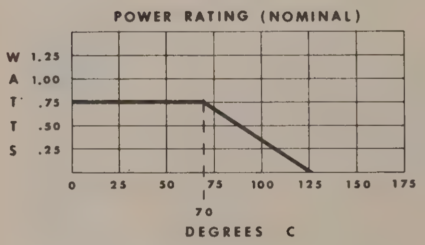
*Factory Quote

830P

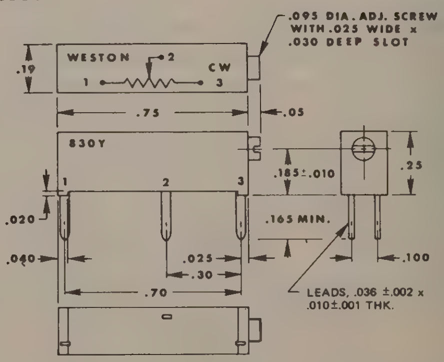

.095 DIA. ADJ. SCREW WITH .025 WIDE x .030 DEEP SLOT
WESTON
2
CW
1
3
.19
.75
.05
830P
1
2
3
.185±.010
.25
.020
.165 MIN.
.040
.20
.100
.50
.130
LEADS, .036 ±.002 x .010 ±.001 THK.

830W


.095 DIA. ADJ. SCREW WITH .025 WIDE x .030 DEEP SLOT
WESTON
2
CW
1
3
.19
.75
.05
830W
1
2
3
.185±.010
.25
.020
.165 MIN.
.040
.20
.200
.50
.130
LEADS, .036 ±.002 x .010 ±.001 THK.



830Y


.095 DIA. ADJ. SCREW WITH .025 WIDE x .030 DEEP SLOT
WESTON
2
CW
1
3
.19
.75
.05
830Y
1
2
3
.185±.010
.25
.020
.165 MIN.
.040
.025
.30
.100
.70
LEADS, .036 ±.002 x .010±.001 THK.

METRIC CONVERSION

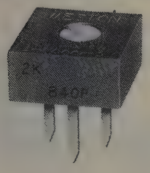
IN.	M.M.	IN.	M.M.
.001	.025	.125	3.175
.005	.127	.130	3.302
.010	.254	.165	4.191
.020	.508	.185	4.699
.025	.635	.190	4.826
.030	.762	.200	5.060
.036	.914	.250	6.350
.040	1.016	.300	7.620
.050	1.270	.500	12.700
.095	2.413	.700	17.780
.100	2.540	.750	19.050

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

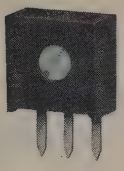
FAIRCHILD WESTON
Schlumberger

SERIES 840 POTENTIOMETERS ⅜" LOW COST CERMET

WESTON



840P



840X

- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning
- Weston hi-stability cermet element
- Wide resistance range, 10 ohms to 2 megohm
- Resistance tolerance ± 10%
- Resolution, essentially infinite
- Adjustability — single turn
- High power — 0.5 watt at 70°C
- Wide operating temperature range -55°C to + 125°C
- Temperature coefficient ± 100 PPM/°C maximum
- Weldable and solderable terminal pins

SPECIFICATIONS

ELECTRICAL

Standard Resistance Range: 10 ohms to 2 megohms

Resistance Tolerance: ± 10%

End Resistance: 2% or 20 ohms, whichever is greater

Contact Resistance Variation: 3% or 20 ohms, whichever is greater

Temperature Coefficient: ± 100 PPM/°C maximum

Power Rating: 0.5 watt (in still air) at 70°C

Insulation Resistance: 1000 megohms minimum (500 VDC)

Dielectric Strength: 900 VAC room conditions

Maximum Working Voltage: 300 VDC (RMS) or within power rating, whichever is less

Continuity: Maintained for full mechanical range

Resolution: Essentially infinite

MECHANICAL

Decimal Tolerance: .XX = ±.010

Unless Otherwise Specified: .XXX = ±.005

Stop Strength: Solid — .15 oz. in. minutes

Mechanical Adjustment: 290° nominal

Rotational Life: 200 cycles minimum with no discontinuity

Torque: 5 oz. in. maximum

Weight: 1 gram maximum

ENVIRONMENTAL

Operating Temperature Range: -55°C to + 125°C

Moisture Resistance: MIL-R-22097, MIL-STD-202, Method 106 2%*

Shock: 100 G's per MIL-R-22097 1%*

Vibration: 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D 1%*

Load Life: 1000 hours @ rated power per MIL-R-22097 3%*

High Temperature Exposure: MIL-R-22097, except 125°C 3%*

Low Temperature Operation: MIL-R-22097(2%*)

*ALLOWABLE RESISTANCE CHANGE

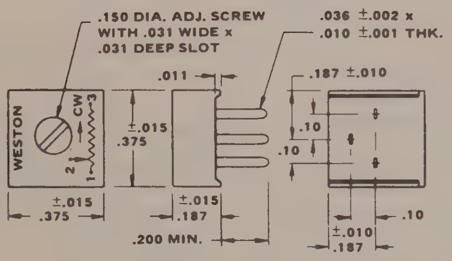
Evaluation samples available upon request.

RESISTANCE OHMS

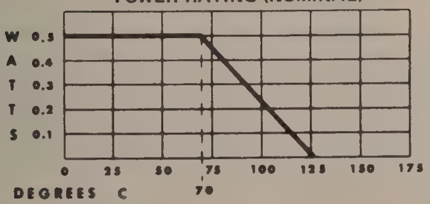
10	1K	50K
20	2K	100K
50	5K	200K
100	10K	250K
200	20K	500K
500	25K	1 MEG.
		2 MEG*

*Factory Quote

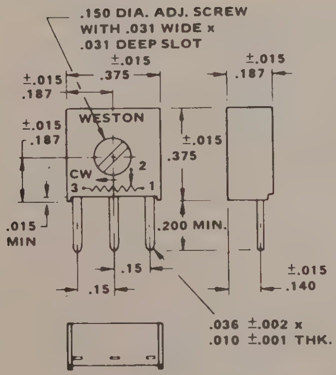
840P


.150 DIA. ADJ. SCREW
WITH .031 WIDE x
.031 DEEP SLOT
.036 ±.002 x
.010 ±.001 THK.
.011
.187 ±.010
WESTON
CW
3
2
1
±.015
.375
.10
.10
±.015
.375
±.015
.187
.200 MIN.
.10
±.010
.187

POWER RATING (NOMINAL)



840X


.150 DIA. ADJ. SCREW
WITH .031 WIDE x
.031 DEEP SLOT
±.015
.375
±.015
.187
±.015
.187
±.015
.187
WESTON
CW
3
2
1
±.015
.375
.015
MIN
.200 MIN.
.15
.15
±.015
.140
.036 ±.002 x
.010 ±.001 THK.

METRIC CONVERSION

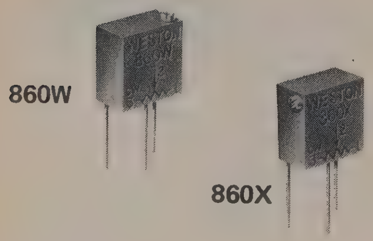
IN.	M.M.	IN.	M.M.
.001	0.025	.125	3.175
.010	0.254	.140	3.556
.011	0.279	.150	3.810
.015	0.381	.187	4.750
.031	0.787	.200	5.080
.036	0.914	.375	9.525
.100	2.540		

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

WESTON

SERIES 860
POTENTIOMETERS
¼" LOW COST CERMET

FAIRCHILD WESTON
Schlumberger



- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning
- Wide resistance range, 10 ohms to 1 megohm
- Weston hi-stability cermet element
- Mechanical protection, stop and clutches
- Resolution, essentially infinite
- Adjustments ratio 16 to 1

SPECIFICATIONS

ELECTRICAL

Standard Resistance Range: 10 ohms to 1 megohm

Resistance Tolerance: ± 10%

Contact Resistance Variation: 3% or 20 ohms, whichever is greater

Temperature Coefficient: ± 100 P.P.M./°C max.

Power Rating: 0.5 watt at 85°C

Insulation Resistance: 1000 megohms minimum (500 V.D.C.)

Dielectric Strength: 600 V.A.C. room conditions

Maximum Working Voltage: 200 V.D.C. (RMS) or within power rating, whichever is less

Continuity: Maintained for full mechanical range

Resolution: Essentially infinite

MECHANICAL

Mechanical Protection: Slip clutch, wiper idles

Mechanical Adjustment: 16 turns nominal

Rotational Life: 200 cycles min. with no discontinuity

Torque: 3 oz. in. maximum

Weight: .5 gram maximum

ENVIRONMENTAL

Operating Temperature Range: -55°C to + 150°C

Moisture Resistance: MIL-R-22097, MIL-STD-202, Method 106

Shock: 100 G's per MIL-R-22097

Vibration: 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D

Load Life: 1000 hrs. @ rated power per MIL-R-22097

High Temperature Exposure: MIL-R-22097

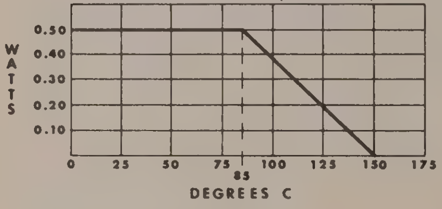
Low Temperature Operation: MIL-R-22097

Evaluation samples available upon request.

RESISTANCE OHMS

10	200	5K	100K
20	500	10K	200K
50	1K	20K	250K
100	2K	50K	500K
			1 Meg

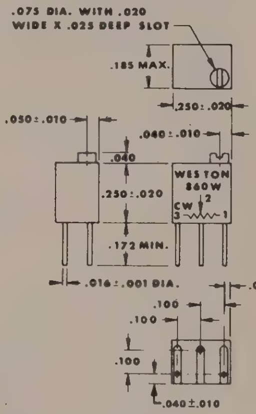
POWER RATING (NOMINAL)



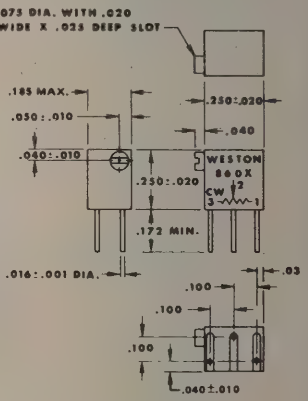
METRIC CONVERSIONS

In.	M.M.	In.	M.M.
.001	0.025	.050	1.270
.005	0.127	.075	1.905
.010	0.254	.100	2.540
.016	0.406	.172	4.369
.020	0.508	.185	4.699
.025	0.635	.250	6.350
.030	0.762	.300	7.620
.040	1.016		

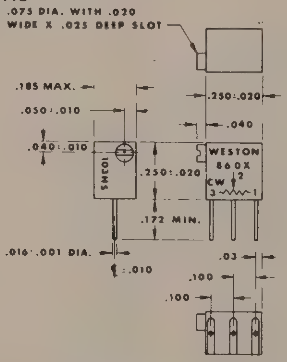
860W


.075 DIA. WITH .020 WIDE X .025 DEEP SLOT
.185 MAX.
.250±.020
.050±.010
.040±.010
.040
WESTON 860W
CW 2 3 1
.250±.020
.172 MIN.
.016±.001 DIA.
.03
.100
.100
.100
.040±.010

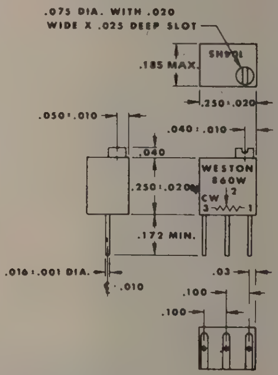
860X


.075 DIA. WITH .020 WIDE X .025 DEEP SLOT
.185 MAX.
.250±.020
.050±.010
.040
.040±.010
WESTON 860X
CW 2 3 1
.250±.020
.172 MIN.
.016±.001 DIA.
.03
.100
.100
.100
.040±.010

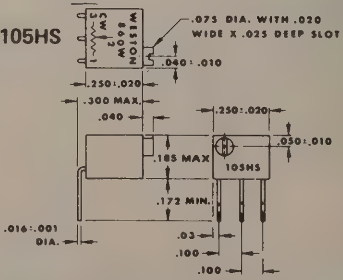
860-103HS


.075 DIA. WITH .020 WIDE X .025 DEEP SLOT
.185 MAX.
.250±.020
.050±.010
.040
.040±.010
103HS
WESTON 860X
CW 2 3 1
.250±.020
.172 MIN.
.016±.001 DIA.
±.010
.03
.100
.100

860-104HS


.075 DIA. WITH .020 WIDE X .025 DEEP SLOT
104HS
.185 MAX.
.250±.020
.050±.010
.040±.010
.040
WESTON 860W
CW 2 3 1
.250±.020
.172 MIN.
.016±.001 DIA.
±.010
.03
.100
.100

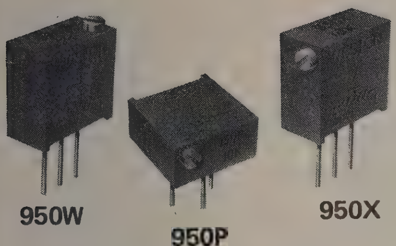
860-105HS


WESTON 860W
CW 2 3 1
.075 DIA. WITH .020 WIDE X .025 DEEP SLOT
.040±.010
.250±.020
.300 MAX.
.040
.250±.020
.050±.010
.185 MAX
105HS
.172 MIN.
.016±.001 DIA.
.03
.100
.100

FAIRCHILD WESTON
Schlumberger

SERIES 950 POTENTIOMETERS ⅜" LOW COST CERMET

WESTON


950W
950P
950X

- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning
- Weston hi-stability cermet element
- Wide resistance range, 10 ohms to 2 megohm
- Resistance tolerance ± 10%
- Resolution, essentially infinite
- Adjustability — 22 turns nominal
- High power — 1 watt at 50°C
- Wide operating temperature range -55°C to + 150°C
- Temperature coefficient ± 100 PPM/°C max.

SPECIFICATIONS

ELECTRICAL

Standard Resistance Range: 10 ohms to 2 megohms

Resistance Tolerance: ± 10%

End Resistance: 2 ohms maximum

Contact Resistance Variation: 3% or 20 ohms, whichever is greater

Temperature Coefficient: ± 100 PPM/°C maximum

Power Rating: 1 watt at 50°C

Insulation Resistance: 1000 megohms minimum (500 VDC)

Dielectric Strength: 900 VAC room conditions

Maximum Working Voltage: 300 VDC (RMS) or within power rating, whichever is less

Continuity: Maintained for full mechanical range

Resolution: Essentially infinite

MECHANICAL

Decimal Tolerance: .XX = ±.010

Unless Otherwise Specified: .XXX = ±.005

Mechanical Protection: Slip clutch, wiper idles

Mechanical Adjustment: 22 turns nominal

Rotational Life: 200 cycles minimum with no discontinuity

Torque: 5 oz. in. maximum

Weight: 1 gram maximum

ENVIRONMENTAL

Operating Temperature Range: -55°C to + 150°C

Moisture Resistance: MIL-R-22097, MIL-STD-202, Method 106 2%*

Shock: 100 G's per MIL-R-22097 1%*

Vibration: 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D

Load Life: 1000 hours @ rated power per MIL-R-22097 3%*

High Temperature Exposure: MIL-R-22097 3%*

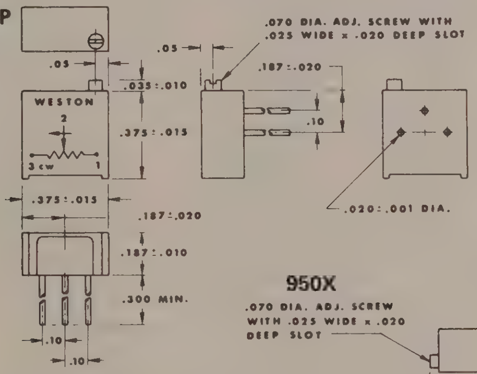
Low Temperature Operation: MIL-R-22097(2%*)

*ALLOWABLE RESISTANCE CHANGE

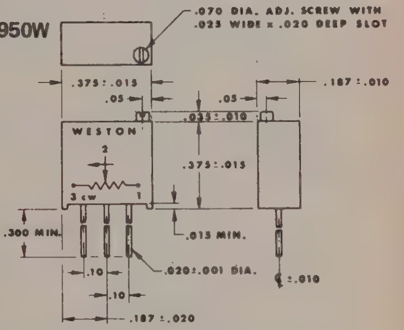
Evaluation samples available upon request.

RESISTANCE	OHMS
10	10 K
20	20 K
50	25 K
100	50 K
200	100 K
500	200 K
1 K	250 K
2 K	500 K
5 K	1 Meg
	2 Meg

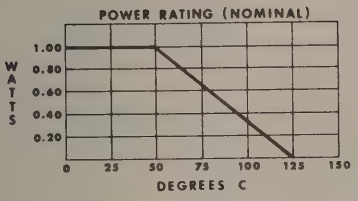
950P


.070 DIA. ADJ. SCREW WITH .025 WIDE x .020 DEEP SLOT
.05
.05
.035±.010
.187±.020
WESTON
2
3 cw
1
.375±.015
.10
.020±.001 DIA.
.375±.015
.187±.020
.187±.010
.300 MIN.
.10
.10

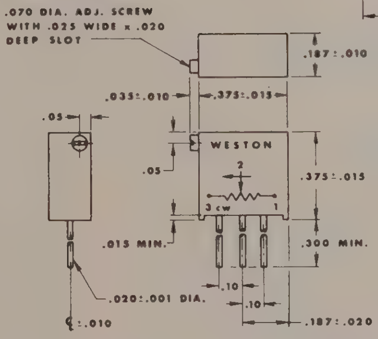
950W


.070 DIA. ADJ. SCREW WITH .025 WIDE x .020 DEEP SLOT
.375±.015
.05
.05
.187±.010
.035±.010
WESTON
2
3 cw
1
.375±.015
.300 MIN.
.015 MIN.
.020±.001 DIA.
.10
.10
℄±.010
.187±.020

POWER RATING (NOMINAL)



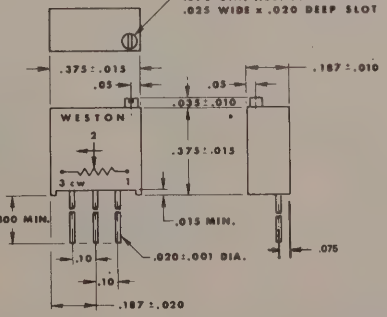
950X


.070 DIA. ADJ. SCREW WITH .025 WIDE x .020 DEEP SLOT
.187±.010
.035±.010
.375±.015
.05
WESTON
2
3 cw
1
.05
.375±.015
.015 MIN.
.300 MIN.
.10
.10
.020±.001 DIA.
℄±.010
.187±.020

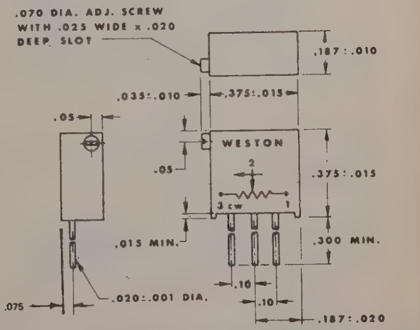
METRIC CONVERSION

INCHES	M.M.	INCHES	M.M.
.001	0.025	.050	1.270
.010	0.254	.070	1.778
.015	0.381	.100	2.540
.020	0.508	.187	4.750
.025	0.635	.300	7.620
.035	0.889	.375	9.525

950W - 115


.070 DIA. ADJ. SCREW WITH .025 WIDE x .020 DEEP SLOT
.375±.015
.05
.05
.187±.010
.035±.010
WESTON
2
3 cw
1
.375±.015
.300 MIN.
.015 MIN.
.020±.001 DIA.
.075
.10
.10
.187±.020

950X - 116


.070 DIA. ADJ. SCREW WITH .025 WIDE x .020 DEEP SLOT
.187±.010
.035±.010
.375±.015
.05
WESTON
2
3 cw
1
.05
.375±.015
.015 MIN.
.300 MIN.
.075
.020±.001 DIA.
.10
.10
.187±.020

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

WESTON

TRIMMER POTENTIOMETER CROSS-REFERENCE GUIDE

FAIRCHILD WESTON
Schlumberger

THIS GUIDE PROVIDES A FAST CROSS-REFERENCE BETWEEN WESTON PRODUCTS AND COMPETITIVE UNITS OFFERED BY OTHER POTENTIOMETER COMPANIES. IT IS NOT MEANT TO INFER *EXACT* INTERCHANGEABILITY IN ALL INSTANCES. FOR FURTHER INFORMATION CONCERNING PRODUCT SUBSTITUTES CONTACT YOUR WESTON SALES REPRESENTATIVE OR DISTRIBUTOR.

NOTE 1: Where a Weston series number is followed by a Mil-Designation style (EG: RT22C2P) this type unit is listed on the Qualified Product List (QPL). The competitive unit would also appear on the QPL list unless otherwise noted.

COMPETITIVE PART NUMBERS

ALLEN BRADLEY

75P 102 M
BASIC TYPE
TAPER AND RESISTANCE TOLERANCE
NOMINAL RESISTANCE VALUE

OR

E 2A 103
BASIC TYPE
RESISTANCE VALUE
TERMINAL TYPE & ADJUSTMENT LOCATION

LITTON INDUSTRIES/POTENTIOMETER DIV. (FORMERLY AMPHENOL (BORG))

992 P-100 M
MODEL NO.
PANEL MOUNT
TERMINAL TYPE
RESISTANCE CODE

BECKMAN (HELIPOT)

77P R10K
MODEL
RESISTANCE VALUE

BOURNS

200 L 1 102 M
MODEL NO.
PANEL MOUNT
TERMINAL TYPE
RESISTANCE CODE
CATALOG ITEM (2 OR 3 DIGITS INDICATE A SPECIAL)

CTS

362 S 500 B
MODEL NO.
RESISTANCE TOLERANCE
ADJUSTMENT LOCATION (SIDE OR TOP)
RESISTANCE CODE

DALE

817-200-5%
MODEL NO.
RESISTANCE TOLERANCE
RESISTANCE VALUE

MEPCO/ELECTRA

ET 24 * P 103 ***
PRODUCT TYPE
MODIFICATION KEY NUMBER
MODEL DESIGNATION
RESISTANCE VALUE CODE NO.
QPL (IF REQUIRED)
PIN OR LEAD DESIGNATION

OR

8014 E M F 103
SERIES
RESISTANCE VALUE
PIN STYLE
E = INDUSTRIAL
J = RJ
R = RJR
TOLERANCE
M = ±20%
K = ±10%
J = ±5%

VRN ST. PETERSBURG (FORMERLY IRC (TRW))

205 00 1K
TYPE NUMBER
RESISTANCE VALUE
TERMINAL STYLE (WHERE APPLICABLE)

SPECTROL

41 2 1 100 P
MODEL NO.
PANEL MOUNT (IF APPLICABLE)
RESISTANCE VALUE
TERMINAL STYLE
SHAFT & OTHER FEATURES

TECHNO

17 S - 1K
MODEL NO.
RESISTANCE VALUE
CLUTCH STOP

WESTON

555 00HS P 10K
SERIES
RESISTANCE VALUE
MODEL & SUFFIX
PANEL MOUNT (IF APPLICABLE)

ALLEN-BRADLEY	WESTON
75P	830P
75W	830W
75F	830P
81E	566-00HS
85P	850P (or 950P)
85W	850W (or 950W)
85X	850X (or 950X)
94P	830P
94PS	830P
RT5H	830P
RT5L	830P
RT6H	830W
RT6L	830W
RT7H	830Y
RT7L	830Y
SV	567-00HS
ZA	566-00HS
ZV	567-00HS
A2A	566-00HS
A2B	567-00HS
E2A	840P
E4C	840X
E4F*	840X
E4H	840X
MT2P	850Y
MT2W	850W (or 950W-115)
MT2X	850W (or 950W)
MT4P	850P (or 950P)
MT4X	850X (or 950X-116)
MT4Y	850X (or 950X)

*Terminals are Reversed

NOTE: Weston Models 830, 840 & 850 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

LITTON INDUSTRIES/POTENTIOMETER DIV.
Formerly

AMPHENOL (BORG)	WESTON
992L	534-00HS
992P	539-00HS
994L	534-00HS
994P	539-00HS
2300P	544-105HS (RT24C2P)
2300W	545-101HS (RT24C2W)
2300X	545-102HS (RT24C2X)
2301P	870-105HS (RJ24FP)
2301W	870-101HS (RJ24FW)
2301X	870-102HS (RJ24FX)
2305P	870-105HS (RJ24FP)
2305W	870-101HS (RJ24FW)
2305X	870-102HS (RJ24FX)
2600P (Wirewound)	830P (Cermet)
2610P (Wirewound)	830P (Cermet)
2750L	534-118HS (RT12C2L)
2750P	535-105HS (RT12C2P)
2850L	534-00HS
2850P	539-00HS
2860L	534-00HS
2860P	539-00HS
2870L	534-00HS
2880L	534-00HS
2900L	553-118HS (RT22C2L)
2900P	701-105HS (RT22C2P)
2900W	555-101HS (RT22C2W)
2900X	555-102HS (RT22C2X)

LITTON INDUSTRIES/POTENTIOMETER DIV.
Formerly

AMPHENOL (BORG)	WESTON
3600P	544-00HS
3600W	545-00HS
3600X	545-72HS
3610P	544-00HS
3610W	545-00HS
3610X	545-72HS
3800K (Wirewound)	830W (Cermet)
3800P (Wirewound)	830P (Cermet)
3805K	830W
3805P	830P
3810K (Wirewound)	830W (Cermet)
3810P (Wirewound)	830P (Cermet)
3811K	830W
3811P	830P
3815K	830W
3815P	830P
6034K	830W
6034P	830P
6034Y	830Y
6203P	566-00HS
6900P	1000-69HS
6905P	840P

NOTE: Weston Model 830 & 840. Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

BECKMAN (HELIPOT)	WESTON
61PN	566-00HS
61MN	567-00HS
62M	567-00HS
62P	566-00HS
62PF	566-00HS
RJ24FP	870-105HS (RJ24FP)
RJ24FW	870-101HS (RJ24FW)
RJ24FX	870-102HS (RJ24FX)
RJ50	567-105HS (RJ50CP)
63P	850P (or 950P)
63W	850W (or 950W)
63X	850X (or 950X)
66P	547-00HS (or 850P)(or 950P)
66W	548-00HS (or 850W)(or 950W)
66X	548-72HS (or 850X)(or 950X)
67P	850P (or 950P)
67W	850W (or 950W)
67X	850X (or 950X)
67Y	850Y
67Z	850Z
68P	850P (or 950P)
68W	850W (or 950W-115)
68X	850X (or 950X-116)
72P	840P
72RXW*	840X
72XW	840X
76P	830Y
77P	830W
79P	830P
82P	566-00HS
82PF	566-00HS
89P	830P
89W	830W
89X	830Y
RJR24FP	870-160HS (RJR24FP)
RJR24FW	870-161HS (RJR24FW)
RJR24FX	870-162HS (RJR24FX)

*Schematic is Reversed

NOTE: Weston Models 830, 840 & 850 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

FAIRCHILD WESTON
Schlumberger

TRIMMER POTENTIOMETER CROSS- REFERENCE GUIDE

WESTON

BOURNS	WESTON
200L	534-00HS
200L-M (Panel Mount)	
200P	539-00HS
224L**	534-118HS (RT12C2L)
224L-M (Panel Mount)	
224P**	535-105HS (RT12C2P)
224Y**	539-105HS (RT12C2Y)
M224L**	534-118HS (RT12C2L)
M224P**	535-105HS (RT12C2P)
M224Y**	539-105HS (RT12C2Y)
224L-500**	534-160HS (RTR12DL)
224P-500**	535-160HS (RTR12DP)
236L	534-00HS
236L-M (Panel Mount)	
236P	539-00HS
260L	534-00HS
260L-M (Panel Mount)	
260P	539-00HS
271	534-00HS
271-M (Panel Mount)	
275	539-00HS
3005P (Wirewound)	830P (Cermet)
3006P	830P
3006W	830W
3006Y	830Y
3007P (Wirewound)	830P (Cermet)
3009P	830P
3009Y	830Y
3010L**	534-118HS (RT12C2L)
3010L-M (Panel Mount)	
3010P**	539-105HS (RT12C2Y)
3057L	534-00HS
3057L-M (Panel Mount)	
3057P	535-00HS
3057Y	539-00HS
R3057L	534-118HS (RT12C2L)
R3057P	535-105HS (RT12C2P)
R3057Y	539-105HS (RT12C2Y)
R3057L	534-160HS (RTR12DL)
R3057P	535-160HS (RTR12DP)
R3057Y	539-160HS (RTR12DY)
3065P (Wirewound)	830W (Cermet)
3066P	830W
3067P (Wirewound)	830W (Cermet)
3068P	830W
3069P	830W
3082P	522-00HS
3250L	553-118HS (RT22C2L)
3250L-M (Panel Mount)	
3250P	701-105HS (RT22C2P)
3250W	555-101HS (RT22C2W)
3250W-66	555-102HS (RT22C2X)
M3250L	553-118HS (RT22C2L)
M3250L-M (Panel Mount)	
M3250P	701-105HS (RT22C2P)
M3250W	555-101HS (RT22C2W)
M3250X	555-102HS (RT22C2X)
M3250L-501	553-160HS (RTR22DL)
M3250L-501M (Panel Mount)	
M3250P-501	701-160HS (RTR22DP)
M3250W-501	555-160HS (RTR22DW)
M3250W-66-501	555-161HS (RTR22DX)
3255L	553-00HS
3255L-M (Panel Mount)	
3255P	701-00HS
3255W	555-00HS
3255W-66	555-72HS
R3260W	562-101HS (RT26C2W)
R3260X	562-102HS (RT26C2X)
3260H	562-102HS (RT26C2X)
3260W	562-101HS (RT26C2W)
3262W	860W
3262X	860X
B3262W (3262W)	860-101HS (RJ26FW)
B3262X (3262X)	860-102HS (RJ26FX)
3262W	860-160HS (RJR26FW)
3262X	860-161HS (RJR26FX)
3279W	860W
3279X	860X
3280L	543-00HS
3280P	544-00HS
3280W	545-00HS
3280W-66	545-72HS
3281L	546-00HS
3281P	547-00HS (or 850P)(or 950P)
3281W	548-00HS (or 850W)(or 950W-115)
3281W-66	548-72HS (or 850X)(or 950X-116)
3282L	546-00HS
3282P	547-00HS (or 850P)(or 950P)
3282W	548-00HS (or 850W)(or 950W-115)
3282H	548-72HS (or 850X)(or 950X-116)
3290L	543-118HS (RT24C2L)
3290P	544-105HS (RT24C2P)
3290W	545-101HS (RT24C2W)
3290X (H)	545-102HS (RT24C2X)
A3290P	544-105HS (RT24C2P)
A3290W	545-101HS (RT24C2W)
A3290X	545-102HS (RT24C2X)
M3290P	544-160HS (RTR24DP)
M3290W	545-160HS (RTR24DW)
M3290X (H)	545-161HS (RTR24DX)
3292L (B3292L)	546-118HS (RJ24FL)
3292P (B3292P)	870-105HS (RJ24FP)
3292W (B3292W)	870-101HS (RJ24FW)
3292X (B3292X)	870-102HS (RJ24FX)
B3292P	870-160HS (RJR24FP)
B3292W	870-161HS (RJR24FW)
B3292X	870-162HS (RJR24FX)
3296W	950W
3296X	950X
3299P	547-00HS (or 850P)(or 950P)
3299W	548-00HS (or 850W) (or 950W-115)
3299X	548-72HS (or 850X)(or 950X-116)
3299Y	850Y
3299Z	850Z
3322P**	567-105HS (RJ50CP)
3326P	567-00HS
3329H	566-00HS
3329P	567-00HS
3339P (4 turns)	860W (16 turns)
3339W (4 turns)	860X (16 turns)
3345P	1000-67HS
3345P (TW)	1000-00HS
3345W	1000-68HS
3345W (TW)	1000-75HS
(TW-Thumbwheel)	
3386B***	840X
3386J ****	840X
3386P	840P
3386S*****	840X
3389P	840P
3389S*	840X

*Terminals are Reversed
**Not Listed on QPL
***Schematic is Reversed
****Schematic is Reversed; Terminals Located on Center Line
*****Terminals & Schematic is Reversed; Terminals Located on Center Line

Bourns model number with letter prefix indicates type unit listed on QPL (Example: M3250L)

NOTE: Weston Models 830, 840 & 850 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

CTS	WESTON
M164P**	870-105HS (RJ24FP)
M165W**	870-101HS (RJ24FW)
M165X**	870-102HS (RJ24FX)
186	830P
187	830W
188	830Y
190	830P
191	830W
192	830Y
340	566-00HS
345	566-00HS
345Y	567-00HS
360S*	840X
362Y	840P

*Terminals are Reversed **Not Listed on QPL

NOTE: Weston Models 830 & 840 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

DALE	WESTON
100SX	840W
100TX	840T
101SX*	840H
101T	840P
102T	840M
150SX	840X
150TX***	840R
195	534-00HS
295	534-00HS
721 (Wirewound)	830Y (Cermet)
723 (Wirewound)	830W (Cermet)
724 (Wirewound)	830P (Cermet)
781	830Y
783	830W
784	830P
817	522-00HS
887	522-00HS
1186 (Panel Mount)	
1187	539-00HS
1188	534-00HS
1286 (Panel Mount)	
1287	539-00HS
1288	534-00HS
1580	535-00HS
1597	534-00HS
1680	535-105HS (RT12C2P)
1686 (Panel Mount)	
1697	534-118HS (RT12C2L)
1880	534-160HS (RTR12DL)
1897	535-160HS (RTR12DP)
2186 (Panel Mount)	
2187	539-00HS
2188	534-00HS
2317 (Wirewound)	830W (Cermet)
2387 (Wirewound)	830W (Cermet)
2417 (Wirewound)	830P (Cermet)
2487 (Wirewound)	830P (Cermet)
2723 (Wirewound)	830W (Cermet)
2724 (Wirewound)	830P (Cermet)
5050**	553-118HS (RT22C2L)
5080**	555-101HS (RT22C2W)
5087**	555-102HS (RT22C2X)
5091**	701-105HS (RT22C2P)
5850**	543-118HS (RT24C2L)
5880**	545-101HS (RT24C2W)
5887**	545-102HS (RT24C2X)
5891**	544-105HS (RT24C2P)
8317	830W
8387	830W
8417	830P
8487	830P
8781	830Y
8783	830W
8784	830P

*Terminals are Reversed
**Not Listed on QPL
***Schematic is Reversed

NOTE: Weston Models 830 & 840 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

WESTON

TRIMMER POTENTIOMETER CROSS- REFERENCE GUIDE

FAIRCHILD WESTON
Schlumberger

MEPCO/ELECTRA	WESTON
E24L	546-00HS
ET24P (8024EKX)	547-00HS (or 850P) (or 950P)
ET24W (8024EKA)	548-00HS (or 850W) (or 950W)
ET24X (8024EKN)	548-72HS (or 850X) (or 950X)
ET26W (8026EKB)	860W
ET26X (8026EKM)	860X
ET34P (8034EKP)	830P
ET34X (8034EKR)	830Y
ET34Y (8034EKO)	830W
(8035EKP)	830P
(8035EKR)	830Y
ET38P (8038EKP)	840P
(8038EKY)**	840X
(8038EKZ)***	840X
ET50P (8014EKB)	567-00HS
ET50W (8014EKF)	566-00HS
(8014EMB)	567-00HS
(8014EMF)	566-00HS
RJ24L*	546-118HS (RJR24FL)
RJ24P	870-105HS (RJ24FP)
RJ24W	870-101HS (RJ24FW)
RJ24X	870-102HS (RJ24FX)
RJ26W	860-101HS (RJ26FW)
RJ26X	860-102HS (RJ26FX)
RJ50P (RF50)	567-105HS (RF50CP)
RJR24P	870-160HS (RJR24FP)
RJR24W	870-161HS (RJR24FW)
RJR24X	870-162HS (RJR24FX)
RJR26W	860-160HS (RJR26FW)
RJR26X	860-161HS (RJR26FX)

*Not Listed on QPL **Schematic is Reversed
***Terminals & Schematic is Reversed
NOTE: Weston Models 830 & 840 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

VRN St. Petersburg Formerly IRC (TRW)	WESTON
76-10	840P
76-70	840X
76-72**	840X
100	1000-69HS (or 1000-67HS)
106-2	1000-68HS
110	1000-00HS (or 1000-73HS)
170	566-00HS
171	567-00HS
180	566-00HS
181	567-105HS (RJ50CP)
205-00	553-118HS (RT22C2L)
205-10	701-105HS (RT22C2P)
205-60 (Panel Mount)	
205-207	555-102HS (RT22C2X)
205-208	555-101HS (RT22C2W)
260-207	860-102HS (RJ26FX)
260-208	860-101HS (RJ26FW)
261-207 (260-207)	860-161HS (RJR26FX)
261-208 (260-208)	860-160HS (RJR26FW)
400-00	534-118HS (RT12C2L)
400-10	535-105HS (RT12C2P)
400-20	539-105HS (RT12C2Y)
400-60 (Panel Mount)	
500	1000-00HS
501	1000-69HS
502	1000-67HS
506	1000-75HS
600-00	534-00HS
600-00M (Panel Mount)	
600-20	539-00HS
700-00	543-118HS (RT24C2L)
700-10	544-105HS (RT24C2P)
700-207	545-102HS (RT24C2X)
700-208	545-101HS (RT24C2W)
700-307	545-72HS
700-308	545-00HS
701-10	544-160HS (RTR24DP)
701-207	545-161HS (RTR24DX)
701-208	545-160HS (RTR24DW)
750-10	870-105HS (RJ24FP)
750-307 (750-207)	870-102HS (RJ24FX)
750-308 (750-208)	870-101HS (RJ24FW)
751-10	870-160HS (RJR24FP)
751-307	870-162HS (RJR24FX)
751-308	870-161HS (RJR24FW)

VRN St. Petersburg Formerly IRC (TRW)	WESTON
752-10	950P
752-207	950X
752-208	950W
752-407	850Y
752-408	850Z
RJ24FP (752 10)	870-105HS (RJ24FP)
RJ24FW (752-208)	870-101HS (RJ24FW)
RJ24FX (752-207)	870-102HS (RJ24FX)
760-10	840P
760-72	840X
780-10A*	840P
780-12P	840P
780-40X*	840X
780-70B	840X
780-72S*	840X
780-73J	840X
800-20	502-72HS
800-208	502-00HS
850-20	860X
850-208	860W
910-20 (Wirewound)	830P (Cermet)
910-30 (Wirewound)	830P (Cermet)
930-20 (Wirewound)	830W (Cermet)
960-20	830P
980-20	830W
989-20	830Y
961-20	830P
981-20	830W
988-20	830Y

*Terminals are Reversed **Terminals & Schematic are Reversed
NOTE: Weston Models 830 & 840 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

SPECTROL	WESTON .
40L	534-118HS (RT12C2L)
40P	535-105HS (RT12C2P)
40Y	539-105HS (RT12C2Y)
41-2-1	830P
41-3-1	830W
41-4-1	830Y
42-1-1	534-00HS
42-1-1XXXP (Panel Mount)	
42-1-10*	534-118HS (RT12C2L)
42-2-1	535-00HS
42-2-10*	535-105HS (RT12C2P)
43P	830P
43W	830W
43Y	830Y
44-1-1	534-00HS
44-1-1-XXXP (Panel Mount)	
44-2-1	539-00HS
50-1-10	543-00HS
50-1-11	543-00HS
50-2-10	545-72HS
50-2-11	545-72HS
50-3-10	545-00HS
50-3-11	545-00HS
50-4-10	544-00HS
50-4-11	544-00HS
50-5-10*	544-105HS (RT24C2P)
51-2-10*	545-102HS (RT24C2X)
51-3-10*	545-101HS (RT24C2W)
51-4-10*	544-105HS (RT24C2P)
52P	850P (or 950P)
52W	850W (or 950W-115)
52X	850X (or 950X-116)
52Y	850Y
52Z	850Z
55-1-8	553-00HS
55-1-8-XXXP (Panel Mount)	
55-2-8	555-72HS
55-3-8	555-00HS
55-4-8	701-00HS
55-1-10	553-118HS (RT22C2L)
55-1-10-XXXP (Panel Mount)	
55-2-10	555-102HS (RT22C2X)
55-3-10	555-101HS (RT22C2W)
55-4-10	701-105HS (RT22C2P)
55-1-12 †	553-00HS
55-1-12-XXXP † (Panel Mount)	
55-2-12 †	555-72HS
55-3-12 †	555-00HS
55-4-12 †	701-00HS
55-1-20	553-118HS (RT22C2L)
55-1-20-XXXP (Panel Mount)	
55-2-20	555-102HS (RT22C2X)
55-3-20	555-101HS (RT22C2W)
55-4-20	701-105HS (RT22C2P)
62-1-1	566-00HS
62-1-2	566-00HS
62-3-1	567-00HS
62-3-2	567-00HS
63P-1	840P
63P-2	840P
63V-1	840X
63V-2	840X
64P	850P (or 950P)
64W	850W (or 950W-115)
64X	850X (or 950X-116)
64Y	850Y
64Z	850Z
65P-1	566-00HS
65Y-1	567-00HS
74-1-1	534-00HS
74-1-1-XXXP (Panel Mount)	
74-2-1	539-00HS
84-3-8	1000-69HS
84-3-10	1000-00HS
94-1-1	534-00HS
94-1-1-XXXP (Panel Mount)	
94-2-1	539-00HS

†Continuous Rotation *Not Listed on QPL
NOTE: Weston Models 830, 840 & 850 - Terminal Lead Dimension is .036±.002 x .010±.001 (Thickness)

TECHNO	WESTON
17S	562-101HS (RT26C2W)
18S	562-102HS (RT26C2X)
85S	545-00HS
95S	545-72HS
101S	543-00HS
117S	543-118HS (RT24C2L)
126S	544-105HS (RT24C2P)
129S	544-00HS
133S	544-105HS (RT24C2P)
151S	545-101HS (RT24C2W)
155S	545-00HS
176S	545-102HS (RT24C2X)
181S	545-72HS
226	870-105HS (RJ24CP)
229	547-00HS (or 850P) (or 950P)
251	870-101HS (RJ24CW)
276	870-102HS (RJ24CX)
285	548-00HS (or 850W) (or 950W)
286	548-00HS (or 850W) (or 950W)
295	548-72HS (or 850X) (or 950X)
296	548-72HS (or 850X) (or 950X)
410	870-102HS (RJ24FX)
411	870-101HS (RJ24FW)
412	870-105HS (RJ24FP)
(Type 452) P	870-105HS (RJ24FP)
(Type 452) W	870-101HS (RJ24FW)
(Type 452) X	870-102HS (RJ24FX)
715 (RJ50)	567-105HS (RJ50CP)
717	860-101HS (RJ26FW)
718	860-102HS (RJ26FX)
719	566 00HS
(Type 752) W	860-101HS (RJ26FW)
(Type 752) X	860-102HS (RJ26FX)
M39015/3–L (Type 117S)	543-160HS (RTR24DL)
M39015/3–P (Type 126S)	
M39015/3–W (Type 151S)	
M39015/3–X (Type 176S)	
RJR24 (FP) (Type 450, 452)	870-160HS (RJR24FP)
RJR24 (FW) (Type 450, 452)	870-161HS (RJR24FW)
RJR24 (FX) (Type 450, 452)	870-162HS (RJR24FX)
RJR26 (Type 717) (Type 750)	860-160HS (RJR26FW)
RJR26 (Type 718) (Type 750)	860-161HS (RJR26FX)

WESTON CONTROLS • Archbald, Pennsylvania 18403 • Tel: (717) 876-1500 • Telex: 83-1873 • TWX: 510-656-2902

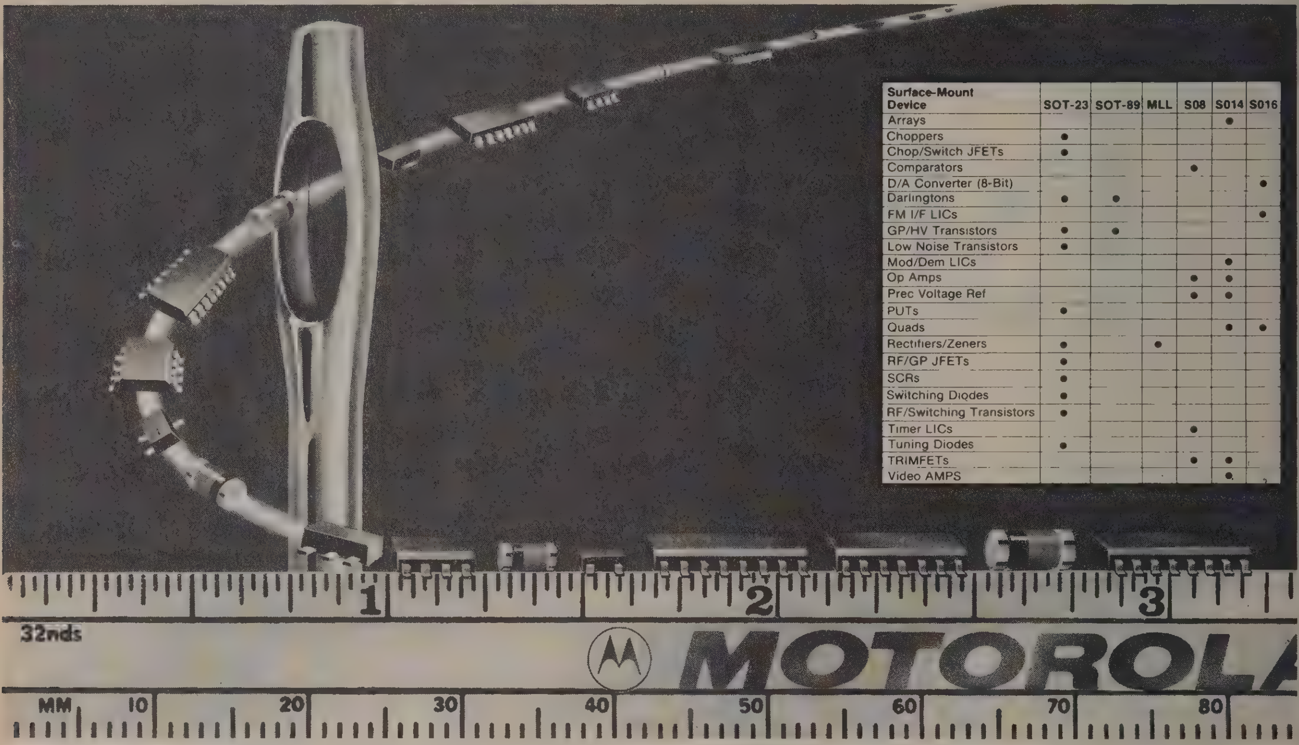
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms ..... **1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code ..... **3**•1103
Batteries, Product Selection Guide ..... **3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **2**•1003
Capacitors, Basic Formulas ..... **1A**•1093
Capacitors, Miniglossary ..... **1A**•1069
Capacitors, Product Selection Guide ..... **1A**•1003
Circuit Boards (Printed), Product Selection Guide ..... **2**•1089
Coils, Chokes, & Inductors, Product Selection Guide ..... **1A**•1219
Connectors, Miniglossary ..... **2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide ..... **2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **1A**•1309
Delay Lines, Product Selection Guide ..... **1A**•1445
Discrete Semiconductors, Product Selection Guide ..... **1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **1B**•1021
EBCDIC Code ..... **3**•1153
Encapsulation, Miniglossary ..... **2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **2**•1801
Filters, Product Selection Guide ..... **1A**•1577
Instruments, Graphic Recording, Product Selection Guide ..... **3**•1381
Instruments, Panel Meters, Product Selection Guide ..... **3**•1321
Instruments, Test & Measuring, Product Selection Guide ..... **3**•1182
Interconnection Systems, Product Selection Guide ..... **2**•1873
Keyboards & Keypads, Product Selection Guide ..... **1B**•1759
Microwave Components, Product Selection Guide ..... **1A**•1685
Military Qualified Products Lists ..... **1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **1B**•1121
Opto Semiconductors, Miniglossary ..... **1B**•1218
Oscilloscopes, Product Selection Guide ..... **3**•1361
Panel Hardware, Product Selection Guide ..... **2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **1A**•2017
Power Supplies, Miniglossary ..... **3**•1455
Power Supplies, AC, Product Selection Guide ..... **3**•1815
Power Supplies, DC, Product Selection Guide ..... **3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **1B**•1255
Relay Contact Forms ..... **1B**•1317
Relays, Electromechanical, Miniglossary ..... **1•B**1292
Relays, Product Selection Guide ..... **1B**•1289
Resistor Color Codes ..... **1A**•1791
Resistors, Product Selection Guide ..... **1A**•1789
Servo Components, Miniglossary ..... **3**•1935
Solenoids, Product Selection Guide ..... **1B**•1481
Switches, Product Selection Guide ..... **1B**•1499
Thyristors/High Power Diodes, Miniglossary ..... **1A**•1652
Transducers & Encoders, Product Selection Guide ..... **1B**•1827
Transformers, Product Selection Guide ..... **1A**•2115
Wire & Cable, Product Selection Guide ..... **2**•1935

More squeeze per square inch. Motorola surface mount.



Surface-Mount Device	SOT-23	SOT-89	MLL	S08	S014	S016
Arrays					●	
Choppers	●					
Chop/Switch JFETs	●					
Comparators				●		
D/A Converter (8-Bit)						●
Darlingtons	●	●				
FM I/F LICs						●
GP/HV Transistors	●	●				
Low Noise Transistors	●					
Mod/Dem LICs					●	
Op Amps				●	●	
Prec Voltage Ref				●	●	
PUTs	●					
Quads					●	●
Rectifiers/Zeners	●		●			
RF/GP JFETs	●					
SCRs	●					
Switching Diodes	●					
RF/Switching Transistors	●					
Timer LICs				●		
Tuning Diodes	●					
TRIMFETs				●	●	
Video AMPS					●	

Motorola surface-mount technology slashes system size and weight to one-tenth or less of what's acceptable now. Packages aren't much bigger than the chips they contain. Layers are cut in half, costs plunged 75% or more, higher frequencies optimized through short, uniform trace lengths.

You can mass-place them at up to 200K/hour.

We already offer the broadest line of easy, automatable, testable, surface-mount semiconductors--over 800--with more coming.

Pick and place in a fraction of discrete space.

Choose from most-popular switching transistors, Darlingtons, HV and low-noise types, RF, JFETs, tuning diodes, thyristors, rectifiers and PINs, plus numerous other discrete functions. All are SOT-23 packaged, with many in SOT-89 and MLL outlines for application flexibility. All SOT-23s are ready for placement; no lead forming is required. SOT-23/SOT-89 packaging is laser-marked. And, we'll encapsulate almost any discrete in a SOT package, depending on die compatibility and requirements. Low-profile, too.

MLL. Most economical of all.

Think of a DO-35 or DO-41 without leads and you've got the MLL (Motorola leadless) package...optimized for very high-volume, very low-cost application. Whereas SOT-23s are ideal for transistors, reliable MLL packaging is perfect for our full line of 0.5 to 1 W zeners and rectifiers in an extensive voltage range because of minimized space, ease of placement and second-to-none economy.

SOIC. Space-saving linear alternative.

Get standard linear DIP performance in tiny SOICs from Motorola and give yourself a 2.5:1 delta in board space savings.

Out lineup includes op amps, comparators, voltage regulators, TRIMFETs™, DACs, arrays and timers.

All current and future linear ICs are potential candidates for SO8, SO14 or SO16 packaging as long as chip size and power dissipation are within viable parameters.

SOICs pass the same assembly procedures as DIPs and offer identical performance at both 0° to 70°C and -40° to 85°C ranges. Device reliability is inherent because industry studies show it to be so...and because it's Motorola. A 20-times improvement in quality over manually-inserted units not only enhances reliability but saves rework and returns.

Automate it with tape and reel.

T1 or T2 options in industry-accepted 8 mm and 12 mm tape and reel format, 3,000 devices per reel, enable immediate placement of most discretes on automatic or semi-automatic lines. All can be wave or reflow soldered.

Write for our new Surface-Mount brochure BR127REVI. Motorola Semiconductor Products, Inc., Box 20912, Phoenix, AZ 85036.

The squeeze is on.

MOTOROLA INC.

discrete semiconductors-4800

THYRISTORS, RECTIFIERS & DIODES

Manufacturer	Thyristors SCR	Triacs	Diacs	Rectifiers Silicon	Germanium	Selenium	Bridges & Assemblies	Diodes Zener	Varactor	Other	Types
Allen-Bradley				1A•2089						1A•2089	Power Modules
American MicroSemiconductor	1A•2090	1A•2090		1A•2090	1A•2090		1A•2090	1A•2090			
Capar Comps.				1A•2092			1A•2092	1A•2092		1A•2092	Hi-Speed Switching Diodes
International Components				1A•2096			1A•2096	1A•2096		1A•2096	Switching Diodes
Iskra Electronics				1A•2097							
ISL Products				1A•2098			1A•2098				
Motorola	1A•2099 1A•2104	1A•2104		1A•2105			1A•2105	1A•2099 1A•2102	1A•2099	1A•2099 1A•2101 1A•2104	Switching Diodes RF Power Hybrid Modules SIDACs
Murata Erie				1A•2107							
Philips ECG Sylvania	1A•2108	1A•2108	1A•2109	1A•2108	1A•2108		1A•2108	1A•2108	1A•2108	1A•2108 1A•2109	Varistors, Pin Diodes SBS; SUS; SAS; SCS
Teccor Semiconductors	1A•2111	1A•2111	1A•2111							1A•2111	SIDACs; Quadracs
Varo Semiconductor				1A•2112			1A•2112				
Voltage Multipliers (VMI)				1A•2113			1A•2113			1A•2113	HV Multipliers

TRANSISTORS

Manufacturer	RF (Incl. Microwave)	Power Bipolar	Power FET	Switching	UJT	Darlington	Chip	Germanium	Small Signal
Allen-Bradley		1A•2088		1A•2088		1A•2088			
American MicroSemiconductor		1A•2090	1A•2090					1A•2090	
General Electric			1A•2095						
Motorola	1A•2101	1A•2101 1A•2103	1A•2101 1A•2103			1A•2103	1A•2101		1A•2100 1A•2101
Philips ECG					1A•2109				

Series PTC

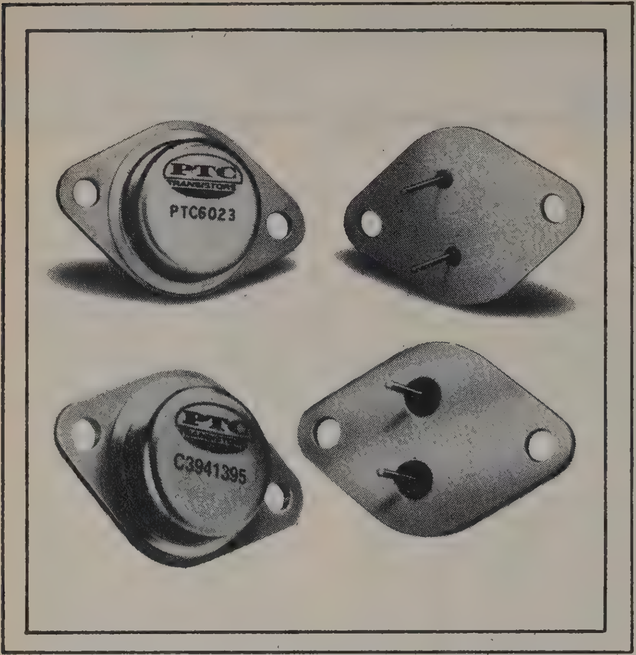
High Voltage NPN Darlington Transistors

FEATURES

- High Voltage Ratings
- Fast-Switching Capabilities/Fast Turn-Off Time
- Glass Passivated Die to Provide Excellent High Temperature Stability
- Thermally Stable Structure for Reliability in Power Cycling
- No Parasitic Diode on Output Transistor

APPLICATIONS

- High Voltage Switching Power Supplies
- Inverters/Regulators
- Deflection Circuits
- Pulse-Width-Modulated (PWM) System Control Circuitry



HIGH VOLTAGE NPN DARLINGTON TRANSISTORS

Series PTC 5000/5001 20 Amperes — 400 Volts

Series PTC 6000/6001/6002/6003
15 Amperes — 500 Volts

Series PTC 6060/6061/6062/6063
20 Amperes — 500 Volts

Series PTC 6072/6073 40 Amperes — 600 Volts

Series PTC 6022/6023 40 Amperes — 600 Volts

Series PTC 7000/7001/7002/7003
50 Amperes — 500 Volts

Series PTC 9000/9001/9002
20 Amperes — 750, 850 and 900 Volts

General

The Powermode power transistor line consists of NPN high voltage transistors and Darlington transistors. Power transistors are available in the current range of 3 to 20 amperes with voltages of 200 to 1000 volts. The Darlington transistors come in the current range of 5 to 50 amperes with voltages of 200 to 1000 volts.

For more information request PTC Publications.

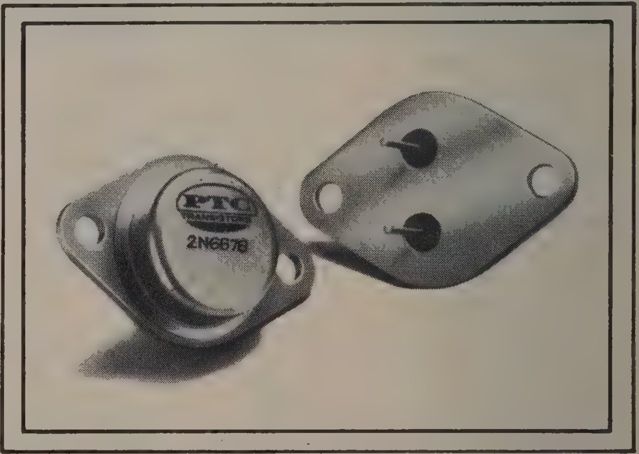
High Voltage NPN Transistors

FEATURES

- High Voltage Rating — 400 Volts
- Glass Passivation
- Superior Resistance to Thermal Fatigue
- Industrial and Military Applications

APPLICATIONS

- Switching Regulators
- PWM Inverters
- Deflection Circuits
- Motor Controls
- Solenoid Drivers



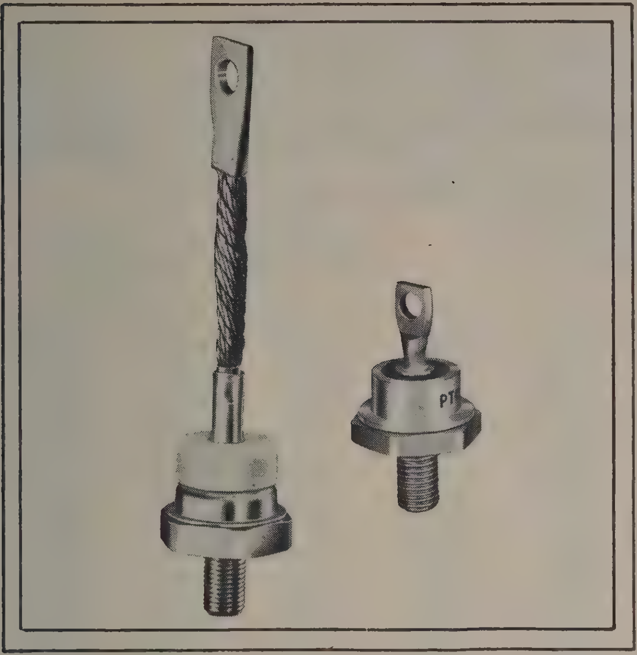
HIGH VOLTAGE NPN TRANSISTORS

Series 2N6674/2N6675
10 Amperes — 400 Volts

Series 2N6676/2N6677/2N6678
15 Amperes — 400 Volts

ALLEN-BRADLEY

Milwaukee, Wisconsin 53204



FAST RECOVERY RECTIFIERS

Series PTC 862/864/866
40 Amperes — 200-600 Volts

Series PTC 872/874/876
50 Amperes — 200-600 Volts

Series PTC 900/901/902/903
50 Amperes — 900-1200 Volts

Series PTC 920/921/922/923
50 Amperes — 900-1200 Volts

Series PTC 940/941/942/943
100 Amperes — 900-1200 Volts

Series PTC 950/951/952/953
130 Amperes — 900-1200 Volts

Series PTC

Fast Recovery Rectifiers

FEATURES

- Low Forward Voltages
- High Voltage Ratings
- Fast Reverse Recovery Time
- Glass Passivated Die to Provide Excellent High Temperature Stability
- High Surge Capability

APPLICATIONS

- Switching Power Supplies
- Inverters/Regulators
- Free Wheeling Diodes

General

The Powermode rectifier line features high voltage, high current and fast recovery times. These rectifiers are intended for use in switching power supplies and as freewheeling diodes in inverter circuits. The ratings of the rectifier line range from 40 to 130 amperes with voltages of 200 to 1200 volts.

For more information request PTC Publications.

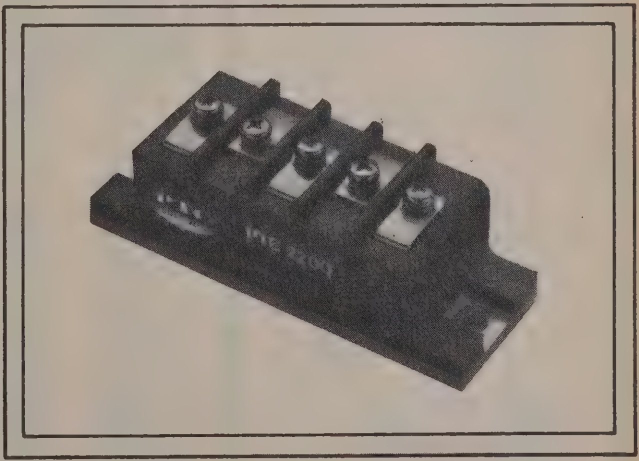
Power Modules

FEATURES

- Isolated Collectors
- High Voltage Rating – 600 Volts
- Overload Short Circuit Rating
- Glass Passivated Die to Provide Excellent High Temperature Stability

APPLICATIONS

- High Current Switching Power Supplies
- Inverters/Regulators
- Pulse-Width-Modulated (PWM) System Control Circuitry



POWER MODULES

Series PTC 2200/2201
30 Amperes — 600 Volts

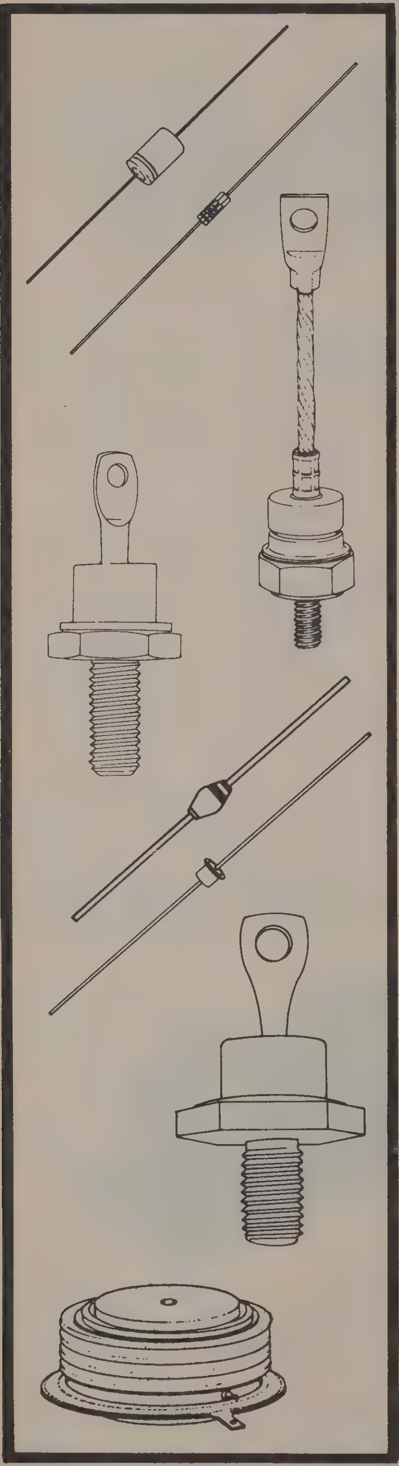
ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

AMERICAN MICROSEMICONDUCTOR INC.

THE #1 SOURCE FOR SEMICONDUCTORS

- TRANSISTORS, DIODES, SILICON CONTROLLED RECTIFIERS, TRIACS
- INTEGRATED CIRCUITS
- DAILY SHIPMENTS FROM STOCK
- LARGE INVENTORY
- OBSOLETE DEVICES



SIGNAL DIODES

1N87
1N137
1N138
1N193
1N194
1N195
1N251
1N252
1N300
1N301
1N302
1N303
1N304
1N330
1N331
1N350
1N351
1N352
1N353
1N354
1N401
1N403
1N404
1N405
1N406
1N407
1N408
1N433
1N434
1N456
1N464
1N488
1N799
1N804
1N810
1N844
1N892
1N899
1N908
1N912
1N914
1N917
1N931
1N934
1N948
1N993
1N999
1N2146
1N2327
1N2328
1N2902
1N2911
1N2925
1N3062
1N3071
1N3124
1N3147
1N3180
1N3206
1N3223
1N3298
1N3381
1N3391
1N3471
1N3480
1N3485
1N3538
1N3565
1N3568
1N3579
1N3614
1N3625
1N3647
1N3731
1N3933
1N3954
1N3983
1N4148
1N4150
1N4157
1N4320
1N4392
1N4457
1N4548
1N4608
1N4610
1N4718
1N4726
1N4727
1N4830
1N4864
1N4888
1N4952
1N5179
1N5220
1N5319
1N5414
1N5431
1N5609
1N5627
1N5767

REFERENCE DIODES

1N701
1N716
1N721
1N727
1N733
1N739
1N745
1N751
1N757
1N766
1N769
1N821
1N826
1N829
1N935
1N939
1N943
1N948
1N957
1N959
1N960
1N966
1N970
1N974
1N978
1N982
1N986
1N990
1N992
1N2970
1N2972
1N2976
1N2980
1N2984
1N2988
1N2992
1N2996
1N3000
1N3003
1N3007
1N3011
1N3015
1N4000
1N4733
1N4741
1N4747
1N4753
1N4759
1N4764
1N5223
1N5224
1N5225
1N5226
1N5227
1N5228
1N5229
1N5230
1N5231
1N5232
1N5233
1N5234
1N5235
1N5333
1N5334
1N5335
1N5336
1N5337
1N5338
1N5339
1N5340
1N5521
1N5530
1N5535

GERMANIUM DIODES

1N34A
1N35
1N38A
1N48
1N54A
1N58A
1N60
1N63
1N64
1N65
1N67A
1N68A
1N69A
1N70A
1N81A
1N87
1N90
1N91
1N98
1N99
1N100
1N115
1N116
1N117
1N118
1N126A
1N127A
1N128
1N191
1N192
1N198
1N270
1N277
1N279
1N281
1N283
1N294
1N295
1N297
1N298
1N498
1N500
1N631
1N632
1N633
1N634
1N636
1N695
1N770
1N805
1N933
1N995
1N996
1N3125
1N3287
1N3592
1N4008
1N4524

RECTIFIERS

1N200
1N205
1N217
1N222
1N250
1N316
1N321
1N332
1N342
1N349
1N365
1N413
1N440
1N443
1N445
1N503
1N514
1N526
1N530
1N534
1N540
1N547
1N563
1N596
1N600
1N606
1N645
1N649
1N676
1N681
1N689
1N846
1N853
1N865
1N877
1N889
1N1028
1N1039
1N1051
1N1063
1N1075
1N1081
1N1084
1N1085
1N1092
1N1095
1N1100
1N1105
1N1128
1N1139
1N1150
1N1167
1N1176
1N1191
1N1197
1N1202
1N1217
1N1223
1N1226
1N1251
1N1255
1N1406
1N1443
1N1486
1N1492
1N1587
1N1624
1N1692
1N1701
1N1730
1N1907
1N1912
1N1916
1N2103
1N2108
1N2154
1N2174
1N2187
1N2199
1N2211
1N2240
1N2258
1N2293
1N2316
1N2367
1N2374
1N2424
1N2536
1N2560
1N2572
1N2606
1N2781
1N2858
1N2864
1N3053
1N3055
1N3084
1N3196
1N3494
1N3549
1N4000
1N4001
1N4002
1N4003
1N4004
1N4005
1N4006
1N4007
1N4245
1N4530
1N4822
1N5062
1N5188
1N5406
1N5599
1N5679

MISCELLANEOUS DIODES

DB3
GT32
HT32
ST2
1N23
1N82A
1N830A
1N3713
1N3833
1N3834
1N3835
1N3837
1N3838
1N5411
1N5760

CALL OR WRITE FOR COMPLETE LISTING

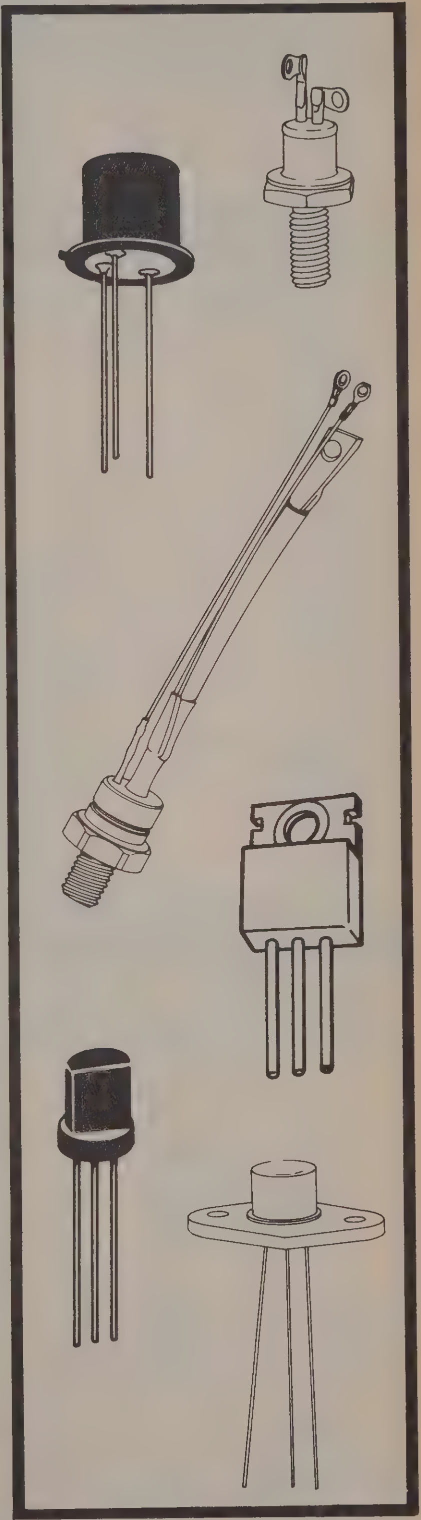
AMERICAN MICROSEMICONDUCTOR INC.

133 KINGS ROAD • MADISON, NEW JERSEY 07940 • (201) 377-9566 TELEX: 710-986-8500

AMERICAN MICROSEMICONDUCTOR INC.

THE #1 SOURCE FOR SEMICONDUCTORS

- TRANSISTORS, DIODES, SILICON CONTROLLED RECTIFIERS, TRIACS
- INTEGRATED CIRCUITS
- DAILY SHIPMENTS FROM STOCK
- LARGE INVENTORY
- OBSOLETE DEVICES



LOW POWER TRANSISTORS

2N117
2N118
2N119
2N120
2N327
2N328
2N329
2N336
2N337
2N338
2N473
2N474
2N475
2N476
2N477
2N706
2N707
2N916
2N929
2N930
2N1150
2N1156
2N2217
2N2218
2N2219
2N2220
2N2221
2N2222
2N2330
2N2368
2N2369
2N2569
2N2837
2N2890
2N2891
2N2904
2N2905
2N2906
2N2907
2N2913
2N2914
2N2915
2N2916
2N2917
2N2918
2N2919
2N2920
2N3241
2N3242
2N3250
2N3251
2N3494
2N3495
2N3563
2N3565
2N3566
2N3567
2N3568
2N3569
2N3638
2N3641
2N3642
2N3643
2N3646
2N3903
2N3904
2N3905
2N4080
2N4125
2N4126
2N4143
2N4383
2N4400
2N4401
2N4402
2N4403
2N4409
2N4410
2N4937
2N5400
2N5401
2N5824
2N5825
2N5826
2N5827
2N5828
2N5856
2N5858
2N5910

HIGH POWER TRANSISTORS

2N122
2N1015A
2N1016
2N1485
2N1613
2N1711
2N2876
2N2877
2N2878
2N2879
2N2880
2N2892
2N2893
2N3053
2N3054
2N3055
2N3118
2N3119
2N3232
2N3233
2N3234
2N3235
2N3252
2N3253
2N3375
2N3432
2N3439
2N3440
2N3442
2N3445
2N3446
2N3447
2N3448
2N3632
2N3713
2N3714
2N3715
2N3716
2N3766
2N3767
2N3771
2N3772
2N3878
2N3879
2N4037
2N4040
2N4231
2N4232
2N4233
2N4234
2N4235
2N4398
2N4399
2N4404
2N4405
2N4905
2N4918
2N5323
2N5680
2N6249
2N6292
2N6338
2N6377
2N6380
2N6474
2N6486
2N6579
2N6584

GERMANIUM TRANSISTORS

2N34
2N35
2N43
2N45
2N59
2N60
2N61
2N77
2N78
2N104
2N108
2N109
2N111
2N123
2N174
2N277
2N326
2N350
2N375
2N393
2N404
2N414
2N441
2N464
2N525
2N652
2N705
2N1011
2N1099
2N1175
2N1295
2N1305
2N1306
2N1502
2N1751
2N2142
2N2043
2N3428
2N4048
2N5324
2N5435
2N5887
2N5900
2N5901

FIELD EFFECT TRANSISTORS

2N2386
2N2608
2N3066
2N3087
2N3365
2N3370
2N3436
2N3453
2N3460
2N3578
2N3684
2N3819
2N3824
2N3968
2N3994
2N4092
2N4119
2N4221
2N4339
2N4382
2N4416
2N4856
2N4979
2N5103
2N5159
2N5270
2N5393
2N5433
2N5459
2N5592
2N5798
2N5803
2N5950
2N5951
2N5952
2N5953
2N6452
2N6568

MISCELLANEOUS

2N489
2N490
2N491
2N492
2N493
2N494
2N1671
2N2160
2N2417
2N2418
2N2419
2N2420
2N2421
2N2422
2N2646
2N2647
2N3980
2N4851
2N4852
2N4853
2N4870
2N4871
2N4947
2N4948
2N4949
2N6383
2N6384
2N6385
2N6387
2N6388

SCR's

2N681
2N682
2N683
2N685
2N690
2N692
2N877
2N889
2N1595
2N1604
2N1770
2N1773
2N1798
2N1842
2N1848
2N1909
2N1916
2N2023
2N2030
2N2322
2N2329
2N2574
2N2579
2N3096
2N3272
2N3529
2N3649
2N3658
2N3753
2N3872
2N3940
2N4152
2N4198
2N5164
2N5204
2N6167
2N6174
2N6394
2N6404

TRIACS

2N5567
2N5568
2N5569
2N5570
2N5571
2N5572
2N5573
2N5754
2N5755
2N5756
2N6068
2N6069
2N6070
2N6071
2N6072
2N6073
2N6074
2N6075
2N6139
2N6155
2N6165
2N6174
2N6342
2N6347

CALL OR WRITE FOR COMPLETE LISTING

AMERICAN MICROSEMICONDUCTOR INC.

133 KINGS ROAD • MADISON, NEW JERSEY 07940 • (201) 377-9566 TELEX: 710-986-8500

Diodes, Rectifiers and Bridges

CAPAR COMPONENTS CORPORATION

HIGH SPEED SWITCHING DIODES

Absolute Maximum Ratings (Ta = 25°C)

Type No.	Peak voltage V_{RM} (V)	DC voltage V_R (V)	Peak current I_{FM} (mA)	Average current I_0 (mA)	DC current I_F (mA)	*Peak forward surge current I_{FSM} (A) (1μsec.)	Power dissipation Pd (mw)
1N4148 1N914	100	75	450	150	200	2	500
1N4154	35	25	450	150	200	2	500
1N4454 1N3064	75	50	450	150	200	2	500

SILICON ZENER DIODES

Zener Voltage at Izt	(400Mw)	(400Mw)	(500Mw)	(1W)	Zener Voltage at Izt	(400Mw)	(400Mw)	(500Mw)	(1W)
5.1	1N751 A		1N5231 B	1N4733 A	16		1N966 B	1N5246 B	1N4745 A
5.6	1N752 A		1N5232 B	1N4734 A	17			1N5247 B	
6.0			1N5233 B		18		1N967 B	1N5248 B	1N4746 A
6.2	1N753 A		1N5234 B	1N4735 A	19			1N5249 B	
6.8	1N754 A	1N957 B	1N5235 B	1N4736 A	20		1N968 B	1N5250 B	1N4747 A
7.5	1N755 A	1N958 B	1N5236 B	1N4737 A	22		1N969 B	1N5251 B	1N4748 A
8.2	1N756 A	1N959 B	1N5237 B	1N4738 A	24		1N970 B	1N5252 B	1N4749 A
8.7			1N5238 B		25			1N5253 B	
9.1	1N757 A	1N960 B	1N5239 B	1N4739 A	27		1N971 B	1N5254 B	1N4750 A
10	1N758 A	1N961 B	1N5240 B	1N4740 A	28			1N5255 B	
11		1N962 B	1N5241 B	1N4741 A	30		1N972 B	1N5256 B	1N4751 A
12	1N759 A	1N963 B	1N5242 B	1N4742 A	32			1N5257 B	
13		1N964 B	1N5243 B	1N4743 A	33		1N973 B		1N4752 A
14			1N5244 B		36		1N974 B		
15		1N965 B	1N5245 B	1N4744 A					

RECTIFIERS AND BRIDGES

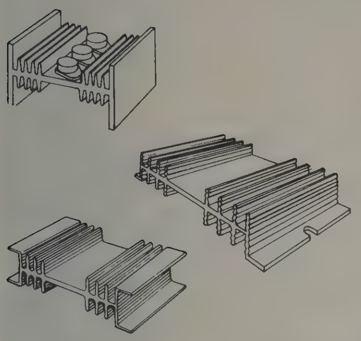
Voltage	Plastic Silicon Rectifiers			Fast Recovery Rectifiers		Single Phase Silicon Bridges
	1 AMP	1.5 AMPS	3 AMPS	1AMP	3 AMPS	
50	1N4001	1N5391	1N5400	1N4933 PR1001	PR3001	PB151 M W005 M
100	1N4002	1N5392	1N5401	1N4934 PR1002	PR3002	
200	1N4003	1N5393	1N5402	1N4935 PR1003	PR3003	PB153 M W02 M
300		1N5394	1N5403			
400	1N4004	1N5395	1N5404	1N4936 PR1004	PR3004	PB154 M W04 M
500		1N5396	1N5405			
600	1N4005	1N5397	1N5406	1N4937 PR1005	PR3005	PB155 M W06 M
800	1N4007	1N5398	1N5407	PR1006	PR3006	PB156 M W07 M

EASTERN DIVISION & HEADQUARTERS
25 Dubon Court
Farmingdale, New York 11735
(516) 454-6390
EAST OF MISSISSIPPI:
TOLL FREE: (800) 645-9626 TELEX: 221794

WESTERN DIVISION
1701 East Edinger Avenue, Unit F2
Santa Ana, California 92705
(714) 547-7034
WEST OF MISSISSIPPI
TOLL FREE: (800) 628-5780 TELEX: 181604

CAPAR COMPONENTS CORPORATION

The DELBERT BLINN COMPANY has for many years designed, fabricated and supplied specialty hardware items for the rapidly changing and expanding electronics industry. Our vast experience in plastic and metal fabrication guarantees you the best possible service for your particular needs regardless of quantity.



HEAT SINK DISSIPATORS

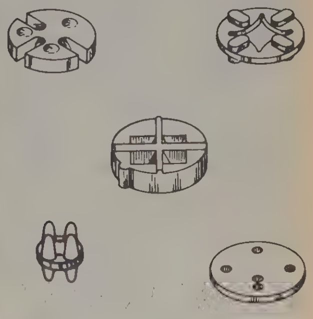
Efficiency, light weight and economy are incorporated in a complete line of professionally engineered heat sinks available in a variety of sizes and shapes. Material: Aluminum 6063-T5 alloy, mill finish. Lengths to 5 ft. available. (Serrations--U.S. Pat. No. 3163207). Can be cut, drilled, anodized or painted to your specifications.

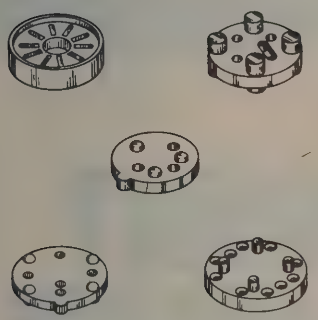
CATALOG SERIES — AHS

NYLON TRANSISTOR PADS

Precision molded from Zytel 101 (MIL-P-20693), these pads provide an economical insulator and thermal barrier with high dielectric strength. Resist continuous exposure to 135° C.

CATALOG SERIES — TPN





DIALLYL PHTHALATE TRANSISTOR PADS

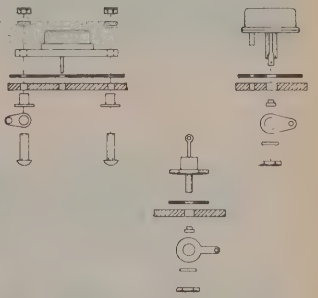
Available with and without stand-offs in configurations for all applications, these pads are molded of glass-filled Diallyl Phthalate (Mil-M-14F SDG) and provide an excellent mounting base. They resist continuous exposure to 400°F. and offer very high dielectric strength.

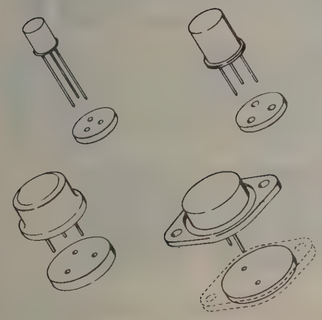
CATALOG SERIES — TPD

MOUNTING KITS

These and other standard kits incorporating mica, beryllium oxide or anodized aluminum insulators provide the parts necessary to mount all semi-conductors. Special materials and configurations can also be furnished to your specifications.

CATALOG SERIES — MK





BERYLLIUM OXIDE TRANSISTOR HEAT SINKS

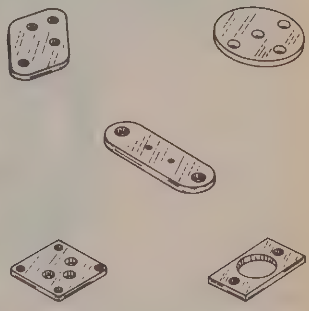
Made of high purity (99+%) sintered BeO, these sinks provide a satisfactory solution to the design engineer where electronic applications require both dielectric insulation and high heat transfer.

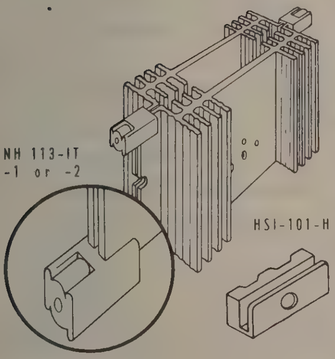
CATALOG SERIES — BOS

MICA INSULATORS

Delbert Blinn mica insulators are precision stamped from quality controlled stock and will withstand temperatures to 1000°F. with negligible dehydration. Standard thickness is .002 ± .001. Other designs, shapes, thicknesses or tolerances are available on special order.

CATALOG SERIES — MI





HEAT SINK MOUNTING INSULATOR

Delbert Blinn mounting insulators are precision molded of Microlon "202" and provide a practical, compact and economical method for mounting and insulating all standard heat sinks.

These insulators are capable of continuous operation to 175° C. and have a dielectric strength of 340 V/MIL.

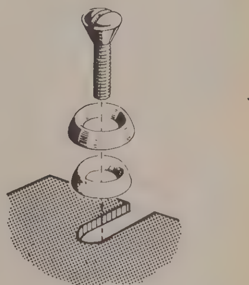
CATALOG SERIES — HSM

NYLON CUP WASHER FILLERS

Employed as insurance against damage, these quality fillers are molded from high strength Polyamide (nylon) and guarantee chip and crack free panel installation.

Available in Nos. 6, 8, 10 and 12 screw sizes.

CATALOG SERIES — NWF



Many other heat sink, transistor pad and specialty items not shown above are available.

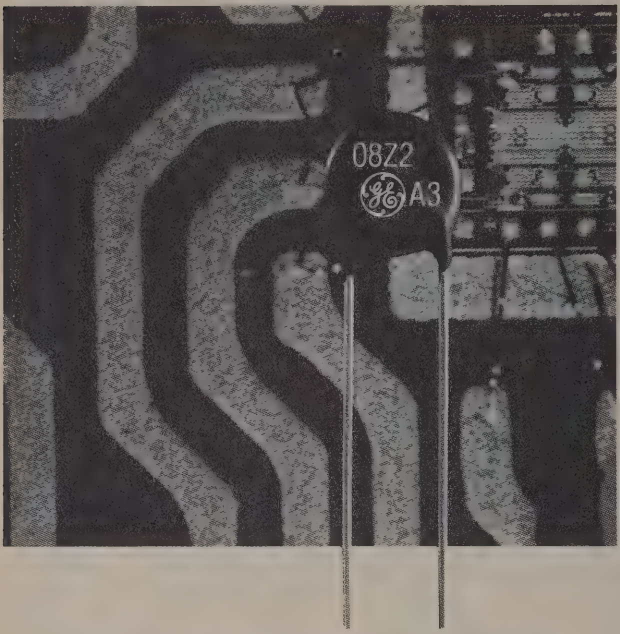
Write for additional information.

When custom designs or modifications of standard electronic hardware parts are needed, our years of experience in the molding, extruding, stamping and fabrication of metal and plastic parts enables us to supply you with parts unsurpassable in quality.

We can help you successfully meet competition in today's highly competitive market.

PHONE (714) 623-1257
or (213) 628-8794

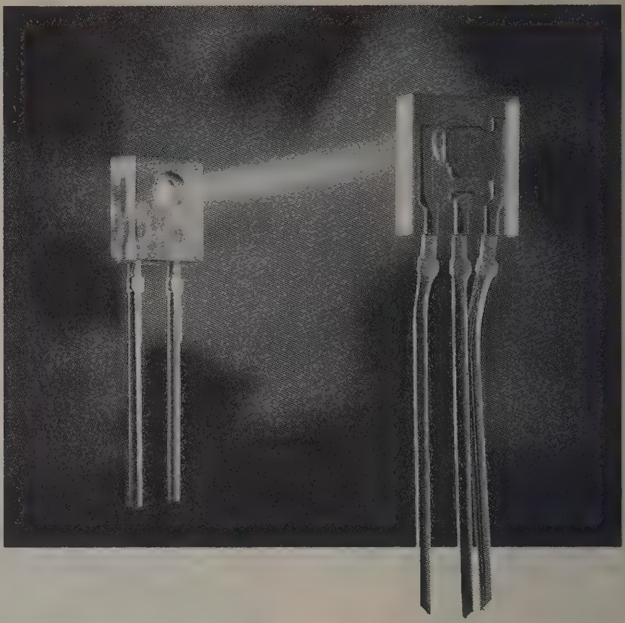
Delbert Blinn
ELECTRONIC SPECIALTIES
P. O. BOX 2007 • POMONA, CALIFORNIA 91766



YOU WANT TO PROTECT YOUR IC'S

As integrated circuits grow more sophisticated, the risk of failure from voltage transients grows, too. But now you can protect your IC's with the world's first effective, low cost varistor designed specifically for 5-volt logic levels — the low voltage GE-MOV® II Varistor.

We've extended the GE-MOV II Varistor line from 5.5 volts dc up to 2,800 volts (RMS) . . . energy ratings from .07 to 10,000 joules . . . and peak current ratings from 40 to 70,000 amperes. Now GE-MOV II Varistors provide all the transient protection you need for data communications, consumer electronics, business machines, personal computers and telecommunications . . . as well as for higher voltage industrial applications. Write for our free low voltage varistor design kit.



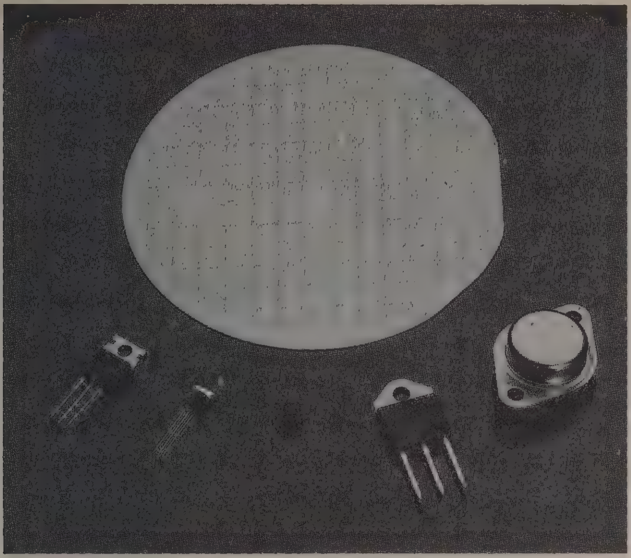
YOU WANT TO SIMPLIFY YOUR CIRCUITS

Few companies offer you more ways to design in quality and reliability with optoelectronics than General Electric. And your options are still growing.

Example: GE's new H23L emitter-detector pair improves board flexibility and economy in digital systems with optical sensing by incorporating a Schmitt trigger directly into the detector. Result — a clean, noiseless signal without added circuitry or components.

Another example: GE's new L14N/P high sensitivity detector lets you utilize more of the available light signal. Now you can design systems to operate at lower light levels, or with greater distances between components, or with lower transmitter power consumption.

And remember: GE's unique liquid phase epitaxial IRED process enables all of your GE optoelectronics components to keep working like new long after other devices no longer can. Write General Electric for free samples of our new optoelectronic products.



YOU WANT TO MULTIPLY YOUR DESIGN OPTIONS

AND WE WANT TO HELP

In 1983, General Electric added more than 30 new power semiconductor devices.

We've added a complete new line of Power MOSFETs with over 150 ratings, 0.2 to 40 amperes in TO-237, TO-220, TO-218, TO-3 and 4 P-I-N DIP packages. And a second source line for the popular IRF series.

We've added a new power MOSIGT that combines the best of both MOSFETs and bipolar devices. The MOSIGT gives you the high input impedance and voltage-controlled turn on-off capability of a MOSFET. And the low on-state conduction losses of a bipolar transistor.

In thyristors, we're expanding our inverter offering to include new ACSR modules with ratings from 55 to 90 amperes, voltages up to 1400 volts and t_Q's down to 10 μ sec.

The very latest GE power electronics literature is available in our new Transistor-Diode, Power MOS and Thyristor-Rectifier product manuals. Write for your free copies.

Semiconductors from General Electric.
For more information on any of our innovative product lines, write on your letterhead to General Electric Company, W. Genesee Street, MD 44, Auburn, NY 13021. 222-37.1

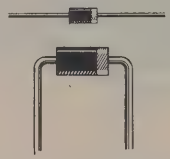
WE BRING GOOD THINGS TO LIFE.

GENERAL ELECTRIC

DIODES

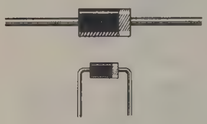
by International©

ICC has created a line of diodes that satisfies a broad range of requirements. Included are Plastic Silicon Rectifiers, Fast Recovery Rectifiers, Bridges, Switching and Zener Diodes. We invite inquiries about the types described here as well as any other diode you may require.



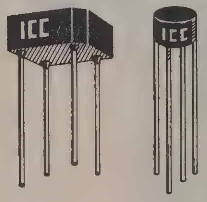
Plastic Silicon Rectifiers — General Purpose Cathode Band I.D.

1N4001 - 1N4007	1.0 AMP - 50V to 1000V	Case DO-41
1N5391 - 1N5399	1.5 AMP - 50V to 1000V	Case DO-15
1N5400 - 1N5408	3.0 AMP - 50V to 1000V	Case DO-27



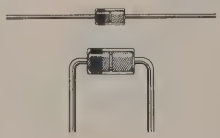
Plastic Silicon Rectifiers — Fast Recovery — 150ns to 500ns Cathode Band I.D.

ICC1001 - ICC1007	1.0 AMP - 50V to 1000V	Case DO-41
ICC1501 - ICC1507	1.5 AMP - 50V to 1000V	Case DO-15
ICC3001 - ICC3007	3.0 AMP - 50V to 1000V	Case DO-27



Bridge Rectifiers

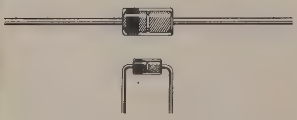
BRR101M - BRR107M	1.0 AMP - 50V to 1000V
BRR151M - BRR157M	1.5 AMP - 50V to 1000V



Silicon Switching Diodes — Cathode Band I.D.

1N4148 - 1N4536

- Peak Inverse Voltage 25V to 75V
- Reverse Recovery Time 2.0ns to 4.0ns
- Capacitance - 2.0 pF to 4.0 pF
- Case DO-35



Zener Diodes — Cathode Band I.D.

1N5231B - 1N5257B	0.5 watt	5% Tolerance	Case DO-35
1N4733A - 1N4752A	1.0 watt	5% Tolerance	Case DO-41

Packaging

- Tape & Reel
- Cut & Form

Ask about International Components Corporation's other fine products.

Capacitors ☐ Resistors ☐ Speakers ☐ Connectors
Cable Assemblies ☐ Telephone Modular Plugs & Jacks

CALL TOLL FREE
800-645-9154
IN N.Y. STATE
516-293-1500

International©
International Components Corporation

105 Maxess Road
Melville, New York 11747
(516) 293-1500
TELEX # 221576

ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

SEMICONDUCTORS

BRIDGES, DIODES, HIGH VOLTAGE, HIGH CURRENT DEVICES

1N4000 SERIES SILICON RECTIFIER DIODES 1 AMP, 50-1000V

- △ **Plastic Rectifiers**
- △ **Subminiature Size Axial Lead Mounted Rectifiers for General Purpose Low-Power Applications**
- △ **Silicone Passivated, JEDEC Numbered**
- △ **Available Bulk or Taped and Reeled**

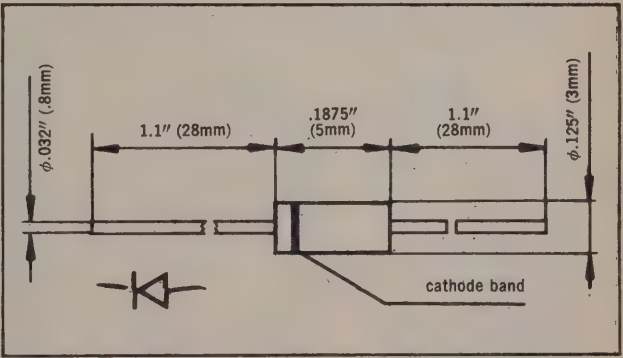
MAXIMUM RATINGS

Rating	Symbol	Unit	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	U_{RRM} U_{RM} U_R	V	50	100	200	400	600	800	1000
Non-Repetitive Peak Reverse Voltage 10 ms (Halfwave, Single Phase 50 Hz Peak)	U_{RSM}	V	(100)* 60	(150)* 120	(300)* 240	(600)* 480	(900)* 720	(1200)* 1000	(1500)* 1200
RMS Voltage	U_{RMS}	V	35	70	140	280	420	560	700
Average Rectified Forward Current (Single Phase, Resistive Load 50 Hz)	I_O	A		1.0					
Non-Repetitive Peak Current (Surge Current, 1 Cycle for 10 ms)	I_{FSM}	A		50					
Operating Temperature	T_{op}	°C		−65 to +175					
Storage Temperature	T_{STG}	°C		−65 to +175					

**Available on special request*

ELECTRICAL CHARACTERISTICS

Characteristics and Conditions	Symbol	Unit	Head
Max. Instantaneous Forward Voltage Drop (I_F = 1,0A T_j = 25°C)	U_{FWD}	V	1.1
Max. Reverse Current at U_{RRM} (T_j = 25°C)	I_R	μA	10
Max. Reverse Current at U_{RRM} (T_j = 100°C)	I_R	μA	50
Typical Thermal Resistance Junction to Ambient (Mounting Method A)	R_{TH}	°C/W	85



ALSO AVAILABLE IN 5400 SERIES
3 AMP, 50 - 1000 V

Also in 5400 Series 3 Amp Rectifiers

ISKRA ELECTRONICS INC.
8 GREENFIELD RD., SYOSSET, NY 11791 • (516) 364-2616

ISL PRODUCTS INTERNATIONAL LTD.

Dept. EM, 235-P Robbins Lane / Syosset, NY 11791 / (516) 822-9601 / TWX 510-221-2109 / ISL-SYST

CAPACITORS / SILICON DIODES / CARBON FILM RESISTORS / LEDS / POTENTIOMETERS / TRANSFORMERS ADAPTORS AND POWER SUPPLIES

SILICON DIODES AND BRIDGES

Silicon rectifier diodes 1A 50V to 1,000V, 1N4001 — 1N4007

Type	U_{RRM} (V)	U_{RSM} 10 ms (V)	I_{FAV} (A)	I_{FSM} 10 ms (A)	T_{op} (°C)	U_F I_F=1.0A T_j=25°C (V)	I_R at U_{RRM} T_j=25°C (μA)
1N4001	50	60	1.0	50	−65 to +175	1.1	10
1N4002	100	120					
1N4003	200	240					
1N4004	400	480					
1N4005	600	720					
1N4006	800	1,000					
1N4007	1,000	1,200					

Silicon rectifier diodes 3A 100V to 1,200V, 1N5400 — 1N5408

Type	U_{RRM} (V)	U_{RSM} 10 ms (V)	I_{FAV} T_L=45°C L=10mm (A)	I_{FSM} 10 ms (A)	T_{op} (°C)	U_F I_F=6A T_j=25°C (V)	I_R at U_{RRM} T_j=25°C (μA)	T_j=150°C (μA)
1N5400	50	60	3	150	−40 to +175	1.3	20	500
1N5401	100	120						
1N5402	200	240						
1N5403	300	360						
1N5404	400	480						
1N5405	500	600						
1N5406	600	720						
1N5407	800	1,000						
1N5408	1,000	1,200						

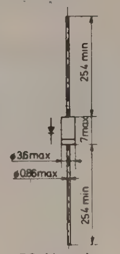
Silicon planar epitaxial signal diodes BA500 series

Type	U_{BR} 100 μA (V)	I_o (mA)	U_F at I_F at 25°C (V)	(mA)
BA511 (1N4148)	100	75	1.0	10
BA513 (1N4448)	100	75	1.0	100
BA517 (1N4150)	70 1 μA	200	1.0	200
BA518 (1N4151)	75 5 μA	75	1.0	50
BA519 (1N4152)	40 5 μA	75	0.88	20
BA520 (1N4153)	75 5 μA	75	0.88	20
BA521 (1N4154)	35 5 μA	75	1.0	30
BA523 (1N4444)	70 5 μA	200	1.0	100
BA531 (IN4727)	30 5 μA	75	0.85	10
BA533 (1N4864)	125	100	1.1	100
BA543 (BAY17)	15	200	1.0	100
BA544 (BAY18)	60	200	1.0	100
BA545 (BAY19)	120	200	1.0	100
BA546 (BAY20)	180	200	1.0	100
BA547 (BAY80)	150	100	1.0	100

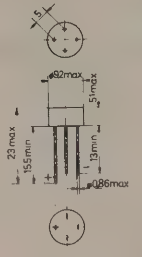
Type	I_R at 25°C (nA)	at 150°C (μA)	at U_R (V)	C at 1 MHz U_R=0V (pF)	t_{rr} (ns)
BA511 (1N4148)	25	50	20	4	4[1]
BA513 (1N4448)	25	50	20	4	4[1]
BA517 (1N4150)	100	100	50	2.5	6[4]
BA518 (1N4151)	50	50	50	2	2[1]
BA519 (1N4152)	50	50	30	2	2[1]
BA520 (1N4153)	50	50	50	2	2[1]
BA521 (1N4154)	100	100	25	4	2[1]
BA523 (1N4444)	50	50	50	2	7[2]
BA531 (IN4727)	100	10 (100°C)	20	4	Q=40 pC
BA533 (1N4864)	100	100	80	1.3	4[1]
BA543 (BAY17)	100	15	12	1.5	50[3]
BA544 (BAY18)	100	15	50	1.5	50[3]
BA545 (BAY19)	100	15	100	1.5	50[3]
BA546 (BAY20)	100	15	150	1.5	50[3]
BA547 (BAY80)	100	100	120	6	50[3]

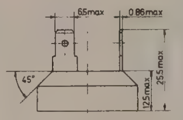
Reverse recovery time:

1. I_F=10 mA U_R=6V R_L=100Ω measured at I_R=1 mA
2. I_F=10 mA U_R=1V R_L=100Ω measured at I_R=1 mA
3. I_F=30 mA I_R=30 mA R_L=100Ω measured at I_R=3 mA
4. I_F=10 mA I_R=1 mA measured at I_R=0.1 mA

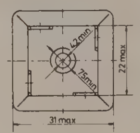


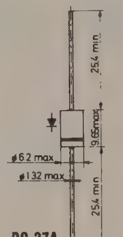
DO-41 mod.



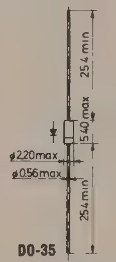


Polarity designated on the case.

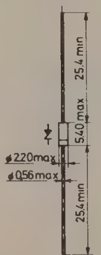




DO-27A



DO-35



Index of symbols

α — Conduction angle
C — Capacitance
I_F — Forward (DC) current
I_{FAV} — Average forward current 40 to 1,000 Hz of one halfsine wave at T_{amb} or T_{case}
I_{FSM} — Surge forward current, peak value 10 ms
I_Z — Zener (reverse) current
I_R — Reverse current, maximum value at T_j and U_{RRM}
L — Distance from case
P_{tot} — Total power dissipation
R — Resistance
t_{rr} — Reverse recovery time, typical value
T_{amb} — Ambient temperature
T_{case} — Case temperature
T_j — Junction temperature
T_L — Lead temperature
T_{op} — Operating temperature
T_{stg} — Storage temperature
U_{BR} — Breakdown voltage
U_F — Forward voltage drop, maximum value at rated I_F
U_{RMS} — RMS voltage
U_{RRM} — Repetitive Peak reverse voltage
U_{RSM} — Peak reverse voltage, 10 ms
U_Z — Zener (reverse) voltage

Single-phase bridge B . . . C800, B . . . C1000, B . . . C1500

Type	U_{RRM}[1] (V)	U_{RSM}[1] 10 ms (V)	I_{FAV} T_{amb} 45°C C load (A)	I_{FSM}[1] t= 10 ms T_j= 25°C (A)	T_{op} (°C)	U_F[1] I_F= 1.0A T_j= 25°C (V)	I_R[1] at U_{RRM} T_j= 25°C (μA)
B40C800	100	120	0.8	50	−40 to +175	1.3	10
B80C800	200	240					
B125C800	300	350					
B250C800	600	720					
B380C800	800	1,000					
B500C800	1,000	1,200					
B40C1000	100	120	1	50	−40 to +175	1.2	10
B80C1000	200	240					
B125C1000	300	350					
B250C1000	600	720					
B380C1000	800	1,000					
B500C1000	1,000	1,200					
B40C1500	100	120	1.5	50	−40 to +175	1.1	10
B80C1500	200	250					
B125C1500	300	350					
B250C1500	600	720					
B380C1500	800	1,000					
B500C1500	1,000	1,200					

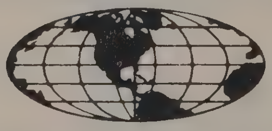
Single-phase bridge B. . . C10, B . . . C25

T_j at 25°C Type	U_{RRM}[1] (V)	U_{RSM}[1] (V)	I_{FAV} T_c=80°C (A)	I_{FSM}[1] t=10 ms (A)	T_{op} (°C)
B40C10	100	120	10	250	−40 to +150
B80C10	200	240			
B125C10	300	350			
B250C10	600	720			
B500C10	800	1,000			
B40C25	100	120	25	350	−40 to +150
B80C25	200	240			
B125C25	300	350			
B250C25	600	720			
B500C25	800	1,000			

[1] Ratings and characteristics hold for every diode in the bridge structure.

Zener diodes 500 mW, 0.7V to 35V/±5%, BZX . . .

Type	Zener Voltage at I_z=5 mA Min.	Max.	$I_{z\,max}$ mA at 45°C amb	αU_z 10^{-4}/K	R_z typ. Ω at I_z	U_R min. V at 100 nA
BZX3.3	3.1	3.5	109	−8 . . . − 3	80 (<90)	–
BZX3.6	3.4	3.8	101	−8 . . . − 3	80 (<90)	–
BZX3.9	3.7	4.1	92	−7 . . . − 3	80 (<90)	–
BZX4.3	4.0	4.6	85	−6 . . . + 1	80 (<90)	–
BZX4.7	4.4	5.0	76	−5 . . . + 2	70 (<78)	–
BZX5.1	4.8	5.4	67	−3 . . . + 4	30 (<60)	0.8
BZX5.6	5.2	6.0	59	−2 . . . + 6	10 (<40)	1
BZX6.2	5.8	6.6	54	−1 . . . + 7	4.8 (<10)	2
BZX6.8	6.4	7.2	49	+2 . . . + 7	4.5 (<8)	3
BZX7.5	7.0	7.9	44	+3 . . . + 7	4.0 (<7)	5
BZX8.2	7.7	8.7	40	+4 . . . + 7	4.5 (<7)	6
BZX9.1	8.5	9.6	36	+5 . . . + 8	4.8 (<10)	7
BZX10	9.4	10.6	33	+5 . . . + 8	5.2 (<15)	7.5
BZX11	10.4	11.6	30	+5 . . . + 9	6.0 (<20)	8.5
BZX12	11.4	12.7	28	+6 . . . + 9	7.0 (<20)	9
BZX13	12.4	14.1	25	+7 . . . + 9	9.0 (<25)	10
BZX15	13.8	15.6	23	+7 . . . + 9	11 (<30)	11
BZX16	15.3	17.1	20	+8 . . . + 9.5	13 (<40)	12
BZX18	16.8	19.1	18	+8 . . . +10	18 (<50)	14
BZX20	18.8	21.2	17	+8 . . . +10	20 (<50)	15
BZX22	20.8	23.3	16	+8 . . . +10	25 (<55)	17
BZX24	22.8	25.6	13	+8 . . . +10	28 (<80)	18
BZX27	25.1	28.9	12	+8 . . . +10	30 (<80)	20
BZX30	28.0	32.0	10	+8 . . . +10	35 (<80)	22.5
BZX33	31.0	35.0	9	+8 . . . +10	40 (<80)	25



MANUFACTURERS OF QUALITY
ELECTRONIC COMPONENTS WORLD WIDE

ISL PRODUCTS INTERNATIONAL LTD.
Dept. EM, 235-P Robbins Lane
Syosset, NY 11791
(516) 822-9601 TWX 510-221-2109
ISL-SYST

SEE OUR PAGES ON CAPACITORS IN SECTION 1500 PAGES 1A•1082, 1A•1083

MOTOROLA

SEMICONDUCTORS

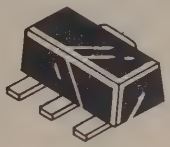
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

SURFACE MOUNT ALTERNATIVES FOR DISCRETE DEVICES

TO-236AA

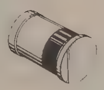
SOT-23

CASE 345-1



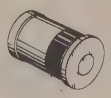
SOT-89

CASE 362



MLL34

CASE 362B



MLL41

A wide variety of discrete components from Motorola's repertoire of reliability-proven semiconductor processes and geometries are available in the SOT (Small-Outline Transistor) packages and leadless diodes. Products include Bipolar and Field-Effect Transistors (FETs); Switching, Zener and Varactor Diodes; and Silicon Controlled Rectifiers (SCRs). These surface-mounted devices are currently being used by circuit designers on printed circuit boards as well as ceramic substrates.

Significant features of surface mount devices include:

- Complete Pretest Capability — 100% electrically tested.
- Handling and Assembly Ease — devices can be positioned manually or by using automated placement equipment.
- Reliability — SOTs are subjected to the same rigid reliability tests performed on all Motorola plastic packages.
- Small Size/Less Weight — considerable size reduction and weight saving is achieved in circuit designs using "SO" surface mount technology.
- Broad Line — Motorola offers over 250 standard discrete devices in the SOT package (inquiries regarding customers special requirements are invited).
- Full Line of Rectifiers and Zeners — Available in Case 362 and Case 362B packages.
- Leadless Diode Devices — Available in 8 mm tape and reel for automatic placement.
- Marking Capability — A multi-digit code is laser marked on all SOT devices.
- Multi-Sources — There are many U.S. and foreign sources of SOTs.
- Packaging — SOTs are shipped in vials or via the industry accepted 8 mm tape and reel format for automatic placement.
- Standard SOT-23 versus "Low Profile" SOT-23 — Motorola offers both the standard SOT-23 outline (TO-236AA) and the new "low profile" SOT-23 (TO236AB). The only difference is the clearance from the bottom of the package to the surface of the substrate:

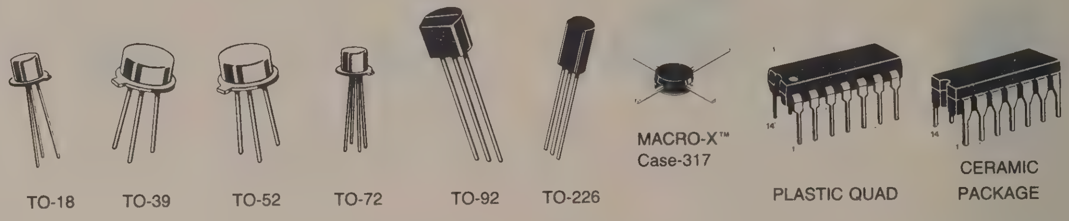
  Standard SOT-23: 0.004″ Min./0.0098″ Max.
  "Low Profile" SOT-23: 0.0005″ Min./0.004″ Max.

  The low profile package is primarily designed for customers using double-sided PCB with the SOT-23s mounted on the bottom side of the board and the non-surface mounted devices inserted in the top side of the board.
- Higher Power TO-220 and Case 77 Devices — Available with lead forming for surface mount application. (Consult factory)
- Selector Guide — Send for your copy of Motorola's "Surface Mount Selector Guide and Cross-Reference" (BR-127 Rev 1) for additional information.

MOTOROLA
SEMICONDUCTORS
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

SMALL-SIGNAL TRANSISTORS

Motorola offers a broad line of small-signal transistors. This includes both Bipolar and Field-Effect Transistors. That encompasses the latest technology for semiconductors.



- TO-92 is offered in the standard package as well as the 1.0 W TO-92 for higher power dissipation applications. These devices are laser marked for ease of identification. They can be shipped in bulk or in tape and reel configuration. Lead forming to TO-5 configuration is also available. All plastic devices are shipped in antistatic containers as part of Motorola's ongoing practice of maintaining the highest standards of quality and reliability.
- Small-signal metal can transistors are designed for general-purpose amplifiers, high-speed switches, high-voltage amplifiers, low-level/low-noise amplifiers, high frequency amplifiers, choppers and Darlingtons. These devices are manufactured in a variety of metal can packages. Motorola is the leader in JAN, JANTX, JANTXV and JANS qualified devices.
- Surface mount SOT-23 and SOT-89 packages are available to meet the requirements of the surface mount assembly industry. These packages offer ease of automatic handling, proven high reliability, small size and weight reduction. A full line of product is offered including general-purpose, switching, VHF/UHF amplifiers, mixers, oscillators, choppers, Darlington, low-noise, high-voltage, RF and junction FETs. The packages are laser marked for legibility and shipped in either antistatic bags or conductive 8 mm tape and reel.
- Field-Effect Transistors encompass the latest technology and covers the full range of small-signal FET applications. Available products include a variety of junction FETs, GaAs FETs, MOSFETs (with both P- or N-channel polarity with both single and dual Gates) and TMOS FETs. This product line includes devices designed for operation across the frequency range from dc to UHF in switching and amplifying applications.

  Various package options are available from low cost plastic to TO-72 metal can.
- Multiple devices* are available in plastic, ceramic and metal can packages. A large selection of quad, dual and Darlington transistors are available for off the shelf delivery. Most of the popular discrete transistor chips are available in multiple packages.

  *Multiple devices as referred to here are two or more transistor chips in a single package. This includes the Darlington transistors which consist of two interconnected devices functioning as a single amplifier.

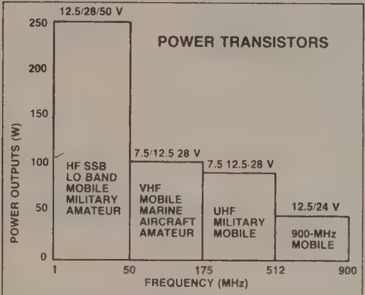
For additional information, the Motorola Small-Signal Transistor Data Book, DL126, is available with data sheets for all available devices. The Microminiature Products is a selector guide for surface mount SOT-23 and SOT-89 products. The Field-Effect Transistors Selector Guide & Cross Reference is available for FET design.

MOTOROLA
SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

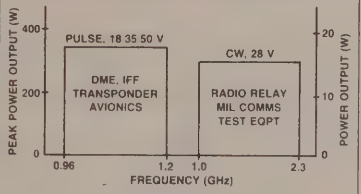
RF COMPONENTS

The Motorola broad line RF component portfolio encompasses small-signal low-noise devices to high-power transmitter devices, unencapsulated chips to packaged transistors to hybrid modules. Device technology covers silicon bipolars, TMOS power FETs, and GaAs FETs. We have a complete engineering staff to help you with your application and extensive technical literature in application notes, engineering bulletins, selector guides, and the RF data manual. For RF components think Motorola RF.



Motorola's RF Power Bipolar and TMOS Field-Effect Transistors are categorized according to the application and frequency band for which each type is optimized. Outputs up to 250 watts are available, suitable for commercial, military, ground, airborne, and marine use from 1.5 MHz to 1 GHz

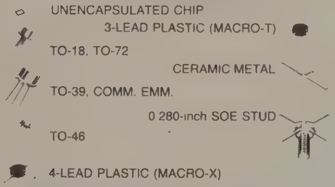
MICROWAVE POWER TRANSISTORS



The Motorola line of microwave power transistors are engineered for ruggedness and consistency of performance from unit to unit, lot to lot. Gold metal systems and silicon nitride passivation ensure reliability. Both hermetic and organic sealed packages provide cost effective options to suit the end-use environment. Internal input output impedance matching elements facilitate broadband designs

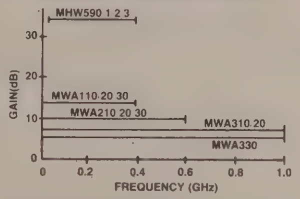
SMALL-SIGNAL/LOW-NOISE

BIPOLARS WITH f_T TO 8 GHz, GaAs FETs to 2 GHz AND ALL THE PACKAGES



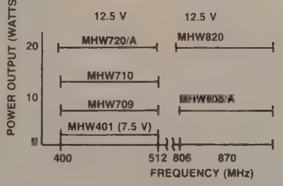
Small-signal high-frequency Bipolar and GaAs Field-Effect Transistors from Motorola are characterized as low-noise amplifiers, oscillators, high-speed switches and class A linear amplifiers. The broad line of low power RF transistors range from low cost consumer devices to full military processed high reliability devices. Packaging options include plastic/ceramic stripline, metal can, and unencapsulated chips to suit performance and cost requirements.

GENERAL-PURPOSE MODULES



The MHW590/1/2/3 are derivatives of the CATV module family and offer two frequency ranges, 1.0-250 MHz/10-400 MHz, and two operating voltages, 13.6/24 V. They are suitable for operation in 50 to 100 Ω systems
The MWA wideband amplifiers in TO-39 packages provide a cost-effective alternative to complex feedback designs using discrete transistors. Consistent performance and unconditional stability of the MWA's take the pain out of broadband high-gain circuit design.

POWER HYBRID MODULES



Power Hybrid Modules are self-contained Power Amplifiers which provide a pre-engineered, functional performance-tested alternative to the use of individual power transistors. Producing VHF/UHF power outputs up to 20 W, these modules offer field-replaceable, consistent performance, and tolerance to load mismatch.

RF LITERATURE

SG-46R2 RF Selector Guide and Cross Reference

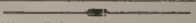
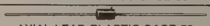
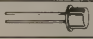
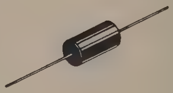
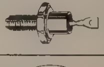
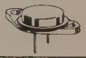
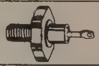
For additional information, send requests for this selector guide to:
Literature Distribution Center
P.O. Box 20912
Phoenix, AZ 85036

MOTOROLA

SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

ZENER DIODES

POWER DISSIPATION	BASIC FUNCTION AND DEVICE		PACKAGE
250 mW	GENERAL PURPOSE	● 1N4678 Thru 1N4717 1.8 Volts Thru 43 Volts	AXIAL LEAD GLASS **CASE 299-02**
	LOW NOISE	● 1N4614 Thru 1N4627 1.8 Volts Thru 6.2 Volts ● 1N4099 Thru 1N4135 6.8 Volts Thru 100 Volts	
400 mW/500 mW	GENERAL PURPOSE	● 1N4370 Thru 1N4372 2.4 Volts Thru 3.0 Volts ● 1N746 Thru 1N759 3.3 Volts Thru 12 Volts ● 1N957 Thru 1N986 6.8 Volts Thru 110 Volts ● 1N5221 Thru 1N5272 2.4 Volts Thru 110 Volts ● 1N5985 Thru 1N6025 2.4 Volts Thru 110 Volts	AXIAL LEAD GLASS **CASE 299-02**
	LOW NOISE	● 1N5518 Thru 1N5546 3.3 Volts Thru 33 Volts	
	TEMPERATURE COMPENSATED	● 1N821 Thru 1N829 6.2 Volts ● 1N4565 Thru 1N4584 6.4 Volts	
	GENERAL PURPOSE	● 1N987 Thru 1N992 120 Volts Thru 200 Volts	AXIAL LEAD GLASS **CASE 51-02**
	TEMPERATURE COMPENSATED	● 1N821A Thru 1N829A 6.2 Volts ● MZ605 Thru MZ640 6.2 Volts ● 1N3154 Thru 1N3157 8.4 Volts ■ 1N4775 Thru 1N4784 8.5 Volts ● 1N935 Thru 1N939 9.0 Volts ● 1N941 Thru 1N945 11.7 Volts	
	GENERAL PURPOSE	● 1N5273 Thru 1N5281 120 Volts Thru 200 Volts	 AXIAL LEAD PLASTIC **CASE 51-02**
600 mW	CURRENT REGULATOR	● 1N5283 Thru 1N5314 0.22 mA Thru 4.7 mA ● MCL1300 Thru MCL1305 0.5 mA Thru 5.05 mA	AXIAL LEAD GLASS **CASE 51-02**
1 WATT	GENERAL PURPOSE	● 1N4728 Thru 1N4764 3.3 Volts Thru 100 Volts	AXIAL LEAD GLASS **CASE 59**
	GENERAL PURPOSE	● 1M110ZS10 Thru 1M200ZS10 110 Volts Thru 200 Volts	 AXIAL LEAD PLASTIC **CASE 59**
	GENERAL PURPOSE	● 1N3821 Thru 1N3830 3.3 Volts Thru 7.5 Volts ● 1N3016 Thru 1N3051 6.8 Volts Thru 200 Volts	AXIAL LEAD METAL **CASE 52**
1.5 WATT	GENERAL PURPOSE	● 1N5913 Thru 1N5956 3.3 Volts Thru 200 Volts	AXIAL LEAD PLASTIC **CASE 59**
	GENERAL PURPOSE	● 1N3785 Thru 1N3820 6.8 Volts Thru 200 Volts	SINGLE ENDED METAL **CASE 55** 
5 WATT	GENERAL PURPOSE	● 1N5333 Thru 1N5388 3.3 Volts Thru 200 Volts	AXIAL LEAD PLASTIC **CASE 17-02**
	TRANSIENT SUPPRESSORS (Mosorbs)	● P6KE6.8 Thru P6KE200 6.8 Volts Thru 200 Volts 600 WATTS PEAK POWER	
		● 1N6267 Thru 1N6303 6.8 Volts Thru 200 Volts 1500 WATTS PEAK POWER ● 1.5KE6.8 Thru 1.5KE200 6.8 Volts Thru 200 Volts 1500 WATTS PEAK POWER ● 1N5908 5 Volts 1500 WATTS PEAK POWER ● ICTE-5 Thru ICTE-45 ● MPTE-5 Thru MPTE-45 5 Volts Thru 45 Volts 1500 WATTS PEAK POWER ● 1N6373 Thru 1N6389 5 Volts Thru 45 Volts	 AXIAL LEAD PLASTIC **CASE 41-11**
10 WATTS	GENERAL PURPOSE	● 1N3993 Thru 1N4000 3.9 Volts Thru 7.5 Volts ● 1N2970 Thru 1N3015 6.8 Volts Thru 200 Volts	STUD **CASE 56** 
50 WATTS	GENERAL PURPOSE	● 1N4557 Thru 1N4564 3.9 Volts Thru 7.5 Volts ● 1N2804 Thru 1N2846 6.8 Volts Thru 200 Volts	**CASE 54** TO-3 
	GENERAL PURPOSE	● 1N4549 Thru 1N4556 3.9 Volts Thru 7.5 Volts ● 1N3305 Thru 1N3350 6.8 Volts Thru 200 Volts	STUD **CASE 58** 

Also available are the leadless packages for Surface Mount manufacturing, in Case 362 and Case 362B outlines.

MOTOROLA SEMICONDUCTORS

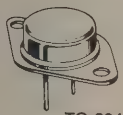
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

SILICON POWER TRANSISTORS

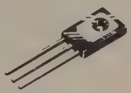
BIPOLAR and MOSFETs

THE LARGEST SELECTION OF MOSFET AND BIPOLAR SILICON POWER TRANSISTORS FROM THE LEADING SUPPLIER IN THE WORLD.

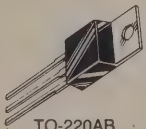
Over 300 Standard Power MOSFETs from Motorola



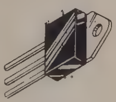
TO-204
Case 1



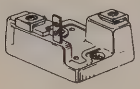
TO-225AA
Case 77



TO-220AB
Case 221A



TO-218AC
Case 340



Case 353

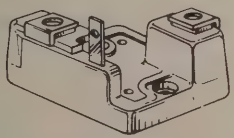
- Breakdown Voltages to 1000 Volts
- Current Ratings to 200 Amperes
- $r_{DS(on)}$ as low as 0.009 Ohms

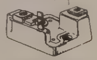
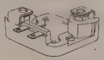
Over 1200 Standard Bipolar Silicon Power Transistors from Motorola

Bipolar Silicon Power Transistor Package Types

Package	 Case 152	 TO-202AC Case 306	 TO-225AA Case 77	 TO-225AB Case 90	 TO-220AB Case 221A	 TO-218 Case 340	 TO-205AA Case 31	 TO-205AD Case 79	 TO-210AA Case 160	 TO-213AA Case 80	 TO-204AA Case 1 Case 11	 TO-204AE Case 197
I_C Range (Amps)	0.5-2.0	0.1-3.0	0.3-5.0	5-15	0.5-15	12-25	3.0	0.5-5.0	7.0-10	1-10	2-30	2-60
V_{CE} Range (Volts)	30-300	30-350	25-400	40-100	30-750	40-400	40-80	40-400	60-100	40-400	40-1500	40-1500
P_D (Watts)	10	6.25-12.5	12.5-40	65-100	15-100	125-150	6.0	5-10	60	20-100	36-300	36-300

Control up to 50 kVA with Motorola High Current, Energy Management Series Darlingtons.



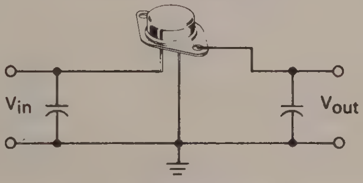
Device		Operating Current (AMP)	$V_{CEO(SUS)}$ (Volts)
 Case 353	MJ10041*, MJ10042	25	850
	MJ10044*, MJ10045	50	450
	MJ10047*, MJ10048	100	250
 Case 346	MJ10050, MJ10051*	50	850
	MJ10100, MJ10101*	100	450
	MJ10200, MJ10201*	200	250

* Indicates devices with speed-up diode for use in high frequency inverters and pulse width modulated motor controls.

SMARTpower™ is a technology that combines integrated circuits on a power control device. The unique feature is that vertical current flow is controlled rather than lateral current flow that is conventionally used in lower power circuits.

The MPC100, 102 and 104 are 5, 12 and 15 V monolithic series-pass regulators capable of supplying 10 A. Features include current limit, thermal shutdown, low differential voltage as well as excellent input and load regulation.

STANDARD APPLICATION



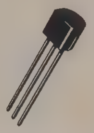
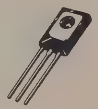
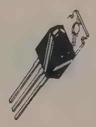
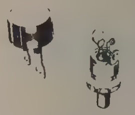
MOTOROLA

SEMICONDUCTORS

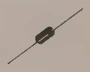
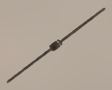
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

THYRISTORS
SCRs • TRIACS
SIDACs

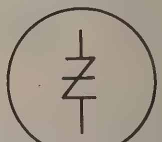
Families Recommended for New Designs

	0.2A	2.5–4A	6–16A	20–55A	≥25A
PACKAGES	 (Formerly TO-92) (TO-226AA)	 (C-77)	 (TO-220)		 (174-03, 311-01)
SCRs	2N5060 Series	2N6236-41	MCR218 Series	2N6504 Series	2N3870-3
	MCR100 Series	MCR106 Series	C122 Series	MCR264 Series	2N3896-9
		C106 Series	S2800 Series	MCR265 Series	2N6171-4
	MCR120 Series		MCR72(SCN) Series		MCR63-5
	MCR22 Series		2N6394 Series		MCR3835
	MCR606 Series		2N6400 Series		MCR3935
			MCR68 Series		C35
			MCR200/21 Series		C228-9
TRIACS		2N6068-75	T2500 Series	MAC223 Series	2N5441-6 Series
		2N6068A-75A	T2801 Series	MAC224 Series	2N6157-9 Series
	MAC97 Series	2N6068B-75B	SC141 Series		2N6160-5 Series
		T2322F-M	MAC218 Series		T6400-1 Series
	MAC97A Series	T2323F-M	2N6342 Series		T6410-1 Series
			T2800/02 Series		T6420-1 Series
	MAC97B Series		MAC228(SCN) Series		T6411 Series
			MAC210 Series		2N5444 Series
			2N6343A Series		
			MAC15,A Series		

SIDACS

Package	Device Type	I_{TSM} Amps	V_{BO} Volts Min	V_{BO} Volts Max
Case 267-01 	MK1V115	20	104	115
	MK1V125	20	110	125
	MK1V135	20	120	135
	MK1V240	20	220	250
	MK1V260	20	240	270
	MK1V270	20	250	280
Case 59-04 	MKP9V120	4.0	110	125
	MKP9V130	4.0	120	135
	MKP9V240	4.0	220	250
	MKP9V260	4.0	240	270
	MKP9V270	4.0	250	280

SIDAC



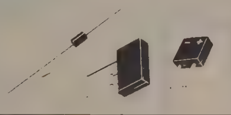
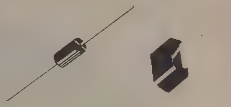
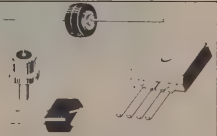
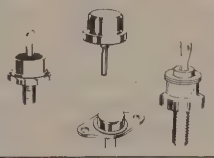
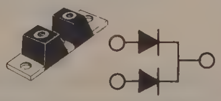
MOTOROLA

SEMICONDUCTORS

P.O. BOX 20912 • PHOENIX, ARIZONA 85036

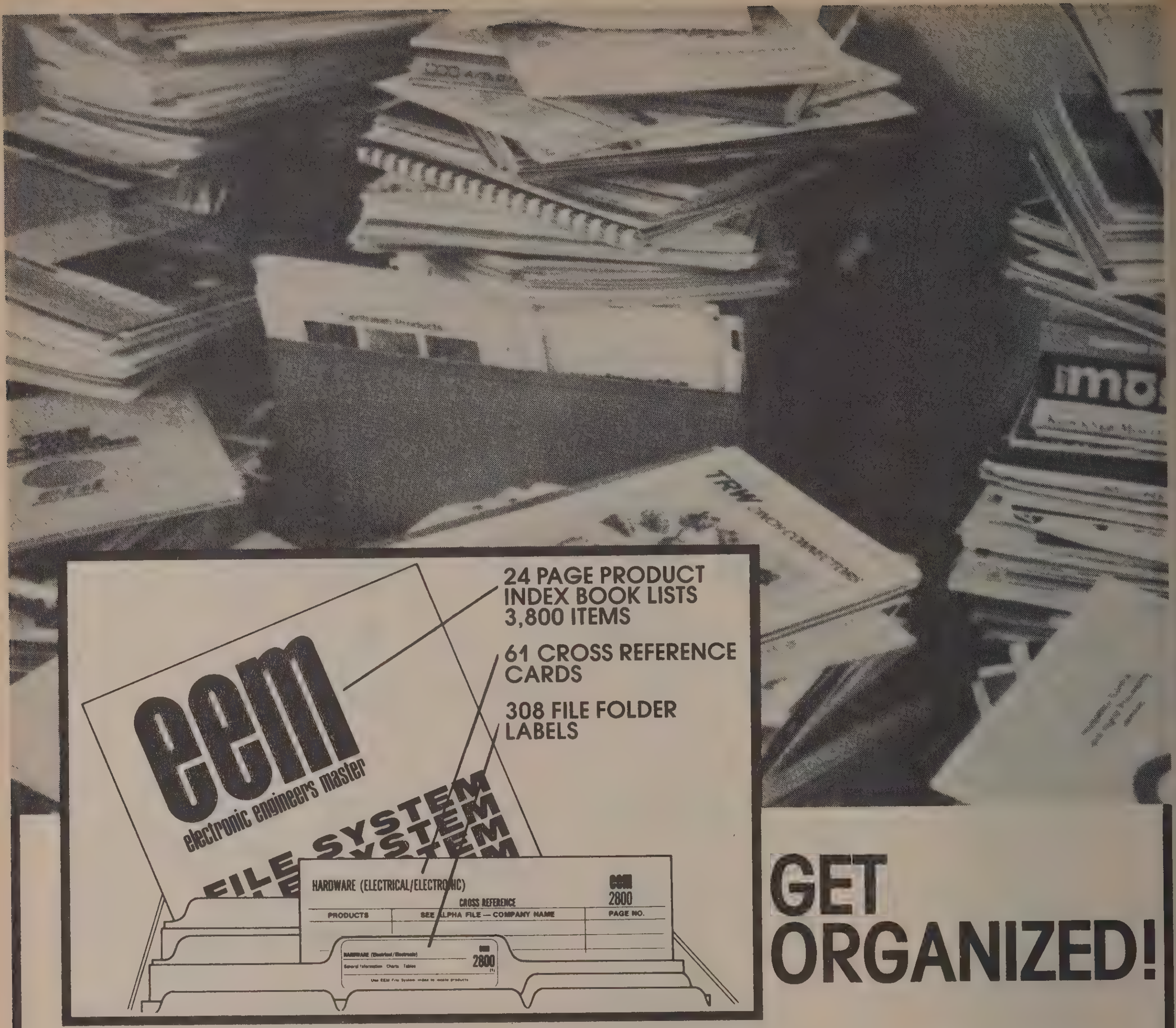
RECTIFIERS

Offering the user a broad line of rectifiers to fit all design requirements is what made us the unquestioned leader in this field. And quality, reliability and competitive prices are what keep us there.

I_O	V_R	DISCRETES / BRIDGES	GENERAL PURPOSE	BRIDGES	ULTRA-FAST RECOVERY	FAST RECOVERY	SCHOTTKY
0.5A / 2A	20-45 50-1000		1N5391-9 1N4001-7 MR5059-MR5061†	MDA920A series MDA100A* series MDA200* series	MUR105-MUR120	1N4933-7 MR810 series	MBR030 MBR040 1N5817-9 MBR120P series
3A	20-45 50-1000		1N4997-1N5003 1N5400-9 1N4719-25 MR500		MUR800-MUR860	MR830 series MR850 series MR910 series	MBR320P series 1N5820-2 MBR1020 series 1 MBR1520CT series 2
5A / 6A	20-45 50-1000		MR750 series	MDA970A series	MUR800-MUR860	MR820 series 1N3879 series 1N3879A series	MBR735-MBR745 MBR835-MBR845 3 MBR320M series 1N5823-5 MBR1020 series 1 MBR1520CT series 2
10A / 15A	20-45 50-1000		MR1120 series 1N1199,A,B series 1N1199C series	MDA980 series	MUR1605CT-MUR1620CT MUR800-MUR860 MUR1500-MUR1560	1N3889 series 1N3889A series	MBR1645 1N5626-8 MBR1520 series MBR1020 series 1 MBR1520CT series 2
20A / 25A	20-45 50-1000		1N1191 series MR2000S series 1N3491 series MR2500 series MR2400 series	MDA2500*FR* series MDA2550 series MDA990 series	MUR2505 series	1N3899 series MR2400F series	MBR2045CT 1N5829-31 MBR2520 series
30A / 35A	20-45 50-1000		1N3659 series 1N1183 series	MDA3500*FR* series MDA3500 series	MUR3020PT	R710XPT 1N3909 series	MBR3045PT MBR3545CT 3 SD41, MBR3520 series 1N6095-6 MBR3020CT series SD241
40A / 75A	20-45 50-1000		1N1183A series MR5005 series		MUR5005 series	MR860 series MR870 series	MBR6045CT 3 1N5832-4, MBR4020 series 1N6097/8, SD51, MBR6020 series, MBR7520 series MBR8045 3 MBR6545 3
100A / 300A	35-45 50-400	POWERTAP 			MUR10020CT		MBR12045CT MBR20045CT MBR30045CT

*UL Recognized †Avalanche 1 Single-diode TO-220 2 Dual-diode TO-220 3-175°C Schottky

Also available are the leadless packages for Surface Mount manufacturing, in Case 362 and Case 362B outlines.


24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
2800
TRW

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

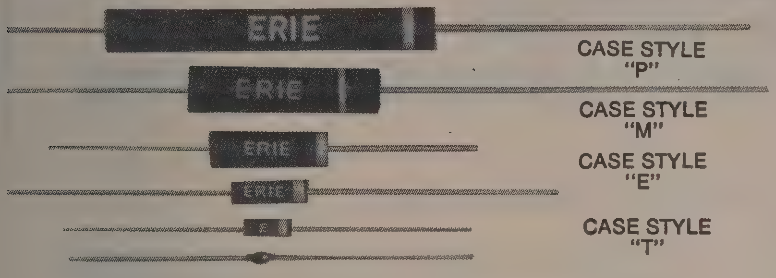
The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

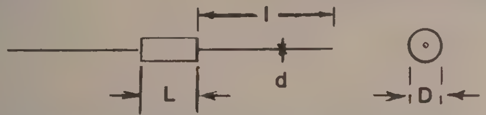
EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

high voltage silicon rectifiers fast recovery, HX / low leakage, HV

muRata ERiE
MURATA ERIE NORTH AMERICA, INC.



ACTUAL SIZES



Murata Erie high voltage silicon rectifiers are available with peak reverse voltage ratings from 1KV to 30KV, in either transfer molded or epoxy protected packages. Features include nanoampere leakage, compact design and high reliability over a wide temperature range. These rectifiers have found applications in numerous military, industrial and aerospace projects.

Case Style	Dimensions (Inches) L (Max.)	D (Max.)	l (Min.)	d
P	.130	.085	.75	.015
M	.25	.105	.75	.015
E	.625	.20	.70	.015
T	1.03	.26	1.0	.030
L	1.70	.235	1.00	.030

ELECTRICAL CHARACTERISTICS AND RATINGS

Part Number	Case Style	Peak Reverse Voltage (P.R.V.) Volts Peak	Min. Peak Transient Reverse Voltage Rating (P.T.R.V.) Volts Peak	Max. Forward Current (I_f) @ 100°C mA DC	Max. Forward Voltage (V_f) @ 10mADC and 25°C Volts DC	Max. Reverse Current (I_r) @ P.R.V. At 25°C nA	At 100°C µA	Reverse Recovery Time (Typical) (T_{rr}) TEK "S" 2mAI_f → 2mAI_f µS	Max. Capacitance @ 100VDC pF	Max. Operating Temperature °C	Storage Temperature Range °C	Cathode Identification
HV10P	P	1000	1500	50	5.0	10	1.0	2.5	0.5	150	−55 to +175	1 Brown Dot Cathode Band
HV10M	M	1000	1500	50	5.0	10	1.0	2.5		150		
HX10P	P	1000	1500	40	7.5	100	3.0	0.25		125		2 Brown Dots Cathode Band
HX10M	M	1000	1500	40	7.5	100	3.0	0.25		125		
*HV20P	P	2000	3000	50	5.0	10	1.0	2.5		150		1 Red Dot Cathode Band
HV20M	M	2000	3000	50	5.0	10	1.0	2.5		150		
*HX20P	P	2000	3000	40	7.5	100	3.0	0.25		125		2 Red Dots Cathode Band
HX20M	M	2000	3000	40	7.5	100	3.0	0.25		125		
*HV30P	P	3000	4500	50	5.0	10	1.0	2.5		150		1 Orange Dot Cathode Band
*HV30M	M	3000	4500	50	5.0	10	1.0	2.5		150		
*HX30P	P	3000	4500	40	7.5	100	3.0	0.25		125		2 Orange Dots Cathode Band
*HX30M	M	3000	4500	40	7.5	100	3.0	0.25		125		
*HV40P	P	4000	6000	50	5.0	10	1.0	2.5		150		1 Yellow Dot Cathode Band
*HV40M	M	4000	6000	50	5.0	10	1.0	2.5		150		
*HX40P	P	4000	6000	40	7.5	100	3.0	0.25		125		2 Yellow Dots Cathode Band
*HX40M	M	4000	6000	40	7.5	100	3.0	0.25		125		
*HV50P	P	5000	7500	50	5.0	10	1.0	2.5		150		1 Green Dot Cathode Band
*HV50M	M	5000	7500	50	5.0	10	1.0	2.5		150		
*HX50P	P	5000	7500	40	7.5	100	3.0	0.25		125		2 Green Dots Cathode Band
*HX50M	M	5000	7500	40	7.5	100	3.0	0.25		125		
HX50E	E	5000	7500	40	7.5	100	3.0	0.25		125		Cathode Band
*HV80ML	M	8000	12000	25	10.0	50	3.0	2.5		150		Cathode Band
*HX80ML	M	8000	12000	20	15.5	100	5.0	0.25		125		Cathode Band
HTV100	T	10000	15000	5.0	25	100	5.0	0.25		100	−55 to +150	Cathode Band
*HTV125S	E	12500	18000	5.0	30	100	5.0	0.25		125		Cathode Band
*HTV150S	E	15000	20000	5.0	30	100	5.0	0.25		125		Cathode Band

* **NOTE:** Further encapsulation is recommended for rectifiers marked "*"

ECG® Sylvania
Universal Replacement Semiconductors

Maintenance — Routine Preventive Maintenance
Repair — Repair of Equipment Failures
Operations — Plant/Equipment Renovations

TRANSISTORS	69 case styles to fit almost every application
Bi-Polar Types	Both Silicon and Germanium
Complementary Pairs	Up to 200 watts, up to 1500 volts
Bi-Polar Selector Guide (Silicon & Germanium)	
RF Selector Guide	Covering RF Power devices to 870 MHz
Field Effect Transistors (FET)	Both single and dual gate devices. Suitable from audio through UHF
Darlington Power Transistors	Gain up to 90K, power up to 250W, IC to 50A
DIODES AND RECTIFIERS	42 case styles for most applications
General Purpose	Both Silicon and Germanium
PIN Diodes	For fast switching
HV Rectifiers	Voltages to 45,000 volts
Varistors (Temperature Compensating Diodes)	Biasing diodes to achieve stability
Varistors (Voltage Compensating Diodes)	
Varactors (Variable Capacitance Diodes)	For tuning, AFC
Bridge Rectifiers	1 Amp to 40 Amps, up to 1000 volts
HV Rectifiers (Avalanche Silicon)	High voltage and high current
ZENER DIODES	From ½ to 50 watts, from 2.4 to 200 volts, axial and stud cases
INDUSTRIAL RECTIFIERS	From 3 to 2200 Amps up to 1600 volts
SILICON CONTROL RECTIFIERS (SCR)	
Phase Control	0.8 to 1880 Amps, voltages to 1200v
Switching	Frequencies to 16 kHz
TRIACS	0.8 to 40 amperes, with voltages up to 1000v in a variety of case styles to accommodate most applications
MICROPROCESSORS/RAM's	Seven popular microprocessors and their peripherals

FOR NEAREST STOCKING DISTRIBUTOR
SEE MANUFACTURER'S DIRECTORY OR CALL 1-800-225-8326

PhilipsECG
A North American Philips Company

ECG® Sylvania Universal Replacement Semiconductors

LINEAR INTEGRATED CIRCUITS

- Linear IC and Module Circuits

Op amps, wideband amplifiers, single and dual comparators, voltage regulators, VCO's, Audio PO's, zero crossing switches and timing circuits. Some in choice of package styles.

OPTO-ELECTRONIC DEVICES

- Discrete LED Indicators
- Infrared Emitting Diodes
- Phototransistor Detectors
- Optoisolators
- Opto Interruptors
- Bar Graph & LED Arrays

Red, orange, green, yellow and IR, in both narrow and wide angle. Photo-transistors to cover the IR and visible spectrum. Optoisolators with transistor, Darlington, SCR or TRIAC outputs. Both 1 and 2 digit numeric displays.

INTERFACE INTEGRATED CIRCUITS

- Display Driver Circuits
- Display Driver Outlines

Analog and digital IC's for both decoding and driving from both CMOS and TTL logic.

DIGITAL INTEGRATED CIRCUITS

- CMOS
- TTL (Including 74C CMOS Series)
- DTL
- HTL
- RTL
- HLL

4000, 4500 series and 40000 series.
74C, 74L, 74H, 74LS, 74S and 7400 series.

ECG Semiconductors

Master Replacement Guide

- Entertainment • Industrial • Commercial
- Equipment Maintenance and Repair

If it's ECG... it fits and it works

Sylvania Electronic Components

545-page Philips ECG Master Guide...
3200 ECG types that replace
over 207,000 industry numbers.

SPECIAL PURPOSE DEVICES

- Silicon Unijunction Transistors (UJT)
- Programmable Unijunction Transistor (PUT)
- Silicon Bilateral Switch (SBS)
- Silicon Unilateral Switch (SUS)
- Silicon Asymmetrical Switch (SAS)
- Silicon Controlled Switch (SCS)
- Bilateral Trigger Diodes (DIACs)

TRANSIENT SUPPRESSORS

- Metal Oxide Varistors (MOV)
- Surge Clamping Diodes
- Direct Plug-in Transient Surge Suppressors

FOR NEAREST STOCKING DISTRIBUTOR
SEE MANUFACTURER'S DIRECTORY OR CALL 1-800-225-8326

PhilipsECG

A North American Philips Company

TRIACS, SCRs, DIACS, SIDACS

TECCOR
SEMICONDUCTORS
P.O. BOX 61447
DALLAS, TEXAS 75261

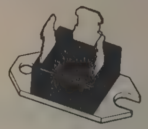
DO-35

TO-92

TO-202 AB

TO-220 AB ISOLATED

TO-220 AB NON-ISOLATED


TO-3 BASE

DO-35	TO-92	TO-202 AB	TO-220 AB ISOLATED	TO-220 AB NON-ISOLATED	TO-3 BASE
HT	E	F	L	R	P

LOGIC TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}*(mA)	PKG. TYPE
1 AMP	L201E3	200	3	E
	L201E5	200	5	
	L201E7	200	10	
	L201E9	200	25	
	L401E3	400	3	
	L401E5	400	5	
	L401E7	400	10	
	L401E9	400	25	
1.6 AMPS	L2001L3	200	3	L
	L2001L5	200	5	
	L2001L7	200	10	
	L2001L9	200	25	
	L4001L3	400	3	
	L4001L5	400	5	
	L4001L7	400	10	
	L4001L9	400	25	
4 AMPS	L2004L3	200	3	
	L2004L5	200	5	
	L2004L7	200	10	
	L2004L9	200	25	
	L4004L3	400	3	
	L4004L5	400	5	
	L4004L7	400	10	
	L4004L9	400	25	
	L2004F31	200	3	F
	L2004F51	200	5	
	L2004F71	200	10	
	L2004F91	200	25	
	L4004F31	400	3	
	L4004F51	400	5	
	L4004F71	400	10	
	L4004F91	400	25	

I_{GT} in Quadrants I, II, III, & IV

QUADRACS
(Internal Diac Trigger)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	VOLTS	PKG. TYPE
1.6 AMPS	Q2001LT	200	30–40	L
	Q4001LT	400		
3 AMPS	Q2003LT	200		
	Q4003LT	400		
4 AMPS	Q2004FT1	200	30–40	F
	Q4004FT1	400		
	Q5004FT1	500		
	Q6004FT1	600		
	Q2004LT	200	30–40	L
	Q4004LT	400		
	Q5004LT	500		
	Q6004LT	600		
6 AMPS	Q2006FT1	200	30–40	F
	Q4006FT1	400		
	Q5006FT1	500		
	Q6006FT1	600		
	Q2006LT	200	30–40	L
	Q4006LT	400		
	Q5006LT	500		
	Q6006LT	600		
8 AMPS	Q2008FT1	200	30–40	F
	Q4008FT1	400		
	Q5008FT1	500		
	Q6008FT1	600		
	Q2008LT	200	30–40	L
	Q4008LT	400		
	Q5008LT	500		
	Q6008LT	600		
10 AMPS	Q2010FT1	200	30–40	F
	Q4010FT1	400		
	Q5010FT1	500		
	Q6010FT1	600		
	Q2010LT	200	30–40	L
	Q4010LT	400		
	Q5010LT	500		
	Q6010LT	600		
15 AMPS	Q2015LT	200	30–40	
	Q4015LT	400		
	Q5015LT	500		
	Q6015LT	600		

SIDACS

PART NUMBER	VOLTS	PKG. TYPE
K1050E	105	E
K1100E	110	
K1200E	120	
K1300E	130	
K2000F1	200	F
K2200F1	220	
K2400F1	240	

DIACS

PART NUMBER	V_{BO}	PKG. TYPE
HT-5760	28	HT
HT-32	32	
HT-5761	32	
HT-5761A	32	
HT-5762	36	
HT-35	40	
HT-40	45	
HT-50	58	
HT-60	60	
HT-105	113	
HT-110	118	
HT-120	125	
HT-130	138	
HT-200	200	
HT-220	230	
HT-240	250	

TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG. TYPE
1 AMP	Q201E3	200	10	E
	Q201E4	200	25	
	Q401E3	400	10	
	Q401E4	400	25	
	Q2001L3	200	10	L
	Q2001L4	200	25	
	Q4001L3	400	10	
	Q4001L4	400	25	
3 AMPS	Q2003L3	200	10	
	Q2003L4	200	25	
	Q4003L3	400	10	
	Q4003L4	400	25	
4 AMPS	Q2004F31	200	10	F
	Q2004F41	200	25	
	Q4004F31	400	10	
	Q4004F41	400	25	
	Q5004F41	500	25	
	Q6004F41	600	25	
	Q2004L3	200	10	L
	Q2004L4	200	25	
	Q4004L3	400	10	
	Q4004L4	400	25	
	Q5004L3	500	10	
	Q5004L4	500	25	
	Q6004L4	600	25	
	Q8004L4	800	25	
	Q2004R4	200	25	R
	Q4004R4	400	25	
	Q5004R4	500	25	
	Q6004R5	600	50	
6 AMPS	Q2006F41	200	25	F
	Q4006F41	400	25	
	Q5006F41	500	25	
	Q6006F51	600	50	
	Q2006L4	200	25	L
	Q2006L5	200	50	
	Q4006L4	400	25	
	Q4006L5	400	50	
	Q5006L4	500	25	
	Q5006L5	500	50	
	Q6006L5	600	50	

TRIACS (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG. TYPE
6 AMPS	Q2006R4	200	25	R
	Q4006R4	400	25	
	Q5006R4	500	25	
	Q6006R5	600	50	
8 AMPS	Q2008F41	200	25	F
	Q4008F41	400	25	
	Q5008F41	500	25	
	Q6008F51	600	50	
	Q2008L4	200	25	L
	Q2008L5	200	50	
	Q4008L4	400	25	
	Q4008L5	400	50	
	Q5008L4	500	25	
	Q5008L5	500	50	
	Q6008L5	600	50	
	Q2008R4	200	25	R
	Q4008R4	400	25	
	Q5008R4	500	25	
	Q6008R5	600	50	
10 AMPS	Q2010F41	200	25	F
	Q4010F41	400	25	
	Q5010F41	500	25	
	Q6010F51	600	50	
	Q2010L4	200	25	L
	Q2010L5	200	50	
	Q4010L4	400	25	
	Q4010L5	400	50	
	Q5010L4	500	25	
	Q5010L5	500	50	
	Q6010L5	600	50	
	Q8010L5	800	50	
	Q2010R4	200	25	R
	Q4010R4	400	25	
	Q5010R4	500	25	
	Q6010R5	600	50	
	Q8010R5	800	50	
12 AMPS	Q2012L5	200	50	L
	Q4012L5	400	50	
	Q5012L5	500	50	
	Q6012L5	600	50	
	Q8012L5	800	50	
	Q2012R5	200	50	R
	Q4012R5	400	50	
	Q5012R5	500	50	
	Q6012R5	600	50	
	Q8012R5	800	50	
15 AMPS	Q2015L5	200	50	L
	Q4015L5	400	50	
	Q5015L5	500	50	
	Q6015L5	600	50	
	Q8015L5	800	50	
	Q2015R5	200	50	R
	Q4015R5	400	50	
	Q5015R5	500	50	
	Q6015R5	600	50	
	Q8015R5	800	50	
25 AMPS	Q2025L5	200	50	L
	Q4025L5	400	50	
	Q5025L5	500	50	
	Q6025L5	600	50	
	Q2025R5	200	50	R
	Q4025R5	400	50	
	Q5025R5	500	50	
	Q6025R5	600	50	
	Q2025P	200	80	P
	Q4025P	400	80	
	Q5025P	500	80	
	Q6025P	600	80	
40 AMPS	Q2040P	200	100	
	Q4040P	400	100	
	Q5040P	500	100	
	Q6040P	600	100	

TECCOR
SEMICONDUCTORS

TRIACS, SCRs, DIACS, SIDACS

THYRISTOR SPECIALIST

214/252-7651

SENSITIVE SCR's

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(\mu A)}$	PKG. TYPE
.8 AMPS	EC103Y	30	200	E
	EC103Y1	30	10	
	EC103Y2	30	50	
	EC103Y3	30	500	
	EC103A	100	200	
	EC103A1	100	10	
	EC103A2	100	50	
	EC103A3	100	500	
	EC103B	200	200	
	EC103B1	200	10	
	EC103B2	200	50	
	EC103B3	200	500	
	EC103C	300	200	
	EC103C1	300	10	
	EC103C2	300	50	
	EC103C3	300	500	
	EC103D	400	200	
	EC103D1	400	10	
	EC103D2	400	50	
	EC103D3	400	500	
	EC103E	500	200	
	EC103E1	500	10	
	EC103E2	500	50	
	EC103E3	500	500	
	EC103M	600	200	
	EC103M1	600	10	
	EC103M2	600	50	
	EC103M3	600	500	
	2N5060	30	200	
	2N5061	60	200	
	2N5062	100	200	
	2N5063	150	200	
	2N5064	200	200	
1.6 AMPS	S0301LS1	30	100	L
	S0301LS2	30	200	
	S0301LS3	30	500	
	S0501LS1	50	100	
	S0501LS2	50	200	
	S0501LS3	50	500	
	S1001LS1	100	100	
	S1001LS2	100	200	
	S1001LS3	100	500	
	S2001LS1	200	100	
	S2001LS2	200	200	
	S2001LS3	200	500	
	S4001LS1	400	100	
	S4001LS2	400	200	
	S4001LS3	400	500	
3 AMPS	S0303LS1	30	100	
	S0303LS2	30	200	
	S0303LS3	30	500	
	S0503LS1	50	100	
	S0503LS2	50	200	
	S0503LS3	50	500	
	S1003LS1	100	100	
	S1003LS2	100	200	
	S1003LS3	100	500	
	S2003LS1	200	100	
	S2003LS2	200	200	
	S2003LS3	200	500	
	S4003LS1	400	100	
	S4003LS2	400	200	
	S4003LS3	400	500	
4 AMPS	T106Q1	15	200	F
	T107Q1	15	500	
	T106Y1	30	200	
	T107Y1	30	500	
	T106F1	50	200	
	T107F1	50	500	
	T106A1	100	200	
	T107A1	100	500	
	T106B1	200	200	
	T107B1	200	500	
	T106C1	300	200	
	T107C1	300	500	
	T106D1	400	200	
	T107D1	400	500	
	T106E1	500	200	
	T107E1	500	500	
	T106M1	600	200	
	T107M1	600	500	
6 AMPS	S0306FS21	30	200	
	S0306FS31	30	500	
	S0506FS21	50	200	
	S0506FS31	50	500	
	S1006FS21	100	200	
	S1006FS31	100	500	
	S2006FS21	200	200	
	S2006FS31	200	500	
	S4006FS21	400	200	
	S4006FS31	400	500	
	S0306LS2	30	200	L
	S0306LS3	30	500	
	S0506LS2	50	200	
	S0506LS3	50	500	
	S1006LS2	100	200	
	S1006LS3	100	500	
	S2006LS2	200	200	
	S2006LS3	200	500	
	S4006LS2	400	200	
	S4006LS3	400	500	

SEN. SCR's (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(\mu A)}$	PKG. TYPE
8 AMPS	S0308FS21	30	200	F
	S0308FS31	30	500	
	S0508FS21	50	200	
	S0508FS31	50	500	
	S1008FS21	100	200	
	S1008FS31	100	500	
	S2008FS21	200	200	
	S2008FS31	200	500	
	S4008FS21	400	200	
	S4008FS31	400	500	
	S0308LS2	30	200	L
	S0308LS3	30	500	
	S0508LS2	50	200	
	S0508LS3	50	500	
	S1008LS2	100	200	
	S1008LS3	100	500	
	S2008LS2	200	200	
	S2008LS3	200	500	
	S4008LS2	400	200	
	S4008LS3	400	500	
10 AMPS	S0310FS21	30	200	F
	S0310FS31	30	500	
	S0510FS21	50	200	
	S0510FS31	50	500	
	S1010FS21	100	200	
	S1010FS31	100	500	
	S2010FS21	200	200	
	S2010FS31	200	500	
	S4010FS21	400	200	
	S4010FS31	400	500	
	S0310LS2	30	200	L
	S0310LS3	30	500	
	S0510LS2	50	200	
	S0510LS3	50	500	
	S1010LS2	100	200	
	S1010LS3	100	500	
	S2010LS2	200	200	
	S2010LS3	200	500	
	S4010LS2	400	200	
	S4010LS3	400	500	

SCR's

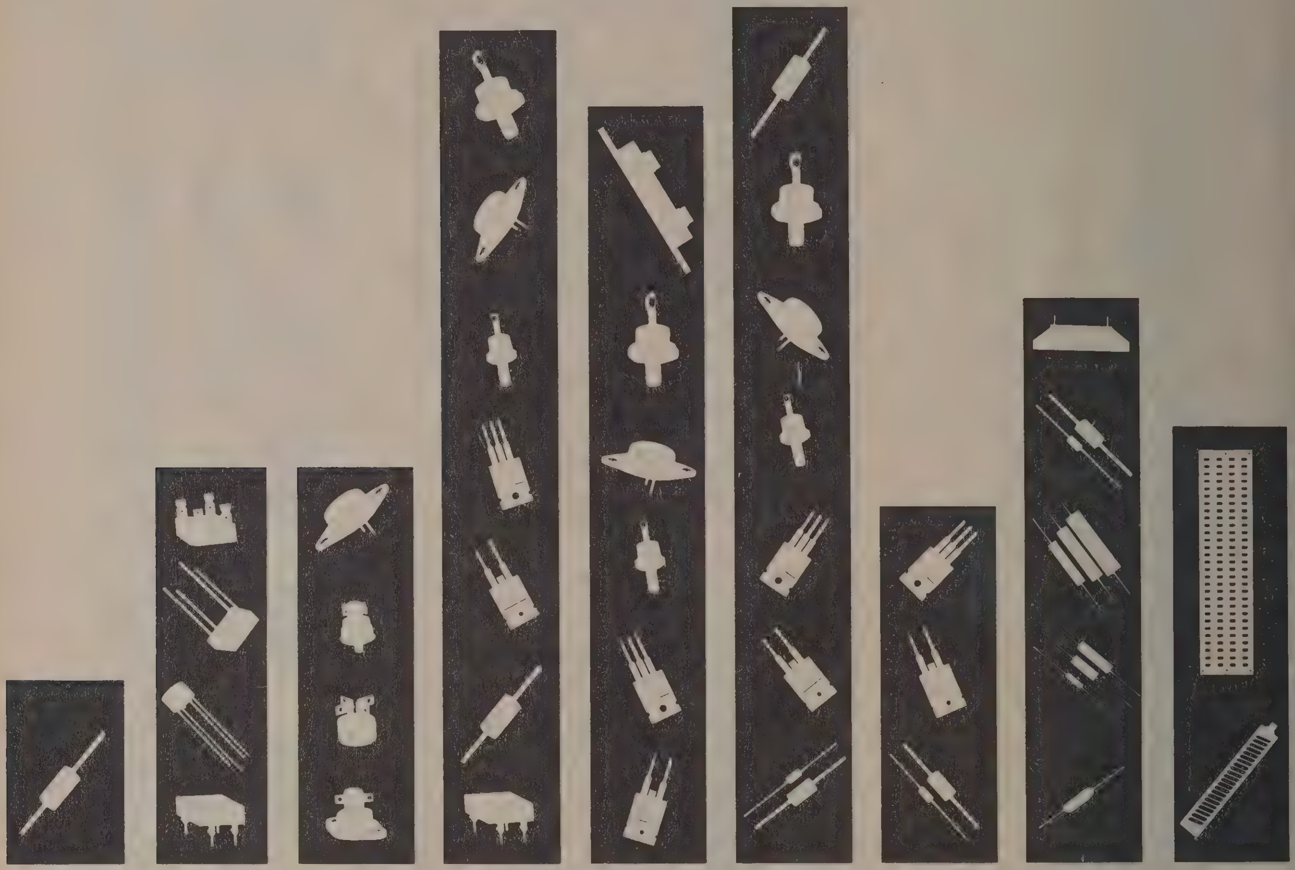
$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(mA)}$	PKG. TYPE
1 AMPS	S031E	30	10	E
	S051E	50	10	
	S101E	100	10	
	S201E	200	10	
	S401E	400	10	
	S601E	600	10	
1.6 AMPS	S0301L	30	10	L
	S0501L	50	10	
	S1001L	100	10	
	S2001L	200	10	
	S4001L	400	10	
	S6001L	600	10	
3 AMPS	S0303L	30	10	
	S0503L	50	10	
	S1003L	100	10	
	S2003L	200	10	
	S4003L	400	10	
	S6003L	600	10	
4 AMPS	S0304F1	30	10	F
	S0504F1	50	10	
	S1004F1	100	10	
	S2004F1	200	10	
	S4004F1	400	10	
	S6004F1	600	10	
6 AMPS	S0306F1	30	15	
	S0506F1	50	15	
	S1006F1	100	15	
	S2006F1	200	15	
	S4006F1	400	15	
	S6006F1	600	15	
	S0306L	30	15	L
	S0506L	50	15	
	S1006L	100	15	
	S2006L	200	15	
	S4006L	400	15	
	S6006L	600	15	
8 AMPS	S0308F1	30	15	F
	S0508F1	50	15	
	S1008F1	100	15	
	S2008F1	200	15	
	S4008F1	400	15	
	S6008F1	600	15	
	S0308L	30	15	L
	S0508L	50	15	
	S1008L	100	15	
	S2008L	200	15	
	S4008L	400	15	
	S6008L	600	15	

SCR's (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(mA)}$	PKG. TYPE
8 AMPS	S0308R	30	15	R
	S0508R	50	15	
	S1008R	100	15	
	S2008R	200	15	
	S4008R	400	15	
	S6008R	600	15	
10 AMPS	S0310F1	30	15	F
	S0510F1	50	15	
	S1010F1	100	15	
	S2010F1	200	15	
	S4010F1	400	15	
	S6010F1	600	15	
	S0310L	30	15	L
	S0510L	50	15	
	S1010L	100	15	
	S2010L	200	15	
	S4010L	400	15	
	S6010L	600	15	
12 AMPS	S0312L	30	20	
	S0512L	50	15	
	S1012L	100	20	
	S2012L	200	20	
	S4012L	400	20	
	S6012L	600	20	
	S0312R	30	15	R
	S0512R	50	15	
	S1012R	100	20	
	S2012R	200	20	
	S4012R	400	20	
	S6012R	600	20	
15 AMPS	S0315L	30	30	L
	S0515L	50	15	
	S1015L	100	30	
	S2015L	200	30	
	S4015L	400	30	
	S6015L	600	30	
	S8015L	800	50	
16 AMPS	S0316R	30	30	R
	S0516R	50	15	
	S1016R	100	30	
	S2016R	200	30	
	S4016R	400	30	
	S6016R	600	30	
	S8016R	800	50	
20 AMPS	S0320L	30	30	L
	S0520L	50	30	
	S1020L	100	30	
	S2020L	200	30	
	S4020L	400	30	
	S6020L	600	30	
	S8020L	800	50	
25 AMPS	S0325L	30	30	
	S0525L	50	30	
	S1025L	100	30	
	S2025L	200	30	
	S4025L	400	30	
	S6025L	600	30	
	S8025L	800	50	
	S0325R	30	30	R
	S0525R	50	30	
	S1025R	100	30	
	S2025R	200	30	
	S4025R	400	30	
	S6025R	600	30	
	S8025R	800	50	
65 AMPS	S0365P	30	50	P
	S0565P	50	50	
	S1065P	100	50	
	S2065P	200	50	
	S4065P	400	50	
	S6065P	600	50	

Power. Speed. Packages.

Varo offers you the best choice of silicon rectifiers and bridges.



Epoxy Axial Lead: V3 Series; 3a w/100-200a surge; 50v to 1000v; Fast Recovery (200 ns)

Epoxy Bridge: VM, VE, VS, VH, VJ, VK Series; 1a-30a; 25v to 1000v; Fast Recovery (200 ns)

Integrated Bridge: IN, VT, VY, R700 Series; 10a to 36a; 200v to 600v; Fast Recovery (200 ns)

Schottky Barrier: VSB, VSK Series; 750ma-60a; 20v to 45v; Ultra Fast Recovery (< 10 ns)

High Temp Schottky: VSK Series; 10a to 200a; 20v to 60v; Ultra Fast Recovery (< 10 ns)

EPI High Efficiency: VHE Series; 1a to 70a; 50v to 200v; Fast Recovery (35-50 ns)

Very Fast Recovery: TG Series; 1a to 16a; 400v to 1000v; (100 ns)

HV Silicon: H, VA, VB, VG, VF, VC Series; 3ma to 2a; 1kV to 50kV; Fast Recovery (100-250 ns)

HV Assemblies: H series; X-Ray; Pollution Control; 7 kV to 360kV; Fast Recovery (100-250 ns)

VARO

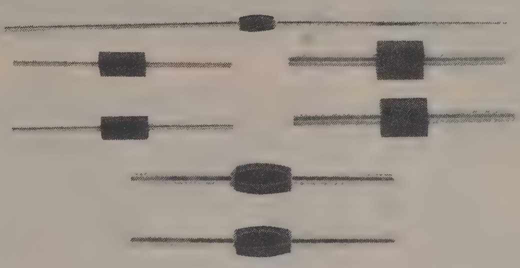
The World's Leading Rectifier Company

For application information, specs or a sample device, call 214/271-8511
VARO Semiconductor Box 469013 Garland, TX 75046-9013 TWX 910-860-5178

© 1983 Varo Semiconductor/5352

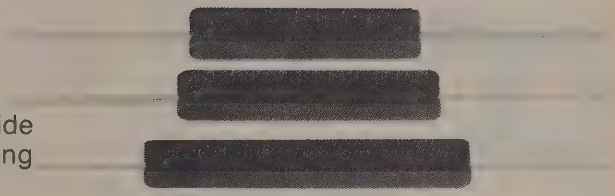
HIGH VOLTAGE DISCRETES 1.5 KV to 10 KV

- 25 MA - 80 MA to 100 NS Recovery Time (Body Size .090" x .250")
- 100 MA - 250 MA to 100 NS Recovery Time (Body Size .125" x .250")
- 500 MA - 2 AMP to 100 NS Recovery Time (Body Size .200" x .250")



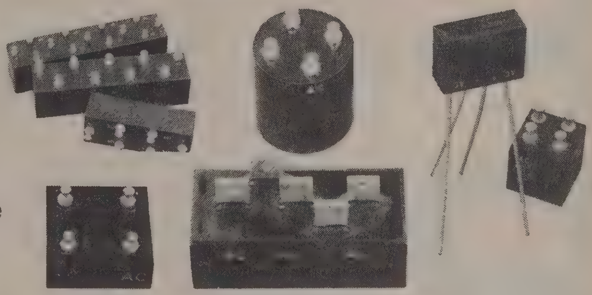
HIGH VOLTAGE RECTIFIER STACKS

Stacked High Voltage Discretes repotted to provide the PIV needed. Size made depending on operating in air or oil media.



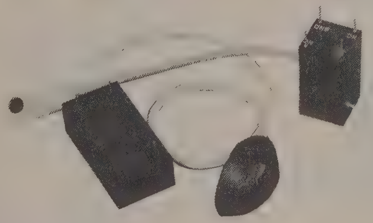
HIGH or LOW VOLTAGE ASSEMBLIES

Single bridge or multiple bridge configurations available or to your package criteria. Low voltage with or without MIL QPL Rectifiers.



HIGH VOLTAGE MULTIPLIERS

Multipliers made with number of stages to yield output to 150 KV+.



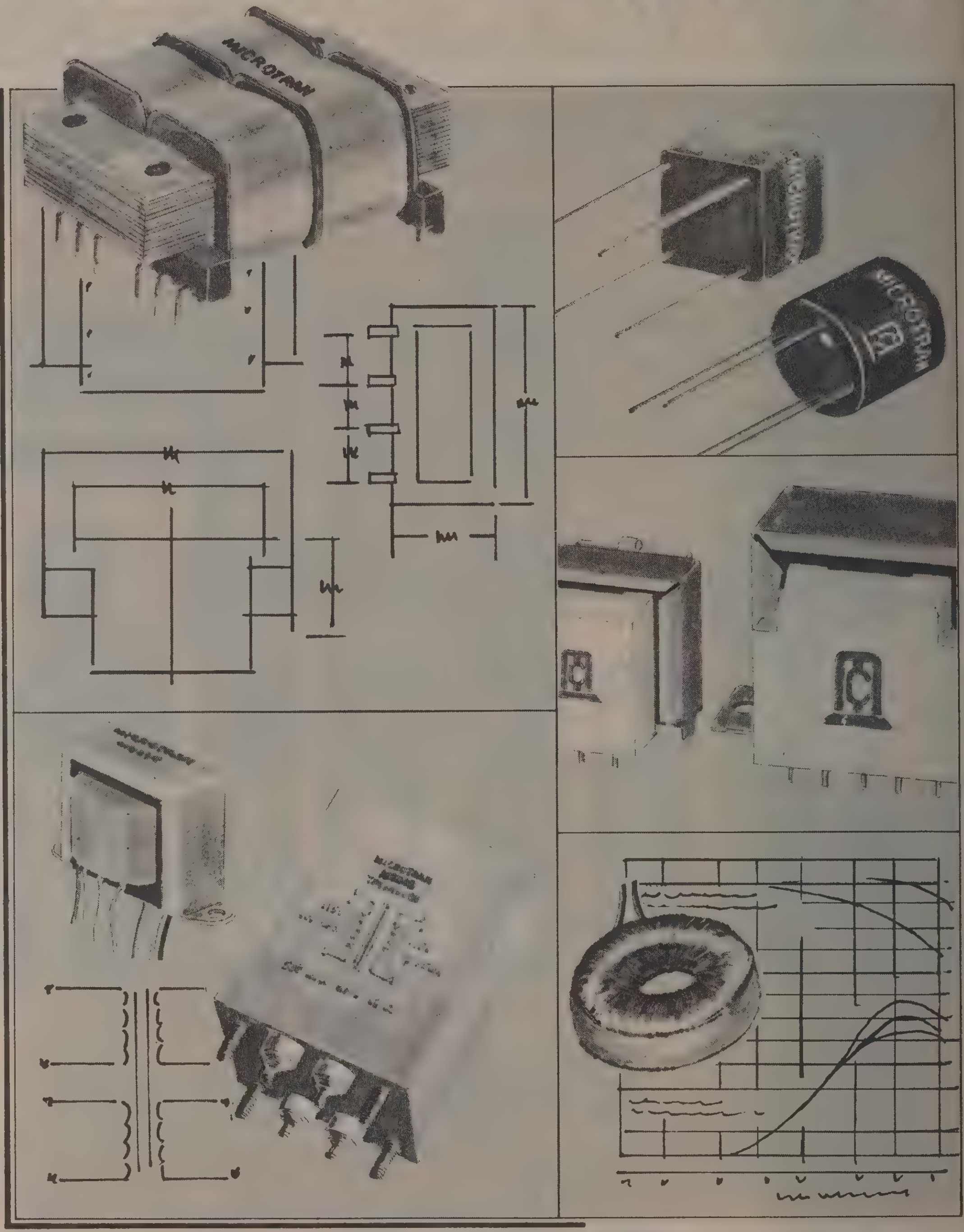
CUSTOM PACKAGING/PROCESSING

- Packaging can be tailored to characteristics and space.
- Processing of discretes or assemblies can be to specs or MIL.

vmi **VOLTAGE MULTIPLIERS, INC.**

8711 West Roosevelt ▪ Visalia, CA 93291 ▪ (209) 651-1402 ▪ TL 176559

MICROTRAN TRANSFORMERS


MICROTRAN
MICROTRAN
MICROTRAN

MICROTRAN
company, inc.

AUDIO-POWER
COMMERCIAL-MIL

Immediate Delivery From Distributors

**See EEM Pages 1A·2192 to 1A·2205
and Coil Section 1800 Page 1A·1245**

POWER & CONTROL

Manufacturer	Power										Control		Current (Instrument)	Switch Mode
	115/230V Input		Filament	Rectifier	Isolation	Voltage Regulating	DC-to-DC Converter	Variable (Incl. Auto Transformer)	Power Distribution	High Voltage	Synchro/Resolver/Synchro	Servo		
	50/60 Hz	400 Hz												
Abbott	1A•2117-1A•2123*	1A•2117-1A•2123*	1A•2117-1A•2122*	1A•2120-1A•2122*										
Advanced Transformers	1A•2264 1A•2265													
Amecon	1A•2129 1A•2130												1A•2127	1A•2127
Arstan Products	1A•2132		1A•2132	1A•2132										
BH Electronics	1A•2136* 1A•2137*						1A•2136							
Dale Electronics	1A•2142-1A•2149			1A•2142-1A•2149	1A•2142-1A•2149		1A•2139							
Del Electronics	1A•2151				1A•2151					1A•2151			1A•2151	
Endicott Coil	1A•2152*													
EWC Inc.	1A•2154-1A•2161* 1A•2163				1A•2162			1A•2162						
Flex-Core													1A•2165	
Freed Transformer	1A•2166* 1A•2169	1A•2166*	1A•2166* 1A•2169		1A•2169			1A•2169		1A•2166*				
Hipotronics	1A•2172-1A•2174			1A•2174	1A•2173			1A•2172 1A•2173		1A•2172-1A•2174				
Hisonic	1A•2175*	1A•2175*					1A•2175			1A•2175	1A•2175			
Hitran	1A•2176		1A•2176	1A•2176	1A•2176	1A•2176			1A•2176	1A•2176				
Jerome Industries	1A•2177			1A•2177	1A•2177								1A•2177	
JM Transformer	1A•2178-1A•2181				1A•2178-1A•2181									
Lenco Electronics	1A•2182 1A•2183	1A•2183	1A•2183		1A•2183		1A•2183	1A•2182						
Magnetico	1A•2185	1A•2185									1A•2185	1A•2185	1A•2185	1A•2185
MCI Transformer	1A•2191													
Microtran	1A•2192-1A•2199	1A•2198			1A•2199 1A•2204		1A•2198						1A•2192-1A•2195	
MTE Corp.	1A•2208*			1A•2208*									1A•2208	
Multi Products	1A•2206									1A•2206				1A•2206
Murata Erie										1A•2209				
North Hills					1A•2210					1A•2210				
NWL Transformers	1A•2211	1A•2211	1A•2211							1A•2211			1A•2211	
OPT Industries	1A•2212 1A•2213													
Pan-Magnetics	1A•2215 1A•2218 1A•2219			1A•2218 1A•2219	1A•2217		1A•2215							
Paraline	1A•2223-1A•2225		1A•2223 1A•2224											
PC Transformer	1A•2226-1A•2228		1A•2226		1A•2229			1A•2229						
Pearson Electronics										1A•2230			1A•2230	
Perkin-Elmer					1A•2231						1A•2231	1A•2231		
Pico Electronics	1A•2233 1A•2255	1A•2233 1A•2255	1A•2254				1A•2233 1A•2252 1A•2253							
Prem Magnetics	1A•2257-1A•2259													
Shogyo	1A•2263			1A•2263										
Signal Transformer	1A•2267-1A•2279	1A•2267 1A•2272 1A•2273 1A•2278		1A•2267 1A•2270 1A•2272-1A•2276	1A•2267 1A•2278			1A•2267 1A•2277						
Staco Energy Products	1A•2280 1A•2281				1A•2281			1A•2280 1A•2281	1A•2280 1A•2281					
Staco Transpower	1A•2283			1A•2283				1A•2283					1A•2283	
Stancor	1A•2284-1A•2286 1A•2289		1A•2284-1A•2286	1A•2284-1A•2286	1A•2290-1A•2292								1A•2287 1A•2288	
Sterling Transformer	1A•2293-1A•2295	1A•2294* 1A•2295*			1A•2293			1A•2293						
Superior Electric	1A•2298 1A•2299							1A•2298 1A•2299						
TDK Corporation	1A•2300												1A•2300	

* Mil. Spec.

POWER & CONTROL

	Power										Control			
	115/230V Input													
Manufacturer	50/60 Hz	400 Hz	Filament	Rectifier	Isolation	Voltage Regulating	DC-to-DC Converter	Variable (Incl. Auto Transformer)	Power Distribution	High Voltage	Synchro/ Resolver/ Synchro	Servo	Current (Instrument)	Switch Mode
Technipower						1A•2301		1A•2301						
Thordarson Meissner	1A•2305- 1A•2307									1A•2304				
Todd Systems	1A•2308- 1A•2311*	1A•2308 1A•2309	1A•2308 1A•2309	1A•2308 1A•2309	1A•2310	1A•2311		1A•2311						
Toroid Corp.	1A•2312 1A•2313			1A•2312 1A•2313										
Torotel Products	1A•2317- 1A•2320*	1A•2319			1A•2314- 1A•2316*									
Torwico Electronics	1A•2322* 1A•2323*	1A•2322* 1A•2323*												
Trans American Transformer	1A•2325*	1A•2325*	1A•2325*											
Transduktor	1A•2327 1A•2328	1A•2327 1A•2328		1A•2327 1A•2328	1A•2327 1A•2328			1A•2327 1A•2328	1A•2326				1A•2327 1A•2328	
Triad-Utrad	1A•2330- 1A•2337	1A•2336	1A•2330 1A•2331	1A•2332 1A•2334	1A•2335			1A•2333						
TRW Inductive Products	1A•2338* 1A•2354* 1A•2358- 1A•2360	1A•2338* 1A•2354* 1A•2357- 1A•2360*	1A•2338* 1A•2356* 1A•2357* 1A•2359*	1A•2354* 1A•2355* 1A•2359* 1A•2360*	1A•2339- 1A•2344* 1A•2357* 1A•2359- 1A•2361*		1A•2355*	1A•2346	1A•2357*	1A•2338*				
Wayne Transformer	1A•2365		1A•2365		1A•2365					1A•2365				

AUDIO, RF, SPECIAL

	Audio									
Manufacturer	Driver	Input	Interstage	Matching	Microphone	Output	Telephone Coupling	Isolation	RF-IF	Pulse (Including Trigger)
Arstan Products							1A•2134			
BH Electronics										1A•2136*
Dale Electronics							1A•2140 1A•2141	1A•2142- 1A•2149		
Del Electronics								1A•2151		
EWC Inc.								1A•2162		
Freed Transformer								1A•2169		1A•2166*
Hammond Manufacturing										1A•2171
Hipotronics								1A•2173		
Hisonic				1A•2175					1A•2175	1A•2175
Jerome Industries								1A•2177		
JM Transformer						1A•2178- 1A•2181				
Lenco Electronics		1A•2183		1A•2182 1A•2183		1A•2183				
Microtran		1A•2199 1A•2204	1A•2199 1A•2204	1A•2199 1A•2204	1A•2199	1A•2199 1A•2204	1A•2199- 1A•2202			
Multi Products				1A•2206 1A•2207					1A•2206	1A•2206
North Hills				1A•2210					1A•2210	1A•2210
OPT Industries	1A•2213									
Pan-Magnetics				1A•2217			1A•2215 1A•2217			1A•2215 1A•2216
Paraline							1A•2224 1A•2225			
PC Transformer		1A•2229	1A•2229			1A•2229	1A•2229			
Pearson Electronics										1A•2230
Pico Electronics		1A•2233- 1A•2249* 1A•2254*		1A•2233- 1A•2249*	1A•2233*					1A•2233* 1A•2250* 1A•2251*
Renco Electronics	1A•2260 1A•2261		1A•2260 1A•2261							
Shogyo						1A•2263				
Stancor							1A•2290- 1A•2292			
Sterling Transformer					1A•2296 1A•2297*					
Torotel Products	1A•2314- 1A•2316*	1A•2314- 1A•2316*	1A•2314- 1A•2316*			1A•2314- 1A•2316*				
Triad-Utrad							1A•2335			
TRW Inductive Products		1A•2338* 1A•2346- 1A•2353*	1A•2338- 1A•2353* 1A•2361*	1A•2345* 1A•2346*		1A•2338- 1A•2346* 1A•2349- 1A•2353	1A•2338* 1A•2345*		1A•2338*	1A•2338* 1A•2361- 1A•2363*
Wayne Transformer						1A•2365				

* Mil. Spec.

abbott TRANSFORMERS

60 Hz Power Transformers

MODEL 6B

SPECIFICATIONS

INPUT PRIMARY: 115 VAC standard. 230 VAC at 10% additional cost. Specify by suffixing "A" to model number. 115/230 VAC dual input at 10% additional cost. Specify by suffixing "B" to model number.

INPUT FREQUENCY: 50 to 400 Hz, 1 phase.

REGULATION: 15% max. from no load to full load (6% on units size 8 and larger).

SECONDARY VOLTAGE TOLERANCE: Within 5% of listed output voltage when measured at full load and 115 VAC input.

INSULATION TEST: 1500 VAC.

OPERATING TEMPERATURE: 80°C maximum ambient (70°C on units size 8 and larger).

APPROXIMATE EFFICIENCY: Ranges from 80% to 90%.

CONSTRUCTION: Commercial grade using Silicon Iron for core and heavy insulated synthetic film magnet wire with class "B" rating impregnated with a high quality insulating varnish having a class "H" rating. Other outputs and/or inputs available on request.

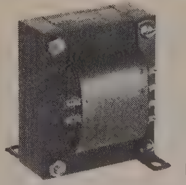


FIG. 1, 2, 3

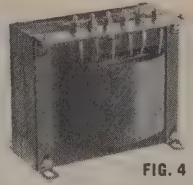


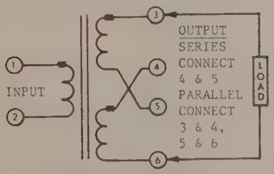
FIG. 4

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
5V Parallel 10V C.T. Series	2.0	1.0	1	1.2	6B5-10
	3.0	1.5	2	1.5	6B5-15
	6.0	3.0	3	2.2	6B5-30
	12.0	6.0	4	3.0	6B5-60
	18.0	9.0	5	4.3	6B5-90
	26.0	13.0	6	5.5	6B5-130
	32.0	16.0	7	7.0	6B5-160
	60.0	30.0	8	13.0	6B5-300†
	100.0	50.0	9	23.0	6B5-500†
6.3V Parallel 12.6V C.T. Series	1.60	0.80	1	1.2	6B6-10
	2.40	1.20	2	1.5	6B6-15
	4.80	2.40	3	2.2	6B6-30
	9.40	4.70	4	3.0	6B6-60
	14.4	7.20	5	4.3	6B6-90
	20.6	10.3	6	5.5	6B6-130
	25.4	12.7	7	7.0	6B6-160
	48.0	24.0	8	13.0	6B6-300†
	95.0	47.5	9	23.0	6B6-600†
8V Parallel 16V C.T. Series	1.20	0.60	1	1.2	6B8-10
	1.80	0.90	2	1.5	6B8-15
	3.60	1.80	3	2.2	6B8-30
	7.60	3.80	4	3.0	6B8-60
	11.2	5.60	5	4.3	6B8-90
	16.2	8.10	6	5.5	6B8-130
	20.0	10.0	7	7.0	6B8-160
	37.5	18.75	8	13.0	6B8-300†
	75.0	37.50	9	23.0	6B8-600†
	100.0	50.0	10	26.0	6B8-800†
10V Parallel 20V C.T. Series	1.0	0.5	1	1.2	6B10-10
	1.5	0.75	2	1.5	6B10-15
	3.0	1.5	3	2.2	6B10-30
	6.0	3.0	4	3.0	6B10-60
	9.0	4.5	5	4.3	6B10-90
	13.0	6.5	6	5.5	6B10-130
	16.0	8.0	7	7.0	6B10-160
	30.0	15.0	8	13.0	6B10-300†
	60.0	30.0	9	23.0	6B10-600†
	85.0	42.5	10	26.0	6B10-850†
	100.0	50.0	11	36.0	6B10-1000†
12V Parallel 24V C.T. Series	0.82	0.41	1	1.2	6B12-10
	1.24	0.62	2	1.5	6B12-15
	2.50	1.25	3	2.2	6B12-30
	5.0	2.50	4	3.0	6B12-60
	7.5	3.75	5	4.3	6B12-90
	10.82	5.41	6	5.5	6B12-130
	13.32	6.66	7	7.0	6B12-160
	25.00	12.50	8	13.0	6B12-300*
	50.00	25.00	9	23.0	6B12-600†
	71.00	35.50	10	26.0	6B12-850†
	100.00	50.00	11	36.0	6B12-1200†
17V Parallel 34V C.T. Series	0.58	0.29	1	1.2	6B17-10
	0.88	0.44	2	1.5	6B17-15
	1.76	0.88	3	2.2	6B17-30
	3.52	1.76	4	3.0	6B17-60
	5.28	2.64	5	4.3	6B17-90
	7.64	3.82	6	5.5	6B17-130
	9.40	4.70	7	7.0	6B17-160
	17.65	8.8	8	13.0	6B17-300*
	35.00	17.5	9	23.0	6B17-600†
	50.00	25.00	10	26.0	6B17-850†
	76.5	38.25	11	36.0	6B17-1300†
20V Parallel 40V C.T. Series	0.5	0.25	1	1.2	6B20-10
	0.74	0.37	2	1.5	6B20-15
	1.5	0.75	3	2.2	6B20-30
	3.0	1.5	4	3.0	6B20-60
	4.5	2.25	5	4.3	6B20-90
	6.5	3.25	6	5.5	6B20-130
	8.0	4.0	7	7.0	6B20-160
	15.0	7.50	8	13.0	6B20-300*
	30.0	15.0	9	23.0	6B20-600†
	42.5	21.25	10	26.0	6B20-850†
	65.0	32.50	11	36.0	6B20-1300†
28V Parallel 56V C.T. Series	0.36	0.18	1	1.2	6B28-10
	0.52	0.26	2	1.5	6B28-15
	1.06	0.53	3	2.2	6B28-30
	2.14	1.07	4	3.0	6B28-60
	3.20	1.60	5	4.3	6B28-90
	4.64	2.32	6	5.5	6B28-130
	5.70	2.85	7	7.0	6B28-160
	10.70	5.35	8	13.0	6B28-300*
	21.43	10.71	9	23.0	6B28-600*
	30.36	15.18	10	26.0	6B28-850*
	46.42	23.21	11	36.0	6B28-1300†
44V Parallel 88V C.T. Series	0.22	0.11	1	1.2	6B44-10
	0.34	0.17	2	1.5	6B44-15
	0.68	0.34	3	2.2	6B44-30
	1.36	0.68	4	3.0	6B44-60
	2.04	1.02	5	4.3	6B44-90
	2.94	1.47	6	5.5	6B44-130
	3.62	1.81	7	7.0	6B44-160
	6.82	3.41	8	13.0	6B44-300*
	13.64	6.82	9	23.0	6B44-600*
	19.32	9.66	10	26.0	6B44-850
	29.54	14.77	11	36.0	6B44-1300 †
60V Parallel 120V C.T. Series	0.16	0.08	1	1.2	6B60-10
	0.250	0.125	2	1.5	6B60-15
	0.50	0.25	3	2.2	6B60-30
	1.0	0.50	4	3.0	6B60-60
	1.5	0.75	5	4.3	6B60-90
	2.16	1.08	6	5.5	6B60-130
	2.66	1.33	7	7.0	6B60-160
	5.00	2.50	8	13.0	6B60-300*
	10.00	5.00	9	23.0	6B60-600*
	14.16	7.08	10	26.0	6B60-850*
	21.67	10.83	11	36.0	6B60-1300†

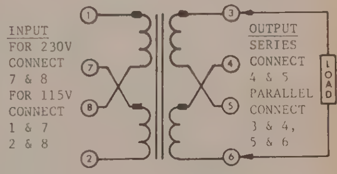
* Use Fig. 3 for layout †Use Fig. 4 for layout

SIZE	A	B	C	D	E	F	HOLE	FIG.
1	1.95	1.68	2.31	2.37	—	2.87	0.18	1
2	2.26	1.93	2.68	2.81	—	3.12	0.18	1
3	2.57	2.18	3.06	3.12	—	3.56	0.18	1
4	2.81	2.43	3.37	2.25	2.12	2.70	0.2 x 0.3	2
5	3.12	2.68	3.75	2.50	2.25	2.86	0.2 x 0.3	2
6	3.44	2.93	4.12	2.75	2.37	2.98	0.2 x 0.3	3
7	3.75	3.18	4.50	3.00	2.50	3.11	0.2 x 0.3	3
8	5.25	3.87	4.37	4.37	2.85	3.75	0.26 x 0.4	3 or 4
9	6.37	4.62	5.31	5.31	3.22	4.20	0.26 x 0.4	3 or 4
10	6.37	4.99	5.31	5.31	3.60	4.58	0.26 x 0.4	3 or 4
11	7.50	5.37	6.25	6.75	3.60	4.85	0.26 x 0.4	3 or 4

DIMENSIONAL TOLERANCE: ±0.06 except B is max.



STANDARD & "A" OPTION



"B" OPTION

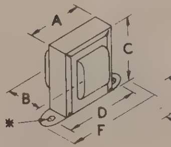


FIG. 1

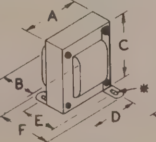


FIG. 2

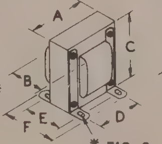


FIG. 3

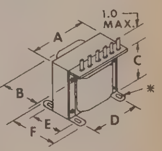


FIG. 4

ABBOTT TRANSISTOR LABORATORIES, INC.

Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ, 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235

abbott
TRANSFORMERS

60 Hz 3 Ø Power Transformers

MODEL 6D

SPECIFICATIONS

INPUT PRIMARY: **WYE:** 120V L-Com. Suffix A
WYE: 208V L-L Suffix B
DELTA: 120V L-L Suffix C
DELTA: 230V L-L Suffix E
DELTA: 440V L-L Suffix F

NOTE: To order a specific input voltage add suffix to model number.
(EXAMPLE: 6D ( ) 15-200E has input 230V L-L (3 wire DELTA)).

INPUT FREQUENCY: 50 Hz to 60 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% max. no load to full load. (6% on size 3 thru 6).

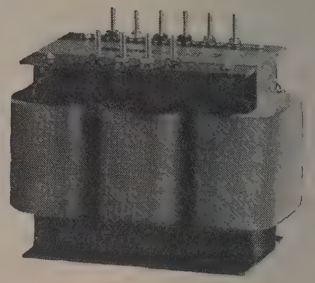
INSULATION TEST: 1500 VRMS

EFFICIENCY: Ranges from 90% to 95%.

OPERATING TEMP.: +80°C ambient max.

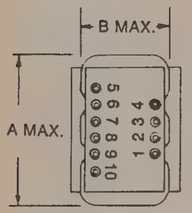
CONSTRUCTION: Industrial Grade (open frame): Specify the letter "F" in the model number. (Example: 6DF 15-200 ( )). MIL-T-27D (Grade 5 Class S). Specify the letter "M" in the model number. (Example. 6DM15-200 ( )).

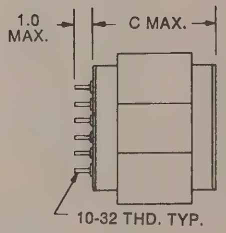
NOTE: MIL-T-27D add .20 to Dim. A, B, C.
Other inputs and/or outputs available.

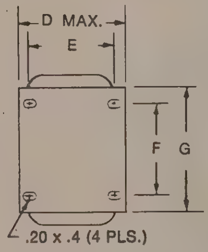


Model No.	Output Per Phase				Size	Wt. Lbs. (Typ.)
	Delta: L to L (3 wire) WYE: L to Com. (4 wire)		WYE: L to L (3 wire)			
	Volts R.M.S.	Load Current (Amps)	Volts R.M.S.	Load Current (Amps)		
6D( )5-200( )	5	13.30	8.66	7.70	1	14
6D( )5-450( )	5	30.00	8.66	17.30	2	20
6D( )5-650( )	5	43.30	8.66	25.00	3	28
6D( )12-200( )	12	5.56	20.8	3.21	1	14
6D( )12-450( )	12	12.50	20.8	7.21	2	20
6D( )12-650( )	12	18.10	20.8	10.40	3	28
6D( )12-850( )	12	23.60	20.8	13.60	4	42
6D( )12-1100( )	12	30.60	20.8	17.60	5	51
6D( )12-1500( )	12	41.70	20.8	24.00	6	67
6D( )15-200( )	15	4.44	26.0	2.56	1	14
6D( )15-450( )	15	10.00	26.0	5.77	2	20
6D( )15-650( )	15	14.40	26.0	8.33	3	28
6D( )15-850( )	15	18.90	26.0	10.90	4	42
6D( )15-1100( )	15	24.40	26.0	14.10	5	51
6D( )15-1500( )	15	33.30	26.0	19.20	6	67
6D( )20-200( )	20	3.33	34.6	1.93	1	14
6D( )20-450( )	20	7.50	34.6	4.33	2	20
6D( )20-650( )	20	10.80	34.6	6.26	3	28
6D( )20-850( )	20	14.20	34.6	8.19	4	42
6D( )20-1100( )	20	18.30	34.6	10.60	5	51
6D( )20-1500( )	20	25.00	34.6	14.40	6	67

Model No.	Output Per Phase				Size	Wt. Lbs. (Typ.)
	Delta: L to L (3 wire) WYE: L to Com. (4 wire)		WYE: L to L (3 wire)			
	Volts R.M.S.	Load Current (Amps)	Volts R.M.S.	Load Current (Amps)		
6D( )28-200( )	28	2.38	48.5	1.37	1	14
6D( )28-450( )	28	5.36	48.5	3.09	2	20
6D( )28-650( )	28	7.74	48.5	4.47	3	28
6D( )28-850( )	28	10.10	48.5	5.83	4	42
6D( )28-1100( )	28	13.10	48.5	7.56	5	51
6D( )28-1500( )	28	17.90	48.5	10.30	6	67
6D( )48-200( )	48	1.39	83.1	.80	1	14
6D( )48-450( )	48	3.13	83.1	1.81	2	20
6D( )48-650( )	48	4.51	83.1	2.61	3	28
6D( )48-850( )	48	5.90	83.1	3.41	4	42
6D( )48-1100( )	48	7.64	83.1	4.41	5	51
6D( )48-1500( )	48	10.40	83.1	6.02	6	67
6D( )115-200( )	115	.58	200.0	.34	1	14
6D( )115-450( )	115	1.30	200.0	.75	2	20
6D( )115-650( )	115	1.88	200.0	1.09	3	28
6D( )115-850( )	115	2.46	200.0	1.42	4	42
6D( )115-1100( )	115	3.19	200.0	1.84	5	51
6D( )115-1500( )	115	4.35	200.0	2.51	6	67

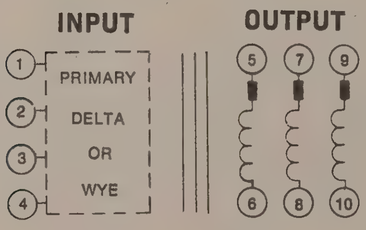






SIZE	A	B	C	D	E	F	G
1	6.10	4.10	4.62	4.10	3.10	3.75	4.81
2	7.70	4.10	5.43	4.10	3.10	4.00	6.00
3	7.70	5.10	5.43	5.10	4.10	4.00	6.00
4	9.20	4.85	6.78	5.35	4.11	5.24	7.50
5	9.20	5.35	6.78	5.85	4.61	5.24	7.50
6	11.00	5.35	8.13	5.60	4.36	6.40	9.00

DIM. TOL.: E, F, G ±.06



INPUT CONNECTION

WYE: L-Com. 1, 2, 3 Line. 4 com.
WYE: L-L 1, 2, 3
DELTA: L-L 1, 2, 3

OUTPUT CONNECTION

WYE: L-Com. connect 6-8-10 Load 5-6, 7-6, 9-6
DELTA: L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE: L-L connect 6-10, 8-10 Load 5, 7, 9

ABBOTT TRANSISTOR LABORATORIES, INC.
Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ, 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235

abbott
TRANSFORMERS

60 Hz-400 Hz MIL-T-27D Transformers

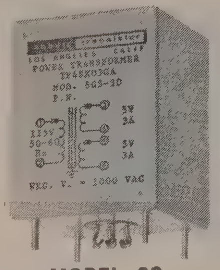
MODELS 6C 4A

SPECIFICATIONS

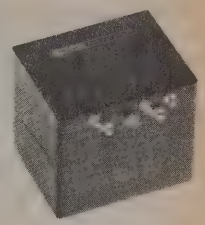
	6C Series	4A Series
INPUT PRIMARY:	115 VAC, 50 to 65 Hz, 1 Phase	115V, 400 Hz ±20 Hz, 1 Phase
REGULATION:	10% no load to full load	10% no load to full load
SECONDARY VOLTAGE TOLERANCE:	Within 3% when measured at full load and 115 VAC input	Within 5% when measured at full load and 115 VAC input
INSULATION TEST:	1500 VAC	1500 VAC
OPERATING TEMP.:	90°C maximum ambient operating temperature	95°C maximum ambient operating temperature
CONSTRUCTION	To MIL-T-27D, grade 4, class "S", life "X", (10,000 hrs.)	To MIL-T-27D, grade 5, class "S", life "X", (10,000 hrs.)
EFFICIENCY:	From 80% to 90%	From 90% to 93%

ENVIRONMENT Encapsulated to meet MIL-STD-810C for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.

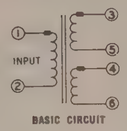
OPTIONS AVAILABLE: Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.



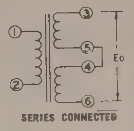
MODEL 6C



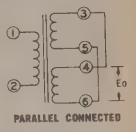
MODEL 4A



BASIC CIRCUIT



SERIES CONNECTED

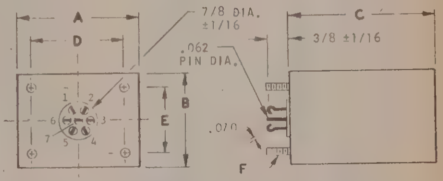


PARALLEL CONNECTED

Output Volts (F.L.)	6C Series Output Current (Amps) Parallel Connection	6C Series Output Current (Amps) Series Connection	6C Series Size	6C Series Weight Lbs. Typ.	6C Series Model Number	4A Series Output Current (Amps) Parallel Connection	4A Series Output Current (Amps) Series Connection	4A Series Size	4A Series Weight Lbs. Typ.	4A Series Model Number
5V Parallel 10V C.T. Series	1.00	0.50	EB	1.2	6C5-5	1.40	0.70	1	0.26	4A5-7
	3.00	1.50	FA	2.2	6C5-15	2.00	1.00	2	0.30	4A5-10
	6.00	3.00	GA	3.3	6C5-30	5.00	2.50	3	0.47	4A5-25
	12.00	6.00	HA	4.7	6C5-60	8.00	4.00	4	0.77	4A5-40
	20.00	10.00	JA	7.4	6C5-100	24.0	12.0	5	1.6	4A5-120
						30.0	15.0	6	2.0	4A5-150
6.3V Parallel 12.6V C.T. Series	0.80	0.40	EB	1.2	6C6-5	1.11	0.55	1	0.26	4A6-7
	2.38	1.19	FA	2.2	6C6-15	1.58	0.79	2	0.30	4A6-10
	4.76	2.38	GA	3.3	6C6-30	4.00	2.00	3	0.47	4A6-25
	9.52	4.76	HA	4.7	6C6-60	8.00	4.00	4	0.77	4A6-50
	20.00	10.00	JA	7.4	6C6-126	19.0	9.50	5	1.6	4A6-120
						23.8	11.9	6	2.0	4A6-150
8V Parallel 16V C.T. Series	0.62	0.31	EB	1.2	6C8-5	0.874	0.437	1	0.26	4A8-7
	1.86	0.93	FA	2.2	6C8 15	1.25	0.625	2	0.30	4A8-10
	3.72	1.86	GA	3.3	6C8-30	3.12	1.56	3	0.47	4A8-25
	7.44	3.72	HA	4.7	6C8-60	6.24	3.12	4	0.77	4A8-50
	17.50	8.75	JA	7.4	6C8-140	15.0	7.50	5	1.6	4A8-120
	20.00	10.00	KA	9.8	6C8-160	18.7	9.35	6	2.0	4A8-150
10V Parallel 20V C.T. Series	0.50	0.25	EB	1.2	6C10-5	0.70	0.35	1	0.26	4A10-7
	1.50	0.75	FA	2.2	6C10-15	1.00	0.50	2	0.30	4A10-10
	3.00	1.50	GA	3.3	6C10-30	2.50	1.25	3	0.47	4A10-25
	6.00	3.00	HA	4.7	6C10-60	5.00	2.50	4	0.77	4A10-50
	14.00	7.00	JA	7.4	6C10-140	12.0	6.00	5	1.6	4A10-120
	17.00	8.50	KA	9.8	6C10-170	15.0	7.50	6	2.0	4A10-150
12V Parallel 24V C.T. Series	0.40	0.20	EB	1.2	6C12-5	0.58	0.29	1	0.26	4A12-7
	1.20	0.60	FA	2.2	6C12-15	0.84	0.42	2	0.30	4A12-10
	2.40	1.20	GA	3.3	6C12-30	2.08	1.04	3	0.47	4A12-25
	4.80	2.40	HA	4.7	6C12-60	4.16	2.08	4	0.77	4A12-50
	11.60	5.80	JA	7.4	6C12-140	10.0	5.00	5	1.6	4A12-120
	14.16	7.08	KA	9.8	6C12-170	12.5	6.25	6	2.0	4A12-150
17V Parallel 34V C.T. Series	0.30	0.15	EB	1.2	6C17-5	0.411	0.205	1	0.26	4A17-7
	0.88	0.44	FA	2.2	6C17-15	0.588	0.294	2	0.30	4A17-10
	1.76	0.88	GA	3.3	6C17-30	1.47	0.735	3	0.47	4A17-25
	3.52	1.76	HA	4.7	6C17-60	2.94	1.47	4	0.77	4A17-50
	8.20	4.10	JA	7.4	6C17-140	7.06	3.53	5	1.6	4A17-120
	10.00	5.00	KA	9.8	6C17-170	8.82	4.41	6	2.0	4A17-150
20V Parallel 40V C.T. Series	0.24	0.12	EB	1.2	6C20-5	0.35	0.175	1	0.26	4A20-7
	0.72	0.36	FA	2.2	6C20-15	0.50	0.250	2	0.30	4A20-10
	1.44	0.72	GA	3.3	6C20-30	1.25	0.625	3	0.47	4A20-25
	2.88	1.44	HA	4.7	6C20-60	2.50	1.25	4	0.77	4A20-50
	7.00	3.50	JA	7.4	6C20-140	6.00	3.00	5	1.6	4A20-120
	8.50	4.25	KA	9.8	6C20-170	7.50	3.75	6	2.0	4A20-150
28V Parallel 56V C.T. Series	0.18	0.09	EB	1.2	6C28-5	0.250	0.125	1	0.26	4A28-7
	0.54	0.27	FA	2.2	6C28-15	0.356	0.178	2	0.30	4A28-10
	1.08	0.54	GA	3.3	6C28-30	0.892	0.446	3	0.47	4A28-25
	2.16	1.08	HA	4.7	6C28-60	1.78	0.89	4	0.77	4A28-50
	5.00	2.50	JA	7.4	6C28-140	4.28	2.14	5	1.6	4A28-120
	6.06	3.03	KA	9.8	6C28-170	5.36	2.68	6	2.0	4A28-150
44V Parallel 88V C.T. Series	0.10	0.05	EB	1.2	6C44-5	0.158	0.079	1	0.26	4A44-7
	0.30	0.15	FA	2.2	6C44-15	0.226	0.113	2	0.30	4A44-10
	0.60	0.30	GA	3.3	6C44-30	0.568	0.284	3	0.47	4A44-25
	1.20	0.60	HA	4.7	6C44-60	1.12	0.56	4	0.77	4A44-50
	3.16	1.58	JA	7.4	6C44-140	2.72	1.36	5	1.6	4A44-120
	3.86	1.93	KA	9.8	6C44-170	3.40	1.70	6	2.0	4A44-150
60V Parallel 120V C.T. Series	0.08	0.04	EB	1.2	6C60-5	0.116	0.058	1	0.26	4A60-7
	0.24	0.12	FA	2.2	6C60-15	0.166	0.083	2	0.30	4A60-10
	0.48	0.24	GA	3.3	6C60-30	0.416	0.208	3	0.47	4A60-25
	0.96	0.48	HA	4.7	6C60-60	0.82	0.41	4	0.77	4A60-50
	2.32	1.16	JA	7.4	6C60-140	2.00	1.00	5	1.6	4A60-120
	2.82	1.41	KA	9.8	6C60-170	2.50	1.25	6	2.0	4A60-150

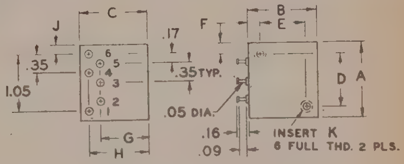
Size	A	B	C	D	E	F
EB	1.938	1.812	2.438	1.375	1.250	6-32 x 3/8
FA	2.312	2.062	3.125	1.688	1.438	6-32 x 3/8
GA	2.750	2.375	3.812	2.125	1.750	6-32 x 3/8
HA	3.062	2.625	4.250	2.297	1.859	8-32 x 3/8
JA	3.562	3.062	4.875	2.625	2.125	8-32 x 3/8
KA	3.938	3.375	5.250	3.000	2.438	10-32 x 1/2

Dimension A, B = +0.000 −0.125.
Dimension C = +0.000 −0.188
Dimension D, E = ±0.016 except size KA = 0.031
Dimension F = ±0.062

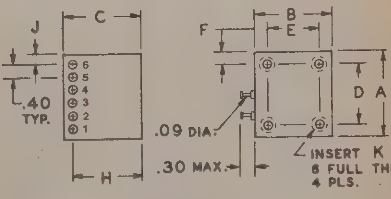


SIZES EB, FA, GA, HA, JA, KA

Size	A	B	C	D	E	F	G	H	J	K
1	1.37	1.25	1.31	1.00	.87	.19	1.00	1.19	.16	4-40
2	1.50	1.37	1.37	1.12	1.00	.19	1.06	1.25	.22	4-40
3	1.75	1.50	1.56	1.25	1.00	.25	1.25	1.44	.35	6-32
4	2.00	1.62	1.81	1.50	1.12	.25	1.50	1.69	.47	6-32
5	2.43	2.00	2.10	1.93	1.50	.25	—	1.90	.21	6-32
6	2.81	2.12	2.43	2.21	1.52	.30	—	2.23	.40	8-32



SIZES 1, 2, 3, 4



SIZES 5, 6

ABBOTT TRANSISTOR LABORATORIES, INC.

Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ, 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235

abbott
TRANSFORMERS

60 Hz Transformers

MODEL P

SPECIFICATIONS

INPUT PRIMARY: 115 VAC, 60 Hz ±5 Hz, 1 phase.

REGULATION: 10% no load to full load.

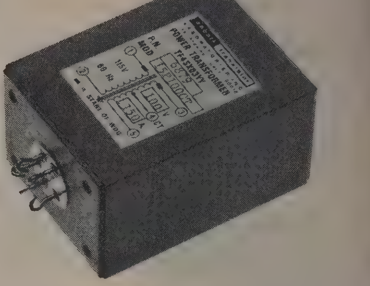
SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VAC input.

CONSTRUCTION: To MIL-T-27D, grade: 4 class: "S", Case: steel.

ENVIRONMENT: To operate in 95°C maximum ambient temperature. Encapsulated to meet MIL-STD-810C for vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: For high altitude operation, encapsulate terminals.

INSULATION TEST: 1750 VAC.

SECONDARY: See output voltage and current of specific models listed. For 50 Hz operation, reduce secondary current by 10% of ratings listed. These units are capable of 400 Hz operation; however, see Abbott's distinct line of miniature 400 Hz transformers.



Output Volts (F.L.)	Output Current (Amp)	Size	Secondary DCR ohms (typical)	Model Number
5.0	1.00	A1	0.335	5P5CT
	2.00	A2	0.12	10P5CT
	3.00	A3	0.07	15P5CT
	4.00	A4	0.066	20P5CT
	6.00	A5	0.04	30P5CT
	8.00	A6	0.03	40P5CT
	16.00	A7	0.014	80P5CT
6.3	0.79	A1	0.53	5P6.3CT
	1.58	A2	0.18	10.6:3CT
	2.38	A3	0.094	15P6.3CT
	3.16	A4	0.1	20P6.3CT
	4.76	A5	0.06	30P6.3CT
	6.35	A6	0.059	40P6.3CT
	12.70	A7	0.02	80P6.3CT
	19.00	A8	0.0014	120P6.3CT
8.0	0.67	A1	0.87	5P8CT
	1.25	A2	0.27	10P8CT
	1.88	A3	0.16	15P8CT
	2.50	A4	0.15	20P8CT
	3.76	A5	0.08	30P8CT
	5.00	A6	0.079	40P8CT
	10.00	A7	0.04	80P8CT
	15.00	A8	0.022	120P8CT
	20.00	A9	0.0072	160P8CT
10	0.50	A1	1.34	5P10CT
	1.00	A2	0.42	10P10CT
	1.50	A3	0.23	15P10CT
	2.00	A4	0.23	20P10CT
	3.00	A5	0.14	30P10CT
	4.00	A6	0.11	40P10CT
	8.00	A7	0.05	80P10CT
	12.00	A8	0.031	120P10CT
	16.00	A9	0.008	160P10CT
	20.00	A10	0.02	200P10CT
12.6	0.39	A1	2.06	5P12.6CT
	0.79	A2	0.65	10P12.6CT
	1.19	A3	0.4	15P12.6CT
	1.59	A4	0.34	20P12.6CT
12.6	2.38	A5	0.2	30P12.6CT
	3.18	A6	0.18	40P12.6CT
	6.35	A7	0.07	80P12.6CT
	9.53	A8	0.041	120P12.6CT
	12.70	A9	0.035	160P12.6CT
	15.90	A10	0.027	200P12.6CT
14	0.36	A1	2.95	5P14CT
	0.72	A2	0.74	10P14CT
	1.07	A3	0.6	15P14CT
	1.43	A4	0.4	20P14CT
	2.15	A5	0.23	30P14CT
	2.86	A6	0.19	40P14CT
	5.72	A7	0.1	80P14CT
	8.59	A8	0.055	120P14CT
	11.40	A9	0.042	160P14CT
	14.30	A10	0.029	200P14CT
16	0.34	A1	3.35	5P16CT
	0.68	A2	1.08	10P16CT
	0.94	A3	0.67	15P16CT
	1.25	A4	0.52	20P16CT
	1.87	A5	0.28	30P16CT
	2.50	A6	0.28	40P16CT
	5.00	A7	0.12	80P16CT
	7.50	A8	0.072	120P16CT
	10.00	A9	0.046	160P16CT
	12.50	A10	0.034	200P16CT
	18.70	A11	0.02	300P16CT
18	0.28	A1	4.65	5P18CT
	0.55	A2	1.42	10P18CT
	0.83	A3	0.78	15P18CT
	1.11	A4	0.62	20P18CT
	1.67	A5	0.38	30P18CT
	2.21	A6	0.36	40P18CT
	4.44	A7	0.16	80P18CT
	6.68	A8	0.08	120P18CT
	8.89	A9	0.060	160P18CT
	11.10	A10	0.04	200P18CT
	16.70	A11	0.022	300P18CT
20	0.25	A1	5.25	5P20CT
	0.50	A2	1.54	10P20CT
	0.75	A3	0.9	15P20CT
	1.00	A4	0.85	20P20CT
	1.50	A5	0.4	30P20CT
	2.00	A6	0.43	40P20CT
	4.00	A7	0.19	80P20CT
	6.00	A8	0.120	120P20CT
	8.00	A9	0.070	160P20CT
	10.00	A10	0.066	200P20CT
	15.00	A11	0.026	300P20CT
22	0.22	A1	7.3	5P22CT
	0.45	A2	1.9	10P22CT
	0.68	A3	1.2	15P22CT
	0.91	A4	0.95	20P22CT
	1.36	A5	0.55	30P22CT
	1.82	A6	0.57	40P22CT
	3.64	A7	0.25	80P22CT
	5.45	A8	0.125	120P22CT
	7.27	A9	0.092	160P22CT
	9.10	A10	0.073	200P22CT
	13.60	A11	0.031	300P22CT
25	0.20	A1	8.23	5P25CT
	0.40	A2	2.55	10P25CT
	0.60	A3	1.4	15P25CT
	0.80	A4	1.37	20P25CT
	1.20	A5	0.7	30P25CT
	1.60	A6	0.67	40P25CT
	3.20	A7	0.3	80P25CT
	4.80	A8	0.182	120P25CT
	6.40	A9	0.11	160P25CT
	8.00	A10	0.079	200P25CT
	12.00	A11	0.042	300P25CT
28	0.18	A1	11.4	5P28CT
	0.36	A2	3.0	10P28CT
	0.54	A3	1.9	15P28CT
	0.71	A4	1.6	20P28CT
	1.07	A5	0.94	30P28CT
	1.43	A6	0.90	40P28CT
28	2.86	A7	0.4	80P28CT
	4.29	A8	0.205	120P28CT
	5.72	A9	0.150	160P28CT
	7.10	A10	0.11	200P28CT
	10.70	A11	0.046	300P28CT
31	0.16	A1	13.8	5P31CT
	0.32	A2	3.8	10P31CT
	0.48	A3	2.2	15P31CT
	0.64	A4	2.2	20P31CT
	0.97	A5	0.96	30P31CT
	1.29	A6	0.95	40P31CT
	2.58	A7	0.45	80P31CT
	3.87	A8	0.31	120P31CT
	5.17	A9	0.166	160P31CT
	6.40	A10	0.12	200P31CT
	9.67	A11	0.054	300P31CT
35	0.14	A1	17.6	5P35CT
	0.29	A2	4.5	10P35CT
	0.43	A3	3.0	15P35CT
	0.57	A4	2.4	20P35CT
	0.86	A5	1.4	30P35CT
	1.14	A6	1.32	40P35CT
	2.28	A7	0.5	80P35CT
	3.43	A8	0.35	120P35CT
	4.57	A9	0.240	160P35CT
	5.71	A10	0.17	200P35CT
	8.59	A11	0.072	300P35CT
39	0.13	A1	19.7	5P39CT
	0.26	A2	6.3	10P39CT
	0.38	A3	3.5	15P39CT
	0.51	A4	3.6	20P39CT
	0.77	A5	1.62	30P39CT
	1.03	A6	1.5	40P39CT
	2.05	A7	0.7	80P39CT
	3.07	A8	0.342	120P39CT
	4.10	A9	0.270	160P39CT
	5.12	A10	0.18	200P39CT
	7.69	A11	0.08	300P39CT

Other standard models to 486V

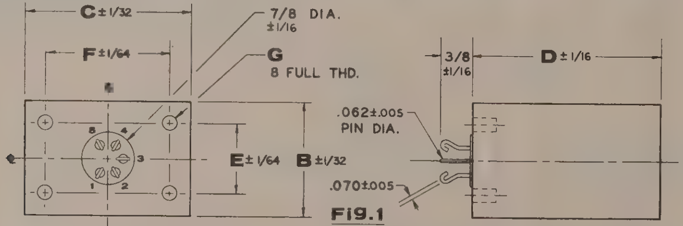


Fig.1

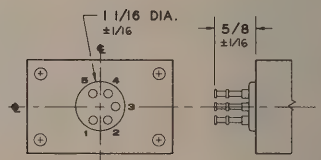


Fig.2

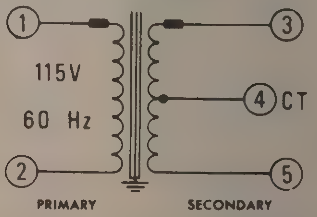
Size	B	C	D	E	F	G
A1	1½	1¾	2⅜	1 1/16	1¼	6-32
A2	1¾	2 1/16	2¾	1¼	1½	6-32
A3	1⅞	2⅜	3⅛	1¼	1¾	8-32
A4	2	2⅜	3⅛	1½	1¾	8-32
A5	2⅛	2 11/16	3½	1½	2	8-32
A6	2¼	2 11/16	3½	1⅝	2	8-32
A7*	2⅝	3⅛	4⅛	2	2¼	8-32
A8*	2⅞	3 7/16	4½	2¼	2½	10-32
A9*	3⅛	3¾	4⅞	2 7/16	2¾	10-32
A10*	3⅜	4 1/16	5¼	2⅝	3	¼-20
A11*	3⅞	4 11/16	6	2¾	3½	¼-20

Model Type	Weight Lbs. (Max.)	Primary DCR (ohms typical)
5P	1.0	86
10P	1.5	36
15P	2.0	24
20P	2.5	15
30P	3.0	8.5
40P	3.3	6.7
80P	5.0	3.7
120P	6.5	1.9
160P	8.2	1.6
200P	10.5	1.1
300P	17.0	0.5

* See Fig. 2 for header configuration used on any unit with output current greater than 10 amps.

TYPICAL CIRCUIT DIAGRAM

"■" refers to the start of winding



ABBOTT TRANSISTOR LABORATORIES, INC.

Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ, 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235

abbott TRANSFORMERS

400 Hz Transformers

MODEL E

SPECIFICATIONS

Input Primary
115V, 400 Hz ±20 Hz, 1 phase

Regulation
10% no load to full load

Secondary Voltage Tolerance
Within 5% when measured at full load and 115 VAC input

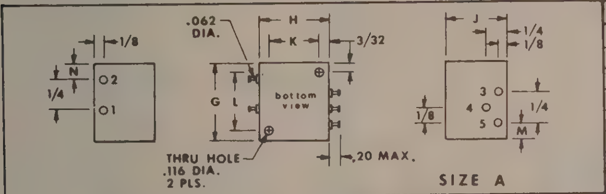
Construction
To MIL-T-27D, grade 5, class: "S"
Molded Diallyl Phthalate

Environment
Encapsulated to meet MIL-STD-810C, including vibration, ambient temperature ot 85°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum).

Output Secondary
See voltage and current of specific models listed.

Other models are available. Contact our nearest office for complete information.

Output Volts	Output Current (Amps)	Size	Sec. DCR (ohms)	Model Number
5.0	0.400	A	0.60	2E5CT
	1.200	B	0.144	6E5CT
	3.000	C	0.046	15E5CT
	4.800	D	0.040	24E5CT
	16.000	E2	0.009	80E5CT
	35.000	F2	0.012	175E5CT
6.3	0.317	A	1.06	2E6.3CT
	0.950	B	0.24	6E6.3CT
	2.380	C	0.088	15E6.3CT
	3.800	D	0.107	24E6.3CT
	12.800	E2	0.016	80E6.3CT
	27.800	F2	0.019	175E6.3CT
8.0	0.250	A	1.63	2E8CT
	0.750	B	0.396	6E8CT
	1.880	C	0.135	15E8CT
	3.000	D	0.140	24E8CT
	10.000	E2	0.017	80E8CT
	22.000	F2	0.010	175E8CT
10.0	0.200	A	2.50	2E10CT
	0.600	B	0.587	6E10CT
	1.500	C	0.27	15E10CT
	2.400	D	0.180	24E10CT
	8.000	E	7.2	80E10CT
	17.500	F2	0.020	175E10CT
12.6	0.158	A	4.10	2E12.6CT
	0.475	B	0.99	6E12.6CT
	1.180	C	0.32	15E12.6CT
	1.900	D	0.225	24E12.6CT
	6.350	E	0.030	80E12.6CT
	13.900	F2	0.021	175E12.6CT
14.0	0.142	A	5.59	2E14CT
	0.428	B	1.11	6E14CT
	1.070	C	0.35	15E14CT
	1.720	D	0.32	24E14CT
	5.600	E	0.04	80E14CT
	12.500	F2	0.022	175E14CT
16	0.125	A	6.63	2E16CT
	0.375	B	1.58	6E16CT
	0.940	C	0.54	15E16CT
	1.500	D	0.35	24E16CT
	5.000	E	0.05	80E16CT
	10.900	F2	0.025	175E16CT
18	0.111	A	9.00	2E18CT
	0.333	B	2.21	6E18CT
	0.832	C	0.74	15E18CT
	1.330	D	0.40	24E18CT
	4.450	E	0.08	80E18CT
	9.700	F	0.027	175E18CT
20	0.100	A	10.9	2E20CT
	0.300	B	2.78	6E20CT
	0.750	C	1.4	15E20CT
	1.200	D	0.48	24E20CT
	4.000	E	0.09	80E20CT
	8.750	F	0.020	175E20CT
22	0.091	A	14.6	2E22CT
	0.273	B	2.80	6E22CT
	0.680	C	0.92	15E22CT
	1.090	D	0.63	24E22CT
	3.630	E	0.12	80E22CT
	7.900	F	0.020	175E22CT
25	0.080	A	20.4	2E25CT
	0.240	B	3.60	6E25CT
	0.600	C	1.3	15E25CT
	0.900	D	0.68	24E25CT
	3.200	E	0.13	80E25CT
	7.000	F	0.042	175E25CT
28	0.071	A	30.0	2E28CT
	0.214	B	4.20	6E28CT
	0.535	C	1.83	15E28CT
	0.855	D	0.98	24E28CT
	2.850	E	0.14	80E28CT
	6.250	F	0.043	175E28CT
31	0.064	A	25.6	2E31CT
	0.192	B	5.71	6E31CT
	0.485	C	1.62	15E31CT
	0.717	D	1.27	24E31CT
	2.470	E	0.18	80E31CT
	5.650	F	0.061	175E31CT
35	0.057	A	29.5	2E35CT
	0.171	B	6.89	6E35CT
	0.428	C	2.28	15E35CT
	0.685	D	1.70	24E35CT
	2.280	E	0.28	80E35CT
	5.000	F	0.098	175E35CT
39	0.051	A	38.6	2E39CT
	0.154	B	9.39	6E39CT
	0.384	C	2.54	15E39CT
	0.615	D	2.20	24E39CT
	2.050	E	0.32	80E39CT
	4.480	F	0.110	175E39CT
43	0.046	A	44.3	2E43CT
	0.139	B	10.25	6E43CT
	0.348	C	2.85	15E43CT
	0.556	D	2.42	24E43CT
	1.860	E	0.35	80E43CT
	4.060	F	0.114	175E43CT
48	0.041	A	57.0	2E48CT
	0.125	B	15.30	6E48CT
	0.312	C	4.05	15E48CT
	0.500	D	3.27	24E48CT
	1.660	E	0.40	80E48CT
	3.650	F	0.160	175E48CT
55	0.036	A	89.0	2E55CT
	0.109	B	17.30	6E55CT
	0.262	C	7.2	15E55CT
	0.435	D	3.83	24E55CT
	1.450	E	0.67	80E55CT
	3.170	F	0.196	175E55CT
63	0.031	A	100.0	2E63CT
	0.095	B	24.9	6E63CT
	0.238	C	6.51	15E63CT
	0.380	D	5.35	24E63CT
	1.270	E	0.71	80E63CT
	2.770	F	0.20	175E63CT
70	0.028	A	139.0	2E70CT
	0.085	B	27.1	6E70CT
	0.214	C	9.4	15E70CT
	0.342	D	8.10	24E70CT
	1.140	E	0.80	80E70CT
	2.500	F	0.25	175E70CT
80	0.025	A	163.0	2E80CT
	0.075	B	39.0	6E80CT
	0.198	C	13.4	15E80CT
	0.300	D	9.0	24E80CT
	1.000	E	0.92	80E80CT
	2.180	F	0.34	175E80CT
90	0.022	A	218.0	2E90CT
	0.067	B	41.0	6E90CT
	0.166	C	15.9	15E90CT
	0.267	D	12.5	24E90CT
	0.890	E	1.08	80E90CT
	1.940	F	0.38	175E90CT
100	0.020	A	283.0	2E100CT
	0.060	B	59.5	6E100CT
	0.150	C	16.8	15E100CT
	0.240	D	14.4	24E100CT
	0.800	E	1.64	80E100CT
	1.750	F	0.52	175E100CT
110	0.018	A	392.0	2E110CT
	0.054	B	62.3	6E110CT
	0.136	C	22.1	15E110CT
	0.218	D	19.5	24E110CT
	0.728	E	2.03	80E110CT
	1.590	F	0.72	175E110CT

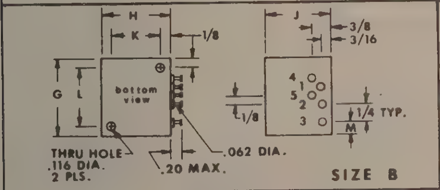


SIZE A

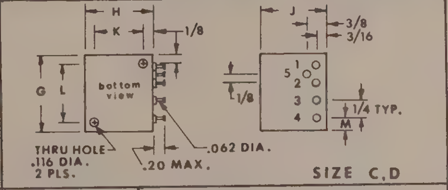
SIZE	G	H	J	K	L	M	N
A	.87	.74	.78	.55	.68	3/16	3/16
B	1.25	1.19	.88	.94	1.00	1/4	—
C	1.43	1.24	1.27	.99	1.18	1/4	—
D	1.47	1.28	1.40	1.03	1.22	1/4	—
E	2.31	1.52	1.75	1.02	1.81	1/2	—
E2	2.31	1.52	1.75	1.02	1.81	1/2	3/4
F	2.75	2.71	2.31	2.21	2.25	3/4	—
F2	2.75	2.71	2.31	2.21	2.25	3/4	1

Dim. Tol. =
Fraction ±1/32,
xx = ±0.015,
xxx = ±0.005

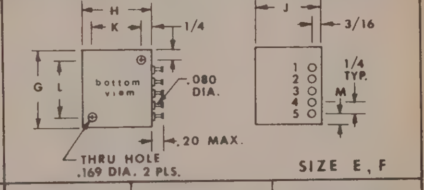
NOTE:
DIMENSIONS G & H MEASURED AT TOP OF TRANSFORMER



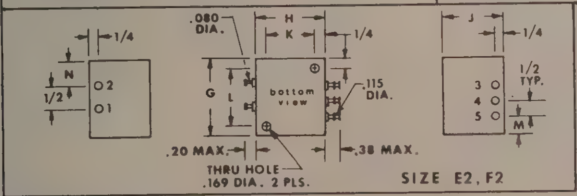
SIZE B



SIZE C,D

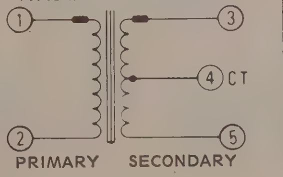


SIZE E, F



SIZE E2, F2

TYPICAL CIRCUIT DIAGRAM



MODEL TYPE	WEIGHT lbs. (max)	PRIMARY DCR ohms (typical)
2E	0.06	201
6E	0.15	61
15E	0.28	14
24E	0.32	12
80E	0.80	2.0
175E	2.2	0.7

OTHER STANDARD MODELS TO 1200V.

ABBOTT TRANSISTOR LABORATORIES, INC.

Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ, 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235

abbott TRANSFORMERS

400 Hz Power Toroid Transformers

MODELS TM TF

SPECIFICATIONS

INPUT PRIMARY: 115V, 400 Hz ±20 Hz, 1 phase for 230V operation add the suffix "A"

REGULATION: 5% or less, no load to full load

SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input

INSULATION TEST: 1000 VAC

OPERATING TEMPERATURE: MODEL TM 90°C Maximum ambient/MODEL TF 80°C Maximum ambient

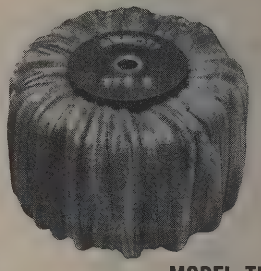
APPROXIMATE EFFICIENCY: 90% to 95%

OUTPUT SECONDARY: See voltage and current of specific models listed

CONSTRUCTION: MODEL TF — Open frame, Industrial Grade with Teflon leads 6" long MODEL TM — to meet MIL-T-27D, Grade 5, Class S, MIL-type Designation TF5S03ZZ

OPTIONS: "A" option is for 230V input primary. Add suffix "A" to model number (i.e. TF10-1A). "C" option is for center tapped output. Add suffix "C" to model number (i.e. TF10-1C)

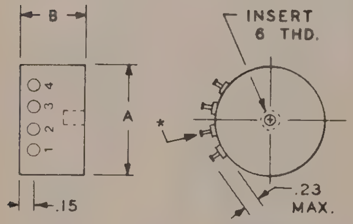
MODEL TM



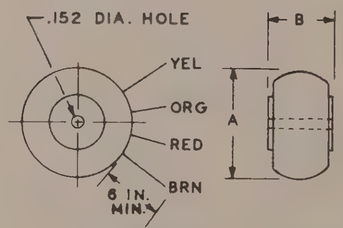
MODEL TF

Output Volts (F.L.)	Model No.		Output Current (Amps)	Size	VA
	TM	TF			
5V	TM1-1	TF1-1	3.00	1	15
	TM1-2	TF1-2	5.00	2	25
	TM1-3	TF1-3	10.00	3	50
7V	TM2-1	TF2-1	2.14	1	15
	TM2-2	TF2-2	3.57	2	25
	TM2-3	TF2-3	7.14	3	50
	TM2-4	TF2-4	10.00	4	70
10V	TM3-1	TF3-1	1.50	1	15
	TM3-2	TF3-2	2.50	2	25
	TM3-3	TF3-3	5.00	3	50
	TM3-4	TF3-4	7.50	4	75
	TM3-5	TF3-5	10.00	5	100
12V	TM4-1	TF4-1	1.25	1	15
	TM4-2	TF4-2	2.08	2	25
	TM4-3	TF4-3	4.17	3	50
	TM4-4	TF4-4	6.25	4	75
	TM4-5	TF4-5	8.33	5	100
14V	TM5-1	TF5-1	1.07	1	15
	TM5-2	TF5-2	1.79	2	25
	TM5-3	TF5-3	3.57	3	50
	TM5-4	TF5-4	5.36	4	75
	TM5-5	TF5-5	7.14	5	100

Output Volts (F.L.)	Model No.		Output Current (Amps)	Size	VA
	TM	TF			
17V	TM6-1	TF6-1	0.88	1	15
	TM6-2	TF6-2	1.47	2	25
	TM6-3	TF6-3	2.94	3	50
	TM6-4	TF6-4	4.41	4	75
	TM6-5	TF6-5	5.88	5	100
24V	TM7-1	TF7-1	0.63	1	15
	TM7-2	TF7-2	1.04	2	25
	TM7-3	TF7-3	2.08	3	50
	TM7-4	TF7-4	3.13	4	75
	TM7-5	TF7-5	4.17	5	100
28V	TM8-1	TF8-1	0.54	1	15
	TM8-2	TF8-2	0.89	2	25
	TM8-3	TF8-3	1.79	3	50
	TM8-4	TF8-4	2.68	4	75
	TM8-5	TF8-5	3.57	5	100
34V	TM9-1	TF9-1	0.44	1	15
	TM9-2	TF9-2	0.75	2	25
	TM9-3	TF9-3	1.47	3	50
	TM9-4	TF9-4	2.21	4	75
	TM9-5	TF9-5	2.94	5	100
115V	TM10-1	TF10-1	0.13	1	15
	TM10-2	TF10-2	0.21	2	25
	TM10-3	TF10-3	0.43	3	50
	TM10-4	TF10-4	0.65	4	75
	TM10-5	TF10-5	0.87	5	100

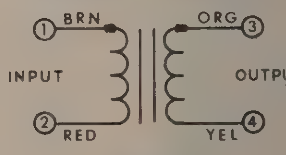


MODEL TM

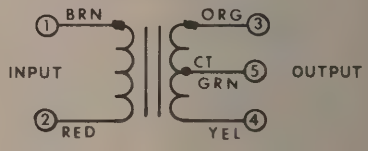


MODEL TF

STANDARD & OPTION A



OPTION C



SIZE	1		2		3		4		5	
MODEL	TM	TF	TM	TF	TM	TF	TM	TF	TM	TF
DIM A	1.62	1.50	1.75	1.63	2.13	2.00	2.13	2.00	2.38	2.25
DIM B	0.95	0.95	1.00	1.00	1.10	1.10	1.30	1.30	1.60	1.60
WT. (LB. MAX.)	0.26	0.17	0.33	0.25	0.52	0.38	0.66	0.52	1.1	0.79
INSERT	6-32	—	8-32	—	8-32	—	10-32	—	10-32	—

DIMENSIONAL TOLERANCE: Model TM ±.03; Model TF Dim A, B Max.
*Terminal Spacing is 0.35.

ABBOTT TRANSISTOR LABORATORIES, INC.

Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ, 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235

abbott TRANSFORMERS

400 Hz 3 Ø Power Transformers

MODEL 4D

SPECIFICATIONS

INPUT PRIMARY:
WYE: (4 wire) Line to Common 115 VAC
WYE: (3 wire) Line to Line 200 VAC
DELTA: (3 wire) Line to Line 115 VAC (see option "A")
DELTA: (3 wire) Line to Line 200 VAC (see option "B")

INPUT FREQUENCY: 400 Hz ±20 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% no load to full load.

INSULATION TEST: 1500 VRMS.

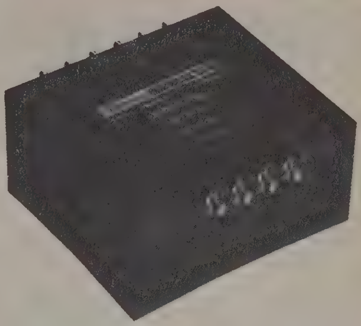
EFFICIENCY: Ranges from 90% to 95%.

OPERATING AMBIENT TEMPERATURE: 80°C Maximum

TEMPERATURE RISE: Less than 50°C.

CONSTRUCTION: To MIL-T-27D, Grade 5, class "S".

ENVIRONMENT: Encapsulated to meet MIL-STD-810C, including vibration, temperature to 80°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion. Note: For high altitude operation encapsulate terminals.



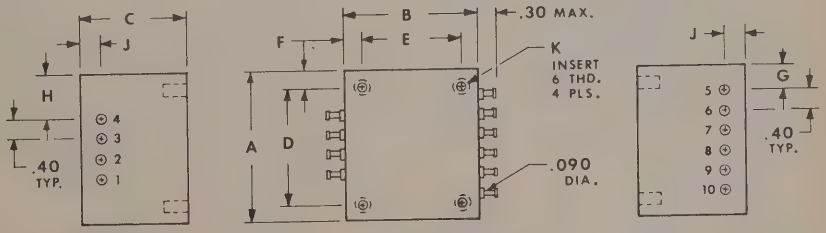
Model Number	OUTPUT PER PHASE — DELTA: L to L (3 wire) — WYE: L to COM. (4 wire) Volts RMS	Load Current (Amps)	WYE: L to L (3 wire) Volts RMS	Load Current (Amps)	Size	Weight Lbs. Max.
4D5-90	5	6.00	8.66	3.47	1	1.3
4D5-120	5	8.00	8.66	4.62	2	1.6
4D5-150	5	10.00	8.66	5.78	3	2.3
4D5-200	5	13.34	8.66	7.70	4	2.4
4D12-90	12	2.50	20.8	1.45	1	1.3
4D12-120	12	3.34	20.8	1.93	2	1.6
4D12-150	12	4.17	20.8	2.41	3	2.3
4D12-200	12	5.56	20.8	3.21	4	2.4
4D12-270	12	7.50	20.8	4.33	5	2.8
4D12-375	12	10.42	20.8	6.02	6	3.8
4D15-90	15	2.00	26.0	1.16	1	1.3
4D15-120	15	2.67	26.0	1.54	2	1.6
4D15-150	15	3.34	26.0	1.93	3	2.3
4D15-200	15	4.45	26.0	2.57	4	2.4
4D15-270	15	6.00	26.0	3.47	5	2.8
4D15-375	15	8.34	26.0	4.82	6	3.8
4D20-90	20	1.50	34.6	0.87	1	1.3
4D20-120	20	2.00	34.6	1.16	2	1.6
4D20-150	20	2.50	34.6	1.45	3	2.3
4D20-200	20	3.34	34.6	1.93	4	2.4
4D20-270	20	4.50	34.6	2.60	5	2.8
4D20-375	20	6.25	34.6	3.61	6	3.8
4D28-90	28	1.08	48.5	0.62	1	1.3
4D28-120	28	1.43	48.5	0.83	2	1.6
4D28-150	28	1.79	48.5	1.03	3	2.3
4D28-200	28	2.38	48.5	1.38	4	2.4
4D28-270	28	3.22	48.5	1.86	5	2.8
4D28-375	28	4.47	48.5	2.58	6	3.8
4D48-90	48	0.63	83.1	0.36	1	1.3
4D48-120	48	0.84	83.1	0.49	2	1.6
4D48-150	48	1.05	83.1	0.61	3	2.3
4D48-200	48	1.39	83.1	0.81	4	2.4
4D48-270	48	1.88	83.1	1.09	5	2.8
4D48-375	48	2.61	83.1	1.51	6	3.8
4D115-90	115	0.26	200	0.15	1	1.3
4D115-120	115	0.35	200	0.20	2	1.6
4D115-150	115	0.44	200	0.25	3	2.3
4D115-200	115	0.58	200	0.34	4	2.4
4D115-270	115	0.79	200	0.45	5	2.8
4D115-375	115	1.09	200	0.63	6	3.8

Option "A" — To order DELTA input 115 VAC L-L. Add suffix "A" to Model No. e.g. 4D5-90A
Option "B" — To order DELTA input 200 VAC L-L. Add suffix "B" to Model No. e.g. 4D5-90B

Size	A	B	C	D	E
1	2.90	2.40	1.45	2.50	2.00
2	2.90	2.70	1.55	2.50	2.30
3	3.65	2.80	1.70	3.15	2.30
4	3.65	3.00	1.70	3.15	2.50
5	3.65	3.00	1.95	3.15	2.50
6	4.95	3.20	1.90	4.45	2.70

Size	F	G	H	J	K
1	.20	.45	.85	.20	6-32
2	.20	.45	.85	.20	6-32
3	.25	.82	1.22	.20	8-32
4	.25	.82	1.22	.20	8-32
5	.25	.82	1.22	.20	8-32
6	.25	1.47	1.87	.20	8-32

DIMENSIONAL TOL.: D, E ±0.02; all others ±0.04

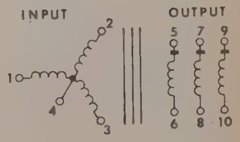


INPUT CONNECTION:

WYE, 115V to Com 1, 2, 3 Line 4 Com
WYE, 200V L-L 1, 2, 3
DELTA 115V or 200V L-L 1, 2, 3

OUTPUT CONNECTION:

WYE, L-Com Connect 6-8-10 Load 5-6, 7-6, 9-6
DELTA L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE, L-L Connect 6-10, 8-10 Load 5, 7, 9



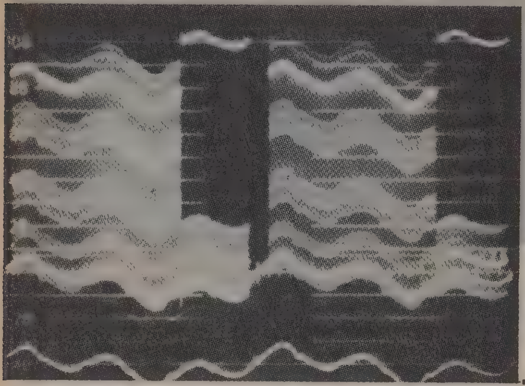
ABBOTT TRANSISTOR LABORATORIES, INC.

Transformer Div., Western Offices: 639 S. Glenwood Pl., Burbank, CA 91506 (818) 841-3630. Telex: 69-6282
Eastern: 520 Main St., Ft. Lee, NJ, 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
New England: (617) 272-5676 • Florida: (305) 788-0845 • Southeast: (205) 881-2207 • E. Canada: (416) 675-6235

ALLEN AVIONICS, INC.

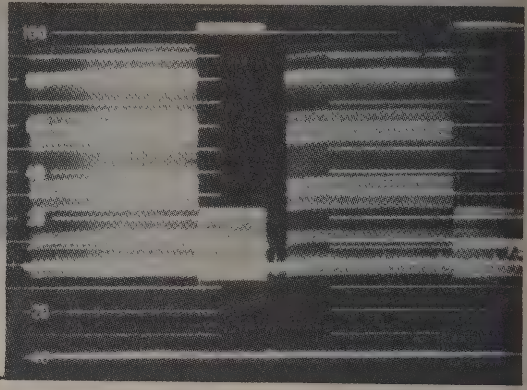
224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

HUM ELIMINATOR HEC1000

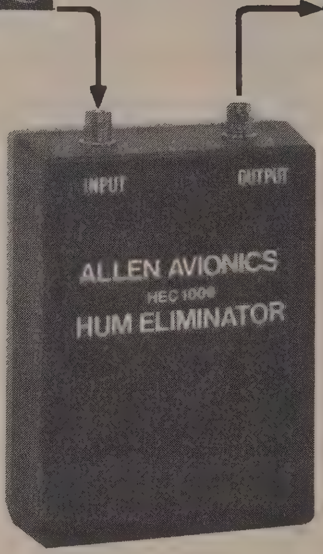


INCOMING VIDEO

OUTGOING VIDEO



ELIMINATES HUM AND OTHER INTERFERENCE in Video Lines caused by differences in Ground Potential



- FLAT - DC to 10 MHz
- For Color and Black & White
- No Low Frequency or High Frequency Roll-Off
- No Differential Gain Distortion
- No Differential Phase Distortion
- Passive Device - Failure Free
- Reversible
- Small Compact Package
- Low Price

IN FIELD:

- Between Remote Truck & Telco
- Between Remote Truck & Microwave
- For Intertruck Hookup
- For VTR Units
- For Monitoring Lines

IN STUDIO:

- Between Buildings
- On long runs in Buildings
- Between Studios & Transmitter
- On incoming Telco Circuits
- On outgoing Telco Circuits

SPECIFICATIONS:

Impedance	75 ohms, unbalanced
Connectors	Type BNC
Bandwidth	DC to 10 MHz (0.6 dB @ 10 MHz)
Hum Reduction	to 50 dB depending on system
Dimensions	5.3″ x 4.0″ x 2.0″ (135 x 102 x 51 mm)
Weight	Approx. 3 lbs. (1.36kg)
Insertion Loss	< 0.2 dB

AMECON

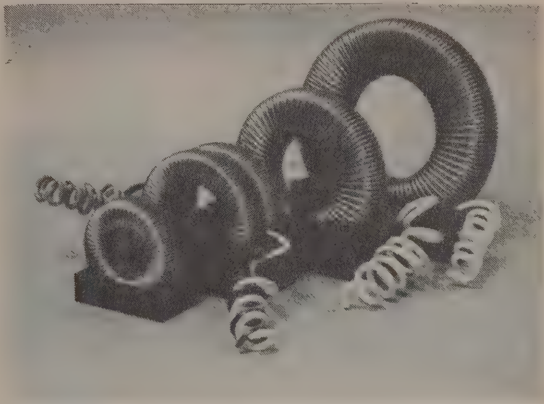
QUALITY MAGNETIC COMPONENTS • DESIGNED WITH 25 YRS. OF EXPERTISE

1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

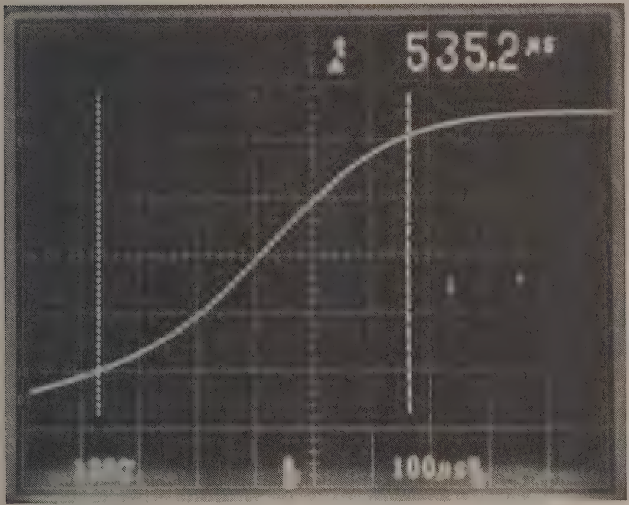
ADVANCED HEAVY DUTY TOROIDAL FILTER INDUCTORS

FOR PROFESSIONAL LIGHT DIMMERS: THEATRICAL, TOURING & ARCHITECTURAL FOR E.M.I/R.F.I SCR CONTROLS, MOTOR CONTROLS, LINE FILTERS, ETC.

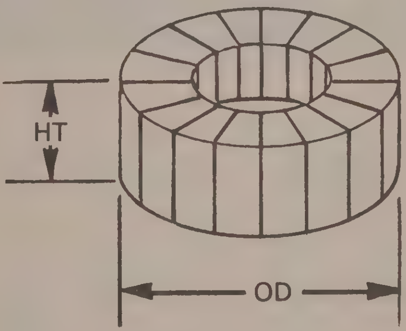
- Open • semi enclosed • totally enclosed styles
- Horizontal & vertical mounting
- All "UL" recognizable materials
- From 1,000 to 18,000 watts at 120 v. & 2,000 to 36,000 w. @ 240 v.
- Absolutely latest "State of the Art" materials, production & testing technologies are employed throughout all phases of this product line, which is designed for peak performance.



VERTICAL MTG. SHOWN LEFT TO RIGHT. 10A, DUAL 20A., 50A & 100.A.



TYPICAL TURN ON RISE TIME 90° FIRING



Part No.	Current Rating AMPS RMS	Line Drop VRMS	di/dt 10% to 90% µs	Δt°C Above Ambient	Dimensions Open Style OD HT
5007	8.33	1.85	150	69	2.06 × 1.00
5008	8.33	1.75	150	60	2.18 × 0.87
5009	8.33	3.00	260	62	2.20 × 1.25
5011	10.00	2.20	155	78	2.06 × 1.00
5012	10.00	2.10	155	70	2.18 × 0.87
5013	10.00	3.30	260	70	2.20 × 1.25
5014	10.00	3.20	255	79	2.50 × 0.95
5015	10.00	4.60	320	116	2.50 × 1.00
5016	10.00	5.3	400	100	3.25 × 0.75
5021	15.00	2.85	250	76	2.55 × 1.09
5022	15.00	3.00	315	78	2.56 × 1.56
5026	16.66	2.95	255	82	2.55 × 1.09
5027	16.66	3.10	320	84	2.56 × 1.56
5031	20.00	3.85	300	113	2.56 × 1.56
5032	20.00	4.00	365	98	3.25 × 1.32
5033	20.00	4.30	410	75	3.28 × 1.85
5034	20.00	5.10	520	76	4.28 × 1.18
5035	20.00	4.4	466	72	4.30 × 1.45
5036	20.00	5.5	600	86	4.30 × 1.70
5045	25.00	5.0	275	92	330 × 1.32
5046	25.00	4.1	430	70	4.3 × 1.25
5047	25.00	5.8	525	102	4.30 × 1.18
5051	30.00	3.5	405	87	3.30 × 1.85
5052	30.00	6.4	510	130	4.30 × 1.18
5055	40.00	4.00	405	101	4.30 × 1.60
5056	40.00	5.60	465	116	4.30 × 1.80
5061	50.00	5.20	485	109	4.25 × 1.70
5062	50.00	4.40	440	93	4.30 × 1.80
5068	75.00	N/A	~425	~115	4.30 × 2.20
5070	100.00	N/A	~405	~104	5.87 × 2.37
5072	125.00	N/A	~400	~106	5.87 × 3.20
5075	150.00	N/A	~380	~108	6.00 × 4.00

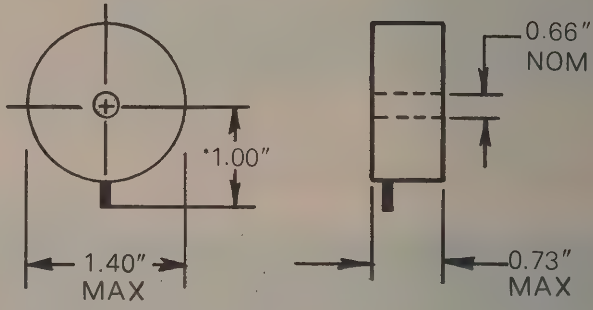
AMECON

QUALITY MAGNETIC COMPONENTS SINCE 1972

1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

MPP TOROIDS

FOR PRECISION LC FILTERS



*Optional Per Customer Specification

PART NUMBER	INDUCTANCE VALUE (@ KHZ)	Q_{MIN} @ KHZ	R_{DC} ±20%	*$F_{SR\,MIN}$ (KHZ)	I_{REF} (MA)
5701	5.0 MH ± 2.5% @ 5	115 @ 7.0	0.60	255	402
5702	6.0 MH ± 2.5% @ 5	115 @ 7.0	0.67	229	402
5703	7.2 MH ± 1.5% @ 5	115 @ 7.0	0.88	208	320
5704	8.6 MH ± 1.5% @ 5	115 @ 7.0	1.00	187	320
5705	10.0 MH ± 1.5% @ 5	115 @ 5.0	1.07	172	320
5706	12.0 MH ± 1.5% @ 2	115 @ 5.0	1.19	157	320
5707	15.0 MH ± 1.5% @ 2	115 @ 5.0	1.65	139	254
5708	17.5 MH ± 1.5% @ 2	115 @ 5.0	1.79	135	254
5709	20.0 MH ± 1.5% @ 2	115 @ 5.0	1.89	127	254
5710	24.0 MH ± 1.0% @ 2	115 @ 5.0	2.62	107	201
5711	30.0 MH ± 1.0% @ 2	115 @ 5.0	2.93	95	201
5712	36.0 MH ± 1.0% @ 2	115 @ 5.0	4.07	87	160
5713	43.0 MH ± 1.0% @ 2	115 @ 5.0	4.38	78	160
5714	50.0 MH ± 1.0% @ 2	115 @ 5.0	6.00	72	127
5715	60.0 MH ± 1.0% @ 2	115 @ 5.0	6.61	65	127
5716	72.0 MH ± 1.0% @ 2	105 @ 4.0	7.20	59	127
5717	86.0 MH ± 1.0% @ 2	105 @ 4.0	9.91	54	100
5718	100 MH ± 1.0% @ 1	105 @ 4.0	10.60	50	100
5719	120 MH ± 1.0% @ 1	105 @ 4.0	14.66	45	80.0
5720	150 MH ± 1.0% @ 1	105 @ 4.0	16.50	40	80.0
5721	175 MH ± 1.0% @ 1	105 @ 4.0	17.76	37	80.0
5722	200 MH ± 1.0% @ 1	105 @ 4.0	23.90	34	63.0
5723	240 MH ± 1.0% @ 1	93 @ 3.0	26.20	30	63.0
5724	300 MH ± 1.0% @ 1	93 @ 3.0	37.00	28	50.0
5725	360 MH ± 1.0% @ 1	93 @ 3.0	40.50	25	50.0
5726	430 MH ± 1.0% @ 1	93 @ 3.0	44.20	23	50.0
5727	500 MH ± 1.0% @ .4	93 @ 3.0	60.20	21	40.0
5728	600 MH ± 1.0% @ .4	73 @ 2.0	65.90	19	40.0
5729	720 MH ± 1.0% @ .4	73 @ 2.0	91.00	17	31.5
5730	860 MH ± 1.0% @ .4	73 @ 2.0	99.70	16	31.5
5731	1.00 HY ± 1.0% @ .4	73 @ 2.0	107	15	31.5
5732	1.20 HY ± 1.0% @ .4	73 @ 2.0	148	13	25.0
5733	1.50 HY ± 1.0% @ .4	58 @ 1.5	185	12	25.0

*Minimum self resonant frequency in KHZ.

PART NUMBER	INDUCTANCE VALUE (@ KHZ)	Q_{MIN} @ KHZ	R_{DC} ±20%	*$F_{SR\,MIN}$ (KHZ)	I_{REF} (MA)
5734	1.75 HY ± 1.0% @ .4	58 @ 1.5	225	11	20.0
5735	2.00 HY ± 1.0% @ .4	58 @ 1.5	240	10	20.0
5736	2.40 HY ± 1.0% @ .1	58 @ 1.5	260	9	20.0
5737	3.00 HY ± 1.0% @ .1	58 @ 1.5	372	8	16.0
5738	3.60 HY ± 1.0% @ .1	42 @ 1.0	407	7.5	16.0
5739	4.30 HY ± 1.0% @ .1	42 @ 1.0	562	6.5	12.5
5740	5.00 HY ± 1.0% @ .1	42 @ 1.0	605	6.0	12.5
5741	5.0 MH ± 1.5% @ 7	145 @ 10	1.0	260	320
5742	6.0 MH ± 1.5% @ 7	145 @ 10	1.5	235	254
5743	7.2 MH ± 1.5% @ 5	145 @ 10	1.6	213	254
5744	8.6 MH ± 1.5% @ 5	145 @ 10	1.8	193	254
5745	10.0 MH ± 1.5% @ 5	145 @ 10	2.3	178	202
5746	12.0 MH ± 1.5% @ 5	145 @ 10	2.5	161	202
5747	15.0 MH ± 1.0% @ 5	145 @ 10	2.8	153	202
5748	17.5 MH ± 1.0% @ 3	145 @ 10	4.0	130	160
5749	20.0 MH ± 1.0% @ 3	145 @ 10	4.3	120	160
5750	24.0 MH ± 1.0% @ 3	145 @ 10	5.9	109	127
5751	30.0 MH ± 1.0% @ 3	145 @ 10	6.6	97	127
5752	36.0 MH ± 1.0% @ 3	117 @ 7	7.3	87	127
5753	43.0 MH ± 1.0% @ 2	117 @ 7	10.0	79	100
5754	50.0 MH ± 1.0% @ 2	117 @ 7	11.0	73	100
5755	60.0 MH ± 1.0% @ 2	117 @ 7	15.0	66	80.0
5756	72.0 MH ± 1.0% @ 2	117 @ 7	16.5	60	80.0
5757	86.0 MH ± 1.0% @ 2	117 @ 7	18.0	54	80.0
5758	100 MH ± 1.0% @ 2	117 @ 7	24.0	50	63.0
5759	120 MH ± 1.0% @ 1	95 @ 5	26.5	45	63.0
5760	150 MH ± 1.0% @ 1	95 @ 5	38.0	40	50.0
5761	175 MH ± 1.0% @ 1	95 @ 5	41.0	37	50.0
5762	200 MH ± 1.0% @ 1	95 @ 5	44.0	35	50.0
5763	240 MH ± 1.0% @ 1	95 @ 5	60.0	31	40.0
5764	300 MH ± 1.0% @ 1	77 @ 4	67.0	28	40.0
5765	360 MH ± 1.0% @ 1	77 @ 4	92.0	25	31.5
5766	430 MH ± 1.0% @ 1	77 @ 4	102	23	31.5
5767	500 MH ± 1.0% @ 1	77 @ 4	110	21	31.5

*Minimum self resonant frequency in KHZ.

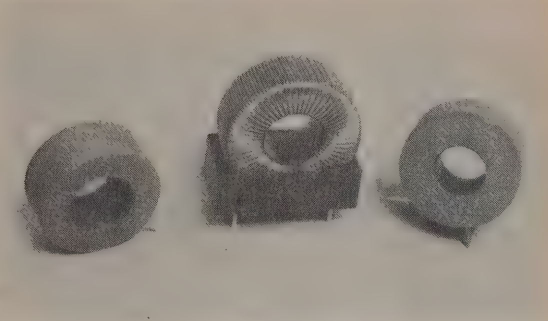
AMECON

QUALITY MAGNETIC COMPONENTS FOR S.M.P.S. SINCE 1972

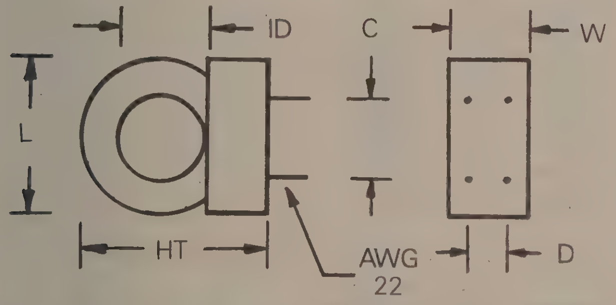
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

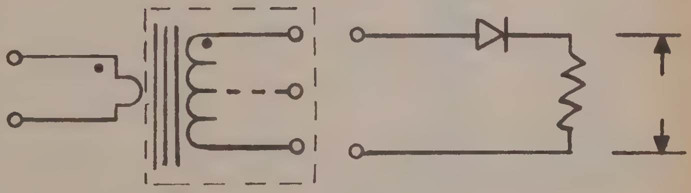
TOROIDAL CURRENT SENSE TRANSFORMERS

- Designed for switching power supply applications.
- Cost effective design.
- Operating frequency 20KHZ above.
- Pri Peak current up to 20 amps
- Available with open winding type, pvc sealed, and totally epoxy encapsulated.
- All our SMPS components backed by 19 yrs. of experience.



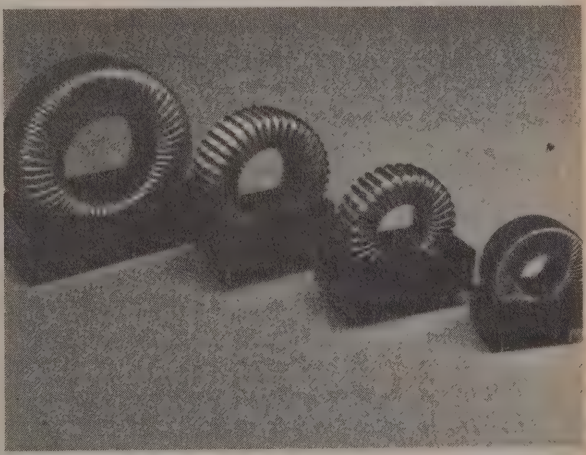
Part Number	Turns Ratio	Fig.	L_{MIN}(MH) @ 20KHZ 1 Volt	DCR_{MAX} (OHMS)	R_L (OHMS)	Dimensions (inch)				
						L_{MAX}	ID_{MIN}	HT_{MAX}	W_{MAX}	CXD
5600	30:1	1	2.0	0.30	30	0.67	0.18	0.75	0.4	0.50 x 0.25
5601	50:1	1	5.0	0.50	50					
5602	100:1	1	20.0	1.20	100					
5603	200:1	1	90.0	2.00	200					
5604	400:1	1	210.0	5.0	400	1.18	0.31	1.25	0.50	0.75 x 0.37
5605	600:1	1	480.0	9.0	600					
5606	800:1	1	850.0	15.0	800					
5607	20CT:1	2	1.0	0.20	20	0.67	0.18	0.75	0.4	0.50 x 0.25
5608	40CT:1	2	3.5	0.40	40					
5609	100CT:1	2	22.0	1.20	100					
5610	200CT:1	2	90.0	2.00	200					
5611	500CT:1	2	350.0	7.5	500	1.18	0.31	1.25	0.50	0.75 x 0.37
5612	800CT:1	2	850.0	15.0	800					
5613	1000CT:1	2	1400.0	24.5	1000					





S.M.P.S. FILTER INDUCTORS

- Minimum possible size
- Performance verified in 25KHZ switching power supply
- Large selection of sizes available
- Available with open winding type or encapsulated and semi-encapsulated constructions.
- Custom designs are available up to 200 AMPS.
- Advanced materials
- Best production technologies, with 19 yrs. of SMPS expertise

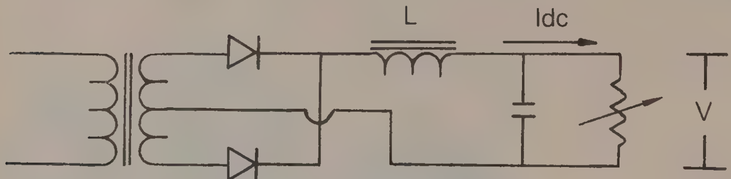


AMECON

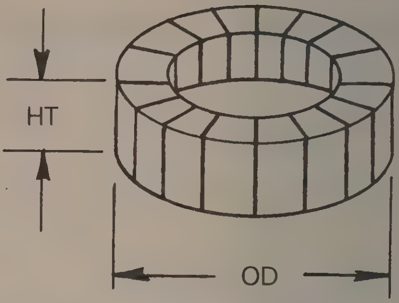
QUALITY MAGNETIC COMPONENTS FOR S.M.P.S. SINCE 1972

1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

S.M.P.S. FILTER INDUCTORS



ENERGY STORAGE = $\frac{1}{2}LI^2_{dc}$



I_{dc} (AMPS)	Part Number	L_{MIN}(MH) @ Rated I_{dc}	L_{MIN}(MH) @ Zero I_{dc}	DCR_{NOM} (OHMS)	Min Energy Storage (μ-Joule)	Mechanical Specifications (inch)	
						$OD_{NOM.}$	$HT_{NOM.}$
5 VOLTS POWER INDUCTORS							
1	5500	480	430	0.360	240	1.12	0.49
2	5501	275	330	0.150	550	1.14	0.52
3	5502	160	210	0.080	720	1.17	0.54
5	5503	104	160	0.055	1250	1.20	0.58
8	5504	60	84	0.015	1920	1.25	0.76
10	5505	50	62	0.012	2500	1.30	0.81
12	5506	40	48	0.009	3456	1.32	0.84
15	5507	30	50	0.009	3712	1.52	0.57
20	5508	25	40	0.006	5000	1.56	0.72
25	5509	20	26	.004	6250	1.62	0.76
30	5510	16	28	.004	7200	1.65	1.25
40	5511	12	20	.003	9600	1.72	1.28
50	5512	10	14	.002	12500	2.12	1.00
60	5513	8	12	.0015	14400	2.20	1.10
100	5514	5	7	.001	25000	2.12	1.00
10 VOLTS POWER INDUCTORS							
1	5520	1000	850	0.53	500	1.12	0.63
2	5521	500	510	0.27	1000	1.14	0.66
3	5522	310	320	0.13	1395	1.17	0.68
5	5523	180	210	0.17	2250	1.42	0.55
8	5524	120	150	0.04	3840	1.72	0.73
10	5525	100	140	0.03	5000	1.75	0.76
12	5526	75	110	0.02	7920	1.78	0.80
15	5527	68	100	0.016	8437	1.81	0.82
20	5528	51	65	0.010	10200	2.10	1.00
30	5529	32	42	0.010	14400	1.90	1.87
15 VOLTS POWER INDUCTORS							
1	5530	1250	1250	0.650	625	1.60	0.52
2.5	5531	500	520	0.170	1000	1.62	0.54
5.0	5532	250	315	0.080	3937	1.70	0.70
7.5	5533	170	225	0.050	4780	1.75	0.75
10	5534	125	170	0.030	6250	1.78	0.78
15	5535	85	130	0.017	9560	2.06	0.94
25	5536	50	90	0.009	15625	2.12	1.00
30	5537	43	75	0.008	19350	2.31	1.42
24 VOLTS POWER INDUCTORS							
2	5540	1100	1050	0.22	2200	1.95	0.82
5	5541	550	510	0.10	6875	2.00	0.87
7.5	5542	300	380	0.06	8437	2.12	1.00
10	5543	225	300	0.04	11250	2.25	1.12
15	5544	150	220	0.026	16875	2.35	1.31
25	5545	90	150	0.013	28125	2.30	1.88
35	5546	65	95	0.008	39812	2.4	2.06
48 VOLTS POWER INDUCTORS							
5	5550	750	820	0.14	9375	2.0	1.6
10	5551	375	520	2.06	18750	2.25	1.87
15	5552	250	450	0.05	28125	2.37	1.93
25	5553	150	280	0.03	46875	2.5	2.5

AMECON

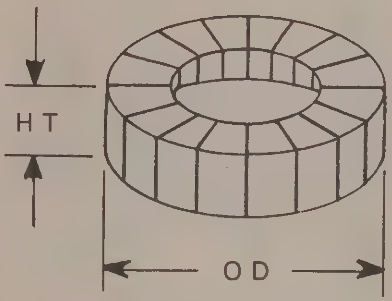
QUALITY MAGNETIC COMPONENTS • DESIGNED FOR PEAK PERFORMANCE
1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMER

SOME ADVANTAGES OF TOROIDAL POWER TRANSFORMERS COMPARED TO LAMINATED TRANSFORMERS

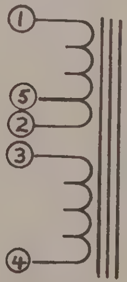
- Lower mechancial hum
- Lower electrical noise
- Lower magnetic leakage
- Easier to electrostatically shield
- Lower weight
- Smaller dimensions
- Higher efficiency
- And most important price competitive vs. old fashioned laminated transformers

MECHANICAL DRAWING



INTERNATIONAL PRIMARY CONFIGURATIONS

Voltage	100 V	120 V	220 V	240 V
Input	1 & 5	1 & 2	1 & 4	1 & 4
Connection	1 & 3 5 & 4	1 & 3 2 & 4	5 & 3	2 & 3



Secondary Power VA	Part No.	Secondary: No Load Voltage V	Secondary: Load Voltage V	Secondary: Load Current A	Dimensions: Nom. OD	Dimensions: (Inch) HT
5	5100	7.0	6	0.83	2.00	1.06
	5101	13.9	12	0.41		
	5102	17.4	15	0.33		
10	5110	10.4	9	1.11	2.37	1.10
	5111	13.9	12	0.83		
	5112	17.4	15	0.67		
	5113	34.8	30	0.33		
15	5120	11.6	10	1.5	2.37	1.31
	5121	17.4	15	1.0		
	5122	34.8	30	0.5		
	5123	2 × 7.0	2 × 6	1.25		
	5124	2 × 10.5	2 × 9	0.83		
	5125	2 × 13.9	2 × 12	0.62		
	5126	2 × 17.4	2 × 15	0.50		
	5127	2 × 20.9	2 × 18	0.41		
	5128	2 × 27.8	2 × 24	0.31		

Secondary Power VA	Part No.	Secondary: No Load Voltage V	Secondary: Load Voltage V	Secondary: Load Current A	Dimensions: Nom. OD	Dimensions: (Inch) HT
24	5130	11.6	10	2.4	2.75	1.37
	5131	13.9	12	2.0		
	5132	27.7	24	1.0		
	5133	34.7	30	0.8		
	5134	2 × 7	2 × 6	2.0		
	5135	2 × 11.6	2 × 10	1.2		
	5136	2 × 17.3	2 × 15	0.8		
	5137	2 × 20.7	2 × 18	0.67		
	5138	2 × 27.7	2 × 26	0.5		
30	5140	17.3	15	2.0	2.81	1.43
	5141	27.7	24	1.25		
	5142	34.7	30	1.0		
	5143	2 × 7	2 × 6	2.5		
	5144	2 × 11.6	2 × 10	1.5		
	5145	2 × 17.3	2 × 15	1.0		
	5146	2 × 20.7	2 × 18	0.83		
	5147	2 × 27.7	2 × 24	0.62		

AMECON

QUALITY MAGNETIC COMPONENTS • APPLICATION ORIENTED DESIGNS

1900 CHRIS LANE / ANAHEIM, CA 92805 / TEL 714-634-2220/800-392-2292

LARGEST SELECTION OF HEAVY DUTY 50/60Hz TOROIDAL POWER TRANSFORMER

Secondary Power VA	Part No.	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(inch) HT
50	5150	27.2	24	2.10	3.25	1.43
	5151	34.2	30	1.67		
	5152	2 × 13.6	2 × 12	2.10		
	5153	2 × 17.1	2 × 15	1.67		
	5154	2 × 20.5	2 × 18	1.39		
	5155	2 × 22.8	2 × 20	1.25		
	5156	2 × 27.2	2 × 24	1.04		
80	5160	17.0	15	5.3•	3.75	1.45
	5161	27.0	24	3.3		
	5162	33.4	30	2.67		
	5163	40.5	36	2.22		
	5164	47.4	42	1.90		
	5165	2 × 6.8	2 × 6	6.6		
	5166	2 × 20.4	2 × 18	2.2		
	5167	2 × 27.0	2 × 24	1.04		
	5168	2 × 33.4	2 × 30	1.33		
100	5170	16.8	15	6.67	4.00	1.50
	5171	20.2	18	5.55		
	5172	26.8	24	4.17		
	5173	33.6	30	3.33		
	5174	2 × 9	2 × 8	6.25		
	5175	2 × 16.8	2 × 15	3.33		
	5176	2 × 20.2	2 × 18	2.8		
	5177	2 × 26.8	2 × 24	2.08		
	5178	2 × 33.6	2 × 30	1.67		
120	5180	26.8	24	5.0	4.12	1.75
	5181	33.6	30	4.0		
	5182	47.0	42	2.8		
	5183	2 × 20	2 × 18	3.3		
	5184	2 × 24.5	2 × 22	2.7		
	5185	2 × 31.2	2 × 28	2.14		
	5186	2 × 33.5	2 × 30	2.0		
	5187	133.5	120	1.0		
150	5190	26.5	24	6.25	4.37	1.87
	5191	33.2	30	5.0		
	5192	66.5	60	2.5		
	5193	2 × 20	2 × 18	4.16		
	5194	2 × 26.5	2 × 24	3.12		
	5195	2 × 39.8	2 × 36	2.08		
200	5200	26.5	24	8.3	4.37	2.12
	5201	39.8	36	5.55		
	5202	66.5	60	3.33		
	5203	2 × 66.4	2 × 60	1.63		
		13.2	12	8.5		
	5204	2 × 33	2 × 30	3.33		

Secondary Power VA	Part No.	Secondary			Dimensions	
		No Load Voltage V	Load Voltage V	Load Current A	Nom. OD	(Inch) HT
250	5210	26.5	24	10.4	4.75	2.12
	5211	2 × 26.5	2 × 24	5.2		
	5212	2 × 33	2 × 30	4.17		
	5213	2 × 66	2 × 60	2.08		
	5214	2 × 53	2 × 48	2.48		
			12	1.0		
300	5220	26.0	24	12.5	4.75	2.37
	5221	32.5	30	10		
	5222	52.0	2 × 48	3.0		
		13.0	12	1.0		
	5223	2 × 65	2 × 60	2.4		
		13.0	12	1.0		
400	5230	25.8	24	16.7	4.87	2.50
	5231	64.8	60	6.7		
	5232	38.6	2 × 36	5.56		
	5233	40.7	2 × 38	5.10		
			12	1.0		
	5234	51.6	2 × 48	4.04		
			12	1.0		
500	5240	2 × 25.7	2 × 24	10.4	5.50	2.60
	5241	2 × 29.7	2 × 28	8.9		
	5242	2 × 35	2 × 33	8.3		
	5243	2 × 40.3	2 × 38	6.5		
	5244	2 × 51	2 × 48	5.2		
	5245	2 × 64	2 × 60	4.17		
750	5250	2 × 31.6	2 × 30	12.5	6.25	2.75
	5251	2 × 50.5	2 × 48	7.8		
	5252	2 × 63.4	2 × 60	6.25		
	5253	2 × 126.5	2 × 120	3.12		
1K	5260	2 × 31.4	2 × 30	16.7	6.37	2.87
	5261	2 × 63	2 × 60	8.3		
	5262	2 × 125	2 × 120	4.12		
2.5K	5270	2 × 49.8	2 × 48	26.0	9.25	3.25
	5271	2 × 62.4	2 × 60	20.8		
	5272	2 × 124.5	2 × 120	10.4		
5K	5280	2 × 62.2	2 × 60	41.6	10.87	4.25
	5281	2 × 124	2 × 120	20.8		
7.5K	5290	2 × 61.5	2 × 60	62.5	12.62	4.25
	5291	2 × 122.5	2 × 120	31.2		
10K	5295	2 × 61.5	2 × 60	83.3	14.75	5.25
	5296	2 × 122.5	2 × 120	41.6		

IMPORTANT NOTES:

1. All transformers have been designed for 50/60HZ. .
2. 60HZ & 400HZ. Designs available upon request.
3. Custom designs tailored to your specs. are made & evaluated on a 2 wk. cycle.
4. 100% electrostatic shielding available on all transformers with a small power derating.
5. Magnetic shielding & lower magnetic leakage designs for sensitive areas such as encountered in computers & audio equipment, are available on all transformers.
6. Low profile designs are available upon request.
7. Amecon has the world's most complete toroidal mfg. facilities. We can machine wind toroids in excess of 50" dia. & 2000 lbs.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC	alternating current
A/D	analog to digital
ADC	analog to digital converter
ADP	automatic data processing
AF	audio frequency
AFC	automatic frequency control
ALGOL	algorithmic language
AM	amplitude modulation
AND	a logical operator
AQL	acceptable quality level
ASCII	American national standard code for information interchange
AWG	American wire guage

B

BALUN	balanced to unbalanced
BASIC	beginners' all-purpose symbolic instruction code
BCD	binary-coded decimal
BNC	baby "N" connector
BUS	basic utility system

C

CAD	computer aided design
CAM	computer aided manufacture
CATV	cable television or community antenna television
CERMET	ceramic metal element
Comm.	communications
CMOS	complementary metal-oxide semiconductor
CPS	characters per second
CPU	central processing unit

D

D/A	digital to analog
DAC	digital to analog converter
DC	direct curent
DIL	dual in-line
DIP	dual in-line package
DPM	digital panel meter
DTL	diode transistor logic

E

EDP	electronic data processing
EBCDIC	extended binary coded decimal interchange code
EEPROM	electrically erasable PROM
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EPROM	electrically programmable ROM
ESR	equivalent series resistance

F

FEP	fluorinated ethylene propylene Copolymar, 200° Teflon
FET	field-effect transistor
FM	frequency modulation
FORTRAN	formula translator

G

GaAsFET	gallium arsenide field effect transistor
GPIB	general purpose interface bus

H

HF	high frequency (3 to 30 MHz)
HIPOT	test, measurement and diagnostic equipment
HLL	high level language
HV	high voltage
Hz	Hertz

I

IC	integrated circuit
IF	intermediate frequency
IO	input/output (devices)
IR	insulation resistance (or) infrared

J

JFET	junction field effect transistor
JMOS	junction metal oxide semiconductor

K

kHz	kilohertz (10^3 hertz)
KSR	keyboard send receive

L

LC	inductance capacitance
LCD	liquid crystal display
LED	light-emitting diode
LF	low frequency (30 to 300 kHz)
LSI	large scale integration
LVDT	linear velocity displacement transformer

M

MATV	master antenna television
μF	microforad
MHz	megahertz
MOS	metal oxide semiconductor
MOSFET	metal oxide semiconductor field effect transistor
MOV	metal oxide varistor
MPU	microprocessor unit
MSI	medium scale integration

N

NBS	National Bureau of Standards
NIM	nuclear instrumentation module
NOR	not OR

O

OEM	original equipment manufacturer
OR	a logical operator

P

pF	picofarad
PC	printed circuit
PCB	printed circuit board
PIN	positive-intrinsic-negative (transistor)
PLA	programmable logic array
PPI	plan position indicator
PROM	programmable read only memory
PUT	programmable unijunction transistor

Q

QAM	quadrature amplitude modulation
Q (meter)	quality-factor meter

R

RAM	random access memory
RC	resistance-capacitance
RFI	radio frequency interference
RMS	root mean square
ROM	read only memory
RF	radio frequency
RFC	radio-frequency choke
RFI	radio-frequency interference
RTD	resistance-temperature detector
RTL	resistor transistor logic
RTV	room temperature vulcanizing
RW	read/write

S

SAS	silicon asymmetrical switch
SBC	single board (micro) computer
SBS	silicon bilateral switch
SCR	silicon-controlled rectifier
SIP	single in-line package
SSI	small scale integration
SSR	solid state relay
STL	Schottky transistor logic

T

TC	temperature coefficient
TCXO	temperature compensated crystal oscillator
TFE	tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL	transistor-transistor logic
TTY	teletypewriter

U

UHF	ultra high frequency (300 MHz to 3 GHz)
UL	Underwriters Laboratory
UPS	uninterruptible power supply

V

VAC	volts (of) alternating current
VAR	volt-ampere reactive
VCR	video cassette recorder
VDC	volts (of) direct current
VHF	very high frequency
VHSIC	very high speed integrated circuit
VLF	very low frequency (3 to 30 kHz)
VLSI	very large scale integration
VRM	voice recognition module
VTVM	vacuum tube volt meter
VU	volume unit
VSWR	voltage standing wave ratio

W

WPS	word processing software

Y

YIG	yttrium iron garnet

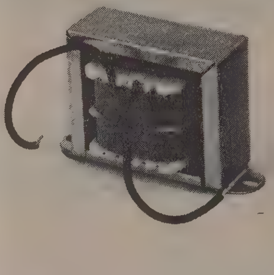
ARSTAN

POWER TRANSFORMERS TO 100 WATTS OUR SPECIALTY

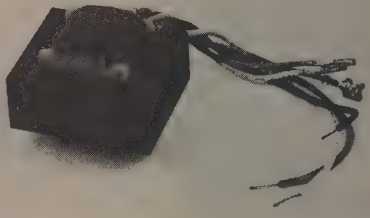
Our products are manufactured in the **FAR EAST** and are competitively priced. We can cross reference to standard designs or our engineers will help you select the features which will best fit your application.

AVAILABLE FEATURES

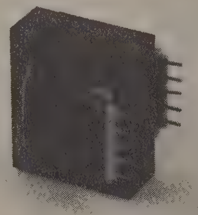
- ☐ Any combination of output voltages and load currents
- ☐ Single and dual primaries 120/240 volts
- ☐ 50/60 Hz operation
- ☐ Single or split secondaries
- ☐ Split bobbin or concentric winding
- ☐ Vertical or horizontal mounting
- ☐ Leads or terminals
- ☐ Specified breakdown voltage 500-3500 VAC
- ☐ High efficiency, specified power dissipation
- ☐ Designed to meet UL/CSA/VDE as required



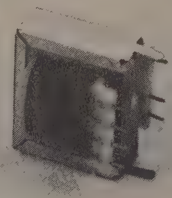
STYLE HMV



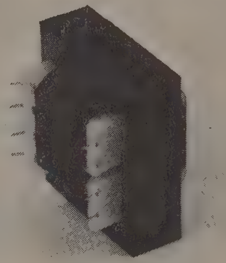
STYLE HMH



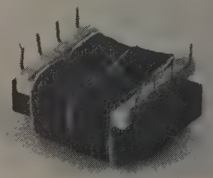
STYLE PCV1



STYLE PCV2



STYLE PCH



STYLE PCL

STYLE AND SIZE SELECTION GUIDE (SIZE IN INCHES — LxWxH)

POWER VA	HMV/HMH	PCV	PCH	PCL
1 - 1.5	⁎	1.375 x 1.125 x 1.187	1.375 x 1.125 x .937	⁎
1.5 - 5	1.625 x 1.062 x 1.183	1.625 x 1.25 x 1.375	1.375 x 1.125 x 1.187	1.875 x 1.562 x .65
5 - 8	1.687 x 1.25 x 1.375	⁎	1.625 x 1.312 x 1.312	1.875 x 1.562 x .85
8 - 15	1.937 x 1.375 x 1.625	1.875 x 1.437 x 1.625	1.875 x 1.562 x 1.437	2.50 x 2.00 x 1.065
15 - 25	⁎	1.625 x 2.25 x 1.375	2.25 x 1.875 x 1.437	⁎
25 - 35	2.312 x 1.687 x 1.937	⁎	2.625 x 2.187 x 1.562	⁎
35 - 60	2.687 x 1.812 x 2.25	———	———	———
60 - 100	3.062 x 2.25 x 1.562	———	———	———

⁎Available in non-standard sizes.

We are transformer specialists! You get technical assistance from our engineers here and top performance at low prices from our factories in the FAR EAST. We provide approval samples on quantity orders prior to production. TECHNICAL EXPERTISE, PERFORMANCE, PRICE... It's all here!

ARSTAN

PRODUCTS INTERNATIONAL LTD.
99 JERICHO TPKE., JERICHO, NY 11753 ● (516) 333-8100 ● TELEX 221519 ARSTN

ARSTAN AC TO AC AND AC TO DC WALL PLUG-IN ADAPTERS

Our products are manufactured in the **FAR EAST** and are competitively priced. Selection available from a variety of designs which are UL/CSA recognized or have our engineers help you select a custom design for your application.

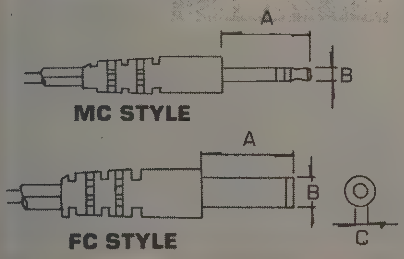
AVAILABLE FEATURES

- ☐ Any combination of voltage and load current
- ☐ Selection of input voltages for domestic or overseas use
- ☐ Center tap for AC adapters
- ☐ Specified regulation
- ☐ Selection of cords and connectors
- ☐ Table top option for large adapters
- ☐ UL/CSA recognized or designed as required

SIZE SELECTION GUIDE

POWER (watts)	SIZE (inches) H x W x D	AC to AC (TYPICAL STANDARD DESIGNS)		AC to DC (TYPICAL STANDARD DESIGNS)	
6	2.0 x 1.687 x 1.375	———	———	8 V @ 50 MA	12 V @ 100 MA
10	2.375 x 2.0 x 1.312	9 V @ 600 MA	15 V @ 300 MA	6 V @ 500 MA	9 V @ 300 MA
18	2.375 x 2.375 x 1.875	12 V @ 1.25 A	16 V @ 700 MA	9 V @ 800 MA REG	24 V @ 400 MA
20	2.75 x 1.96 x 1.5	12 V @ 830 MA	24 V @ 170 MA CT	———	———
30	3.125 x 2.187 x 1.875	15 V @ 1.2 A	20 V @ 850 MA	10 V @ 1.2 A	26 V @ 400 MA
40	3.375 x 2.375 x 2.125	20 V @ 1.5 A	———	±15V @ 200 MA REG	———
50	3.375 x 2.625 x 2.375	24 V @ 1.2 A	———	12 V @ 1.2 A	———

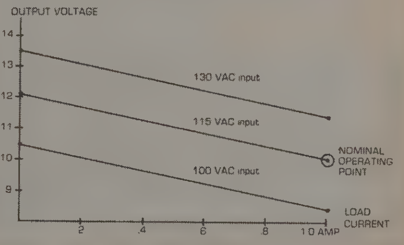
TYPICAL CONNECTORS



CONNECTOR SELECTION GUIDE

STYLE	Dimensions (mm) A	B	C
MC 1	14.5	3.5	——
MC 2	11.5	2.5	——
FC 1	12	5.0	2.0
FC 2	12	5.0	2.5
FC 3	12	5.5	2.1
FC 4	12	5.5	2.5

TYPICAL OUTPUT LOAD CURVES for adapter with nominal output 10 V @ 1 A.



ARSTAN PRODUCTS INTERNATIONAL LTD.

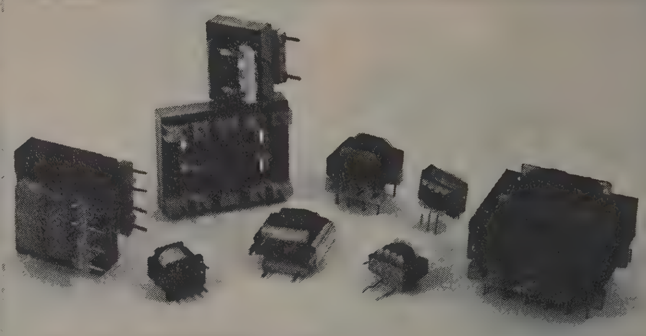
99 JERICHO TPKE., JERICHO, NY 11753 ● (516) 333-8100 ● TELEX 221519 ARSTN

ARSTAN QUALITY INDUCTIVE COMPONENTS

Large variety of standard and custom designed components. Technical expertise and design assistance here as well as competitive prices from our factories in the **FAR EAST.**

TRANSFORMERS FOR AUDIO, COMMUNICATIONS AND TELEPHONE APPLICATIONS

We can cross reference to standard designs or our engineers will help you select the features which will best fit your application.



AVAILABLE FEATURES

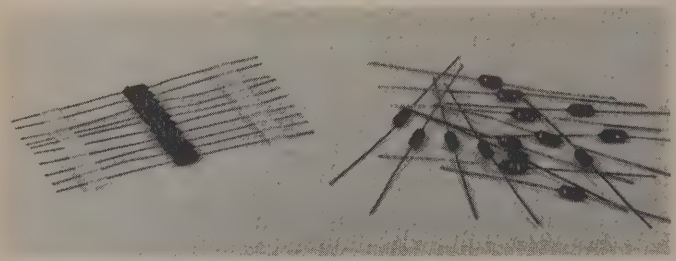
- ☐ Choice of input/output impedance
- ☐ Optimum tradeoff between DC current, DCR insertion loss, frequency response and return loss
- ☐ PC board plug in
- ☐ Flat frequency response and more efficient power transfer for audio transformers

TYPICAL AVAILABLE DESIGNS

	A	B	C
Input/output impedance	600/600 ohms	600/600 ohms	10,000/50 ohms
Insertion loss	1.0 db	2.5 db	3 db
Frequency response	± .5 db	± .5 db	± 1 db
DC current	100 mA	0	0
DCR	40/40 ohms	180/80 ohms	300/10 ohms
Return loss	26 db	———	———

AXIAL CHOKE INDUCTORS

We have a full line of molded choke inductors for unwanted signal suppression and a variety of other applications.



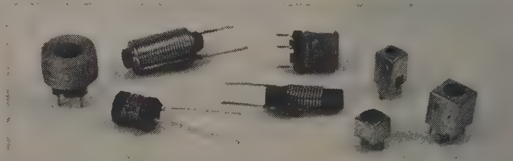
AXIAL COIL SPECIFICATIONS

Inductance range	.22-1000 microhenry
Tolerance	± 10%
DCR range	.1-20 ohms*
Min Q range	35-50*
DC current range	100-3000 MA*
Temperature range	-20 to +90°C
Coating	Epoxy
Leads	Tinned copper

*Depends on inductance value

FIXED AND VARIABLE INDUCTORS

A variety of inductors and high frequency transformers for a wide array of applications.



ARSTAN PRODUCTS INTERNATIONAL LTD.
99 JERICHO TPKE., JERICHO, NY 11753 ● (516) 333-8100 ● TELEX 221519 ARSTN

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

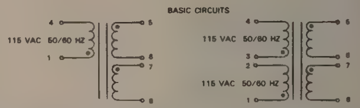
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

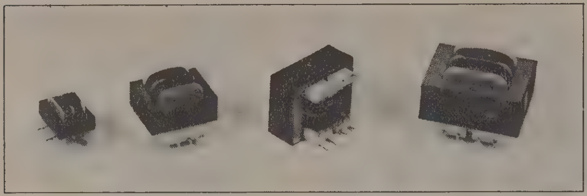
BH Electronics, Inc.

A UNIT OF **BMC** INDUSTRIES, INC.

PRODUCTS SUMMARY	APPLICATION
Pulse Transformers	Data Transmission, High Frequency Coupling
Trigger Transformers	SCR Trigger, Motor Speed Controls
Flyback Transformers	High Voltage CRT, Spark Gap Ignition, High Voltage Power Supplies
Power Transformers	Instrumentation, DC Power Supplies, Control Circuits.
Low Power Step-up Transformer	Neuro Stimulators, Infant Monitors, Implantable Medical Electronics
DC-DC Converters	I.C. Bias Circuits, Miniature Power Supplies, Aerospace Instruments
Switching Magnetics	State of the Art DC Supplies, High Frequency Inverters & Converters
Audio Transformers	Telephone Industry, Communications, Impedence Matching
Potted Transformer Assemblies	Medical Devices, Hazardous Environments, High Reliability Military

SPLIT BOBBIN POWER TRANSFORMERS


BASIC CIRCUITS
115 VAC 50/60 HZ
4
1
5
8
7
8
115 VAC 50/60 HZ
3
2
115 VAC 50/60 HZ
1



SIZE	SINGLE PRIMARY	DUAL PRIMARY	SERIES OUTPUT Volts AC	SERIES OUTPUT AMPS RMS	PARALLEL OUTPUT Volts AC	PARALLEL OUTPUT AMPS RMS
1 1 VA	507-3200	507-3200D	6 VCT	180	3V	360
	507-3201	507-3201D	10 VCT	110	5V	220
	507-3202	507-3202D	12.6 VCT	.090	6.3V	.180
	507-3203	507-3203D	16 VCT	070	8V	140
	507-3204	507-3204D	20 VCT	.055	10V	.110
	507-3205	507-3205D	24 VCT	.045	12V	.090
	507-3206	507-3206D	28 VCT	.040	14V	.080
	507-3207	507-3207D	36 VCT	.030	18V	.060
	507-3208	507-3208D	48 VCT	.023	24V	.046
	507-3209	507-3209D	56 VCT	.020	28V	.040
2 4 VA	507-3300	507-3300D	6 VCT	400	3V	.800
	507-3301	507-3301D	10 VCT	250	5V	500
	507-3302	507-3302D	12.6 VCT	.200	6.3V	.400
	507-3303	507-3303D	16 VCT	.150	8V	300
	507-3304	507-3304D	20 VCT	.120	10V	.240
	507-3305	507-3305D	24 VCT	100	12V	200
	507-3306	507-3306D	28 VCT	085	14V	170
	507-3307	507-3307D	36 VCT	.065	18V	.130
	507-3308	507-3308D	48 VCT	050	24V	100
	507-3309	507-3309D	56 VCT	045	28V	.090
6 VA	507-3400	507-3400D	6 VCT	1.00	3V	2 00
	507-3401	507-3401D	10 VCT	.600	5V	1.20
	507-3402	507-3402D	12 6 VCT	.500	6.3V	1.30
	507-3403	507-3403D	16 VCT	.400	8V	.800
	507-3404	507-3404D	20 VCT	.300	10V	.600
	507-3405	507-3405D	24 VCT	.250	12V	.500
	507-3406	507-3406D	28 VCT	.200	14V	400
	507-3407	507-3407D	36 VCT	.170	18V	.340
	507-3408	507-3408D	48 VCT	.125	24V	.250
	507-3409	507-3409D	56 VCT	.110	28V	.220
12 VA	507-3500	507-3500D	6 VCT	2.00	3V	4 00
	507-3501	507-3501D	10 VCT	1.20	5V	2.40
	507-3502	507-3502D	12 6 VCT	1.00	6.3V	2 00
	507-3503	507-3503D	16 VCT	.800	8V	1.60
	507-3504	507-3504D	20 VCT	.600	10V	1 20
	507-3505	507-3505D	24 VCT	.500	12V	1.00
	507-3506	507-3506D	28 VCT	.420	14V	.840
	507-3507	507-3507D	36 VCT	.350	18V	.700
	507-3508	507-3508D	48 VCT	.250	24V	.500
	507-3509	507-3509D	56 VCT	.220	28V	.440

Custom Outputs Available Within VA Limits

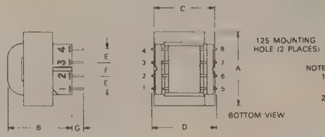
FEATURES

- High Dielectric Breakdown Strength
- Less Need For Electrostatic Shielding
- Compact Construction
- Single Or Dual Primary
- Custom Outputs Available On Request
- Designed To Meet U.L. Specs

SPECIFICATIONS

- 2500 VRMS Hipot
- Temperature Class B, 130°C
- Primary 115 VAC Or 115/230 VAC
- Sizes — 1.1, 2.4, 6, 12 VA

MECHANICAL


C
4
3
2
1
E
F
E
8
7
6
5
A
125 MOUNTING HOLE (2 PLACES)
BOTTOM VIEW
B
G
D

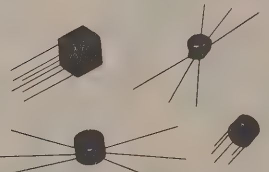
NOTES —
1 PINS 2 3 REMOVED ON SINGLE PRIMARY MODELS
2 NYLON MOUNTING HARDWARE AVAILABLE FROM BH ON REQUEST

SIZE	A	B	C	D	E	F	G	Mounting Hardware
1.1 VA	1 375	.937	1.125	1.200	.250	.250	.250	None
2 4 VA	1 375	1.187	1.125	1.200	250	.250	250	None
6 VA	1 625	1.312	1.312	1.280	250	.350	.250	4-40X1 3/8
12 VA	1 875	1.437	1.562	1.410	.300	.400	.250	4-40X1 3/8

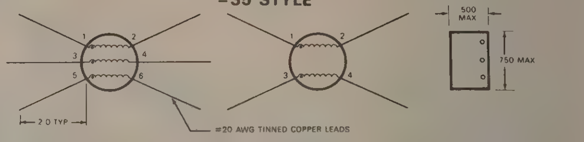
SERIES 505 - SCR TRIGGER TRANSFORMERS

- FOUR CASE STYLES
- 1600 OR 2500 VRMS ISOLATION
- TINNED COPPER LEADS
- LOW Ciw TO PREVENT FALSE TRIGGERING
- AVAILABLE FROM STOCK
- ORDER BY PART NUMBER 505-XX YY

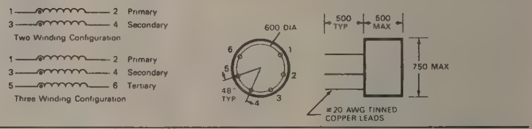
★ SPECIFY CASE STYLE
★★ SPECIFY ELECTRICAL PARAMETERS



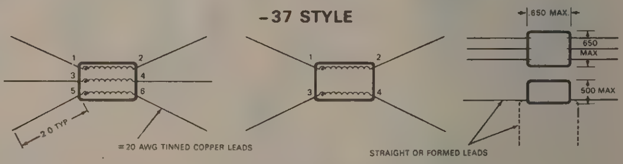
–35 STYLE


1
2
3
4
5
6
2 0 TYP
1
2
3
4
500 MAX
750 MAX
≠20 AWG TINNED COPPER LEADS

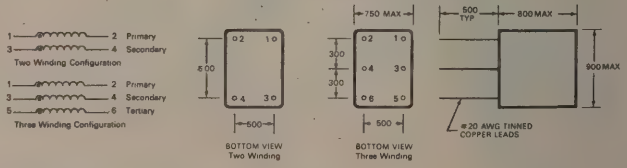
–36 STYLE


1 2 Primary
3 4 Secondary
Two Winding Configuration
1 2 Primary
3 4 Secondary
5 6 Tertiary
Three Winding Configuration
600 DIA
6
1
5
2
4
3
48° TYP
500 TYP
500 MAX
750 MAX
≠20 AWG TINNED COPPER LEADS

–37 STYLE


1
2
3
4
5
6
2 0 TYP
≠20 AWG TINNED COPPER LEADS
1
2
3
4
650 MAX
650 MAX
500 MAX
STRAIGHT OR FORMED LEADS

–55 STYLE


1 2 Primary
3 4 Secondary
Two Winding Configuration
1 2 Primary
3 4 Secondary
5 6 Tertiary
Three Winding Configuration
750 MAX
600
300
300
500
500
BOTTOM VIEW Two Winding
BOTTOM VIEW Three Winding
500 TYP
800 MAX
900 MAX
≠20 AWG TINNED COPPER LEADS

★ STANDARD CASE STYLES

CASE NO.	PCB MOUNTING	ISOLATION VOLTAGE	TEMPERATURE RANGE	ENCAPSULATED	LEAD SIZE
35	YES	1600 VRMS 60HZ	–10°C TO +70°C	YES	20 AWG
36	YES	1600 VRMS 60HZ	0°C TO 60°C	YES	20 AWG
37	YES	1600 VRMS 60HZ	0°C TO 60°C	NO	20 AWG
55	YES	2500 VRMS 60HZ	0°C TO 60°C	YES	20 AWG

★★ STANDARD ELECTRICAL SPECIFICATIONS

ELECTRICAL PARAMETER NUMBER	TURNS RATIO	PRIMARY INDUCTANCE (mh –MIN.)	PRIMARY ET CONSTANT (V–μsec MIN.)	INTERWINDING CAPACITANCE (PF –MAX.)	LEAKAGE INDUCTANCE (μh –MAX.)
00	1:1	.25	45	20	5
01	1:1	1.0	90	30	20
02	1:1	5.0	180	30	45
03	1:1	20 0	360	50	200
04	1:1:1	.25	45	20	5
05	1:1:1	1.0	90	30	20
06	1:1:1	5.0	180	30	45
07	1:1:1	20 0	360	50	200
08	2:1	1.0	90	30	40
09	2:1	5.0	180	30	60
10	2:1:1	1.0	90	30	40
11	2·1:1	5.0	180	30	60
12	5:1	20.0	360	50	200
13	5:1:1	20.0	360	50	200

CUSTOM VERSIONS AVAILABLE

SEND FOR FULL CATALOG

331 BREMER BLDG.
ST PAUL, MN 55101

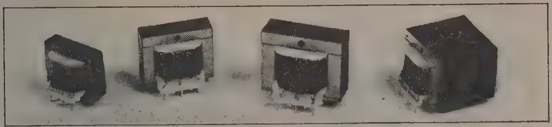
BH Electronics, Inc.
A UNIT OF **BMC** INDUSTRIES, INC

PHONE 612/228-6463
TELEX 29-7022

BH Electronics, Inc.

A UNIT OF **BMC** INDUSTRIES, INC.

MINIATURE POWER TRANSFORMERS

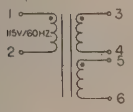


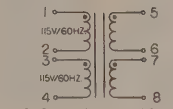
FEATURES

- PC Mount
- Designed To U.L. Specs
- Mounting Frame Optional
- Single or Dual Primary
- Wide Range of Outputs
- Thermal Cutout Available on Request

SPECIFICATIONS

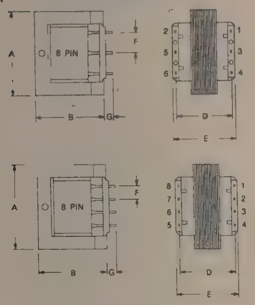
- Sizes — 1.5, 4.5, 10, 24 VA Rating
- Dielectric Strength 1250 VRMs
- Inputs 115V Or 115/230V





115 VAC PARALLEL / 230 VAC SERIES

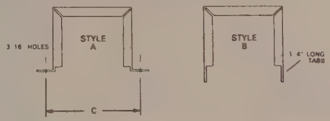
MECHANICAL



DIMENSIONS

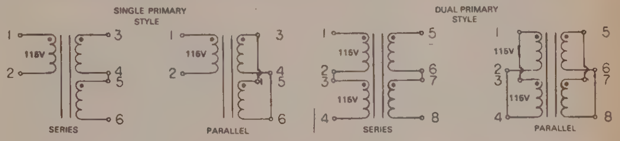
SIZE	PIN	A	B	C	D	E	F	G
1.5	6	1.375	1.22	1.750	1.00	1 125	312	188
1.5	8	1.375	1.22	1.750	1.00	1.125	.200	.188
4.5	6	1.625	1.4	2.0	1.10	1.25	.400	.188
4.5	8	1.625	1.4	2.0	1.10	1.25	.250	.188
10	6	1.875	1.625	2.375	1.30	1.312	.400	.188
10	8	1.875	1.625	2.375	1.30	1.312	.250	.188
24	6	1.625	1.375	—	2.1	2.25	.400	.188
24	8	1.625	1.375	—	2.1	2.25	.250	.188

**Dim. A, B ⅛" Larger with mounting frame*
**Mounting frame not available on 24 VA size*

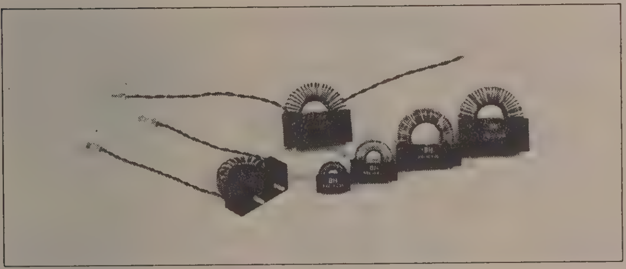


SIZE	BH PART NUMBER Single 115V	BH PART NUMBER Dual 115/230	SERIES Volts AC AMPS RMS	PARALLEL Volts AC AMPS RMS
1.5 VA	507-2001	507-2001D	6 VCT At .250	3V At .500
	507-2002	507-2007D	10 VCT At .150	5V At .300
	507-2003	507-2003D	12.6 VCT At .120	6.3V At .240
	507-2004	507-2004D	15 VCT At .100	7.5V At .200
	507-2005	507-2005D	20 VCT At .075	10V At .150
	507-2006	507-2006D	24 VCT At .060	12V At .120
	507-2007	507-2007D	34 VCT At .040	17V At .080
	507-2008	507-2008D	48 VCT At .030	24V At .060
	507-2009	507-2009D	56 VCT At .020	28 VCT At .040
4.5 VA	507-2101	507-2101D	6 VCT At .75	3V At 1.5
	507-2102	507-2102D	10 VCT At .450	5V At .900
	507-2103	507-2103D	12.6 VCT At .350	6.3V At .700
	507-2104	507-2104D	15 VCT At .300	7.5V At .600
	507-2105	507-2105D	20 VCT At .220	10V At .440
	507-2106	507-2106D	24 VCT At .180	12V At .360
	507-2107	507-2107D	34 VCT At .125	17V At .250
	507-2108	507-2108D	48 VCT At .090	24V At .180
	507-2109	507-2109D	56 VCT At .080	28V At .160
10 VA	507-2201	507-2201D	6 VCT At 1.6	3V At 3.3
	507-2202	507-2202D	10 VCT At 1	5V At 2
	507-2203	507-2203D	12.6 VCT At .800	6.3V At 1.6
	507-2204	507-2204D	15 VCT At .650	7.5V At 1.3
	507-2205	507-2205D	20 VCT At .500	10V At 1.0
	507-2206	507-2206D	24 VCT At .400	12V At .800
	507-2207	507-2207D	34 VCT At .300	17V At .600
	507-2208	507-2208D	48 VCT At .200	24V At .400
	507-2209	507-2209D	56 VCT At .180	28V At .360
24 VA	507-2301	507-2301D	6 VCT At 4.0	3V At 8.0
	507-2302	507-2302D	10 VCT At 2.4	5V At 4.8
	507-2303	507-2303D	12.6 VCT At 1.9	6.3V At 3.8
	507-2304	507-2304D	15 VCT At 1.6	7.5V At 3.2
	507-2305	507-2305D	20 VCT At 1.2	10V At 2.4
	507-2306	507-2306D	24 VCT At 1 0	12V At 2.0
	507-2307	507-2307D	34 VCT At .700	17V At 1.4
	507-2308	507-2308D	48 VCT At 500	24V At 1.0
	507-2309	507-2309D	56 VCT At .420	28V At .840

Additional Outputs Available Within VA Limits



TOROID INDUCTORS FOR SWITCHING POWER SUPPLIES

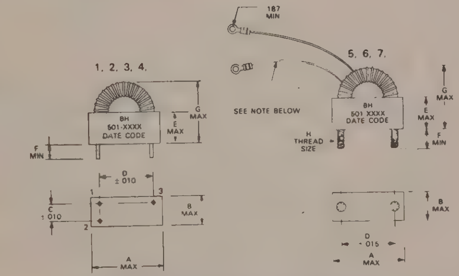


- Current Range, 1 AMP To 50 AMPS
- Cost Effective Design
- Wide Range Of Inductance
- Maximum Temperature Rise, 40°C Above Ambient
- PC Mount

ELECTRICAL CHARACTERISTICS AT 25° C

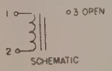
BH PART NUMBER	RATED DC CURRENT (AMPS)	MINIMUM INDUCTANCE AT RATED DC µh	MINIMUM INDUCTANCE AT ZERO DC µh	DC RESISTANCE MAXIMUM Ω	MIN. ENERGY STORAGE ½ LI²	PACKAGE STYLE	LEAD DIA. INCHES ±.004
501-1001	1.0	725	1400	.75	366	1	.025
501-1002	2.5	115	230	.12	366	1	.025
501-1003	2.5	370	740	.23	1166	2	.025
501-1004	4.1	40	80	.045	361	1	.032
501-1005	4.1	140	280	.086	1185	2	.032
501-1006	4.1	360	720	.177	3034	3	.032
501-1007	6.5	15	30	.018	359	1	.040
501-1008	6.5	50	100	.035	1162	2	.040
501-1009	6.5	140	280	.070	3000	3	.040
501-1010	6.5	290	580	.098	6190	4	.040
501-1011	10.0	7	14	.0075	350	1	.051
501-1012	10.0	20	40	.014	1150	2	.051
501-1013	10.0	60	120	.028	3000	3	.051
501-1014	10.0	120	240	.040	6200	4	.051
501-1015	20.0	6	12	.004	1200	5	NA
501-1016	20.0	15	30	.0072	3200	6	NA
501-1017	20.0	30	60	.010	6400	7	NA
501-1018	40.0	3.5	7.0	.0017	2800	6	NA
501-1019	40.0	7	14	.0024	5920	7	NA
501-1020	50.0	4.5	9	.0016	5875	7	NA

—CUSTOM VERSIONS AVAILABLE ON REQUEST—



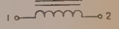
STYLE	A	B	C	D	E	F	G	H
1	1.05 26,67	.55 13,97	.400 10,16	800 20,32	55 13,97	20 5,08	1 10 27,94	N/A
2	1.45 36,83	.80 20,32	.600 15,24	900 22,86	.58 14,73	20 5,08	1 40 35,56	N/A
3	2.00 50,80	95 24,13	.700 17,78	1.20 30,48	.75 19,05	20 5,08	1 90 48,26	N/A
4	2 16 54,86	1 12 28,45	900 22,86	1 50 38,10	1 05 26,67	20 5,08	2 20 55,88	N/A
5	1 45 36,83	80 20,32	N/A	900 22,86	58 14,73	25 6,35	1 40 15,56	6-32
6	2.00 50,80	.95 24,13	N/A	1 20 30,48	75 19,05	.25 6,35	1.90 48,26	8-32
7	2.16 54,86	1 12 28,45	N/A	1.50 38,10	1.05 26,67	.25 6,35	2.20 55,88	10-32

STYLE 1-4



SCHEMATIC

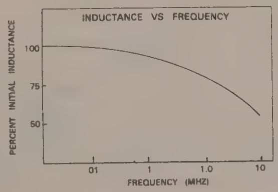
STYLE 5-7



SCHEMATIC

NOTE: Style 5, 6, 7 Leads Cut to 6" Length/Custom Lengths Available Upon Request

TYPICAL INDUCTANCE CHARACTERISTICS



331 BREMER BLDG
ST PAUL, MN 55101

BH Electronics, Inc.
A UNIT OF **BMC** INDUSTRIES, INC.

PHONE 612/228-6463
TELEX 29-7022

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

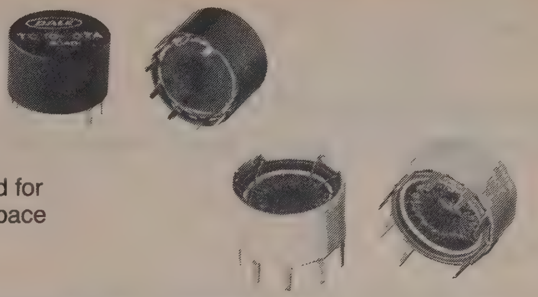
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms	**1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code	**3**•1103
Batteries, Product Selection Guide	**3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide	**2**•1003
Capacitors, Basic Formulas	**1A**•1093
Capacitors, Miniglossary	**1A**•1069
Capacitors, Product Selection Guide	**1A**•1003
Circuit Boards (Printed), Product Selection Guide	**2**•1089
Coils, Chokes, & Inductors, Product Selection Guide	**1A**•1219
Connectors, Miniglossary	**2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide	**2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	**1A**•1309
Delay Lines, Product Selection Guide	**1A**•1445
Discrete Semiconductors, Product Selection Guide	**1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide	**1B**•1021
EBCDIC Code	**3**•1153
Encapsulation, Miniglossary	**2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	**2**•1801
Filters, Product Selection Guide	**1A**•1577
Instruments, Graphic Recording, Product Selection Guide	**3**•1381
Instruments, Panel Meters, Product Selection Guide	**3**•1321
Instruments, Test & Measuring, Product Selection Guide	**3**•1182
Interconnection Systems, Product Selection Guide	**2**•1873
Keyboards & Keypads, Product Selection Guide	**1B**•1759
Microwave Components, Product Selection Guide	**1A**•1685
Military Qualified Products Lists	**1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide	**1B**•1121
Opto Semiconductors, Miniglossary	**1B**•1218
Oscilloscopes, Product Selection Guide	**3**•1361
Panel Hardware, Product Selection Guide	**2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	**1A**•2017
Power Supplies, Miniglossary	**3**•1455
Power Supplies, AC, Product Selection Guide	**3**•1815
Power Supplies, DC, Product Selection Guide	**3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	**1B**•1255
Relay Contact Forms	**1B**•1317
Relays, Electromechanical, Miniglossary	**1•B**1292
Relays, Product Selection Guide	**1B**•1289
Resistor Color Codes	**1A**•1791
Resistors, Product Selection Guide	**1A**•1789
Servo Components, Miniglossary	**3**•1935
Solenoids, Product Selection Guide	**1B**•1481
Switches, Product Selection Guide	**1B**•1499
Thyristors/High Power Diodes, Miniglossary	**1A**•1652
Transducers & Encoders, Product Selection Guide	**1B**•1827
Transformers, Product Selection Guide	**1A**•2115
Wire & Cable, Product Selection Guide	**2**•1935

DALE®

TC CONVERTER TRANSFORMERS



FEATURES

- High conversion efficiency from DC input to filtered DC output
- Designed especially for low-power solid state circuits
- Designed for mounting on printed circuit boards
- Miniature size for minimum space
- Choice of encapsulated or open (impregnated) styles

SPECIFICATIONS

ELECTRICAL

Transformer Power Rating: 3 watts

Isolation, Primary-Secondary: 500 volts 60 Hz, operating characteristics may be varied to suit specific applications by appropriate selection of circuit components

ENVIRONMENTAL

Operating Temp. Range: −20°C to +80°C, intended for use in enclosed commercial and industrial applications

MECHANICAL

Coating: Varnish dip coat or epoxy encapsulated

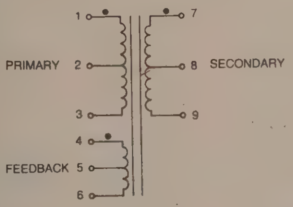
Terminals: .015″ thick, solder plated, varnish-free. Intended for P.C. board mounting

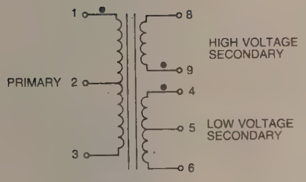
TYPICAL APPLICATIONS

Power supply for gas discharge display, battery-operated portable instruments, operational amplifier power supplies.

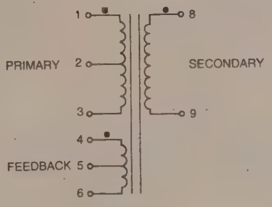
SCHEMATICS

NO. 1

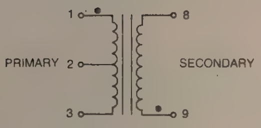

1
7
PRIMARY 2
8 SECONDARY
3
9
4
FEEDBACK 5
6


1
8
HIGH VOLTAGE SECONDARY
9
PRIMARY 2
4
5
LOW VOLTAGE SECONDARY
3
6

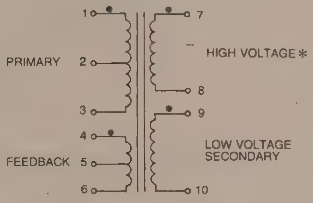
NO. 2


1
8
PRIMARY 2
SECONDARY
3
9
4
FEEDBACK 5
6

NO. 3


1
8
PRIMARY 2
SECONDARY
3
9

NO. 4


1
7
PRIMARY 2
HIGH VOLTAGE*
8
3
9
4
FEEDBACK 5
LOW VOLTAGE SECONDARY
6
10

*Omit high voltage winding for TC 10-06.

NO. 5

OPERATING CHARACTERISTICS*

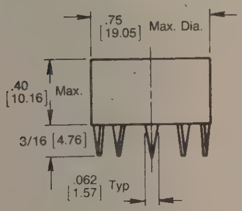
MODEL NO.	INPUT	OUTPUT	FREQUENCY ±20%	EFFICIENCY MIN.	TEST CIRCUIT	SCHEMATIC NO.
TC 10-01	3.6 VDC	+7.2 ± .2 VDC at 150 MW −7.2 ± .2 VDC at 150 MW	7.5 KHz	50%	1	1
TC 10-02	5 VDC	200 ± 10 VDC at 250 MW	11 KHz	64%	2*	4
TC 10-03	5 VDC	200 ± 10 VDC at 250 MW +15 ± .4 VDC at 125 MW −15 ± .4 VDC at 125 MW	11 KHz	60%	2	2
TC 10-04	5 VDC	+15 ± .4 VDC at 500 MW −15 ± .4 VDC at 500 MW	8 KHz	75%	3	1
TC 10-05	5 VDC	+170 ± 5.1 VDC at 850 MW +32 ± 1.0 VDC at 510 MW	11 KHz	75%	4	5
TC 10-06	5 VDC	+35 ± 1.0 VDC at 610 MW	11 KHz	70%	4*	5
TC 10-07	7.5 VDC	16.3 ± .4 VDC at 330 MW	7 KHz	65%	5	1
TC 10-08	12 VDC	15 ± .4 VDC at 1 watt	7.5 KHz	72%	3	1
TC 10-09	12 VDC	160 ± 5 VDC at 1.5 watts	10 KHz	75%	6	3
TC 10-10	12 VDC	14.2 ± .7 VDC at 3 watts	10 KHz	70%	5	1
TC 10-11	12 VDC	+24 ± .5 VDC at 2.0 watts	10 KHz	80%	5	1
TC 10-12	24 VDC	170 ± 5.1 VDC at 850 MW 32 ± 1.0 VDC at 510 MW	11 KHz	70%	4	5

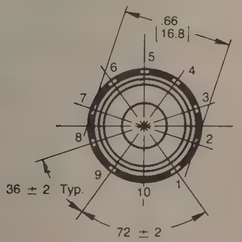
*Characteristics relate to transformer when operated in applicable test circuit and at specified load power.

[Numbers in brackets indicate millimeters]

DIMENSIONS (All·Models)

OPEN STYLE

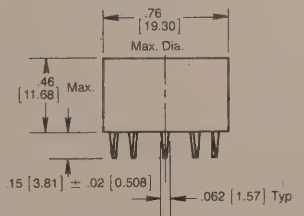

.75 [19.05] Max. Dia.
.40 [10.16] Max.
3/16 [4.76]
.062 [1.57] Typ


.66 [16.8]
5
6
4
7
3
8
2
9
10
1
36 ± 2 Typ.
72 ± 2

BOTTOM VIEW *

* Shows typical pin spacing. Pin 10 is omitted on all models except -05, -06, -12

ENCAPSULATED STYLE C-A


.76 [19.30]
Max. Dia.
.46 [11.68] Max.
.15 [3.81] ± .02 [0.508]
.062 [1.57] Typ

ORDERING INFORMATION

TC-10	−01	A
	DASH NUMBER	ENCAPSULATED STYLE. Leave blank for open style.

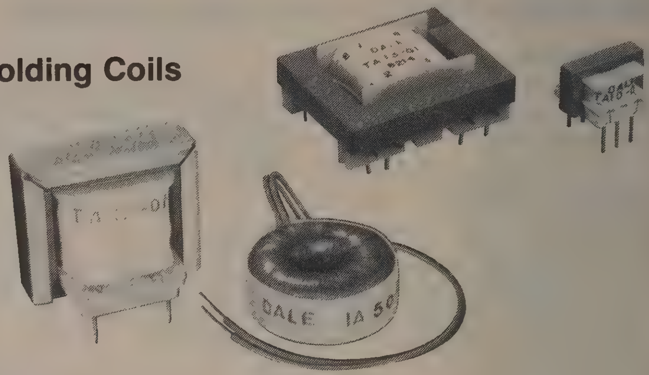
For complete information, write or phone

DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DALE®

TA and IA SERIES

Telephone Coupling Transformers and Holding Coils



FEATURES

- Designed and built to meet telephone company requirements for data and voice access on leased private telephone lines or through the dial-up switched telephone network.
- Provides line isolation, impedance matching, line balance, hybrid and holding coil applications.

SPECIFICATIONS

ELECTRICAL

Frequency Response: ±.5 DB from 300 to 3500 Hz

Power Level: −45 DBM to +7 DBM

Impedance Matching: ±10% from 300 to 3500 Hz

Return Loss:
22 DB min. = TA 10-03
13 DB min. = TA 13-01
14 DB min. = TA 14-01
26 DM min. = TA 10-01, TA 10-02, TA 10-04, TA 10-05, TA 10-06, TA 10-07, TA 11-01

Longitudinal Balance: Per FCC 68.310

Distortion: .5% max.

MECHANICAL

Coating: TA = Vacuum impregnated with polyester varnish.
IA = Tough vinyl coating.

Terminals: TA = Precision spaced PC type plug-in terminals.
IA = #28 AWG teflon coated insulated terminals.

SCHEMATICS

Fig. 1

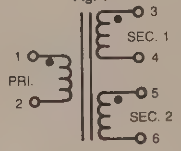


Fig. 2

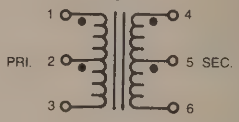


Fig. 3

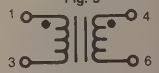


Fig. 4

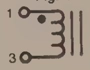


Fig. 5

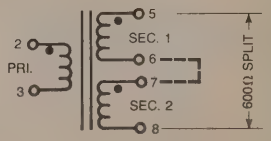
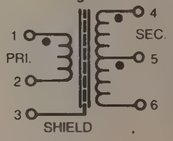


Fig. 6



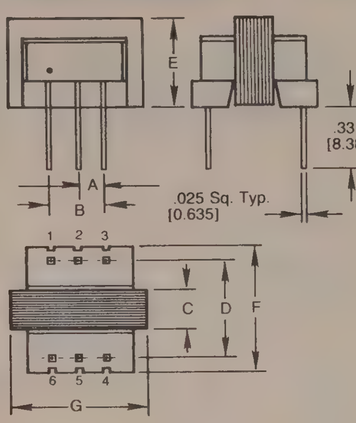
ELECTRICAL CHARACTERISTICS

MODEL NO.	APPLICATION	PRIMARY IMPEDANCE	SECONDARY IMPEDANCE	FIGURE LETTER	SCHEMATIC FIGURE NO.	NO. OF UNITS REQ'D	TERMINAL NUMBERS USED
TA 10-01	HYBRID	600Ω	600Ω/600Ω	C	1	2	1, 2, 3, 4, 5, 6
TA 10-02	COUPLING	600Ω	900Ω	C	3	1	1, 3, 4, 6
TA 10-03	BRIDGING	4KΩ	600Ω	C	3	1	1, 3, 4, 6
TA 10-04	COUPLING	600Ω CT	600Ω CT	C	2	1	1, 2, 3, 4, 5, 6
TA 10-05	COUPLING	600Ω	600Ω	C	3	1	1, 3, 4, 6
TA 10-06	COUPLING	900Ω	900Ω	C	3	1	1, 3, 4, 6
TA 10-07	COUPLING	600Ω	600Ω	A	3	1	1, 3, 4, 6
TA 11-01	HYBRID	600Ω	600Ω/600Ω	C	1	2	1, 2, 3, 4, 5, 6
TA 13-01	COUPLING	600Ω	600Ω SPLIT 75 MA DC	B	5	1	2, 3, 5, 6, 7, 8
TA 14-01	COUPLING	600Ω	900Ω/600Ω 100/120 MA DC	D	6	1	1, 2, 3, 4, 5, 6
TA 12-01	HOLDING COIL	2.0 H @ 60 MA, 1.3 H @ 100 MA DC DCR = 180Ω		C	4	1	1, 3
IA 40-01	HOLDING COIL	1.0 H @ 0 MA, .8 H @ 25 MA DC DCR = 225Ω		—	4	1	—
IA 50-01	HOLDING COIL	1.0 H @ 0 MA, .8 H @ 40 MA DC DCR = 113Ω		—	4	1	—

DIMENSIONS—TA [Numbers in brackets indicate millimeters]

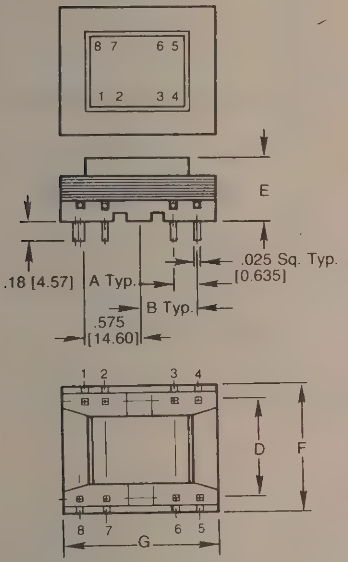
MODEL NO.	A	B	C	D	E	F	G	WEIGHT (Ozs.)
TA 10-01	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-02	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-03	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-04	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-05	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-06	.187 [4.75]	.375 [9.52]	.187 [4.75]	.420 [10.7]	.719 [18.3]	.688 [17.5]	.766 [19.4]	.5
TA 10-07	.150 [3.81]	.300 [7.62]	.187 [4.75]	.500 [12.7]	.470 [11.94]	.675 [17.14]	.766 [19.4]	.4
TA 11-01	.200 [5.08]	.400 [10.16]	.250 [6.35]	.781 [19.8]	.844 [21.4]	.953 [24.2]	1.01 [25.6]	1.2
TA 12-01	.312 [7.92]	.625 [15.9]	.375 [9.52]	1.00 [25.4]	1.187 [30.2]	1.125 [28.6]	1.375 [34.9]	3.5
TA 13-01	.250 [6.35]	.625 [15.9]	—	1.00 [25.4]	.645 [16.38]	1.313 [33.34]	1.625 [41.27]	2.5
TA 14-01	.400 [10.16]	.800 [20.32]	.680 [17.27]	1.30 [33.02]	1.60 [40.64]	1.438 [36.51]	2.00 [50.8]	9.5

FIGURE A



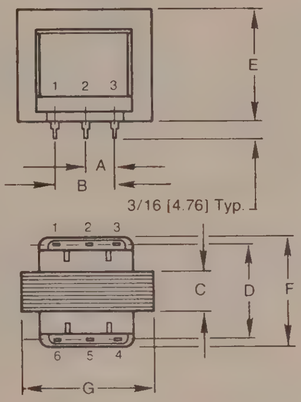
E
.33
[8.38]
A
B
.025 Sq. Typ.
[0.635]
1 2 3
C
D
F
6 5 4
G

FIGURE B



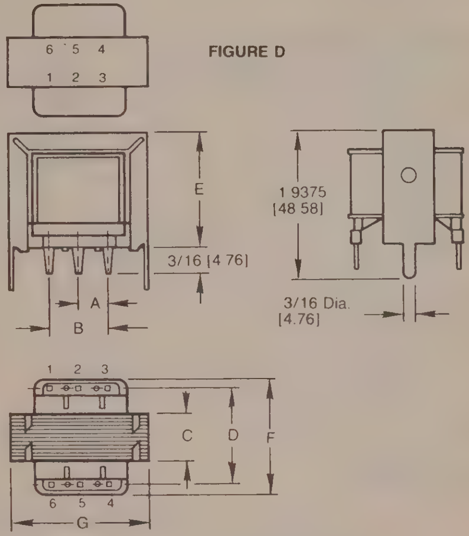
8 7 6 5
1 2 3 4
E
.025 Sq. Typ.
[0.635]
.18 [4.57]
A Typ.
B Typ.
.575
[14.60]
1 2 3 4
D
F
8 7 6 5
G

FIGURE C



1 2 3
E
A
B
3/16 [4.76] Typ.
1 2 3
C
D
F
6 5 4
G

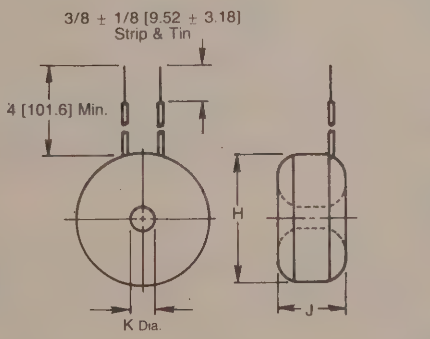
FIGURE D



6 5 4
1 2 3
E
3/16 [4 76]
A
B
1 9375
[48 58]
3/16 Dia.
[4.76]
1 2 3
C
D
F
6 5 4
G

DIMENSIONS—IA [Numbers in brackets indicate millimeters]

MODEL NO.	H (Max.)	J (Max.)	K (Min.)	WEIGHT (Ozs.)
IA 40-01	1.06 [26.9]	.437 [11.1]	.22 [5.59]	.75
IA 50-01	1.32 [33.5]	.688 [17.5]	.22 [5.59]	2



3/8 ± 1/8 [9.52 ± 3.18]
Strip & Tin
4 [101.6] Min.
H
K Dia.
J

ORDERING INFORMATION

The following model number information must be supplied when ordering transformers.

MODEL TA

STYLE	SIGNIFIES SIZE OF UNIT	DASH NUMBER SIGNIFIES VALUE
TA	14, 13, 12, 11, 10	-01 thru -07

MODEL IA

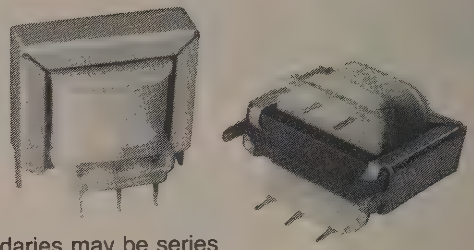
STYLE	SIGNIFIES SIZE OF UNIT	DASH NUMBER SIGNIFIES VALUE
IA	50 40	-01

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DALE® LOW POWER TRANSFORMERS

PL SERIES (PL-11, PL-12, PL-13, PL-14)

Low Power Dual Secondary Transformers



FEATURES

- P.C. pin mounting
- Precision spaced plug-in terminals
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- Recognized under the Component Program of Underwriters Laboratories, Inc. Listed Under File E71961.
- Provides isolation from power line and voltage step down or step up
- Transformer secondaries may be series or parallel connected for twice the voltage or twice the current rating for individual windings
- Mounting brackets available on request at no additional cost. (See drawing.)

SPECIFICATIONS

OPERATING CHARACTERISTICS

Wattage: PL-11 = .75; PL-12 = 1.5; PL-13 = 4.5; PL-14 = 10

Temperature: Class B 130°C max.
Operating: −55°C to +105°C
Storage: −55°C to +130°C

Excitation Current at 115V 60HZ: PL-11, PL-12 = 25 MA max. PL-13, PL-14 = 35 MA max.

Temperature Rise: 25°C max. at rated operating voltages and loads

Dielectric Strength: 1250V 60HZ between primary and secondary windings, and between all windings and core

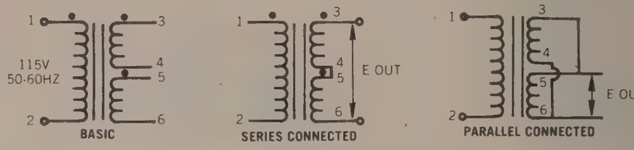
MECHANICAL

Construction: Laminated, vacuum impregnated

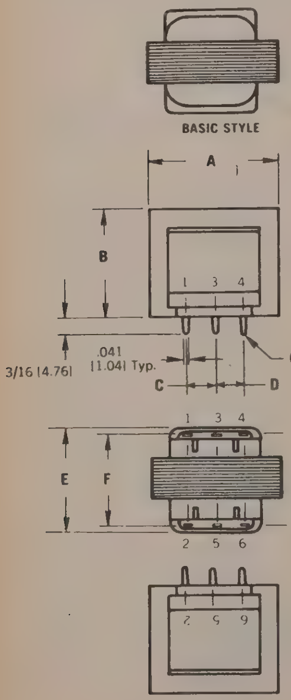
Weight: PL-11 = 35 grams; PL-12 = 100 grams; PL-13 = 160 grams; PL-14 = 240 grams

Terminals: Brass, solder coated

SCHEMATIC


1
3
115V
50-60HZ
4
5
2
6
BASIC
1
3
4
5
6
2
E OUT
SERIES CONNECTED
1
3
4
5
6
2
E OUT
PARALLEL CONNECTED

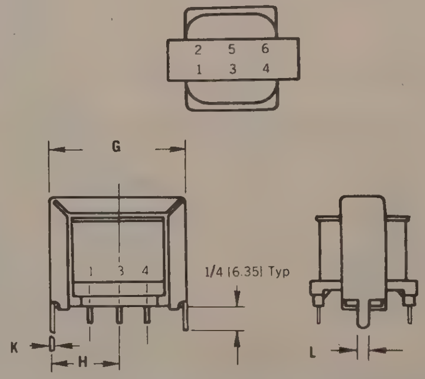
DIMENSIONS


BASIC STYLE
A
B
1 3 4
3/16 [4.76]
.041 [1.04] Typ.
P.C. Terminal (Plug in Mounting))
C
D
1 3 4
E
F
2 5 6
2 5 6

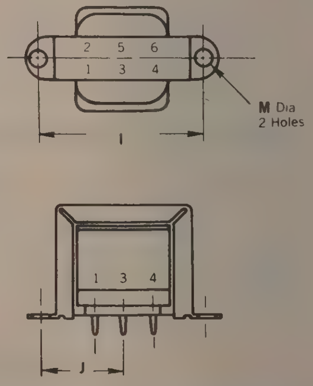
BASIC SCHEMATICS [Numbers in brackets indicate millimeters]

	A	B	C	D	E	F	G	H	I	J	K	L	M
PL-11	1.01 [25.65]	.84 [21.34]	.25 [6.35]	.25 [6.35]	.875 [22.22]	.720 [18.29]	1.06 [26.92]	.52 [13.21]	1-3/8 [34.92]	11/16 [17.46]	.018 [.46]	1/8 [3.20]	.120 [3.05]
PL-12	1-3/8 [34.92]	1-3/16 [30.16]	.312 [7.92]	.312 [7.92]	1-1/8 [28.58]	1.00 [25.4]	1-29/64 [36.91]	.71 [18.03]	1-3/4 [44.35]	7/8 [22.22]	.031 [0.79]	1/8 [3.20]	3/16 [4.81]
PL-13	1-5/8 [41.28]	1-3/8 [34.92]	.400 [10.16]	.400 [10.16]	1-1/4 [31.75]	1.100 [27.94]	1-45/64 [43.26]	.84 [21.34]	2.00 [50.80]	1.00 [25.40]	.031 [0.79]	1/8 [3.20]	3/16 [4.81]
PL-14	1-7/8 [47.62]	1.60 [40.64]	.400 [10.16]	.400 [10.16]	1-7/16 [36.51]	1.30 [33.02]	1-61/64 [49.61]	.97 [24.64]	2-3/8 [60.33]	1-3/16 [30.16]	.031 [0.79]	3/16 [4.81]	3/16 [4.81]

"A" TYPE OF MOUNTING FRAME


2 5 6
1 3 4
G
1 3 4
1/4 [6.35] Typ
K
H
L

"B" TYPE OF MOUNTING FRAME


2 5 6
1 3 4
M Dia
2 Holes
I
1 3 4
J

ELECTRICAL CHARACTERISTICS

INPUT VOLTAGE = 115V @ 60HZ

OUTPUT VOLTAGE		OUTPUT CURRENT (MA)		MODEL NO.
Series	**Parallel**	**Series**	**Parallel**	
8 V CT	4 V	94	188	**PL-11-01**
		188	376	**PL-12-01**
		562	1124	**PL-13-01**
		940	1880	**PL-14-01**
10 V CT	5 V	75	150	**PL-11-02**
		120	240	**PL-12-02**
		440	880	**PL-13-02**
		1000	2000	**PL-14-02**
12.6 V CT	6.3 V	60	120	**PL-11-03**
		100	200	**PL-12-03**
		350	700	**PL-13-03**
		800	1600	**PL-14-03**
15 V CT	7.5 V	50	100	**PL-11-04**
		100	200	**PL-12-04**
		300	600	**PL-13-04**
		500	1000	**PL-14-04**
16 V CT	8 V	47	94	**PL-11-05**
		75	150	**PL-12-05**
		260	520	**PL-13-05**
		640	1280	**PL-14-05**
20 V CT	10 V	38	76	**PL-11-06**
		60	120	**PL-12-06**
		220	440	**PL-13-06**
		500	1000	**PL-14-06**
24 V CT	12 V	31	62	**PL-11-07**
		50	100	**PL-12-07**
		180	360	**PL-13-07**
		450	900	**PL-14-07**
30 V CT	15 V	25	50	**PL-11-08**
		50	100	**PL-12-08**
		150	300	**PL-13-08**
		250	500	**PL-14-08**

OUTPUT VOLTAGE		OUTPUT CURRENT (MA)		MODEL NO.
Series	**Parallel**	**Series**	**Parallel**	
34 V CT	17 V	22	44	**PL-11-09**
		35	70	**PL-12-09**
		125	250	**PL-13-09**
		300	600	**PL-14-09**
40 V CT	20 V	19	38	**PL-11-10**
		30	60	**PL-12-10**
		110	220	**PL-13-10**
		250	500	**PL-14-10**
54 V CT	27 V	28	56	**PL-12-11**
		84	168	**PL-13-11**
		140	280	**PL-14-11**
56 V CT	28 V	20	40	**PL-12-12**
		80	160	**PL-13-12**
		180	360	**PL-14-12**
76 V CT	38 V	20	40	**PL-12-13**
		60	120	**PL-13-13**
		100	200	**PL-14-13**
88 V CT	44 V	15	30	**PL-12-14**
		50	100	**PL-13-14**
		120	240	**PL-14-14**
120 V CT	60 V	10	20	**PL-12-15**
		35	70	**PL-13-15**
		85	170	**PL-14-15**
180 V CT	90 V	6	12	**PL-12-16**
		24	48	**PL-13-16**
		55	110	**PL-14-16**
230 V CT	115 V	5	10	**PL-12-17**
		20	40	**PL-13-17**
		40	80	**PL-14-17**

ORDERING INFORMATION

The following model number information must be supplied when ordering transformers.

PL-11, PL-12, PL-13, PL-14	–01 thru –17	A B
POWER TRANSFORMER, Miniature P.C. Mount	**DASH NUMBER** for Output Voltage and Current	**TYPE OF MOUNTING FRAME,** if required. (If none, leave blank.)

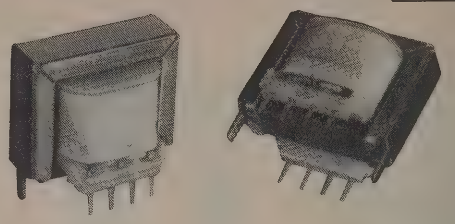
Special designs not listed available upon request.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DALE® LOW POWER TRANSFORMERS

PL SERIES (PL-22, PL-23, PL-24)

Low Power Transformers
Dual Primary — Dual Secondary



FEATURES

- P.C. pin mounting
- Precision spaced plug-in terminals
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- Recognized under the Component Program of Underwriters Laboratories, Inc. Listed Under File E71961.
- Provides isolation from power line and voltage step down or step up
- Transformer secondaries may be series or parallel connected for twice the voltage or twice the current rating for individual windings
- Dual primary for operation from 115V or 230V 50/60Hz line voltage
- Mounting brackets available on request at no additional cost. (See drawing.)

SPECIFICATIONS

OPERATING CHARACTERISTICS

Wattage: PL-22, 1.5; PL-23, 4.5; PL-24, 10.0

Temperature: Class B, 130°C
Operating: –55°C to +105°C
Storage: –55°C to +130°C

Dielectric Strength:
1500 V 60 Hz between primary and secondary windings and all windings to core

Temperature Rise: 25°C maximum at rated operating voltages and loads

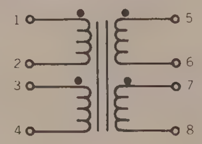
MECHANICAL

Construction: Laminated

Weight: PL-22, 100 grams; PL-23, 160 grams; PL-24, 240 grams

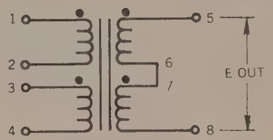
SCHEMATIC

SCHEMATIC BASIC STYLE

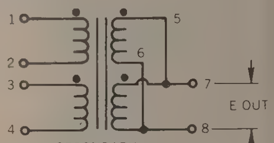


CUSTOMER APPLICATION

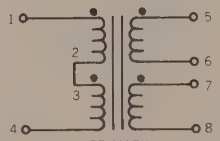
SCHEMATIC OPTIONS



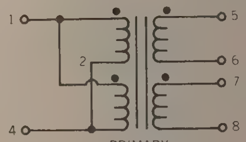
SECONDARY
SERIES CONNECTED



SECONDARY
PARALLEL CONNECTED



PRIMARY
230 V INPUT
SERIES CONNECTED



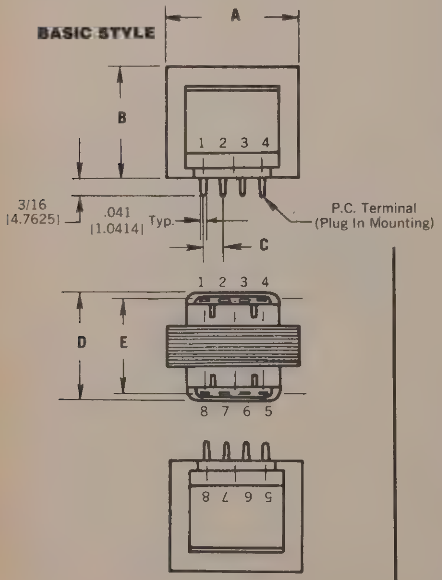
PRIMARY
115 V INPUT
PARALLEL CONNECTED

DIMENSIONS

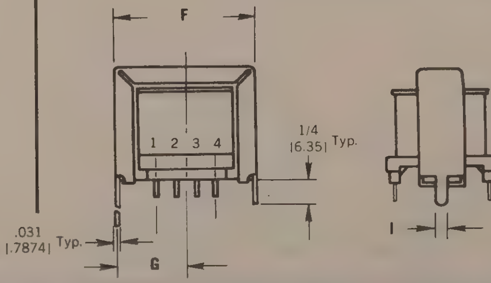
BASIC SCHEMATICS |Numbers in brackets indicate millimeters|

	A	B	C	D	E	F	G	H	I	J
PL-22	1-3/8 [34.92]	1-3/16 [30.16]	.20 [5.08]	1-1/8 [28.58]	1.00 [25.40]	1-29/64 [36.91]	.71 [18.03]	7/8 [22.22]	1/8 [3.18]	1-3/4 [44.35]
PL-23	1-5/8 [41.28]	1-3/8 [34.92]	.25 [6.35]	1-1/4 [31.75]	1.10 [27.94]	1-45/64 [43.26]	.84 [21.34]	1.00 [25.40]	1/8 [3.18]	2.00 [50.80]
PL-24	1-7/8 [47.62]	1.60 [40.64]	.25 [6.35]	1-7/16 [36.51]	1.30 [33.02]	1-61/64 [49.61]	.97 [24.64]	1-3/16 [30.16]	3/16 [4.76]	2-3/8 [60.32]

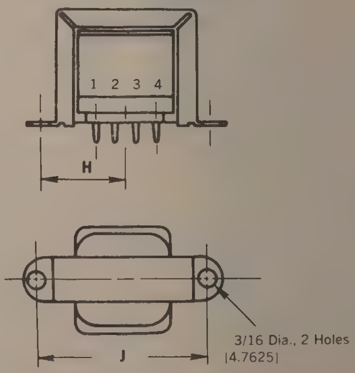
BASIC STYLE



"A" TYPE OF MOUNTING FRAME



"B" TYPE OF MOUNTING FRAME



ELECTRICAL CHARACTERISTICS

INPUT VOLTAGE = 115V 60HZ OR 230V 50HZ-60HZ

OUTPUT VOLTAGE		OUTPUT CURRENT (MA)		MODEL NO.
Series	Parallel	Series	Parallel	
8 V CT	4 V	188	376	PL-22-01
		562	1124	PL-23-01
		940	1880	PL-24-01
10 V CT	5 V	120	240	PL-22-02
		440	880	PL-23-02
		1000	2000	PL-24-02
12.6 V CT	6.3 V	100	200	PL-22-03
		350	700	PL-23-03
		800	1600	PL-24-03
15 V CT	7.5 V	100	200	PL-22-04
		300	600	PL-23-04
		500	1000	PL-24-04
16 V CT	8 V	75	150	PL-22-05
		260	520	PL-23-05
		640	1280	PL-24-05
20 V CT	10 V	60	120	PL-22-06
		220	440	PL-23-06
		500	1000	PL-24-06
24 V CT	12 V	50	100	PL-22-07
		180	360	PL-23-07
		450	900	PL-24-07
30 V CT	15 V	50	100	PL-22-08
		150	300	PL-23-08
		250	500	PL-24-08
34 V CT	17 V	35	70	PL-22-09
		125	250	PL-23-09
		300	600	PL-24-09
40 V CT	20 V	30	60	PL-22-10
		110	220	PL-23-10
		250	500	PL-24-10
54 V CT	27 V	28	56	PL-22-11
		84	168	PL-23-11
		140	280	PL-24-11
56 V CT	28 V	20	40	PL-22-12
		80	160	PL-23-12
		180	360	PL-24-12
76 V CT	38 V	20	40	PL-22-13
		60	120	PL-23-13
		100	200	PL-24-13
88 V CT	44 V	15	30	PL-22-14
		50	100	PL-23-14
		120	240	PL-24-14
120 V CT	60 V	10	20	PL-22-15
		35	70	PL-23-15
		85	170	PL-24-15
180 V CT	90 V	6	12	PL-22-16
		24	48	PL-23-16
		55	110	PL-24-16
230 V CT	115 V	5	10	PL-22-17
		20	40	PL-23-17
		40	80	PL-24-17

ORDERING INFORMATION

The following model number information must be supplied when ordering transformers.

PL-22, PL-23, PL-24

POWER TRANSFORMER
Miniature P.C. Mount

-01
thru
-17

DASH NUMBER
for Output Voltage and Current

A
B

TYPE OF MOUNTING FRAME,
if required.
(If none, leave blank.)

Special designs not listed available upon request.

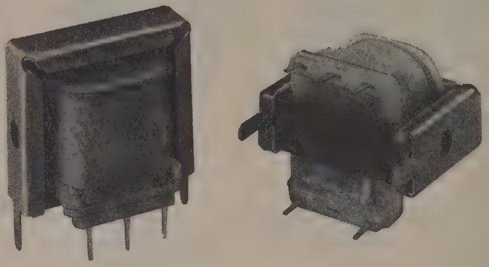
For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DALE®

LOW POWER TRANSFORMERS

PL SERIES (PL-32, PL-33, PL-34)

Low-Cost Single Secondary Power Transformer, 115 Volt Primary Input



FEATURES

- P.C. pin mounting
- Precision spaced plug-in terminals
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- Recognized under the Component Program of Underwriters Laboratories, Inc. Listed Under File E71961.
- Provides isolation from power line and voltage step down or step up
- Mounting brackets available on request at no additional cost. (See drawing.)

SPECIFICATIONS

OPERATING CHARACTERISTICS

Wattage: PL-32 = 1.5, PL-33 = 4.5, PL-34 = 10

Temperature: Class B 130°C max.
Operating: −55°C to +105°C
Storage: −55°C to +130°C

Regulation: 20% nominal

Temperature Rise: 25°C max. at rated operating voltages and loads

Dielectric Strength: Between primary and secondary windings, and between all windings and core. 1250 VRMS 60 Hz.

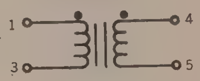
MECHANICAL

Construction: Laminated, vacuum impregnated

Weight: PL-32 = 100 grams, PL-33 = 160 grams, PL-34 = 240 grams

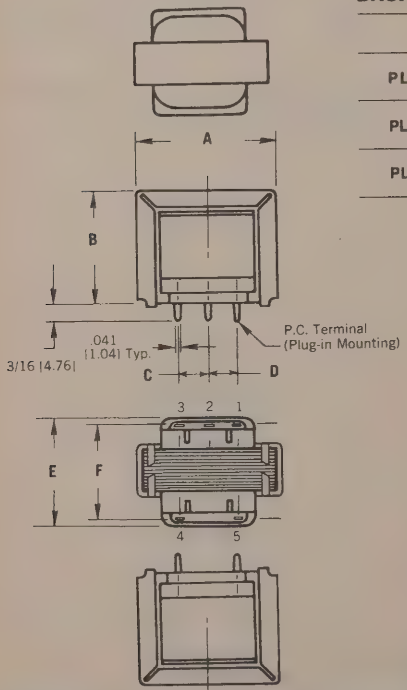
Terminals: Brass, solder coated

SCHEMATIC



DIMENSIONS

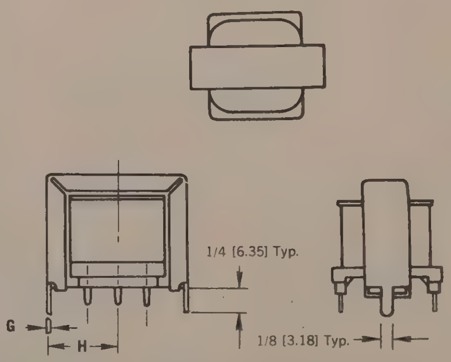
BASIC STYLE



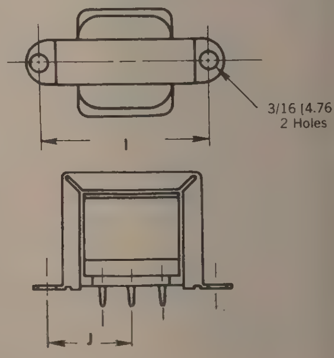
BASIC SCHEMATICS [Numbers in brackets indicate millimeters]

	A	B	C	D	E	F	G	H	I	J
PL-32	1.45 [36.91]	1.16 [29.37]	.31 [7.92]	.31 [7.92]	1.13 [28.58]	1.00 [25.40]	.03 [.79]	.71 [18.03]	1.75 [44.45]	.88 [22.23]
PL-33	1.70 [43.26]	1.38 [34.93]	.40 [10.16]	.40 [10.16]	1.25 [31.75]	1.10 [27.94]	.03 [.79]	.84 [21.34]	2.00 [50.80]	1.00 [25.40]
PL-34	1.95 [49.61]	1.63 [41.28]	.40 [10.16]	.40 [10.16]	1.44 [36.51]	1.30 [33.02]	.03 [.79]	.96 [24.38]	2.38 [60.33]	1.19 [30.16]

"A" TYPE OF MOUNTING FRAME



"B" TYPE OF MOUNTING FRAME



ELECTRICAL CHARACTERISTICS

OUTPUT VOLTAGE	OUTPUT CURRENT (MA)	MODEL NO.
6.4 V	200	PL32-01
	700	PL33-01
	1300	PL34-01
10 V	120	PL32-02
	450	PL33-02
	800	PL34-02
12.6 V	100	PL32-03
	350	PL33-03
	650	PL34-03
15 V	80	PL32-04
	300	PL33-04
	550	PL34-04
20 V	60	PL32-05
	225	PL33-05
	400	PL34-05
24 V	50	PL32-06
	185	PL33-06
	330	PL34-06
30 V	40	PL32-07
	150	PL33-07
	270	PL34-07
54 V	22	PL32-08
	80	PL33-08
	150	PL34-08
76 V	16	PL32-09
	60	PL33-09
	110	PL34-09
88 V	14	PL32-10
	50	PL33-10
	90	PL34-10
115 V	10	PL32-11
	40	PL33-11
	70	PL34-11
180 V	7	PL32-12
	25	PL33-12
	45	PL34-12
230 V	5	PL32-13
	20	PL33-13
	35	PL34-13

ORDERING INFORMATION

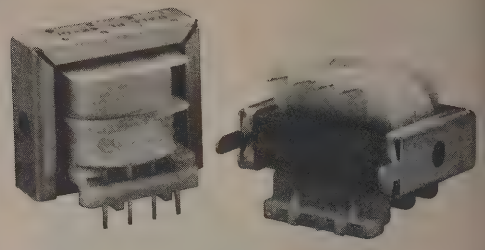
The following model number information must be supplied when ordering transformers.

PL-32, PL-33, PL-34	–01 thru –13	A B
POWER TRANSFORMER Miniature P.C. Mount	**DASH NUMBER** for Output Voltage and Current	**TYPE OF MOUNTING FRAME** if required. (If none, leave blank.)

Special designs not listed available upon request.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DALE® LOW POWER TRANSFORMERS



PL SERIES (PL-42, PL-43, PL-44)

Low Power Transformers — Dual Primary — Dual Secondary

FEATURES

- P.C. pin mounting
- Precision spaced plug-in terminals
- Split-section windings, meaning increased dielectric between primary and secondaries, electrostatic shielding inherently built-in, and reduced interwinding capacitance
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- Designed to meet UL requirements
- Provides isolation from power line and voltage step down or step up
- Transformer secondaries may be series or parallel connected for twice the voltage or twice the current rating for individual windings
- Dual primary for operation from 115V or 230V 50/60Hz line voltage
- Mounting brackets available on request at no additional cost. (See drawing.)

SPECIFICATIONS

OPERATING CHARACTERISTICS

Wattage: PL-42 = 1.5; PL-43 = 4.5; PL-44 = 10

Temperature: Class B 130°C max.
Operating: −55°C to +105°C
Storage: −55°C to +130°C

Excitation Current at 115V 60HZ; PL-42 = 25 MA max. PL-43, PL-44 = 35 MA max.

Temperature Rise: 25°C max. at rated operating voltages and loads.

Dielectric Strength: 2500V, 60 HZ between primary and secondary windings, and between all windings and core. 1000V, 60HZ between secondary windings 500V, 60HZ between primary windings.

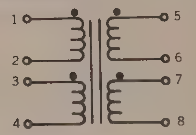
MECHANICAL

Construction: Laminated, varnish impregnated

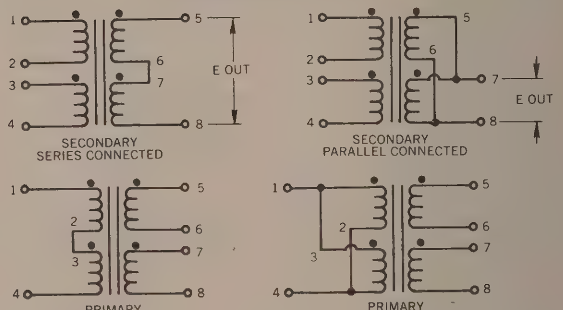
Weight: PL-42 = 100 grams; PL-43 = 160 grams; PL-44 = 240 grams

Terminals: Brass, solder coated

SCHEMATIC BASIC STYLE



SCHEMATIC OPTIONS



SECONDARY SERIES CONNECTED

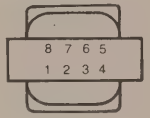
SECONDARY PARALLEL CONNECTED

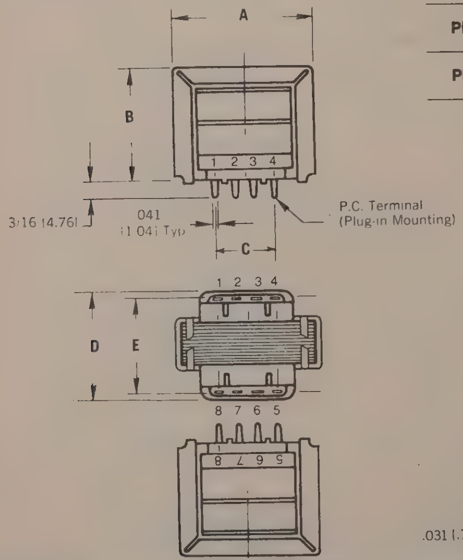
PRIMARY 230 V INPUT SERIES CONNECTED

PRIMARY 115 V INPUT PARALLEL CONNECTED

DIMENSIONS

BASIC STYLE

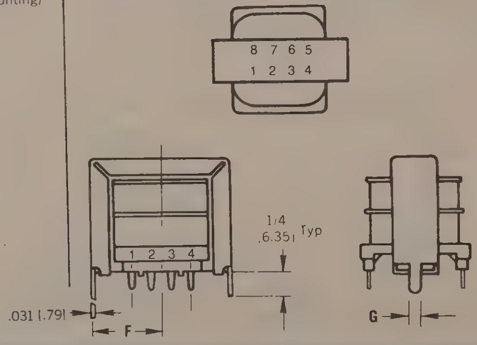




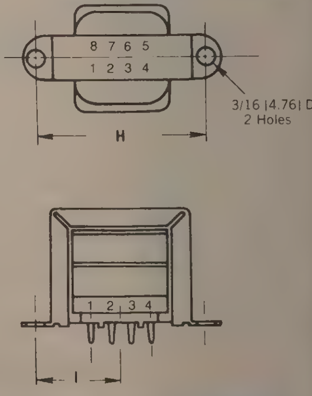
BASIC SCHEMATICS [Numbers in brackets indicate millimeters]

	A	B	C	D	E	F	G	H	I
PL-42	1-29/64 [36.91]	1-13/16 [30.16]	.20 [5.08]	1-1/8 [28.58]	1.00 [25.40]	.71 [18.03]	1/8 [3.18]	1-3/4 [44.45]	7/8 [22.22]
PL-43	1-45/64 [43.26]	1-3/8 [34.92]	.25 [6.35]	1-1/4 [31.75]	1.10 [27.94]	.84 [21.34]	1/8 [3.18]	2.00 [50.80]	1.00 [25.40]
PL-44	1-61/64 [49.61]	1.60 [40.64]	.25 [6.35]	1-7/16 [35.51]	1.30 [33.02]	.97 [24.64]	3/16 [4.76]	2-3/8 [60.32]	1-3/16 [30.16]

"A" TYPE OF MOUNTING FRAME



"B" TYPE OF MOUNTING FRAME



ELECTRICAL CHARACTERISTICS

INPUT VOLTAGE = 115V 60HZ OR 230V 50HZ-60HZ

OUTPUT VOLTAGE		OUTPUT CURRENT (MA)		MODEL NO.
Series	Parallel	Series	Parallel	
8 V CT	4 V	188	376	PL-22-01
		562	1124	PL-23-01
		940	1880	PL-24-01
10 V CT	5 V	120	240	PL-22-02
		440	880	PL-23-02
		1000	2000	PL-24-02
12.6 V CT	6.3 V	100	200	PL-22-03
		350	700	PL-23-03
		800	1600	PL-24-03
15 V CT	7.5 V	100	200	PL-22-04
		300	600	PL-23-04
		500	1000	PL-24-04
16 V CT	8 V	75	150	PL-22-05
		260	520	PL-23-05
		640	1280	PL-24-05
20 V CT	10 V	60	120	PL-22-06
		220	440	PL-23-06
		500	1000	PL-24-06
24 V CT	12 V	50	100	PL-22-07
		180	360	PL-23-07
		450	900	PL-24-07
30 V CT	15 V	50	100	PL-22-08
		150	300	PL-23-08
		250	500	PL-24-08
34 V CT	17 V	35	70	PL-22-09
		125	250	PL-23-09
		300	600	PL-24-09
40 V CT	20 V	30	60	PL-22-10
		110	220	PL-23-10
		250	500	PL-24-10
54 V CT	27 V	28	56	PL-22-11
		84	168	PL-23-11
		140	280	PL-24-11
56 V CT	28 V	20	40	PL-22-12
		80	160	PL-23-12
		180	360	PL-24-12
76 V CT	38 V	20	40	PL-22-13
		60	120	PL-23-13
		100	200	PL-24-13
88 V CT	44 V	15	30	PL-22-14
		50	100	PL-23-14
		120	240	PL-24-14
120 V CT	60 V	10	20	PL-22-15
		35	70	PL-23-15
		85	170	PL-24-15
180 V CT	90 V	6	12	PL-22-16
		24	48	PL-23-16
		55	110	PL-24-16
230 V CT	115 V	5	10	PL-22-17
		20	40	PL-23-17
		40	80	PL-24-17

ORDERING INFORMATION

The following model number information must be supplied when ordering transformers.

PL-22, PL-23, PL-24	-01 thru -17	A B
POWER TRANSFORMER Miniature P.C. Mount	**DASH NUMBER** for Output Voltage and Current	**TYPE OF MOUNTING FRAME,** if required. (If none, leave blank.)

Special designs not listed available upon request.

For complete information, write or phone
DALE ELECTRONICS, INC., East Highway 50, Yankton, South Dakota 57078 • Phone 605-665-9301

DALE® CUSTOM INDUCTIVE PRODUCTS

Can't find it in the catalog? Dale has the custom capability to design and produce a wide range of magnetic components to your requirements.

POWER TRANSFORMERS:	50 to 400 Hz, VA ratings to 100 VA. Specialty models in Low Profile and PC Mount
INDUCTORS:	Inductance values to 20 H, current ratings to 60 amps. Capability of many styles, including: Toroidal, Laminated, E Core, Pot Core, Slug Core, Air Core
AUDIO TRANSFORMERS:	Coupling Transformers and Hybrid Transformers available in PC Mount, Leadset and Low Profile
SWITCH MODE MAGNETICS:	Switching Converters, Power Transformers, Current Sense Transformers, Inductors

• UL, CSA & VDE Capabilities • Designs to Military Specifications

TOUGH COIL JOBS

Whether you need a hundred pieces or a million, we offer:

- Complete facilities to design, engineer and produce prototype quantities.
- Faster turn-around on custom samples and short run production quantities.
- Close production coordination including cost-saving statistical control on high volume items.

ENGINEERING AND DEVELOPMENT

When engineering assistance is required, Dale is staffed and equipped to perform…

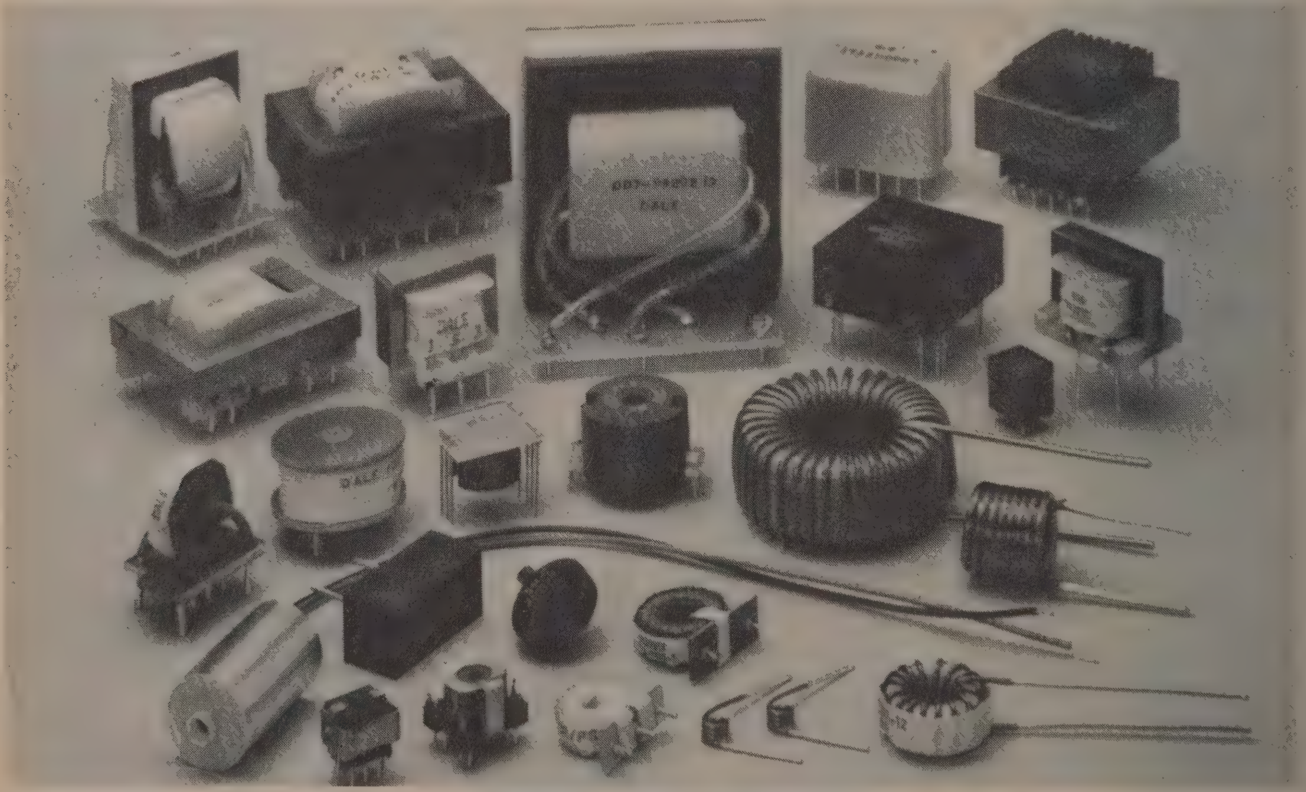
1. Production Engineering to translate your specifications into a product with **optimum quality** and **economy.**
2. Development Engineering to provide the electrical function you require.
3. Design Engineering to transform your basic idea into parts.

PRODUCTION

Ability to move quickly in converting your order to finished parts is a Dale trademark. Facilities are available for everything from high volume commercial parts to highly sophisticated military items requiring specialized production and test equipment. In dealing with Dale, you draw on a background of production experience which can provide a definite advantage in accelerating availability.

QUALITY CONTROL

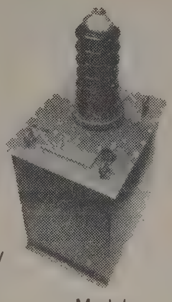
Full time quality control personnel and the facilities of Dale's company-wide reliability and quality control organization enable fast action in establishing military test procedures and in meeting other government requirements—including MIL-Q-9858.



For complete information, write or phone

DALE ELECTRONICS. INC., East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

High Voltage Line Isolation Transformers In Oil Insulating Tanks



Model
3–TR–150–11

FEATURES:
- ▼ Complete varnish impregnation under vacuum
- ▼ Epoxy anchoring
- ▼ Immersed in high grade insulating oil*
- ▼ Electrostatic shield between primary and secondary windings
- ▼ "AN" type connector provided for input connections
- ▼ Good regulation

*Note: Shipped without oil to minimize transportation charges, except when otherwise specified in order.

SPECIFICATIONS:
- ▼ Each model available with porcelain output insulator
- ▼ Models also available with two shielded polyethylene output cables in place of porcelain insulator
- ▼ Standard types available for 120V and 240V input lines in 1:1, 1:2, and 2:1 voltage ratios with other input and output voltages available upon request
- ▼ Recommended for industrial, research, and developmental applications

Standard 60Hz Types

Model No.*	Max. kVA	kV dc Insulation	Tank Size (in.) (W X D X H)**	Insulator Height (in.)***
1-TR-30-XX	1	30	10 X 12 X 11	6
1.5-TR-30-XX	1.5	30	13 X 13⅞ X 16½	6
1-TR-50-XX	1	50	13 X 13⅞ X 16⅜	8½
3-TR-50-XX	3	50	13 X 13⅞ X 16⅜	8½
1-TR-60-XX	1	60	9¾ X 12⅜ X 13⅜	11
2-TR-60-XX	2	60	16½ X 16½ X 21⅜	11
3-TR-60-XX	3	60	16½ x 16½ X 21⅜	11
5-TR-60-XX	5	60	16½ X 16½ X 21⅜	11
3-TR-75-XX	3	75	16½ X 16½ X 22	11
1-TR-100-XX	1	100	20¾ X 17½ X 17 13/16	14
3-TR-100-XX	3	100	20¾ X 17½ X 17 13/16	14
3-TR-150-XX	3	150	15½ X 18¾ X 24	19½
5-TR-150-XX	5	150	15½ X 18¾ X 24	19½
0.5-TR-250-XX	0.5	250	25 X 33 X 37 5/16	28¾
2-TR-250-XX	2	250	25 X 33 X 37 5/16	28¾
3-TR-250-XX	3	250	29¾ X 29¾ X 36⅜	28¾
5-TR-250-XX	5	250	25 X 33 X 37¼	28¾
4-TR-300-XX	4	300	39½ X 47½ X 50½	35
Models With Shielded Cables Instead Of Porcelain Insulator:				
0.5-CTR-250-XX	0.5	250	25 X 33 X 37 5/16	
2-CTR-250-XX	2	250	25 X 33 X 37 5/16	
3-CTR-250-XX	3	250	29¾ X 29¾ X 36⅜	
4-CTR-300-XX	4	300	25 X 33 X 37¼	
5-CTR-250-XX	5	250	39½ X 47½ X 50½	

*Note: Add the following suffix in place of XX:

For	Suffix	For	Suffix
120/120	11	240/120	21
120/240	12	240/240	22

**Note: Dimensions are nominal and outline drawings are available upon request.
***Note: If shielded polyethylene output cables are desired in place of porcelain insulator, designate part number with a "C" prefix, e.g., 1-CTR-30-XX.

Transformer, High Voltage—Filament Isolation Open Type Construction—Epoxy Coated

High Voltage Filament Isolation Transformers

Type	Secondary Volts	Secondary Amps	Isolation kV dc (Working)	Size (A X B X C)
AD 3227	5	1	10	2⅝ X 2⅜ X 3⅛
AD 3231	5	3	10	3 X 2⅝ X 3½
AD 3234	5	5	10	3¼ X 2⅝ X 3⅞
AD 3226	6.3	1	10	2⅝ X 2⅜ X 3⅛
AD 3230	6 3	3	10	3 X 2⅞ X 3½
AD 3233	6.3	5	10	3¼ X 2⅞ X 3⅞
AD 3238	5	1	20	4½ X 3 X 4
AD 3239	5	3	20	4⅜ X 3½ X 4⅜
AD 3240	5	5	20	4⅞ X 3½ X 5⅛
AD 3241	6.3	1	20	4½ X 3 X 4
AD 3242	6.3	3	20	4⅜ X 3½ X 4⅜
AD 3243	6.3	5	20	4⅞ X 3½ X 5⅛
AD 3247	5	1	30	4⅞ X 3½ X 5
AD 3248	5	3	30	5¾ X 3¾ X 5¼
AD 3249	5	5	30	6¼ X 3¾ X 6½
AD 3250	6.3	1	30	4⅞ X 3½ X 5
AD 3251	6.3	3	30	5¾ X 3¾ X 5¼
AD 3252	6.3	5	30	6¼ X 3¾ X 6½

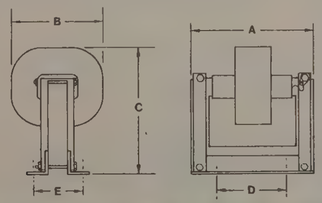
All primaries: 115 volts, 60Hz.

Transformer, High Voltage—Line Isolation Open Type Construction—Epoxy Coated

FEATURES:
- ▼ Designed for continuous operation at rated voltage and power
- ▼ Epoxy coated, air insulated up to 30kV dc, oil insulated over 30kV dc
- ▼ Well suited to applications requiring reliable isolated line voltage at power ratings up to 1kVA
- ▼ Other higher voltage and power units available upon request

SPECIFICATIONS:
Primaries: 115V or 230V, 60Hz
Secondaries: 115V

Type	Rating kVA	Size (A X B X C)	Mounting Dimensions (D X E)	Insulation kV dc Working
AD 1640	0 200	6⅛ X 4 X 5⅛	4½ X 3	10
AD 1641	0.500	7⅝ X 5⅞ X 7¾	5⅜ X 4¼	10
AD 1642	0.750	9½ X 6 5/16 X 8¼	7¼ X 4 13/16	10
AD 1643	1.000	8½ X 8 X 9¾	6 X 5	10
AD 1644	0.200	8½ X 4 X 5⅝	6⅞ X 3⅛	20
AD 1645	0 500	10¼ X 5⅝ X 7½	8 X 4¼	20
AD 1646	0.750	9¾ X 6¾ X 8	7½ X 4 13/16	20
AD 1647	1.000	11¼ X 6⅝ X 8¾	8¾ X 4⅝	20
AD 3060	0.250	8½ X 7¼ X 6½	7 5/16 X 3⅜	30
AD 3061	0.500	9¾ X 7 X 8¾	7 13/16 X 3½	30
AD 3062	0.750	10½ X 7½ X 9½	8½ X 3⅝	30
AD 3063	1.000	11 X 9 X 9½	8¾ X 3¾	30
AD 3064	0.250	10 X 7 X 6½	8 13/16 X 3⅜	40
AD 3065	0.500	11¼ X 7¼ X 8¾	9⅛ X 3½	40
AD 3066	0.750	12½ X 7½ X 9½	10¼ X 3⅝	40
AD 3067	1.000	12¾ X 9 X 9½	10 7/16 X 3¾	40
AD 3068	0.250	13¼ X 7¼ X 6½	12 X 3⅜	50
AD 3069	0.500	13¼ X 7¼ X 8¾	11⅛ X 3½	50
AD 3070	0.750	14½ X 7½ X 9½	12¼ X 3⅝	50
AD 3071	1 000	14¾ X 9 X 9½	12 7/16 X 3¾	50



DEL ELECTRONICS CORPORATION

250 East Sandford Boulevard, Mount Vernon, New York 10550
Phone: 914/699-2000 TWX 710-562-0130

From A Single Source

Magnetic Components To Your Specs.

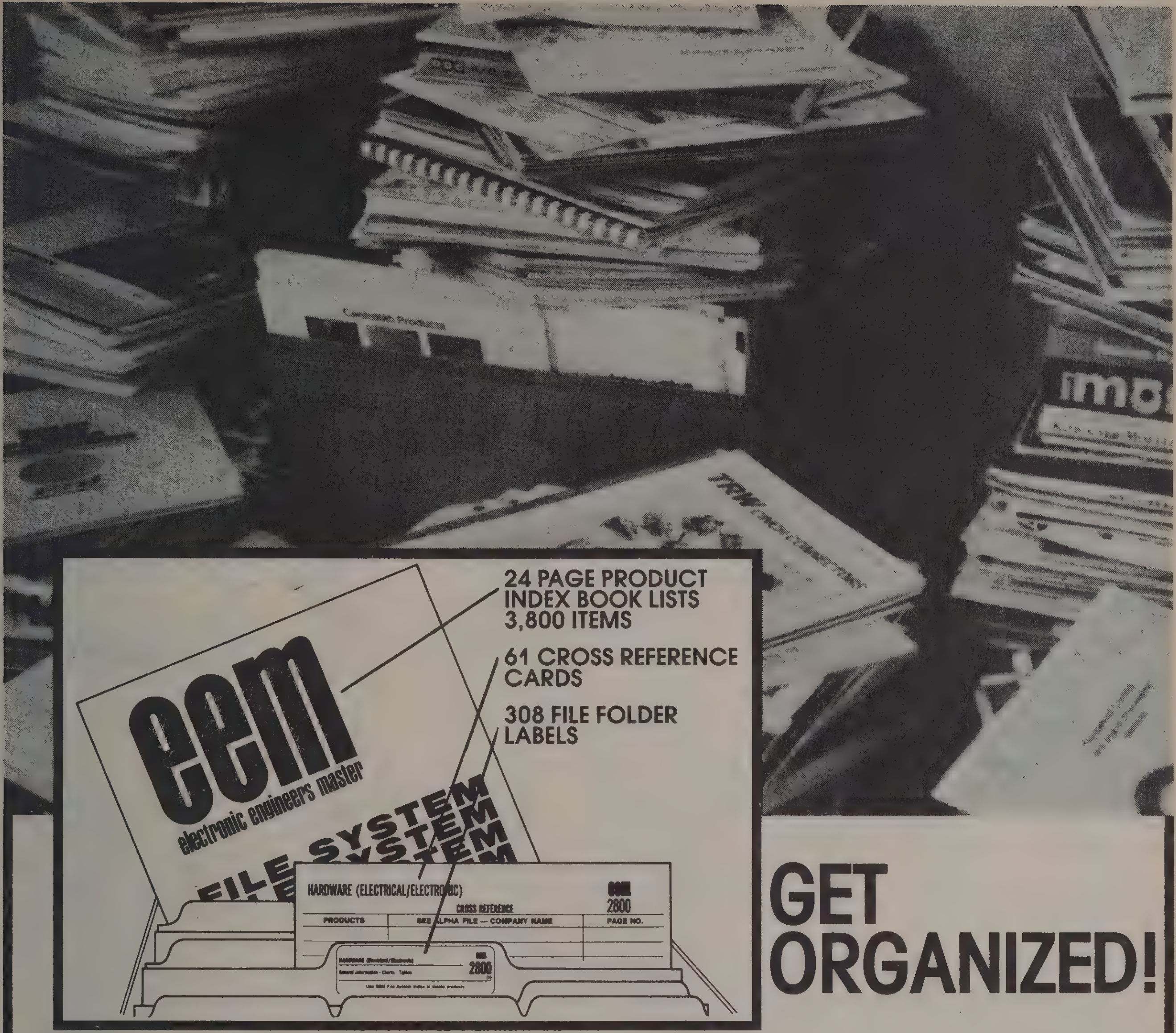
When you need transformers, solenoids, coils, torroids or similar magnetic components, ECC has the experience, personnel and facilities to design, build and deliver your parts . . . on time.

Whatever techniques your magnetic components require:
HIGH SPEED WINDING • HAND WINDING • ASSEMBLY
MOLDING • POTTING • VACUUM IMPREGNATION

We are ready to put our facility to work for you.
For a complete capabilities brochure, call us at:

ECC
Endicott Coil Co., Inc.

24 Charlotte Street • P.O. Box 67 • Binghamton, NY 13905
607-797-1263


eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
2800
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
TRW
imo

24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

61 CROSS REFERENCE CARDS

308 FILE FOLDER LABELS

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

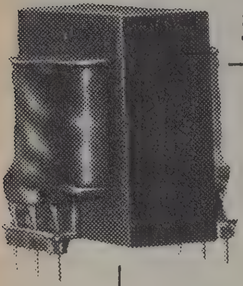
The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

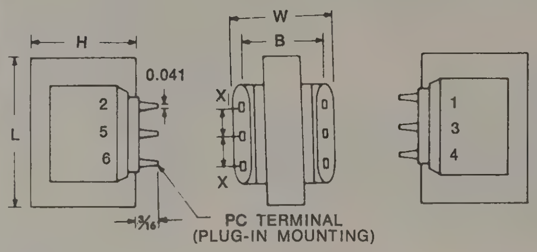
EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

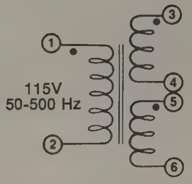
Power Transformers-P.C.

Recognized Component
Underwriters Labs, Inc.

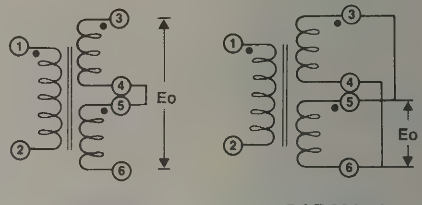


SINGLE 115V PRIMARY TYPE PC-6 PINS

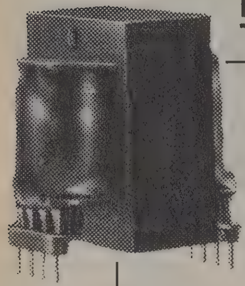

H
W
B
L
0.041
X
X
2
5
6
1
3
4
3/16
PC TERMINAL
(PLUG-IN MOUNTING)


1
2
3
4
5
6
115V
50-500 Hz

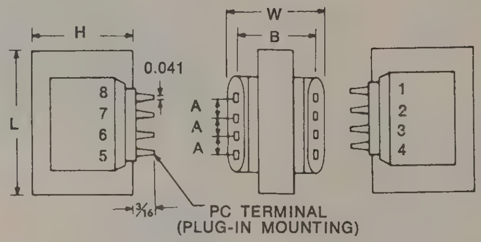
BASIC SCHEMATIC
Transformer can be connected in series or parallel.

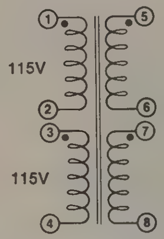

1
2
3
4
5
6
Eo
1
2
3
4
5
6
Eo

SERIES CONNECTED **PARALLEL CONNECTED**

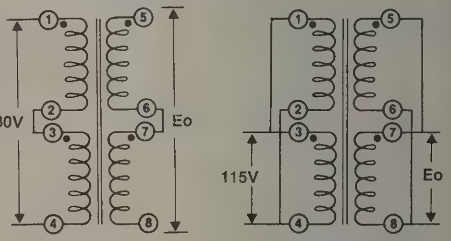


DUAL 115/230V PRIMARY TYPE DPC-8 PINS


H
W
B
L
0.041
8
7
6
5
A
A
A
1
2
3
4
3/16
PC TERMINAL
(PLUG-IN MOUNTING)


1
2
3
4
5
6
7
8
115V
115V

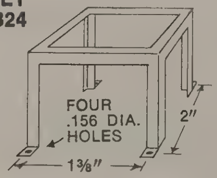
BASIC SCHEMATIC
Transformer can be connected in series or parallel.


1
2
3
4
5
6
7
8
230V
Eo
1
2
3
4
5
6
7
8
115V
Eo

SERIES CONNECTED **PARALLEL CONNECTED**

BRACKET AND CHANNEL FRAME MOUNTING AVAILABLE FOR SINGLE AND DUAL PRIMARY

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24


FOUR
.156 DIA.
HOLES
2"
1⅜"

Size	VA	L	W	H	6 PIN X	8 PIN A	B	Wt. Oz.
25	1.0	1	1⅜	0.83	0.250	0.200	1.200	2.5
37	1.2	1⅜	1⅛	1³⁄₁₆	0.312	0.200	1.000	3
50	4.4	1⅝	1¼	1⅜	0.400	0.250	1.100	5
62	10	1⅞	1⁷⁄₁₆	1⅝	0.400	0.250	1.300	9
24	24	1⅝	2¼	1⅜	0.400	0.250	2.100	12

HOW TO ORDER

D PC - 10 - 2400 B 4

Primary Rating

No Letter	115V	50/60 Hz	6 pin
C	230V	50/60 Hz	6 pin
D	115/230V	50/60 Hz	8 pin
E	277V	50/60 Hz	6 pin
F	332V	50/60 Hz	6 pin

Transformer Series

PC—Single Section Bobbin PC Transformers
EL—"2" Section" Split Bobbin PC Transformer

Secondary Voltage Rating — in volts RMS

Secondary Current Rating — in ma RMS

Individual Spec

Mechanical-Configuration

A = Channel Frame Mounting — Style A — Screw Mount
B = No Frame
C = Channel Frame Mounting — Style C — PC to b Mount
E = Channel Frame — No Mounting
P = Potted — FORM-TRAN™ Construction

Recognized Component
Underwriters Labs, Inc.

Power Transformers-P.C.

SECONDARY RMS RATING / **PRIMARY 50/500 Hz**

Series V.C.T. MA	Parallel @ 2x Current V MA	Size	* Single 115V 6 Pin	* Single 230V 6 Pin	* Dual 115/230V 8 Pin	Single 277V 6 Pin	Single 332V 6 Pin
10 @ 90	5 @ 180	25	PC-10-90B53	CPC-10-90B53	DPC-10-90B53	EPC-10-90B53	FPC-10-90B53
10 @ 120	5 @ 240	37	PC-10-120B1	CPC-10-120B1	DPC-10-120B1	EPC-10-120B1	FPC-10-120B1
10 @ 440	5 @ 880	50	PC-10-440B2	CPC-10-440B2	DPC-10-440B2	EPC-10-440B2	FPC-10-440B2
10 @ 1000	5 @ 2000	62	PC-10-1000B3	CPC-10-1000B3	DPC-10-1000B3	EPC-10-1000B3	FPC-10-1000B3
10 @ 2400	5 @ 4800	24	PC-10-2400B4	CPC-10-2400B4	DPC-10-2400B4	EPC-10-2400B4	FPC-10-2400B4
12.6 @ 70	6 @ 140	25	PC-12-70B54	CPC-12-70B54	DPC-12-70B54	EPC-12-70B54	FPC-12-70B54
12.6 @ 100	6.3 @ 200	37	PC-12-100B5	CPC-12-100B5	DPC-12-100B5	EPC-12-100B5	FPC-12-100B5
12.6 @ 350	6.3 @ 700	50	PC-12-350B6	CPC-12-350B6	DPC-12-350B6	EPC-12-350B6	FPC-12-350B6
12.6 @ 800	6.3 @ 1600	62	PC-12-800B7	CPC-12-800B7	DPC-12-800B7	EPC-12-800B7	FPC-12-800B7
12.6 @ 2000	6.3 @ 4000	24	PC-12-2000B8	CPC-12-2000B8	DPC-12-2000B8	EPC-12-2000B8	FPC-12-2000B8
16 @ 55	8 @ 110	25	PC-16-55B55	CPC-16-55B55	DPC-16-55B55	EPC-16-55B55	FPC-16-55B55
16 @ 75	8 @ 150	37	PC-16-75B9	CPC-16-75B9	DPC-16-75B9	EPC-16-75B9	FPC-16-75B9
16 @ 260	8 @ 520	50	PC-16-260B10	CPC-16-260B10	DPC-16-260B10	EPC-16-260B10	FPC-16-260B10
16 @ 640	8 @ 1280	62	PC-16-640B11	CPC-16-640B11	DPC-16-640B11	EPC-16-640B11	FPC-16-640B11
16 @ 1500	8 @ 3000	24	PC-16-1500B12	CPC-16-1500B12	DPC-16-1500B12	EPC-16-1500B12	FPC-16-1500B12
20 @ 45	10 @ 90	25	PC-20-45B56	CPC-20-45B56	DPC-20-45B56	EPC-20-45B56	FPC-20-45B56
20 @ 60	10 @ 120	37	PC-20-60B13	CPC-20-60B13	DPC-20-60B13	EPC-20-60B13	FPC-20-60B13
20 @ 220	10 @ 440	50	PC-20-220B14	CPC-20-220B14	DPC-20-220B14	EPC-20-220B14	FPC-20-220B14
20 @ 500	10 @ 1000	62	PC-20-500B15	CPC-20-500B15	DPC-20-500B15	EPC-20-500B15	FPC-20-500B15
20 @ 1200	10 @ 2400	24	PC-20-1200B16	CPC-20-1200B16	DPC-20-1200B16	EPC-20-1200B16	FPC-20-1200B16
24 @ 35	12 @ 70	25	PC-24-35B57	CPC-24-35B57	DPC-24-35B57	EPC-24-35B57	FPC-24-35B57
24 @ 50	12 @ 100	37	PC-24-50B17	CPC-24-50B17	DPC-24-50B17	EPC-24-50B17	FPC-24-50B17
24 @ 180	12 @ 360	50	PC-24-180B18	CPC-24-180B18	DPC-24-180B18	EPC-24-180B18	FPC-24-180B18
24 @ 450	12 @ 900	62	PC-24-450B19	CPC-24-450B19	DPC-24-450B19	EPC-24-450B19	FPC-24-450B19
24 @ 1000	12 @ 2000	24	PC-24-1000B20	CPC-24-1000B20	DPC-24-1000B20	EPC-24-1000B20	FPC-24-1000B20
28 @ 30	14 @ 60	25	PC-28-30B58	CPC-28-30B58	DPC-28-30B58	EPC-28-30B58	FPC-28-30B58
28 @ 40	14 @ 80	37	PC-28-40B49	CPC-28-40B49	DPC-28-40B49	EPC-28-40B49	FPC-28-40B49
28 @ 160	14 @ 320	50	PC-28-160B50	CPC-28-160B50	DPC-28-160B50	EPC-28-160B50	FPC-28-160B50
28 @ 360	14 @ 720	62	PC-28-360B51	CPC-28-360B51	DPC-28-360B51	EPC-28-360B51	FPC-28-360B51
28 @ 800	14 @ 1.6A	24	PC-28-800B52	CPC-28-800B52	DPC-28-800B52	EPC-28-800B52	FPC-28-800B52
34 @ 25	17 @ 50	25	PC-34-25B59	CPC-34-25B59	DPC-34-25B59	EPC-34-25B59	FPC-34-25B59
34 @ 35	17 @ 70	37	PC-34-35B21	CPC-34-35B21	DPC-34-35B21	EPC-34-35B21	FPC-34-35B21
34 @ 125	17 @ 250	50	PC-34-125B22	CPC-34-125B22	DPC-34-125B22	EPC-34-125B22	FPC-34-125B22
34 @ 300	17 @ 600	62	PC-34-300B23	CPC-34-300B23	DPC-34-300B23	EPC-34-300B23	FPC-34-300B23
34 @ 700	17 @ 1400	24	PC-34-700B24	CPC-34-700B24	DPC-34-700B24	EPC-34-700B24	FPC-34-700B24
40 @ 20	20 @ 40	25	PC-40-20B60	CPC-40-20B60	DPC-40-20B60	EPC-40-20B60	FPC-40-20B60
40 @ 30	20 @ 60	37	PC-40-30B25	CPC-40-30B25	DPC-40-30B25	EPC-40-30B25	FPC-40-30B25
40 @ 110	20 @ 220	50	PC-40-110B26	CPC-40-110B26	DPC-40-110B26	EPC-40-110B26	FPC-40-110B26
40 @ 250	20 @ 500	62	PC-40-250B27	CPC-40-250B27	DPC-40-250B27	EPC-40-250B27	FPC-40-250B27
40 @ 600	20 @ 1200	24	PC-40-600B28	CPC-40-600B28	DPC-40-600B28	EPC-40-600B28	FPC-40-600B28
56 @ 15	28 @ 30	25	PC-56-15B61	CPC-56-15B61	DPC-56-15B61	EPC-56-15B61	FPC-56-15B61
56 @ 20	28 @ 40	37	PC-56-20B29	CPC-56-20B29	DPC-56-20B29	EPC-56-20B29	FPC-56-20B29
56 @ 80	28 @ 160	50	PC-56-80B30	CPC-56-80B30	DPC-56-80B30	EPC-56-80B30	FPC-56-80B30
56 @ 180	28 @ 360	62	PC-56-180B31	CPC-56-180B31	DPC-56-180B31	EPC-56-180B31	FPC-56-180B31
56 @ 420	28 @ 840	24	PC-56-420B32	CPC-56-420B32	DPC-56-420B32	EPC-56-420B32	FPC-56-420B32
88 @ 10	44 @ 20	25	PC-88-10B62	CPC-88-10B62	DPC-88-10B62	EPC-88-10B62	FPC-88-10B62
88 @ 15	44 @ 30	37	PC-88-15B33	CPC-88-15B33	DPC-88-15B33	EPC-88-15B33	FPC-88-15B33
88 @ 50	44 @ 100	50	PC-88-50B34	CPC-88-50B34	DPC-88-50B34	EPC-88-50B34	FPC-88-50B34
88 @ 120	44 @ 240	62	PC-88-120B35	CPC-88-120B35	DPC-88-120B35	EPC-88-120B35	FPC-88-120B35
88 @ 270	44 @ 540	24	PC-88-270B36	CPC-88-270B36	DPC-88-270B36	EPC-88-270B36	FPC-88-270B36
120 @ 8	60 @ 16	25	PC-120-8B63	CPC-120-8B63	DPC-120-8B63	EPC-120-8B63	FPC-120-8B63
120 @ 10	60 @ 20	37	PC-120-10B37	CPC-120-10B37	DPC-120-10B37	EPC-120-10B37	FPC-120-10B37
120 @ 35	60 @ 70	50	PC-120-35B38	CPC-120-35B38	DPC-120-35B38	EPC-120-35B38	FPC-120-35B38
120 @ 85	60 @ 170	62	PC-120-85B39	CPC-120-85B39	DPC-120-85B39	EPC-120-85B39	FPC-120-85B39
120 @ 200	60 @ 400	24	PC-120-200B40	CPC-120-200B40	DPC-120-200B40	EPC-120-200B40	FPC-120-200B40
180 @ 5	90 @ 10	25	PC-180-5B64	CPC-180-5B64	DPC-180-5B64	EPC-180-5B64	FPC-180-5B64
180 @ 6	90 @ 12	37	PC-180-6B41	CPC-180-6B41	DPC-180-6B41	EPC-180-6B41	FPC-180-6B41
180 @ 24	90 @ 48	50	PC-180-24B42	CPC-180-24B42	DPC-180-24B42	EPC-180-24B42	FPC-180-24B42
180 @ 55	90 @ 110	62	PC-180-55B43	CPC-180-55B43	DPC-180-55B43	EPC-180-55B43	FPC-180-55B43
180 @ 130	90 @ 260	24	PC-180-130B44	CPC-180-130B44	DPC-180-130B44	EPC-180-130B44	FPC-180-130B44
230 @ 4	115 @ 8	25	PC-230-4B65	CPC-230-4B65	DPC-230-4B65	EPC-230-4B65	FPC-230-4865
230 @ 5	115 @ 10	37	PC-230-5B45	CPC-230-5B45	DPC-230-5B45	EPC-230-5B45	FPC-230-5B45
230 @ 20	115 @ 40	50	PC-230-20B46	CPC-230-20B46	DPC-230-20B46	EPC-230-20B46	FPC-230-20B46
230 @ 40	115 @ 80	62	PC-230-40B47	CPC-230-40B47	DPC-230-40B47	EPC-230-40B47	FPC-230-40B47
230 @ 100	115 @ 200	24	PC-230-100B48	CPC-230-100B48	DPC-230-100B48	EPC-230-100B48	FPC-230-100B48

RATINGS BASED ON 20% REGULATION.

METHOD OF DETERMINING SECONDARY RMS CURRENT:

Rectifier Type	Filter Type	RMS Secondary Current
Full Wave Center Tap	Choke Input	.7 x DC Amps
Full Wave Center Tap	Capacitor Input	1.2 x DC Amps
Full Wave Bridge	Choke Input	1.0 x DC Amps
Full Wave Bridge	Capacitor Input	1.8 x DC Amps

EWC® INC.

725 FEDERAL AVENUE, KENILWORTH, NJ 07033 • (201) 245-3200 TWX 710-996-5993 800-526-4048

Economy Line of Split-Bobbin Miniature Power Transformers

For printed circuit plug-in applications

Recognized Component
Underwriters Labs, Inc.

ATTRACTIVE PRICE SAVINGS IN QUANTITIES OF 500 AND OVER!

Available only in three types of channel frames as shown and in three different VA ratings these units are priced lower than our standard PC/DPC series and will afford substantial savings in larger quantity ranges. Additional savings can be realized if single secondary can be used in lieu of dual secondaries as shown.

Electrical characteristics differ from our standard PC/DPC series.

Style "C" channel frames supplied hot tin dipped to assure proper solderability. Other styles supplied electro tin plated.

SECONDARY RMS RATING

Series V.C.T. @ MA	Parallel @ 2x Current V @ MA	Size
10 @ 120	5 @ 240	37
10 @ 440	5 @ 880	50
10 @ 1000	5 @ 2000	62
10 @ 2400	5 @ 4800	24
12.6 @ 100	6.3 @ 200	37
12.6 @ 350	6.3 @ 700	50
12.6 @ 800	6.3 @ 1600	62
12.6 @ 2000	6.3 @ 4000	24
16 @ 75	8 @ 150	37
16 @ 260	8 @ 520	50
16 @ 640	8 @ 1280	62
16 @ 1500	8 @ 3000	24
20 @ 60	10 @ 120	37
20 @ 220	10 @ 440	50
20 @ 500	10 @ 1000	62
20 @ 1200	10 @ 2400	24
24 @ 50	12 @ 100	37
24 @ 180	12 @ 360	50
24 @ 450	12 @ 900	62
24 @ 1000	12 @ 2000	24
28 @ 40	14 @ 80	37
28 @ 160	14 @ 320	50
28 @ 360	14 @ 720	62
28 @ 800	14 @ 1.6A	24
34 @ 35	17 @ 70	37
34 @ 125	17 @ 250	50
34 @ 300	17 @ 600	62
34 @ 700	17 @ 1400	24
40 @ 30	20 @ 60	37
40 @ 110	20 @ 220	50
40 @ 250	20 @ 500	62
40 @ 600	20 @ 1200	24
56 @ 20	28 @ 40	37
56 @ 80	28 @ 160	50
56 @ 180	28 @ 360	62
56 @ 420	28 @ 840	24
88 @ 15	44 @ 30	37
88 @ 50	44 @ 100	50
88 @ 120	44 @ 240	62
88 @ 270	44 @ 540	24
120 @ 10	60 @ 20	37
120 @ 35	60 @ 70	50
120 @ 85	60 @ 170	62
120 @ 200	60 @ 400	24
180 @ 6	90 @ 12	37
180 @ 24	90 @ 48	50
180 @ 55	90 @ 110	62
180 @ 130	90 @ 260	24
230 @ 5	115 @ 10	37
230 @ 20	115 @ 40	50
230 @ 40	115 @ 80	62
230 @ 100	115 @ 200	24

PRIMARY 50/60 Hz

Single 115V 6 Pin	Dual 115/230V 8 Pin
EL-10-120*1	DEL-10-120*1
EL-10-440*2	DEL-10-440*2
EL-10-1000*3	DEL-10-1000*3
EL-10-2400*4	DEL-10-2400*4
EL-12-100*5	DEL-12-100*5
EL-12-350*6	DEL-12-350*6
EL-12-800*7	DEL-12-800*7
EL-12-2000*8	DEL-12-2000*8
EL-16-75*9	DEL-16-75*9
EL-16-260*10	DEL-16-260*10
EL-16-640*11	DEL-16-640*11
EL-16-1500*12	DEL-16-1500*12
EL-20-60*13	DEL-20-60*13
EL-20-220*14	DEL-20-220*14
EL-20-500*15	DEL-20-500*15
EL-20-1200*16	DEL-20-1200*16
EL-24-50*17	DEL-24-50*17
EL-24-180*18	DEL-24-180*18
EL-24-450*19	DEL-24-450*19
EL-24-1000*20	DEL-24-1000*20
EL-28-40*49	DEL-28-40*49
EL-28-160*50	DEL-28-160*50
EL-28-360*51	DEL-28-360*51
EL-28-800*52	DEL-28-800*52
EL-34-35*21	DEL-34-35*21
EL-34-125*22	DEL-34-125*22
EL-34-300*23	DEL-34-300*23
EL-34-700*24	DEL-34-700*24
EL-40-30*25	DEL-40-30*25
EL-40-110*26	DEL-40-110*26
EL-40-250*27	DEL-40-250*27
EL-40-600*28	DEL-40-600*28
EL-56-20*29	DEL-56-20*29
EL-56-80*30	DEL-56-80*30
EL-56-180*31	DEL-56-180*31
EL-56-420*32	DEL-56-420*32
EL-88-15*33	DEL-88-15*33
EL-88-50*34	DEL-88-50*34
EL-88-120*35	DEL-88-120*35
EL-88-270*36	DEL-88-270*36
EL-120-10*37	DEL-120-10*37
EL-120-35*38	DEL-120-35*38
EL-120-85*39	DEL-120-85*39
EL-120-200*40	DEL-120-200*40
EL-180-6*41	DEL-180-6*41
EL-180-24*42	DEL-180-24*42
EL-180-55*43	DEL-180-55*43
EL-180-130*44	DEL-180-130*44
EL-230-5*45	DEL-230-5*45
EL-230-20*46	DEL-230-20*46
EL-230-40*47	DEL-230-40*47
EL-230-100*48	DEL-230-100*48

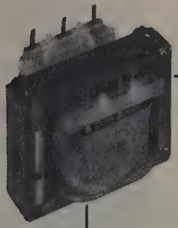
RATINGS BASED ON 20% REGULATION.

* Specify letter "E", "A" or "C" for mounting style of channel frame required. Size #24 only style B and P available.
For FORM-TRAN® construction use letter "P". See Page 1A•2156

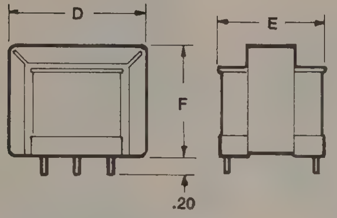
Recognized Component
Underwriters Labs, Inc.

Economy Line of Split-Bobbin Miniature Power Transformers

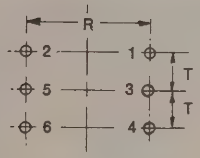
P.C. Board Layout (Circuit Side)



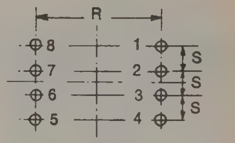
STYLE E CHANNEL FRAME

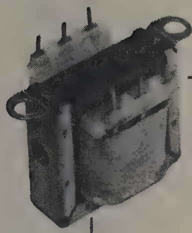


6 PIN

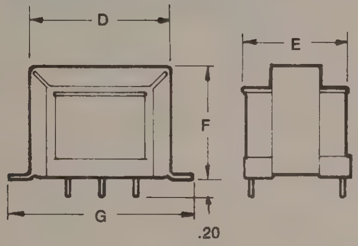


8 PIN

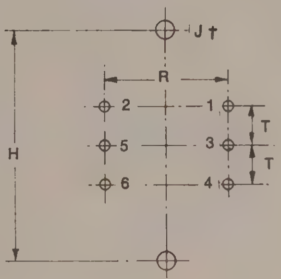

R
8
1
7
2
6
3
5
4
S
S
S



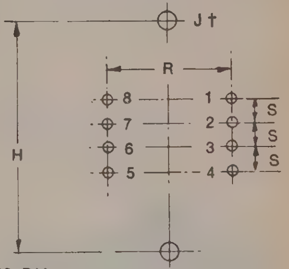
STYLE A CHANNEL FRAME



6 PIN

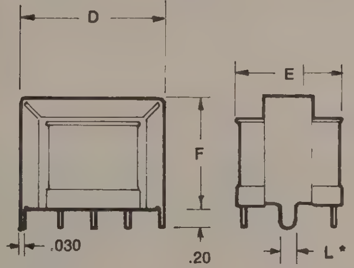

J†
R
2
1
5
3
6
4
T
T
H

8 PIN


J†
R
8
1
7
2
6
3
5
4
S
S
S
H

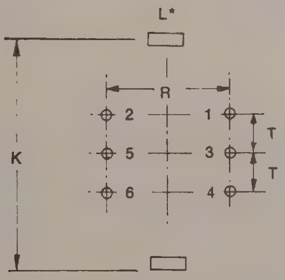
J† = 0..190 DIA.

STYLE C CHANNEL FRAME

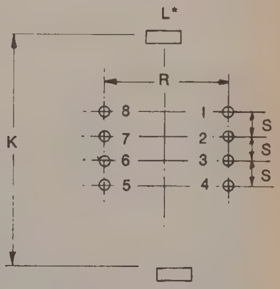


* FOR SIZE 37 & 50 = .13
FOR SIZE 62 = .19

6 PIN

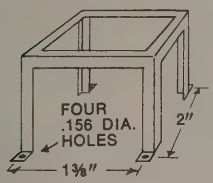

L*
R
2
1
5
3
6
4
T
T
K

8 PIN


L*
R
8
1
7
2
6
3
5
4
S
S
S
K

Recommended PC Hole Dia. = 0.052

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24


FOUR
.156 DIA.
HOLES
2″
1⅜″

Size	D	E	F	G	H	K	R	S	T	Wgt. Oz.
37	1½	1⅛	$1\frac{7}{32}$	$2\frac{1}{16}$	1.75	1.422	1.000	0.200	0.312	3
50	$1\frac{23}{32}$	1¼	$1\frac{13}{32}$	2⅜	2.00	1.672	1.100	0.250	0.400	5
62	$1\frac{31}{32}$	$1\frac{7}{16}$	$1\frac{21}{32}$	$2\frac{13}{16}$	2.38	1.922	1.300	0.250	0.400	9
24	1⅝	2¼	1⅜	NA	**	**	2.100	0.250	0.400	12

** Use B24 Bracket

EWC® INC.

Miniature Plug-In Power Transformers

Recognized Component
Underwriters Labs, Inc.

For triple-output regulated supplies

IDEAL FOR MICROPROCESSOR APPLICATIONS

This line was designed around our standard PC and LP Series and is specified in terms of DC output.

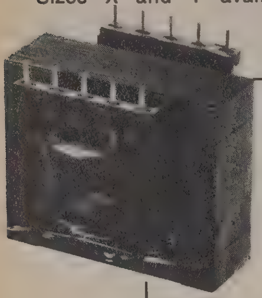
Size "V" available with single primary only.

Sizes "X" and "Y" available with single or dual primary.

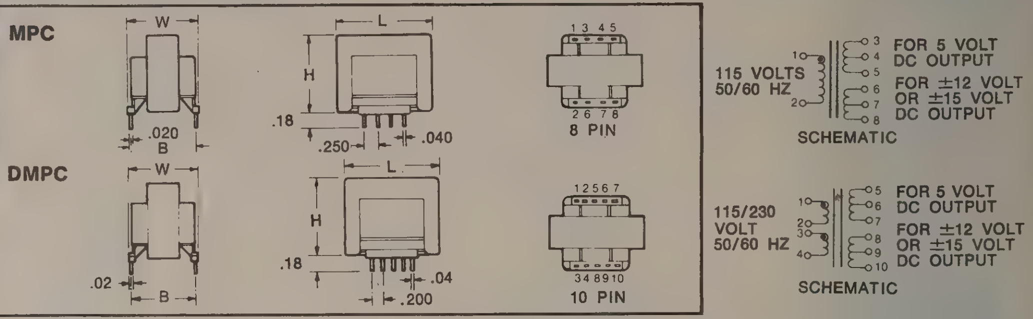
Sizes "6" and "12" available with dual primary only.

1000V hipot is standard on Sizes "V", "X" and "Y".

1500V hipot is standard on Sizes "6" and "12".

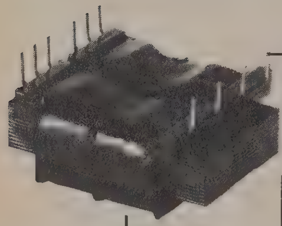


TYPE MPC AND DMPC

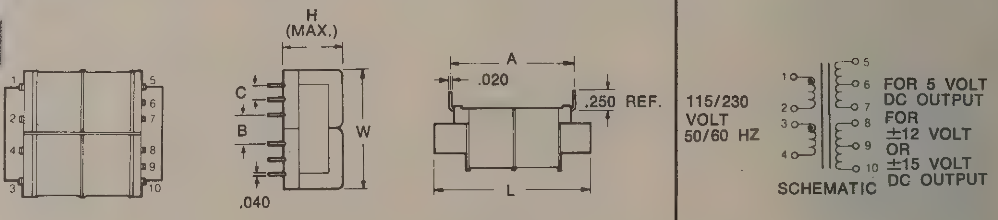

MPC
W
.020
B
L
H
.18
.250
.040
1 3 4 5
2 6 7 8
8 PIN
115 VOLTS
50/60 HZ
1
2
3
4
5
6
7
8
FOR 5 VOLT DC OUTPUT
FOR ±12 VOLT OR ±15 VOLT DC OUTPUT
SCHEMATIC
DMPC
W
.02
B
L
H
.18
.04
.200
1 2 5 6 7
3 4 8 9 10
10 PIN
115/230 VOLT 50/60 HZ
1
2
3
4
5
6
7
8
9
10
FOR 5 VOLT DC OUTPUT
FOR ±12 VOLT OR ±15 VOLT DC OUTPUT
SCHEMATIC

Size	L	W	H	8-Pin	10-Pin	B	Lbs.
V	1⅝	1¼	1⅜	0.250	0.200	1.100	0.31
X	1⅞	1⁷⁄₁₆	1⅝	0.250	0.200	1.300	0.56
Y	1⅝	2¼	1⅜	0.250	0.200	2.100	0.75

MPC and DMPC's also available with channel frames see page **1A**•2159 or FORM-TRAN® Construction.
See page **1A**•2159 for ordering information.



TYPE MPL


1
2
4
3
5
6
7
8
9
10
H (MAX.)
C
B
W
.040
A
.020
.250 REF.
L
115/230 VOLT 50/60 HZ
1
2
3
4
5
6
7
8
9
10
FOR 5 VOLT DC OUTPUT
FOR ±12 VOLT OR ±15 VOLT DC OUTPUT
SCHEMATIC

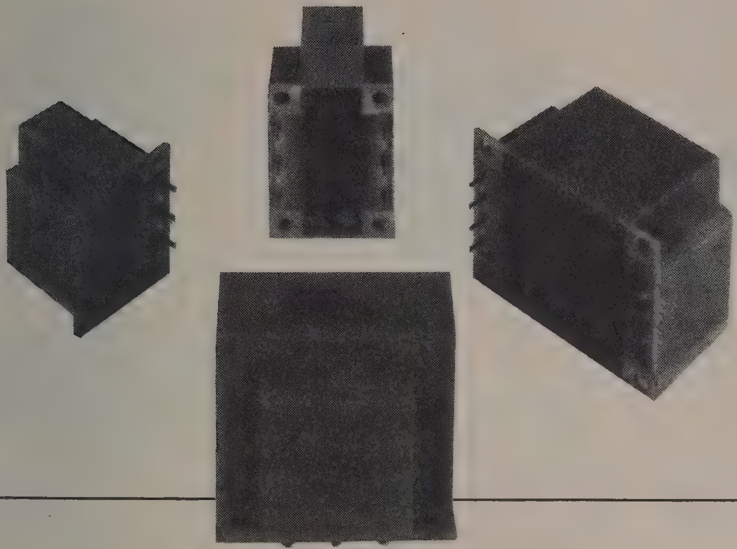
Size	L	W	H	A	B	C	Lbs.
6	1⅞	1⁹⁄₁₆	0.850	1.600	0.375	0.187	0.43
12	2½	2.000	1.065	2.000	0.500	0.250	0.68

Part Number Primary 50/60 Hz		DC Output		
115V (8 Pin)	115/230V (10 Pin)	Output #1	Output #2	Size
MPC-V-12B1	N/A	5VDC 180ma	±12VDC 35ma	V
MPC-V-15B2	N/A	5VDC 180ma	±15VDC 30ma	V
MPC-X-12B11	DMPC-X-12B31	5VDC 360ma	±12VDC 60ma	X
MPC-X-15B12	DMPC-X-15B32	5VDC 360ma	±15VDC 50ma	X
MPC-Y-12B21	DMPC-Y-12B41	5VDC 835ma	±12VDC 150ma	Y
MPC-Y-15B22	DMPC-Y-15B42	5VDC 835ma	±15VDC 130ma	Y
N/A	MPL-6-12B51	5VDC 135ma	±12VDC 40ma	6
N/A	MPL-6-15B52	5VDC 135ma	±15VDC 35ma	6
N/A	MPL-12-12B61	5VDC 270ma	±12VDC 85ma	12
N/A	MPL-12-15B62	5VDC 270ma	±15VDC 70ma	12

Recognized Component
Underwriters Labs, Inc.

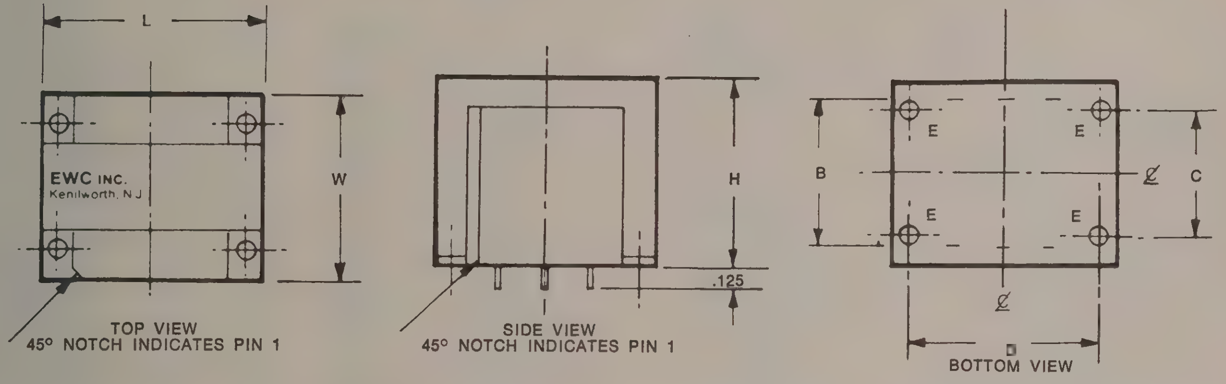
FORM-TRAN™

For military style packaging of printed circuit board plug-in transformers — at commercial prices



FEATURES

- Assures greater reliability.
- Encapsulated in form fitting shells to protect against possible damage due to use of water soluble and other fluxes as well as electrolytic corrosion experienced on open type construction
- Enhances physical appearance of your printed circuit board.
- In addition to UL recognition modified "Form-Tran" packaging can be provided that will meet safety requirements valid in all member countries of the European Community and Canada.



TOP VIEW
45° NOTCH INDICATES PIN 1

SIDE VIEW
45° NOTCH INDICATES PIN 1

BOTTOM VIEW

FORM-TRAN PACKAGING CAN BE PROVIDED FOR OUR STANDARD LINES OF

PC/DPC*
EL/DEL*
MPC/DMPC*

Simplify by inserting the letter "P" for mechanical configuration.

* See preceeding pages for part numbers and details.

Size	L ±.03	W ±.03	H ±.03	B ±.010	C ±.010	D ±.010	E DIA.
25	1.11	1.45	0.92	1.200	**	**	NA
37	1.52	1.22	1.26	1.000	.840	1.270	.125 .132
50	1.77	1.30	1.44	1.100	1.000	1.463	.159 .169
62	2.02	1.50	1.70	1.300	1.125	1.625	.159 .169
24	1.70	2.32	1.42	2.100	2.000	1.463	.159 .169

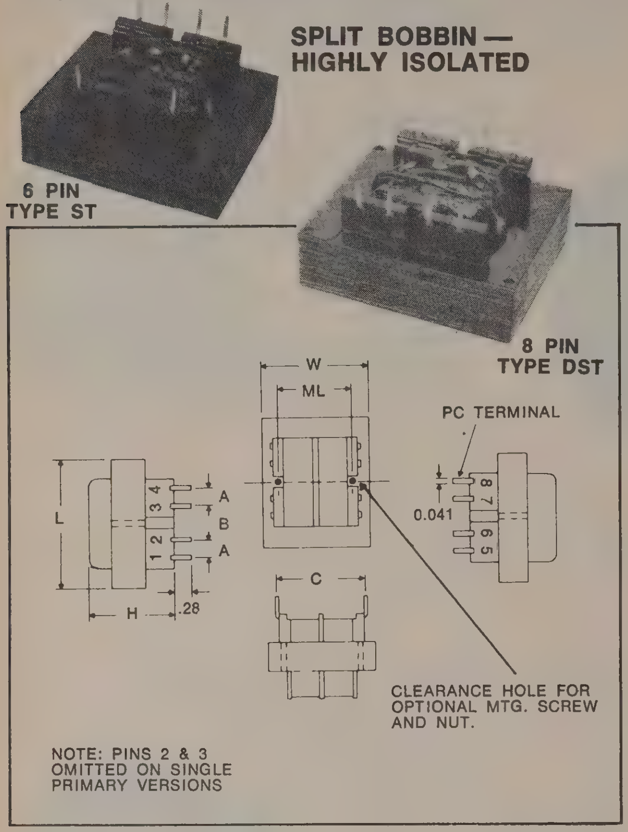
** No mtng's. for size #25.

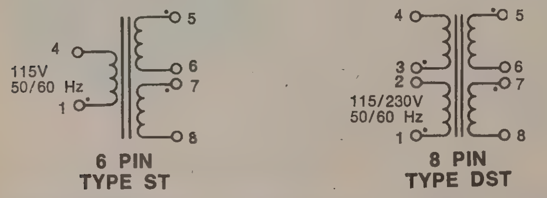
Miniature Split-Bobbin Plug-In Power Transformers

Recognized Component
Underwriters Labs, Inc.

For printed circuit applications

SPLIT BOBBIN — HIGHLY ISOLATED


6 PIN
TYPE ST
8 PIN
TYPE DST
W
ML
L
H
.28
A
B
A
1
2
3
4
C
PC TERMINAL
0.041
8
7
6
5
CLEARANCE HOLE FOR OPTIONAL MTG. SCREW AND NUT.
NOTE: PINS 2 & 3 OMITTED ON SINGLE PRIMARY VERSIONS



TRANSFORMERS WOUND ON A SPLIT BOBBIN PERMIT THE PRIMARIES AND SECONDARIES TO BE WOUND SIDE BY SIDE RATHER THAN ONE OVER THE OTHER.

FEATURES ARE:

2500V RMS Hipot
Elimination of electro-static shield
No cross-overs of primary and secondary leads
Class S insulation — 130°C

Transformers can be supplied with single 115V or 115/230V, 50/60 Hz dual primaries. Secondaries can be series or parallel connected.

Size	VA	L	W	H	ML	A	B	C	Lbs.
2	1.1	1 3/8	1 1/8	15/16	——	.250	.250	1.200	0.17
3	2.4	1 3/8	1 1/8	1 3/16	——	.250	.250	1.200	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	0.44
5	12	1 7/8	1 9/16	1 7/16	1 1/4	.300	.400	1.410	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	0.80
7	36	2 5/8	2 3/16	1 9/16	†	.400	.400	1.850	1.10

†Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

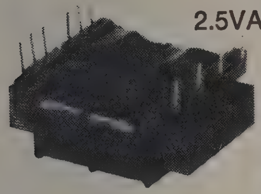
Part Number		Secondary RMS Rating	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10B41	DST 2-10B41	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10B1	DST 3-10B1	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10B2	DST 4-10B2	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10B3	DST 5-10B3	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10B4	DST 6-10B4	10V C.T. @ 2A	5V @ 4A
ST 7-10B51	DST 7-10B51	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12B42	DST 2-12B42	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12B5	DST 3-12B5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12B6	DST 4-12B6	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12B7	DST 5-12B7	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12B8	DST 6-12B8	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12B52	DST 7-12B52	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16B43	DST 2-16B43	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16B9	DST 3-16B9	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16B10	DST 4-16B10	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16B11	DST 5-16B11	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16B12	DST 6-16B12	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16B53	DST 7-16B53	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20B44	DST 2-20B44	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20B13	DST 3-20B13	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20B14	DST 4-20B14	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20B15	DST 5-20B15	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20B16	DST 6-20B16	20V C.T. @ 1A	10V @ 2A
ST 7-20B54	DST 7-20B54	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24B45	DST 2-24B45	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24B17	DST 3-24B17	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24B18	DST 4-24B18	24VC.T. @ 0.25A	12V @ 0.5A
ST 5-24B19	DST 5-24B19	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24B20	DST 6-24B20	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24B55	DST 7-24B55	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28B46	DST 2-28B46	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28B21	DST 3-28B21	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28B22	DST 4-28B22	28V C.T. @ 0.2A	14V @ 0.4A
ST 5-28B23	DST 5-28B23	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28B24	DST 6-28B24	28V C.T. @0.7A	14V @ 1.4A
ST 7-28B56	DST 7-28B56	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36B47	DST 2-36B47	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36B25	DST 3-36B25	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36B26	DST 4-36B26	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36B27	DST 5-36B27	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36B28	DST 6-36B28	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36B57	DST 7-36B57	36V C.T. @ 1A	18V @ 2A
ST 2-48B48	DST 2-48B48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48B29	DST 3-48B29	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48B30	DST 4-48B30	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48B31	DST 5-48B31	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48B32	DST 6-48B32	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48B58	DST 7-48B58	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56B49	DST 2-56B49	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56B33	DST 3-56B33	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56B34	DST 4-56B34	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56B35	DST 5-56B35	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56B36	DST 6-56B36	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56B59	DST 7-56B59	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120B50	DST 2-120B50	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120B37	DST 3-120B37	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120B38	DST 4-120B38	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120B39	DST 5-120B39	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120B40	DST 6-120B40	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120B60	DST 7-120B60	120V C.T. @ 0.3A	60V @ 0.6A

EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033 • (201) 245-3200 TWX 710-996-5993 800-526-4048

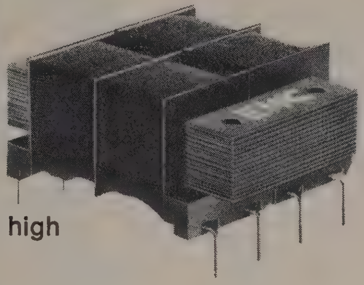
Recognized Component
Underwriters Labs, Inc.

Miniature LO-PROFILE Plug-In Power Transformers

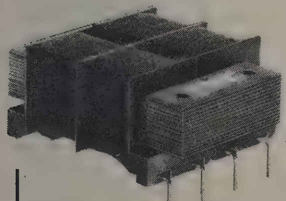
For printed circuit applications



2.5VA — 0.650 inches high



12VA — 1.065 inches high



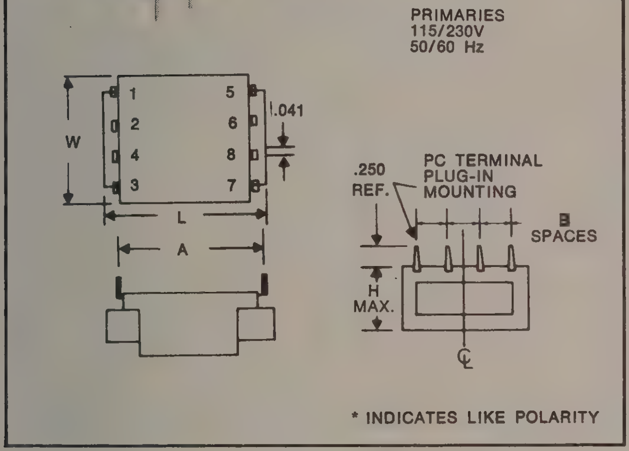
6VA — 0.850 inches high

THREE SIZES:

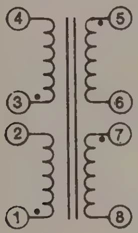
EWC's lo-profile, plug-in power transformers are designed for low height, critical pc board applications in semiconductor control and instrumentation. Interchangeable with those of other manufacturers, the units are for use in single, dual or reference dc supplies, or isolated control circuits.

EWC TRANSFORMERS FEATURE

- Non-concentric winding, achieved by secondary being wound alongside primary rather than directly over it, to lower inter-winding capacitance, thus eliminating the use of an electrostatic shield.
- Hum-bucking (semi-toroidal) construction to diminish radiated magnetic field and balance winding.
- Lo-profile design permitting close card spacing: ¾" for 2.5VA units, 1" for 6VA units and 1¼" for 12VA units.
- Dual Primaries: 115/230V, 50/60 Hz
- 1500V RMS HIPOT



* INDICATES LIKE POLARITY



Size	L	W	H	A	B	Oz.
2	1⅞	1 9/16	0.650	1.600	0.375	5
6	1⅞	1 9/16	0.850	1.600	0.375	7
12	2½	2	1.065	2.000	0.500	11

*Regulation of Size 2 and 6 units is 30%, i.e., no load-secondary voltage is 30% higher than full load. Regulation of Size 12 units is 20%.

Part No.	Size	SECONDARY*	
		Series	Parallel
LP 10-250-B23	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600-B1	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200-B2	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 12-200-B24	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450-B3	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900-B4	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 16-150-B25	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350-B5	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700-B6	12	16V C.T. @ 700MA	8V @ 1.4A
LP 20-125-B26	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300-B7	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600-B8	12	20V C.T. @ 600MA	10V @ 1.2A
LP 24-100-B27	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250-B9	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500-B10	12	24V C.T. @ 500MA	12V @ 1A
LP 34-75-B28	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170-B11	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340-B12	12	34V C.T. @ 340MA	17V @ 680MA
LP 40-60-B29	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150-B13	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300-B14	12	40V C.T. @ 300MA	20V @ 600MA
LP 56-45-B30	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100-B15	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200-B16	12	56V C.T. @ 200MA	28V @ 400MA
LP 88-28-B31	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65-B17	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130-B18	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20-B32	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50-B19	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100-B20	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10-B33	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25-B21	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50-B22	12	230V C.T. @ 50MA	115V @ 100MA

Split-Bobbin Dual Chokes
Split-Bobbin Isolation Transformers & Auto Transformers

SPLIT BOBBIN DUAL CHOKES FOR RECTIFIER POWER CIRCUITS

UL Class B (130°C) — Open Frame (STD)
0.1 AD.C to 100 AD.C — 1500V RMS Hipot

RATINGS PARALLEL (DUAL CHOKES)

L = 0.25 x IND (Series: I-DC = 2 x AMPS (Series)
RDC = 0.25 x OHMS (Series): ET = 0.5 x ET (Series)

Rectifier Power Choke (Two For One)	Series (Nom Values) Inductance (MHY)	I-DC (Amps)	DCR (Ohms)	ET (Volt-sec) Series	Mtg. Style (OF)	Size
RP-CL 0.1/0.2	3000	0.1	280	0.4	C	I
RP-CM 0.1/0.2	6000	0.1	360	0.75	C	II
RP-CH 0.1/0.2	14,000	0.1	500	1.75	C	IV
RP-CL 0.25/0.5	480	0.25	44	0.15	C	I
RP-CM 0.25/0.5	1500	0.25	72	0.5	C	III
RP-CH 0.25/0.5	3200	0.25	96	1.0	C	V
RP-CL 0.5/1	240	0.5	14	0.15	C	II
RP-CM 0.5/1	560	0.5	20	0.35	C	IV
RP-CH 0.5/1	1200	0.5	36	0.80	C	VI
RP-CL 1/2	100	1.0	4.4	0.125	C	III
RP-CM 1/2	200	1.0	6.0	0.25	C	V
RP-CH 1/2	380	1.0	8.0	0.50	C	VII
RP-CL 2/4	25	2.0	1.1	0.06	C	III
RP-CM 2/4	50	2.0	1.4	0.125	C	V
RP-CH 2/4	160	2.0	3.0	0.40	C	VIII
RP-CL 4/8	8.4	4.0	0.3	0.045	C	IV
RP-CM 4/8	24	4.0	0.5	0.125	C	VII
RP-CH 4/8	68	4.0	1.00	0.30	B	IX
RP-CL 6/12	7.2	6.0	0.2	0.065	C	VI
RP-CM 6/12	17	6.0	0.3	0.125	C	VIII
RP-CH 6/12	28	6.0	0.4	0.20	B	IX
RP-CL 8/16	10	8.0	0.18	0.10	C	VIII
RP-CM 8/16	26	8.0	0.36	0.25	B	X
RP-CH 8/16	76	8.0	0.56	0.75	B	XIV
RP-CL 10/20	6	10	0.10	0.075	C	VIII
RP-CM 10/20	22	10	0.28	0.25	B	XI
RP-CH 10/20	46	10	0.34	0.55	B	XIV
RP-CL 12/24	4.6	12	0.072	0.06	C	VIII
RP-CM 12/24	15	12	0.18	0.20	B	XI
RP-CH 12/24	32	12	0.22	0.45	B	XIV
RP-CL 15/30	4	15	0.064	0.08	B	IX
RP-CM 15/30	16	15	0.14	0.30	B	XII
RP-CH 15/30	32	15	0.22	0.55	B	XVI
RP-CL 25/50	1.7	25	0.028	0.05	B	IX
RP-CM 25/50	6.8	25	0.056	0.20	B	XIV
RP-CH 25/50	12	25	0.080	0.35	B	XVI
RP-CL 50/100	0.9	50	0.012	0.055	B	XI
RP-CM 50/100	1.7	50	0.014	0.10	B	XIV
RP-CH 50/100	3.0	50	0.020	0.175	B	XVI

SPLIT BOBBIN ISOLATION TRANSFORMERS

3 VA to 1.25 KVA (50/60 Hz) 230V/230V or 115V/115V or 230V/115V or 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C) Open or Enclosed.

Isolation Transformer (Four For One)	VA Max.	Mtg. Style (OF)	Mtg. Style (EF)	Size
IT 200.3	3	C	EC	I
IT 200.7	7	C	EC	II
IT 201.5	15	C	EC	III
IT 202.5	25	C	EB-V	IV
IT 204	40	C	EB-V	V
IT 206	60	C	EB-V	VI
IT 208	80	C	EB-V	VII
IT 212	120	C	EB-V	VIII
IT 218	180	B	EB-V	IX
IT 225	250	B	EB-V	X
IT 235	350	B	EB-V	XI
IT 255	550	B	EB-V	XII
IT 280	800	B	EB-V	XIV
IT 2125	1250	B	EB-V	XV

ISOLATION TRANSFORMER PART NO. SYSTEM

IT—(VA Part No.)—OF: (Four For One)—Std
IT—(VA Part No.)—EF-1: (115V/115V)—Std
IT—(VA Part No.)—EF-2: (230V/230V)—Std
IT—(VA Part No.)—EF-12: (115V/230V)—Non Std
IT—(VA Part No.)—EF-21: (230V/115V)—Non Std

BOBBIN AUTO TRANSFORMERS

10 VA to 2.5 KVA (50-500 Hz) Step Down: 230V/115V or Step Up: 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C) Open or Enclosed.

Auto Transformer (Two For One)	VA Max.	Mtg. Style (OF)	Mtg. Style (EF)	Size
AT 101	10	C	EC	I
AT 102	20	C	EC	II(a)
AT 104	40	C	EC	III
AT 107	70	C	EB-V	IV
AT 110	100	C	EB-V	V
AT 112	120	C	EB-V	V(a)
AT 115	150	C	EB-V	VI
AT 120	200	C	EB-V	VII
AT 125	250	C	EB-V	VIII
AT 135	350	B	EB-V	IX
AT 150	500	B	EB-V	IX(a)
AT 175	750	B	EB-V	IX(b)
AT 1100	1000	B	EB-V	XII
AT 1120	1200	B	EB-V	XIII
AT 1150	1500	B	EB-V	XIV
AT 1250	2500	B	EB-V	XV

AUTO TRANSFORMER PART NO. SYSTEM

AT——(VA Part No.)—OF: (Two For One)—Std
AT—(VA Part No.) EF-SD: (Step Down)—Std
AT—(VA Part No.)—EF-SU: (Step Up)—Non Std

MECHANICAL DIMENSIONS

Size	RPT (Max.) VA	RPT (Max.) REG (%)	Wt (#) OF (Approx)	Mtg. Scr.	Mtg. Styles See RPT Data Sheet	W OF (Approx)	W EF (Nom)	— C : EC : B — L (Nom)	H (Nom)	ML (Nom)	B:B-V ..MW (Nom)	— C-V : B-V : EB-V — L (Nom)	H (Nom)	ML (Nom)	EB-V MW (Nom)
I	2.5	30	.25	#8	C:EC	1¼	1⅜	2 1/16	1 3/16	1¾	—	—	—	—	—
II	6.5	25	.375	#8	C:EC:C-V	1⅜	1¾	2⅜	1⅜	2	—	2	1 11/16	1 23/32	—
II(a)	—	—	.5	#8	C:EC	1½	1⅞	2⅜	1⅜	2	—	—	—	—	—
III	13	25	.625	#8	C:EC:C-V	1½	1⅞	2 13/16	1⅝	2⅜	—	2 7/16	1 15/16	2	—
IV	25	25	1.0	#8	C:C-V	1⅝	—	3¼	1 15/16	2 13/16	—	2⅞	2 5/16	2⅜	—
IV	—	—	—	#8	EB-V	—	2⅛	—	—	—	—	1⅞	2¼	1½	1 5/16
V	40	25	1.25	#8	C:C-V	1⅞	—	3¼	1 15/16	2 13/16	—	2⅞	2 5/16	2⅜	—
V	—	—	—	#8	EB-V	—	2⅜	—	—	—	—	1⅞	2¼	1½	1 9/16
V(a)	—	—	1.5	#8	C:EB-V	2⅛	2⅝	3¼	1 15/16	2 13/16	—	1⅞	2¼	1½	1 13/16
VI	65	20	1.75	#8	C:C-V	2	—	3 11/16	2¼	3⅛	—	3⅛	2 11/16	2 13/16	—
VI	65	20	1.75	#8	B:B-V:EB-V	2	2 9/16	2⅝	2 3/16	2 3/16	2	2 3/16	2⅝	1¾	1 9/16
VII	90	20	2.5	#8	C:C-V	2¼	—	4	2 9/16	3 9/16	—	3 9/16	3 1/16	3⅛	—
VII	90	20	2.5	#8	B:B-V:EB-V	2¼	2 11/16	3	2½	2½	2	2½	3	2	1 11/16
VIII	130	15	3.5	#8	C	2½	—	4½	2⅞	4	—	—	—	—	—
VIII	130	15	3.5	#8	B:B-V:EB-V	2½	3 3/16	3⅜	2 13/16	2 13/16	2⅛	2 13/16	3⅜	2¼	2
IX	185	15	4.75	#8	B:B-V:EB-V	2¾	3 7/16	3¾	3⅛	3⅛	2¼	3⅛	3¾	2½	2 3/16
IX(a)	—	—	6.0	#10	B:B-V:EB-V	3¼	3 15/16	3¾	3⅛	3⅛	2¾	3⅛	3¾	2½	2 11/16
IX(b)	—	—	8.0	#10	B:B-V:EB-V	4	4⅝	3¾	3⅛	3⅛	3 7/16	3⅛	3¾	2½	3⅜
X	270	10	6.25	#10	B:B-V:EB-V	3	3 13/16	4⅛	3 7/16	3 7/16	2⅜	3 7/16	4⅛	2¾	2 11/16
XI	360	10	8.0	#10	B:B-V:EB-V	3¼	3 15/16	4½	3¾	3¾	2½	3¾	4½	3	2 13/16
XII	550	7½	12.0	#10	B:B-V:EB-V	4¼	4 15/16	4½	3¾	3¾	3½	3¾	4½	3	3 13/16
XIII	575	7½	12.5	¼	B:B-V:EB-V	3¾	4⅞	5¼	4⅜	4⅜	2⅞	4⅜	5¼	3½	3¼
XIV	825	5	17.0	¼	B:B-V:EB-V	4½	5⅝	5¼	4⅜	4⅜	3⅝	4⅜	5¼	3½	4
XV	1600	5	25.0	¼	B:B-V:EB-V	6	7⅛	5¼	4⅜	4⅜	5⅛	4⅜	5¼	3½	5½
XVI	1500	5	22.5	¼	B:B-V	4½	—	6⅜	5 5/16	5 5/16	3¼	5 5/16	6⅜	4¼	—

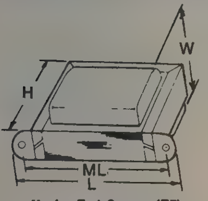
For special requirements please contact our Engineering Departments at listed telephone numbers or addresses.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement. Prices subject to change without notice.

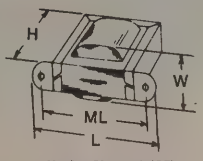
EWC® INC. 725 FEDERAL AVENUE, KENILWORTH, NJ 07033 • (201) 245-3200 TWX 710-996-5993 800-526-4048

Split-Bobbin Rectifier Power Transformers

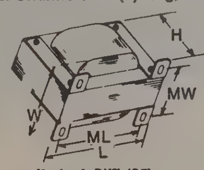
End Covers & Channels — (2) Mtg. Holes. End Bells & L-BKTS — (4) Mtg. Slots.



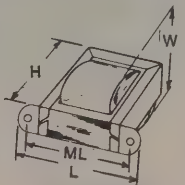
Horiz. End Covers (EF)
(Mtg. Style: EC)
(STD. SIZE I-III) (AT & IT only)



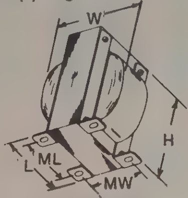
Horiz. Channel (OF)
(Mtg. Style: C)
(STD: SIZE I-VIII)
(STD: SZE I-VII) (RPT)



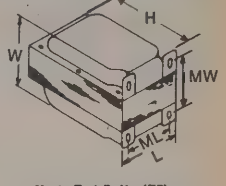
Horiz. L-BKT (OF)
(Mtg. Style: B)
(STD: SIZE IX-XVI)
(STD: SIZE VIII-XVI) (RPT)



Vert. Channel (OF)
(Mtg. Style: C-V)



Vert. L-BKT (OF)
(Mtg. Style: B-V)



Vert. End Bells (EF)
(Mtg. Style: EB-V)
(STD: SIZE IV-XV) (AT & IT only)

1 VA to 1.5 KVA — 115V @ 50/60 Hz Primary 1500V RMS Hipot — UL Class B (130°C) — Open Frame (STD)

Primary 115V 50/60 Hz	Secondary Ratings (RMS)		Mtg. Style	Size
	Series	Parallel		
RPT 10-0.1	10V C.T. @ 0.1A	5V C.T. @ 0.2A	C	I
RPT 10-0.25	10V C.T. @ 0.25A	5V C.T. @ 0.5A	C	I
RPT 10-0.5	10V C.T. @ 0.5A	5V C.T. @ 1A	C	II
RPT 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	III
RPT 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	IV
RPT 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	V
RPT 10-6	10V C.T. @ 6A	5V C.T. @ 12A	C	VI
RPT 10-8	10V C.T. @ 8A	5V C.T. @ 16A	C	VII
RPT 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	VIII
RPT 10-15	10V C.T. @ 15A	5V C.T. @ 30A	B	IX
RPT 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	X
RPT 10-30	10V C.T. @ 30A	5V C.T. @ 60A	B	XI
RPT 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	XII
RPT 10-75	10V C.T. @ 75A	5V C.T. @ 150A	B	XIV
RPT 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	XVI
RPT 12-8-0.1	12.8V C.T. @ 0.1A	6.4V C.T. @ 0.2A	C	I
RPT 12.8-0.25	12.8V C.T. @ 0.25A	6.4V C.T. @ 0.5A	C	II
RPT 12.8-0.5	12.8V C.T. @ 0.5A	6.4V C.T. @ 1A	C	II
RPT 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	III
RPT 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	C	V
RPT 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	C	VI
RPT 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	C	VII
RPT 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	B	VIII
RPT 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	IX
RPT 12.8-20	12.8V C.T. @ 20A	6.4V C.T. @ 40A	B	X
RPT 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	XI
RPT 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	XIV
RPT 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	XVI
RPT 16-0.1	16V C.T. @ 0.1A	8V C.T. @ 0.2A	C	I
RPT 16-0.25	16V C.T. @ 0.25A	8V C.T. @ 0.5A	C	II
RPT 16-0.5	16V C.T. @ 0.5A	8V C.T. @ 1A	C	III
RPT 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	IV
RPT 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	V
RPT-16-4	16V C.T. @ 4A	8V C.T. @ 8A	C	VI
RPT 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	VIII
RPT 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	VIII
RPT 16-10	16V C.T. @ 10A	8V C.T. @ 20A	B	IX
RPT 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	X
RPT 16-20	16V C.T. @ 20A	8V C.T. @ 40A	B	XI
RPT 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	XII
RPT 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	XIV
RPT 16-75	16V C.T. @ 75A	8V C.T. @ 150A	B	XVI
RPT 24-0.1	24V C.T. @ 0.1A	12V C.T. @ 0.2A	C	I
RPT 24-0.25	24V C.T. @ 0.25A	12V C.T. @ 0.5A	C	II
RPT 24-0.5	24V C.T. @ 0.5A	12V C.T. @ 1A	C	III
RPT 24-1	24V C.T. @ 1A	12V C.T. @ 2A	C	IV
RPT 24-2	24V C.T. @ 2A	12V C.T. @ 4A	C	VI
RPT 24-3	24V C.T. @ 3A	12V C.T. @ 6A	C	VII
RPT 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	VIII
RPT 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	IX
RPT 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	X
RPT 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	XI
RPT 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	XII
RPT 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	XIV
RPT 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	XVI
RPT 36-0.1	36V C.T. @ 0.1A	18V C.T. @ 0.2A	C	II
RPT 36-0.25	36V C.T. @ 0.25A	18V C.T. @ 0.5A	C	III
RPT 36-0.5	36V C.T. @ 0.5A	18V C.T. @ 1A	C	IV
RPT 36-1	36V C.T. @ 1A	18V C.T. @ 2A	C	VI
RPT 36-2	36V C.T. @ 2A	18V C.T. @ 4A	C	VII
RPT 36-3	36V C.T. @ 3A	18V C.T. @ 6A	B	VIII
RPT 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	IX
RPT 36-6	36V C.T. @ 6A	18V C.T.@ 12A	B	X
RPT 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	XI
RPT 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	XII
RPT 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	XIV
RPT 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	XVI
RPT 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	XVI
RPT 56-01	56V C.T. @ 0.1A	28V C.T. @ 0.2A	C	II
RPT 56-0.25	56V C.T. @ 0.25A	28V C.T. @ 0.5A	C	IV
RPT 56-0.5	56V C.T. @ 0.5A	28V C.T. @ 1A	C	V
RPT 56-1	56V C.T. @ 1A	28V C.T. @ 2A	C	VI
RPT 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	VIII
RPT 56-3	56V C.T. @ 3A	28V C.T. @ 6A	B	IX
RPT 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	X
RPT 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	XI
RPT 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	XII
RPT 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	XIV
RPT 56-20	56V C.T. @ 20A	28V C.T. @ 40A	B	XVI
RPT 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	XVI

Primary 115V 50/60 Hz	Secondary Ratings (RMS)		Mtg. Style	Size
	Series	Parallel		
RPT 68-0.1	68V C.T. @ 0.1A	34V C.T. @ 0.2A	C	III
RPT 68-0.25	68V C.T. @ 0.25A	34V C.T. @ 0.5A	C	IV
RPT 68-0.5	68V C.T. @ 0.5A	34V C.T. @ 1A	C	V
RPT 68-1	68V C.T. @ 1A	34V C.T. @ 2A	C	VII
RPT 68-1.5	68V C.T. @ 1.5A	34V C.T. @ 3A	B	VIII
RPT 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	IX
RPT 68-3	68V C.T. @ 3A	34V C.T. @ 6A	B	X
RPT 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	XI
RPT 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	XII
RPT 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	XII
RPT 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	XIV
RPT 68-15	68V C.T. @ 15A	34V C.T. @ 30A	B	XVI
RPT 68-20	68V C.T. @ 20A	34V C.T. @ 40A	B	XVI
RPT 80-0.1	80V C.T. @ 0.1A	40V C.T. @ 0.2A	C	III
RPT 80-0.25	80V C.T. @ 0.25A	40V C.T. @ 0.5A	C	IV
RPT 80-0.5	80V C.T. @ 0.5A	40V C.T. @ 1A	C	VI
RPT 80-1	80V C.T. @ 1A	40V C.T. @ 2A	C	VII
RPT 80-1.5	80V C.T. @ 1.5A	40V C.T. @ 3A	B	VIII
RPT 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	IX
RPT 80-3	80V C.T. @ 3A	40V C.T. @ 6A	B	X
RPT 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	XI
RPT 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	XII
RPT 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	XIV
RPT 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	XVI
RPT 88-0.1	88V C.T. @ 0.1A	44V C.T. @ 0.2A	C	III
RPT 88-0.25	88V C.T. @ 0.25A	44V C.T. @ 0.5A	C	IV
RPT 88-0.5	88V C.T. @ 0.5A	44V C.T. @ 1A	C	VI
RPT 88-1	88V C.T. @ 1A	44V C.T. @ 2A	C	VII
RPT 88-2	88V C.T. @ 2A	44V C.T. @ 4A	B	IX
RPT 88-3	88V C.T. @ 3A	44V C.T. @ 6A	B	X
RPT 88-4	88V C.T. @ 4A	44V C.T. @ 8A	B	XI
RPT 88-6	88V C.T. @ 6A	44V C.T. @ 12A	B	XII
RPT 88-8	88V C.T. @ 8A	44V C.T. @ 16A	B	XIV
RPT 88-12	88V C.T. @ 12A	44V C.T. @ 24A	B	XVI
RPT 120-0.1	120V C.T. @ 0.1A	60V C.T. @ 0.2A	C	III
RPT 120-0.25	120V C.T. @ 0.25A	60V C.T. @ 0.5A	C	V
RPT 120-0.5	120V C.T. @ 0.5A	60V C.T. @ 1A	C	VI
RPT 120-1	120V C.T. @ 1A	60V C.T. @ 2A	B	VIII
RPT 120-1.5	120V C.T. @ 1.5A	60V C.T. @ 3A	B	IX
RPT 120-2	120V C.T. @ 2A	60V C.T. @ 4A	B	X
RPT 120-3	120V C.T. @ 3A	60V C.T. @ 6A	B	XI
RPT 120-4	120V C.T. @ 4A	60V C.T. @ 8A	B	XII
RPT 120-6	120V C.T. @ 6A	60V C.T. @ 12A	B	XIV
RPT 120-8	120V C.T. @ 8A	60V C.T. @ 16A	B	XVI
RPT 120-12	120V C.T. @ 12A	60V C.T. @ 24A	B	XVI
RPT 160-0.1	160V C.T. @ 0.1A	80V C.T. @ 0.2A	C	IV
RPT 160-0.25	160V C.T. @ 0.25A	80V C.T. @ 0.5A	C	VI
RPT 160-0.5	160V C.T. @ 0.5A	80V C.T. @ 1A	C	VII
RPT 160-0.75	160V C.T. @ 0.75A	80V C.T. @ 1.5A	B	VIII
RPT 160-1	160V C.T. @ 1A	80V C.T. @ 2A	B	IX
RPT 160-1.5	160V C.T. @ 1.5A	80V C.T. @ 3A	B	X
RPT 160-2	160V C.T. @ 2A	80V C.T. @ 4A	B	XI
RPT 160-4	160V C.T. @ 4A	80V C.T. @ 8A	B	XIV
RPT 160-6	160V C.T. @ 6A	80V C.T. @ 12A	B	XVI
RPT 160-8	160V C.T. @ 8A	80V C.T. @ 16A	B	XVI
RPT 180-0.1	180V C.T. @ 0.1A	90V C.T. @ 0.2A	C	IV
RPT 180-0.25	180V C.T. @ 0.25A	90V C.T. @ 0.5A	C	VI
RPT 180-0.5	180V C.T. @ 0.5A	90V C.T. @ 1A	C	VII
RPT 180-1	180V C.T. @ 1A	90V C.T. @ 2A	B	IX
RPT 180-1.5	180V C.T. @ 1.5A	90V C.T. @ 3A	B	X
RPT 180-2	180V C.T. @ 2A	90V C.T. @ 4A	B	XI
RPT 180-4	180V C.T. @ 4A	90V C.T. @ 8A	B	XIV
RPT 180-6	180V C.T. @ 6A	90V C.T. @ 12A	B	XVI
RPT 180-8	180V C.T. @ 8A	90V C.T. @ 16A	B	XVI
RPT 230-0.1	230V C.T. @ 0.1A	115V C.T. @ 0.2A	C	IV
RPT 230-0.25	230V C.T. @ 0.25A	115V C.T. @ 0.5A	C	VI
RPT 230-0.5	230V C.T. @ 0.5A	115V C.T. @ 1A	B	VIII
RPT 230-0.75	230V C.T. @ 0.75A	115V C.T. @ 1.5A	B	IX
RPT 230-1	230V C.T. @ 1A	115V C.T. @ 2A	B	X
RPT 230-1.5	230V C.T. @ 1.5A	115V C.T. @ 3A	B	XI
RPT 230-2	230V C.T. @ 2A	115V C.T. @ 4A	B	XII
RPT 230-4	230V C.T. @ 4A	115V C.T. @ 8A	B	XVI
RPT 230-6	230V C.T. @ 6A	115V C.T. @ 12A	B	XVI
RPT 300-0.1	300V C.T. @ 0.1A	150V C.T. @ 0.2A	C	V
RPT 300-0.25	300V C.T. @ 0.25A	150V C.T. @ 0.5A	C	VII
RPT 300-0.5	300V C.T. @ 0.5A	150V C.T. @ 1A	B	IX
RPT 300-1	300V C.T. @ 1A	150V C.T. @ 2A	B	XI
RPT 300-2	300V C.T. @ 2A	150V C.T. @ 4A	B	XIV
RPT 300-4	300V C.T. @ 4A	150V C.T. @ 8A	B	XVI

EWC® INC.

725 FEDERAL AVENUE, KENILWORTH, NJ 07033 • (201) 245-3200 TWX 710-996-5993 800-526-4048

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

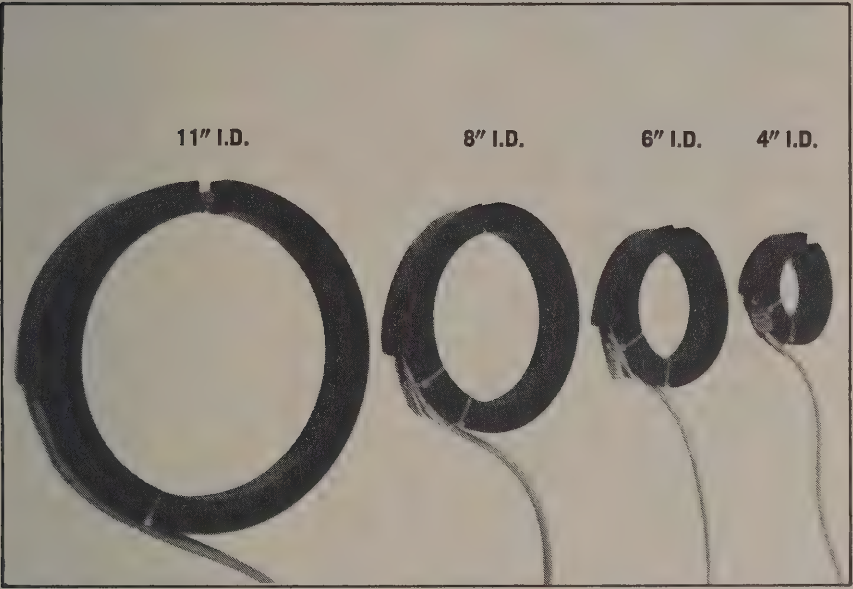
Y

YIG yttrium iron garnet

FLEX-CORE DIV.
MORLAN & ASSOCIATES, INC.
6625 McVEY BLVD. — WORTHINGTON, OHIO 43085

PHONE
(614) 889-6152

SPLIT-CORE CURRENT TRANSFORMERS



NOTE: Open split-core with a twisting motion only.

- OTHER RATIOS AVAILABLE
- FOUR OPENING SIZES
- 1, 3, OR 5 AMP SECONDARIES
- DUAL TAP RATIOS AVAILABLE
- ALL RATIOS STOCKED
- LOOP COIL MULTIPLIER AVAILABLE

DESCRIPTION: This split-core current transformer was designed for easy installation on large bus or wire conductors in order to make electrical load surveys or for continuous monitoring of current.

APPLICATION: To be used with any 5 amp indicating or recording ammeter or amp or watt transducer. Also useable with indicating or recording clamp-on ammeter.

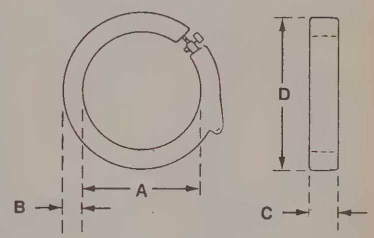
CONSTRUCTION: Directional silicon steel is used for the flexible core. Secondary windings are of copper. Unit is encapsulated in silicon rubber which protects against moisture, dirt, oil and corona. Remains flexible from −45° to +200°C.

INSULATION LEVEL: 600VAC — can be used over insulated conductors on higher voltage circuits.

SAFETY FACTOR: Secondary voltage limited to less than 50VAC when secondary leads are open circuited.

SECONDARY LEADS: 12 feet long with spade connectors.

COLOR: Transformer (red) — leads (yellow).



A	B	C	D
4″	1¼″	1½″	6½″
6″	1¼″	1½″	8½″
8″	1¼″	1½″	10½″
11″	1¼″	1½″	13½″

CURRENT RATIO	INSIDE DIAMETER 4″	6″	8″	11″	BURDEN CAPACITY	ACCURACY	THERMAL FACTOR	OTHER APPLICATIONS
300/5	X	X	—	—	2VA	4%	1.25	• WATT TRANSDUCER • CURRENT TRANSDUCER • KWH METER • DEMAND METER • ENERGY MANAGEMENT SYSTEMS • POWER FACTOR METER • CURRENT SENSING RELAYS
400/5	X	X	—	—	2VA	4%	1.25	
500/5	X	X	—	—	3VA	3%	1.25	
600/5	X	X	—	—	3VA	3%	1.25	
800/5	X	X	—	—	5VA	2%	1.5	
1000/5	X	X	—	—	10VA	2%	2.0	
1200/5	X	X	—	—	10VA	2%	2.0	
1500/5	X	X	X	—	10VA	2%	2.0	
2000/5	X	X	X	—	10VA	2%	2.0	
2500/5	—	X	X	—	10VA	2%	2.0	
3000/5	—	X	X	X	10VA	2%	1.5	
3500/5	—	X	X	X	10VA	2%	1.5	
4000/5	—	X	X	X	10VA	2%	1.25	
5000/5	—	X	X	X	10VA	2%	1.25	
6000/5	—	—	X	X	10VA	2%	1.25	

FREED TRANSFORMER CO., INC.

MIL-T-27 COMPONENTS

TRANSISTOR SUPPLY TRANSFORMERS

TST SERIES

Manufactured and Guaranteed to Specifications MIL-T-27

TST-6 — Frequency 57 Hz to 63 Hz — Primary 115 volts units with * primary 115 and/or 230 volts

TST-4 — Frequency 380 Hz to 1000 Hz — Primary 115 volts

TST units can be supplied in commercial type construction (channel or shell type with leads).

**When ordering specify (6) for 57 to 63 Hz and (4) for 380 to 1000 Hz

D.C. to RMS Conversion Chart

Resistive or Inductive Loads		Capacitive Loads	
Full Wave Center Tapped	Full Wave Bridge	Full Wave Center Tapped	Full Wave Bridge
E_{RMS} = 2.22 Edc	E_{RMS} = 1.11 Edc	E_{RMS} = 1.6 Edc	E_{RMS} = .8 Edc
I_{RMS} = .75 Idc	I_{RMS} = 1.05 Idc	I_{RMS} = 1.1 Idc	I_{RMS} = 1.55 Idc

Edc – should include voltage drop across reactor and voltage drop across one diode for F W C T and voltage drop across two diodes for F W Bridge

	R.M.S. Output		Case	
Part No.	Volt	Amp	—4	—6
TST(**)-1	6.3 CT	.30	AH	AH
TST(**)-2	6.3 CT	.60	AH	AJ
TST(**)-3	12.6 Split	.80	AJ	EB
TST(**)-4	12.6 Split	1.5	AJ	FA
TST(**)-5	12.6 Split	2.0	AJ	GB*
TST(**)-6	25.2 Split	1.5	EB	GA*
TST(**)-7	25.2 Split	4.0	GB	JA*
TST(**)-8	30 Split	.50	AJ	FA
TST(**)-9	30 Split	1.0	AJ	GB*
TST(**)-10	30 Split	1.5	EB	GA*
TST(**)-11	30 Split	2.0	FA	HA*
TST(**)-12	40 Split	.50	AJ	FA
TST(**)-13	40 Split	1.0	EB	GA*
TST(**)-14	40 Split	1.5	FA	HA*
TST(**)-15	40 Split	2.0	FA	JB*
TST(**)-16	50 Split	.50	AJ	GB*
TST(**)-17	50 Split	1.0	FA	GA*
TST(**)-18	50 Split	1.5	FA	JB*
TST(**)-19	50 Split	2.0	GB	JA*
TST(**)-20	60 Split	.50	AJ	GB*
TST(**)-21	60 Split	1.0	FA	HA*
TST(**)-22	60 Split	1.5	FA	JA*
TST(**)-23	70 Split	.50	EB	GA*
TST(**)-24	70 Split	1.0	FA	JB*
TST(**)-25	70 Split	1.5	GB	JA*
TST(**)-26	80 Split	.25	AJ	FA
TST(**)-27	80 Split	.50	EB	GA*
TST(**)-28	80 Split	1.0	FA	JB*
TST(**)-29	90 Split	.25	AJ	GB*
TST(**)-30	90 Split	.50	EB	GA*
TST(**)-31	90 Split	1.0	FA	JA*
TST(**)-32	100 Split	.25	AJ	GB*
TST(**)-33	100 Split	.50	FA	GA*
TST(**)-34	100 Split	1.20	GA	KB*

STANDARD MILITARY AUDIO TRANSFORMERS

Frequency Response 300-10,000 Hz ±2 DB

Catalog No.	Application	Type Designation	Impedance Level in Ohms Primary	Impedance Level in Ohms Secondary	Ratio	Max. Power Level DBM	Pri. D.C. Per Side in Ma	Max. D.C. unbal-ance	Case
MGA 1	Transformer; interstage, single or P.P. plates to single or P.P. grid	TF4RX15AJ	10,000 C.T.	90,000 split and C.T.	1:3 overall	+15	10	10	AJ
MGA 2	Transformer; matching 600 ohm line to voice coil.	TF4RX16AJ	600 split	4, 8, 16	6.12:1 overall	+33	0	0	AJ
MGA 3	Transformer; input, 600 ohm line to single or P.P. grids.	TF4RX10AJ	600 split	135,000 C.T.	1:15	+15	0	0	AJ
MGA 4	Transformer; matching, 600 ohm line to 600 ohm line.	TF4RX16AJ	600 split	600 split	1:1	+15	0	0	AJ
MGA 5	Transformer; output, single plate 7,600 ohm, 4,800 ohm to 600 ohm line.	TF4RX13AJ	7,600 tap @ 4,800	600 split	3.56:1	+33	40	40	AJ
MGA 6	Transformer; output, single plate 7,600 ohm, 4,800 ohm to voice coil.	TF4RX13AJ	7,600 tap @ 4,800	4, 8, 16	21.8:1	+33	40	40	AJ
MGA 7	Transformer; output, single or P.P. plates to 600 ohm line.	TF4RX13AJ	15,000 C.T.	600 split	5:1	+33	10	10	AJ
MGA 8	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	24,000 C.T.	600 split	6.32:1	+30	10	1	AJ
MGA 9	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	60,000 C.T.	600 split	10:1	+27	10	1	AJ

STANDARD MILITARY POWER AND FILAMENT TRANSFORMERS

Primary 105/115/125V 60~

SINGLE PHASE 400 Hz , AND THREE PHASE 60 AND 400 Hz TRANSFORMERS CAN BE SUPPLIED ON SPECIAL ORDER.

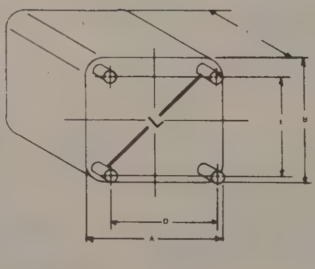
Catalog No.	MIL-T-27 Type Designation	Hi Volt	D.C. Volts	D.C. Amps	Fil. No. 1	Fil. No. 2	Case
MGP 1	TF4RX03HA001	200/100/0/100/200	185	.070	5 6. 3V @ 2A	6. 3V @ 3A	HA
MGP 2	TF4RX03JB002	650 C.T.	260	.070	5/6. 3V @ 2A	6. 3V @ 4A	JB
MGP 3	TF4RX03KB006	650 C.T.	245	.150	6. 3V @ 5A	5V @ 3A	KB
MGP 4	TF4RX03LB003	800 C.T.	318	.175	5V @ 3A	6. 3V @ 8A	LB
MGP 5	TF4RX03MB004	900 C.T.	345	.250	5V @ 3A	6. 3V @ 8A	MB
MGP 6	TF4RX02KB001	700 C.T.	255	.250			KB
MGP 7	TF4RX02LB002	1100 C.T.	419	.250			LB
MGP 8	TF4RX02NB003	1600 C.T.	640	.250			NB

Catalog No.	MIL-T-27 Type Designation	Secondary Volts	Secondary Current Amps	Secondary Test Volts RMS	Case
MGF 1	TF4RX01EB002	2.5	3.0	2,500	EB
MGF 2	TF4RX01GB003	2.5	10.0	2,500	GB
MGF 3	TF4RX01FB004	5.0	3.0	2,500	FB
MGF 4	TF4RX01HB005	5.0	10.0	2,500	HB
MGF 5	TF4RX01FB006	6.3	2.0	2,500	FB
MGF 6	TF4RX01GB007	6.3	5.0	2,500	GB
MGF 7	TF4RX01JB008	6.3	10.0	2,500	JB
MGF 8	TF4RX01KB009	6.3	20.0	2,500	KB
MGF 9	TF4RX01JB012	2.5	10.0	10,000	JB
MGF 10	TF4RX01KB013	5.0	10.0	10,000	KB

PULSE TRANSFORMERS

Catalog No.	MIL Type	Blocking Osc.	Inter-stage Coupling	Low Power Output	Pulse Voltage Kilovolts	Pulse Duration Micro-seconds	Duty Rate	No. of Windings	Test Voltage KV., RMS	Character-istic Impedance Ohms	Case No.
MPT-1	TF4RX35YY	✓	✓		0.25/0.25/0.25	0.2-1.0	.004	3	0.7	250	DM-20
MPT-2	TFR4X35YY	✓	✓		0.25/0.25	0.2-1.0	.004	2	0.7	250	DM-20
MPT-3	TF4RX35YY	✓	✓		0.5/0.5/0.5	0.2-1.5	.002	3	1,0	250	DM-18
MPT-4	TF4RX35YY	✓	✓		0.5/0.5	0.2-1.5	.002	2	1.0	250	DM-18
MPT-5	TF4RX35YY	✓	✓		0.5/0.5/0.5	0.5-2.0	.002	3	1.0	500	DM-20
MPT-6	TF4RX35YY	✓	✓		0.5/0.5	0.5-2.0	.002	2	1.0	500	DM-20
MPT-7	TF4RX35YY	✓	✓	✓	0.7/0.7/0.7	0.5-1.5	.002	3	1.5	200	DM-18
MPT-8	TF4RX35YY	✓	✓	✓	0.7/0.7	0.5-1.5	.002	2	1.5	200	DM-18
MPT-9	TF4RX35YY	✓	✓	✓	1.0/1.0/1.0	0.7-3.5	.002	3	2.0	200	DM-18
MPT-10	TF4RX35YY	✓	✓	✓	1.0/1.0	0.7-3.5	.002	2	2.0	200	DM-18
MPT-11	TF4RX35YY	✓	✓	✓	1.0/1.0/1.0	1.0-5.0	.002	3	2.0	500	DM-01
MPT-12	TF4RX35YY	✓	✓	✓	0.15/0.15/0.3/0.3	0.2-1.0	.004	4	0.7	700	DM-8

MIL CASES, NOMINAL DIMENSIONS, INCHES



Mil Case	A	B	C	D	L	E	Mtg. Studs	Wt. Lbs.
AH	1⁵⁄₁₆	1⁵⁄₁₆	1¾		1¼		6-32 x ⅜	⅜
AJ	1⅝	1⅝	2⅜	1³⁄₁₆		1³⁄₁₆	6-32 x ⅜	⅔
EA	1¹⁵⁄₁₆	1¹³⁄₁₆	2¾	1⅜		1¼	6-32 x ⅜	1
EB	1¹⁵⁄₁₆	1¹³⁄₁₆	2⁷⁄₁₆	1⅛		1¼	6-32 x ⅜	⅞
FA	2⁵⁄₁₆	2¹⁄₁₆	3⅛	1¹¹⁄₁₆		1⁷⁄₁₆	6-32 x ⅜	1¾
FB	2⁵⁄₁₆	2¹⁄₁₆	2½	1¹¹⁄₁₆		1⁷⁄₁₆	6-32 x ⅜	1½
GA	2¾	2⅜	3¹³⁄₁₆	2⅛		1¾	6-23 x ⅜	3½
GB	2¾	2⅜	2¹³⁄₁₆	2⅛		1¾	6-32 x ⅜	2½
HA	3¹⁄₁₆	2⅝	4¼	2¹⁹⁄₆₄		1⁵⁵⁄₆₄	8-32 x ⅜	4½
HB	3¹⁄₁₆	2⅝	3³⁄₁₆	2¹⁹⁄₆₄		1⁵⁵⁄₆₄	8-32 x ⅜	3½
JA	3⁹⁄₁₆	3¹⁄₁₆	4⅞	2⅝		2⅛	8-32 x ⅜	6
JB	3⁹⁄₁₆	3¹⁄₁₆	3⅞	2⅝		2⅛	8-32 x ⅜	5
KA	3¹⁵⁄₁₆	3⅜	5¼	3		2⁷⁄₁₆	10-32 x ½	8½
KB	3¹⁵⁄₁₆	3⅜	4⁵⁄₁₆	3		2⁷⁄₁₆	10-32 x ½	7

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST., RIDGEWOOD, N.Y. 11385

FREED TRANSFORMER CO., INC.

HERMETICALLY SEALED MINIATURE AND SUB-MINIATURE FILTERS TO MIL-F-18327

Freed Standard Filters are **Hermetically Sealed Miniature and Sub-Miniature** high performance components designed for both production and laboratory applications in the Communications and Electronic industry. In order to achieve attenuation requirements not obtainable with one single filter, one can combine several standard filters of different transmission characteristics. Wide Band Pass characteristics are obtainable by combining low and high Pass Units. The astatic construction of inductive components together with special shielding reduces the hum pick-up of the standard filters.

Low Pass Filters: The attenuation characteristics of Low Pass Filters are 6db or less at cut-off frequency • **ILP-ILM Interstage Low Pass Filter.** Characteristic impedance 10,000 ohms, in and out • **LLP-LLM Line Low Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **High Pass Filters:** The attenuation characteristics of High Pass Filters are 6db or less at cut-off frequency • **IHP-IHM Interstage High Pass Filter.** Characteristic Impedance 10,000 ohms, in and out. • **LHP-LHM Line High Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **Band Pass Filters:** The attenuation characteristics of Band Pass Filters are 2db or less at plus or minus 3% of center frequency • **IBP-IBM Interstage Band Pass Filter.** Normal input impedance — 10,000 ohms. Output impedance .5 megohms. Effective voltage step-up 2:1. (Output voltage to source voltage.) • **LBP-LBM Line Band Pass Filter.** Nominal input impedance 500 to 600 ohms. Output impedance .5 megohms. Effective voltage step-up 5:1. (Output voltage to source voltage.)

Special filters in all six types are available upon request.

MINIATURE

Catalog No.	Cut-off Frequency Hz
ILP- 100	100
ILP- 200	200
ILP- 300	300
ILP- 500	500
ILP- 750	750
ILP- 1,000	1,000
ILP- 1,500	1,500
ILP- 2,000	2,000
ILP- 2,500	2,500
ILP- 3,000	3,000
ILP- 5,000	5,000
ILP- 7,000	7,000
ILP- 10,000	10,000
ILP- 15,000	15,000
ILP- 20,000	20,000
ILP- 23,000	23,000
ILP- 25,000	25,000
ILP- 32,000	32,000
ILP-130,000	130,000
ILP-150,000	150,000

LLP- 500	500
LLP- 1,000	1,000
LLP- 1,500	1,500
LLP- 1,600	1,600
LLP- 2,000	2,000
LLP- 2,500	2,500
LLP- 3,000	3,000
LLP-16,000	16,000
LLP-20,000	20,000
LLP-70,000	70,000
LLP-80,000	80,000

Low Pass Filters

attenuation ≧35 Db at 1.5 x Fc ≧ 40 Db at 2 x Fc

IHP- 200	200
IHP- 250	250
IHP- 300	300
IHP- 400	400
IHP- 500	500
IHP- 1,000	1,000
IHP- 2,000	2,000
IHP- 3,000	3,000
IHP-10,000	10,000
IHP-15,000	15,000

LHP- 200	200
LHP- 300	300
LHP- 400	400
LHP- 500	500
LHP- 800	800
LHP- 1,000	1,000
LHP- 2,000	2,000
LHP- 6,000	6,000
LHP-10,000	10,000

High Pass Filters

attenuation ≧35 Db at .67 x Fc ≧40 Db at .5 Fc

IBP- 100	100
IBP- 200	200
IBP- 250	250
IBP- 400	400
IBP- 500	500
IBP- 700	700
IBP- 800	800
IBP- 900	900
IBP- 1,000	1,000
IBP- 1,500	1,500
IBP- 2,000	2,000
IBP- 3,000	3,000
IBP- 5,000	5,000
IBP- 7,200	7,200
IBP-10,000	10,000
IBP-12,000	12,000
IBP-15,000	15,000
IBP-30,000	30,000
IBP-57,600	57,600

LBP- 100	100
LBP- 300	300
LBP- 400	400
LBP- 600	600
LBP- 800	800
LBP- 1,000	1,000
LBP- 1,500	1,500
LBP- 2,000	2,000
LBP- 3,000	3,000
LBP- 7,200	7,200
LBP-10,000	10,000
LBP-14,400	14,400
LBP-20,000	20,000
LBP-28,800	28,800

Band Pass Filters

attenuation ≧40 Db at 0.5 x Fc and 2 x Fc

SUB-MINIATURE

Catalog No.	Cut-off Freq. Hz	Case No.
ILM- 300	300	DF-01
ILM- 500	500	DF-01
ILM- 750	750	DF-01
ILM- 1,000	1,000	DF-01
ILM- 1,500	1,500	DF-01
ILM- 2,000	2,000	DF-01
ILM- 2,500	2,500	DF-01
ILM- 3,000	3,000	DF-01
ILM- 5,000	5,000	DF-01
ILM- 7,000	7,000	DF-01
ILM- 10,000	10,000	DF-01
ILM- 15,000	15,000	DF-01
ILM- 20,000	20,000	DF-01
ILM- 23,000	23,000	DF-01
ILM- 25,000	25,000	DF-01
ILM- 32,000	32,000	DF-01
ILM-130,000	130,000	DF-01
ILM-150,000	150,000	DF-01

LLM- 500	500	DF-03
LLM- 1,000	1,000	DF-03
LLM- 1,500	1,500	DF-02
LLM- 1,600	1,600	DF-02
LLM- 2,000	2,000	DF-02
LLM- 2,500	2,500	DF-02
LLM- 3,000	3,000	DF-02
LLM-16,000	16,000	DF-02
LLM-20,000	20,000	DF-02
LLM-70,000	70,000	DF-02
LLM-80,000	80,000	DF-02

Low Pass Filters

attenuation ≧30 Db at 1.5 x Fc

≧40 Db at 2 x Fc

IHM- 300	300	DF-01
IHM- 400	400	DF-01
IHM- 500	500	DF-01
IHM- 1,000	1,000	DF-01
IHM- 2,000	2,000	DF-01
IHM- 3,000	3,000	DF-01
IHM-10,000	10,000	DF-01
IHM-15,000	15,000	DF-01

LHM- 300	300	DF-03
LHM- 400	400	DF-03
LHM- 500	500	DF-03
LHM- 800	800	DF-03
LHM- 1,000	1,000	DF-02
LHM- 2,000	2,000	DF-02
LHM- 6,000	6,000	DF-02
LHM-10,000	10,000	DF-02

High Pass Filters

attenuation ≧30 Db at .67 x Fc ≧40 Db at .5 Fc

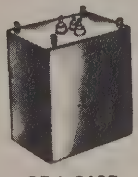
IBM- 400	400	DF-02
IBM- 500	500	DF-02
IBM- 700	700	DF-02
IBM- 800	800	DF-02
IBM- 900	900	DF-02
IBM- 1,000	1,000	DF-02
IBM- 1,500	1,500	DF-02
IBM- 2,000	2,000	DF-01
IBM- 3,000	3,000	DF-01
IBM- 5,000	5,000	DF-01
IBM- 7,200	7,200	DF-01
IBM-10,000	10,000	DF-01
IBM-12,000	12,000	DF-01
IBM-15,000	15,000	DF-01
IBM-30,000	30,000	DF-01
IBM-57,600	57,600	DF-01

LBM- 300	300	DF-02
LBM- 400	400	DF-02
LBM- 600	600	DF-02
LBM- 800	800	DF-02
LBM- 1,000	1,000	DF-01
LBM- 1,500	1,500	DF-01
LBM- 2,000	2,000	DF-01
LBM- 3,000	3,000	DF-01
LBM- 7,200	7,200	DF-01
LBM-10,000	10,000	DF-01
LBM-14,400	14,400	DF-01
LBM-20,000	20,000	DF-01
LBM-28,800	28,800	DF-01

Band Pass Filters

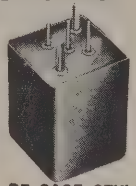
attenuation ≧35 Db at 0.5 x Fc and 2 x Fc

ALL MINIATURE FILTERS ARE SUPPLIED IN DF-1 CASE



DF-1 CASE

Height: 2½″
Width: 1 11/16″
Depth: 1 3/16″
Mtg. Cen.: 1¼″x¾″
Studs: 4 6-32x⅜″
Knockout: ⅞″ dia.



DF CASE STYLE
DF-01

Height: 1⅜″
Width: ¾″
Depth.: ¾″
Mtg. Cen.: 9/16″ Diag.
Studs: 2 ÷ 4-40

DF-02

Height: 1⅜″
Width: 1″
Depth.: 1″
Mtg. Cen.: ¾″ Diag.
Studs: 2 ÷ 4-40

DF-03

Height: 1¾″
Width: 1″
Depth.: 1″
Mtg. Cen.: ¾″
Studs: 2 ÷ 4-40

SUBMINIATURE TELEMETERING BAND PASS FILTERS

Type No.	Center Frequency Fo - in Hz	Band Width <3DB	Stop Band Attenuation
MTN-.4	.4	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-.56	.56	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-.73	.73	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-.96	.96	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-1.3	1.3	±7½%	≧38 DB @ 1.75 & .58 Fo
MTN-1.7	1.7	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-2.3	2.3	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-3.0	3.0	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTH-3.9	3.9	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-5.4	5.4	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-7.35	7.35	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTH-10.5	10.5	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-14.5	14.5	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-22	22	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-30	30	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-40	40	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-52.5	52.5	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-70	70	±7½%	≧ 38 DB @ 1.75 & .58 Fo
MTN-22	22	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-30	30	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-40	40	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-52.5	52.5	±15%	≧ 40 DB @ 2.5 & .4 Fo
MTW-70	70	±15%	≧ 40 DB @ 2.5 & .4 Fo

DF-01	CASE SIZES	DF-02
¾ x ¾ x 1⅜		1 x 1 x 1⅜
MTN-2.3 Thru MTW-70		MTN-4 Thru MTN 1.7

NULL "T" FILTERS
SERIES 1950

Standard models are available for 30, 60 and 120 cycles in a wide range of impedances. Each network will give a minimum of 50 db attenuation at the null frequency.

The null frequency is adjusted to a tolerance of ±2%.

All Null T Filters are hermetically sealed.

Prices on request.

Catalog No.	Frequency
NTF- 30	30 Hz
NTF- 60	60 Hz
NTF-120	120 Hz

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST., RIDGEWOOD, N.Y. 11385

FREED TRANSFORMER CO., INC.

TOROIDAL INDUCTORS

Using the latest developments in the field of magnetic materials and new impregnation and molding techniques the Freed Transformer Co. makes available to the industry the most extensive line of toroidal inductors.

Freed toroids are available in three types of constructions. Open units coated with a special high temperature extremely low loss compound, hermetically sealed in metal cases or molded in special **Freed Epoxy Resin.** Both hermetically sealed and molded units meet the latest military specification MIL-T-27A(graded 1 or 4 and 2 or 5 respectively.)Freed toroidal inductors are supplied with either molypermalloy or carbonyl iron powder cores

1. Temperature Stabilization:

The molypermalloy and carbonyl iron powder cores have a temperature coefficient of inductance. Depending on the degree of temperature stabilization the cores have different temperature coefficients. The degree of stabilization is denoted by a two-letter code.

SF Non-stabilized cores, ±2½% inductance variations from —55°C to +85°C.
SN Non-stabilized cores, +2% inductance variations from —55°C to +85°C.
SE Temperature stabilized cores, +0.1% to —0.4% inductance variations from —1.5°C to +54°C.
SB Temperature stabilized cores, ±0.1% inductance variations from +13°C to +35°C.
SD Temperature stabilized cores, ±0.1% inductance variations from —1.5°C to +54°C.
SW Temperature stabilized cores, ±0.25% inductance variations from —54°C to +85°C.
SM Temperature stabilized cores, ±.25% —65°C to +125°C.
SP Temperature stable carbonyl iron cores, ±0.3% inductance variations from —55°C to +85°C.

The temperature (stabilization) coefficient of an inductor will depend upon the nominal inductance value, operating frequency and A.C. voltage across the coil. Under some unfavorable working conditions the temperature coefficient of inductance corresponding to a given stability characteristic may be exceeded.

Toroids with special requirements such as tapped toroids, toroidal transformers, molded and cased units with dimensions other than standard sizes and high temperature toroids can be supplied on request. Our engineering and laboratory facilities are available for consultation, research and development.

TOROIDAL INDUCTORS

Type	Ω/H	Max. Norm. Idc	Max. Norm. Iac	Max. Norm. Vac	Uncased	Mold	Case	Frequency
TI- 1	70	55	73.5	0.46	OS-8	MR-6	DT-3, DT-5	1–15 KHz
TI- 1A	68	75	90.5	0.57	OS-9	MR-7	DT-4	1–15 KHz
TI- 2	160	90	135	0.85	OS-6	MR-5	DT-3, DT-5	10–50 KHz
TI- 3	600	100	67	0.42	OS-6	MR-5	DT-3, DT-5	50–200 KHz
TI- 3A	310	150	240	1.5	OS-10	MR-8	DT-4	50–200 KHz
TI- 4	110	55	67	0.42	OS-5	MR-4	DT-2, DM-11	1–15 KHz
TI- 5	260	28	35	0.22	OS-3	MR-3	DT-1, DM-2	1–15 KHz
TI- 6	230	75	125	0.80	OS-10	MR-8	DT-4	10–50 KHz
TI- 7	480	40	53	0.33	OS-3	MR-3	DT-1, DM-2	10–50 KHz
TI- 8	1,500	50	80	0.5	OS-3	MR-3	DT-1, DM-2	30–75 KHz
TI- 9	150	200	240	1.5	OS-10	MR-3	DT-4	30–75 KHz
TI-10	430	125	270	1.7	OS-7	MR-5	DT-3, DT-5	30–75 KHz
TI-11	30	120	190	1.2	OS-11	MR-10	DT-4	1–15 KHz
TI-12	45	100	160	1	OS-9	MR-8	DT-4	1–15 KHz
TI-13	55	140	175	1.1	OS-9	MR-8	DT-4	10–50 KHz
TI-14	580	150	—	—	OS-5	MR-4	DT-2, DM-11	10–100 KHz
TI-15	900	100	—	—	OS-3	MR-3	DT-1, DM-2	10–100 KHz
TI-16	600	16	21	0.13	OS-1	MR-1, MS-1	DST-1	1–15 KHz
TI-17	1,200	20	29	0.18	OS-1	MR-1, MS-1	DST-1	10–50 KHz
TI-18	2,600	30	40	0.25	OS-1	MR-1, MS-1	DST-1	30–75 KHz
TI-19	4,500	25	29	0.18	OS-I	MR-1, MS-1	DST-1	50–200 KHz
TI-20	2,750	100	*	*	OS-4	MR-3A	DT-2	20KHz–2MHz
TI-21	1,200	350	*	*	OS-1	MR-1, MS-1	DT-1	100KH –10MHz
TI-22	5,600	210	*	*	OS-2	MR-2	DT-1	50KHz–5MHz
TI-23	7,000	250	*	*	OS-2	MR-2	DT-1	50KHz–5MHz
TI-24	330	15	18	0.11	OS-1	MR-1, MS-1	DST-1	200Hz–12KHz
TI-25	200	20	24	0.15	OS-12	MR-2	DT-1	200Hz–12KHz
TI-26	150	25	32	0.20	OS-3	MR-3	DT-1, DM-3	200Hz–12KHz
TI-27	76.5	50	62	0.39	OS-5	MR-4	DT-2, DM-11	200Hz–12KHz
TI-28	48.5	50	64	0.40	OS-8	MR-6	DT-3, DT-5	200Hz–12KHz
TI-29	33.5	70	88	0.55	OS-9	MR-7	DT-4	200Hz–12KHz
TI-30	28	100	135	0.84	OS-9	MR-8	DT-4	200Hz–12KHz
TI-31	19.5	100	136	0.85	OS-11	MR-10	DT-4	200Hz–12KHz
TI-32	48.5	6	14.5	0.09	OS-3	MR-3	DT-1, DM-2	100Hz–10KHz
TI-33	2,150	8	13	0.08	OS-13	MR-11	DT-6	1–15 KHz
TI-34	1,700	8	9.5	0.06	OS-14	MR-11	DT-6	1–15 KHz
TI-35	4,100	10	18	0.11	OS-13	MR-11	DT-6	10–50 KHz
TI-36	3,950	10	11	0.07	OS-14	MR-11	DT-6	10–50 KHz
TI-37	23.5	10	32	0.20	OS-5	MR-14	DT-2, DM-11	100Hz–10KHz
TI-38	100	4	9.5	0.06	OS-1	MR-1, MS-1	DST-1	100Hz–10KHz

*TI-20 through TI-23 have a very low voltage coefficient and inductance will change very little with voltage. Because of high frequency application, the maximum voltage is limited rather by breakdown than by saturation.

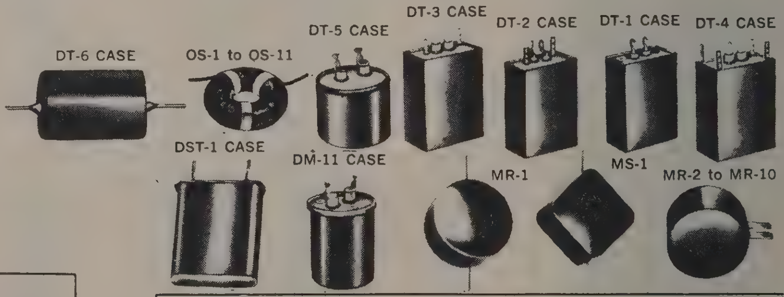
$$\text{Normalized } V_{AC} = \frac{V}{F}\,\frac{1}{\sqrt{L_H}}$$

$$\text{Normalized } I_{AC} = I_{AC}\sqrt{L_H}$$

$$\text{Normalized } I_{DC} = I_{DC}\sqrt{L_H}$$

where F —operating frequency in Hz
L_H —inductance in henries
Iac—A.C. current in MA
Idc—D.C. current in MA
V —A.C. voltage across the core

CASED, UNCASED AND MOLDED UNITS



UNCASED		
Type	O.D.	Hi.
OS-1	5/8″	5/16″
OS-2	7/8″	3/8″
OS-3	1″	3/8″
OS-4	1″	9/16″
OS-5	1 5/16″	5/8″
OS-6	1 5/8″	7/8″
OS-7	1 11/16″	5/8″
OS-8	1 7/8″	11/16″
OS-9	2 1/4″	1 1/8″
OS-10	2 3/8″	1 1/4″
OS-11	2 5/8″	1 1/8″
OS-12	13/16″	3/8″
OS-13	3/8″	1/4″
OS-14	7/16″	7/32″

MOLDED			
Type	O.D.	Hi.	Clearance Hole Mounting
MR-1	7/8″	13/32″	Pig Tails
MR-2	1 1/16″	1/2″	No. 4
MR-3	1 3/16″	1/2″	No. 6
MR-3A	1 3/16″	11/16″	No. 6
MR-4	1 1/2″	3/4″	No. 8
MR-5	1 7/8″	1″	No. 8
MR-6	2 1/8″	7/8″	No. 8
MR-7	2 3/8″	1 5/16″	No. 10
MR-8	2 1/2″	1 3/8″	No. 10
MR-9	2 5/8″	1 7/16″	No. 10
MR-10	2 7/8″	1 3/8″	No. 10
MR-11	7/16″	1/4″	Pig Tails
MS-1	25/32″x25/32″	13/32″	Pig Tails

CASED							
Type	Hi.	Dia.	Length	Width	Mtg.	Mtg. Cen.	Cutout
DT-1	1 7/32″		1 1/16″	1/2″	2 4-40 inserts	3/4″	5/16″ x 1/2″
DT-2	1 3/4″		1 7/16″	13/16″	2 6-32 studs	7/8″ x 9/32″	3/8″ x 11/16″
DT-3	2″		1 25/32″	7/8″	2 6-32 studs	1 1/4″ x 3/8″	3/8″ x 3/4″
DT-4	3 1/8″		2 3/4″	1 5/16″	4 8-32 studs	2 1/16″ x 11/16″	3/4″ x 3/8″
DT-5	1 3/16″	1 13/16″			2 6-32 inserts	1 1/8″	3/8″ x 1″
DT-6	5/8″	1/2″			Pig Tails		
DM-2	1″	1 1/8″			2 4-40 inserts	5/8″	3/8″ x 7/8″
DM-11	1 1/2″	1 3/8″			2 6-32 inserts	7/8″	3/8″ x 7/8″
DST-1	25/32″		3/4″	11/32″	1/4″ long pins	To fit 1/2″ crystal socket	

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST., RIDGEWOOD, N.Y. 11385

FREED TRANSFORMER CO., INC.

COMMERCIAL GRADE COMPONENTS

These components are designed to meet the demand for low-cost replacement parts for commercial electronic equipment.

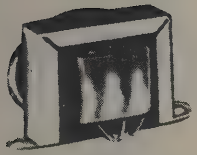
The best commercially available materials have been utilized in the design of these units, to insure reliability and excellent performance characteristics. Vacuum impregnation with a non-hygroscopic varnish to prevent penetration of humidity are employed to give these units long life and trouble-free performance.

230-115 V, 50-60 C.P.S. Stepdown Transformers rated from 25 V A up to 5,000 V A Rating and line booster transformers are included in this series.

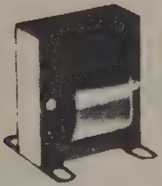
All units, with only a few exceptions, are uncased or of shell-type construction.

Isolation transformers and Stepdown transformers are equipped with line cord and receptacle.

DC

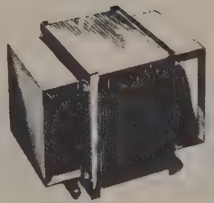


CH

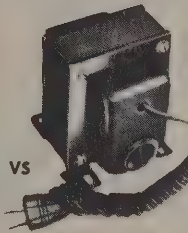


FV

Case No.	Height	Width	Depth	Mtg. Centers	Mtg. Studs
DC2B	3½	2⅝	2¼	2x1¾	(4)8-32
DC4A	3¾	3⅛	3	2½x2½	(4)8-32
DC5C	4⅞	4⅛	3½	3⅛x2⅝	(4)10-32
DC6A	4⅞	5	4⅛	3¾x3	(4)10-32
CH60	2	3¼	1¾	2 13/16	(2)3/16
CH62	2	3¼	2⅛	2 13/16	(2)3/16
CH70	2 5/16	3 11/16	2¼	3⅛	(2)3/16
CH80	2⅝	4	2⅝	3 9/16	(2)3/16
FV10	3 1/16	2½	2 9/16	2x2	(4)13/64x21/64
FV12	3 1/16	2½	2 11/16	2x2⅛	(4)13/64x21/64
FV22	3 7/16	2 13/16	2⅞	2¼x2¼	(4)3/16x⅜
FV30	4 1/32	3⅛	3	2½x2¼	(4)13/64x21/64
HB718	6¼	6½	8½	4¾x4½	(4)9/32x21/32
HB728	6¼	6½	9¾	4¾x5¾	(4)9/32x21/32
VS401	3 9/16	2 15/16	3¼	2¼x1 15/16	(4)3/16x⅜
VS501	3 29/32	3¼	3⅜	2½x2 1/16	(4)3/16x⅜
VS503	3 29/32	3¼	3⅝	2½x2 5/16	(4)3/16x⅜
VS601	4 21/32	3⅞	3⅝	3x2 7/16	(4)3/16x⅜
VS603	4 21/32	3⅞	3⅞	3x2 11/16	(4)3/16x⅜
VS604	4 21/32	3⅞	4	3x2⅞	(4)3/16x⅜
VS611	4 21/32	3⅞	4⅞	3x3 11/16	(4)3/16x⅜
VS612	4 21/32	3⅞	5	3x3 13/16	(4)3/16x⅜
VS706	5 7/16	4 9/16	5½	3½x3¾	(4)3/16x⅜
VS714	5 7/16	4 9/16	6½	3½x4¾	(4)3/16x⅜
VS718	5 7/16	4 9/16	7	3½x5¼	(4)9/32x21/32
VS728	5 7/16	4 9/16	8¼	3½x6½	(4)3/16x⅜



HB



VS

FILAMENT TRANSFORMERS

All primaries are for 115V, 50/60 c.p.s.

Catalog No.	Secondary Voltage	Secondary Current Amps	Secondary Test Voltage RMS	Case Size
TF 1	2.5 (C.T.)	7.5	1500	CH60
TF 2	2.5 (C.T.)	10	1500	CH70
TF 3	2.5 (C.T.)	5	7500	DC2B
TF 4	2.5 (C.T.)	10	7500	DC4A
TF 5	5.0 (C.T.)	4	1500	CH60
TF 6	5.0 (C.T.)	6	1500	CH70
TF 7	5.0 (C.T.)	10	1500	CH80
TF 8	5.0 (C.T.)	10	1500	FV10
TF 9	5.0 (C.T.)	20	2500	FV30
TF 10	5.0 (C.T.)	20	10,000	DC6A
TF 11	6.3 (C.T.)	1.35	1500	CH50
TF 12	6.3 (C.T.)	3	1500	CH60
TF 13	6.3 (C.T.)	5	1500	CH70
TF 14	6.3 (C.T.)	7	1500	FV12
TF 15	6.3 (C.T.)	10	1500	FV22
TF 16	10 (C.T.)	5	2500	CH80
TF 17	10 (C.T.)	5	2500	FV10
TF 18	10 (C.T.) or 11 (C.T.) (tapped primary)	12 or 11	7500	DC-5C
TF 19	12.6 (C.T.)	2	1500	CH62

TF 3, 4, 10 & 18 supplied with terminals. All others with leads.

AUTO TRANSFORMERS

To be used as step-down transformer. Equipped with standard receptacle and line cord.

Catalog No.	Transformation	VA Rating	Weight (lbs.)	Case Size
SDT 1*	230/115 V. 50/60 c.p.s.	25	1	CH-60
SDT 2*	230/115 V. 50/60 c.p.s.	50	1¼	CH-62
SDT 3	230/115 V. 50/60 c.p.s.	50	2½	VS-300
SDT 4	230/115 V. 50/60 c.p.s.	100	3	VS-401
SDT 5	230/115 V. 50/60 c.p.s.	200	5	VS-501
SDT 6	230/115 V. 50/60 c.p.s.	300	6½	VS-601
SDT 7	230/115 V. 50/60 c.p.s.	400	8	VS-604
SDT 8	230/115 V. 50/60 c.p.s.	500	11	VS-611
SDT 9	230/115 V. 50/60 c.p.s.	750	15	VS-706
SDT 10	230/115 V. 50/60 c.p.s.	1000	23	VS-718
SDT 11	230/115 V. 50/60 c.p.s.	1500	29½	VS-728
SDT 12*	230/115 V. 50/60 c.p.s.	2000	37	HB-718

*Supplied with leads without line cord and receptacle

ISOLATION TRANSFORMERS

Electrostatic shield between primary and secondary. Equipped with standard receptacle and line cord.

Catalog Number	Primary Voltage 50/60 c.p.s.	Secondary Voltage	VA Rating	Case Size
IT 1	115	115	50	VS-401
IT 2	115	115	100	VS-503
IT 3	115	115	300	VS-700
IT 4	115	115	500	VS-714
IT 5*	220/440	110/220	250	VS-612
IT 6*	220/440	110/220	500	VS-714

*Supplied with leads without line cords and receptacle.

MCV – CONSTANT VOLTAGE TRANSFORMERS – MCV

(FERRO-RESONANT TRANSFORMERS)

The MCV line of constant voltage transformers provides accurate regulation against line and/or load variations, without the use of tubes or moving parts.

Input Voltage Range 95 to 130

Rated output within ± 2% of nominal value. Regulation automatically maintained within ± 1%. Regulation from 25% to full load ± 2%.

- MILITARY SPECIFICATIONS
- NO TUBES
- COMMERCIAL
- NO MOVING PARTS
- ACCURATE REGULATIONS
- FAST RESPONSE
- FULLY AUTOMATIC
- SUPPLIED WITH CONDENSERS

Reg. Output in R.M.S. Volts	Output in V.A. P.F-1	CATALOG NUMBERS			
		60 Cycles		400 Cycles	
		Comm.	Military*	Comm.*	Military*
115	5	MCV65LC	MCV65LM	MCV45LC	MCV45LM
115	25	MCV625LC	MCV625LM	MCV425LC	MCV425LM
115	75	MCV675LC	MCV675LM	MCV475LC	MCV475LM
115	125	MCV6125LC	MCV6125LM	MCV4125LC	MCV4125LM
115	175	MCV6175LC	MCV6175LM	MCV4175LC	MCV4175LM
115	250	MCV6250LC	MCV6250LM	MCV4250LC	MCV4250LM
115	375	MCV6375LC	MCV6375LM	MCV4375LC	MCV4375LM
115	500	MCV6500LC	MCV6500LM	MCV4500LC	MCV4500LM
115	750	MCV6750LC	MCV6750LM	MCV4750LC	MCV4750LM
115	1000	MCV61000LC	MCV61000LM	MCV41000LC	MCV41000LM
26	5	MCV654FC	MCV654FM	MCV454FC	MCV454FM
26	25	MCV6254FC	MCV6254FM	MCV4254FC	MCV4254FM
26	75	MCV6754FC	MCV6754FM	MCV4754FC	MCV4754FM
26	125	MCV61254FC	MCV61254FM	MCV41254FC	MCV41254FM
6.4	5	MCV65FC	MCV65FM	MCV45FC	MCV45FM
6.4	25	MCV625FC	MCV625FM	MCV425FC	MCV425FM
6.4	75	MCV675FC	MCV675FM	MCV475FC	MCV475FM
6.4	125	MCV6125FC	MCV6125FM	MCV4125FC	MCV4125FM

*Condensers are not provided with units. Where condensers are provided they are external to units

AVAILABLE UPON REQUEST MAGNETIC AMPLIFIERS AND SATURABLE TRANSFORMERS

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST., RIDGEWOOD, N.Y. 11385

EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

The Hammond Alternative For Electronic Transformers

Series 107, 108, 109 PC mounted audio transformers

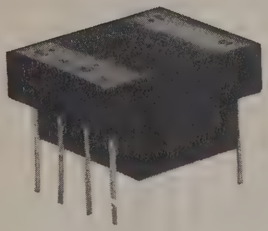
Features

- These P.C. mounted audio transformers are designed to meet rugged commercial requirements at low cost.
- Transformers are moisture resistant and will also resist most industrial solvents.
- Pins are brass with solder plate and will withstand soldering for 10 seconds at 260° C.

Series 1536 and 1537 RF Chokes

Features

- This series of R.F. filter chokes is ideally suited for power supply filtering applications.
- The coils are designed to offer a relatively high inductance and high current.
- Customers can expect high quality from this Hammond Manufacturing line of R.F. chokes.



Series 600-602; 630, 631, 632, 640, 641 Pulse and Trigger Transformers

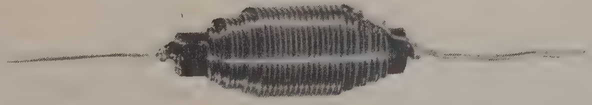
Features

600-602

- Suitable for computer and data process applications.
- Moulded epoxy case, p.c. mountable.

630-632

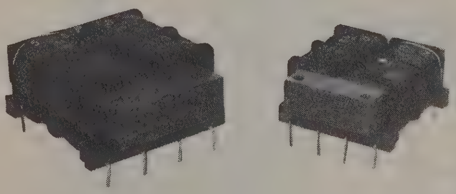
- Specially designed to trigger Thyristors and Triacs.
- Encapsulated in plastic case, p.c. mountable.
- Recommended operating class 600V.



640-641

- Designed for S.C.R. and Triac triggering.
- Moulded into case with epoxy resin, p.c. mountable.
- Recommended operating class 600V.

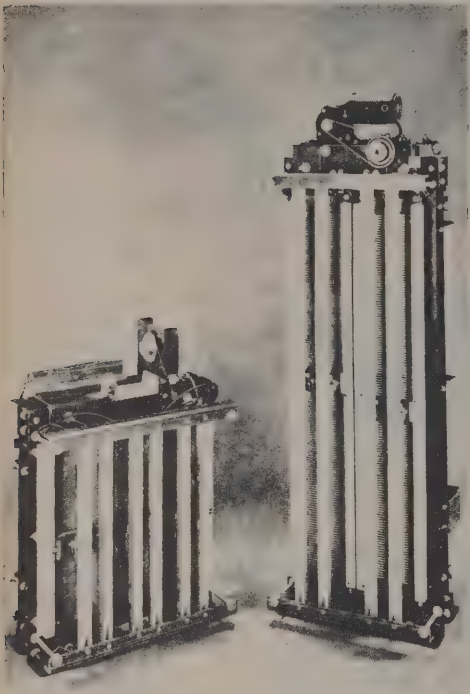
- Primaries 115/230 volts, 50/60 Hz.
- Due to physical separation of primary and secondary windings the need for electro-static shield has been eliminated and allows a 1750V RMS Hipot test on all models.
- Two-coil design provides balanced windings and low magnetic radiation.
- Ideally suited for power applications in solid state control and instrumentation, and isolated D.C. supplies requiring single or dual outputs.



And Many More . . . .
Hammond Manufacturing's 5C catalog contains a wide range of electronic transformers including: broadcast, power, pulse, trigger, transistor, reactor, rectifier and many many more stock transformers. Send for catalog 5C today.

HAMMOND MANUFACTURING™
1690 Walden Ave.
Buffalo, New York 14225
Phone: (716) 894-5710
Telex: 92-6452

THE PESCHEL VARIABLE TRANSFORMER ™



Front View

Back View

Hipotronics

AC VARIABLE TRANSFORMERS

480 Volt Input, Three Phase, Delta Connected

	KVA	Amps	Model
0-600 V Output	216	120	45A48-60D12
	324	180	45A48-60D18
	432	240	43A48-60D24
0-960 V Output	346	120	45A48-96D12
	518	180	45A48-96D18
	691	240	45A48-96D24

240 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-300 V Output	31	60	30A24-30Y6
	46	90	30A24-30Y9
	62	120	30A24-30Y12
	93	180	30A24-30Y18
	124	240	30A24-30Y24
	187	360	30A24-30Y36
0-480 V Output	50	60	30A24-48Y6
	75	90	30A24-48Y9
	100	120	30A24-48Y12
	150	180	30A24-48Y18
	200	240	30A24-48Y24
	300	360	30A24-48Y36

480 Volt Input, Three Phase, Wye Connected

	KVA	Amps	Model
0-600 V Output	62	60	30A48-60Y6
	94	90	30A48-60Y9
	125	120	30A48-60Y12
	187	180	30A48-60Y18
	249	240	30A48-60Y24
	374	360	30A48-60Y36
0-960 V Output	150	9	30A48-96Y9
	200	120	30A48-96Y12
	299	180	30A48-96Y18
	399	240	30A48-96Y24
	599	360	30A48-96Y36

240 Volt Input, Single Phase

	KVA	Amps	Model
0-300 V Output	27	90	30A24-30S9
	36	120	30A24-30S12
	54	180	30A24-30S18
	72	240	30A24-30S24
	108	360	30A24-30S36
	144	480	30A24-30S48
0-480 V Output	43	90	45A24-48S9
	57	120	45A24-48S12
	86	180	45A24-48S18
	115	240	45A24-48S24
	173	360	45A24-48S36
	230	480	45A24-48S48

480 Volt Input, Single Phase

	KVA	Amps	Model
0-600 V Output	54	90	30A48-60S9
	72	120	30A48-60S12
	108	180	30A48-60S18
	144	240	30A48-60S24
	240	360	30A48-60S36
0-960 V Output	86	90	45A48-96S9
	115	120	45A48-96S12
	173	180	45A48-96S18
	230	240	45A48-96S24
	346	360	45A48-96S36

HIPOTRONICS INC., DRAWER A, BREWSTER, NY 10509 ▪ 914-279-8091 ▪ TWX 710-574-2420

VARIABLE TRANSFORMER

THE PROBLEM:

Conventional variable transformers have been built for years by dozens of companies all over the world, all along the same lines. A core of transformer steel (typically toroidal) is wound with a layer of copper wire which has a bare surface track ground down to provide a contact area for a traversing carbon brush. The inherent design flaw is that to provide continuous contact while traversing, the brush shorts two turns of the coil. This creates a turn-to-turn short circuit in the transformer which, if not for the relatively high impedance winding, the resistance of the wire, and the voltage drop in the carbon brush, would cause overheating and ultimate failure in the coil and brush. This weakness precludes the manufacture of a large KVA unit. More KVA requires lower impedance, heavier wire (less resistance in the shorted turn loop) and larger mass of brush (less voltage drop). Each of these changes increases the shorted-turn circulating current to the point that elaborate cooling systems are required to prevent the device from self destructing. Therefore, manufacturers of conventional adjustable transformers have been limited to the relatively small sizes of 7.5KVA or 21KVA three phase, or the system must be oil cooled to remove the destructive heat. At power levels above 7.5 and 21KVA multiple units must be stacked, with all the resulting size, cost and manpower penalties.

THE SOLUTION:

The PESCHEL VARIABLE TRANSFORMER (PVT) has the same basic transformer steel core surrounded by a copper wire winding. However, the winding is done so that all odd turns compose one track and all even turns the other. Each nickel plated track is traversed by its own copper (not carbon) brush a few thousandths of an inch narrower than winding wire dimension. The two brushes are connected together through one or more sets of back-to-back diodes with a standard .6 volt forward voltage drop. Thus as long as the turn-to-turn voltage is less than 1.2 volts, no current can circulate. The .6 volt drop is insignificant (See Schematic #1).

The diodes are extremely inexpensive because there is no PIV requirement, the copper brushes are not only less expensive than carbon brushes, but provide much better conductivity, consequently, electrical losses which occur in carbon brushes are avoided.

The PVT also incorporates ampere balancing coils under the tapped winding. These balancing coils eliminate higher centerpoint or non-linear impedance characteristics found in single layer variable transformers.

Heat from diode drop/load current is minimal compared to the rating of the unit and is not dissipated on the core, but on the track hardware. Less heat generation allows considerably lengthened overload time ratings. Furthermore, the brush mechanism of the PVT has significantly less mass than the brush mechanism of conventional ganged units, allowing smaller drive motors and/or much faster traverse speeds.

If line isolation or step-up or step-down voltages are required a primary is inserted under the tapped winding. This eliminates the need for an extra transformer and simultaneously reduces wasted power.

DC OUTPUT: If the same blocking diodes (with appropriate higher PIV) on the AC machine are connected in a bridge circuit, output is a continuously adjustable DC voltage. (See Schematic #2).

Analysis of the schematic shows turn-to-turn current is precluded from circulating by the drop of the two diodes and the load resistance. Two extra diodes are required in a single phase bridge, six in three phase, but the cost of the diodes are insignificant when compared to SCR's and associated firing circuits. The advantages of the PVT over an SCR controller are many. The cost per horsepower within a certain range (like 5 to 100HP) should be less. Maintenance is greatly simplified. Since the PVT is an electro-mechanical device, plant maintenance people can see the problem whereas modern electronic controllers are "Black Boxes" beyond the technical capabilities of most plant electricians. Electro-magnetic interference caused by high frequencies generated by SCR turn-on is eliminated and output voltages, other than rectified line voltage, are easily obtained without an additional transformer.

CONCLUSION:

The invention of the PVT eliminates the one inherent flaw in existing variable transformer design and permits manufacture of **any size** for **any voltage.**

PESCHEL VARIABLE TRANSFORMER

Hipotronics

USES:

- DC Motor Speed Controller
- Chemical Processes
- Electro-Magnets
- Electropainting

ADVANTAGES:

- No Electronics
- No Waveshape Chopping
- No Effect on Power Factor
- No EMI
- Same Ripple, Any Voltage

DC VARIABLE TRANSFORMERS

DC Output, Insulated Primary, Three Phase, Full Wave Bridge

Output Voltage	Amps	KW	Model	Input Voltage
300	50	15	D30A24P-30Y5	240
500	50	25	D30A24P-50Y5	240
750	50	30	D30A24P-750Y5	240
1000	50	50	D60A24P-100Y5	240
2500	50	125	D60A48P-250Y5	480
5000	50	250	D60A48P-500Y5	480
10000	50	500	D60A48P-1000Y5	480
20000	50	1000	D60A416P-2000Y5	4160
40000	50	2000	D60A416P-4000Y5	4160

Output Voltage	Amps	KW	Model	Input Voltage
300	90	27	D30A24P-30Y9	240
500	90	45	D30A24P-50Y9	240
750	90	67.5	D30A24P-750Y9	240
1000	90	90	D60A24P-100Y9	240
2500	90	225	D60A48P-250Y9	480
5000	90	450	D60A48P-500Y9	480
10000	90	900	D60A48P-1000Y9	480
20000	90	1800	D60A416P-2000Y9	4160
40000	90	3600	D60A416P-4000Y9	4160

HIPOTRONICS INC., DRAWER A, BREWSTER, NY 10509 ▪ 914-279-8091 ▪ TWX 710-574-2420

Hipotronics

TRANSFORMERS "RM" SERIES

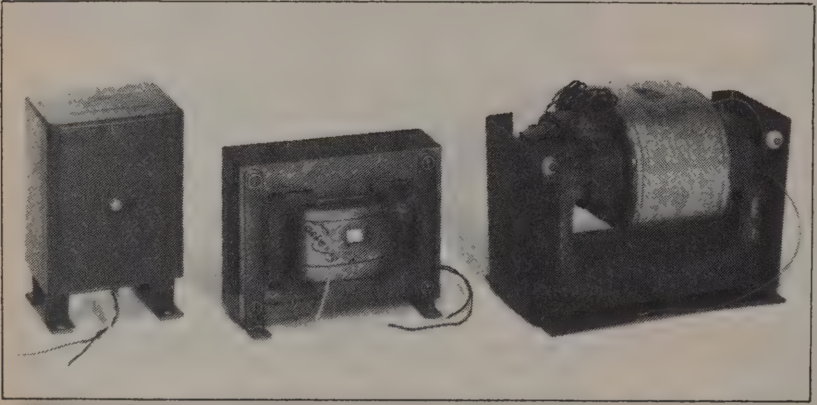
Hipotronics RM Series of high quality transformers are basically designed for air or oil envirnoment. Models RM 17-3, RM 21-3 & RM 25-3 are manufactured for oil environment only.

Models RM 6-1, RM 7-1, RM 8-1, RM 9-1 and RM 10-1 are available manufactured in an epoxy incloser on special request.

TECHNICAL DATA

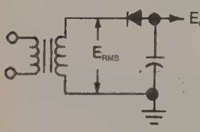
INPUT—117 VOLTS AC
FREQUENCY—TYPE A&C—50/60 Hz TYPE B—60 Hz
OUTPUT CURRENT—15mA AT RATED RMS OUTPUT.

Model Number	Type	Secondary Volts	Half Wave Rectifier (5 mA)	Full Wave Bridge (10 mA)	Full Wave Doubler (5 mA)	Secondary VA	Insulation Primary to Secondary
RM1-1	A	1 kV	1.2 kV	1.2 kV	2.4 kV	15	5 kV
RM1-2	B	1 kV	1.2kV	1.2 kV	2.4	15	5 kV
RM1.5-1	A	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM1.5-2	B	1.5 kV	1.8 kV	1.8 kV	3.6	23	5 kV
RM2-1	A	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2-2	B	2 kV	2.4 kV	2.4 kV	4.8	30	6 kV
RM2.5-1	A	2.5 kV	3 kV	3 kV	6	38	6 kV
RM2.5-2	B	2.5 kV	3 kV	3 kV	6	38	6 kV
RM3-1	A	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3-2	B	3 kV	3.6 kV	3.6 kV	7	45	8 kV
RM3.5-1	A	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM3.5-2	B	3.5 kV	4.2 kV	4.2 kV	8	53	10 kV
RM4-1	A	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4-2	B	4 kV	4.8 kV	4.8 kV	9.5	60	10 kV
RM4.5-1	A	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM4.5-2	B	4.5 kV	5.5 kV	5.5 kV	10.5	68	12 kV
RM5-1	A	5 kV	6 kV	6 kV	12	75	12 kV
RM5-2	B	5 kV	6 kV	6 kV	12	75	12 kV
RM6-1	A	6 kV	7 kV	7 kV	14	90	14 kV
RM7-1	A	7 kV	8 kV	8 kV	16	105	15 kV
RM8-1	A	8 kV	9.5 kV	9.5 kV	19	120	17 kV
RM9-1	A	9 kV	10.5 kV	10.5 kV	21	135	20 kV
RM10-1	A	10 kV	12.5 kV	125 kV	24	150	24 kV
RM12.5-3	C	12.5 kV	15 kV	15 kV	30	188	28 kV
RM17-3	C	17 kV	20 kV	20 kV	40	255	32 kV
RM21-3	C	21 kV	25 kV	25 kV	50	315	45 kV
RM25-3	C	25 kV	30 kV	30 kV	60	375	54 kV



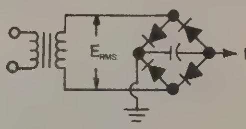
DC RECTIFER CIRCUITS FOR LISTED TRANSFORMERS

HALF WAVE RECTIFIER
(COLUMN 5 ABOVE)



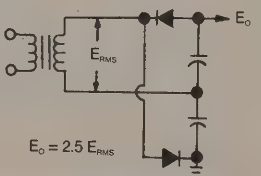
$E_o = 1.25\ E_{RMS}$

FULL WAVE BRIDGE
(COLUMN 6 ABOVE)

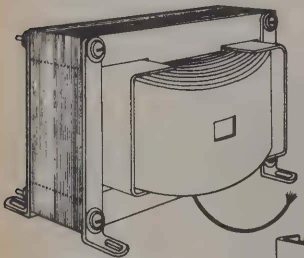


$E_o = 1.25\ E_{RMS}$

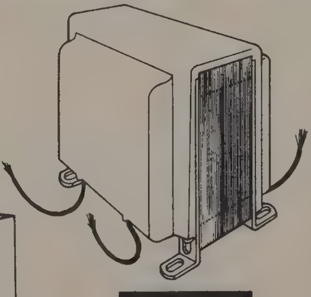
FULL WAVE DOUBLER
COLUMN 7 ABOVE)



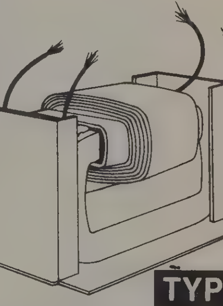
$E_o = 2.5\ E_{RMS}$



TYPE A



TYPE B



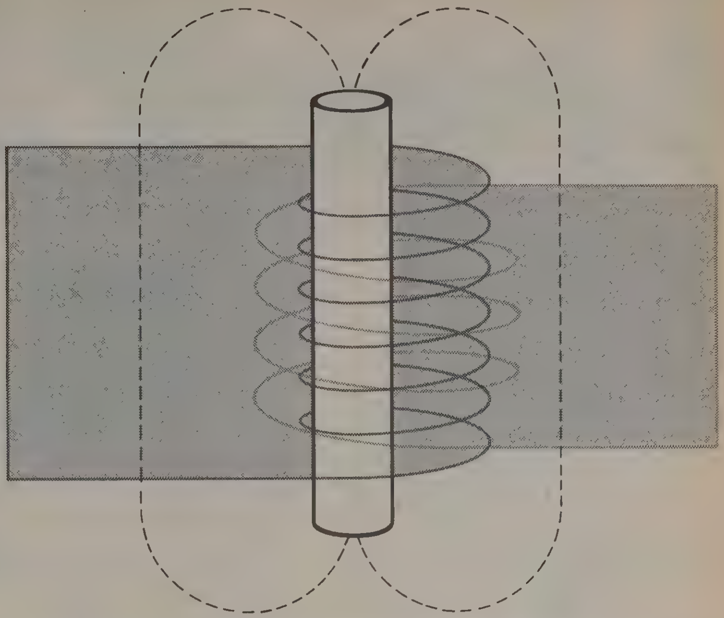
TYPE C

DIMENSIONAL DATA

Model Number	Dimensions A in. (mm)	B in. (mm)	C in. (mm)	Weights lbs. (kg)
RM1-1	2 13/16 (71)	3 (76)	2 1/4 (57)	2 (.9)
RM1-2	3 1/16 (77)	2 7/8 (73)	2 3/8 (60)	2 1/2 (1.1)
RM1.5-1	2 13/16 (71)	3 3/8 (86)	2 3/8 (60)	3 (1.4)
RM1.5-2	3 1/16 (77)	2 7/8 (73)	2 3/8 (60)	2 1/2 (1.1)
RM2-1	2 13/16 (71)	3 3/8 (86)	2 3/8 (60)	3 (1.4)
RM2-2	3 1/16 (77)	2 7/8 (73)	2 3/8 (60)	2 1/2 (1.1)
RM2.5-1	3 3/8 (86)	3 3/4 (95)	2 7/16 (62)	3 1/2 (1.6)
RM2.5-2	3 1/16 (77)	2 7/8 (73)	2 3/8 (60)	2 1/2 (1.1)
RM3-1	3 3/8 (86)	3 3/4 (95)	2 7/16 (62)	3 1/2 (1.6)
RM3-2	3 1/16 (77)	2 7/8 (73)	2 3/8 (60)	2 1/2 (1.1)
RM3.5-1	3 3/8 (86)	3 3/4 (95)	2 7/8 (73)	3 3/4 (17)
RM3.5-2	4 1/8 (105)	3 1/8 (79)	2 3/8 (60)	3 3/4 (17)
RM4-1	4 (101)	4 1/2 (114)	3 1/8 (79)	6 (2.7)
RM4-2	4 1/8 (105)	3 1/8 (79)	2 3/8 (60)	3 3/4 (17)
RM4.5-1	4 (101)	4 1/2 (114)	3 1/8 (79)	6 (2.7)
RM4.5-2	4 1/8 (105)	3 1/8 (79)	2 3/8 (60)	3 3/4 (17)
RM5-1	4 (101)	4 1/2 (114)	3 1/4 (83)	6 1/8 (28)
RM5-2	4 1/8 (105)	3 1/8 (79)	2 3/8 (60)	3 3/4 (17)
RM6-1	4 (101)	4 1/2 (114)	3 3/8 (86)	6 1/4 (28)
RM7-1	4 1/2 (114)	5 3/4 (146)	3 1/16 (78)	8 3/4 (40)
RM8-1	4 1/2 (114)	5 3/4 (146)	3 3/16 (81)	9 (4.0)
RM9-1	4 1/2 (114)	5 3/4 (146)	3 5/16 (84)	9 1/2 (4.3)
RM10-1	4 1/2 (114)	5 3/4 (146)	3 1/2 (89)	11 3/4 (53)
RM12.5-3	5 3/8 (137)	7 5/8 (194)	4 1/2 (114)	18 3/4 (85)
RM17-3	5 5/8 (142)	7 5/8 (194)	4 1/2 (114)	19 1/2 (87)
RM21-3	5 3/4 (146)	7 5/8 (194)	4 1/2 (114)	19 3/4 (90)
RM25-3	6 (152)	7 5/8 (194)	5 (127)	20 1/4 (92)

HIPOTRONICS INC., DRAWER A, BREWSTER, NY 10509 ■ 914-279-8091 ■ TWX 710-574-2420

Hisonic... specialists in custom and standard inductor and transformer components



The control of electric current is only as good as the components that carry it.

INDUCTORS: Our manufacturing capabilities are the result of experience dating back to 1950 and now include virtually every known construction your special applications may require . . . and at reasonable prices.

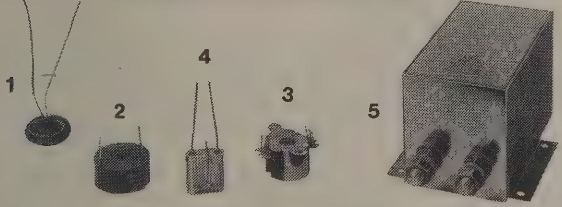
TRANSFORMERS: Hisonic's special power/converter and signal/matching transformers for both audio and wide video ranges are used in airborne comm/nav and ground communications systems. Included are toroidal, pot core, and laminated core types manufactured to commercial and MIL specifications. Our 30 year experience is at your disposal to help solve your transformer and inductor problems.

UNCASED **STANDARD MOLDED** **METAL CASED**

*Toroidal Series	Ind. Range	Max. Q	Freq. Range	DC R Ohms/MH	Uncased Size
J2	5.6MH to 3.3HY	90	Up to 30 KHZ	.50	.620D x .30H
J3	2.7 to 470MH	110	20 to 150KHZ	1.1	.620D x .30H
J4	.56 to 33MH	110	100 to 400KHZ	5.1	.620D x .30H
J5	.10 to 10MH	150	250KHZ to 1.5MHZ	8.9	.620D x .30H
R2	6.8MH to 6.8HY	135	Up to 20KHZ	.18	.960D x .40H
R3	3.3 to 470MH	180	10 to 60KHZ	.39	.960D x .40H
R4	1.2 to 68MH	170	40 to 160KHZ	.90	.960D x .40H
S2	6.8MH to 15HY	160	Up to 15KHZ	.10	1.250D x .62H
S3	3.3 to 560MH	225	10 to 60KHZ	.21	1.250D x .62H
T2	22MH to 39HY	210	Up to 15KHZ	.045	1.850D x .85H
V2	68MH to 68HY	245	Up to 8KHZ	.028	2.400D x .92H
W2	100MH to 100HY	260	Up to 6KHZ	.021	2.700D x 1.05H

*Write for Series Bulletins on electrical and case style details

EXAMPLE *CUSTOM INDUCTORS

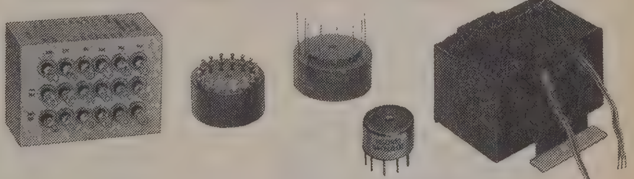


P/N	Fig.	Description	Characteristics	Type	Size
26-5103 Series	2	Encaps. PC Mtg.	See R Series Std.	Tor.	1.06x.5H
06-4000-27	1	DC Filter Choke	250uH@1.5ACD	Tor.	970Dx.4H
06-4000-39	3	Var. Ind. PC Mtg.	90-110MH Q250	Pot	.80Dx.5H
26-5034 Series	4	Xtal Case Mtg.	See J Series Std.	Tor.	.34x.75x.8H
26-5135-00	5	Shielded Choke	50uH@100ADC	Lam.	2.65x5x3H

*Advise requirements for recommended solution and quotation

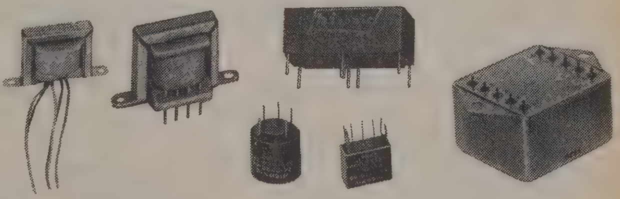
Hisonic, Inc.
249 N. Troost
Dept. EM-84
P.O. Box 1130
Olathe, Kansas 66061
PHONE: 913-782-0012
TELEX: 4-2562

EXAMPLE DC CONV/AC POWER



P/N	Input	OP Freq.	VA Rating	Output Volts Peak (or RMS)	Size
24-0170-10	10V DC	24KHZ	0.8	20CT	.28x .6x 48H
24-0193-10	14/28V DC	6KHZ	18	4.7.11.5CT.22.5CT.550	1.8 ODx .94H
06-2124-10	200 V L-L	400HZ-3ϕ	840	200L-L	4.3x3.9x2.1H
24-0107-10	14/28V DC	2KHZ	27	90/45CT.180/25.180/25	2.1 ODx .88H
24-0512-10	260V PK	100PPS	20KVA PK	4.6 KV PK PULSE	2.5x2.3x1.1H
24-0114-10	14/28V DC	400HZ	75	26.60	2.9 ODx1.5H
24-0271-10	14/28V DC	5KHZ	80	6.5CT.22.5CT.100.100	2.0x2.0x1.OH
24-0277-10	42V DC	10KHZ	200	100	2.0x2.5x1.2H
24-0177-10	10V AC	400HZ	2	1.4.1.4.10(RMS)	1.9 ODx .86H
24-0169-10	26V AC	400HZ	17	21/13CT(RMS)	1.0x1.4x1.3H
24-0215-10	115V AC	400HZ	180	20.27.27.42(RMS)	3.2x3.8x4.1H

EXAMPLE SIGNAL/PULSE/MATCH



P/N	Description	Impedance	Response	Level	Size
24-0239-11	Video Range Match	150:150.25	100KHZ-2.5MHZ	60mw	.63x.63x.44H
24-0275-10	Wide Band Match	135CT:1000	1KHZ-2MHZ	4mw	1.1 ODx.75H
24-0659-10	Syncro/Resolver	800 OHMS	400HZ	270mw	1.5x.75x.56H
24-0240-10	Wide Bank Hybrid	600.600+600	50HZ-50KHZ	1mw	1.8x2.0x1.0H
24-0171-10	Radio Freq. Hybrid	50.100+100	700KHZ-4MHZ	10mw	75 ODx85H
24-0153-10	Pulse Match	10K.40K	tp1.2ms.tr60us	25mw	.53x.53x.7H
24-0180-10	Pulse Output	5.600w/tap	tp.4us.tr.2us	6KW	1.5 ODx.8H

OTHER PRODUCTS: :(Mil Spec & Commercial) Filters — Transformers — Tuned Circuits — Amp/phase Equalizers — Lumped Constant Delay Lines

HITRAN

Division of AGEX

Key source for reliable magnetic components, power supplies and control systems for over 40 years.

300 VA TO 3000 KVA STANDARD & SPECIALTY MAGNETIC COMPONENTS

STANDARD TRANSFORMERS

DIT SERIES — Drive Isolation Transformers. (12-550KVA, U.L. Listed)

Designed to provide electrical isolation and voltage transformation for SCR adjustable-speed motor drives. Dry type. 600V class. Single phase and three phase. 50HZ and 60Hz. 5% FCAN and FCBN primary taps. Open frame or NEMA 1 enclosed, 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

- 1, 1½, 3, 5, 8, 12, 15, 20, 27, 30, 34

Three Phase

- 8, 12, 15, 20, 27, 34, 40, 51, 63, 75, 93, 120, 150, 180, 220, 280, 330, 440, 550, 660, 760, 870, 980, 1100.

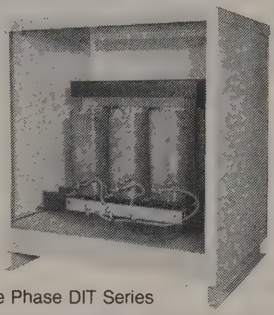
Standard Voltages Available

Single Phase

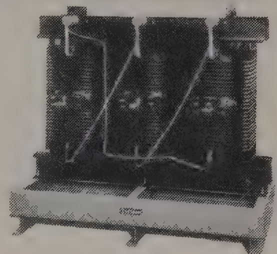
- Primary or Secondary 208, 230, 380, 460, 575, 230/460, 415

Three Phase

- Primary (△) 208, 230, 380, 460, 575, 230/460, 415
- Secondary 208Y/120, 230Y/133, 380Y/220, 460Y/266, 575Y/332, 230x460Y/133x266, 415Y/240



Three Phase DIT Series



1500KVA HVDT 15KV Class Transformer

GPT SERIES — General Purpose Transformers

Designed to provide electrical isolation and voltage transformation for lighting, electric heating and industrial motor loads. Dry type, 600V class, single phase and three phase, 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

- 3, 5, 7½, 10, 15, 25, 37½, 50, 75, 100, 167

Three Phase

- 3, 6, 9, 15, 30, 45, 60, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

Standard Voltages Available

Single Phase

- Primary (3KVA-15KVA) 240/480, 208, 277, 480, 600
(25KVA-167KVA) 240x480, 480, 600
- Secondary (All KVA sizes) 120/240

Three Phase

- Primary (△) 240, 480, 600
- Secondary 208Y/120, 240△, 480Y/277

HVDT SERIES—High Voltage Distribution Transformers

Designed for in-plant distribution and voltage step-down. Conventional dry type or resin cast coil. 5KV through 15KV class. Single phase and three phase. 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

- 3, 5, 10, 15, 25, 37½, 50, 75, 100, 167, 200, 250, 333, 500

Three Phase

- 15, 30, 45, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

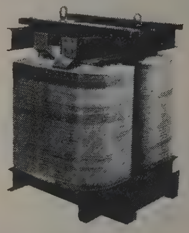
Standard Voltages Available

Single Phase

- Primary
5KV Class: 2400/4160Y
8.66KV Class: 4160/7200Y
15KV Class: 7200/12470Y
7620/13200Y, 7960/13800Y
- Secondary (All KVA Sizes)
120/240

Three Phase

- Primary (△)
5KV Class: 2400, 4160, 4800
8.66KV Class: 7200
15 KV Class: 12000, 12470, 13200, 13800
- Secondary
208Y/120, 240△,
480Y/277



DC Link Choke
4 mH at 1000 Adc
5 KV Class

SPECIALTY MAGNETIC COMPONENTS

Also see our catalog pages under AC POWER SOURCES and DC POWER SOURCES.

Transformers

- Convection, forced air or water cooled.
- Dry type, liquid filled, cast-resin.
- Low voltage, high voltage to 300KV.
- High current to 20,000 Amperes.
- High frequency to 10KHz.
- Low temperature rise, high efficiency.
- Ferroresonant transformers - conventional constant voltage and harmonic-neutralized.
- Ultra isolation transformers to 0.001 picofarads.
- Low capacitance transformers, electrostatic shielded.
- High reactance transformers - short circuit current limited.
- Modulation (Output) transformers to 50KW.
- Rectifier and filament transformers.

Inductors

LC Series - Link Chokes (DC)

Designed for use as a smoothing inductor in the DC link between rectifier and inverter in variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class.

LR Series - Line Reactors (AC)

Designed for use as a line reactor in the three phase input lines supplying variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class; three phase; 50Hz and 60Hz.

Other specialty inductors include:

- AC, DC.
- Iron-core, air-core.
- Linear, swinging.
- AC current limiting reactors.
- AC power factor correction reactors.
- DC filter chokes.
- AM modulation reactors.

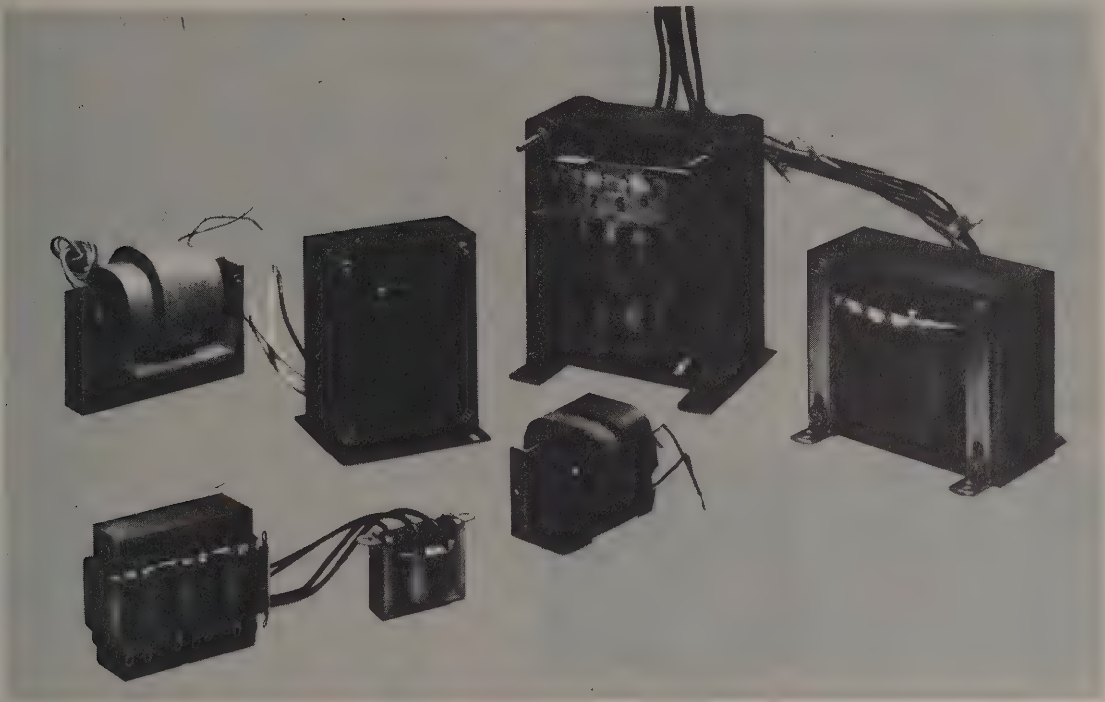
Saturable Reactors:

Low voltage, High voltage to 15 KV. Sizes to 1000 KVA.

Route 31, RD 5-65 • Flemington, New Jersey 08822 • 201-782-5525 • Telex: 833701/AGEX/FLEM

JEROME INDUSTRIES CORPORATION

MAGNETICS IS OUR BUSINESS



TRANSFORMERS

- CONSTANT VOLTAGE
- POWER
- PC MOUNTED
- FERRORESONANT
- ISOLATION
- SPECIALTY
- CHOKES
- REGULATORS
- COILS

ENGINEERED TO YOUR REQUIREMENTS

TO UL & CSA SPECIFICATIONS **CLASS "A" TO "H" INSULATION**

PROTOTYPES **PRODUCTION**

SERVICE **QUALITY** **PRICE**

JEROME INDUSTRIES CORPORATION

CORPORATE OFFICE
730E DIVISION STREET
ELIZABETH, NJ 07201

201-353-5700
TELEX NO: 132001

TRANSFORMER DIVISION
107E TRUMBULL STREET
ELIZABETH,NJ 07206

JEROME INDUSTRIES CORPORATION /730E DIVISION STREET, ELIZABETH, NEW JERSEY 07201 / 201-353-5700 / TELEX 132001

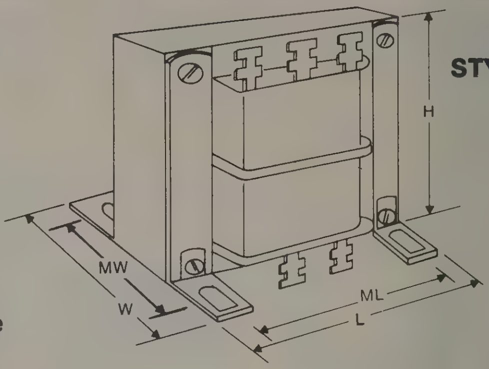
Split Bobbin Transformers

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.

Also available:

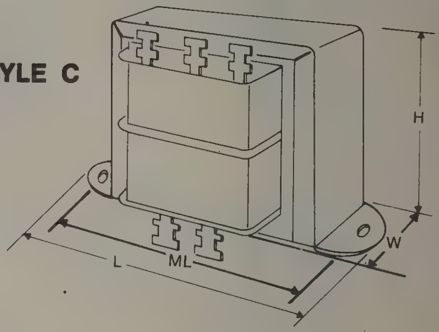
- **Units with 4000 VRMS hipot**
- Steel covers
- Flexible leads
- Multiple outputs
- Tapped primaries
- Quick disconnect terminals
- Consult factory for any other configurations you may require



STYLE B

**CUSTOM PROTOTYPES
AVAILABLE WITHIN ONE WEEK.
CHECK OUR LOW PRICES.**

STYLE C

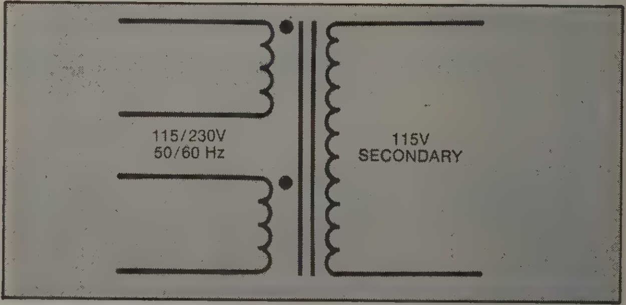


WE SPECIALIZE IN POWER TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS

Size	Mounting Style	L	W	H	ML	MW	Approx. Lbs.	Typical Power
40	C	3 11/16	1 31/32	2¼	3⅛	—	1½	40VA
50	C	3 11/16	2 1/16	2¼	3⅛	—	1¾	50VA
75	C	4 1/32	2 7/32	2 9/16	3 9/16	—	2	75VA
100	C	4 1/32	2 15/32	2 9/16	3 9/16	—	2¾	100VA
120	C	4½	2 15/32	2⅞	4	—	3	120VA
150	B	3¾	2 13/16	3⅛	3⅛	2¼	4	150VA
200	B	4⅛	3	3 7/16	3 7/16	2⅜	5½	200VA
300	B	4½	3¼	3¾	3¾	2½	7	300VA
500	B	4½	4¼	3¾	3¾	3½	11	500VA
750	B	5¼	4½	4⅜	4⅜	3⅝	16	750VA
1000	B	6⅜	4⅝	5 5/16	5 5/16	3¼	20	1000VA
1800	B	7½	5⅜	6¼	6¾	3⅝	32	1800VA

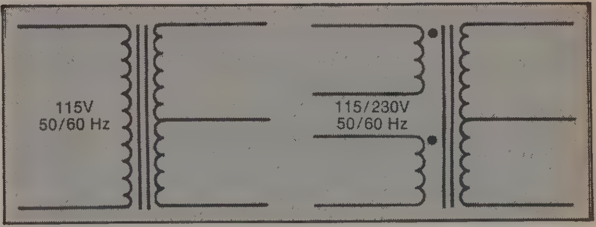
Split Bobbin Power Isolation Transformers

Part Number	Size	Secondary RMS Rating
I-.8	100	115V @ .8A
I-1	120	115V @ 1A
I-1.3	150	115V @ 1.3A
I-1.7	200	115V @ 1.7A
I-2.6	300	115V @ 2.6A
I-4.3	500	115V @ 4.3A
I-6.5	750	115V @ 6.5A
I-9	1000	115V @ 9A
I-15	1800	115V @ 15A



J M Transformer Co., Inc. 112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475

Split Bobbin Power Transformers



Ideal for use in rectifier circuits

Add Prefix D to Part Numbers below if Dual Primary is Required

Part Number	Secondary RMS Rating	Size
10T-4	10VCT @ 4A	40
10T-5	10VCT @ 5A	50
10T-7.5	10VCT @ 7.5A	75
10-10*	10V @ 10A	100
10-12*	10V @ 12A	120
10-15*	10V @ 15A	150
12T-3.2	12.6VCT @ 3.2A	40
12T-4	12.6VCT @ 4A	50
12T-6	12.6VCT @ 6A	75
12T-8	12.6VCT @ 8A	100
12-10*	12.6V @ 10A	120
12-12*	12.6V @ 12A	150
16T-2.5	16VCT @ 2.5A	40
16T-3.2	16VCT @ 3.2A	50
16T-4.5	16VCT @ 4.5A	75
16T-6	16VCT @ 6A	100
16T-8	16VCT @ 8A	120
16-10*	16V @ 10A	150
16-12*	16V @ 12A	200
20T-2	20VCT @ 2A	40
20T-2.5	20VCT @ 2.5A	50
20T-3.8	20VCT @ 3.8A	75
20T-5	20VCT @ 5A	100
20T-6	20VCT @ 6A	120
24T-1.7	24VCT @ 1.7A	40
24T-2	24VCT @ 2A	50
24T-3.2	24VCT @ 3.2A	75
24T-4	24VCT @ 4A	100
24T-5	24VCT @ 5A	120
24T-6	24VCT @ 6A	150
24T-8	24VCT @ 8A	200
24-12*	24V @ 12A	300
28T-1.4	28VCT @ 1.4A	40
28T-1.8	28VCT @ 1.8A	50
28T-2.6	28VCT @ 2.6A	75
28T-3.5	28VCT @ 3.5A	100
28T-4.2	28VCT @ 4.2A	120
28T-5.4	28VCT @ 5.4A	150
28T-7	28VCT @ 7A	200
28-10*	28V @ 10A	300
32T-1.2	32VCT @ 1.2A	40
32T-1.5	32VCT @ 1.5A	50
32T-2.4	32VCT @ 2.4A	75
32T-3	32VCT @ 3A	100
32T-3.8	32VCT @ 3.8A	120
32T-4.5	32VCT @ 4.5A	150
32T-6	32VCT @ 6A	200
36T-1	36VCT @ 1A	40
36T-1.4	36VCT @ 1.4A	50
36T-2	36VCT @ 2A	75
36T-2.8	36VCT @ 2.8A	100
36T-3.3	36VCT @ 3.3A	120
36T-4	36VCT @ 4A	150
36T-5.5	36VCT @ 5.5A	200
36T-8	36VCT @ 8A	300
36-12*	36V @ 12A	500
40T-1	40VCT @ 1A	40
40T-1.2	40VCT @ 1.2A	50
40T-1.8	40VCT @ 1.8A	75
40T-2.5	40VCT @ 2.5A	100
40T-3	40VCT @ 3A	120
40T-3.8	40VCT @ 3.8A	150
40T-5	40VCT @ 5A	200
40T-7.5	40VCT @ 7.5A	300
48T-.8	48VCT @ .8A	40
48T-1	48VCT @ 1A	50
48T-1.5	48VCT @ 1.5A	75
48T-2	48VCT @ 2A	100
48T-2.5	48VCT @ 2.5A	120
48T-3	48VCT @ 3A	150
48T-4	48VCT @ 4A	200
48T-6	48VCT @ 6A	300
56T-.7	56VCT @ .7A	40
56T-.9	56VCT @ .9A	50
56T-1.3	56VCT @ 1.3A	75
56T-1.7	56VCT @ 1.7A	100
56T-2.1	56VCT @ 2.1A	120
56T-2.7	56VCT @ 2.7A	150
56T-3.6	56VCT @ 3.6A	200
56T-5.4	56VCT @ 5.4A	300
56-8*	56V @ 8A	500
56-13*	56V @ 13A	750
68T-.6	68VCT @ .6A	40
68T-.7	68VCT @ .7A	50
68T-1.1	68VCT @ 1.1A	75
68T-1.4	68VCT @ 1.4A	100
68T-1.8	68VCT @ 1.8A	120
68T-2.2	68VCT @ 2.2A	150
68T-2.9	68VCT @ 2.9A	200
68T-4.4	68VCT @ 4.4A	300
68-7*	68V @ 7A	500
68-11*	68V @ 11A	750
80T-.5	80VCT @ .5A	40
80T-.6	80VCT @ .6A	50
80T-.9	80VCT @ .9A	75
80T-1.2	80VCT @ 1.2A	100
80T-1.5	80VCT @ 1.5A	120
80T-1.9	80VCT @ 1.9A	150
80T-2.5	80VCT @ 2.5A	200
80T-3.8	80VCT @ 3.8A	300
80T-6	80VCT @ 6A	500
80-9*	80V @ 9A	750
120T-.3	120VCT @ .3A	40
120T-.4	120VCT @ .4A	50
120T-.6	120VCT @ .6A	75
120T-.8	120VCT @ .8A	100

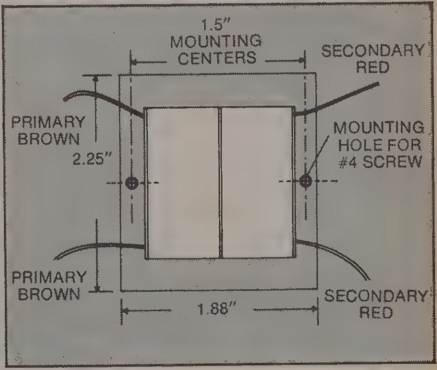
* These items do not have center-tapped secondaries

Low Profile Split Bobbin Power Transformers

- **Only 1.1 inches high**
- 4″ flexible leads • Wt. ½ lb. • 2500 VRMS hipot
- Ideal for PC Board and Chassis Mtg. where low height is required

STANDARD TRANSFORMERS: 115V 50/60 Hz PRIMARY - 10 VA

Part Number	Secondary RMS Rating
LPS 10-8	8V @ 1.25A
LPS 10-10	10V @ 1A
LPS 10-12	12.6V @ .8A
LPS 10-16	16V @ .63A
LPS 10-20	20V @ .5A
LPS 10-24	24V @ .42A
LPS 10-32	32V @ .31A



112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475

J M Transformer Co., Inc.

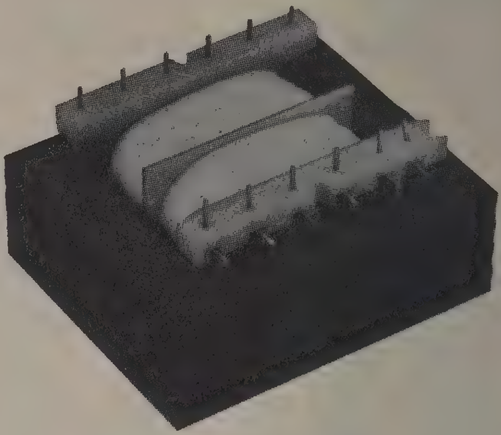
Split Bobbin PC Board Transformers

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.

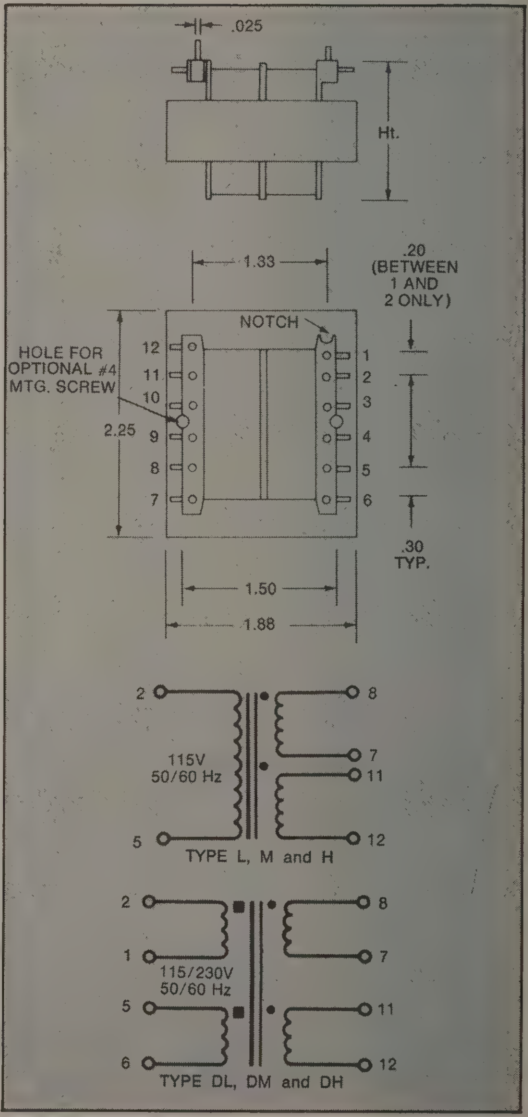
Please note that the standard items listed below utilize 6 or 8 pins, while 12 pins are available. We would like to quote your more complex requirements . . . you may save cost and space by combining two less complex Transformers into one.

We would also be glad to quote your less complex requirements. For example, if only a Single Primary and Single Secondary are needed, you can save considerable cost by utilizing only 4 Pins.



STANDARD TRANSFORMERS

	Part Number		Secondary RMS Ratings			
	Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	Ht.	Approx. Lbs.
LOW PROFILE	L-10	DL-10	10VCT @ 2A	5V @ 4A	1.34	.75
	L-12	DL-12	12.6VCT @ 1.6A	6.3V @ 3.2A	1.34	.75
	L-16	DL-16	16VCT @ 1.25A	8V @ 2.5A	1.34	.75
	L-20	DL-20	20VCT @ 1A	10V @ 2A	1.34	.75
	L-24	DL-24	24VCT @ .8A	12V @ 1.6A	1.34	.75
	L-32	DL-32	32VCT @ .625A	16V @ 1.25A	1.34	.75
	L-40	DL-40	40VCT @ .5A	20V @ 1A	1.34	.75
	L-48	DL-48	48VCT @ .4A	24V @ .8A	1.34	.75
	L-80	DL-80	80VCT @ .25A	40V @ .5A	1.34	.75
	L-120	DL-120	120VCT @ .16A	60V @ .32A	1.34	.75
	M-10	DM-10	10VCT @ 2.4A	5V @ 4.8A	1.55	.9
	M-12	DM-12	12.6VCT @ 1.9A	6.3V @ 3.8A	1.55	.9
	M-16	DM-16	16VCT @ 1.5A	8V @ 3A	1.55	.9
	M-20	DM-20	20VCT @ 1.2A	10V @ 2.4A	1.55	.9
	M-24	DM-24	24VCT @ 1A	12V @ 2A	1.55	.9
	M-32	DM-32	32VCT @ .75A	16V @ 1.5A	1.55	.9
	M-40	DM-40	40VCT @ .6A	20V @ 1.2A	1.55	.9
	M-48	DM-48	48VCT @ .5A	24V @ 1A	1.55	.9
	M-80	DM-80	80VCT @ .3A	40V @ .6A	1.55	.9
	M-120	DM-120	120VCT @ .2A	60V @ .4A	1.55	.9
	H-10	DH-10	10VCT @ 3A	5V @ 6A	1.79	1.1
	H-12	DH-12	12.6VCT @ 2.4A	6.3V @ 4.8A	1.79	1.1
	H-16	DH-16	16VCT @ 1.8A	8V @ 3.6A	1.79	1.1
	H-20	DH-20	20VCT @ 1.5A	10V @ 3A	1.79	1.1
	H-24	DH-24	24VCT @ 1.25A	12V @ 2.5A	1.79	1.1
	H-32	DH-32	32VCT @ .95A	16V @ 1.9A	1.79	1.1
	H-40	DH-40	40VCT @ .75A	20V @ 1.5A	1.79	1.1
	H-48	DH-48	48VCT @ .625A	24V @ 1.25A	1.79	1.1
	H-80	DH-80	80VCT @ .375A	40V @ .75A	1.79	1.1
	H-120	DH-120	120VCT @ .25A	60V @ .5A	1.79	1.1



TYPE L, M and H

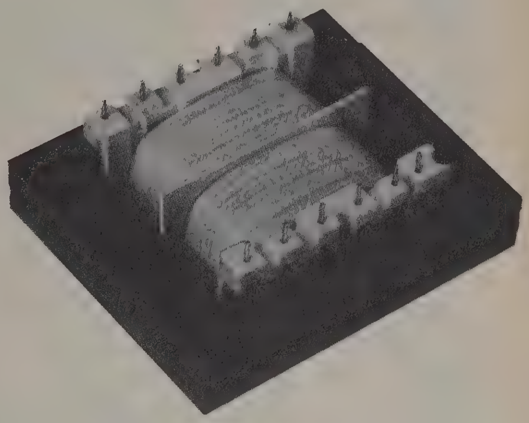
TYPE DL, DM and DH

J M Transformer Co., Inc. 112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475

Low Profile Split Bobbin PC Board Transformers

- **Only 1.13″ high**

XL Series transformers offer a particularly low profile for 18VA, allowing for 1.25″ card spacing.



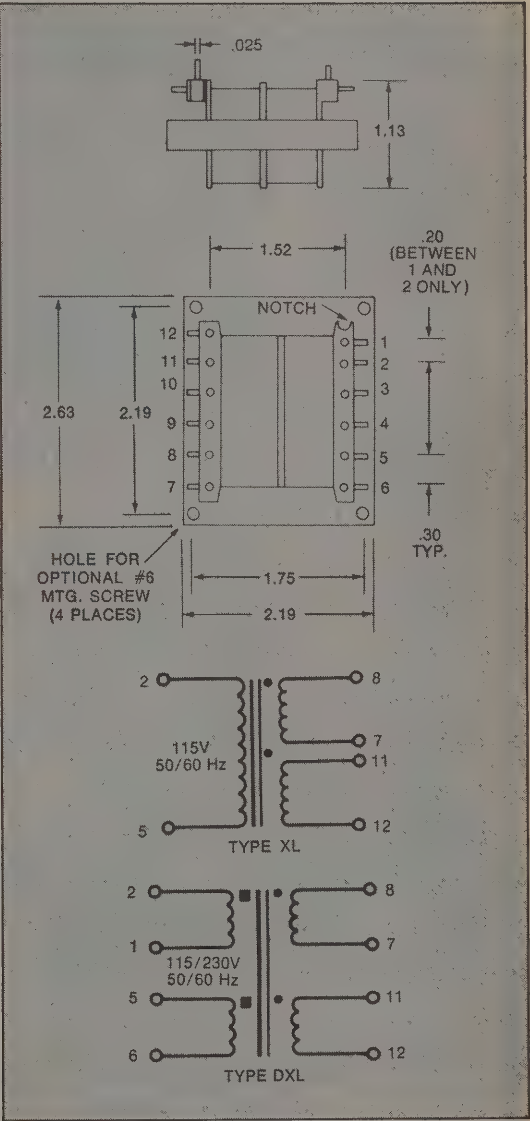
The use of a split bobbin allows winding to be non-concentric (side-by-side), consequently high isolation is achieved at low cost.

- Better Insulation — 2500 VRMS hipot is standard.
- Lower Capacitance — no need for electro-static shield.

If the standard items shown here do not fit your requirements, we would be glad to quote on your custom needs. Often this can save space and considerable cost.

STANDARD TRANSFORMERS

Part Number		Secondary RMS Ratings		Approx. Lbs.
Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	
XL-10	DXL-10	10VCT @ 1.6A	5V @ 3.2A	.7
XL-12	DXL-12	12.6VCT @ 1.25A	6.3V @ 2.5A	.7
XL-14	DXL-14	14VCT @ 1.28A	7V @ 2.56A	.7
XL-16	DXL-16	16VCT @ 1A	8V @ 2A	.7
XL-18	DXL-18	18VCT @ 1A	9V @ 2A	.7
XL-20	DXL-20	20VCT @ .8A	10V @ 1.6A	.7
XL-22	DXL-22	22VCT @ .8A	11V @ 1.6A	.7
XL-24	DXL-24	24VCT @ .68A	12V @ 1.36A	.7
XL-28	DXL-28	28VCT @ .64A	14V @ 1.28A	.7
XL-32	DXL-32	32VCT @ .5A	16V @ 1A	.7
XL-36	DXL-36	36VCT @ .5A	18V @ 1A	.7
XL-40	DXL-40	40VCT @ .4A	20V @ .8A	.7
XL-44	DXL-44	44VCT @ .4A	22V @ .8A	.7
XL-48	DXL-48	48VCT @ .34A	24V @ .68A	.7
XL-56	DXL-56	56VCT @ .32A	28V @ .64A	.7
XL-72	DXL-72	72VCT @ .25A	36V @ .5A	.7
XL-88	DXL-88	88VCT @ .2A	44V @ .4A	.7
XL-120	DXL-120	120VCT @ .134A	60V @ .268A	.7


.025
1.13
1.52
.20 (BETWEEN 1 AND 2 ONLY)
NOTCH
2.63
2.19
12
11
10
9
8
7
1
2
3
4
5
6
.30 TYP.
HOLE FOR OPTIONAL #6 MTG. SCREW (4 PLACES)
1.75
2.19
2
8
115V 50/60 Hz
7
11
5
12
TYPE XL
2
8
1
7
115/230V 50/60 Hz
5
11
6
12
TYPE DXL

AT JM WE USE ONLY PRIME RAW MATERIALS

CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

SERVICE IS AN IMPORTANT PART OF OUR PRODUCTS

112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 **J M Transformer Co., Inc.**

CUSTOM TRANSFORMERS

prototypes/short runs/high volume runs

your special application our specialty
power to 1000 VA
CONSTANT VOLTAGE
POWER
THREE PHASE
CONTROL
ULTRA LOW STRAY FIELD POWER
UI POWER
AUTOFORMER
HIGH CURRENT FOIL WOUND CHOKE
THREE FLANGE POWER
LOW PROFILE POWER
P.C. MOUNT POWER
UL RECOGNIZED INSULATING SYSTEMS FOR CLASS (B) AND CLASS (F) PER UL1446
subminiature
TOROIDALS
ADJUSTABLE P.C. MOUNT INDUCTOR
MINIATURE AUDIOS
HIGH FREQUENCY CHOKES
SWITCH-MODE POWER
HIGH FREQUENCY CURRENT

Some of the many transformers Lenco has designed and produced for a wide range of industries. Our specialty . . . custom designed to your special application. Prototype through production. Power 10 MW to 1000 VA.

SEE OUR CATALOG IN
THOMCAT
THOMAS REGISTER CATALOG FILE

LENCO
ELECTRONICS, INC.

1330-29 BELDEN STREET
McHENRY, ILLINOIS 60050

We're as close as your phone
815/344-2900

send specifications for your special requirements

LENCO, dedicated to transformer design, product improvement, cost reduction and fast delivery to meet your specifications and most critical production schedule. An endless variety of types, sizes and performance capabilities for a wide variety of industries.

Experienced personnel with specially developed electronic skills for an exacting technology to meet the most critical requirements. Manufactured to conform to UL, CSA, VDE, FCC-Part 68, etc.

Our specialty is your special application and we invite you to send or call for your custom requirements. For no obligation quotes, engineering, design consultation and manufacture, contact Lenco, the performance people.

AUDIO Impedance matching — Isolation —Broad frequency response — Low insertion loss — FCC Part 68.

CONSTANT VOLTAGE Regulating transformers built to your specifications for DC power supplies or low distortion AC.

CONTROL Custom designed to UL, VDE, CSA, etc. specifications.

CONVERTER High Conversion efficiency from DC input to filtered DC out. Toroidal, Laminated, Ferrite, (Switch-Mode) etc.

CURRENT Toroidal, Laminated, Core, Impregnated, or Encapsulated.

FILAMENT Dry type, Laminated core.

HIGH TEMPERATURE Vacuum impregnation with temperature material to 200°C. Epoxy encapsulated.

INDUCTORS Filter, A.C. Noise filtering, Switch-mode.

INPUT AND OUTPUT Designed to your specifications.

ISOLATION Audio, Step-down, Step-up, Foil electrostatic shielded, Electromagnetic shielded.

LOW PROFILE PC mount, Split bobbin, Vacuum varnish or epoxy impregnated.

MEDICAL UL 544 Patient connected, or non-patient connected. Power.

POT CORES PC mount, Frame mount, Encapsulated or Impregnated.

SWITCH-MODE POWER Dry type, Air cooled, Laminated or Ferrite.

THREE PHASE 50-60-400 Hertz up to 1 KVA.

BOBBIN WINDING

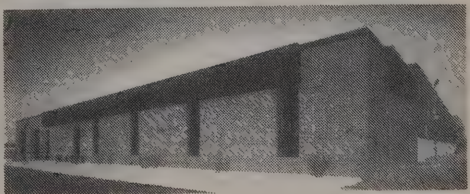
PRODUCTION TESTING

LAYER WINDING MACHINES

VACUUM IMPREGNATION SYSTEM

HAND WINDING

AUTOMATIC LAMINATING


Modern new 20,500 square foot facility for the production and manufacture of high quality transformers.

LENCO
ELECTRONICS, INC.

MEMBER
PCPCI
POWER CONVERSION PRODUCTS COUNCIL INTERNATIONAL

1330-29 BELDEN STREET, McHENRY, ILLINOIS 60050, *We're as close as your phone* **815/344-2900**

NEED MORE INFORMATION?

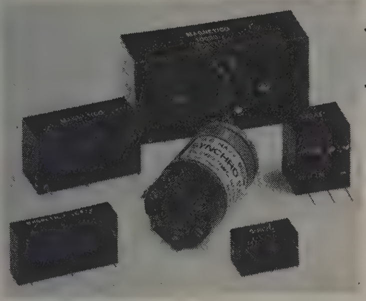
USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?



SCOTT T TRANSFORMERS

SYNCHRO TO RESOLVER CONVERTER TRANSFORMERS

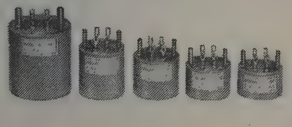
Part No.	Input Voltage (L-L)	Output RMS Sine & Cosine	Frequency Hz	Input Z kΩ	Typical Load kΩ	Accuracy Arc Seconds	Size Inches	Weight Oz.
52975	11.8	1	400	20	100	4 min.	7/8 x 1/2 x 7/16	.5
10472	11.8	6	400	10	10	5 min.	3/4 x 1 1/2 x 3/8	.6
11870	90	6 CT	60	500	100	60	1.1 x 2.1 x 1.1	4
12094	90	6 CT	60 & 400	500	100	2 min.	1.1 x 2.1 x 1.1	4
50460	90	6	400	60	10	60	7/8 x 1 5/8 x 11/16	2
50642	11.8	6	400	30	10	60	7/8 x 1 5/8 x 11/16	2
50726	90	6 CT	400	500	100	60	13/16 x 1 1/2 x 5/8	1.5
9652	11.8	5	400	100	10	30	1 3/8 x 2 3/4 x 7/8	5
9514	90	4.25	400	1000	10	30	1 3/8 x 2 3/4 x 7/8	5
52910	11.8	1	400	10	100	4 min.	1/2 x 7/8 x .31	.5
52450	90	6	400	100	100	5 min.	5/8 x 1 1/4 x 1/2	3 3/4
52290	11.8	3.2	400	20	10	3 min.	7/8 x 1/2 x 7/16	1/3
52569	90	2 CT	400	80	100	5 min.	5/8 x 7/8 x 5/16	1/3
13084	11.8	6 CT	400	100	100	1 min.	3/4 x 1 1/2 x 3/8	1/2
13530	11.8	1	400	10	50	1 min.	5/8 x 1 1/4 x .3	.5

FEATURES:

- PRECISION/INTERCHANGEABILITY
- REPEATABILITY
- STABILITY/NO AGING
- NO SYSTEM TRIMMING REQUIRED

RESOLVER TO SYNCHRO CONVERTER TRANSFORMERS

Part No.	Input Voltage 4 Wire	Output 3 Wire (L-L)	Frequency Hz	Load Ohms (L-L)	Input Z Ohms	Accuracy Arc Minutes	Size Inches	VA Rating
10084	11.8	11.8	400	150	1.5K	2	1 x 2 x .65 H	.5
10086	6.0	11.8	400	150	1K	2	1 x 2 x .65 H	1
10088	9.0	11.8	400	150	2K	1.5	1 3/8 x 2 3/4 x .65 H	1
10090	9.0	90	400	2500	1K	1	1 3/8 x 2 3/4 x 7/8 H	1
11999	7.0	11.8	400	30	500	1	2 x 4 x 1 H	3
50749	7.2	90	60	8000	700	2	1 1/2 x 3 3/8 x 1 1/4 H	3
12186	7.0	90	60	4000	250	1	2 x 4 x1 1/2 H	3.2
52020	9	11.8	400	14	100	3.5	1 1/2 x 2 1/2 x 1 1/4	4.5
52021	9	90	400	800	100	3.5	2 x 4 x 1 1/4	1
52449	6	90	400	2500	150	3	1 x 1 5/8 x 11/16	2
52164	6	90	400	2500	100	2	1 1/2 x 3 x 1 1/8	10
12945	6	11.8	400	300	1K	5	3/4 x 1 1/2 x 7/16	1/2



HOW TO ORDER:

Order Magnetico Standard Units directly by using the Magnetico Part Number.

VA RATING	SECONDARY VOLTAGE
Catalog Number	6.0 thru 300 (VRMS)

SCHEMATIC	SHIELD
X — No Tap	N — No Shield
T — Center Tap	S — Electrostatic Shield

EXAMPLE:

To order a 115 V 400 Hz to 26 V center tapped, 6 VA power transformer with no shield. Order Magnetico Number: **9602-26-T-N.**

VA RATING: 9602 **SCHEMATIC:** T

SECONDARY VOLTAGE: 26 **SHIELD:** N

STANDARD MINIATURE 400 Hz POWER TRANSFORMERS

CONDENSED PERFORMANCE DATA — PRIMARY VOLTAGE 115 VRMS. All Units Designed to Meet MIL-T-27D. IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES.

Catalog Number	VA Rating	Secondary Voltage (RMS)	O.D. ±1/32	Height ±1/32	Nominal Weight	Nom. Reg.	Nom.* Temp. Rise
9600	2	6-300 V	1″	19/32″	1 oz/ 30 gm	18%	10°C
9601	4	6-300 V	1″	11/16″	1.2 oz/ 35 gm	15%	12°C
9602	6	6-300 V	1″	7/8″	1.6 oz/ 45 gm	10%	18°C
9603	9	6-300 V	1″	1 1/16″	2.1 oz/ 60 gm	8%	20°C
9604	30	6-300 V	1 3/8″	1 1/2″	5.3 oz/150 gm	7%	23°C
10648	75	10-300 V	2″	1 5/16″	10 oz	±3%	30°C
10649	150	10-300 V	2 1/4″	1 9/16″	18 oz	±3%	40°C

Example: To order a 115 V 400 Hz to 26 V center tapped, 6 VA transformer with no shield — order Magnetico 9602-26-T-N

VA Rating: 9602 Secondary Voltage: 26 Schematic T: Shield: N.

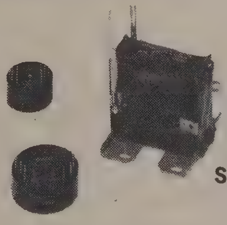
SWITCHING TRANSFORMERS, 20 KHz

13962 — Input 160 VDC —
Output (2) 5V @ 4A, (2) 15V @ 1/2A —
Rated 55VA — 1.5 D x .8 Hi

13963 — Input 160 VDC —
Output (4) 5V @ 4A, (2) 15V @ .66A —
Rated 140 Watts — 1.75 D x .8 Hi

53248 — Input 160 VDC —
Output (2) 12V @ 65A —
Rated 650 Watts — 3″ x 2 3/4″ x 3″ Hi

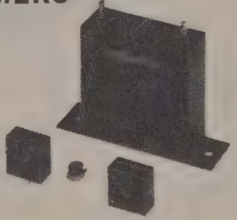
**CUSTOM DESIGNS —
Multiple Outputs —
QUICK RESPONSE**



CURRENT TRANSFORMERS

1V/Amp for Switching Applications
PC mount 13960 Series
1V/Amp for 400 Hz Power,
001V/Amp for 3000 Amp
Transmitter Monitor

**Custom/Standard —
QUICK RESPONSE**

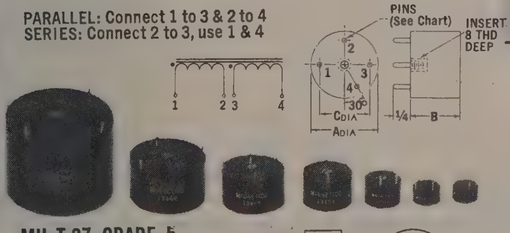


SPECIALS ARE STANDARD WITH US

MAGNETICO

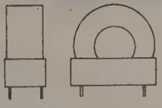
SWITCHING INDUCTORS

PARALLEL: Connect 1 to 3 & 2 to 4
SERIES: Connect 2 to 3, use 1 & 4



MIL-T-27 GRADE 5

Toroidal design on Molypermalloy Cores provides lowest leakage inductance and low pick up, PC mount, Hi-Q, low loss, stable inductance values.



OPEN TYPES OR VERTICAL MOUNTING (OPTIONAL)

Part No.	Induct. ±8% @ .1V 1kHz Par./Ser.		Res. Ohms Par./Ser.		DC Amps @ 90% Induct. Par./Ser.		Safe Operating Current Par./Ser.		A	B	C
13461-010	10 μH	40 μH	.015	.060	2.50	1.25	2.5†	1.25†	5/8	5/16	.500
-040	40 μH	160 μH	.050	1.00	1.25	.625	1.5†	.60†	5/8	5/16	.500
-100	100 μH	400 μH	.075	.30	.83	.415	1.0*	.5*	5/8	5/16	.500
13463-010	10 μH	40 μH	.005	.020	4.65	2.32	17.0*	8.5*	1	5/8	.875
-040	40 μH	160 μH	.012	.045	2.40	1.20	8.2*	4.1*	1	5/8	.875
-100	100 μH	400 μH	.030	.12	1.50	.75	5.0*	2.5*	1	5/8	.875
13464-090	40 μH	160 μH	.010	.040	5.4	2.7	20.0*	10.0*	1 3/8	7/8	1.250
-100	100 μH	400 μH	.010	.040	3.4	1.7	10.0*	5.0*	1 3/8	7/8	1.250
13465-200	200 μH	800 μH	.020	.080	2.75	1.37	10.0*	5.0*	1 3/4	1	1.625
13466-040	40 μH	160 μH	.003	.012	8.40	4.20	30.0*	15.0*	2	1 1/8	1.875
-100	100 μH	400 μH	—	—	5.60	2.80	20.0*	10.0*	2	1 1/8	1.875
13467-100	100 μH	400 μH	.004	.016	8.00	4.00	30.0*	15.0*	2 1/2	1 1/4	2.375
-200	200 μH	800 μH	.009	.036	4.10	2.05	20.0*	10.0*	2 1/2	1 1/4	2.375
-500	500 μH	2 MH	.015	.060	1.10	.55	4.0*	2.0*	2 1/2	1 1/4	2.375

* 50% Inductance † 90% Inductance

CALL FOR PART BEST SUITED FOR YOUR SPEC

**Laminated • Telephone
Matching • Precision
Inductors
High Voltage**

MAGNETICO INC.

182 MORRIS AVENUE, HOLTSVILLE, N.Y. 11742 TELEPHONE: (516) 654-1166

**Toroidal Winding
Scott-T • Inverter
Current • Wideband
Pulse**

LET MAGNETICO QUOTE "ALL" YOUR REQUIREMENTS • THE BEST IN TRANSFORMERS • FILTERS • AUDIO HYBRIDS • POWER SUPPLIES mci

QUALITY TRANSFORMERS AT COMPETITIVE PRICES

Founded a quarter-century ago, MCI Transformer Corporation is an established leader in the manufacture of horizontal, vertical and low profile transformers for printed circuit boards. Recently, the line has been expanded to include quick-connect and encapsulated models.

At MCI, the very latest production automation techniques are employed to ensure the highest possible quality at low competitive prices.

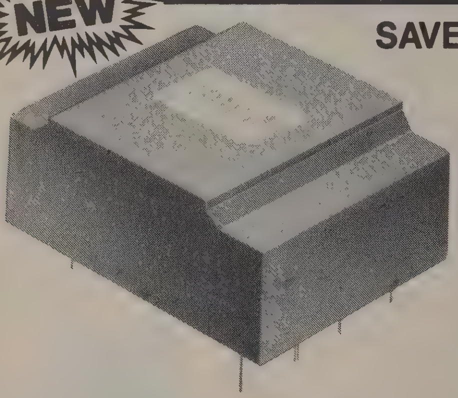
- Made in U.S.A.
- UL-Recognized
- In stock for fast delivery
- Custom designs available
- Shipped in protective vacuum-formed trays

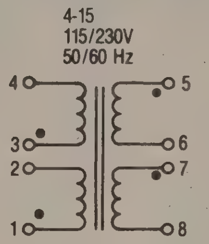
LOW PROFILE PC ENCAPSULATED TRANSFORMERS

SERIES 4-15

NEW

SAVE UP TO 40% IN VOLUME





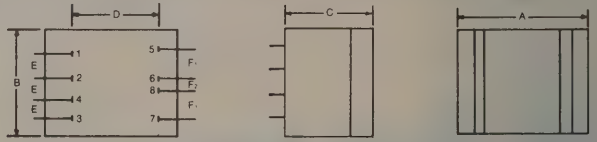
Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consists of 2 split bobbins which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.

CURRENT RATING (AMPS)

Secondary Voltage	Series Parallel	-010 10V C.T. 5V	-012 12.6V C.T. 6.3V	-016 16V C.T. 8V	-020 20V C.T. 10V	-024 24V C.T. 12V	-030 30V C.T. 15V	-034 34V C.T. 17V	-040 40V C.T. 20V	-056 56V C.T. 28V	-088 88V C.T. 44V	-120 120V C.T. 60V	-230 230V C.T. 115V
Series													
Size 2		.600	.450	.350	.300	.250	.200	.170	.150	.100	.065	.050	.025
Parallel													
Size 2		1.200	.900	.700	.600	.500	.400	.340	.300	.200	.130	.100	.050

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F1	F2	WT.
2	6	2.080	1.655	.850	1.300	.400	.600	.200	.46



mci

TOLL FREE:
1-800-MCI-TRAN

HOW TO ORDER A LOW PROFILE PC ENCAPSULATED TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	15	Dual 115/230V Primary
Fourth Digit	2	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-15-2010 is a dual 115/230V primary, 6VA transformer with two 5 volt secondary windings to be used as either 10V CT or 5V.

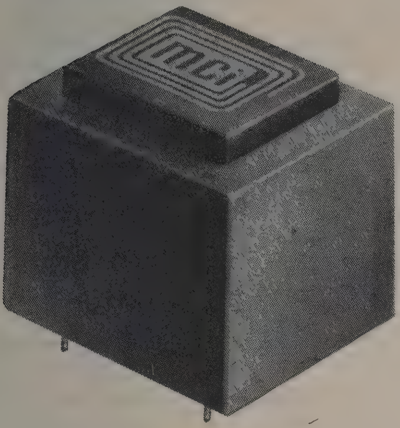
MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 • 516-587-0510

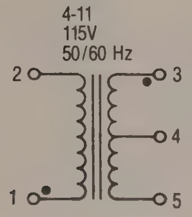
HORIZONTAL PC ENCAPSULATED TRANSFORMERS

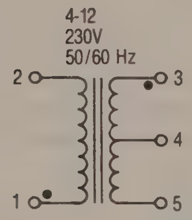
SERIES 4-11 & 4-12

NEW

SAVE UP TO 40% IN VOLUME







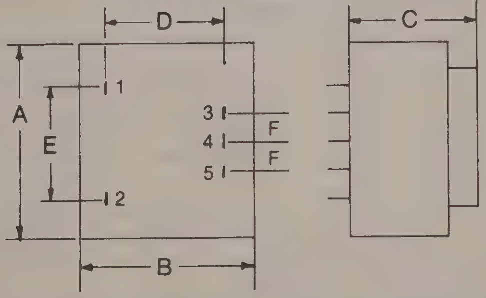
Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consits of a split bobbin which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.

CURRENT RATING (AMPS)

Secondary Voltage	-010 10V C.T.	-012 12.6V C.T.	-016 16V C.T.	-020 20V C.T.	-024 24V C.T.	-028 28V C.T.	-036 36V C.T.	-048 48V C.T.	-056 56V C.T.	-120 120V C.T.
Transformer Size										
2	.100	.080	.065	.050	.045	.035	.030	.020	.018	.008
3	.120	.095	.075	.060	.050	.045	.035	.025	.021	.010
4	.180	.145	.115	.090	.075	.065	.050	.038	.032	.015
5	.220	.175	.140	.110	.095	.080	.060	.045	.040	.018
6	.320	.255	.200	.160	.135	.115	.090	.067	.057	.027
7	.450	.360	.280	.225	.190	.160	.125	.095	.080	.038

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F	Wt. (Lb.)
2	1.0	1.280	1.080	.925	.800	.800	.200	.16
3	1.2	1.280	1.080	.970	.800	.800	.200	.19
4	1.8	1.280	1.080	1.085	.800	.800	.200	.21
5	2.2	1.280	1.080	1.185	.800	.800	.200	.25
6	3.2	1.660	1.415	1.125	1.000	.800	.200	.33
7	4.5	1.780	1.500	1.300	1.000	1.000	.300	.44



HOW TO ORDER A HORIZONTAL PC ENCAPSULATED TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	11	Single 115V Primary
	12	Single 230V Primary
Fourth Digit	2 to 7	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-12-5012 is a 230V primary, 2.2VA transformer with a 12V CT secondary.

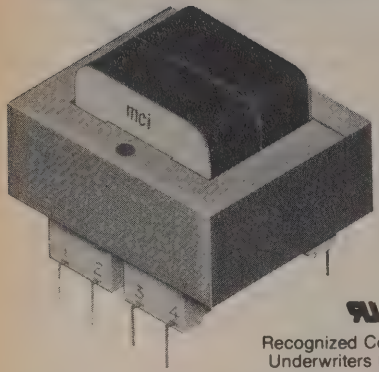
mci

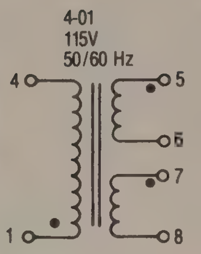
TOLL FREE:
1-800-MCI-TRAN

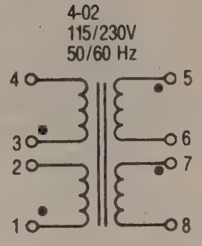
MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 • 516-587-0510

HORIZONTAL PC TRANSFORMERS

SERIES 4-01 & 4-02



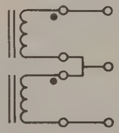
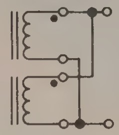




Recognized Component
Underwriters Labs Inc.

2,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Heavier transformers are provided with mounting holes for additional mounting security. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

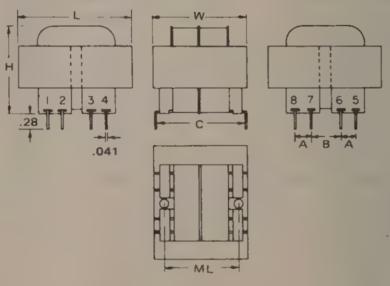
CURRENT RATING

Secondary Voltage	Series Parallel	−010 10V C.T. 5V	−012 12.6V C.T. 6.3V	−016 16V C.T. 8V	−020 20V C.T. 10V	−024 24V C.T. 12V	−028 28V C.T. 14V	−036 36V C.T. 18V	−048 48V C.T. 24V	−056 56V C.T. 28V	−120 120V C.T. 60V
Series											
Size 2		.11A	.09A	.07A	.055A	.045A	.04A	.03A	.023A	.02A	.01A
Size 3		.25A	.2A	.15A	.12A	.1A	.085A	.065A	.05A	.045A	.02A
Size 4		.6A	.5A	.4A	.3A	.25A	.2A	.17A	.125A	.11A	.05A
Size 5		1.2A	1.0A	.8A	.6A	.5A	.42A	.35A	.25A	.22A	.1A
Size 6		2.0A	1.6A	1.25A	1.0A	.8A	.7A	.55A	.4A	.35A	.16A
Size 7		3.6A	2.85A	2.25A	1.8A	1.5A	1.3A	1.0A	.75A	.65A	.3A
Parallel											
Size 2		.22A	.18A	.14A	.11A	.09A	.08A	.06A	.046A	.04A	.02A
Size 3		.5A	.4A	.3A	.24A	.2A	.17 A	.13A	.1A	.09A	.04A
Size 4		1.2A	1.0A	.8A	.6A	.5A	.4A	.34A	.25A	.22A	.1A
Size 5		2.4A	2.0A	1.6A	1.2A	1.0A	.84A	.7A	.5A	.44A	.2A
Size 6		4.0A	3.2A	2.5A	2.0A	1.6A	1.4A	1.1A	.8A	.7A	.32A
Size 7		7.2A	5.7A	4.5A	3.6A	3.0A	2.6A	2.0A	1.5A	1.3A	.6A

DIMENSIONS

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut	Lbs.
2	1.1	1-3/8	1-1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1-3/8	1-1/8	1-3/16	—	.250	.250	1.200	None	0.25
4	6.0	1-5/8	1-5/16	1-5/16	1-1/16	.250	.350	1.280	4-40 × 1-3/8 Nylon	0.44
5	12.0	1-7/8	1-9/16	1-7/16	1-1/4	.300	.400	1.410	4-40 × 1-3/8 Nylon	0.70
6	20.0	2-1/4	1-7/8	1-7/16	1-1/2	.300	.400	1.600	4-40 × 1-3/8 Nylon	0.80
7	36.0	2-5/8	2-3/16	1-9/16	†	.400	.400	1.850	†	1.1

† 4 mounting holes 2³⁄₁₆ × 1¾ for #6 screw



TOLL FREE:
1-800-MCI-TRAN

HOW TO ORDER A HORIZONTAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

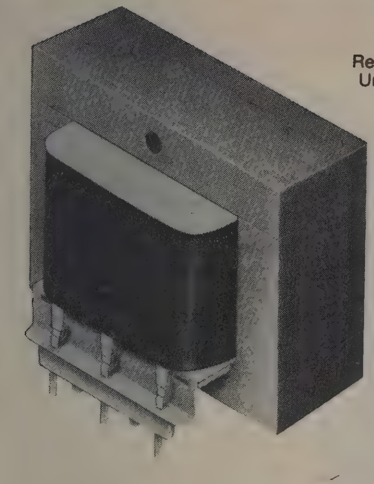
First Digit	4	MCI Product Identification
Second & Third Digits	01 02	Single 115V Primary Dual 115/230V Primary
Fourth Digit	2 to 7	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-01-4016 is a 115V primary 6VA transformer with two 8 volt secondary windings to be used as either 16V CT or 8V.

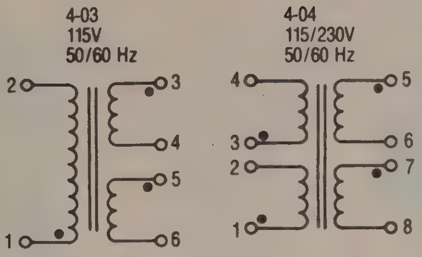
MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 ● 516-587-0510

VERTICAL PC TRANSFORMERS

SERIES 4-03 & 4-04

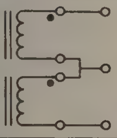
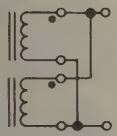


Recognized Component
Underwriters Labs Inc.



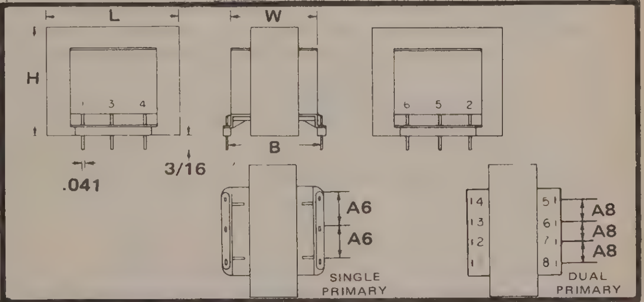
1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	Series Parallel	–010 10V C.T. 5V	–012 12.6V C.T. 6.3V	–016 16V C.T. 8V	–020 20V C.T. 10V	–024 24V C.T. 12V	–028 28V C.T. 14V	–034 34V C.T. 17V	–040 40V C.T. 20V	–056 56V C.T. 28V	–088 88V C.T. 44V	–120 120V C.T. 60V	–180 180V C.T. 90V	–230 230V C.T. 115V
Series														
Size 1		.090A	.070A	.055A	.045A	.035A	.030A	.025A	.020A	.015A	.010A	.008A		
Size 2		.120A	.100A	.075A	.060A	.050A	.040A	.035A	.030A	.020A	.015A	.010A	.006A	.005A
Size 3		.440A	.350A	.260A	.220A	.180A	.160A	.125A	.110A	.080A	.050A	.035A	.024A	.020A
Size 4		1.0A	.800A	.640A	.500A	.450A	.360A	.300A	.250A	.180A	.120A	.085A	.055A	.040A
Size 5		2.4A	2.0A	1.5A	1.2A	1.0A	.800A	.700A	.600A	.420A	.270A	.200A	.130A	.100A
Parallel														
Size 1		.180A	.140A	.110A	.090A	.070A	.060A	.050A	.040A	.030A	.020A	.016A		
Size 2		.240A	.200A	.150A	.120A	.100A	.080A	.070A	.060A	.040A	.030A	.020A	.012A	.010A
Size 3		.880A	.700A	.520A	.440A	.360A	.320A	.250A	.220A	.160A	.100A	.070A	.048A	.040A
Size 4		2.0A	1.6A	1.28A	1.0A	.900A	.720A	.600A	.500A	.360A	.240A	.170A	.110A	.080A
Size 5		4.8A	4.0A	3.0A	2.4A	2.0A	1.6A	1.4A	1.2A	.840A	.540A	.400A	.260A	.200A

DIMENSIONS

Size	VA	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)
1	1.0	1	1-3/8	0.83	0.250	0.200	1.200	2.5
2	1.2	1-3/8	1-1/8	1-3/16	0.312	0.200	1.000	3.0
3	4.4	1-5/8	1-1/4	1-3/8	0.400	0.250	1.100	5.0
4	10.0	1-7/8	1-7/16	1-5/8	0.400	0.250	1.300	9.0
5	24.0	1-5/8	2-1/4	1-3/8	0.400	0.250	2.100	12.0



HOW TO ORDER A VERTICAL PC TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	03	Single 115V Primary
	04	Dual 115/230V Primary
Fourth Digit	1 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-04-3034 is a dual 115/230V primary, 4.4VA transformer with two 17 volt secondary windings to be used as either 34V CT or 17V.

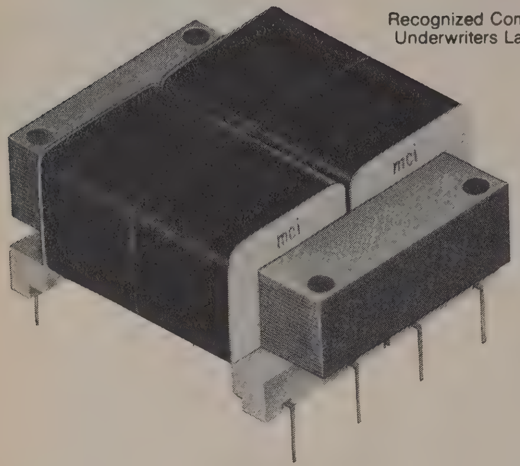
mci

TOLL FREE:
1-800-MCI-TRAN

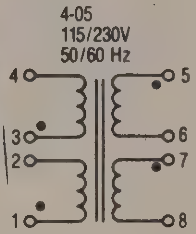
MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 • 516-587-0510

LOW PROFILE PC TRANSFORMERS

SERIES 4-05

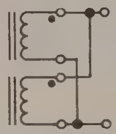
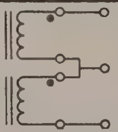


Recognized Component
Underwriters Labs Inc.



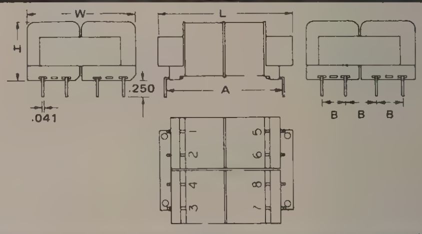
1,000-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	Series Parallel	−010 10V C.T. 5V	−012 12.6V C.T. 6.3V	−016 16V C.T. 8V	−020 20V C.T. 10V	−024 24V C.T. 12V	−034 34V C.T. 17V	−040 40V C.T. 20V	−056 56V C.T. 28V	−088 88V C.T. 44V	−120 120V C.T. 60V	−230 230V C.T. 115V
Series												
Size 1		.250A	.200A	.156A	.125A	.104A	.073A	.062A	.044A	.028A	.020A	.010A
Size 2		.600A	.450A	.350A	.300A	.250A	.170A	.150A	.100A	.065A	.050A	.025A
Size 3		1.200A	.900A	.700A	.600A	.500A	.340A	.300A	.200A	.130A	.100A	.050A
Parallel												
Size 1		.500A	.400A	.312A	.250A	.208A	.146A	.124A	.088A	.056A	.040A	.020A
Size 2		1.2A	.900A	.700A	.600A	.500A	.340A	.300A	.200A	.130A	.100A	.050A
Size 3		2.4A	1.8A	1.4A	1.2A	1.0A	.680A	.600A	.400A	.260A	.200A	.100A

DIMENSIONS

Size	VA	L	W	H	A	B	Oz.
1	2.5	1-7/8	1-9/16	0.650	1.600	0.375	5
2	6.0	1-7/8	1-9/16	0.850	1.600	0.375	7
3	12.0	2-1/2	2	1.065	2.000	0.500	11



TOLL FREE:
1-800-MCI-TRAN

HOW TO ORDER A LOW PROFILE TRANSFORMER

MCI uses a Seven Digit Part Number

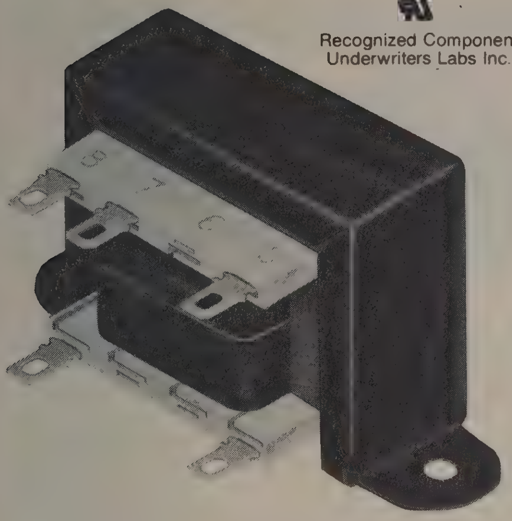
First Digit	4	MCI Product Identification
Second & Third Digits	05	Dual 115/230V Primary
Fourth Digit	1 to 5	Transformer size *(See current rating chart)*
Last three Digits	010 to 230	Secondary voltage *(See current rating chart)*

Example: 4-05-1020 is a dual 115/230V primary, 2.5VA transformer with two 10 volt secondary windings to be used as either 20V CT or 10V.

MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 ● 516-587-0510

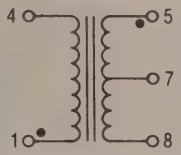
QUICK CONNECT POWER TRANSFORMERS

SERIES 4-06 & 4-07

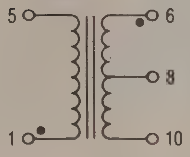


Recognized Component
Underwriters Labs Inc.

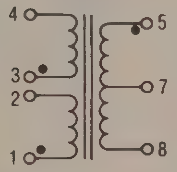
4-06-3, 4, 5
115V
50/60 Hz



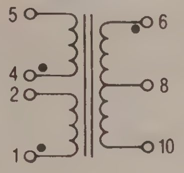
4-06-6, 7, 8
115V
50/60 Hz



4-07-4, 5
115/230V
50/60 Hz



4-07-6, 7, 8
115/230V
50/60 Hz



2500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary (for all but 2.4 VA size).

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

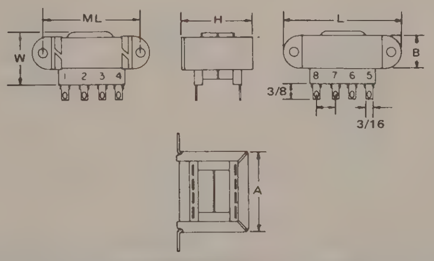
Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

CURRENT RATING

Secondary Voltage	–010 10V C.T.	–012 12.6V C.T.	–016 16V C.T.	–020 20V C.T.	–024 24V C.T.	–028 28V C.T.	–036 36V C.T.	–048 48V C.T.	–056 56V C.T.	–120 120V C.T.
Transformer Size										
3	.25A	.2A	.15A	.12A	.1A	.085A	.065A	.05A	.045A	.02A
4	.6A	.5A	.4A	.3A	.25A	.2A	.17A	.125A	.11A	.05A
5	1.2A	1.0A	.8A	.6A	.5A	.42A	.35A	.25A	.22A	.1A
6	3.0A	2.5A	2.0A	1.5A	1.25A	1.1A	.85A	.63A	.54A	.25A
7	5.0A	4.0A	3.5A	2.8A	2.4A	2.0A	1.5A	1.2A	1.0A	.5A
8	10.0A	8.0A	6.25A	5.0A	4.0A	3.6A	2.8A	2.0A	1.8A	.85A

DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2-1/16	1-1/16	1-3/16	1-7/16	9/16	1-3/4	0.25
4	6	2-3/8	1-1/4	1-3/8	1-11/16	11/16	2	0.44
5	12	2-13/16	1-3/8	1-5/8	1-15/16	13/16	2-3/8	0.7
6	30	3-1/4	1-11/16	1-15/16	2-5/16	1-1/16	2-13/16	1.1
7	56	3-11/16	1-13/16	2-1/4	2-11/16	1-1/16	3-1/8	1.7
8	100	4-1/32	2-1/4	2-9/16	3-1/16	1-5/16	3-9/16	2.75



HOW TO ORDER A QUICK CONNECT POWER TRANSFORMER

MCI uses a Seven Digit Part Number

First Digit	4	MCI Product Identification
Second & Third Digits	06	Single 115V Primary
	07	Dual 115/230V Primary
Fourth Digit	3 to 8	Transformer size *(See current rating chart)*
Last three Digits	010 to 120	Secondary voltage *(See current rating chart)*

Example: 4-06-6016 is a 115V primary 30VA transformer with 16V CT secondary.

TOLL FREE:
1-800-MCI-TRAN

MCI TRANSFORMER CORPORATION 411 MANHATTAN AVENUE, BABYLON, NY 11704 • 516-587-0510

POWER TRANSFORMERS
PRINTED CIRCUIT

MICROTRAN company, inc.

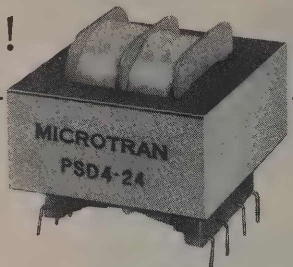
SPLITFORM® split bobbin power transformers

For PC Board Solid-State Power, Control, and Instrumentation Applications

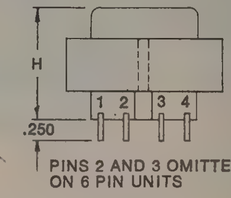
- Split Bobbin Construction
  - Center Flange Insulation Barrier
  - High Isolation for Low Leakage Applications
  - Low Capacitive Coupling Minimizes Line Noise and False Triggering
- 2,500V RMS Hipot
- 115V Single or 115/230V 50/60 Hz Dual Primary
- Dual Secondaries may be either Parallel or Series Connected
- Precision Spaced Molded-in Terminals
  - Terminal Numbers are Molded on Bobbin
- Class S 130°C Insulation
- Attractive Pricing — Superior Quality

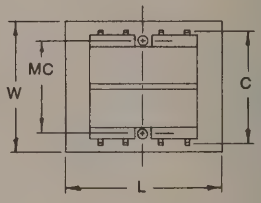
PART NO.		SECONDARY RMS RATING			
		Parallel Connected		Series Connected	
Single 115V PSS Series	Dual 115/230V PSD Series	AC Volts	RMS Amps	AC Volts	RMS Amps
PSS2-10	PSD2-10	5.0	0.22	10.0 CT	0.11
PSS3-10	PSD3-10	5.0	0.5	10.0 CT	0.25
PSS4-10	PSD4-10	5.0	1.2	10.0 CT	0.60
PSS5-10	PSD5-10	5.0	2.4	10.0 CT	1.2
PSS2-12	PSD2-12	6.3	0.18	12.6 CT	0.09
PSS3-12	PSD3-12	6.3	0.4	12.6 CT	0.2
PSS4-12	PSD4-12	6.3	1.0	12.6 CT	0.5
PSS5-12	PSD5-12	6.3	2.0	12.6 CT	1.0
PSS2-16	PSD2-16	8.0	0.14	16.0 CT	0.07
PSS3-16	PSD3-16	8.0	0.3	16.0 CT	0.15
PSS4-16	PSD4-16	8.0	0.8	16.0 CT	0.4
PSS5-16	PSD5-16	8.0	1.6	16.0 CT	0.8
PSS2-20	PSD2-20	10.0	0.11	20.0 CT	0.055
PSS3-20	PSD3-20	10.0	0.24	20.0 CT	0.12
PSS4-20	PSD4-20	10.0	0.6	20.0 CT	0.3
PSS5-20	PSD5-20	10.0	1.2	20.0 CT	0.6
PSS2-24	PSD2-24	12.0	0.09	24.0 CT	0.045
PSS3-24	PSD3-24	12.0	0.2	24.0 CT	0.1
PSS4-24	PSD4-24	12.0	0.5	24.0 CT	0.25
PSS5-24	PSD5-24	12.0	1.0	24.0 CT	0.5
PSS2-28	PSD2-28	14.0	0.08	28.0 CT	0.04
PSS3-28	PSD3-28	14.0	0.17	28.0 CT	0.085
PSS4-28	PSD4-28	14.0	0.4	28.0 CT	0.2
PSS5-28	PSD5-28	14.0	0.84	28.0 CT	0.42
PSS2-36	PSD2-36	18.0	0.06	36.0 CT	0.03
PSS3-36	PSD3-36	18.0	0.13	36.0 CT	0.065
PSS4-36	PSD4-36	18.0	0.34	36.0 CT	0.17
PSS5-36	PSD5-36	18.0	0.7	36.0 CT	0.35
PSS2-48	PSD2-48	24.0	0.046	48.0 CT	0.023
PSS3-48	PSD3-48	24.0	0.1	48.0 CT	0.05
PSS4-48	PSD4-48	24.0	0.25	48.0 CT	0.125
PSS5-48	PSD5-48	24.0	0.5	48.0 CT	0.25
PSS2-56	PSD2-56	28.0	0.04	56.0 CT	0.02
PSS3-56	PSD3-56	28.0	0.09	56.0 CT	0.045
PSS4-56	PSD4-56	28.0	0.22	56.0 CT	0.11
PSS5-56	PSD5-56	28.0	0.44	56.0 CT	0.22
PSS2-120	PSD2-120	60.0	0.02	120.0 CT	0.01
PSS3-120	PSD3-120	60.0	0.04	120.0 CT	0.02
PSS4-120	PSD4-120	60.0	0.1	120.0 CT	0.05
PSS5-120	PSD5-120	60.0	0.2	120.0 CT	0.1

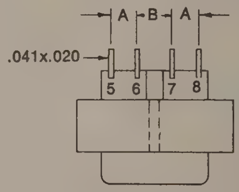
NEW!



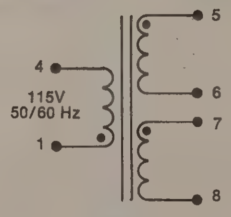
Recognized Component Underwriters Labs Inc.



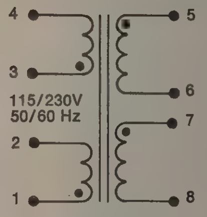




SCHEMATICS



6 PIN
PSS SERIES



8 PIN
PSD SERIES

DIMENSIONS Inches (mm)									
PSS, PSD Series	VA	L	W	H	MC	A	B	C	Lb. (Gm.)
2	1.1	1.44 (36.6)	1.23 (31.2)	1.00 (25.4)	– –	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.17 (77.4)
3	2.4	1.44 (36.6)	1.23 (31.2)	1.26 (32)	– –	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.25 (114)
4	6	1.69 (43)	1.39 (35.3)	1.36 (34.5)	1.0625* (27.0)*	.250 (6.35)	.350 (8.9)	1.280 (32.5)	0.44 (200)
5	12	1.97 (50)	1.63 (41.4)	1.5 (38.1)	1.250* (31.8)*	.300 (7.62)	.400 (10.16)	1.410 (35.8)	0.70 (319)

* Clearance hole for 4-40 x 1⅜″ nylon mtg. screws. Order screw as P/N PS-S and nut as P/N PS-N.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

MICROTRAN
company, inc.

POWER TRANSFORMERS
PRINTED CIRCUIT

international series power transformers

For PC Board Solid-State Power, Control, and Instrumentation Applications

- UL Recognized — Meets IEC-65 Safety Requirements for Worldwide Usage
- Physical Barriers Between Primary and Secondary — Double Protection System — 4,000 Volt Hipot

PW SERIES — FOR CONTROL AND POWER SUPPLY APPLICATIONS

115/230V 50/60 Hz Primary

Part No.	Secondary Parallel Connected AC Volts	 RMS Amps	 Series Connected AC Volts	 RMS Amps	Schematic	Fig.
PW28 SERIES • 0.5 VA						
PW28-10	10.0 CT	.050	(Single Secondary)		1†	A
PW28-16	16.0 CT	.031	(Single Secondary)		1†	A
PW28-24	24.0 CT	.021	(Single Secondary)		1†	A

† PW28 Series has 115V only primary. For 230V only primary, order as PW28-10-230, etc.

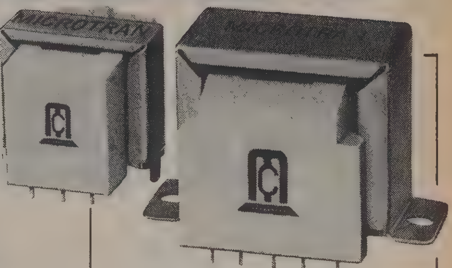
Part No.	Parallel AC Volts	Parallel RMS Amps	Series AC Volts	Series RMS Amps	Schematic	Fig.
PW35 SERIES • 1.1 VA						
PW35-10	10.0 CT	.110	(Single Secondary)		1	A
PW35-12	12.6 CT	.090	(Single Secondary)		1	A
PW35-16	16.0 CT	.070	(Single Secondary)		1	A
PW35-24	24.0 CT	.046	(Single Secondary)		1	A
PW35-36	36.0 CT	.031	(Single Secondary)		1	A
PW41 SERIES • 3.5 VA						
PW41-10	10.0 CT	.350	(Single Secondary)		1	B
PW41-12	12.6 CT	.280	(Single Secondary)		1	B
PW41-16	16.0 CT	.220	(Single Secondary)		1	B
PW41-24	24.0 CT	.150	(Single Secondary)		1	B
PW41-36	36.0 CT	.100	(Single Secondary)		1	B
PW48 SERIES • 9.5 VA						
PW48-10	5.0	1.900	10.0 CT	.950	2	B
PW48-12	6.3	1.500	12.6 CT	.750	2	B
PW48-16	8.0	1.200	16.0 CT	.600	2	B
PW48-24	12.0	.800	24.0 CT	.400	2	B
PW48-36	18.0	.520	36.0 CT	.260	2	B
PW48-56	28.0	.340	56.0 CT	.170	2	B
PW54 SERIES • 12.5 VA						
PW54-10	5.0	2.500	10.0 CT	1.250	2	C
PW54-12	6.3	2.000	12.0 CT	1.000	2	C
PW54-16	8.0	1.560	16.0 CT	.780	2	C
PW54-24	12.0	1.040	24.0 CT	.520	2	C
PW54-36	17.0	.700	36.0 CT	.350	2	C
PW54-56	28.0	.446	56.0 CT	.223	2	C

PWT SERIES — FOR TRIPLE OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

115/230V 50/60 Hz Primary

Part No.	Secondary #1 AC Volts	 RMS Amps	Secondary #2 AC Volts	 RMS Amps	DC Output #1 CT FW DC Volts	 Cur. mA DC	DC Output #2 CT FW DC Volts	 Cur. mA DC	Schematic	Fig.
PWT54-1024	9.0 CT	.800	24.0 CT	.300	+5	670	±15	170	3	C
PWT54-1633	16.0 CT	.550	33.0 CT	.180	+9.0*	470	±21*	120	4	C

* +9.0 and ±21 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator; see Schematic #4.



Recognized
Component
Underwriters
Labs Inc.

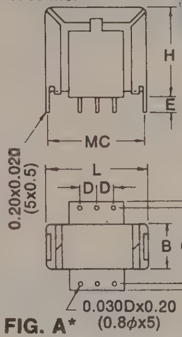
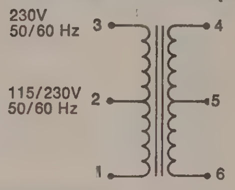


FIG. A*



SCHEMATIC 1

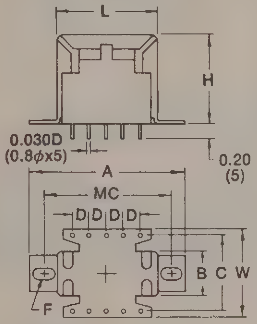
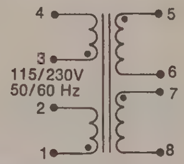
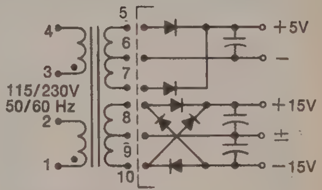


FIG. B*



SCHEMATIC 2



SCHEMATIC 3

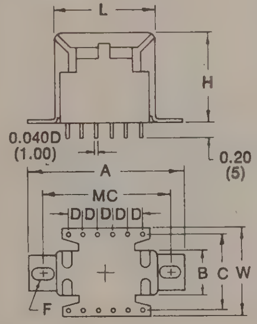
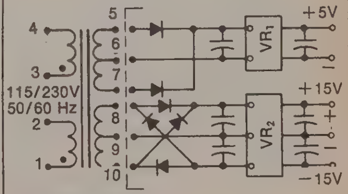


FIG. C*



SCHEMATIC 4

DIMENSIONS Inches (mm)

Series	Max VA	L	W	H	MC	A	B	C	D	E	F	Oz. (Gm)
PW28	0.7	1.16 (29.5)	1.32 (33.5)	1.10 (28)	1.12 (28.5)	— —	0.50 (12.5)	0.984 (25)	0.197 (5)	0.20 (5)	— —	2.5 (70)
PW35	2	1.44 (36.5)	1.69 (43)	1.26 (32)	1.40 (35.5)	— —	0.61 (15.5)	1.380 (35)	0.295 (7.5)	0.24 (6)	— —	4.5 (130)
PW41	5	1.67 (42.5)	1.91 (48.5)	1.42 (36)	2.05 (52)	2.36 (60)	0.85 (21.5)	1.575 (40)	0.394 (10)	— —	0.138x0.177 (3.5x4.5)	8.0 (230)
PW48	9.5	1.99 (50.5)	2.05 (52)	1.69 (43)	2.32 (59)	2.72 (69)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	14.0 (400)
PW54	15	2.22 (56.5)	2.09 (53)	1.93 (49)	2.72 (69)	3.15 (80)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	18.0 (510)

PWT54 and PW54 have same dimensions
* Request terminal layout sheet for pin locations.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

POWER TRANSFORMERS
PRINTED CIRCUIT

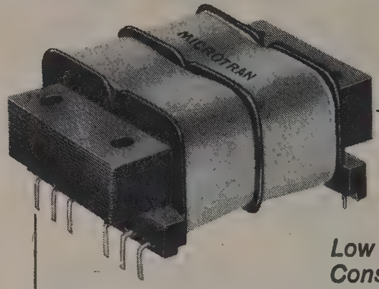
MICROTRAN company, Inc.

Flat Stack® low profile power transformers

115/230V 50/60 Hz

For Low Height PC Board Solid-State Power, Control, and Instrumentation Applications

- TWO SIZES
  6 VA Types 0.85″ high for 1″ Card Spacing
  12 VA Types 1.065″ high for 1¼″ Card Spacing
- SPLIT BOBBIN — Primaries and Secondaries Wound Side by Side.
  1500V Hipot.
  High Isolation for Low Leakage Applications.
  Low Capacity Coupling Minimizes Line Noise and False Triggering.
- HUM-BUCKING SEMI-TOROIDAL CONSTRUCTION
  Balanced Windings Reduce Magnetic Field Radiation.
- PRECISION SPACE MOLDED-IN TERMINALS
- DUAL PRIMARIES: 115/230V, 50/60 Hz.



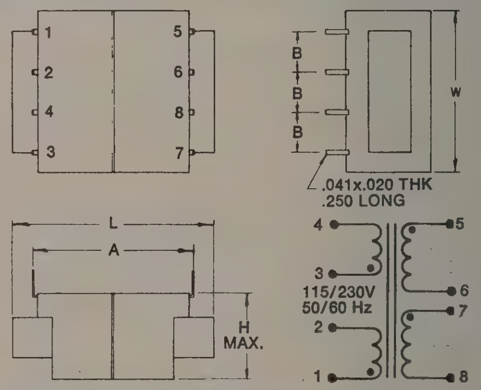
Recognized Component
Underwriters Labs Inc.

Low Profile Construction

PF SERIES — FOR POWER SUPPLIES, INSTRUMENTS, CONTROL EQUIPMENT

Part No.	Secondary			
	Parallel Connected		Series Connected	
	AC Volts	RMS Amps	AC Volts	RMS Amps
PF6 SERIES • 115/230V PRIMARY • 6 VA				
PF6-10	5.0	1.200	10.0 CT	.600
PF6-12	6.3	.900	12.6 CT	.450
PF6-16	8.0	.700	16.0 CT	.350
PF6-24	12.0	.500	24.0 CT	.250
PF6-34	17.0	.340	34.0 CT	.170
PF6-56	28.0	.200	56.0 CT	.100
PF12 SERIES • 115/230V PRIMARY • 12 VA				
PF12-10	5.0	2.400	10.0 CT	1.200
PF12-12	6.3	1.800	12.6 CT	.900
PF12-16	8.0	1.400	16.0 CT	.700
PF12-24	12.0	1.000	24.0 CT	.500
PF12-34	17.0	.680	34.0 CT	.340
PF12-56	28.0	.400	56.0 CT	.200

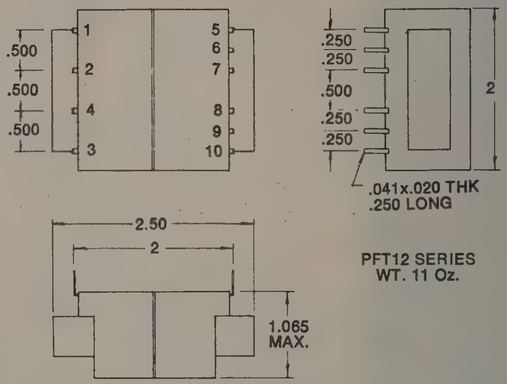
PF SERIES



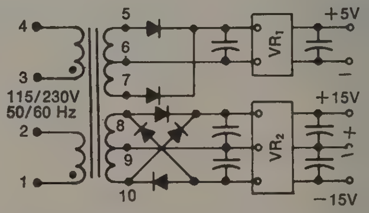
DIMENSIONS (Inches)

Series	L	W	H	A	B	Wt. Oz.
PF6-	1⅞	1⁹⁄₁₆	0.850	1.600	0.375	7
PF12-	2½	2	1.065	2.000	0.500	11

PFT SERIES



PFT12 SERIES
WT. 11 Oz.



PFT SERIES — FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES

For Microprocessor Logic, and Op Amp Applications

Part No.	Secondary #1		Secondary #2		DC Output #1		DC Output #2	
	AC Volts	RMS Amps	AC Volts	RMS Amps	CT FW DC Volts	Cur. mA DC	CT FW DC Volts	Cur. mA DC
PFT SERIES • 115/230V PRIMARY • 12 VA								
PFT12-35	16.0CT	.360	35.0CT	.150	+8.75*	300	±22*	85

* +8.75 and ±22 DC output volts are for inputs to +5V and ±12 or ±15V IC Voltage Regulators. See PFT schematic. Line input 115/230V ±10%.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

MICROTRAN company, inc.

POWER TRANSFORMERS
PRINTED CIRCUIT

printed circuit power transformers

COMPACT DESIGN FOR MINIATURIZED SOLID STATE CIRCUITRY

For power supplies, instruments and control applications.

SINGLE 115V PRIMARY

6 Pin Type Part No.	Fig.	Secondary* Parallel Connected AC Volts		Secondary* Parallel Connected RMS Amps	Secondary* Series Connected AC Volts		Secondary* Series Connected RMS Amps
PC6506	A	6.3 CT		.250	(Single Secondary)		
PC6512	A	12.6		.120	25.2 CT		.060
PC6524	A	40.0		.040	80.0 CT		.020
PC6528	A	58.0		.026	116.0 CT		.013
PC6608	C	6.3		.700	12.6 CT		.350
PC6616	C	28.0		.156	56.0 CT		.078
PC6624	C	40.0		.110	80.0 CT		.055
PC6628	C	58.0		.066	116.0 CT		.033
PC6632	C	115.0V	@	.020A	and 12.6V	@	.150A
PC6708	C	6.3		1.200	12.6 CT		.600
PC6712	C	12.6		.600	25.2 CT		.300
PC6715	C	20.0		.370	40.0 CT		.185
PC6716	C	28.0		.270	56.0 CT		.135
PC6724	C	40.0		.180	80.0 CT		.090
PC6728	C	58.0		.130	116.0 CT		.065
PC6732	C	115.0V	@	.025A	and 12.6V	@	.250A

* Dual secondaries may be parallel connected to obtain twice the current, or series connected to give twice the voltage of one winding.

DUAL 115/230V PRIMARY

8 Pin Type Part No.	8 Pin Type Fig.	Secondary* Parallel Connected AC Volts		Secondary* Parallel Connected RMS Amps	Secondary* Series Connected AC Volts		Secondary* Series Connected RMS Amps	Top Lug Type† Part No.	Top Lug Type† Fig.
PC3506	B	6.3 CT		.250	(Single Secondary)			PC2506	E
PC3512	B	12.6		.120	25.2 CT		.060	PC2512	E
PC3524	B	40.0		.040	80.0 CT		.020	PC2524	E
PC3528	B	58.0		.026	116.0 CT		.013	PC2528	E
PC3608	D	6.3		.700	12.6 CT		.350	PC2608	F
PC3616	D	28.0		.156	56.0 CT		.078	PC2616	F
PC3624	D	40.0		.110	80.0 CT		.055	PC2624	F
PC3628	D	58.0		.066	116.0 CT		.033	PC2628	F
PC3632	D	115.0V	@	.020A	and 12.6V	@	.150A	PC2632	F
PC3708	D	6.3		1.200	12.6 CT		.600	PC2708	F
PC3712	D	12.6		.600	25.2 CT		.300	PC2712	F
PC3715	D	20.0		.370	40.0 CT		.185	PC2715	F
PC3716	D	28.0		.270	56.0 CT		.135	PC2716	F
PC3724	D	40.0		.180	80.0 CT		.090	PC2724	F
PC3728	D	58.0		.130	116.0 CT		.065	PC2728	F
PC3732	D	115.0V	@	.025A	and 12.6V	@	.250A	PC2732	F

* Dual secondaries may be parallel connected to obtain twice the current, or series connected to give twice the voltage of one winding.
† Lugs on PC2000 series provide for 115/230V primary voltage options without changes in PC board.

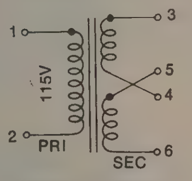
DIMENSIONS

Series	VA	A	B	C	D	E	F	G	Wt. Oz.
6 PIN TYPE									
PC6500	1½	1 25/64	1 13/64	1.00	.312	1 5/32	—	—	3.2
PC6600	4½	1 45/64	1 7/16	1.10	.400	1¼	2	2⅜	6.5
PC6700	7½	1 61/64	1 11/16	1.30	.400	1 15/32	2⅜	2 13/16	9.5
8 PIN TYPE									
PC3500	1½	1 25/64	1 13/64	1.00	.200	1 5/32	—	—	3.2
PC3600	4½	1 45/64	1 7/16	1.10	.250	1¼	2	2⅜	6.5
PC3700	7½	1 61/64	1 11/16	1.30	.250	1 15/32	2⅜	2 13/16	9.5

TOP LUG TYPE

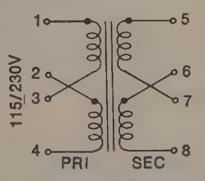
PC2500	1½	1 25/64	1 11/64	1 13/64	1.00	.312	1 5/32	—	—	3.2
PC2600	4½	1 45/64	1 25/64	1 7/16	1.10	.400	1¼	2	2⅜	6.5
PC2700	7½	1 61/64	1 41/64	1 11/16	1.30	.400	1 15/32	2⅜	2 13/16	9.5

6 PIN TYPE



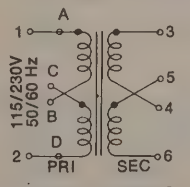
PC6000 SERIES

8 PIN TYPE



PC3000 SERIES

TOP LUG TYPE



PC2000 SERIES

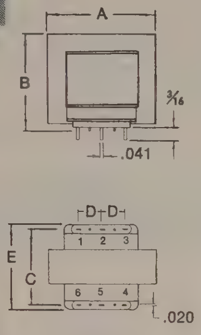


FIG. A

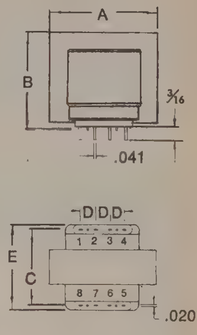


FIG. B

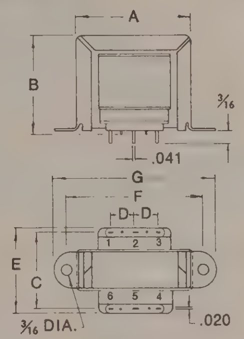


FIG. C

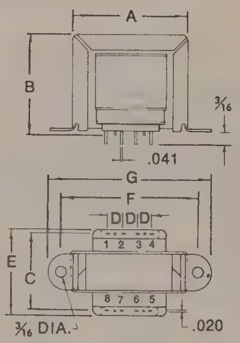
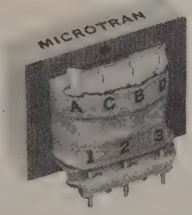
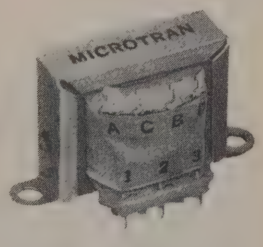


FIG. D





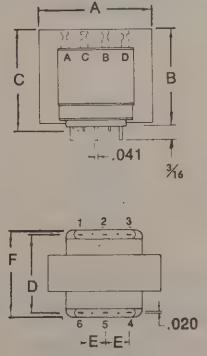


FIG. E

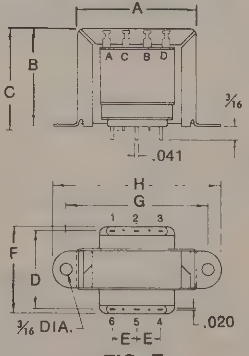


FIG. F

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

POWER TRANSFORMERS
PRINTED CIRCUIT

MICROTRAN company, inc.

printed circuit power supply transformers

For Microprocessor Logic and Op Amp Power Supplies

PLUG-IN PC POWER TRANSFORMERS FOR +5V AND ±15V DC POWER SUPPLIES

For construction of low cost, miniaturized, regulated and unregulated DC power supplies for latest solid-state digital and linear circuitry. Permits packaging flexibility unobtainable with prepackaged power supplies. Low-profile, miniaturized construction permits close stacking of PC boards. Precision spaced molded-in terminals.

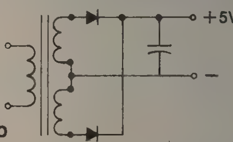
TRANSFORMERS FOR +5V DC SINGLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

* All primaries 115V 50/60 Hz except PCL6605 and PCL6610 which have 115/230V 50/60 Hz primaries.

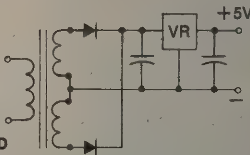
	SECONDARY				DC OUTPUT			
	Parallel Connected		Series Connected		CT FW DC Volts	Current mA DC	Schematic (See Pg. 9)	Fig. (See Pg. 9)
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps				
PC6205	4.50	0.18	9.0 CT	0.09	+5	75	1	A
PC6505	4.50	0.36	9.0 CT	0.18	+5	150	1	C
PC6605	4.50	1.10	9.0 CT	0.55	+5	450	1	G
PCL6605*	4.50	1.10	9.0 CT	0.55	+5	450	2	E
PC6705	4.50	2.00	9.0 CT	1.00	+5	825	1	G
PC6905	4.50	5.00	9.0 CT	2.50	+5	2000	1	J
PC6210	7.75	0.12	15.5 CT	0.06	+8.5**	50	1	A
PC6510	7.75	0.22	15.5 CT	0.11	+8.5**	90	1	C
PC6610	7.75	0.64	15.5 CT	0.32	+8.5**	265	1	G
PCL6610*	7.75	0.64	15.5 CT	0.32	+8.5**	265	2	E
PC6710	7.75	1.20	15.5 CT	0.60	+8.5**	500	1	G
PC6910	7.75	3.10	15.5 CT	1.55	+8.5**	1300	1	J

** +8.5 DC output volts for input to +5V IC Voltage Regulator, see Typical Schematic-Regulated.
* 115/230V primary.

TYPICAL SCHEMATICS



UNREGULATED



REGULATED

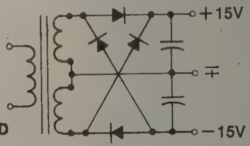
TRANSFORMERS FOR ±15V DC DUAL OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

* All primaries 115V 50/60 Hz except PCL6611 and PCL6614 which have 115/230V 50/60 Hz primaries.

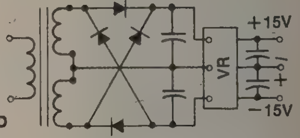
	SECONDARY				DC OUTPUT			
	Parallel Connected		Series Connected		CT FW DC Volts	Current mA DC	Schematic (See Pg. 9)	Fig. (See Pg. 9)
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps				
PC6211	12.0	0.07	24.0 CT	0.035	±15	22	1	A
PC6511	12.0	0.13	24.0 CT	0.065	±15	40	1	C
PC6611	12.0	0.40	24.0 CT	0.200	±15	120	1	G
PCL6611*	12.0	0.40	24.0 CT	0.200	±15	120	2	E
PC6711	12.0	0.76	24.0 CT	0.380	±15	220	1	G
PC6911	12.0	1.90	24.0 CT	0.950	±15	550	1	J
PC6214	16.0	0.05	32.0 CT	0.025	±20**	15	1	A
PC6514	16.0	0.10	32.0 CT	0.050	±20**	30	1	C
PC6614	16.0	0.30	32.0 CT	0.150	±20**	90	1	G
PCL6614*	16.0	0.30	32.0 CT	0.150	±20**	90	2	E
PC6714	16.0	0.56	32.0 CT	0.280	±20**	165	1	G
PC6914	16.0	1.40	32.0 CT	0.700	±20**	410	1	J

** ±20 DC output volts for input to ±15V output IC Voltage Regulator, see Typical Schematic-Regulated.
* 115/230V primary.

TYPICAL SCHEMATICS



UNREGULATED



REGULATED

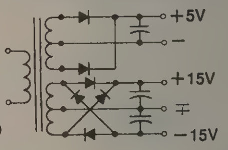
TRANSFORMERS FOR +5V AND ±15V DC TRIPLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

* All primaries 115V 50/60 Hz except PCL6630 and PCL6631 which have 115/230V 50/60 Hz primaries.

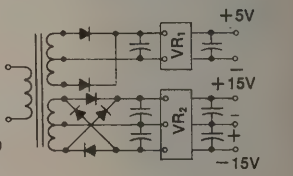
	Secondary #1		Secondary #2		DC Output #1		DC Output #2		Schematic (See Pg. 9)	Fig. (See Pg. 9)
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	CT FW DC Volts	Cur. mA DC	CT FW DC Volts	Cur. mA DC		
PCT6230	9.0 CT	0.048	24.0 CT	0.020	+5	40	±15	12	4	B
PCT6530	9.0 CT	0.072	24.0 CT	0.032	+5	60	±15	20	4	D
PCT6630	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	4	H
PCL6630*	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	3	F
PCT6730	9.0 CT	0.480	24.0 CT	0.160	+5	400	±15	100	4	H
PCT6930	9.0 CT	1.200	24.0 CT	0.440	+5	1000	±15	275	4	K
PCT6531	15.5 CT	0.048	32.0 CT	0.020	+8.5**	40	±20**	12	4	D
PCT6631	15.5 CT	0.140	32.0 CT	0.058	+8.5**	115	±20**	35	4	H
PCL6631*	15.5 CT	0.140	32.0 CT	0.058	+8.5**	115	±20**	35	3	F
PCT6731	15.5 CT	0.300	32.0 CT	0.100	+8.5**	250	±20**	60	4	H
PCT6931	15.5 CT	0.690	32.0 CT	0.298	+8.5**	575	±20**	175	4	K

** +8.5 and ±20 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator, see Typical Schematic-Regulated.
* 115/230V primary.

TYPICAL SCHEMATICS



UNREGULATED



REGULATED

ALL TRANSFORMERS ARE SUPPLIED WITH ENGINEERING BULLETIN LISTING SUGGESTED COMPONENTS

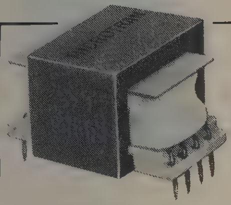
Bulletin provides typical schematics and suggested components for low-cost, miniaturized, unregulated and regulated power supplies. Regulated units have short circuit, thermal overload and overvoltage protection, and have the following typical specifications: Input 105-125V; Output ±0.1V; Load and Line Regulation 0.1% each; Ripple 1 mV RMS.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

MICROTRAN
company, inc.

POWER TRANSFORMERS
PRINTED CIRCUIT

Schematics and Outline Drawings for Page 1A•2196



PC6200 Series
PCT6200 Series
Wt. 2.3 Oz.

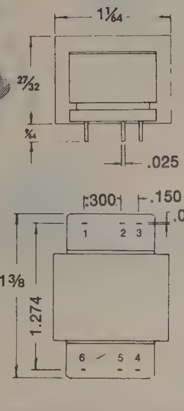

1⅙₄
27/32
¾₄
.025
.300
.150
.015
1
2 3
1⅜
1.274
6 5 4

FIG. A — 6 Pins

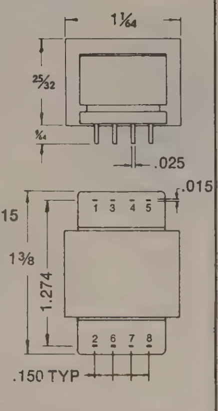
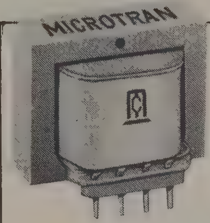

1⅙₄
25/32
¾₄
.025
.015
1 3 4 5
1⅜
1.274
2 6 7 8
.150 TYP

FIG. B — 8 Pins



PC6500 Series
PCT6500 Series
Wt. 3.2 Oz.

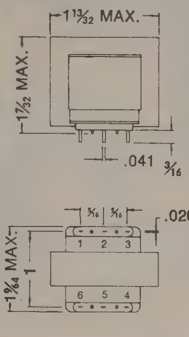

1 13/32 MAX.
1 7/32 MAX.
.041
3/16
3/16 3/16
.020
1 2 3
1 9/64 MAX.
1
6 5 4

FIG. C — 6 Pins

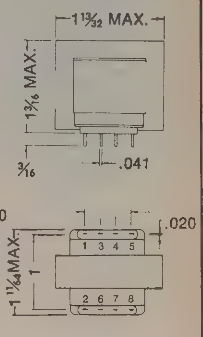
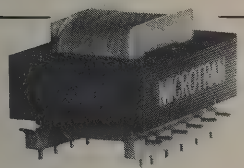

1 13/32 MAX.
1 3/16 MAX.
3/16
.041
.020
1 3 4 5
1 11/64 MAX.
1
2 6 7 8

FIG. D — 8 Pins



PCL6600 Series
Wt. 6.5 Oz.

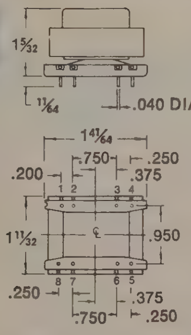

1 5/32
1/64
.040 DIA.
1 41/64
.750
.250
.375
.200
1 2 3 4
1 11/32
.950
8 7 6 5
.250
.375
.750
.250

FIG. E — 8 Pins

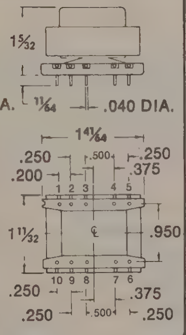

1 5/32
1/64
.040 DIA.
1 41/64
.250
.500
.250
.200
.375
1 2 3 4 5
1 11/32
.950
10 9 8 7 6
.250
.375
.250
.500
.250

FIG. F — 10 Pins

PC6600 &
PC6700 Series

PCT6600 &
PCT6700 Series

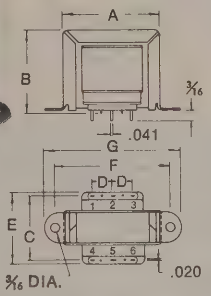

A
B
3/16
.041
G
F
D D
1 2 3
E
C
4 5 6
3/16 DIA.
.020

FIG. G — 6 Pins

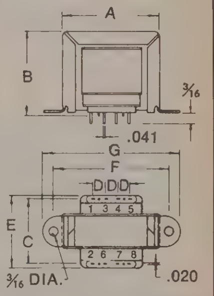
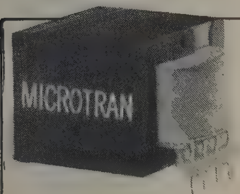

A
B
3/16
.041
G
F
D D D
1 3 4 5
E
C
2 6 7 8
3/16 DIA.
.020

FIG. H — 8 Pins

Series	Fig.	A	B	C	D	E	F	G	Wt. Oz.
PC6600	G	1 45/64	1 7/16	1.10	.400	1¼	2	2⅜	6.5
PC6700	G	1 61/64	1 11/16	1.30	.400	1 15/32	2⅜	2 13/16	9.5
PCT6600	H	1 45/64	1 7/16	1.10	.250	1¼	2	2⅜	6.5
PCT6700	H	1 61/64	1 11/16	1.30	.250	1 15/32	2⅜	2 13/16	9.5



PC6900 Series
PCT6900 Series
Wt. 12 Oz.
Slip-on Mounting
Bracket Available
See Fig. L

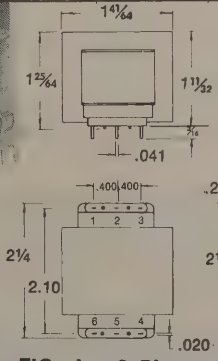

1 41/64
1 25/64
1 11/32
3/16
.041
.400 .400
1 2 3
2¼
2.10
6 5 4
.020

FIG. J — 6 Pins

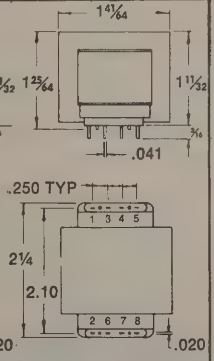

1 41/64
1 25/64
1 11/32
3/16
.041
.250 TYP
1 3 4 5
2¼
2.10
2 6 7 8
.020

FIG. K — 8 Pins

SLIP-ON BRACKET

For PC6900 Series
See Fig. J & K

Order as Part No. PC6900-FB
Mounted height over
bracket 1 7/16" max.

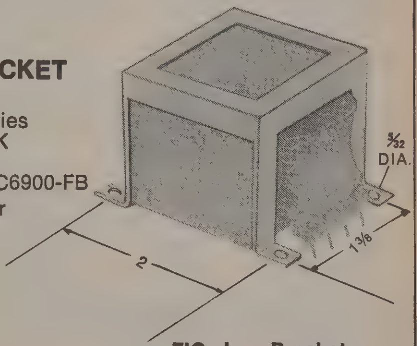
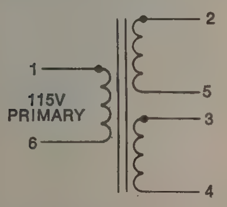
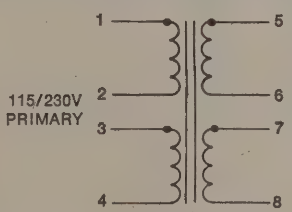


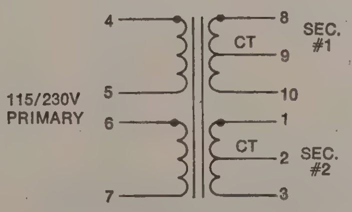
FIG. L — Bracket


1
115V
PRIMARY
6
2
5
3
4

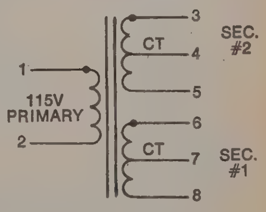
SCHEMATIC #1


1
115/230V
PRIMARY
2
3
4
5
6
7
8

SCHEMATIC #2


4
115/230V
PRIMARY
5
6
7
8
CT
9
10
SEC.
#1
1
CT
2
3
SEC.
#2

SCHEMATIC #3


1
115V
PRIMARY
2
3
CT
4
5
SEC.
#2
6
CT
7
8
SEC.
#1

SCHEMATIC #4

CONVERTER TRANSFORMERS
POWER TRANSFORMERS

MICROTRAN company, Inc.

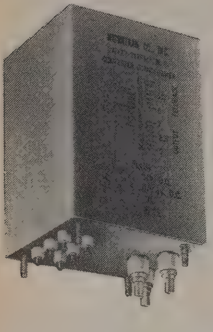


FIG. A

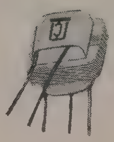


FIG. B

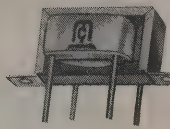


FIG. C

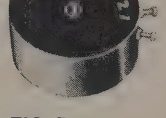


FIG. D

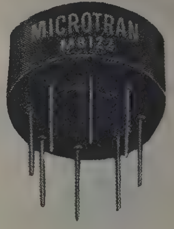


FIG. H

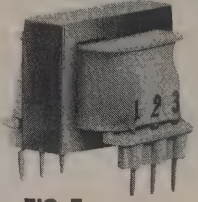


FIG. E

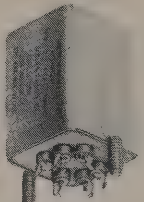


FIG. F

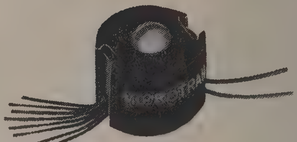


FIG.G

DC-DC CONVERTER TRANSFORMERS

Permits conversion of low-voltage DC to higher voltages for operating mobile equipment or for DC isolation. Supplied with schematic and component values.

Select the Unit That Meets Your Power & Size Requirements	Part No.	Total VA Output‡	DC Input Volts	DC Output¶				Switching Freq. Hz (approx.)	Dimensions			Type of Construction	Fig.	Approx. Wt. Oz.
				Bridge		CT Full Wave				Mtg. Cent.				
				Volts	mA	Volts	mA		D x W x H	MD	MW			
High Voltage Low Power Miniature Design	M8149	25 mW	3	1,000*	25 µA	—	—	400	1 1/64 x 61/64 x 27/32	—	—	Plug-in	E	1.2
	M8050	25 mW	1	1,000*	25 µA	—	—	400	1 11/16 x 13/16 x 27/32	1 3/8	—	Open Frame with Leads	C	1.25
	M8051	25 mW	3	1,000*	25 µA	—	—	400	1 x 1 x 1 3/8	1 1/8	—	MIL — AG	F	2.4
	M8073	25 mW	4	425-500*	50 µA	—	—	50-3K†	3/8 x 3/8 x 3/8	—	—	Open Frame	B	.1
	M8074	50 mW	3	535*	90 µA	—	—	400	1 11/16 x 13/16 x 27/32	1 3/8	—	Open Frame	C	1.25
	M8072	190 mW	2.7	480*	400 µA	—	—	800	1 11/16 x 13/16 x 27/32	1 3/8	—	Open Frame	C	1.25
	M8120	190 mW	28	480*	400 µA	—	—	3.5K	1 11/16 x 13/16 x 27/32	1 3/8	—	Open Frame	C	1.25
For Displays Nixie-Panaplex	M8121	3	5	190	15	—	—	20K	9/16D x 11/32H			Open Frame	G	.3
5 VA High Voltage Low Profile Encapsulated	M8115	5	13.8	±250 or 500§	10	250	20	6K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
	M8117	5	28	±250 or 500§	10	250	20	6K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
	M8122	5	5	±15 or 30	175	15	350	20K	7/8 D x 17/32 H—.140 Cl. Hole			Toroidal	H	1.1
High Frequency Encapsulated	M8132	30	13.8	±15 or 30§	1,000	15	2,000	20K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
	M8133	30	28	±15 or 30§	1,000	15	2,000	20K	1 1/4 D x 3/4 H—.140 Cl. Hole			Toroidal	D	1.1
Medium Power Low Profile Encapsulated	M8113	50	13.8	±14 or 28§	1,750	14	3,500	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6
	M8114	50	28	±14 or 28§	1,750	14	3,500	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6
	M8116	50	13.8	±35 or 70§	700	35	1,400	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6
	M8118	50	28	±35 or 70§	700	35	1,400	2.5K	2 1/8 D x 1 1/4 H—.170 Cl. Hole			Toroidal	D	6

‡ Full-wave and CT loads may be simultaneously drawn, but for continuous duty, total VA output should not be exceeded. † Frequency depends on load and bias conditions. ¶ Based on approximately 1 volt drop per rectifier. § For positive and negative voltage supply as utilized in op-amp and similar circuitry.

400 Hz PLUG-IN P.C. POWER

Compact design for miniature solid state circuitry. Precision spaced molded-in terminals. Dual secondaries may be connected in series or parallel. 115V Primary.

Part No.	Secondary - Parallel	Secondary - Series
PC4304	3.15V @ .1A	6.3V CT @ .05A
PC4312	12.6V @ .026A	25.2V CT @ .013A
PC4316	28V @ .012A	56V CT @ .006A
PC4320	35V @ .01A	70V CT @ .005A
PC4408	6.3V @ 0.60A	12.6V CT @ .30A
PC4412	12.6V @ 0.30A	25.2V CT @ .15A
PC4416	28V @ 0.14A	56V CT @ .07A
PC4424	40V @ 0.10A	80V CT @ .05A
PC4428	58V @ .066A	116V CT @ .033A
PC4432	115V @ .010A, 12.6V @ .150A	

DIMENSIONS

Series	W	D	H	Fig.	Wt. Oz.
PC4300	49/64	11/16	23/32	E	.5
PC4400	1 1/64	61/64	27/32	E	1.2

400 Hz TOROIDAL P.C. POWER

For Applications Requiring Minimum Size and Weight. Epoxy molded. Printed circuit pins can be bent for chassis mounting. .170 Clearance Hole for #8 Screw. Primary 115 Volts, MIL Designation TF5S03ZZ.

Part No.	Secondary AC Volts	Secondary RMS mA	VA	Dimensions		Fig.	Wt. Oz.
				OD	Height		
M8106	28 CT	320	9	1 5/32	1 1/8	H	2
M8107	28 CT	710	20	1 1/2	1 1/4	H	4
M8108	56 CT	160	9	1 5/32	1 1/8	H	2
M8109	56 CT	356	20	1 1/2	1 1/4	H	4
M8110	115 CT	78	9	1 5/32	1 1/8	H	2
M8111	115 CT	170	20	1 1/2	1 1/4	H	4

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

MICROTRAN
company, inc.

MINIATURIZED AUDIO TRANSFORMERS

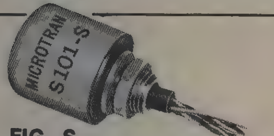


FIG. -S
SINGLE THREADED STUD MOUNTING
Double Mu-metal shielding. 3" color coded leads. 5/16"D. stud provided with nut. 5/8"D x 13/16" H. Wt. 0.55 oz.

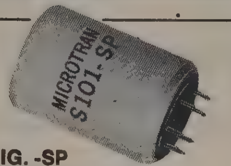


FIG. -SP
PRINTED CIRCUIT MOUNTED
Double Mu-metal shielded. 3/4" D x 1 1/16"H. 7-.040 pins 1/8" H. Wt. 0.62 oz.

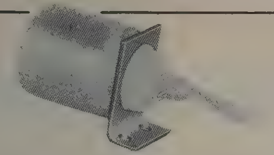
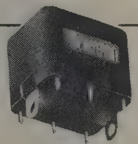
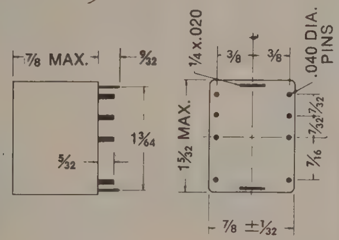
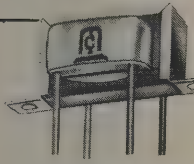
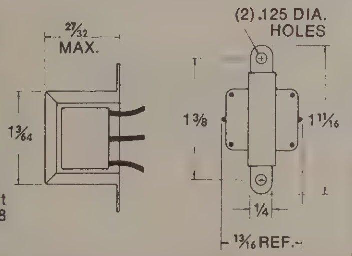


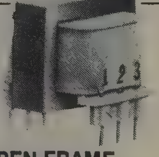
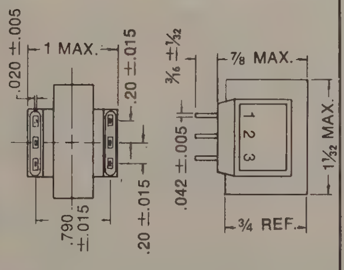
FIG. -FB
RIGHT ANGLE MOUNTING BRACKET
For mounting of -S series transformers. M.C. 3/8".

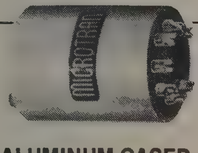
MOLDED M-M
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. 1.75 oz.

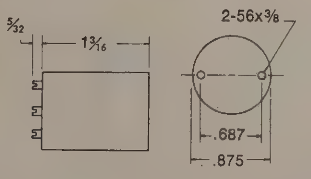



OPEN FRAME WITH CHANNEL M-FB
To order add -FB to Part No. Leads 4" long. #28 PVC Wt. 1.13 oz.

OPEN FRAME PRINTED CIRCUIT M-PC
To order add -PC to Part No. Units with more than 6 pins have 7 or 8 — .025 x .015 pins on .150 centers. Wt. 1.2 oz.





ALUMINUM CASED M-A
To order add -A to Part No. Supplied with 2-56 screws. Wt. 1.25 oz.

MICROPHONE/TRANSDUCER INPUT

FOR: PROFESSIONAL SOUND STUDIOS — BROADCAST MIXING CONSOLES — CONTROL AND INSTRUMENT AMPLIFIERS

EQUIVALENT TO IMPORTED EUROPEAN STUDIO GRADE TRANSFORMERS

- WIDE BANDWIDTH — BROAD FREQUENCY RESPONSE
- EXTREMELY LOW DISTORTION
- NEGLIGIBLE HUM PICK UP
- SUBMINIATURE SIZE
- EASE OF MOUNTING AND ORIENTATION
- POLARIZING VOLTAGE CONNECTION FOR CONDENSER MICROPHONES
- LOW MICROPHONICS
- ELECTROSTATIC SHIELDING

Part No.	Nom. Turns Ratio Pri:Sec	Nominal Impedance Ratio		Typ. Open Circuit Primary Impedance @ 50 Hz†	Frequency Response	Fig.	Replaces Beyer Part No.
		Primary	Secondary				
S101-S	1:20	12.5	5,000	100	30-15,000 Hz ±1 dB	-S	TR-BV35704
S101-SP	1:20	12.5	5,000	100	30-15,000 Hz ±1 dB	-SP	STR-BV37704
S105-S	1:15	200	45,000	2,000	30-15,000 Hz ±1 dB	-S	351.015.006
S105-SP	1:15	200	45,000	2,000	30-15,000 Hz ±1 dB	-SP	370.015.006
S107-S	1:15	200/50 split	45,000	2,000	30-15,000 Hz ±1 dB	-S	351.215.006
S107-SP	1:15	200/50 split	45,000	2,000	30-15,000 Hz ±1 dB	-SP	370.215.006
S108-S	1:10	200	20,000	2,000	30-15,000 Hz ±1 dB	-S	351.010.005
S108-SP	1:10	200	20,000	2,000	30-15,000 Hz ±1 dB	-SP	370.010.005
S111-S	1:7.1	200	10,000	2,000	30-15,000 Hz ±1 dB	-S	351.007.004
S111-SP	1:7.1	200	10,000	2,000	30-15,000 Hz ±1 dB	-SP	370.007.004
S116-S	1:5	200	5,000	2,000	30-15,000 Hz ±1 dB	-S	351.005.003
S116-SP	1:5	200	5,000	2,000	30-15,000 Hz ±1 dB	-SP	370.005.003
S118-S	1:5	200/50 split	5,000	2,000	30-15,000 Hz ±1 dB	-S	351.205.003
S118-SP	1:5	200/50 split	5,000	2,000	30-15,000 Hz ±1 dB	-SP	370.205.003
S126-S	1:1	600 CT	600	3,750	30-20,000 Hz ±.5 dB	-S	TR145/BV35508
S126-SP	1:1	600 CT	600	3,750	30-20,000 Hz ±.5 dB	-SP	STR-145/BV37508
S130-S	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-S	TR-145/BV35590
S130-SP	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-SP	STR-145/BV37590
S100-FB	Right angle mounting bracket for S100-S series.					-FB	

† Designed for optional bridging termination use to provide additional 6 dB output voltage gain.

‡ Frequency response measured with source equal to nominal primary impedance and with unloaded secondary except 100k load on S105 and S107 series.

MINIATURE AUDIO M & MT SERIES

All items shown in charts below are available in any of the mechanical packages shown. These units can be used as input, interstage, output, isolation and other impedance matching applications. Primary and secondary windings may be interchanged to obtain required impedance matching. Also available in hermetic construction.

Part No.*	Primary Impedance	Secondary Impedance	Primary Unbalance mA DC	Operating Level dBm	Frequency Response ±2 dB
M3-(*)•	7.5/30	50,000	0	5	20-20,000
M12-(*)	50/250 CT	50/250/600 CT	0	8	20-20,000
M1-(*)•	50/250/600 CT	50,000	0	5	20-20,000
M1-S	Same as M1 above — with dual nickel alloy shield				
M2-(*)•	50/250/600 CT	50,000 CT	0	5	20-20,000
M14-(*)	200	½ Megohm	0	9	80-3,000
M15-(*)	10,000	1 Megohm	0	11	100-2,500
M8-(*)	15,000	50/250/600 CT	0	8	20-20,000
M9-(*)	15,000	50/250/600 CT	4	11	150-20,000
M4-(*)	15,000	60,000	0	6	20-15,000
M5-(*)	15,000	60,000	4	14	200-20,000
M6-(*)	15,000	95,000 CT	0	5	20-15,000
M7-(*)	15,000	95,000 CT	4	11	200-20,000
M10-(*)•	30,000 CT	50/250/600 CT	0	8	30-50,000
M11-(*)•	50,000	50/250/600 CT	0	5	20-20,000
M13-(*)	Reactor 300 hy. 0 DC	50 hy. @ 3 mA		6000Ω D.C.R.	
M90	Magnetic Shield Mu-Metal slip on can for M-A Series 25 dB shielding				
MT2-(*)	100	10 CT/40 CT	100	27	200-20,000
MT30-(*)	250 CT	500	10	30	200-15,000
MT23-(*)	250 CT	1000	10	30	200-15,000
MT14-(*)	400	10	50	25	200-20,000
MT15-(*)	500 CT	210	30	27	300-20,000
MT1-(*)	600	600	10	23	200-15,000
MT35-(*)‡	600	600 CT & 600 CT	0	5	40-20,000
MT36-(*)†	600 CT	600 CT	0	15	50-15,000
MT26-(*)	600 CT	600 CT	20	23	200-15,000
MT9-(*)	600 CT	1,200 CT	4	23	200-15,000
MT33-(*)	600/150 Split	600/150 Split	20	23	200-20,000
MT22-(*)	600/150 Split	1,200 CT	4	23	200-15,000
MT29-(*)	1600 CT	450	15	30	200-15,000
MT12-(*)	2,000	3.4	10	32	200-15,000
MT24-(*)	2,500	600 CT	10	32	200-15,000
MT13-(*)	4,000 CT	3.4	3	32	200-15,000
MT11-(*)	4,000 CT	600 CT	3	32	200-15,000
MT21-(*)	4,000 CT	600/150 Split	3	32	200-15,000
MT25-(*)	7,500 CT	600 CT	8	32	200-15,000
MT34-(*)	10,000/2500 Split	2000/500 Split	4	20	200-20,000
MT10-(*)•	25,000	600	3	22	200-15,000
MT7-(*)•	25,000	1,200 CT	3	22	200-15,000
MT18-(*)•	25,000 CT	1,200 CT	6	22	200-15,000
MT5-(*)•	50,000	6	3	20	300-15,000
MT3-(*)	50,000	600	3	20	300-15,000
MT8-(*)•	50,000 CT	1,200 CT	3	20	300-15,000
MT20-(*)•	50,000 CT	1200/300 Split	3	20	300-15,000
MT6-(*)•	100,000	1,200 CT	1.4	17	200-15,000

* Add -M, -PC, -A, or -FB to Part No. to designate construction.
• These items not available in -PC construction.
‡ For telephone line coupling or hybrid telephone line.
† Broadcast fidelity line matching transformer. Frequency response ±0.5 dB.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, Inc.

line coupling-hybrid-holding coils

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

DESIGNED TO MEET FCC PART 68

Provides line isolation and matching — Prevents line imbalance — Wide dynamic signal capability — Low distortion
Permits Optimum use of Voice-Grade Telephone Lines for Broadband Data Signals

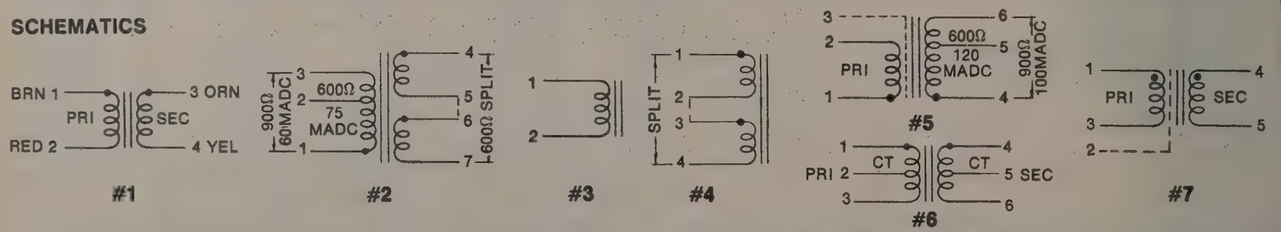
- Frequency Response: 300-3500 Hz ±0.5 dB
- Level: −45 dBm to +7 dBm
- Longitudinal Balance: Per FCC 68.310
- Distortion: 0.5% Max.
- Impedance Matching: ±10% over entire frequency range
- Return Loss: 26 dB Min.

Part No.	Primary Impedance	Secondary Impedance	Unbalance mA DC	Schematic	Page	Fig.	Page	Application Notes
VOICE/DATA COUPLING								
PM32-F	600	600	1.5	1	1A•2200	O	1A•2202	Freq. resp. 300 Hz — 100 kHz ±2 dB. Open frame 0.27″ H.
PM34-F	600 CT	600 CT	3	14	1A•2202	P	1A•2202	Freq. resp. 300 Hz — 100 kHz ±2 dB. Open frame 0.27″ H.
PM32-M	600	600	1.5	1	1A•2200	R	1A•2202	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
PM34-M	600 CT	600 CT	3	14	1A•2202	S	1A•2202	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
T1104	600	600	0	1	1A•2200	A	1A•2201	Low profile.
T2104	600	600	0	1	1A•2200	B	1A•2201	
T2106	600 CT	600 CT	0	6	1A•2200	E	1A•2201	
T2108	600	900	0	1	1A•2200	B	1A•2201	
T2110	900	900	0	7	1A•2200	C	1A•2201	Electrostatic shield.
T2316	4000	600	0	1	1A•2200	B	1A•2201	For bridging applications.
T4113	900/600	600 split	60/75 Pri.	2	1A•2200	J	1A•2201	Level −15 to +7 dBm.
T5114	600	600 split	75	8	1A•2201	K	1A•2202	
T5115	600	600 split	120	9	1A•2201	L	1A•2202	
T6112	600	900/600	100/120 Sec.	5	1A•2200	G	1A•2201	Electrostatic shield.
T9116	600 CT	600 CT	80	16	1A•2202	N	1A•2202	Low profile. Low crosstalk.
T9117	600 CT	600 CT	80	17	1A•2202	N	1A•2202	Low profile. Low crosstalk. Return loss 23 dB @ 440Ω +0.035 μF load in parallel.
DATA MODEM COUPLING — NON-VOICE APPLICATION — FOR 300/1200 BAUD MODEM BOARD FOR MICROCOMPUTERS								
T2111	600	600	90	12	1A•2201	Q	1A•2202	Low profile. Freq. resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz ref.
T2112	600	600 CT	90	13	1A•2201	Q	1A•2202	Low profile. Freq. resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz ref.
T2113	600	600	90	12	1A•2201	B	1A•2201	Freq resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz. ref.
T2114	600	600 CT	90	13	1A•2201	E	1A•2201	Freq resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz. ref.
HOLDING COILS								
T4415	2.0 H/1.3 H		60/100	3	1A•2200	H	1A•2201	DCR 180Ω.
T5415	1.4 H ±20%		120	4	1A•2200	K	1A•2202	Split winding. Total DCR 180Ω.
T5410	1.0 H/0.8 H		0/25	3	1A•2200	D	1A•2201	DCR 225Ω. Toroidal construction. Low crosstalk.
T8410	1.0 H/0.8 H		0/40	3	1A•2200	D	1A•2202	DCR 113Ω. Toroidal construction. Low crosstalk.
HYBRID — TWO REQUIRED FOR CONVENTIONAL HYBRID OPERATION								
T2220	600 (4W)	600/600	0	10	1A•2201	E	1A•2201	Trans-hybrid loss 45 dB typical.
T3220	600 (4W)	600/600	0	10	1A•2201	F	1A•2201	Trans-hybrid loss 45 dB typical.
T4220	600 (4W)	600/600	60 (2W)	11	1A•2201	J	1A•2201	Electrostatic shield.
T5220	600 (4W)	600/600	100 (2W)	15	1A•2202	M	1A•2202	Trans-hybrid loss and long. bal. >60 dB. Max. level +20 dBm. Electrostatic shield.
T9220	600 (4W)	600/600	80 (2W)	18	1A•2202	N	1A•2202	Low profile. Low crosstalk.

Available on special order with other ratings and constructions.

REQUEST ENGINEERING APPLICATION BULLETIN F232.

SCHEMATICS



MICROTRAN
company, Inc.

TELEPHONE INTERCONNECT TRANSFORMERS

OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE 1A•2200

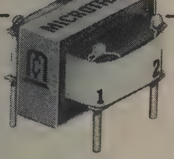
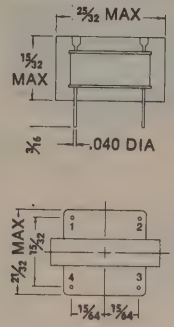
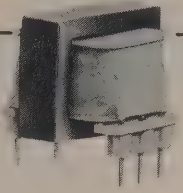


FIG. A


23/32 MAX
15/32 MAX
3/16
.040 DIA
21/32 MAX
15/32
1
2
4
3
15/64
15/64

Plug-in printed circuit construction. Vacuum varnish impregnated. Wt. 0.4 Oz.



Plug-in printed circuit construction. Vacuum varnish impregnated. Wt. 0.5 Oz.

FIG. B

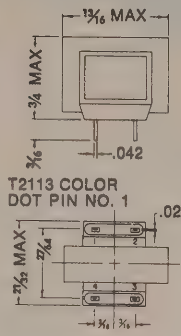
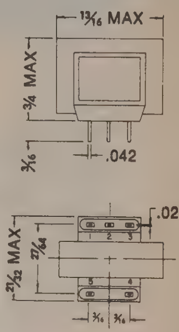

13/16 MAX
3/4 MAX
3/16
.042
T2113 COLOR DOT PIN NO. 1
.020
21/32 MAX
27/64
1
2
4
3
3/16
3/16

FIG. C


13/16 MAX
3/4 MAX
3/16
.042
.020
21/32 MAX
27/64
1
2
3
5
4
3/16
3/16

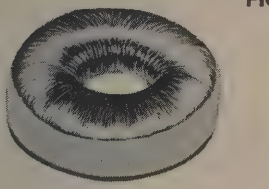
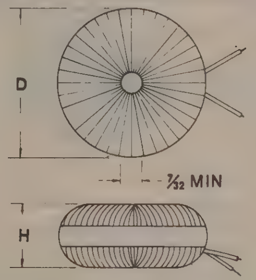


FIG. D



High-Q Toroid. Microcrystalline wax impregnated. Supplied with 4" #28 leads.

Size Series	D	H	Wt. Oz.
T7400	1	13/32	3/4
T8400	1 1/4	5/8	2

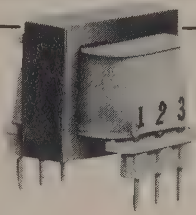


FIG. E
Wt. 0.5 Oz.

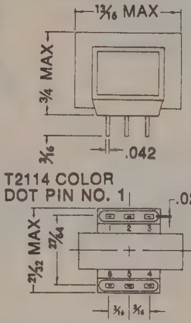
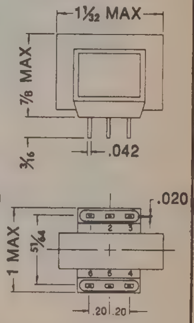

13/16 MAX
3/4 MAX
3/16
.042
T2114 COLOR DOT PIN NO. 1
.020
21/32 MAX
27/64
1
2
3
6
5
4
3/16
3/16

FIG. F
Wt. 1.2 Oz.


1 1/32 MAX
7/8 MAX
3/16
.042
.020
1 MAX
51/64
1
2
3
6
5
4
.20
.20

Plug-in printed circuit construction. Vacuum varnish impregnated.

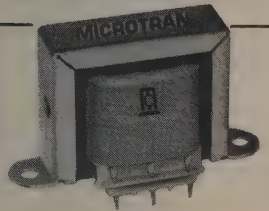
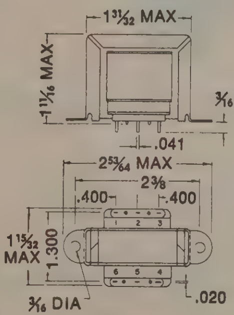


FIG. G


1 31/32 MAX
1 11/16 MAX
3/16
.041
2 53/64 MAX
2 3/8
.400
.400
1 15/32 MAX
1.300
1
2
3
6
5
4
3/16 DIA
.020

Plug-in printed circuit construction with mounting channel. Vacuum varnish impregnated. Wt. 9.5 Oz.

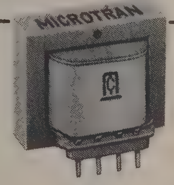


FIG. H

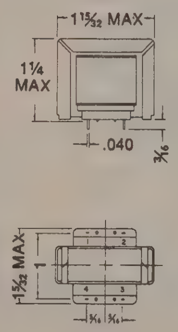
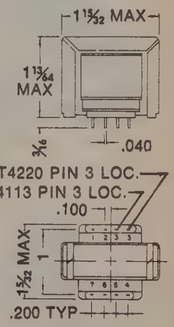
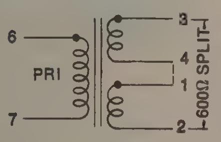

1 15/32 MAX
1 1/4 MAX
.040
3/16
1 15/32 MAX
1
4
3
3/16
3/16

FIG. J

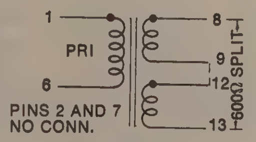

1 15/32 MAX
1 13/64 MAX
.040
3/16
T4220 PIN 3 LOC.
T4113 PIN 3 LOC.
.100
1 15/32 MAX
1
1
2
3
7
6
4
.200 TYP

Plug-in printed circuit construction. Vacuum varnish impregnated. Wt. 3.5 Oz. Available with mounting flanges **on Special Order**. 3/16 Dia. holes, 1 3/4 mounting centers. Add -FB to Part No.

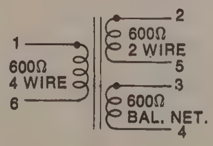
SCHEMATICS


6
PRI
7
3
4
1
2
600Ω SPLIT

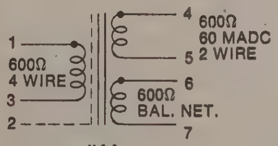
#8


1
PRI
6
PINS 2 AND 7 NO CONN.
8
9
12
13
600Ω SPLIT

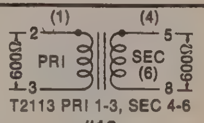
#9


1
600Ω 4 WIRE
6
2
600Ω 2 WIRE
5
3
600Ω BAL. NET.
4

#10

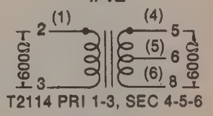

1
600Ω 4 WIRE
3
2
4
600Ω 60 MADC 2 WIRE
5
6
600Ω BAL. NET.
7

#11


(1)
(4)
2
PRI
3
600Ω
5
SEC (6)
8
600Ω

T2113 PRI 1-3, SEC 4-6

#12


(1)
(4)
2
3
600Ω
5
(5)
6
(6)
8
600Ω

T2114 PRI 1-3, SEC 4-5-6

#13

TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, Inc.

OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE 1A•2200

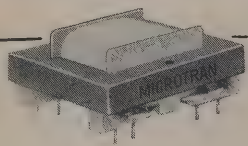
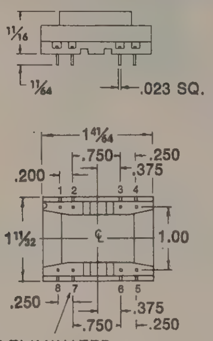


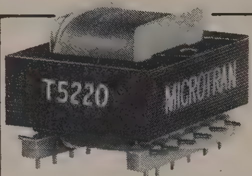
FIG. K



11⁄16
11⁄64
.023 SQ.
1 41⁄64
.750
.250
.375
.200
1 2 3 4
1 11⁄32
℄
1.00
8 7 6 5
.250
.750
.375
.250

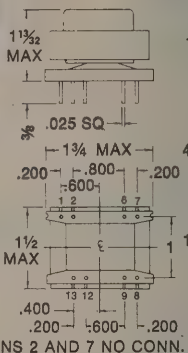
Flat Profile.
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 2.5 Oz.

TERM. 7 ELIMINATED ON P/N T5415



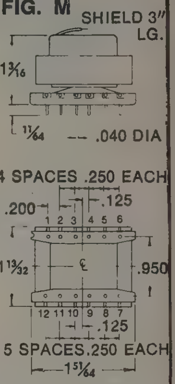
T5220
MICROTRAN

FIG. L



1 13⁄32 MAX
3⁄8
.025 SQ
1 3⁄4 MAX
.200
.800
.200
.600
1 2 6 7
1 1⁄2 MAX
℄
1
13 12 9 8
.400
.200
.600
.200

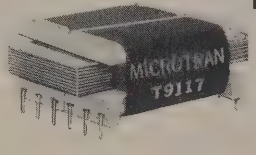
FIG. M



SHIELD 3″ LG.
1 3⁄16
11⁄64
.040 DIA
4 SPACES .250 EACH
.200
.125
1 2 3 4 5 6
1 13⁄32
℄
.950
12 11 10 9 8 7
.125
5 SPACES .250 EACH
1 5⁄64

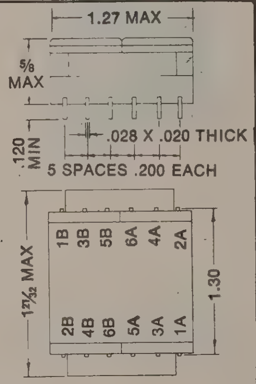
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 5.5 Oz.

PINS 2 AND 7 NO CONN.



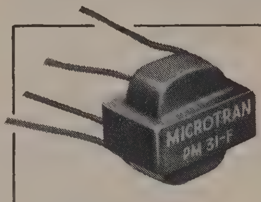
MICROTRAN
T9117

FIG. N



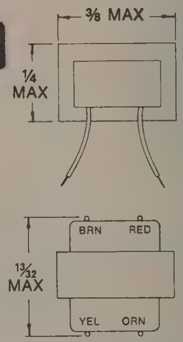
1.27 MAX
5⁄8 MAX
.120 MIN
.028 X .020 THICK
5 SPACES .200 EACH
1 7⁄32 MAX
1B 3B 5B 6A 4A 2A
2B 4B 6B 5A 3A 1A
1.30

Low profile hum-bucking semi-toroidal construction. High crosstalk attenuation. Plug-in printed circuit construction. Vacuum varnish impregnated.
Wt. 2.2 Oz.



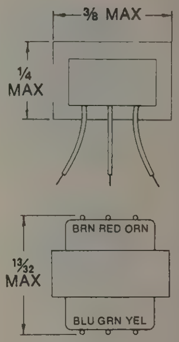
MICROTRAN
PM 31-F

FIG. O



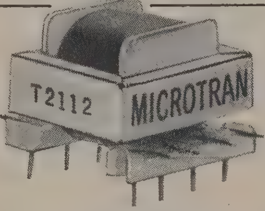
3⁄8 MAX
1⁄4 MAX
BRN
RED
13⁄32 MAX
YEL
ORN

FIG. P



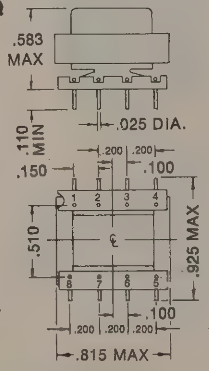
3⁄8 MAX
1⁄4 MAX
BRN RED ORN
13⁄32 MAX
BLU GRN YEL

Pico miniature size.
4″ #30 color coded leads.
Vacuum varnish impregnated.
Wt. 0.05 Oz.



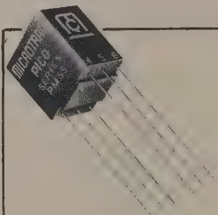
T2112
MICROTRAN

FIG. Q



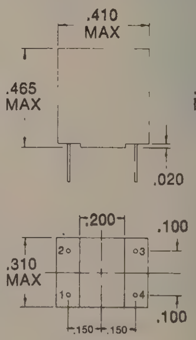
.583 MAX
.110 MIN
.025 DIA.
.200
.200
.150
.100
1 2 3 4
.510
℄
.925 MAX
8 7 6 5
.100
.200
.200
.200
.815 MAX

Low-profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.



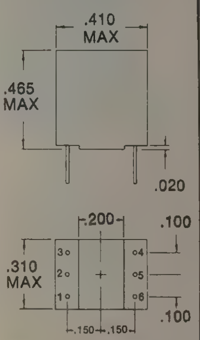
MICROTRAN
PICO

FIG. R



.410 MAX
.465 MAX
.020
.200
.100
2
3
.310 MAX
1
4
.100
.150
.150

FIG. S

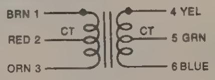


.410 MAX
.465 MAX
.020
.200
.100
3
4
2
5
.310 MAX
1
6
.100
.150
.150

Pico miniature size.
Plug-in printed circuit construction. Epoxy molded to MIL-T-27 TF5R21ZZ. Gold plated nickel alloy leads 0.020 x 3⁄4″. Wt. 0.1 Oz.

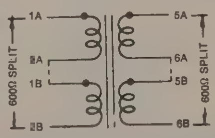
SCHEMATICS

#14



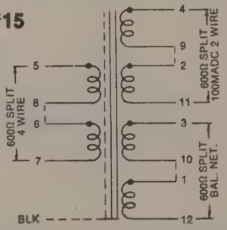
BRN 1
RED 2
ORN 3
CT
CT
4 YEL
5 GRN
6 BLUE

#16



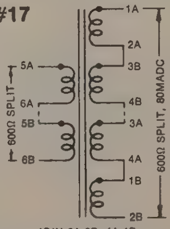
1A
2A
1B
2B
600Ω SPLIT
5A
6A
5B
6B
600Ω SPLIT

#15



5
8
6
7
600Ω SPLIT 4 WIRE
4
9
2
11
600Ω SPLIT 100MADC 2 WIRE
3
10
1
12
600Ω SPLIT BAL. NET.
BLK

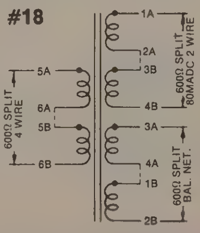
#17



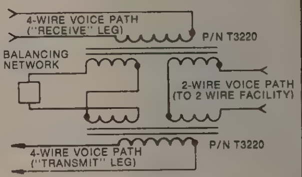
5A
6A
5B
6B
600Ω SPLIT
1A
2A
3B
4B
3A
4A
1B
2B
600Ω SPLIT, 80MADC

JOIN 2A-3B, 4A-1B

#18



5A
6A
5B
6B
600Ω SPLIT 4 WIRE
1A
2A
3B
4B
600Ω SPLIT 80MADC 2 WIRE
3A
4A
1B
2B
600Ω SPLIT BAL. NET.



4-WIRE VOICE PATH ("RECEIVE" LEG)
P/N T3220
BALANCING NETWORK
2-WIRE VOICE PATH (TO 2 WIRE FACILITY)
P/N T3220
4-WIRE VOICE PATH ("TRANSMIT" LEG)

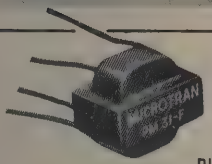
TYPICAL HYBRID APPLICATION

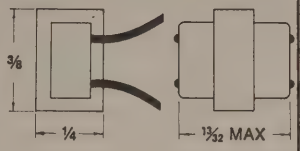
MICROTRAN
company, Inc.

MINIATURIZED AUDIO TRANSFORMERS

PICO — ULTRA
VERI-MINIATURE

OPEN FRAME PM-F

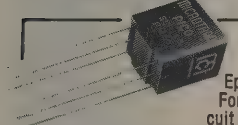


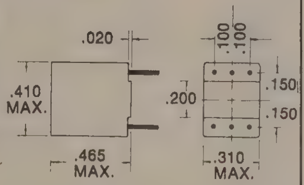


4 inch #30 Plastic color coded leads. Thorough resin impregnation and baking assures reliable life. To order add -F to Part No., i.e. PM33-F. Wt. .05 oz.

MIL Designation: TF6R21ZZ

MOLDED PM-M

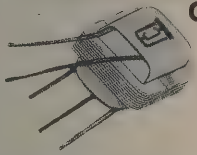


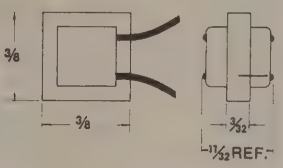


Epoxy molded. For printed circuit application. Gold plated high strength nickel alloy leads .020 x 3/4″ for reliable soldered joints and high-density welded lead packaging. Wt. .1 oz. To order add -M to Part No., i.e. PM12-M.

MIL Designation: TF5R21ZZ

OPEN FRAME UM-F

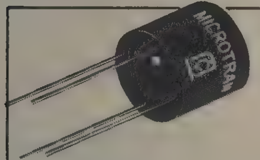


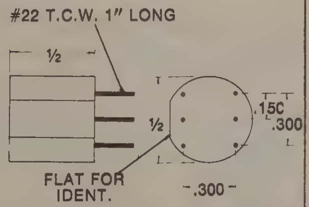


To order add -F to Part No., i.e. UM22-F. Wt. 0.08 oz. 4″ color coded leads.

MIL Designation: TF6R21ZZ

MOLDED UM-M

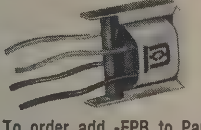


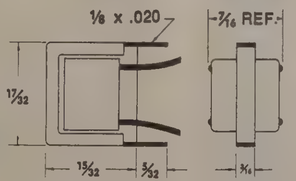


To order add -M to Part No., i.e. UM22-M. Wt. 0.14 oz.

MIL Designation: TF5R21ZZ

PLUG-IN TAB MOUNTED CHANNEL VM-FPB

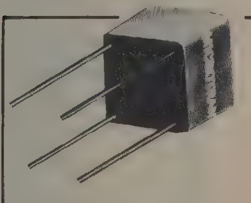


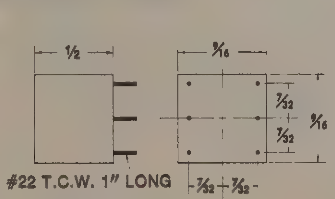


To order add -FPB to Part No., i.e. VM2-FPB. Wt. 0.2 oz. 4″ color coded leads.

MIL Designation: TF6R21ZZ

MOLDED VM-M





Epoxy molded. Wt. 0.25 oz. To order add -M to Part No., i.e. VM2-M.

MIL Designation: TF5R21ZZ

PICO-MINIATURE — PM SERIES

Frequency Response ±2 dB 300 Hz to 100 kHz†

For maximum utilization of space in miniaturized printed circuit board applications. Manufactured per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Power Level mW
PM37-(*)	120 CT	3.2	10	16	0.75	50
PM38-(*)	300 CT	600	7	41	98	50
PM35-(*)	500	50	3	60	8	50
PM36-(*)	500	500/125 split	3	72	85	50
PM32-(*)	600	600	3	75	105	50
PM34-(*)	600 CT	600 CT	3	75	105	50
PM33-(*)	1500 CT	600	3	170	95	50
PM31-(*)	2500	2500 CT	1	250	325	50
• PM29(*)	10,000 CT	500 CT	1	1050	80	50
PM27(*)	10,000	1200	0.5	1050	280	50
• PM23(*)	10,000 CT	1200 CT	1	1050	280	50
• PM25(*)	10,000	1200/300 split	0.5	1050	280	50
• PM19(*)	10,000 CT	2000 CT	1	1000	300	50
• PM21(*)	10,000	2000/500 split	0.5	1000	300	50
• PM17(*)	10,000 CT	10,000 CT	1	1000	1300	50
PM15(*)	25,000	1000	0.25	1700	110	40
• PM11(*)	25,000 CT	1000 CT	0.5	1700	110	40
• PM13(*)	25,000	1000/250 split	0.25	1700	110	40
• PM7(*)	50,000 CT	1000 CT	0	3300	75	10
• PM9(*)	50,000	1000/250 split	0	3300	75	10
• PM5(*)	200,000	1000	0	5300	110	10
• PM3(*)	200,000 CT	1000 CT	0	5300	110	10
PM41-(*)	Audio Choke	.3 H	4	43		
PM40-(*)	Audio Choke	3.5 H	2	700		
PM39-(*)	Audio Choke	6 H	2	1800		
PM90	Magnetic Shield Mu-metal slip-on can for PM-M series. 20dB shielding. 0.365″ x 0.465″ x 0.0500″ high.					

• These items not available in open frame construction.
* Add either -F, -M to Part No. See photos figures PM-M & PM-F. Frequency response measured as stated power level above.
† PM3 and PM5 — 45 kHz.

ULTRA-MINIATURE — UM SERIES

Frequency Response ±2 dB 300 to 10,000 Hz

Measured at level stated for 300 Hz. Miniaturized design offers a relatively high power level and printed circuit packaging. Response measured at level stated for 300 Hz. Mfg. per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW @ 300 Hz	Level mW @ 1 kHz
UM26-(*)	400	11	3	35	1.5	15	500
UM27-(*)	400 CT	11	6	35	1.5	15	500
UM25-(*)	400	50	3	35	5	15	500
UM29-(*)	600 CT	600 CT	7	45	60	5	400
UM24-(*)	1000	50	3	65	10	5	500
UM33-(*)	1000 CT	600	6	80	65	5	500
UM32-(*)	1500 CT	600	5	135	65	5	500
UM39-(*)	2500 CT	600 CT	2	250	50	5	500
UM34-(*)	10,000 CT	600 CT	2	850	40	5	500
UM31-(*)	10,000 CT	1200 CT	2	850	120	5	500
UM37-(*)	10,000	2000 CT	1	850	200	5	500
UM35-(*)	15,000 CT	15,000 CT	1	930	1210	5	300
UM36-(*)	20,000 CT	800 CT	0.5	1100	80	5	500
UM22-(*)	20,000	1000	0.5	1100	100	5	300
UM23-(*)	20,000	1200 CT	0.5	1100	110	5	300
UM21-(*)	100,000	1000	0	1900	135	5	70
UM30-(*)	Choke	1.5 H (0 mA) 0.7 H (2 mA) 100 DCR					
UM28-(*)	Choke	10 H (0 mA) 8 H (0.5 mA) 650 DCR					
UM90	Magnetic Shield Mu-metal slip-on can for UM-M series. 20 dB shielding. 19/32″D x 9/16″H.						

* Add either -F, or -M to Part No. to designate construction. See Photos. Power levels shown are for 7½ % maximum distortion.

VERI-MINIATURE — VM SERIES

Frequency Response ±2 dB 200 to 10,000 Hz

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW
VM1-(*)	50	600	5.5	7	90	15
VM7-(*)	500	3.4	3.5	50	0.5	15
VM16-(*)	500 CT	250 CT	7.5	50	25	15
VM14-(*)	600 CT	600 CT	7.0	50	65	15
VM8-(*)	1250	3.4	2.0	135	0.5	15
VM9-(*)	1250	50	2.0	135	6.5	15
VM10-(*)	2500	2500 CT	1.5	225	215	3
VM17-(*)	10,000 CT	5000 CT	0	400	300	5
VM12-(*)	20,000	1000	0.16	625	85	5
VM13-(*)	20,000	1000 CT	0.16	625	85	5
VM3-(*)	25,000	600	0.15	720	45	5
VM5-(*)	50,000	600	0.1	830	55	5
VM15-(*)	50,000 CT	50,000 CT	0	2000	2600	5
VM6-(*)	100,000	1200 CT	0.07	2000	150	5
VM2-(*)	200,000	600	0.05	3000	110	2.5
VM4-(*)	200,000	1200	0.035	3100	165	5
VM11-(*)	Choke	20 H (0 mA)	12 H (0.5 mA)		1000	
VM90	Magnetic Shield Mu-metal slip-on can for VM-M series. 20 dB shielding. 5/8″ x 5/8″ x 17/32″ high.					

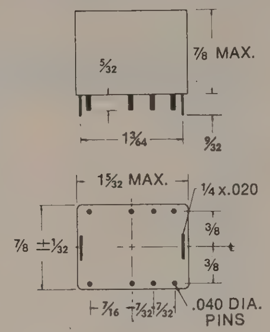
* Add either -FPB, or -M to Part No. to designate construction. See Photos.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

MINIATURIZED AUDIO TRANSFORMERS

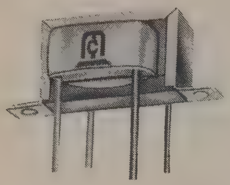
MICROTRAN company, inc.

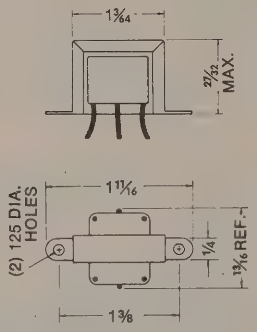
MICROTRAN
MMT18 M
1 2 3



MOLDED MM-M

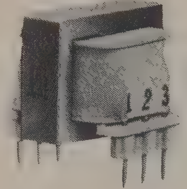
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. .5 oz.

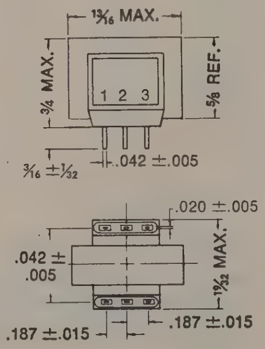




OPEN FRAME WITH CHANNEL MM-FB

To order add -FB to Part No. Leads #28 PVC 4" long. Wt. .36 oz.





PRINTED CIRCUIT — DCM SERIES

New Industrial/Commercial grade miniature printed circuit transformers. Rigid terminals provide fixed mounting centers usually found in expensive molded transformers. Wt. .5 oz.

MICRO-MINIATURE TRANSFORMERS MM & MMT SERIES

Primary and secondary windings may be interchanged to obtain required impedance matching. These units can be used as input, interstage, output, isolation and other impedance matching requirements. Also available in hermetic construction.
The low profile design of this series makes them ideal for use on plug-in printed circuit boards.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Oper. Level dBm	Frequency Response ±2 dB
MM1-(*)	200/50	250,000/62,500	0	4	200-10,000
MM3-(*)	10,000	200	3	20	150-10,000
MM2-(*)	10,000	90,000	0	4	150-10,000
MM4-(*)	30,000	50	1	20	150-10,000
MM7-(*)	30,000	1,200	0.5	20	200-10,000
MM6-(*)	100,000	60	0.5	20	250-10,000
MM5-(*)	Reactor 50H @ 1 mA DC 4,700 DCR				
MMT1-(*)	600	600	8	22	200-15,000
MMT26-(*)	600 CT	600 CT	16	22	200-15,000
MMT33-(*)	600 CT	600/150 Split	16	22	200-15,000
MMT9-(*)	600 CT	1,200 CT	16	22	200-15,000
MMT32-(*)	600 CT	1200/300 Split	16	22	200-15,000
MMT12-(*)	2,000	3.4	5	28	200-15,000
MMT31-(*)	2,000 CT	500 CT	10	28	200-15,000
MMT19-(*)	2,500	2,500 CT	2	23	200-15,000
MMT13-(*)	4,000 CT	3.4	5	28	200-15,000
MMT11-(*)	4,000 CT	600 CT	5	28	200-15,000
MMT21-(*)	4,000 CT	600/150-split	5	28	200-15,000
MMT25-(*)	7,500 CT	600 CT	4	22	200-15,000
MMT30-(*)	7,500 CT	1,200 CT	4	22	200-15,000
MMT35-(*)	10,000 CT	150/37.5 split	2	20	200-15,000
MMT17-(*)	10,000 CT	200 CT	6	20	200-15,000
MMT16-(*)	10,000	1,500 CT	1	20	200-15,000
MMT28-(*)	10,000 CT	1,500 CT	2	20	200-15,000
MMT29-(*)	10,000 CT	10,000	2	20	200-15,000
MMT10-(*)	25,000	600	1	20	200-15,000
MMT27-(*)	25,000 CT	600 CT	2	20	200-15,000
MMT7-(*)	25,000	1,200 CT	1	20	200-15,000
MMT18-(*)	25,000 CT	1,200 CT	2	20	200-15,000
MMT5-(*)	50,000	6	1	20	200-15,000
MMT3-(*)	50,000	600	0.7	20	200-15,000
MMT4-(*)	50,000 CT	600 CT	1.4	20	200-15,000
MMT8-(*)	50,000 CT	1,200 CT	1.4	20	200-15,000

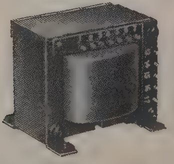
* Add either -M or -FB to Part No. to designate construction.

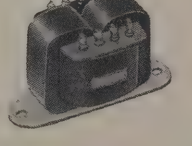
DECI-MINIATURE TRANSFORMERS DCM SERIES

FREQUENCY RESPONSE 200-15,000 Hz ±2 dB

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Operating Level dBm
DCM1-PC	25,000 CT	1,200 CT	2	18
DCM2-PC	15,000 CT	15,000 CT	3	19
DCM3-PC	15,000 CT	600 CT	3	19
DCM4-PC	10,000 CT	5,000 CT	4	20
DCM5-PC	10,000	2,500/625 Split	2	20
DCM6-PC	10,000 CT	1,500 CT	4	20
DCM7-PC	5,000 CT	80,000 CT	6	15
DCM8-PC	4,000 CT	1,200 CT	6	20
DCM9-PC	4,000 CT	600 CT	6	20
DCM10-PC	4,000	600/150 Split	3	20
DCM11-PC	2,500 CT	2,500 CT	8	20
DCM12-PC	2,500	2,500/625 Split	4	20
DCM13-PC	2,500 CT	625 CT	8	20
DCM14-PC	2,500 CT	200 CT	8	20
DCM18-PC	600 CT	50,000 CT	16	20
DCM19-PC	600	8000/2000 Split	8	20
DCM20-PC	600 CT	200 CT	16	20
DCM21-PC	600 CT	600 CT	16	20
DCM22-PC	250 CT	600 CT	25	20
DCM51-PC	Choke 10H @ 0 mA DC		5H @ 3 mA DC	300 DCR
DCM52-PC	Choke 5H @ 0 mA DC		2H @ 5 mA DC	155 DCR
DCM53-PC	Choke 2.5H @ 0 mA DC		1H @ 7 mA DC	75 DCR

MODIFIED CATALOG ITEMS AND CUSTOM DESIGNS AVAILABLE ON SPECIAL ORDER. CALL US WITH YOUR SPECIFICATIONS.





IMMEDIATE DELIVERY OF CATALOG ITEMS AT FACTORY PRICES FROM AUTHORIZED DISTRIBUTORS.

TRANSFORMERS
MICROTRAN

Send for Complete Catalog

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

MICROTRAN
company, inc.

PRICING

net price list

Prices, Mechanical Construction or Electrical Characteristics
Subject to Modification Without Notice — Effective 1/1/84

Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†	Part No.	Net Price 1-9†
DCM1-PC	$ 9.00	M13-A	*13.00	MMT16-H	*18.00	MT11-A	18.00	MT30-PC	*7.50	PC6732	10.50	S101-SP	29.00	SMT36-FB	*12.00
DCM2-PC	9.25	M13-AG	*16.75	MMT16-M	*16.00	MT11-AG	*24.50	MT33-A	*22.00	PC6900-FB	2.70	S105-S	27.00	SMT36-H	*25.25
DCM3-PC	8.75	M13-FB	*8.25	MMT17-FB	10.75	MT11-FB	9.75	MT33-AG	*28.50	PC6905	16.25	S105-SP	35.00	SMT36-M	*22.25
DCM4-PC	8.75	M13-H	*15.50	MMT17-H	*20.00	MT11-H	*21.75	MT33-FB	11.25	PC6910	16.00	S107-S	29.50	T1104	8.75
DCM5-PC	8.25	M13-M	14.50	MMT17-M	17.50	MT11-M	19.25	MT33-H	25.50	PC6911	16.25	S107-SP	37.50	T2104	6.25
DCM6-PC	8.75	M13-P	*14.25	MMT18-FB	10.25	MT11-P	*18.50	MT33-M	*22.25	PC6914	15.25	S108-S	24.75	T2106	7.00
DCM7-PC	10.00	M13-PC	*7.50	MMT18-H	*19.50	MT11-PC	8.25	MT33-P	21.75	PCL6605	12.50	S108-SP	32.00	T2108	7.00
DCM8-PC	8.25	M14-A	*17.00	MMT18-M	17.25	MT12-A	*16.50	MT33-PC	10.00	PCL6610	12.50	S111-S	23.00	T2110	7.25
DCM9-PC	8.25	M14-AG	*22.00	MMT19-FB	9.25	MT12-AG	*20.25	MT34-A	*23.00	PCL6611	12.50	S111-SP	30.00	T2111	6.50
DCM10-PC	8.00	M14-FB	*10.00	MMT19-H	*18.00	MT12-FB	9.00	MT34-AG	*30.00	PCL6614	12.50	S116-S	22.25	T2112	6.50
DCM11-PC	8.00	M14-H	20.50	MMT19-M	16.00	MT12-H	*19.75	MT34-FB	12.50	PCL6630	14.25	S116-SP	29.50	T2113	6.25
DCM12-PC	8.00	M14-M	*18.00	MMT21-FB	9.75	MT12-M	*17.25	MT34-H	*26.50	PCL6631	14.25	S118-S	27.00	T2114	6.25
DCM13-PC	8.00	M14-P	*17.50	MMT21-H	*19.50	MT12-P	*16.75	MT34-M	*23.25	PCT6230	15.60	S118-SP	35.00	T2220	9.00
DCM14-PC	8.00	M14-PC	*9.50	MMT21-M	18.00	MT12-PC	7.50	MT34-P	*22.00	PCT6530	11.00	S126-S	23.75	T2316	7.00
DCM18-PC	9.25	M15-A	*17.75	MMT25-FB	10.00	MT13-A	*17.50	MT34-PC	*11.00	PCT6531	11.00	S126-SP	31.50	T3220	9.75
DCM19-PC	8.00	M15-AG	*22.50	MMT25-H	*19.25	MT13-AG	*20.25	MT35-A	23.00	PCT6630	12.25	S130-S	23.50	T4113	11.25
DCM20-PC	7.50	M15-FB	*10.25	MMT25-M	17.25	MT13-FB	9.50	MT35-AG	*30.00	PCT6631	12.25	S130-SP	31.00	T4220	14.25
DCM21-PC	7.25	M15-H	*21.00	MMT26-FB	8.75	MT13-H	20.25	MT35-FB	12.50	PCT6730	13.50	SM1-CM	*F.Q.	T4415	7.00
DCM22-PC	7.25	M15-M	*18.75	MMT26-H	18.00	MT13-M	*18.00	MT35-H	26.50	PCT6731	13.50	SM1-FB	10.75	T5114	12.00
DCM51-PC	5.25	M15-P	*18.25	MMT26-M	16.25	MT13-P	*17.50	MT35-M	23.25	PCT6930	16.25	SM1-H	*21.50	T5115	15.50
DCM52-PC	5.00	M15-PC	*9.00	MMT27-FB	10.25	MT13-PC	*8.00	MT35-P	22.00	PCT6931	16.25	SM1-M	*21.25	T5220	22.00
DCM53-PC	5.00	M90	3.00	MMT27-H	*19.50	MT14-A	*15.25	MT35-PC	11.00	PF6-10	7.10	SM2-CM	*F.Q.	T5415	12.00
M1-A	23.00	M8050	11.75	MMT27-M	*17.75	MT14-AG	20.00	MT36-A	18.75	PF6-12	7.10	SM2-FB	10.50	T6112	19.00
M1-AG	*28.50	M8051	*26.50	MMT28-FB	*9.50	MT14-FB	7.75	MT36-AG	*24.25	PF6-16	7.10	SM2-H	*21.25	T7410	12.25
M1-FB	12.50	M8072	15.25	MMT28-H	*19.00	MT14-H	18.75	MT36-FB	10.00	PF6-24	7.10	SM2-M	*20.50	T8410	13.00
M1-H	25.50	M8073	10.75	MMT28-M	*16.75	MT14M	16.25	MT36-H	*22.00	PF6-34	7.10	SM3-CM	*F.Q.	T9116	14.25
M1-M	*22.50	M8074	11.75	MMT29-FB	9.75	MT14-P	*15.75	MT36-M	*19.50	PF6-56	7.20	SM3-FB	*10.00	T9117	14.50
M1-P	*21.50	M8106	30.50	MMT29-H	18.75	MT14-PC	6.50	MT36-P	*18.75	PF12-10	8.50	SM3-H	*21.25	T9220	14.75
M1-S	26.50	M8107	32.50	MMT29-M	17.00	MT15-A	*16.25	MT36-PC	8.50	PF12-12	8.50	SM3-M	*20.00	UM21-F	9.75
M2-A	25.00	M8108	30.50	MMT30-FB	*10.25	MT15-AG	*21.50	PC2506	13.75	PF12-16	8.50	SM4-CM	*F.Q.	UM21-M	*14.75
M2-AG	*32.50	M8109	32.50	MMT30-H	*19.50	MT15-FB	*8.00	PC2512	14.00	PF12-24	8.50	SM4-FB	*10.25	UM22-F	*9.50
M2-FB	13.50	M8110	30.50	MMT30-M	*17.75	MT15-H	*19.00	PC2524	14.25	PF12-34	8.50	SM4-H	*21.50	UM22-M	*14.50
M2-H	*27.00	M8111	32.50	MMT31-FB	9.50	MT15-M	16.75	PC2528	14.50	PF12-56	8.60	SM4-M	*20.00	UM23-F	10.50
M2-M	*25.50	M8112	*30.50	MMT31-H	*18.75	MT15-P	*16.25	PC2608	14.75	PFT12-35	10.25	SM5-CM	*F.Q.	UM23-M	15.75
M2-P	*23.75	M8113	70.00	MMT31-M	16.75	MT15-PC	*6.75	PC2616	15.00	PM3-M	25.00	SM5-FB	8.50	UM24-F	8.75
M3-A	21.25	M8114	70.00	MMT32-FB	10.00	MT18-A	*19.25	PC2624	*15.50	PM5-M	*22.00	SM5-H	*18.75	UM24-M	*13.50
M3-AG	*27.00	M8115	41.00	MMT32-H	*19.75	MT18-AG	*25.00	PC2628	15.50	PM7-M	25.00	SM5-M	*18.00	UM25-F	*8.75
M3-FB	*12.50	M8116	58.00	MMT32-M	*17.75	MT18-FB	10.25	PC2632	16.00	PM9-M	25.50	SM6-CM	*F.Q.	UM25-M	13.50
M3-H	*24.50	M8117	41.00	MMT33-FB	10.00	MT18-H	*22.25	PC2708	16.00	PM11-M	23.50	SM6-FB	*10.50	UM26-F	*8.00
M3-M	*21.75	M8118	64.00	MMT33-H	*19.75	MT18-M	19.75	PC2712	15.75	PM13-M	24.00	SM6-H	*21.75	UM26-M	*13.00
M3-P	*21.25	M8120	16.25	MMT33-M	17.75	MT18-P	*19.00	PC2715	16.00	PM15-F	12.75	SM6-M	*21.00	UM27-F	*8.75
M4-A	*17.75	M8121	13.50	MMT35-FB	*10.00	MT20-A	*21.50	PC2716	16.00	PM15-M	*20.25	SMT1-CM	*F.Q.	UM27-M	*14.25
M4-AG	*22.50	M8122	38.50	MMT35-H	*19.75	MT20-AG	*28.00	PC2724	16.00	PM17-M	23.75	SMT1-FB	9.25	UM28-F	6.25
M4-FB	10.25	M8132	36.50	MMT35-M	*17.75	MT20-FB	*12.25	PC2728	16.00	PM19-M	23.25	SMT1-H	*20.75	UM28-M	*11.00
M4-H	21.25	M8133	37.50	MT1-A	16.00	MT20-H	*25.00	PC2732	16.50	PM21-M	23.75	SMT1-M	*18.50	UM29-F	10.25
M4-M	*18.50	M8149	12.00	MT1-AG	*20.50	MT20-M	*22.25	PC3506	11.25	PM23-M	23.75	SMT3-CM	*F.Q.	UM29-M	16.00
M4-P	*18.25	MM1-FB	10.00	MT1-FB	8.25	MT20-P	*21.50	PC3512	11.25	PM25-M	24.00	SMT3-FB	*10.25	UM30-F	*6.00
M4-PC	8.75	MM1-H	*18.00	MT1-H	19.25	MT21-A	*20.50	PC3524	*12.25	PM27-F	13.00	SMT3-H	*21.50	UM30-M	10.50
M5-A	*17.00	MM1-M	*16.00	MT1-M	*16.75	MT21-AG	*27.00	PC3528	*11.50	PM27-M	20.50	SMT3-M	*20.00	UM31-F	*11.75
M5-AG	*21.25	MM2-FB	*10.00	MT1-P	*16.25	MT21-FB	11.25	PC3608	12.25	PM29-M	23.25	SMT4-CM	*F.Q.	UM31-M	17.00
M5-FB	9.75	MM2-H	*18.00	MT1-PC	7.00	MT21-H	24.25	PC3616	12.25	PM31-F	12.50	SMT4-FB	*12.25	UM32-F	9.50
M5-H	*20.00	MM2-M	*16.00	MT2-A	*19.50	MT21-M	21.00	PC3624	12.25	PM31-M	20.75	SMT4-H	*24.50	UM32-M	15.00
M5-M	*17.55	MM3-FB	*9.75	MT2-AG	*26.00	MT21-P	*20.00	PC3628	12.75	PM32-F	10.75	SMT4-M	*22.50	UM33-F	*9.50
M5-P	*17.00	MM3-H	*17.50	MT2-FB	10.00	MT21-PC	*9.75	PC3632	13.00	PM32-M	18.75	SMT5-CM	*F.Q.	UM33-M	15.25
M5-PC	*17.00	MM3-M	*15.50	MT2-H	*23.00	MT22-A	*20.25	PC3708	12.75	PM33-F	*11.75	SMT5-FB	*9.50	UM34-F	11.00
M6-A	19.25	MM4-FB	*9.75	MT2-M	*20.00	MT22-AG	*27.00	PC3712	*12.75	PM33-M	20.25	SMT5-H	*21.00	UM34-M	16.50
M6-AG	*25.50	MM4-H	*17.50	MT2-P	*19.00	MT22-FB	10.75	PC3715	12.75	PM34-F	12.75	SMT5-M	*20.00	UM35-F	11.75
M6-FB	11.25	MM4-M	*15.50	MT2-PC	*8.50	MT22-H	*23.75	PC3716	12.75	PM34-M	21.50	SMT7-CM	*F.Q.	UM35-M	18.00
M6-H	22.75	MM5-FB	*9.00	MT3-A	*17.00	MT22-M	*20.75	PC3724	*13.00	PM35-F	*10.75	SMT7-FB	11.50	UM36-F	*11.25
M6-M	*20.50	MM5-H	16.00	MT3-AG	*21.75	MT22-P	*19.75	PC3728	*13.00	PM35-M	18.25	SMT7-H	*23.00	UM36-M	17.25
M6-P	*19.75	MM5-M	*13.75	MT3-FB	9.50	MT22-PC	*9.50	PC3732	*13.50	PM36-F	*12.75	SMT7-M	*25.00	UM37-F	10.50
M6-PC	10.00	MM6-FB	*10.00	MT3-H	*20.25	MT23-A	*17.00	PC4304	8.25	PM36-M	21.50	SMT8-CM	*F.Q.	UM37-M	15.75
M7-A	*18.75	MM6-H	*18.00	MT3-M	*17.75	MT23-AG	*22.25	PC4312	8.50	PM37-F	*10.50	SMT8-FB	*12.25	UM39-F	10.50
M7-AG	*24.00	MM6-M	*16.00	MT3-P	*17.25	MT23-FB	*9.00	PC4316	8.50	PM37-M	19.00	SMT8-H	24.50	UM39-M	16.25
M7-FB	10.75	MM7-FB	*9.75	MT3-PC	8.00	MT23-H	*19.75	PC4320	*8.50	PM38-F	11.25	SMT8-M	*22.50	UM90	3.50
M7-H	*21.75	MM7-H	*17.50	MT5-A	*16.75	MT23-M	*17.50	PC4408	9.00	PM38-M	19.75	SMT9-CM	*F.Q.	VM1-FPB	7.75
M7-M	*19.50	MM7-M	*15.50	MT5-AG	*21.50	MT23-P	*17.00	PC4412	9.00	PM39-F	*8.25	SMT9-FB	11.00	VM1-M	13.50
M7-P	*19.00	MMT1-CM	*F.Q.	MT5-FB	*9.25	MT23-PC	7.50	PC4416	9.50	PM39-M	*14.75	SMT9-H	*23.25	VM2-FPB	*9.00
M7-PC	*9.50	MMT1-FB	7.50	MT5-H	*20.00	MT24-A	*17.00	PC4424	9.75	PM40-F	*7.75	SMT9-M	*20.75	VM2-M	15.25
M8-A	21.25	MMT1-H	*15.75	MT5-M	*17.55	MT24-AG	*22.25	PC4428	9.75	PM40-M	*14.25	SMT10-CM	*F.Q.	VM3-FPB	*8.25
M8-AG	*26.50	MMT1-M	14.00	MT5-P	*17.00	MT24-FB	*9.00	PC4432	*10.25	PM41-F	*7.25	SMT10-FB	*10.25	VM3-M	14.75
M8-FB	11.50	MMT3-FB	8.75	MT6-A	*18.50	MT24-H	19.75	PC6205	12.50	PM41-M	*13.50	SMT10-H	*21.50	VM4-FPB	*9.25
M8-H	*23.75	MMT3-H	*16.75	MT6-AG	*23.75	MT24-M	17.55	PC6210	13.00	PM90	2.10	SMT10-M	*20.00	VM4-M	15.50
M8-M	*20.75	MMT3-M	*15.25	MT6-FB	*10.50	MT24-P	*17.00	PC6211	13.00	PS-N	~6.50	SMT12-CM	*F.Q.	VM5-FPB	8.25
M8-P	20.75	MMT4-FB	11.00	MT6-H	*21.50	MT24-PC	*7.50	PC6214	13.25	PS-S	~6.50	SMT12-FB	*9.25	VM5-M	14.50
M8-PC	*10.25	MMT4-H	*20.25	MT6-M	*19.75	MT25-A	18.25	PC6505	9.50	PSD2 (Any)	5.60	SMT12-H	*20.75	VM6-FPB	*9.75
M9-A	*21.25	MMT4-M	18.50	MT6-P	*18.75	MT25-AG	*24.00	PC6506	9.25	PSD3 (Any)	5.75	SMT12-M	*18.50	VM6-M	*16.00
M9-AG	*26.50	MMT5-FB	8.75	MT7-A	*17.75	MT25-FB	9.50	PC6510	9.50	PSD4 (Any)	6.20	SMT13-CM	*F.Q.	VM7-FPB	7.75
M9-FB	11.50	MMT5-H	*16.75	MT7-AG	23.00	MT25-H	*20.25	PC6511	9.50	PSD5 (Any)	6.90	SMT13-FB	*10.25	VM7-M	13.50
M9-H	*23.75	MMT5-M	*15.25	MT7-FB	9.75	MT25-M	*19.00	PC6512	9.50	PSS2 (Any)	4.80	SMT13-H	*21.50	VM8-FPB	7.75
M9-M	*20.75	MMT7-FB	9.75	MT7-H	*20.50	MT25-P	*18.00	PC6514	9.75	PSS3 (Any)	4.90	SMT13-M	*19.00	VM8-M	13.50
M9-P	*20.75	MMT7-H	*18.50	MT7-M	*18.25	MT25-PC	8.00	PC6524	10.25	PSS4 (Any)	5.60	SMT16-CM	*F.Q.	VM9-FPB	*7.25
M9-PC	*10.25	MMT7-M	16.50	MT7-P	*18.00	MT26-A	18.25	PC6528	10.50	PSS5 (Any)	6.20	SMT16-FB	*10.75	VM9-M	13.50
M10 A	*25.50	MMT8-FB	11.00	MT8-A	*20.00	MT26-AG	24.25	PC6605	10.75	PW28 (Any)	7.25	SMT16-H	*22.00	VM10-FPB	9.50
M10-AG	*33.00	MMT8-H	*20.25	MT8-AG	*25.50	MT26-FB	9.50	PC6608	10.25	PW35 (Any)	8.25	SMT16-M	*20.75	VM10-M	15.75
M10-FB	13.75	MMT8-M	*18.50	MT8-FB	11.00	MT26-H	20.00	PC6610	10.75	PW41 (Any)	9.25	SMT17-CM	*F.Q.	VM11-FPB	*3.50
M10-H	*27.50	MMT9-FB	9.25	MT8-H	*23.00	MT26-M	19.00	PC6611	10.75	PW48-10	10.25	SMT17-FB	12.00	VM11-M	*12.25
M10-M	*26.00	MMT9-H	18.50	MT8-M	*20.50	MT26-P	18.25	PC6614	10.75	PW48-12	10.25	SMT17-H	*24.25	VM12-FPB	*9.00
M10-P	*24.25	MMT9-M	16.50	MT8-P	*19.50	MT26-PC	8.00	PC6616	10.50	PW48-16	10.25	SMT17-M	*22.25	VM12-M	15.25
M11-A	*22.75	MMT10-FB	8.75	MT9-A	*18.50	MT29-A	*16.75	PC6624	10.50	PW48-24	10.25	SMT18-CM	*F.Q.	VM13-FPB	*9.75
M11-AG	*28.50	MMT10-H	*16.75	MT9-AG	24.50	MT29-AG	*22.00	PC6628	10.50	PW48-36	10.25	SMT18-FB	12.25	VM13-M	16.00
M11-FB	12.50	MMT10-M	15.75	MT9-FB	9.75	MT29-FB	*8.75	PC6632	10.50	PW48-56	10.50	SMT18-H	*24.50	VM14-FPB	9.50
M11-H	*25.50	MMT11-FB	9.45	MT9-H	*21.75	MT29-H	*19.50	PC6705	12.00	PW54-10	12.25	SMT18-M	*22.50	VM14-M	15.75
M11-M	*22.50	MMT11-H	*18.75	MT9-M	19.25	MT29-M	*17.25	PC6708	11.00	PW54-12	12.25	SMT19-CM	*F.Q.	VM15-FPB	11.50
M11-P	*21.00	MMT11-M	17.00	MT9-P	18.50	MT29-P	*16.75	PC6710	11.75	PW54-16	12.25	SMT19-FB	9.00	VM15-M	17.75
M12-A	22.50	MT12-FB	*8.75	MT9-PC	8.25	MT29-PC	*7.25	PC6711	11.75	PW54-24	12.25	SMT19-H	*21.50	VM16-FPB	*9.75
M12-AG	29.00	MMT12-H	*16.75	MT10-A	*16.00	MT30-A	*17.00	PC6712	10.50	PW54-36	12.25	SMT19-M	*20.50	VM16-M	*16.00
M12-FB	12.25	MMT12-M	*15.25	MT10-AG	*21.00	MT30-AG	*22.25	PC6714	11.25	PW54-56	12.50	SMT26-CM	*F.Q.	VM17-FPB	10.25
M12-H	24.25	MMT13-FB	*9.25	MT10-FB	8.75	MT30-FB	*9.00	PC6715	10.75	PWT54-1024	13.00	SMT26-FB	10.75	VM17-M	16.50
M12-M	23.00	MMT13-H	*18.00	MT10-H	*19.50	MT30-H	*19.75	PC6716	10.50	PWT54-1633	13.25	SMT26-H	*23.00	VM90	2.60
M12-P	*21.75	MMT13-M	*16.00	MT10-M	*17.00	MT30-M	*17.50	PC6724	10.50	S100-FB	1.00	SMT26-M	*20.50		
M12-PC	*10.75	MMT16-FB	*9.25	MT10-P	*16.50	MT30-P	*17.00	PC6728	10.50	S101-S	22.25	SMT36-CM	*F.Q.		

* Not stocked. Available on special order. In 1-499 quantity, add $35.00 lot set-up charge. ~ Not subject to standard discounts.

† Quantity pricing schedule: 1-9 Net, 10-49 Net Less 10%, 50-99 Net Less 20%, 10-249 Net Less 26%, 250-499 Net Less 33⅓%. Contact Factory for quantities over 499 pieces.

F.Q.: Contact factory for quote.

145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

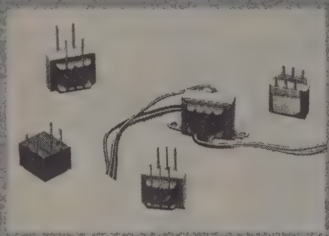
Multi Products International

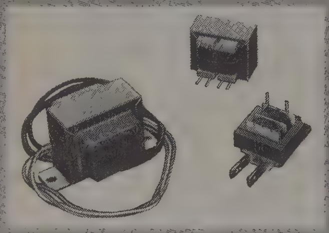
218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009
(201) 239-8183 • TELEX:130430 • CABLE:MUPRINUSA-CEDG

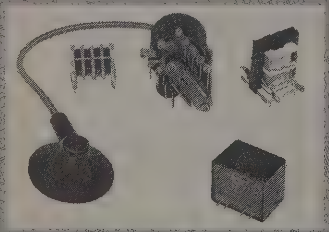
MPI is one of the most reliable suppliers, on a large scale, of transformer and magnetic components to the computer, data processing, communications & medical and recreational electronics OEMS. All units meet MPI's stringent QC standards and are UL CSA & VDE listed as required.

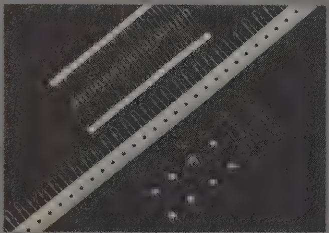
The product categories below provide general specification information for our basic product lines. However, our ability to design and manufacture custom components, to your specs, makes us the industry's true "super source".

Call today! – **(201) 239-8183 • Telex 130430**









AUDIO/MATCHING TRANSFORMERS

Test Voltage	1500, 2100 & 3500 VDE	Return Loss	26db typical
Frequency Response	300 Hz-3500 Hz special to 50,000 Hz	Insertion Loss	.1 to 3.5db
Power Level	−50dbm +30dbm	D.C. Current	0 to 100 MA DC
Long Balance	45db to 75db	Distortion	50db typical
Impedence	input to 40,000 OHMS output 100,000 OHMS	Size	Metric size EI-14, EI-16, EI-19, EI-24, EI-28, & EI-35

POWER TRANSFORMERS

Typical Input For All Transformers
100 ~ 120V
220 ~ 240V
50 ~ 60Hz

METRIC SIZE	OUTPUT	METRIC SIZE	OUTPUT
EI-24	0.5VA	EI-66	50VA
EI-28	1 VA	EI-76	80VA
EI-35	1.8VA	EI-86	150VA
EI-41	5.0VA	EI-96	200VA
EI-48	12 VA	EI-105	300VA
EI-54	15 VA	EI-115	400VA
EI-57	25 VA	EI-133	1000VA

WALL PLUG-IN UNITS

INPUT: 115V60 Hz, Also Available — 120-240V 50-60Hz

AC/AC
6.0V, 0 – 500 MA
9.0V, 0 – 500 MA
12.0V, 0 – 500 MA
15.0V, 0 – 300 MA
18.0V, 0 – 300 MA
20.0V, 0 – 300 MA

AC/DC
3.0V, 0 – 100 MA
6.0V, 0 – 600 MA
9.0V, 0 – 600 MA
12.0V, 0 – 500 MA
15.0V, 0 – 500 MA
18.0V, 0 – 500 MA

UNIVERSAL
DC 3.0, 4.5, 6.0, 7.5, 9.0V @ 300 MA
DC 6.0, 7.5, 9.0V, @ 300 MA
DC 3.0, 4.5, 6.0V, @ 400 MA
DC 6.0, 7.5, 9.0V, @ 400 MA
DC 3.0, 4.5, 6.0, 7.5, 9.0V, @ 400 MA

SPECIALTY ITEMS

- IF and RF Transformers
- Antenna Coils and Assemblies
- Pin cushion Transformers
- Switch Mode Transformers
- Pulse Transformers
- Ballast Transformers
- Deflection Yokes
- Flyback Transformers
- P.C. Board Assemblies
- Delay Lines
- Coil Windings
- Ignition Coils

INDUCTORS

PEAKING COIL AL TYPE

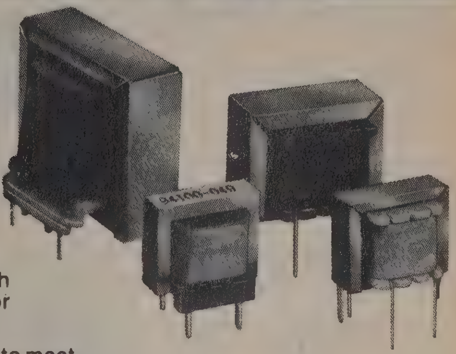
Style	Axial lead
Temperature rise	20°C
Ambient temperature	80°C
Temperature range	−20°C to +100°C
Terminal tensile strength	2.5kg.
Inductance range	0.22μH – 1000μH

PEAKING COIL EL TYPE

Style	Radial lead
Temperature rise	20°C
Ambient temp	80°C
Temperature range	−20°C to +100°C
Terminal tensile strength	1.5Kg.
Inductance range	0.22μH – 1000μH

Multi Products International
218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009
(201) 239-8183 • TELEX:130430 • CABLE:MUPRINUSA-CEDG

AUDIO/MATCHING TRANSFORMERS



MPI's miniature audio transformers are highly reliable and extraordinarily economical. All can be supplied vacuum epoxy impregnated with either standard leads or plug-in printed circuit construction. There are several standard bobbins with various pin spacings permitting optimum use of voice-grade telephone lines for broadband data signals.

Our newest line of extremely small telephone coupling transformers were designed to meet FCC Part 68 specifications for use with telephone equipment, modems and a variety of communications products.

They feature a frequency response of 300-3500 Hz ± 0.5dB; wide dynamic signal level of -45dBm to +7dBm; low distortion (0.5% max.); impedance matching of ± 10% over entire range; return loss of 16 dB min.

Depending on your requirements, any of several standard cores can be used in the construction of specific high quality designs.

Custom designs for your special requirements necessitating other ratings and construction can be met by our MPI design engineers.

Part No.	Impedance		DC Resist.		Max. Power	Insert. Loss	DC Current	FIG.
	Pri	Sec	Pri	Sec				
A19H-CC-1A/1	150	150	25	35	+7dbm	1.0db	2ma	1
A19H-HC-1A/1	600	150	45	35	+7dbm	1.0db	2ma	1
A10N-HH-1A/1	600	600	55	69	0dbm	1.7db	0ma	2
A14N-HH-1A/1	600	600	60	46	6dbm	1.4db	0ma	2
A16N-HH-1A/1	600	600	52	48	7dbm	1.2db	0ma	2
A19N-HH-1A/1	600	600	65	85	+7dbm	2.5db	100ma	2
A19H-HH-1A/2	600	600	180	80	+1dbm	2.5db	80ma	1
A19H-HH-1C/1	600	600	25	40	+7dbm	1.0db	2ma	1
A19H-HH-1A/1	600	600	69	95	0dbm	1.9db	120ma	1
A19F-HH-1A/1	600	600	45	45	+7dbm	1.0db	2ma	4
A28H-HH-1A/1	600	600	36	28	27dbm	1.0db	120ma	1
A19H-HK-1A/1	600	900	45	55	+7dbm	1.0db	2ma	1
A19H-MH-1A/1	1500	600	78	67	0dbm	1.2db	2ma	1
A19H-NN-1C/1	2000	2000	70	93	+7dbm	1.0db	2ma	1

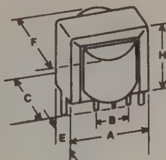


Fig. 1

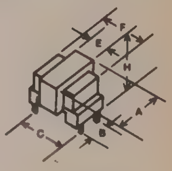


Fig. 2

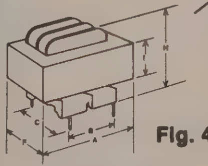


Fig. 4

* Refer to Factory For Dimensions

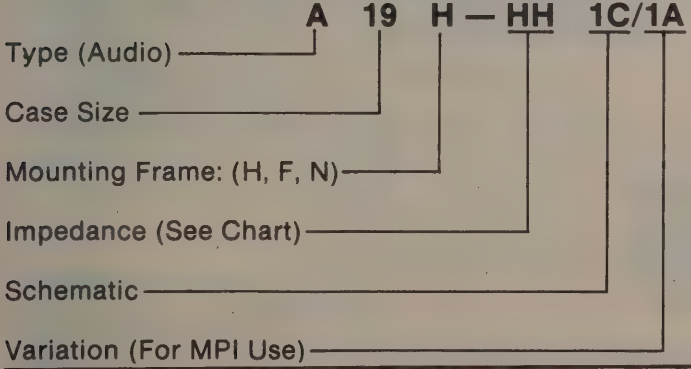
IMPEDANCE CHART

1 — 10	A — 100	J — 800	S — 10,000
2 — 20	B — 120	K — 900	T — 15,000
3 — 30	C — 150	L — 1,000	U — 20,000
4 — 40	D — 200	M — 1,500	V — 30,000
5 — 50	E — 300	N — 2,000	W — 40,000
6 — 60	F — 400	O — 2,500	X — 50,000
7 — 70	G — 500	P — 3,000	Y — 75,000
8 — 80	H — 600	Q — 5,000	Z — 100,000
9 — 90	I — 700	R — 7,500	

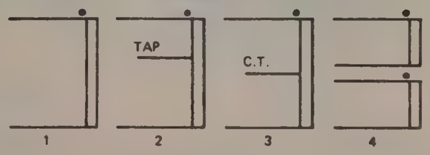
HOW TO SPECIFY TRANSFORMERS

When ordering or inquiring about MPI Audio or Power Transformers, simply follow the diagram below to identify the exact item you are specifying.

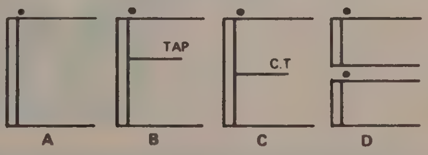
AUDIO TRANSFORMERS



PRIMARY

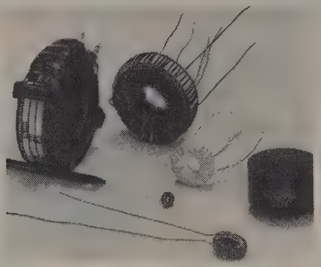


SECONDARY



TRANSFORMERS

Toroidal

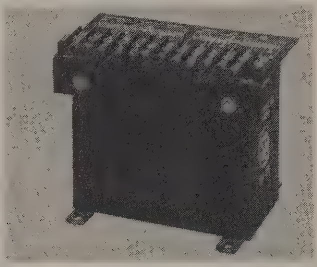


Power, inductor, reactor, current, audio.
Sizes from .125″ I.D. to 5.5″ O.D. automatic winding, larger sizes by special procedures.
High power to weight ratio.
Power to 100 VA.
Standard or custom core.
Impregnated, encapsulated.
Hermetically sealed.

Ferro-Resonant

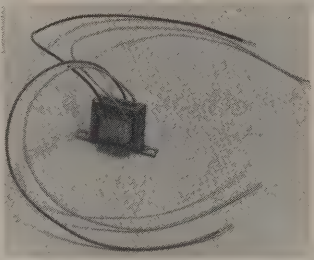
Excellent for DC power supplies.
Nearly square wave outputs.
Minimum additional components required for constant voltage output.
Open or closed construction.

Power

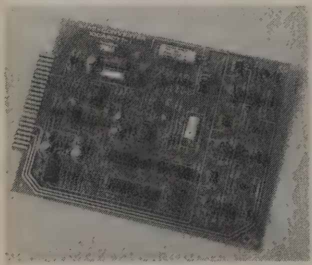


Single phase to 20 Kva. Three phase to 50 Kva.
Frequency up to 1000 Hz — Voltage to 5000 VAC
Multiple primaries and secondaries with or w/o Taps.
Electrostatic shielded windings available.
Thermal cut offs optional.
Choice of insulation, class or temperature rating.
PCB, encapsulated, open, or hermetically sealed.
U.L. to 5 Kva — CSA to 15 Kva.

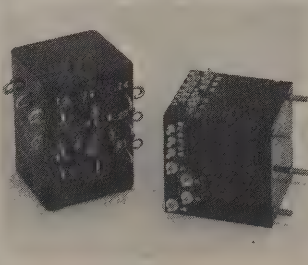
Audio



Frequencies from 25 Hz to 20,000 Hz.
For impedance matching, isolation, low-insertion loss, broad frequency response.
Interstaging and other custom designs to application.
PCB, encapsulated, open and hermetically sealed versions.

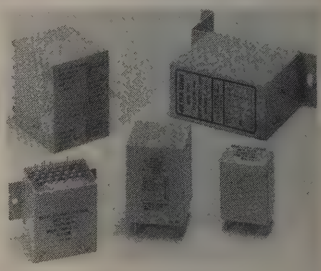


PCB Assemblies



Military Hi-Rel

Custom Assemblies



Power Supplies

MTE CORPORATION

7901 W. Clinton Ave.
P.O. Box 23957
Milwaukee, WI 53223

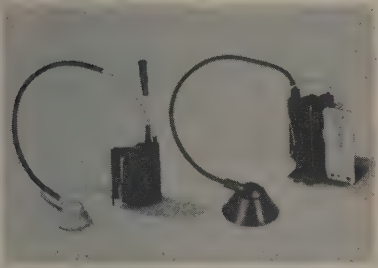
Phone 800/558-4332 • In WI 414/358-5300

high voltage components

MURATA ERIE NORTH AMERICA, INC.

Miniature Flyback Transformers

For 14"-20" color TV and data display



FEATURES

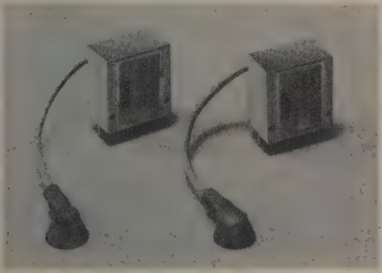
- Integral HV multiplier circuitry
- Small size
- HV resistant epoxy moldings
- Up to 25 KV output

TYPICAL SPECIFICATIONS

Items	Units	MSH-S305	MSH-S477
Input Voltage	V	112	123
Input Current	mA	360	480
Output Voltage	KV	21.0	24.0
Output Current	mA	1.0	1.0
HV Regulation	KV	under 1.4	under 2.0
HV Ringing Ratio	%	under 14	under 16
Collector Peak Voltage	Vp-p	890	1000
Secondary Voltage	V DC	(V_1) 12.5	(V_1) 28.7
Secondary Voltage	V DC	(V_2) 176.6	(V_2) 250
Secondary Voltage	V DC	—	—
Heater Voltage	V rms	6.20	6.30
Collector Pulse Width	μS	11.6	12.12
Def. Yoke Inductance	mH	2.3	1.29
Tuning Capacitance	pF	9520	10000
Primary Inductance	μH	2600	3300

Subminiature Flyback Transformers

For 1.5" to 3" black and white TVs, Viewfinders



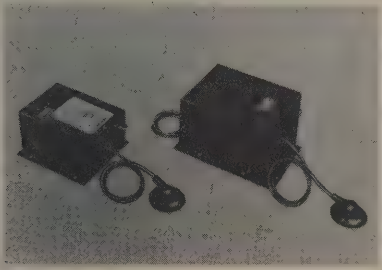
FEATURES

- Just 49mm x 28mm x 19mm
- Integral HV multiplier
- 5 to 6 KV output
- HV resistant epoxy moldings

TYPICAL SPECIFICATIONS

Items	Units	MSH-D618	MSH-T616
Input Voltage	V	5.9	9
Input Current	mA	172	138
Input Power	W	1.01	—
Output Voltage	KV	6.90	5.0
HV Regulation	KV	under 0.7	0.3
Collector Voltage	V	47	79
Collector Pulse Width	μS	12.1	10.4
HV Ringing Ratio	%	under 25	25
Output Current	μA	20	5
G_2 Voltage	V DC	298	700
Video Voltage	V DC	39.5	—
-B Voltage	V DC	−12.0	—

Miniature High Voltage Power Supplies

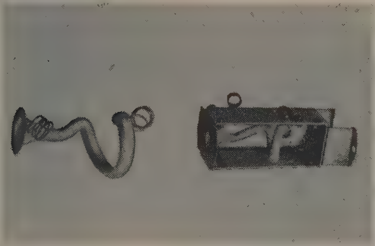


FEATURES

- Up to 17 KV output
- High, 40 KHz conversion frequency reduces size
- Provision for small-signal output control
- Built-in HV output stabilization
- Automatic overload protection
- Low output ripple
- Special epoxy resin for high reliability

CERATRON

Ceramic Electron Multipliers



These units are completely solid-state and may be substituted for standard vacuum-type electron multipliers in a variety of applications including ion, gamma ray, electron, photon and soft x-ray detection. They offer high gains to 10^6 min. and are extremely linear at up to 1 microamp. Noise figures are very low.

MURATA ERIE NORTH AMERICA, INC. 1148 Franklin Rd., S.E., Marietta, Georgia 30067 Tel: (404) 952-9777 Telex: 54-2329 TWX: 810-766-1531

WIDEBAND TRANSFORMERS

UNBALANCED TO BALANCED TRANSFORMERS

Balanced secondaries center-tapped and dc-isolated from primaries. Mid-band insertion loss less than 0.5 dB. Bandwidth defined at low frequency end by 3 dB drop from mid-band response, at high end by max. VSWR of 1.25.

LOW POWER SERIES (1W)

Series	Radio Frequency		Medium Frequency		Video	
Cases	BA, BB, HB		BA, BB		LA, LB	
Unb./Bal. (Ω)	Type No.	Bandwidth MHz	Type No.	Bandwidth MHz	Type No.	Bandwidth MHz
50:50	0001	.1-125	0010	.01-80	0009	.001-25
50:75	0101	.1-125	0111	.01-80	0104	.001-25
50:90	0200	.1-125	0202	.01-60	0203	.001-20
50:100	0300	.1-100	0301	.01-60	0311	.001-20
50:124	0307	.1-100	0302	.01-60	0306	.001-20
50:135	0310	.1-100	0312	.01-60	0303	.001-18
50:150	0400	.1-100	0401	.01-60	0415	.001-15
50:200	0500	.1-100	0520	.01-60	0511	.001-15
50:300	0501	.1-100	0521	.01-50	0517	.001-12
50:450	0600	.1-65	0602	.01-40	0603	.001-10
50:600	0700	.1-65	0703	.01-32	0706	.001-8
50:800	0800	.1-60	0801	.01-25	0802	.001-7
50:1200	0900	.1-30	0902	.01-15	0904	.001-6
75:50	1000	.1-100	1001	.01-60	1002	.001-25
75:75	1100	.1-100	1112	.01-60	1102	.001-25
75:90	1200	.1-100	1201	.01-60	1202	.001-20
75:100	1300	.1-100	1310	.01-60	1314	.001-20
75:124	1302	.1-100	1311	.01-60	1301	.001-20
75:135	1317	.1-100	1315	.01-60	1312	.001-20
75:150	1400	.1-100	1405	.01-60	1404	.001-16
75:200	1500	.1-100	1513	.01-60	1516	.001-15
75:300	1501	.1-100	1514	.01-60	1502	.001-15
75:450	1600	.1-60	1601	.01-40	1602	.001-12
75:600	1700	.1-60	1707	.01-32	1704	.001-10
75:800	1800	.1-30	1801	.01-20	1802	.001-10
75:1200	1900	.1-30	1905	.01-15	1902	.001-9
75:1850	1906	.1-15	1901	.01-8	1903	.001-6

EXTENDED VIDEO SERIES Response down to 20 Hz

Type No.	Unb./Bal.	Bandwidth	Case Styles
0014	50:50	20 Hz-6 MHz	PB
0113	50:75	20 Hz-6 MHz	PB
0315	50:100	20 Hz-6 MHz	PB
0316	50:124	20 Hz-6 MHz	PB
0522	50:200	20 Hz-4 MHz	PB
1003	75:50	20 Hz-6 MHz	PB
1111	75:75	20 Hz-6 MHz	LA, LB
1307	75:110	20 Hz-6 MHz	PB
1309	75:124	20 Hz-9 MHz	PB
1408	75:150	20 Hz-6 MHz	PB
1520	75:300	20 Hz-4 MHz	PB

HIGH POWER SERIES

Power Level	10 W	25 W	100 W	1 kW
Cases	HB	BA, BB	BA, BB	KA
MHz Range	.1-30	.1-30	.5-30	2-32
Unb./Bal. (Ω)	Type No.	Type No.	Type No.	Type No.
50:50	0008	0011	0012	0013
50:75	0108	0109	0105	0107
50:100	0309	0308	0304	0314
50:150	0406	0402	0404	0407
50:200	0519	0512	0516	0515
50:300	0514	0518	0506	0513
50:450	0604	0605	0606	0601
50:600	0705	0701	0704	0702
75:75	1105	1110	1118	1108
75:100	1306	1304	1305	1316
75:150	1406	1401	1403	1407
75:200	1517	1519	1512	1518
75:300	1515	1510	1505	1511
75:450	1603	1604	1605	1606
75:600	1709	1703	1708	1705

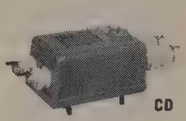
MANY VARIATIONS, MIL SPEC, AND CUSTOM DESIGNS TO 1 GHz ALSO AVAILABLE

North Hills

ISOLATION TRANSFORMERS UNBALANCED TO UNBALANCED

Ground Isolation in 50 and 75Ω Coaxial Systems

CC, PA


CD

- Flat frequency, linear phase response.
- Insulated BNC connectors.
- 140 dB isolation at power frequencies.

Type No.	Impedance Unb/Unb(Ω)	Bandwidth
0005-CC	50:50	1 kHz - 25 MHz
1103-CC	75:75	1 kHz - 25 MHz
0112-CC	50:75	1 kHz - 25 MHz
0017-CC	50:50	10 Hz - 5 MHz
1117-CC	75:75	10 Hz - 5 MHz
0016-PA	50:50	20 Hz - 20 MHz
1116-PA	75:75	20 Hz - 20 MHz
1121-TC	75:75	3.5 Hz - 8 MHz

10 KV Isolation for Public Utility Data Transmission
1 kHz to 6 MHz bandwidths.
1115-CD: 75Ω coax to 75Ω coax.
1313-CD: 75Ω coax to 124Ω balanced line.

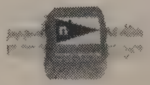
HUMBUCKING CHOKES

75:75 ohms, Insulated BNC connectors

Type	Bandwidth	Rejection at 60 Hz
1119-PA	DC to 15 MHz	50 dB min.
1120-CC	DC to 20 MHz	40 dB min.

ULTRA-WIDE COAXIAL MATCHING TRANSFORMERS

Unbalanced to unbalanced. BNC male and female input and output connectors in all combinations. Low VSWR.



0003-JA	50:50	.05-300 MHz	Phase Reversing
0102-JA	50:75	.05-300 MHz	Impedance Adapter
0114-JA	50:75	10-1000 MHz	Impedance Adapter
0201-JA	50:90	.05-300 MHz	Impedance Adapter
1106-JA	75:75	.05-300 MHz	Phase Reversing
1203-JA	75:90	.05-300 MHz	Impedance Adapter

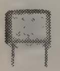
SUBMINIATURE SERIES

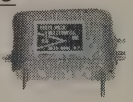
NA molded case. 0.1-300 MHz bandwidth.

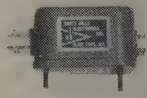
.6 x .6 x .4″

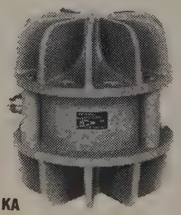
0003-NA 1106-NA 2200-NA	50: 50 75: 75 90: 90	Unbalanced to Unbalanced Phase Reversing DC Coupled
0007-NA 1107-NA 2201-NA	50: 50 75: 75 90: 90	Unbalanced to Unbalanced Phase Reversing DC Isolated
0002-NA 0508-NA 1506-NA	50: 12.5 50:200 75:300	Unbalanced to Unbalanced Non-Inverting DC Coupled
0004-NA 0509-NA 1101-NA 1507-NA 2202-NA	50: 50 50:200 75: 75 75:300 100:100	Unbalanced to Balanced DC Coupled
0510-NA 1508-NA	50:200 75:300	Balanced to Balanced DC Coupled

CASE STYLES


HB


BA, LA


BB, LB, PB

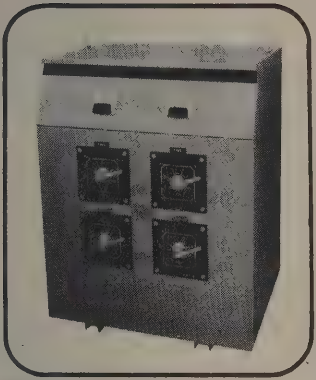

KA

OVERALL DIMENSIONS (Inches)

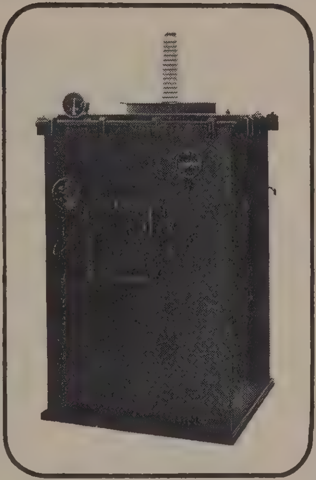
Case	L	W	H
BA	2.3	1.3	1.2
BB	2.6	1.3	1.2
CC	3.5	1.7	1.6
HB	0.9	0.9	0.7
KA	5.4	4.6	5.5
LA	2.9	1.7	1.3
LB	3.2	1.7	1.3
PA	3.0	4.0	2.0
PB	3.0	3.6	2.0

North Hills Electronics, INC.
GLEN COVE, N.Y. 11542 • 516-671-5700

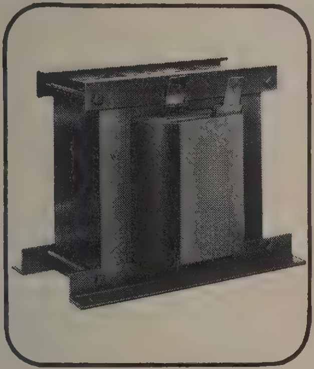
NWL ...the source for industrial and electronic transformers



Heating transformers for resistance and induction furnaces

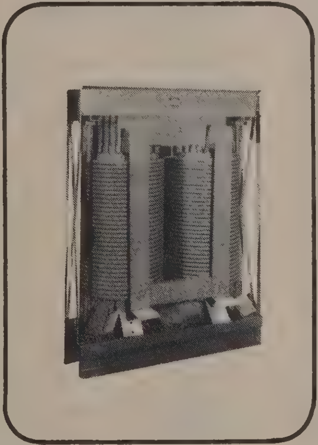


Oil-filled, high voltage Transformer/Rectifier Sets

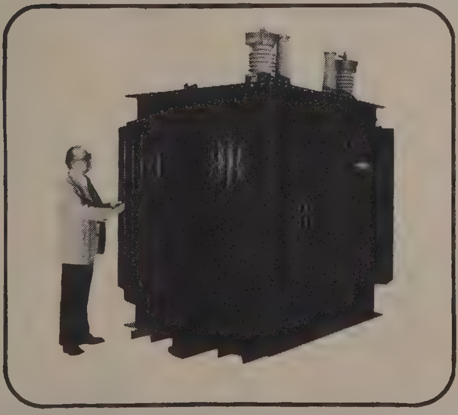


Current limiting reactors

High power and high current water cooled transformers



15 KV Class, 3,000 KVA-equivalent multiple-tapped oil-filled transformer



Since 1929, NWL has consistently been in the forefront of transformer design and manufacture.

High voltage, high frequency and high current transformers are particular strengths at NWL — whether for prototype, standard or special applications.

There's another reason you should look to NWL for solutions to your specific transformer problems. We've never hesitated to tackle the tough design problems head-on. In fact, NWL's technological superiority is a recognized fact in the precipitator, furnace, desalting, nuclear, and other fields requiring high technology.

NWL ...the source for:

TRANSFORMERS ● Furnace ● Filament ● Heating ● Lighting ● SCR Controls ● Plate ● High Frequency ● Instrument ● Phase Changing ● Welding ● High Voltage ● Testing ● High Reactance ● Output

PLUS ● Saturable Core Reactors ● Chokes ● Packaged Controls ● AC Reactors ● Air Core Reactors

MANUFACTURING RANGE

Up to 200 KV
1 ma to 50,000 AMP
4 Hz to 50 kHz
5 KVA to 6,000 KVA
Dry, Oil-Filled, Silicone Fluid-Filled, Water Cooled, and Epoxy Cast Units Available.

NWL TRANSFORMERS

Rising Sun Road ● P.O. Box 358
Bordentown, N.J. 08505
(609) 298-7300 ● TWX: 510-685-3645
Call us for quote or specs

NWL also designs and manufactures custom built AC/DC power supplies, laboratory and industrial types. See our ad under DC POWER SOURCES.

opt INDUSTRIES INC.

300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

TRANSFORMERS

CONSTANT VOLTAGE

- Designed and rated for use in a full wave center tapped rectifier circuit. (Fig. 1):
- OPT's unique insulation allows all units to be rated at 150°C and can be used in higher ambients with extended life.
- Excellent common mode noise suppression characteristics. Spikes as high as 2500 volts are kept from entering the output circuits.
- 100% solids custom formulated epoxy impregnant is used to provide a quieter unit than is usually obtained with most constant voltage transformers as well as providing cooler operation.
- Windings can be connected for dual (+ or −) output voltages by adding another set of diodes. The sum of the + and − currents equals the total rating of the winding.
- Double output voltage at one half of the rated current is possible with a bridge rectifier. (Fig. 2)
- Output voltage remains essentially constant over input line swings of plus and minus 15%.
- Nominal output voltage is set to +/− 2%.
- UL recognized insulation system (UL 1446).
- Will meet international safety standards.
- Resonant capacitor furnished with each unit.

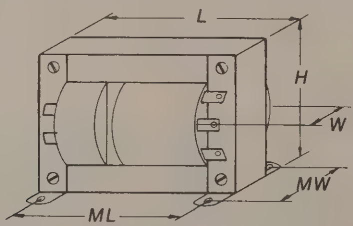
SINGLE OUTPUT

DC Output Volts†	Output DC Amps	Part No.	Load Regulation (AV)*			RMS Ripple Volts	Recommended Diodes		Filter Capacitor CP		Size VA
			10%	25%	50%		PIV	I/Cell	KMFD	DCWV	
5	12	CV8400	.60	.50	.40	.25	35	20	75	10	60
	24	CV8401	.55	.45	.35	.25	35	50	150	10	120
	48	CV8402	.50	.40	.25	.25	35	75	300	10	240
	96	CV8403	.40	.30	.17	.25	35	150	600	10	480
8	7.5	CV8404	.95	.80	.65	.4	35	15	30	10	60
	15	CV8405	.88	.72	.55	.4	35	35	60	10	120
	30	CV8406	.80	.65	.40	.4	35	75	120	10	240
	60	CV8407	.64	.48	.24	.4	35	100	240	10	480
12	5	CV8408	1.45	1.20	.46	.6	50	10	13	15	60
	10	CV8409	1.32	1.08	.84	.6	50	20	26	15	120
	20	CV8410	1.20	.96	.60	.6	50	35	52	15	240
	40	CV8411	.96	.72	.36	.6	50	75	104	15	480
15	4	CV8412	1.80	1.50	1.20	.75	50	10	8	20	60
	8	CV8413	1.65	1.25	1.05	.75	50	20	16	20	120
	16	CV8414	1.55	1.20	.75	.75	50	35	33	20	240
	32	CV8415	1.2	.90	.45	.75	50	75	67	20	480
18	3.3	CV8416	2.15	1.80	1.44	.9	75	10	6	20	60
	6.7	CV8417	1.98	1.62	1.26	.9	75	20	12	20	120
	13.3	CV8418	1.80	1.44	.90	.9	75	35	24	20	240
	26.6	CV8419	1.44	1.08	.54	.9	75	75	48	20	480
24	2.5	CV8420	2.88	2.40	1.92	1.2	100	5	3	25	60
	5	CV8421	2.64	2.16	1.68	1.2	100	10	6	25	120
	10	CV8422	2.40	1.92	1.20	1.2	100	20	12	25	240
	20	CV8423	1.92	1.44	.72	1.2	100	35	24	25	480
	40	CV8424	1.70	1.20	.50	1.2	100	70	48	25	960
28	2.2	CV8425	3.36	2.80	2.24	1.4	100	5	2.5	30	60
	4.3	CV8426	3.08	2.52	1.96	1.4	100	10	5	30	120
	8.6	CV8427	2.83	2.24	1.40	1.4	100	20	10	30	240
	17.2	CV8428	2.24	1.68	.84	1.4	100	35	20	30	480
48	20	CV8429	3.40	2.40	1.00	1.6	200	35	15	60	960

AV — Average Voltage

* Rise in DC Volts. If application has a complete no load condition, it may be necessary to use a Bleeder Resistor.

† Dual Complementary Outputs (e.g. ±12V, or ±15V) may be achieved by use of a center-tapped Bridge Rectifier. In this application, DC current for each side would be halved. Cf — ½ value in MFD, same DCWV, D_1, D_2 — ½ PIV, ½ I/Cell (4 Diode). (See Fig. 2)



Size (VA)	L	W	H	ML	MW	Lbs.	Mtg. Screw
60	4⅛	3	3⅝	3 9/16	2	4.8	#8
120	5 1/16	3 9/16	4 7/16	4⅜	2¼	8.7	#10
240	6¼	4¼	5¾	5 5/16	2½	15.9	¼
480	6¼	6	5¾	5 5/16	3⅞	28.7	¼
960	8	6⅝	7⅛	5 9/16	4	4.8	¼

MULTI OUTPUT

VDC @ Amps Output	Part No.	RMS Ripple Volts	Recommended Diodes		Filter Capacitor		Size VA
			PIV	I/Cell	KMFD	DCWV	
8.5 @ 8 12.0 @ 2	CV8450	.45 .60	35 50	15 5	35 6	15 15	120
5.0 @ 5 8.5 @ 1 12.0 @ 1	CV8451	.25 .45 .60	35 35 50	10 5 5	35 4 3	10 15 15	60
5.0 @ 8 8.5 @ 4 12.0 @ 2	CV8452	.25 .45 .60	35 35 50	15 10 5	60 16 6	10 15 15	120
5.0 @ 12 8.5 @ 2 12.0 @ 2	CV8453	.25 .45 .60	35 35 50	20 5 5	8 8 6	10 15 15	120
8.5 @ 1 12.0 @ 1 24.0 @ 1.5	CV8454	.45 .60 1.20	35 50 100	5 5 5	4 3 2	15 15 30	60
8.5 @ 3 12.0 @ 2 24.0 @ 2	CV8455	.45 .60 1.20	35 50 100	10 5 5	12 6 3	15 15 30	120
8.5 @ 8 12.0 @ 2 24.0 @ 2	CV8456	.45 .60 1.20	35 50 100	10 5 5	35 6 3	15 15 30	240
8.5 @ 8 12.0 @ 4 24.0 @ 4	CV8457	.45 .60 1.20	35 50 100	15 10 10	35 12 6	15 15 30	240
8.5 @ 12 12.0 @ 2 24.0 @ 4	CV8458	.45 .60 1.20	35 50 100	35 5 10	50 6 6	15 15 30	240
5.0 @ 3 8.5 @ 1 12.0 @ 1 24.0 @ 1	CV8459	.25 .45 .60 1.20	35 35 50 100	10 5 5 2	20 4 3 1.5	10 15 15 30	60
5.0 @ 5 8.5 @ 2 12.0 @ 1 24.0 @ 2	CV8460	.25 .45 .60 1.20	35 35 50 100	10 5 5 5	35 8 5 3	10 15 15 30	120
5.0 @ 8 8.5 @ 4 12.0 @ 3 24.0 @ 4	CV8461	.25 .45 1.60 1.20	35 35 50 100	20 10 10 10	60 16 10 6	10 15 15 30	240
5.0 @ 12 8.5 @ 4 12.0 @ 4 24.0 @ 4	CV8462	.25 .45 .60 1.20	35 35 50 100	20 10 10 10	80 16 12 6	10 15 15 30	240

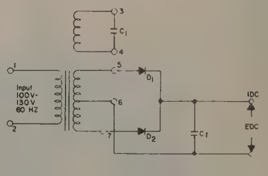


FIGURE 1

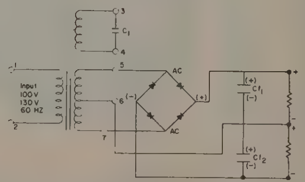


FIGURE 2

opt INDUSTRIES INC.
300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

TRANSFORMERS

20 KHz SWITCHING

- PERFORMANCE VERIFIED IN 20 KHz SWITCHING SUPPLY
- DESIGNED TO MEET INTERNATIONAL SAFETY SPECIFICATIONS
- PC MOUNTABLE PRIMARY AND LOW CURRENT SECONDARIES
- DC POWER RATING TO 700W.

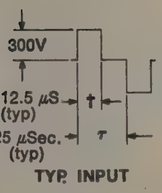
ELECTRICAL SPECIFICATIONS AT 25°C

Part Number	Outline Figure	Schem. Figure	Turns Ratio ±2%, N1:N2 See Schem.	Pri. Induct. L_P (mH Min.)	Leak. Induct. L_L (μH Max.)	DC Resistance Ohms Max.			Secondary Current Rating, Amps DC for 60°C Temp. Rise, 25°C Ambient	
						1-2	3-4	5-7	No Forced Air	30 CFM Forced Air
SM8050	3	1	14:1	12.0	40.0	0.180	0.270	0.0021	50A	70A
SM8051	4	1	14:1	8.0	20.0	0.073	0.113	0.00075	100A	140A

Part Number	Outline Figure	Schem. Figure	Turns Ratio ±2% N1:N2:N3:N4 See Schem.	Pri. Induct. L_P (mH Min.)	Leak Induct. L_L (μH Max.)	DC Resistance Ohms Max.				Secondary Current Rating, Amps DC for 60°C Temp. Rise, 25°C Ambient					
										No Forced Air			30 CFM Forced Air		
						1-2 or 3-4	5-7	8-10	11-13	I1	I2	I3	I1	I2	I3
SM8052	3	2	14:1:3:6	12.0	30.0	0.265	0.0021	0.500	0.270	40	1.5	1.0	55	2.1	1.4
SM8053	4	2	14:1:3:6	8.0	15.0	0.113	0.0075	0.110	0.217	80	3.0	2.0	112	4.2	2.8

1. Turns ratio selected to provide 5 VDC at approx. 80% duty cycle when input line voltage is approx. 70% of nominal.
2. Dielectric strength: Primary to sec. 3750 VRMS, primary to core 2000 VRMS, secondaries to core 1750 VRMS.
3. L_P and L_L measured with 1-2, 3-4 series connected.

STANDARD APPLICATION TEST CIRCUITS



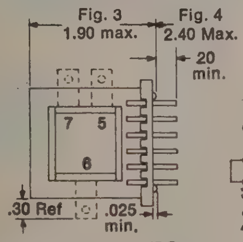


Fig. 3
1.90 max.
Fig. 4
2.40 Max.
20 min.
7
5
6
.30 Ref
.025 min.

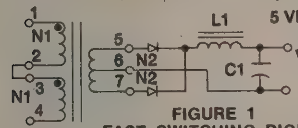

1
N1
2
N1
3
4
5
6
N2
7
N2
L1
5 VDC
1 DC
C1

FIGURE 1
FAST SWITCHING DIODES

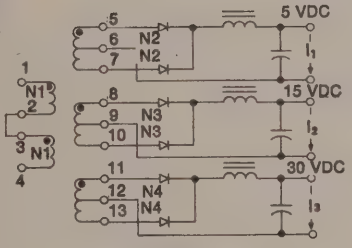

1
N1
2
3
N1
4
5
6
N2
7
N2
5 VDC
I1
8
9
N3
10
N3
15 VDC
I2
11
12
N4
13
N4
30 VDC
I3

FIGURE 2
FAST SWITCHING DIODES

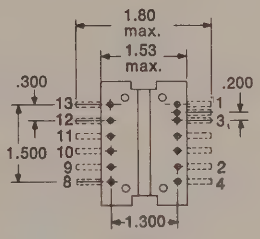

1.80 max.
1.53 max.
.300
.200
13
12
11
10
9
8
1
3
2
4
1.500
1.300

FIGURE 3

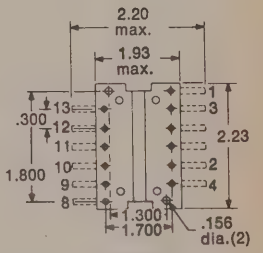

2.20 max.
1.93 max.
.300
13
12
11
10
9
8
1
3
2
4
2.23
1.800
1.300
1.700
.156 dia.(2)

FIGURE 4
All Pins .040 ±.003, Solderable
High Current Solderable
Terminals on 5, 6, 7

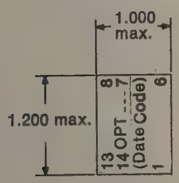
20 KHz BASE DRIVE

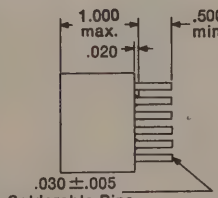
- ENCAPSULATED CONSTRUCTION WITH PLUG IN PINS
- DESIGNED FOR 15 OR 30 VDC INPUT, 20 KHz OPERATING FREQUENCY
- CLAMP WINDING PROVIDED
- PROVIDES PEAK BASE CURRENT TO 1.5A
- DESIGNED TO MEET INTERNATIONAL SAFETY SPECIFICATIONS

ELECTRICAL SPECIFICATIONS AT 25°C

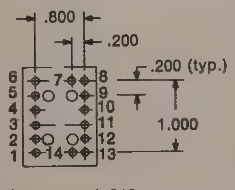
Part Number	Schematic Figure	Turns Ratio ±5% N1:N2:N3	Pri. Ind., N1 mH Min. at IV, 1 KHz (½ of winding)	Leakage Ind. N3- μH Max. Short N1	DC Resistance Ohms Max.		
					N1	N2	N3
SM8000	1	15:15:5	1.25	.85	.80	.70	.055
SM8001	2	15:15:5	1.25	.85	.80	.70	.055
SM8002	1	30:15:5	5.00	.85	1.60	.70	.055
SM8003	2	30:15:5	5.00	.85	1.60	.70	.055

CASE DIMENSIONS


1.000 max.
1.200 max.
8
7
6
13
14 OPT
(Date Code)
1


1.000 max.
.500 min.
.020

.030 ±.005
Solderable Pins


.800
.200
.200 (typ.)
1.000
6
5
4
3
2
1
7
14
8
9
10
11
12
13

Tolerances: ±.010

SCHEMATICS

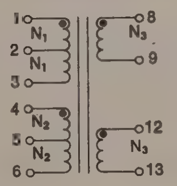

1
N1
2
N1
3
4
N2
5
N2
6
8
N3
9
12
N3
13

FIGURE 1

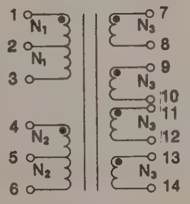

1
N1
2
N1
3
4
N2
5
N2
6
7
N3
8
9
N3
10
11
N3
12
13
N3
14

FIGURE 2

N_1 = Primary end to C.T.
N_2 = Clamp end to C.T.
N_3 = Individual Secondaries

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

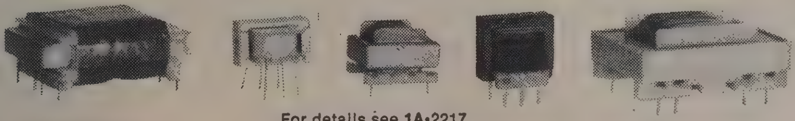
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms ..... **1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code ..... **3**•1103
Batteries, Product Selection Guide ..... **3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide ..... **2**•1003
Capacitors, Basic Formulas ..... **1A**•1093
Capacitors, Miniglossary ..... **1A**•1069
Capacitors, Product Selection Guide ..... **1A**•1003
Circuit Boards (Printed), Product Selection Guide ..... **2**•1089
Coils, Chokes, & Inductors, Product Selection Guide ..... **1A**•1219
Connectors, Miniglossary ..... **2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide ..... **2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **1A**•1309
Delay Lines, Product Selection Guide ..... **1A**•1445
Discrete Semiconductors, Product Selection Guide ..... **1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide ..... **1B**•1021
EBCDIC Code ..... **3**•1153
Encapsulation, Miniglossary ..... **2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **2**•1801
Filters, Product Selection Guide ..... **1A**•1577
Instruments, Graphic Recording, Product Selection Guide ..... **3**•1381
Instruments, Panel Meters, Product Selection Guide ..... **3**•1321
Instruments, Test & Measuring, Product Selection Guide ..... **3**•1182
Interconnection Systems, Product Selection Guide ..... **2**•1873
Keyboards & Keypads, Product Selection Guide ..... **1B**•1759
Microwave Components, Product Selection Guide ..... **1A**•1685
Military Qualified Products Lists ..... **1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **1B**•1121
Opto Semiconductors, Miniglossary ..... **1B**•1218
Oscilloscopes, Product Selection Guide ..... **3**•1361
Panel Hardware, Product Selection Guide ..... **2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **1A**•2017
Power Supplies, Miniglossary ..... **3**•1455
Power Supplies, AC, Product Selection Guide ..... **3**•1815
Power Supplies, DC, Product Selection Guide ..... **3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **1B**•1255
Relay Contact Forms ..... **1B**•1317
Relays, Electromechanical, Miniglossary ..... **1•B**1292
Relays, Product Selection Guide ..... **1B**•1289
Resistor Color Codes ..... **1A**•1791
Resistors, Product Selection Guide ..... **1A**•1789
Servo Components, Miniglossary ..... **3**•1935
Solenoids, Product Selection Guide ..... **1B**•1481
Switches, Product Selection Guide ..... **1B**•1499
Thyristors/High Power Diodes, Miniglossary ..... **1A**•1652
Transducers & Encoders, Product Selection Guide ..... **1B**•1827
Transformers, Product Selection Guide ..... **1A**•2115
Wire & Cable, Product Selection Guide ..... **2**•1935

TTC SERIES
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

The **TTC SERIES** has been developed to meet telephone interconnect, coupling, matching and bridging requirements for use in voice, instrumentation and modem applications. **This series meets FCC PART 68 requirements.**



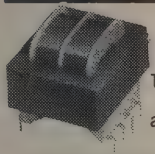
For details see **1A•2217**

DP SERIES
ENCAPSULATED AUDIO TRANSFORMERS

The **DP SERIES** is cost effective for applications involving severe environments. This series is tested to the requirements of **MIL-T-27** and several part numbers meet **FCC PART 68.**

For details see **1A•2216**

3F SERIES
3-FLANGE BOBBIN POWER TRANSFORMERS



The **3F SERIES** offers 2500V RMS dielectric breakdown testing primary-to-secondary (side-by-side winding type). They are available with single and dual primary connections for 115V, or 115/230V, 50/60 Hz circuits.

For details see **1A•2219**

PEP SERIES
UL-1411 RECOGNIZED POWER TRANSFORMERS

This series complies with the safety requirements of most **WORLDWIDE AGENCIES** (UL, CSA, Europe-IEC 65 and Japan-MITI) including 4000V RMS dielectric breakdown testing primary-to-secondary.

For details see **1A•2218**

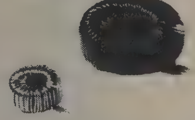
FILE NUMBER
E59673
TAMRADIO

STT SERIES
ENCAPSULATED SCR AND TRIAC TRIGGER TRANSFORMERS

The **STT SERIES** provides line isolation in SCR and Triac controlled circuits. **STT TRIGGER** transformers pass **2600V RMS** dielectric breakdown testing and are completely encapsulated for applications involving severe environments.

For details see **1A•2216**

POWER AND NOISE ABSORBING INDUCTORS



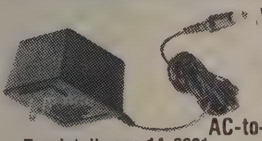
The **SKC SERIES** of toroidal power inductors are gapped for energy storage circuits with DC ratings from **5 to 50A DC.**

The **SKL SERIES** is functionally gapped for circuits requiring high ''L'' at low DC amps and nominal ''L'' at rated DC amps.

The **SKP SERIES** is designed on powered iron toroidal cores for RFI and EMI filtering and noise absorbing applications.

For details see **1A•2220**

WALL PLUG-IN AC TO DC POWER SOURCES



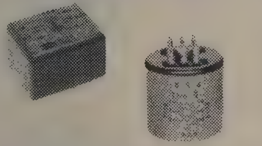
This series of wall plug-in AC-to-DC battery chargers, battery eliminators and power supplies are available in a complete variety of input plug-in styles and comply with worldwide safety agency requirements.

AC-to-AC Wall Plug-in Transformers Are Available

FILE NUMBERS
UL E82180
CSA LR36236
VDE F-7969-331
TAMRADIO

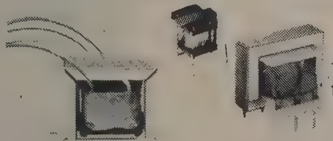
For details see **1A•2221**

PROFESSIONAL AUDIO TRANSFORMER SERIES



This series is widely used in high performance applications and meets most requirements of communications, broadcasting, recording and measuring apparatus. Available in solder lug, lead and printed circuit mounting styles; these transformers are metal cased. Several part numbers are electrostatic and MU-metal shielded.

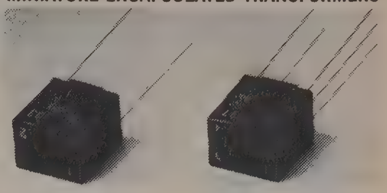
ATT SERIES
AUDIO TRANSFORMERS



These cost effective, volume produced transformers are available for impedance matching circuits and sound distribution systems. They are available as printed circuit, solder lug and lead styles.

Quality magnetic components at competitive prices . . . including COILS, POWER & AUDIO TRANSFORMERS, INDUCTORS, PULSE TRANSFORMERS, NOISE SUPPRESSION COILS, DC-DC CONVERTER TRANSFORMERS, PLUG-IN BATTERY CHARGERS and SWITCH-MODE POWER SUPPLY TRANSFORMERS & INDUCTORS. Our diversified manufacturing facilities are located in Taiwan, Malaysia and Japan. For details on standard and special requirement products, pricing and delivery—contact our headquarters.

MINIATURE ENCAPSULATED TRANSFORMERS



Small Size . . . . 0.310″ × 0.410″ X 0.465″
Gold Plated Leads . . . . 0.020″ Nickel
Response . . . . ± 2dB, 300 Hz to 100 KHz
Impedance Range . . . . 3.2 to 200K Ohms
Meets Requirements of MIL-T-27 as TF5S21ZZ

TRANSFORMERS-MET SERIES

PART NO.	MATCHING IMPEDANCE		DCMA (Max) Primary
	Primary	Secondary	
MET-01	200KCT	1KCT	0
MET-02	100KCT	1KCT	0
MET-03	50KCT	1KCT	0
MET-04	50K	1KCT or 250*	0
MET-05	25KCT	1KCT	0.5
MET-06	25K	1KCT or 250*	0.25
MET-07	25KCT	600CT	0.5
MET-08	20KCT	800CT	0.5
MET-09	10KCT	10KCT	1.0
MET-10	10KCT	4KCT	1.0
MET-11	10KCT	2KCT	1.0
MET-12	10K	2KCT or 500*	0.5
MET-13	10KCT	1.5CT	1.0
MET-14	10KCT	1.2KCT	1.0
MET-15	10K	1.2KCT or 300*	0.5
MET-16	10KCT	600CT	1.0
MET-17	10KCT	500CT	1.0
MET-18	10KCT	4.0	1.0
MET-19	10K	3.2	0.5
MET-20	8KCT	3.2	1.0
MET-21	5KCT	2KCT	1.0
MET-22	2.5KCT	2.5KCT	1.0
MET-23	1.6KCT	3.2	2.5
MET-24	1.5KCT	600	3.0
MET-25	1.2KCT	3.2	3.0
MET-26	1KCT	1KCT	3.0
MET-27	1KCT	600CT	3.0
MET-28	1K	50	3.0
MET-29 +	900CT	600	3.0
MET-30	800CT	3.2	3.0
MET-31 +	600CT	600CT	3.0
MET-32 +	600	600CT or 150*	3.0
MET-33	600CT	250CT	3.0
MET-34	600CT	12	4.5
MET-35	600CT	8	4.5
MET-36	600CT	3.2	4.5
MET-37	500CT	600	3.0
MET-38	500	500CT or 125*	3.0
MET-39	500	50	3.0
MET-40	320CT	3.2	6.0
MET-41	300CT	600	7.0
MET-42	150	12	10.0
MET-43	120CT	3.2	10.0
MET-44	300CT	12.0	7.0
MET-45	10K	10KCT or 2.5K*	1.0
MET-46 +	600	600	3.0
MET-48	200K	1K	0
METC-99	Mu-Metal Magnetic Shield		

*As parallel or split winding connection
+ Meets **FCC PART 68** requirements and 1000V RMS Pri to Sec Hipot Test

INDUCTORS-MEI SERIES

PART NO.	INDUCTANCE Hy @ 300Hz	DCR ohms	DCMA
MEI-01	6 at 15V	1800	2.0
MEI-02	3.5 at 5V	1200	2.0
MEI-03	1.25 at 3V	180	2.0
MEI-04	0.3 at 3V	40	4.0
MEI-05	0.1 at 3V	15	5.0

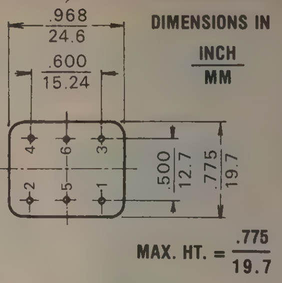
PAN-MAGNETICS INTERNATIONAL, INC.

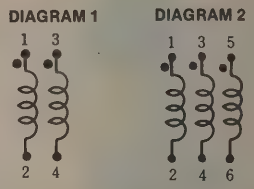
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

STT SERIES
ENCAPSULATED SCR & TRIAC TRIGGER TRANSFORMERS

The **STT SERIES TRIGGER TRANSFORMERS** are designed for low cost source isolation in half and full wave **SCR** or **TRIAC** control circuits. The **STT TRIGGER TRANSFORMERS** are encapsulated for environmental protection and pass **2600 V RMS** dielectric breakdown testing.

PART NUMBER	TURNS RATIO	PRIMARY "L" MH	LEAKAGE "L" μH	WDG. "C" PF	E.T. V-μSEC	D.C.R. OHMS (Max.)	DIA. NO.
STT-101	1:1	> 1.0	< 15	80	> 90	2.5/2.5	1
STT-102	1:1	> 5.0	< 50	80	>200	5.0/5.0	1
STT-103	1:1	>10.0	<100	80	>280	7.0/7.0	1
STT-104	1:1:1	> 1.0	< 25	80	> 90	2.5/2.5/2.5	2
STT-105	1:1:1	> 5.0	<100	80	>200	5.0/5.0/5.0	2
STT-106	1:1:1	>10.0	<200	80	>280	7.0/7.0/7.0	2
STT-107	2:1	> 1.0	< 20	80	> 90	2.5/1.5	1
STT-108	2:1	> 5.0	< 60	80	>200	5.0/2.5	1
STT-109	2:1	>10.0	<130	80	>280	7.0/3.5	1
STT-110	2:1:1	> 1.0	< 30	80	> 90	2.5/1.5/1.5	2
STT-111	2:1:1	> 5.0	<130	80	>200	5.0/2.5/2.5	2
STT-112	2:1:1	>10.0	<200	80	>280	7.0/3.5/3.5	2





DP SERIES ENCAPSULATED AUDIO TRANSFORMERS

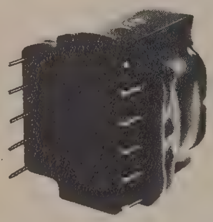
The **DP SERIES** of encapsulated audio transformers are cost effective for applications involving severe environments. Completely encapsulated, these small audio transformers eliminate environmental and board washing problems associated with open style transformers. The environmental quality of the **DP SERIES** is established through testing for humidity, immersion, solvent resistance and temperature cycling to the exacting reqirements of MIL-T-27. Several part numbers meet the requirements of **FCC PART 68** for telephone or modem applications. All **DP SERIES** audio transformers have frequency response characteristics within ±2dB from 200 Hz to 20 KHz.

EI 19 DP SERIES

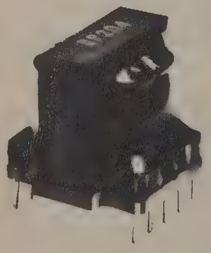
+Meets requirements of FCC PART 68
*Insertion loss 0.9db typical and frequency response ±0.1db, 300 to 3400 Hz and with electrostatic shield.

PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-101+	600CT	600CT	38	48	15dbm	5	A	1
DP-103+	600CT	1.2KCT	38	84	15dbm	5	A	1
DP-105+	4KCT	600CT	277	35	15dbm	1	A	1
DP-107	300	600CT	19	48	15dbm	5	A	2
DP-108+	600	600CT	38	48	15dbm	5	A	2
DP-111	1K	2KCT	53	152	15dbm	2	A	2
DP-114	2.5K	2.5KCT	172	220	15dbm	2	A	2
DP-116	4K	2KCT	277	160	15dbm	1	A	2
DP-118	8K	2KCT	500	143	15dbm	0.5	A	2
DP-119	10K	600CT	370	90	15dbm	0.5	A	2
DP-122	10K	10KCT	695	900	15dbm	0.5	A	2
DP-124	20K	4KCT	1900	305	15dbm	0.5	A	2
DP-126	1KCT	8	55	0.62	15dbm	2	A	3
DP-128+	600	600CT×2	37	42×2	15dbm	0	B	4
DP-129+*	600CT	600CT	26	34	15dbm	0	B	1*

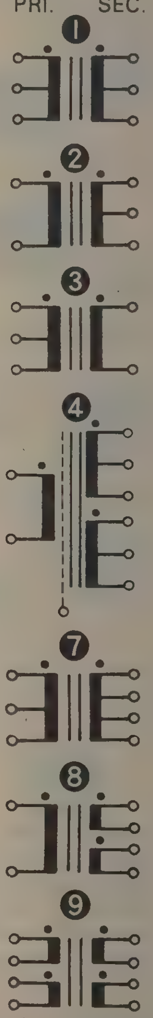
EI 28 DP SERIES



PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-204+	600	600CT	36	50	28dbm	10	C	2
DP-206	4K	2KCT	250	145	28dbm	3	C	2
DP-210	200CT	4, 8, 16	10	0.4, 0.5, 0.7	28dbm	10	C	7
DP-214	600CT	4, 8, 16	32	0.4, 0.5, 0.7	28dbm	10	C	7
DP-220	1.3K	600/150	72	19×2	28dbm	6	C	8
DP-222+	500/125	500/125	19×2	22×2	28dbm	10	C	9
DP-222+	600/150	600/150	19×2	22×2	28dbm	10	C	9
DP-225+	4K/1K	600/150	63×2	20×2	28dbm	3	C	9
DP-226+	600	600CT×2	41	36×2	28dbm	0	C	4



SCHEMATIC DIAGRAMS



DP SERIES MECHANICAL DIAGRAMS

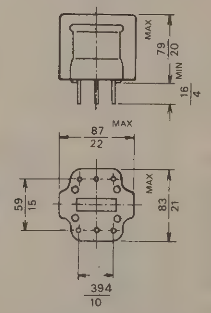


FIGURE A

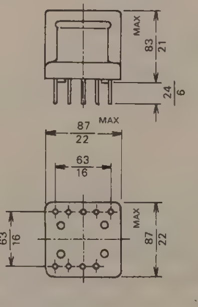


FIGURE B

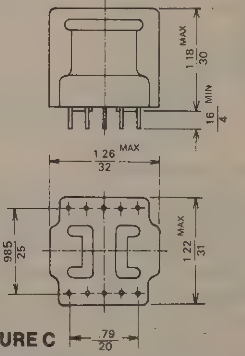


FIGURE C

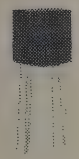
PAN-MAGNETICS INTERNATIONAL, INC.
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

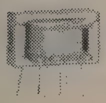
TTC SERIES — MEETS FCC PART 68
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

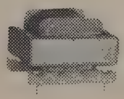
TTC SERIES transformers and holding coils are designed to meet the performance requirements of telephone connected apparatus. They are widely used in the voice, data, isolation, bridging, matching, balancing, hybrid, and holding coil circuits of central office, PABX, subscriber telephone, modem and computer terminal equipments.

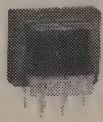
TTC Series transformers provide optimum insertion loss, frequency response, longitudinal balance, distortion, return loss, impedance matching and isolation characteristics.

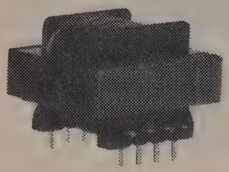
THESE TRANSFORMERS MEET REQUIREMENTS OF FCC PART 68

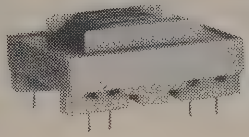

1

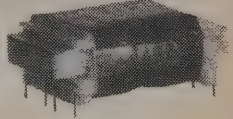

5


6H


6


9H


11H


LP

SCHEMATIC DIAGRAMS

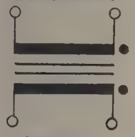


FIGURE 1.

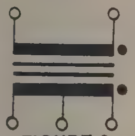


FIGURE 2.

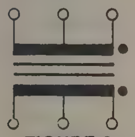


FIGURE 3.

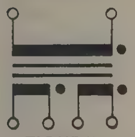


FIGURE 4.

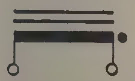


FIGURE 5.

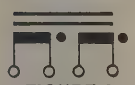


FIGURE 6.

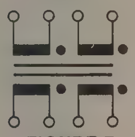


FIGURE 7.

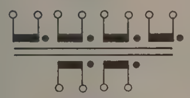


FIGURE 8.

PART NUMBER	APPLICATION	IMPEDANCE (Ω)		SIZE (INCH)			STYLE NO.	SCHEMATIC FIG. NO.	TYPICAL CROSS REF. OR (COMMENTS)**
		PRI.	SEC.	L	W	HT.			
MET-46	DRY COUPLING	600	600	0.41	0.31	0.46	1	1	TRIAD SP-70
TTC-02	DRY COUPLING	600	600	0.78	0.67	0.50	5	1	—
TTC-118	DRY COUPLING	600	600	0.78	0.67	0.50	5	1	MICROTRAN T1104
TTC-105	90 MADC COUPLING	600	600	0.80	0.59	0.73	6	1	(For Smart Modem)
TTC-108-1	LOW COST COUPLING	600	600	0.78	0.55	0.71	6	1	—
TTC-109	90 MADC COUPLING	600	600	0.80	0.96	0.55	6H	1	(For Smart Modem)
TTC-110	DRY COUPLING	600	600	0.78	0.55	0.71	6	1	PREM SPT-128
TTC-114	LOW COST COUPLING	600	600	0.78	0.55	0.71	6	1	—
TTC-111	WIDE BAND MATCHING	600	600	1.40	1.20	1.05	9H	1	(40 to 20,000 Hz)
TTC-126-2	90 MADC COUPLING	600	600	1.40	1.20	1.05	9H	1	(300 to 4000 Hz)
TTC-130	90 MADC COUPLING	600	600	1.40	1.20	0.67	9H	1	(1200 Baud Modem)
TTC-131	90 MADC COUPLING	600	600	1.40	1.20	0.67	9H	1	(w/Shield for Europe)
TTC-106	80 MADC COUPLING	600	600	1.63	1.33	0.65	11H	1	(Min. Crosstalk-Type)
TTC-122	80 MADC COUPLING	600	600	1.63	1.33	0.65	11H	1	PREM SPT-109
TTC-125	90 MADC COUPLING	600	600	1.63	1.27	0.60	LP	7	PREM SPT-101
MET-32	DRY COUPLING	600	600CT*	0.41	0.31	0.46	1	4	STANCOR PCT-27
TTC-103	LOW COST COUPLING	600	600CT*	0.78	0.65	0.62	5	4	—
TTC-113	DRY COUPLING	600CT	600	0.78	0.65	0.71	6	2	(Plus electrostatic shield)
TTC-105-1	90 MADC COUPLING	600	600CT	0.80	0.59	0.73	6	2	—
TTC-108-2	LOW COST COUPLING	600	600CT	0.78	0.55	0.71	6	2	—
TTC-109-1	90 MADC COUPLING	600	600CT	0.80	0.96	0.55	6H	2	(Low Profile)
TTC-109-2	90 MADC COUPLING	600	600CT*	0.80	0.96	0.55	6H	4	(Low Profile)
TTC-126-1	90 MADC COUPLING	600	600CT	1.40	1.20	1.05	9H	2	(300 to 4000 Hz)
TTC-121	75 MADC COUPLING	600	600CT*	1.63	1.33	0.65	11H	4	MICROTRAN T5114
TTC-124	90 MADC COUPLING	600CT*	600CT*	1.63	1.27	0.62	LP	8	PREM SPT-125
MET-31	DRY COUPLING	600CT	600CT	0.41	0.31	0.46	1	3	MICROTRAN PM34-M
TTC-03	DRY COUPLING	600CT	600CT	0.78	0.67	0.50	5	3	—
TTC-09	DRY COUPLING	600CT	600CT	0.78	0.55	0.71	6	3	TRIAD TY304P
TTC-100	DRY COUPLING	600CT	600CT*	0.78	0.65	0.62	5	4	(Pri. as in Fig. 3)
TTC-108	DRY COUPLING	600CT	600CT	0.78	0.55	0.71	6	3	TRIAD TY145P
TTC-126	90 MADC COUPLING	600CT*	600CT*	1.40	1.20	1.05	9H	7	(300 to 4000 Hz)
TTC-127	80 MADC COUPLING	600CT*	600CT*	1.63	1.33	0.65	11H	7	—
MET-29	DRY COUPLING	900CT	600	0.41	0.31	0.46	1	2	TRIAD SP-51
TTC-04	DRY COUPLING	900	600	0.78	0.67	0.50	5	1	—
TTC-107	LOW COST COUPLING	900	600	0.78	0.55	0.71	6	1	(Low Cost TTC-112)
TTC-112	DRY COUPLING	900	600	0.78	0.55	0.71	6	1	TRIAD TY301P
TTC-10	HYBRID	600	600/600	0.78	0.65	0.71	6	4	MICROTRAN T2220
TTC-101	HYBRID	600	600/600	1.02	0.94	0.84	6	4	TRIAD TY302P
TTC-115	LOW COST HYBRID	600	600/600	1.02	0.88	0.78	5	4	(with PC Frame)
TTC-05	BRIDGING	4000	600	0.78	0.67	0.50	5	1	—
TTC-13	BRIDGING	4000	600	0.78	0.55	0.71	6	1	TRIAD TY303P
TTC-128	CENTRAL OFFICE LINE MATCHING	PRI-1200-600-150CT SEC-600CT		1.02	0.85	0.78	6H	Contact Factory	—
TTC-129	HYBRID	PRI-600CT/600CT SEC-600CT		1.63	1.27	0.62	LP	8	(Interconnected on PCB)
TTC-119	HOLDING COIL	1.3HY @ 100 MADC		1.42	1.14	1.20	6	5	TRIAD TY350P
TTC-120	HOLDING COIL	1.4HY @ 120 MADC		1.63	1.33	0.65	11H	6	MICROTRAN T5415

*Windings can be connected as 600 ohm with CT or as 2 isolated 150 ohm windings.

**Cross referenced part numbers are offered as equivalents, but user should first determine complete suitability for the particular application.

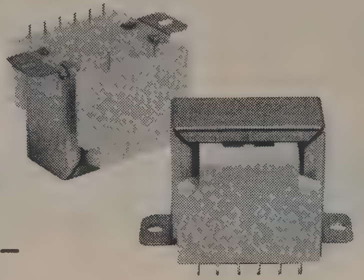
PAN-MAGNETICS INTERNATIONAL, INC.

455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

PRINTED CIRCUIT BOARD POWER TRANSFORMERS THAT MEET INTERNATIONAL AND U.S. SAFETY REQUIREMENTS

PEP Series

FILE NO.
TAMRADIO
E59673



- **UL Recognized — Meets IEC-65 Safety Standards.**
- **Physical Barriers Between Primary and Secondary.**
- **Double Protection System — 4000V Hipot.**

PEP Series • 115V/230V • 50/60Hz Primary

FOR USE IN CONTROL AND POWER SUPPLY APPLICATIONS

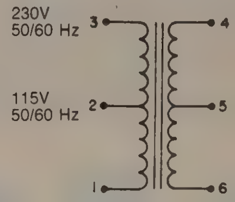
PART NO.	SECONDARY				CIRCUIT NO.	FIG. NO.
	PARALLEL CONNECTED		SERIES CONNECTED			
	V AC	A RMS	V AC	A RMS		
PEP28 x 0.7 VA SERIES						
10A006	(Single Secondary)		10.0 CT	.050	1-115V*	A
10A009			10.0 CT	.050	1-230V*	
10A007			16.0 CT	.031	1-115V*	
10A010			16.0 CT	.031	1-230V*	
10A008			24.0 CT	.021	1-115V*	
10A011			24.0 CT	.021	1-230V*	
*PEP28 Series is not available in Dual Primary versions.						
PEP35 x 2.0 VA SERIES						
10B004	(Single Secondary)		10.0 CT	.110	1	A
10B005			12.6 CT	.090		
10B006			16.0 CT	.070		
11B001H			24.0 CT	.046		
11B002H			36.0 CT	.031		
PEP41 x 5.0 VA SERIES						
10C009	(Single Secondary)		10.0 CT	.350	1	B
10C010			12.6 CT	.280		
10C011			16.0 CT	.220		
10C012			24.0 CT	.150		
11C005H			36.0 CT	.100		
PEP48 x 9.5 VA SERIES						
11D014H	5.0	1.900	10.0 CT	.950	2	B
11D015H	6.3	1.500	12.6 CT	.750		
11D016H	8.0	1.200	16.0 CT	.600		
11D017H	12.0	.800	24.0 CT	.400		
11D018H	18.0	.520	36.0 CT	.260		
11D019H	28.0	.340	56.0 CT	.170		
PEP54 x 15 VA SERIES						
11E006H	5.0	2.500	10.0 CT	1.250	2	C
11E007H	6.3	2.000	12.6 CT	1.000		
11E008H	8.0	1.560	16.0 CT	.780		
11E009H	12.0	1.040	24.0 CT	.520		
11E010H	17.0	.700	36.0 CT	.350		
11E011H	28.0	.446	56.0 CT	.223		

PEP54 SERIES FOR 3-OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

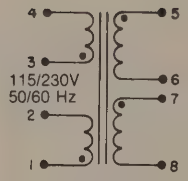
PART NO.	SECONDARY 1		SECONDARY 2		DC OUTPUT 1		DC OUTPUT 2		CIR. NO.	FIG. NO.
	V AC	A RMS	V AC	A RMS	CTFW Vdc	I mAdc	CTFW Vdc	I mAdc		
11E012H	9 CT	.800	24 CT	.300	+5	670	±15	170	3	C
11E013H	16 CT	.550	33 CT	.180	+9†	470	±21†	120	4	C

† +9Vdc and ±21 Vdc outputs are for input to +5 Vdc and ±15 Vdc IC Voltage Regulation (See Circuit 4)

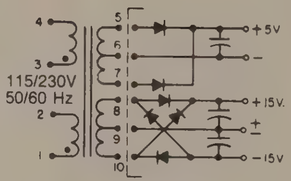
CIRCUIT SCHEMATICS



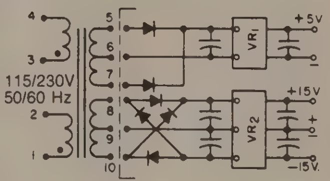
CIRCUIT 1



CIRCUIT 2



CIRCUIT 3



CIRCUIT 4

DIMENSIONS

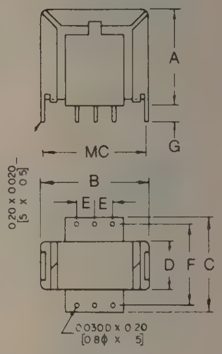


FIGURE A

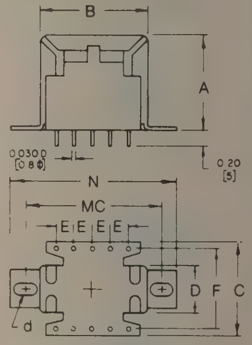


FIGURE B

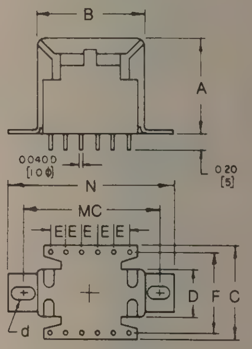


FIGURE C

DIMENSIONS • Inches (mm) WT • Oz. (Gm)

TYPE	A	B	C	MC	D	E	F	G	N	WT.
10A	1.10 (28)	1.16 (29.5)	1.32 (33.5)	1.12 (28.5)	0.50 (12.5)	.197 (5)	0.984 (25)	0.20 (5)	--	2.5 (70)
10B OR 11B	1.26 (32)	1.44 (36.5)	1.69 (43)	1.40 (35.5)	0.61 (15.5)	.295 (7.5)	1.380 (35)	0.24 (6)	--	4.5 (130)
10C OR 11C	1.42 (36)	1.67 (42.5)	1.91 (48.5)	2.05 (52)	0.85 (21.5)	.394 (10)	1.575 (40)	--	2.36 (60)	8 (230)
11D	1.69 (43)	1.99 (50.5)	2.05 (52)	2.32 (59)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	2.72 (69)	16 (450)
11E	1.93 (49)	2.22 (56.5)	2.09 (53)	2.72 (69)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	3.15 (80)	19 (540)

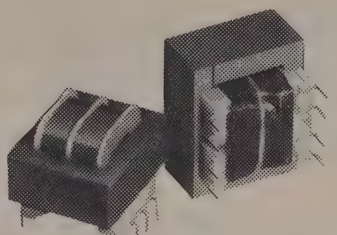
Note: d = PEP41 Series; 0.138 x 0.177 (3.5 x 4.5)
d = PEP48 and PEP54 Series; 0.177 x 0.256 (4.5 x 6.5)

PAN-MAGNETICS INTERNATIONAL, INC.

455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

3F SERIES — 3 FLANGE BOBBIN PRINTED CIRCUIT BOARD POWER TRANSFORMERS

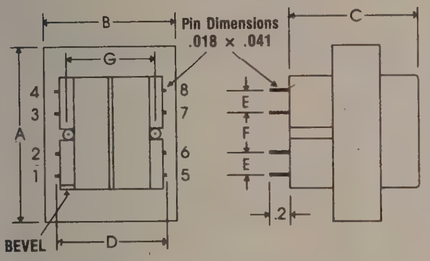
The **3F SERIES POWER TRANSFORMERS** are designed to include the most desirable features required for printed circuit board mounted applications. The 3F Series is constructed on a three flanged bobbin which is molded with UL listed material providing low capacitive coupling without electro-static shielding.



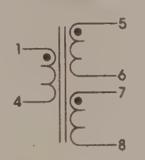
- 2500 VAC HIPOT, PRIMARY TO SECONDARY ISOLATION

- 115V SINGLE OR 115/230V DUAL PRIMARY
- TERMINAL NUMBERS ARE MOLDED ON BOBBIN

- COMPLIES WITH MOST UL SAFETY STANDARDS

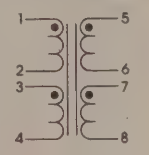


SCHEMATIC S
115V 50/60Hz



Note:
Pins 2 & 3 Omitted

SCHEMATIC D
115/230V 50/60Hz



NOTE: #4 Clearance Hole — 2 Places

3F SERIES PART NUMBER	DIMENSIONS							
	A	B	C	D	E	F	G	WT
3F(*)-2XX	1.38 35.0	1.16 29.5	0.94 23.9	1.200 30.48	0.250 6.350	0.250 6.350	N/A	0.17LB 77.4GM
3F(*)-3XX	1.38 35.0	1.16 29.5	1.18 30.0	1.200 30.48	0.250 6.350	0.25 6.35	N/A	0.25LB 114GM
3F(*)-4XX	1.62 41.0	1.31 33.0	1.31 33.3	1.280 32.51	0.250 6.350	0.350 8.890	1.062 26.97	0.44LB 200GM
3F(*)-5XX	1.89 48.0	1.58 40.0	1.44 36.6	1.410 35.81	0.300 7.62	0.400 10.16	1.250 31.75	0.70LB 319GM

DIMENSIONS SHOWN IN: $\frac{\text{INCH}}{\text{MM}}$

PART NUMBER	SECONDARY RATINGS - R.M.S.		VA
	SERIES	PARALLEL	
3F(*)-210	10.0VCT @ 0.110A	5.0V @ 0.220A	1.1
3F(*)-310	10.0VCT @ 0.250A	5.0V @ 0.500A	2.4
3F(*)-410	10.0VCT @ 0.600A	5.0V @ 1.200A	6.0
3F(*)-510	10.0VCT @ 1.200A	5.0V @ 2.400A	12.0
3F(*)-212	12.6VCT @ 0.090A	6.3V @ 0.180A	1.1
3F(*)-312	12.6VCT @ 0.200A	6.3V @ 0.400A	2.4
3F(*)-412	12.6VCT @ 0.500A	6.3V @ 1.000A	6.0
3F(*)-512	12.6VCT @ 1.000A	6.3V @ 2.000A	12.0
3F(*)-216	16.0VCT @ 0.070A	8.0V @ 0.140A	1.1
3F(*)-316	16.0VCT @ 0.150A	8.0V @ 0.300A	2.4
3F(*)-416	16.0VCT @ 0.400A	8.0V @ 0.800A	6.0
3F(*)-516	16.0VCT @ 0.800A	8.0V @ 1.600A	12.0
3F(*)-220	20.0VCT @ 0.055A	10.0V @ 0.110A	1.1
3F(*)-320	20.0VCT @ 0.120A	10.0V @ 0.240A	2.4
3F(*)-420	20.0VCT @ 0.300A	10.0V @ 0.600A	6.0
3F(*)-520	20.0VCT @ 0.600A	10.0V @ 1.200A	12.0
3F(*)-224	24.0VCT @ 0.045A	12.0V @ 0.090A	1.1
3F(*)-324	24.0VCT @ 0.100A	12.0V @ 0.200A	2.4
3F(*)-424	24.0VCT @ 0.250A	12.0V @ 0.500A	6.0
3F(*)-524	24.0VCT @ 0.500A	12.0V @ 1.000A	12.0
3F(*)-228	28.0VCT @ 0.040A	14.0V @ 0.080A	1.1
3F(*)-328	28.0VCT @ 0.085A	14.0V @ 0.170A	2.4
3F(*)-428	28.0VCT @ 0.200A	14.0V @ 0.400A	6.0
3F(*)-528	28.0VCT @ 0.420A	14.0V @ 0.840A	12.0
3F(*)-236	36.0VCT @ 0.030A	18.0V @ 0.060A	1.1
3F(*)-336	36.0VCT @ 0.065A	18.0V @ 0.130A	2.4
3F(*)-436	36.0VCT @ 0.170A	18.0V @ 0.340A	6.0
3F(*)-536	36.0VCT @ 0.350A	18.0V @ 0.700A	12.0
3F(*)-248	48.0VCT @ 0.023A	24.0V @ 0.046A	1.1
3F(*)-348	48.0VCT @ 0.050A	24.0V @ 0.100A	2.4
3F(*)-448	48.0VCT @ 0.125A	24.0V @ 0.250A	6.0
3F(*)-548	48.0VCT @ 0.250A	24.0V @ 0.500A	12.0
3F(*)-256	56.0VCT @ 0.020A	28.0V @ 0.040A	1.1
3F(*)-356	56.0VCT @ 0.045A	28.0V @ 0.090A	2.4
3F(*)-456	56.0VCT @ 0.110A	28.0V @ 0.220A	6.0
3F(*)-556	56.0VCT @ 0.220A	28.0V @ 0.440A	12.0
3F(*)-2120	120.0VCT @ 0.010A	60.0V @ 0.020A	1.1
3F(*)-3120	120.0VCT @ 0.020A	60.0V @ 0.040A	2.4
3F(*)-4120	120.0VCT @ 0.050A	60.0V @ 0.100A	6.0
3F(*)-5120	120.0VCT @ 0.100A	60.0V @ 0.200A	12.0

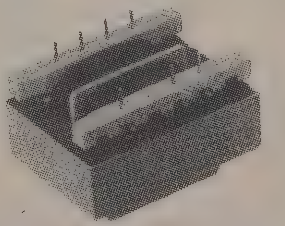
NOTE (*) Insert S for Single Primary 3F Series Transformer
Insert D for Double Primary 3F Series Transformer

3 FLANGE BOBBIN TRANSFORMER FOR UNREGULATED & REGULATED POWER SUPPLIES

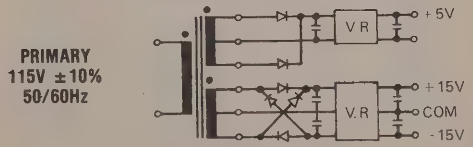
The **LPP SERIES LOW-PROFILE PLUG-IN POWER TRANSFORMERS** offer the circuit designer a variety of options including dual output which may be connected in series or parallel, secondary voltages for unregulated or regulated power supplies, and dual output voltages.

PART NUMBER	SECONDARY RATINGS - R.M.S.		DC OUTPUT	
	SERIES	PARALLEL	VDC	mADC
LPP-401	9.00VCT @ 0.50A	4.5V @ 1.00A	+5.0	600*
LPP-402	15.5V @ 0.33A	7.75VCT @ 0.66A	+5.0	380**
LPP-403	27.00VCT @ 0.19A	13.5V @ 0.38A	±15.0	115*
LPP-404	36.00VCT @ 0.14A	18.0V @ 0.28A	±15.0	70**
LPP-405	9.00VCT @ 0.24A	—	+5.0	200*
	24.00VCT @ 0.08A	—	±15.0	50*
LPP-406	15.50VCT @ 0.14A	—	+5.0	100**
	34.00VCT @ 0.06A	—	±15.0	25**
LPP-408†	15.5V @ 0.33A	7.75VCT @ 0.66A	—	—
LPP-411‡	11.00V @ 0.15A	(Single Secondary)	—	—
LPP-426‡	26.00V @ 0.10A	(Single Secondary)	—	—

*Unregulated DC Output **Regulated DC Output (MADC, typ., depends on regulator efficiency).
†115/230V-Series/Parallel Primary Winding.
‡115V input-connect line to Primary 1 with Primary 2 Open.
‡230V input-connect line across Primary 1 and 2 with Primary 1 and 2 in series.
‡These part numbers have thermal fuse internally connected to Primary 1.



TYPICAL SCHEMATIC FOR LPP-406



PAN-MAGNETICS INTERNATIONAL, INC.

455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

INDUCTORS FOR SWITCH-MODE POWER REGULATOR, CONTROL AND NOISE FILTERING CIRCUITS

The **SKC SERIES INDUCTORS** are designed on gapped toroidal tape wound cores for DC switching power supply, regulator and energy storage circuits — DC current ratings **5 to 50 AMPS DC.**

The **SKL SERIES INDUCTORS** are designed on functional gapped toroidal tape wound cores for power circuits requiring high inductance at low DC currents and nominal inductance at rated DC amps.

The **SKP SERIES INDUCTORS** are designed on powered iron toroidal cores for RFI and EMI filtering and other noise absorbing applications. Also, **SKP SERIES INDUCTORS** are most useful in DC circuit applications, available in a wide range of ''L'' values and DC current ratings to **40 AMPS DC.**

SKC SERIES POWER INDUCTORS FOR DC SWITCH-MODE CIRCUITS

PART NUMBER	AMPS (DC)	''L'' (µH)	DCR (OHMS)	DIMENSIONS (inch/mm)	
				OD (max.)	HT (max.)
SKC-101	5 to 10	30	0.009	1.26/32	.71/18
SKC-102	5 to 10	50	0.011	1.26/32	.71/18
SKC-103	5 to 10	100	0.017	1.26/32	.71/18
SKC-104	5 to 10	150	0.023	1.26/32	.71/18
SKC-105	5 to 10	200	0.024	1.46/37	.79/20
SKC-106	5 to 7.5	400	0.048	1.46/37	.79/20
SKC-107	5 to 7.5	600	0.056	1.73/44	1.02/26
SKC-108	5 to 7.5	800	0.044	2.13/54	.98/25
SKC-109	5 to 6	1200	0.081	2.17/55	1.02/26
SKC-110	5 to 6	1800	0.099	2.17/55	1.02/26
SKC-201	10 to 15	30	0.005	1.26/32	.71/18
SKC-202	10 to 15	50	0.007	1.46/37	.79/20
SKC-203	10 to 15	100	0.012	1.46/37	.79/20
SKC-204	10 to 15	150	0.014	1.73/44	1.02/26
SKC-205	10 to 15	200	0.011	2.13/54	.98/25
SKC-206	10 to 12	400	0.024	2.17/55	1.02/26
SKC-207	10 to 12	600	0.032	2.20/56	1.06/27
SKC-208	10 to 12	800	0.032	2.20/56	1.30/33
SKC-301	15 to 25	30	0.004	1.46/37	.79/20
SKC-302	15 to 25	50	0.006	1.54/39	.83/21
SKC-303	15 to 25	100	0.006	2.13/54	.98/25
SKC-304	15 to 20	150	0.009	2.17/55	1.02/26
SKC-305	15 to 20	200	0.011	2.17/55	1.02/26
SKC-306	15 to 20	400	0.016	2.20/56	1.30/33
SKC-401	20 to 30	30	0.004	1.61/41	.91/23
SKC-402	20 to 30	50	0.005	1.81/46	.98/25
SKC-403	20 to 28	100	0.006	2.17/55	1.02/26
SKC-404	20 to 25	150	0.008	2.20/56	1.06/27
SKC-405	20 to 25	200	0.008	2.20/56	1.30/33
SKC-501	25 to 35	30	0.003	1.77/45	.95/24
SKC-502	25 to 35	50	0.003	2.17/55	1.02/26
SKC-503	25 to 35	100	0.004	2.17/55	1.30/33
SKC-504	25 to 30	150	0.006	2.24/57	1.34/34
SKC-601	30 to 40	30	0.002	2.13/54	.98/25
SKC-602	30 to 40	50	0.003	2.17/55	1.02/26
SKC-603	30 to 35	100	0.004	2.20/56	1.30/33
SKC-801	40 to 50	30	0.002	2.17/55	1.30/33
SKC-802	40 to 50	50	0.002	2.24/57	1.34/34

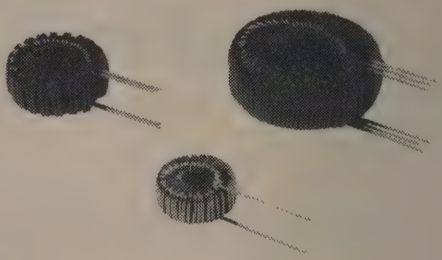
SKL SERIES POWER INDUCTORS WITH HIGH ''L'' AT LOW DC

PART NUMBER	AMPS (DC)	''L'' (µH)		DCR (OHMS)	DIMENSIONS (inch/mm)	
		with DC	0 DC		OD (max.)	HT (max.)
SKL-103	5	100	450	0.017	1.26/32	.71/18
SKL-105	5	200	1000	0.025	1.26/32	.71/18
SKL-203	10	100	500	0.011	1.69/43	.91/23
SKL-205	10	200	1000	0.015	2.13/54	1.15/29
SKL-303	15	100	500	0.008	2.17/55	1.02/26
SKL-305	15	200	1000	0.011	2.20/56	1.06/27
SKL-403	20	100	500	0.008	2.17/55	1.02/26
SKL-404	20	150	750	0.009	2.20/56	1.06/27
SKL-502	25	50	250	0.006	2.17/55	1.02/26
SKL-503	25	100	600	0.007	2.24/57	1.34/34

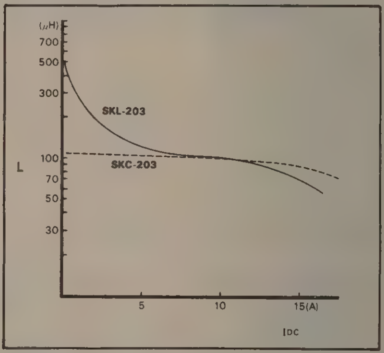
SKP SERIES NOISE ABSORBING INDUCTORS

PART NUMBER	AMPS		''L'' (µH)	DCR (OHMS)	DIMENSIONS (inch/mm)	
	(AC)	(DC)			OD (max.)	HT (max.)
SKP1-30	2	1	30	0.039	.62/16	.31/8
SKP1-40	2	1	55	0.050	.62/16	.31/8
SKP1-50	2	1	80	0.061	.62/16	.33/8.5
SKP2-30	2	1	50	0.051	.62/16	.43/11
SKP2-40	2	1	90	0.066	.62/16	.43/11
SKP2-50	2	1	130	0.082	.62/16	.45/11.5
SKP3-30	3	2	40	0.028	.83/21	.43/11
SKP3-40	3	2	80	0.037	.83/21	.43/11
SKP3-50	3	3	120	0.045	.85/21.5	.45/11.5
SKP4-40	5	3	65	0.023	.98/25	.47/12
SKP4-50	5	3	100	0.028	1.02/26	.47/12
SKP5-40	5	3	100	0.033	1.08/27.5	.55/14
SKP5-50	5	3	150	0.041	1.10/28	.59/15

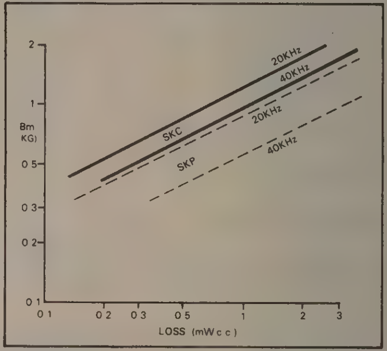
NOTE: SKP SERIES ''L'' with DC is approximately 50% of value shown.



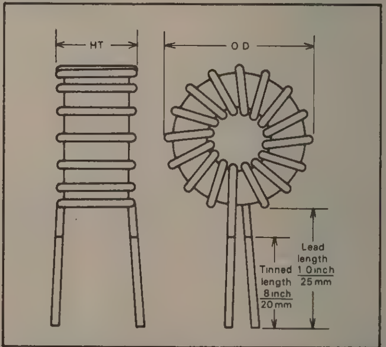
INDUCTANCE WITH DC CURRENT



CORE LOSS VS. INDUCTION



DIMENSIONS



PAN-MAGNETICS INTERNATIONAL, INC.

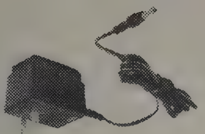
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

UL, CSA AND VDE LISTED WALL PLUG-IN AC-TO-DC BATTERY CHARGERS AND ELIMINATORS

These AC-to-DC plug-in power sources are useful as battery chargers, battery eliminators and DC power supplies. They are available in direct plug-in and desk top styles with a variety of output connectors. Most have capacitor filtered outputs. A complete variety of worldwide input plug-in styles are available and each style meets the respective safety agency requirements.

Special order options include:
Multiple listing and your logo; multiple or regulated outputs; UL-1244 for instruments floating above ground; and AC-to-AC direct plug-in transformers.

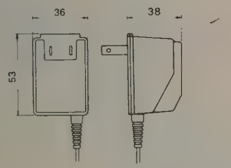
*Indicates File Numbers under TAMRADIO name.



UL FILE No. E82180*
CSA FILE No. LR38236*

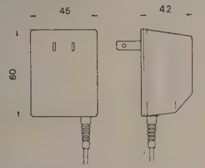
216A SERIES

PART NO.	INPUT (VAC)	OUTPUT (Vdc)	(mAdc)
216A2211	120	3.0	200
216A2214	120	3.0	400
216A2219	120	4.5	200
216A4222	120	4.5	350
216A2225	120	6.0	150
216A4229	120	6.0	300
216A2134	120	7.5	200
216A4139	120	9.0	200
216A4046	120	12.0	150



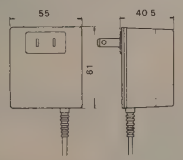
318A SERIES

PART NO.	INPUT (VAC)	OUTPUT (Vdc)	(mAdc)
318A2210	120	3.0	300
318A2213	120	3.0	600
318A2218	120	4.5	300
318A4220	120	4.5	500
318A2225	120	6.0	200
318A4227	120	6.0	400
318A2134	120	7.5	300
318A4140	120	9.0	300
318A4146	120	12.0	200

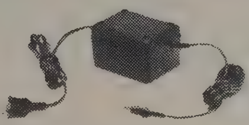


420A SERIES

PART NO.	INPUT (VAC)	OUTPUT (Vdc)	(mAdc)
420A2210	120	3.0	800
420A2212	120	3.0	1200
420A2214	120	4.5	600
420A2216	120	4.5	800
420A2221	120	6.0	500
420A2223	120	6.0	700
420A2127	120	7.5	400
420A2128	120	7.5	500
420A2132	120	9.0	300
420A4134	120	9.0	500
420A2139	120	12.0	300
420A4141	120	12.0	500

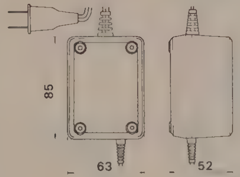


UL FILE No. E50290*
CSA FILE No. LR38236*

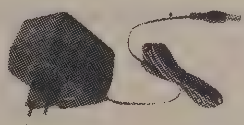


521A SERIES

PART NO.	INPUT (VAC)	OUTPUT (Vdc)	(mAdc)
521A4310	120	9.0	800
521A4312	120	9.0	1200
521A4315	120	12.0	600
521A4317	120	12.0	1000
521A4320	120	13.5	600
521A4322	120	13.5	1000

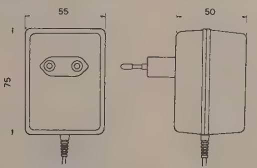


Complies with VDE Requirements



818F SERIES

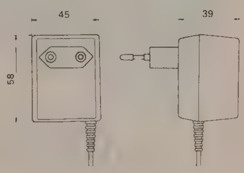
PART NO.	INPUT (VAC)	OUTPUT (Vdc)	(mAdc)
818F4310	220	3.0	800
818F4312	220	3.0	1200
818F4313	220	4.5	600
818F4315	220	4.5	1000
818F4216	220	6.0	600
818F4217	220	6.0	800
818F4118	220	7.5	500
818F4119	220	7.5	700
818A4120	220	9.0	500
818F4121	220	9.0	600
818F4022	220	12.0	350
818F4023	220	12.0	450



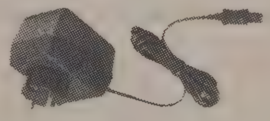
EUROPE
VDE FILE No. F-7969-331*

26D SERIES

PART NO.	INPUT (VAC)	OUTPUT (Vdc)	(mAdc)
26D3853	220	3.0	150
26D3860	220	3.5	200
26D3856	220	4.5	200
26D3611	220	6.0	200

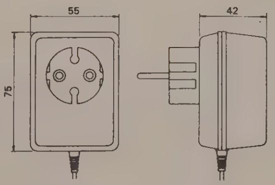


VDE FILE No. F-7969-331*



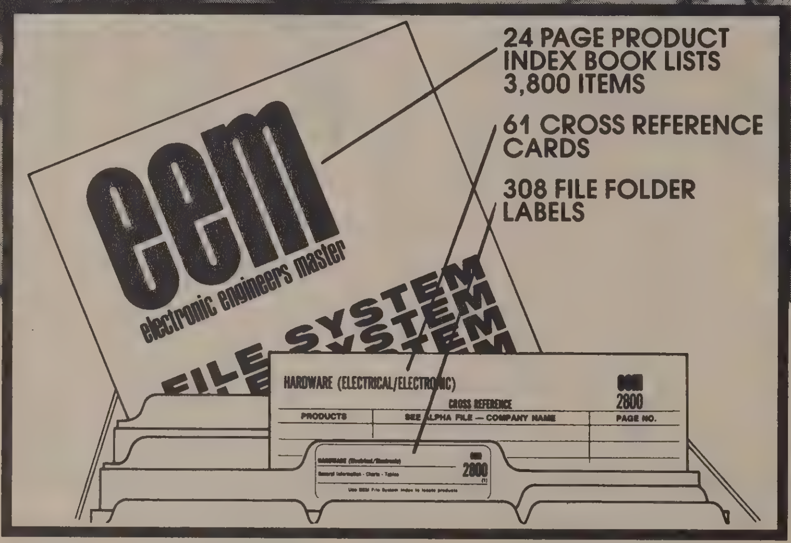
34D SERIES

PART NO.	INPUT (VAC)	OUTPUT (Vdc)	(mAdc)
34D4307	220	3.0	300
34D4301	220	4.5	400
34D4302	220	6.0	300
34D4303	220	7.5	300
34D4304	220	9.0	300
34D4305	220	12.0	200



DIMENSIONS SHOWN IN MILLIMETERS

PAN-MAGNETICS INTERNATIONAL, INC.
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)


24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
2800
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

PARALINE

TRANSFORMER SPECIALISTS

PARALINE SS SERIES

THE PARALINE SS SERIES PROVIDES YOU WITH A WIDE RANGE OF SELECTION IN SMALL 117V PRIMARY POWER TRANSFORMERS (50-60 Hz) FROM SHELF STOCK.

AVAILABLE VOLTAGES CENTER TAPPED AND CURRENT RATINGS IN AMPS OF ALL SERIES SS TRANSFORMERS

VOLTS C/T	AMPERES						
	SIZE 3	SIZE 4	SIZE 5	SIZE 6	SIZE 7	SIZE 8	SIZE 9
4	.100	.50	1.2	2.8	5.2	10	14
6.3	.060	.32	.80	1.7	3.5	7.0	10
8	.050	.28	.60	1.4	2.8	5.0	7.0
10	.045	.20	.50	1.0	2.0	4.0	5.6
12.6	.040	.17	.40	.90	1.7	3.6	4.5
14	.040	.15	.35	.80	1.5	3.2	4.0
16	.038	.13	.32	.70	1.3	3.0	3.7
18	.035	.12	.30	.60	1.2	2.8	3.5
20	.032	.11	.27	.55	1.1	2.6	3.2
22	.030	.10	.25	.50	1.0	2.4	3.0
24	.027	.095	.22	.45	.95	2.2	2.7
26	.025	.090	.20	.40	.90	2.0	2.5
28	.022	.080	.18	.38	.85	1.8	2.2
30	.020	.070	.17	.36	.80	1.7	2.0
32	.018	.065	.16	.34	.75	1.6	1.9
34	.017	.060	.15	.32	.70	1.5	1.8
36	.016	.055	.14	.30	.65	1.4	1.7
40	.015	.050	.13	.27	.55	1.3	1.6
44	.014	.050	.12	.25	.50	1.2	1.5
48	.013	.045	.11	.22	.47	1.1	1.3
52	.012	.040	.10	.20	.45	1.0	1.2
56	.011	.040	.09	.19	.42	.90	1.1
60	.010	.035	.08	.18	.40	.80	1.0
66	.009	.030	.077	.17	.37	.75	.90
72	.008	.027	.070	.15	.35	.70	.85
80	.007	.025	.066	.14	.28	.65	.80
88	.007	.024	.060	.13	.25	.60	.70
96	.006	.022	.055	.11	.23	.55	.65
104	.006	.020	.050	.10	.22	.50	.60
120	.005	.017	.040	.09	.20	.40	.50
140		.014	.035	.08	.17	.35	.40
160		.012	.030	.07	.14	.30	.35
180		.011	.260	.06	.12	.26	.30
200		.010	.022	.05	.11	.22	.28
230		.010	.020	.05	.10	.20	.26

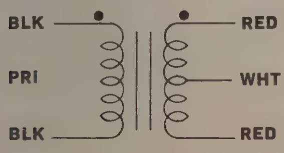
Case A Available in sizes 4, 5, 6, 7, 8 & 9 (Lead Wires)
Case B Available in sizes 4, 5 & 6 (Lugs)
Case C Available in sizes 3, 4, 5 & 6 (6 Pin P.C.)
Case D Available in sizes 4, 5 & 6 (Lugs)

SS SERIES DIMENSIONAL DATA

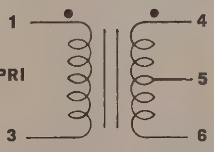
CASE	SIZE	WIDTH (A)	LENGTH (B)	HEIGHT (C)	MOUNTING CENTERS (D)	PIN CENTERS (JXK)
A	4	1.20	2.10	1.19	1.75	
A	5	1.37	2.38	1.38	2.00	
A	6	1.42	2.83	1.63	2.38	
A	7	1.70	3.25	1.94	2.83	
A	8	2.00	3.88	2.25	3.13	
B	4	1.07	1.83	1.42	1.50	
B	5	1.25	2.00	1.68	1.72	
B	6	1.38	2.38	1.93	2.00	
C	3	0.93	1.10	0.88		.78x.40
C	4	1.15	1.38	1.19		1.0x.63
C	5	1.25	1.63	1.38		1.1x.80
C	6	1.44	1.88	1.63		1.3x.80
D	4	1.07	2.10	1.19	1.75	
D	5	1.25	2.38	1.38	2.00	
D	6	1.38	2.83	1.63	2.38	

REFER TO SS SERIES TRANSFORMERS BY PART NUMBERS. CASES ARE ILLUSTRATED ON LAST PAGE.
SAMPLE: SS-A-4-12.6

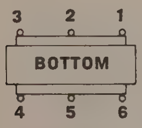
SCHEMATICS



WIRES



LUGS & PC PINS



LOCATOR

PARALINE DS SERIES

THE PARALINE DS SERIES PROVIDES YOU WITH GOOD OFF THE SHELF SELECTION OF 115/230 VOLT 50-60 Hz POWER TRANSFORMERS WITH DUAL SECONDARIES.

AVAILABLE TOTAL SERIES VOLTAGES AND CURRENT RATINGS OF SECONDARIES

VOLTS (SERIES)	AMPERES					
	SIZE 8	SIZE 9	SIZE 10	SIZE 11	SIZE 12	SIZE 13
8	6.0	8.5	12	17	24	30
10	5.0	7.0	10	14	20	24
12.6	4.0	5.6	8.0	11	16	19
14	3.5	5.0	7.0	10	14	17
16	3.0	4.4	6.2	8.7	12	15
18	2.8	3.9	5.5	7.7	11	13
20	2.5	3.5	5.0	7.0	10	12
22	2.3	3.2	4.5	6.3	9.0	11
24	2.0	2.9	4.1	5.8	8.3	10
26	1.9	2.7	3.8	5.4	7.8	9.2
28	1.8	2.5	3.6	5.0	7.1	8.5
30	1.7	2.3	3.3	4.6	6.6	8.0
32	1.6	2.2	3.1	4.3	6.2	7.5
34	1.5	2.0	2.9	4.1	5.8	7.0
36	1.4	1.9	2.7	3.8	5.5	6.6
40	1.3	1.7	2.5	3.5	5.0	6.0
44	1.1	1.6	2.2	3.1	4.5	5.4
48	1.0	1.4	2.1	2.9	4.1	5.0
52	1.0	1.3	1.9	2.7	3.8	4.6
56	.90	1.2	1.8	2.5	3.5	4.2
60	.80	1.1	1.7	2.3	3.3	4.0
66	.75	1.0	1.5	2.1	3.0	3.6
72	.70	1.0	1.4	1.9	2.7	3.3
80	.63	.90	1.2	1.7	2.5	3.0
88	.56	.80	1.1	1.6	2.2	2.7
96	.52	.70	1.0	1.4	2.0	2.5
104	.48	.66	.95	1.3	1.9	2.3
120	.42	.58	.83	1.1	1.6	2.0
140	.36	.50	.71	1.0	1.4	1.7
160	.31	.43	.62	.87	1.2	1.5
180	.28	.38	.55	.77	1.1	1.3
200	.25	.35	.50	.70	1.0	1.2
230	.22	.30	.43	.60	.86	1.0

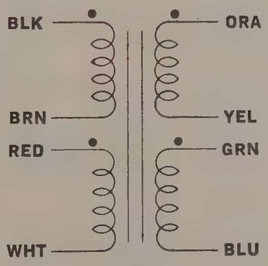
DS SERIES TRANSFORMER SIZES 8 AND 9 ARE AVAILABLE IN STYLES:
"A" (with lead wires)
"B" (with lugs)
"D" (with lugs)

DS SERIES TRANSFORMER SIZES 10 THRU 13 ARE AVAILABLE IN STYLES:
"F" (with lead wires)
"G" (with lugs)
"H" (with lugs)

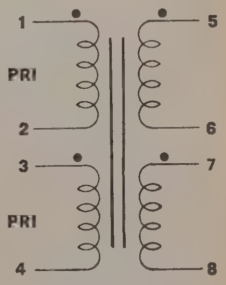
DS SERIES DIMENSIONAL DATA

CASE	SIZE	A	B	C	D	E	F	G
A	8	2.00	3.70	2.25	3.13		2.70	.19
A	9	2.30	4.00	2.56	3.56		3.06	.19
B	8	2.00	3.13	2.70	2.81		2.27	.19
B	9	2.30	3.56	3.06	3.13		2.56	.19
D	8	2.00	3.70	2.25	3.13		2.70	.19
D	9	2.30	4.00	2.56	3.56		3.06	.19
F	10	3.38	2.50	2.81	2.81	2.13	2.69	.2x.37
F	11	3.75	2.80	3.13	3.13	2.25	2.81	.2x.37
F	12	4.13	3.00	3.44	3.44	2.38	2.94	.2x.37
F	13	4.50	3.30	3.75	3.75	2.50	3.06	.2x.37
G	10	2.81	2.50	3.38	2.25	2.13	2.69	.2x.37
G	11	3.13	2.80	3.75	2.50	2.25	2.81	.2x.37
G	12	3.44	3.00	4.13	2.75	2.38	2.94	.2x.37
G	13	3.75	3.30	4.50	3.00	2.50	3.06	.2x.37
H	10	3.38	2.50	2.81	2.81	2.13	2.69	.2x.37
H	11	3.75	2.80	3.13	3.13	2.25	2.81	.2x.37
H	12	4.13	3.00	3.44	3.44	2.38	2.94	.2x.37
H	13	4.50	3.30	3.75	3.75	2.50	3.06	.2x.37

SCHEMATICS

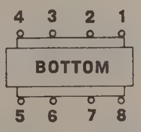


WIRES



LUGS & PC PINS

LOCATOR



PARALINE, 511 South Palm Avenue, Alhambra, CA 91803 • Telephone (818) 281-0222

PARALINE DS SERIES

THE PARALINE DS SERIES IS AVAILABLE IN SIZES 4, 5, & 6 WITH DUAL PRIMARY AND DUAL SECONDARY 8 PIN PRINTED CIRCUIT CONFIGURATION.

AVAILABLE TOTAL SERIES VOLTAGES AND CURRENT RATINGS OF SECONDARIES.

VOLTS (SERIES)	AMPERES		
	SIZE 4	SIZE 5	SIZE 6
4	.50	1.2	2.8
6.3	.32	.80	1.7
8	.28	.60	1.4
10	.20	.50	1.0
12.6	.17	.40	.90
14	.15	.35	.80
16	.13	.32	.70
18	.12	.30	.60
20	.11	.27	.55
22	.10	.25	.50
24	.095	.22	.45
26	.090	.20	.40
28	.080	.18	.38
30	.070	.17	.36
32	.065	.16	.34
34	.060	.15	.32
36	.055	.14	.30
40	.050	.13	.27
44	.050	.12	.25
48	.045	.11	.22
52	.040	.10	.20
56	.040	.09	.19
60	.035	.08	.18
66	.030	.077	.17
72	.027	.070	.15
80	.025	.066	.14
88	.024	.060	.13
96	.022	.055	.11
104	.020	.050	.10
120	.017	.040	.09
140	.014	.035	.08
160	.012	.030	.07
180	.011	.026	.06
200	.010	.022	.05
230	.010	.020	.05

DS SERIES DIMENSIONAL DATA

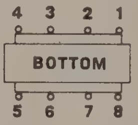
CASE	SIZE	A	C	F	H	J	K
C	4	1.15	1.19	1.38	.20	1.0	.60
C	5	1.25	1.38	1.63	.25	1.1	.75
C	6	1.44	1.63	1.88	.25	1.3	.75

REFER TO DS SERIES TRANSFORMERS BY PART NUMBERS.

SAMPLE: DS — C — 4 — 12.6

SERIES
STYLE
SIZE
TOTAL SERIES VOLTS

PINS LOCATOR



Paraline manufactures a wide variety of power transformers. They are stocked in 11 different sizes with 32 available secondary voltages totaling over 1600 different types.

There are five general series designations, each series designed to suit the requirements of your particular application.

A brief description of each series is as follows:

- The "SS" series has a single 115V primary and a single center-tapped secondary. Also available with a 230V primary.
- The "CS" series has a single 115V primary and two identical and separate secondaries. Also available with a 230V primary.
- The "DS" series has dual primaries for 115V or 230V operation and two identical and separate secondaries.
- The "MS" series has dual primaries for 115V or 230V operation and two center-tapped secondaries designed for 5V and 15V logic and OP amp power supplies.
- The "TT" series includes a number of coupling transformers, holding coils, and telephone associated devices for use in interconnective data modem terminals.

All Paraline stock power transformers may be used for 50 Hz or 60 Hz applications.

PARALINE CS SERIES

THE PARALINE CS SERIES WITH STANDARD 117V (50-60 Hz) PRIMARIES IS AVAILABLE FROM STOCK WITH SINGLE PRIMARY AND DUAL SECONDARY 6 PIN PRINTED CIRCUIT CONFIGURATION.

AVAILABLE TOTAL SERIES VOLTAGES AND CURRENT RATINGS OF SECONDARIES

VOLTS (SERIES)	AMPERES		
	SIZE 4	SIZE 5	SIZE 6
4	.50	1.2	2.8
6.3	.32	.80	1.7
8	.28	.60	1.4
10	.20	.50	1.0
12.6	.17	.40	.90
14	.15	.35	.80
16	.13	.32	.70
18	.12	.30	.60
20	.11	.27	.55
22	.10	.25	.50
24	.095	.22	.45
26	.090	.20	.40
28	.080	.18	.38
30	.070	.17	.36
32	.065	.16	.34
34	.060	.15	.32
36	.055	.14	.30
40	.050	.13	.27
44	.050	.12	.25
48	.045	.11	.22
52	.040	.10	.20
56	.040	.09	.19
60	.035	.08	.18
66	.030	.077	.17
72	.027	.070	.15
80	.025	.066	.14
88	.024	.060	.13
96	.022	.055	.11
104	.020	.050	.10
120	.017	.040	.09
140	.014	.035	.08
160	.012	.030	.07
180	.011	.026	.06
200	.010	.022	.05
230	.010	.020	.05

CS SERIES DIMENSIONAL DATA

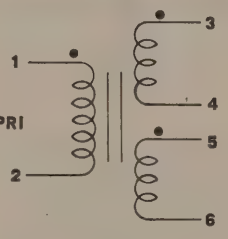
CASE	SIZE	A	C	F	H	J	K
C	4	1.15	1.19	1.38	.31	1.0	.63
C	5	1.25	1.38	1.63	.40	1.1	.80
C	6	1.44	1.63	1.88	.40	1.3	.80

REFER TO CS SERIES TRANSFORMERS BY PART NUMBERS.

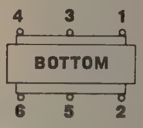
SAMPLE: CS — C — 4 — 12.6

SERIES
STYLE
SIZE
TOTAL SERIES VOLTS

SCHEMATIC



PINS



PINS LOCATOR

PARALINE, 511 South Palm Avenue, Alhambra, CA 91803 • Telephone (818) 281-0222

PARALINE
TRANSFORMER SPECIALISTS

PARALINE MS SERIES

8 PIN P.C. WITH SINGLE 120V PRIMARY. (Fig. 1)

PART NUMBER	SEC. #1 V/CT	MA.	SEC. #2 V/CT	MA.
MSC4-924	9.0	70	24	30
MSC5-924	9.0	240	24	70
MSC6-924	9.0	480	24	150
MSC4-1632	16	50	32	18
MSC5-1632	16	140	32	55
MSC6-1632	16	280	32	100

12 PIN P.C. LOW PROFILE DUAL 120V PRIMARIES WITH 100V TAPS. (Fig. 2)

PART NUMBER	SEC. #1 V/CT	MA.	SEC. #2 V/CT	MA.
MSL4-9024	9.0	70	24	28
MSL5-9024	9.0	240	24	70
MSL6-9024	9.0	480	24	150
MSL7-9024	9.0	800	24	280
MSL4-16032	16	50	32	18
MSL5-16032	16	140	32	55
MSL6-16032	16	280	32	100
MSL7-16032	16	500	32	180

12 LUGS CASE 'H' DUAL 120V PRIMARIES WITH 100V TAPS. (Fig. 3)

PART NUMBER	SEC. #1 V/CT	AMPS	SEC. #2 V/CT	AMPS
MSH10-16032	16	3.8	32	1.2
MSH11-16032	16	5.0	32	1.8
MSH12-16032	16	7.0	32	2.5
MSH13-16032	16	9.0	32	3.0

SCHEMATICS

FIG. 1

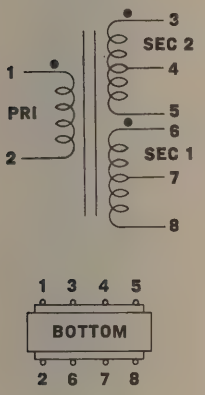

1
PRI
2
3
SEC 2
4
5
6
SEC 1
7
8
1 3 4 5
BOTTOM
2 6 7 8

FIG. 2

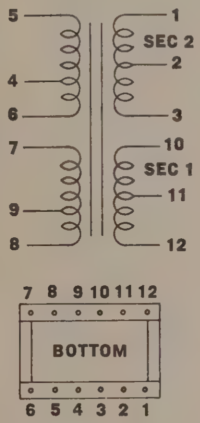
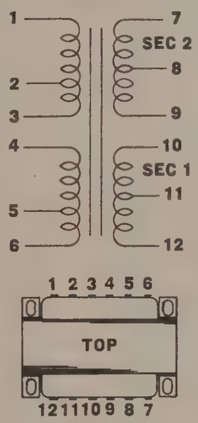

5
4
6
7
9
8
1
SEC 2
2
3
10
SEC 1
11
12
7 8 9 10 11 12
BOTTOM
6 5 4 3 2 1

FIG. 3


1
2
3
4
5
6
7
SEC 2
8
9
10
SEC 1
11
12
1 2 3 4 5 6
TOP
12 11 10 9 8 7

PARALINE TT SERIES

TRANSFORMERS FOR DATA MODEM TERMINALS DESIGNED TO EXCEED 1200 VAC BREAKDOWN REQUIREMENTS.
FREQUENCY RESPONSE: 300-3500 Hz (TOL. 0.5 DB)
LEVEL: −45DBM TO +7DBM
DISTORTION: 0.4% MAX.
IMPEDANCE: ±10%
RETURN LOSS: 26 DB MIN.

PART NUMBER	PRI. IMP.	SEC. IMP.	FIG.
TTC2-07	600	600	1
TTC3-6549	600	600	1
TTC3-7222	600	600 +900	2
TTC4-7226	600	600	1
TTC4-7657	600	600 +900	2
TTC4-18	Holding Coil 1.3 Hy. @ 100 MA. DC.		—

WIDE RANGE AUDIO MATCHING TRANSFORMERS.
FREQUENCY RESPONSE: 20 Hz (TOL. 2 DB)
LEVEL: 5DBM

PART NUMBER	PRI. IMP.	SEC. IMP.	FIG.
TTC2-8746	400	40K	3
TTC2-8750	200	40K	1
TTC2-8758	200/CT/50	50K	3
TTC2-8761	600/CT/150	50K	3
TTC2-8762	250/CT/62	50K	3
TTC2-8763	50/CT/12	50K	3
TTC2-8772	150	60K	1

SCHEMATICS

FIG. 1

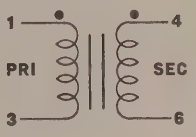

1
PRI
3
4
SEC
6

FIG. 2

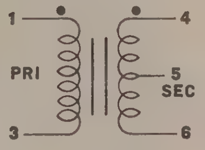
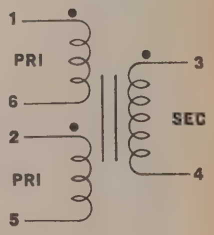
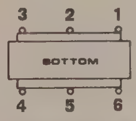

1
PRI
3
4
5
SEC
6

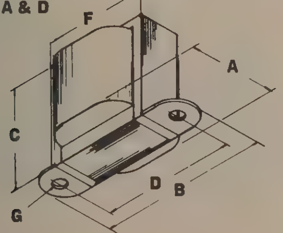
FIG. 3


1
PRI
6
2
PRI
5
3
SEC
4

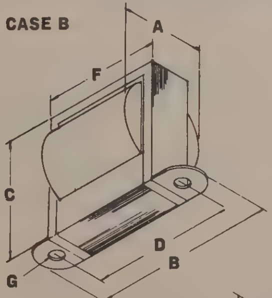

3 2 1
BOTTOM
4 5 6

PINS LOCATOR

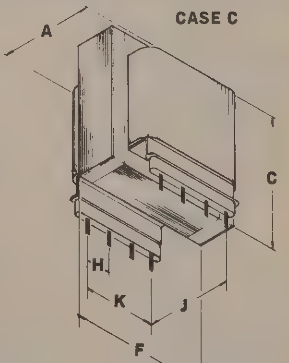
CASE A & D

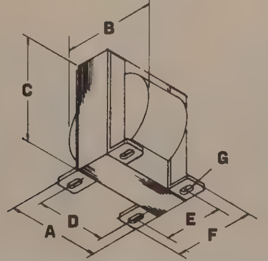


CASE B

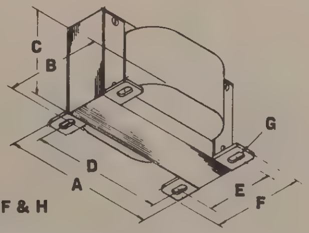


CASE C





CASE G



CASE F & H

PARALINE, 511 South Palm Avenue, Alhambra, CA 91803 • Telephone (818) 281-0222

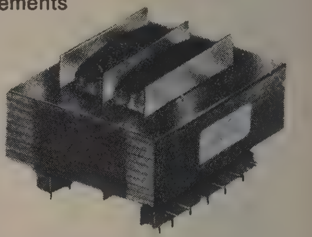
PC TRANSFORMER CORP.

64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300

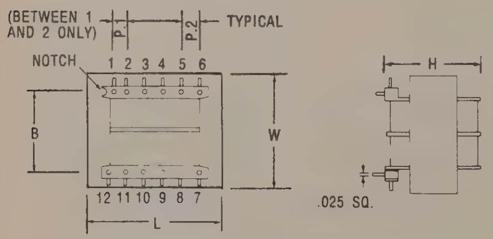
OUR SPECIALTY 1 WEEK DELIVERY FOR CUSTOM PROTOTYPES

LOW PROFILE SPLIT BOBBIN PRINTED CIRCUIT POWER TRANSFORMERS

- Low profile — allows closer printed circuit board stacking
- Split bobbin construction — center flange insulation barrier provides 2500 VRMs Hipot — non concentric coil winding results in low interwinding capacitance, eliminates need for electro-static shielding.
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard.
- Dual secondaries for variety of utilization
- 12 pin bobbin design increases available options for multi-winding special orders
- Low regulation
- Units are inspected and tested 100%
- Low prices — no minimum quantity requirements

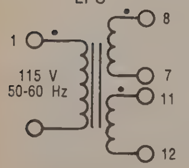


PRIMARY 50/60HZ		R.M.S. SECONDARY RATINGS			
Single 115V	**Dual 115V/230V**	**Series**	**Parallel**	**SIZE**	**VA**
LPC3- 12	LDPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
LPC3- 16	LDPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
LPC3- 20	LDPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
LPC3- 24	LDPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
LPC3- 34	LDPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
LPC3- 40	LDPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
LPC3- 56	LDPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
LPC3-120	LDPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
LPC4- 12	LDPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
LPC4- 16	LDPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
LPC4- 20	LDPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
LPC4- 24	LDPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
LPC4- 34	LDPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
LPC4- 40	LDPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
LPC4- 56	LDPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
LPC4-120	LDPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
LPC5- 12	LDPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
LPC5- 16	LDPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
LPC5- 20	LDPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
LPC5- 24	LDPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
LPC5- 34	LDPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
LPC5- 40	LDPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
LPC5- 56	LDPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
LPC5-120	LDPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
LPC6- 12	LDPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
LPC6- 16	LDPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
LPC6- 20	LDPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
LPC6- 24	LDPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
LPC6- 34	LDPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
LPC6- 40	LDPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
LPC6- 56	LDPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
LPC6-120	LDPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0

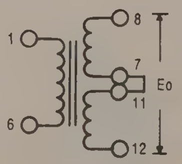


LPC, LDPC SIZE	VA	L″	W″	H″	P-1	P-2	B	WT. (oz.)
3	1.25	1⅜	1 5/16	1 1/16	.150	.200	.862	3
4	4.50	1⅝	1⅜	1 3/16	.200	.250	.950	5
5	10.0	1⅞	1⅝	1 5/16	.200	.300	1.100	9
6	24.0	2¼	1⅞	1 9/16	.200	.300	1.300	14

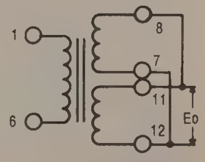
LPC



BASIC SCHEMATIC

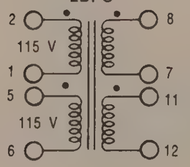


SERIES CONNECTED

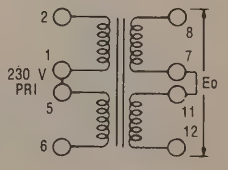


PARALLEL CONNECTED

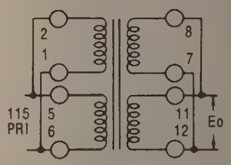
LDPC



BASIC SCHEMATIC



SERIES CONNECTED

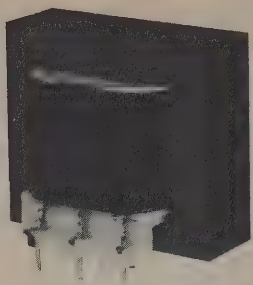


PARALLEL CONNECTED

PC TRANSFORMER CORP.

64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300

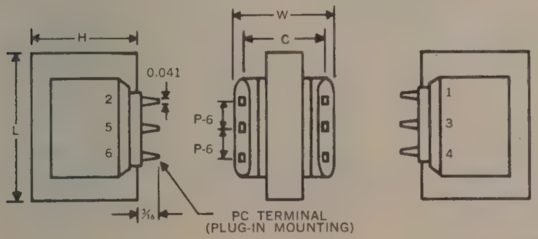
OUR SPECIALTY ONE WEEK DELIVERY FOR CUSTOM PROTOTYPES



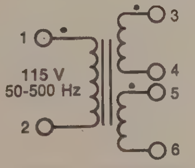
PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

- Packaging flexibility
- Miniaturized construction
- Precision spaced molded-in terminals
- Single 115V and dual 115V/230V primaries are standard
- 105°C insulation system
- 1000V Hipot
- Low regulation
- Low prices — no minimum quantity requirements
- Units are inspected and tested 100%
- Dual secondaries for variety of utilization

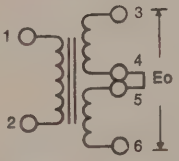
PRIMARY 50/400HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
PC2- 12	DPC2- 12	12.6VCT @ 70MA	6.3V @ 140MA	2	1.0
PC2- 16	DPC2- 16	16 VCT @ 55MA	8 V @ 110MA	2	1.0
PC2- 20	DPC2- 20	20 VCT @ 45MA	10 V @ 90MA	2	1.0
PC2- 24	DPC2- 24	24 VCT @ 35MA	12 V @ 70MA	2	1.0
PC2- 34	DPC2- 34	34 VCT @ 25MA	17 V @ 50MA	2	1.0
PC2- 40	DPC2- 40	40 VCT @ 20MA	20 V @ 40 MA	2	1.0
PC2- 56	DPC2- 56	56 VCT @ 15MA	28 V @ 30MA	2	1.0
PC3- 12	DPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
PC3- 16	DPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
PC3- 20	DPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
PC3- 24	DPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
PC3- 34	DPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
PC3- 40	DPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
PC3- 56	DPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
PC3-120	DPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
PC4- 12	DPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
PC4- 16	DPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
PC4- 20	DPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
PC4- 24	DPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
PC4- 34	DPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
PC4- 40	DPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
PC4- 56	DPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
PC4-120	DPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
PC5- 12	DPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
PC5- 16	DPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
PC5- 20	DPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
PC5- 24	DPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
PC5- 34	DPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
PC5- 40	DPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
PC5- 56	DPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
PC5-120	DPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
PC6- 12	DPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
PC6- 16	DPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
PC6- 20	DPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
PC6- 24	DPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
PC6- 34	DPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
PC6- 40	DPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
PC6- 56	DPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
PC6-120	DPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



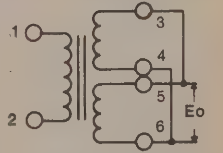
PC-6 PINS



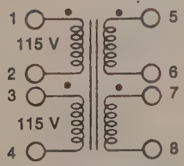
BASIC SCHEMATIC



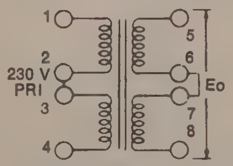
SERIES CONNECTED



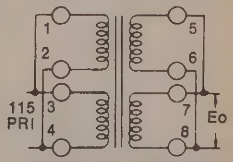
PARALLEL CONNECTED



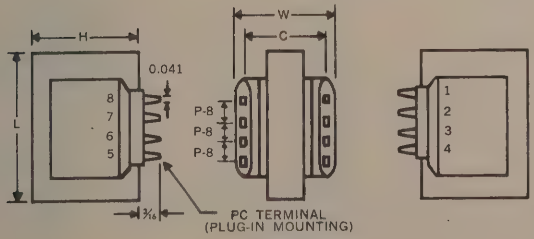
BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED



DPC-8 PINS

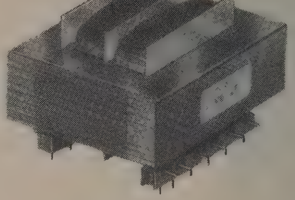
SIZE	VA	L	W	H	P-6 PIN	P-8 PIN	C	WT. (oz.)
2	1.0	1	1⅜	0.83	.250	.200	1.200	2.5
3	1.25	1⅜	1⅛	1³⁄₁₆	.312	.200	1.000	3
4	4.50	1⅝	1¼	1⅜	.400	.250	1.100	5
5	10.0	1⅞	1⁷⁄₁₆	1⅝	.400	.250	1.300	9
6	24.0	1⅝	2¼	1⅜	.400	.250	2.100	12

PC TRANSFORMER CORP.

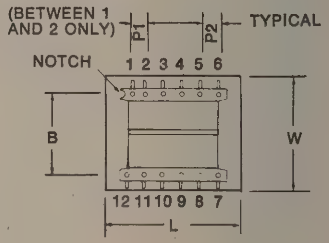
64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300
OUR SPECIALTY 1 WEEK DELIVERY FOR CUSTOM PROTOTYPES

LOW PROFILE SPLIT BOBBIN MICROPROCESSOR PRINTED CIRCUIT POWER TRANSFORMERS

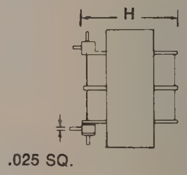
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction—center flange insulation barrier provides 2500 VRMs Hipot—non concentric coil winding results in low inter-winding capacitance, eliminates need for electro-static shielding
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard
- DC output combinations — ±12 and 5V or ±15 and 5V rated at the regulator output with allowance for line variations up to ±13%
- Packaging Flexibility
- Units are inspected and tested 100%
- Low prices — no minimum quantity requirements



Primary 50/60 Hz		Regulated DC Ratings		
Single 115V	Dual 115V/230V	IC1	IC2	Size
LM4-12	LDM4-12	5VDC@185mA	±12VDC@35mA	4
LM5-12	LDM5-12	5VDC@365mA	±12VDC@60mA	5
LM6-12	LDM6-12	5VDC@850mA	±12VDC@150mA	6
LM4-15	LDM4-15	5VDC@185mA	±15VDC@30mA	4
LM5-15	LDM5-15	5VDC@365mA	±15VDC@50mA	5
LM6-15	LDM6-15	5VDC@850mA	±15VDC@130mA	6


(BETWEEN 1 AND 2 ONLY)
P1
P2
TYPICAL
NOTCH
1 2 3 4 5 6
B
W
12 11 10 9 8 7
L

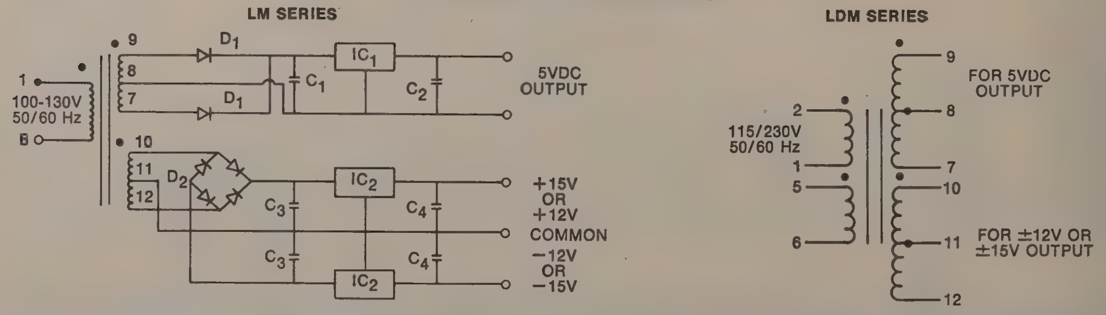
LM, LDM Size	L″	W″	H″	P-1	P-2	B	WT. (oz.)
4	1⅝	1⅜	1³⁄₁₆	.200	.250	.950	5
5	1⅞	1⅝	1⁵⁄₁₆	.200	.300	1.100	9
6	2¼	1⅞	1⁹⁄₁₆	.200	.300	1.300	14



RECOMMENDED COMPONENTS

Part Number	C_1		C_2		C_3		C_4		D_1(2)	D_2(4)	IC_1	IC_2
	MFD	V	MFD	V	MFD	V	MFD	V				
LM4-12/LDM4-12	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM326N
LM4-15/LDM4-15	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM325N
LM5-12/LDM5-12	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM326N
LM5-15/LDM5-15	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM325N
LM6-12/LDM6-12	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM326N
LM6-15/LDM6-15	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM325N

SCHEMATIC DIAGRAMS


LM SERIES

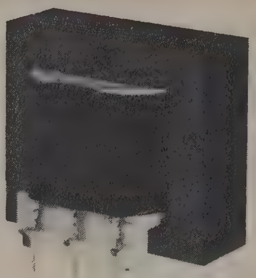
LDM SERIES
9
D1
8
C1
IC1
C2
5VDC OUTPUT
7
D1
1
100-130V 50/60 Hz
B
10
11
12
D2
C3
IC2
C4
+15V OR +12V
COMMON
−12V OR −15V
C3
IC2
C4
9
FOR 5VDC OUTPUT
2
8
115/230V 50/60 Hz
1
7
5
10
6
11
FOR ±12V OR ±15V OUTPUT
12

PC TRANSFORMER CORP.

64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300

OUR SPECIALTY 1 WEEK DELIVERY FOR CUSTOM PROTOTYPES

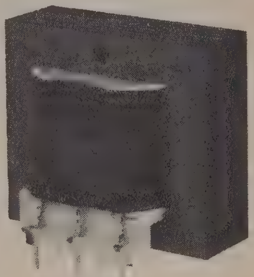
PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS



Designed for Input, Interstage, Output and Isolation Circuits. ±2db 200 Hz-15,000 Hz Frequency Response and 20dbm Power Rating for Entire Series.

P/N	PRI Z	Sec Z	Idc	Schematic
APC1-1	600Ω	600Ω	8mA	1
APC1-2	600Ω C.T.	600Ω C.T.	16mA	2
APC1-3	600Ω	8000/2000Ω Split	8mA	4
APC1-4	2500Ω	600Ω	4mA	1
APC1-5	2500Ω C.T.	600Ω C.T.	8mA	2
APC1-6	2500Ω C.T.	2500Ω C.T.	8mA	2
APC1-7	4000Ω	600Ω/150Ω Split	3mA	4
APC1-8	4000Ω C.T.	600Ω C.T.	6mA	2
APC1-9	4000Ω C.T.	1200Ω C.T.	6mA	2

PLUG-IN PRINTED CIRCUIT TELEPHONE COUPLING TRANSFORMERS

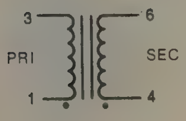


Designed for Interconnection of Voice/Data Modem Terminals to Telephone Lines.

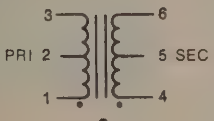
- Frequency response ±0.5dB 300Hz-3500Hz
- Power level −45dbm to +7dbm
- Longitudinal balance — per FCC Part 68
- Distortion — 0.5% max.
- Impedance matching ±10% over frequency range
- Return loss — 26dB min.
- Units are inspected and tested 100%
- Low prices — no minimum quantity requirements

P/N	PRI Z	Sec Z	Application	Schematic
TPC1-1	600Ω	600Ω	Coupling	1
TPC1-2	600Ω C.T.	600Ω C.T.	Coupling	2
TPC1-3	600Ω	900Ω	Coupling	1
TPC1-4	900Ω	900Ω	Coupling	1
TPC1-5	900Ω/600Ω	600Ω	Coupling	3
TPC1-6	4000Ω	600Ω	Bridging	1
TPC1-7	600Ω (4W)	600Ω/600Ω	Hybrid (2) Req'd	5

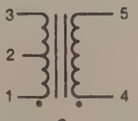
APC & TPC SCHEMATICS AND MECHANICAL LAYOUT



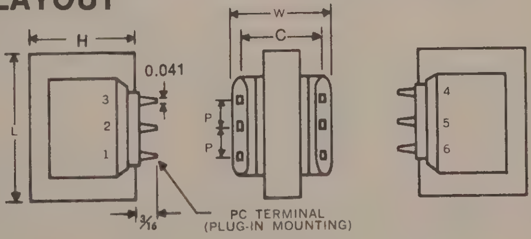
1



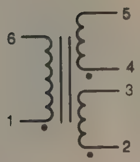
2



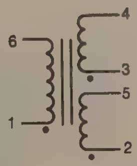
3



PC-6 PINS



4



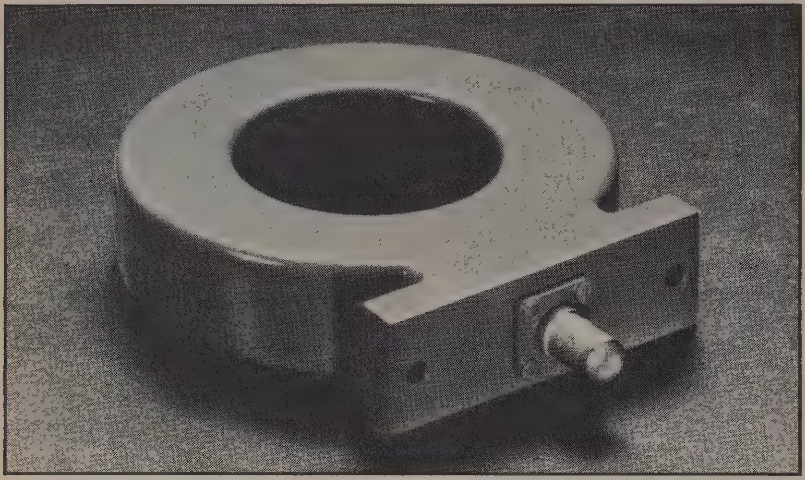
5

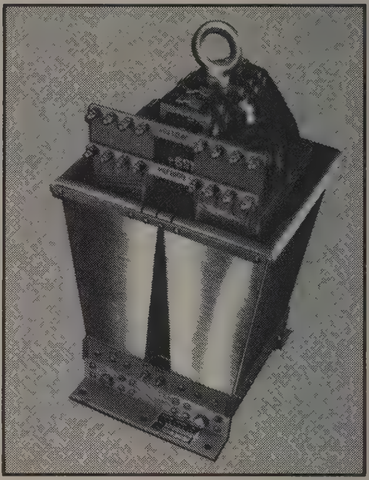
L	W	H	P	C	Wt. (oz.)
13/16	19/32	3/4	.187	.420	.5

Other ratings and configurations are available on special order for your custom requirements.

OVER 25 YEARS OF DESIGN EXPERTISE IS AVAILABLE TO ASSIST YOU WITH YOUR CUSTOM DESIGN AND APPLICATION REQUIREMENTS.

PEARSON ELECTRONICS, INC.





Wide Band, Precision Current Monitor Transformers

With a Pearson current monitor and an oscilloscope, you can measure pulse or ac currents from milliamperes to kiloamperes, in any conductor or beam of charged particles, at any voltage level up to a million volts, at frequencies up to 250 MHz or down to below 1 Hz.

The monitor is physically isolated from the circuit. It is a current transformer capable of highly precise measurement of pulse amplitude and waveshape. The one shown above, for example, offers pulse-amplitude accuracy of + 1%, − 0% (typical of all Pearson current monitors), 20 nanosecond rise time, and droop of only 0.5% per millisecond. Three db bandwidth is 1 Hz to 35 MHz. Whether you wish to measure current in a conductor, an electron device or a particle accelerator, it is likely that one of our off-the-shelf models (ranging from ½″ to 10¾″ ID) will do the job. In addition to our standard models, we build many custom designed current transformers to meet special needs and applications.

Very High Voltage & Very High Current

Pulse Transformers

Pearson Electronics specializes in the development, design and manufacture of high and super high voltage pulse transformers. Typical of the applications for which we have designed and manufactured pulse transformers are units for supplying beam power to high power microwave tubes such as klystrons and traveling wave tubes, units providing pulse voltage to particle accelerator injection systems, pulsed x-ray tubes and high power lasers.

Pearson Current Monitor Transformers

Model Number	Output † (volts/amp.)	Hole Dia. (inches)	Maximum Peak Curr. (amps)	Maximum RMS Curr. (amps)	Droop (%/microsec.)	Useable Rise Time (nanosec.)	IT Max. (amp-sec.)	Approx. Low Freq. 3db pt. (Hz)	I/f (peak amps/ Hz)	Connector
2877	1.0	0.25	100	2.5	0.2	20	0.0004	320	0.0025	SMA
4100	1.0	0.5	500	5	0.09	10	0.002**	140	0.006	UG-290A/U
2100	1.0	2	500	7.5	0.08	20	0.005**	125	0.017	UG-290A/U
3100	1.0	3.5	500	12	0.02	50	0.03**	40	0.096	SO-239
150	0.5	2	1,000	15	0.02	20	0.02**	40	0.067	UG-290A/U
325	0.25	3.5	2,000	60	0.1	30	0.09	160	0.58	SO-239
2878	0.1	0.25	400	10	0.02	5	0.004	32	0.025	SMA
410	0.1	0.5	5,000	50	0.06	20	0.27	120	1.7	UG-290A/U
411	0.1	0.5	5,000	50	0.0009	20	0.19**	1	0.59	UG-290A/U
110	0.1	2	5,000	65	0.0008	20	0.49**	1	1.5	UG-290A/U
110A	0.1	2	10,000	65	0.0008	20	0.49**	1	1.5	UG-568/U
310*	0.1	3.5	5,000	140	0.02	40	0.58	40	3.6	SO-239
1010*	0.1	10.75	5,000	120	0.25	50	0.7	400	4.4	SO-239
1025	0.025	2	20,000	100	0.1	100	0.5	160	3.1	UG-290A/U
3025*	0.025	3.5	20,000	325	0.004	100	3.2	7	20	SO-239
2879	0.01	0.25	2,000	25	0.002	20	0.04	3	0.25	SMA
301X*	0.01	3.5	50,000	400	0.003	200	22.	5	138	SO-239

† Initial pulse response with one megohm in parallel with 20 pF load impedance. A 50 ohm termination will cut the output in half.

* Double shielded. ** May need small bias current through secondary for maximum rating.

Contact us and we will send you engineering data.

PEARSON ELECTRONICS, INC.

1860 Embarcadero Road, Palo Alto, California 94303 U.S.A. Telephone (415)494-6444 Telex 171-412

PERKIN-ELMER

PRECISION TOROIDAL TRANSFORMERS

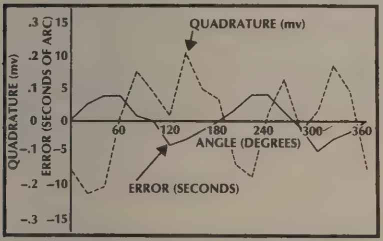
- **INPUT SCOTT T**
- **REFERENCE ISOLATION**
- **OUTPUT SCOTT T**
- **DIGITALLY TAPPED**
- **COMBINATION**
- **PRECISION RATIO**
- **RESOLVER ISOLATION**
- **CUSTOM DESIGNS**

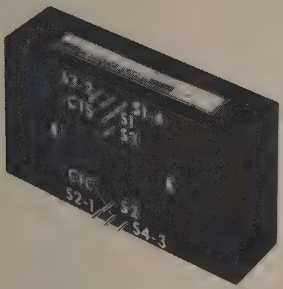
The Electronic Products Department of the Perkin-Elmer Corporation is in a unique position to provide Custom Precision Signal Transformers as a result of 20 years of experience designing and manufacturing very special transformers for the Vernistat® a.c. potentiometer and allied products. **High Performance in small size has always been a successful objective.** Our State of The Art Winding Equipment and Techniques enable close control of turns and taps for close matching of windings and repeatibility of product.

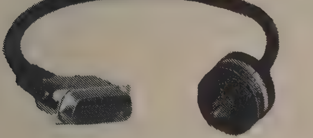
Perkin-Elmer can provide Custom Signal Transformers with high accuracies over the full MIL temperature range. For example, exponential function units with 80 taps to an accuracy of ±0.003% can be provided. SCOTT T Transformers have been built to an accuracy of 5 seconds of arc with a null of 0.1 millivolt. The transformers are fully encapsulated toroidal units and are available with contact pins for PC board mounting. They are manufactured in accordance with MIL-T-27C Grade 5. High input impedance and low output impedance can be matched to specifications. Operating frequency can also be per specifications.

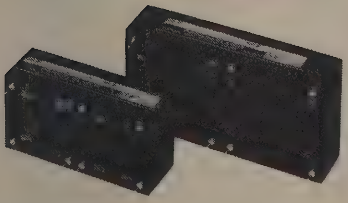
SCOTT T TRANSFORMERS

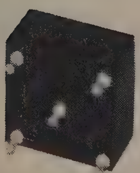
The SCOTT T input transformers converts 3 wire synchro inputs to 4 wire resolver outputs (sin θ and cos θ) with high transformation accuracy and minimum quadrature. SCOTT T Transformers for converting 4 wire resolver inputs to 3 wire synchro outputs can also be supplied. Our output SCOTT T Transformers maintain high accuracies even under heavy load conditions. These units are useful in solid state synchro to digital and digital to synchro converter applications and are particularly applicable in multiplexed conversion systems.











INPUT SCOTT T TRANSFORMERS (SYNCHRO TO RESOLVER)

Input V rms L-L	Output V rms	Load K Ω	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	2.5	25	45	1.0	40	8	2x1x.625	PC 2x6-32	403-2187
	5.0	20	30	1.0	50	75	2x1x.6	PC 2x4-40	403-2064
	7.2 CT	10 to CT	60	1.0	20	10 to CT	2x1x.6	PC 2x4-40	403-2065
	10.2	10	60	2.0	50	50	2x1x.6	PC 2-4-40	403-2066
12	7.5	10	15	1.0	50	75	2x1x.6	PC 2x4-40	403-2055
90	1.1	10	15	0.03	300	1	2x1x1.1	PC 2x4-40	403-2078
	4.25	10	30	1.0	1000	11	2.5x1.25x.65	PC 2x4-40	403-2034
	4.25 CT	10	30	1.0	1000	11	2.78x1.41x.8	PC 2x4-40	403-2033
	17.8 CT	2.3 to CT	30	.7	100	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2019
	26.0 CT	10 to CT	30	1.4	100	15 to CT	2.78x1.41x.8	PC 2x4-40	403-2051
90 (60 Hz)	14 CT	100 to CT	360	12.0	45	15 to CT	4x2.25x1.15	2x6-32	403-2058
96	14.4 CT	10 to CT	15	.25	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2067
			45	.75	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2068
			180	5.0	30	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2069
	20 CT	10 to CT	15	.25	200	10 to CT	2.78x1.41x.8	PC 2x4-40	403-2007

COMBINATION INPUT SCOTT T TRANSFORMERS

11.8 2 channel	5.0	20	30	1.0	50	45	2x1x.8	PC 2x4-40	403-2042
11.8 3 channel	3.2	300	45	.5	50	20	2.94x1.06x.8	PC 2x4-40	403-2048

COMBINATION SCOTT T / RESOLVER ISOLATION

Scott T 11.8	6.0	20	30	1.0	35	20	2x1x.6	PC 2x4-40	403-2070
OR									
Resolver 26	6.0	20	30	1.0	300	20			

OUTPUT SCOTT T TRANSFORMERS (RESOLVER TO SYNCHRO)

Output V rms	Input V rms L-L	Load Ω L-L	Trans. Accuracy Arc. Min.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	4.7	150	1	15	.25	7	2.78x1.41x.8	PC 2x4-40	403-2027
	6	150	2	8	.5	8	2.78x1.41x.61	PC 2x4-40	403-2071
	5 F.B. 2.5	100	3	8	.35	8	2.78x1.41x.61	PC 2x4-40	403-2075
	11.8 F.B. 6 CT	25	6	12	.8	2	2.78x1.41x.61	PC 2x4-40	403-2056
90	7	6000	1.5	50	3.0	600	2x1x1.1	PC 2x4-40	403-2077
	F.B. 2.8	6000	1.5	80	3.0	500	2.3x1.3x1	PC 4x4-40	403-2176

F.B. = Feedback winding.

RESOLVER ISOLATION TRANSFORMERS

Output V rms L-L	Input V rms L-L	Load K Ω L-L	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
7	7 (5 KHz)	10	.5	2	50	25	2x1x.6	PC 2x4-40	403-2072
9 CT	11.8	25 to CT	.3	1	80	50 to CT	1.63x.81x.5	PC	403-2063
11.1	6	.4	2	36	6	14	2.5x1.25x.65	PC 2x4-40	403-2003
26	6	6	3	36	.2	10	2.78x1.41x.61	PC 2x4-40	403-2073

PRECISION REFERENCE ISOLATION TRANSFORMERS

Output V rms	Input V rms	Load K Ω	Trans. Accuracy %	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
3	115 26	90	.05	2.5 5	40 4.5	.7	1.5x1.5x.75	PC 1x6-32	403-2061
	115	10	.1	1.3	180	2.75	.814x.814x.5	PC	403-2166
5	26	.4	.1	1	100	5.5	1x1x.58	PC	403-2026
		20	2	6	100	30	.813x.813x.5	PC	403-2189
6	26	10	.01	2.5	70	15	1x1x.58	PC	403-2040
			.02	2.5	70	15	1x1x.58	PC	403-2041
6 CT	26	45 to CT	.1	1.5	100	4 to CT	1.25x1.25x.5	PC	403-2015
20	20	5	.2	2	50	140	1x1x.5	PC	403-2062
30	7.5	50	.2	200	.5	225	.88x.88x.88	2x2-56	403-2047

Operating Temperature Range −55°C to +125°C.
Frequencies 400 Hz except as otherwise stated.

Manufactured in accordance with MIL-T-27 Grade 5.
Specified transformation accuracies are with stated load.

For information on price, delivery and other standard or custom designed transformers call or write
THE PERKIN-ELMER CORPORATION • ELECTRONIC PRODUCTS DEPT. • Main Avenue, Norwalk, Connecticut 06856 • Telephone (203) 762-6574 or 762-4786
Contact us about our **VERNISTAT® a.c. Potentiometers, Adjustable Function Generators and Digital Converters.**

eem COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

YIG yttrium iron garnet

PICO Catalog Contents

22 PAGES OF MINIATURIZED TRANSFORMERS OPERATING OVER THE FREQUENCY RANGE OF 20 Hz TO 250 KHz, WITH PULSE TRANSFORMERS OPERATING TO 32MHz.

AUDIO TRANSFORMERS ARE ARRANGED ACCORDING TO SIZE WITH 1/4″ X 1/4″ (400 Hz-250 KHz) SHOWN FIRST, AND THE 3/4″ X 13/16″ (20 Hz-25 KHz) SHOWN LAST.

PULSE TRANSFORMERS .05μSEC TO 100μSEC WITH MINIATURIZED PLUG-IN CONSTRUCTION.

400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA-MINIATURE SIZE.

ULTRA MINIATURE D C —D C CONVERTER TRANSFORMERS.

MICROPHONE/TRANSDUCER AUDIO INPUT TRANSFORMERS.

MINIATURIZED POWER INDUCTORS

EMI COMMON MODE SUPPRESSION INDUCTORS

MINIATURE HIGH "Q" INDUCTORS

Description	Page
1/4″ X 1/4″; 2 OHM TO 30K OHM; 400 Hz TO 250 KHz 100 MILLIWATT AT 1 KHz	1A•2234, 1A•2235
.35″ X .32″; 2 OHM TO 40K OHM; 400 Hz TO 100 KHz 400 MILLIWATT AT 1 KHz	1A•2236, 1A•2237
.35″ X .46″; 2 OHM TO 100K OHM; 300 Hz TO 100 KHz 600 MILLIWATT AT 1 KHz	1A•2238, 1A•2239
.5″ X .35″; 2 OHM TO 100K OHM; 300 Hz TO 75 KHz 600 MILLIWATT AT 1 KHz	1A•2240, 1A•2241
.5″ X .5″; 2 OHM TO 250K OHM; 150 Hz TO 75 KHz 1 WATT AT 1 KHz	1A•2242, 1A•2243
.75″ X .375″; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz 1.5 WATT AT 1 KHz	1A•2244, 1A•2245
.75″ X .52″; 2 OHM TO 135K OHM; 50 Hz TO 30KHz 2 WATT AT 1 KHz	1A•2246, 1A•2247
.75″ X .82″; 2 OHM TO 80K OHM; 20 Hz TO 25 KHz 3 WATT AT 1 KHz	1A•2248, 1A•2249
PULSE TRANSFORMERS .05μSEC TO 100μSEC WITH MINIATURIZED PLUG-IN CONSTRUCTION.	1A•2250, 1A•2251
ULTRA MINIATURE D C —D C CONVERTER TRANSFORMERS	1A•2252, 1A•2253
MICROPHONE/TRANSDUCER AUDIO INPUT TRANSFORMERS ***Interchangeable with transformers made by Beyer Dynamic of Germany.***	1A•2254
400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA-MINIATURE SIZE.	1A•2255

See EEM Section 1800: Coils, Chokes & Inductors for PICO's latest line of:

- **Miniature High "Q" Inductors**
- **Miniaturized Power Inductors**
- **EMI Common Mode Suppression Inductors**

Pages 1A•1271 - 1A•1275

Delivery—
stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

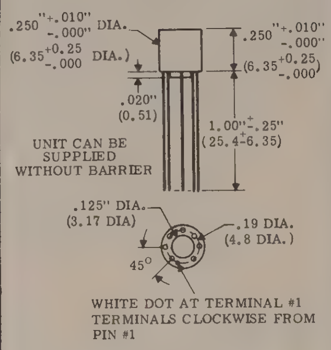
PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

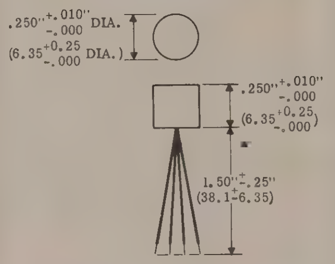
1/4"x1/4" PICO's

ultra-miniature transformers

F SERIES
Plug-In



G SERIES
Insulated Leads



DIMENSICNS ARE IN INCHES (MM)

PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER MILLIWATTS				SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PRICES 1-9 ***	
F Series Plug-In	G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SER	PAR	1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	F-Series	G-Series
F-28003	G-29003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	16.41	15.60
F-28005	G-29005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1 58:1	3.16:1	16.41	15.60
F-28010	G-29010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	16.41	15.60
F-28015	G-29015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2·1	16.41	15.60
F-28020	G-29020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1·1	2.1	16.28	15.60
F-28025	G-29025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73.1	3.46:1	14.91	14.20
F-28030	G-29030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1·1	2:1	14.91	14.20
F-28035	G-29035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	16.28	14.20
F-28040	G-29040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	16.28	14.20
F-28045	G-29045	100 ct	100 ct	[illegible]5	125	20	3.6	12.1	12	3	1:1	2·1	14.91	14.20
F-28050	G-29050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	14.91	14.20
F-28055	G-29055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83 1	17.83	14.20
F-28060	G-29060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1.1	2:1	17.83	16.92
F-28065	G-29065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	17.25	15.42
F-28070	G-29070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73.1	3.46:1	17.83	15.42
F-28075	G-29075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	17.83	16.92
F-28080	G-29080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	17.83	16.92
F-28085	G-29085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	17.83	16.92
F-28090	G-29090	200 ct	200 ct	50	125	20	2.5	22	26.8	6.7	1:1	2:1	17.83	16.92
F-28095	G-29095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	17.83	16.92
F-28100	G-29100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	17.83	16.92
F-28105	G-29105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.41:1	2.83:1	17.83	16.92
F-28110	G-29110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	17.83	16.92
F-28115	G-29115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	16.20	15.42
F-28120	G-29120	320 ct	12.8ct	3.2	125	20	2	34	1.6	0.4	5·1	10·1	19.11	18.15
F-28125	G-29125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16·1	6.32:1	19.11	18.15
F-28130	G-29130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83 1	3.65:1	19.11	18.15
F-28135	G-29135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	19.11	18.15
F-28140	G-29140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2 1	17.37	16.54
F-28145	G-29145	400 ct	1000 ct	250	125	20	1.8	49	120	30	1:1.58	1.26·1	19.11	18.15
F-28150	G-29150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	19.11	18.15
F-28155	G-29155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1·3.16	1:1.58	19.11	18.15
F-28160	G-29160	500 ct	12.8ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	17.37	16.54
F-28165	G-29165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	17.37	16.54
F-28170	G-29170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32·1	17.37	16.54
F-28175	G-29175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	17.37	16.54
F-28180	G-29180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	19.11	18.15
F-28185	G-29185	*500 ct	500 ct	-	125	20	1.6	54	65	-	1.1	-	19.11	18.15
F-28190	G-29190	500 ct	600 ct	150	125	20	1.6	54	72	18	1·1.1	1.83:1	19.11	18.15
F-28195	G-29195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7·1	19.11	18.15
F-28200	G-29200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	17.37	16.54
F-28205	G-29205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	17.37	16.54
F-28210	G-29210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73·1	3.46:1	17.37	16.54
F-28215	G-29215	600 ct	600 ct	150	125	20	1.5	59	72	18	1·1	2:1	17.37	16.54
F-28220	G-29220	*600 ct	600 ct	-	125	20	1.5	59	72	-	1:1	-	19.11	18.15
F-28225	G-29225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	17.37	16.54
F-28230	G-29230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	17.37	16.54
F-28235	G-29235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	17.37	16.54
F-28240	G-29240	800 ct	12.8 ct	3.2	125	20	1.3	88	16	4	7.9:1	15.8:1	19.11	18.15
F-28245	G-29245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	17.83	16.97
F-28250	G-29250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	17.83	16.97
F-28255	G-29255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45·1	17.83	16.97
F-28260	G-29260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	19.61	18.62
F-28265	G-29265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	19.61	18.62
F-28270	G-29270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	17.83	16.97
F-28275	G-29275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	19.61	18.62
F-28280	G-29280	1200 ct	12.8 c	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	19.61	18.62
F-28285	G-29285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.1:1	19.61	18.62
F-28290	G-29290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	19.61	18.62
F-28295	G-29295	*1200 ct	1200 ct	-	125	20	1	133	160	-	1:1	-	19.61	18.62
F-28300	G-29300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	19.61	18.62
F-28305	G-29305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	17.83	16.97
F-28310	G-29310	*1500 ct	600 ct	-	125	20	1	180	73	-	1.58:1	-	17.83	16.97
F-28315	G-29315	*1500 ct	1500 ct	-	125	20	1	180	215	-	1:1	-	19.61	18.62
F-28320	G-29320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	19.61	18.62
F-28325	G-29325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	19.61	18.62
F-28330	G-29330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	19.61	18.62
F-28335	G-29335	*2000 ct	2000 ct	-	125	20	0.8	218	260	-	1·1	-	19.61	18.62
F-28340	G-29340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	19.11	18.19

*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

SPECIFICATIONS

- MIL-T-27: . . . . All Units Meet MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- FREQUENCY RESPONSE: . . . . ±3dB, 400 Hz-250 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . 1.1 Grams.
- OPERATING TEMPERATURE: . . -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c).
- TERMINALS: . . . . Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—
stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILLIWATTS 1 KHz and higher	POWER MILLIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PRICES 1-9 *** F-Series	PRICES 1-9 *** G-Series
F-28345	G-29345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	19.11	18.19
F-28350	G-29350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	19.11	18.19
F-28355	G-29355	*3000 ct	3000 ct	-	125	20	0.65	330	330	-	1:1	-	19.61	18.62
F-28360	G-29360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	19.11	18.19
F-28365	G-29365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	19.11	18.19
F-28370	G-29370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	19.11	18.19
F-28375	G-29375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	19.11	18.19
F-28380	G-29380	*4000 ct	8000 ct	-	125	20	0.57	400	1070	-	1:1.41	-	21.01	19.97
F-28385	G-29385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	19.11	18.19
F-28390	G-29390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	21.01	19.97
F-28395	G-29395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2:1	24.5:1	21.01	19.97
F-28400	G-29400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	19.56	18.62
F-28405	G-29405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3.54:1	7.07:1	19.56	18.62
F-28410	G-29410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	19.56	18.62
F-28415	G-29415	*7500 ct	7500 ct	-	125	20	0.4	835	1020	-	1:1	-	19.56	18.62
F-28420	G-29420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	21.01	19.97
F-28425	G-29425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	21.01	19.97
F-28430	G-29430	*8000 ct	1200 ct	-	125	20	0.4	865	160	-	2.58:1	-	21.01	19.97
F-28435	G-29435	*9000 ct	9000 ct	-	125	20	0.4	1160	1160	-	1:1	-	21.01	19.97
F-28440	G-29440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	21.01	19.97
F-28445	G-29445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	19.56	18.62
F-28450	G-29450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	19.56	18.62
F-28455	G-29455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	19.56	18.62
F-28460	G-29460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	19.56	18.62
F-28465	G-29465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	19.56	18.62
F-28470	G-29470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	19.56	18.62
F-28475	G-29475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	19.56	18.62
F-28480	G-29480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16 1	19.97	19.97
F-28485	G-29485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	19.56	18.62
F-28490	G-29490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	19.56	18.62
F-28495	G-29495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	19.56	18.62
F-28500	G-29500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	17.83	16.97
F-28505	G-29505	*10,000 ct	10,000 ct	-	125	20	0.36	1200	1440	-	1:1	-	21.01	19.97
F-28510	G-29510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	19.61	18.62
F-28515	G-29515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48.1	10.95:1	19.61	18.62
F-28520	G-29520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	19.61	18.62
F-28525	G-29525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	19.61	18.62
F-28530	G-29530	*15,000 ct	15,000 ct	-	100	15	0.35	1420	1730	-	1:1	-	21.01	19.97
F-28535	G-29535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	19.61	18.62
F-28540	G-29540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	19.61	18.62
F-28545	G-29545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33:1	12.65:1	21.01	19.97
F-28550	G-29550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	21.01	19.97
F-28555	G-29555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	21.01	19.97
F-28560	G-29560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47:1	8.94:1	21.01	19.97
F-28565	G-29565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	21.01	19.97
F-28570	G-29570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	21.01	19.97
F-SHIELD	MU-METAL SHIELD .285" d X .268" h (7.24 mm d X 6.73 mm h) SINGLE SHIELD												1.80	
FYY-SHIELD	MU-METAL SHIELD .315" d X .275" h (8.0 mm d X 6.99 mm h) USE WITH F-SHIELD FOR DOUBLE SHIELDING												1.80	
G-SHIELD	MU-METAL SHIELD .285" d X .335" h (7.24 mm d X 8.51 mm h) SINGLE SHIELD													1.79
GYY-SHIELD	MU-METAL SHIELD .315" d X .40" h (8.00 mm d X 10.16 mm h) USE WITH G-SHIELD FOR DOUBLE SHIELDING													1.79
GXX-SHIELD	MU-METAL SHIELD .35" d X .465" h (8.89 mm d X 11.81 mm h) USE WITH G-SHIELD AND GYY SHIELD FOR TRIPLE SHIELDING													1.79

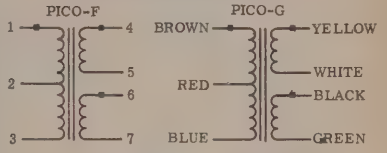
*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

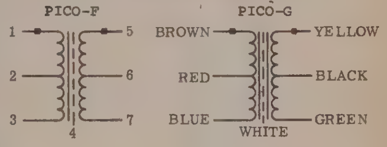
F SERIES Plug-In

G SERIES Insulated Leads

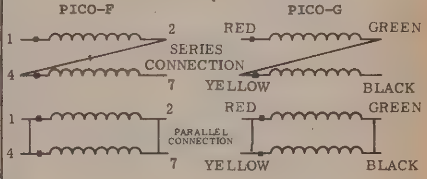
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- 5 MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

INDUCTORS

PART NUMBER F-SERIES	PART NUMBER G-SERIES	INDUCTANCE HENRIES		DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9*** F SERIES	PRICES 1-9*** G SERIES
F-5825	G-6125	SERIES	10.0 2.75	0 2	2250	16.20	15.42
		PARALLEL	2.5 .65	0 4	560		
F-5830	G-6130	SERIES	5.5 1.5	0 2	1000	16.20	15.42
		PARALLEL	1.3 .40	0 4	250		
F-5835	G-6135	SERIES	.85 .25	1 6	240	16.20	15.42
		PARALLEL	.21 .06	2 12	60		
F-5840	G-6140	SERIES	.6 .15	0 5	144	16.20	15.42
		PARALLEL	.15 .04	0 10	36		

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

*For immediate engineering assistance or to place an order—***Call Toll Free 800-431-1064**

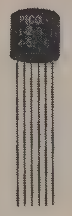
Delivery—
stock to one week

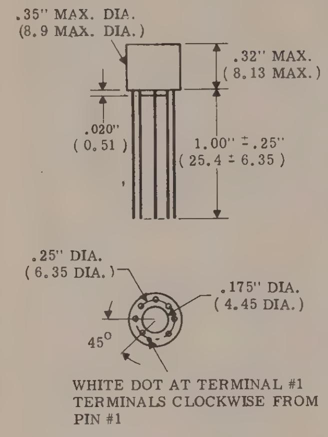
PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO's ultra-miniature transformers

W SERIES
Plug-In





DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- MIL-T-27: . . . .
All Units Meet MIL-T-27. Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.

- FREQUENCY RESPONSE: . . . .
±3dB, 400 Hz-100 KHz at 1.0 Milliwatt.

- MAXIMUM DISTORTION: . . . .
5% With Rated Power Level at 1 KHz and 400 Hz.

- DIELECTRIC STRENGTH: . . . .
All Units Tested at 200 V RMS.

INSULATION RESISTANCE: . . .
Greater Than 10,000 Megohms at 300 V DC.

- WEIGHT: . . . .
2.5 Grams.

- OPERATING TEMPERATURE: . .
-55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c)

- TERMINALS: . . . .
Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.

- THERMAL SHOCK: . . . .
25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS		PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 * * * W-Series
		SER	PAR	1KHz and higher	400 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	
W-26003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	12.11
W-26005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	12.11
W-26010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	12.11
W-26015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	12.11
W-26020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	12.11
W-26025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	12.84
W-26030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	12.84
W-26035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	15.24
W-26040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	12.84
W-26045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	12.84
W-26050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	11.55
W-26055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	15.24
W-26060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	15.24
W-26065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	11.55
W-26070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	12.84
W-26075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	12.84
W-26080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	15.24
W-26085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	12.84
W-26090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	12.84
W-26095	300 ct	12 ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	11.55
W-26100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	12.84
W-26105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	12.84
W-26110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	15.24
W-26115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	11.55
W-26120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	11.55
W-26125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	15.24
W-26130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	15.24
W-26135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	12.84
W-26140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	15.24
W-26145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	17.49
W-26150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	17.49
W-26155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	15.79
W-26160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	13.38
W-26165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	13.38
W-26170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	13.38
W-26175	500 ct	150 ct	37.5	.4	.075	4.5	50	18	4.5	1.83:1	3.65:1	13.38
W-26180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	13.38
W-26185	*500 ct	500 ct	-	.4	.075	4.5	50	60	-	1:1	-	13.38
W-26190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	13.38
W-26195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	11.55
W-26200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	12.11
W-26205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	12.11
W-26210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	12.11
W-26215	600 ct	600 ct	150	.4	.075	4.1	60	72	18	1:1	2:1	12.11
W-26220	*600 ct	600 ct	-	.4	.075	4.1	60	72	-	1:1	-	13.38
W-26225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	12.11
W-26230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.14:1	12.11
W-26235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	12.11
W-26240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9 :1	15.8:1	12.11
W-26245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	13.38
W-26250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	12.11
W-26255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	12.11
W-26260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	12.11
W-26265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	13.38
W-26270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	13.38
W-26275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	12.11
W-26280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	10.90
W-26285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	10.90
W-26290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	10.90
W-26295	*1200 ct	1200 ct	-	.4	.075	2.9	120	140	-	1:1	-	14.90
W-26300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11 2:1	22.4:1	12.11
W-26305	1500 ct	500 ct	125	4	.075	2.6	150	60	15	1.73:1	3.46:1	13.38
W-26310	*1500 ct	600 ct	-	.4	.075	2.6	150	72	-	1.58:1	-	13.38
W-26315	*1500 ct	1500 ct	-	.4	.075	2.6	150	180	-	1:1	-	13.38
W-26320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	12.11
W-26325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	15.79
W-26330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	15.79
W-26335	*2000 ct	2000 ct	-	.4	.075	2.2	200	240	-	1:1	-	17.49
W-26340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	15.79
W-26345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	15.79

* * * Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery—
stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9*** W-Series
W-26350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	12.84
W-26355	*3000 ct	3000 ct	-	.4	.075	1.8	300	360	-	1:1	-	17.49
W-26360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	12.84
W-26365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	15.79
W-26370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	15.79
W-26375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	17.49
W-26380	*4000 ct	8000 ct	-	.4	.075	1.6	400	960	-	1:1.41	-	17.49
W-26385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	13.38
W-26390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	13.38
W-26395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	13.38
W-26400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	13.38
W-26405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	14.90
W-26410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	14.90
W-26415	*7500 ct	7500 ct	-	.33	.075	1.2	750	900	-	1:1	-	17.49
W-26420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	13.38
W-26425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	14.90
W-26430	*8000 ct	1200 ct	-	.3	.075	1.1	800	144	-	2.58:1	-	17.49
W-26435	*9000 ct	9000 ct	-	.27	.075	1.1	900	1080	-	1:1	-	17.40
W-26440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	12.11
W-26445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	12.11
W-26450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	13.38
W-26455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	13.38
W-26460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	13.38
W-26465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	13.38
W-26470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	13.38
W-26475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	15.79
W-26480	10.000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	15.79
W-26485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	15.47
W-26490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	15.75
W-26495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	15.79
W-26500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	15.24
W-26505	*10,000 ct	10,000 ct	-	.25	.075	1.0	1000	1200	-	1:1	-	17.49
W-26510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	15.24
W-26515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	15.24
W-26520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	15.24
W-26525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	15.24
W-26530	*15,000 ct	15,000 ct	-	.16	.075	.82	1500	1800	-	1:1	-	17.49
W-26535	15,000 ct	15,000 ct	3750	.16	.075	.82	1500	1800	450	1:1	2:1	15.79
W-26540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	15.79
W-26545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	15.24
W-26550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	15.24
W-26555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	13.93
W-26560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	17.49
W-26565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	15.24
W-26570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	15.24
W-26575	*20,000 ct	20,000 ct	-	.125	.075	.7	2000	2400	-	1:1	-	17.49
W-26580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	15.79
W-26585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	15.79
W-26590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49.1	15.79
W-26595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	15.79
W-26600	30.000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	15.79
W-26605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	15.79
W-26610	30.000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	15.79
W-26615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	15.79
W-26620	*30,000 ct	30,000 ct	-	.083	.075	.58	3000	3600	-	1:1	-	17.49
W-26625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	17.49
W-SHIELD	MU-METAL SHIELD .37"D x .32"H (9.4mmD x 8.1mmH) SINGLE SHIELD											1.80
WXX-SHIELD	MU-METAL SHIELD .395"D x .33"H (10mmD x 8.4mmH) USE WITH W SHIELD FOR DOUBLE SHIELDING											1.80

*INCLUDES ELECTROSTATIC SHIELD

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	INDUCTANCE HENRIES		DC CURRENT ma	DC RESISTANCE OHMS	PRICE*** 1-9
W-26705	SERIES	0.1 08	4 10	25	12.11
	PARALLEL	.025 .02	8 20	6.5	
W-26710	SERIES	0.9 0.5	2 6	105	12.11
	PARALLEL	.23 .13	4 12	26	
W-26715	SERIES	2.5 0.9	2 4	630	12.11
	PARALLEL	0.6 0.23	4 8	160	
W-26720	SERIES	4.5 1.2	2 4	2300	12.85
	PARALLEL	1.1 0.3	4 8	575	

*** Discount Prices: 1-9 Net;
10-24 less 10%; 25-49 less 16%;
50-99 less 23%; 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York.
P.O. Box 1206

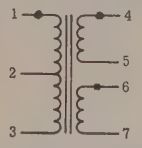
For immediate engineering assistance or to place an order—

Call Toll Free
800-431-1064

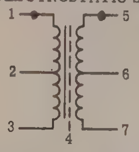
PICO's ultra-miniature transformers

W SERIES Plug-In

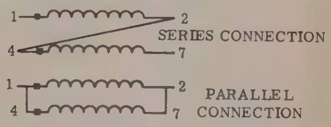
SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

Delivery—
stock to one week

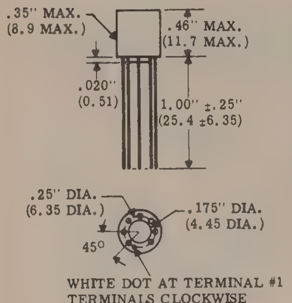
PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

phone
914-699-5514

PICO's ultra-miniature transformers

Y SERIES Plug-In



DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- MIL-T-27: . . . .
All Units Meet MIL-T-27, Military Designation is TF5R21ZZ, for Transformers, TFR20ZZ for Inductors.

- FREQUENCY RESPONSE: . . .
±3db, 300 Hz - 100 KHz at 1.0 Milliwatt.

o MAXIMUM DISTORTION: . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz.

- DIELECTRIC STRENGTH: . . .
All Units Tested at 200 V RMS.

- INSULATION RESISTANCE: . .
Greater Than 10,000 Megohms at 300 V DC.

- WEIGHT: . . . .
3 Grams

- OPERATING TEMPERATURE: .
-55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°C).

- TERMINALS: . . . .
Solid .016 Diameter Conductor.
Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.

- THERMAL SHOCK: . . . .
25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO
Electronics, Inc.
453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552
phone
914-699-5514

Delivery—
stock to one week

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***
		SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	Y-Series
Y-27003	10 ct	10 ct	2.5	.6	.2	.1	31.6	1	1.25	.32	1:1	2:1	12.11
Y-27005	20 ct	8 ct	2	.6	.2	.1	22.3	2	.9	.23	1.58:1	3.16:1	12.11
Y-27010	20 ct	20 ct	5	.6	.2	.1	22.3	2.1	2.25	.56	1:1	2:1	12.11
Y-27015	32 ct	32 ct	8	.6	.2	.1	17.6	3.4	4	1	1:1	2:1	12.11
Y-27020	40 ct	40 ct	10	.6	.2	.1	15.8	4.2	4.5	1.13	1:1	2:1	12.11
Y-27025	48 ct	16 ct	4	.6	.2	.1	14.4	5	1.8	.45	1.73:1	3.46:1	12.11
Y-27030	50 ct	50 ct	12.5	.6	.2	.1	14.1	5.25	5.6	1.4	1:1	2:1	12.11
Y-27035	80 ct	32 ct	8	.6	.2	.1	11.1	8.4	4	1	1.58:1	3.16:1	15.23
Y-27040	100 ct	40 ct	10	.6	.2	.1	10	10	4.5	1.13	1.58:1	3.16:1	15.23
Y-27045	100 ct	100 ct	25	.6	.2	.1	10	11	11.25	2.8	1:1	2:1	15.23
Y-27050	120 ct	12.8 ct	3.2	.6	.2	.1	9.1	14.4	1.8	.45	3.06:1	6.12:1	11.55
Y-27055	120 ct	60 ct	15	.6	.2	.1	9.1	14.4	8.4	2.1	1.41:1	2.83:1	15.23
Y-27060	120 ct	120 ct	30	.6	.2	.1	9.1	14.4	16.8	4.2	1:1	2:1	15.23
Y-27065	150 ct	12 ct	3	.6	.2	.1	8.2	15	1.5	.38	3.54:1	7.08:1	11.55
Y-27070	150 ct	50 ct	12.5	.6	.2	.1	8.2	15	6	1.5	1.73:1	3.46:1	12.83
Y-27075	150 ct	100 ct	25	.6	.2	.1	8.2	15	12	3	1.22:1	2.45:1	12.83
Y-27080	150 ct	150 ct	37.5	.6	.2	.1	8.2	15	18	4.5	1:1	2:1	15.13
Y-27085	150 ct	600 ct	150	.6	.2	.1	8.2	15	72	18	1:2	1:1	12.83
Y-27090	200 ct	200 ct	50	.6	.2	.1	7	22	24	6	1:1	2:1	12.83
Y-27095	300 ct	12 ct	3	.6	.2	.1	5.8	30	1.4	.35	5:1	10:1	11.55
Y-27100	300 ct	50 ct	12.5	.6	.2	.1	5.8	30	6	1.5	2.45:1	4.9:1	12.83
Y-27105	300 ct	150 ct	37.5	.6	.2	.1	5.8	30	18	4.5	1.41:1	2.83:1	12.83
Y-27110	300 ct	300 ct	75	.6	.2	.1	5.8	30	36	9	1:1	2:1	15.23
Y-27115	300 ct	600 ct	150	.6	.2	.1	5.8	30	72	18	1:1.41	1.41:1	12.11
Y-27120	320 ct	12.8 ct	3.2	.6	.2	.1	5.6	36	1.8	.45	5:1	10:1	11.55
Y-27125	400 ct	40 ct	10	.6	.2	.1	5	40	4.8	1.2	3.16:1	6.32:1	15.23
Y-27130	400 ct	120 ct	30	.6	.2	.1	5	40	14.5	3.6	1.83:1	3.65:1	15.23
Y-27135	400 ct	200 ct	50	.6	.2	.1	5	40	24	6	1.4:1	2.83:1	12.83
Y-27140	400 ct	400 ct	100	.6	.2	.1	5	40	48	12	1:1	2:1	15.23
Y-27145	400 ct	1000 ct	250	.6	.2	.1	5	40	125	31	1:1.58	1.26:1	17.48
Y-27150	400 ct	2000 ct	500	.6	.2	.1	5	40	240	60	1:2.24	1:1.12	17.48
Y-27155	400 ct	4000 ct	1000	.6	.2	.1	5	40	480	120	1:3.16	1:1.58	15.78
Y-27160	500 ct	12.8 ct	3.2	.6	.2	.1	4.5	50	1.5	.38	6.25:1	12.5:1	13.56
Y-27165	500 ct	16 ct	4	.6	.2	.1	4.5	50	1.9	.48	5.6:1	11.2:1	13.56
Y-27170	500 ct	50 ct	12.5	.6	.2	.1	4.5	50	6	1.5	3.16:1	6.32:1	13.56
Y-27175	500 ct	150 ct	37.5	.6	.2	.1	4.5	50	18	4.5	1.83:1	3.65:1	13.56
Y-27180	500 ct	500 ct	125	.6	.2	.1	4.5	50	60	15	1:1	2:1	13.56
Y-27185	* 500 ct	500 ct	-	.6	.2	.1	4.5	50	60	-	1:1	-	13.56
Y-27190	500 ct	600 ct	150	.6	.2	.1	4.5	50	72	18	1:1.1	1.83:1	12.11
Y-27195	600 ct	12.8 ct	3.2	.6	.2	.1	4.1	60	1.5	.38	6.85:1	13.7:1	10.90
Y-27200	600 ct	30 ct	7.5	.6	.2	.1	4.1	60	3.6	.9	4.47:1	8.94:1	12.11
Y-27205	600 ct	48 ct	12	.6	.2	.1	4.1	60	5.8	1.45	3.54:1	7.07:1	12.11
Y-27210	600 ct	200 ct	50	.6	.2	.1	4.1	60	24	6	1.73:1	3.46:1	12.11
Y-27215**	600 ct	600 ct	150	.6	.2	.1	4.1	60	72	18	1:1	2:1	12.11
Y-27220**	*600 ct	600 ct	-	.6	.2	.1	4.1	60	72	-	1:1	-	12.11
Y-27225**	600 ct	1200 ct	300	.6	.2	.1	4.1	60	144	36	1:1.41	1.41:1	12.11
Y-27230	640 ct	12.8 ct	3.2	.6	.2	.1	3.9	64	1.5	.38	7.07:1	14.14:1	12.11
Y-27235	700 ct	100 ct	25	.6	.2	.1	3.8	70	12	3	2.65:1	5.29:1	12.11
Y-27240	800 ct	12.8 ct	3.2	.6	.2	.1	3.5	80	1.5	.38	7.9:1	15.8:1	12.11
Y-27245	800 ct	48 ct	12	.6	.2	.1	3.5	80	5.8	1.45	4.08:1	8.16:1	13.56
Y-27250	800 ct	800 ct	200	.6	.2	.1	3.5	80	96	24	1:1	2:1	13.56
Y-27255	900 ct	600 ct	150	.6	.2	.1	3.3	90	72	18	1.22:1	2.45:1	12.11
Y-27260	1000 ct	12 ct	3	.6	.2	.1	3.2	100	1.4	.35	9.13:1	18.3:1	12.11
Y-27265	1000 ct	50 ct	12.5	.6	.2	.1	3.2	100	6	1.5	4.47:1	8.94:1	13.56
Y-27270	1000 ct	1000 ct	250	.6	.2	.1	3.2	100	120	30	1:1	2:1	13.56
Y-27275	1060 ct	12.8 ct	3.2	.6	.2	.1	3.1	106	1.5	.38	9.1:1	18.2:1	12.11
Y-27280	1200 ct	12.8 ct	3.2	.6	.2	.1	2.9	120	1.5	.38	9.68:1	19.4:1	10.90
Y-27285	1200 ct	500 ct	125	.6	.2	.1	2.9	120	60	15	1.55:1	3.1:1	10.90
Y-27290	1200 ct	1200 ct	300	.6	.2	.1	2.9	120	144	36	1:1	2:1	10.90
Y-27295	*1200 ct	1200 ct	-	.6	.2	.1	2.9	120	144	-	1:1	-	12.11
Y-27300	1500 ct	12 ct	3	.6	.2	.1	2.6	150	1.44	.36	11.2:1	22.4:1	12.11
Y-27305	1500 ct	500 ct	125	.6	.2	.1	2.6	150	60	15	1.73:1	3.46:1	13.56
Y-27310	*1500 ct	600 ct	-	.6	.2	.1	2.6	150	72	-	1.58:1	-	17.48
Y-27315	*1500 ct	1500 ct	-	.6	.2	.1	2.6	150	180	-	1:1	-	13.56
Y-27320	1600 ct	12.8 ct	3.2	.6	.2	.1	2.5	160	1.5	.38	11.2:1	22.4:1	12.11
Y-27325	2000 ct	8 ct	2	.6	.2	.1	2.2	200	.96	.24	15.8:1	31.6:1	13.56
Y-27330	2000 ct	2000 ct	500	.6	.2	.1	2.2	200	240	60	1:1	2:1	15.78
Y-27335	*2000 ct	2000 ct	-	.6	.2	.1	2.2	200	240	-	1:1	-	17.48
Y-27340	2000 ct	8000 ct	2000	.6	.2	.1	2.2	200	960	240	1:2	1:1	15.78
Y-27345	2500 ct	2500 ct	625	.6	.2	.1	2	250	300	75	1:1	2:1	15.78
Y-27350	3000 ct	3000 ct	725	.6	.2	.1	1.8	300	360	90	1:1	2:1	12.70
Y-27355	*3000 ct	3000 ct	-	.6	.2	.1	1.8	300	360	-	1:1	-	17.48
Y-27360	3600 ct	3600 ct	900	.6	.2	.1	1.7	360	432	108	1:1	2:1	15.78
Y-27365	4000 ct	16 ct	4	.6	.2	.1	1.6	400	1.92	.48	15.8:1	31.6:1	15.78
Y-27370**	4000 ct	600 ct	150	.6	.2	.1	1.6	400	72	18	2.58:1	5.16:1	15.78
Y-27375	4000 ct	1000 ct	250	.6	.2	.1	1.6	400	120	30	2:1	4:1	15.78
Y-27380	*4000 ct	8000 ct	-	.6	.2	.1	1.6	400	960	-	1:1.41	-	15.78
Y-27385	5000 ct	500 ct	125	.5	.2	.1	1.4	500	60	15	3.16:1	6.32:1	12.70
Y-27390	5000 ct	5000 ct	1250	.5	.2	.1	1.4	500	600	150	1:1	2:1	12.70
Y-27395	7500 ct	50 ct	12.5	.33	.2	.1	1.2	750	6	1.5	12.2:1	24.5:1	12.70
Y-27400	7500 ct	100 ct	25	.33	.2	.1	1.2	750	12	3	8.66:1	17.3:1	13.56
Y-27405	7500 ct	600 ct	150	.33	.2	.1	1.2	750	72	18	3.54:1	7.07:1	14.89

***Discount Prices: 1-9 Net:
10-24 less 10%: 25-49 less 16%:
50-99 less 23%: 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** Y-Series
Y-27410	7500 ct	2500 ct	625	.33	.2	.1	1.2	750	300	75	1.73:1	3.46:1	14.89
Y-27415	*7500 ct	7500 ct	-	.33	.2	.1	1.2	750	900	-	1:1	-	17.48
Y-27420	8000 ct	12.8 ct	3.2	.3	.2	.1	1.1	800	1.5	.38	25:1	50:1	12.70
Y-27425	8000 ct	1000 ct	250	.3	.2	.1	1.1	800	120	30	2.83:1	5.66:1	14.89
Y-27430	*8000 ct	1200 ct	-	.3	.2	.1	1.1	800	144	-	2.58:1	-	15.78
Y-27435	*9000 ct	9000 ct	-	.27	.2	.1	1.1	900	1080	-	1:1	-	16.42
Y-27440	10,000 ct	12.8 ct	3.2	.25	.2	.1	1.0	1000	1.5	.38	28:1	56:1	12.11
Y-27445	10,000 ct	16 ct	4	.25	.2	.1	1.0	1000	1.92	.48	25:1	50:1	13.37
Y-27450	10,000 ct	100 ct	25	.25	.2	.1	1.0	1000	12	3	10:1	20:1	13.37
Y-27455	10,000 ct	200 ct	50	.25	.2	.1	1.0	1000	24	6	7.07:1	14.14:1	13.37
Y-27460	10,000 ct	500 ct	125	.25	.2	.1	1.0	1000	60	15	4.47:1	8.94·1	13.37
Y-27465	10,000 ct	600 ct	150	.25	.2	.1	1.0	1000	72	18	4.08:1	8.16:1	13.37
Y-27470	10,000 ct	1000 ct	250	.25	.2	.1	1.0	1000	120	30	3.16:1	6.32:1	13.37
Y-27475	10,000 ct	1200 ct	300	.25	.2	.1	1.0	1000	144	36	2.89:1	5.77:1	13.37
Y-27480	10,000 ct	1500 ct	375	.25	.2	.1	1.0	1000	180	45	2.58:1	5.16:1	14.58
Y-27485	10,000 ct	2000 ct	500	.25	.2	.1	1.0	1000	240	60	2.24:1	4.47:1	14.58
Y-27490	10,000 ct	5000 ct	1250	.25	.2	.1	1.0	1000	600	150	1.41·1	2.83:1	15.61
Y-27495	10,000 ct	7500 ct	1875	.25	.2	.1	1.0	1000	900	225	1.15.1	2.3.1	15.61
Y-27500	10,000 ct	10,000 ct	2500	.25	.2	.1	1.0	1000	1200	300	1:1	2:1	15.23
Y-27505	*10,000 ct	10,000 ct	-	.25	.2	.1	1.0	1000	1200	-	1:1	-	16.98
Y-27510	15,000 ct	400 ct	100	.16	.16	.1	.82	1500	48	12	6.12:1	12.24:1	15.23
Y-27515	15,000 ct	500 ct	125	.16	.16	.1	.82	1500	60	15	5.48:1	10.95:1	15.23
Y-27520	15,000 ct	600 ct	150	.16	.16	.1	.82	1500	72	18	5:1	10:1	15.23
Y-27525	15,000 ct	10,000 ct	2500	.16	.16	.1	.82	1500	1200	300	1.22:1	2.45:1	16.98
Y-27530	*15,000 ct	15,000 ct	-	.16	.16	.1	.82	1500	1800	-	1.1	-	16.98
Y-27535	15,000 ct	15,000 ct	3750	.16	.16	.1	.82	1500	1800	450	1.1	2:1	16.98
Y-27540	16,000 ct	1000 ct	250	.15	.15	.1	.8	1600	120	30	4:1	8:1	15.78
Y-27545	20,000 ct	500 ct	125	.125	.125	.1	.7	2000	60	15	6.33:1	12.65:1	15.23
Y-27550	20,000 ct	600 ct	150	.125	.125	.1	.7	2000	72	18	5.77:1	11.55:1	15.23
Y-27555	20,000 ct	800 ct	200	.125	.125	.1	.7	2000	96	24	5·1	10:1	12.11
Y-27560	20,000 ct	1000 ct	250	.125	.125	.1	.7	2000	120	30	4.47:1	8.94.1	15.23
Y-27565	20,000 ct	5000 ct	1250	.125	.125	.1	.7	2000	600	150	2:1	4:1	15.23
Y-27570	20,000 ct	10,000 ct	2500	.125	.125	.1	.7	2000	1200	300	1.41 1	2.83:1	15.23
Y-27575	*20,000 ct	20,000 ct	-	.125	.125	.1	.7	2000	2400	-	1:1	-	15.23
Y-27580	25,000 ct	500 ct	125	.1	.1	.1	.63	2500	60	15	7.07 1	14.14:1	15.23
Y-27585	25,000 ct	1000 ct	250	.1	.1	.1	.63	2500	120	30	5:1	10:1	15.23
Y-27590	30,000 ct	50 ct	12.5	.08	.08	.08	.58	3000	6	1.5	24.5:1	49 1	15.23
Y-27595	30,000 ct	1200 ct	300	.08	.08	.08	.58	3000	144	36	5:1	10.1	15.23
Y-27600	30,000 ct	500 ct	125	.08	.08	.08	.58	3000	60	15	7.75:1	15.5 1	15.23
Y-27605	30,000 ct	200 ct	50	.08	.08	.08	.58	3000	24	6	12.25·1	24.5·1	15.23
Y-27610	30,000 ct	5000 ct	1250	.08	.08	.08	.58	3000	600	150	2.45:1	4.9 1	16.98
Y-27615	30,000 ct	10,000 ct	2500	.08	.08	.08	.58	3000	1200	300	1.73.1	3.46:1	16.98
Y-27620	*30,000 ct	30,000 ct	-	.08	.08	.08	.58	3000	3600	-	1.1	-	16.98
Y-27625	40,000 ct	400 ct	100	.06	.06	.06	.5	4000	48	12	10:1	20 1	16.98
Y-27630	40,000 ct	2,000 ct	500	.06	.06	.06	.5	4000	240	60	4.47:1	8.94.1	16.98
Y-27635	40,000 ct	4,000 ct	1000	.06	.06	.06	.5	4000	480	120	3.16·1	6.32·1	17.62
Y-27640	40,000 ct	20,000 ct	5000	.06	.06	.06	.5	4000	2400	600	1.41:1	2.83:1	16.98
Y-27645	*40,000 ct	40,000 ct	-	.06	.06	.06	.5	4000	4800	-	1:1	-	16.98
Y-27650	50,000 ct	200 ct	50	.05	.05	.05	.45	5000	24	6	15.8:1	31.6:1	18.56
Y-27655	50,000 ct	500 ct	125	.05	.05	.05	.45	5000	60	15	10:1	20.1	18.56
Y-27660	50,000 ct	600 ct	150	.05	.05	.05	.45	5000	72	18	9.13:1	18.26:1	18.56
Y-27665	60,000 ct	15,000 ct	3750	.04	.04	.04	.41	6000	1800	450	2:1	4:1	18.56
Y-27670	62,500 ct	50 ct	12.5	.04	.04	.04	.4	6250	6	1.5	35.4:1	70.7:1	18.56
Y-27675	80,000 ct	15,000 ct	3750	.03	.03	.03	.35	8000	1800	450	2.3.1	4.6:1	18.56
Y-27680	90,000 ct	10,000 ct	2500	.028	.028	.028	.33	9000	1200	300	3:1	6:1	18.56
Y-27685	95,000 ct	15,000 ct	3750	.026	.026	.026	.32	9500	1800	450	2.52:1	5.03:1	18.56
Y-27690	100,000 ct	60 ct	15	.025	.025	.025	.31	10,000	7.2	1.8	40.8.1	81.6:1	19.49
Y-27695	100,000 ct	100 ct	25	.025	.025	.025	.31	10,000	12	3	31.6:1	63.2:1	19.49
Y-27700	100,000 ct	500 ct	125	.025	.025	.025	.31	10,000	60	15	14.1:1	28.3:1	19.49
Y-27705	100,000 ct	10,000 ct	2500	.025	.025	.025	.31	10,000	1200	300	3.16:1	6.32:1	19.49
Y-SHIELD	MU-METAL SHIELD .37" DIA. X .46" HT. (9.4MM DIA. X 11.7MM HT.) SINGLE SHIELD												1.79
YXX-SHIELD	MU-METAL SHIELD .395" DIA. X .47" HT. (10.1MM DIA. X 11.9"MM HT.) USE WITH Y-SHIELD FOR DOUBLE SHIELDING												1.79

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

* INCLUDES ELECTROSTATIC SHIELD

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS.

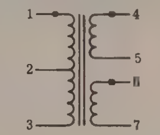
TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR.

Y-Series Plug-In		INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9***
Y-27750	SERIES	.075 .06	10 30	10.5	11.56
	PARALLEL	.018 .015	20 60	2.6	
Y-27760	SERIES	.3 .15	4 20	25	12.84
	PARALLEL	.075 .04	8 40	6.2	
Y-27770	SERIES	3.5 1.0	2 5	560	12.84
	PARALLEL	0.9 0.25	4 10	140	
Y-27780	SERIES	6.0 1.5	2 5	2100	12.84
	PARALLEL	1.5 0.38	4 10	525	
Y-27790	SERIES	20 8	1 3	5100	15.78
	PARALLEL	5 2	2 6	1275	

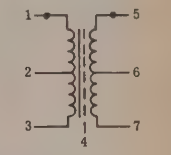
PICO's ultra-miniature transformers

Y SERIES Plug-In

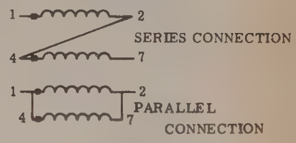
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

This Product is Patented

Delivery—
stock to one week

PICO
Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

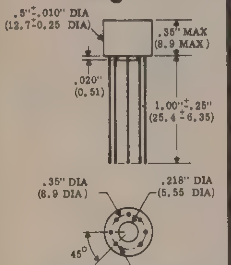
phone
914-699-5514

For immediate engineering assistance or to place an order—

Call Toll Free
800-431-1064

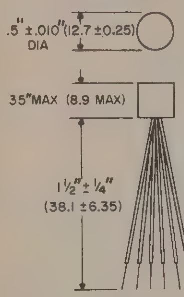
PICO's ultra-miniature transformers

L SERIES
Plug-In



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM
PIN #1

P SERIES
Insulated
Leads



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27 . . . .
All Units Meet MIL-T-27 and are Hermetically Sealed in a Metal Case. Audio Transformers are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . .
±3db, 300 Hz - 75 KHz At 1.0 Milliwatt
- MAXIMUM DISTORTION: . . . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz
- DIELECTRIC STRENGTH: . . . .
All Units Tested at 200 V RMS
- INSULATION RESISTANCE: . . .
Greater than 10,000 Megohms at 300 V DC
- WEIGHT: . . . .
5 Grams
- OPERATING TEMPERATURE: . .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: . . . .
Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

PICO PART NUMBER L-Series Plug-in	PICO PART NUMBER P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 *** L-Series	PICO PRICES 1-9 *** P-Series
L-8203	P-9203	20 ct	8 ct	2	.6	.4	.3	30.0	2	1.2	.3	1.58:1	3.16:1	14.38	13.89
L-8205	P-9205	20 ct	20 ct	5	.6	.4	.3	30.0	2	2.8	.7	1:1	2:1	14.38	13.89
L-8210	P-9210	32 ct	32 ct	8	.6	.4	.3	23.0	3.3	4.5	1.13	1:1	2:1	14.38	13.89
L-8215	P-9215	40 ct	40 ct	10	.6	.4	.3	21.0	3.7	5	1.25	1:1	2:1	14.38	13.89
L-8218	P-9218	48 ct	16 ct	4	.6	.4	.3	19.0	3.75	3	.75	1.73:1	3.46:1	14.38	13.89
L-8220	P-9220	50 ct	50 ct	12.5	.6	.4	.3	19.0	5	7	1.75	1:1	2:1	14.38	13.89
L-8225	P-9225	80 ct	32 ct	8	.6	.4	.3	15.0	7.5	4.3	1.13	1.58:1	3.16:1	14.38	13.89
L-8228	P-9228	100 ct	40 ct	10	.6	.4	.3	13.0	10.8	5	1.25	1.58:1	3.16:1	14.38	13.89
L-8230	P-9230	100 ct	100 ct	25	.6	.4	.3	13.0	10.8	12	3	1:1	2:1	14.38	13.89
L-8235	P-9235	120 ct	12.8 ct	3.2	.6	.4	.3	12.0	9.3	2.2	55	3.06:1	6.12:1	14.38	13.89
L-8240	P-9240	120 ct	60 ct	15	.6	.4	.3	12.0	9	7.2	1.8	1.41:1	2.83:1	14.38	13.89
L-8245	P-9245	120 ct	120 ct	30	.6	.4	.3	12.0	11.6	13	3.3	1:1	2:1	14.38	13.89
L-8250	P-9250	150 ct	12 ct	3	.6	.4	.3	11.0	11.2	2.2	.55	3.54:1	7.08:1	14.38	13.89
L-8255	P-9255	150 ct	50 ct	12.5	.6	.4	.3	11.0	13	6.8	1.7	1.73:1	3.46:1	14.38	13.89
L-8260	P-9260	150 ct	100 ct	25	.6	.4	.3	11.0	13	11.8	3	1.22:1	2.45:1	14.38	13.89
L-8265	P-9265	150 ct	150 ct	37.5	.6	.4	.3	11.0	13	18.3	4.6	1:1	2:1	14.38	13.89
L-8270	P-9270	150 ct	600 ct	150	.6	.4	.3	11.0	13	75	19	1:2	1:1	14.38	13.89
L-8275	P-9275	200 ct	200 ct	50	.6	.4	.3	10.0	19	21.3	5.4	1:1	2:1	14.38	13.89
L-8280	P-9280	300 ct	12 ct	3	.6	.4	.3	8.0	24	1.7	.43	5:1	10:1	14.38	13.89
L-8285	P-9285	300 ct	50 ct	12.5	.6	.4	.3	8.0	30	6.8	1.7	2.45:1	4.9:1	14.38	13.89
L-8290	P-9290	300 ct	150 ct	37.5	.6	.4	.3	8.0	30	18	4.6	1.41:1	2.83:1	14.38	13.89
L-8295	P-9295	300 ct	300 ct	75	.6	.4	.3	8.0	30	34	8.5	1:1	2:1	14.38	13.89
L-8300	P-9300	300 ct	600 ct	150	.6	.4	.3	8.0	30	60	15	1:1.41	1.41:1	14.38	13.89
L-8305	P-9305	320 ct	12.8 ct	3.2	.6	.4	.3	7.5	31	1.7	.43	5:1	10:1	14.38	13.89
L-8310	P-9310	400 ct	40 ct	10	.6	.4	.3	7.0	41	4.5	1.13	3.16:1	6.32:1	14.38	13.89
L-8315	P-9315	400 ct	120 ct	30	.6	.4	.3	7.0	41	12	3	1.83:1	3.65:1	14.38	13.89
L-8320	P-9320	400 ct	200 ct	50	.6	.4	.3	7.0	41	21.3	5.4	1.41:1	2.83:1	14.38	13.89
L-8325	P-9325	400 ct	400 ct	100	.6	.4	.3	7.0	41	37.5	9.4	1:1	2:1	14.38	13.89
L-8330	P-9330	400 ct	1000 ct	250	.6	.4	.3	7.0	41	96	24	1:1.58	1.26:1	14.38	13.89
L-8335	P-9335	400 ct	2000 ct	500	.6	.4	.3	7.0	41	212	53	1:2.24	1:1.12	14.38	13.89
L-8340	P-9340	400 ct	4000 ct	1000	.6	.4	.3	7.0	41	375	94	1:3.16	1:1.58	14.38	13.89
L-8342	P-9342	500 ct	12.8 ct	3.2	.6	.4	.3	6.0	48	1.7	.43	6.25:1	12.5:1	14.38	13.89
L-8344	P-9344	500 ct	16 ct	4	.6	.4	.3	6.0	48	1.9	.5	5.6:1	11.2:1	14.38	13.89
L-8345	P-9345	500 ct	50 ct	12.5	.6	.4	.3	6.0	39	6.8	1.7	3.16:1	6.32:1	14.38	13.89
L-8347	P-9347	500 ct	150 ct	37.5	.6	.4	.3	6.0	48	18	4.6	1.83:1	3.65:1	14.38	13.89
L-8350	P-9350	500 ct	500 ct	125	.6	.4	.3	6.0	48	54	13.5	1:1	2:1	14.38	13.89
L-8355	P-9355	*500 ct	500 ct	-	.6	.4	.3	6.0	48	68	-	1:1	-	14.98	14.38
L-8360	P-9360	500 ct	600 ct	150	.6	.4	.3	6.0	48	59	15	1:1.1	1.83:1	14.38	14.38
L-8365	P-9365	600 ct	12.8 ct	3.2	.6	.4	.3	5.5	53	1.7	.43	6.85:1	13.7:1	14.38	14.38
L-8367	P-9367	600 ct	30 ct	7.5	.6	.4	.3	5.5	53	4.2	1.1	4.47:1	8.94:1	14.38	14.38
L-8370	P-9370	600 ct	48 ct	12	.6	.4	.3	5.5	53	6.8	1.7	3.54:1	7.07:1	14.38	14.38
L-8375	P-9375	600 ct	200 ct	50	.6	.4	.3	5.5	53	21.3	5.3	1.73:1	3.46:1	14.38	13.89
L-8380**	P-9380	600 ct	600 ct	150	.6	.4	.3	5.5	57	79	20	1:1	2:1	14.38	13.89
L-8385**	P-9385	*600 ct	600 ct	-	.6	.4	.3	5.5	53	75	-	1:1	-	14.98	14.38
L-8387**	P-9387	600 ct	1200 ct	300	.6	.4	.3	5.5	53	105	26	1:1.41	1.41:1	14.38	13.89
L-8390	P-9390	640 ct	12.8 ct	3.2	.6	.4	.3	5.5	66	1.7	.43	7.07:1	14.14:1	14.38	13.89
L-8395	P-9395	700 ct	100 ct	25	.6	.4	.3	5.0	69	12	3	2.65:1	5.29:1	14.38	13.89
L-8400	P-9400	800 ct	12.8 ct	3.2	.6	.4	.3	5.0	75	1.7	.43	7.9:1	15.8:1	14.38	13.89
L-8405	P-9405	800 ct	48 ct	12	.6	.4	.3	5.0	75	6.8	1.7	4.08:1	8.16:1	14.38	13.89
L-8410	P-9410	800 ct	800 ct	200	.6	.4	.3	5.0	75	105	26	1:1	2:1	14.38	13.89
L-8415	P-9415	900 ct	600 ct	150	.6	.4	.3	4.5	79	75	19	1.22:1	2.45:1	14.38	13.89
L-8420	P-9420	1000 ct	12 ct	3	.6	.4	.3	4.5	103	1.6	.4	9.13:1	18.3:1	14.38	13.89
L-8425	P-9425	1000 ct	50 ct	12.5	.6	.4	.3	4.5	103	6.4	1.6	4.47:1	8.94:1	14.38	13.89
L-8430	P-9430	1000 ct	1000 ct	250	.6	.4	.3	4.5	103	115	29	1:1	2:1	14.38	13.89
L-8435	P-9435	1060 ct	12.8 ct	3.2	.6	.4	.3	4.0	108	1.7	.43	9.1:1	18.2:1	14.38	13.89
L-8440	P-9440	1200 ct	12.8 ct	3.2	.6	.4	.3	4.0	113	1.7	.43	9.68:1	19.4:1	14.38	13.89
L-8445	P-9445	1200 ct	500 ct	125	.6	.4	.3	4.0	113	54	13.5	1.55:1	3.1:1	14.38	13.89
L-8450	P-9450	1200 ct	1200 ct	300	.6	.4	.3	4.0	113	126	31.6	1:1	2:1	14.38	13.89
L-8455	P-9455	*1200 ct	1200 ct	-	.6	.4	.3	4.0	111	125	-	1:1	-	14.98	14.38
L-8460	P-9460	1500 ct	12 ct	3	.6	.4	.3	3.5	126	1.6	.4	11.2:1	22.4:1	14.38	13.89
L-8465	P-9465	1500 ct	500 ct	125	.6	.4	.3	3.5	126	68	17	1.73:1	3.46:1	14.38	13.89
L-8470	P-9470	*1500 ct	600 ct	-	.6	.4	.3	3.5	126	94	-	1.58:1	-	14.98	14.38
L-8475	P-9475	*1500 ct	1500 ct	-	.6	.4	.3	3.5	126	176	-	1:1	-	14.98	14.38
L-8480	P-9480	1600 ct	12.8 ct	3.2	.6	.4	.3	3.5	130	1.7	.43	11.2:1	22.4:1	14.38	13.89
L-8483	P-9483	2000 ct	8 ct	2	.6	.4	.3	3.0	210	1.2	.3	15.8:1	31.6:1	14.38	13.89
L-8485	P-9485	2000 ct	2000 ct	500	.6	.4	.3	3.0	198	218	55	1:1	2:1	14.38	13.89
L-8490	P-9490	*2000 ct	2000 ct	-	.6	.4	.3	3.0	198	218	-	1:1	-	14.38	13.89
L-8495	P-9495	2000 ct	8000 ct	2000	.6	.4	.3	3.0	198	850	213	1:2	1:1	14.38	13.89
L-8497	P-9497	2500 ct	2500 ct	625	.6	.4	.3	2.5	220	305	76	1:1	2:1	14.38	13.89
L-8500	P-9500	3000 ct	3000 ct	750	.6	.4	.3	2.5	243	335	84	1:1	2:1	14.38	13.89

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery—stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

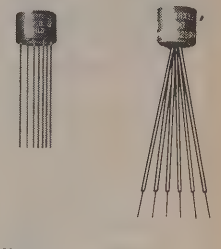
PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***	
L-Series Plug-in	P-Series Insulated Leads		SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8505	P-9505	*3000 ct	3000 ct	-	.6	.4	.3	2.5	304	335	-	1:1	-	14.98	14.38
L-8510	P-9510	3600 ct	3600 ct	900	.6	.4	.3	2.5	330	366	92	1:1	2:1	14.38	13.89
L-8512	P-9512	4000 ct	16 ct	4	.6	.4	.3	2.0	350	3	.75	15.8:1	31.6:1	14.38	13.89
L-8514	P-9514	4000 ct	600 ct	150	.6	.4	.3	2.0	350	76	19	2.58:1	5.16:1	14.38	13.89
L-8515	P-9515	4000 ct	1000 ct	250	.6	.4	.3	2.0	350	115	29	2:1	4:1	14.38	13.89
L-8520	P-9520	*4000 ct	8000 ct	-	.6	.4	.3	2.0	350	1062	-	1:1.41	-	14.98	14.38
L-8525	P-9525	5000 ct	500 ct	125	.6	.4	.3	2.0	350	67	17	3.16:1	6.32:1	14.38	13.89
L-8530	P-9530	5000 ct	5000 ct	1250	.6	.4	.3	2.0	390	538	135	1:1	2:1	14.38	13.89
L-8535	P-9535	7500 ct	50 ct	12.5	.6	.4	.3	1.5	600	7	1.75	12.2:1	24.5:1	15.96	15.49
L-8540	P-9540	7500 ct	100 ct	25	.6	.4	.3	1.5	600	12	3	8.66:1	17.3:1	15.96	15.49
L-8545	P-9545	7500 ct	600 ct	150	.6	.4	.3	1.5	600	78	19.5	3.54:1	7.07:1	15.96	15.49
L-8550	P-9550	7500 ct	2500 ct	625	.6	.4	.3	1.5	600	305	77	1.73:1	3.46:1	15.96	15.49
L-8555	P-9555	*7500 ct	7500 ct	-	.6	.4	.3	1.5	750	828	-	1:1	-	17.09	15.95
L-8560	P-9560	8000 ct	12.8 ct	3.2	.6	.4	.3	1.5	750	1.7	.43	25:1	50:1	15.96	15.49
L-8565	P-9565	8000 ct	1000 ct	250	.6	.4	.3	1.5	750	115	29	2.83:1	5.66:1	15.96	15.49
L-8570	P-9570	*8000 ct	1200 ct	-	.6	.4	.3	1.5	750	158	-	2.58:1	-	17.09	15.95
L-8575	P-9575	*9000 ct	9000 ct	-	.6	.4	.3	1.4	796	1100	-	1:1	-	17.09	15.95
L-8580	P-9580	10,000 ct	12.8 ct	3.2	.6	.4	.3	1.4	1048	1.7	.43	28:1	56:1	15.96	15.49
L-8585	P-9585	10,000 ct	16 ct	4	.6	.4	.3	1.4	1048	3	.75	25:1	50:1	15.96	15.49
L-8590	P-9590	10,000 ct	100 ct	25	.6	.4	.3	1.4	839	12	3	10:1	20:1	15.96	15.49
L-8595	P-9595	10,000 ct	200 ct	50	.6	.4	.3	1.4	839	27	6.7	7.07:1	14.14:1	15.96	15.49
L-8600	P-9600	10,000 ct	500 ct	125	.6	.4	.3	1.4	850	67	17	4.47:1	8.94:1	15.96	15.49
L-8605	P-9605	10,000 ct	600 ct	150	.6	.4	.3	1.4	850	74	18.5	4.08:1	8.16:1	15.96	15.49
L-8610	P-9610	10,000 ct	1000 ct	250	.6	.4	.3	1.4	850	115	29	3.16:1	6.32:1	15.96	15.49
L-8615	P-9615	10,000 ct	1200 ct	300	.6	.4	.3	1.4	850	158	39.5	2.89:1	5.77:1	15.96	15.49
L-8620	P-9620	10,000 ct	1500 ct	375	.6	.4	.3	1.4	850	177	44	2.58:1	5.16:1	15.96	15.49
L-8625	P-9625	10,000 ct	2000 ct	500	.6	.4	.3	1.4	850	255	64	2.24:1	4.47:1	15.96	15.49
L-8630	P-9630	10,000 ct	5000 ct	1250	.6	.4	.3	1.4	850	630	158	1.41:1	2.83:1	15.96	15.49
L-8635	P-9635	10,000 ct	7500 ct	1875	.6	.4	.3	1.4	850	772	193	1.15:1	2.3:1	15.96	15.49
L-8640	P-9640	10,000 ct	10,000 ct	2500	.6	.4	.3	1.4	866	1215	304	1:1	2:1	15.96	15.49
L-8645	P-9645	*10,000 ct	10,000 ct	-	.6	.4	.3	1.4	1060	1215	-	1:1	-	17.09	15.95
L-8650	P-9650	15,000 ct	400 ct	100	.6	.4	.3	1.0	1305	47	12	6.12:1	12.24:1	15.96	15.49
L-8652	P-9652	15,000 ct	500 ct	125	.6	.4	.3	1.0	1305	53	13	5.48:1	10.95:1	15.96	15.49
L-8655	P-9655	15,000 ct	600 ct	150	.6	.4	.3	1.0	1305	72.5	18	5:1	10:1	15.96	15.49
L-8660	P-9660	15,000 ct	10,000 ct	2500	.6	.4	.3	1.0	1305	1215	304	1.22:1	2.45:1	15.96	15.49
L-8665	P-9665	*15,000 ct	15,000 ct	-	.6	.4	.3	1.0	1305	1800	-	1:1	-	17.09	15.95
L-8670	P-9670	15,000 ct	15,000 ct	3750	.6	.4	.3	1.0	1305	1800	450	1:1	2:1	15.96	15.49
L-8675	P-9675	16,000 ct	1000 ct	250	.6	.4	.3	1.0	1343	115	29	4:1	8:1	15.96	15.49
L-8680	P-9680	20,000 ct	500 ct	125	.5	.4	.3	1.0	1560	68	17	6.33:1	12.65:1	17.09	15.95
L-8685	P-9685	20,000 ct	600 ct	150	.5	.4	.3	1.0	1560	75	19	5.77:1	11.55:1	17.09	15.95
L-8690	P-9690	20,000 ct	800 ct	200	.5	.4	.3	1.0	1560	108	27	5:1	10:1	17.09	15.95
L-8695	P-9695	20,000 ct	1000 ct	250	.5	.4	.3	1.0	1560	121	30.5	4.47:1	8.94:1	17.09	15.95
L-8700	P-9700	20,000 ct	5000 ct	1250	.5	.4	.3	1.0	1560	672	168	2:1	4:1	17.09	15.95
L-8705	P-9705	20,000 ct	10,000 ct	2500	.5	.4	.3	1.0	1560	1520	380	1.41:1	2.83:1	17.09	15.95
L-8710	P-9710	*20,000 ct	20,000 ct	-	.5	.4	.3	1.0	1560	2727	682	1:1	-	17.76	17.09
L-8715	P-9715	25,000 ct	500 ct	125	.4	.4	.3	0.8	2170	68	17	7.07:1	14.14:1	17.09	15.95
L-8720	P-9720	25,000 ct	1000 ct	250	.4	.4	.3	0.8	2170	120	30	5:1	10:1	17.09	15.95
L-8725	P-9725	30,000 ct	50 ct	12.5	.33	.33	.3	0.8	2400	7	1.75	24.5:1	49:1	17.76	17.09
L-8730	P-9730	30,000 ct	1200 ct	300	.33	.33	.3	0.8	2400	156	39	5:1	10:1	17.76	17.09
L-8732	P-9732	30,000 ct	500 ct	125	.33	.33	.3	0.8	2400	68	17	7.75:1	15.5:1	17.76	17.09
L-8734	P-9734	30,000 ct	200 ct	50	.33	.33	.3	0.8	2400	29	7.2	12.25:1	24.5:1	17.76	17.09
L-8735	P-9735	30,000 ct	5000 ct	1250	.33	.33	.3	0.8	2400	673	169	2.45:1	4.9:1	17.76	17.09
L-8740	P-9740	30,000 ct	10,000 ct	2500	.33	.33	.3	0.8	2400	1520	380	1.73:1	3.46:1	17.76	17.09
L-8745	P-9745	*30,000 ct	30,000 ct	-	.33	.33	.3	0.8	3000	3310	-	1:1	-	19.08	17.94
L-8750	P-9750	40,000 ct	400 ct	100	.25	.25	.25	0.7	3400	57	14.3	10:1	20:1	19.08	17.94
L-8755	P-9755	40,000 ct	2000 ct	500	.25	.25	.25	0.7	3400	268	67	4.47:1	8.94:1	19.08	17.94
L-8760	P-9760	40,000 ct	4000 ct	1000	.25	.25	.25	0.7	3400	476	119	3.16:1	6.32:1	19.08	17.94
L-8765	P-9765	40,000 ct	20,000 ct	5000	.25	.25	.25	0.7	3400	2700	675	1.41:1	2.83:1	19.08	17.94
L-8770	P-9770	*40,000 ct	40,000 ct	-	.25	.25	.25	0.7	3400	4750		1:1	-	21.27	20.34
L-8775	P-9775	50,000 ct	200 ct.	50	.2	.2	.2	0.6	4850	27	6.7	15.8:1	31.6:1	21.27	20.34
L-8777	P-9777	50,000 ct	500 ct	125	.2	.2	.2	0.6	4850	68	17	10:1	20:1	21.27	20.34
L-8779	P-9779	50,000 ct	600 ct	150	.2	.2	.2	0.6	4850	75	18.5	9.13:1	18.26:1	21.27	20.34
L-8780	P-9780	60,000 ct	15,000 ct	3750	.16	.16	.16	0.5	5275	2250	563	2:1	4:1	22.94	22.37
L-8785	P-9785	62,500 ct	50 ct	12.5	.16	.16	.16	0.5	5445	8.7	2.2	35.4:1	70.7:1	22.94	22.37
L-8787	P-9787	80,000 ct	15,000 ct	3750	.12	.12	.12	0.4	6130	2250	563	2.3:1	4.6:1	22.94	22.37
L-8790	P-9790	90,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8140	1520	380	3:1	6:1	24.09	23.22
L-8795	P-9795	95,000 ct	15,000 ct	3750	.1	.1	.1	0.4	8400	2250	563	2.52:1	5.03:1	24.09	23.22
L-8800	P-9800	100,000 ct	60 ct	15	.1	.1	.1	0.4	8750	9.2	2.3	40.8:1	81.6:1	24.09	23.22
L-8805	P-9805	100,000 ct	100 ct	25	.1	.1	.1	0.4	8750	15	3.8	31.6:1	63.2:1	24.09	23.22
L-8810	P-9810	100,000 ct	500 ct	125	.1	.1	.1	0.4	8750	68	17	14.1:1	28.3:1	24.09	23.22
L-8815	P-9815	100,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8750	1535	385	3.16:1	6.32:1	24.09	23.22
L-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)													1.80	
P-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)														1.79

*INCLUDES ELECTROSTATIC SHIELD

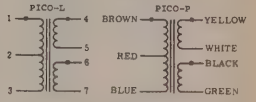
*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

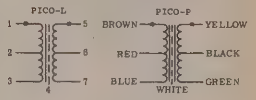
L SERIES Plug-In   P SERIES Insulated Leads



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

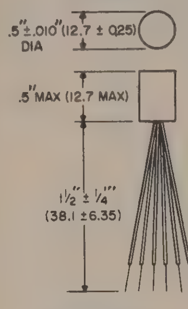
phone
914-699-5514

For immediate engineering assistance or to place an order—

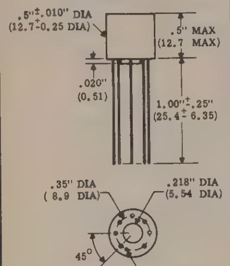
Call Toll Free 800-431-1064

PICO's ultra-miniature transformers

K SERIES Insulated Leads



N SERIES Plug-In



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27 . . . .
All Units Meet MIL-T-27, and Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . .
±3 db, 150 Hz - 75 KHz at 1.0 Milliwatt (When Primary Impedance ≥ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- MAXIMUM DISTORTION: . . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz
- DIELECTRIC STRENGTH: . . . .
All Units Tested at 200 V RMS
- INSULATION RESISTANCE: . . .
Greater Than 10,000 Megohms at 300 V DC
- WEIGHT: . . . .
7.5 Grams
- OPERATING TEMPERATURE: . .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: . . . .
Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

Delivery: Stock to one week

This Product is Patented

PICO PART NUMBER K-Series Insulated Leads	PICO PART NUMBER N-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 *** K-Series	PICO PRICES 1-9 *** N-Series
K-7203	N-6203	20 ct	8 ct	2	1.0	.75	.11	22.0	1.75	1.0	.25	1.58:1	3.16:1	13.89	14.39
K-7205	N-6205	20 ct	20 ct	5	1.0	.75	.11	22.0	1.75	2.5	.63	1:1	2:1	13.89	14.39
K-7210	N-6210	32 ct	32 ct	8	1.0	.75	.11	18.0	2.7	3.7	.93	1:1	2:1	13.89	14.39
K-7215	N-6215	40 ct	40 ct	10	1.0	.75	.11	16.0	3	5.2	1.3	1:1	2:1	13.89	14.39
K-7218	N-6218	48 ct	16 ct	4	1.0	.75	.11	13.0	4.5	2.4	.6	1.73:1	3.46:1	13.89	14.39
K-7220	N-6220	50 ct	50 ct	12.5	1.0	.75	.11	13.0	4.5	6.2	1.6	1:1	2:1	13.89	14.39
K-7225	N-6225	80 ct	32 ct	8	1.0	.75	.11	11.0	6.6	3.7	.93	1.58:1	3.16:1	13.89	14.39
K-7228	N-6228	100 ct	40 ct	10	1.0	.75	.11	10.0	9.7	5.6	1.4	1.58:1	3.16:1	13.89	14.39
K-7230	N-6230	100 ct	100 ct	25	1.0	.75	.11	10.0	9.7	11	2.8	1:1	2:1	13.89	14.39
K-7235	N-6235	120 ct	12.8 ct	3.2	1.0	.75	.11	9.0	10.8	1.6	.4	3.06:1	6.12:1	13.89	14.39
K-7240	N-6240	120 ct	60 ct	15	1.0	.75	.11	9.0	10.8	8.5	2.2	1.41:1	2.83:1	13.89	14.39
K-7245	N-6245	120 ct	120 ct	30	1.0	.75	.11	9.0	10.8	15	3.8	1:1	2:1	13.89	14.39
K-7250	N-6250	150 ct	12 ct	3	1.0	.75	.11	8.0	13.5	1.75	.44	3.54:1	7.08:1	13.89	14.39
K-7255	N-6255	150 ct	50 ct	12.5	1.0	.75	.11	8.0	12	5.8	1.5	1.73:1	3.46:1	13.89	14.39
K-7260	N-6260	150 ct	100 ct	25	1.0	.75	.11	8.0	12	13	3.3	1.22:1	2.44:1	13.89	14.39
K-7265	N-6265	150 ct	150 ct	37.5	1.0	.75	.11	8.0	12	20	5	1:1	2:1	13.89	14.39
K-7270	N-6270	150 ct	600 ct	150	1.0	.75	.11	8.0	12	82	20.5	1:2	1:1	13.89	14.39
K-7275	N-6275	200 ct	200 ct	50	1.0	.75	.11	7.0	17	24	6.0	1:1	2:1	13.89	14.39
K-7280	N-6280	300 ct	12 ct	3	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	13.89	14.39
K-7285	N-6285	300 ct	50 ct	12.5	1.0	.75	.11	5.0	27	6.2	1.6	2.45:1	4.9:1	13.89	14.39
K-7290	N-6290	300 ct	150 ct	37.5	1.0	.75	.11	5.0	26	21	5.3	1.41:1	2.83:1	13.89	14.39
K-7295	N-6295	300 ct	300 ct	75	1.0	.75	.11	5.0	27	38	9.5	1:1	2:1	13.89	14.39
K-7300	N-6300	300 ct	600 ct	150	1.0	.75	.11	5.0	27	66	17	1:1.41	1.41:1	13.89	14.39
K-7305	N-6305	320 ct	12.8 ct	3.2	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	13.89	14.39
K-7310	N-6310	400 ct	40 ct	10	1.0	.75	.11	5.0	39	4.3	1.1	3.16:1	6.32:1	13.89	14.39
K-7315	N-6315	400 ct	120 ct	30	1.0	.75	.11	5.0	30	14	3.5	1:83:1	3.65:1	13.89	14.39
K-7320	N-6320	400 ct	200 ct	50	1.0	.75	.11	5.0	39	24	6	1.41:1	2.83:1	13.89	14.39
K-7325	N-6325	400 ct	400 ct	100	1.0	.75	.11	5.0	39	42	10.5	1:1	2:1	13.89	14.39
K-7330	N-6330	400 ct	1000 ct	250	1.0	.75	.11	5.0	39	109	28	1:1.58	1.26:1	13.89	14.39
K-7335	N-6335	400 ct	2000 ct	500	1.0	.75	.11	5.0	39	198	49	1:2.24	1:1.12	13.89	14.39
K-7340	N-6340	400 ct	4000 ct	1000	1.0	.75	.11	5.0	39	436	109	1:3.16	1:1.58	13.89	14.39
K-7342	N-6342	500 ct	12.8 ct	3.2	1.0	.75	.11	4.5	43	1.6	.4	6.25:1	12.5:1	13.89	14.39
K-7344	N-6344	500 ct	16 ct	4	1.0	.75	.11	4.5	43	2.3	.56	5.6:1	11.2:1	13.89	14.39
K-7345	N-6345	500 ct	50 ct	12.5	1.0	.75	.11	4.5	43	5.8	1.5	3.16:1	6.32:1	13.89	14.39
K-7347	N-6347	500 ct	150 ct	37.5	1.0	.75	.11	4.5	43	19.8	5	1.83:1	3.65:1	13.89	14.39
K-7350	N-6350	500 ct	500 ct	125	1.0	.75	.11	4.5	43	60	15	1:1	2:1	13.89	14.39
K-7355	N-6355	*500 ct	500 ct	-	1.0	.75	.11	4.5	43	60	-	1:1	-	14.38	14.98
K-7360	N-6360	500 ct	600 ct	150	1.0	.75	.11	4.5	43	66	17	1:1.1	1.83:1	13.89	14.39
K-7365	N-6365	600 ct	12.8 ct	3.2	1.0	.75	.11	4.0	68	1.75	.44	6.85:1	13.7:1	13.89	14.39
K-7367	N-6367	600 ct	30 ct	7.5	1.0	.75	.11	4.0	60	3.7	.93	4.47:1	8.94:1	13.89	14.39
K-7370	N-6370	600 ct	48 ct	12	1.0	.75	.11	4.0	60	5.9	1.5	3.54:1	7.07:1	13.89	14.39
K-7375	N-6375	600 ct	200 ct	50	1.0	.75	.11	4.0	60	25	6.3	1.73:1	3.46:1	13.89	14.39
K-7380**	N-6380**	600 ct	600 ct	150	1.0	.75	.11	4.0	60	66	17	1:1	2:1	13.89	14.39
K-7385**	N-6385**	*600 ct	600 ct	-	1.0	.75	.11	4.0	60	68	-	1:1	-	14.38	14.98
K-7386**	N-6386**	*600 ct	900 ct	-	1.0	.75	.11	4.0	60	104	-	1:1.22	-	14.38	14.98
K-7387**	N-6387**	600 ct	1200 ct	300	1.0	.75	.11	4.0	60	116	29	1:1.41	1.41:1	13.89	14.39
K-7390	N-6390	640 ct	12.8 ct	3.2	1.0	.75	.11	4.0	69	1.75	.44	7.07:1	14.14:1	13.89	14.39
K-7395	N-6395	700 ct	100 ct	25	1.0	.75	.11	4.0	62	10.6	2.7	2.65:1	5.29:1	13.89	14.39
K-7400	N-6400	800 ct	12.8 ct	3.2	1.0	.75	.11	3.5	78	1.75	.44	7.91:1	15.8:1	13.89	14.39
K-7405	N-6405	800 ct	48 ct	12	1.0	.75	.11	3.5	74	6	1.5	4.08:1	8.16:1	13.89	14.39
K-7410	N-6410	800 ct	800 ct	200	1.0	.75	.11	3.5	74	102	26	1:1	2:1	13.89	14.39
K-7415	N-6415	900 ct	600 ct	150	1.0	.75	.11	3.0	90	66	17	1.23:1	2.45:1	13.89	14.39
K-7417**	N-6417**	*900 ct	900 ct	-	1.0	.75	.11	3.0	90	102	-	1:1	-	14.38	14.98
K-7420	N-6420	1000 ct	12 ct	3	1.0	.75	.11	3.0	115	1.75	.44	9.13:1	18.26:1	13.89	14.39
K-7425	N-6425	1000 ct	50 ct	12.5	1.0	.75	.11	3.0	100	5.8	1.5	4.47:1	8.94:1	13.89	14.39
K-7430	N-6430	1000 ct	1000 ct	250	1.0	.75	.11	3.0	75	103	26	1:1	2:1	13.89	14.39
K-7435	N-6435	1060 ct	12.8 ct	3.2	1.0	.75	.11	3.0	115	1.75	.44	9.1:1	18.2:1	13.89	14.39
K-7440	N-6440	1200 ct	12.8 ct	3.2	1.0	.75	.11	3.0	122	1.75	.44	9.68:1	19.4:1	13.89	14.39
K-7445	N-6445	1200 ct	500 ct	125	1.0	.75	.11	3.0	113	63	16	1.55:1	3.1:1	13.89	14.39
K-7450	N-6450	1200 ct	1200 ct	300	1.0	.75	.11	3.0	113	155	39	1:1	2:1	13.89	14.39
K-7455	N-6455	*1200 ct	1200 ct	-	1.0	.75	.11	3.0	109	150	-	1:1	-	14.38	14.98
K-7460	N-6460	1500 ct	12 ct	3	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	13.89	14.39
K-7465	N-6465	1500 ct	500 ct	125	1.0	.75	.11	2.5	150	60	15	1.73:1	3.46:1	13.89	14.39
K-7470	N-6470	*1500 ct	600 ct	-	1.0	.75	.11	2.5	150	66	-	1.58:1	-	14.38	14.98
K-7475	N-6475	*1500 ct	1500 ct	-	1.0	.75	.11	2.5	150	168	-	1:1	-	14.38	14.98
K-7480	N-6480	1600 ct	12.8 ct	3.2	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	13.89	14.39
K-7483	N-6483	2000 ct	8 ct	2	1.0	.75	.11	2.0	250	1.0	.25	15.8:1	31.6:1	13.89	14.39
K-7485	N-6485	2000 ct	2000 ct	500	1.0	.75	.11	2.0	185	255	64	1:1	2:1	13.89	14.39
K-7490	N-6490	*2000 ct	2000 ct	-	1.0	.75	.11	2.0	175	240	-	1:1	-	14.38	14.98
K-7495	N-6495	2000 ct	8000 ct	2000	1.0	.75	.11	2.0	185	1015	254	1:2	1:1	13.89	14.39
K-7497	N-6497	2500 ct	2500 ct	625	1.0	.75	.11	2.0	245	268	68	1:1	2:1	13.89	14.39
K-7500	N-6500	3000 ct	3000 ct	750	1.0	.75	.11	1.8	267	295	74	1:1	2:1	13.89	14.39
K-7505	N-6505	*3000 ct	3000 ct	-	1.0	.75	.11	1.8	267	368	-	1:1	-	14.38	14.98
K-7510	N-6510	3600 ct	3600 ct	900	1.0	.75	.11	1.5	300	413	103	1:1	2:1	13.89	14.39
K-7512	N-6512	4000 ct	16 ct	4	1.0	.75	.11	1.5	395	2.5	.65	15.8:1	31.6:1	13.89	14.39
K-7514**	N-6514**	4000 ct	600 ct	150	1.0	.75	.11	1.5	395	66	17	2.58:1	5.16:1	13.89	14.39

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

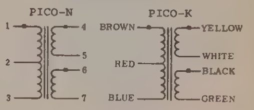
*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 * * *	
K-Series Insulated Leads	N-Series Plug-in		SER	PAR	1KHz higher	400 Hz and higher	150 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7515	N-6515	4000 ct	1000 ct	250	1.0	.75	.11	1.5	395	108	27	2:1	4:1	13.89	14.39
K-7520	N-6520	*4000 ct	8000 ct	-	1.0	.75	.11	1.5	390	955	-	1:1.41	-	14.38	14.98
K-7525	N-6525	5000 ct	500 ct	125	1.0	.75	.11	1.3	450	62	16	3.16:1	6.32:1	13.89	14.39
K-7530	N-6530	5000 ct	5000 ct	1250	1.0	.75	.11	1.3	450	620	155	1:1	2:1	13.89	14.39
K-7535	N-6535	7500 ct	50 ct	12.5	1.0	.75	.11	1.0	670	6	1.5	12.25:1	24.5:1	15.49	15.96
K-7540	N-6540	7500 ct	100 ct	25	1.0	.75	.11	1.0	670	11	2.8	8.66:1	17.32:1	15.49	15.96
K-7545	N-6545	7500 ct	600 ct	150	1.0	.75	.11	1.0	670	66	16.5	3.54:1	7.07:1	15.49	15.96
K-7550	N-6550	7500 ct	2500 ct	625	1.0	.75	.11	1.0	670	268	67	1.73:1	3.46:1	15.49	15.96
K-7555	N-6555	*7500 ct	7500 ct	-	1.0	.75	.11	1.0	670	925	-	1:1	-	15.95	17.09
K-7560	N-6560	8000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	765	1.75	.44	25:1	50:1	15.49	15.96
K-7565	N-6565	8000 ct	1000 ct	250	1.0	.75	.11	1.0	695	106	26.5	2.83:1	5.66:1	15.49	15.96
K-7570	N-6570	*8000 ct	1200 ct	-	1.0	.75	.11	1.0	715	153	-	2.58:1	-	15.95	17.09
K-7575	N-6575	*9000 ct	9000 ct	-	1.0	.75	.11	1.0	925	1020	-	1:1	-	15.95	17.09
K-7580	N-6580	10,000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	768	1.6	.4	28:1	56:1	15.49	15.96
K-7585	N-6585	10,000 ct	16 ct	4	1.0	.75	.11	1.0	756	1.7	.43	25:1	50:1	15.49	15.96
K-7590	N-6590	10,000 ct	100 ct	25	1.0	.75	.11	1.0	780	10	2.5	10:1	20:1	15.49	15.96
K-7595	N-6595	10,000 ct	200 ct	50	1.0	.75	.11	1.0	780	24	6	7.07:1	14.14:1	15.49	15.96
K-7600	N-6600	10,000 ct	500 ct	125	1.0	.75	.11	1.0	780	60	15	4.47:1	8.94:1	15.49	15.96
K-7605	N-6605	10,000 ct	600 ct	150	1.0	.75	.11	1.0	780	83	21	4.08:1	8.16:1	15.49	15.96
K-7610	N-6610	10,000 ct	1000 ct	250	1.0	.75	.11	1.0	780	106	27	3.16:1	6.32:1	15.49	15.96
K-7615	N-6615	10,000 ct	1200 ct	300	1.0	.75	.11	1.0	780	145	36	2.89:1	5.77:1	15.49	15.96
K-7620	N-6620	10,000 ct	1500 ct	375	1.0	.75	.11	1.0	780	160	40	2.58:1	5.16:1	15.49	15.96
K-7625	N-6625	10,000 ct	2000 ct	500	1.0	.75	.11	1.0	780	300	75	2.24:1	4.47:1	15.49	15.96
K-7630	N-6630	10,000 ct	5000 ct	1250	1.0	.75	.11	1.0	780	610	153	1.41:1	2.83:1	15.49	15.96
K-7635	N-6635	10,000 ct	7500 ct	1875	1.0	.75	.11	1.0	780	932	233	1.16:1	2.31:1	15.49	15.96
K-7640	N-6640	10,000 ct	10,000 ct	2500	1.0	.75	.11	1.0	780	1075	269	1:1	2:1	15.49	15.96
K-7645	N-6645	*10,000 ct	10,000 ct	-	1.0	.75	.11	1.0	715	985	-	1:1	-	15.95	17.09
K-7650	N-6650	15,000 ct	400 ct	100	.66	.66	.11	0.8	1165	52	13	6.12:1	12.25:1	15.49	15.96
K-7652	N-6652	15,000 ct	500 ct	125	.66	.66	.11	0.8	1165	60	15	5.48:1	10.95:1	15.49	15.96
K-7655	N-6655	15,000 ct	600 ct	150	.66	.66	.11	0.8	1165	80	20	5:1	10:1	15.49	15.96
K-7660	N-6660	15,000 ct	10,000 ct	2500	.66	.66	.11	0.8	1165	1050	263	1.22:1	2.45:1	15.49	15.96
K-7665	N-6665	*15,000 ct	15,000 ct	-	.66	.66	.11	0.[illegible]	1165	1600	-	1:1	-	15.95	17.09
K-7670	N-6670	15,000 ct	15,000 ct	3750	.66	.66	.11	0.8	1165	1600	400	1:1	2:1	15.49	15.96
K-7675	N-6675	16,000 ct	1000 ct	250	.62	.62	.11	0.8	1560	108	27	4:1	8:1	15.49	15.96
K-7680	N-6680	20,000 ct	500 ct	125	.5	.5	.11	0.7	1750	60	15	6.32:1	12.65:1	15.95	17.09
K-7685	N-6685	20,000 ct	600 ct	150	.5	.5	.11	0.7	1750	82	20.5	5.77:1	11.55:1	15.95	17.09
K-7690	N-6690	20,000 ct	800 ct	200	.5	.5	.11	0.7	1750	98	24.5	5:1	10:1	15.95	17.09
K-7695	N-6695	20,000 ct	1000 ct	250	.5	.5	.11	0.7	1750	135	34	4.47:1	8.94:1	15.95	17.09
K-7700	N-6700	20,000 ct	5000 ct	1250	.5	.5	.11	0.7	1750	610	153	2:1	4:1	15.95	17.09
K-7705	N-6705	20,000 ct	10,000 ct	2500	.5	.5	.11	0.7	1750	1075	269	1.41:1	2.83:1	15.95	17.09
K-7710	N-6710	*20,000 ct	20,000 ct	-	.5	.5	.11	0.7	1715	2370	-	1:1	-	17.09	17.76
K-7715	N-6715	25,000 ct	500 ct	125	.4	.4	.11	0.6	2470	60	15	7.07:1	14.14:1	15.95	17.09
K-7720	N-6720	25,000 ct	1000 ct	250	.4	.4	.11	0.6	2470	106	27	5:1	10:1	15.95	17.09
K-7725	N-6725	30,000 ct	50 ct	12.5	.33	.33	.11	0.5	2730	6.2	1.6	24.5:1	49:1	17.09	17.76
K-7730	N-6730	30,000 ct	1200 ct	300	.33	.33	.11	0.[illegible]	2815	156	39	5:1	10:1	17.09	17.76
K-7732	N-6732	30,000 ct	500 ct	125	.33	.33	.11	0.5	2730	61	15.3	7.7:1	15.5:1	17.09	17.76
K-7734	N-6734	30,000 ct	200 ct	50	.33	.33	.11	0.5	2730	24	6	12.2:1	24.5:1	17.09	17.76
K-7735	N-6735	30,000 ct	5000 ct	1250	.33	.33	.11	0.5	2730	620	155	2.45:1	4.9:1	17.09	17.76
K-7740	N-6740	30,000 ct	10,000 ct	2500	.33	.33	.11	0.5	2730	1090	272	1.73:1	3.46:1	17.09	17.76
K-7745	N-6745	*30,000 ct	30,000 ct	-	.33	.33	.11	0.5	2730	3740	-	1:1	-	17.94	19.08
K-7750	N-6750	40,000 ct	400 ct	100	.25	.25	.11	0.5	3150	53	13	10:1	20:1	17.94	19.08
K-7755	N-6755	40,000 ct	2000 ct	500	.25	.25	.11	0.5	3150	300	75	4.47:1	8.94:1	17.94	19.08
K-7760	N-6760	40,000 ct	4000 ct	1000	.25	.25	.11	0.5	3150	548	137	3.16:1	6.32:1	17.94	19.08
K-7765	N-6765	40,000 ct	20,000 ct	5000	.25	.25	.11	0.5	3150	3075	769	1.41:1	2.83:1	17.94	19.08
K-7770	N-6770	*40,000 ct	40,000 ct	~	.25	.25	.11	0.5	3940	4350	-	1:1	-	20.34	21.27
K-7775	N-6775	50,000 ct	200 ct	50	.2	.2	.11	0.4	4275	24	6	15.8:1	31.6:1	20.34	21.27
K-7777	N-6777	50,000 ct	500 ct	125	.2	.2	.11	0.4	4275	60	15	10:1	20:1	20.34	21.27
K-7778	N-6778	50,000 ct	600 ct	150	.2	.2	.11	0.4	4275	82	21	9.13:1	18.26:1	20.34	21.27
K-7779	N-6779	50,000 ct	50,000 ct	12,500	.2	.2	.11	0.4	4500	6270	1568	1:1	2:1	20.34	21.27
K-7780	N-6780	60,000 ct	15,000 ct	3750	.16	.16	.11	0.4	5960	1650	412	2:1	4:1	22.37	23.02
K-7785	N-6785	62,500 ct	50 ct	12.5	.16	.16	.11	0.4	5960	6	1.5	35.4:1	70.7:1	22.37	23.02
K-7787	N-6787	80,000 ct	15,000 ct	3750	.12	.12	.11	0.3	7200	1690	423	2.3:1	4.6:1	22.37	23.02
K-7789	N-6789	80,000 ct	80,000 ct	20,000	.12	.12	.11	0.3	7200	9920	2480	1:1	2:1	22.37	23.02
K-7790	N-6790	90,000 ct	10,000 ct	2500	.11	.11	.11	0.3	7500	1350	338	3:1	6:1	23.22	24.09
K-7795	N-6795	95,000 ct	15,000 ct	3750	.1	.1	.10	0.3	9550	1635	410	2.5:1	5:1	23.22	24.09
K-7800	N-6800	100,000 ct	60 ct	15	.1	.1	.10	0.3	10,000	8.5	2.2	40.8:1	81.6:1	23.22	24.09
K-7805	N-6805	100,000 ct	100 ct	25	.1	.1	.10	0.3	10,000	14	3.5	31.6:1	63.2:1	23.22	24.09
K-7810	N-6810	100,000 ct	500 ct	125	.1	.1	.10	0.3	10,000	62	15.5	14.1:1	28.3:1	23.22	24.09
K-7813	N-6813	100,000 ct	1000 ct	250	.1	.1	.10	0.3	10,000	140	35	10:1	20:1	23.22	24.09
K-7814	N-6814	100,000 ct	2000 ct	500	.1	.1	.10	0.3	10,000	248	62	7.07:1	14.14:1	23.22	24.09
K-7815	N-6815	100,000 ct	10,000 ct	2500	.1	.1	.10	0.3	10,000	1075	270	3.16:1	6.32:1	23.22	24.09
K-7820	N-6820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	24.45	25.17
K-7823	N-6823	200,000 ct	500 ct	125	.05	.05	.05	0.2	17,340	75	19	20:1	40:1	24.45	25.17
K-7825	N-6825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3:1	24.45	25.17
K-7830	N-6830	200,000 ct	10,000 ct	2500	.05	.05	.05	0.2	17,340	1350	336	4.47:1	8.94:1	24.45	25.17
K-7835	N-6835	200,000 ct	20,000 ct	5000	.05	.05	.05	0.2	17,340	3000	750	3.16:1	6.32:1	24.45	25.17
K-7837	N-6837	250,000 ct	200 ct	50	.04	.04	.04	0.2	17,340	28	7	35.4:1	70.7:1	25.17	25.82
K-7840	N-6840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6:1	25.17	25.82
K-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)													1.79	
N-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)														1.80

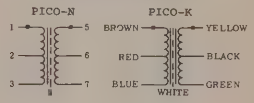
K SERIES
Insulated
Leads

N SERIES
Plug-In

SCHEMATIC FOR TRANSFORMERS
WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS
WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO
Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

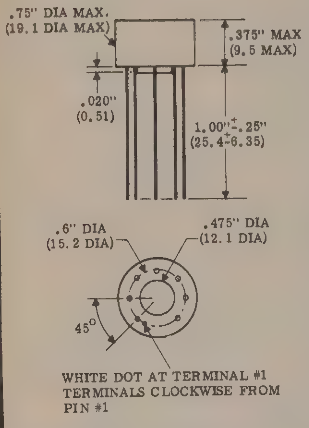
phone
914-699-5514

For immediate engineering assistance or to place an order—

Call Toll Free
800-431-1064

PICO's ultra-miniature transformers

R SERIES Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . .
All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.

- FREQUENCY RESPONSE: . . .
± 3 db, 75 Hz - 30 KHz at 1.0 Milliwatt.

- MAXIMUM DISTORTION: . . .
5% With Rated Power Level at 1 KHz, 300 Hz and 75 Hz

- DIELECTRIC STRENGTH: . . .
All Units Tested at 200 V RMS.

- INSULATION RESISTANCE: . .
Greater Than 10,000 Megohms at 300 V DC.

- WEIGHT: . . . .
12 Grams

- OPERATING TEMPERATURE: .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).

- TERMINALS: . . . .
Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.

- THERMAL SHOCK: . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery— stock to one week

PICO PART NUMBER R-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 * * *
		SER	PAR	1KHz and higher	300 Hz and higher	75 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	R-Series
R-20003	20 ct	8 ct	2	1.5	.9	.03	22	1.6	.76	.19	1.58:1	3.16:1	15.76
R-20005	20 ct	20 ct	5	1.5	.9	.03	22	1.6	1.9	.48	1:1	2:1	15.76
R-20010	32 ct	32 ct	8	1.5	.9	.03	17.5	2.56	3	.75	1:1	2:1	15.76
R-20015	40 ct	40 ct	10	1.5	.9	.03	16	3.2	3.8	.95	1:1	2:1	15.76
R-20018	48 ct	16 ct	4	1.5	.9	.03	14.5	3.84	1.52	.38	1.73:1	3.46:1	15.76
R-20020	50 ct	50 ct	12.5	1.5	.9	.03	14	4	4.75	1.19	1:1	2:1	15.76
R-20025	80 ct	32 ct	8	1.5	.9	.03	11	6.4	3	.75	1.58:1	3.16:1	15.76
R-20028	100 ct	40 ct	10	1.5	.9	.03	10	8	3.8	.95	1.58:1	3.16:1	15.76
R-20030	100 ct	100 ct	25	1.5	.9	.03	10	8	9.5	2.38	1:1	2:1	15.76
R-20035	120 ct	12.8 ct	3.2	1.5	.9	.03	9	9.6	1.22	.3	3.06:1	6.12:1	15.76
R-20040	120 ct	60 ct	15	1.5	.9	.03	9	9.6	5.7	1.4	1.41:1	2.83:1	15.76
R-20045	120 ct	120 ct	30	1.5	.9	.03	9	9.6	11.4	2.85	1:1	2:1	15.76
R-20050	150 ct	12 ct	3	1.5	.9	.03	8	12	1.14	.29	3.54:1	7.08:1	15.76
R-20055	150 ct	50 ct	12.5	1.5	.9	.03	8	12	4.75	1.19	1.73:1	3.46:1	15.76
R-20060	150 ct	100 ct	25	1.5	.9	.03	8	12	9.5	2.38	1.22:1	2.44:1	15.76
R-20065	150 ct	150 ct	37.5	1.5	.9	.03	8	12	14.3	3.56	1:1	2:1	15.76
R-20070	150 ct	600 ct	150	1.5	.9	.03	8	12	57	14.3	1:2	1:1	15.76
R-20075	200 ct	200 ct	50	1.5	.9	.03	7	16	19	4.75	1:1	2:1	15.76
R-20080	300 ct	12 ct	3	1.5	.9	.03	5.5	24	1.14	.29	5:1	10:1	15.76
R-20085	300 ct	50 ct	12.5	1.5	.9	.03	5.5	24	4.75	1.19	2.45:1	4.9:1	15.76
R-20090	300 ct	150 ct	37.5	1.5	.9	.03	5.5	24	14.25	3.56	1.41:1	2.83:1	15.76
R-20095	300 ct	300 ct	75	1.5	.9	.03	5.5	24	28.5	7.13	1:1	2:1	15.76
R-20100	300 ct	600 ct	150	1.5	.9	.03	5.5	24	57	14.25	1:1.41	1.41:1	15.76
R-20105	320 ct	12.8 ct	3.2	1.5	.9	.03	5.5	25.6	1.22	.3	5:1	10:1	15.76
R-20110	400 ct	40 ct	10	1.5	.9	.03	5	32	3.8	.95	3.16:1	6.32:1	15.76
R-20115	400 ct	120 ct	30	1.5	.9	.03	5	32	11.4	2.85	1.83:1	3.65:1	15.76
R-20120	400 ct	200 ct	50	1.5	.9	.03	5	32	19	4.75	1.41:1	2.83:1	15.76
R-20125	400 ct	400 ct	100	1.5	.9	.03	5	32	38	9.5	1:1	2:1	15.76
R-20130	400 ct	1000 ct	250	1.5	.9	.03	5	32	95	23.8	1:1.58	1.26:1	15.76
R-20135	400 ct	2000 ct	500	1.5	.9	.03	5	32	190	47.5	1:2.24	1:1.12	15.76
R-20140	400 ct	4000 ct	1000	1.5	.9	.03	5	32	380	95	1:3.16	1:1.58	15.76
R-20142	500 ct	12.8 ct	3.2	1.5	.9	.03	4.5	40	1.22	.3	6.25:1	12.5:1	15.76
R-20144	500 ct	16 ct	4	1.5	.9	.03	4.5	40	1.52	.38	5.6:1	11.2:1	15.76
R-20145	500 ct	50 ct	12.5	1.5	.9	.03	4.5	40	4.75	1.19	3.16:1	6.32:1	15.76
R-20147	500 ct	150 ct	37.5	1.5	.9	.03	4.5	40	14.25	3.56	1.83:1	3.65:1	15.76
R-20150	500 ct	500 ct	125	1.5	.9	.03	4.5	40	47.5	11.88	1:1	2:1	15.76
R-20155	*500 ct	500 ct	-	1.5	.9	.03	4.5	40	47.5	-	1:1	-	16.42
R-20160	500 ct	600 ct	150	1.5	.9	.03	4.5	40	57	14.25	1:1.1	1.83:1	15.76
R-20165	600 ct	12.8 ct	3.2	1.5	.9	.03	4	48	1.22	.3	6.85:1	13.7	15.76
R-20167	600 ct	30 ct	7.5	1.5	.9	.03	4	48	2.85	.71	4.47:1	8.94:1	15.76
R-20170	600 ct	48 ct	12	1.5	.9	.03	4	48	4.56	1.14	3.54:1	7.07:1	15.76
R-20175	600 ct	200 ct	50	1.5	.9	.03	4	48	19	4.75	1.73:1	3.46:1	15.76
R-20180**	600 ct	600 ct	150	1.5	.9	.03	4	48	57	14.25	1:1	2:1	15.76
R-20185**	*600 ct	600 ct	-	1.5	.9	.03	4	48	57	-	1:1	-	16.42
R-20186**	*600 ct	900 ct	-	1.5	.9	.03	4	48	85.5	-	1:1.22	-	16.42
R-20187**	600 ct	1200 ct	300	1.5	.9	.03	4	48	114	28.5	1:1.41	1.41:1	15.76
R-20190	640 ct	12.8 ct	3.2	1.5	.9	.03	4	51.2	1.22	.3	7.07:1	14.14:1	15.76
R-20195	700 ct	100 ct	25	1.5	.9	.03	3.5	56	9.5	2.38	2.65:1	5.29:1	15.76
R-20200	800 ct	12.8 ct	3.2	1.5	.9	.03	3.5	64	1.22	.3	7.91:1	15.8:1	15.76
R-20205	800 ct	48 ct	12	1.5	.9	.03	3.5	64	4.56	1.14	4.08:1	8.16:1	15.76
R-20210	800 ct	800 ct	200	1.5	.9	.03	3.5	64	76	19	1:1	2:1	15.76
R-20215	900 ct	600 ct	150	1.5	.9	.03	3	72	57	14.3	1.23:1	2.45:1	15.76
R-20217**	*900 ct	900 ct	-	1.5	.9	.03	3	72	85.5	-	1:1	-	16.42
R-20220	1000 ct	12 ct	3	1.5	.9	.03	3	80	1.14	.29	9.13:1	18.26:1	15.76
R-20225	1000 ct	50 ct	12.5	1.5	.9	.03	3	80	4.75	1.19	4.47:1	8.94:1	15.76
R-20230	1000 ct	1000 ct	250	1.5	.9	.03	3	80	95	23.8	1:1	2:1	15.76
R-20235	1060 ct	12.8 ct	3.2	1.5	.9	.03	3	85	1.22	.3	9.1:1	18.2:1	15.76
R-20240	1200 ct	12.8 ct	3.2	1.5	.9	.03	3	96	1.22	.3	9.68:1	19.4:1	15.76
R-20245	1200 ct	500 ct	125	1.5	.9	.03	3	96	47.5	11.88	1.55:1	3.1:1	15.76
R-20250	1200 ct	1200 ct	300	1.5	.9	.03	3	96	114	28.5	1:1	2:1	15.76
R-20255	*1200 ct	1200 ct	-	1.5	.9	.03	3	96	114	-	1:1	-	16.42
R-20260	1500 ct	12 ct	3	1.5	.9	.03	2.5	120	1.14	.29	11.18:1	22.36:1	15.76
R-20265	1500 ct	500 ct	125	1.5	.9	.03	2.5	120	47.5	11.88	1.73:1	3.46:1	15.76
R-20270	*1500 ct	600 ct	-	1.5	.9	.03	2.5	120	57	-	1.58:1	-	16.42
R-20275	*1500 ct	1500 ct	-	1.5	.9	.03	2.5	120	142	-	1:1	-	16.42
R-20280	1600 ct	12.8 ct	3.2	1.5	.9	.03	2.5	128	1.22	3	11.18:1	22.36:1	15.76
R-20283	2000 ct	8 ct	2	1.5	.9	.03	2.2	160	.76	.19	15.8:1	31.6:1	15.76
R-20285	2000 ct	2000 ct	500	1.5	.9	.03	2.2	160	190	47.5	1:1	2:1	15.76
R-20290	*2000 ct	2000 ct	-	1.5	.9	.03	2.2	160	190	-	1:1	-	16.42
R-20295	2000 ct	8000 ct	2000	1.5	.9	.03	2.2	160	760	190	1:2	1:1	15.76
R-20297	2500 ct	2500 ct	625	1.5	.9	.03	2	200	238	59.5	1:1	2:1	15.76
R-20300	3000 ct	3000 ct	750	1.5	.9	.03	1.8	240	285	71.3	1:1	2:1	15.76
R-20305	*3000 ct	3000 ct	-	1.5	.9	.03	1.8	240	285	-	1:1	-	16.42

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

* * * Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO PART NUMBER R-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9*** R-Series
		SER	PAR	1KHz and higher	300 Hz and higher	75 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	
R-20310	3600 ct	3600 ct	900	1.5	.9	.03	1.7	288	342	86	1:1	2:1	15.76
R-20312	4000 ct	16 ct	4	1.5	.9	.03	1.6	320	1.52	.38	15.8:1	31.6:1	15.76
R-20314**	4000 ct	600 ct	150	1.5	.9	.03	1.6	320	57	14.3	2.58:1	5.16:1	15.76
R-20315	4000 ct	1000 ct	250	1.5	.9	.03	1.6	320	95	23.8	2:1	4:1	15.76
R-20320	*4000 ct	8000 ct	-	1.5	.9	.03	1.6	320	760	-	1:1.41	-	16.42
R-20325	5000 ct	500 ct	125	1.5	.9	.03	1.4	400	47.5	11.88	3.16:1	6.32:1	15.76
R-20330	5000 ct	5000 ct	1250	1.5	.9	.03	1.4	400	475	119	1:1	2:1	15.76
R-20335	7500 ct	50 ct	12.5	1.3	.9	.03	1.2	600	4.75	1.19	12.25:1	24.5:1	17.49
R-20340	7500 ct	100 ct	25	1.3	.9	.03	1.2	600	9.5	2.38	8.66:1	17.32:1	17.49
R-20345	7500 ct	600 ct	150	1.3	.9	.03	1.2	600	57	14.3	3.54:1	7.07:1	17.49
R-20350	7500 ct	2500 ct	625	1.3	.9	.03	1.2	600	238	59.5	1.73:1	3.46:1	17.49
R-20355	*7500 ct	7500 ct	-	1.3	.9	.03	1.2	600	713	-	1:1	-	18.72
R-20360	8000 ct	12.8 ct	3.2	1.2	.9	.03	1.1	640	1.22	.3	25:1	50:1	17.49
R-20365	8000 ct	1000 ct	250	1.2	.9	.03	1.1	640	95	23.8	2.83:1	5.66:1	17.49
R-20370	*8000 ct	1200 ct	-	1.2	.9	.03	1.1	640	114	-	2.58:1	-	18.72
R-20375	*9000 ct	9000 ct	-	1.1	.9	.03	1.1	720	855	-	1:1	-	18.72
R-20380	10,000 ct	12.8 ct	3.2	1.0	.9	.03	1	800	1.22	.3	28:1	56:1	17.49
R-20385	10,000 ct	16 ct	4	1.0	.9	.03	1	800	1.52	.38	25:1	50:1	17.49
R-20390	10,000 ct	100 ct	25	1.0	.9	.03	1	800	9.5	2.38	10:1	20:1	17.49
R-20395	10,000 ct	200 ct	50	1.0	.9	.03	1	800	19	4.75	7.07:1	14.14:1	17.49
R-20400	10,000 ct	500 ct	125	1.0	.9	.03	1	800	47.5	11.88	4.47:1	8.94:1	17.49
R-20405	10,000 ct	600 ct	150	1.0	.9	.03	1	800	57	14.25	4.08:1	8.16:1	17.49
R-20410	10,000 ct	1000 ct	250	1.0	.9	.03	1	800	95	23.8	3.16:1	6.32:1	17.49
R-20415	10,000 ct	1200 ct	300	1.0	.9	.03	1	800	114	28.5	2.89:1	5.77:1	17.49
R-20420	10,000 ct	1500 ct	375	1.0	.9	.03	1	800	143	35.8	2.58:1	5.16:1	17.49
R-20425	10,000 ct	2000 ct	500	1.0	.9	.03	1	800	190	47.5	2.24:1	4.47:1	17.49
R-20430	10,000 ct	5000 ct	1250	1.0	.9	.03	1	800	475	119	1.41:1	2.83:1	17.49
R-20435	10,000 ct	7500 ct	1875	1.0	.9	.03	1	800	713	178	1.16:1	2.31:1	17.49
R-20440	10,000 ct	10,000 ct	2500	1.0	.9	.03	1	800	950	238	1:1	2:1	17.49
R-20445	*10,000 ct	10,000 ct	-	1.0	.9	.03	1	800	950	-	1:1	-	18.72
R-20450	15,000 ct	400 ct	100	.66	.66	.03	.8	1200	38	9.5	6.12:1	12.25:1	17.49
R-20452	15,000 ct	500 ct	125	.66	.66	.03	.8	1200	48	12	5.48:1	10.95:1	17.49
R-20455	15,000 ct	600 ct	150	.66	.66	.03	.8	1200	57	14.3	5:1	10:1	17.49
R-20460	15,000 ct	10,000 ct	2500	.66	.66	.03	.8	1200	950	238	1.22:1	2.45:1	17.49
R-20465	*15,000 ct	15,000 ct	-	.66	.66	.03	.8	1200	1430	-	1:1	-	18.72
R-20470	15,000 ct	15,000 ct	3750	.66	.66	.03	.8	1200	1430	357	1:1	2:1	17.49
R-20475	16,000 ct	1000 ct	250	.62	.62	.03	.8	1280	95	23.8	4:1	8:1	17.49
R-20480	20,000 ct	500 ct	125	.5	.5	.03	.7	1600	47.5	11.88	6.32:1	12.65:1	18.72
R-20485	20,000 ct	600 ct	150	.5	.5	.03	.7	1600	57	14.25	5.77:1	11.55:1	18.72
R-20490	20,000 ct	800 ct	200	.5	.5	.03	.7	1600	76	19	5:1	10:1	18.72
R-20495	20,000 ct	1000 ct	250	.5	.5	.03	.7	1600	95	23.8	4.47:1	8.94:1	18.72
R-20500	20,000 ct	5000 ct	1250	.5	.5	.03	.7	1600	475	119	2:1	4:1	18.72
R-20505	20,000 ct	10,000 ct	2500	.5	.5	.03	.7	1600	950	238	1.41:1	2.83:1	18.72
R-20510	*20,000 ct	20,000 ct	-	.5	.5	.03	.7	1600	1900	-	1:1	-	19.46
R-20515	25,000 ct	500 ct	125	.4	.4	.03	.6	2000	47.5	11.88	7.07:1	14.14:1	18.72
R-20520	25,000 ct	1000 ct	250	.4	.4	.03	.6	2000	95	23.8	5:1	10:1	18.72
R-20525	30,000 ct	50 ct	12.5	.33	.33	.03	.6	2400	4.75	1.19	24.5:1	49:1	19.46
R-20530	30,000 ct	1200 ct	300	.33	.33	.03	.6	2400	114	28.5	5:1	10:1	19.46
R-20532	30,000 ct	500 ct	125	.33	.33	.03	.6	2400	47.5	11.88	7.7:1	15.5:1	19.46
R-20534	30,000 ct	200 ct	50	.33	.33	.03	.6	2400	19	4.75	12.2:1	24.5:1	19.46
R-20535	30,000 ct	5000 ct	1250	.33	.33	.03	.6	2400	475	119	2.45:1	4.9:1	19.46
R-20540	30,000 ct	10,000 ct	2500	.33	.33	.03	.6	2400	950	238	1.73:1	3.46:1	19.46
R-20545	*30,000 ct	30,000 ct	-	.33	.33	.03	.6	2400	2850	-	1:1	-	20.91
R-20550	40,000 ct	400 ct	100	.25	.25	.03	.5	3200	38	9.5	10:1	20:1	20.91
R-20555	40,000 ct	2000 ct	500	.25	.25	.03	.5	3200	190	47.5	4.47:1	8.94:1	20.91
R-20560	40,000 ct	4000 ct	1000	.25	.25	.03	.5	3200	380	95	3.16:1	6.32:1	20.91
R-20565	40,000 ct	20,000 ct	5000	.25	.25	.03	.5	3200	1900	475	1.41:1	2.83:1	20.91
R-20570	*40,000 ct	40,000 ct	-	.25	.25	.03	.5	3200	3800	-	1:1	-	23.28
R-20575	50,000 ct	200 ct	50	.2	.2	.03	.4	4000	19	4.75	15.8:1	31.6:1	23.28
R-20577	50,000 ct	500 ct	125	.2	.2	.03	.4	4000	47.5	11.88	10:1	20:1	23.28
R-20578	50,000 ct	600 ct	150	.2	.2	.03	.4	4000	57	14.3	9.13:1	18.26:1	23.28
R-20579	50,000 ct	50,000 ct	12,500	.2	.2	.03	.4	4000	4750	1190	1:1	2:1	23.28
R-20580	60,000 ct	15,000 ct	3750	.16	.16	.03	.4	4800	1430	358	2:1	4:1	25.14
R-20585	62,500 ct	50 ct	12.5	.16	.16	.03	.4	5000	4.75	1.19	35.4:1	70.7:1	25.14
R-20587	80,000 ct	15,000 ct	3750	.12	.12	.03	.3	6400	1430	358	2.3:1	4.6:1	25.14
R-20590	90,000 ct	10,000 ct	2500	.11	.11	.03	.3	7200	950	238	3:1	6:1	26.39
R-20595	95,000 ct	15,000 ct	3750	.1	.1	.03	.3	7600	1430	358	2.5:1	5:1	26.39
R-20600	100,000 ct	60 ct	15	.1	.1	.03	.3	8000	5.7	1.43	40.8:1	81.6:1	26.39
R-20605	100,000 ct	100 ct	25	.1	.1	.03	.3	8000	9.5	2.38	31.6:1	63.2:1	26.39
R-20610	100,000 ct	500 ct	125	.1	.1	.03	.3	8000	47.5	11.88	14.1:1	28.3:1	26.39
R-20613	100,000 ct	1000 ct	250	.1	.1	.03	.3	8000	95	23.8	10:1	20:1	26.39
R-20614	100,000 ct	2000 ct	500	.1	.1	.03	.3	8000	190	47.5	7.07:1	14.14:1	26.39
R-20615	100,000 ct	10,000 ct	2500	.1	.1	.03	.3	8000	950	238	3.16:1	6.32:1	26.39
R-20620	135,000 ct	82 ct	20.5	.07	.07	.03	.2	10,800	7.8	1.9	40.6:1	81.2:1	27.57

*INCLUDES ELECTROSTATIC SHIELD

**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

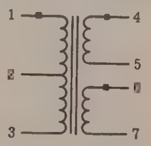
PICO's ultra-miniature transformers

R SERIES Plug-In

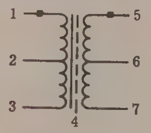
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

phone
914-699-5514

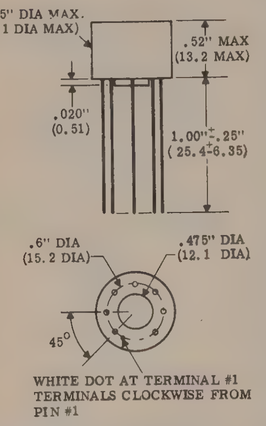
For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

Delivery— stock to one week

PICO's ultra-miniature transformers

S SERIES
Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27:** . . . .
All Units Meet MIL-T-27
And Are Hermetically Sealed in a
Metal Case, Audio Transformers
Are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . .
± 3 db, 50 Hz - 30 KHz at 1.0
Milliwatt. (±0.5 db, 300 Hz-5 KHz)
- **MAXIMUM DISTORTION:** . . .
5% With Rated Power Level at 1 KHz,
300 Hz and 50 Hz.
- **DIELECTRIC STRENGTH:** . . .
All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** . .
Greater Than 10,000 Megohms
at 300 V DC.
- **WEIGHT:** . . . .
17 Grams
- **OPERATING TEMPERATURE:** .
-55°c to 105°c (All Units Can Be
Supplied to Class S Requirements
130°c Maximum).
- **TERMINALS:** . . . .
Solid .020 Conductor,
Copper Clad Steel
Tinned 100%, Electroplated
Per MIL-T-10727A and
ASTM CCS B452
- **THERMAL SHOCK:** . . . . . .
25 Cycles, Method 107C,
MIL-STD-202D, Test Condition A-1

This Product is Patented

PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	50 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	S-Series
S-21003	20 ct	8 ct	2	2.0	1.5	.05	22	1.6	.88	.22	1.58:1	3.16:1	15.76
S-21005	20 ct	20 ct	5	2.0	1.5	.05	22	1.6	2.2	.55	1:1	2:1	15.76
S-21010	32 ct	32 ct	8	2.0	1.5	.05	17.5	2.56	3.52	.88	1:1	2:1	15.76
S-21015	40 ct	40 ct	10	2.0	1.5	.05	16	3.2	4.4	1.1	1:1	2:1	15.76
S-21018	48 ct	16 ct	4	2.0	1.5	.05	14.5	3.84	1.76	.44	1.73:1	3.46:1	15.76
S-21020	50 ct	50 ct	12.5	2.0	1.5	.05	14	4	5.5	1.38	1:1	2:1	15.76
S-21025	80 ct	32 ct	8	2.0	1.5	.05	11	6.4	3.52	.88	1.58:1	3.16:1	15.76
S-21028	100 ct	40 ct	10	2.0	1.5	.05	10	8	4.4	1.1	1.58:1	3.16:1	15.76
S-21030	100 ct	100 ct	25	2.0	1.5	.05	10	8	11	2.75	1:1	2:1	15.76
S-21035	120 ct	12.8 ct	3.2	2.0	1.5	.05	9	9.6	1.41	.35	3.06:1	6.12:1	15.76
S-21040	120 ct	60 ct	15	2.0	1.5	.05	9	9.6	6.6	1.65	1.41:1	2.83:1	15.76
S-21045	120 ct	120 ct	30	2.0	1.5	.05	9	9.6	13.2	3.3	1:1	2:1	15.76
S-21050	150 ct	12 ct	3	2.0	1.5	.05	8	12	1.32	.33	3.54:1	7.08:1	15.76
S-21055	150 ct	50 ct	12.5	2.0	1.5	.05	8	12	5.5	1.38	1.73:1	3.46:1	15.76
S-21060	150 ct	100 ct	25	2.0	1.5	.05	8	12	11	2.75	1.22:1	2.44:1	15.76
S-21065	150 ct	150 ct	37.5	2.0	1.5	.05	8	12	16.5	4.13	1:1	2:1	15.76
S-21070	150 ct	600 ct	150	2.0	1.5	.05	8	12	66	16.5	1:2	1:1	15.76
S-21075	200 ct	200 ct	50	2.0	1.5	.05	7	16	22	5.5	1:1	2:1	15.76
S-21080	300 ct	12 ct	3	2.0	1.5	.05	5.5	24	1.32	.33	5:1	10:1	15.76
S-21085	300 ct	50 ct	12.5	2.0	1.5	.05	5.5	24	5.5	1.38	2.45:1	4.9:1	15.76
S-21090	300 ct	150 ct	37.5	2.0	1.5	.05	5.5	24	16.5	4.13	1.41:1	2.83:1	15.76
S-21095	300 ct	300 ct	75	2.0	1.5	.05	5.5	24	33	8.25	1:1	2:1	15.76
S-21100	300 ct	600 ct	150	2.0	1.5	.05	5.5	24	66	16.5	1:1.41	1.41:1	15.76
S-21105	320 ct	12.8 ct	3.2	2.0	1.5	.05	5.5	25.6	1.41	.35	5:1	10:1	15.76
S-21110	400 ct	40 ct	10	2.0	1.5	.05	5	32	4.4	1.1	3.16:1	6.32:1	15.76
S-21115	400 ct	120 ct	30	2.0	1.5	.05	5	32	13.2	3.3	1.83:1	3.65:1	15.76
S-21120	400 ct	200 ct	50	2.0	1.5	.05	5	32	22	5.5	1.41:1	2.83:1	15.76
S-21125	400 ct	400 ct	100	2.0	1.5	.05	5	32	44	11	1:1	2:1	15.76
S-21130	400 ct	1000 ct	250	2.0	1.5	.05	5	32	110	27.5	1:1.58	1.26:1	15.76
S-21135	400 ct	2000 ct	500	2.0	1.5	.05	5	32	220	55	1:2.24	1:1.12	15.76
S-21140	400 ct	4000 ct	1000	2.0	1.5	.05	5	32	440	110	1:3.16	1:1.58	15.76
S-21142	500 ct	12.8 ct	3.2	2.0	1.5	.05	4.5	40	1.41	.35	6.25:1	12.5:1	15.76
S-21144	500 ct	16 ct	4	2.0	1.5	.05	4.5	40	1.76	.44	5.6:1	11.2:1	15.76
S-21145	500 ct	50 ct	12.5	2.0	1.5	.05	4.5	40	5.5	1.38	3.16:1	6.32:1	15.76
S-21147	500 ct	150 ct	37.5	2.0	1.5	.05	4.5	40	16.5	4.13	1.83:1	3.65:1	15.76
S-21150	500 ct	500 ct	125	2.0	1.5	.05	4.5	40	55	13.75	1:1	2:1	15.76
S-21155	*500 ct	500 ct	-	2.0	1.5	.05	4.5	40	55	-	1:1	-	16.42
S-21160	500 ct	600 ct	150	2.0	1.5	.05	4.5	40	66	16.5	1:1.1	1.83:1	15.76
S-21165	600 ct	12.8 ct	3.2	2.0	1.5	.05	4	48	1.41	.35	6.85:1	13.7	15.76
S-21167	600 ct	30 ct	7.5	2.0	1.5	.05	4	48	3.3	.83	4.47:1	8.94:1	15.76
S-21170	600 ct	48 ct	12	2.0	1.5	.05	4	48	5.28	1.37	3.54:1	7.07:1	15.76
S-21175	600 ct	200 ct	50	2.0	1.5	.05	4	48	22	5.5	1.73:1	3.46:1	15.76
S-21180**	600 ct	600 ct	150	2.0	1.5	.05	4	48	66	16.5	1:1	2:1	15.76
S-21185**	*600 ct	600 ct	-	2.0	1.5	.05	4	48	66	-	1:1	-	16.42
S-21186**	*600 ct	900 ct	-	2.0	1.5	.05	4	48	99	-	1:1.22	-	16.42
S-21187**	600 ct	1200 ct	300	2.0	1.5	.05	4	48	132	33	1:1.41	1.41:1	15.76
S-21190	640 ct	12.8 ct	3.2	2.0	1.5	.05	4	51	1.41	.35	7.07:1	14.14:1	15.76
S-21195	700 ct	100 ct	25	2.0	1.5	.05	3.5	56	11	2.75	2.65:1	5.29:1	15.76
S-21200	800 ct	12.8 ct	3.2	2.0	1.5	.05	3.5	64	1.41	.35	7.91:1	15.8:1	15.76
S-21205	800 ct	48 ct	12	2.0	1.5	.05	3.5	64	5.28	1.32	4.08:1	8.16:1	15.76
S-21210	800 ct	800 ct	200	2.0	1.5	.05	3.5	64	88	22	1:1	2:1	15.76
S-21215	900 ct	600 ct	150	2.0	1.5	.05	3	72	66	16.5	1.23:1	2.45:1	15.76
S-21217**	*900 ct	900 ct	-	2.0	1.5	.05	3	72	99	-	1:1	-	16.42
S-21220	1000 ct	12 ct	3	2.0	1.5	.05	3	80	1.32	.33	9.13:1	18.26:1	15.76
S-21225	1000 ct	50 ct	12.5	2.0	1.5	.05	3	80	5.5	1.38	4.47:1	8.94:1	15.76
S-21230	1000 ct	1000 ct	250	2.0	1.5	.05	3	80	110	27.5	1:1	2:1	15.76
S-21235	1060 ct	12.8 ct	3.2	2.0	1.5	.05	3	85	1.41	.35	9.1:1	18.2:1	15.76
S-21240	1200 ct	12.8 ct	3.2	2.0	1.5	.05	3	96	1.41	.35	9.68:1	19.4:1	15.76
S-21245	1200 ct	500 ct	125	2.0	1.5	.05	3	96	55	13.75	1.55:1	3.1:1	15.76
S-21250	1200 ct	1200 ct	300	2.0	1.5	.05	3	96	132	33	1:1	2:1	15.76
S-21255	*1200 ct	1200 ct	-	2.0	1.5	.05	3	96	132	-	1:1	-	16.42
S-21260	1500 ct	12 ct	3	2.0	1.5	.05	2.5	120	1.32	.33	11.18:1	22.36:1	15.76
S-21265	1500 ct	500 ct	125	2.0	1.5	.05	2.5	120	55	13.75	1.73:1	3.46:1	15.76
S-21270	*1500 ct	600 ct	-	2.0	1.5	.05	2.5	120	66	-	1.58:1	-	16.42
S-21275	*1500 ct	1500 ct	-	2.0	1.5	.05	2.5	120	165	-	1:1	-	16.42
S-21280	1600 ct	12.8 ct	3.2	2.0	1.5	.05	2.5	128	1.41	.35	11.18:1	22.36:1	15.76
S-21283	2000 ct	8 ct	2	2.0	1.5	.05	2.2	160	.88	.22	15.8:1	31.6:1	15.76
S-21285	2000 ct	2000 ct	500	2.0	1.5	.05	2.2	160	220	55	1:1	2:1	15.76
S-21290	*2000 ct	2000 ct	-	2.0	1.5	.05	2.2	160	220	-	1:1	-	16.42
S-21295	2000 ct	8000 ct	2000	2.0	1.5	.05	2.2	160	880	220	1:2	1:1	16.42
S-21297	2500 ct	2500 ct	625	2.0	1.5	.05	2	200	275	69	1:1	2:1	16.42
S-21300	3000 ct	3000 ct	750	2.0	1.5	.05	1.8	240	330	83	1:1	2:1	16.42
S-21305	*3000 ct	3000 ct	-	2.0	1.5	.05	1.8	240	330	-	1:1	-	16.42

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

PICO Electronics, Inc.
453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	50 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	S-Series
S-21310	3600 ct	3600 ct	900	2.0	1.5	.05	1.7	288	396	99	1:1	2:1	16.42
S-21312	4000 ct	16 ct	4	2.0	1.5	.05	1.6	320	1.76	.44	15.8:1	31.6:1	16.42
S-21314**	4000 ct	600 ct	150	2.0	1.5	.05	1.6	320	66	16.5	2.58:1	5.16:1	16.42
S-21315	4000 ct	1000 ct	250	2.0	1.5	.05	1.6	320	110	27.5	2:1	4:1	16.42
S-21320	*4000 ct	8000 ct	-	2.0	1.5	.05	1.6	320	880	-	1:1.41	-	16.42
S-21325	5000 ct	500 ct	125	2.0	1.5	.05	1.4	400	55	13.8	3.16:1	6.32:1	15.76
S-21330	5000 ct	5000 ct	1250	2.0	1.5	.05	1.4	400	550	138	1:1	2:1	15.76
S-21335	7500 ct	50 ct	12.5	1.3	1.3	.05	1.2	600	5.5	1.38	12.25:1	24.5:1	17.48
S-21340	7500 ct	100 ct	25	1.3	1.3	.05	1.2	600	11	2.75	8.66:1	17.32:1	17.48
S-21345	7500 ct	600 ct	150	1.3	1.3	.05	1.2	600	66	16.5	3.54:1	7.07:1	17.48
S-21350	7500 ct	2500 ct	625	1.3	1.3	.05	1.2	600	275	69	1.73:1	3.46:1	17.48
S-21355	*7500 ct	7500 ct	-	1.3	1.3	.05	1.2	600	825	-	1:1	-	18.72
S-21360	8000 ct	12.8 ct	3.2	1.2	1.2	.05	1.1	640	1.4	.35	25:1	50:1	17.48
S-21365	8000 ct	1000 ct	250	1.2	1.2	.05	1.1	640	110	27.5	2.83:1	5.66:1	17.48
S-21370	*8000 ct	1200 ct	-	1.2	1.2	.05	1.1	640	132	-	2.58:1	-	18.72
S-21375	*9000 ct	9000 ct	-	1.1	1.1	.05	1.1	720	990	-	1:1	-	18.72
S-21380	10,000 ct	12.8 ct	3.2	1.0	1.0	.05	1	800	1.4	.35	28:1	56:1	17.48
S-21385	10,000 ct	16 ct	4	1.0	1.0	.05	1	800	1.76	.44	25:1	50:1	17.48
S-21390	10,000 ct	100 ct	25	1.0	1.0	.05	1	800	11	2.75	10:1	20:1	17.48
S-21395	10,000 ct	200 ct	50	1.0	1.0	.05	1	800	22	5.5	7.07:1	14.14:1	17.48
S-21400	10,000 ct	500 ct	125	1.0	1.0	.05	1	800	55	13.75	4.47:1	8.94:1	17.48
S-21405	10,000 ct	600 ct	150	1.0	1.0	.05	1	800	66	16.5	4.08:1	8.16:1	17.48
S-21410	10,000 ct	1000 ct	250	1.0	1.0	.05	1	800	110	27.5	3.16:1	6.32:1	17.48
S-21415	10,000 ct	1200 ct	300	1.0	1.0	.05	1	800	132	33	2.89:1	5.77:1	17.48
S-21420	10,000 ct	1500 ct	375	1.0	1.0	.05	1	800	165	41.3	2.58:1	5.16:1	17.48
S-21425	10,000 ct	2000 ct	500	1.0	1.0	.05	1	800	220	55	2.24:1	4.47:1	17.48
S-21430	10,000 ct	5000 ct	1250	1.0	1.0	.05	1	800	550	138	1.41:1	2.83:1	17.48
S-21435	10,000 ct	7500 ct	1875	1.0	1.0	.05	1	800	825	206	1.16:1	2.31:1	17.48
S-21440	10,000 ct	10,000 ct	2500	1.0	1.0	.05	1	800	1100	275	1:1	2:1	17.48
S-21445	*10,000 ct	10,000 ct	-	1.0	1.0	.05	1	800	1100	-	1:1	-	18.72
S-21450	15,000 ct	400 ct	100	.65	.65	.05	.8	1200	44	11	6.12:1	12.25:1	17.48
S-21452	15,000 ct	500 ct	125	.65	.65	.05	.8	1200	55	13.8	5.48:1	10.95:1	17.48
S-21455	15,000 ct	600 ct	150	.65	.65	.05	.8	1200	66	16.5	5:1	10:1	17.48
S-21460	15,000 ct	10,000 ct	2500	.65	.65	.05	.8	1200	1100	275	1.22:1	2.45:1	17.48
S-21465	*15,000 ct	15,000 ct	-	.65	.65	.05	.8	1200	1650	-	1:1	-	18.72
S-21470	15,000 ct	15,000 ct	3750	.65	.65	.05	.8	1200	1650	413	1:1	2:1	17.48
S-21475	16,000 ct	1000 ct	250	.62	.62	.05	.8	1280	110	27.5	4:1	8:1	17.48
S-21480	20,000 ct	500 ct	125	.5	.5	.05	.7	1600	55	13.8	6.32:1	12.65:1	18.72
S-21485	20,000 ct	600 ct	150	.5	.5	.05	.7	1600	66	16.5	5.77:1	11.55:1	18.72
S-21490	20,000 ct	800 ct	200	.5	.5	.05	.7	1600	88	22	5:1	10:1	18.72
S-21495	20,000 ct	1000 ct	250	.5	.5	.05	.7	1600	110	27.5	4.47:1	8.94:1	18.72
S-21500	20,000 ct	5000 ct	1250	.5	.5	.05	.7	1600	550	138	2:1	4:1	18.72
S-21505	20,000 ct	10,000 ct	2500	.5	.5	.05	.7	1600	1100	275	1.41:1	2.83:1	18.72
S-21510	*20,000 ct	20,000 ct	-	.5	.5	.05	.7	1600	2200	-	1:1	-	19.46
S-21515	25,000 ct	500 ct	125	.4	.4	.05	.6	2000	55	13.8	7.07:1	14.14:1	18.72
S-21520	25,000 ct	1000 ct	250	.4	.4	.05	.6	2000	110	27.5	5:1	10:1	18.72
S-21525	30,000 ct	50 ct	12.5	.33	.33	.05	.6	2400	5.5	1.38	24.5:1	49:1	19.46
S-21530	30,000 ct	1200 ct	300	.33	.33	.05	.6	2400	132	33	5:1	10:1	19.46
S-21532	30,000 ct	500 ct	125	.33	.33	.05	.6	2400	55	13.8	7.7:1	15.5:1	19.46
S-21534	30,000 ct	200 ct	50	.33	.33	.05	.6	2400	22	5.5	12.2:1	24.5:1	19.46
S-21535	30,000 ct	5000 ct	1250	.33	.33	.05	.6	2400	550	137.5	2.45:1	4.9:1	19.46
S-21540	30,000 ct	10,000 ct	2500	.33	.33	.05	.6	2400	1100	275	1.73:1	3.46:1	19.46
S-21545	*30,000 ct	30,000 ct	-	.33	.33	.05	.6	2400	3300	-	1:1	-	20.91
S-21550	40,000 ct	400 ct	100	.25	.25	.05	.5	3200	44	11	10:1	20:1	20.91
S-21555	40,000 ct	2000 ct	500	.25	.25	.05	.5	3200	220	55	4.47:1	8.94:1	20.91
S-21560	40,000 ct	4000 ct	1000	.25	.25	.05	.5	3200	440	110	3.16:1	6.32:1	20.91
S-21565	40,000 ct	20,000 ct	5000	.25	.25	.05	.5	3200	2200	550	1.41:1	2.83:1	20.91
S-21570	*40,000 ct	40,000 ct	-	.25	.25	.05	.5	3200	4400	-	1:1	-	23.28
S-21575	50,000 ct	200 ct	50	.2	.2	.05	.4	4000	22	5.5	15.8:1	31.6:1	23.28
S-21577	50,000 ct	500 ct	125	.2	.2	.05	.4	4000	55	13.8	10:1	20:1	23.28
S-21578	50,000 ct	600 ct	150	.2	.2	.05	.4	4000	66	16.5	9.13:1	18.26:1	23.28
S-21579	50,000 ct	50,000 ct	12,500	.2	.2	.05	.4	4000	5500	1380	1:1	2:1	23.28
S-21580	60,000 ct	15,000 ct	3750	.16	.16	.05	.4	4800	1650	413	2:1	4:1	25.14
S-21585	62,500 ct	50 ct	12.5	.16	.16	.05	.4	5000	5.5	1.38	35.4:1	70.7:1	25.14
S-21587	80,000 ct	15,000 ct	3750	.12	.12	.05	.3	6400	1650	413	2.3:1	4.6:1	25.14
S-21590	90,000 ct	10,000 ct	2500	.11	.11	.05	.3	7200	1100	275	3:1	6:1	26.39
S-21595	95,000 ct	15,000 ct	3750	.1	.1	.05	.3	7600	1650	413	2.5:1	5:1	26.39
S-21600	100,000 ct	60 ct	15	.1	.1	.05	.3	8000	6.6	1.65	40.8:1	81.6:1	26.39
S-21605	100,000 ct	100 ct	25	.1	.1	.05	.3	8000	11	2.75	31.6:1	63.2:1	26.39
S-21610	100,000 ct	500 ct	125	.1	.1	.05	.3	8000	55	13.8	14.1:1	28.3:1	26.39
S-21613	100,000 ct	1000 ct	250	.1	.1	.05	.3	8000	110	27.5	10:1	20:1	26.39
S-21614	100,000 ct	2000 ct	500	.1	.1	.05	.3	8000	220	55	7.07:1	14.14:1	26.39
S-21615	100,000 ct	10,000 ct	2500	.1	.1	.05	.3	8000	1100	275	3.16:1	6.32:1	26.39
S-21620	135,000 ct	82 ct	20.5	.07	.07	.05	.2	10,800	9	2.25	40.6:1	81.2:1	27.57

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

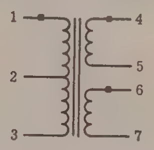
PICO's ultra-miniature transformers

S SERIES Plug-In

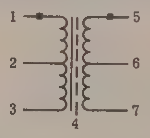
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

phone
914-699-5514

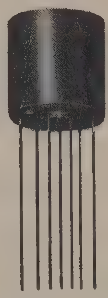
For immediate engineering assistance or to place an order—

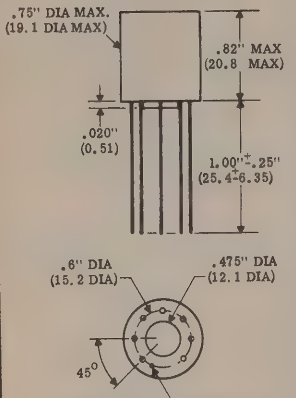
Call Toll Free
800-431-1064

Delivery—
stock to one week

PICO's
ultra-miniature transformers

T SERIES
Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 20 Hz - 25 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . 28 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . Solid .020 Conductor, Copper Clad Steel Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452
- THERMAL SHOCK: . . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery—
stock to one week

PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	20 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	T-Series
T-22003	20 ct	8 ct	2	3.0	2.0	.006	22	1.6	.8	.2	1.58:1	3.16:1	17.32
T-22005	20 ct	20 ct	5	3.0	2.0	.006	22	1.6	2	.5	1:1	2:1	17.32
T-22010	32 ct	32 ct	8	3.0	2.0	.006	17.5	2.56	3.2	.8	1:1	2:1	17.32
T-22015	40 ct	40 ct	10	3.0	2.0	.006	16	3.2	4	1	1:1	2:1	17.32
T-22018	48 ct	16 ct	4	3.0	2.0	.006	14.5	3.84	1.6	.4	1.73:1	3.46:1	17.32
T-22020	50 ct	50 ct	12.5	3.0	2.0	.006	14	4	5	1.25	1:1	2:1	17.32
T-22025	80 ct	32 ct	8	3.0	2.0	.006	11	6.4	3.2	.8	1.58:1	3.16:1	17.32
T-22028	100 ct	40 ct	10	3.0	2.0	.006	10	8	4	1	1.58:1	3.16:1	17.32
T-22030	100 ct	100 ct	25	3.0	2.0	.006	10	8	10	2.5	1:1	2:1	17.32
T-22035	120 ct	12.8 ct	3.2	3.0	2.0	.006	9	9.6	1.3	.32	3.06:1	6.12:1	17.32
T-22040	120 ct	60 ct	15	3.0	2.0	.006	9	9.6	6	1.5	1.41:1	2.83:1	17.32
T-22045	120 ct	120 ct	30	3.0	2.0	.006	9	9.6	12	3	1:1	2:1	17.32
T-22050	150 ct	12 ct	3	3.0	2.0	.006	8	12	1.2	.3	3.54:1	7.08:1	17.32
T-22055	150 ct	50 ct	12.5	3.0	2.0	.006	8	12	5	1.25	1.73:1	3.46:1	17.32
T-22060	150 ct	100 ct	25	3.0	2.0	.006	8	12	10	2.5	1.22:1	2.44:1	17.32
T-22065	150 ct	150 ct	37.5	3.0	2.0	.006	8	12	15	3.75	1:1	2:1	17.32
T-22070	150 ct	600 ct	150	3.0	2.0	.006	8	12	60	15	1:2	1:1	17.32
T-22075	200 ct	200 ct	50	3.0	2.0	.006	7	16	20	5	1:1	2:1	17.32
T-22080	300 ct	12 ct	3	3.0	2.0	.006	5.5	24	1.2	.3	5:1	10:1	17.32
T-22085	300 ct	50 ct	12.5	3.0	2.0	.006	5.5	24	5	1.25	2.45:1	4.9:1	17.32
T-22090	300 ct	150 ct	37.5	3.0	2.0	.006	5.5	24	15	3.75	1.41:1	2.83:1	17.32
T-22095	300 ct	300 ct	75	3.0	2.0	.006	5.5	24	30	7.5	1:1	2:1	17.32
T-22100	300 ct	600 ct	150	3.0	2.0	.006	5.5	24	60	15	1:1.41	1.41:1	17.32
T-22105	320 ct	12.8 ct	3.2	3.0	2.0	.006	5.5	25.6	1.3	.32	5:1	10:1	17.32
T-22110	400 ct	40 ct	10	3.0	2.0	.006	5	32	4	1	3.16:1	6.32:1	17.32
T-22115	400 ct	120 ct	30	3.0	2.0	.006	5	32	12	3	1.83:1	3.65:1	17.32
T-22120	400 ct	200 ct	50	3.0	2.0	.006	5	32	20	5	1.41:1	2.83:1	17.32
T-22125	400 ct	400 ct	100	3.0	2.0	.006	5	32	40	10	1:1	2:1	17.32
T-22130	400 ct	1000 ct	250	3.0	2.0	.006	5	32	100	25	1:1.58	1.26:1	17.32
T-22135	400 ct	2000 ct	500	3.0	2.0	.006	5	32	200	50	1:2.24	1:1.12	17.32
T-22140	400 ct	4000 ct	1000	3.0	2.0	.006	5	32	400	100	1:3.16	1:1.58	17.32
T-22142	500 ct	12.8 ct	3.2	3.0	2.0	.006	4.5	40	1.3	.32	6.25:1	12.5:1	17.32
T-22144	500 ct	16 ct	4	3.0	2.0	.006	4.5	40	1.6	.4	5.6:1	11.2:1	17.32
T-22145	500 ct	50 ct	12.5	3.0	2.0	.006	4.5	40	5	1.25	3.16:1	6.32:1	17.32
T-22147	500 ct	150 ct	37.5	3.0	2.0	.006	4.5	40	15	3.75	1.83:1	3.65:1	17.32
T-22150	500 ct	500 ct	125	3.0	2.0	.006	4.5	40	50	12.5	1:1	2:1	17.32
T-22155	*500 ct	500 ct	-	3.0	2.0	.006	4.5	40	50	-	1:1	-	18.05
T-22160	500 ct	600 ct	150	3.0	2.0	.006	4.5	40	60	15	1:1.1	1.83:1	17.32
T-22165	600 ct	12.8 ct	3.2	3.0	2.0	.006	4	48	1.3	.32	6.85:1	13.7:1	17.32
T-22167	600 ct	30 ct	7.5	3.0	2.0	.006	4	48	3	.75	4.47:1	8.94:1	17.32
T-22170	600 ct	48 ct	12	3.0	2.0	.006	4	48	4.8	1.2	3.54:1	7.07:1	17.32
T-22175	600 ct	200 ct	50	3.0	2.0	.006	4	48	20	5	1.73:1	3.46:1	17.32
T-22180**	600 ct	600 ct	150	3.0	2.0	.006	4	48	60	15	1:1	2:1	17.32
T-22185**	*600 ct	600 ct	-	3.0	2.0	.006	4	48	60	-	1:1	-	18.05
T-22186**	*600 ct	900 ct	-	3.0	2.0	.006	4	48	90	-	1:1.22	-	18.05
T-22187**	600 ct	1200 ct	300	3.0	2.0	.006	4	48	120	30	1:1.41	1.41:1	17.32
T-22190	640 ct	12.8 ct	3.2	3.0	2.0	.006	4	51	1.3	.32	7.07:1	14.14:1	17.32
T-22195	700 ct	100 ct	25	3.0	2.0	.006	3.5	56	10	2.5	2.65:1	5.29:1	17.32
T-22200	800 ct	12.8 ct	3.2	3.0	2.0	.006	3.5	64	1.3	.32	7.91:1	15.8:1	17.32
T-22205	800 ct	48 ct	12	3.0	2.0	.006	3.5	64	4.8	1.2	4.08:1	8.16:1	17.32
T-22210	800 ct	800 ct	200	3.0	2.0	.006	3.5	64	80	20	1:1	2:1	17.32
T-22215	900 ct	600 ct	150	3.0	2.0	.006	3	72	60	15	1.22:1	2.45:1	17.32
T-22217**	*900 ct	900 ct	-	3.0	2.0	.006	3	72	90	-	1:1	-	18.05
T-22220	1000 ct	12 ct	3	3.0	2.0	.006	3	80	1.2	.3	9.13:1	18.26:1	17.32
T-22225	1000 ct	50 ct	12.5	3.0	2.0	.006	3	80	5	1.25	4.47:1	8.94:1	17.32
T-22230	1000 ct	1000 ct	250	3.0	2.0	.006	3	80	100	25	1:1	2:1	17.32
T-22235	1060 ct	12.8 ct	3.2	3.0	2.0	.006	3	85	1.3	.32	9.1:1	18.2:1	17.32
T-22240	1200 ct	12.8 ct	3.2	3.0	2.0	.006	3	96	1.3	.32	9.68:1	19.4:1	17.32
T-22245	1200 ct	500 ct	125	3.0	2.0	.006	3	96	50	12.5	1.55:1	3.1:1	17.32
T-22250	1200 ct	1200 ct	300	3.0	2.0	.006	3	96	120	30	1:1	2:1	17.32
T-22255	*1200 ct	1200 ct	-	3.0	2.0	.006	3	96	120	-	1:1	-	18.05
T-22260	1500 ct	12 ct	3	3.0	2.0	.006	2.5	120	1.2	.3	11.18:1	22.36:1	17.32
T-22265	1500 ct	500 ct	125	3.0	2.0	.006	2.5	120	50	12.5	1.73:1	3.46:1	17.32
T-22270	*1500 ct	600 ct	-	3.0	2.0	.006	2.5	120	60	-	1.58:1	-	18.05
T-22275	*1500 ct	1500 ct	-	3.0	2.0	.006	2.5	120	150	-	1:1	-	18.05
T-22280	1600 ct	12.8 ct	3.2	3.0	2.0	.006	2.5	128	1.[illegible]	.32	11.18:1	22.36:1	17.32
T-22283	2000 ct	8 ct	2	3.0	2.0	.006	2.2	160	.8	.2	15.8:1	31.6:1	17.32
T-22285	2000 ct	2000 ct	500	3.0	2.0	.006	2.2	160	200	50	1:1	2:1	17.32
T-22290	*2000 ct	2000 ct	-	3.0	2.0	.006	2.2	160	200	-	1:1	-	18.05
T-22295	2000 ct	8000 ct	2000	3.0	2.0	.006	2.2	160	800	200	1:2	1:1	17.32
T-22297	2500 ct	2500 ct	625	3.0	2.0	.006	2	200	250	63	1:1	2:1	17.32
T-22300	3000 ct	3000 ct	750	3.0	2.0	.006	1.8	240	300	75	1:1	2:1	17.32
T-22305	*3000 ct	3000 ct	-	3.0	2.0	.006	1.8	240	300	-	1:1	-	17.32

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York, P.O. Box 1206

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO's ultra-miniature transformers

T SERIES Plug-In

PICO PART NUMBER T-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	20 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	T-Series
T-22310	3600 ct	3600 ct	900	2.7	2.0	.006	1.7	288	360	90	1:1	2:1	17.32
T-22312	4000 ct	16 ct	4	2.5	2.0	.006	1.6	320	1.6	.4	15.8:1	31.6:1	17.32
T-22314**	4000 ct	600 ct	150	2.5	2.0	.006	1.6	320	60	15	2.58:1	5.16:1	17.32
T-22315	4000 ct	1000 ct	250	2.5	2.0	.006	1.6	320	100	25	2:1	4:1	17.32
T-22320	*4000 ct	8000 ct	-	2.5	2.0	.006	1.6	320	800	-	1:1.41	-	18.05
T-22325	5000 ct	500 ct	125	2.0	2.0	.006	1.4	400	50	12.5	3.16:1	6.32:1	17.32
T-22330	5000 ct	5000 ct	1250	2.0	2.0	.006	1.4	400	500	125	1:1	2:1	17.32
T-22335	7500 ct	50 ct	12.5	1.3	1.3	.006	1.2	600	5	1.25	12.25:1	24.5:1	19.22
T-22340	7500 ct	100 ct	25	1.3	1.3	.006	1.2	600	10	2.5	8.66:1	17.32:1	19.22
T-22345	7500 ct	600 ct	150	1.3	1.3	.006	1.2	600	60	15	3.54:1	7.07:1	19.22
T-22350	7500 ct	2500 ct	625	1.3	1.3	.006	1.2	600	250	63	1.73:1	3.46:1	19.22
T-22355	*7500 ct	7500 ct	-	1.3	1.3	.006	1.2	600	750	-	1:1	-	20.59
T-22360	8000 ct	12.8 ct	3.2	1.2	1.2	.006	1.1	640	1.3	.32	25:1	50:1	19.22
T-22365	8000 ct	1000 ct	250	1.2	1.2	.006	1.1	640	100	25	2.83:1	5.66:1	19.22
T-22370	*8000 ct	1200 ct	-	1.2	1.2	.006	1.1	640	120	-	2.58:1	-	20.59
T-22375	*9000 ct	9000 ct	-	1.1	1.1	.006	1.1	720	900	-	1:1	-	20.59
T-22380	10,000 ct	12.8 ct	3.2	1.0	1.0	.006	1	800	1.3	.32	28:1	56:1	19.22
T-22385	10,000 ct	16 ct	4	1.0	1.0	.006	1	800	1.6	.4	25:1	50:1	19.22
T-22390	10,000 ct	100 ct	25	1.0	1.0	.006	1	800	10	2.5	10:1	20:1	19.22
T-22395	10,000 ct	200 ct	50	1.0	1.0	.006	1	800	20	5	7.07:1	14.14:1	19.22
T-22400	10,000 ct	500 ct	125	1.0	1.0	.006	1	800	50	12.5	4.47:1	8.94:1	19.22
T-22405	10,000 ct	600 ct	150	1.0	1.0	.006	1	800	60	15	4.08:1	8.16:1	19.22
T-22410	10,000 ct	1000 ct	250	1.0	1.0	.006	1	800	100	25	3.16:1	6.32:1	19.22
T-22415	10,000 ct	1200 ct	300	1.0	1.0	.006	1	800	120	30	2.89:1	5.77:1	19.22
T-22420	10,000 ct	1500 ct	375	1.0	1.0	.006	1	800	150	38	2.58:1	5.16:1	19.22
T-22425	10,000 ct	2000 ct	500	1.0	1.0	.006	1	800	200	50	2.24:1	4.47:1	19.22
T-22430	10,000 ct	5000 ct	1250	1.0	1.0	.006	1	800	500	125	1.41:1	2.83:1	19.22
T-22435	10,000 ct	7500 ct	1875	1.0	1.0	.006	1	800	750	188	1.16:1	2.31:1	19.22
T-22440	10,000 ct	10,000 ct	2500	1.0	1.0	.006	1	800	1000	250	1:1	2:1	19.22
T-22445	*10,000 ct	10,000 ct	-	1.0	1.0	.006	1	800	1000	-	1:1	-	20.59
T-22450	15,000 ct	400 ct	100	.66	.66	.006	.8	1200	40	10	6.12:1	12.25:1	19.22
T-22452	15,000 ct	500 ct	125	.66	.66	.006	.8	1200	50	12.5	5.48:1	10.95:1	19.22
T-22455	15,000 ct	600 ct	150	.66	.66	.006	.8	1200	60	15	5:1	10:1	19.22
T-22460	15,000 ct	10,000 ct	2500	.66	.66	.006	.8	1200	1000	250	1.22:1	2.45:1	19.22
T-22465	*15,000 ct	15,000 ct	-	.66	.66	.006	.8	1200	1500	-	1:1	-	20.59
T-22470	15,000 ct	15,000 ct	3750	.66	.66	.006	.8	1200	1500	375	1:1	2:1	19.22
T-22475	16,000 ct	1000 ct	250	.62	.62	.006	.8	1280	100	25	4:1	8:1	19.22
T-22480	20,000 ct	500 ct	125	.5	.5	.006	.7	1600	50	12.5	6.32:1	12.65:1	20.59
T-22485	20,000 ct	600 ct	150	.5	.5	.006	.7	1600	60	15	5.77:1	11.55:1	20.59
T-22490	20,000 ct	800 ct	200	.5	.5	.006	.7	1600	80	20	5:1	10:1	20.59
T-22495	20,000 ct	1000 ct	250	.5	.5	.006	.7	1600	100	25	4.47:1	8.94:1	20.59
T-22500	20,000 ct	5000 ct	1250	.5	.5	.006	.7	1600	500	125	2:1	4:1	20.59
T-22505	20,000 ct	10,000 ct	2500	.5	.5	.006	.7	1600	1000	250	1.41:1	2.83:1	20.59
T-22510	*20,000 ct	20,000 ct	-	.5	.5	.006	.7	1600	2000	-	1:1	-	21.40
T-22515	25,000 ct	500 ct	125	.4	.4	.006	.6	2000	50	12.5	7.07:1	14.14:1	20.59
T-22520	25,000 ct	1000 ct	250	.4	.4	.006	.6	2000	100	25	5:1	10:1	20.59
T-22525	30,000 ct	50 ct	12.5	.33	.33	.006	.6	2400	5	1.25	24.5:1	49:1	21.40
T-22530	30,000 ct	1200 ct	300	.33	.33	.006	.6	2400	120	30	5:1	10:1	21.40
T-22532	30,000 ct	500 ct	125	.33	.33	.006	.6	2400	50	12.5	7.7:1	15.5:1	21.40
T-22534	30,000 ct	200 ct	50	.33	.33	.006	.6	2400	20	5	12.2:1	24.5:1	21.40
T-22535	30,000 ct	5000 ct	1250	.33	.33	.006	.6	2400	500	125	2.45:1	4.9:1	21.40
T-22540	30,000 ct	10,000 ct	2500	.33	.33	.006	.6	2400	1000	250	1.73:1	3.46:1	21.40
T-22545	*30,000 ct	30,000 ct	-	.33	.33	.006	.6	2400	3000	-	1:1	-	22.96
T-22550	40,000 ct	400 ct	100	.25	.25	.006	.5	3200	40	10	10:1	20:1	22.96
T-22555	40,000 ct	2000 ct	500	.25	.25	.006	.5	3200	200	50	4.47:1	8.94:1	22.96
T-22560	40,000 ct	4000 ct	1000	.25	.25	.006	.5	3200	400	100	3.16:1	6.32:1	22.96
T-22565	40,000 ct	20,000 ct	5000	.25	.25	.006	.5	3200	2000	500	1.41:1	2.83:1	22.96
T-22570	*40,000 ct	40,000 ct	-	.25	.25	.006	.5	3200	4000	-	1:1	-	25.60
T-22575	50,000 ct	200 ct	50	.2	.2	.006	.4	4000	20	5	15.8:1	31.6:1	25.60
T-22577	50,000 ct	500 ct	125	.2	.2	.006	.4	4000	50	12.5	10:1	20:1	25.60
T-22578	50,000 ct	600 ct	150	.2	.2	.006	.4	4000	60	15	9.13:1	18.26:1	25.60
T-22579	50,000 ct	50,000 ct	12,500	.2	.2	.006	.4	4000	5000	1250	1:1	2:1	25.60
T-22580	60,000 ct	15,000 ct	3750	.16	.16	.006	.4	4800	1500	375	2:1	4:1	27.64
T-22585	62,500 ct	50 ct	12.5	.16	.16	.006	.4	5000	5	1.25	35.4:1	70.7:1	27.64
T-22587	80,000 ct	15,000 ct	3750	.12	.12	.006	.3	6400	1500	375	2.3:1	4.6:1	27.64

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

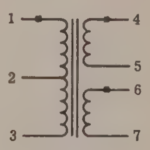
***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

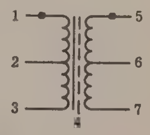
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

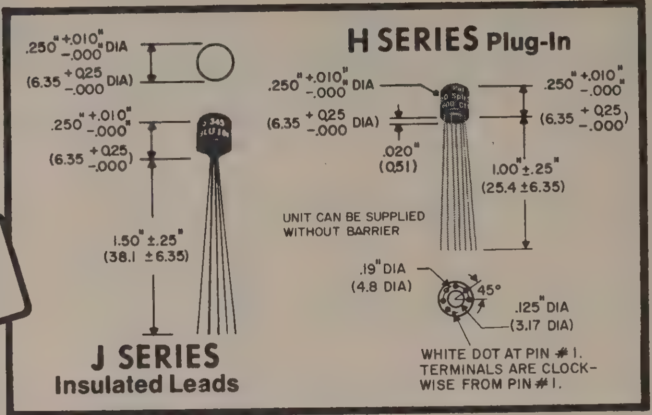
Delivery— stock to one week

PICO Electronics, Inc.

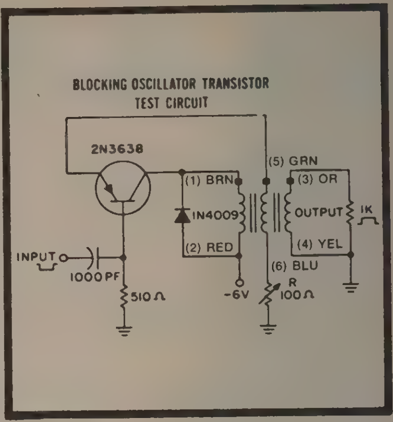
453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO's ultra-miniature PULSE transformers

1/4"x1/4"


H SERIES Plug-In
.250" +.010" -.000" DIA
(6.35 +.025 -.000 DIA)
.250" +.010" -.000"
(6.35 +.025 -.000)
1.50" ±.25"
(38.1 ±6.35)
J SERIES
Insulated Leads
.020"
(0.51)
1.00" ±.25"
(25.4 ±6.35)
UNIT CAN BE SUPPLIED WITHOUT BARRIER
.19" DIA
(4.8 DIA)
45°
.125" DIA
(3.17 DIA)
WHITE DOT AT PIN #1. TERMINALS ARE CLOCKWISE FROM PIN #1.

Dimensions are in inches (MM)


BLOCKING OSCILLATOR TRANSISTOR TEST CIRCUIT
2N3638
(1) BRN
(2) RED
IN4009
(5) GRN
(6) BLU
(3) OR
(4) YEL
OUTPUT
IK
INPUT
1000 PF
510 Ω
-6V
R 100 Ω

SPECIFICATIONS

- MIL-T-21038: Units Meet MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH: All Units tested at 200 V RMS
- INSULATION RESISTANCE: Greater than 10,000 Megohms at 300 V DC
- WEIGHT: 1.1 Grams
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS							BLOCKING OSCILLATOR CIRCUIT					PICO PRICES 1-9 *	
H-Series Plug-In	J-Series Insulated Leads	P Width μSec	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp* in/out,	P Width μSec	Rise Time	% Over Shoot	Droop %	% Back Swing	H-Series	J-Series
H-5400	J-5600	0.05	0.2	0.01	0	0	20	50	0.05	0.01	0	.0	35	13.60	12.48
H-5405	J-5605	0.1	0.5	0.015	0	0	20	50	0.1	0.012	0	0	25	13.60	12.48
H-5410	J-5610	0.2	1.2	0.02	0	0	20	100	0.2	0.02	0	0	15	13.60	12.48
H-5415	J-5615	0.5	1.5	0.023	0	5	25	100	0.5	0.023	0	5	15	13.60	12.48
H-5420	J-5620	1	1.5	0.025	0	20	28	100	1	0.03	0	10	15	13.60	12.48
H-5425	J-5625	2	1.5	0.028	0	15	23	100	2	0.035	0	10	15	13.60	12.48
H-5430	J-5630	3	1.5	0.030	0	15	28	100	3	0.04	0	10	15	13.60	12.48
H-5435	J-5635	5	2	0.035	0	20	20	200	5	0.040	0	15	15	13.60	12.48
H-5440	J-5640	10	2	0.05	0	25	25	200	10	0.060	0	15	10	13.60	12.48
H-5445	J-5645	15	2	0.06	0	25	18	200	15	0.07	0	15	15	13.60	12.48
H-5450	J-5650	25	3	0.1	0	30	30	500	25	0.08	0	15	15	13.60	12.48
H-5455	J-5655	50	3	0.3	0	20	20	500	50	0.2	0	10	5	13.60	12.48
H-5460	J-5660	100	6	0.4	0	15	18	500	100	0.35	0	10	15	13.60	12.48

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1 V

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

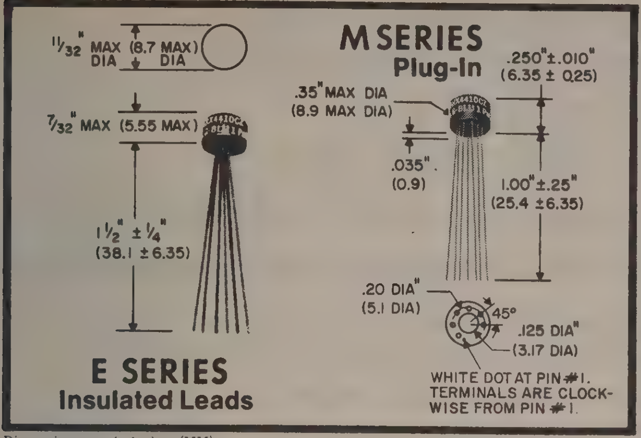
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery— stock to one week

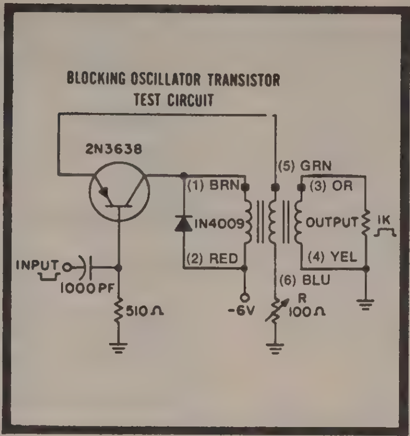
For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514



Dimensions are in inches (MM)



PICO's ultra-miniature PULSE transformers

SPECIFICATIONS

- **MIL-T-21038:** All Units Meet MIL-T-21038 and are Hermetically Sealed in a Metal Case
- **DIELECTRIC STRENGTH:** All Units tested at 200 V RMS
- **INSULATION RESISTANCE:** Greater than 10,000 Megohms at 300 V DC
- **WEIGHT:** 1/20 Ounce
- **OPERATING TEMPERATURE:** -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** . . . . Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** 25 Cycles, Method 107C, MIL-STD-202D. Test Condition A-1

This Product is Patented

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

MILITARY DESIGNATION TP6RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS								BLOCKING OSCILLATOR CIRCUIT					D.C. RESISTANCE			PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	P. WIDTH μ SEC.	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	4 TNS BRN RED	4 TNS OR YEL	1 TURN GRN BLU	E-Series	M-Series
E5020	M5300	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.05	0.02	0	0	35	0.21	0.23	0.13	9.45	10.48
E5040	M5305	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.1	0.025	0	0	25	0.47	0.56	0.17	9.45	10.48
E5060	M5310	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	0.2	0.030	0	0	15	1.0	1.25	0.37	9.45	10.48
E5080	M5315	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	0.5	0.05	0	0	15	1.5	1.80	0.54	9.45	10.48
E5100	M5320	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	1	0.08	0	0	15	2.5	3.1	0.9	9.45	10.48
E5120	M5325	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	2	0.10	0	0	15	3.0	3.7	1.1	9.45	10.48
E5140	M5330	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	3	0.20	0	0	15	4.9	6.0	1.8	9.45	10.48
E5160	M5335	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	5	0.30	0	0	3	8.0	9.7	2.9	9.45	10.48
E5180	M5340	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	10	0.35	0	5	10	13.0	15.8	4.7	9.45	10.48

MILITARY DESIGNATION TP6RX5310CZ TURNS RATIO 5:3:1

E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	P. WIDTH μ SEC.	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	5 TURNS	3 TURNS	1 TURN	E-Series	M-Series
E5200	M5345	0.1	8	0.01	0	0	5	140/50	170 KHz-32 MHz	0.1	0.01	0	0	20	0.55	0.40	0.15	9.45	10.48
E5220	M5350	1	8	0.05	0	6	10	280/100	12.5 KHz-3.3 MHz	1	0.02	5	5	5	3.0	2.2	0.9	9.45	10.48
E5240	M5355	5	8	0.09	0	12	25	560/200	15 KHz-4 MHz	5	0.05	0	10	10	9.5	7.0	2.6	9.45	10.48

MILITARY DESIGNATION TP6RX4440CZ TURNS RATIO 4:4:4

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS											PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	4 TNS BRN RED	4 TNS OR YEL	4 TURNS GRN BLU	E-Series	M-Series
E5181	M-5356	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.21	0.23	0.25	10.48	10.48
E5182	M-5357	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.47	0.56	0.67	10.48	10.48
E5183	M-5358	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	1.0	1.25	1.56	10.48	10.48
E5184	M-5359	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	1.5	1.80	2.2	10.48	10.48
E5185	M-5360	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	2.5	3.1	3.9	10.48	10.48
E5186	M-5361	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	3.0	3.7	4.6	10.48	10.48
E5187	M-5362	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	4.9	6.0	7.4	10.48	10.48
E5188	M-5363	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	8.0	9.7	11.8	10.48	10.48
E5189	M-5364	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	13.0	15.8	19.2	10.48	10.48

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1V

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery— stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

Ultra Miniature DC-DC Converter Transformers

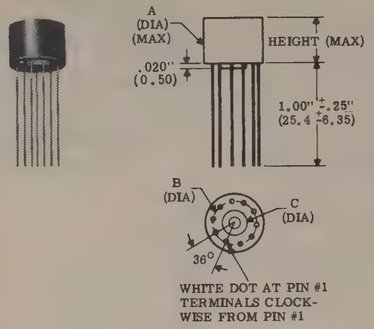
Input Voltages of: 5V, 12V, 24V and 48V

Power Levels up to 40 Watts

All units are magnetically shielded

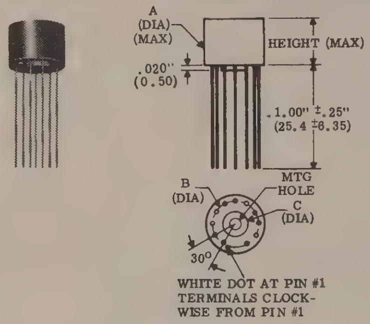
All units can be supplied with higher or lower output voltages. (Example, size 2 can have output voltage of 400V D.C.)

Delivery - stock to one week, special voltages 9 days.



SIZE	MAX. HEIGHT	A MAX. DIA	B BOLT CIRCLE	C STAND-OFF
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

All dimensions are in inches, ( )=MM



SIZE	MAX. HEIGHT	A MAX. DIA	B BOLT CIRCLE	C STAND-OFF	MTG HOLE
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	.140 (3.55)
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	.170 (4.31)

All dimensions are in inches, ( )=MM

INPUT 5 VOLTS

PART NUMBER	D.C. OUT VOLTS			MAX. POWER OUT		APPROX. SWITCH FREQ.		SIZE	*** PRICE 1-9
	BRIDGE	FULL WAVE	DUAL BRIDGE	-55°c - +105°c	-55°c - +70°c	SELF-SATURATED	SQUARE-WAVE DRIVEN**		
31020	10	5	± 5	1.5W	3W	15K	30K to 60K	1	22.38
31040	12	6	± 6	1.5W	3W	15K	30K to 60K	1	22.38
31060	28	14	±14	1.5W	3W	15K	30K to 60K	1	22.38
31080	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31100	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
32105	10	5.	± 5	3W	4.5W	15K	30K to 60K	2	22.38
32125	12	6	± 6	3W	4.5W	15K	30K to 60K	2	22.38
32145	28	14	±14	3W	4.5W	15K	30K to 60K	2	22.38
32165	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32185	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
33103	10	5	± 5	5W	7.5W	10K	20K to 50K	3	22.38
33123	12	6	± 6	5W	7.5W	10K	20K to 50K	3	22.38
33143	28	14	±14	5W	7.5W	10K	20K to 50K	3	22.38
33163	48	24	±24	5W	7.5W	10K	20K to 50K	3	22.38
33183	100	50	±50	5W	7.5W	10K	20K to 50K	3	22.38
34500	10	5	± 5	10W	14W	10K	20K to 40K	4	22.38
34520	28	14	±14	10W	14W	10K	20K to 40K	4	22.38
34540	48	24	±24	10W	14W	10K	20K to 40K	4	22.38

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

PART NUMBER	D.C. OUT VOLTS			MAX. POWER OUT		APPROX. SWITCH FREQ.		SIZE	*** PRICE 1-9
	BRIDGE	FULL WAVE	DUAL BRIDGE	-55°c - +105°c	-55°c - +70°c	SELF-SATURATED	SQUARE-WAVE DRIVEN**		
31120	12	6	± 6	1.5W	3W	15K	30K to 60K	1	22.38
31140	24	12	±12	1.5W	3W	15K	30K to 60K	1	22.38
31160	28	14	±14	1.5W	3W	15K	30K to 60K	1	22.38
31180	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31200	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
32205	12	6	± 6	3W	4.5W	15K	30K to 60K	2	22.38
32225	24	12	±12	3W	4.5W	15K	30K to 60K	2	22.38
32245	28	14	±14	3W	4.5W	15K	30K to 60K	2	22.38
32265	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32285	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
33203	12	6	± 6	5W	7.5W	15K	30K to 60K	3	22.38
33223	28	14	±14	5W	7.5W	15K	30K to 60K	3	22.38
33243	48	24	±24	5W	7.5W	20K	40K to 60K	3	22.38
33263	100	50	±50	5W	7.5W	20K	40K to 60K	3	22.38
34560	24	12	±12	10W	14W	15K	30K to 50K	4	22.38
34580	28	14	±14	10W	14W	15K	30K to 50K	4	22.38
34600	48	24	±24	10W	14W	15K	30K to 50K	4	22.38
35107	24	12	±12	17W	25W	15K	30K to 50K	5	33.57
35127	28	14	±14	17W	25W	15K	30K to 50K	5	33.57
35147	48	24	±24	17W	25W	15K	30K to 50K	5	33.57

** Lower switching frequency may be used at lower output power.

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from −55°c to +105°c. All units meet the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.
4) All units are magnetically shielded.

For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064

PICO
Electronics, Inc.

453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

phone
914-699-5514

INPUT 24 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c -+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31220	10	5	±5	1.5W	3W	15K	30K to 60K	1	22.38
31240	28	14	±14	1.5W	3W	15K	30K to 60K	1	22.38
31260	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31280	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
32305	10	5	±5	3W	4.5W	15K	30K to 60K	2	22.38
32325	28	14	±14	3W	4.5W	15K	30K to 60K	2	22.38
32345	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32365	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
33283	10	5	±5	5W	7.5W	15K	30K to 60K	3	22.38
33303	28	14	±14	5W	7.5W	15K	30K to 60K	3	22.38
33323	48	24	±24	5W	7.5W	20K	40K to 60K	3	22.38
33343	100	50	±50	5W	7.5W	20K	40K to 60K	3	22.38
34620	28	14	±14	10W	14W	15K	30K to 50K	4	22.38
34640	48	24	±24	10W	14W	15K	30K to 50K	4	22.38
35167	24	12	±12	17W	25W	15K	30K to 50K	5	33.57
35187	28	14	±14	17W	25W	15K	30K to 50K	5	33.57
35207	48	24	±24	17W	25W	15K	30K to 50K	5	33.57
36705	48	24	±24	25W	40W	15K	30K to 40K	6	38.72
36725	56	28	±28	25W	40W	15K	30K to 40K	6	38.72

** Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c -+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31300	24	12	±12	1.5W	3W	15K	30K to 60K	1	22.38
31320	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31340	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
31360	150	75	±75	1.5W	3W	20K	40K to 60K	1	22.38
32385	24	12	±12	3W	4.5W	15K	30K to 60K	2	22.38
32405	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32425	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
32445	150	75	±75	3W	4.5W	20K	40K to 60K	2	22.38
33363	24	12	±12	5W	7.5W	15K	30K to 60K	3	22.38
33383	48	24	±24	5W	7.5W	20K	40K to 60K	3	22.38
33403	100	50	±50	5W	7.5W	20K	40K to 60K	3	22.38
33423	150	75	±75	5W	7.5W	20K	40K to 60K	3	22.38
34660	24	12	±12	10W	14W	15K	30K to 50K	4	22.38
34680	48	24	±24	10W	14W	15K	30K to 50K	4	22.38
34700	56	28	±28	10W	14W	15K	30K to 50K	4	22.38
35227	24	12	±12	17W	25W	15K	30K to 50K	5	33.57
35247	48	24	±24	17W	25W	15K	30K to 50K	5	33.57
35267	56	28	±28	17W	25W	15K	30K to 50K	5	33.57
36745	48	24	±24	25W	40W	15K	30K to 40K	6	38.72
36765	56	28	±28	25W	40W	15K	30K to 40K	6	38.72
36785	100	50	±50	25W	40W	15K	30K to 40K	6	38.72

** Lower switching frequency may be used at lower output power.

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

For immediate engineering assistance or to place an order—
Call Toll Free 800-431-1064

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

SCHEMATIC FOR SIZES 1, 2 & 3 USING TRANSFORMERS AS SELF-SATURATING

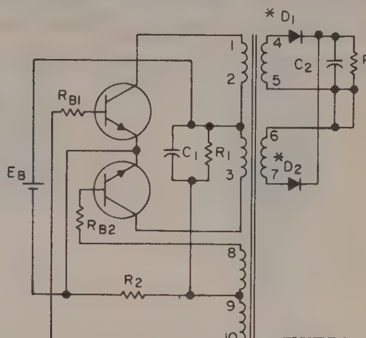


FIGURE D

SCHEMATIC FOR SIZES 1, 2, AND 3 USING TRANSFORMERS AS LINEAR SWITCHING

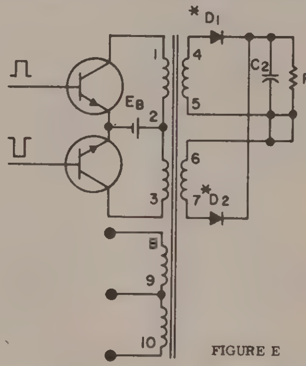


FIGURE E

* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZES 4, 5 & 6 USING TRANSFORMER AS SELF-SATURATING

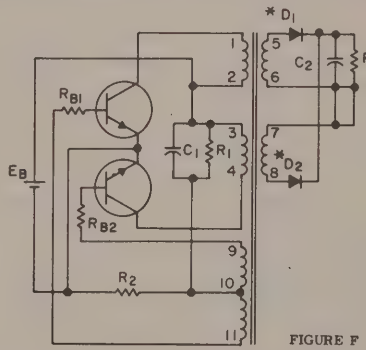


FIGURE F

SCHEMATIC FOR SIZES 4, 5 & 6 USING TRANSFORMERS AS LINEAR SWITCHING.

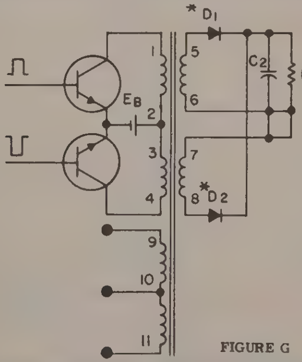


FIGURE G

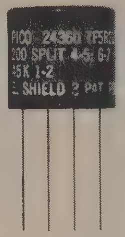
*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

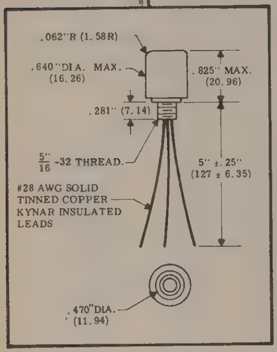
PICO Microphone/Transducer Audio Input Transformers

Used for Professional Sound Studios/Broadcast Mixing Consoles/Control and Instrument Amplifiers.

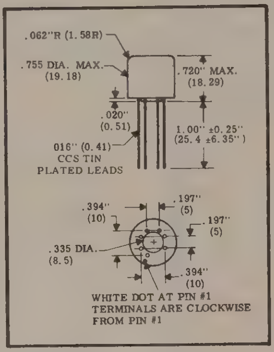
Interchangeable with transformers made by Beyer Dynamic of Germany.

PICO 23360
200 SPLIT
45K
SHIELD





NOTE
ALL DIMENSIONS ARE IN INCHES, ( ) = MM



NOTES:
ALL DIMENSIONS ARE IN INCHES, ( )=MM.
CCS-COPPER CLAD STEEL. TINNED 100%.
ELECTROPLATED PER MIL-T-10727A
AND ASTM CCS B452.

- *Large step-up ratios with flat frequency response over the entire audio range.*
- *Gapless laminations provide wide bandwidth with extremely low distortion. Use of two magnetic shields made with extra thick mu-metal and gapless core provide negligible hum pick up. All units provided with electrostatic shield.*
- *Your choice of two package styles, stud mounting with flying leads or low profile plug-in. Identical electrical performance regardless of package style.*
- *Frequency response ±1 dB, 30 Hz – 15 kHz.*
- *Low profile plug-in (24000 series) meets MIL-T-27D (TF5R21ZZ).*
- *Because of gapless laminations, unbalanced DC current should be avoided.*
- *Typical distortion of 1% at power level of 0 dBm (1 Milliwatt), 30 Hz – 15 kHz. If the low frequency is raised, the power level for 1% distortion is as follows:*

50 Hz	-	3 Milliwatts (4.7 dBm)
100 Hz	-	10 Milliwatts (10 dBm)
300 Hz	-	150 Milliwatts (21.7 dBm)

For immediate engineering assistance
or to place an order—
Call Toll Free 800-431-1064

All units have two extra thick mu-metal shields.

Delivery-Stock to 1 week

Modification of standards 9 days!

This Product is Patented

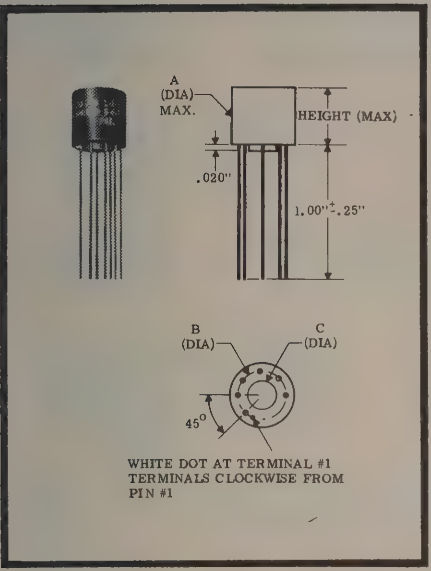
PART NUMBER		IMPEDANCE OHMS		TURNS RATIO PRIM/SEC		D.C. RESISTANCE			TYPICAL PRIM OPEN CIRCUIT IMPEDANCE AT 50 Hz	REPLACES BEYER/GERMANY PART NUMBER		PRICES 1-9***	
STUD MOUNTING	PLUG-IN	PRIM	SEC	PRIM SERIES CONN	PRIM PAR CONN	PRIM SERIES CONN	PRIM PAR CONN	SEC		STUD MOUNTING (23000 SERIES)	PLUG-IN (24000 SERIES)	STUD MOUNTING	PLUG-IN
23120	24120	12.5	5K	1·20	-	4.6	-	1K	125	TR-BV35704	STR-BV37704	16.82	20.19
23140	24140	200	200	1:1	-	50	-	75	2K	351 001 001	370 001 001	15.91	18.56
23160	24160	200 ct/50 SPLIT	200	1:1	1:2	50	12.5	75	2K	351 201 001	370 201 001	15.69	19.07
23180	24180	200	2K	1:3.16	-	50	-	580	2K	351 003 002	370 003 002	15.91	18.56
23200	24200	200 ct/50 SPLIT	2K	1:3.16	1:6.33	50	12.5	580	2K	351 203 002	370 203 002	15.69	19.07
23220	24220	200	5K	1:5	-	50	-	1.45K	2K	351 005 003	370 005 003	15.91	18.56
23240	24240	200 ct/50 SPLIT	5K	1·5	1:10	50	12.5	1.45K	2K	351 205 003	370 205 003	15.91	20.81
23260	24260	200	10K	1:7.07	-	50	-	3.45K	2K	351 007 004	370 007 004	15.69	19.07
23280	24280	200 ct/50 SPLIT	10K	1:7.07	1:14.14	50	12.5	3.45K	2K	351 207 004	370 207 004	17.94	21.32
23300	24300	200	20K	1:10	-	85	-	4.75K	2K	351 010 005	370 010 005	16.31	19.69
23320	24320	200 ct/50 SPLIT	20K	1·10	1:20	85	21	4.75K	2K	351 210 005	370 210 005	18.56	21.94
23340	24340	200	45K	1·15	-	85	-	10.4 K	2K	351 015 006	370 015 006	19.07	22.44
23360	24360	200 ct/50 SPLIT	45K	1:15	1·30	85	21	10.4 K	2K	351 215 006	370 215 006	21.32	24.70
23380	24380	200	80K	1:20	-	115	-	13.5 K	2K	351 020 007	370 020 007	20.19	23.57
23400	24400	200 ct/50 SPLIT	80K	1:20	1·40	115	29	13.5 K	2K	351 220 007	370 220 007	22.44	25.82
23420	24420	600 ct	600	1·1	-	140	-	190	6K	TR-145/BV35508 351 101 031	STR-145/BV37508 370 101 031	15.69	19.07
23440	24440	600 ct/15C SPLIT	600	1:1	1:2	140	35	190	6K	351 201 031	370 201 031	16.82	20.19
23460	24460	600 ct/150 SPLIT	2.4K	1:2	1:4	140	35	575	6K	351 202 032	370 202 032	17.94	21.32
23480	24480	600 ct/150 SPLIT	6K	1:3.16	1:6.33	140	35	1.45K	6K	351 203 033	370 203 033	19.07	22.44
23500	24500	600 ct/150 SPLIT	15K	1:5	1:10	140	35	3.9 K	6K	351 205 034	370 205 034	20.19	23.57
23520	24520	600 ct/150 SPLIT	30K	1:7.07	1:14.14	140	35	7.05K	6K	351 207 035	370 207 035	21.32	24.70
23540	24540	600 ct/150 SPLIT	60K	1:10	1:20	199	50	11 K	6K	351 210 036	370 210 036	22.44	25.82
23560	24560	1.2K ct/300 SPLIT	1.2K	1:1	1:2	310	78	430	12K	351 201 061	370 201 061	16.82	20.19
23580	24580	1.2K ct/300 SPLIT	5K	1:2.04	1:4.08	310	78	1.4 K	12K	351 202 062	370 202 062	17.94	21.32
23600	24600	1.2K ct/300 SPLIT	12K	1:3.16	1:6.33	310	78	3.75K	12K	351 203 063	370 203 063	19.07	22.44
23620	24620	1.2K ct/300 SPLIT	30K	1:5	1:10	475	119	8.45K	12K	351 205 064	370 205 064	20.19	23.57
23640	24640	10K	10K	1:1	-	2.5 K	-	3.1 K	100K	TR-145/BV35590	STR-145/BV37590	15.91	18.56

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

PICO Electronics, Inc. 453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO's miniature 400 Hz transformers

115V/26V Primary
Printed Circuit Construction



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM
PIN #1

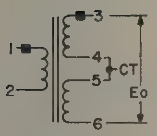
CASE SIZE	HEIGHT (MAX)	A (DIA) MAX	B (DIA)	C (DIA)
L	.35	.51	.35	.218
N	.5	.51	.35	.218
R	.375	.75	.6	.475
S	.52	.75	.6	.475
T	.82	.75	.6	.475

FEATURES

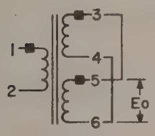
- 400 Hz Aerospace Application
- Smallest Possible Size
- Printed Circuit Plug-In Construction
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS

- MIL-T-27D (TF5S03ZZ)
- 90 °c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.



SERIES CONNECTED
SECONDARY



PARALLEL CONNECTED
SECONDARY

This Product is Patented

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
5.0 CT	75	L	L-8948	L-8951	19.08
	150	N	N-6948	N-6951	19.08
	204	R	R-20650	R-20815	22.97
	338	S	S-21650	S-21815	25.06
	480	T	T-22650	T-22815	26.12
6.3 CT	59.5	L	L-8947	L-8952	19.08
	119	N	N-6947	N-6952	19.08
	162	R	R-20655	R-20820	22.97
	268	S	S-21655	S-21820	25.06
	381	T	T-22655	T-22820	26.12
8.0 CT	47	L	L-8946	L-8953	19.08
	94	N	N-6946	N-6953	19.08
	128	R	R-20660	R-20825	22.97
	211	S	S-21660	S-21825	25.06
	300	T	T-22660	T-22825	26.12
10 CT	37.5	L	L-8945	L-8954	19.08
	75	N	N-6945	N-6954	19.08
	102	R	R-20665	R-20830	22.97
	169	S	S-21665	S-21830	25.06
	240	T	T-22665	T-22830	26.12
12.8 CT	29	L	L-8940	L-8956	19.08
	58.6	N	N-6940	N-6956	19.08
	79.7	R	R-20670	R-20835	22.97
	132	S	S-21670	S-21835	25.06
	188	T	T-22670	T-22835	26.12
14 CT	26.8	L	L-8937	L-8957	19.08
	53.6	N	N-6937	N-6957	19.08
	72.9	R	R-20675	R-20840	22.97
	121	S	S-21675	S-21840	25.06
	171	T	T-22675	T-22840	26.12
16 CT	23	L	L-8935	L-8958	19.08
	47	N	N-6935	N-6958	19.08
	63.8	R	R-20680	R-20845	22.97
	106	S	S-21680	S-21845	25.06
	150	T	T-22680	T-22845	26.12
18 CT	20.8	L	L-8934	L-8959	19.08
	41.7	N	N-6934	N-6959	19.08
	56.7	R	R-20685	R-20850	22.97
	93.9	S	S-21685	S-21850	25.06
	133	T	T-22685	T-22850	26.12
20 CT	18.8	L	L-8933	L-8961	19.08
	37.5	N	N-6933	N-6961	19.08
	51	R	R-20690	R-20855	22.97
	84.5	S	S-21690	S-21855	25.06
	120	T	T-22690	T-22855	26.12
22 CT	17	L	L-8932	L-8962	19.08
	34	N	N-6932	N-6962	19.08
	46.4	R	R-20695	R-20860	22.97
	76.8	S	S-21695	S-21860	25.06
	109	T	T-22695	T-22860	26.12
24 CT	15.5	L	L-8930	L-8963	19.08
	31	N	N-6930	N-6963	19.08
	42.5	R	R-20700	R-20865	22.97
	70.4	S	S-21700	S-21865	25.06
	100	T	T-22700	T-22865	26.12
28 CT	13.4	L	L-8929	L-8964	19.08
	26.8	N	N-6929	N-6964	19.08
	36.4	R	R-20705	R-20870	22.97
	60.4	S	S-21705	S-21870	25.06
	85.7	T	T-22705	T-22870	26.12
31 CT	12	L	L-8927	L-8966	19.08
	24	N	N-6927	N-6966	19.08
	32.9	R	R-20710	R-20875	22.97
	54.5	S	S-21710	S-21875	25.06
	77.4	T	T-22710	T-22875	26.12
36 CT	10.4	L	L-8925	L-8967	19.08
	20.8	N	N-6925	N-6967	19.08
	28.3	R	R-20715	R-20880	22.97
	46.9	S	S-21715	S-21880	25.06
	66.7	T	T-22715	T-22880	26.12
39 CT	9.6	L	L-8924	L-8968	19.08
	19.2	N	N-6924	N-6968	19.08
	26.2	R	R-20720	R-20885	22.97
	43.3	S	S-21720	S-21885	25.06
	61.5	T	T-22720	T-22885	26.12

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
43 CT	8.7	L	L-8923	L-8969	19.08
	17.4	N	N-6923	N-6969	19.08
	23.7	P	R-20725	R-20890	22.97
	39.3	S	S-21725	S-21890	25.06
	55.8	T	T-22725	T-22890	26.12
48 CT	7.8	L	L-8922	L-8971	19.08
	15.6	N	N-6922	N-6971	19.08
	21.1	R	R-20730	R-20895	22.97
	35.2	S	S-21730	S-21895	25.06
	50	T	T-22730	T-22895	26.12
56 CT	6.6	L	L-8920	L-8972	19.08
	13.2	N	N-6920	N-6972	19.08
	18.2	R	R-20735	R-20900	22.97
	30.2	S	S-21735	S-21900	25.06
	42.9	T	T-22735	T-22900	26.12
63 CT	6	L	L-8917	L-8973	19.08
	11.9	N	N-6917	N-6973	19.08
	16.2	R	R-20740	R-20905	22.97
	26.9	S	S-21740	S-21905	25.06
	38.2	T	T-22740	T-22905	26.12
68 CT	5.5	L	L-8915	L-8974	19.08
	11	N	N-6915	N-6974	19.08
	15	R	R-20745	R-20910	22.97
	24.9	S	S-21745	S-21910	25.06
	35.3	T	T-22745	T-22910	26.12
80 CT	4.6	L	L-8910	L-8976	19.08
	9.4	N	N-6910	N-6976	19.08
	12.1	R	R-20750	R-20915	22.97
	21.1	S	S-21750	S-21915	25.06
	30	T	T-22750	T-22915	26.12
88 CT	4.2	L	L-8905	L-8977	19.08
	8.5	N	N-6905	N-6977	19.08
	11.6	R	R-20755	R-20920	22.97
	19.2	S	S-21755	S-21920	25.06
	27.3	T	T-22755	T-22920	26.12
100 CT	3.7	L	L-8902	L-8978	19.08
	8.5	N	N-6902	N-6978	19.08
	10.2	R	R-20760	R-20925	22.97
	16.9	S	S-21760	S-21925	25.06
	24	T	T-22760	T-22925	26.12
115 CT	3.2	L	L-8900	L-8979	19.08
	6.5	N	N-6900	N-6979	19.08
	8.9	R	R-20765	R-20930	22.97
	14.7	S	S-21765	S-21930	25.06
	20.9	T	T-22765	T-22930	26.12
123 CT	8.3	R	R-20770	R-20935	22.97
	13.7	S	S-21770	S-21935	25.06
	19.5	T	T-22770	T-22935	26.12
138 CT	7.4	R	R-20775	R-20940	22.97
	12.2	S	S-21775	S-21940	25.06
	17.4	T	T-22775	T-22940	26.12
157 CT	6.5	R	R-20780	R-20945	22.97
	10.8	S	S-21780	S-21945	25.06
	15.3	T	T-22780	T-22945	26.12
175 CT	5.8	R	R-20785	R-20950	22.97
	9.6	S	S-21785	S-21950	25.06
	13.7	T	T-22785	T-22950	26.12
200 CT	5.1	R	R-20790	R-20955	22.97
	8.4	S	S-21790	S-21955	25.06
	12	T	T-22790	T-22955	26.12
220 CT	7.7	S	S-21795	S-21960	26.32
	10.9	T	T-22795	T-22960	27.43
250 CT	6.8	S	S-21800	S-21965	27.57
	9.6	T	T-22800	T-22965	28.73
275 CT	6.1	S	S-21805	S-21970	28.84
	8.7	T	T-22805	T-22970	30.02
310 CT	5.4	S	S-21810	S-21975	30.08
	7.7	T	T-22810	T-22975	31.37

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

Delivery— stock to one week

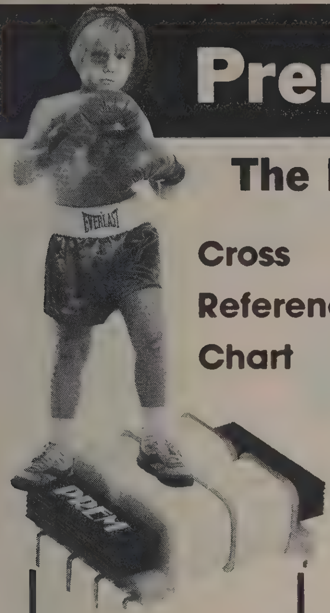
PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

enclosures · capacitors · circuit boards · coils, chokes, inductors · connectors, electronic · sockets/terminals · crystals · oscillators · crystal filters delay lines · panel hardware · displays · lamps/lights · cooling equipment · filters · generators · multimeters · panel meters · oscilloscopes · graphic recorde[illegible]nnections · microwave components [illegible]tors/drives · ba[illegible] power supplies, dc · power supplies, ac · [illegible] · relays · solenoids · resistors · potentiometers/trimmers controls/rhe[illegible] · switches · [illegible] · transducers/encoders · transformers · wire & cable · enclosures capacitors · circuit boards · coils, chokes, inductors · connectors, electronic · sockets,/terminals

EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.



Prem PC Power Transformers

The New Kid on the Board is a Price Fighter

Cross Reference Chart

PREM	EWC	MICROTRAN	TRIAD	SIGNAL
SPW-050	LP 10-250B23	N/A	N/A	LP 10-250
SPW-051	LP 12-200B24	N/A	N/A	LP 12-200
SPW-052	LP 16-150B25	N/A	N/A	LP 16-150
SPW-053	LP 20-125B26	N/A	N/A	LP 20-125
SPW-054	LP 24-100B27	N/A	N/A	LP 24-100
SPW-055	LP 34-75B28	N/A	N/A	LP 34-75
SPW-056	LP 40-60B29	N/A	N/A	LP 40-60
SPW-057	LP 56-45B30	N/A	N/A	LP 56-45
SPW-058	LP 88-28B31	N/A	N/A	LP 88-28
SPW-059	LP 120-20B32	N/A	N/A	LP 120-20
SPW-060	LP 230-10B33	N/A	N/A	LP 230-10
SPW-061	N/A	N/A	N/A	LP 30-85
SPW-100	LP 10-600B1	PF 6-10	FP 10-600	LP 10-600
SPW-101	LP 12-450B3	PF 6-12	FP 12-475	LP 12-450
SPW-102	LP 16-350B5	PF 6-16	FP 16-375	LP 16-350
SPW-103	LP 20-300B7	N/A	FP 20-300	LP 20-300
SPW-104	LP 24-250B9	PF 6-24	FP 24-250	LP 24-250
SPW-105	LP 34-170B11	PF 6-34	FP 34-170	LP 34-170
SPW-106	LP 40-150B13	N/A	FP 40-150	LP 40-150
SPW-107	LP 56-100B15	PF 6-56	FP 56-100	LP 56-100
SPW-108	LP 88-65B17	N/A	FP 88-65	LP 88-65
SPW-109	LP 120-50B19	N/A	FP 120-50	LP 120-50
SPW-110	LP 230-25B21	N/A	FP 230-25	LP 230-25
SPW-111	N/A	N/A	FP 30-200	LP 30-200
SPW-300	LP 10-1200B2	PF 12-10	FP 10-1200	LP 10-1200
SPW-301	LP 12-900B4	PF 12-12	FP 12-950	LP 12-900
SPW-302	LP 16-700B6	PF 12-16	FP 16-750	LP 16-700
SPW-303	LP 20-600B8	N/A	FP 20-600	LP 20-600
SPW-304	LP 24-500B10	PF 12-24	FP 24-500	LP 24-500
SPW-305	LP 34-340B12	PF 12-34	FP 34-340	LP 34-340
SPW-306	LP 40-300B14	N/A	FP 40-300	LP 40-300
SPW-307	LP 56-200B16	PF 12-56	FP 56-200	LP 56-200
SPW-308	LP 88-130B18	N/A	FP 88-130	LP 88-130
SPW-309	LP 120-100B20	N/A	FP 120-100	LP 120-100
SPW-310	LP 230-50B22	N/A	FP 230-50	LP 230-50
SPW-311	N/A	N/A	FP 30-200	LP 30-400
SPW-350-S/D	ST/DST 2-10B41	PSS/PSD 2-10	N/A	ST/DST 2-10
SPW-351-S/D	ST/DST 2-12B42	PSS/PSD 2-12	N/A	ST/DST 2-12
SPW-352-S/D	ST/DST 2-16B43	PSS/PSD 2-16	N/A	ST/DST 2-16
SPW-353-S/D	ST/DST 2-20B44	PSS/PSD 2-20	N/A	ST/DST 2-20
SPW-354-S/D	ST/DST 2-24B45	PSS/PSD 2-24	N/A	ST/DST 2-24
SPW-355-S/D	ST/DST 2-28B46	PSS/PSD 2-28	N/A	ST/DST 2-28
SPW-356-S/D	ST/DST 2-36B47	PSS/PSD 2-36	N/A	ST/DST 2-36
SPW-357-S/D	ST/DST 2-48B48	PSS/PSD 2-48	N/A	ST/DST 2-48
SPW-358-S/D	ST/DST 2-56B49	PSS/PSD 2-56	N/A	ST/DST 2-56
SPW-359-S/D	ST/DST 2-120B50	PSS/PSD 2-120	N/A	ST/DST 2-120
SPW-400-S/D	ST/DST 3-10B1	PSS/PSD 3-10	F/FS 10-250	ST/DST 3-10
SPW-401-S/D	ST/DST 3-12B5	PSS/PSD 3-12	F/FS 12-200	ST/DST 3-12
SPW-402-S/D	ST/DST 3-16B9	PSS/PSD 3-16	F/FS 16-150	ST/DST 3-16
SPW-403-S/D	ST/DST 3-20B13	PSS/PSD 3-20	F/FS 20-120	ST/DST 3-20
SPW-404-S/D	ST/DST 3-24B17	PSS/PSD 3-24	F/FS 24-100	ST/DST 3-24
SPW-405-S/D	ST/DST 3-28B21	PSS/PSD 3-28	F/FS 28-85	ST/DST 3-28
SPW-406-S/D	ST/DST 3-36B25	PSS/PSD 3-36	F/FS 36-65	ST/DST 3-36
SPW-407-S/D	ST/DST 3-48B29	PSS/PSD 3-48	N/A	ST/DST 3-48
SPW-408-S/D	ST/DST 3-56B33	PSS/PSD 3-56	N/A	ST/DST 3-56
SPW-409-S/D	ST/DST 3-120B37	PSS/PSD 3-120	N/A	ST/DST 3-120
SPW-500-S/D	ST/DST 4-10B2	PSS/PSD 4-10	F/FS 10-600	ST/DST 4-10
SPW-501-S/D	ST/DST 4-12B6	PSS/PSD 4-12	F/FS 12-500	ST/DST 4-12
SPW-502-S/D	ST/DST 4-16B10	PSS/PSD 4-16	F/FS 16-400	ST/DST 4-16
SPW-503-S/D	ST/DST 4-20B14	PSS/PSD 4-20	F/FS 20-300	ST/DST 4-20
SPW-504-S/D	ST/DST 4-24B18	PSS/PSD 4-24	F/FS 24-250	ST/DST 4-24
SPW-505-S/D	ST/DST 4-28B22	PSS/PSD 4-28	F/FS 28-200	ST/DST 4-28
SPW-506-S/D	ST/DST 4-36B26	PSS/PSD 4-36	F/FS 36-170	ST/DST 4-36
SPW-507-S/D	ST/DST 4-48B30	PSS/PSD 4-48	N/A	ST/DST 4-48
SPW-508-S/D	ST/DST 4-56B34	PSS/PSD 4-56	N/A	ST/DST 4-56
SPW-509-S/D	ST/DST 4-120B38	PSS/PSD 4-120	N/A	ST/DST 4-120
SPW-600-S/D	ST/DST 5-10B3	PSS/PSD 5-10	F/FS 10-1200	ST/DST 5-10
SPW-601-S/D	ST/DST 5-12B7	PSS/PSD 5-12	F/FS 12-1000	ST/DST 5-12
SPW-602-S/D	ST/DST 5-16B11	PSS/PSD 5-16	F/FS 16-800	ST/DST 5-16
SPW-603-S/D	ST/DST 5-20B15	PSS/PSD 5-20	F/FS 20-600	ST/DST 5-20
SPW-604-S/D	ST/DST 5-24B19	PSS/PSD 5-24	F/FS 24-500	ST/DST 5-24
SPW-605-S/D	ST/DST 5-28B23	PSS/PSD 5-28	F/FS 28-420	ST/DST 5-28
SPW-606-S/D	ST/DST 5-36B27	PSS/PSD 5-36	F/FS 36-350	ST/DST 5-36
SPW-607-S/D	ST/DST 5-48B31	PSS/PSD 5-48	N/A	ST/DST 5-48
SPW-608-S/D	ST/DST 5-56B35	PSS/PSD 5-56	N/A	ST/DST 5-56
SPW-609-S/D	ST/DST 5-120B39	PSS/PSD 5-120	N/A	ST/DST 5-120
SPW-610-S/D	ST/DST 6-10B4	N/A	N/A	ST/DST 6-10
SPW-611-S/D	ST/DST 6-12B8	N/A	N/A	ST/DST 6-12
SPW-612-S/D	ST/DST 6-16B12	N/A	N/A	ST/DST 6-16
SPW-613-S/D	ST/DST 6-20B16	N/A	N/A	ST/DST 6-20
SPW-614-S/D	ST/DST 6-24B20	N/A	N/A	ST/DST 6-24
SPW-615-S/D	ST/DST 6-28B24	N/A	N/A	ST/DST 6-28
SPW-616-S/D	ST/DST 6-36B28	N/A	N/A	ST/DST 6-36
SPW-617-S/D	ST/DST 6-48B32	N/A	N/A	ST/DST 6-48
SPW-618-S/D	ST/DST 6-56B36	N/A	N/A	ST/DST 6-56
SPW-619-S/D	ST/DST 6-120B40	N/A	N/A	ST/DST 6-120
SPW-620-S/D	ST/DST 7-10B51	N/A	N/A	ST/DST 7-10
SPW-621-S/D	ST/DST 7-12B52	N/A	N/A	ST/DST 7-12
SPW-622-S/D	ST/DST 7-16B53	N/A	N/A	ST/DST 7-16
SPW-623-S/D	ST/DST 7-20B54	N/A	N/A	ST/DST 7-20
SPW-624-S/D	ST/DST 7-24B55	N/A	N/A	ST/DST 7-24
SPW-625-S/D	ST/DST 7-28B56	N/A	N/A	ST/DST 7-28
SPW-626-S/D	ST/DST 7-36B57	N/A	N/A	ST/DST 7-36
SPW-627-S/D	ST/DST 7-48B58	N/A	N/A	ST/DST 7-48
SPW-628-S/D	ST/DST 7-56B59	N/A	N/A	ST/DST 7-56
SPW-629-S/D	ST/DST 7-120B60	N/A	N/A	ST/DST 7-120

Prem has taken on the Ol' Boys head-to-head. And you come out the winner. Prem stocks the same low profile, three-flange designs and delivers fast with consistent, reliable quality. Why pay more? Check out Prem's prices today, you'll find it's nice to have someone in your corner for a change.

For further information and pricing, contact Prem's Customer Service Department.

PREM
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, IL 60050
TWX 910/642-3763
(815) 385-2700

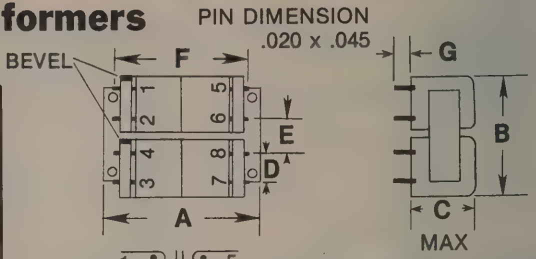
Prem PC Power Transformers

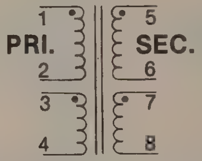
EVERLAST
PREM

The New Kid on the Board is a Price Fighter

Low Profile Power Transformers

	SPW 050	SPW 100	SPW 300
VA	2.5	6	12
A	1.875	1.875	2.500
B	1.562	1.562	2.000
C	.660	.850	1.065
D	.375	.375	.500
E	.375	.375	.500
F	1.600	1.600	2.000
G	.200	.200	.200





EXTERNAL CONNECTIONS
PARALLEL
1-3, 2-4, 5-7, 6-8
SERIES
2-3, 6-7

Prem — the price leader in Low Profile Power Transformers.

- Low profile — .660" in 2.5 VA design
- ®UL Recognized Class B system*
- Three flange bobbin design — 1500 VRMS High-pot
- No electro-static shield needed

Other primary and secondary voltages may be custom-designed to your specifications. Since 12 terminals are available, tapped primaries or secondaries may also be utilized.

For further information and pricing, contact Prem's Customer Service Department.

PREM
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, IL 60050
TWX 910/642-3763
(815) 385-2700

LOW PROFILE POWER TRANSFORMERS

115/230V DUAL PRIMARIES	SECONDARY	
Part No.	Parallel	Series
SPW-050	5V @ 500 mA	10V CT @ 250 mA
SPW-051	6.3V @ 400 mA	12.6V CT @ 200 mA
SPW-052	8V @ 300 mA	16V CT @ 150 mA
SPW-053	10V @ 250 mA	20V CT @ 125 mA
SPW-054	12V @ 200 mA	24V CT @ 100 mA
SPW-055	17V @ 150 mA	34V CT @ 75 mA
SPW-056	20V @ 120 mA	40V CT @ 60 mA
SPW-057	28V @ 90 mA	56V CT @ 45 mA
SPW-058	44V @ 56 mA	88V CT @ 28 mA
SPW-059	60V @ 40 mA	120V CT @ 20 mA
SPW-060	115V @ 20 mA	230V CT @ 10 mA
SPW-061	15V @ 170 mA	30V CT @ 85 mA
SPW-100	5V @ 1.2A	10V CT @ 600 mA
SPW-101	6.3V @ 900 mA	12.6V CT @ 450 mA
SPW-102	8V @ 700 mA	16V CT @ 350 mA
SPW-103	10V @ 600 mA	20V CT @ 300 mA
SPW-104	12V @ 500 mA	24V CT @ 250 mA
SPW-105	17V @ 340 mA	34V CT @ 170 mA
SPW-106	20V @ 300 mA	40V CT @ 150 mA
SPW-107	28V @ 200 mA	56V CT @ 100 mA
SPW-108	44V @ 130 mA	88V CT @ 65 mA
SPW-109	60V @ 100 mA	120V CT @ 50 mA
SPW-110	115V @ 50 mA	230V CT @ 25 mA
SPW-111	15V @ 400 mA	30V CT @ 200 mA
SPW-300	5V @ 2.4A	10V CT @ 1.2A
SPW-301	6.3V @ 1.8A	12.6V CT @ 900 mA
SPW-302	8V @ 1.4A	16V CT @ 700 mA
SPW-303	10V @ 1.2A	20V CT @ 600 mA
SPW-304	12V @ 1.0A	24V CT @ 500 mA
SPW-305	17V @ 680 mA	34V CT @ 340 mA
SPW-306	20V @ 600 mA	40V CT @ 300 mA
SPW-307	28V @ 400 mA	56V CT @ 200 mA
SPW-308	44V @ 260 mA	88V CT @ 130 mA
SPW-309	60V @ 200 mA	120V CT @ 100 mA
SPW-310	115V @ 100 mA	230V CT @ 50 mA
SPW-311	15V @ 800 mA	30V CT @ 400 mA

*Recognized under the component program of Underwriters Laboratory, Inc., under file #E85315, yellow card available upon request.

Prem PC Power Transformers

EVERLAST
PREM

The New Kid on the Board is a Price Fighter

PC Power Transformers

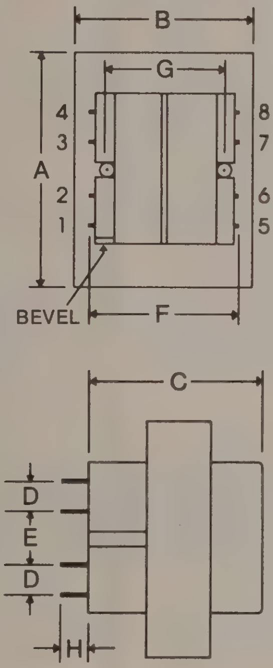
	SPW-350	SPW-400	SPW-500	SPW-600	SPW-610	SPW-620
VA	1.1	2.4	6.0	12.0	20.0	36.0
A	1.375	1.375	1.625	1.875	2.250	2.625
B	1.125	1.125	1.312	1.5625	1.875	2.187
C	.9375	1.187	1.290	1.4375	1.410	1.562
D	.250	.250	.250	.300	.300	.400
E	.250	.250	.350	.400	.400	.400
F	1.200	1.200	1.270	1.410	1.600	1.850
G	N/A	N/A	1.0625	1.250	1.50	NOTE
H	.28	.20	.20	.20	.20	.20

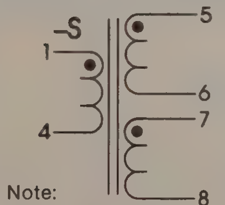
Prem — the price leader in PC Power Transformers

- Small board area — 1 3/8" x 1 1/8" in 2.4 VA design
- ® Recognized Class B system*
- Three flange bobbin design — 1500 VRMS High-pot

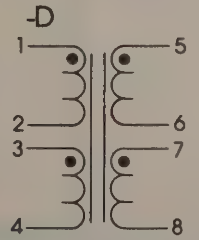
*Recognized under the component program of Underwriters Laboratory, Inc., under file #E85315, yellow card available upon request.

PIN DIMENSION
.020 x .041





Note:
Pins 2 & 3 Omitted



For further information and pricing, contact Prem's Customer Service Department.

PREM
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, IL 60050
TWX 910/642-3763
(815) 385-2700

PC Power Transformers

Part No.	Parallel Secondaries	Series Secondaries
SPW-350-*	5V @ 220 mA	10V CT @ 110 mA
SPW-351-	6.3V @ 180 mA	12.6V CT @ 90 mA
SPW-352-	8V @ 140 mA	16V CT @ 70 mA
SPW-353-	10V @ 110 mA	20V CT @ 55 mA
SPW-354-	12V @ 90 mA	24V CT @ 45 mA
SPW-355-	14V @ 80 mA	28V CT @ 40 mA
SPW-356-	18V @ 60 mA	36V CT @ 30 mA
SPW-357-	24V @ 46 mA	48V CT @ 23 mA
SPW-358-	28V @ 40 mA	56V CT @ 20 mA
SPW-359-	60V @ 20 mA	120V CT @ 10 mA
SPW-400-	5V @ 500 mA	10V CT @ 250 mA
SPW-401-	6.3V @ 400 mA	12.6V CT @ 200 mA
SPW-402-	8V @ 300 mA	16V CT @ 150 mA
SPW-403-	10V @ 240 mA	20V CT @ 120 mA
SPW-404-	12V @ 200 mA	24V CT @ 100 mA
SPW-405-	14V @ 170 mA	28V CT @ 85 mA
SPW-406-	18V @ 130 mA	36V CT @ 65 mA
SPW-407-	24V @ 100 mA	48V CT @ 50 mA
SPW-408-	28V @ 90 mA	56V CT @ 45 mA
SPW-409-	60V @ 40 mA	120V CT @ 20 mA
SPW-500-	5V @ 1.2A	10V CT @ 600 mA
SPW-501-	6.3V @ 1.0A	12.6V CT @ 500 mA
SPW-502-	8V @ 800 mA	16V CT @ 400 mA
SPW-503-	10V @ 600 mA	20V CT @ 300 mA
SPW-504-	12V @ 500 mA	24V CT @ 250 mA
SPW-505-	14V @ 400 mA	28V CT @ 200 mA
SPW-506-	18V @ 340 mA	36V CT @ 170 mA
SPW-507-	24V @ 250 mA	48V CT @ 125 mA
SPW-508-	28V @ 220 mA	56V CT @ 110 mA
SPW-509-	60V @ 100 mA	120V CT @ 50 mA
SPW-600-	5V @ 2.4A	10V CT @ 1.2A
SPW-601-	6.3V @ 2.0A	12.6V CT @ 1.0A
SPW-602-	8V @ 1.6A	16V CT @ 800 mA
SPW-603-	10V @ 1.2A	20V CT @ 600 mA
SPW-604-	12V @ 1.0A	24V CT @ 500 mA
SPW-605-	14V @ 840 mA	28V CT @ 420 mA
SPW-606-	18V @ 700 mA	36V CT @ 350 mA
SPW-607-	24V @ 500 mA	48V CT @ 250 mA
SPW-608-	28V @ 440 mA	56V CT @ 220 mA
SPW-609-	60V @ 200 mA	120V CT @ 100 mA
SPW-610-	5V @ 4.0A	10V CT @ 2.0A
SPW-611-	6.3V @ 3.2A	12.6V CT @ 1.6A
SPW-612-	8V @ 2.5A	16V CT @ 1.25A
SPW-613-	10V @ 2.0A	20V CT @ 1.0A
SPW-614-	12V @ 1.6A	24V CT @ 800 mA
SPW-615-	14V @ 1.4A	28V CT @ 700 mA
SPW-616-	18V @ 1.1A	36V CT @ 550 mA
SPW-617-	24V @ 800 mA	48V CT @ 400 mA
SPW-618-	28V @ 700 mA	56V CT @ 350 mA
SPW-619-	60V @ 320 mA	120V CT @ 160 mA
SPW-620-	5V @ 7.2A	10V CT @ 3.6A
SPW-621-	6.3V @ 5.7A	12.6V CT @ 2.85A
SPW-622-	8V @ 4.5A	16V CT @ 2.25A
SPW-623-	10V @ 3.6A	20V CT @ 1.8A
SPW-624-	12V @ 3.0A	24V CT @ 1.5A
SPW-625-	14V @ 2.6A	28V CT @ 1.3A
SPW-626-	18V @ 2.0A	36V CT @ 1.0A
SPW-627-	24V @ 1.5A	48V CT @ 750 mA
SPW-628-	28V @ 1.3A	56V CT @ 650 mA
SPW-629-	60V @ 600 mA	120V CT @ 300 mA

***Primary Voltage — S (115V)**
— D (115/230V)

NOTE: 4 corner mounting holes 2.187 x 1.750 centers clearance for #6 screw on SPW-620 series.

RENCO ELECTRONICS, INC.

Custom Transformers AT STANDARD PRICES For Your Switching Power Supplies

RL 1287

The driver, interstage, and inverter transformers in all switching power supplies should be custom designed by experts. If they're not, they're apt to be overrated, bulky, and difficult to manufacture.

Custom design, however, is usually expensive. And takes time.

That's why we developed the Renco SC&B (Standard Core & Bobbin) System, which enables us to give you custom transformers at the prices you'd pay for standards. And deliver them almost as fast as we deliver our standard products.

After extensive research, we selected six standard ferrite "E" cores which are good for most applications at all popular switching frequencies; and glass filled nylon bobbins, which have excellent rigidity and high temperature performance, and can easily be mounted on printed circuit boards.

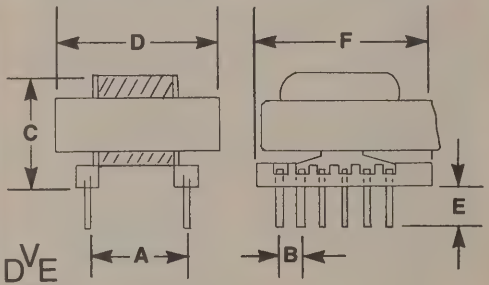
With these cores and bobbins we can custom-design your transformers, and normally ship prototypes to you within ten days. Since we always have large stocks of cores and bobbins on hand, you'll get fast delivery on your complete order. And since we buy in volume, you're never charged a premium, even for small quantity orders.

And your transformers are wound on custom engineered equipment that ensures conformance to requirements.

Other companies have copied this system. But none offer nearly as much engineering assistance as we do. All you have to do is give us your bare specs, and we'll translate them into transformers.

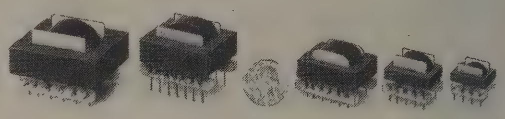
And none have nearly as much experience as we do. We've been exclusively engaged in the design and manufacture of coil wound products for over 30 years. So when you come to us you can be certain that your transformers will be exactly right for your application.

Just call our Engineering Hotline (800-645-5828 outside of New York State; in New York, call 516-586-5566) and tell us your requirements. Note: a small charge may be required on some designs.



DVE designs

Recognized under the Component Program of Underwriters Laboratories Inc. Insulation Class B



RL-1287-6 not shown in photo.

STYLE NUMBER	TYPICAL DIMENSIONS							TERMINAL
	A	B	C	D	E	F	NO.	SIZE
RL-1287-1	.515	.200	.660	.650	.175	.780	8*	.025 SQ.
RL-1287-2	.630	.200	.830	.770	.175	1.030	10*	.025 SQ.
RL-1287-3	.800	.200	.915	1.140	.175	1.375	12*	.025 SQ.
RL-1287-4	1.000	.200	1.050	1.325	.375	1.700	14	.025 SQ.
RL-1287-5	1.100	.300	1.300	1.700	.185	2.000	12*	.025 SQ.
RL-1287-6	1.300	.300	1.500	2.000	.250	2.300	12*	.025 SQ.

All Dimensions in Inches

*Pin 1 — 2 spacing is less for polarity

DESIGN NOTES:

1 - Primary to secondary isolation 1500V RMS Min.
2 - All designs meet Class B requirements (130°C).
3 - Encapsulation available.
4 - Winding to core isolation 2500V RMS Min.
5 - Higher isolation voltages available.
6 - Higher temperature classes available.

TOLL-FREE ENGINEERING HOTLINE 800-645-5828 • RENCO ELECTRONICS, INC. • 60 Jefryn Blvd., East • Deer Park, N.Y. 11729 • (516) 586-5566 • RCA Telex No. 220-883

MADE IN USA
SHIPPED WORLDWIDE

RENCO
ELECTRONICS, INC.

FREE SAMPLES!
ENGINEERING HOTLINE!
LARGE-ORDER TREATMENT FOR SMALL ORDERS!

These are the kinds of services that have helped us become probably the leading firm exclusively in the business of making coil-wound products.

FREE SAMPLES just for the asking.

Think you could use any of the chokes described on pages 000-000? Then call our TOLL-FREE engineering Hot-Line (800-645-5828 outside of New York State; in New York State call 516-586-5566) and tell us your specs — and we'll send you a free sample. If your specs hit squarely on one of our standards (and since our line has 1428 standard values, they frequently do), we'll ship out your sample the same day.

If your specs do not exactly match any of our standards — in fact, even if they're nowhere near any of our standards — give us a call and we'll make up a custom sample. We have a special prototype and sampling laboratory that does nothing but make up custom samples. So unless you need something exceptionally complex, we'll ship your sample within 10 days.

Our Engineering Hotline is for you!

800•645•5828

Please feel free to use it even if you have no intention of giving us an order.

Use it if, for example, you're having any kind of problem with any coil wound product — ours or anyone else's. We have, after all, been making chokes, inductors, toroids, and transformers for 29 years now, so we have considerable expertise in that line. When you call the Hotline you'll be talking to an expert who won't try to sell you a thing. He'll just be helping you work out a solution to your problem, and if that solution involves a competitor's product, that's fine, too!

Even if you don't have a problem; even if there's just something you'd like to know about magnetics; or if there's something you'd like to tell us — we'd be delighted to hear from you. We actually established the Hotline because we've found, over the years, that a vital factor in our growth has been the continuous exchange of ideas with engineers who are using chokes and transformers.

Small orders get large order treatment.

Don't hesitate to call us even if you only want to order a few chokes or transformers. You'll get the same attention — and your order will go out just as fast — as if you were ordering thousands.

The reason is that we have a separate, completely independent small order department, staffed with people who are capable of handling orders for just about any kind of coil-wound product. If you order any of our standard products, our small order people go into the stockroom, take your order off the shelf, and ship it out. And if it's a special, they'll make it themselves, no matter how complex or unusual it may be.

They're really a little factory within a factory. They can read drawings. They have the machines and equipment they need to do their own winding, soldering, and testing (and years of experience in using them). When they finish your order all they have to do is bring your finished parts to QC for a final AQL, and ship it out.

And because we're set up this way, you don't have to pay a penalty for ordering small!

TOLL-FREE ENGINEERING HOTLINE 800-645-5828 • RENCO ELECTRONICS, INC. • 60 Jefryn Blvd., East • Deer Park, N.Y. 11729 • (516) 586-5566 • RCA Telex No. 220-883

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

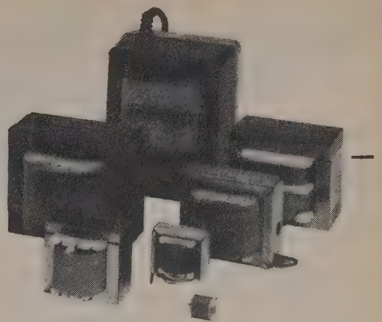
INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

SHOGYO
INTERNATIONAL CORPORATION

DEPT. EM, 287 NORTHERN BOULEVARD
GREAT NECK, NEW YORK 11021
(516) 466-0911
CABLE: "SHOGYONEWYORK"
TELEX: 12218 + 4758024



TRANSFORMERS T & L TYPE TO UL STANDARD 1411

HAZARDOUS OUTPUT (SELF-LEAD TYPE)

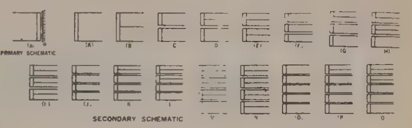
Cat. No.	Input (V)	Reference Schematic Pri.	Reference Schematic Sec.	Total Output VA	Dimensions (mm) A ±1	B	C Min.-Max.	D	Horizontal Type / Vertical Type E Max.	F Max.	G	H ±2
TL-1	120	a	A-N	30	78	Optional	25-54	Optional	78	110	Optional	67
					66							79
TL-2	120	a	A-N	110	88	Optional	28-59	Optional	83	120	Optional	75
					74							89
TL-3	120	a	A-N	145	98	Optional	32-64	Optional	88	130	Optional	83
					82							[illegible]
TL-4	120	a	A-Q	180	107	Optional	35-64	Optional	91	140	Optional	91
					90							108
TL-5	120	a	A-Q	240	116	Optional	38-69	Optional	100	150	Optional	98
					97							117

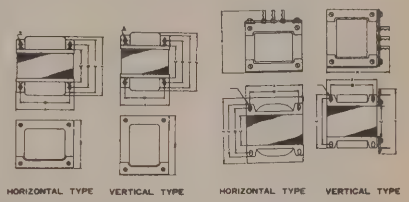
DESIGNED ESPECIALLY FOR COLOR TV SETS AND STEREOS

HAZARDOUS OUTPUT (METAL TERMINAL TYPE)

Cat. No.	Input (V)	Reference Schematic Pri.	Reference Schematic Sec.	Total Output VA	Dimensions (mm) A ±1	B	C Min.-Max.	D	Horizontal Type / Vertical Type E Max.	F Max.	G	H ±2
TL-6	120	a	A-N	30	78	Optional	25-54	Optional	78	110	Optional	84
					66							96
TL-7	120	a	A-N	110	88	Optional	28-59	Optional	83	120	Optional	92
					74							106
TL-8	120	a	A-N	145	98	Optional	32-64	Optional	88	130	Optional	100
					82							116
TL-9	120	a	A-Q	180	107	Optional	35-64	Optional	91	140	Optional	108
					90							125
TL-10	120	a	A-Q	240	116	Optional	38-69	Optional	100	150	Optional	115
					97							134

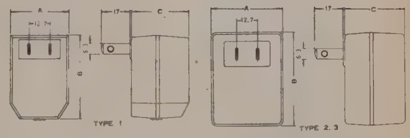
DESIGNED ESPECIALLY FOR COLOR TV SETS AND STEREOS





ADAPTORS—AC/DC MODEL UL/CSA APPROVED

Model	Input	Output	Type	Model	Input	Output	Type
AD-1	105-120V 60Hz 3W	3 VDC 100mA	1	AD-17	117V 60Hz 5W	7.5VDC 200mA	2
AD-2	105-120V 60Hz 3W	3 VDC 200mA	1	AD-18	117V 60Hz 3W	9 VDC 100mA	2
AD-3	105-120V 60Hz 3W	4.5VDC 100mA	1	AD-19	117V 60Hz 5W	9 VDC 200mA	2
AD-4	105-120V 60Hz 3W	4.5VDC 200mA	1	AD-20	117V 60Hz 6W	9 VDC 300mA	2
AD-5	105-120V 60Hz 3W	6 VDC 100mA	1	AD-21	110-120V 60Hz 3W	3 VDC 100mA	2
AD-6	105-120V 60Hz 3W	6 VDC 200mA	1	AD-22	110-120V 60Hz 3W	3 VDC 200mA	2
AD-7	105-120V 60Hz 3W	7.5VDC 100mA	1	AD-23	110-120V 60Hz 3W	4 VDC 60mA	2
AD-8	105-120V 60Hz 3W	9 VDC 100mA	1	AD-24	110-120V 60Hz 3W	6 VDC 100mA	2
AD-9	117V 60Hz 3W	3 VDC 100mA	2	AD-25	110-120V 60Hz 5W	6 VDC 200mA	3
AD-10	117V 60Hz 3W	3 VDC 200mA	2	AD-26	110-120V 60Hz 5W	6 VDC 300mA	3
AD-11	117V 60Hz 3W	4.5VDC 100mA	2	AD-27	110-120V 60Hz 3W	9 VDC 100mA	2
AD-12	117V 60Hz 3W	4.5VDC 200mA	2	AD-28	110-120V 60Hz 5W	9 VDC 200mA	3
AD-13	117V 60Hz 3W	6 VDC 100mA	2	AD-29	110-120V 60Hz 5W	9 VDC 300mA	3
AD-14	117V 60Hz 3W	6 VDC 200mA	2	AD-30	110-120V 60Hz 5W	12 VDC 300mA	3
AD-15	117V 60Hz 5W	6 VDC 300mA	2	AD-31	117V 60Hz 5W	18 VDC 140mA	3
AD-16	117V 60Hz 3W	7.5VDC 100mA	2				



TYPE	DIMENSIONS (MM) A	B	C
1	35.4	50	34.5
2	44	57	36
3	50	60	39

POWER TRANSFORMERS—UL APPROVED

FAMILY 1 NON-HAZARDOUS OUTPUT (BOBBIN WOUND)

Cat. No.	Input (V)	Reference Schematic Pri.	Reference Schematic Sec.	Total Output VA	Dimensions (mm) A±1	B	C Max.	D Min.-Max.	Horizontal Type / Vertical Type E Min.-Max.	F	H ±2
PT-1	120	A	a-e	0.7 Min.	29.5	Optional	52	9-15	25-34	Optional	28
					26.5		49				31
PT-2	120	A	a-e	2.0	36.5	Optional	59	10-17	31-40	Optional	32
					31		54				38
PT-3	120	A	a-l	7.8	42.5	Optional	65	14-24	32-46	Optional	36
					34.5		57				44
PT-4	120	A	a-i	10.0 Max.	50.0	Optional	72	17-25	37-50	Optional	43
					42		64				51

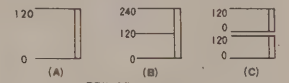
FAMILY 2 HAZARDOUS OUTPUT (BOBBIN WOUND)

Cat. No.	Input (V)	Reference Schematic Pri.	Reference Schematic Sec.	Total Output VA	Dimensions (mm) A ±1	B	C Max.	D Min.-Max.	Horizontal Type / Vertical Type E Min.-Max.	F	H ±2
PT-6	120	A	a-i	4 Min.	42.5	Optional	65	14-24	32-46	Optional	36
					34.5		57				44
PT-7	120	A	a-i	7	50	Optional	72	17-25	37-50	Optional	43
					42		64				51
PT-8	120	A	a-j	16	56	Optional	80	19-29	43-54	Optional	48
					47		71				57
PT-9	120	A	a-j	22	59	Optional	85	20-33	44-62	Optional	51
					49.5		76				60
PT-10	120	A	a-j	31	62	Optional	88	21-33	45-62	Optional	53
					52		78				63
PT-11	120	A	a-j	39 Max.	68	Optional	95	23-41	53-76	Optional	58
					57		84				69

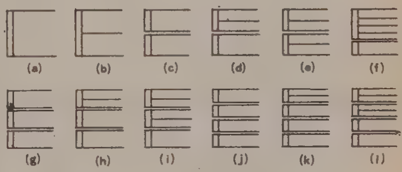
FAMILY 3 HAZARDOUS OUTPUT (LAYER WOUND)

Cat. No.	Input (V)	Reference Schematic Pri.	Reference Schematic Sec.	Total Output VA	Dimensions (mm) A ±1	B	C Max.	D Min.-Max.	Horizontal Type / Vertical Type E Min.-Max.	F	H ±2
PT-12	120	A	a-i	7 Min.	50	Optional	72	17-25	37-56	Optional	43
					42		64				51
PT-13	120	A	a-j	16	56	Optional	80	19-29	43-64	Optional	48
					47		71				57
PT-14	120	A	a-j	22	59	Optional	85	20-33	44-68	Optional	51
					49.5		76				[illegible]
PT-15	120	A	a-j	32	62	Optional	88	21-33	45-72	Optional	53
					52		78				63
PT-16	120	A	a-j	38 Max.	68	Optional	95	23-41	53-83	Optional	58
					57		84				69

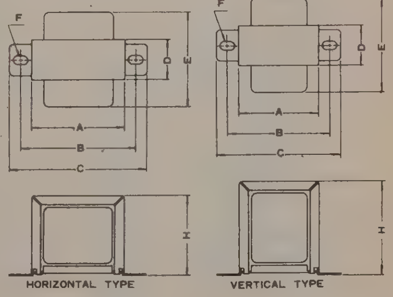
UL APPROVED AND CSA APPROVEABLE



PRIMARY SCHEMATIC



SECONDARY SCHEMATIC



The products illustrated and listed are only a small representation of the full range of items available.

SEE OUR OTHER CATALOG PAGES IN EEM SECTIONS 1300/2100/2450/2950/4750/6000

Advanced Transformers Industries Inc.

power transformer for printed circuits applications

• Encapsulated for best Protection from Moisture and Foreign Particles • Split Bobbin (3 Flange) • Primaries and Secondaries Wound Side by Side • Dual Secondaries • Also Available in Different Currents or Pin Arrangements

Drawing Schematic	Type Prim 115/230V 50-60Hz	Power Rating (VA)	Series Connection		Parallel Connection	
			Sec Voltage (Volts)	Max Sec Current (mA)	Sec Voltage (Volts)	Max Sec Current (mA)
*3	SPK 2202/6	0.2	6	33		
	SPK 2202/8	0.2	8	25		
	SPK 2202/12	0.2	12	16		
	SPK 2202/15	0.2	15	13		
	SPK 2202/18	0.2	18	11		
	SPK 2202/24	0.2	24	8		
*2	SPK 2207/6	0.7	6	116		
	SPK 2207/8	0.7	8	87		
	SPK 2207/12	0.7	12	58		
	SPK 2207/15	0.7	15	46		
	SPK 2207/18	0.7	18	38		
	SPK 2207/24	0.7	24	29		
*1	SPK 2205/6	0.5	6	83		
	SPK 2205/8	0.5	8	62		
	SPK 2205/12	0.5	12	42		
	SPK 2205 15	0.5	15	33		
	SPK 2205/18	0.5	18	27		
	SPK 2205/24	0.5	24	20		
	SPK 2215/6/6	1.5	12	125	6	250
	SPK 2215/8/8	1.5	16	94	8	187
	SPK 2215/12/12	1.5	24	62	12	125
	SPK 2215/15/15	1.5	30	50	15	100
	SPK 2215/18/18	1.5	36	41	18	83
	SPK 2215/24/24	1.5	48	31	24	62
	SPK 2220/6/6	1.8	12	150	6	300
	SPK 2220/8/8	1.8	16	112	8	225
	SPK 2220/12/12	1.8	24	75	12	150
	SPK 2220/15/15	1.8	30	60	15	120
	SPK 2220/18/18	1.8	36	50	18	100
	SPK 2220/24/24	1.8	48	37	24	75
	SPK 2230/6/6	2.5	12	208	6	416
	SPK 2230/8/8	2.5	16	156	8	312
	SPK 2230/12/12	2.5	24	104	12	208
	SPK 2230/15/15	2.5	30	83	15	166
	SPK 2230/18/18	2.5	36	69	18	138
	SPK 2230/24/24	2.5	48	52	24	104
	SPK 2231/6/6	3.0	12	250	6	500
	SPK 2231/8/8	3.0	16	187	8	375
	SPK 2231/12/12	3.0	24	125	12	250
	SPK 2231/15/15	3.0	30	100	15	200
	SPK 2231/18/18	3.0	36	83	18	166
	SPK 2231/24/24	3.0	48	62	24	125
	SPK 2240/6/6	3.75	12	312	6	624
	SPK 2240/8/8	3.75	16	234	8	468
	SPK 2240/12/12	3.75	24	156	12	312
	SPK 2240/15/15	3.75	30	125	15	250
	SPK 2240/18/18	3.75	36	104	18	208
	SPK 2240/24/24	3.75	48	78	24	156
*4	SPK 2260/6/6	5.5	12	458	6	916
	SPK 2260/8/8	5.5	16	343	8	687
	SPK 2260/12/12	5.5	24	229	12	458
	SPK 2260/15/15	5.5	30	183	15	366
	SPK 2260/18/18	5.5	36	152	18	305
	SPK 2260/24/24	5.5	48	114	24	229
	SPK 2280/6/6	8.0	12	Amp. 0.66	6	Amp. 1.33
	SPK 2280/8/8	8.0	16	0.5	8	1.0
	SPK 2280/12/12	8.0	24	0.33	12	0.66
	SPK 2280/15/15	8.0	30	0.26	15	0.53
	SPK 2280/18/18	8.0	36	0.22	18	0.44
	SPK 2280/24/24	8.0	48	0.16	24	0.33
*5	SPK 22120/6/6	12.0	12	1.0	6	2.0
	SPK 22120/8/8	12.0	16	0.75	8	1.5
	SPK 22120/12/12	12.0	24	0.5	12	1.0
	SPK 22120/15/15	12.0	30	0.4	15	0.8
	SPK 22120/18/18	12.0	36	0.33	18	0.66
	SPK 22120/24/24	12.0	48	0.25	24	0.5
*6	SPK 22160/6/6	16.0	12	1.33	6	2.66
	SPK 22160/8/8	16.0	16	1.0	8	2.0
	SPK 22160/12/12	16.0	24	0.66	12	1.33
	SPK 22160/15/15	16.0	30	0.53	15	1.06
	SPK 22160/18/18	16.0	36	0.44	18	0.88
	SPK 22160/24/24	16.0	48	0.33	24	0.66
*7	SPK 22250/6/6	25.0	12	2.08	6	4.16
	SPK 22250/8/8	25.0	16	1.56	8	3.12
	SPK 22250/12/12	25.0	24	1.04	12	2.08
	SPK 22250/15/15	25.0	30	0.83	15	1.66
	SPK 22250/18/18	25.0	36	0.69	18	1.38
	SPK 22250/24/24	25.0	48	0.52	24	1.04

flat-pack power transformer for printed circuits applications

• Encapsulated for best Protection from Moisture and Foreign Particles • Split Bobbin • Primaries and Secondaries Wound Side by Side • Dual Primary: 115V/230V, 50-60 Hz • Dual Secondaries • Also Available in Different Currents or Pin Arrangements

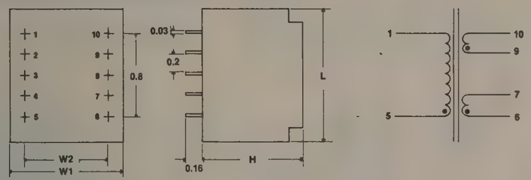
Drawing Schematic	Type Prim 115/230 V 50-60 Hz	Power Rating (VA)	Series Connection		Parallel Connection	
			Sec Voltage (Volts)	Max Sec Current (mA)	Sec Voltage (Volts)	Max Sec Current (mA)
*8	SPF 2233/6/6	3.0	12	250	6	500
	SPF 2233/8/8	3.0	16	187	8	375
	SPF 2233/12/12	3.0	24	125	12	250
	SPF 2233/15/15	3.0	30	100	15	200
	SPF 2233/18/18	3.0	36	83	18	166
	SPF 2233/24/24	3.0	48	62	24	125
	SPF 2243/6/6	4.0	12	333	6	666
	SPF 2243/8/8	4.0	16	250	8	500
	SPF 2243/12/12	4.0	24	166	12	333
	SPF 2243/15/15	4.0	30	133	15	266
	SPF 2243/18/18	4.0	36	111	18	222
	SPF 2243/24/24	4.0	48	83	24	166
	SPF 2263/6/6	6.0	12	500	6	1,000
	SPF 2263/8/8	6.0	16	375	8	750
	SPF 2263/12/12	6.0	24	250	12	500
	SPF 2263/15/15	6.0	30	200	15	200
	SPF 2263/18/18	6.0	36	166	18	333
	SPF 2263/24/24	6.0	48	125	24	250
	SPF 2293/6/6	9.0	12	750	6	1,500
	SPF 2293/8/8	9.0	16	563	8	1,125
	SPF 2293/12/12	9.0	24	375	12	750
	SPF 2293/15/15	9.0	30	300	15	600
	SPF 2293/18/18	9.0	36	250	18	500
	SPF 2293/24/24	9.0	48	187	24	375
*9	SPF 22103/6/6	10.0	12	Amp. 1.2	6	Amp. 1.67
	SPF 22103/8/8	10.0	16	0.625	8	1.25
	SPF 22103/12/12	10.0	24	0.416	12	1.2
	SPF 22103/15/15	10.0	30	0.333	15	0.666
	SPF 22103/18/18	10.0	36	0.277	18	0.555
	SPF 22103/24/24	10.0	48	0.208	24	0.416
	SPF 22143/6/6	14.0	12	1.167	6	2.333
	SPF 22143/8/8	14.0	16	0.875	8	1.75
	SPF 22143/12/12	14.0	24	0.583	12	1.167
	SPF 22143/15/15	14.0	30	0.466	15	0.933
	SPF 22143/18/18	14.0	36	0.388	18	0.777
	SPF 22143/24/24	14.0	48	0.292	24	0.583
	SPF 22183/6/6	18.0	12	1.5	6	3.0
	SPF 22183/8/8	18.0	16	1.125	8	2.25
	SPF 22183/12/12	18.0	24	0.75	12	1.50
	SPF 22183/15/15	18.0	30	0.60	15	1.20
	SPF 22183/18/18	18.0	36	0.50	18	1.00
	SPF 22183/24/24	18.0	48	0.375	24	0.75
	SPF 22253/6/6	25.0	12	2.08	6	4.166
	SPF 22253/8/8	25.0	16	1.562	8	3.125
	SPF 22253/12/12	25.0	24	1.04	12	2.08
	SPF 22253/15/15	25.0	30	0.83	15	1.66
	SPF 22253/18/18	25.0	36	0.69	18	1.38
	SPF 22253/24/24	25.0	48	0.52	24	1.04
*10	SPF 2283/6/6	8.0	12	0.66	6	1.33
	SPF 2283/8/8	8.0	16	0.50	8	1.0
	SPF 2283/12/12	8.0	24	0.33	12	0.66
	SPF 2283/15/15	8.0	30	0.26	15	0.53
	SPF 2283/18/18	8.0	36	0.22	18	0.44
	SPF 2283/24/24	8.0	48	0.16	24	0.33
	SPF 22123/6/6	12.0	12	1.0	6	2.0
	SPF 22123/8/8	12.0	16	0.75	8	1.5
	SPF 22123/12/12	12.0	24	0.50	12	1.0
	SPF 22123/15/15	12.0	30	0.40	15	0.80
	SPF 22123/18/18	12.0	36	0.33	18	0.66
	SPF 22123/24/24	12.0	48	0.25	24	0.50

*** SEE OPPOSITE PAGE FOR DRAWINGS AND SCHEMATICS**

ADVANCED TRANSFORMERS INDUSTRIES INC. • 114 CENTER STREET, EL SEGUNDO, CA 90245 • (213) 322-4249

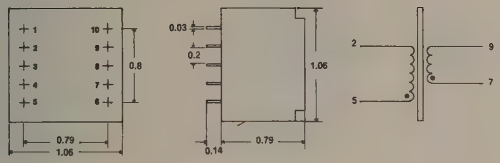
Advanced Transformers Industries Inc.

DRAWING/SCHEMATIC NO. 1

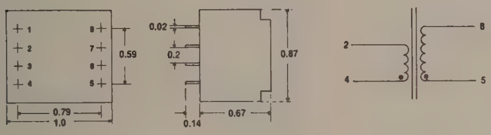

1
2
3
4
5
10
9
8
7
6
0.8
0.03
0.2
L
0.16
H
W2
W1
1
5
10
9
7
6

	W1	W2	L	H		W1	W2	L	H
SPK 2205	1.06	0.79	1.26	0.6	SPK 2230	1.06	0.79	1.26	1.06
SPK 2215	1.06	0.79	1.26	0.86	SPK 2231	1.06	0.79	1.26	1.18
SPK 2220	1.06	0.79	1.26	0.94	SPK 2240	1.38	1.1	1.61	1.1

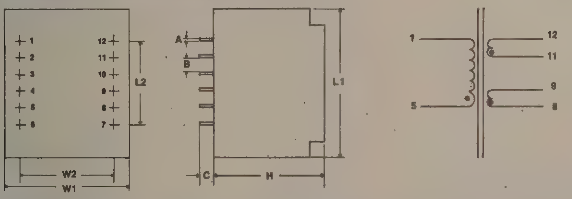
DRAWING/SCHEMATIC NO. 2


1
2
3
4
5
10
9
8
7
6
0.8
0.03
0.2
1.06
0.79
1.06
0.14
0.79
2
5
9
7

DRAWING/SCHEMATIC NO. 3

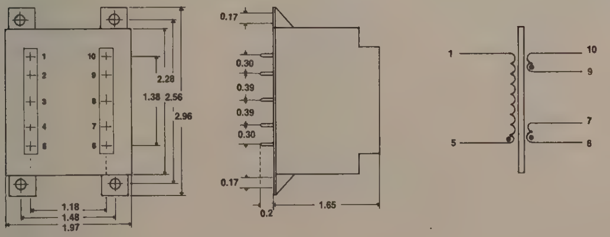

1
2
3
4
8
7
6
5
0.59
0.02
0.2
0.87
0.79
1.0
0.14
0.67
2
4
8
5

DRAWING/SCHEMATIC NO. 4

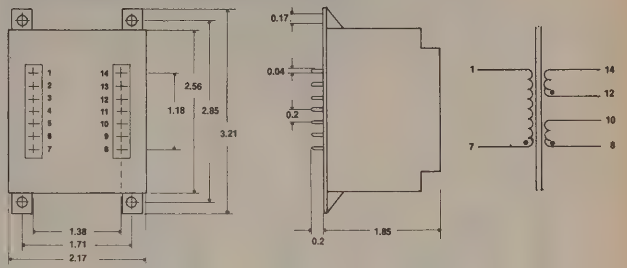

1
2
3
4
5
6
12
11
10
9
8
7
L2
A
B
L1
C
H
W2
W1
1
5
12
11
9
8

	W1	W2	L1	L2	H	A	B	C
SPK 2260	1.46	1.10	1.73	1.0	1.30	0.03	0.2	0.16
SPK 2280	1.69	1.10	2.05	1.0	1.50	0.04	0.2	0.2

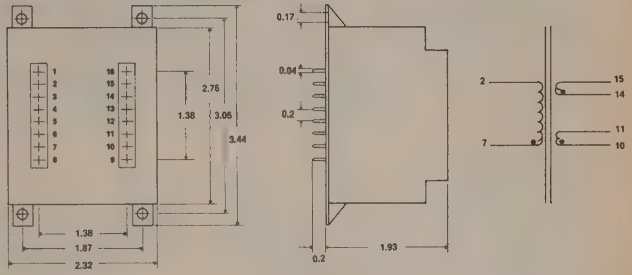
DRAWING/SCHEMATIC NO. 5


1
2
3
4
5
10
9
8
7
6
2.28
1.38
2.56
2.96
1.18
1.48
1.97
0.17
0.30
0.39
0.39
0.30
0.17
0.2
1.65
1
5
10
9
7
6

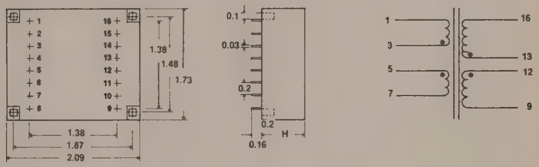
DRAWING/SCHEMATIC NO. 6


1
2
3
4
5
6
7
14
13
12
11
10
9
8
2.56
1.18
2.85
3.21
1.38
1.71
2.17
0.17
0.04
0.2
0.2
1.85
1
7
14
12
10
8

DRAWING/SCHEMATIC NO. 7

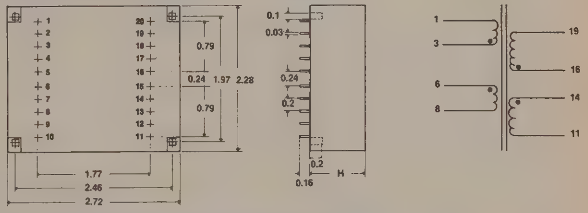

1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9
2.76
1.38
3.05
3.44
1.38
1.87
2.32
0.17
0.04
0.2
0.2
1.93
2
7
15
14
11
10

DRAWING/SCHEMATIC NO. 8


1
2
3
4
5
6
7
8
16
15
14
13
12
11
10
9
1.38
1.48
1.73
1.38
1.87
2.09
0.1
0.03
0.2
0.2
0.16
H
1
3
5
7
16
13
12
9

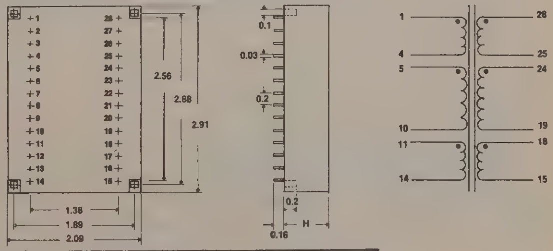
	SPF 2233	SPF 2243	SPF 2263	SPF 2293
H	0.67	0.73	0.87	0.98

DRAWING/SCHEMATIC NO. 9


1
2
3
4
5
6
7
8
9
10
20
19
18
17
16
15
14
13
12
11
0.79
0.24
1.97
2.28
0.79
1.77
2.46
2.72
0.1
0.03
0.24
0.2
0.2
0.16
H
1
3
6
8
19
16
14
11

	SPF 22103	SPF 22143	SPF 22183	SPF 22253
H	0.87	0.94	1.06	1.38

DRAWING/SCHEMATIC NO. 10


1
2
3
4
5
6
7
8
9
10
11
12
13
14
28
27
26
25
24
23
22
21
20
19
18
17
16
15
2.56
2.68
2.91
1.38
1.89
2.09
0.1
0.03
0.2
0.2
0.16
H
1
4
5
10
11
14
28
25
24
19
18
15

	SPF 2283	SPF 22123
H	0.71	0.83

ADVANCED TRANSFORMERS INDUSTRIES INC. • 114 CENTER STREET, EL SEGUNDO, CA 90245 • (213) 322-4249

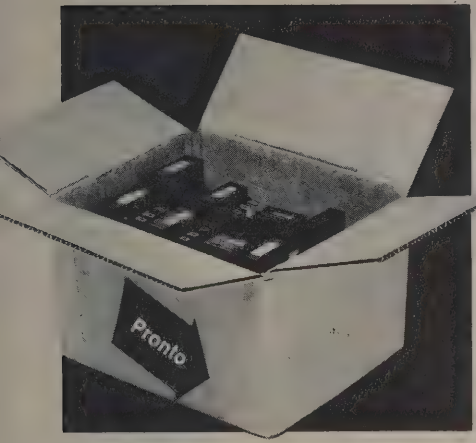
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms .... **1A**•1137, **1B**•1035, **2**•1014, **3**•1014
ASCII Code .... **3**•1103
Batteries, Product Selection Guide .... **3**•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide .... **2**•1003
Capacitors, Basic Formulas .... **1A**•1093
Capacitors, Miniglossary .... **1A**•1069
Capacitors, Product Selection Guide .... **1A**•1003
Circuit Boards (Printed), Product Selection Guide .... **2**•1089
Coils, Chokes, & Inductors, Product Selection Guide .... **1A**•1219
Connectors, Miniglossary .... **2**•1264
Connectors, Terminals, & Sockets, Product Selection Guide .... **2**•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide .... **1A**•1309
Delay Lines, Product Selection Guide .... **1A**•1445
Discrete Semiconductors, Product Selection Guide .... **1A**•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide .... **1B**•1021
EBCDIC Code .... **3**•1153
Encapsulation, Miniglossary .... **2**•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .... **2**•1801
Filters, Product Selection Guide .... **1A**•1577
Instruments, Graphic Recording, Product Selection Guide .... **3**•1381
Instruments, Panel Meters, Product Selection Guide .... **3**•1321
Instruments, Test & Measuring, Product Selection Guide .... **3**•1182
Interconnection Systems, Product Selection Guide .... **2**•1873
Keyboards & Keypads, Product Selection Guide .... **1B**•1759
Microwave Components, Product Selection Guide .... **1A**•1685
Military Qualified Products Lists .... **1B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide .... **1B**•1121
Opto Semiconductors, Miniglossary .... **1B**•1218
Oscilloscopes, Product Selection Guide .... **3**•1361
Panel Hardware, Product Selection Guide .... **2**•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide .... **1A**•2017
Power Supplies, Miniglossary .... **3**•1455
Power Supplies, AC, Product Selection Guide .... **3**•1815
Power Supplies, DC, Product Selection Guide .... **3**•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... **1B**•1255
Relay Contact Forms .... **1B**•1317
Relays, Electromechanical, Miniglossary .... **1•B**1292
Relays, Product Selection Guide .... **1B**•1289
Resistor Color Codes .... **1A**•1791
Resistors, Product Selection Guide .... **1A**•1789
Servo Components, Miniglossary .... **3**•1935
Solenoids, Product Selection Guide .... **1B**•1481
Switches, Product Selection Guide .... **1B**•1499
Thyristors/High Power Diodes, Miniglossary .... **1A**•1652
Transducers & Encoders, Product Selection Guide .... **1B**•1827
Transformers, Product Selection Guide .... **1A**•2115
Wire & Cable, Product Selection Guide .... **2**•1935

THE SIGNAL WAY OF DOING BUSINESS



PRONTO 48-Hour Shipment

We have long recognized that, in most instances, engineers and buyers need immediate delivery of transformers and chokes. To meet this challenge, Signal maintains an extensive inventory of every item in these pages — over 1,000 different transformers and chokes. More importantly, we're dedicated to shipping out each and every order (1-4 pieces guaranteed) within 48 hours, and we can usually fill your entire order. We call this service "PRONTO." Last year we shipped over 10,000 such orders and we didn't disappoint anyone.

How and Why We Are Able to Maintain Our Low Price Policy

At Signal, we sell direct. There are no salesmen or distributors — no middlemen, no extra mark-ups. We pass the savings on to you. We answer your questions directly. There is no chance of misinterpretation and you get fast accurate answers. We maintain larger inventories than any distributors could. We're able to react to your order requirements more quickly and efficiently. These savings have enabled us to install modern machinery, specify better materials and continuously invest in new R & D. In this manner our prices are kept as low as possible. We both profit from this policy.

Advanced Technology and Innovation

The basic transformer concept and design has been with us for many years. But, the state-of-the-art in electronics has changed drastically in the last 20 years, especially the last ten. We now live in a digital as well as analog world. Circuit size has shrunk and new termination methods have evolved. Again, Signal has recognized the need to develop new designs to meet these new low weight and height constraints. The result has been the development of such new and exclusive products as the SPLIT/TRAN® (see opposite page), the miniature PC board transformer featuring non-concentric windings which result in high isolation and the elimination of the need for electro-static shielding. The FLATHEAD® which has a height of only 0.65″ is still another example of creative innovation. Therefore, what many of our competitors call custom designs (matched by custom prices) often turn out to be a Signal standard product. You can depend on Signal to have the products you need when you're ready for them and, of course, always in stock.

Custom Requirements Are Welcome

We also recognize that no matter how hard we try, it is impossible to anticipate everyone's need. Therefore, we are eager to discuss and evaluate your transformer and choke requirements. If we can't recommend a standard product that will do the job and save you money and time, we'll gladly quote on your requirement. Many times all that is needed is a modification of one of our standards. Again, you will get consistently high quality and very competitive prices, whether your order is for 10 or 10,000 pieces.

We don't have anyone out in the field telling you how good we are. We have to prove it to you by deed. Thank you for considering Signal.

CONTENTS (See Following Pages)

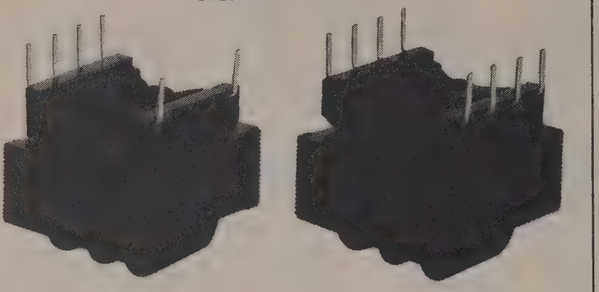
- P.C. Board Power Transformer
  - SPLIT/TRAN® — High Isolation
  - FLATHEAD® — Low Profile
  - Standard Miniature
- Lightweight/Low-Cost Small Power Transformers ("2-4-1" Series)
- Rectifier Power Transformers
- Chokes
  - Filter
  - Dual
- Constant-Voltage Transformers for dc supplies
- Step-down Auto Transformers
- Industrial Grade Power Isolation Transformers
- Transformers for Triple-Output Regulated DC Supplies
- Ideal for Microprocessor Applications

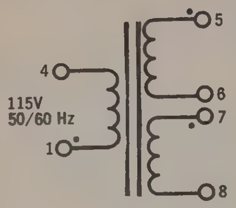
signal
TRANSFORMER
500 Bayview Ave., Inwood, N.Y. 11696
Tel.: (516) 239-4510
An Insilco Company

split/tran® p.c. board transformers

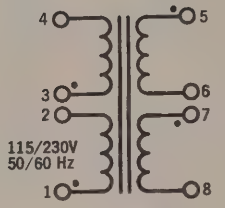
SPLIT BOBBIN—HIGHLY ISOLATED

Recognized Component
Underwriters Labs Inc.

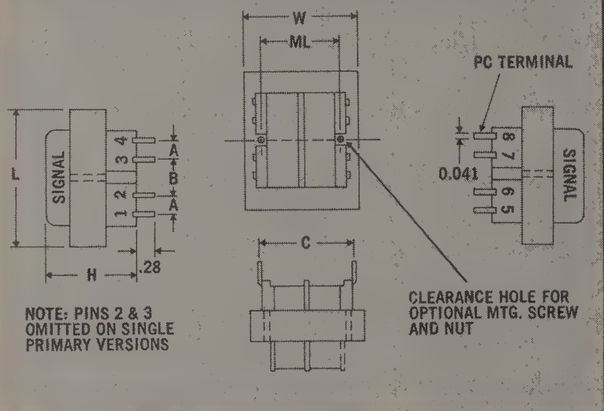




6 PIN
TYPE ST



8 PIN
TYPE DST



NOTE: PINS 2 & 3 OMITTED ON SINGLE PRIMARY VERSIONS

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut*	Lbs.
2	1.1	$1\frac{3}{8}$	$1\frac{1}{8}$	$\frac{15}{16}$	—	.250	.250	1.200	None	0.17
3	2.4	$1\frac{3}{8}$	$1\frac{1}{8}$	$1\frac{3}{16}$	—	.250	.250	1.200	None	0.25
4	6	$1\frac{5}{8}$	$1\frac{5}{16}$	$1\frac{5}{16}$	$1\frac{1}{16}$	.250	.350	1.280	4-40 x $1\frac{3}{8}$ Nylon	0.44
5	12	$1\frac{7}{8}$	$1\frac{9}{16}$	$1\frac{7}{16}$	$1\frac{1}{4}$	.300	.400	1.410	4-40 x $1\frac{3}{8}$ Nylon	0.70
6	20	$2\frac{1}{4}$	$1\frac{7}{8}$	$1\frac{7}{16}$	$1\frac{1}{2}$	.300	.400	1.600	4-40 x $1\frac{3}{8}$ Nylon	0.80
7	36	$2\frac{5}{8}$	$2\frac{3}{16}$	$1\frac{9}{16}$	†	.400	.400	1.850	†	1.1

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).
† Size 7 has 4 mtg. holes on $2\frac{3}{16}$ x $1\frac{3}{4}$ centers for a #6 screw. Need not be nylon.

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — **2500V** hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.
- Class S insulation — 130°C.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

Special variations will be quoted and shipped promptly.

PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10	DST 2-10	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10	DST 3-10	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10	DST 4-10	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10	DST 5-10	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10	DST 6-10	10V C.T. @ 2A	5V @ 4A
ST 7-10	DST 7-10	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12	DST 2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12	DST 3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12	DST 4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12	DST 5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12	DST 6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12	DST 7-12	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16	DST 2-16	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16	DST 3-16	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16	DST 4-16	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16	DST 5-16	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16	DST 6-16	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16	DST 7-16	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20	DST 2-20	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20	DST 3-20	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20	DST 4-20	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20	DST 5-20	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20	DST 6-20	20V C.T. @ 1A	10V @ 2A
ST 7-20	DST 7-20	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24	DST 2-24	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24	DST 3-24	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24	DST 4-24	24V C.T. @ 0.25A	12V @ 0.5A
ST 5-24	DST 5-24	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24	DST 6-24	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24	DST 7-24	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28	DST 2-28	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28	DST 3-28	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28	DST 4-28	28V C.T. @ 0.2A	14V @ 0.4A
ST 5 28	DST 5-28	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28	DST 6-28	28V C.T. @ 0.7A	14V @ 1.4A
ST 7-28	DST 7-28	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36	DST 2-36	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36	DST 3-36	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36	DST 4-36	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36	DST 5-36	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36	DST 6-36	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36	DST 7-36	36V C.T. @ 1A	18V @ 2A
ST 2-48	DST 2-48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48	DST 3-48	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48	DST 4-48	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48	DST 5-48	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48	DST 6-48	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48	DST 7-48	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56	DST 2-56	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56	DST 3-56	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56	DST 4-56	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56	DST 5-56	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56	DST 6-56	56V C.T. @ 0.35A	28C @ 0.7A
ST 7-56	DST 7-56	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120	DST 2-120	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120	DST 3-120	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120	DST 4-120	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120	DST 5-120	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120	DST 6-120	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120	DST 7-120	120V C.T. @ 0.3A	60V @ 0.6A

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A•2279 for prices"

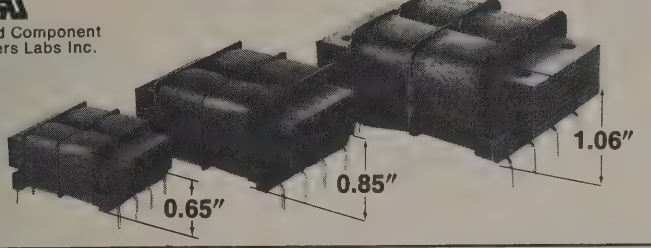
signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

flathead® plug in power transformers

FOR PRINTED CIRCUIT APPLICATIONS

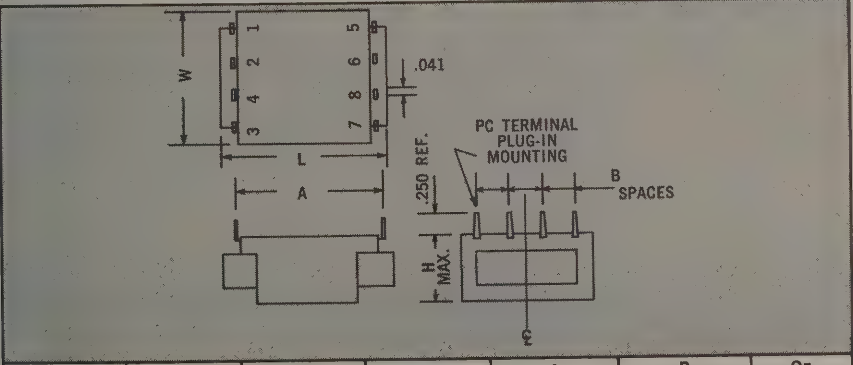
3 SIZES — 2.5VA — 0.650 inches high
6VA — 0.850 inches high
12VA — 1.065 inches high

Recognized Component
Underwriters Labs Inc.



Part No.	Size	SECONDARY*	
		Series	Parallel
LP 10-250	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 16-150	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700	12	16V C.T. @ 700MA	8V @ 1.4A
LP 20-125	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600	12	20V C.T. @ 600MA	10V @ 1.2A
LP 24-100	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500	12	24V C.T. @ 500MA	12V @ 1A
LP 30-85	2	30V C.T. @ 85MA	15V @ 170MA
LP 30-200	6	30V C.T. @ 200MA	15V @ 400MA
LP 30-400	12	30V C.T. @ 400MA	15V @ 800MA
LP 34-75	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340	12	34V C.T. @ 340MA	17V @ 680MA
LP 40-60	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300	12	40V C.T. @ 300MA	20V @ 600MA
LP 56-45	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200	12	56V C.T. @ 200MA	28V @ 400MA
LP 88-28	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50	12	230V C.T. @ 50MA	115V @ 100MA

* Regulation of Size 2 and 6 units is 30%, i.e., no load-secondary voltage is 30% higher than full load. Regulation of Size 12 units is 20%.



Size	L	W	H	A	B	Oz.
2	1⅞	1 9/16	0.650	1.600	0.375	5
6	1⅞	1 9/16	0.850	1.600	0.375	7
12	2½	2	1.065	2.000	0.500	11

LOW PROFILE: Allows ¾″ card spacing for 2.5va units, 1 inch card spacing for 6va units, or 1¼″ inch card spacing for 12va units.

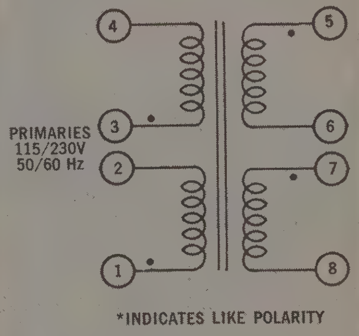
DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.



*INDICATES LIKE POLARITY

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A•2279 for prices"

signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

p.c. board transformers for triple-output regulated supplies

IDEAL FOR MICROPROCESSOR APPLICATIONS

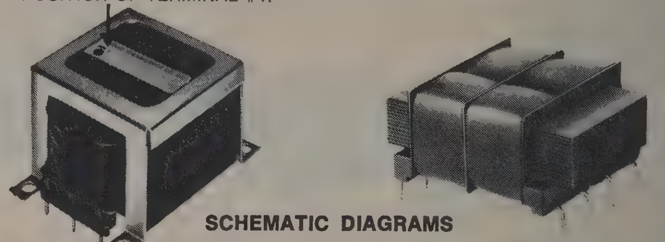
"MP" types have been developed specifically for use in triple-output regulated DC supplies that are commonly used in **Microprocessor Circuits** and other logic, op-amp combinations. Two output combinations have been provided, namely 5V and ±12V, and 5V and ±15V.

All "MP" units are rated in terms of the final **DC** output after a standard three terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100 to 130V 50/60 Hz (or 200 to 260V for nominal 230V lines).

Two basic mechanical configurations are available. Standard PC types (MPC or DMPC) are tested to pass 1500V RMS hipot. Optional mounting brackets are available. MPL types are based on Signal's "flat-head" style and feature low profile, 115/230V primaries, hum-bucking construction, 1500V RMS hipot and the advantages of non-concentric winding (low inter-winding capacitance, high isolation, and no need for an electro-static shield).

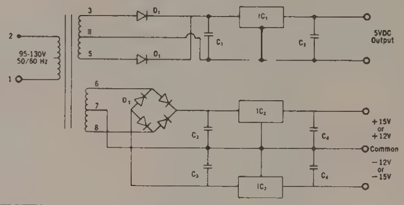
All MP's are stocked in depth for immediate delivery. In addition, special variations can be supplied with reasonable delivery times.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.

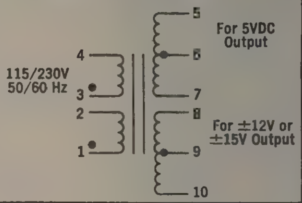


SCHEMATIC DIAGRAMS

MPC TYPE



DMPC & MPL TYPES



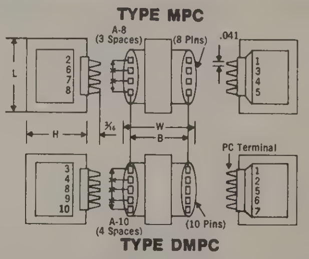
MPC & DMPC TYPES

PART NUMBER PRIMARY 50/60 Hz		DC OUTPUT			SUGGESTED COMPONENTS							
115V (8 Pin)	115/230V (10 Pin)	Regulator I	Regulator II	Size	C_1	C_2	C_3	C_4	D_1(2)	D_2(4)	IC_1*	IC_2*
MPC-X-12	DMPC-X-12	5VDC 360ma	±12VDC 60ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPC-X-15	DMPC-X-15	5VDC 360ma	±15VDC 50ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N
MPC-Y-12	DMPC-Y-12	5VDC 835ma	±12VDC 150ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM326N
MPC-Y-15	DMPC-Y-15	5VDC 835ma	±15VDC 130ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM325N

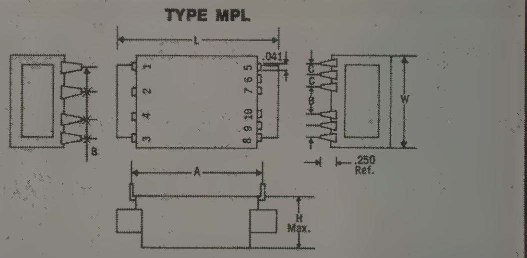
MPL TYPES (Dual 115/230V Primary is Standard)

MPL- 6-12	5VDC 135ma	±12VDC 40ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM326N
MPL- 6-15	5VDC 135ma	±15VDC 35ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM325N
MPL-12-12	5VDC 270ma	±12VDC 85ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPL-12-15	5VDC 270ma	±15VDC 70ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N

*National Semiconductor



Size	L	W	H	A-8 (8 Pin)	A-10 (10 Pin)	B	Lbs.	Optional Bracket		
								No.	MW	MD
X	1⅞	1⁷⁄₁₆	1⅝	.250	.200	1.300	.56	10-BR	1⁴¹⁄₆₄	1⅛
Y	1⅝	2¼	1⅜	.250	.200	2.100	.75	24-BR	1⅜	2



Size	L	W	H	A	B	C	Lbs.
6	1⅞	1⁹⁄₁₆	0.850	1.600	0.375	0.187	.43
12	2½	2	1.065	2.000	0.500	0.250	.68

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A-2279 for prices"

signal TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

"2-4-1" style split-bobbin transformers for triple-output (μp) applications (type MT)

Signal has extended its line of triple-output transformers for microprocessor applications with three new sizes rated to 100VA (35 watts DC regulated). Similar to the split-bobbin design used in Signal's "2-4-1" series, the chassis-mounted style allows for these new higher power applications.

Two output combinations are provided: 5V and ±12V; and 5V and ±15V. Designated "MT" (single primary) and "DMT" (dual primary), these transformers are rated in terms of the final DC output after a 3-terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100-130V, 50/60 Hz (or 200-260V for nominal 230V lines). All auxiliary components required to complete the DC supply are tabulated.

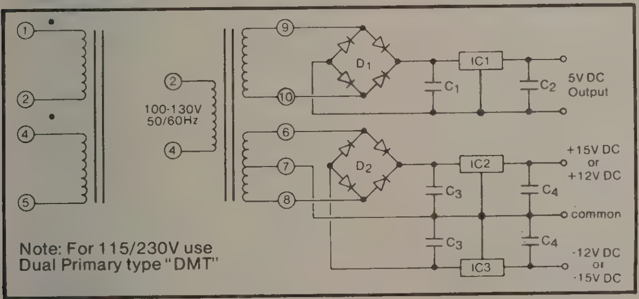
All MT types are stocked in depth for immediate delivery. In addition, custom variations can be supplied with minimal turnaround time.

Specifications

PART NUMBER PRIMARY 50/60Hz		DC OUTPUT		SIZE	SUGGESTED COMPONENTS C_2, C_4 See Note ①						
115V	115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
MT-6-12	DMT-6-12	5V @ 1.75A	±12V @ 210MA	6	10 KMFD @ 20V DC	1.5 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
MT-6-15	DMT-6-15	5V @ 1.75A	±15V @ 175MA	6			LM-323K-5	LM-340K-15	LM-320K-15	3N253	3N247
MT-7-12	DMT-7-12	5V @ 2.8A	±12V @ 350MA	7	15 KMFD @ 20V DC	2 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247
MT-7-15	DMT-7-15	5V @ 2.8A	±15V @ 280MA	7			LM-323K-5	LM-340K-15	LM-320K-15	MDA-400	3N247
MT-8-12	DMT-8-12	5V @ 4A	±12V @ 600MA	8	26 KMFD @ 20V DC	3.1 KMFD @ 50V DC	LM-338②	LM-340K-12	LM-320K-12	MDA-800	3N247
MT-8-15	DMT-8-15	5V @ 4A	±15V @ 500MA	8			LM-338②	LM-340K-15	LM-320K-15	MDA-800	3N247

Note ① : Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic, 20V min.
Note ② : LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③ : All IC's are National Semiconductor types.
Note ④ : All diodes are Motorola types.

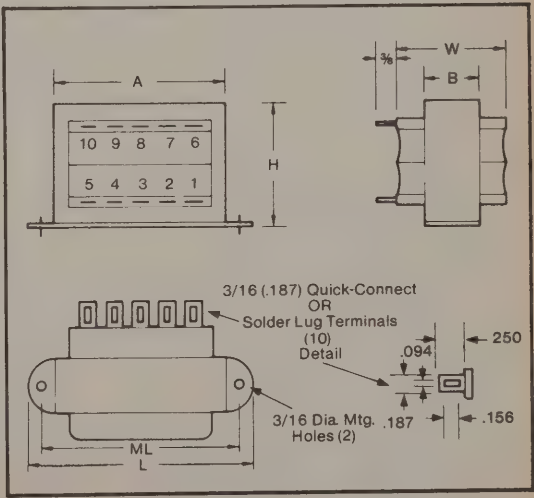
SCHEMATIC



Note: For 115/230V use Dual Primary type "DMT"

DIMENSIONS

Size	L	W	H	A	B	ML	Lbs.
6	3 1/4	1 3/4	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75



Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

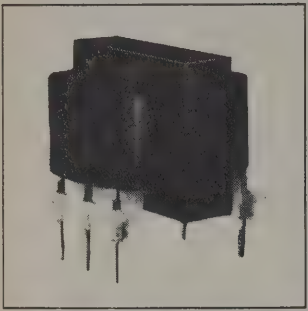
"See page 1A·2279 for prices"

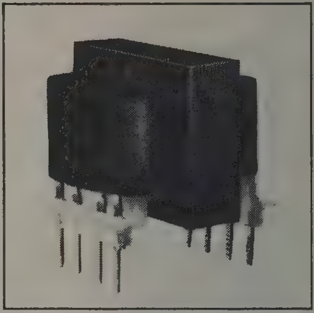
signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

miniature plug in power transformers

SINGLE
115V PRIMARY
TYPE PC 6 PINS

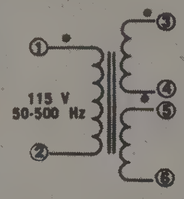
DUAL
115/230V PRIMARY
TYPE DPC 8 PINS



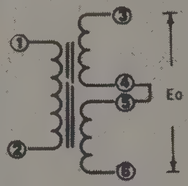


PRIMARY 50/500 Hz		SECONDARY RMS RATING*		Size (VA)
Single 115V (6 Pin)	Dual 115/230V (8 Pin)	Series	Parallel	
PC 10-90	DPC 10-90	10V C.T. @ 90MA	5V @ 180MA	1.0
PC 10-120	DPC 10-120	10V C.T. @ 120MA	5V @ 240MA	1.2
PC 10-440	DPC 10-440	10V C.T. @ 440MA	5V @ 880MA	4.4
PC 10-1000	DPC 10-1000	10V C.T. @ 1A	5V @ 2A	10
PC 10-2400	DPC 10-2400	10V C.T. @ 2.4A	5V @ 4.8A	24
PC 12-70	DPC 12-70	12.6V C.T. @ 70MA	6.3V @ 140MA	1.0
PC 12-100	DPC 12-100	12.6V C.T. @ 100MA	6.3V @ 200MA	1.2
PC 12-350	DPC 12-350	12.6V C.T. @ 350MA	6.3V @ 700MA	4.4
PC 12-800	DPC 12-800	12.6V C.T. @ 800MA	6.3V @ 1.6A	10
PC 12-2000	DPC 12-2000	12.6V C.T. @ 2A	6.3V @ 4A	24
PC 16-55	DPC 16-55	16V C.T. @ 55MA	8V @ 110MA	1.0
PC 16-75	DPC 16-75	16V C.T. @ 75MA	8V @ 150MA	1.2
PC 16-260	DPC 16-260	16V C.T. @ 260MA	8V @ 520MA	4.4
PC 16-640	DPC 16-640	16V C.T. @ 640MA	8V @ 1.28A	10
PC 16-1500	DPC 16-1500	16V C.T. @ 1.5A	8V @ 3A	24
PC 20-45	DPC 20-45	20V C.T. @ 45MA	10V @ 90MA	1.0
PC 20-60	DPC 20-60	20V C.T. @ 60MA	10V @ 120MA	1.2
PC 20-220	DPC 20-220	20V C.T. @ 220MA	10V @ 440MA	4.4
PC 20-500	DPC 20-500	20V C.T. @ 500MA	10V @ 1A	10
PC 20-1200	DPC 20-1200	20V C.T. @ 1.2A	10V @ 2.4A	24
PC 24-35	DPC 24-35	24V C.T. @ 35MA	12V @ 70MA	1.0
PC 24-50	DPC 24-50	24V C.T. @ 50MA	12V @ 100MA	1.2
PC 24-180	DPC 24-180	24V C.T. @ 180MA	12V @ 360MA	4.4
PC 24-450	DPC 24-450	24V C.T. @ 450MA	12V @ 900MA	10
PC 24-1000	DPC 24-1000	24V C.T. @ 1A	12V @ 2A	24
PC 28-30	DPC 28-30	28V C.T. @ 30MA	14V @ 60MA	1.0
PC 28-40	DPC 28-40	28V C.T. @ 40MA	14V @ 80MA	1.2
PC 28-160	DPC 28-160	28V C.T. @ 160MA	14V @ 320MA	4.4
PC 28-360	DPC 28-360	28V C.T. @ 360MA	14V @ 720MA	10
PC 28-800	DPC 28-800	28V C.T. @ 800MA	14V @ 1.6A	24
PC 34-25	DPC 34-25	34V C.T. @ 25MA	17V @ 50MA	1.0
PC 34-35	DPC 34-35	34V C.T. @ 35MA	17V @ 70MA	1.2
PC 34-125	DPC 34-125	34V C.T. @ 125MA	17V @ 250MA	4.4
PC 34-300	DPC 34-300	34V C.T. @ 300MA	17V @ 600MA	10
PC 34-700	DPC 34-700	34V C.T. @ 700MA	17V @ 1.4A	24
PC 40-20	DPC 40-20	40V C.T. @ 20MA	20V @ 40MA	1.0
PC 40-30	DPC 40-30	40V C.T. @ 30MA	20V @ 60MA	1.2
PC 40-110	DPC 40-110	40V C.T. @ 110MA	20V @ 220MA	4.4
PC 40-250	DPC 40-250	40V C.T. @ 250MA	20V @ 500MA	10
PC 40-600	DPC 40-600	40V C.T. @ 600MA	20V @ 1.2A	24
PC 56-15	DPC 56-15	56V C.T. @ 15MA	28V @ 30MA	1.0
PC 56-20	DPC 56-20	56V C.T. @ 20MA	28V @ 40MA	1.2
PC 56-80	DPC 56-80	56V C.T. @ 80MA	28V @ 160MA	4.4
PC 56-180	DPC 56-180	56V C.T. @ 180MA	28V @ 360MA	10
PC 56-420	DPC 56-420	56V C.T. @ 420MA	28V @ 840MA	24
PC 120-8	DPC 120-8	120V C.T. @ 8MA	60V @ 16MA	1.0
PC 120-10	DPC 120-10	120V C.T. @ 10MA	60V @ 20MA	1.2
PC 120-35	DPC 120-35	120V C.T. @ 35MA	60V @ 70MA	4.4
PC 120-85	DPC 120-85	120V C.T. @ 85MA	60V @ 170MA	10
PC 120-200	DPC 120-200	120V C.T. @ 200MA	60V @ 400MA	24

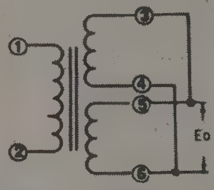
* See Table on opposite page for method of determining RMS Secondary Current.



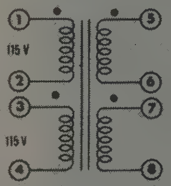
BASIC SCHEMATIC



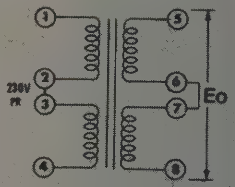
SERIES CONNECTED



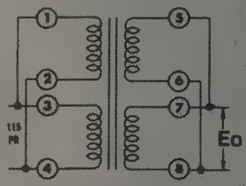
PARALLEL CONNECTED



BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A•2279 for prices"

signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

. . . for printed circuits applications

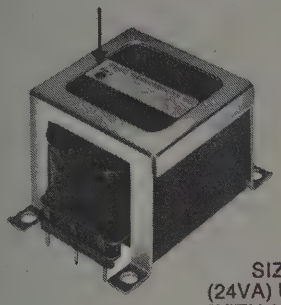
Signal has the most complete and diversified selection of miniature plug-in power transformers.

Primary ratings of 115V (Style PC - 6 Pin) or Dual 115/230V (Style DPC -8 Pin) are standard for the entire line. 1500V. Hipot is standard.

Size 1.0 is used extensively where height is a limiting factor since its height of 0.83 inches allows 1 inch spacing of PC boards. Size 24 is unusual since 24 watt PC transformers are not readily available, especially with a height of 1⅜ inches.

The RMS current ratings are based on a load regulation of 15-20% and not on temperature rise (except for the largest item, size 24). Therefore, these ratings may be exceeded without overheating, if the additional drop in full load voltage is acceptable. There is, of course, a limit and it would be best to check with our engineering department on specific units.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



SIZE 24 (24VA) UNIT WITH 24-BR SLIDE-ON MOUNTING BRACKET

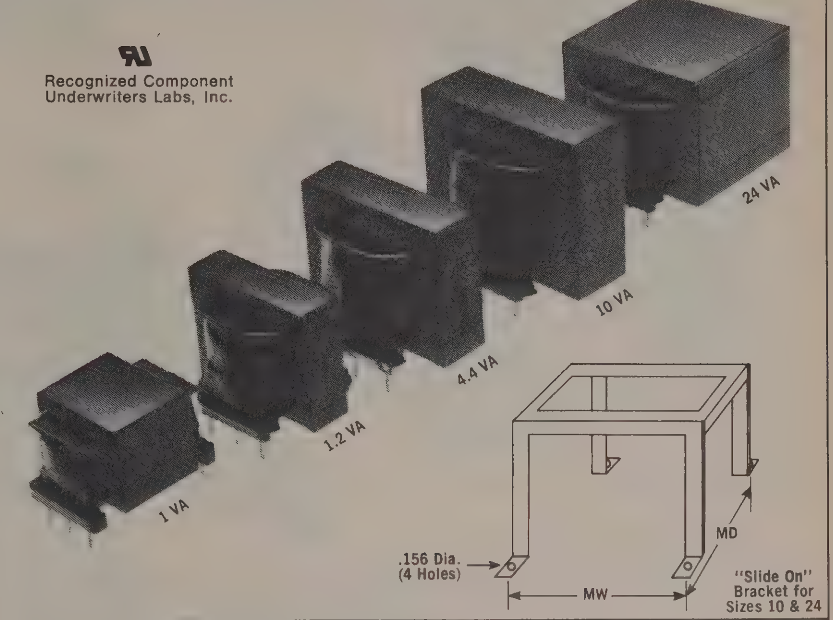
METHOD OF DETERMINING SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type		RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	=	0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	=	1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	=	DC Amps
Full Wave Bridge	Capacitor Input	=	1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

Recognized Component
Underwriters Labs, Inc.

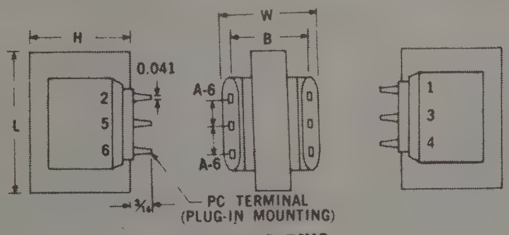


"Slide On" Bracket for Sizes 10 & 24

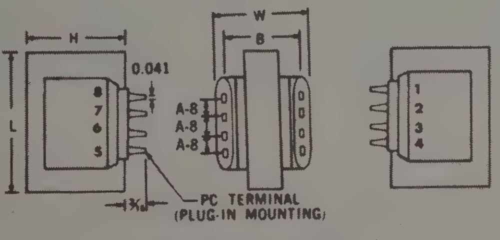
DIMENSIONS

Size (VA)	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)	OPTIONAL BRACKET* No.	MW	MD
1.0	1	1⅜	0.83	0.250	0.200	1.200	2.5	—	—	—
1.2	1⅜	1⅛	1³⁄₁₆	0.312	0.200	1.000	3	—	—	—
4.4	1⅝	1¼	1⅜	0.400	0.250	1.100	5	—	—	—
10	1⅞	1⁷⁄₁₆	1⅝	0.400	0.250	1.300	9	10-BR	1⁴¹⁄₆₄	1⅛
24	1⅝	2¼	1⅜	0.400	0.250	2.100	12	24-BR	1⅜	2

* An optional "Slide On" Mounting Bracket is available for sizes 10 and 24. The brackets do not use up any extra "Floor Space" but add ⅓₂" to the height of the transformer.



TYPE PC 6 PINS



TYPE DPC 8 PINS

Always in Stock —"THE PRONTO CHALLENGE":—We ship your prototypes (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A·2279 for prices"

signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

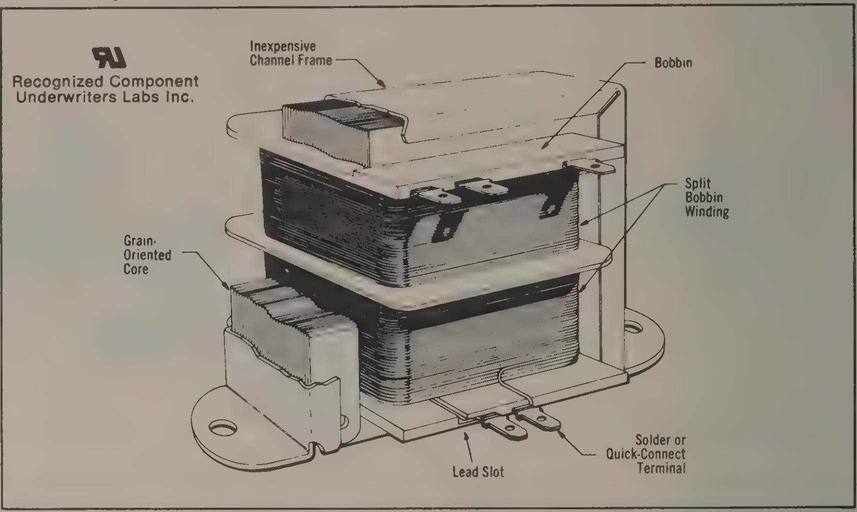
cut size and weight with "2-4-1". . . . .

The 2-4-1 series is an illustration of the use of creative design applied to small power transformers. The result is a line where, for a given va rating, size and weight are reduced almost 50%. Hence the name "241" series.

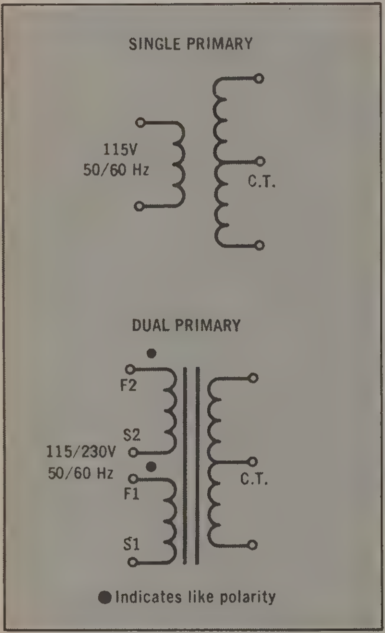
- GRAIN ORIENTED CORE — High Saturation Density — Lower Core Loss — Less Steel and Copper.
- BOBBIN WOUND — Maximum Utilization of Winding Area — Space and Size Reduced.
- SPLIT BOBBIN — NON-CONCENTRIC WINDING — Lower Capacitance — Better Insulation — 2500V RMS Hipot — No need for Electro-Static Shield — High Isolation and Insulation Resistance. No Cross-Overs of Primary and Secondary Leads.
- SPECIAL TERMINAL — Solder or Quick-Connect.

The series is available with single 115V or dual 115/230V primary, rated 50/60 Hz. Class S insulation is used for a maximum total temperature rating of 130°C continuous.

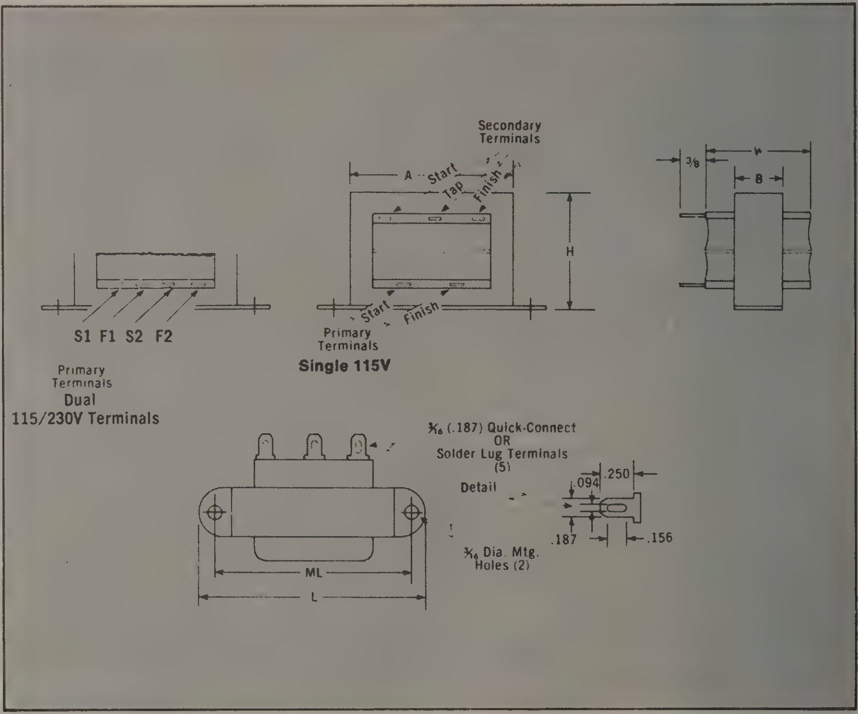
AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES



Recognized Component
Underwriters Labs Inc.
Inexpensive Channel Frame
Bobbin
Split Bobbin Winding
Grain-Oriented Core
Solder or Quick-Connect Terminal
Lead Slot



SINGLE PRIMARY
115V
50/60 Hz
C.T.
DUAL PRIMARY
F2
S2
115/230V
50/60 Hz
F1
S1
C.T.
● Indicates like polarity



Secondary Terminals
A
Start
Tap
Finish
H
3/8
W
B
S1 F1 S2 F2
Primary Terminals
Dual
115/230V Terminals
Start
Finish
Primary Terminals
Single 115V
3/16 (.187) Quick-Connect OR Solder Lug Terminals (5)
Detail
.094
.250
.187
.156
3/16 Dia. Mtg. Holes (2)
ML
L

DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1•2631 for prices"

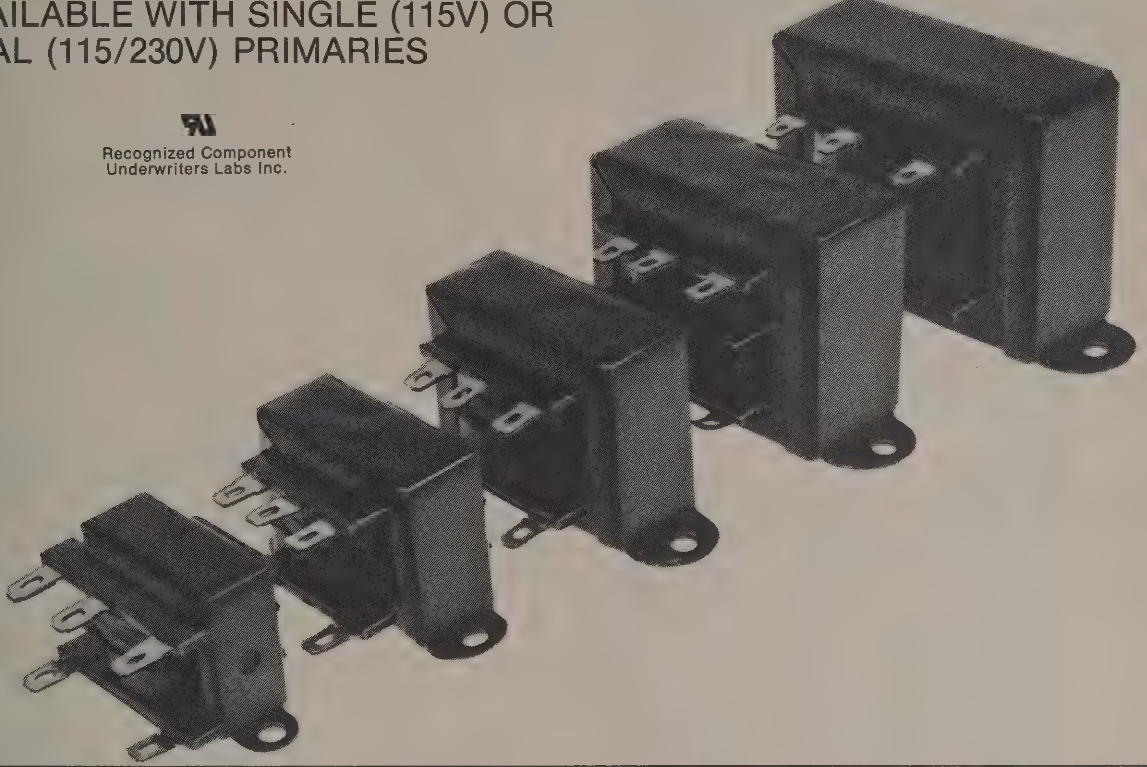
signal TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

series of small power transformers

AVAILABLE WITH SINGLE (115V) OR
DUAL (115/230V) PRIMARIES

Recognized Component
Underwriters Labs Inc.



METHOD OF DETERMINING
SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F. W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

CUSTOM VARIATIONS

Signal is equipped to quote on Custom Variations of "241" types. The secondary combinations are restricted by the number of secondary terminals available, as follows:

Size	Maximum Number of Secondary Terminals	VA Rating
3	3	2.4
4	4	6
5	4	12
6	5	30
7	5	56
8	5	100

We answer requests promptly and can deliver prototypes in one to three weeks. Production lead times can be scheduled with very reasonable lead times.

Part Number		Secondary RMS Ratng	Part Number		Secondary RMS Rating
Single 115V	Dual 115/230V		Single 115V	Dual 115/230V	
241-3-10	Not Available	10V C.T. @ 0.25A	241-3-28	Not Available	28V C.T. @ 0.085A
241-4-10	DP 241-4-10	10V C.T. @ 0.6A	241-4-28	DP 241-4-28	28V C.T. @ 0.2A
241-5-10	DP 241-5-10	10V C.T. @ 1.2A	241-5-28	DP 241-5-28	28V C.T. @ 0.42A
241-6-10	DP 241-6-10	10V C.T. @ 3.0A	241-6-28	DP 241-6-28	28V C.T. @ 1.1A
241-7-10	DP 241-7-10	10V C.T. @ 5.0A	241-7-28	DP 241-7-28	28V C.T. @ 2.0A
241-8-10	DP 241-8-10	10V C.T. @ 10A	241-8-28	DP 241-8-28	28V C.T. @ 3.6A
241-3-12	Not Available	12.6V C.T. @ 0.2A	241-3-36	Not Available	36V C.T. @ 0.065A
241-4-12	DP 241-4-12	12.6V C.T. @ 0.5A	241-4-36	DP 241-4-36	36V C.T. @ 0.17A
241-5-12	DP 241-5-12	12.6V C.T. @ 1.0A	241-5-36	DP 241-5-36	36V C.T. @ 0.35A
241-6-12	DP 241-6-12	12.6V C.T. @ 2.5A	241-6-36	DP 241-6-36	36V C.T. @ 0.85A
241-7-12	DP 241-7-12	12.6V C.T. @ 4.0A	241-7-36	DP 241-7-36	36V C.T. @ 1.5A
241-8-12	DP 241-8-12	12.6V C.T. @ 8.0A	241-8-36	DP 241-8-36	36V C.T. @ 2.8A
241-3-16	Not Available	16V C.T. @ 0.15A	241-3-48	Not Available	48V C.T. @ 0.05A
241-4-16	DP 241-4-16	16V C.T. @ 0.4A	241-4-48	DP 241-4-48	48V C.T. @ 0.125A
241-5-16	DP 241-5-16	16V C.T. @ 0.8A	241-5-48	DP 241-5-48	48V C.T. @ 0.25A
241-6-16	DP 241-6-16	16V C.T. @ 2.0A	241-6-48	DP 241-6-48	48V C.T. @ 0.63A
241-7-16	DP 241-7-16	16V C.T. @ 3.5A	241-7-48	DP 241-7-48	48V C.T. @ 1.2A
241-8-16	DP 241-8-16	16V C.T. @ 6.25A	241-8-48	DP 241-8-48	48V C.T. @ 2.0A
241-3-20	Not Available	20V C.T. @ 0.12A	241-3-56	Not Available	56V C.T. @ 0.045A
241-4-20	DP 241-4-20	20V C.T. @ 0.3A	241-4-56	DP 241-4-56	56V C.T. @ 0.11A
241-5-20	DP 241-5-20	20V C.T. @ 0.6A	241-5-56	DP 241-5-56	56V C.T. @ 0.22A
241-6-20	DP 241-6-20	20V C.T. @ 1.5A	241-6-56	DP 241-6-56	56V C.T. @ 0.54A
241-7-20	DP 241-7-20	20V C.T. @ 2.8A	241-7-56	DP 241-7-56	56V C.T. @ 1.0A
241-8-20	DP 241-8-20	20V C.T. @ 5.0A	241-8-56	DP 241-8-56	56V C.T. @ 1.8A
241-3-24	Not Available	24V C.T. @ 0.1A	241-3-120	Not Available	120V C.T. @ 0.02A
241-4-24	DP 241-4-24	24V C.T. @ 0.25A	241-4-120	DP 241-4-120	120V C.T. @ 0.05A
241-5-24	DP 241-5-24	24V C.T. @ 0.5A	241-5-120	DP 241-5-120	120V C.T. @ 0.1A
241-6-24	DP 241-6-24	24V C.T. @ 1.25A	241-6-120	DP 241-6-120	120V C.T. @ 0.25A
241-7-24	DP 241-7-24	24V C.T. @ 2.4A	241-7-120	DP 241-7-120	120V C.T. @ 0.5A
241-8-24	DP 241-8-24	24V C.T. @ 4.0A	241-8-120	DP 241-8-120	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used for dual primary versions

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A•2279 for prices"

signal
TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

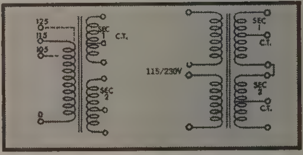
rectifier power transformers

CHOICE OF SINGLE 115V OR DUAL 115/230V PRIMARIES

Primary 50/60 Hz		Secondary RMS Rating*									
Single 115V.	**Dual* 115/230V.**	**Series**	**Parallel**	**Mtg. Style**	**L**	**W**	**H**	**ML**	**MW**	**Mtg. Screw**	**Approx. Lbs.**
10-1	DL 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	2⅞	1¾	2 5/16	2⅜	—	#8	1.0
10-2	DL 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
10-4	DL 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	3 3/16	2⅜	3 1/16	3⅛	—	#8	2.3
10-6	DL 10-6	10V C.T. @ 6A	5V C.T. @ 12A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
10-8	DL 10-8	10V C.T. @ 8A	5V C.T. @ 16A	B	3⅜	3⅛	2 13/16	2 13/16	2½	#8	4.0
10-12	DL 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
10-25	DL 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
10-50‡	DL 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	5¼	5½	4⅜	4⅜	3⅝	¼	17.0
10-100‡	DL 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
12.8-1	DL 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
12.8-2	DL 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	B	3	2½	2½	2½	2	#8	2.3
12.8-4	DL 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	B	3	2⅞	2½	2½	2⅜	#8	2.8
12.8-6	DL 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
12.8-8	DL 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
12.8-12	DL 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	6.0
12.8-25	DL 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.5
12.8-50‡	DL 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	5¼	6	4⅜	4⅜	4⅛	¼	20.7
12.8-100‡	DL 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
16-1	DL 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
16-2	DL 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7
16-4	DL 16-4	16V C.T. @ 4A	8V C.T. @ 8A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
16-6	DL 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	3¾	3⅛	3⅛	3⅛	2¼	#10	4.5
16-8	DL 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	3¾	3½	3⅛	3⅛	2⅝	#10	5.4
16-12	DL 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	4⅛	3⅞	3 7/16	3 7/16	3	#10	7.9
16-25	DL 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	4½	5⅜	3¾	3¾	4	#10	14.5
16-50‡	DL 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
16-100‡	DL 16-100	16V C.T. @ 100A	8V C.T. @ 200A	B	7½	7½	6⅜	6¾	4⅝	¼	50.0
24-1	DL 24-1	24V C.T. @ 1A	12V C.T. @ 2A	B	3	2½	2½	2½	2	#8	2.3
24-2	DL 24-2	24V C.T. @ 2A	12V C.T. @ 4A	B	3	2⅞	2½	2½	2⅜	#8	2.9
24-4	DL 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
24-6	DL 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	5.8
24-8	DL 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	4⅛	3⅞		3 7/16	3	#10	7.9
24-12‡	DL 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	4½	4½	3¾	3¾	3⅜	#10	11.0
24-20‡	DL 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	5¼	4¾	4⅜	4⅜	3⅜	¼	15.3
24-25‡	DL 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	5¼	5⅝	4⅜	4⅜	4⅛	¼	19.5
24-50‡	DL 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	6⅜	6¼	5 5/16	5 5/16	4⅜	¼	31.3
——	24-100 △	24V C.T. @ 100A	12V C.T. @ 200A	B	7½	7	6⅜	6¾	4⅛	¼	43.0
36-1	DL 36-1	36V C.T. @ 1A	18V C.T. @ 2A	B	3	2¾	2½	2½	2¼	#8	2.6
36-2	DL 36-2	36V C.T. @ 2A	18V C.T. @ 4A	B	3⅜	2 15/16	2 13/16	2 13/16	2⅜	#8	3.8
36-4	DL 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
36-6	DL 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
36-8‡	DL 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	4½	4½	3¾	3¾	3⅜	#10	11.0
36-12‡	DL 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
36-20‡	DL 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	6⅜	5⅜	5 5/16	5 5/16	3⅜	¼	22.8
36-25‡	DL 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
36-30‡	DL 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	6⅜	6	5 5/16	5 5/16	4⅜	¼	31.5
——	36-50△	36V C.T. @ 50A	18V C.T. @ 100A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	40.0
56-1	DL 56-1	56V C.T. @ 1A	28V C.T. @ 2A	B	3⅜	2⅞	2 13/16	2 13/16	2¼	#8	3.5
56-2	DL 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
56-4	DL 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	4⅛	3¾	3 7/16	3 7/16	3	#10	7.7
56-6	DL 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.0
56-8‡	DL 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	5¼	5	4⅜	4⅜	3⅝	¼	17.0
56-12†	DL 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	6⅜	5¼	5 5/16	5 5/16	3⅜	¼	22.0
56-25‡	DL 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	6⅜	7⅛	5 5/16	5 5/16	5⅛	¼	38.0
——	56-50△	56V C.T. @ 50A	28V C.T. @ 100A	B	7½	7½	6¼	6¾	4⅞	¼	56.3
68-1	DL 68-1	68V C.T. @ 1A	34V C.T. @ 2A	B	3⅜	2 15/16	2 13/16	2 13/16	2⅜	#8	3.8
68-2	DL 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
68-4	DL 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	4½	4½	3¾	3¾	3⅜	#10	11.5
68-6‡	DL 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
68-8‡	DL 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	5¼	5½	4⅜	4⅜	3⅞	¼	19.0
68-12‡	DL 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
——	68-25△	68V C.T. @ 25A	34V C.T. @ 50A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	39.7
80-1	DL 80-1	80V C.T. @ 1A	40V C.T. @ 2A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
80-2	DL 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
80-4	DL 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	5¼	4¼	4⅜	4⅜	2⅞	¼	12.3
80-6‡	DL 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	5¼	5½	4⅜	4⅜	3⅞	¼	19.0
80-8‡	DL 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	6⅜	5¼	5 5/16	5 5/16	3¼	¼	20.5
80-12‡	DL 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	6⅜	6	5 5/16	5 5/16	4⅛	¼	29.0
——	80-25△	80V C.T. @ 25A	40V C.T. @ 50A	B	7½	6½	6¼	6¾	3⅞	¼	40.3

△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

Items shown in shaded area are not normally in stock. They are standard designs generally available in 3-4 weeks.



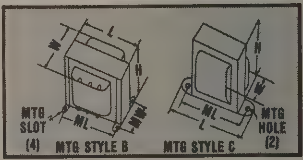
All transformers are designed conservatively and are rated for 50/60 Hz. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss varnish. The transformers and chokes are rugged in construction, well insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation. Hipot rating of 1500V RMS is standard.

Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings, which may be series or parallel connected as indicated in rating chart.

*The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.



"See page 1A•2279 for prices"

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696 • Telephone: (516) 239-4510

signal TRANSFORMER

filter chokes

1.0 TO 200 AMPS

Signal's line of filter chokes is the most extensive available. It is designed to complement the selection of Rectifier Power Transformers so that a set may be specified for power supplies using inductive filters.

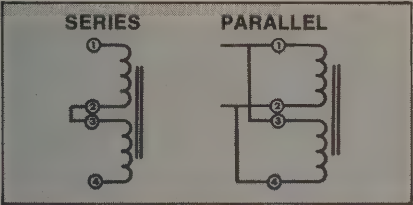
The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values. Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

Part No.	Inductance (MHY)	Current (Amps)	Resistance (Ohms)	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
CH-1	100	1	1.5	B	3	2½	2½	2½	2	#8	2.3
CH-2	70	2	0.9	B	3⅜	2¾	2⅞	2 13/16	2⅛	#8	3.2
CH-4	70	4	0.6	B	3¾	3⅛	3¼	3⅛	2½	#8	5.3
CH-6	40	6	0.4	B	3¾	3⅝	3¼	3⅛	3	#8	6.5
CH-8	30	8	0.3	B	4⅛	3⅝	3½	3 7/16	3	#10	8
CH-12	15	12	0.1	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.7
CH-16	15	16	0.08	B	5¼	4⅝	4 7/16	4⅜	3⅝	#10	17.5
CH-20	7	20	0.05	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.3
CH-25	5	25	0.025	B	5¼	4¾	4 7/16	4⅜	3⅞	#10	17.8
CH-30	4	30	0.01	B	6⅜	5	5⅜	5 5/16	3⅜	¼	24.4
CH-50	1.4	50	0.01	B	6⅜	5¼	5⅜	5 5/16	3¾	¼	26.7
CH-100	0.5	100	0.005	B	6⅜	6¼	5⅜	5 5/16	4⅛	¼	31.4
CH-200	0.3	200	0.001	B	7½	7½	6¼	6¾	4⅛	¼	48.0

dual chokes

FOR LOWER INDUCTANCE APPLICATIONS



Part No.	Series Connected			Parallel Connected			Mtg. Style	Dimensions					Mtg. Screw	Appr. Lbs.
	Ind. (MHY)	Curr. (Amps)	Res. Ω	Ind. (MHY)	Curr. (Amps)	Res. Ω		L	W	H	ML	MW		
CL-1-2	72	1	1.4	18	2	0.35	C	2⅞	1¾	2 5/16	2⅜	—	#8	0.9
CL-2-4	40	2	0.7	10	4	0.18	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
CL-4-8	20	4	0.3	5	8	0.075	B	3	2⅞	2½	2½	2½	#8	3.0
CL-6-12	12	6	0.15	3	12	0.038	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
CL-12-24	4.8	12	0.052	1.2	24	0.013	B	3⅜	3 9/16	2 13/16	2 13/16	3	#8	5.3
CL-25-50	1.2	25	0.012	0.3	50	0.003	B	3¾	3⅜	3⅜	3⅛	2¾	#8	6.0
CL-50-100	0.5	50	0.0043	0.12	100	0.0011	B	4½	3¾	3¾	3¾	2½	#8	8.0

Signal's Dual Chokes are supplied with 2 windings which may be series or parallel connected with rating shown on chart. This line is basically designed for application requiring lower inductance value at high currents, such as low voltage, DC supplies or SCR filters.

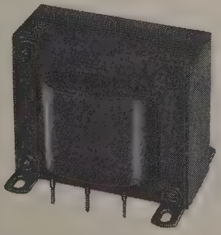
step down auto transformers

50/60 Hz 100-2000 VA — 230/115V

ENCLOSED STYLE "EB"

UL APPROVED 2 PRONG LINE CORD RECEPTACLE — LOW REGULATION BLACK ENAMEL FINISH

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110	1⅞	2⅜	2½	1½ x 1 11/16	1.5
120	112	2⅞	2⅛	3½	2¼ x 1¾	3.0
150	115	2⅞	3⅜	3½	2¼ x 2	3.5
200	120	2⅞	3½	3½	2¼ x 2⅛	4.0
250	125	2⅞	3⅞	3½	2¼ x 2½	4.8
300	130	3¼	3⅞	3⅞	2½ x 2 7/16	5.5
500	150	3¼	4⅞	3⅞	2½ x 3 7/16	8
750	175	3¼	5⅞	3⅞	2½ x 4 7/16	11
1000	1100	4½	5⅛	5½	3½ x 3½	14
1500	1150	4½	6⅛	5½	3½ x 4½	20
2000	1200	4½	7⅛	5½	3½ x 5½	26



OPEN FRAME STYLE "OF"

(May be used step-up or step-down)

BLACK ENAMEL FINISH. 8″ LEADS INEXPENSIVE VERSION FOR USE IN EQUIPMENT

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110-OF	2¼	2	1 15/16	2 13/16*	1.3
120	112-OF	3⅜	2½	2⅞	2 13/16 x 1⅞	2.5
150	115-OF	3⅜	2¾	2⅞	2 13/16 x 2⅛	3.0
200	120-OF	3⅜	2⅞	2⅞	2 13/16 x 2¼	3.5
250	125-OF	3⅜	3¼	2⅞	2 13/16 x 2⅝	4.2
300	130-OF	3¾	3¼	3⅛	3⅛ x 2½	5.0
500	150-OF	3¾	4¼	3⅛	3⅛ x 3½	8.0
750	175-OF	3¾	5¼	3⅛	3⅛ x 4½	11
1000	1100-OF	5¼	4½	4⅜	4⅜ x 3⅛	14
1500	1150-OF	5¼	5½	4⅜	4⅜ x 4⅛	19
2000	1200-OF	5¼	6½	4⅜	4⅜ x 5⅛	25

* Part 110-OF is mounted by means of a channel with 2 mtg. tabs.

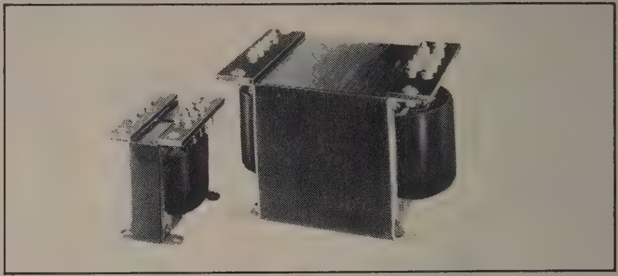
Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A•2279 for prices"

signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

power isolation transformers

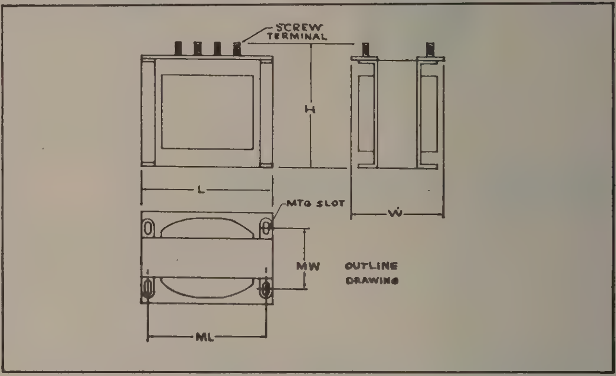
INDUSTRIAL GRADE/STEP-UP OR STEP-DOWN. MANY POSSIBLE VOLTAGE RATINGS.



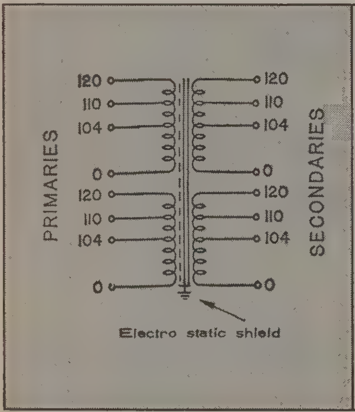
AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "SU" lines are designed for a maximum of 55°C rise above ambient for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated and have a consistently uniform appearance. All ratings are at full load current, continuous operation. 2500V. RMS Hipot is standard.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers (10-32 on ¼ and ½ KVA, ¼-20 on larger sizes). Connections can be easily made with a nut driver. It is also simple to alter the interconnections to change transformer ratings. **Electro static shields are provided grounded to the core.** The connection is made with a lug to ground and may be opened if an ungrounded shield is desired.



DU SERIES 110/220 Dual Primary to 110/220V. Dual Sec. (Primary & Secondary may be reversed)

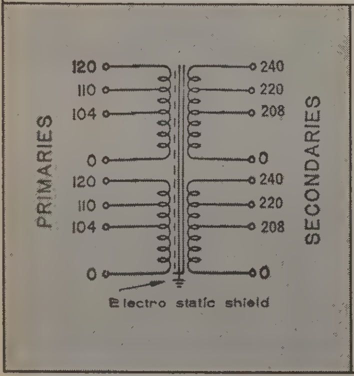


As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts. It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is doubled.

Part No.	KVA	Series Secondaries		Parallel Secondaries		Mechanical Dimensions					Mtg. & Term. Screw	Appr. Lbs.
		Volts	Max. Amps	Volts	Max. Amps	L *	W *	H *	ML †	MW ‡		
DU-¼	¼	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4¼	5¼	4⅜	2½	#10	12
DU-½	½	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
DU-1	1	0/208/220/240	4.5	0/104/110/120	9	7 9/16	6¼	7¼	6¾	4⅛	¼	33
DU-2	2	0/208/220/240	9	0/104/110/120	18	7 9/16	8¼	7¼	6¾	6	¼	56
DU-3	3	0/208/220/240	14	0/104/110/120	28	7 9/16	9¼	7¼	6¾	7	¼	70
DU-5	5	0/208/220/240	23	0/104/110/120	46	7 9/16	10¾	7¼	6¾	8½	¼	89
DU-7.5	7.5	0/208/220/240	31	0/104/110/120	62	9	10¾	8	7½	6½	¼	105
DU-10	10	0/208/220/240	41	0/104/110/120	83	9	13	8	7½	9	¼	150

* Maximum. † ±1/32. ‡ ±1/16.

SU SERIES 110/220 Dual Primary to 220/440V. Dual Sec. (Primary & Secondary may be reversed)



"SU" transformers are similar to "DU" types except that a 220/240V secondary is provided.

Part No.	KVA	Series Secondaries		Parallel Secondaries		Mechanical Dimensions					Mtg. & Term. Screw	Appr. Lbs.
		Volts	Max. Amps	Volts	Max. Amps	L *	W *	H *	ML †	MW ‡		
SU-¼	¼	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4¼	5¼	4⅜	2½	#10	12
SU-½	½	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
SU-1	1	0/416/440/480	2.25	0/208/220/240	4.5	7 9/16	6¼	7¼	6¾	4⅛	¼	33
SU-2	2	0/416/440/480	4.5	0/208/220/240	9	7 9/16	8¼	7¼	6¾	6	¼	56
SU-3	3	0/416/440/480	7	0/208/220/240	14	7 9/16	9¼	7¼	6¾	7	¼	70
SU-5	5	0/416/440/480	11.5	0/208/220/240	23	7 9/16	10¾	7¼	6¾	8½	¼	89
SU-7.5	7.5	0/416/440/480	15.5	0/208/220/240	31	9	10¾	8	7½	6½	¼	105
SU-10	10	0/416/440/480	20.5	0/208/220/240	41	9	13	8	7½	9	¼	150

* Maximum. † ±1/32. ‡ ±1/16.

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 1A•2279 for prices"

signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, NY 11696
Telephone: (516) 239-4510
An Insilco Company

price list

JANUARY 1, 1983

RECTIFIER POWER

Part No.	Net
10-1	$16.60
10-2	19.20
10-4	21.70
10-6	28.10
10-8	36.30
10-12	40.50
10-25	57.00
10-50	90.00
10-100	142.00
12.8-1	17.70
12.8-2	22.90
12.8-4	27.00
12.8-6	31.00
12.8-8	36.50
12.8-12	45.50
12.8-25	62.40
12.8-50	99.00
12.8-100	150.00
16-1	17.90
16-2	19.80
16-4	28.00
16-6	32.90
16-8	42.70
16-12	45.00
16-25	78.00
16-50	144.00
16-100	198.00
24-1	22.20
24-2	25.40
24-4	31.90
24-6	39.00
24-8	44.00
24-12	63.00
24-20	84.00
24-25	99.00
24-50	136.00
24-100	256.00
36-1	23.40
36-2	28.70
36-4	39.10
36-6	46.90
36-8	59.00
36-12	77.00
36-20	114.00
36-25	124.00
36-30	145.00
36-50	188.00
56-1	27.00
56-2	32.40
56-4	41.80
56-6	59.00
56-8	84.00
56-12	99.00
56-25	170.00
56-50	330.00
68-1	27.90
68-2	36.40
68-4	54.00
68-6	68.50
68-8	88.00
68-12	127.00
68-25	200.00
80-1	30.00
80-2	39.10
80-4	62.50
80-6	94.50
80-8	106.00
80-12	130.00
80-25	208.00
DL-10-1	17.43
DL-10-2	20.16
DL-10-4	22.79
DL-10-6	29.51
DL-10-8	38.12
DL-10-12	42.53
DL-10-25	59.83
DL-10-50	94.50
DL-10-100	149.10
DL-12.8-1	18.59
DL-12.8-2	24.05
DL-12.8-4	28.35
DL-12.8-6	32.55
DL-12.8-8	38.50
DL-12.8-12	47.78
DL-12.8-25	65.52
DL-12.8-50	$103.95
DL-12.8-100	157.50
DL-16-1	18.80
DL-16-2	20.79
DL-16-4	29.40
DL-16-6	34.55
DL-16-8	44.84
DL-16-12	47.00
DL-16-25	81.90
DL-16-50	151.20
DL-16-100	202.00
DL-24-1	23.31
DL-24-2	26.67
DL-24-4	33.50
DL-24-6	40.95
DL-24-8	46.00
DL-24-12	66.15
DL-24-20	87.00
DL-24-25	103.95
DL-24-50	142.80
DL-36-1	24.57
DL-36-2	30.14
DL-36-4	41.06
DL-36-6	49.25
DL-36-8	61.95
DL-36-12	80.85
DL-36-20	119.70
DL-36-25	127.00
DL-36-30	152.25
DL-56-1	28.35
DL-56-2	34.02
DL-56-4	43.89
DL-56-6	61.95
DL-56-8	88.20
DL-56-12	103.95
DL-56-25	178.50
DL-68-1	29.30
DL-68-2	38.22
DL-68-4	56.70
DL-68-6	71.93
DL-68-8	92.40
DL-68-12	133.35
DL-80-1	31.50
DL-80-2	41.00
DL-80-4	65.63
DL-80-6	99.23
DL-80-8	111.50
DL-80-12	136.50

CHOKES

Part No.	Net
CH-1	17.80
CH-2	22.70
CH-4	37.40
CH-6	40.00
CH-8	43.70
CH-12	60.20
CH-16	84.00
CH-20	68.10
CH-25	79.20
CH-30	99.00
CH-50	108.00
CH-100	124.00
CH-200	182.00

DUAL CHOKES

Part No.	Net
CL-1-2	15.80
CL-2-4	18.00
CL-4-8	32.50
CL-6-12	36.00
CL-12-24	40.00
CL-25-50	49.00
CL-50-100	66.00

POWER ISOLATION TRANSFORMERS

Part No.	Net
DU-¼	90.00
DU-½	114.00
DU-1	190.00
DU-2	260.00
DU-3	$350.00
DU-5	440.00
DU-7.5	580.00
DU-10	790.00
SU-¼	90.00
SU-½	114.00
SU-1	190.00
SU-2	260.00
SU-3	350.00
SU-5	440.00
SU-7.5	580.00
SU-10	790.00

AUTO TRANSFORMERS

Part No.	Net
110	30.00
112	34.00
115	35.50
120	37.00
125	39.00
130	42.00
150	49.00
175	60.00
1100	77.00
1150	99.00
1200	120.00
110-OF	19.00
112-OF	23.00
115-OF	25.00
120-OF	26.50
125-OF	28.80
130-OF	32.00
150-OF	40.80
175-OF	53.50
1100-OF	61.40
1150-OF	94.00
1200-OF	112.00

PC POWER

Part No.	Net
PC-10-90	8.65
PC-10-120	6.34
PC-10-440	7.42
PC-10-1000	8.65
PC-10-2400	11.45
PC-12-70	8.65
PC-12-100	6.34
PC-12-350	7.42
PC-12-800	8.65
PC-12-2000	11.45
PC-16-55	8.65
PC-16-75	6.34
PC-16-260	7.42
PC-16-640	8.65
PC-16-1500	11.45
PC-20-45	8.65
PC-20-60	6.34
PC-20-220	7.42
PC-20-500	8.65
PC-20-1200	11.45
PC-24-35	8.65
PC-24-50	6.34
PC-24-180	7.42
PC-24-450	8.65
PC-24-1000	$11.45
PC-28-30	8.65
PC-28-40	6.34
PC-28-160	7.42
PC-28-360	8.65
PC-28-800	11.45
PC-34-25	8.65
PC-34-35	6.34
PC-34-125	7.42
PC-34-300	8.65
PC-34-700	11.45
PC-40-20	8.65
PC-40-30	6.34
PC-40-110	7.42
PC-40-250	8.65
PC-40-600	11.45
PC-56-15	8.65
PC-56-20	6.34
PC-58-80	7.42
PC-56-180	8.65
PC-58-420	11.45
PC-120-8	8.65
PC-120-10	6.34
PC-120-35	7.42
PC-120-85	8.65
PC-120-200	11.45
DPC-10-90	10.00
DPC-10-120	7.40
DPC-10-440	8.62
DPC-10-1000	10.10
DPC-10-2400	12.66
DPC-12-70	10.00
DPC-12-100	7.40
DPC-12-350	8.62
DPC-12-800	10.10
DPC-12-2000	12.66
DPC-16-55	10.00
DPC-16-75	7.40
DPC-16-260	8.62
DPC-16-640	10.10
DPC-16-1500	12.66
DPC-20-45	10.00
DPC-20-60	7.40
DPC-20-220	8.62
DPC-20-500	10.10
DPC-20-1200	12.66
DPC-24-35	10.00
DPC-24-50	7.40
DPC-24-180	8.62
DPC-24-450	10.10
DPC-24-1000	12.66
DPC-28-30	10.00
DPC-28-40	7.40
DPC-28-160	8.62
DPC-28-360	10.10
DPC-28-800	12.66
DPC-34-25	10.00
DPC-34-35	7.40
DPC-34-125	8.62
DPC-34-300	10.10
DPC-34-700	12.66
DPC-40-20	10.00
DPC-40-30	7.40
DPC-40-110	8.62
DPC-40-250	10.10
DPC-40-600	12.66
DPC-56-15	10.00
DPC-56-20	7.40
DPC-56-80	8.62
DPC-56-180	10.10
DPC-56-420	12.66
DPC-120-8	10.00
DPC-120-10	7.40
DPC-120-35	8.62
DPC-120-85	10.10
DPC-120-200	12.66
10-BR	.60
24-BR	.60

FLAT-HEAD PC TYPES

Part No.	Net
LP-10-250	9.00
LP-10-600	9.92
LP-10-1200	11.96
LP-12-200	9.00
LP-12-450	9.92
LP-12-900	11.96
LP-16-150	9.00
LP-16-350	$ 9.92
LP-16-700	11.96
LP-20-125	9.00
LP-20-300	9.92
LP-20-600	11.96
LP-24-100	9.00
LP-24-250	9.92
LP-24-500	11.96
LP-30-85	9.00
LP-30-200	9.92
LP-30-400	11.96
LP-34-75	9.00
LP-34-170	9.92
LP-34-340	11.96
LP-40-60	9.00
LP-40-150	9.92
LP-40-300	11.96
LP-56-45	9.00
LP-56-100	9.92
LP-56-200	11.96
LP-88-28	9.00
LP-88-65	9.92
LP-88-130	11.96
LP-120-20	9.00
LP-120-50	9.92
LP-120-100	11.96
LP-230-10	9.00
LP-230-25	9.92
LP-230-50	11.96

MICRO-PROCESSOR PC TYPES

Part No.	Net
MPC-X-12	10.40
MPC-X-15	10.40
MPC-Y-12	13.20
MPC-Y-15	13.20
DMPC-X-12	11.85
DMPC-X-15	11.85
DMPC-Y-12	14.40
DMPC-Y-15	14.40
MPL-6-12	12.40
MPL-6-15	12.40
MPL-12-12	14.20
MPL-12-15	14.20

MICRO-PROCESSOR 2-4-1 TYPES

Part No.	Net
MT-6-12	13.50
MT-6-15	13.50
MT-7-12	17.65
MT-7-15	17.65
MT-8-12	22.76
MT-8-15	22.76
DMT-6-12	15.00
DMT-6-15	15.00
DMT-7-12	18.12
DMT-7-15	18.12
DMT-8-12	23.80
DMT-8-15	23.80

2-4-1

Part No.	Net
241-3-(ANY)	6.88
241-4-(ANY)	7.54
241-5-(ANY)	8.42
241-6-(ANY)	11.28
241-7-(ANY)	15.26
241-8-(ANY)	20.16
DP-241-4-(ANY)	9.20
DP-241-5-(ANY)	10.00
DP-241-6-(ANY)	12.80
DP-241-7-(ANY)	15.70
DP-241-8-(ANY)	21.20

SPLIT/TRAN

Part No.	Net
ST-2-(ANY)	6.75
ST-3-(ANY)	6.88
ST-4-(ANY)	7.88
ST-5-(ANY)	8.70
ST-6-(ANY)	10.48
ST-7-(ANY)	11.70
DST-2-(ANY)	7.85
DST-3-(ANY)	8.10
DST-4-(ANY)	8.70
DST-5-(ANY)	9.70
DST-6-(ANY)	11.90
DST-7-(ANY)	13.10
ST-MS	9.00/C
ST-MN	9.00/C

DISCOUNT SCHEDULE*

Quantity	Discount
1-9	Net
10-24	25%
25-49	35%
50-99	43%
100-249	50%
250 Over	Quote

---

* Different part numbers may not be aggregated to obtain quantity discount.
Terms: Net 30 days on approved credit. FOB Factory, Inwood, N.Y.
Prices subject to change without notice!

All items on this price schedule are stocked with the exception of those in shaded areas. Normal lead time for these parts is 3 to 4 weeks and orders require a $35.00 set-up charge per item.

signal TRANSFORMER

An Insilco Company

500 Bayview Ave., Inwood, NY 11696 • Telephone: (516) 239-4510
Telex: 96-8112 — TWX 510-225-8440

STACO ENERGY PRODUCTS CO. variable

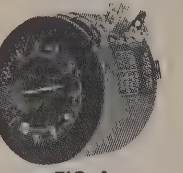


FIG. A

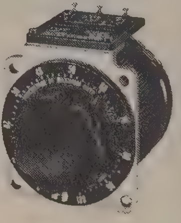


FIG. B

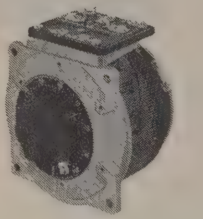


FIG. C

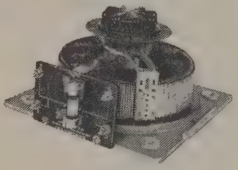


FIG. D

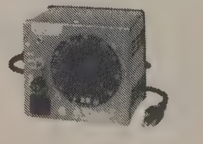


FIG. E

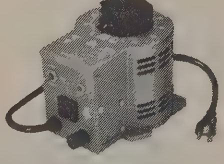


FIG. F

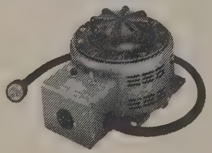


FIG. G

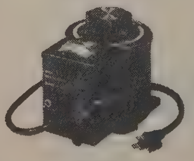


FIG. H

Staco variable transformers offer versatility and reliability unmatched by solid state voltage controls. Staco controls are used worldwide for industrial and laboratory applications to control voltage, current, power, heat, speed, light and electro-mechanical force. Staco variable transformers provide continuously adjustable output voltage from AC power sources without wave form distortions or SCR generated noise. Outstanding features include gold-plated commutators, precise regulation, high efficiency, conservative ratings and rugged construction.

You can select from panel mounted types, cord and plug types, ganged and/or motor driven types, metered types, and fully portable power supplies with or without meters, and ratings from 0.8 amps to 540 amps, 40 volts to 560 volts for single or three phase applications.

Staco has a nationwide network of distributors qualified to offer technical assistance whenever you need it. Additionally, the Staco Engineering Staff is available to help you with special or non-standard applications. Staco's Variable Voltage Controls handbook will be sent to you upon request ... it's loaded with illustrations, engineering data, specifications and ordering information on standard voltage controls. Prices shown are list prices at press time and are subject to change.

PANEL OR BENCH MOUNTING MODELS *120 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
171	A	*0-120/132	1.75	0.23	2 13/16 x 1 7/8	3.0	$ 20.00
201	A	*0-120/132	2.0	0.26	2 13/16 x 1 7/8	3.0	20.50
221	A	*0-120/132	2.25	0.30	2 13/16 x 2 1/8	3.2	21.00
251	A	*0-120/132	2.5	0.33	2 13/16 x 2 5/16	3.5	25.00
291	A	*0-120/132	3.0	0.40	2 13/16 x 2 5/16	3.5	27.00
501	B	0-120/140	5.0	0.70	3 3/4 x 3 3/4 x 3 5/16	6.0	37.00
1010	B	0-120/140	10.0	1.4	5 5/16 x 5 x 4 3/16	12.0	48.00
1010CT	J	0-120/140	10.0	1.4	6 7/8 x 5 x 4 7/16	12.0	75.00
SQ1010	B	0-120/140	10.0	1.4	5 3/16 x 4 1/4 x 4 5/32	12.0	50.00
1210	B	**0-120	12.0	1.44	5 5/16 x 5 x 4 3/16	12.0	54.00
1210CT	J	**0-120	12.0	1.44	6 7/8 x 5 x 4 7/16	12.0	74.00
SQ1210	B	**0-120	12.0	1.44	5 3/16 x 4 1/4 x 4 5/32	12.0	60.00
1510	C	0-120/140	15.0	2.1	6 1/8 x 6 5/8 x 4 3/8	20.0	98.00
1510CT	C	0-120/140	15.0	2.1	8 31/32 x 6 3/16 x 4 1/2	20.0	131.00
2510	C	0-120/140	25.0	3.5	8 3/16 x 7 5/8 x 4 1/8	23.0	142.00
2510CT	K	0-120/140	25.0	3.5	9 5/8 x 7 5/8 x 4 1/8	26.0	176.00
5010	D	0-140	50.0	7.0	15 3/8 x 13 7/8 x 5 1/4	60.0	336.00
5010CT	D	0-140	50.0	7.0	17 15/16 x 14 x 7 1/8	66.0	381.00
6010	D	0-120/140	60.0	8.4	15 3/8 x 13 7/8 x 5 1/4	67.0	403.00
6010C	D	0-120/140	60.0	8.4	15 3/8 x 13 7/8 x 7 1/8	67.0	419.00
6010CT	D	0-120/140	60.0	8.4	17 15/16 x 14 x 7 1/8	67.0	457.00

PANEL OR BENCH MOUNTING MODELS *240 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
252	A	0-240/264	0.8	0.21	2 13/16 x 2 7/16	3.5	$ 33.00
1020	B	0-240/280	3.5	0.98	5 5/16 x 5 x 4 3/16	12.0	64.00
1020CT	J	0-240/280	3.5	0.98	6 7/8 x 5 x 4 7/16	12.0	81.00
SQ1020	B	0-240/280	3.5	0.98	5 3/16 x 4 1/4 x 4 5/32	12.0	64.00
1220	B	**0-240	5.0	1.2	5 5/16 x 5 x 4 3/16	12.0	67.00
1220CT	J	**0-240	5.0	1.2	6 7/8 x 5 x 4 7/16	12.0	84.00
SQ1220	B	**0-240	5.0	1.2	5 3/16 x 4 1/4 x 4 5/32	12.0	67.00
1520	C	0-240/280	9.5	2.66	6 1/8 x 6 5/8 x 4 13/16	20.0	98.00
1520CT	K	0-240/280	9.5	2.66	6 3/8 x 9 1/8 x 5	23.0	124.00
2520	C	0-240/280	10.0	2.8	8 3/16 x 7 5/8 x 4 1/8	23.0	142.00
2520CT	K	0-240/280	10.0	2.8	9 5/8 x 7 5/8 x 4 1/8	26.0	176.00
5020	D	0-240/280	28.0	7.8	15 3/8 x 13 7/8 x 5 1/4	60.0	330.00
5020CT	D	0-240/280	28.0	7.8	17 15/16 x 14 x 7 1/8	66.0	381.00
6020	D	0-240/280	35.0	9.8	15 3/8 x 13 7/8 x 5 1/4	63.0	413.00
6020C	D	0-240/280	35.0	9.8	15 3/8 x 13 7/8 x 7 1/8	63.0	436.00
6020CT	D	0-240/280	35.0	9.8	17 15/16 x 14 x 7 1/8	63.0	476.00

PORTABLE MODELS *120 VOLT INPUT SINGLE PHASE*

Cord, matching receptacle, switch, pilot light, fuse, connected for clockwise knob rotation. Available with 2 conductor line cord and receptacle (2PF) or a 3-conductor grounded line cord and receptacle (3PN).

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
2PF171	E	**0-132	1.75	0.23	3 15/16 x 3 15/16 x 3 1/2	3.5	$ 56.00
3PN171	E	**0-132	1.75	0.23	3 15/16 x 3 15/16 x 3 1/2	3.5	58.00
2PF501	E	0-120/140	5.0	0.70	5 3/8 x 6 1/16 x 5 5/8	9.0	69.00
3PN501	E	0-120/140	5.0	0.70	5 3/8 x 6 1/16 x 5 5/8	9.0	71.00
2PF1010	F	0-120/140	10.0	1.4	5 x 6 7/8 x 5 5/8	12.0	71.00
3PN1010	F	0-120/140	10.0	1.4	5 x 6 7/8 x 5 5/8	12.0	74.00
3PN1210†	F	**0-120	12.0	1.44	5 x 6 7/8 x 5 5/8	12.0	91.00
3PN1510†	G	0-120/140	15.0	2.1	5 7/8 x 6 3/8 x 9	21.0	146.00
3PN2210†	G	0-140	22.0	3.08	5 5/8 x 7 5/8 x 10 3/4	24.0	211.00

PORTABLE MODELS *240 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
2PF1020	F	0-240/280	3.5	0.98	5 x 6 7/8 x 5 5/8	12.0	$ 86.00
3PN1020	F	0-240/280	3.5	0.98	5 x 6 7/8 x 5 5/8	12.0	93.00
3PN1220†	F	**0-240	5.0	1.2	5 x 6 7/8 x 5 5/8	12.0	103.00
3PN1520†	G	0-240/280	9.5	2.66	5 7/8 x 6 3/8 x 9	21.0	150.00
3PN2520†	G	0-280	10.0	2.8	5 5/8 x 7 5/8 x 10 3/4	24.0	211.00

CT refers to enclosed coil and terminals
*60 HZ Only on Overvoltage Connection
**60 HZ operation only
C refers to enclosed coil only

†2PF Model available at same price

transformers

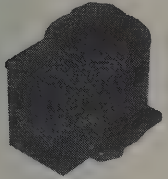


FIG. J

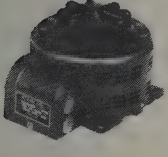


FIG. K

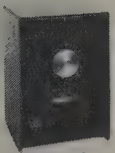


FIG. L

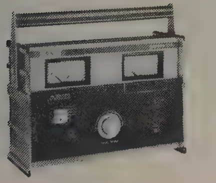


FIG. M

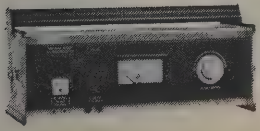


FIG. N

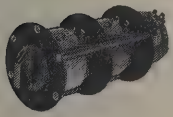


FIG. O

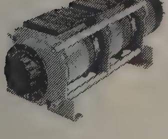


FIG. P

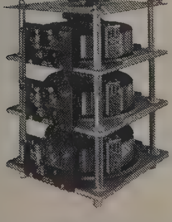


FIG. Q

METERED PORTABLE MODELS *120V & 240V SINGLE PHASE*

As above with an accurate, high quality pivot and jewel meter conveniently located atop the enclosure for easy, accurate readout. 120V models have 0-150V meter, 240V models have 0-300V meter.

MFG. TYPE No.	FIG.	INPUT VOLTS	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
2PF1010V	H	120	0-140	10.0	1.4	5 x 6⅞ x 5⅝	12.0	$117.00
3PN1010V	H	120	0-140	10.0	1.4	5 x 6⅞ x 5⅝	12.0	119.00
3PF1510V	—	120	0-140	15.0	2.1	5⅞ x 6⅜ x 9	21.0	184.00
2PF1020V	H	240	0-280	3.5	9.8	5 x 6⅞ x 5⅝	12.0	133.00
3PN1020V	H	240	0-280	3.5	9.8	5 x 6⅞ x 5⅝	12.0	135.00
3PN1520V	—	240	0-280	9.5	2.66	5⅞ x 6⅜ x 9	21.0	189.00

Ammeter equipped models available. Change suffix V to A.

VARIABLE ISOLATION TRANSFORMERS *120 VOLT INPUT SINGLE PHASE*

An exclusive by STACO, for use where the safety of isolation is required. The output voltage is completely isolated from the power line (input voltage). On uncased models, when proper external connections are made between windings, it is possible to increase the voltage or current output or input through non-isolated, voltage doubler, or series connection.

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
J201	B	0-140	2.0	0.28	5 5/16 x 5 x 4¾	13.0	$102.00
J401	B	0-140	4.0	0.56	6⅛ x 6⅝ x 4 7/16	20.0	156.00
J901	C	0-140	9.0	1.26	8 3/16 x 7⅝ x 4¾	32.0	272.00

ISOLATED PORTABLE MODELS *120 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	METER	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
3PNJ201	F	0-140	2.0	0.28	NO	5 x 6⅞ x 5⅝	11.0	$120.00
3PNJ201V	H	0-140	2.0	0.28	0-150	5 x 6⅞ x 5⅝	11.0	161.00
3PNJ401	G	0-140	4.0	0.56	NO	5⅞ x 6⅜ x 9	20.0	191.00
3PNJ401V	—	0-140	4.0	0.56	0-150	5⅞ x 6⅜ x 9	20.0	235.00

Ammeter equipped 3PNJ201A and 3PNJ401A available.

AC POWER SUPPLIES *120 VOLT SINGLE PHASE*

Portable AC Power Supplies are ideal for labs or test bench use. Housed in a ventilated steel and aluminum enclosure with carrying handle, each model is complete with a three-conductor line cord, plug & matching receptacle, pilot light, switch and circuit breaker. Metered models are available with Voltmeter, Ammeter or a Wattmeter (or a combination of meters).

MFG. TYPE NO.	FIG.	INPUT VOLTS	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
L221	L	**120	0-132	1.75	0.23	6 3/32 x 5 x 4¼	5.0	$ 67.00
L501	L	120	0-140	4.5	0.63	7 23/32 x 5⅜ x 5⅞	12.0	86.00
L1010	L	120	0-140	10.0	1.4	9 13/32 x 6½ x 6¼	20.0	102.00
E501V	N	120	0-120/140	5.0	0.7	6⅛ x 17⅝ x 5⅞	20.0	215.00
E501VA	M	120	0-120/140	5.0	0.7	10 x 15 1/16 x 5⅞	25.0	357.00
E501VAW	M	120	0-120/140	5.0	0.7	10 x 15 1/16 x 5⅞	28.0	555.00
E1010V	N	120	0-120/140	10.0	1.4	6 3/16 x 17⅝ x 5⅞	27.0	208.00
E1010VA	M	120	0-120/140	10.0	1.4	10 x 15 1/16 x 5⅞	33.0	422.00
E1010VAW	M	120	0-120/140	10.0	1.4	10 x 15 1/16 x 5⅞	35.0	624.00

E Series Models E171, E501 and E1010, without meters are also available.

ISOLATED AC/DC POWER SUPPLIES *120 VOLT SINGLE PHASE*

As above plus a 0-150V direct rating output voltmeter. 0-140V AC and 0-120V DC isolated outputs at full rated current available from banana jacks located on front panel.

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
EJ201V	N	0-140	2.0	0.28	6 3/16 x 17⅝ x 5⅞	20.0	$237.00
EJ401V	N	0-140	4.0	0.56	10 x 15 1/32 x 5⅞	30.0	303.00
EJ901V	N	0-140	9.0	1.26	10 x 16 5/32 x 7½	43.0	428.00

THREE PHASE MODELS *240 VOLTS OR 480 VOLTS INPUT*

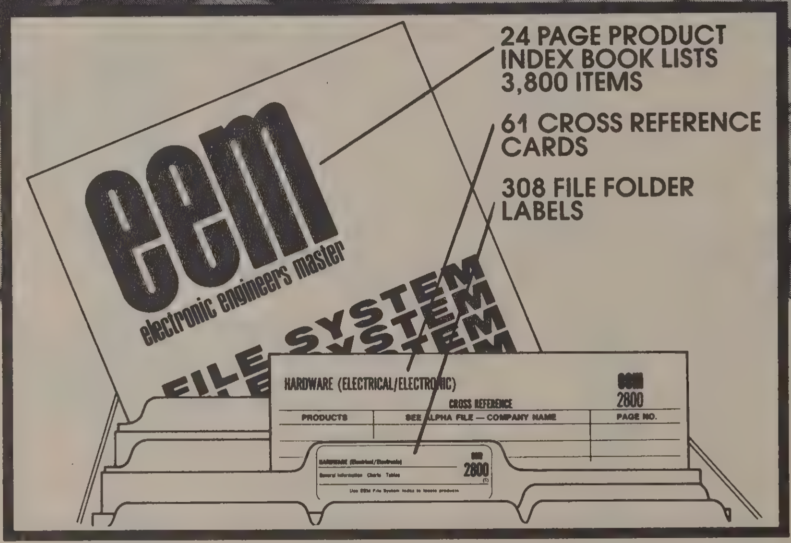
Three phase types are three individual units driven by a common shaft and electrically connected in three-phase wye configuration.

MFG. TYPE NO.	FIG.	INPUT		OUTPUT		KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.	PRICE EACH
		VOLTS	FREQ. HZ	VOLTS	AMPS				
221-3	O	240	60	0-240	2.25	0.94	3⅞ x 3⅞ x 8⅛	9	$ 121.00
1010-3	P	240	50/60*	0-240/280	10.0	4.85	6⅛ x 5 x 14 19/32	36	200.00
1510-3	P	240	50/60*	0-240/280	15.0	7.26	7 1/16 x 6⅛ x 14 9/16	56	361.00
2510-3	P	240	50/60*	0-240/280	25.0	12.10	8⅝ x 7⅝ x 14⅝	72	517.00
5010-3Y	Q	240	60	0-280	50.0	24.2	15 9/16 x 13⅞ x 19⅝	225	1199.00
6010-3Y	Q	240	60	0-240/280	60.0	29.1	15 9/16 x 13⅞ x 19⅝	242	1439.00
252-3	O	480	56/60*	0-480/528	0.8	0.73	3⅞ x 3⅞ x 8⅛	9	150.00
1020-3	P	480	50/60*	0-480/560	3.5	3.40	6⅛ x 5 x 14 19/32	36	237.00
1520-3	P	480	50/60*	0-480/560	9.5	9.20	7 1/16 x 6⅛ x 15 11/16	56	356.00
2520-3	P	480	56/60*	0-480/560	10.0	9.70	8⅝ x 7⅝ x 14⅝	72	536.00
5020-3Y	Q	480	50/60*	0-480/560	28.0	27.2	15 9/16 x 13⅞ x 19⅝	225	1205.00
6020-3Y	Q	480	50/60	0-480/560	35.0	33.9	15 9/16 x 13⅞ x 19⅝	240	1506.00

V = Voltmeter VA = Voltmeter-Ammeter VAW = Voltmeter, Ammeter, Wattmeter **60 HZ operation only

STACO
ENERGY PRODUCTS CO.
301 Gaddis Blvd • Dayton, Ohio 45403
(513) 253-1191 • TWX:810/459-1798 • TELEX 288-032

Centralab Products
TRW
imo


24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS
61 CROSS REFERENCE CARDS
308 FILE FOLDER LABELS
eem
electronic engineers master
FILE SYSTEM
HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
PRODUCTS
SEE ALPHA FILE — COMPANY NAME
PAGE NO.
EEM
2800

GET ORGANIZED!

Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

The EEM File System was invented over twenty-five years ago to help people who specify, buy, or work with electronic products and equipment. It is upgraded on a constant basis to reflect the current state of the art. It's easy to use and easy to customize to your particular needs.

You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

There are thousands of EEM File Systems in everyday use in engineering and procurement offices all over the world. Shouldn't you be using this proven system?

The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $5.00 for postage and handling. An invoice will accompany your System.

Don't waste any more time. Get organized now!

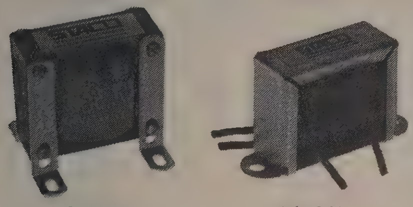
EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

STACO TRANSPOWER® | STANDARD-CUSTOM TRANSFORMERS

• AUDIOS • POWERS • CHOKES • CONTROLS • SWEEPS • IMPEDANCE • MINIATURES •

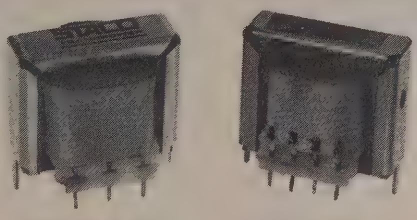
- **5 VA to 5 kVA, 1 ϕ & 3 ϕ**
- **CUSTOM SPECIALISTS FOR OVER 40 YEARS**
- **MEET UL, VDE, CSA & INTERNATIONAL SPECS**

STACO transformers and chokes are available in a wide variety of standard styles and ratings to meet most normal requirements. However, STACO is also a custom specialist with nearly a half century of reliable service. It is easy to specify custom transformers or chokes to meet your specific needs. Simply send your specs to STACO, our design engineers will design a product to fit your needs. Ask for copies of the STACO Specification sheet and the current catalog. They are yours for the asking.


STYLE B STYLE C

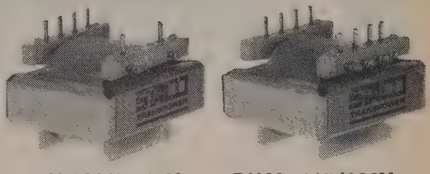
RECTIFIER POWER

For single or dual output DC power supplies. Max. temp. rise above ambient 45°C. Standard units for single (115V) or dual (115/230V) inputs. (Some available with 105/115/125V). Outputs from 5V to 230V and from 1 to 4000 VA. Connect series or parallel. STACO type SP01A & SP01B.


SINGLE 6 PIN DUAL 8-PIN

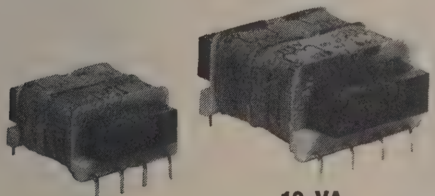
MINIATURE P/C POWER

For P/C applications where between board spacing is critical. 63 standards in single (6 pin) and 63 in dual (8 pin). Ratings based on load regulation. Outputs from 5 to 230 VAC in 5 ranges from 1 to 24 VA. Connect series or parallel. STACO type SP02A & SP02B.


SINGLE 115V DUAL 115/230V

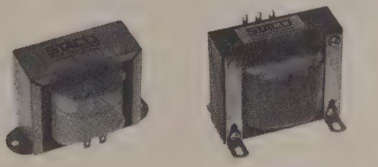
MULTI-SECTION BOBBIN P/C

For high isolation (2500V hipot) and low capacitive coupling with superior performance at lowest cost. 60 duals and 60 singles standard in 6 VA ratings (1.1, 2.4, 6, 12, 20, 36 VA). Connect series or parallel for outputs from 5 to 120V. 6, 12, & 20 VA avail. with mtg. screw. STACO type SP03A & SP03B.


6 VA 12 VA

LOW PROFILE P/C POWER

Ultra low profile in 6 & 12 VA types. 6 VA only 0.850″ high, 12 VA is 1.065″. 11 standard ratings in each for outputs from 5 to 230 V. Connect in series or parallel. Multi-section bobbin non-concentric winding eliminates need for shielding. STACO type SP04B.


SINGLE DUAL

SMALL POWER TRANSFORMERS

Made with grain oriented core lamination for maximum efficiency at least weight and size for low cost. 110 standard ratings in single or dual outputs from 10 to 120V CT and 2.5 to 100 VA. Choice of solder or QC terminals. For operation to 130°C. Hipot 2500V RMS. STACO SP05A SP05B.

BARRIER STRIP TERMINAL

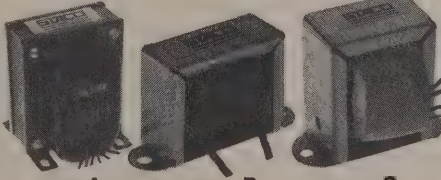
POWER ISOLATION

Step up or down industrial grade. Output .25 to 10 kVA. Either 110/220 dual primary to 110/220 secondary or 110/220 to 220/440 secondary (primary may be reversed). Supplied with rugged barrier block terminals. Hipot 2500V RMS. Tapped windings 104/110/120 and 208/220/240. STACO types SP06 & SP07.

ENCLOSED OPEN

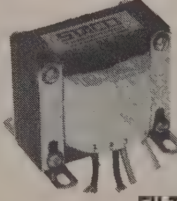
STEP DOWN AUTOTRANSFORMERS

Enclosed, low regulation (ST01) or open frame (ST02) styles to 2 kVA are standard. Heavy duty to 6 kVA. Heavy duty may be used step-up or down. ST01 may be supplied with UL approved line cord and receptacle. ST02 and ST03 have 6″ leads.


A B C

AUDIO TRANSFORMERS

A wide variety of audio transformers is available from STACO. Although designed primarily for solid state applications, all models may be used in tube circuits for maximum reliability. There are 3 standard configurations as shown above plus plug in P/C models (see min. P/C above). STACO types SA01 to SA08.


FILTER

FILTER CHOKES

Both single and dual models are standard. Singles handle 0.5 to 1000 Amps, duals handle 1.0 to 50A and may be connected in series or parallel. Available in two mounting styles. 24 ratings are standard, but specials are readily available. Call for details. STACO types SC01 & SC02.

301 GADDIS BLVD., DAYTON, OH 45403 • 513/253-1191 • TWX 810/459-1798 • TELEX 288-032

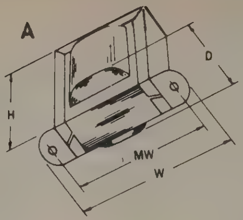
STANCOR

TRANSFORMERS

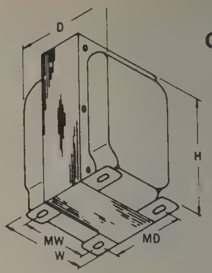
RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH SINGLE SECONDARY: ALL PRIMARIES 50/60 Hz.§

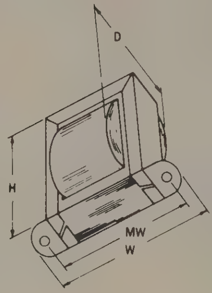
A



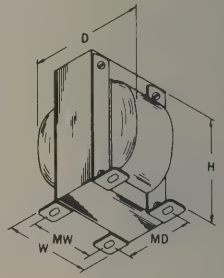
C



S



NV



SECT	STANCOR Part No.	Style	Secondary▲		Primary Volts	Insulation Test AMS Volts*	Termination		Dimensions-Inches					Wt. Lbs.
									Case			Mounting		
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
A	P-8628	A	2.5C.T.	0.3	117	1500	Leads	Leads	1¼	2⅛	1⁵⁄₁₆	1¾	—	.3
	P-8629	A	2.5	1.0	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.4
	P-4026	A	2.5	1.5	117	2500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.7
	P-6133÷	S	2.5C.T.	5.0	117	7500	Leads	Leads	2¾	3⅛	2¼	2¹³⁄₁₆	—	1.5
	P-3024÷	C	2.5C.T.	10.0	117/107	2500	Leads	Leads	3⅛	2½	2¾	2	1¾	2.5
	P-6454	S	2.5C.T.	10.0	117/107	7500	Leads	Leads	3⅛	3⅝	2½	3⅛	—	2.5
B	P-6467	A	5.0C.T.	3.0	117	2500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-6455	S	5.0C.T.	6.0	117/107	2000	Leads	Leads	2¾	3⅛	2⅛	2¹³⁄₁₆	—	2.0
	P-6135	NV	5.0C.T.	10.0	117	2500	Leads	Leads	3⅛	2½	2¾	2	2⅜	3.0
	P-6433÷	NV	5.0C.T.	15.0	117	2500	Leads	Leads	3⅛	2½	2¾	2	2¼	3,0
	P-6492	C	5.0C.T.	30.0	117	2500	Leads	Leads	4¹¹⁄₁₆	3¾	4	3	2¹³⁄₁₆	7.5
	P-6468÷	C	5.0C.T.	30.0	117/107	2500	Lugs	Lugs	4¼	3⁷⁄₁₆	3⅞	2¾	2¹¹⁄₁₆	6.3
C	P-8385	A	6.3C.T.	0.3	117	1500	Leads	Leads	1¼	2⅛	1⅜	1¾	—	.3
	P-6465	A	6.3C.T.	0.6	117	1500	Leads	Leads	1⅜	2⅜	1½	2	—	.4
	P-8705	A	6.3C.T.	0.6	230	1500	Leads	Leads	1⅜	2⅜	1½	2	—	.4
	P-8389	A	6.3	1.0	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.6
	P-6134	A	6.3C.T.	1.2	117	3000	Leads	Leads	1⅝	2⅞	1⅞	2⅜	—	.8
	P-8190	A	6.3	1.2	117	5000	Leads	Leads	2	3¼	1⅞	2¹³⁄₁₆	—	1.0
	P-5014÷	NV	6.3C.T.	3.0	117	2500	Lugs	Lugs	3⅛	2½	2½	2	1¾	2.0
D	P-6466	A	6.3C.T.	3.0	117	2500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-6462	S	6.3	3.0	117/107	7000	Leads	Leads	3⅛	3⅝	2⅜	3⅛	—	2.0
	P-4019÷	C	6.3C.T.	4.0	117/107	2500	Leads	Leads	3⅛	2½	2¾	2	1¾	2.7
	P-8648	A	6.3C.T.	4.0	117	1500	Leads	Leads	2⅜	3¾	2⅛	3⅛	—	1.6
	P-8649	A	6.3C.T.	5.0	117	1500	Leads	Leads	2⅜	3¾	2⅛	3⅛	—	1.8
	P-3064÷	NV	6.3C.T.	6.0	117	2500	Lugs	Lugs	3⅛	2½	2⅜	2	2	2.4
	P-6456	A	6.3C.T.	6.0	117/107	2000	Leads	Leads	2⅜	3¾	2⅜	3⅛	—	2.0
	P-8651	A	6.3C.T.	8.0	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.4
	P-6464	C	6.3C.T.	10.0	117	2000	Leads	Leads	3½	2¹³⁄₁₆	3¼	2¼	2	3.5
	P-6308÷	NV	6.3C.T.	10.0	117/107	2500	Leads	Leads	3⁷⁄₁₆	2¹³⁄₁₆	2⅝	2¼	2⅛	3.4
	P-8189	C	6.3C.T.	20.0	117	2500	Leads	Leads	3⅞	3⅛	4¼	2½	3	6.9
	P-6309	NV	6.3C.T.	20.0	117/107	2500	Leads	Leads	4⁹⁄₁₆	3¾	3⅜	3	2⅜	6.7
E	P-5015÷	NV	7.5C.T.	4.0	117	2500	Lugs	Lugs	3⅛	2½	2¼	2	2⅛	2.7
	P-6138÷	NV	7.5C.T.	8.0	117	2500	Leads	Leads	3¹³⁄₁₆	3⅛	2¾	2½	2⅜	4.7
	P-6457	C	7.5C.T.	21.0	117/107	2000	Leads	Leads	4⅝	3¾	4	3	2¾	8.0
F	P-8652	A	10.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	.9
	P-8653	A	10.0C.T.	2.0	117	1500	Leads	Leads	2	3¼	2	2¹³⁄₁₆	—	1.3
	P-8380	A	10.0C.T.	3.0	117	1500	Leads	Leads	2⅜	3¾	2¼	3⅛	—	1.6
	P-8654	A	10.0C.T.	4.0	117	1500	Leads	Leads	2⅝	4	2⅛	3⁹⁄₁₆	—	2.3
	P-5016÷	NV	10.0C.T.	4.0	117	2500	Lugs	Lugs	3⁷⁄₁₆	2¹³⁄₁₆	2½	2¼	2	3.3
	P-6458	NV	10.0C.T.	5.0	117/107	2000	Leads	Leads	3¹⁄₁₆	2½	2½	2⅛	1¹³⁄₁₆	3.0
	P-4096÷	C	10.0C.T.	5.0	117/107	2500	Leads	Leads	3⅞	3⅛	3¼	2½	1¹⁵⁄₁₆	4.0

§May be operated from a 400 Hz. source with no change in output ratings. ÷Has electrostatic shield.
*Insulation Test Voltage: Twice allowable RMs working voltage plus 1000 volts. ▲R.M.S. values.

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH SINGLE SECONDARY: ALL PRIMARIES 50/60 HZ.§ (cont'd.)

STANCOR

SECT	STANCOR Part No.	Style	Secondary▲		Primary Volts	Insulation Test AMS Volts*	Termination		Dimensions-Inches					Wt. Lbs.
									Case			Mounting		
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
A	P-8655	NV	10.0C.T.	6.0	117	1500	Leads	Leads	3⅛	2½	2¾	2	2⁵⁄₁₆	3.1
	P-8656	NV	10.0C.T.	8.0	117	1500	Leads	Leads	3⁷⁄₁₆	2¹³⁄₁₆	3	2¼	2½	4.1
	P-6139†	NV	10.0C.T.	8.0	117	2500	Leads	Leads	3¹³⁄₁₆	3⅛	3	2½	2⅜	4.9
	P-4097†	C	10.0C.T.	8.0	117/107	2500	Leads	Leads	3⅞	3⅛	3¾	2½	2½	5.2
	P-6461	C	10.0C.T.	10.0	117	2000	Leads	Leads	3⅞	3¼	3⁹⁄₁₆	2½	2¹¹⁄₁₆	5.0
B	P-8390	A	12.0	.150	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8391	A	12.0	.350	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8392	A	12.0	.700	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8393	A	12.0	1.200	117	1500	Leads	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	.85
	P-8657	A	12.0	2.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.3
	P-8658	A	12.0	4.0	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.3
	P-8659	NV	12.0	6.0	117	1500	Leads	Leads	3⁷⁄₁₆	2¹³⁄₁₆	2⅝	2¼	2⅛	3.4
	P-8660	NV	12.0	8.0	117	1500	Leads	Leads	3¹³⁄₁₆	3⅛	2¾	2½	2⅛	4.3
C	P-8384	A	12.6C.T.	1.0	117	1500	Leads	Leads	2	3¼	1¾	2¹³⁄₁₆	—	.9
	✓P-8550	A	12.6C.T.	1.5	115	1500	Leads	Leads	1¹⁵⁄₁₆	3⁵⁄₁₆	2	2¹³⁄₁₆	—	1.3
D	P-8130	A	12.6C.T.	2.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8715	A	12.6C.T.	2.0	230	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8358	A	12.6C.T.	3.0	117	1500	Leads	Leads	2⅜	3¾	2¼	3⅛	—	1.6
	P-8641	A	12.6C.T.	4.0	117	1500	Leads	Leads	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
	P-8642	C	12.6C.T.	6.0	117	1500	Leads	Leads	3½	2¹³⁄₁₆	3⅜	2¼	2³⁄₁₆	3.8
	P-8643	C	12.6C.T.	8.0	117	1500	Leads	Leads	3⅞	3⅛	3⅝	2½	2⅜	5.0
	P-8644	C	12.6C.T.	10.0	117	1500	Leads	Leads	4¼	3⁷⁄₁₆	3⅞	2¾	2¾	6.3
	P-8716	A	12.6C.T.	4.0	230	2500	Leads	Leads	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
E	✓P-8577	A	14.0C.T.	.250	115/230	1500	Leads	Leads	1⅜	2⅜	1½	2	—	.3
	✓P-8553	A	14.0C.T.	.250	115	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.4
	✓P-8555	A	14.0C.T.	1.0	115	1500	Leads	Leads	1¹⁵⁄₁₆	3¼	1¾	2¹³⁄₁₆	—	1.2
	✓P-8556	A	14.0C.T.	2.0	115	1500	Leads	Leads	2¼	3¹¹⁄₁₆	1¹⁵⁄₁₆	3⅛	—	1.5
	✓P-8557	NV	14.0C.T.	4.0	115	1500	Leads	Leads	3	2½	2⁷⁄₁₆	2	2¼	3.0
	✓P-8558	NV	14.0C.T.	6.0	115	1500	Leads	Leads	3⅜	2¹³⁄₁₆	2⅞	2¼	2⅜	4.0
F	✓P-8690	A	18.0C.T.	.750	115	1500	Leads	Leads	1¹⁵⁄₁₆	3⁵⁄₁₆	2	2¹³⁄₁₆	—	1.3
	✓P-8691	A	18.0C.T.	1.0	115	1500	Leads	Leads	1¹⁵⁄₁₆	3⁵⁄₁₆	2⅛	2¹³⁄₁₆	—	1.5
	✓P-8692	A	18.0C.T.	1.5	115	1500	Leads	Leads	2⁹⁄₃₂	3¾	2⅛	3⅛	—	1.7
	✓P-8693	A	18.0C.T.	2.0	115	1500	Leads	Leads	2⁹⁄₃₂	3¾	2¼	3⅛	—	2.0
G	P-8500	A	20C.T.	.050	115/230	2500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.3
	P-8501	A	20C.T.	.100	115/230	2500	Leads	Leads	1⁹⁄₃₂	2⅛	1¼	1¾	—	.4
	P-8502	A	20C.T.	.150	115/230	2500	Leads	Leads	1⁹⁄₃₂	2⅛	1¼	1¾	—	.4
	P-8503	A	20C.T.	.200	115/230	2500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.4
	P-8504	A	20C.T.	.250	115/230	2500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.4
	P-8505	A	20C.T.	.300	115/230	2500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.6
	P-8506	A	20C.T.	.400	115/230	2500	Leads	Leads	1⅝	2⅞	1½	2⅜	—	.6
	P-8507	A	20C.T.	.500	115/230	2500	Leads	Leads	1⅝	2⅞	1½	2⅜	—	.8
	P-8508	A	20C.T.	1.0	115/230	2500	Leads	Leads	2	3¼	2¼	2¹³⁄₁₆	—	1.4
H	P-8604	A	20.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	✓P-8559	NV	20.0C.T.	2.0	115	1500	Leads	Leads	2⁹⁄₁₆	4	2¼	3⁹⁄₁₆	—	2.5
	✓P-8560	NV	20.0C.T.	4.0	115	1500	Leads	Leads	3⅜	2¹³⁄₁₆	2⅞	2¼	2⅜	4.0
I	✓P-8551#	A	24.0	1.0	115	1500	Leads	Leads	1¹⁵⁄₁₆	3¼	2⅛	2¹³⁄₁₆	—	1.4
	✓P-8694#	A	24.0	2.0	115	1500	Leads	Leads	2⁹⁄₁₆	4	2	3⁹⁄₁₆	—	2.3
J	P-8394	A	24.0C.T.	.085	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8720	A	24.0C.T.	.085	230	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8395	A	24.0C.T.	.200	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8721	A	24.0C.T.	.200	230	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	✓P-8578	A	24.0C.T.	.20	115/230	1500	Leads	Leads	1⅜	2⅜	1½	2	—	.3
	P-8396	A	24.0C.T.	.400	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8722	A	24.0C.T.	.400	230	1500	Leads	Leads	1⅝	2⅞	1½	2⅜	—	.60
	P-8397	A	24.0C.T.	.700	117	1500	Leads	Leads	2	3¼	1¾	2¹³⁄₁₆	—	.85
	P-8723	A	24.0C.T.	.700	230	1500	Leads	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	.85
K	P-8661	A	24.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	2¹⁄₁₆	2¹³⁄₁₆	—	1.4
	✓P-8575	A	24.0C.T.	1.0	115/230	1500	Leads	Leads	1¹⁵⁄₁₆	3⁵⁄₁₆	2	2¹³⁄₁₆	—	1.3
	P-8662	A	24.0C.T.	2.0	117	1500	Leads	Leads	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
	P-8663	NV	24.0C.T.	4.0	117	1500	Leads	Leads	3¹³⁄₁₆	3⅛	2¹³⁄₁₆	2½	2⅛	4.0
	P-8664	NV	24.0C.T.	6.0	117	1500	Leads	Leads	4³⁄₁₆	3⁷⁄₁₆	2¹³⁄₁₆	2¾	2¼	5.7
	P-8665	NV	24.0C.T.	8.0	117	1500	Leads	Leads	4³⁄₁₆	3⁷⁄₁₆	3⅜	2¾	2¾	7.3
	✓P-8695	NV	24.0C.T.	10.0	115	1500	Leads	Leads	4⅛	3⁷⁄₁₆	3¾	2¾	3	8.0
	P-8666	NV	24.0C.T.	12.0	117	1500	Leads	Leads	4⁹⁄₁₆	3¾	4⅝	3	3¼	11.2

*Insulation Test Voltage Twice allowable RMS working voltage plus 1000 volts. †Has electrostatic shield. ▲R.M.S. values

§May be operated from a 400 Hz source with no change in output ratings. #60 Hz. only ✓New item

STANCOR

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS (Continued)

WITH MULTIPLE SECONDARIES: ALL PRIMARIES 50/60 Hz.§

SECT	STANCOR Part No.	Style	Secondary▲		Primary Volts	Insulation Test AMS Volts*	Termination		Dimensions-Inches					Wt. Lbs.
									Case			Mounting		
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
A	P-6469	A	25.2	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8707	A	25.2	1.0	230	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8180	A	25.2C.T.	1.0	117	1500	Leads	Leads	2	3¼	2¼	2¹³⁄₁₆	—	1.4
	P-8357	A	25.2C.T.	2.0	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.2
	✓P-8574	A	25.2C.T.	2.0	115/230	1500	Leads	Leads	2¹⁹⁄₃₂	4	2¼	3⁹⁄₁₆	—	2.2
	P-8388	A	25.2C.T.	2.8	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.2
	P-8645	C	25.2C.T.	5.0	117	1500	Leads	Leads	4¼	3⁷⁄₁₆	3⅞	2¾	2¹¹⁄₁₆	6.0
	P-8646	C	25.2C.T.	7.5	117	1500	Leads	Leads	4¼	3½	4¼	2¾	3⅛	7.3
	P-8647	C	25.2C.T.	10.0	117	1500	Leads	Leads	4¹¹⁄₁₆	3¾	5	3	3⅞	12.3
B	P-8606	A	26.0C.T. Nominal	.040	117‡	2500	Leads	Leads	1¼	2⅛	1⅜	1¾	—	.25
			‡Primary tapped to provide secondary voltages of 24.5C.T. or 27.5C.T. or 29C.T.											
	P-8607	A	26.0C.T. Nominal	.25	117‡	2500	Leads	Leads	1⅝	2⅞	1¾	2⅜	—	.70
			‡Primary tapped to provide secondary voltages of 24.5C.T. or 27.5C.T. or 29C.T.											
	P-8608	A	26.5C.T.	.6	117	2500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.3
	P-8609	A	26.8C.T.	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.3
C	P-8600	A	28.0C.T.	.085	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8601	A	28.0C.T.	.175	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8602	A	28.0C.T.	.300	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8603	A	28.0C.T.	.800	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.0
	P-8667	A	28.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8668	NV	28.0C.T.	2.0	117	1500	Leads	Leads	3⅛	2½	2½	2	2³⁄₁₆	2.9
	P-8669	NV	28.0C.T.	4.0	117	1500	Leads	Leads	3¹³⁄₁₆	3⅛	3¼	2½	2½	5.3
	P-8670	NV	28.0C.T.	6.0	117	1500	Leads	Leads	4³⁄₁₆	3⁷⁄₁₆	3½	2¾	2⅝	7.0
D	✓P-8561	A	30C.T.	1.0	115	1500	Leads	Leads	2¼	3¹¹⁄₁₆	1¹⁵⁄₁₆	3⅛	—	1.5
	✓P-8554	A	30C.T.	1.7	115	1500	Leads	Leads	2¹⁹⁄₃₂	4	2¼	3⁹⁄₁₆	—	1.5
	✓P-8562	NV	30C.T.	2.0	115	1500	Leads	Leads	3	2½	2⁹⁄₁₆	2	2⅜	3.2
	✓P-8563	NV	30C.T.	4.0	115	1500	Leads	Leads	3¾	3⅛	3⅛	2½	2⅝	5.7
	✓P-8576	A	35C.T.	1.5	115/230	1500	Leads	Leads	2¹⁹⁄₃₂	4	2¼	3⁹⁄₁₆	—	2.2
E	P-8610	A	36.0C.T.	.065	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8728	A	36.0C.T.	.065	230	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8611	A	36.0C.T.	.135	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8612	A	36.0C.T.	.300	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8613	A	36.0C.T.	.550	117	1500	Leads	Leads	2	3¼	1⅞	2¹³⁄₁₆	—	1.0
	P-8671	A	36.0C.T.	1.0	117	1500	Leads	Leads	2⅜	3¾	2¼	3⅛	—	2.0
	P-8672	NV	36.0C.T.	2.0	117	1500	Leads	Leads	3⁷⁄₁₆	2¹³⁄₁₆	2¾	2¼	2⅛	3.5
	P-8673	NV	36.0C.T.	4.0	117	1500	Leads	Leads	4³⁄₁₆	3¹⁄₁₆	2⅞	2¾	2⅜	6.0
	P-8674	NV	36.0C.T.	6.0	117	1500	Leads	Leads	4⁹⁄₁₆	3¾	3½	3	2⅝	8.3
F	P-8540	A	40C.T.	.120	115/230	2500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.4
	P-8541	A	40C.T.	.200	115/230	2500	Leads	Leads	1⅝	2⅞	1½	2⅜	—	.6
	P-8542	A	40C.T.	.250	115/230	2500	Leads	Leads	1⅝	2⅞	1½	2⅜	—	.8
	✓P-8564	A	40C.T.	1.0	115	1500	Leads	Leads	2⁹⁄₁₆	4	2¼	3⁹⁄₁₆	—	2.6
	✓P-8565	NV	40C.T.	2.0	115	1500	Leads	Leads	3⅜	2¹³⁄₁₆	2⅞	2¼	2⅜	4.0
	✓P-8566	NV	40C.T.	4.0	115	1500	Leads	Leads	3¾	3⅛	3½	2½	2⅞	6.4
G	P-8605	A	48.0C.T. Nominal	1.0	117‡	2500	Leads	Leads	2⅝	4.	2⅜	3⁹⁄₁₆	—	2.3
			‡Primary tapped to provide secondary voltages of 45C.T. or 51C.T. or 54 C.T.											
H	✓P-8567	A	50C.T.	1.0	115	1500	Leads	Leads	2⁹⁄₁₆	4	2¼	3⁹⁄₁₆	—	2.4
	✓P-8568	NV	50C.T.	2.0	115	1500	Leads	Leads	3¾	3⅛	2⅞	2½	2⅜	4.7
	✓P-8569	NV	50C.T.	4.0	115	1500	Leads	Leads	4⅛	3⁷⁄₁₆	3½	2¾	2¾	7.4
I	✓P-8552	A	60C.T.	.4	115	1500	Leads	Leads	1¹⁵⁄₁₆	3⁵⁄₁₆	2	2¹³⁄₁₆	—	1.3
	✓P-8570	NV	60C.T.	1.0	115	1500	Leads	Leads	3	2½	2⅝	2	2⅜	3.4
	✓P-8571	NV	60C.T.	2.0	115	1500	Leads	Leads	3¾	3⅛	3⅛	2½	2⅝	5.6
J	✓P-8572	NV	70C.T.	1.0	115	1500	Leads	Leads	3⅜	2¹³⁄₁₆	2⅝	2¼	2¼	4.0
	✓P-8573	NV	70C.T.	2.0	115	1500	Leads	Leads	3¾	3⅛	3½	2½	2⅞	6.0

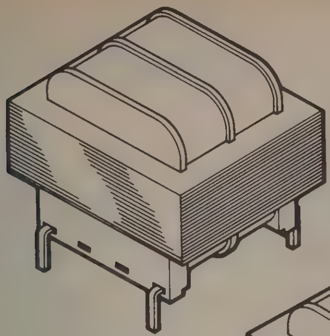
*Insulation Test voltage Twice allowable RMS working voltage plus 1000 volts ▲R.M.S. values

§May be operated from a 400 Hz source with no change in output ranges ✓New item

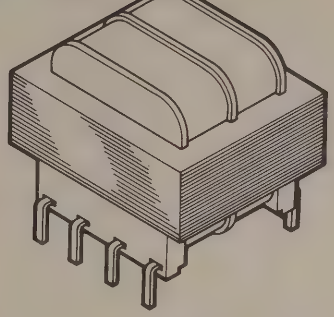
STANCOR TRANSFORMERS

"SIDE WINDER"

Split Bobbin— PC Mount Transformers



TYPE SW



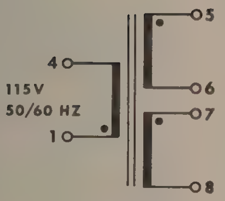
TYPE DSW

Stancor offers this compact transformer with primary and secondaries wound side by side. The "Side Winder" is non-concentrically wound, to reduce size and cost.

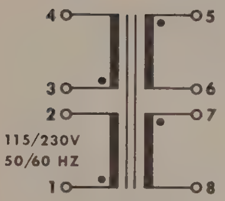
Split bobbin winding and low capacitive coupling design eliminates electrostatic shielding requirement and expense.

- High isolation…2,500 V RMS. Hi-Pot Testing
- PC Pins…Precision spaced insert directly into PC Boards
- Class B Insulation…130°C

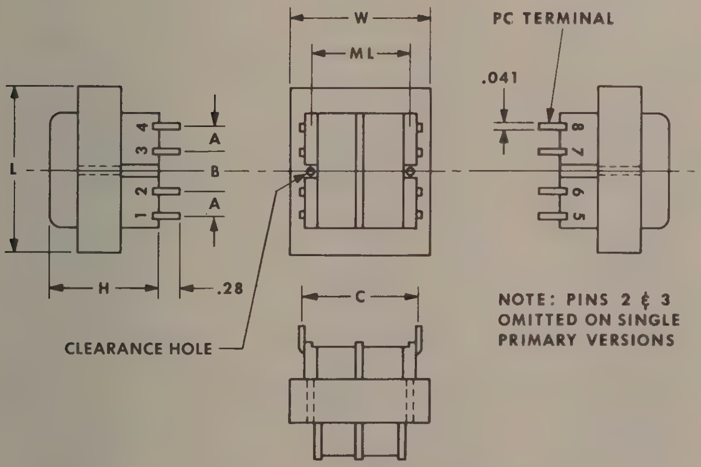
"Side Winders" are available with Single 115V or Dual 115/230V Primaries, plus, secondaries are split to permit series or parallel connection.



6 PIN
TYPE SW



8 PIN
TYPE DSW



NOTE: PINS 2 & 3 OMITTED ON SINGLE PRIMARY VERSIONS

SIDE WINDER APPLICATIONS:

Electronic Game Systems.
Computer Peripherals.
Switching Power Supplies.
Medical Electronics.
Instrumentation Equipment.
Communications Equipment.
Computer "On Board" Power.
Machine Control Logic Systems.
ROBOTICS.
Consumer Electronics.

Consult Factory For Special Design Requirements.

Size	Dimensions-Inches								Wt. Lbs.
	VA	H	W	L	ML	A	B	C	
2	1.1	15/16	1 1/8	1 3/8	—	.250	.250	1.200	.17
3	2.5	1 3/16	1 1/8	1 3/8	—	.250	.250	1.200	.25
4	6.0	1 5/16	1 5/16	1 5/8	1 1/16	.250	.350	1.200	.44
5	12.0	1 7/16	1 9/16	1 7/8	1 1/4	.300	.400	1.410	.70
6	20.0	1 7/16	1 7/8	2 1/4	1 1/2	.300	.400	1.600	.80

See size as first digit in Part Number.

STANCOR

"SIDE WINDER" (Cont'd.)

SINGLE & DUAL PRIMARY—SPLIT BOBBIN–PC MOUNT TRANSFORMERS

SECT	STANCOR Part No.		Secondary RMS * Rating		
	Single 115V 6 Pin	Dual 115/230 V 8 Pin	Individual	Series	Parallel
A	√SW-210 √SW-310 √SW-410 √SW-510 √SW-610	√DSW-210 √DSW-310 √DSW-410 √DSW-510 √DSW-610	5V @ 0.11A 5V @ 0.25A 5V @ 0.6A 5V @ 1.2A 5V @ 2A	10V C.T. @ 0.11A 10V C.T. @ 0.25A 10V C.T. @ 0.6A 10V C.T. @ 1.2A 10V C.T. @ 2A	5 V @ 0.22A 5 V @ 0.5A 5 V @ 1.2A 5 V @ 2.4A 5 V @ 4A
B	√SW-212 √SW-312 √SW-412 √SW-512 √SW-612	√DSW-212 √DSW-312 √DSW-412 √DSW-512 √DSW-612	6.3V @ 0.09A 6.3V @ 0.2A 6.3V @ 0.5A 6.3V @ 1.0A 6.3V @ 1.6A	12.6V C.T. @ 0.09A 12.6V C.T. @ 0.2A 12.6V C.T. @ 0.5A 12.6V C.T. @ 1.0A 12.6V C.T. @ 1.6A	6.3V @ 0.18A 6.3V @ 0.4A 6.3V @ 1.0A 6.3V @ 2.0A 6.3V @ 3.2A
C	√SW-216 √SW-316 √SW-416 √SW-516 √SW-616	√DSW-216 √DSW-316 √DSW-416 √DSW-516 √DSW-616	8V @ 0.07A 8V @ .15A 8V @ .4A 8V @ .8A 8V @ 1.25A	16V C.T. @ 0.07A 16V C.T. @ .15A 16V C.T. @ .4A 16V C.T. @ .8A 16V C.T. @ 1.25A	8V @ 0.14A 8V @ 0.3A 8V @ 0.8A 8V @ 1.6A 8V @ 2.5A
D	√SW-220 √SW-320 √SW-420 √SW-520 √SW-620	√DSW-220 √DSW-320 √DSW-420 √DSW-520 √DSW-620	10V @ 0.055A 10V @ 0.12A 10V @ 0.3A 10V @ 0.6A 10V @ 1A	20V C.T. @ 0.055A 20V C.T. @ 0.12A 20V C.T. @ 0.3A 20V C.T. @ 0.6A 20V C.T. @ 1A	10V @ 0.11A 10V @ 0.24A 10V @ 0.6A 10V @ 1.2A 10V @ 2A
E	√SW-224 √SW-324 √SW-424 √SW-524 √SW-624	√DSW-224 √DSW-324 √DSW-424 √DSW-524 √DSW-624	12V @ 0.045A 12V @ 0.1A 12V @ 0.25A 12V @ 0.5A 12V @ 0.3A	24V C.T. @ 0.045A 24V C.T. @ 0.1A 24V C.T. @ 0.25A 24V C.T. @ 0.5A 24V C.T. @ 0.3A	12V @ 0.09A 12V @ 0.2A 12V @ 0.5A 12V @ 1.0A 12V @ 1.6A
F	√SW-228 √SW-328 √SW-428 √SW-528 √SW-628	√DSW-228 √DSW-328 √DSW-428 √DSW-528 √DSW-628	14V @ 0.04A 14V @ 0.085A 14V @ 0.2A 14V @ 0.42A 14V @ 0.7A	28V C.T. @ 0.04A 28V C.T. @ 0.085A 28V C.T. @ 0.2A 28V C.T. @ 0.42A 28V C.T. @ 0.7A	14V @ 0.08A 14V @ 0.17A 14V @ 0.4A 14V @ 0.84A 14V @ 1.4A
G	√SW-232 √SW-332 √SW-432 √SW-532 √SW-632	√DSW-232 √DSW-332 √DSW-432 √DSW-532 √DSW-632	16V @ 0.035A 16V @ 0.075A 16V @ 0.188A 16V @ 0.375A 16V @ 0.625A	32V C.T. @ 0.035A 32V C.T. @ 0.075A 32V C.T. @ 0.188A 32V C.T. @ 0.375A 32V C.T. @ 0.625A	16V C.T. @ 0.07A 16V C.T. @ 0.15A 16V C.T. @ 0.376A 16V C.T. @ 0.750A 16V C.T. @ 1.25A
H	√SW-236 √SW-336 √SW-436 √SW-536 √SW-636	√DSW-236 √DSW-336 √DSW-436 √DSW-536 √DSW-636	18V @ 0.03A 18V @ 0.065A 18V @ 0.17A 18V @ 0.35A 18V @ 0.55A	36V C.T. @ 0.03A 36V C.T. @ 0.065A 36V C.T. @ 0.17A 36V C.T. @ 0.35A 36V C.T. @ 0.55A	18V @ 0.06A 18V @ 0.13A 18V @ 0.34A 18V @ 0.7A 18V @ 1.1A
I	√SW-248 √SW-348 √SW-448 √SW-548 √SW-648	√DSW-248 √DSW-348 √DSW-448 √DSW-548 √DSW-648	24V @ 0.023A 24V @ 0.05A 24V @ 0.125A 24V @ 0.25A 24V @ 0.4A	48V C.T. @ 0.023A 48V C.T. @ 0.05A 48V C.T. @ 0.125A 48V C.T. @ 0.25A 48V C.T. @ 0.4A	24V @ 0.046A 24V @ 0.1A 24V @ 0.25A 24V @ 0.5A 24V @ 0.8A
J	√SW-256 √SW-356 √SW-456 √SW-556 √SW-656	√DSW-256 √DSW-356 √DSW-456 √DSW-556 √DSW-656	28V @ 0.02A 28V @ 0.045A 28V @ 0.11A 28V @ 0.22A 28V @ 0.35A	56V C.T. @ 0.02A 56V C.T. @ 0.045A 56V C.T. @ 0.11A 56V C.T. @ 0.22A 56V C.T. @ 0.35A	28V @ 0.04A 28V @ 0.09A 28V @ 0.22A 28V @ 0.44A 28V @ 0.7A
K	√SW-2120 √SW-3120 √SW-4120 √SW-5120 √SW-6120	√DSW-2120 √DSW-3120 √DSW-4120 √DSW-5120 √DSW-6120	60V @ 0.01A 60V @ 0.02A 60V @ 0.1A 60V @ 0.05A 60V @ 0.16A	120V C.T. @ 0.01A 120V C.T. @ 0.02A 120V C.T. @ 0.1A 120V C.T. @ 0.05A 120V C.T. @ 0.16A	60V @ 0.02A 60V @ 0.04A 60V @ 0.1A 60V @ 0.2A 60V @ 0.32A

*RMS (Root Mean Square) = 70.7% of Peak Voltage

√New Item

STANCOR

FOR SMALL D.C. POWER SUPPLIES PLUG-IN PRINTED CIRCUIT TYPE POWER TRANSFORMERS (cont'd.)

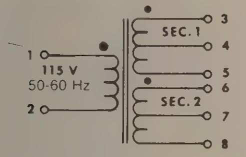
SECT	STANCOR Part No.	Style	VA Cap.*	Output From Two Secondary Windings▲ Individually	Parallel	Series	Dimensions-Inches Case H	W	D	Mounting MW	A	E	Wt. Lbs.
F	√PPC-49	APC	7.5	7.5V. @ 500MA.	7.5V @ 1.0A	15V.C.T. @ 500MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-50	APC	7.5	15V. @ 250MA.	15V. @ 500MA.	30V.C.T. @ 250MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	PPC-31	APC	8.0	20V. @ 200MA	20V. @ 400MA.	40V.C.T. @ 200MA.	1⅝	2⅞	1½	2⅜	1.30	.25	.75
G	√PPC-42	APC	10.0	6.3V. @ 800MA.	6.3V. @ 1.6A.	12.6V.C.T. @ 800MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-43	APC	10.0	8V. @ 640MA.	8V. @ 1.28A.	16V.C.T. @ 640MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-41	APC	10.0	10V. @ 500MA.	10V. @ 1.0A.	20V.C.T. @ 500MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	√PPC-40	APC	10.0	12V. @ 450MA.	12V. @ 900MA.	24V.C.T. @ 450MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
	PPC-30	APC	10.0	20V. @ 250MA.	20V. @ 500MA.	40V.C.T. @ 250MA.	1⅝	2⅞	1½	2⅜	1.30	.25	.75
	√PPC-53	APC	10.0	115V. @ 87MA	115V. @ 174MA.	230V.C.T. @ 87MA.	1⅝	2 13/16	1 7/16	2⅜	1.31	.25	.75
H	√PPC-54	PC	24.0	5V. @ 2.4A.	5V. @ 4.8A.	10V.C.T. @ 2.4A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-55	PC	24.0	6.3V. @ 2.0A.	6.3V. @ 4.0A.	12.6V.C.T. @ 2.0A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-56	PC	24.0	8.V @ 1.5A	8V. @ 3.0A.	16.0V.C.T. @ 1.5A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-57	PC	24.0	10V. @ 1.2A	10V. @ 2.4A.	20V.C.T. @ 1.2A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-58	PC	24.0	12V. @ 1.0A	12V. @ 2.0A.	24V.C.T. @ 1.0A.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-59	PC	24.0	14V. @ 800MA.	14V. @ 1.6A.	28V.C.T. @ 800MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
I	√PPC-60	PC	24.0	17V. @ 700MA.	17V. @ 1.4A.	34V.C.T. @ 700MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-61	PC	24.0	20V. @ 600MA.	20V. @ 1.2A	40V.C.T. @ 600MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-62	PC	24.0	28V. @ 420MA.	28V. @ 840MA.	56V.C.T. @ 420MA.	1⅜	1⅝	2¼	—	2.11	.25	.90
	√PPC-63	PC	24.0	60V. @ 200MA.	60V. @ 400MA.	120V.C.T. @ 200MA.	1⅜	1⅝	2¼	—	2.11	.25	.90

√—New item—U.L. Recognition not available at time of catalog printing. * All primaries for 115-230 V., 50-60 Hz. ▲ R.M.S. values.

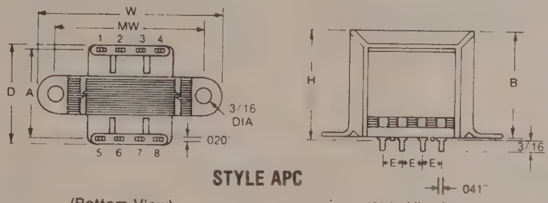
NEW!!

MICROPROCESSOR POWERS

Developed especially for triple output regulated DC supplies that are used in microprocessor, logic and OP-amp circuit combinations. Outputs are listed in RMS values and will deliver popular ±12 and ±15 volts with 5V standby values included.

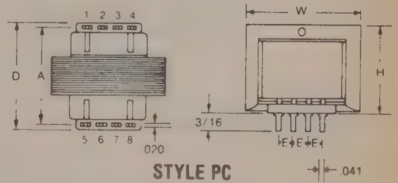


DUAL TAPPED SECONDARIES



STYLE APC

(Bottom View) (Side View)



STYLE PC

(Bottom View) (Side View)

WITH SINGLE PRIMARY FOR 115 VOLTS, 50-60 HERTZ INPUT

SECT	STANCOR Part No.	Style	VA Cap.	Output From Two Secondary Windings▲ RMS Secondary No. 1	Secondary No. 2	Dimensions-Inches Case H	W	D	Mounting MW	A	E	Wt. Lbs.
A	√PPC-35	PC	1.5	9V. C.T. @ .100A.	24V.C.T. @ .025A.	1⅛	1 25/64	1 5/32	—	1.00	.20	.22
	√PPC-37	PC	1.5	15V.C.T. @ .060A.	32V.C.T. @ .020A.	1⅛	1 25/64	1 5/32	—	1.00	.20	.22
	√PPC-38	APC	4.5	15V.C.T. @ .195A.	32V.C.T. @ .050A.	1 25/64	2⅜	1¼	2⅜	1.31	.25	.47
	√PPC-36	APC	7.5	9V.C.T. @ .500A.	24V.C.T. @ .125A.	1 41/64	2 13/16	1 15/32	2⅜	1.31	.25	.75
	√PPC-39	APC	7.5	15V.C.T. @ .287A.	32V.C.T. @ .100A	1 41/64	2 13/16	1 15/32	2⅜	1.31	.25	.75
B	√PPC-X-12	PC	6.0	10V.C.T. @ .390A.	20V.C.T. @ .107A.	1⅝	1⅞	1 7/16	—	1.31	.25	.56
	√PPC-X-15	PC	6.0	10V.C.T. @ .390A	24V.C.T. @ .090A	1⅝	1⅞	1 7/16	—	1.31	.25	.56
	√PPC-Y-12	PC	15.0	10V.C.T. @ .900A.	20V.C.T. @ .270A	1⅜	1⅝	2¼	—	2.1	.25	.75
	√PPC-Y-15	PC	15.0	10V.C.T. @ .900A	24V.C.T. @ .240A	1⅜	1⅝	2¼	—	2.1	.25	.75

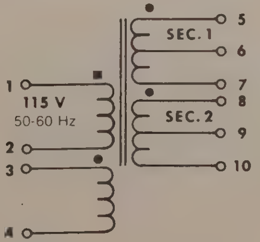
WITH DUAL PRIMARIES FOR 115/230 VOLTS,— 50-60 HERTZ INPUT. (SEE SCHEMATIC BELOW)

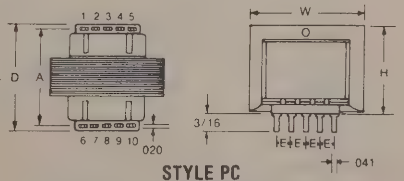
C	√DPC-X-12	PC	6.0	10V.C.T. @ .390A	20V.C.T. @ .107A	1⅝	1⅞	1 7/16	—	1.31	.20	.56
	√DPC-X-15	PC	6.0	10V.C.T. @ .390A.	24V.C.T. @ .090A	1⅝	1⅞	1 7/16	—	1.31	.20	.56
	√DPC-Y-12	PC	15.0	10V.C.T. @ .900A	20V.C.T. @ .270A.	1⅜	1⅝	2¼	—	2.1	.20	.56
	√DPC-Y-15	PC	15.0	10V.C.T. @ .900A	24V.C.T. @ .240A	1⅜	1⅝	2¼	—	2.1	.20	.56

√ New Item.

DUAL TAPPED SECONDARIES

DPC

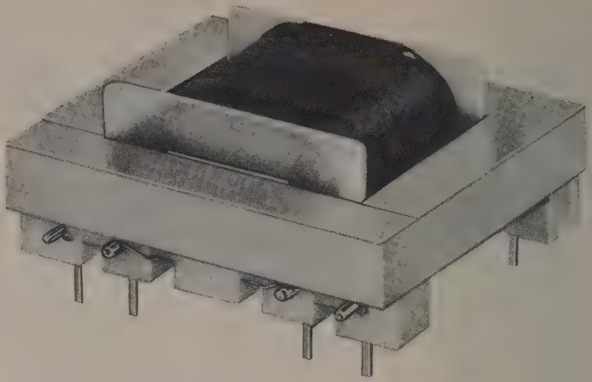




(Bottom View) **STYLE PC 10 PIN STYLE** (Side View)

STANCOR

TELEPHONE COUPLING TRANSFORMERS



For Interconnecting Data/Voice Modem Terminals to Telephone Lines
Designed to Meet FCC Part 68
1500 Volt DIELECTRIC STRENGTH

APPLICATION DATA

Stancor's TTPC series transformers are designed to meet the high performance requirements of today's phone interconnect and instrumentation applications. Stancor has the broadest range of units for general use in impedance matching, circuit isolation, line balancing or bridging, and hybrid applications.

TTPC transformers are ideal for use in voice and data interconnect networks such as modem terminal connection to telephone lines. Stancor's units will handle 1500 volts dielectric breakdown and meet FCC Part 68 requirements.

REFERENCE CHART

SECT	STANCOR Part Number	Impedence		D.C. Curr. MA	Insertion Losses db	Schematic No.	Style	Wt. Oz.
		Primary	Secondary					
A	✓TTPC- 1	600 C.T.	600 C.T.	0	1.4 db	2	A	.6
	✓TTPC- 2	600	600	0	1.2 db	1	B	.5
	✓TTPC- 3	600 C.T.	600 C.T.	0	1.2 db	2	C	.5
	✓TTPC- 4	600	900	0	1.5 db	10	B	.5
	✓TTPC- 5	4000	600	0	1.5 db	11	B	.5
B	✓TTPC- 6	600	600 C.T.	90MA	1.8 db	3	E	1.0
	✓TTPC- 7	600	600	0	1.2 db	1	A	.6
	✓TTPC- 8	600 C.T.	600 C.T.	0	1.2 db	2	A	.6
	✓TTPC- 9	600	600/600	0	1.2 db	4&12	D	1.0
	✓TTPC-10	900	600	0	1.2 db	11	A	.6
	✓TTPC-11	4000	600	0	1.2 db	11	A	.6
C	✓TTPC-12	Holding Coil (Inductance 1.3 Hy)			—	5	F	1.5
	✓TTPC-13	600	600 C.T. Split	90MA	1.8 db	6	G	.5
	✓TTPC-14	600	600 C.T. Split	75MA	1.1 db	13&14	H	2.5
	✓TTPC-15	600	600	80MA	1.1 db	1	H	2.5
	✓TTPC-16	900	600	80MA	1.7 db	10	H	2.5
D	✓TTPC-17	Holding Coil (Inductance 1.4 Hy)			—	9	H	2.5
	✓TTPC-18	600	600 C.T. or 150 Split	80MA	1.7 db	7	J	2.5
	✓TTPC-19	600 C.T.	600 C.T.	80MA	1.7 db	8	L	2.5
E	*PCT-24	900 C.T.	600	3MA	2.0 db	3	K	.3
	*PCT-27	600	600 C.T./150 Split	3MA	2.0 db	13	K	.3
	*PCT-77	600 C.T.	600 C.T.	3MA	2.0 db	2	K	.3
	✓*PCT-78	600	600	3MA	2.0 db	1	K	.3

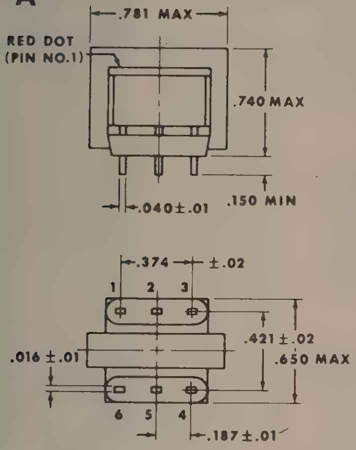
*1000 Volt Dielectric Strength
✓ New Item.

STANCOR PRODUCTS • 131 GODFREY ST. • LOGANSPORT, IN 46947 • PHONE 219/722-2244 • TWX 810-295-0699

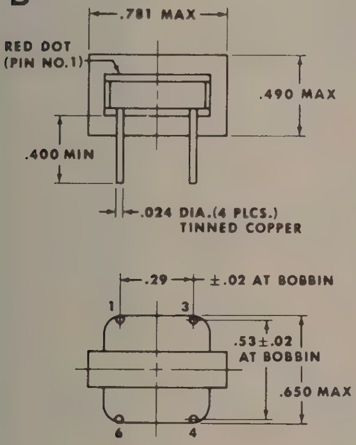
TELEPHONE COUPLING TRANSFORMERS

STYLES

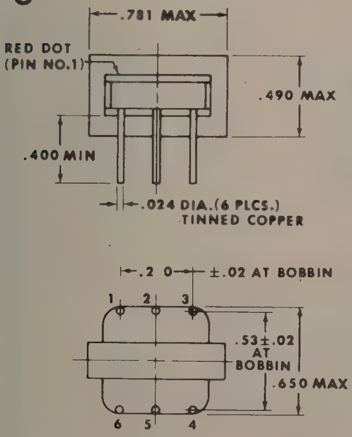
A


.781 MAX
RED DOT
(PIN NO.1)
.740 MAX
.040±.01
.150 MIN
.374
±.02
1
2
3
.421±.02
.650 MAX
.016±.01
6
5
4
.187±.01

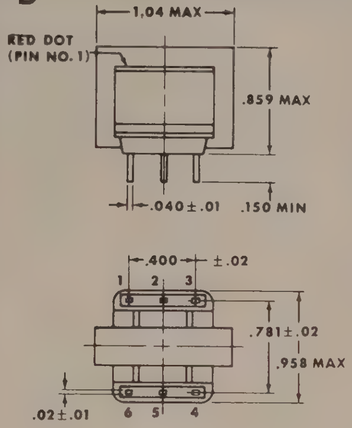
B


.781 MAX
RED DOT
(PIN NO.1)
.490 MAX
.400 MIN
.024 DIA.(4 PLCS.)
TINNED COPPER
.29
±.02 AT BOBBIN
1
3
.53±.02
AT BOBBIN
.650 MAX
6
4

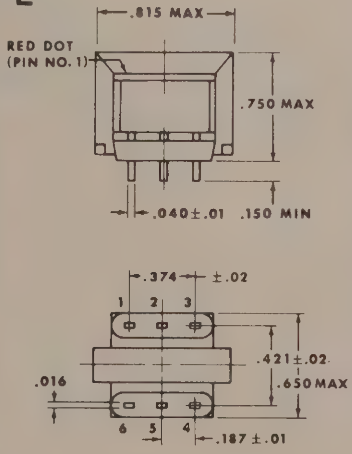
C


.781 MAX
RED DOT
(PIN NO.1)
.490 MAX
.400 MIN
.024 DIA.(6 PLCS.)
TINNED COPPER
.2 0
±.02 AT BOBBIN
1
2
3
.53±.02
AT
BOBBIN
.650 MAX
6
5
4

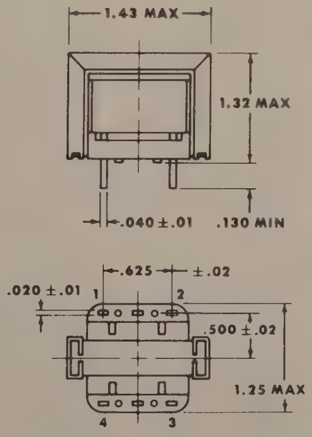
D


1.04 MAX
RED DOT
(PIN NO.1)
.859 MAX
.040±.01
.150 MIN
.400
±.02
1
2
3
.781±.02
.958 MAX
.02±.01
6
5
4

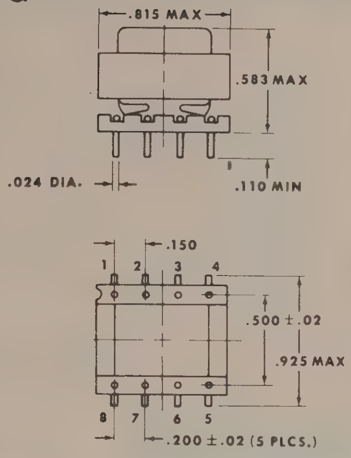
E


.815 MAX
RED DOT
(PIN NO. 1)
.750 MAX
.040±.01
.150 MIN
.374
±.02
1
2
3
.421±.02
.650 MAX
.016
6
5
4
.187±.01

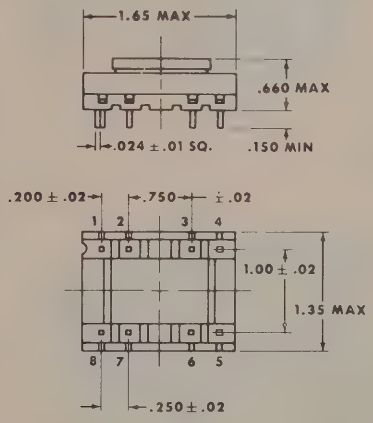
F


1.43 MAX
1.32 MAX
.040±.01
.130 MIN
.625
±.02
.020±.01
1
2
.500±.02
1.25 MAX
4
3

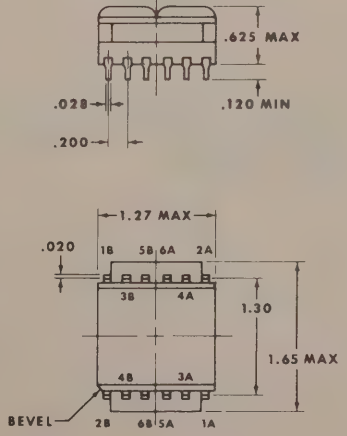
G


.815 MAX
.583 MAX
.024 DIA.
.110 MIN
.150
1
2
3
4
.500±.02
.925 MAX
8
7
6
5
.200±.02 (5 PLCS.)

H


1.65 MAX
.660 MAX
.024±.01 SQ.
.150 MIN
.200±.02
.750
±.02
1
2
3
4
1.00±.02
1.35 MAX
8
7
6
5
.250±.02

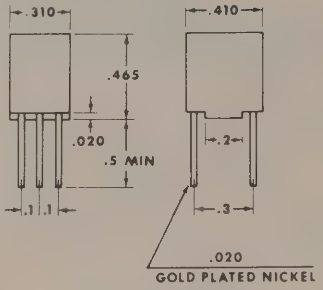
J


.625 MAX
.028
.120 MIN
.200
1.27 MAX
.020
1B
5B
6A
2A
3B
4A
1.30
1.65 MAX
4B
3A
BEVEL
2B
6B
5A
1A

STANCOR TELEPHONE COUPLING TRANSFORMERS

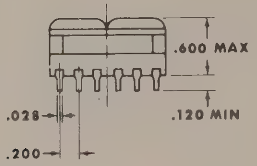
STYLES

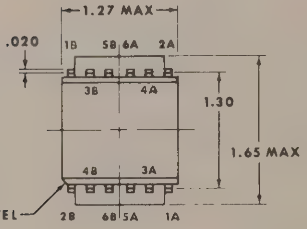
K


.310
.410
.465
.020
.5 MIN
.2
.1
.1
.3
.020
GOLD PLATED NICKEL

* * *

L


.600 MAX
.028
.120 MIN
.200

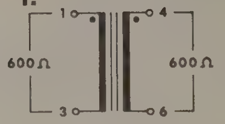

1.27 MAX
.020
1B
5B
6A
2A
3B
4A
1.30
1.65 MAX
4B
3A
BEVEL
2B
6B
5A
1A

* * *

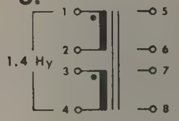
REFER TO TELEPHONE COUPLER REFERENCE CHART FOR IMPEDENCE SPECIFICATIONS

SCHEMATICS

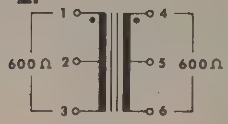
1.


1
4
600Ω
600Ω
3
6

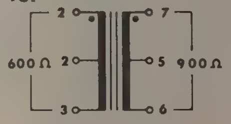
9.


1
5
2
6
1.4 Hy
3
7
4
8

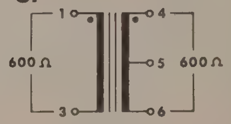
2.


1
4
600Ω
2
5
600Ω
3
6

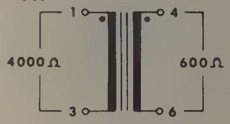
10.


2
7
600Ω
2
5
900Ω
3
6

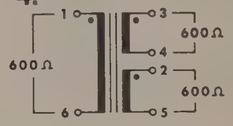
3.


1
4
600Ω
5
600Ω
3
6

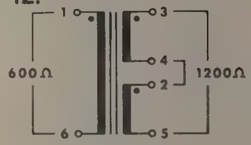
11.


1
4
4000Ω
600Ω
3
6

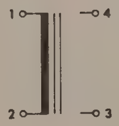
4.


1
3
600Ω
4
600Ω
2
600Ω
6
5

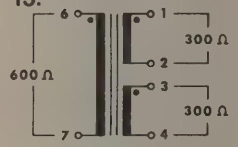
12.


1
3
600Ω
4
2
1200Ω
6
5

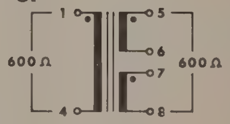
5.



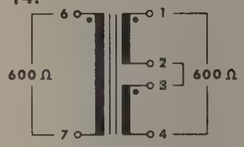
13.


6
1
300Ω
2
600Ω
3
300Ω
7
4

6.


1
5
6
600Ω
600Ω
7
4
8

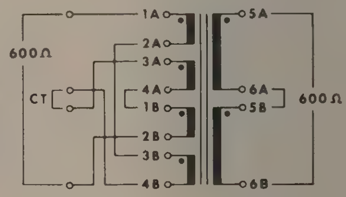
14.


6
1
600Ω
2
3
600Ω
7
4

7.

NECESSARY EXTERNAL CONNECTIONS;

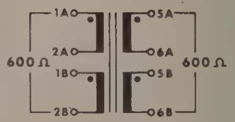
SHORT 2A-3B
4A-1B
6A-5B
3A-4B


1A
5A
600Ω
2A
3A
CT
4A
1B
6A
5B
600Ω
2B
3B
4B
6B

8.

NECESSARY EXTERNAL CONNECTIONS;

SHORT 2A-1B
6A-5B


1A
5A
600Ω
2A
6A
600Ω
1B
5B
2B
6B

STERLING
TRANSFORMER

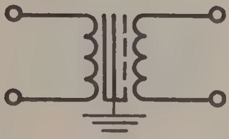
step-up/step-down
ISOLATION – AUTO
transformers

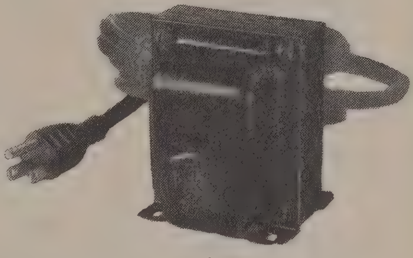
STEP-DOWN ISOLATION TRANSFORMERS

PRIMARY: 240 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle
• Electrostatic Shield • UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.
S2-50	50	A	2 29/32	3 7/16	3½	2¼	1 13/16	3
S2-100	100	A	3 7/32	3⅞	3⅞	2½	2 3/16	5
S2-150	150	A	3 17/32	4⅜	4¼	2¾	2 13/16	7
S2-220	220	A	3 27/32	4⅝	4⅝	3	3 1/16	9.5
S2-330	330	A	4 17/32	5¼	5 7/16	3½	3¼	14.5
S2-500	500	A	4 17/32	6¼	5 7/16	3½	4¼	21
S2-700	700	A	5½	5 15/16	6 9/16	4¼	3½	25
S2-1000	1000	A	5½	6 15/16	6 9/16	4¼	4½	35
S2-1500	1500	B	9	7¾	6 5/16	8¼	4⅜	42
S2-2200	2200	B	9	9⅜	6 5/16	8¼	6	65
S2-3300	3300	B	9	11⅝	6 5/16	8¼	8¼	95

**Style A Only; Style B — Knockouts for Conduit Connectors.*





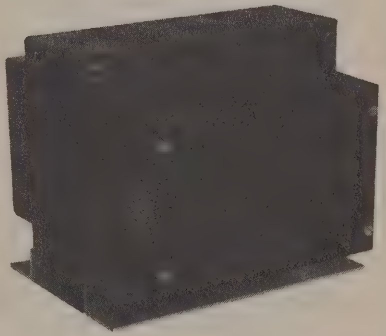
Style A

ISOLATION TRANSFORMERS

PRIMARY: 120 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle
• Electrostatic Shield • UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.
S1-50	50	A	2 29/32	3 7/16	3½	2¼	1 13/16	3
S1-100	100	A	3 7/32	3⅞	3⅞	2½	2 3/16	5
S1-150	150	A	3 17/32	4⅜	4¼	2¾	2 13/16	7
S1-220	220	A	3 27/32	4⅝	4⅝	3	3 1/16	9.5
S1-330	330	A	4 17/32	5¼	5 7/16	3½	3¼	14.5
S1-500	500	A	4 17/32	6¼	5 7/16	3½	4¼	21
S1-700	700	A	5½	5 15/16	6 9/16	4¼	3½	25
S1-1000	1000	A	5½	6 15/16	6 9/16	4¼	4½	35
S1-1500	1500	B	9	7¾	6 5/16	6¾	4⅜	42
S1-2200	2200	B	9	9⅜	6 5/16	6¾	6	65
S1-3300	3300	B	9	11⅝	6 5/16	6¾	8¼	95

**Style A Only; Style B — Knockouts for Conduit Connectors.*



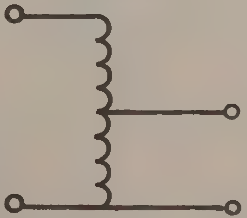
Style B

STEP-DOWN AUTO TRANSFORMERS

PRIMARY: 240 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle
• UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.
SA-100	100	A	2 29/32	3 7/16	3½	2¼	1 13/16	3
SA-150	150	A	2 29/32	3¾	3½	2¼	2⅛	4
SA-200	200	A	3 7/32	3⅞	3⅞	2¼	2 3/16	5
SA-300	300	A	3 17/32	4⅜	4¼	2¾	2 13/16	7
SA-450	450	A	3 27/32	4⅝	4⅝	3	3⅙	9½
SA-650	650	A	4 17/32	5¼	5 7/16	3½	3¼	14½
SA-1000	1000	A	4 17/32	6¼	5 7/16	3½	4¼	21
SA-1500	1500	A	5½	5 15/16	6 9/16	4¼	3½	25
SA-2000	2000	A	5½	6 15/16	6 9/16	4¼	4½	35
SA-3000	3000	B	9	7¾	6 5/16	6¾	4⅜	42
SA-4500	4500	B	9	9⅜	6 5/16	6¾	6	65
SA-6500	6500	B	9	11⅝	6 5/16	6¾	8¼	95
SA-8000**	8000	B	10⅝	9⅝	8¼	7½	6⅛	90
SAB-5300†	5300	A	5¾	8 5/16	4	3¾	6½	17.5

**Style A Only **60 HZ Only Style B — Knockouts for Conduit Connector*
†Step-up/down Auto Transformer. Connections for 208/230 V or 230/208 V, 23 Amp 50/60 HZ



STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

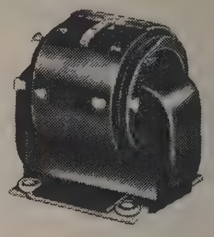
STERLING
TRANSFORMER

ENCAPSULATED *400 cps transformers*

CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp	Insul. Volts (RMS)	Pri. Volts	Mold Size
19	4C1	6.3 CT	0.8	1500	115	SM3
19	4C2	6.3 CT	1.2	1500	115	SM2
19	4C3	6.3 CT	6.8	1500	110/115/120	2
20	4C4	6.3 6.3	4.9 2.7	1500	115	3
19	4C5	6.3 CT	7.2	1500	115	35
21	4C6	6.3 6.3 6.3	7 7 1.5	1500 1500 1500	120	35
22	4C7	6.3 CT 6.3 CT	7 7	1500 1500	120	4
21	4C8	6.3 6.3 6.3	13.7 2.9 0.3	1500 1500 1500	115	4
19	4C9	6.3 CT	12.3	1500	115	5
21	4C11	6.3 6.3 6.3	2.4 2.5 2.7	1500	115	3
19	4C26	6.3 CT	2	1500	115	SM1
19	4C27	6.3 CT	3	1500	115	1A
19	4C28	6.3 CT	5	1500	115	2
19	4C29	5 CT	3	2500	115	SM1
19	4C30	5 CT	6	2500	115	2
19	4C31	8.5 CT	12	1500	115	5
19	4C32	8.5 CT	23	1500	115	7
19	4C33	8.5 CT	35	1500	115	8
19	4C34	8.5 CT	45	1500	115	9
18	4C12	14.1	3	1500	115	3
19	4C35	21 CT	4.5	1500	115	5
19	4C13	21 CT	9	1500	115	7
19	4C36	21 CT	18	1500	115	9
19	4C10	20 CT	0.6	1500	115	SM1

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C
Specifications

MIL Type
TF5S03ZZ
85°C Max. Ambient
130°C Max.
Oper. Temp.

HIGH SHOCK
EXTREME
ENVIRONMENT
CONDITIONS
LIGHTWEIGHT FOR
AIRBORNE USE
10,000 HOUR
PLUS-LIFE
SERVO
APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL
CIRCUITS
MISSILE CIRCUITS

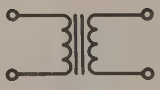


FIG. 18

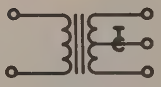


FIG. 19

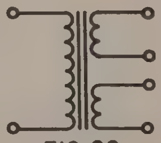


FIG. 20

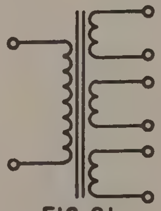


FIG. 21

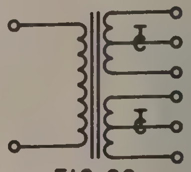


FIG. 22

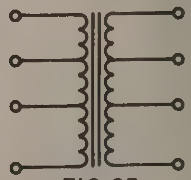


FIG. 23

STERLING TRANSFORMER CORPORATION

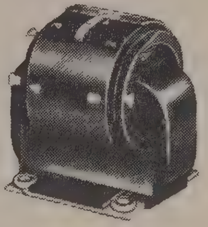
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

STERLING
TRANSFORMER

ENCAPSULATED 400 cps transformers
CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp.	Insul. Volts (RMS)	Pri. Volts	Mold Size
19	4C37	21 CT	24	1500	115	10
19	4C38	24 CT	4	1500	115	5
19	4C39	24 CT	8	1500	115	7
19	4C40	24 CT	16	1500	115	9
19	4C41	24 CT	21	1500	115	10
18	4C14	26	0.5	1500	115	SM1
19	4C15	26 CT	1.5	1500	115	3
19	4C23	26 CT	3	1500	115	4
19	4C24	26 CT	5	1500	115	6
22	4C16	28 CT 6.3 CT	0.8 7	1500	115	3
19	4C42	41 CT	2.3	1500	115	5
19	4C43	41 CT	4.5	1500	115	7
19	4C44	41 CT	9	1500	115	9
19	4C45	41 CT	12	1500	115	10
19	4C46	48 CT	2	1500	115	5
19	4C47	48 CT	4	1500	115	7
19	4C48	48 CT	8	1500	115	9
19	4C49	48 CT	10	1500	115	10
19	4C25	52 CT	2	1500	115	5
19	4C17	52 CT	0.2	1500	115	SM1
19	4C18	90 CT	4.5	1500	115	9
18	4C19	115	.05	1500	115	SM2
18	4C21	115	2.8	1500	115	8
23	4C20	105/115/125	0.4	1500	105/115/125	2
23	4C50	105/115/125	1	1500	105/115/125	6
23	4C51	105/115/125	2.4	1500	105/115/125	8
23	4C52	105/115/125	3.2	1500	105/115/125	9
23	4C53	105/115/125	4	1500	105/115/125	10
18	4C22	334	025	1500	115	SM1

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C .
Specifications

MIL Type
TF5S03ZZ
85°C Max. Ambient
130°C Max.
Oper. Temp.

HIGH SHOCK
EXTREME
ENVIRONMENT
CONDITIONS
LIGHTWEIGHT FOR
AIRBORNE USE
10,000 HOUR
PLUS-LIFE
SERVO
APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL
CIRCUITS
MISSILE CIRCUITS

Mold No.	Overall Dimen.			Mtg. Dimen.		App. Wt. (Lbs.)	Mtg. Meth.
	L	W	H	F	G		
SM3	1 1/32	1 5/16	1¼	1	Note 1	0.06	Note 1
SM2	1½	1¼	1 11/16	1	Note 1	0.10	Note 1
SM1	1½	1½	1 11/16	1⅛	Note 1	0.16	Note 1
1	1 13/16	1⅞	1 13/16	1¼	1 7/16	0.25	Note 2
1A	1 11/16	1 17/32	1 13/16	1 5/32	1⅛	0.25	Note 2
2	2	1 15/16	2⅛	1 9/32	1¼	0.40	Note 2
3	2 5/16	1 13/16	2⅛	1 9/32	1 7/16	0.45	Note 2
35	2 1/16	2⅜	2 3/16	1 17/32	1 11/16	0.70	Note 2
4	2 5/16	2⅜	2 9/16	1 17/32	1 11/16	0.90	Note 2
5	2¾	2⅜	2⅞	1 17/32	2 3/16	1.20	Note 2
6	2¾	2⅝	3⅛	1 17/32	2 3/16	1.50	Note 2
7	3	2⅞	3⅜	1 25/32	2½	2.00	Note 2
8	3⅜	2⅞	3⅜	1 25/32	2½	2.50	Note 2
83	3¾	3¼	3⅜	2¼	3	3.25	Note 3
86	3¾	3¾	3⅜	2¾	3⅛	4.25	Note 3
9	4 1/16	3⅜	3⅞	2 3/16	3½	5.00	Note 3
10	4½	3 15/16	3 15/16	2¾	3⅛	6.00	Note 3

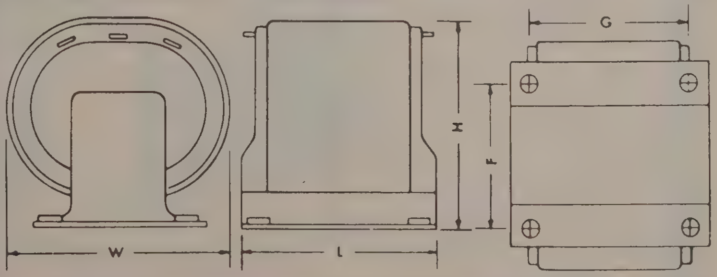
Note 1 —
SM Series are two hole mounting with holes on center line. #4-40 Pem nuts are fastened to the bracket.

Note 2 —
#6-32 Pem nuts on bracket are standard.

Note 3 —
#8-32 Pem nuts on bracket are standard.

- All primaries 380-1000 cps
- Dielectric test voltages:

  PRIMARIES 1500 Volts RMS
  SECONDARIES 1500 Volts RMS
- Epoxy resin used as encapsulant
- Prices subject to change without notice



STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

transistor transformers

STERLING TRANSFORMER

MINISPEC TRANSISTOR TRANSFORMERS — 300 SERIES

Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ± 2 db.
300	Line to Base	600	600	10	23	200–15,000
301	Coll. to P.P. Base	100	10 C.T./40 C.T.	100	27	200–20,000
302	Coll. to Base or line	50,000	600	3	20	300–15,000
303	Collector to speaker	50,000	6	3	20	300–15,000
304	Coll. to P.P. Base	100,000	1,200 C.T.	1.4	17	200–15,000
305	Coll. to P.P. Base	25,000	1,200 C.T.	3	22	200–15,000
306	P.P. Coll. to P.P. Base	50,000 C.T.	1,200 C.T.	3	20	300–15,000
307	Line to P.P. Base	600 C.T.	1,200 C.T.	4	23	200–15,000
308	Collector to Base	25,000	600	3	22	200–15,000
309	P.P. Coll. to P.P. Base	4,000 C.T.	600 C.T.	3	32	200–15,000
310	Output Coll. to speaker	2,000	3.4	10	32	200–15,000
311	P.P. Coll. to speaker	4,000 C.T.	3.4	3	32	200–15,000
312	Coll. to Speaker	400	10	50	25	200–20,000
313	P.P. Servo Output	500 C.T.	210	30	27	300–20,000
314	P.P. Coll. to P.P. Base	25,000 C.T.	1,200 C.T.	6	22	200–15,000
315	P.P. Coll. to P.P. Base	50,000 C.T.	1200/300 Split	3	20	300–15,000
316	P.P. Coll. to P.P. Base	4,000 C.T.	600/150 Split	3	32	200–15,000
317	Line to P.P. Base	600/150 Split	1,200 C.T.	4	23	200–15,000
318	P.P. Coll. to Servo	250 C.T.	1,000	10	30	200–15,000
319	Coll. to P.P. Base	2,500	600 C.T.	10	32	200–15,000
320	P.P. Coll. to P.P. Base	7,500 C.T.	600 C.T.	8	32	200–15,000
321	Line to P.P. Base	600 C.T.	600 C.T.	20	23	200–15,000
322	P.P. Coll. to Servo	1,600 C.T.	450	15	30	200–15,000
323	P.P. Coll. to Servo	250 C.T.	500	10	30	200–15,000

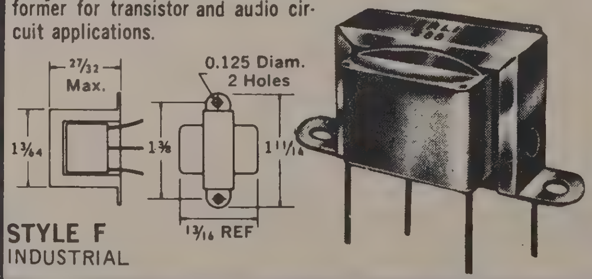
MINISPEC AUDIO TRANSFORMERS — 300 SERIES

Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ± 2 db.
375	Mike or line to 1 grid	50/250/600 C.T.	50,000	0	5	20–20,000
376	Mike or line to 2 grids	50/250/600 C.T.	50,000 C.T.	0	5	20–20,000
377	Dynamic mike to 1 grid	7.5/30	50,000	0	5	20–20,000
378	Single plate to 1 grid	15,000	60,000	0	6	20–15,000
379	Single plate to 1 grid	15,000	60,000	4	14	200–20,000
380	Single plate to 2 grids	15,000	95,000 C.T.	0	5	20–15,000
381	Single plate to 2 grids	15,000	95,000 C.T.	4	11	200–20,000
382	Single plate to line	15,000	50/250/600 C.T.	0	8	20–20,000
383	Single plate to line	15,000	50/250/600 C.T.	4	21	150–20,000
384	Push pull plates to line	30,000 C.T.	50/250/600 C.T.	0	8	30–50,000
385	Crystal mike to line	50,000	50/250/600 C.T.	0	5	20–20,000
386	Mixing and matching	50/250 C.T.	50/250/600 C.T.	0	8	20–20,000
387	Reactor	300 hy. 0 d.c.	50 hy. @ 3 ma.			DCR 6,000
388	50:1 mike to grid	200	½ Megohm	0	9	80–3,000
389	10:1 plate to grid	10,000	1 Megohm	0	11	100–2,500

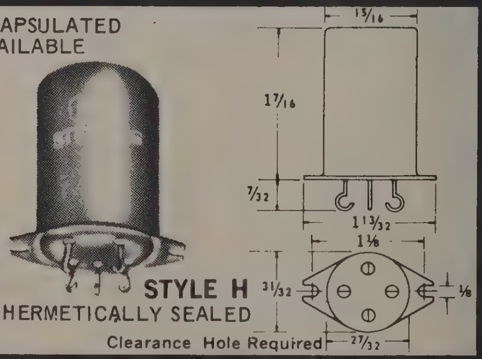
MINISPEC 300 SERIES

Highest efficiency miniature transformer for transistor and audio circuit applications.

MILITARY STYLE ENCAPSULATED VERSIONS ARE AVAILABLE



STYLE F
INDUSTRIAL



STYLE H
HERMETICALLY SEALED

STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

STERLING
TRANSFORMER

transistor transformers

MICROSPEC TRANSISTOR TRANSFORMERS — 600 SERIES

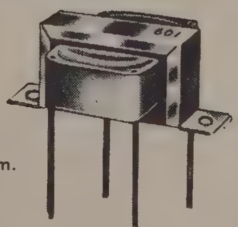
Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ± 2 db.
601	Line to Base	600	600	8	22	200–15,000
602	Coll. to Base or line	50,000	600	0.7	20	200–15,000
603	P.P. coll. to P.P. Base	50,000 C.T.	600 C.T.	1.4	20	200–15,000
604	Collector to speaker	50,000	6	1	20	200–15,000
605	Coll. to P.P. Base	25,000	1,200 C.T.	1	20	200–15,000
606	P.P. coll. to P.P. Base	50,000 C.T.	1,200 C.T.	1.4	20	200–15,000
607	Line to P.P. Base	600 C.T.	1,200 C.T.	16	22	200–15,000
608	Collector to Base	25,000	600	1	20	200–15,000
609	P.P. coll. to P.P. Base or line	4,000 C.T.	600 C.T.	5	28	200–15,000
610	Coll. to Spkr.	2,000	3.4	5	28	200–15,000
611	Output P.P. coll. to spkr.	4,000 C.T.	3.4	5	28	200–15,000
612	Coll. to P.P. Base	10,000	1,500 C.T.	1	20	200–15,000
613	P.P. Coll. to P.P. Base	10,000 C.T.	200 C.T.	6	20	200–15,000
614	P.P. Coll. to P.P. Base	25,000 C.T.	1,200 C.T.	2	20	200–15,000
615	Coll. to P.P. Base	2,500	2,500 C.T.	2	23	200–15,000
616	P.P. Coll. to P.P. Base	4,000 C.T.	600/150 split	5	28	200–15,000
617	P.P. Coll. to P.P. Base	7,500 C.T.	600 C.T.	4	22	200–15,000
618	Line to Base	600 C.T.	600 C.T.	16	22	200–15,000
619	P.P. Coll. to P.P. Base	25,000 C.T.	600 C.T.	2	20	200–15,000
620	P.P. Coll. to P.P. Base	10,000 C.T.	1,500 C.T.	2	20	200–15,000
621	Driver/Isolation	10,000 C.T.	10,000 C.T.	2	20	200–15,000
622	P.P. Coll. to P.P. Base	7,500 C.T.	1,200 C.T.	4	22	200–15,000
623	P.P. Coll. to P.P. Base	2,000 C.T.	500 C.T.	10	28	200–15,000
624	Line to P.P. Base	600 C.T.	1200/300 split	16	22	200–15,000

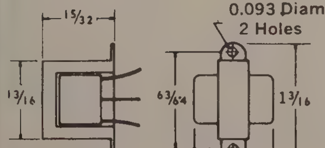
MICROSPEC AUDIO TRANSFORMERS — 600 SERIES

Part No.	Application	Primary Impedance	Secondary Impedance	Pri. D.C. Unbal. Ma.	Oper. Lev. DBM	Freq. Response ± 2 db.
675	Input	200/50	250,000/62,500	0	4	200–10,000
676	Interstage 3:1	10,000	90,000	0	4	150–10,000
677	Plate to line	10,000	200	3	20	150–10,000
678	Output	30,000	50	1	20	150–10,000
679	Reactor 50 HY at 1 madc				4700	ohms DCR
680	Output	100,000	60	0.5	20	250–10,000
681	Output	30,000	1,200	0.5	20	200–10,000

MICROSPEC 600 SERIES

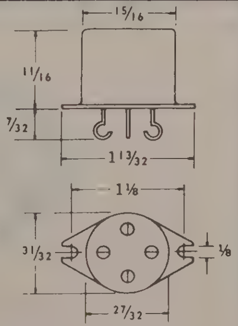
Subminiature transformers
for high efficiency circuits.





STYLE F
INDUSTRIAL

MILITARY STYLE ENCAPSULATED
VERSIONS ARE AVAILABLE



Clearance Hole Required

STYLE H
HERMETICALLY SEALED

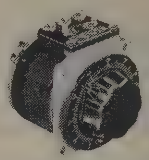
STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

POWERSTAT® Variable Transformers now

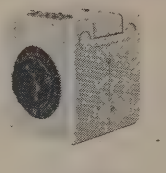
New epoxy-coated POWERKOTE Coils make the POWERSTAT line the most outstanding value in variable transformers today. *Without increase in price, size or weight,* only POWERSTAT Variable Transformers give an average of 20% higher current ratings, 10:1 greater overload capability, longer life, greater resistance to fungus, salt spray and other contaminating atmospheres. POWERKOTE Coil commutator bars are embedded in place preventing steady-state operating temperature and severe overloads from distorting the commutator.

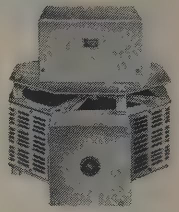
POWERSTAT Variable Transformers are designed to deliver continuously adjustable voltage from a-c power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types listed in the charts except the 10B-12, EN116B-EN216B and EN117B-EN217B Series are available with motor drives if desired. Motor-driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types having -4, -5, or -6 suffixes which do not offer the 5-second speed. Single types in the 116B-216B, 117B-217B, 126-226 and 136B-236B Series are also offered with 2- or 3-wire cord-plug sets. 1156D-1256D Series types are available in ratings to 244 kva.

TYPE 10B


TYPE 21

TYPE 136BT


TYPE EN216B


TYPE 5MB1156DT

RATINGS AND SPECIFICATIONS

INPUT		OUTPUT					TYPE	Ship. Wt. Lbs.
Volts	Hertz	Volts	Const. Current Load		Const. Impedance Load			
			Max. Amp.	Max. KVA	Max. Amp.	Max. KVA		
10B-12 SERIES								
Single Phase								
120 120	50/60 60	0 120 0-132	2 25* 2 25*	0 27 0 30	3‡ —	0 36 —	✓ 10B	2½
240 240	50/60 50/60	0 240 0-264	0 7* 0 5**	0 17 0 13	0 9‡ —	0 22 —	✓ 12	2½
240 240	50/60 60	0-240 0-264	2 25* 2 25*	0.54 0 59	3‡ —	0.72 —	10B-2	6
480 480	50/60 50/60	0-480 0-528	0 7* 0 5**	0 34 0 26	0 9‡ —	0 43 —	12-2	6
Three Phase								
120 120	50/60 60	0-120 0-132	2 25* 2 25*	0 47 0 51	3‡ —	0 62 —	10B-2	6
240 240	50/60 50/60	0-240 0 264	0 7* 0 5**	0 29 0 23	0 9‡ —	0 37 —	12-2	6
240	60	0-240	2 25*	0 94	3‡	1 2	10B-3	8½
480 480	50/60 60	0 480 0-528	0 7* 0 5**	0 58 0 46	0 9‡ —	0 75 —	12-3	8½
21-22 SERIES								
Single Phase								
120 120	50/60 50/60	0-120 0-140	4 5 4 5	0 54 0 63	6.5 —	0 78 —	✓ 21	6
240 240	50/60 50/60	0 240 0-280	2 25 2 25	0.54 0.63	3 25 —	0 78 —	✓ 22	6
240 240	50/60 50/60	0-240 0-280	4.5 4 5	1 1 1 3	6 5 —	1 6 —	✓ 21-2	13½
480 480	50/60 50/60	0-480 0-560	2 25 2.25	1 1 1 3	3 25 —	1 6 —	22-2	13½
Three Phase								
120 120	50/60 50/60	0-120 0-140	4 5 4 5	0 94 1 1	6 5 —	1 4 —	21-2	13½
240 240	50/60 50/60	0 240 0-280	2 25 2 25	0 94 1 1	3 25 —	1 4 —	22-2	13½
240 240	50/60 60	0-240 0-280	4.5 4 5	1 9 2 2	6 5 —	2.7 —	21-3	19
480 480	50/60 60	0-480 0-560	2 25 2 25	1 9 2 2	3 25 —	2 7 —	✓ 22-3	19

INPUT		OUTPUT					TYPE	Ship. Wt Lbs.
Volts	Hertz	Volts	Const. Current Load		Const. Impedance Load			
			Max. Amp.	Max. KVA	Max. Amp	Max KVA		
116B-216B and 117B-217B SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0 140	10 10	1 2 1 4	13 —	1 6 —	✓116B	12
120	60	0-120	12	1 4	15	1 8	✓117BT	12
240 240	50/60 50/60	0-240 0-280	3 5 3 5	0 84 0 98	5 —	1 2 —	✓216B	12
240	60	0 240	5	1 2	7	1 7	✓217BT	12
240 240	50/60 50/60	0 240 0-280	10 10	2 4 2 8	13 —	3 1 —	✓116BT 2	24
240	60	0-240	12	2 9	15	3 6	117BT 2	24
480 480	50/60 50/60	0 480 0-560	3 5 3 5	1 7 2 0	5 —	2 4 —	216BT 2	24
480	60	0-480	5	2 4	7	3 4	217BT 2	24
Three Phase								
120 120	50/60 50/60	0 120 0 140	10 10	2 1 2 4	13 —	2 7 —	✓116BT 2	24
120	60	0-120	12	2 5	15	3 1	117BT 2	24
240 240	50/50 50/60	0-240 0-280	3 5 3 5	1 5 1 7	5 —	2 1 —	216BT 2	24
240	60	0-240	5	2 1	7	2 9	217BT 2	24
240 240	50/60 60	0-240 0-280	10 10	4 2 4 8	13 —	5 4 —	✓116BT 3	36
240	60	0-240	12	5 0	15	6 2	117BT 3	36
480 480	50/60 60	0-480 0-560	3 5 3 5	2 9 3 4	5 —	4 2 —	✓216BU-3	36
480	60	0-480	5	4 2	7	5 8	✓217BU-3	36
EN116B-EN216B and EN117B-EN217B SERIES								
Single Phase								
120 120	50 60 50 60	0-120 0-140	8 8	0 96 1 1	13 —	1 6 —	✓EN116B	15
120	60	0-120	10	1 2	14 5	1 7	✓EN117B	15
Three Phase								
480 480	50 60 60	0 480 0 560	3 3	2.5 2.9	4.5 —	3.7 —	✓EN216B-3	39
40-VOLT SERIES								
Single Phase								
40	60	0-40	7 18	0 28 0 72	9 22	0 36 0 88	✓ 10B 40 ✓ 21 40	3½ 6

LW136B SERIES

INPUT		OUTPUT‡‡			TYPE	Ship. Wt Lbs
Volts	Hertz	Volts	Max. Amps.	Max. KVA		
Single Phase						
120 240 120 240	50 60 50 60	15-0-15 0 30	35 25	0 52 0 75	✓ LW136B	25

‡‡LW136B Series ratings are for use as low voltage isolated output transformer

*Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 1 75 amp., 12 Series to 0.5 amp.

‡Rating when mounted on metal panel. On bracket or nonmetallic panel derate 10B Series to 2 5 amp., 12 Series to 0.75 amp.

**0 7 amp. maximum in range from 0 to line voltage when mounted on metal panel

†Also available with open construction Suffix U when ordering

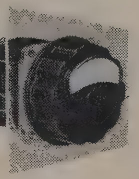
✓ AVAILABLE OFF-THE-SHELF FROM DISTRIBUTOR STOCK

THE
SUPERIOR ELECTRIC
COMPANY

1000 MIDDLE STREET, BRISTOL, CONN. 06010
PHONE: (203) 582-9561

with POWERKOTE® COILS

STATIONARY METERED KNOB TYPES



ENCLOSED TYPES

TYPE L10B

TYPE L116B

Single units (those listed in charts without -2 or -3 suffixes) in the 116B-216B, 117B-217B, 126-226, 136B-236B and 146-246 series are also available with metered knobs. Stationary voltmeter does not turn with knob. Voltmeter accurate within ±3% of full scale and insensitive to stray magnetic fields. When ordering, add VS prefix to type number. *Back-of-panel* mounted types in the 21-22 through 146-246 series can be combined with Metered Knob Assemblies. Existing models can be retrofitted also. Assembly type VS150 has a 0-150 volt scale and type VS300 has 0-300. Types VS116B, VS3PN116B and VS3PN136B are available off-the-shelf from distributor stock.

Designed to meet OSHA requirements. Portable 120 volt, single-phase units have grounded NEMA cord-plug assembly, on-off switch, grounded output receptacle, pilot light and fuse. Panel controls are recessed for protection from accidental bumping. Slots at rear for wall hanger brackets. Type L10B rated 0-132 volts, 1.75 amp; type L21 rated 0-140 volts, 4.5 amp; type L116B rated 0-140 volts, 10 amp. All available off-the-shelf from distributor stock.

INPUT		OUTPUT					TYPE	Ship. Wt. Lbs.
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA		
126-226 SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	15 15	1.8 2.1	20 —	2.4 —	✓ 126	17
240 240	50/60 50/60	0-240 0-280	7.5 7.5	1.8 2.1	10 —	2.4 —	✓ 226	17
240 240	50/60 50/60	0-240 0-280	15 15	3.6 4.2	20 —	4.8 —	126-2	32
480 480	50/60 50/60	0-480 0-560	7.5 7.5	3.6 4.2	10 —	4.8 —	✓ 226U-2	32
Three Phase								
120 120	50/60 50/60	0-120 0-140	15 15	3.1 3.6	20 —	4.2 —	126-2	32
240 240	50/60 50/60	0-240 0-280	7.5 7.5	3.1 3.6	10 —	4.2 —	✓ 226U-2	32
240 240	50/60 60	0-240 0-280	15 15	6.2 7.3	20 —	8.3 —	126-3	49
480 480	50/60 60	0-480 0-560	7.5 7.5	6.2 7.3	10 —	8.3 —	✓ 226T-3	49
136B-236B SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	22 22	2.6 3.1	28 —	3.4 —	✓ 136B	25
120 120	50/60 50/60	0-120 0-140	44 44	5.3 6.2	56 —	6.7 —	136B-2 §	52
240 240	50/60 50/60	0-240 0-280	10 10	2.4 2.8	13 —	3.1 —	✓ 236B	25
240 240	50/60 50/60	0-240 0-280	22 22	5.3 6.2	28 —	6.7 —	✓ 136B-2	52
480 480	50/60 50/60	0-480 0-560	20 20	4.8 5.6	26 —	6.2 —	✓ 236B-2	52
Three Phase								
120 120	50/60 50/60	0-120 0-140	22 22	4.6 5.3	28 —	5.8 —	✓ 136B-2	52
240 240	50/60 50/60	0-240 0-280	10 10	4.2 4.8	13 —	5.4 —	✓ 236B-2	52
240 240	50/60 60	0-240 0-280	22 22	9.1 10.7	28 —	11.6 —	✓ 136B-3	7[illegible]
480 480	50/60 60	0-480 0-560	10 10	8.3 9.7	13 —	10.8 —	✓ 236B-3	76
146-246 SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	30 30	3.6 4.2	35 —	4.2 —	✓ 146	38
120 120	50/60 50/60	0-120 0-140	60 60	7.2 8.4	70 —	8.4 —	146-2 §§	83
240 240	50/60 50/60	0-240 0-280	15 15	3.6 4.2	19 —	4.6 —	✓ 246	38
240 240	50/60 50/60	0-240 0-280	30 30	7.2 8.4	35 —	8.4 —	146-2	83
[illegible] 4[illegible]	50/60 50/60	0-480 0-560	15 15	7.2 8.4	19 —	9.1 —	246-2	83
146-246 SERIES† (contd.)								
Three Phase								
120 120	50/60 50/60	0-120 0-140	30 30	6.2 7.3	35 —	7.3 —	146-2	83
240 240	50/60 50/60	0-240 0-280	15 15	6.2 7.3	19 —	7.9 —	246-2	83
240 240	50/60 60	0-240 0-280	30 30	12.5 14.5	35 —	14.5 —	146-3	125
480 480	50/60 60	0-480 0-560	15 15	12.5 14.5	19 —	15.8 —	246-3	125
1156D-1256D SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	50 50	6.0 7.0	55 —	6.6 —	✓ 1156D	82
120 120	50/60 50/60	0-120 0-140	100 100	12.0 14.0	110 —	13.2 —	1156D 2P	169
120 120	50/60 50/60	0-120 0-140	150 150	18.0 21.0	165 —	19.8 —	1156D 3P	272
240 240	50/60 50/60	0-240 0-280	28 28	6.7 7.8	28 —	6.7 —	✓ 1256D	82
240 240	50/60 50/60	0-240 0-280	50 50	12.0 14.0	55 —	13.2 —	1156D 2S	156
240 240	50/60 50/60	0-240 0-280	56 56	13.4 15.7	56 —	13.4 —	✓ 1256D 2P	169
240 240	50/60 50/60	0-240 0-280	84 84	20.2 23.5	84 —	20.2 —	1256D 3P	272
240 240	50/60 50/60	0-240 0-280	100 100	24.0 28.0	110 —	26.4 —	1156D 4PS	361
480 480	50/60 50/60	0-480 0-560	28 28	13.4 15.7	28 —	13.4 —	✓ 1256D 2S	156
480 480	50/60 50/60	0-480 0-560	56 56	26.9 31.4	56 —	26.9 —	1256D 4PS	361
Three Phase								
120 120	50/60 50/60	0-120 0-140	50 50	10.4 12.1	55 —	11.4 —	1156D 2D	155
240 240	50/60 50/60	0-240 0-280	28 28	11.6 13.6	28 —	11.6	✓ 1256D-2D	155
240 240	50/60 60	0-240 0-280	50 50	20.8 24.2	55 —	22.9 —	✓ 1156D 3Y	230
240 240	50/60 50/60	0-240 0-280	100 100	41.6 48.5	110 —	45.7 —	1156D 6Y	507
480 480	50/60 60	0-480 0-560	28 28	23.3 27.2	28 —	23.3 —	✓ 1256D 3Y	235
480 480	50/60 60	0-480 0-560	56 56	46.6 54.3	56 —	46.6 —	1256D 6Y	507

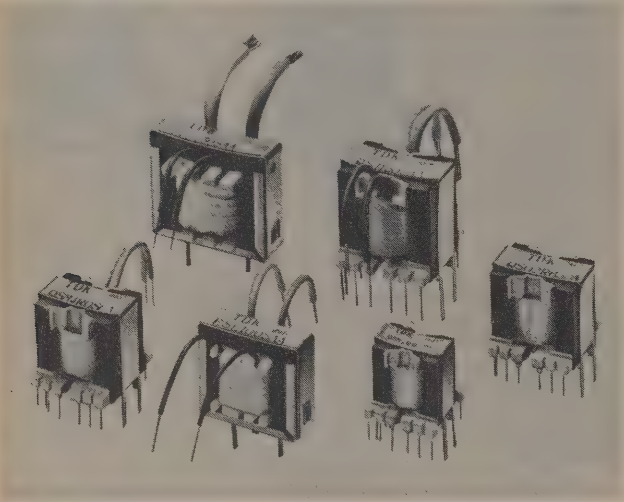
†Also available with open construction. Suffix U when ordering.
§Requires also one paralleling choke type T5000.
§§Requires also one paralleling choke type T6053.

✓ AVAILABLE OFF-THE-SHELF FROM DISTRIBUTOR STOCK

TDK

TRANSFORMERS

POWER TRANSFORMERS



TDK power transformers utilize high performance ferrite cores originally perfected for high reliability switching power supplies. They are designed to operate at a switching frequency of 50 kHz.

FEATURES

1. Conform to UL standards.
2. Compact.
3. Highly efficient.
4. TDK high performance ferrite cores used.

APPLICATIONS

Used in power supplies for circuits incorporating microprocessors and microcomputers such as: calculators, microcomputers, peripherals, games facsimile and copying machines, audio and video equipment, industrial controls and robotics.

Specifications

Input voltage	140 Vdc ±20 V
Switching frequency	50 kHz
Duty	40% max. (max. pulse width; 8 μs)
Circuit type	Single forward converter
Output voltage	Refer to Table
Output current	Refer to Table
Operating temperature range	−10° to 55°C
Insulation class	A type (105°C)
Withstand voltage	2 kV.a.c., 1 mA, 1 minute
Insulation resistance	500 V.d.c., 500 MΩ
Temperature rise	45°C, max.

(Test method conforms to MIL-STD-2025.)

Power transformers (EI core)

Output voltage (V)	E130 (50 kHz 70W)		E140 (50 kHz 150W)		E150 (50 kHz 300W)	
	Rated output current (A)	Part No.	Rated output current (A)	Part No.	Rated output current (A)	Part No.
5	14.0	E130-SE14RSEA	30.0	E140-SE30RSEA	63.0	E150-SC63RSAA
6	11.0	E130-SF11RSEA	26.0	E140-SF26RSEA	54.0	E150-SF54RSAA
9	8.0	E130-SH8R0SEA	17.0	E140-SH17RSEA	35.0	E150-SH35RSAA
12	6.0	E130-SJ6R0SEA	13.0	E140-SJ13RSEA	29.0	E150-SJ29RSAA
15	5.0	E130-SK5R0SDA	10.0	E140-SK10RSEA	24.0	E150-SK24RSAA
20	3.7	E130-SL3R7SDA	8.0	E140-SL8R0SEA	17.0	E150-SL17RSAA
24	3.1	E130-SM3R1SDA	7.0	E140-SM7R0SEA	14.0	E150-SM17RSAA
28	2.5	E130-SN2R5SDA	6.0	E140-SN6R0SEA	13.0	E150-SN13RSAA
36	2.1	E130-SO2R1SDA	4.5	E140-SO4R5SEA	10.0	E150-SO10RSAA
48	1.5	E130-SQ1R5SDA	3.5	E140-SQ3R5SEA	7.0	E150-SQ7R0SAA
Dimensions (mm)	30.0 x 35.5 x 24.0		37.5 x 45.5 x 31.5		46.0 x 53.5 x 37.0	

Power transformers (PQ core)

Output voltage (V)	PQ20/20 (50 kHz 40W)		PQ26/25 (50 kHz 90W)		PQ32/30 (50 kHz 180W)	
	Rated output current (A)	Part No.	Rated output current (A)	Part No.	Rated output current (A)	Part No.
5.0	8.0	PQ20/20-SE8R0SEA	19.0	PQ26/25-SF19RSEA	35.0	PQ32/30-SE35RSAA
6.0	6.5	PQ20/20-SF6R5SEA	15.0	PQ26/25-SF15RSEA	30.0	PQ32/30-SF30RSAA
9.0	4.4	PQ20/20-SH4R4SDA	11.0	PQ26/25-SH11RSEA	22.0	PQ32/30-SH22RSAA
12.0	3.3	PQ20/20SJ3R3SDA	8.5	PQ26/25-SJ8R6SEA	15.0	PQ32/30-SJ15RSAA
15.0	2.7	PQ20/20-SK2R7SDA	6.5	PQ26/25-SK6R5SDA	12.0	PQ32/30-SK12RSAA
20.0	2.1	PQ20/20-SL2R1SDA	5.0	PQ26/25-SL5R0SDA	9.5	PQ32/30-SL9R5SAA
24.0	1.7	PQ20/20-SM1R7SDA	4.3	PQ26/25-SM4R3SDA	8.0	PQ32/30-SM8R0SAA
28.0	1.4	PQ20/20-SN1R4SDA	3.7	PQ26/25-SN3R7SDA	7.5	PQ32/30-SN7R5SAA
36.0	1.1	PQ20/20-SO1R1SDA	2.8	PQ26/25-SO2R8SDA	5.5	PQ32/30-SO5R5SKA
48.0	0.8	PQ20/20-SQRB0SDA	2.2	PQ26/25-SQ2R2SDA	4.0	PQ32/30-SQ4R0SKA
Dimensions (mm)	26.0 x 24.4 x 24.4		30.6 x 29.8 x 30.7		36.3 x 35.5 x 35.4	

TECHNIPOWER® A Penril COMPANY

VARIAC® VARIABLE AUTOTRANSFORMERS

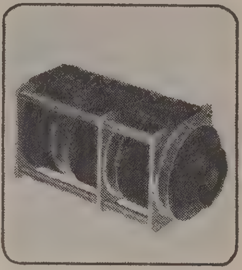
The Industry's Standard for Quality, Performance Reliability and Efficiency. Available in 700 models with more than 1000 possible custom variations to individual "spec." Durable, cool running and overloadable to 1000% short term, they generate output from 0 to line or above line voltages independent of load size or power factors. In single and three phase models, manual and motor driven, with 120, 208, 240 and 480 V outputs plus many current ranges. A special group of militarized "400 Hz" units featuring excellent regulation are included.

SINGLE PHASE VARIAC® AUTOTRANSFORMERS

In 120, 240, 480 V inputs, 50/60 Hz, many with UL and CSA listings and from 2.0-300.0 Amps. Choose from fully enclosed or open designs, in single phase or three phase configurations, 50/60 Hz and 400 Hz models. Connectable in parallel or series and single line.

MANUAL 3-PHASE GANGED VARIAC® AUTOTRANSFORMERS

Control 3-phase power requiring 208, 240 or 480 V inputs. These Variacs come in 208, 240 and 50/60 Hz ratings and in 7.1, 8.5 and 10 Amps. 29 other units permit overvoltage use on an open Delta connection. 14 other models are Y connected. Ball bearings are also included.



MILITARIZED "400 Hz" VARIAC® AUTOTRANSFORMERS

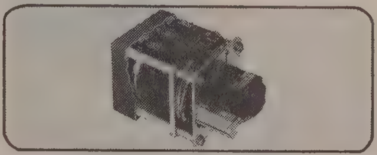
For ruggedized use from 350 to 1200 Hz. With excellent regulation, smaller and lighter than 60 Hz units, they conform to most mil-specs for harsh environments. Single Phase and 3-Phase configurations.

PORTABLE VARIAC® AUTOTRANSFORMERS

Metered, encased and available in 20 models featuring an autotransformer and overload protection. Some have Voltmeters, Ammeters, and Wattmeters. 120 V and 240 V models to 18.0A; 2 and 3 wire versions also offered.

MOTOR DRIVEN VARIAC® AUTOTRANSFORMERS

More than 60 motor driven models, single or ganged. Motors are fully enclosed, 2 phase, gear-reduction, servo types with motor speeds of 2, 4, 8, 16, 32, 64 and 128 secs at 60 Hz. All have ball bearings and adjustable limit switches.



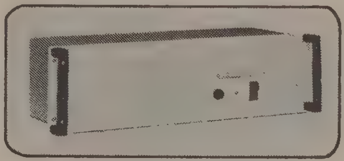
TECHNIPOWER® A Penril COMPANY

VARIAC® AUTOMATIC VOLTAGE REGULATORS

Control Industrial Loads, Encourage Peak Performance While You Protect Sensitive Equipment e.g. computers. Variac Voltage Regulators offer smooth voltage control, have fast response and function up to 10 times the rating for transient surges without power factor restrictions. Particularly suitable to offset brown-out effects and do not introduce distortion or noise. Offered in 5 basic models with over 100 custom variation possibilities.

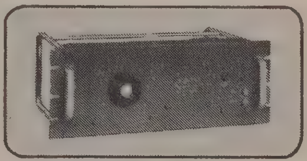
TYPE 1591

Compact 1 kVA with 115 V ratings. Low cost, small and available in portable and rack mounted models.



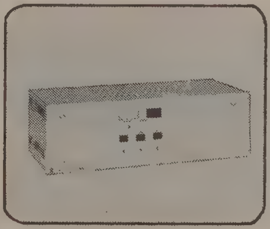
TYPE 1571

Militarized, in 4 models, for use where shock or vibration is encountered. Available in 400 Hz or 50/60 Hz with 115 V outputs, rack mountable. 5.8 kVA.



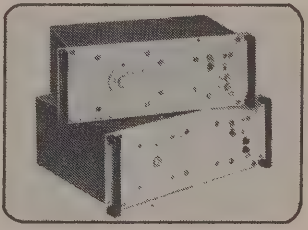
TYPE 1592

Provides proper voltage for long term operation — remotely programmable. In 2 models, capacity to 5.3 kVA, handle 120-480 V and are used in single and three-phase applications.



TYPES 1581 and 1582

High capacity. Automatically compensate for line voltage fluctuations. 115 V and 230 V models, 19.7 kVA capacities. For industrial and lab use e.g. computers, transmitters and critical processes.



POWER SUPPLIES

See EEM Page 3•1789 For Technipower Mil-Qual Encapsulated and Open Frame Modular Power Sources — Companion Models to Variac® Autotransformers and Voltage Regulators.

You'll Think They're Custom Built

Send for Complete Catalog

TECHNIPOWER®
A Penril COMPANY
P.O. Box 222, Commerce Park, Danbury, CT 06810
Tel: (203) 748-7001 TWX: 710-456-9280

DEFLECTION YOKE

THORDARSON

THORDARSON CRT Display Products utilize advance design and construction techniques which meet or exceed all applicable standards. Development and production capabilities located in Mt. Carmel and Robinson, Illinois, are devoted primarily to producing custom requirements as well as standard flybacks and yokes for CRT Display and related applications

We invite you to send us your specifications for deflection yokes and/or high voltage transformers (flybacks). We'll send you a professionally designed prototype. Our engineering staff wants to work with you to design transformers for your special projects.

20mm 90° Yoke With Adjustable Magnets (monochrome)

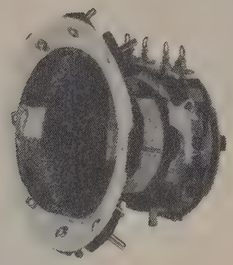
Applications for this yoke and the 29mm 110°·

- CAD/CAM Display Terminals
- Data Display Terminals
- Video Monitors
- Military Defense Terminals
- Instruments With CRT Displays
- Specific Custom Applications

29mm 110° Yoke With Adjustable Magnets (monochrome)

Features for this yoke and the 20mm 90°·

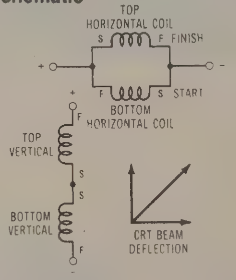
- Adjustable Magnets Are Standard For Geometric Corrections
- Adapts to Any Size CRT
- High Resolution And Excellent Focus
- Frequency Up To 64 kHz
- Built to Customer Specifications
- Excellent Performance and Reliability
- Available With or Without Lead Wire
- Produced and Serviced in U.S.A.



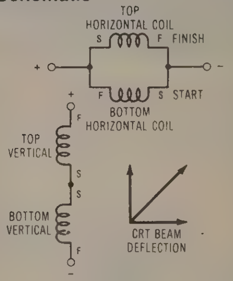
20mm 90°

29mm 110°

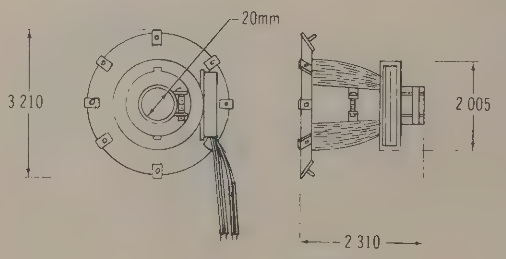
20mm 90° Yoke Schematic


TOP
HORIZONTAL COIL
S
F
FINISH
+
-
+
F
S
START
BOTTOM
HORIZONTAL COIL
F
TOP
VERTICAL
S
S
BOTTOM
VERTICAL
F
-
CRT BEAM
DEFLECTION

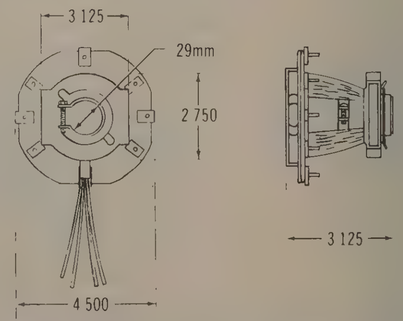
29mm 110° Yoke Schematic


TOP
HORIZONTAL COIL
S
F
FINISH
+
-
+
F
S
START
BOTTOM
HORIZONTAL COIL
F
TOP
VERTICAL
S
S
BOTTOM
VERTICAL
F
-
CRT BEAM
DEFLECTION

Dimensional Diagram


20mm
3 210
2 005
2 310

Dimensional Diagram


3 125
29mm
2 750
3 125
4 500

THORDARSON MEISSNER INC.

628 Belmont St. • Mt Carmel IL 62863 • (618) 262-5121 TWX 510-525-2254

DEFLECTION YOKES AND HIGH VOLTAGE TRANSFORMERS (FLYBACK)

THORDARSON

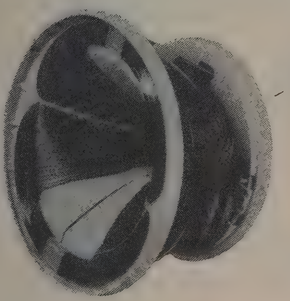
37mm 90° Color Yokes

Applications:
- CAD/CAM Display Terminals
- Data Display Terminals
- Military Defense Terminals
- Video Monitors
- Instruments With CRT Displays
- Special Custom Applications

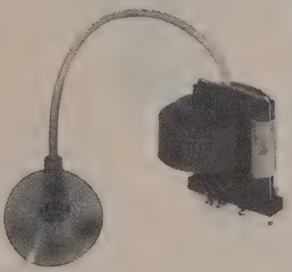
Features:
- Adapts to Any Size CRT
- Good Convergence and Color Purity
- Built To Customer Specifications
- Excellent Performance and Reliability
- Produced and Serviced in U.S.A.

Fully Integrated Sweep, Horizontal Output Transformers

Features:
- Epoxy or Silicon Encapsulated
- Frequency Up To 32 kHz
- Retrace Time As Low As 5.5μ secs.
- Footprint Styles – Delta, Rectangular, Custom, "T" Print see pg. 20.
- Built to Customer Specification
- Excellent Performance and Reliability
- Produced and Serviced in U.S.A.

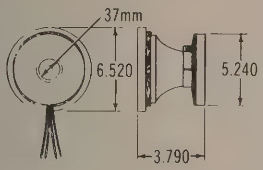

Standard Color 37mm 90°

Compact Color 37mm 90°

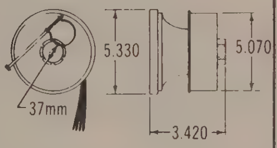

Fully Integrated With Doubler

Diodes and Bleeder Resistor

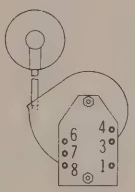
37mm 90° Standard Color Dimensions


37mm
6.520
5.240
3.790

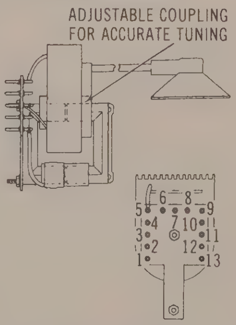
37mm 90° Compact Color Dimensions


5.330
5.070
37mm
3.420

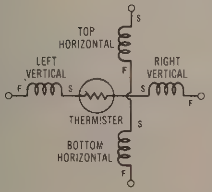
Fully Integrated With Doubler Encapsulated in Epoxy



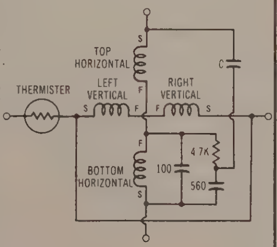
Diodes and Bleeder Resistor Fully Encapsulated


ADJUSTABLE COUPLING
FOR ACCURATE TUNING
6
8
5
9
4
7
10
3
11
2
12
1
13

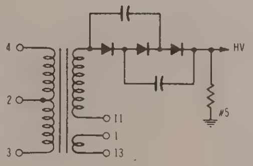
Typical Circuit


S
TOP HORIZONTAL
F
LEFT VERTICAL
F
S
THERMISTER
S
RIGHT VERTICAL
F
S
BOTTOM HORIZONTAL
F

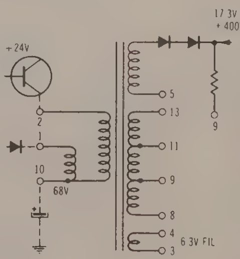
Typical Circuit


S
TOP HORIZONTAL
C
THERMISTER
LEFT VERTICAL
S
F
F
RIGHT VERTICAL
F
S
F
BOTTOM HORIZONTAL
S
100
4 7K
560

Schematic


4
2
3
HV
11
1
13
#5

Schematic


17 3V
+ 400V
+ 24V
5
13
9
2
1
11
10
68V
9
8
4
3
6 3V FIL

THORDARSON MEISSNER INC.

628 Belmont St. • Mt. Carmel, IL 62863 • (618) 262-5121 TWX 510-525-2254

HIGH VOLTAGE TRANSFORMERS (FLYBACK)

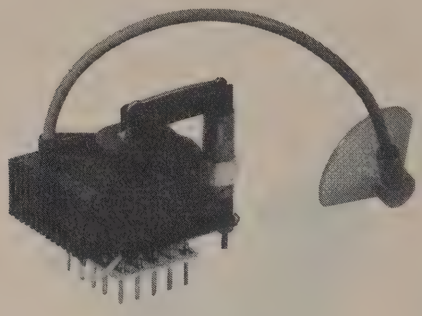
THORDARSON

Standard Sweep, Horizontal Output Transformers

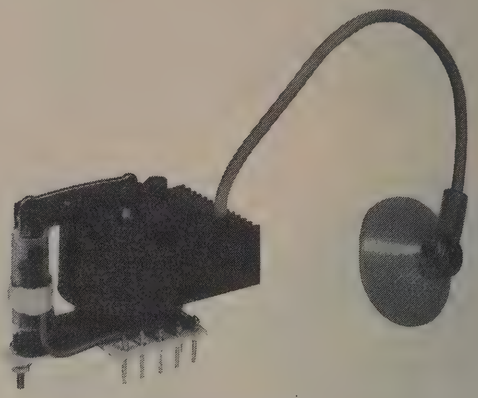
Features:
- Epoxy or Silicon Encapsulated
- Frequency Up to 32 kHz
- Retrace Time down to 5.5μ sec.
- Footprint Styles – Delta, Rectangular, Custom, "T" Print
- Built to Customer Specification
- Excellent Performance and Reliability
- Produced and Serviced in U.S.A.

If your footprint requirements do not match our standards, contact us with your specific specifications. We custom design to fit your project.

We invite you to send us your specifications for high voltage transformers (flybacks) and/or deflection yokes. We will send you a professionally designed prototype. Our engineering staff wants to work with you to design transformers for your special projects.

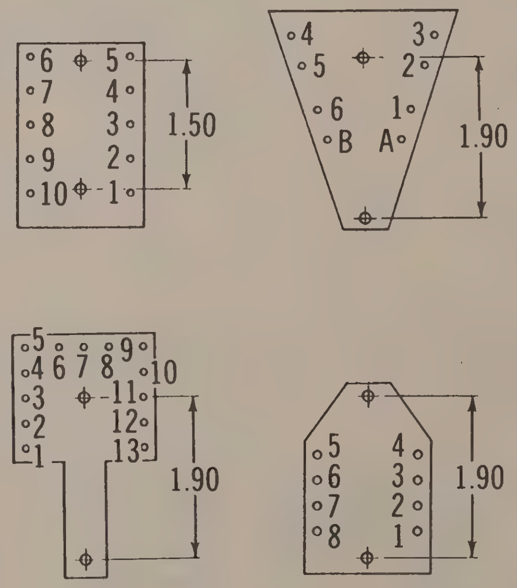


Silicon Encapsulated

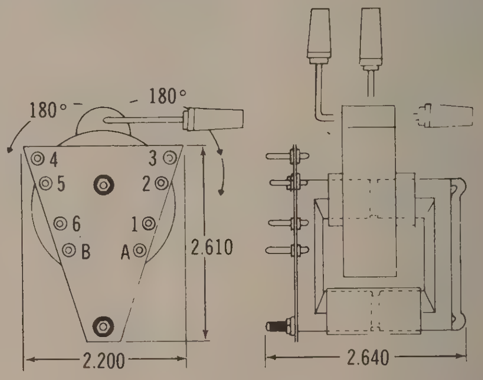


Epoxy Encapsulated

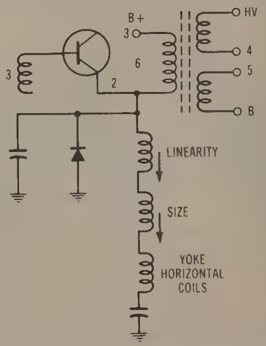
Terminal Board Standards (Footprints)


6
5
7
4
8
3
9
2
10
1
1.50
4
3
5
2
6
1
B
A
1.90
5
9
4
6
7
8
10
3
11
2
12
1
13
1.90
5
4
6
3
7
2
8
1
1.90

Flyback Outline Dimensions


180°
180°
4
3
5
2
6
1
B
A
2.610
2.200
2.640

Typical Circuit

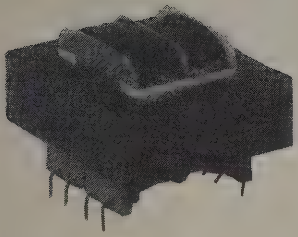

B+
3
HV
4
5
B
6
3
2
LINEARITY
SIZE
YOKE
HORIZONTAL
COILS

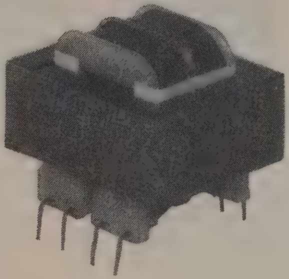
THORDARSON MEISSNER INC.
628 Belmont St. • Mt. Carmel, IL 62863 • (618) 262-5121 TWX 510-525-2254

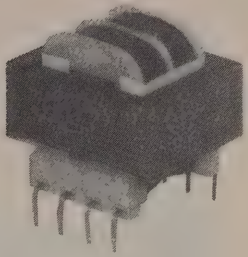
MINI-ISO-MITES

THORDARSON

Low-Voltage Printed Circuit Plug-In Power Transformers



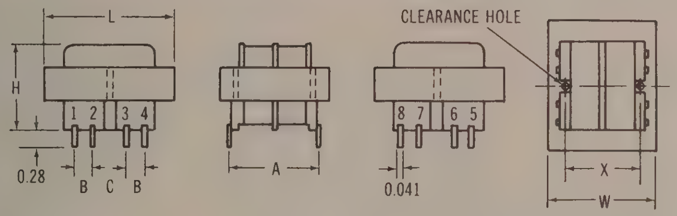




The MINI-ISO-MITES are low voltage, plug-in, power transformers added to THORDARSON'S printed circuit line. The Mini-Iso-Mite series are designed for ANY low voltage power supply application where tight space restrictions are a consideration. The single 115V or the dual 115/230V primaries and secondaries are wound non-concentrically meaning, side by side. This construction results in smaller units and eliminates the need for costly electro-static shielding.

The Mini-Iso-Mites are highly isolated units with 2500 HIPOT standard and are built to MIL-T-27 specifications.

The power ratings are: 2.4VA, 6VA, 12VA, 20VA, and 36VA. The tallest of the series is 1⁹⁄₁₆ inches and the smallest is 1³⁄₁₆ inches.



VA Size	H	L	W	X	A	B	C	Wt.
2.4	1.1875	1.375	1.1250	—	1.200	0.250	0.250	0.25
6	1.3125	1.625	1.3125	1.0625	1.280	0.250	0.350	0.44
12	1.4375	1.875	1.5626	1.2500	1.410	0.300	0.400	0.70
20	1.4375	2.250	1.8750	1.5000	1.600	0.300	0.400	0.80
36	1.5625	2.625	2.1875	—	1.850	0.400	0.400	1.10

Part Number			Secondary RMS Ratings	
Single 115V 6 Pin	Dual 115/230V 8 Pin	VA	Series	Parallel
MIM 421	MIM 420	2.4	10V CT @ 0.25A	5V @ 0.5A
MIM 423	MIM 422	2.4	12.6V CT @ 0.2A	6.3V @ 0.4A
MIM 425	MIM 424	2.4	16V CT @ 0.15A	8V @ 0.3A
MIM 427	MIM 426	2.4	20V CT @ 0.12A	10V @ 0.24A
MIM 429	MIM 428	2.4	24V CT @ 0.1A	12V @ 0.2A
MIM 431	MIM 430	2.4	28V CT @ 0.085A	14V @ 0.17A
MIM 433	MIM 432	2.4	26V CT @ 0.065A	18V @ 0.13A
MIM 435	MIM 434	2.4	48V CT @ 0.05A	24V @ 0.1A
MIM 437	MIM 436	2.4	56V CT @ 0.045A	28V @ 0.09A
MIM 439	MIM 438	2.4	120V CT @ 0.02A	60V @ 0.04A
MIM 521	MIM 520	6	10V CT @ 0.6A	5V @ 1.2A
MIM 523	MIM 522	6	12.6V CT @ 0.5A	6.3V @ 1A
MIM 525	MIM 524	6	16V CT @ 0.4A	8V @ 0.8A
MIM 527	MIM 526	6	20V CT @ 0.3A	10V @ 0.6A
MIM 529	MIM 528	6	24V CT @ 0.25A	12V @ 0.5A
MIM 531	MIM 530	6	28V CT @ 0.2A	14V @ 0.4A
MIM 533	MIM 532	6	36V CT @ 0.17A	18V @ 0.34A
MIM 535	MIM 534	6	48V CT @ 0.125A	24V @ 0.25A
MIM 537	MIM 536	6	56V CT @ 0.11A	28V @ 0.22A
MIM 539	MIM 538	6	120V CT @ 0.05A	60V @ 0.1A
MIM 621	MIM 620	12	10V CT @ 12A	5V @ 2.4A
MIM 623	MIM 622	12	12.6V CT @ 1A	6.3V @ 2A
MIM 625	MIM 624	12	16V CT @ 0.8A	8V @ 1.6A
MIM 627	MIM 626	12	20V CT @ 0.6A	10V @ 1.2A
MIM 629	MIM 628	12	24V CT @ 0.5A	12V @ 1A

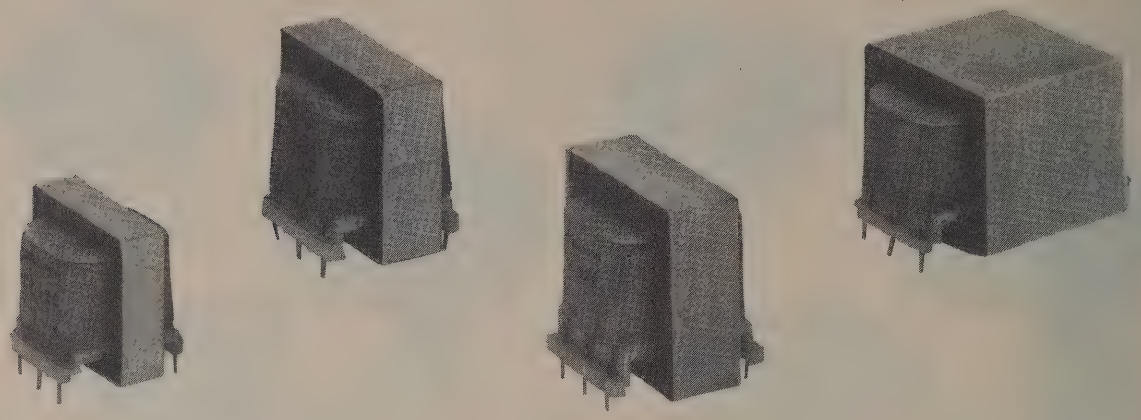
Part Number			Secondary RMS Ratings	
Single 115V 6 Pin	Dual 115/230V 8 Pin	VA	Series	Parallel
MIM 631	MIM 630	12	28V CT @ 0.42A	14V @ 0.84A
MIM 633	MIM 632	12	36V CT @ 0.35A	18V @ 0.7A
MIM 635	MIM 634	12	48V CT @ 0.25A	24V @ 0.5A
MIM 637	MIM 636	12	56V CT @ 0.22A	28V @ 0.44A
MIM 639	MIM 638	12	120V CT @ 0.1A	60V @ 0.2A
MIM 720	MIM 721	20	10V CT @ 2000 mA	5V @ 4A
MIM 722	MIM 723	20	12.6V CT @ 1600 mA	6.3V @ 3.2A
MIM 724	MIM 725	20	16V CT @ 1250 mA	8V @ 2.5A
MIM 726	MIM 727	20	20V CT @ 1000 mA	10V @ 2A
MIM 728	MIM 729	20	24V CT @ 800 mA	12V @ 1.6A
MIM 730	MIM 731	20	28V CT @ 700 mA	14V @ 1.4A
MIM 732	MIM 733	20	36V CT @ 550 mA	18V @ 1.1A
MIM 734	MIM 735	20	48V CT @ 400 mA	24V @ 0.8A
MIM 736	MIM 737	20	56V CT @ 350 mA	28V @ 0.7A
MIM 738	MIM 739	20	120V CT @ 160 mA	60V @ 0.32A
MIM 820	MIM 821	36	10V CT @ 3600 mA	5V @ 7.2A
MIM 822	MIM 823	36	12.6V CT @ 2850 mA	6.3V @ 5.7A
MIM 824	MIM 825	36	16V CT @ 2250 mA	8V @ 4.5A
MIM 826	MIM 827	36	20V CT @ 1800 mA	10V @ 3.6A
MIM 828	MIM 829	36	24V CT @ 1500 mA	12V @ 3.0A
MIM 830	MIM 831	36	28V CT @ 1300 mA	14V @ 2.6A
MIM 832	MIM 833	36	36V CT @ 1000 mA	18V @ 2A
MIM 834	MIM 835	36	48V CT @ 750 mA	24V @ 1.5A
MIM 836	MIM 837	36	56V @ 650 mA	28V @ 1.3A
MIM 838	MIM 839	36	120V CT @ 300 mA	60V @ 0.6A

THORDARSON MEISSNER INC.
628 Belmont St. • Mt. Carmel, IL 62863 • (618) 262-5121 TWX 510-525-2254

MINIATURE TRANSFORMERS

THORDARSON

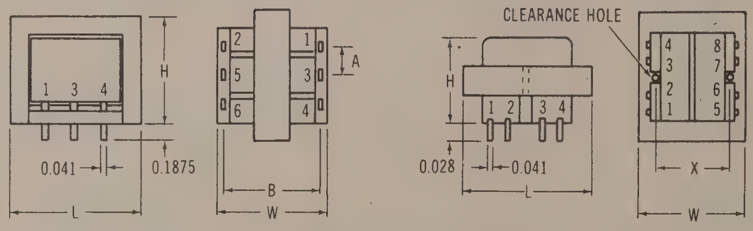
Printed Circuit Plug-In Power Miniature Transformers



Thordarson's new step down PCP transformer series is utilized in miniaturized equipment. 1.2, 4.4, 10, and 24 VA sizes are available.

All THORDARSON transformers are thoroughly impregnated and built to MIL-T-27 specifications to insure quality products.

The six and eight plug-in terminal pins are precisely placed with consistency for ease in mounting. The smallest of the PCP series is 3 oz., with a height of 1$^{3}/_{16}$ inches. The largest unit weighs 12 oz., and is 1$^{3}/_{8}$ inches in height. Additional statistical information is contained in the charts.



VA Size	W	L	H	A	B	Oz.
1.2	1.125	1.375	1.125	0.312	1.000	3
4.4	1.226	1.625	1.312	0.400	1.100	5
10	1.426	1.875	1.562	0.400	1.300	9
24	2.226	1.625	1.312	0.400	2.100	12

Part Number			Secondary RMS Ratings	
Single 115V	Dual 115/230V	VA	Series S*	Parallel P*
PCP 150	PCP 151	1.2	10V CT @ 120 mA	5V @ 0.240A
PCP 152	PCP 153	1.2	12.6V CT @ 100 mA	6.3V @ 0.200A
PCP 162	PCP 163	1.2	16V CT @ 75 mA	8V @ 0.150A
PCP 182	PCP 183	1.2	24V CT @ 50 mA	12V @ 0.100A
PCP 192	PCP 193	1.2	28V CT @ 40 mA	14V @ 0.080A
PCP 202	PCP 203	1.2	34V CT @ 35 mA	17V @ 0.070A
PCP 212	PCP 213	1.2	40V CT @ 30 mA	20V @ 0.060A
PCP 222	PCP 223	1.2	56V CT @ 20 mA	28V @ 0.040A
PCP 232	PCP 233	1.2	120V CT @ 10 mA	60V @ 0.020A
PCP 160	PCP 161	4.4	10V CT @ 440 mA	5V @ 0.880A
PCP 154	PCP 155	4.4	12.6V CT @ 350 mA	6.3V @ 0.700A
PCP 164	PCP 165	4.4	16V CT @ 260 mA	8V @ 0.520A
PCP 184	PCP 185	4.4	24V CT @ 180 mA	12V @ 0.360A
PCP 194	PCP 195	4.4	28V CT @ 180 mA	14V @ 0.320A
PCP 204	PCP 205	4.4	34V CT @ 125 mA	17V @ 0.250A
PCP 214	PCP 215	4.4	40V CT @ 110 mA	20V @ 0.220A
PCP 224	PCP 225	4.4	56V CT @ 80 mA	28V @ 0.160A
PCP 234	PCP 235	4.4	120V CT @ 35 mA	60V @ 0.070A

Part Number			Secondary RMS Ratings	
Single 115V	Dual 115/230V	VA	Series S*	Parallel P*
PCP 170	PCP 171	10	10V CT @ 1000 mA	5V @ 2A
PCP 156	PCP 157	10	12.6V CT @ 800 mA	6.3V @ 1.60A
PCP 166	PCP 167	10	16V CT @ 640 mA	8V @ 1.28A
PCP 186	PCP 187	10	24V CT @ 450 mA	12V @ 0.900A
PCP 196	PCP 197	10	28V CT @ 360 mA	14V @ 0.720A
PCP 206	PCP 207	10	34V CT @ 300 mA	17V @ 0.600A
PCP 216	PCP 217	10	40V CT @ 250 mA	20V @ 0.500A
PCP 226	PCP 227	10	56V CT @ 180 mA	28V @ 0.360A
PCP 236	PCP 237	10	120V CT @ 85 mA	60V @ 0.170A
PCP 180	PCP 181	24	10V CT @ 2400 mA	5V @ 4.8A
PCP 158	PCP 159	24	12.6V CT @ 2A	6.3V @ 4A
PCP 168	PCP 169	24	16V CT @ 1.5A	8V @ 3A
PCP 188	PCP 189	24	24V CT @ 1A	12V @ 2A
PCP 198	PCP 199	24	28V CT @ 800 mA	14V @ 1.6A
PCP 208	PCP 209	24	34V CT @ 700 mA	17V @ 1 4A
PCP 218	PCP 219	24	40V CT @ 600 mA	20V @ 1.2A
PCP 228	PCP 229	24	56V CT @ 420 mA	28V @ 0.840A
PCP 238	PCP 239	24	120V CT @ 200 mA	60V @ 0.400A

* Note: V_S is a series hookup; V_P is a parallel hookup.

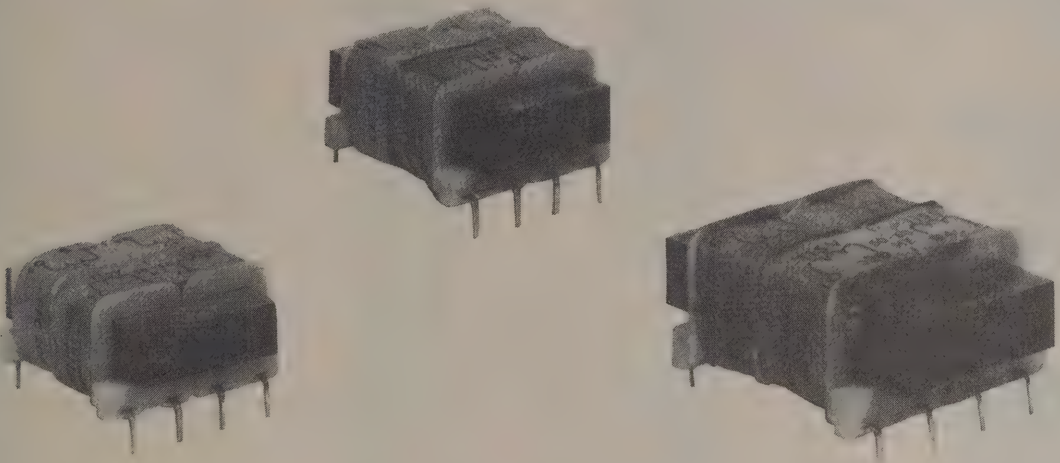
THORDARSON MEISSNER INC.

628 Belmont St. • Mt. Carmel, IL 62863 • (618) 262-5121 TWX 510-525-2254

FLAT COMPACT TRANSFORMERS

THORDARSON

FLAT COMPACT Printed Circuit Power Transformers



Sleek design: The 6VA FLAT COMPACT permits 1 inch card spacing and is 0.850 inches high. The 12VA model permits 1¼ inch card spacing and is 1.065 inches high.

The electro-static shield has been removed. Why? It incorporates non-concentric windings which means the secondary is located next to the primary instead of being wound directly over it. The high isolation has diminished the capacitance between windings.

1500 V RMS HIPOT: High isolation is a standard feature.

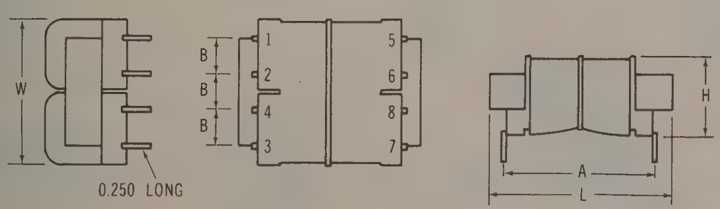
The FLAT COMPACT Transformer was created for use in ANY low voltage application where space is critical. For single or dual output DC supplies and isolated control circuits and reference supplies, use the FLAT COMPACT.

Part Number	VA Size	Secondary*	
		Series	Parallel
PFC 202	6	10V CT @ 600 mA	5V @ 1.2A
PFC 212	6	12.6V CT @ 450 mA	6.3V @ 0.9A
PFC 222	6	16V CT @ 350 mA	8V @ 0.7A
PFC 232	6	20V CT @ 300 mA	10V @ 0.6A
PFC 242	6	24V CT @ 250 mA	12V @ 0.5A
PFC 192	6	30V CT @ 200 mA	15V @ 0.4A
PFC 252	6	34V CT @ 170 mA	17V @ 0.34A
PFC 262	6	40V CT @ 150 mA	20V @ 0.3A
PFC 272	6	56V CT @ 100 mA	28V @ 0.2A
PFC 282	6	88V CT @ 65 mA	44V @ 0.13A
PFC 292	6	120V CT @ 50 mA	60V @ 0.1A
PFC 302	6	230V CT @ 25 mA	115V @ 0.05A

Part Number	VA Size	Secondary*	
		Series	Parallel
PFC 204	12	10V CT @ 1200 mA	5V @ 2.4A
PFC 214	12	12.6V CT @ 900 mA	6.3V @ 1.8A
PFC 224	12	16V CT @ 700 mA	8V @ 1.4A
PFC 234	12	20V CT @ 600 mA	10V @ 1.2A
PFC 244	12	24V CT @ 500 mA	12V @ 1.0A
PFC 294	12	30V CT @ 400 mA	15V @ 0.8A
PFC 254	12	34V CT @ 340 mA	17V @ 0.68A
PFC 264	12	40V CT @ 300 mA	20V @ 0.6A
PFC 274	12	56V CT @ 200 mA	28V @ 0.4A
PFC 284	12	88V CT @ 130 mA	44V @ 0.26A
PFC 324	12	120V CT @ 100 mA	60V @ 0.2A
PFC 334	12	230V CT @ 50 mA	115V @ 0.1A

* Regulation of size 6 units is 30%, i.e., no load secondary voltage is 30% higher than full load. Regulation of size 12 units is 20%.

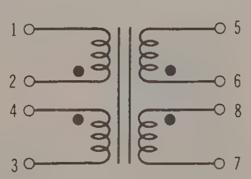
DIMENSIONAL DIAGRAM



VA Size	L	W	H	A	B	Oz.
6	1.875	1.5625	0.850	1.600	0.375	7
12	2.500	2.0000	1.065	2.000	0.500	11

DUAL PRIMARIES

115/230V, 50/60Hz



THORDARSON MEISSNER INC.

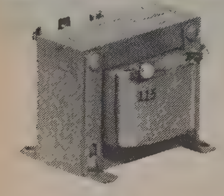
628 Belmont St. • Mt. Carmel, IL 62863 • (618) 262-5121 TWX 510-525-2254

TODD ENGINEERED

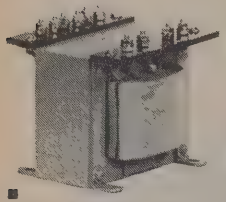
- NAME PLATES
- WIRING DIAGRAMS

HIGH CURRENT TRANSFORMERS

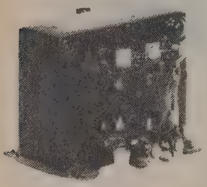
- 45° TEMP. RISE
- MINIMUM REGULATION



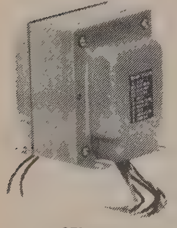
STYLE B



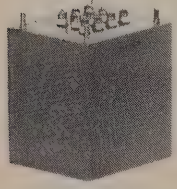
STYLE B (OVER 700 VA)



STYLE BE



STYLE V



STYLE CM

SECONDARY VOLTS TAP VOLTS	PART NO.	PRIMARY VOLTS 50-500 Hz	RATING VA	SECONDARY AMPS (RMS) SERIES HOOKUP	SECONDARY AMPS (RMS) PARALLEL HOOKUP
10 VOLTS Series 2.5 - 5 - 7.5 - 10 Parallel 2.5 - 5	10 02	115	20	2	4
	10 05	115	50	5	10
	10 10	115	100	10	20
	10 20	115	200	20	40
12.6 VOLTS Series 3.1 - 6.3 - 9.4 - 12.6 Parallel 3.1 - 6.3	12 02	115	24	2	4
	12 05	115	60	5	10
	12 10	115	120	10	20
	12 20	115	240	20	40
24 VOLTS Series 6 - 12 - 18 - 24 Parallel 6 - 12	24 01	115	24	1	2
	24 02	115	48	2	4
	24 04	115	96	4	8
	24 06	115	144	6	12
	24 08	115	192	8	16
	24 12	105, 115, 125	288	12	24
	24 20	105, 115, 125	480	20	40
	24 25	105, 115, 125	600	25	50
	24 30	105, 115, 125	720	30	60
	24 50	105, 115, 125	1200	50	100
	24 100	115, 230	2400	100	200
36 VOLTS Series 9 - 18 - 27 - 36 Parallel 9 - 18	36 00	115	18	0.5	1
	36 01	115	36	1	2
	36 02	115	72	2	4
	36 04	115	144	4	8
	36 06	115	216	6	12
	36 08	105, 115, 125	288	8	16
	36 12	105, 115, 125	432	12	24
	36 20	105, 115, 125	720	20	40
	36 25	105, 115, 125	900	25	50
	36 30	105, 115, 125	1080	30	60
	36 50	115, 230	1800	50	100
	36 100	115, 230	3600	100	200
56 VOLTS Series 14 - 28 - 42 - 56 Parallel 14 - 28	56 00	115	28	0.5	1
	56 01	115	56	1	2
	56 02	115	112	2	4
	56 04	115	224	4	8
	56 06	115	336	6	12
	56 08	105, 115, 125	448	8	16
	56 12	105, 115, 125	672	12	24
	56 25	105, 115, 125	1400	25	50
	56 50	115, 230	2800	50	100
	56 100	115, 230	5600	100	200
64 VOLTS Series 16 - 32 - 48 - 64 Parallel 16 - 32	64 00	115	32	0.5	1
	64 01	115	64	1	2
	64 02	115	128	2	4
	64 04	115	256	4	8
	64 06	115	384	6	12
	64 08	105, 115, 125	512	8	16
	64 12	105, 115, 125	768	12	24
	64 25	105, 115, 125	1600	25	50
	64 50	115, 230	3200	50	100
80 VOLTS Series 20 - 40 - 60 - 80 Parallel 20 - 40	80 00	115	40	0.5	1
	80 01	115	80	1	2
	80 02	115	160	2	4
	80 05	115	400	5	10
	80 10	105, 115, 125	800	10	20
	80 25	115, 230	2000	25	50
	80 50	115, 230	4000	50	100
120 VOLTS Series 30 - 60 - 90 - 120 Parallel 30 - 60	120 00	115	60	0.5	1
	120 01	115	120	1	2
	120 02	115	240	2	4
	120 04	115	480	4	8
	120 08	105, 115, 125	960	8	16
	120 12	105, 115, 125	1400	12	24
	120 20	105, 115, 125	2400	20	40
180 VOLTS Series 45 - 90 - 135 - 180 Parallel 45 - 90	180 00	115	90	0.5	1
	180 01	115	180	1	2
	180 02	115	360	2	4
	180 05	115	640	5	10
	180 10	105, 115, 125	1800	10	20
230 VOLTS Series 57.5 - 115 - 172.5 - 230 Parallel 57.5 - 115	230 00	115	115	0.5	1
	230 01	115	230	1	2
	230 02	115	460	2	4
	230 05	105, 115, 125	1150	5	10
	230 08	115, 230	1840	8	16
300 VOLTS Series 75 - 150 - 225 - 300 Parallel 175 - 150	300 00	115	150	0.5	1
	300 01	115	300	1	2
	300 02	115	600	2	4
	300 05	105, 115, 125	1500	5	10

FOUR STYLES STOCKED IN DEPTH

DC TO RMS CONVERSION CHART

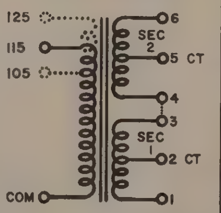
SECONDARY RMS CURRENT = DC CURRENT × FACTOR BELOW

	Choke Input Filter or Inductive Load	Resistive Load	Capacitor Input Filter or Capacitive Load
FULL WAVE BRIDGE	1.0	1.0	1.8
FULL WAVE C.T.	.7	1.0	1.15

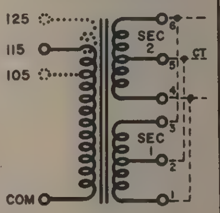
CERTIFIED DATA AVAILABLE

CUSTOM VARIATIONS QUOTED PROMPTLY

SERIES HOOKUP



PARALLEL HOOKUP



TODD SYSTEMS "HIGH CURRENT TRANSFORMERS & CHOKES" are designed for use in high power rectifier circuits, and high current A.C. applications. "TODD ENGINEERED" designs feature a nominal temperature rise of 45°C., at full load, thus providing outstanding overload capacity. All designs utilize extremely low regulation, varying from 10% in the smallest to 1% in the larger units. Four styles . . . select the type best suited for your lab, test rigs, OEM or production equipment

DATA SUBJECT TO CHANGE WITHOUT NOTICE

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED PRECISION BUILT

TODD SYSTEMS INC.

50 ASH STREET, DEPT. EM YONKERS, NY, U.S.A. 10701 (914) 963-3400

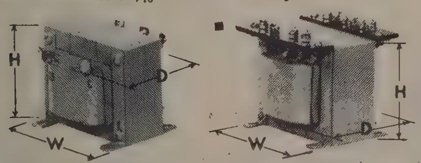
TODD ENGINEERED

HIGH CURRENT TRANSFORMERS

MECHANICAL SPECIFICATIONS ············ SPECIFY STYLE REQUIRED

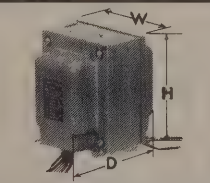
	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE)						• FULLY MTD. SHELLS (STYLE V)						• HERMETIC SEALED MIL-T (STYLE CM)						
PART NO.	H	W	D	MW	MD	WGT.	H	W	D	MW	MD	WGT.	H	W	D	MW	MD	WGT.	PART NO.
10 02	2½	3	2⅛	2½	1½	1¼	3	2½	2¼	2	1¼	1¼	3¹³⁄₁₆	3½	3	2⅝	2⅛	2⅛	10 02
10 05	2½	3	2⅝	2½	2⅛	2½	3	2½	2⅞	2	1⅞	2½	3¹³⁄₁₆	3½	3	2⅝	2⅛	3½	10 05
10 10	3⅛	3¾	3¼	3⅛	2⅜	4¼	3⅞	3¼	3⅝	2½	2⅜	4¾	4⁷⁄₁₆	4½	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	6½	10 10
10 20	3¾	4½	3⅞	3¾	2⅝	8¼	4½	3¾	4⅛	3	3	8¾	5⁷⁄₁₆	5	4¼	4¹⁄₁₆	3⁵⁄₁₆	12	10 20
12 02	2½	3	2⅛	2½	1⅝	1½	3⅛	2½	2⅜	2	1¼	1¾	3¹³⁄₁₆	3½	3	2⅝	2⅛	2¾	12 02
12 05	2½	3	3	2½	2⅜	3	3⅛	2½	3⅛	2	2	3¼	3¹³⁄₁₆	3½	3	2⅝	2⅛	4¾	12 05
12 10	3¼	3¾	3⅝	3⅛	2⅛	5¼	3⅞	3¼	3⅝	2½	2½	5¼	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	7½	12 10
12 20	3¾	4½	4⅛	3¾	2¾	9	4½	3¾	4¼	3	3⅛	9½	6¼	5¾	4⅞	4⅜	3½	12½	12 20
24 01	2½	3	2⅛	2½	1¾	1¾	3⅛	2½	2⅝	2	1½	2¼	3¹³⁄₁₆	3½	3	2⅝	2⅛	3⅜	24 01
24 02	2½	3	2½	2½	2	2¼	3⅛	2½	2⅞	2	1¾	2½	3¹³⁄₁₆	3½	3	2⅝	2⅛	3¾	24 02
24 04	3⅛	3¾	3⅜	3⅛	2⅛	4¼	3¾	3⅛	3⅜	2½	2⅛	4¼	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	6¼	24 04
24 06	3½	4⅛	3⅜	3⁷⁄₁₆	2⁵⁄₁₆	6¼	4⅛	3½	3⅝	2¾	2½	6¾	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	9½	24 06
24 08	3½	4⅛	4	3⁷⁄₁₆	3	9	4¼	3½	4⅜	2¾	3⅜	8½	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	11½	24 08
24 12	3¾	4½	4⅞	3¾	3⅜	12	4½	3¾	5	3	3¾	12½	5⁷⁄₁₆	5	4¼	4¹⁄₁₆	3⁵⁄₁₆	16	24 12
24 20	4⅜	5¼	5	4⅜	3½	16½	5¼	4⅜	5½	3½	3⅞	17	6¼	5¾	4⅞	4⅜	3½	22	24 20
24 25	4⅜	5¼	5⅝	4⅜	3⅞	19½	5¼	4⅜	6	3½	4⅜	20	6¼	5¾	4⅞	4⅜	3½	24½	24 25
24 30	■ 4⅜	5¼	6	4⅜	4⅜	21¼	5¼	4⅜	6⅜	3½	4¾	22	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	27½	24 30
24 50	■ 5⅜	6⅜	6⅜	5⁵⁄₁₆	5⅜	39	6½	5½	7⅜	4¼	5⁵⁄₁₆	43	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	52	24 50
24 100	■ 6⅛	7¹⁄₁₆	8	5⅞	6½	64							8¾	8	6¾	6¾	5½	74	24 100
36 00	2³⁄₁₆	2⅝	1⅜	2³⁄₁₆	1½	1	2¾	2¼	2¼	1¾	1½	1¼	3¹³⁄₁₆	3½	3	2⅝	2⅛	2	36 00
36 01	2½	3	2⅛	2½	1⅞	1⅞	3⅛	2½	2¾	2	1⅝	2	3¹³⁄₁₆	3½	3	2⅝	2⅛	3	36 01
36 02	2⅞	3⅜	2¾	2¹³⁄₁₆	2¼	3¼	3½	2⅞	3¼	2¼	2³⁄₁₆	3⅝	4¼	3⅞	3⁵⁄₁₆	3	2⁷⁄₁₆	5¼	36 02
36 04	3½	4⅛	3½	3⁷⁄₁₆	2½	6¾	4¼	3½	4	2¾	2⅞	6¾	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	9½	36 04
36 06	3¾	4½	4¼	3¾	2⅝	8¼	4⅝	3⅞	4⅛	3	2⅞	9¼	5⁷⁄₁₆	5	4¼	4¹⁄₁₆	3⁵⁄₁₆	13	36 06
36 08	3¾	4½	5⅛	3¾	3½	12½	4⅝	3⅞	5	3	3⅞	12¼	5⁷⁄₁₆	5	4¼	4¹⁄₁₆	3⁵⁄₁₆	17	36 08
36 12	4⁷⁄₁₆	5¼	5¼	4⅜	3⅝	16¾	5½	4½	5¾	3½	4¹⁄₁₆	17¼	6¼	5¾	4⅞	4⅜	3½	22	36 12
36 20	■ 5⅜	6⅜	4⅝	5⁵⁄₁₆	3¾	24	6½	5½	5¾	4¼	3¾	25	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	31	36 20
36 25	■ 5⅜	6⅜	5½	5⁵⁄₁₆	4	30	6½	5½	6	4¼	4	28	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	34	36 25
36 30	■ 5⁵⁄₁₆	6⅜	6	5⁵⁄₁₆	4¾	33	6½	5½	6¾	4¼	4¾	36	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	43	36 30
36 50	■ 6¼	7¹⁄₁₆	7½	5⅞	6⅛	55							8¼	7⁹⁄₁₆	6⅝	5¹³⁄₁₆	4¾	61	36 50
36 100	■ 7½	9	9	7½	7	105													36 100
56 00	2¹³⁄₁₆	2⅝	1½	2¹³⁄₁₆	1⅝	1¼	2¾	2¼	2⅜	1¾	1¾	1⅝	3¹³⁄₁₆	3½	3	2⅝	2⅛	2¾	56 00
56 01	2½	3	2⅞	2½	2¼	2⅞	3	2⅝	2⅞	2	2	3¼	3¹³⁄₁₆	3½	3	2⅝	2⅛	4	56 01
56 02	3⅛	3¾	3¼	3⅛	2⅜	4¼	3⅞	3¼	3½	2½	2⁵⁄₁₆	4¾	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	7½	56 02
56 04	3½	4⅛	4	3⁷⁄₁₆	3	9	4¼	3½	4½	2¾	3⅜	8½	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	12½	56 04
56 06	4⅜	5¼	4½	4⅜	2⅞	12	5⁷⁄₁₆	4½	4¾	3½	3⅛	12½	6¼	5¾	4⅞	4⅜	3½	16	56 06
56 08	4⅜	5¼	5	4⅜	3⅝	16¾	5⁷⁄₁₆	4½	5⅝	3½	4	18	6¼	5¾	4⅞	4⅜	3½	22½	56 08
56 12	■ 5⁵⁄₁₆	6⅜	4⅝	5⁵⁄₁₆	3⁷⁄₁₆	24	6½	5½	5½	4¼	3½	25	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	31	56 12
56 25	■ 5⁵⁄₁₆	6⅜	6⅜	5⁵⁄₁₆	5⁵⁄₁₆	39	6½	5½	7¼	4¼	5¼	39	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	45	56 25
56 50	■ 6¼	7¹⁄₁₆	8½	5⅞	7¼	78							8¾	8	6¾	6¾	5½	85	56 50
56 100	■ 7½	9	11	7½	9	140													56 100
64 00	2½	3	2¼	2½	1⅞	2	3	2½	2⅝	2	1¾	2	3¹³⁄₁₆	3½	3	2⅝	2⅛	3¼	64 00
64 01	2½	3	2¾	2½	2⅜	3	3⅛	2⅝	3⅛	2	2⅛	2⅛	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	3¾	64 01
64 02	3⅛	3¾	3¼	3⅛	2⅜	5	3⅞	3⅛	3⅝	2½	2⅜	4¾	5¹⁵⁄₁₆	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	4⅞	7¼	64 02
64 04	3¾	4½	4⅜	3¾	3⅛	10	4⅝	3¾	4½	3	3⅜	11	5⁷⁄₁₆	5	4¼	4¹⁄₁₆	3⁵⁄₁₆	15½	64 04
64 06	3¾	4½	5½	3¾	4⅜	15	4⅝	3¾	4⅞	3	3⅝	16	6¼	5¾	4⅞	4⅜	3½	22	64 06
64 08	4⅜	5¼	5⅛	4⅜	3¾	18	5½	4½	5⅞	3½	4¼	19¼	6¼	5¾	4⅞	4⅜	3½	25	64 08
64 12	■ 5½	6⅜	4⅞	5⁵⁄₁₆	3¾	27	6½	5½	5¾	4¼	3¾	27	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	32½	64 12
64 25	■ 6¼	7¹⁄₁₆	7¼	5¹³⁄₁₆	5⅜	50							7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	57	64 25
64 50	■ 7⅝	9	8¼	7½	6⅜	95							10⅜	8	6¾	6¾	5½	103	64 50
80 00	2½	3	2⅝	2½	2⅛	2½	3	2½	2⅞	2	2	2½	3¹³⁄₁₆	3½	3	2⅝	2⅛	3¾	80 00
80 01	2¹³⁄₁₆	3⅜	2⅞	2¹³⁄₁₆	2¼	3½	3½	2⅞	3¼	2¼	2¼	3⅝	4¼	3⅞	3⁵⁄₁₆	3	2⁷⁄₁₆	5¼	80 01
80 02	3⁷⁄₁₆	4⅛	3¼	3⁷⁄₁₆	2½	6½	4¼	3½	4	2¾	2⅞	6¾	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	9	80 02
80 05	4⅜	5¼	5	4⅜	3½	17	5⁷⁄₁₆	4½	5½	3½	3¾	17½	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	21½	80 05
80 10	■ 5½	6⅜	5	5⅜	3⅞	30	6½	5½	6	4¼	4	31	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	36½	80 10
80 25	■ 6¼	7⅛	5⅞	5¹³⁄₁₆	4½	44							8¼	7⁹⁄₁₆	6⅝	5¹³⁄₁₆	4¾	48½	80 25
80 50	■ 7⅝	9	9¼	7½	7⅜	115													80 50
120 00	2¹³⁄₁₆	3⅜	2⅝	2¹³⁄₁₆	2⅛	3	3⁷⁄₁₆	2⅞	3⅛	2¼	2	3	4¼	3⅞	3⁵⁄₁₆	3	2⁷⁄₁₆	4¾	120 00
120 01	3⅛	3¾	3⅜	3⅛	2⅜	5	3⅞	3¼	3½	2½	2¼	4⅞	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	6¾	120 01
120 02	3¾	4½	4⅝	3¾	3⅜	11	4⅝	3⅞	4⅝	3	3⅜	10½	5⁷⁄₁₆	5	4¼	4¹⁄₁₆	3⁵⁄₁₆	14	120 02
120 04	4⅜	5¼	4⅞	4⅜	3½	16	5½	4½	5½	3⁷⁄₁₆	4	17	6¼	5⅜	4⅞	4⅜	3½	21¼	120 04
120 08	■ 5⅜	6⅜	6½	5⁵⁄₁₆	4½	35	6⅜	5⁷⁄₁₆	6⅜	4¼	4½	34	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	40½	120 08
120 12	■ 5⅜	6⅜	6⅞	5⁵⁄₁₆	5¾	45	6⅜	5⁷⁄₁₆	7⅝	4¼	5¾	47	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	51½	120 12
120 20	■ 6¼	7⅛	8¼	5¹³⁄₁₆	6⅜	64							8¼	7⁹⁄₁₆	6⅝	5¹³⁄₁₆	4¾	70½	120 20
180 00	3⅛	3¾	3⅜	3⅛	2⅛	4¼	3⅞	3³⁄₁₆	3½	2½	2¼	4¾	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	6⅝	180 00
180 01	3⁷⁄₁₆	4⅛	3⅜	3⁷⁄₁₆	2½	5¾	4¼	3½	3⅞	2¾	2⅞	6½	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	8¾	180 01
180 02	4⅜	5¼	4¾	4⅜	3¼	15	5⁷⁄₁₆	4½	5⅜	3½	3⅛	15¾	6¼	5¾	4⅞	4⅜	3½	19½	180 02
180 05	■ 5⁵⁄₁₆	6⅜	5¾	5⁵⁄₁₆	4⅜	34	6⅜	5⁷⁄₁₆	6⅜	4¼	4⅜	32	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	39¼	180 05
180 10	■ 6¼	7¹⁄₁₆	7½	5⅞	6⅛	54							7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	57½	180 10
230 00	3⅛	3¾	3⅜	3⅛	2½	5	3⅞	3⅛	3⅝	2½	2½	5¼	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	7½	230 00
230 01	3½	4⅛	4	3⁷⁄₁₆	3⅛	9½	4¼	3½	4⅝	2¾	3½	8½	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	11¼	230 01
230 02	4⅜	5¼	5¼	4⅜	4	18	5⁷⁄₁₆	4½	5⅞	3½	3⅝	18	6¼	5¾	4⅞	4⅜	3½	21¾	230 02
230 05	■ 5⅜	6⅜	6	5⁵⁄₁₆	4¾	36	6⅜	5⁷⁄₁₆	6⅞	4¼	4⅞	36	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	41	230 05
230 08	■ 6¼	7¹⁄₁₆	7½	5⅞	6⅛	54							8¼	7⁹⁄₁₆	6½	5¹³⁄₁₆	4¾	59¼	230 08
300 00	3¾	4½	3½	3¾	2¼	6	4½	3¾	3¾	3	2⅝	6½	4⅞	4⅝	3¹⁵⁄₁₆	3¹¹⁄₁₆	3	9	300 00
300 01	4⅜	5¼	4	4⅜	3⅛	12½	5½	4½	5	3½	3⅜	13½	6¼	5¾	4⅞	4⅜	3½	16¾	300 01
300 02	4⅜	5¼	5⅝	4⁵⁄₁₆	4¾	23	5½	4½	6⅝	3½	5	24	6¼	5¾	4⅞	4⅜	3½	27½	300 02
300 05	■ 5⁵⁄₁₆	6⅜	7⅛	5⁵⁄₁₆	6¼	49	6½	5½	8	4¼	6	48	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	52½	300 05

Add ³⁄₁₆ to H W D for Style BE

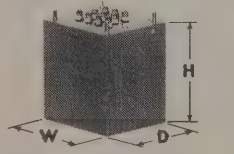


STYLE B:
- "Open Frame" Bracket Mounted
- Double Vacuum Varnish Impregnated

STYLE BE:
- Conforms to MIL-T-27B
- Epoxy Encapsulation added to Style B



STYLE V:
- Fully Enclosed in Metal Shells
- Ease of "Wiring with Leads"
- Attractive Appearance
- Dbl Vacuum Varnish Impregnated



STYLE CM:
- Hermetically Sealed to MIL-T-27B
- Environment Proof
- Attractive Gray Finish
- Permanent Name Plate

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED PRECISION BUILT

TODD SYSTEMS INC.

50 ASH STREET, DEPT. EM
YONKERS, NY, U.S.A. 10701
(914) 963-3400

TODD ENGINEERED

LINE ISOLATION …………… HIGH CURRENT CHOKES

LINE ISOLATION

OUTPUT 115 VOLTS

50/60 HERTZ
UL COMPONENTS

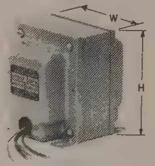
STRAIGHT ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

TWO STYLES

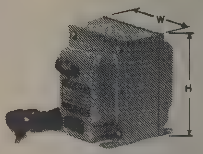
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS					
				H	W	D	MW	MD	WGT.
LI-25	25	115	1500	3⅛	2⅝	2½	2	1½	1⅝
LI-50	50	115	1500	3½	2⅞	3	2¼	1⅞	3
LI-100	100	115	1500	3½	2⅞	3½	2¼	2¼	4
LI-175	175	115	1500	4⅝	3⅞	3⅞	3	2¾	7
LI-250	250	115	1500	4⅝	3⅞	4⅜	3	3¼	10
LI-350	350	115	1500	4⅝	3⅞	5¼	3	4⅛	14
LI-500	500	115	1500	6	4⅜	5⅛	3⁷⁄₁₆	3⅜	17½
LI-750	750	115	1500	6	4⅜	6⅜	3⁷⁄₁₆	4½	24
LI-1000	1000	115	1500	6	4⅜	7¼	3⁷⁄₁₆	5½	30
LI-1500	1500	115	1500	6½	5½	7½	4¼	5⅜	42
LI-2000	2000	115	1500	6½	5½	9	4¼	6⅞	58
LI-100-1	100	230	2000	3½	2⅞	3½	2¼	2¼	4
LI-250-1	250	230	2000	4⅝	3⅞	4⅜	3	3¼	10
LI-500-1	500	230	2000	6	4⅜	5⅛	3⁷⁄₁₆	3⅜	17½
LI-1000-1	1000	230	2000	6	4⅜	7¼	3⁷⁄₁₆	5½	30
LI-1500-1	1500	230	2000	6½	5½	7½	4¼	5⅜	42
LI-2000-1	2000	230	2000	6½	5½	9	4¼	6⅞	58

STYLE LO



LEAD WIRE TERMINALS

STYLE LRG



LINE CORD RECEPTACLE (W/GROUND)

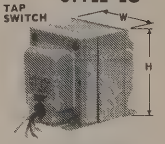
ADJUSTABLE ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

- PRIMARY TAPPED
- TWO STYLES

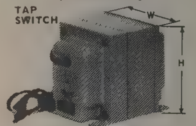
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS					
				H	W	D	MW	MD	WGT.
LI-50-2	50	105/115/125	1500	3½	2⅞	3⅞	2¼	2½	3
LI-100-2	100	105/115/125	1500	3½	2⅞	4⅜	2¼	3	4½
LI-250-2	250	105/115/125	1500	4⅝	3⅞	5⅛	3	4	11½
LI-500-2	500	105/115/125	1500	6	4⅜	5⅞	3⁷⁄₁₆	4⅛	19
LI-1000-2	1000	105/115/125	1500	6	4⅜	8⅛	3⁷⁄₁₆	6⅜	34
LI-50-3	50	210/230/250	2000	3½	2⅞	3⅞	2¼	2½	3
LI-100-3	100	210/230/250	2000	3½	2⅞	4⅜	2¼	3	4½
LI-250-3	250	210/230/250	2000	4⅝	3⅞	5⅛	3	4	11½
LI-500-3	500	210/230/250	2000	6	4⅜	5⅞	3⁷⁄₁₆	4⅛	19
LI-1000-3	1000	210/230/250	2000	6	4⅜	8⅛	3⁷⁄₁₆	6⅜	34

STYLE LO



LEAD WIRE TERMINALS

STYLE LRG



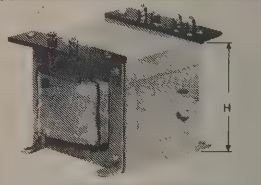
LINE CORD RECEPTACLE (W/GROUND)

HI-POWER ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

BRACKET MOUNTED

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS					
				H	W	D	MW	MD	WGT.
LI-2500-4	2500	115/230	2000	6⅛	7⅛	8¾	5⅞	7	60
LI-3000-4	3000	115/230	2000	7½	9	7⅞	7½	6½	95
LI-4000-4	4000	115/230	2000	7½	9	9	7½	7⅝	113
LI-5000-4	5000	115/230	2000	7½	9	10¼	7½	8⅞	135
LI-6000-4	6000	115/230	2000	7½	9	11¾	7½	10¼	168
LI-2500-5	2500	230/460	2500	6⅛	7⅛	8¾	5⅞	7	60
LI-3000-5	3000	230/460	2500	7½	9	7⅞	7½	6½	95
LI-4000-5	4000	230/460	2500	7½	9	9	7½	7⅝	113
LI-5000-5	5000	230/460	2500	7½	9	10¼	7½	8⅞	135
LI-6000-5	6000	230/460	2500	7½	9	11¾	7½	10¼	168

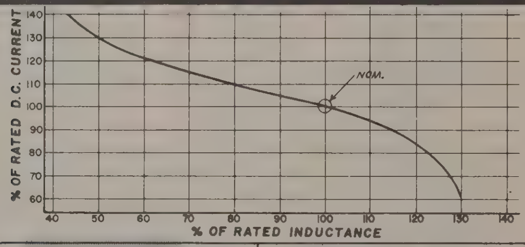


SCREW TERMINALS

HIGH CURRENT CHOKES

50/500 HERTZ

DIMENSIONS REFER TO HIGH CURRENT XFMR SKETCHES



- **Matching styles complement high current transformers**
- **Wide variety of compatible current ratings**

INDUCTANCE VARIATION

Graph indicates typical variation of inductance (%) when used at D.C. currents (%) other than the rated values.

Chokes operated at D. C. currents higher than rated value must be run on an intermittent basis to avoid overheating.

CATALOG NUMBER	INDUCTANCE (mh)	D.C. CURRENT (AMPS)	RESISTANCE (OHMS)	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE)						• FULLY MTD. SHELLS (STYLE V)						• HERMETICALLY SEALED MIL-T (STYLE CM)					
				H	W	D	MW	MD	WGT.	H	W	D	MW	MD	WGT.	H	W	D	MW	MD	WGT.
CH-00	200	.5	3.00	2¼	2⅝	2	2	1¾	1½	2⅝	2¼	2¼	1¾	1⅝	1¾	3⅛	3	2⁹⁄₁₆	2⁵⁄₁₆	1⅞	2⅛
CH-01	100	1	1.50	2½	2	2⅛	2½	2	2¼	3⅛	2½	2⅝	2	1¾	2¼	3¹³⁄₁₆	3½	3	2⅝	2⅛	3¼
CH-02	80	2	1.30	2½	3	2½	2½	2	2½	3⅛	2½	2½	2	1¾	2½	3¹³⁄₁₆	3½	3	2⅝	2⅛	3½
CH-04	60	4	.60	3⅛	3¾	3¼	3⅛	2½	5¼	3⅞	3³⁄₁₆	3¾	2½	2¼	6	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	7¼
CH-05	50	5	.50	3⅛	3¾	3⅜	3⅛	2¾	5¾	3⅞	3³⁄₁₆	4	2½	3	6½	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	8
CH-06	40	6	.35	3⅛	3¾	3⅜	3⅛	2¾	6	3⅞	3³⁄₁₆	4	2½	3	6½	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	8⅝
CH-08	30	8	.25	3½	4⅛	3⅞	3⅜	3	8	4⅛	3½	4⅜	2¾	3⅜	8½	4⅞	4⅝	4	3¹¹⁄₁₆	3	11⅛
CH-12	20	12	.12	3¾	4½	4⅞	3⅜	3½	15½	4⅝	3⅞	4⅞	3	3¾	14	5⁷⁄₁₆	5	4¼	4¹⁄₁₆	3⁵⁄₁₆	20
CH-16	15	16	.08	4⁷⁄₁₆	5¼	4⅝	4⅜	3⅜	14¼	5⁷⁄₁₆	4½	5¼	3½	3¾	15	6¼	5¾	4⅞	4⅜	3½	22½
CH-20	10	20	.05	4⁷⁄₁₆	5¼	4½	4⅜	3½	15½	5⁷⁄₁₆	4½	5⅜	3½	3⅞	16	6¼	5¾	4⅞	4⅜	3½	24
CH-25	6.5	25	.028	4⁷⁄₁₆	5¼	5	4⅜	4	18½	5⁷⁄₁₆	4½	5⅞	3½	4⅜	19½	6¼	5¾	4⅞	4⅜	3½	26½
CH-30	5.5	30	.022	5⅜	6⅜	4½	5¼	3¼	21	6½	5⁷⁄₁₆	5½	4¼	3¼	24	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	29½
CH-40	4.0	40	.014	5⅜	6⅜	4⅝	5¼	3½	23	6½	5⁷⁄₁₆	5¾	4¼	3½	25	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	32½
CH-50	3.0	50	.010	5⅜	6⅜	5½	5¼	4⅛	29	6½	5⁷⁄₁₆	6⅜	4½	4⅛	30	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	37
CH-100	.8	100	.003	5⅜	6⅜	5¾	5¼	4⅝	35	6½	5⁷⁄₁₆	6⅞	4¼	4⅝	36	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	45
CH-200	.35	200	.001	6⅛	7⅛	6¾	5⅞	5½	43												

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED PRECISION BUILT

TODD SYSTEMS INC.

50 ASH STREET, DEPT. EM YONKERS, NY, U.S.A. 10701 (914) 963-3400

TODD ENGINEERED

STEPDOWN AUTOTRANSFORMERS

CONVERT DOMESTIC APPLIANCES FOR USE ON FOREIGN VOLTAGES

COND. CAT.-SD-81

50/60 HERTZ—*UL* COMPONENTS • ALSO AVAILABLE WIRED FOR STEPUP

PORTABLE MODEL

220/240 INPUT
110/120 OUTPUT

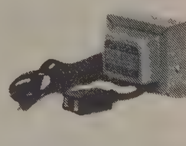
CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-35	20	⅞	1½	2	2⅝
SD-36	40	1¼	1⁷⁄₁₆	2⅛	3½
SD-37	60	1⁵⁄₁₆	1⁷⁄₁₆	2⅛	3½
SD-41	80	1⁷⁄₁₆	1⁷⁄₁₆	2⅛	3½

LINE CORD • RECEPTACLE

NORMAL DUTY MODEL

220/240 INPUT
110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-24	50	1⅝	2¼	2¾	2¼
SD-21	65	1⅝	2¼	2¾	2¼
SD-25	80	1¾	2¼	2¾	2⅜
SD-23	100	1¾	2¼	2¾	2⅜
SD-26	125	2⅜	2⅝	3¹⁄₁₆	2½
SD-27	150	2⅜	2⅝	3¹⁄₁₆	2½

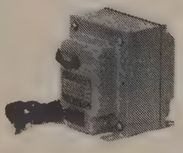


LINE CORD • PIGTAIL

HEAVY DUTY MODEL

220/240 INPUT
110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16	100	2¼	3⅛	2⅝	3¼
SD-17	150	3½	3⅛	2⅝	3⅞
SD-38	200	3¾	3⅛	2⅝	4
SD-12	250	5½	4⅝	3⅞	3⅜
SD-18	350	6½	4⅝	3⅞	3⅝
SD-11	500	9¾	4⅝	3⅞	4¼
SD-19	750	12	4⅝	3⅞	5
SD-13	1000	13¾	4⅝	3⅞	5¼
SD-14	1500	19	4⅝	3⅞	6⅝
SD-20	2000	24½	6	4⅜	6⅜
SD-39	2500	35½	6½	5½	6⅝

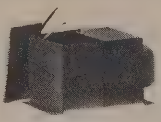


LINE CORD • RECEPTACLE

INDUSTRIAL MODEL

220/240 INPUT
110/120 OUTPUT

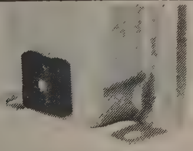
CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-28	3000	47	6⅛	7⁷⁄₁₆	10¼
SD-29	4000	54	6⅛	7⁷⁄₁₆	12
SD-22	5000	59	6⅛	7⁷⁄₁₆	11¼
SD-30	6000	70	6⅛	7⁷⁄₁₆	12¼



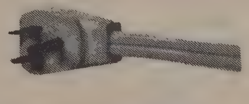
JUNCTION BOX
LEAD TERMINALS

ACCESSORIES

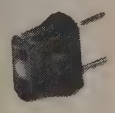
AVAILABLE FOR USE
WHERE APPLICABLE



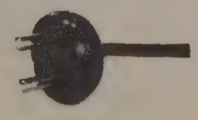
3 WIRE RECEPTACLE



3 WIRE LINE CORD



PLUG ADAPTERS



FOREIGN PLUGS

3 TAP REFRIGERATION

188/210
210/236
236/260
→ 105V-50Hz
115V - 60Hz.
INPUT V. +10%

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LRG	350	6½	4⅝	3⅞	4⅜
SD-32LRG	550	9¼	4⅝	3⅞	5
SD-33LRG	750	12	4⅝	3⅞	5¾
SD-42LRG	850	14½	4⅝	3⅞	6⅝
SD-34LRG	1000	16¼	4⅝	3⅞	7
SD-40LRG	1500	23	4⅝	3⅞	8½

STYLE LRG

3 WIRE LINE CORD
& RECEPTACLE
(WITH GROUND)

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31LO	350	6¼	4⅝	3⅞	4½
SD-32LO	550	9	4⅝	3⅞	5⅛
SD-33LO	750	12	4⅝	3⅞	5½
SD-42LO	850	14	4⅝	3⅞	6
SD-34LO	1000	16	4⅝	3⅞	6½
SD-40LO	1500	22	4⅝	3⅞	8

STYLE LO

JUNCTION BOX

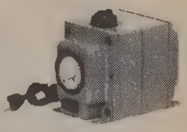
LEAD WIRE TERMINALS

MULTI-TAPPED VOLTAGE REGULATOR

METER • SWITCH

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	115
12	84	92	100	108	115	122	130	138	208, 230
21	170	185	200	215	230	245	260	275	115
22	170	185	200	215	230	245	260	275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D
MVR-17	11 or 22	150	4⅝	4⅝	3⅞	5
MVR-18	11 or 22	350	6½	4⅝	3⅞	5½
MVR-11	11 or 22	500	8	4⅝	3⅞	5¾
MVR-19	11 or 22	750	11	4⅝	3⅞	6⅝
MVR-13	11 or 22	1000	13¼	4⅝	3⅞	7⅛
MVR-14	11 or 22	1500	17	6	4⅜	7⅜
MVR-20	11 or 22	2000	22	6	4⅜	8¼
MVR-17	12 or 21	150	6	4⅝	3⅞	5⅛
MVR-18	12 or 21	350	9	4⅝	3⅞	5⅞
MVR-11	12 or 21	500	12½	4⅝	3⅞	6¾
MVR-19	12 or 21	750	15	4⅝	3⅞	7¼
MVR-13	12 or 21	1000	18¾	6	4⅜	7½
MVR-14	12 or 21	1500	24	6	4⅜	8½
MVR-20	12 or 21	2000	30½	6	4⅜	9¼



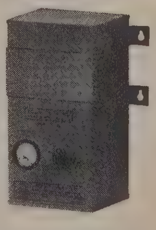
3 WIRE LINE CORD
& RECEPTACLE
(WITH GROUND)

PANEL MOUNTED VOLTAGE REGULATOR

METER • SWITCH
JUNCTION BOX

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	115
12	84	92	100	108	115	122	130	138	208, 230
21	170	185	200	215	230	245	260	275	115
22	170	185	200	215	230	245	260	275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D
PVR-20	11 or 22	2000	29	5⅜	6⅜	11¼
PVR-28	11 or 22	3000	40	5⅜	6⅜	12¼
PVR-29	11 or 22	4000	49	5⅜	6⅜	13⅜
PVR-22	11 or 22	5000	57	5⅜	6⅜	14⅝
PVR-30	11 or 22	6000	63	6⅛	7⅛	13¾
PVR-20	12 or 21	2000	44	6⅛	7⅛	13
PVR-28	12 or 21	3000	58	6⅛	7⅛	14
PVR-29	12 or 21	4000	78	6⅛	7⅛	15½
PVR-22	12 or 21	5000	91	6⅛	7⅛	16½
PVR-30	12 or 21	6000	105	6⅛	7⅛	18



- JUNCTION BOX
- LEAD TERMINALS

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED PRECISION BUILT

TODD SYSTEMS INC.

50 ASH STREET, YONKERS, NY, U.S.A. 10701 (914) 963-3400

50/60 Hz TOROIDAL POWER TRANSFORMERS CUSTOM MADE OR STANDARD

LOW WEIGHT	Typically less than half the weight of stacked core transformers.
SMALL DIMENSIONS	Low height allows slim compact design of electronic equipment.
EASY MOUNTING	Washer mounting requires only one single bolt to the chassis.
LOW HUM	Continuously rolled core has no airgap. No loose parts to rattle.
LOW STRAYFIELD	Primary and secondary windings are distributed evenly along the core, which has no airgap.
SMALL NO-LOAD LOSSES	Typically less than ¼ of the no-load losses of ordinary stacked core transformers.
MEETS ALL SAFETY REQUIREMENTS	TOROID transformers are made to meet all major safety regulations such as US (UL 1411), Scandinavian (SEMKO 115, etc.), West German (VDE 550) and Swiss (SEV). 4000V RMS insulation is standard.
CUSTOM DESIGN	Our application engineers will help you to select the best transformer for your application, and will also custom design a rectifier transformer from DC data. Prototypes can be delivered 2 to 3 weeks after order.

STANDARD OFF-THE-SHELF TRANSFORMERS FOR 117V - 60 Hz PRIMARY VOLTAGE

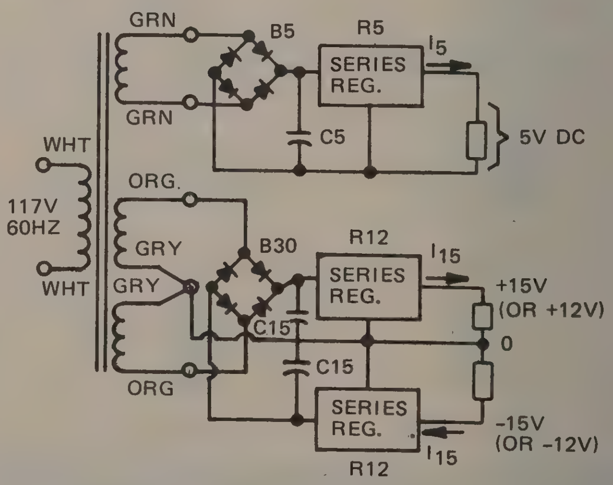
Nominal Power	Size OD × H Weight	Secondaries*		Stock Number
		Nominal Volt/ Current	No-Load Vo.	
20VA	2.4″ × 1.2″ .7 lbs	2×8.5V/1.18A	2×10.4V	102.082
		2×12V/.83A	2×14.9V	102.122
		2×15V/.67A	2×18.0V	102.152
		2×18V/.56A	2×21.2V	102.182
		2×24V/.42A	2×29.8V	102.242
40VA	2.8″ × 1.3″ 1.1 lbs	2×8.5V/2.35A	2×10.4V	104.082
		2×12V/1.67A	2×14.6V	104.122
		2×15V/1.33A	2×18.3V	104.152
		2×18V/1.10A	2×22.1V	104.182
		2×24V/.83A	2×29.3V	104.242
70VA	3.2″ × 1.4″ 1.5 lbs	24V/2.9A	28.2V	107.241
		220V/.31A	261V	107.220
		2×8.5V/4.1A	2×10.0V	107.082
		2×12V/2.9A	2×14.1V	107.122
		2×15V/2.3A	2×17.6V	107.152
		2×18V/1.9A	2×21.0V	107.182
100VA	3.7″ × 1.4″ 2.2 lbs	24V/4.15A	27.8V	110.241
		2×8.5V/5.8A	2×9.8V	110.082
		2×12V/4.15A	2×13.9V	110.122
		2×15V/3.3A	2×17.4V	110.152
		2×18V/2.8A	2×20.7V	110.182
150VA	3.7″ × 1.8″ 2.9 lbs	24V/6.2A	26.8V	115.241
		220V/.67A	246.5V	115.220
		2×8.5V/8.6A	2×9.5V	115.082
		2×12V/6.2A	2×13.4V	115.122
		2×15V/5.0A	2×16.8V	115.152
		2×18V/4.1A	2×20.2V	115.182
340VA	4.5″ × 2.3″ 5.3 lbs	220V/1.55A	235V	134.220
		2×24V/7.08A	2×25.7V	134.242
		2×30V/5.67A	2×32.1V	134.302
		2×33V/5.15A	2×35.3V	134.332
600VA	5.5″ × 2.4″ 8.2 lbs	220V/2.73A	2×232V	160.220
		2×24V/12.5V	2×25.4V	160.242
		2×30V/10.0A	2×31.7V	160.302
		2×33V/9.1A	2×34.9V	160.332
		2×38V/7.9A	2×40.1V	160.382

*Dual secondaries can be used separately, in parallel or in series. Series connection forms centertap.

+5V/±15V RECTIFIER TRANSFORMERS FOR 105V-130V 60 Hz PRIMARY SUPPLY.

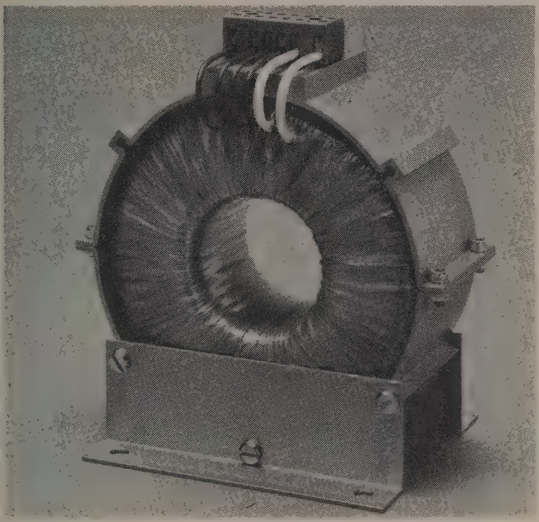
Transformer Size-Wt. OD x H	Maximum DC Currents	Diode Bridge Required RMS	Regulator Max. Load Volts/Power	Capacitor Data (min) µF/Volts	Transformer Stock Number
20VA- .7 lbs 2.4″x1.2″	I_5 = .75A	B5: 1.3A/15V	R5: 10V/4.5W	C5: 6000/16V	102.530
	I_{15} = .20A	B30: .35A/50V	R12: 19V/2.5W	C12: 1,500/30V	
40VA-1.1 lbs 2.8″x1.3″	I_5 = 1.9A	B5: 3.2A/15V	R5: 10V/12W	C5: 14,000/16V	104.530
	I_{15} = .24A	B30: .4A/50V	R12: 19V/3W	C12: 1,800/30V	
70VA-1.5 lbs 3.2″x1.4″	I_5 = 3.2A	B5: 5.5A/15V	R5: 9V/18W	C5: 24,000/16V	107.530
	I_{15} = .37A	B30: .64A/50V	R12: 17V/4W	C12: 2,600/30V	
100VA-2.2 lbs 3.7″x1.4″	I_5 = 5.6A	B5: 9.4A/15V	R5: 9V/33W	C5: 40,000/16V	110.530
	I_{15} = .37A	B30: .64A/50V	R12: 17V/4.5W	C12: 2,600/30V	

Transformer to be used with user-provided components per schematic below. Specs for diode bridges, capacitors and series regulators must meet or exceed data per table above.

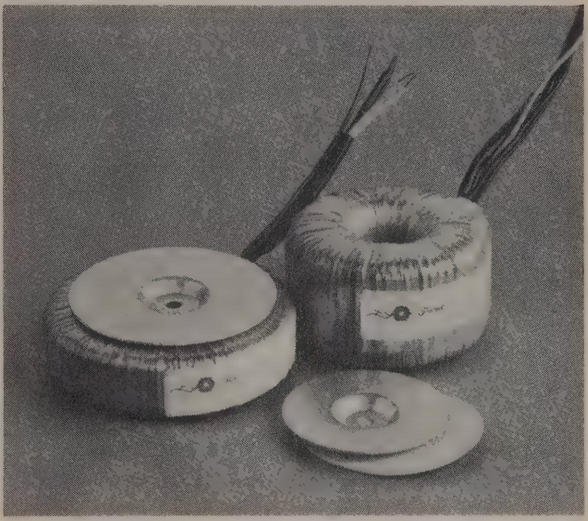


TOROID CORPORATION OF MARYLAND • 6000 Laurel-Bowie Road • Bowie, MD 20715-4037 • 301-464-2100

50/60 Hz TOROIDAL POWER TRANSFORMERS CUSTOM MADE OR STANDARD



Belt mounted (800VA-3,000VA)



Washer mounted (15VA-1,400VA)

BASIC DATA FOR TOROID TRANSFORMERS ON STANDARD CORE SIZES

Max. Power		No Load Loss W	Max. Copper Loss W	Size and Weight (Unmounted transformer)	
60Hz VA	50Hz VA			OD × H inches	Weight lbs
20	15	.20	3.3	2.4 × 1.2	.7
40	30	.25	6.4	2.8 × 1.3	1.1
70	50	.42	12	3.2 × 1.4	1.5
100	80	.50	15	3.7 × 1.4	2.2
150	120	.75	18	3.7 × 1.8	2.9
180	150	.9	21	4.5 × 1.6	3.3
275	225	1.5	23	4.5 × 1.9	4.4
340	285	1.8	25	4.5 × 2.3	5.3
430	360	1.8	31	5.5 × 2.0	5.7
600	500	2.4	35	5.5 × 2.4	8.2
720	600	2.9	38	5.5 × 2.8	9.7
1,000	800	3.5	47	6.3 × 2.4	12.1
1,200	1,000	4.4	50	6.3 × 2.8	14.6
1,400	1,150	5.3	48	6.3 × 3.3	17.9
1,750	1,450	5.4	61	7.9 × 2.6	20.6
2,100	1,750	6.7	64	7.9 × 3.0	25.1
2,400	2,000	8.1	67	7.9 × 3.3	27.3
2,750	2,300	7.7	82	8.7 × 3.2	29.0
3,300	2,700	9.2	84	8.7 × 3.5	34.6

Complete Data and Application Notes available on request.

GENERAL INFORMATION

Both standard and custom made transformers are made on standard core sizes (see table on left). Non-standard core sizes can be made for large volume users to meet special size requirements. Cores are tape-wound from grain-oriented silicon steel and heat-treated for optimum performance.

Both ends of windings are normally taken out as 8″ leads with colored PVC tube insulation. Taps can be formed by external interconnection of leads.

Temperature rise.

TOROID transformers are normally designed for a temperature rise of 60-70°C (140-158°F). The steady-state temperature in a transformer depends on the mounting environment.

Inrush current.

Due to absence of air gap and good magnetic properties of the core material, the inrush current at power-on is higher than in stacked core transformers. Slow fuses should be chosen for primary circuit protection, especially for transformers over 300 VA.

Static shielding.

A static shield to minimize capacitive coupling between primary and secondary is available as an option. The shield occupies space and thus reduces the effective output power of the transformer.

Magnetic strayfield.

The strayfield from a well made toroidal power transformer is very insignificant compared to the strayfield from a conventional stacked-core transformer. The small residual strayfield from a TOROID transformer can, if required, be further reduced by means of a thin ring of magnetic material fitted as a belt around the toroid.

3-phase transformers.

A 3-phase toroidal transformer consists of three separate units that can be mounted individually or stacked upon each other, depending on available space.

TOROID CORPORATION OF MARYLAND • 6000 Laurel-Bowie Road • Bowie, MD 20715-4037 • 301-464-2100

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TRANSFORMERS

SUBMINIATURE AUDIO TRANSFORMERS

LT & LS SERIES
LU SERIES

The LS Series is electrically and mechanically the same as the LT Series except for phase relationships between terminals.

LS, LT, and LU Series transformers have successfully passed the rigid requirements of MIL-T-27, Class S, Grade 5.

Subminiature in size, weighing less than 0.1 ounce, these transformers have tenth inch grid spacing between terminals and are ideally suited for transistor circuit applications which utilize printed circuit board design. All three series have risers on mountng surfaces to facilitate inspection and board cleaning and also to prevent moisture traps.

A wide range of standard designs are available which meet the requirements of most common applications and allow for rapid delivery of prototype quantities. Special designs are also available in all three types.

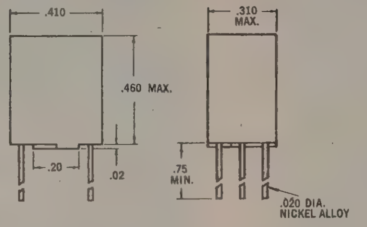
The new LU Series exhibits the same electrical characteristics as the LS and LT Series but has been packaged in a "thin line" configuration to allow for closer board spacing for "card cage" applications or where height dimensions are critical.

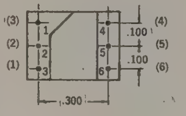
MAGNETIC SHIELDING

LS, LT and LU Series transformers are available with magnetic shields.

To order transformers with shields installed, add 500 to dash numbers shown in the table below. For example: to order an LS-22 with shield, specify LS-522.

LS/LT SERIES

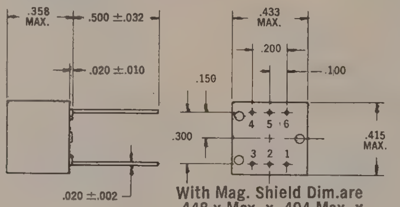




WT. 0.1oz

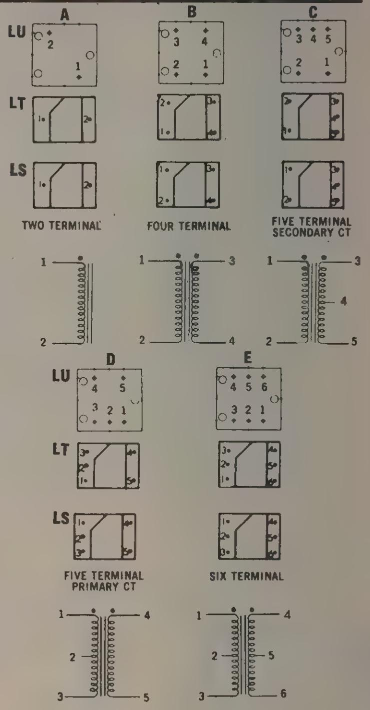
With Mag. Shield Dimensions are .365 Max. x .465 Max. x .531 Max.

LU SERIES



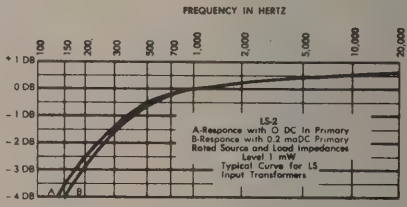
With Mag. Shield Dim.are .448 x Max. x .494 Max. x .400 Max.

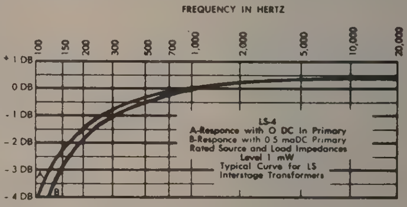
Mech. Tol. = ±.010 unless indicated.

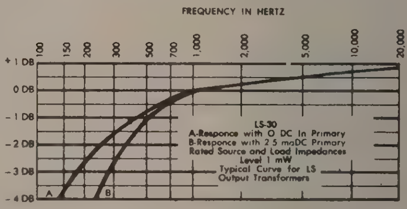


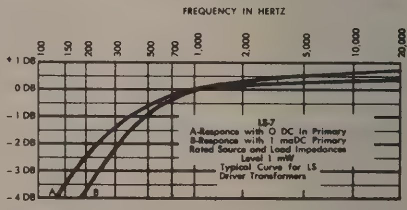
LS, LT or LU No.	Type	MIL-T-27 Designation	Primary Impedance	DCR Pri. Ohms	DC ma Pri.	Secondary Impedance	Max. Power mW	Terminal Layout
2	Input	TF5S21ZZ	50000 CT	3800	0.2	1000CT	25	E
4	Interstage	TF5S21ZZ	20,000/30,000	1700	0.5	800/1200	40	B
5	Interstage	TF5S21ZZ	20,000/30,000CT	1700	0.5	800/1200CT	40	E
6	Interstage	TF5S21ZZ	10,000/12,000CT	1050	1	1500/1800CT	50	E
7	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	1200/1500CT	50	E
8	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	2000/2500CT	50	E
9	Driver	TF5S21ZZ	10,000/12,000CT	1050	1	500/600CT	50	E
10	Output	TF5S21ZZ	500/600	60	3	50/60	50	B
11	Output	TF5S21ZZ	1000/1200	145	3	50/60	50	B
12	Output	TF5S21ZZ	600	70	3	3.2	50	B
13	Output	TF5S21ZZ	1200	120	2	3.2	50	B
14	Output	TF5S21ZZ	10,000	1160	1	3.2	50	B
15	Output	TF5S21ZZ	150/200CT	18	10	12/16	50	D
16	Output	TF5S21ZZ	300/400CT	38	7	12/16	50	D
17	Output	TF5S21ZZ	600/800CT	75	4.5	12/16	50	D
18	Output	TF5S21ZZ	1000/1330CT	120	3.5	12/16	50	D
19	Output	TF5S21ZZ	1500/2000CT	180	3	12/16	50	D
20	Output	TF5S21ZZ	7500/10,000CT	820	1	12/16	50	D
21	Output	TF5S21ZZ	300CT	37	7	600	50	D
22	Output	TF5S21ZZ	500CT	60	3	600	50	D
23	Output	TF5S21ZZ	900CT	100	4	600	50	D
24	Output	TF5S21ZZ	1500CT	170	3	600	50	D
25	Output	TF5S21ZZ	120/150CT	15	10	3.2/4	50	D
26	Output	TF5S21ZZ	320/400CT	40	6	3.2/4	50	D
27	Output	TF5S21ZZ	600/750CT	70	4.5	3.2/4	50	D
28	Output	TF5S21ZZ	800/1000CT	100	4	3.2/4	50	D
29	Output	TF5S21ZZ	1200/1500CT	125	3	3.2/4	50	D
30	Output	TF5S21ZZ	1600/2000CT	190	2.5	3.2/4	50	D
31	Output	TF5S21ZZ	8000/10,000CT	820	1	3.2/4	50	D
32	Output	TF5S21ZZ	10,000CT	1000	1	10,000CT	50	E
33	Driver	TF5S21ZZ	10,000/12,000	1050	1	500/600CT	50	C
34	Driver	TF5S21ZZ	20000	1700	0.3	1000	50	B
35	Output	TF5S21ZZ	1000	135	3	50	50	B
36	Output	TF5S21ZZ	400CT	40	3	11	50	D
37	Driver	TF5S21ZZ	10,000/12,000	1050	1	2000/2500CT	50	C
38	Output	TF5S21ZZ	600CT	72	3	600CT	50	E
39	Output	TF5S21ZZ	10,000	1000	1	10,000 split	50	*
40	Output	TF5S21ZZ	600	72	3	600 split	50	*
41	Input	TF5S21ZZ	25,000CT	4300	0.6	1000CT	30	E
42	Isolation	TF5S21ZZ	600CT	90	4	600CT	30	E
101	Choke	TF5S20ZZ	6 H @ 2 ma DC	1700				A
102	Choke	TF5S20ZZ	1.25 H @ 2 ma DC	180				A
103	Choke	TF5S20ZZ	3.5 M @ 2 ma DC	1100				A
104	Choke	TF5S20ZZ	.3 H @ 4 ma DC	42				A

* Primary terminals 1-2, secondary 3-4 & 5-6.









The above are typical response curves up to 20 kHz however many items in this series have useful frequency ranges up to 100 kHz and beyond.

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

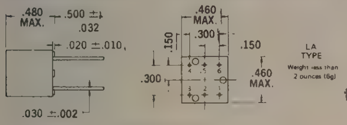
TRANSFORMERS

SUBMINIATURE AUDIO TRANSFORMERS

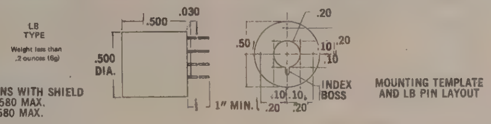
Torotel LA and LB series transformers are manufacturered to MIL-T-27, Grade 5, Class S specification. These series have 0.1 grid spaced terminals for printed circuit application. Both types have risers on mounting surfaces to prevent the formation of moisture traps and to facilitate cleaning of board assemblies.

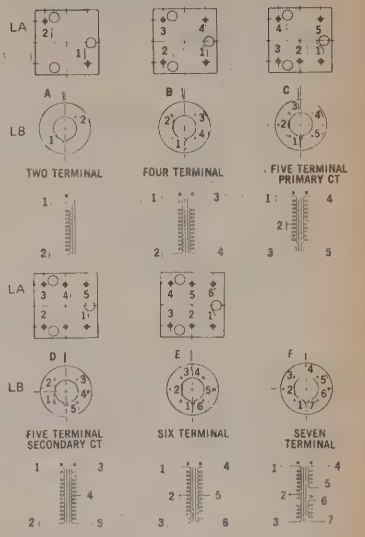
The LA Series is electrically the same as the LB Series, but is packaged in a .460 inch cube with smaller outline dimensions for application where this configuration is more suitable.

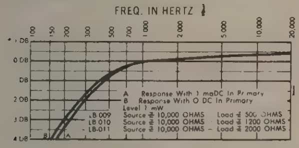
Leads are made of 20 AWG tinned copper. Units utilizing Dumet wire are available on special request.

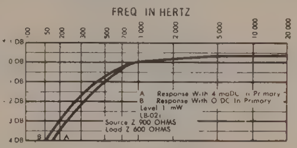


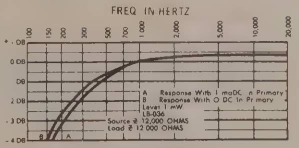
†LB DIMENSIONS WITH SHIELD
O.D. .580 MAX.
HT. .580 MAX.

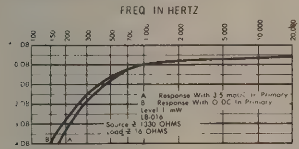


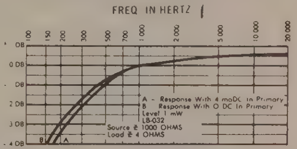


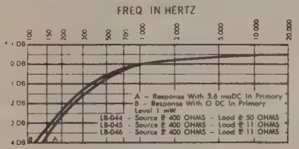












LA or LB No.	MIL Type	Application	Pri. Imp.	DC ma in Pri.	Sec. Imp.	Nom. Pri. DCR	mW Level @ 1 KHz	Term. Layout
001	TF5S21ZZ	Interstage	20,000 30,000	.5 .5	800 1200	850	50	B
002	TF5S21ZZ	Output	500 600	3 3	50 60	60	100	B
003	TF5S21ZZ	Output	1000 1200	3 3	50 60	115	100	B
004	TF5S21ZZ	Output	600	3	3.2	60	100	B
005	TF5S21ZZ	Output	1200	2	3.2	115	100	B
006	TF5S21ZZ	Output	10,000	1	3.2	790	100	B
007	TF5S21ZZ	Input Other Application	200,000 500	0 0	1000 100,000	8500	25	B
008	TF5S20ZZ	Reactor 3.5 H @ 2 maDC, 1 H @ 5 maDC				630		A
009	TF5S21ZZ	Output or Driver	10,000 12,000	1 1	500CT 600CT	800	100	D
010	TF5S21ZZ	Driver	10,000 12,000	1 1	1200CT 1500CT	800	100	D
011	TF5S21ZZ	Driver	10,000 12,000	1 1	2000CT 2500CT	800	100	D
012	TF5S21ZZ	Single or PP Output	150CT 200CT	10 10	12 16	11	500	C
013	TF5S21ZZ	Single or PP Output	300CT 400CT	7 7	12 16	20	500	C
014	TF5S21ZZ	Single or PP Output	600CT 800CT	5 5	12 16	43	500	C
015	TF5S21ZZ	Single or PP Output	800CT 1070CT	4 4	12 16	51	500	C
016	TF5S21ZZ	Single or PP Output	1000CT 1330CT	3.5 3.5	12 16	71	500	C
017	TF5S21ZZ	Single or PP Output	1500CT 2000CT	3 3	12 16	108	500	C
018	TF5S21ZZ	Single or PP Output	7500CT 10,000CT	1 1	12 16	505	500	C
019	TF5S21ZZ	Output to Line	300CT	7	600	19	500	C
020	TF5S21ZZ	Output or Line to Line or Mixing	500CT	5.5	600	31	500	C
021	TF5S21ZZ	Output to Line	900CT	4	600	53	500	C
022	TF5S21ZZ	Output to Line	1500CT	3	600	86	500	C
023	TF5S21ZZ	Interstage	20,000CT 30,000CT	0.5 0.5	800CT 1200CT	850	100	E
024	TF5S21ZZ	Input Other Application	200,000CT 500CT	0 0	1000CT 100,000CT	8500	25	E
025	TF5S21ZZ	Interstage	10,000CT 12,000CT	1 1	1500CT 1800CT	800	100	E
026	TF5S20ZZ	Reactor 6 H @ 2 maDC, 1.5 H @ 5 maDC				2100		A
027	TF5S20ZZ	Reactor 1.2 H @ 2 maDC, 0.5 H @ 1 maDC				100		A
028	TF5S20ZZ	Reactor 0.3 H @ 4 maDC, 0.15 H @ 20 maDC				31		A
029	TF5S21ZZ	Single or PP Output	120CT 150CT	10 10	3.2 4	10	500	C
030	TF5S21ZZ	Single or PP Output	320CT 400CT	7 7	3.2 4	20	500	C

* These LA types have no primary center tap

LA or LB No.	MIL Type	Application	Pri. Imp.	DC ma in Pri.	Sec. Imp.	Nom. Pri. DCR	mW Level @ 1 KHz	Term. Layout
031	TF5S21ZZ	Single or PP Output	640CT 800CT	5 5	3.2 4	43	500	C
032	TF5S21ZZ	Single or PP Output	800CT 1000CT	4 4	3.2 4	51	500	C
033	TF5S21ZZ	Single or PP Output	1060CT 1330CT	3.5 3.5	3.2 4	71	500	C
034	TF5S21ZZ	Single or PP Output	1600CT 2000CT	3 3	3.2 4	109	500	C
035	TF5S21ZZ	Single or PP Output	8000CT 10,000CT	1 1	3.2 4	505	100	C
036	TF5S21ZZ	Isolation or Interstage	10,000CT 12,000CT	1 1	10,000CT 12,000CT	950	100	E
037	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	1200CT 1500CT	800	100	E
038	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	2000CT 2500CT	800	100	E
039	TF5S21ZZ	Driver	10,000CT 12,000CT	1 1	500CT 600CT	800	100	E
040	TF5S21ZZ	Input	100,000	0	1000	1700	70	B
041	TF5S21ZZ	Driver	20,000	0.5	1000	1000	100	B
042	TF5S21ZZ	Driver	20,000	0.5	1200CT	1000	100	D
043	TF5S21ZZ	Output	1000	3	50	60	100	B
044	TF5S21ZZ	Output	400	3	50	30	100	B
045	TF5S21ZZ	Output	400	3	11	30	100	B
046	TF5S21ZZ	Single or PP Output	400CT	3	11	30	500	C
047	TF5S20ZZ	Reactor 10 H @ 0 maDC, 8 H @ 5 maDC				650		A
*048	TF5S21ZZ	Isolation or Interstage Ratio 1:1:1	2000CT 2500CT	3 3	8000 split 10,000 split	195	100	F
*049	TF5S21ZZ	Interstage	10,000CT 12,000CT	1 1	2000 split 2400 split	560	100	F
*050	TF5S21ZZ	Interstage	20,000CT 30,000CT	0.5 0.5	1000 split 1500 split	800	100	F
*051	TF5S21ZZ	Interstage	40,000CT 50,000CT	0.25 0.25	400 split 500 split	1700	50	F
*052	TF5S21ZZ	Interstage or Output	400CT 500CT	8 6	400 split 500 split	46	500	F
*053	TF5S21ZZ	Interstage	400CT 500CT	8 6	120 split 150 split	46	500	F
*054	TF5S21ZZ	Interstage	400CT 500CT	8 6	40 split 50 split	46	500	F
*055	TF5S21ZZ	Interstage	80CT 100CT	12 10	32 split 40 split	9.8	500	F
056	TF5S21ZZ	Input	50,000CT	0.3	1000CT	1900	50	E
057	TF5S21ZZ	Output	600CT 750CT	4.5	3.2 4	40	500	C
058	TF5S21ZZ	Output	1200CT 1500CT	3	3.2 4	100	500	C
059	TF5S21ZZ	Input	100,000CT	0	1000CT	3300	50	E
060	TF5S21ZZ	Driver	10,000CT	1	600CT	1100	100	E
061	TF5S21ZZ	Driver	4000CT	1.5	10,000CT	440	100	E
062	TF5S21ZZ	Output	1000CT	3	600CT	110	100	E
063	TF5S21ZZ	Output	600CT	4	25,000CT	65	100	E
064	TF5S21ZZ	Output	600CT	4	600CT	67	100	E
065	TF5S21ZZ	Output	600CT	4	60CT	65	100	E
066	TF5S21ZZ	Output	600CT	4	4	65	100	C
† 500		Magnetic Shielding Case						

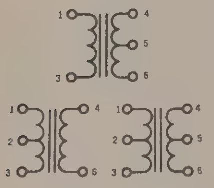
† The LB-Mag. Shield may be supplied for all LB Types.
Add 500 to dash no. (I.E. LB-001 with Shield, order LB-501)

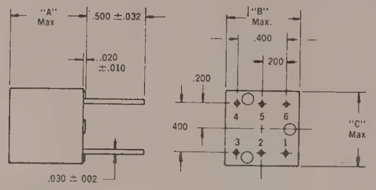
TOROTEL PRODUCTS INC.
13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TRANSFORMERS

AUDIO TRANSFORMERS

LL & LR SERIES



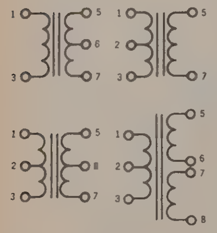


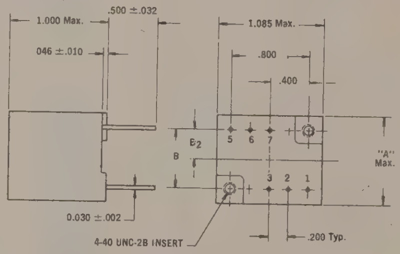
Series	A	B	C
LL	.600	.590	.590
LR	.925	.800	.710

These tiny, versatile "LL" transformers are provided with .020 risers and 0.1 grid spacing for printed circuit board applications and are manufactured to MIL-T-27, Grade 5, Class S specifications.
Response: ±1 db 200 to 50,000 Hz
Distortion: 10% max. at rated power, 200 to 50,000 Hz
Weight: 0.4 oz.

These miniaturized "LR" transformers are manufactured to MIL-T-27, Grade 5, Class S specifications and are ideally suited for a wide range of printed circuit applications.
Response: ±1 db 200 to 20,000 Hz
Distortion: 10% max. at rated power, 200 to 20,000 Hz
Weight: 1.0 oz.

LW & LY SERIES



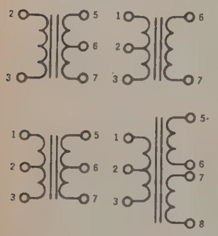


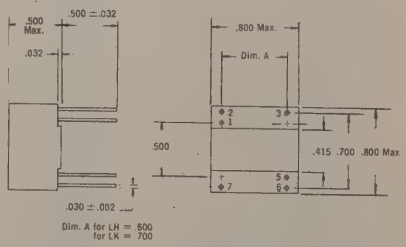
Series	A	B	B_2
LW	.900	.600	.300
LY	1.125	.800	.400

"LW" Series transformers are manufactured to MIL-T-27, Grade 5, Class S specifications. Riser areas and 0.1 grid spacing make these units ideal for printed circuit board applications.
Response: ±1 db 100 to 10,000 Hz
Distortion: 1.5% max. at 60 mW, 200 to 10,000 Hz
Weight: 2.0 oz.

"LY" Series transformers are highly compact, efficient units with power output ratings to 7.5 watts. These transformers are manufactured to MIL-T-27, Grade 5, Class S specifications.
Response: ±1 db 60 to 10,000 Hz
Distortion: 1% max. at 250 mW, 200 to 10,000 Hz — 10% max. at rated power, 200 to 10,000 Hz
Weight: 2.5 oz.

LH & LK SERIES





Series	A
LK	.700
LH	.600

"LH & LK" Series transformers are the ultimate in compactness. Designed to meet MIL-T-27, Grade 5, Class S.
Response: ±1 db 200 to 10,000 Hz
Distortion: 10% max. at rated power, 200 to 10,000 Hz
Weight: .75 oz.

LL Series

No.	MIL-T-27 Designation	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
			Pri.	Sec.	Pri.	Sec.		
001	TF5S21ZZ	Input	100,000CT	1000CT	6000	60	0	150
002	TF5S21ZZ	Interstage	25,000CT	1000CT	2800	120	0	150
003	TF5S21ZZ	Interstage	10,000CT	10,000CT	1100	1200	1	150
004	TF5S21ZZ	Driver	10,000CT	1500CT	1100	200	1	150
005	TF5S21ZZ	Output to Line	10,000CT	600CT	1100	75	1	150
006	TF5S21ZZ	Interstage	4000CT	10,000CT	440	1200	1.5	150
007	TF5S21ZZ	Output to Line	1000CT	600CT	100	60	3	150
008	TF5S21ZZ	Output	1000CT	4	100	0.4	3	150
009	TF5S21ZZ	Input	600CT	25,000CT	65	3500	4	150
010	TF5S21ZZ	Isolation	600CT	600CT	65	75	4	150
011	TF5S21ZZ	Output	600CT	60	65	7	4	150
012	TF5S21ZZ	Output	600CT	4	65	0.5	4	150
013	TF5S21ZZ	Driver	10,000CT	2000CT	1100	240	1	150
014	TF5S21ZZ	Driver	10,000CT	500CT	1100	65	1	150
015	TF5S21ZZ	Line to Line	500CT	600CT	55	75	4.5	150
016	TF5S21ZZ	Output to Line	300CT	600CT	33	75	5.5	150

LR Series

001	TF5S21ZZ	Interstage	25,000CT	1000CT	2600	110	0.5	750
002	TF5S21ZZ	Interstage	10,000CT	10,000CT	1000	1100	1	750
003	TF5S21ZZ	Driver	10,000CT	1500CT	1000	165	1	750
004	TF5S21ZZ	Output to Line	10,000CT	600CT	1000	70	1	750
005	TF5S21ZZ	Output	10,000CT	4	1000	0.5	1	750
006	TF5S21ZZ	Interstage	4000CT	10,000CT	400	1100	1.5	750
007	TF5S21ZZ	Output	1500CT	15	150	2	2.5	750
008	TF5S21ZZ	Output to Line	1000CT	600CT	100	70	3	750
009	TF5S21ZZ	Output	1000CT	4	100	0.5	3	750
010	TF5S21ZZ	Input	600CT	25,000CT	60	2900	4	750
011	TF5S21ZZ	Isolation	600CT	600CT	60	70	4	750
012	TF5S21ZZ	Output	600CT	60	60	6.5	4	750
013	TF5S21ZZ	Output	600CT	15	60	2	4	750
014	TF5S21ZZ	Output	600CT	4	60	0.5	4	750
015	TF5S21ZZ	Output to Line	250	600CT	25	70	7	750
016	TF5S21ZZ	Driver	10,000CT	2000CT	1000	110	1	750
017	TF5S21ZZ	Driver	10,000CT	500CT	1000	110	1	750
018	TF5S21ZZ	Line to Line	500CT	600CT	50	70	4.5	750
019	TF5S21ZZ	Output to Line	300CT	600CT	30	70	5.5	750

LW Series

No.	MIL-T-27 Designation	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri. DC (ma)	Max. 200 Hz Power† (watts)
			Pri.	Sec.	Pri.	Sec.		
001	TF5S21ZZ	Interstage	10,000CT	10,000CT	800	1050	1	3.5
002	TF5S21ZZ	Output to Line	10,000CT	600CT	800	60	1	3.5
003	TF5S21ZZ	Output	10,000CT	4	800	0.5	1	3.5
004	TF5S21ZZ	Output	1500CT	15	110	1.5	2.5	3.5
005	TF5S21ZZ	Output to Line	1000CT	600CT	75	60	3	3.5
006	TF5S21ZZ	Output	1000CT	4	75	0.5	3	3.5
007	TF5S21ZZ	Input	600CT	25,000CT	45	2700	4	2.5
008	TF5S21ZZ	Isolation	600CT	600CT	45	60	4	3.5
009	TF5S21ZZ	Output	600CT	60	45	6.5	4	3.5
010	TF5S21ZZ	Output	600CT	15	45	1.5	4	3.5
011	TF5S21ZZ	Output	600CT	4	45	0.5	4	3.5
012	TF5S21ZZ	Output to Line	250	600CT	20	60	7	3.5
013	TF5S21ZZ	Interstage	25,000CT	1000CT	2500	85	0.5	2.5
014	TF5S21ZZ	Driver	10,000CT	2000CT	800	170	1	3.5
015	TF5S21ZZ	Driver	10,000CT	500CT	800	50	1	3.5
016	TF5S21ZZ	Line to Line	500CT	600CT	50	60	4.5	3.5
017	TF5S21ZZ	Output to Line	300CT	600CT	30	60	5.5	3.5
018	TF5S21ZZ	Interstage	2500CT	10K split	200	900	1.5	3.5

LY Series

001	TF5S21ZZ	Interstage	10,000CT	10,000CT	700	900	1	6
002	TF5S21ZZ	Output to Line	10,000CT	600CT	700	55	1	6
003	TF5S21ZZ	Output	10,000CT	4	700	0.4	1	6
004	TF5S21ZZ	Output	1500CT	15	100	1.5	2.5	7.5
005	TF5S21ZZ	Output to Line	1000CT	600CT	65	55	3	7.5
006	TF5S21ZZ	Output	1000CT	4	65	0.4	3	7.5
007	TF5S21ZZ	Isolation	600CT	600CT	40	55	4	7.5
008	TF5S21ZZ	Output	600CT	60	40	6	4	7.5
009	TF5S21ZZ	Output	600CT	15	40	1.5	4	7.5
010	TF5S21ZZ	Output	600CT	4	40	0.4	4	7.5
011	TF5S21ZZ	Output to Line	250	600CT	16	55	7	7.5
012	TF5S21ZZ	Driver	10,000CT	2000CT	700	150	1	6
013	TF5S21ZZ	Driver	10,000CT	500CT	700	45	1	6
014	TF5S21ZZ	Line to Line	500CT	600CT	45	55	4.5	7.5
015	TF5S21ZZ	Output to Line	300CT	600CT	27	55	5.5	7.5
016	TF5S21ZZ	Interstage	2500CT	10K split	170	800	1.5	7.5

LH & LK No.	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri. DC (ma)	Max. 200 Hz Power† (mW)
		Pri.	Sec.	Pri.	Sec.		
001	Interstage	25,000CT	1000CT	1325	53	0.5	300
002	Interstage	10,000CT	10,000CT	510	525	1	325
003	Driver	10,000CT	1500CT	510	80	1	325
004	Output to Line	10,000CT	600CT	510	31	1	325
005	Output	10,000CT	4	510	0.3	1	325
006	Interstage	4000CT	10,000CT	200	525	1.5	325
007	Output	1500CT	15	75	1	2.5	325
008	Output to Line	1000CT	600CT	50	31	3	325
009	Output	1000CT	4	50	0.3	3	325
010	Input	600CT	25,000CT	30	1500	4	300
011	Isolation	600CT	600CT	30	31	4	325
012	Output	600CT	60	30	3	4	325
013	Output	600CT	15	30	1	4	325
014	Output	600CT	4	30	0.3	4	325
015	Output to Line	250	600CT	13	31	7	325
016	Driver	10,000CT	2000CT	510	106	1	325
017	Driver	10,000CT	500CT	510	26	1	325
018	Line to Line	500CT	600CT	25	31	4.5	325
019	Output to Line	300CT	600CT	15	31	5.5	325
020	Isolation-Ratio 1:1:1	2000CT	8K split	100	425	2	300
021	Isolation	10,000CT	2K split	510	106	1	300

† These power ratings are based upon lowest frequency operation. Much higher ratings are possible at higher operating frequencies.

TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

These 400 Hz Miniature Power Transformers are selected for use in all Military and Industrial applications requiring high performance in the smallest possible package size. They conform to all of the requirements of MIL-T-27, Class S (−55°C to +130°C). The minimum continuous operating life expectancy is 10,000 hours. This series is available having power ratings of 0.5 VA through 25 VA. The primaries are 115 Vrms with secondary voltages ranging from 5 Vrms through 300 Vrms.

It is recommended that these transformers be specified for all applications where space, weight, and cost effectiveness are prime considerations.

PART NUMBER EXAMPLE

0.5 S T 26

V.A. Rating (See Table I) — 0.5
Package Style — S
Schematic (See Table I) — T
Secondary Voltage (See Table II) — 26

TABLE I

VA Rating	Package Style	Schematic	Size	Max. Height (Inches)	Regulation (%)		Available Secondary Voltages (VRMS)		Exciting Current (ma)	Efficiency (%)		Temperature Rise (°C) — MIL-T-27 No Heat Sink		Weight (Oz.)	
					Nom.	Max.	Min.	Max.	Max.	Min.	Nom.	Nom.	Max.	Nom.	Max.
0.5	S	T, X	—	—	15	18	5	300	1.5	65	70	10	15	0.38	0.4
0.5	S	S, Y	—	—	17	21	5	300	1.5	65	70	12	17	0.38	0.4
1.5	E, P	T, X	A	0.47	20	23	5	300	1.5	70	76	13	17	0.76	0.85
1.5	E, P	S, Y	A	0.59	15	18	5	300	3	70	76	13	17	0.97	1.1
2	E, P	T, X	A	0.78	3	3.7	5	300	6	72	87	10	15	1.5	1.65
2.4	E, P	S, Y	A	1.03	3	3.8	5	300	9	73	88	11	16	1.9	2.2
3	E, P	T, X	A	0.59	15	18	5	300	3	75	84	15	20	0.97	1.1
3	E, P	S, Y	A	0.78	10	12	5	300	6	75	84	15	20	1.5	1.65
3.6	E, P	T, X	A	1.03	3	3.8	5	300	9	76	87	10	15	1.9	2.2
6	E, P	T, X	A	0.78	10	12	5	300	6	81	88	18	25	1.5	1.65
6	E, P	S, Y	A	1.03	8	10	5	300	9	80	88	18	25	1.9	2.2
7.3	E, P	S, T, X, Y	B	0.97	3	3.5	5	300	16	84	92	15	23	3.2	3.4
9	E, P	T, X	A	1.03	8	10	5	300	9	83	89	23	30	1.9	2.2
13	E, P	S, T, X, Y	B	1.20	3	3.6	5	300	25	87	93	21	28	4.2	4.4
16	E, P	S, T, X, Y	B	0.97	7	8	5	300	16	87	92	25	32	3.2	3.4
25	E, P	S, T, X, Y	B	1.20	6	7	5	300	25	88	93	36	45	4.2	4.4

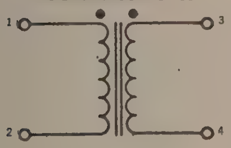
TABLE II INDUSTRY STANDARD SECONDARY VOLTAGES

Secondary Voltage	5	5.5	6	6.3	7	7.5	8	9	10	11	12	12.6	13	15	16	18	20	22	24	26	28	30	33
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325

Secondary Voltage	36	39	43	47	51	56	62	68	75	82	91	100	110	115	120	130	150	180	200	220	240	270	300
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	440	440	440	580	580

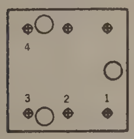
SCHEMATIC AND TERMINAL CONFIGURATIONS

SCHEMATIC X

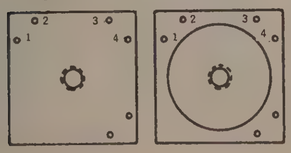


TERMINAL LAYOUTS

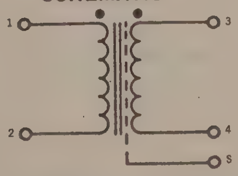
STYLE S



STYLE E STYLE P

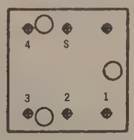


SCHEMATIC Y

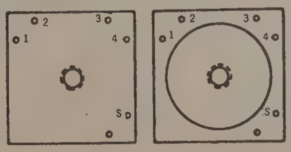


TERMINAL LAYOUTS

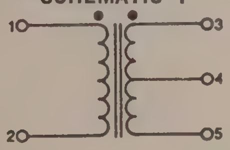
STYLE S



STYLE E STYLE P

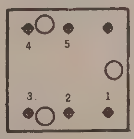


SCHEMATIC T

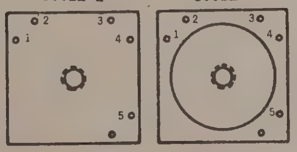


TERMINAL LAYOUTS

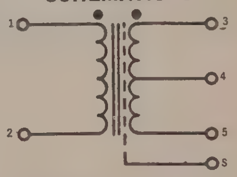
STYLE S



STYLE E STYLE P

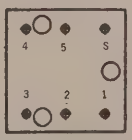


SCHEMATIC S

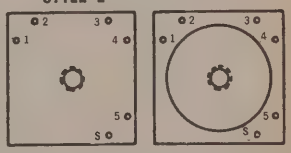


TERMINAL LAYOUTS

STYLE S



STYLE E STYLE P



TOROTEL PRODUCTS INC. 13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TRANSFORMERS

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

PHYSICAL SPECIFICATIONS

Size: Sizes for Standard VA Types are given in Table I, and Outline Drawings.

Construction: MIL-T-27, Grade 5; Black Epoxy Encapsulated.

Terminals: Printed circuit pins — tinned brass.

Terminal Strength (Method 211 of MIL-STD-202, Test Condition A): 2.0 pounds.

Marking: Includes MIL-T-27 Type Designation, winding ratings, maximum working voltage, schematc, Torotel name, and part number.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range: −55°C to +130°C (ambient plus temperature rise).

Altitude: 70,000 feet, maximum.

Vibration: MIL-STD-202, Method 204, Test Condition D.

Life Expectancy: 10,000 hours minimum.

Other Environmental Specifications: In accordance with MIL-T-27, Grade 5· Class S, Family 03.

ELECTRICAL SPECIFICATIONS

Primary Voltage: 115 volts rms ±10%.

Frequency: 400 Hz ±5%.

Secondary Voltage: See Table II.

Secondary Voltage Tolerance: ±3% at full load and 115 volts, 400 Hz applied to primary.

Electrostatic Shielding (Schematics S and Y): 5 to 1 minimum voltage ratio at 20 KHz.

Phase Shift: 1.0 electrical degree between primary and secondary voltage at rated load, maximum.

Insulation Resistance: 10,000 megohms minimum at 500 VDC.

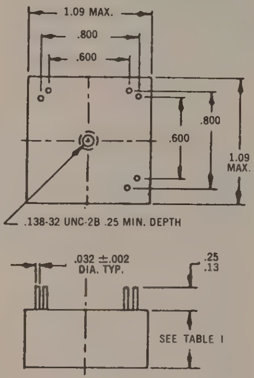
Dielectric Strength: At sea level—2.8 times the maximum working voltage. At reduced barometric pressure—1.25 times the maximum working voltage.

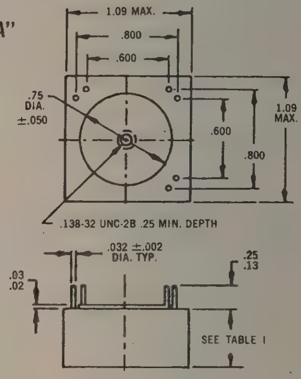
Mech. Tol. = ±.005 unless indicated.

PACKAGE STYLE E

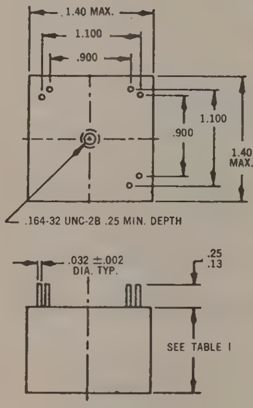
PACKAGE STYLE P

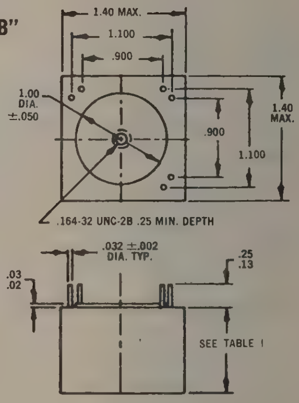
SIZE "A"


1.09 MAX.
.800
.600
.800
.600
1.09 MAX.
.138-32 UNC-2B .25 MIN. DEPTH
.032 ±.002 DIA. TYP.
.25
.13
SEE TABLE I

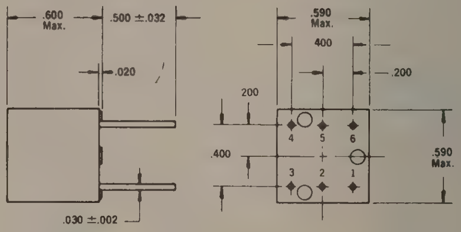

1.09 MAX.
.800
.600
.75 DIA. ±.050
1.09 MAX.
.600
.800
.138-32 UNC-2B .25 MIN. DEPTH
.032 ±.002 DIA. TYP.
.03
.02
.25
.13
SEE TABLE I

SIZE "B"


1.40 MAX.
1.100
.900
1.100
.900
1.40 MAX.
.164-32 UNC-2B .25 MIN. DEPTH
.032 ±.002 DIA. TYP.
.25
.13
SEE TABLE I


1.40 MAX.
1.100
.900
1.00 DIA. ±.050
1.40 MAX.
.900
1.100
.164-32 UNC-2B .25 MIN. DEPTH
.032 ±.002 DIA. TYP.
.03
.02
.25
.13
SEE TABLE I

PACKAGE STYLE S


.600 Max.
.500 ±.032
.020
.030 ±.002
.590 Max.
400
.200
200
.400
.590 Max.
4
5
6
3
2
1

MECH. TOL. FOR STYLE "S" = ±.010 UNLESS INDICATED.

TOROTEL PRODUCTS INC.
13402 South 71 Highway/Grandview, MO 64030/(816) 761-6314 TWX 910-777-7037

TRANSFORMERS

PC MOUNT POWER TRANSFORMERS

Torotel standard PC mount transformers are designed for 115 Vrms 60 Hz input and are generally usable to above 400 Hz. Voltages listed in table are standard values but transformers can be furnished with other voltage and current ratings. Transformers are available with Channel Frame mounting, either tab style, (Type C) twist prong (Type B) or without Frame (Style A).

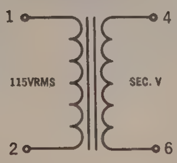
Also custom designed power transformers and audio transformers are available in these and other types and sizes upon special request.

PART NUMBER EXAMPLE

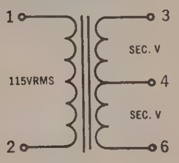
T1 — 230 — A — B
VA Size
Secondary Voltage
Schematic
Frame Style

Prefix	VA Size
T1	.50
T2	1.50
T3	4.50
T4	7.50

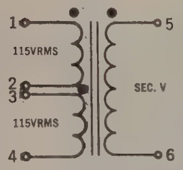
SCHEMATIC "A"



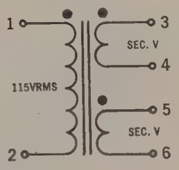
SCHEMATIC "B"



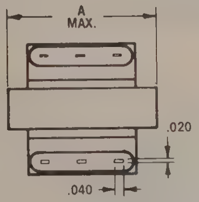
SCHEMATIC "C"



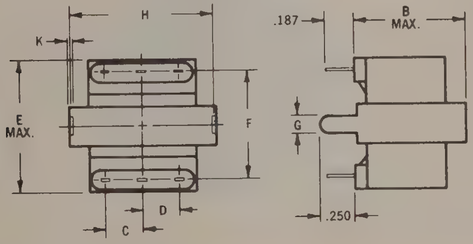
SCHEMATIC "D"



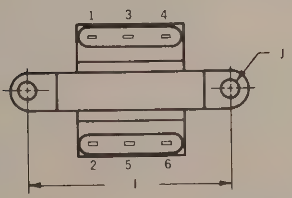
FRAME STYLE "A" NO FRAME



FRAME STYLE "B" P.C. MOUNT



FRAME STYLE "C" TAB MOUNT



SECONDARY VOLTAGE TABLE

Standard Secondary Voltages	
4	30
5	34
6.3	40
7.5	44
8	54
10	56
12	60
12.6	76
15	88
16	90
17	115
20	120
24	180
27	230
28	

DIMENSION TABLE

Size	A	B	C	D	E	F	G	H	I	J	K
T1	1.125	.870	.250	.250	.930	.720	.125	1.040	1.375	.125	.018
T2	1.500	1.250	.310	.310	1.156	1.000	.125	1.420	1.750	.187	.032
T3	1.750	1.450	.400	.400	1.275	1.100	.125	1.680	2.000	.187	.032
T4	1.970	1.690	.400	.400	1.468	1.300	.187	1.940	2.375	.187	.032

TOROTEL
PRODUCTS
INC.

THE MOST RESPECTED NAME IN MAGNETIC COMPONENTS

• HIGH RELIABILITY • LOW COST TRANSFORMERS AND INDUCTORS FOR "SWITCHERS"

3718208-1
D 8202
QHP156A1

TOROTEL
PRODUCTS
INC.

WRITE OR PHONE FOR PROMPT QUOTATIONS
13402 South 71 Highway / Grandview, MO 64030
Phone: (816) 761-6314 TWX 910-777-7037

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

AC alternating current
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
AWG American wire guage

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction code
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C

CAD computer aided design
CAM computer aided manufacture
CATV cable television or community antenna television
CERMET ceramic metal element
Comm. communications
CMOS complementary metal-oxide semiconductor
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DC direct curent
DIL dual in-line
DIP dual in-line package
DPM digital panel meter
DTL diode transistor logic

E

EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EMC electromagnetic compatibility
EMI electromagnetic interference
EPROM electrically programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide field effect transistor
GPIB general purpose interface bus

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IC integrated circuit
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J

JFET junction field effect transistor
JMOS junction metal oxide semiconductor

K

kHz kilohertz (10^3 hertz)
KSR keyboard send receive

L

LC inductance capacitance
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LSI large scale integration
LVDT linear velocity displacement transformer

M

MATV master antenna television
μF microforad
MHz megahertz
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor field effect transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NIM nuclear instrumentation module
NOR not OR

O

OEM original equipment manufacturer
OR a logical operator

P

pF picofarad
PC printed circuit
PCB printed circuit board
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PPI plan position indicator
PROM programmable read only memory
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SIP single in-line package
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic

T

TC temperature coefficient
TCXO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

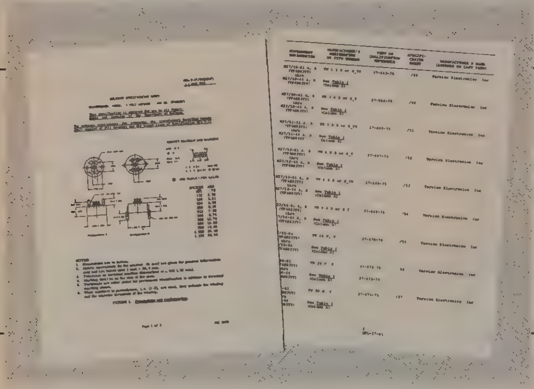
WPS word processing software

Y

YIG yttrium iron garnet

TORWICO ELECTRONICS INC. LEADER IN MAGNETIC COMPONENTS

TINYMAX® Transformers have QPL Status on Qualified Product List 27.



Now you can specify Military Standard Transformers without the need for Qualification Testing or requests for non-standard parts approval.

MIL-STD
TINYMAX
TRANSFORMERS
TORWICO

These miniature transformers are of toroidal construction and offer a size and weight reduction when compared to conventional laminated and "C" core designs. Yet, the prices on these custom engineered transformers are competitive with off-the-shelf stock items.

So, when you need a 115V, 400 Hz transformer having a specific secondary voltage don't settle for an off-the-shelf item that may only approximate your requirement. Torwico has over 2,000 MIL/STD units and an almost infinite selection of STD TINYMAX.

What's more, Torwico offers fast delivery and competitive pricing. Selection, delivery and price--Torwico has it all.

STD TINYMAX -- MIL-T-27, Grade 4 and Grade 5, Class S, 115 volt, 400 Hz transformers available in power ratings ranging from 1.5 VA through 250 VA, with an almost infinite combination of secondary voltages of 6V through 300V.

MIL-STD TINYMAX -- Grade 4 and Grade 5, Class S, 115 Volt, 400 Hz transformers. Reference M27/37 through M27/66. Over 2,000 choices of secondary voltages.

EXTENSION OF APPROVAL -- Any design selected directly from, or based, on our MIL/STD TINYMAX transformer may be qualified to MIL-T-27 by similarity.

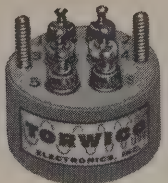
PROCUREMENT NOTE -- Catalog information and cross referenced sheets may be obtained from the factory or for MIL-STD units, refer directly to specification sheets M27/37 through M27/66.

PROTOTYPE DELIVERIES -- A large assortment of TINYMAX transformers is always maintained in stock for immediate delivery. Others can be shipped within 10 days.

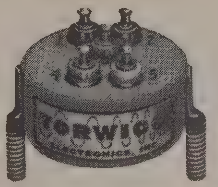
For a copy of Torwico's MIL-STD TINYMAX catalog, contact your local Torwico representative. He'll show you why Torwico is the easy way to deal with military standards.

TORWICO
ELECTRONICS INC.
LEADER IN MAGNETIC COMPONENTS

TINYMAX® 400 HZ Power Transformers



This Case style
available in
1.5 through 250 VA

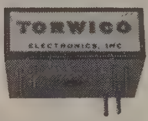


This Case style
available in
1.5 through 9 VA

TINYMAX®

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 4 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF4S03YY

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ± 3% (from range shown) with 115V PRI.	O.D ± .031"	HT. ± .031"	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.000	.469	1.00 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.000	.594	1.25 oz.	18%	17°C
3	6.0 to 300	1.000	.594	1.25 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.000	.812	1.70 oz.	12%	20°C
6	6.0 to 300	1.000	.812	1.70 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.000	1.062	2.30 oz.	10%	25°C
9	6.0 to 300	1.000	1.062	2.30 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
16 WITH OR WITHOUT ELECTROSTATIC SHIELD	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
25	6.0 to 300	1.375	1.375	4.95 oz.	7%	45°C
50	6.0 to 300	2.000	1.500	11.00 oz.	3%	35°C
75	10 to 300	2.000	1.750	13.50 oz.	3%	40°C
100	12 to 300	2.250	2.000	18.70 oz.	2.5%	43°C
250	26 to 300	2.875	2.000	30.00 oz.	2%	55°C



TINYMAX®

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 5 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF5S03ZZ

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ± 3% (from range shown) with 115V PRI.	SIZE MAX- INCHES	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.09 Sq. X .47 ht.	.85 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	17°C
3	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	20°C
6	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	25°C
9	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
16 WITH OR WITHOUT ELECTROSTATIC SHIELD	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
25	6.0 to 300	1.40 Sq. X 1.20 ht.	4.40 oz.	7%	45°C

TORWICO
ELECTRONICS INC.

NEW HAMPSHIRE AVENUE & ROUTE 70, LAKEWOOD, N.J. 08701 201•364-1800 enclosures · capacitors · circuit boards · coils, chokes, inductors · connectors, electronic · sockets/terminals · crystals · oscillators · crystal filters · delay lines · panel hardware · displays · lamps/lights · cooling equipment · filters · generators · multimeters · panel meters · oscilloscopes · graphic recorde[illegible]nnections · microwave components [illegible]tors/drives · [illegible] supplies, ac · [illegible] · relays · solenoids · resistors · potentiometers/trimmers controls/rh[illegible] · switches · terminals/[illegible] · transducers/encoders · transformers · wire & cable · enclosures capacitors · circuit boards · coils, chokes, inductors · connectors, electronic · sockets/terminals

EEM PRODUCT SELECTION GUIDES

There are 33 Guides in this edition of EEM. See page 2 (1A•2, 1B•2, 2•2, 3•2) of each volume to locate the Product Selection Guides that pertain to your needs.

MILITARY MAGNETIC SPECIALISTS

Engineering / Design — Prototype • High Volume — Airborne • Shipboard • Land Based

Call for information on any design requirement or for technical assistance.

PRECISION TOROIDAL TRANSFORMERS — SCOTT "T" TRANSFORMERS

Trans American Transformer provides custom signal transformers with high accuracies over the full military temperature/environmental range. Our speciality is High Performance and Consistency in the smallest size. Your design or our design to your specifications.

These transformers are fully encapsulated P-C mount toroidal/laminated units. They are manufactured in accordance with Mil-T27D Grades 4 and 5. They have high input impedance and low output impedance combined with high transformation accuracy and minimum quadrature. These characteristics make these units particularly useful in solid state synchro to digital and digital to synchro converter applications.

Send for catalog T-101A

HIGH FREQUENCY SWITCHING POWER SUPPLY MAGNETICS

Switching power supply magnetics designed and manufactured to meet all high reliability military requirements. Typical circuit designs include push pull, forward converter and flyback. Power requirements from milliwatts to approximately 1 kilowatt. Units available in Grade 4, 5, 6 and temperature Class S through U.

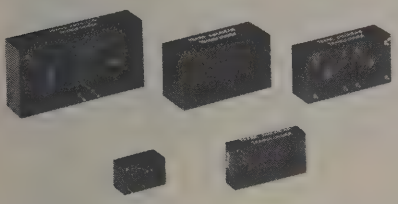
Send for catalog T-202A

POWER TRANSFORMERS 60-400 Hz

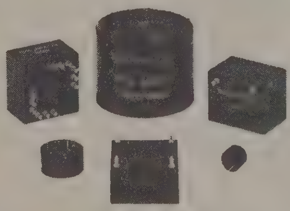
Designed and built to meet the specifications of Mil-T-27D, high reliability and long life are major features of these units. All designs available in Grades 4, 5, 6 and temperature Class S through U. Low profile and PC mount toroidal and laminated units provide the absolute smallest size/volume for any system requirement.

Send for catalog T-303A

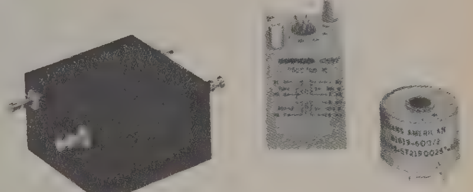
SCOTT "T"



HIGH FREQUENCY



POWER TRANSFORMER



TRANS AMERICAN TRANSFORMER PRECISION DIGITAL RATIO TRANSFORMERS

TRANS AMERICAN TRANSFORMER
MODEL 4460
IN
COM
OUT
RATIO TRANSFORMER

QUALITY — RELIABILITY

Trans American Transformer engineers will custom design all magnetics to meet any high reliability requirement.

Qualification Testing — Environmental Testing
Mil-T-27D/Mil-STD-202/Mil-STD/810/
Mil-Q-9858/Mil-I-45208/Mil-C-45662

Quality is built-in and confirmed by testing.

THERMAL TOOLS

1. Wire stripper
2. Resistive tweezer
3. Conductive tweezer

Options: Temperature control/Multiple units/Temperature monitoring

RATIO INFORMATION **DECADE RATIO TRANSFORMER**

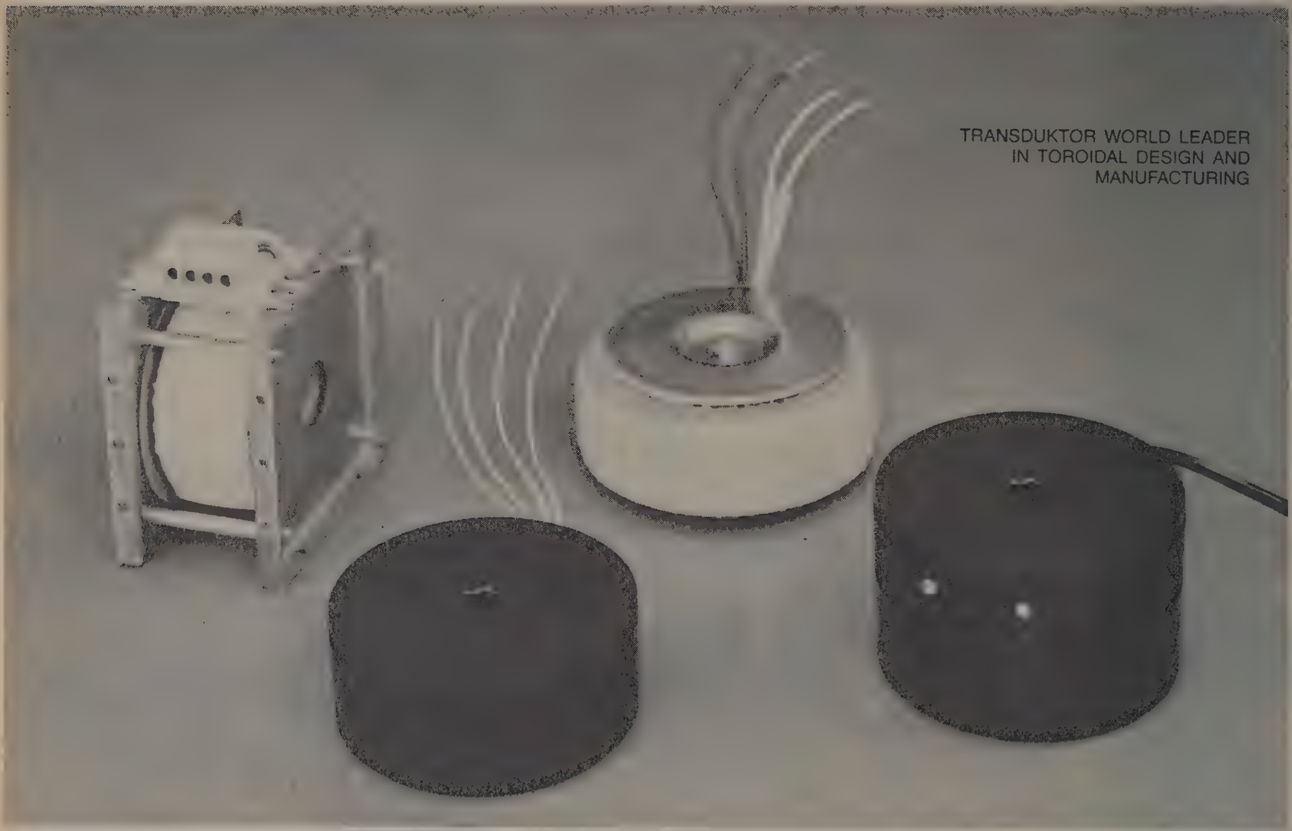
Model	Ratio Range	Accuracy 10V to Max Input	Frequency Range	Input Impedance	Max Input Voltage	Nom. Out. Res.	Resolution	Size	Approx. Wt.
M450	0.000000 to 1.111110	1 part per million at 50 to 3000 Hz	50 to 10,000 Hz	200K @ 400Hz	.35 x f (f in Hz) not to exceed 350V	4 ohm	Continuous	3½″ H x 19″ W x 10″ D	7¾ lbs.
M460	0.000000 to 1.111110	1 part per million at 30 to 400 Hz	30 to 1,000 Hz	250K @ 60Hz	2.5 x f. (f in Hz) not to exceed 350V	8 ohm	Continuous	3½″ H x 19″ W x 10″ D	9 lbs.

Trans American Transformer, Inc.

142 PECONIC AVENUE, MEDFORD, NY 11763 • PHONE (516) 654-1880

Transduktor

Toroidal Power Transformers


TRANSDUKTOR WORLD LEADER IN TOROIDAL DESIGN AND MANUFACTURING

Transduktor offers high quality Toroidal Power Transformers with the following features:

UL-RECOGNIZED
Transduktor Toroidal Power Transformers, custom made or standard, are UL-recognized and also approved by all major safety agencies such as VDE (West Germany), SEV (Switzerland), OEV (Austria), SEMKO (Scandinavia), etc. All Transduktor transformers are provided with 4000V RMS insulation as standard.

LOW WEIGHT
Typically 50% lighter than traditional stacked lamination transformers.

SMALL DIMENSIONS
Low height profile allows slim, compact design of electronic equipment.

FLEXIBLE DIMENSIONS
The Transduktor Toroidal Power Transformer can be "modeled" to fit very limited spaces and still conform to your electrical requirements.

EASY TO MOUNT
Just one center screw easily and quickly mounts the Transduktor Toroidal Power Transformer to the chassis.

LOW MAGNETIC STRAYFIELD
No air gap and the primary and secondary windings are evenly spread around the core, resulting in a very low radiated magnetic field.

LOW MECHANICAL HUM
A single continuous strip of steel tightly wound into a roll results in a very solid and stable unit. No loose parts to buzz.

SMALL NO LOAD LOSSES
Transduktor Toroidal Power Transformers can reduce open circuit power by 90% compared to traditional stacked lamination transformers.

TRANSDUKTOR INC./600 Steamboat Road, Greenwich, Connecticut 06830/Tel. (203) 661-5726/Telex 996491 SID

Transduktor

Toroidal Power Transformers

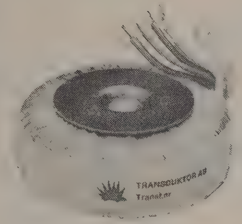
TRANSDUKTOR'S LINES OF TOROIDAL COMPONENTS

- 50/60 Hz power transformers
- Isolation transformers
- Step-up/Step down transformers
- Rectifier transformers
- Autotransformers
- 1-phase and 3-phase transformers
- 400 Hz transformers
- Current transformers
- DC and low frequency chokes
- Filter chokes for SMPS

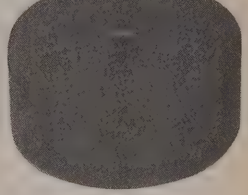
STANDARD OFF-THE-SHELF TRANSFORMERS SERIES 5000

Primary voltage: 120V, 60 Hz

Primary to secondary insulation: 4000V RMS



DISK MOUNTED



ENCAPSULATED TYPE TD

Nominal Power VA	Secondary Voltage V AC	Secondary Current A AC	Type No.	DISK MOUNTED		ENCAPSULATED TYPE T	
				Dimensions OD × H	Weight lbs.	Dimensions OD × H	Weight lbs.
20	2 × 9	1.11	5020-2009	2.4 × 1.3	.7	2.6 × 1.7	.8
	2 × 12	.83	5020-2012				
	2 × 15	.67	5020-2015				
	2 × 18	.56	5020-2018				
40	2 × 9	2.22	5040-2009	2.8 × 1.3	1.2	3.1 × 1.7	1.3
	2 × 12	1.67	5040-2012				
	2 × 15	1.33	5040-2015				
	2 × 18	1.11	5040-2018				
60	2 × 9	3.33	5060-2009	3.2 × 1.5	1.5	3.5 × 1.7	1.7
	2 × 12	2.50	5060-2012				
	2 × 15	2.00	5060-2015				
	2 × 18	1.67	5060-2018				
100	2 × 12	4.20	5100-2012	3.9 × 1.5	2.2	4.0 × 1.7	2.4
	2 × 15	3.3	5100-2015				
	2 × 18	2.8	5100-2018				
	2 × 22	2.3	5100-2022				
150	2 × 12	6.3	5150-2012	3.9 × 1.9	3.2	4.0 × 2.0	3.3
	2 × 15	5.0	5150-2015				
	2 × 18	4.2	5150-2018				
	2 × 22	3.4	5150-2022				
200	220	.9	5200-1220	4.5 × 1.9	4.0	4.8 × 2.2	4.1
	2 × 18	5.5	5200-2018				
	2 × 22	4.5	5200-2022				
	2 × 24	4.1	5200-2024				
250	220	1.1	5250-1220	4.5 × 2.0	4.6	4.8 × 2.2	4.8
	2 × 22	5.6	5250-2022				
	2 × 24	5.2	5250-2024				
	2 × 30	4.1	5250-2030				
350	220	1.6	5350-1220	4.5 × 2.4	5.8	4.8 × 2.6	6.0
	2 × 24	7.3	5350-2024				
	2 × 30	5.8	5350-2030				
	2 × 33	5.3	5350-2033				
	2 × 38	4.6	5350-2038				
425	220	1.9	5425-1220	5.5 × 2.0	6.9	—	—
	2 × 30	7.1	5425-2030				
	2 × 33	6.4	5425-2033				
	2 × 38	5.6	5425-2038				
550	220	2.5	5550-1220	5.5 × 2.4	8.5	—	—
	2 × 30	9.1	5550-2030				
	2 × 33	8.3	5550-2033				
	2 × 38	7.2	5550-2038				

TRANSDUKTOR INC./600 Steamboat Road, Greenwich, Connecticut 06830/Tel. (203) 661-5726/Telex 996491 SID

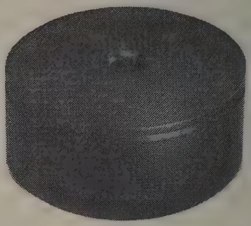
Transduktor

Toroidal Power Transformers

CUSTOM DESIGNED TOROIDAL POWER TRANSFORMERS 50/60 Hz
SERIES AA

Transduktor has years of experience in designing and manufacturing toroidal power transformers. Our application engineers will assist you to select the best transformer for your application.

Our computers are programmed to immediately analyze your data and prepare custom designs. Samples can be delivered 2-3 weeks after order.



ENCAPSULATED TYPE TD
(20 VA — 360 VA)

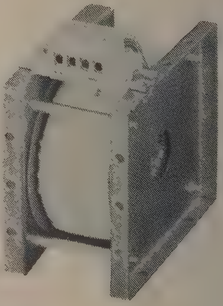
ELECTRICAL AND MECHANICAL DATA

Power Range		No Load Loss W	Max Copper Loss W	Size and Weight (unmounted transformer)	
60 Hz VA	50 Hz VA			OD × H inches	Weight lbs.
20	15	.20	3.2	2.4 × 1.3	0.7
40	30	.25	6.3	2.8 × 1.3	1.2
60	50	.45	9.2	3.2 × 1.5	1.5
100	80	.60	13.0	3.9 × 1.5	2.2
150	120	.90	17.0	3.9 × 1.9	3.2
200	160	1.20	21.0	4.4 × 1.7	4.0
300	250	1.70	18.0	4.5 × 2.4	5.5
360	300	2.00	24.0	4.5 × 2.7	6.6
480	400	2.40	29.0	5.4 × 2.3	7.9
600	500	3.10	33.0	5.4 × 2.8	9.5
750	630	3.80	39.0	6.5 × 2.6	12.0
960	800	4.70	49.0	6.5 × 3.0	14.0
1200	990	6.50	49.0	6.5 × 3.4	17.0
1600	1300	5.70	64.0	7.9 × 2.6	20.0
1900	1600	7.10	67.0	7.9 × 3.0	23.0
2300	1900	8.50	70.0	7.9 × 3.3	26.0
2650	2200	8.10	79.0	8.9 × 3.3	29.0
3000	2500	9.70	85.0	8.9 × 3.5	33.0
3400	2800	11.00	96.0	9.6 × 3.1	35.0
3900	3200	13.00	98.0	9.6 × 3.5	42.0
4500	3700	15.00	100.0	9.6 × 3.9	46.0
5300	4400	17.00	120.0	11.2 × 4.3	53.0
6000	5000	20.00	120.0	11.2 × 4.7	62.0
7600	6300	27.00	140.0	12.4 × 4.7	84.0
9600	8000	28.00	150.0	13.4 × 4.7	88.0
12000	10000	39.00	150.00	13.4 × 5.9	120.0

Data above are typical and may be changed without prior notice.

TRANSDUKTOR AB

DISK MOUNTED
(20 VA — 1200 VA)



FLANGE MOUNTED
(150 VA — 12,000 VA)

Complete Data Sheets and Application Notes are available on request.

TRANSDUKTOR INC./600 Steamboat Road, Greenwich, Connecticut 06830/Tel. (203) 661-5726/Telex 996491 SID

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF
VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

TRIAD-UTRAD

Standard Products
Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: (219) 356-6500 • TWX: 810-333-1532

POWER TRANSFORMERS

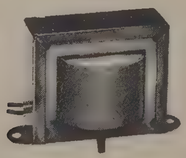
FOR POWER SUPPLY, CONTROL AND FILAMENT CIRCUITS

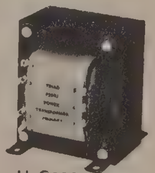
115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡)

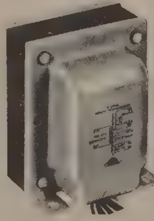
LISTED IN ORDER OF INCREASING SECONDARY VOLTAGES

Triad Part No.	Secondary		RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension			Mounting Dimension		Mounting Hole Size	Max. Unit Wt. Lbs.
	Volts	Amps				H	W	D	MW	MD		
F-1X‡+	2.5 CT	3	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.68
F-72Z‡	2.5 CT	5	Sec. 7500	Z	Sec.-Lugs	2 23/32	3 1/8	2 1/8	2 13/16	—	3/16	1.7
F-6X‡+	2.5 CT	6	Sec. 2500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1
F-3X‡	2.5 CT	10	Sec. 3000	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-5U	2.5 CT	10	Sec. 7500	U	Leads	3 1/16	2 1/2	2 7/16	2	1 7/8	5/16 x 3/16	2.2
F-7X	5.0 CT	3	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-8X	5.0 CT	6	1500	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-12X	5.0 CT	8	2500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.5
F-10U‡	5.0 CT	14	Sec.10,000	U	Leads	3 13/16	3 3/16	3 1/4	2 1/2	2 9/16	5/16 x 3/16	4.75
F-15U‡	5.0 CT	15	Sec. 3000	U	Lugs	3 1/2	2 7/8	2 11/16	2 1/4	2 3/16	5/16 x 3/16	3.25
F-9U	5.2 CT	13	1500	U	Leads	3 7/16	2 13/16	3 1/4	2 1/4	2 3/8	5/16 x 3/16	4
F-11U	5.2 CT	24	1500	U	Leads	3 13/16	3 3/16	3 7/8	2 1/2	3 1/16	5/16 x 3/16	6.75
F-13X+	6.3	.6	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.37
R-84K	6.3§	.6	Sec. 3500	K	2-Leads	2 3/4	2 1/4	2 11/16	1 1/2	2 3/8	3/16	1.5
F-14X‡+	6.3 CT	1.2	Sec. 2500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.7
F-14Z‡	6.3 CT	1.2	Sec. 2500	Z	Leads	1 15/16	2 3/8	1 5/8	2	—	3/16	.7
F-52X	6.3§	1.2	Sec. 5000	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1
F-51X‡	6.3§	2	Sec. 5000	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-16X+	6.3 CT	3	Sec. 2500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-53X	6.3	4	Sec. 5000	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.1
F-43X‡	6.3	4	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-18A	6.3 CT	6	1500	A	1-Leads	3 3/16	2 21/32	2 5/8	2	1 11/16	3/8 x 3/16	2.5
F-18X+	6.3 CT	6	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-69X	6.3 CT	8	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.3
F-21A	6.3 CT	10	1500	A	1-Leads	3 19/32	2 31/32	3 1/8	2 1/4	2	3/8 x 3/16	3.8
F-20U†	6.3 CT-6 CT	11	Sec. 3000	U	Leads	3 1/2	2 7/8	3	2 1/4	2 7/16	5/16 x 3/16	4
F-17U‡	6.3 CT	15	Sec.10,000	U	Pri. Leads	4 1/4	3 1/2	3 3/4	2 3/4	2 13/16	5/16 x 3/16	7.5
F-22A	6.3 CT	20	2000	A	2-Leads	3 7/8	3 9/32	4 1/8	2 1/2	3	3/8 x 3/16	7
F-24U†	7.5 CT-6.3 CT	8	Sec. 3000	U	2-Leads	3 1/2	2 7/8	2 13/16	2 1/4	2 5/16	5/16 x 3/16	3.65
F-28U†	7.5 CT-6.3 CT	25	Sec. 3000	U	Leads/Lugs	4 5/8	3 13/16	3 5/8	3	3 1/16	5/16 x 3/16	7.5
F-180X	10.0 CT	1	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	.9
F-31X	10.0 CT	3	2000	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-95X	10.0 CT	4	1500	X	Leads	2 5/8	4	2 1/8	3 9/16	—	3/16	2.1
F-33U	10.0 CT	5	2000	U	Leads	3	2 1/2	2 5/8	2	2 1/16	3/16 x 3/8	2.5
F-96U	10.0 CT	6	1500	U	Leads	3	2 1/2	2 3/4	2	2 5/16	3/8 x 3/16	2.1
F-23U	10.0 CT	7	1500	U	Leads	3 1/2	2 7/8	2 15/16	2 1/4	2 7/16	5/16 x 3/16	3.9
F-97U	10.0 CT	8	1500	U	Leads	3 7/16	2 13/16	3	2 1/4	2 1/2	3/8 x 3/16	4.0
F-35U	10.0 CT	10	2000	U	Leads	4 1/8	4 1/2	3 1/4	2 3/4	2 7/16	3/16 x 3/8	9.1
F-113X	12.0	0.15	1500	X	Leads	1 3/8	2 3/8	1 3/8	—	2	3/16	.4
F-216X‡	12.0	.35	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.37
F-114X	12.0	0.7	1500	X	Leads	1 5/8	2 13/16	1 5/8	—	2 3/8	3/16	.8
F-217X‡	12.0	1.2	1500	X	Leads	2	3 1/4	1 3/4	2 13/16	—	3/16	1.0
F-218X‡	12.0	2	1500	X	Leads	2	3 1/4	1 7/8	2 7/8	—	3/16	1.13
F-219X‡	12.0	4	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.3
F-220U‡	12.0	6	1500	U	Leads	3 7/16	2 13/16	2 1/2	2 1/4	2 1/8	3/8 x 3/16	3.5
F-221U‡	12.0	8	1500	U	Leads	3 13/16	3 1/8	2 3/8	2 1/2	2 1/8	3/8 x 3/16	4.0
F-29U†	12 CT-11 CT 10.0 CT	11	Sec. 3000	U	Leads	4 3/8	3 1/2	3 3/8	2 3/4	2 9/16	5/16 x 3/16	6.5
F-70X	12.6 CT	1.0	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	3/16	1.3
F-25X +	12.6 CT	1.5	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-44X‡+	12.6 CT	2	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.25
F-26X‡+	12.6 CT	2.5	1500	X	Leads	2 9/32	3 11/16	2	3 1/8	—	3/16	1.55
F-224X‡	12.6	3	1500	X	Leads	2 1/4	3 3/4	2 1/8	3 1/8	—	3/16	1.6
F-225X‡	12.6	4	1500	X	Leads	2 5/8	4	2 1/16	3 9/16	—	3/16	2.3
F-181U+	12.6 CT	4	1500	U	Leads	3 1/16	2 9/16	2 3/16	2	2	3/16	2.3
F-182U	12.6 CT	6	1500	U	Leads	3 3/8	2 13/16	2 7/16	2 1/4	2 3/8	5/16 x 3/16	3.8

§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation. + Available 115/230 PRI.


X Case


U Case


A Case

Z Case

POWER TRANSFORMERS

TRIAD-UTRAD
Standard Products

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: (219) 356-6500 • TWX: 810-333-1532

115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡) CONTINUED

Triad Part No.	Secondary		RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension			Mounting Dimension		Mounting Hole Size	Max. Unit Wt. Lbs.
	Volts	Amps				H	W	D	MW	MD		
F-183U	12.6 CT	8	1500	U	Leads	3 13/16	3 3/16	2 15/16	2 1/2	2 1/4	5/16 x 3/16	5
F-112X+	14.0 CT	0.25	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	—	3/16	.4
F-250X	14.0 CT	1	1500	X	Leads	1 15/16	3 1/4	1 3/4	2 13/16	—	3/16	1.2
F-251X	14.0 CT	2	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	3/16	—	1.5
F-252U	14.0 CT	4	1500	U	Leads	3	2 1/2	2 7/16	2	2 1/4	5/16 x 3/16	3
F-253U	14.0 CT	6	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-410X	18.0 CT	.75	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-411X	18.0 CT	1	1500	X	Leads	1 15/16	3 5/16	2 1/8	2 13/16	—	3/16	1.45
F-412X	18.0 CT	1.5	1500	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	—	3/16	1.7
F-413X	18.0 CT	2	1500	X	Leads	2 9/32	3 3/4	2 1/4	3 1/8	—	3/16	1.95
F-254X	20.0 CT	1	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	3/16	1.5
F-255X	20.0 CT	2	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.5
F-256U	20.0 CT	4	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-257U	20.0 CT	6	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.7
F-258U	20.0 CT	8	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-259U	20.0 CT	10	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-115X+	24.0 CT	0.085	1500	X	Leads	1 3/16	2 1/16	1 1/4	1 3/4	—	3/16	3
F-116X+	24.0 CT	0.2	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.45
F-117X+	24.0 CT	0.4	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.8
F-118X+	24.0 CT	0.7	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1.3
F-45X‡+	24.0 CT	1	1500	X	Leads	1 15/16	3 5/16	2	3 1/8	—	3/16	1.3
F-46X‡+	24.0	1	1500	X	Leads	1 15/16	3 11/16	2 1/8	3 1/8	—	3/16	1.4
F-192X	24.0 CT	2	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-229X‡	24.0	2	1500	X	Leads	2 9/16	4	1 7/8	3 9/16	—	3/16	2.3
F-193U	24.0 CT	4	1500	U	Leads	3 13/16	3 1/8	2 13/16	2 1/2	2 1/8	5/16 x 3/16	4
F-260U	24.0 CT	6	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-261U	24.0 CT	8	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-401U	24.0 CT	10	1500	U	Leads	4 1/8	3 7/16	3 3/4	2 3/4	3	3/8 x 3/16	8.0
F-226U	24.0 CT	12	1500	U	Leads	4 9/16	3 3/4	4 1/8	3	3 1/4	3/8 x 3/16	10.4
F-57X†	25.2 CT	1	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.5
F-41X‡+	25.2 CT	2	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.2
F-56X	25.2 CT	2.8	1500	X	Leads	2 21/32	4	2 1/4	3 9/16	—	3/16	2.5
F-119X	26.8 CT	0.15	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.45
F-120X	26.8 CT	0.5	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1.3
F-40X‡+	26.8 CT	1	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-55X+	26.8 CT	1.7	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.3
F-121X	28.0 CT	.085	1500	X	Leads	1 3/16	2 1/16	1 3/8	1 3/4	—	3/16	.25
F-122X	28.0 CT	.175	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	—	3/16	.35
F-123X	28.0 CT	.300	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.6
F-124X	28.0 CT	.800	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	—	3/16	1
F-184X	28.0 CT	1	1500	X	Leads	2 9/32	3 3/4	2 1/8	2 13/16	—	3/16	1.4
F-185U+	28.0 CT	2	1500	U	Leads	3 1/16	2 1/2	2 7/16	2	2 1/4	3/16 x 3/8	2.9
F-187U	28.0 CT	4	1500	U	Leads	3 1/2	2 7/8	3 1/16	2 1/4	2 3/4	5/16 x 3/16	5.3
F-262X	30.0 CT	1	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	—	3/16	1.5
F-210X	30.0 CT	1.7	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	1.55
F-263U	30.0 CT	2	1500	U	Leads	3	2 1/2	2 9/16	2	2 3/8	5/16 x 3/16	3.2
F-264U	30.0 CT	4	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.7
F-265U	30.0 CT	6	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-266U‡	30.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-227X‡	35.0 CT	.065	1500	X	Leads	1 3/16	2 1/16	1 5/16	1 3/4	—	3/16	.3
F-188X	35.0 CT	.1	1500	X	Leads	1 5/8	2 13/16	1 7/16	2 3/8	—	3/16	.35
F-228X‡	35.0 CT	.3	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	—	3/16	.6
F-189X	35.0 CT	.5	1500	X	Leads	2 5/16	3 11/16	1 15/16	3 1/8	—	3/16	1
F-54X+	35.0 CT	1.5	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	—	3/16	2.2
F-190U	35.0 CT	2	1500	U	Leads	3 3/8	2 13/16	2 3/4	2 1/4	2 3/8	5/16 x 3/16	3.5
F-191U	35.0 CT	4	1500	U	Leads	3 13/16	3 3/16	3 3/16	2 3/4	2 1/2	5/16 x 3/16	6
F-267U	35.0 CT	6	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-268U	35.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 1/4	5/16 x 3/16	11
F-269U	35.0 CT	10	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 3/4	5/16 x 3/16	12
F-270X	40.0 CT	1	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.6
F-271U	40.0 CT	2	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8	5/16 x 3/16	4
F-272U	40.0 CT	4	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6.4
F-273U	40.0 CT	6	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-274U	40.0 CT	8	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 5/8	5/16 x 3/16	10.5
F-275U	40.0 CT	10	1500	U	Leads	5 1/4	4 3/8	4 1/2	3 1/2	3 1/4	5/16 x 3/16	14.5
F-276X	50.0 CT	1	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	—	3/16	2.4
F-277U	50.0 CT	2	1500	U	Leads	3 3/4	3 1/8	2 7/8	2 1/2	2 3/8	5/16 x 3/16	4.7
F-278U	50.0 CT	4	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4
F-58A	50.0 CT	5	1500	A	Leads	4 5/8	3 15/16	4 1/2	3	3 3/8	3/8 x 3/16	10
F-59X	60.0 CT	.4	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	—	3/16	1.3
F-279U	60.0 CT	1	1500	U	Leads	3	2 1/2	2 5/8	2	2 3/8	5/16 x 3/16	3.4
F-280U	60.0 CT	2	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8	5/16 x 3/16	5.6
F-281U	60.0 CT	4	1500	U	Leads	4 1/2	3 3/4	4	3	3	5/16 x 3/16	10
F-282U	60.0 CT	6	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 7/8	5/16 x 3/16	12.5
F-283U	70.0 CT	1	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-284U	70.0 CT	2	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8	5/16 x 3/16	6

§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation. + Available 115/230 PRI.

TRIAD-UTRAD

Standard Products

POWER TRANSFORMERS

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: (219) 356-6500 • TWX: 810-333-1532

MICROPROCESSOR POWER TRANSFORMERS

DUAL C.T. SECONDARIES, 115V PRIMARY/50/60 Hz

F234Z-F245U HAVE 2 ISOLATED WINDINGS

Triad Part No.	Secondary		RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension			Mounting Dimension		Mounting Hole Size	Max. Unit Wt. Lbs.
	Volts	Amps				H	W	D	MW	MD		
F-234Z‡	12.0 CT	.1	1500	Z	Lugs	1 3/8	2	1 5/16	1 3/4	—	3/16	.3
F-235Z‡	12.0 CT	.25	1500	Z	Lugs	2	2 3/8	1 7/16	2	—	3/16	.6
F-236Z‡	12.0 CT	.5	1500	Z	Lugs	2 5/16	2 7/8	1 5/8	2 3/8	—	3/16	.9
F-237Z‡	12.0 CT	1	1500	Z	Lugs	2 3/8	2 13/16	2 1/16	2 3/8	—	3/16	1.1
F-238U‡	12.0 CT	2	1500	U	Lugs	2 1/2	3	2 3/16	2 1/2	2	3/8 x 3/16	2.2
F-239U‡	12.0 CT	4	1500	U	Lugs	3 1/8	3 3/4	2 3/4	3 1/8	2 1/4	3/8 x 3/16	4.3
F-240U‡	12.0 CT	6	1500	U	Lugs	3 1/2	4 1/8	3 1/16	2 1/2	2 1/4	3/8 x 3/16	5.4
F-241U‡	18.0 CT	1	1500	U	Lugs	2 1/2	3	2 1/2	2 1/8	2	3/8 x 3/16	2.2
F-242U‡	18.0 CT	2	1500	U	Lugs	3 1/8	3 3/4	3 1/8	3 7/16	2	3/8 x 3/16	4.0
F-243U‡	18.0 CT	4	1500	U	Lugs	3 1/2	4 1/8	3 1/4	3 3/4	2 1/4	3/8 x 3/16	5.2
F-244U‡	18.0 CT	8	1500	U	Lugs	3 3/4	4 1/2	4	3 3/4	2 3/4	3/8 x 3/16	8.3
F-245U‡	18.0 CT	12	1500	U	Lugs	4 3/8	5 3/16	4 1/4	4 1/2	2 3/4	3/8 x 3/16	11.9
F-194X	32.0 CT 15.5 CT	.050 .200	1500	X	Leads	1 5/8	2 7/8	1 3/8	2 3/8	—	3/16	.45
F-195X	32.0 CT 15.5 CT	.250 .750	1500	X	Leads	2 1/4	3 3/4	1 7/8	3 1/8	—	3/16	1.3
F-196U	32.0 CT 15.0 CT	1 2	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-197U	32.0 CT 15.0 CT	1 4	1500	U	Leads	3 3/4	3 1/8	2 15/16	2 1/2	2 1/4	5/16 x 3/16	4.7
F-198U	32.0 CT 15.0 CT	1 6	1500	U	Leads	3 3/4	3 1/8	3 3/16	2 1/2	2 3/4	5/16 x 3/16	6.2
F-199U	32.0 CT 15.0 CT	1 10	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4	5/16 x 3/16	7.4

* Windings may be connected in series to obtain their combined voltage when properly phased. Current will be equal to the current of the lowest winding. Example: Two 6.3V windings @ 2A in series would be 12.6V @ 2A. Windings may also be connected in parallel to obtain combined current. Example: Two 6.3V windings @ 2A in parallel would be 6.3V @ 4A. ¶ Tapped primary 105-115-125. ‡ 60 cycle operation.

DUAL C.T. SECONDARIES/PRIMARY 230V, 50/60 Hz

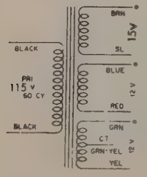
Triad Part No.	Secondary		RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension			Mounting Dimension		Mounting Hole Size	Max. Unit Wt. Lbs.
	Volts	Amps				H	W	D	MW	MD		
F-395X	32.0 CT 15.0 CT	.250 .750	1500	X	Leads	2 1/4	3 3/4	1 7/8	3 1/8	—	3/16	1.3
F-396U	32.0 CT 15.0 CT	1 2	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4	5/16 x 3/16	4
F-397U	32.0 CT 15.0 CT	1 4	1500	U	Leads	3 3/4	3 1/8	2 15/16	2 1/2	2 1/4	5/16 x 3/16	4.7

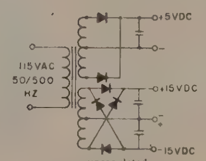
TRIPLE SECONDARIES, 115V PRIMARY, 60 Hz ONLY (3 ISOLATED WINDINGS)

Type No.	Secondary		RMS Test Voltage	Case Type	Connections	Case Dimensions				Mtg. Hole Size	Max. Unit Wt. Lbs.
	Volts	Amps				H	W	D	MW		
F-295Z	12VCT-12V 15V	.1	1500	Z	Leads	1 3/4	2	1 1/2	1 3/4	3/16	.4
F-296Z		.15	1500	Z	Leads	1 15/16	2 3/8	1 1/2	2	3/16	.6
F-297Z		.25	1500	Z	Leads	1 15/16	2 7/16	1 5/8	2	3/16	.7
F-298Z		.5	1500	Z	Leads	2 1/4	3 3/4	1 7/8	3	3/16	1.3
F-299X		1.5	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	3/16	2.3

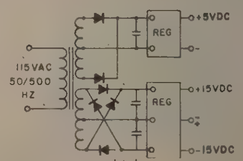
TRIPLE SECONDARIES, 115-230V PRIMARY, 50-60 Hz (3 ISOLATED WINDINGS)

F-3295Z	12VCT-12V 15V	.1	1500	Z	Leads	1 3/4	2	1 1/2	1 3/4	3/16	.41
F-3297Z		.25	1500	Z	Leads	2 3/8	2 7/8	1 5/8	2 3/8	3/16	.8
F-3298Z		.5	1500	Z	Leads	2 3/8	2 13/16	2	2 3/8	3/16	1.25





unregulated



regulated

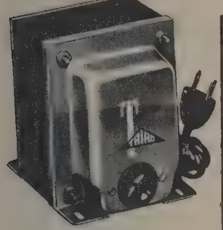
TRANSFORMERS

TRIAD-UTRAD

Standard Products

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: (219) 356-6500 • TWX: 810-333-1532

STEPDOWN AUTOFORMERS/50-60 Hz



M Case

Triad Part No.	Output Watts (VA)	Primary Volts	Secondary Volts ±5%	Secondary RMS Amps	RMS Test Voltage	Case Type	Connections	Mounting Dimension MW	Mounting Dimension MD
N-1X	50	230	115	.435	1500	X	Leads	3⅛	—
N-3M	85	230	115	.74	1500	M	6′ Cord & Plug & Socket	2¼	1⅝
N-2X	100	230	115	.87	1500	X	Leads	3⅝	—
N-4M	150	230	115	1.3	1500	M	6′ Cord & Plug & Socket	2¼	2⅜
N-6U	200	230	115	1.7	1500	U	Leads	2¼	2¼
N-5M	250	230	115	2.17	1500	M	6′ Cord & Plug & Socket	2½	3
N-7M	600	230	115	5.22	1500	M	6′ Cord & Plug & Socket	3	3⅞
N-39X	50	0-100-115-127-135	115	.43	1500	X	Lugs	2 13/16	—
N-40X	100	0-100-115-127-135	115	.87	1500	X	Lugs	2 13/16	—
N-100MG	100	115	230	.65	1500	MG	6′ 3 Wire, Cord Plug & Socket	2¼	2 31/32
N-250MG	250	115	230	1.1	1500	MG	6′ 3 Wire, Cord Plug & Socket	2½	3¼
N-500MG	500	115	230	2.2	1500	MG	6′ 3 Wire, Cord Plug & Socket	3	3⅝
N-1000MG	1000	115	230	4.35	1500	MG	6′ 3 Wire, Cord Plug & Socket	3½	4⅛

LOW VOLTAGE RECTIFIER/TRANSISTOR DRIVE VOLTAGE, 50-60 Hz

Triad Part No.	Primary Volts	Secondary AC Volts	Secondary AC Amps	DC Volts Half Wave	DC Volts Bridge	RMS Test Voltage	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-94X	115†	10-20 CT — 40 CT	.035	15	30	1500	X	Leads	1⅜	2⅜	1⅜	2	—
F-90X	115†	10-20 CT — 40 CT	.1	15	30	1500	X	Leads	1⅝	2 13/16	1⅝	2⅜	—
F-91X	115†	10-20 CT — 40 CT	.3	15	30	1500	X	Leads	2 9/32	3 11/16	2	3⅛	—
F-93X	115†	10-20 CT — 40 CT	.75	15	30	1500	X	Leads	2 19/32	4	2¼	3 9/16	—
F-92A	115†	10-20 CT — 40 CT	1.0	15	30	1500	A	Leads (2 Holes)	3 3/16	2 21/32	3	2	2 1/16
F-394X	230	10-20 CT — 40 CT	.035	15	30	1500	X	Leads	1⅜	2⅜	1⅜	2	—
F-390X	230	10-20 CT — 40 CT	.1	15	30	1500	X	Leads	1⅝	2 13/16	1⅝	2⅜	—
F-391X	230	10-20 CT — 40 CT	.3	15	30	1500	X	Leads	2¼	3 11/16	2	3⅛	—
F-393X	230	10-20 CT — 40 CT	.75	15	30	1500	X	Leads	2 19/32	4	2¼	3 9/16	—
F-392A	230	10-20 CT — 40 CT	1.0	15	30	1500	A	Leads	3 3/16	2 21/32	3	2	2 1/16

UNIVERSAL RECTIFIER POWER/PRIMARY 117V, 50-60 Hz

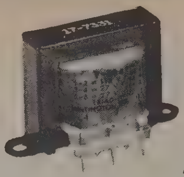
Triad Part No.	Secondary No. 1 AC Volts	Secondary DC Amps Full Wave CT	Secondary DC Amps Bridge	Secondary No. 2 AC Volts	Secondary No. 2 DC Amps	RMS Test Volts	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-202U	11.0 to 29.5	2.0	1.25	—	—	1000	U	Lugs	3	2½	3	2	2⅛
F-203U	12.0 to 30.0	4.0	2.0	—	—	1000	U	Lugs	3⅜	2 13/16	3¼	2¼	2⅜
F-204U	11.5 to 29.0	8.0	4.0	—	—	1000	U	Lugs	3¾	3⅛	4⅛	2½	2⅞
F-205U	12.0 to 29.5	12.0	6.0	—	—	1000	U	Lugs	4⅛	3 7/16	5⅛	2¾	3¼

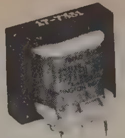
Triad Part No.	Primary Volts	Secondary AC Volts	Secondary AC Amps	DC Volts Half Wave	DC Volts Bridge	RMS Test Voltage	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-47U F-347U	115 115/230	0-17-18	3	6-7	13-14	1500	U	Leads	3	2½	2¾	1⅝	2⅜
F-48U	115	0-17-18	6	6-7	13-14	1500	U	Leads	3 13/16	3 3/16	3 3/16	2½	2 11/16
F-49U	115	36* 36*	3 3	13 13	26 26	1500	U	Leads	4⅝	3 13/16	3¾	3	3 1/16
F-60U	115	0-6.5-13-19.5-26	3	9	18	1500	U	Leads	3⅜	2 13/16	2⅝	2¼	2 3/16
F-360U	115/230	—	—	—	—	—	—	—	—	—	—	—	—
F-61U	115	0-24-27-30-33-36	3	13	26	1500	U	Leads	3¾	3⅛	3¼	2½	2⅝
F-361U	115/230	—	—	—	—	—	—	—	—	—	—	—	—
F-67U‡	110-120	0-24-27-30-33-36	8	13	26	1500	U	Leads	4⅝	3 13/16	4⅜	3	3 5/16
F-64U	115	0-7-8-9	7	—	5-6-7	1500	U	Leads	3⅜	2 13/16	2¾	2¼	2 3/16

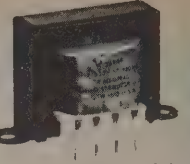
TRIAD-UTRAD

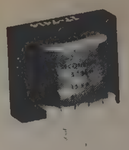
Standard Products

Dept. EM, 1124 East Franklin St., Huntington, IN 46750
Phone: (219) 356-6500 • TWX: 810-333-1532


A


B


A-1, A-2


B-1

LOW-VOLTAGE, LOW-CURRENT PLUG-IN PRINTED CIRCUIT POWER

115V, 50-60 Hz PRIMARY/DUAL SECONDARIES*

Cat. No.	Fig.	Output Watts	Secondary		Dimensions						Mtg. Dim.	Wt. Oz.
			Series Connection	Parallel Connection	H	W	D	L	A	B		
F-131P	B	1½	8V CT @ .188A	4V @ .376A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-139P	B	1½	12.6V CT @ .12A	6.3V @ .24A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-132P	B	1½	15V CT @ .100A	7.5V @ .200A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-150P	B	1½	17V CT @ .085A	8.5V @ .170A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-138P	B	1½	25.2V CT @ .06A	12.6V @ .12A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-133P	B	1½	30V CT @ .050A	15V @ .100A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-160P	B	1½	34V CT @ .045A	17V @ .090A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-135P	B	1½	76V CT @ .020A	38V @ .040A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1	—	3.5
F-149XP	A	4½	12.6V CT @ .35A	6.3V @ .70A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-142XP	A	4½	15V CT @ .300A	7.5V @ .600A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-161XP	A	4½	17V CT @ .264A	8.5V @ .528A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-148XP	A	4½	25.2V CT @ .178A	12.6V @ .356A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-143XP	A	4½	30V CT @ .150A	15V @ .300A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-162XP	A	4½	34V CT @ .132A	17V @ .264A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-147XP	A	4½	40V CT @ .112A	20V @ .224A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-144XP	A	4½	54V CT @ .084A	27V @ .168A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-159XP	A	7½	12.6V CT @ .60A	6.3V @ 1.2A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-152XP	A	7½	15V CT @ .500A	7.5V @ 1.000A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-163XP	A	7½	17V CT @ .441A	8.5V @ .882A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-158XP	A	7½	25.2V CT @ .30A	12.6V @ .60A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-153XP	A	7½	30V CT @ .250A	15V @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-164XP	A	7½	34V CT @ .220A	17V @ .440A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-154XP	A	7½	54V CT @ .140A	27V @ .280A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5

115-230V, 50-60 Hz DUAL PRIMARY*/DUAL SECONDARIES*

F-3132P	B-1	1½	15V CT @ .1A	7.5V @ .200A	1 1/8	1 3/8	1 1/8	1 3/8	13/64	1	1 3/8	4.0
F-3142XP	A-1	4½	15V CT @ .3A	7.5V @ .600A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-3152XP	A-1	7½	15V CT @ .5A	7.5V @ .100A	1 5/8	2 13/16	1 61/64	1 7/16	1/4	1 15/16	2 3/8	11.0
F-3143XP	A-1	4½	30V CT @ .150A	15V @ .300A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-3153XP	A-1	7½	30V CT @ .250A	15V @ .500A	1 5/8	2 13/16	1 61/64	1 7/16	1/4	1 15/16	2 3/8	11.0
F-333P	B-1	1½	30V CT @ .050A	15V @ .100A	1 1/8	—	1 1/8	1 3/8	13/64	1	—	4.0
F-349XP	A-1	4½	16V CT @ .280A	8V @ .560A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-359XP	A-2	10	24V CT @ .450A	12V @ .900A	1 5/8	2 13/16	1 7/16	1 7/8	1/4	1 5/16	2 3/8	11.0
F-362XP	A-2	10	20V CT @ .500A	10V @ 1.0A	1 5/8	2 13/16	1 7/16	1 7/8	1/4	1 5/16	2 3/8	11.0

PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS/

115V, 50-60 Hz PRIMARY/TRIPLE OUTPUT SECONDARIES FOR ±15V AND ±5V DC

Cat. No.	Fig.	Output Watts	Secondary		Dimensions						Mtg. Dim.	Wt. Oz.
			Series Connection	Parallel Connection	H	W	D	L	A	B		
F-165P	B	1½	24V CT @ .025A	9V CT @ .100A	1 1/8	1 25/64	1 5/32	1 25/64	13/64	1	—	3.5
F-167P	B	1½	32V CT @ .020A	15V CT @ .060A	1 1/8	1 25/64	1 5/32	1 25/64	13/64	1	—	3.5
F-168XP	A	4½	32V CT @ .050A	15V CT @ .195A	1 25/64	2 3/8	1 1/4	1 45/64	1/4	1 3/32	2	7.5
F-166XP	A	7½	24V CT @ .125A	9V CT @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	1/4	1 5/16	2 3/8	10.5
F-169XP	A	7½	32V CT @ .100A	15V CT @ .287A	1 41/64	2 13/16	1 15/32	1 61/64	1/4	1 5/16	2 3/8	10.5

PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS

Cat. No.	Fig.	Output M.W.	Primary Impedance	Secondary Impedance	Primary D.C. Unbalance	Dimensions			Pin Dimension		Wt. Oz.
						H	W	D			
TY-141P	B	100	10,000 CT	10,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-142P	B	100	10,000 CT	2,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-147P	B	100	150 CT	600 CT	15 ma.	5/8	13/16	19/32	3/16	.042	5

* Two isolated windings.

TRANSFORMERS

TRIAD-UTRAD

Standard Products

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750
Phone: (219) 356-6500 • TWX: 810-333-1532

ISOLATION/50-60 Hz ALL ISOLATION UNITS HAVE STATIC SHIELDS

Type No.	Output Watts (VA)	Primary Volts	Secondary AC Volts ±5%	Secondary AC Amps	RMS Test Voltage	Case Type	Connections	Lead Holes Used	Case Dimensions H	Case Dimensions W	Case Dimensions D	Mounting Dimensions MW	Mounting Dimensions MD
N-48X	15	115	115	.13	1500	X	Leads	—	1 15/16	3 5/16	2	2 13/16	—
N-51X‡	35	115	115	.3	1500	X	Leads	—	2 9/32	3 11/16	2 1/8	3 1/8	—
N-68X	50	115-230§	115	.435	1500	X	Leads	—	2 9/32	3 11/16	2 1/8	3 1/8	—
N-53M	85	115	115	.74	1500	M	6′ Cord, Plug & Socket	—	3 19/32	2 31/32	3 5/8	2 1/4	2 3/8
N-54M	150	115	115	1.3	1500	M	6′ Cord, Plug & Socket	—	3 7/8	3 9/32	4 1/4	2 1/2	3
N-73A	150	115	115-230§	.65	1500	A	Leads	1	3 7/8	3 9/32	3 7/8	2 1/2	2 3/4
N-67A	150	115-230§	115	1.3	1500	A	Leads	2	3 7/8	3 9/32	4 1/8	2 1/2	3
N-55M	250	115	115	2.17	1500	M	6′ Cord, Plug & Socket	—	4 5/8	3 15/16	5	3	3 7/8
N-55MG†	—	115	—	—	—	—	—	—	—	—	—	—	—
N-66A	250	115-230§	115	2.17	1500	A	Leads	2	4 5/8	3 15/16	4 5/8	3	3 5/8
N-469A‡	50	220-440§	115	.435	1500	A	Leads	1	3 3/16	2 21/32	2 1/2	2	1 9/16
N-471A‡	300	220-440§	115	2.6	2000	A	Leads	1	4 5/8	3 15/16	4 3/8	3	3 3/8

CONTROL TRANSFORMERS/6V, 12V, 24V SECONDARIES

Triad Part No.	Primary	Secondary Parallel	Secondary Series	VA Rating	Case Type	Connections	Height Overall	Base Area	Mounting Dimension	Shpg. Wt. in lbs.
F-105Z	115V/230V 50/60 CPS on all	6V @ 2A	12V @ 1A	12	Z	Lugs	3 3/8	2 7/8 x 1 3/4	2 3/8	1
F-106Z		6V @ 4A	12V @ 2A	24	Z	Lugs	2 3/4	3 1/8 x 2	2 13/16	1 1/2
F-107Z		12V @ 4A	24V @ 2A	48	Z	Lugs	3 1/8	3 5/8 x 2 3/8	3 1/8	2 1/2
F-398U		12V @ 6A	24V @ 3A	72	U	Lugs	3 1/2	2 13/16 x 2 13/16	2 1/4 x 2 1/4	4 1/4
F-108U		12V @ 8A	24V @ 4A	96	U	Lugs	3 1/2	2 7/8 x 3	2 1/4 x 2 1/4	4 1/4
F-399U		12V @ 12A	24V @ 6A	144	U	Lugs	3 3/4	3 1/8 x 3 1/2	2 1/2 x 2 7/8	5.9
F-109U		12V @ 16A	24V @ 8A	192	U	Lugs	4 1/8	3 3/4 x 3 1/2	3 x 2 3/4	8
F-211Z		24V @ .5A	48V @ .25A	12	Z	Lugs	2 5/16	2 13/16 x 1 1/2	2 3/8	.678
F-212Z		24V @ 1A	48V @ .50A	24	Z	Lugs	2 3/4	3 1/8 x 2 1/4	2 13/16	1.05
F-213Z		24V @ 2A	48V @ 1A	48	Z	Lugs	3 1/16	3 5/8 x 2 3/8	3 1/8	1.55
F-214U		24V @ 4A	48V @ 2A	96	U	Lugs	3 31/32	3 3/16 x 2 3/16	2 1/4 x 2 5/8	3.24
F-400U		24V @ 6A	48V @ 3A	144	U	Lugs	3 3/4	3 1/8 x 3 1/2	2 1/2 x 2 7/8	5.9
F-215U		24V @ 8A	48V @ 4A	192	U	Lugs	4 5/32	3 3/4 x 3 7/16	2 3/4 x 3	6.06

MINIATURE AUDIO TRANSFORMERS

Type No.	Power Output	Application	Matching Impedance Primary	Matching Impedance Secondary	DC Resistance Primary	DC Resistance Secondary	Overall Turns Ratio	Frequency Response ±3DB	RMS Test Volts	Case Type	Case Dimension H	Case Dimension W	Case Dimension D	Mtg. Dimen. MW
T-1X‡	1MW	Line or Mike to Grid	600/250/50	50,000	80	3200	1:9.16	60-15,000	500	X	5/8	1 7/32	3/4	1
T-31X‡	10MW	Line to Line	600/250/50	600/250/50	55	80	1:1	50-15,000	500	X	5/8	1 7/32	3/4	1
T-34X	20MW	Transistor or Line to Transistor or Line	500 CT 2 MA. D.C.	500 CT/ 125§	45	55	1:1.03	50-20,000	500	X	5/8	1 9/32	11/16	1 1/16
T-35X	10MW	Transistor or Line to Transistor	600 CT 1 MA. D.C.	2000 CT/ 500§	68	200	1:1.7	50-20,000	500	X	5/8	1 7/32	3/4	1

TELEPHONE COUPLING TRANSFORMERS

Cat. No.	Fig. No.	Application	Primary Impedance	Secondary Impedance	Dimensions A	B	C	D	E	F	G	H	I	J	Wt. Oz.
TY-300P	B	Hybrid*	600	600/600†	.63	.75	.55	.421	.187	.375	.25	.203	.020	.041	3.2
TY-301P	B	Coupling	600	900	.63	.75	.55	.421		.375	.25	.203	.020	.041	3.2
TY-302P	B	Hybrid*	600	600/600	.75	1.00	.94	.781	.200	.400	.26	.203	.020	.041	3.2
TY-303P	B	Bridging	4000	600	.63	.75	.55	.421		.375	.25	.203	.020	.041	3.2
TY-304P	B	Coupling	600 CT	600 CT	.63	.75	.55	.421	.187	.375	.25	.188	.018	.041	4.8
TY-350P	B	Holding Coil	2.0 hy @ 60 ma. 1.3 hy @ 100 maDC, 180 ohms DCR		1.19	1.44	.98	1.00		.63	.25		.020	.040	4.8

* Two required for hybrid operation. † Split winding; one wide band, one narrow band.

TRIAD-UTRAD

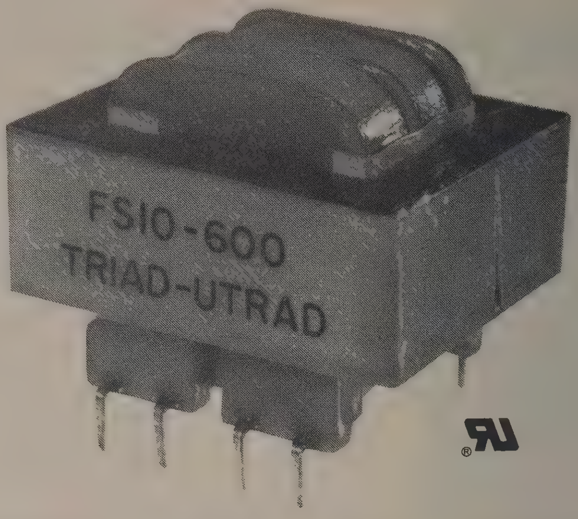
Standard Products

SPLIT PACK

Dept. EM, 1124 East Franklin Street, Huntington, IN 46750 • Phone: 219-356-6500 • TWX: 810-333-1532

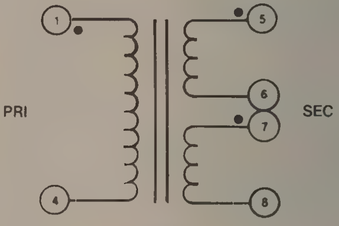
Split Bobbin Transformer

Triad-Utrad's new Split Pack split bobbin transformer increases the depth and versatility of Triad's already extensive line of PC board mounted transformers. Like Triad's recent Flat Pack series, the Split Pack transformers are nonconcentrically wound—with primary and secondaries wound side by side, unlike the secondary-on-top-of-primary windings of standard PC board transformers. Split bobbin winding and low capacitive coupling eliminate costly electrostatic shielding. The Split Pack's unique construction makes possible higher HiPot testing—2,500V rather than 1,500V.

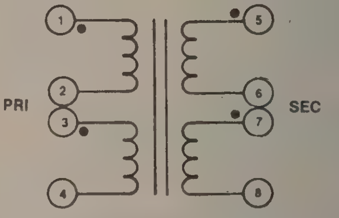


Triad Split Pack

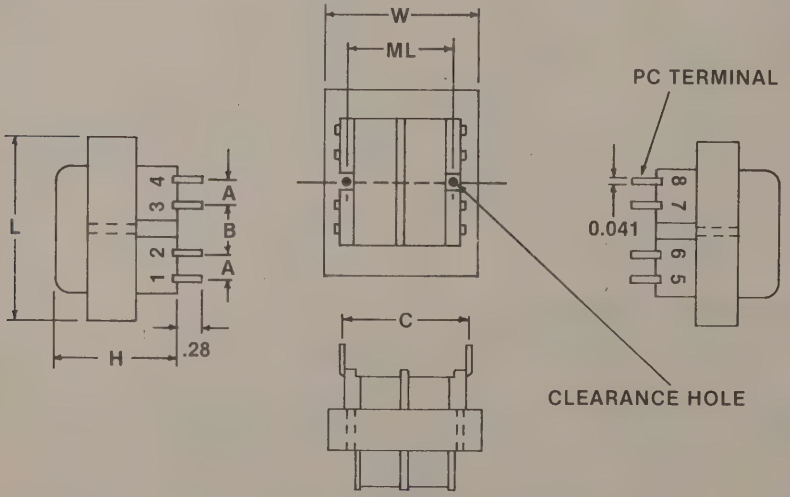
PRIMARY			SECONDARY RATINGS (RMS)		
115V 6 PIN	115/230V 8 PIN	VA	INDIVIDUAL	SERIES	PARALLEL
F10-250	FS10-250	2.5	5V @ .25A	10V CT @ .25A	5V @ .5A
F10-600	FS10-600	6	5V @ .6A	10V CT @ .6A	5V @ 1.2A
F10-1200	FS101200	12	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A
F12-200	FS12-200	2.5	6.3V @ .2A	12.6V CT @ .2A	6.3V @ .4A
F12-500	FS12-500	6	6.3V @ .5A	12.6V CT @ .5A	6.3V @ 1.0A
F12-1000	FS121000	12	6.3V @ 1.0A	12.6V CT @ 1.0A	6.3V @ 2.0A
F16-150	FS16-150	2.5	8V @ .15A	16V CT @ .15A	8V @ .3A
F16-400	FS16-400	6	8V @ .4A	16V CT @ .4A	8V @ .8A
F16-800	FS16-800	12	8V @ .8A	16V CT @ .8A	8V @ 1.6A
F20-120	FS20-120	2.5	10V @ .12A	20V CT @ .12A	10V @ .24A
F20-300	FS20-300	6	10V @ .3A	20V CT @ .3A	10V @ .6A
F20-600	FS20-600	12	10V @ .6A	20V CT @ .6A	10V @ 1.2A
F24-100	FS24-100	2.5	12V @ .1A	24V CT @ .1A	12V @ .2A
F24-250	FS24-250	6	12V @ .25A	24V CT @ .25A	12V @ .5A
F24-500	FS24-500	12	12V @ .5A	24V CT @ .5A	12V @ 1.0A
F28-85	FS28-85	2.5	14V @ .085A	28V CT @ .085A	14V @ .17A
F28-200	FS28-200	6	14V @ .2A	28V CT @ .2A	14V @ .4A
F28-420	FS28-420	12	14V @ .42A	28V CT @ .42A	14V @ .84A
F36-65	FS36-65	2.5	18V @ .065A	36V CT @ .065A	18V @ .13A
F36-170	FS36-170	6	18V @ .17A	36V CT @ .17A	18V @ .34A
F36-350	FS36-350	12	18V @ .35A	36V CT @ .35A	18V @ .7A



6 PIN



8 PIN



VA	H	W	L	ML	A	B	C	WT
2.5	1-3/16	1-1/8	1-3/8	—	.250	.250	1.20	.25
6	1-5/16	1-5/16	1-5/8	1-1/16	.250	.350	1.280	.44
12	1-7/16	1-9/16	1-7/8	1-1/4	.300	.400	1.410	.70

Specifications:

Dual Primaries—115/230V, 50/400 Hz

Split Bobbin—side by side windings reduce interwinding capacitance and eliminate the need for a static shield.

Hi-Pot—2,500V RMS is standard.

Terminals—are precision spaced.

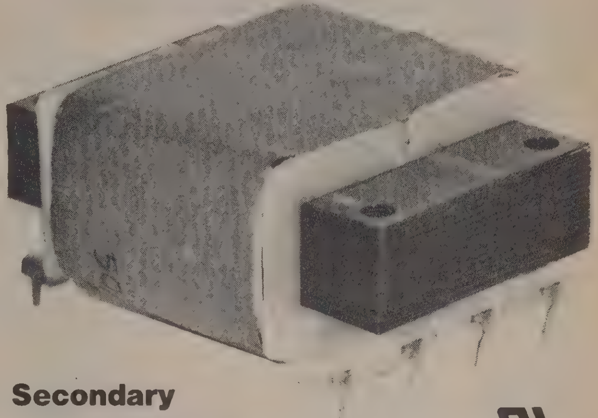
FLAT PACK POWER

TRIAD-UTRAD

Standard Products

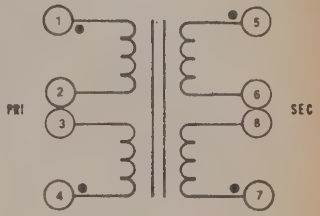
Dept. EM, 1124 East Franklin Street, Huntington, IN 46750
Phone: (219) 356-6500 • TWX: 810-333-1532

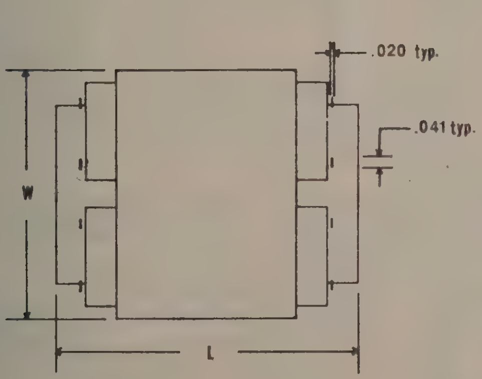
Triad-Utrad's Flat Pack power transformer is designed to meet the needs of low clearance printed circuit board and solid state power designs. These new units can also be used for control and instrumentation applications. Voltages and currents were chosen for widely used power applications and could be used in single or dual output supplies. The Triad-Utrad Flat Pack has a unique construction feature allowing them to pass a 2000V HiPot test.

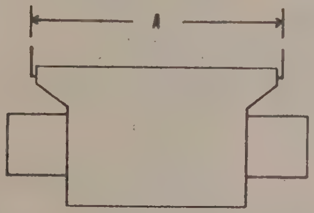


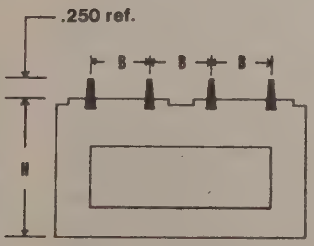
115-230 volts, 50-60 Hz, Dual Primary, Dual Secondary

TYPE NO.	OUTPUT WATTS	INDIVIDUAL	SERIES	SECONDARY PARALLEL
FP10-600	6	5V @ .6A	10V CT @ .6A	5V @ 1.2A
FP10-1200	12	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A
FP12-475	6	6.3V @ .475A	12.6V CT @ .475A	6.3V @ .95A
FP12-950	12	6.3V @ .95A	12.6V CT @ .95A	6.3V @ 1.9A
FP16-375	6	8V @ .375A	16V CT @ .375A	8V @ .75A
FP16-750	12	8V @ .75A	16V CT @ .75A	8V @ 1.5A
FP20-300	6	10V @ .3A	20V CT @ .3A	10V @ .6A
FP20-600	12	10V @ .6A	20V CT @ .6A	10V @ 1.2A
FP24-250	6	12V @ .25A	24V CT @ .25A	12V @ .5A
FP24-500	12	12V @ .5A	24V CT @ .5A	12V @ 1.0A
FP30-200	6	15V @ .2A	30V CT @ .2A	15V @ .4A
FP30-400	12	15V @ .4A	30V CT @ .4A	15V @ .8A
FP34-170	6	17V @ .17A	34V CT @ .17A	17V @ .34A
FP34-340	12	17V @ .34A	34V CT @ .34A	17V @ .68A
FP40-150	6	20V @ .15A	40V CT @ .15A	20V @ .3A
FP40-300	12	20V @ .3A	40V CT @ .3A	20V @ .6A
FP56-100	6	28V @ .1A	56V CT @ .1A	28V @ .2A
FP56-200	12	28V @ .2A	56V CT @ .2A	28V @ .4A
FP88-65	6	44V @ .065A	88V CT @ .065A	44V @ .13A
FP88-130	12	44V @ .13A	88V CT @ .13A	44V @ .26A
FP120-50	6	60V @ .05A	120V CT @ .05A	60V @ .1A
FP120-100	12	60V @ .1A	120V CT @ .1A	60V @ .2A
FP230-25	6	115V @ .025A	230V CT @ .025A	115V @ .05A
FP230-50	12	115V @ .05A	230V CT @ .05A	115V @ .1A









OUTPUT WATTS	H	W	L	A	B
6	.875	1.562	1.875	1.600	.375
12	1.062	2.000	2.500	2.000	.500

Specifications:

Flat Pack = allows 1" card spacing for 6VA units or 1-1/4" for 12VA units

Dual Primaries = 115/230V, 50/60HZ

Split Bobbin = side by side windings reduce interwinding capacitance and eliminates the need for a static shield

Semi-Toroidal Construction reduces radiated magnetic fields and results in balanced windings

Hi-Pot = 2000V RMS is standard

Terminals are precision spaced

Selection Guide for TRW Transformers

STANDARD AUDIO TRANSFORMERS AND INDUCTORS

Product Series	Description	Frequency Range	Max. Power
Military Types: Grade 5, Metal Encased			
BIT-250	Ribbon style Kovar leads; compatible with transistor and IC flat pack styles. Transformers and inductors.	300 Hz to 250 kHz	80 mW @ 1 kHz
DO-T	Flexible 1½″ Dumet leads. Ultraminiature transformers and inductors for transistor circuitry.	300 Hz to 20 kHz	500 mW @ 1 kHz
DO-T200	Plug-in — TO-5 pattern. Ultraminiature transformers and inductors for transistor style circuitry.	300 Hz to 20 kHz	100 mW @ 1 kHz
DI-T	Flexible 1½″ Dumet leads. Ultraminiature transformers and inductors for transistor circuitry.	400 Hz to 100 kHz	500 mW @ 1 kHz
DI-T200	Plug-in — TO-5 pattern. Ultraminiature transformers and inductors for transistor circuitry.	400 Hz to 100 kHz	500 mW @ 1 kHz
TOP-1000	Plug-in, .50 D by .35 High	300 Hz to 75 kHz	.6 W @ 1 kHz
TOP-2000	Plug-in, .50 D by .5 High	150 Hz to 75 kHz	1 W @ 1 kHz
TOP-3000	Plug-in, .750 D by .52 High	50 Hz to 30 kHz	2 W @ 1 kHz
Military Types: Grade 4, Metal Encased			
H	**Transformers** — Full line of input, interstage and output types for transistor and tube use. Chopper type transformers. **Inductors** — Range from .4 mHys to 450 Hys.	30 Hz to 20 kHz	1 mW to 10 mW
FHA	Low profile audio unit, straight 1″ pin terminals for plug-in mounting.	300 Hz to 20 kHz	100 mW @ 300 Hz
W (Mil Std)	Qualified to Mil Stds. print No.'s M27/3-01A to M27/11-01A. Inputs, interstage and output types.	300 Hz to 10 kHz	2W @ 300 Hz
Military Types: Grade 5, Molded			
SSO-P	Transistor and tube type transformers. Input, interstage, output and inductors.	300 Hz to 20 kHz	100 mW @ 300 Hz
SO-P	Transistor and tube type transformers. Input, interstage, output and inductors.	200 Hz to 20 kHz	250 mW @ 200 Hz
MTC	Plug-in, MIL-T-27, transformers for telephone interconnect and hybrid action.	300 Hz to 4 kHz	10 mW
Industrial Types: Cased, Non-Hermetic			
I-DI-T	Industrial versions of standard DI-T types.	400 Hz to 100 kHz	500 mW
I-DO-T	Industrial versions of standard DO-T types.	300 Hz to 20 kHz	500 mW
O	Excellent quality compact audio transformers and inductors, full range of transistor and tube applications	300 Hz to 20 kHz	1 Watt
A	Ultra compact wideband transistor and tube type transformers and inductors, hybrids and choppers.	10 kHz 50 kHz	5 Watt
LS	Linear standard transformers. Hi-fidelity, highest quality. Tube and transistor types. Includes low dist. high efficiency, shielded types, hybrid transformers. Broadcast quality.	7 Hz to 50 kHz	Low level to 50W
Industrial Types: Open Frame, Non-Hermetic			
SSO	Flexible lead type transformers and inductors for tube and transistor application. Channel frame available.	300 Hz to 20 kHz	100 mW
SO	Small, broadband type, flexible lead type. Transistor and tube types. Channel frame available.	200 Hz to 20 kHz	250 mW
PC	Plug-in types for mounting on PC boards. Same electrical characteristics as standard ouncer, sub-ouncer and sub-sub-ouncer lines.	100 Hz to 20 kHz 200 Hz to 20 kHz 300 Hz to 20 kHz	1W 250 mW 100 mW
TC	Plug-in and lead type transformers and inductors for telephone interconnect	100 Hz to 10 kHz	1 mW to 10 mW

IN ADDITION TO THE NEEDS met by TRW stock audio and power components listed on this page, there are many unique applications that can be met with special units.

Our catalog audio line, for example, represents close to 500 commercial and MIL grade components covering a frequency band from 5 Hz to 250 kHz, at levels of mWs to 250 W and ranging in weight from 1/20 oz. to 16 lb. Our custom designs — which often can be MIL qualified by similarity — cover an even broader range of frequencies and power ratings.

Custom power designs range from milliwatts to 100 kVA capacity. They comprise temperature ranges from Class R (105°C) to Class U (higher than 170°C.) All types of mechanical and electrical configurations are available, and special engineering emphasis is placed on individual requirements.

STANDARD POWER TRANSFORMERS AND INDUCTORS

Product Series	Description	Frequency	Power Range
Military Types			
DO-T400	Flexible lead ultraminiature power transformer. Hermetically sealed to MIL-T-27D Grade 5, Metal Clad.	380 Hz to 2400 Hz	400 mW
FP	MIL-T-27, Grade 5, low profile power transformers. 115V pri; secs deliver 2 to 30V.	400 Hz	10W to 30W
LL	MIL-T-27 Inductors Grade 5. Axially leaded units. .365 D x .49 L.	.25 Amps to 3 Amps	30 µHys to 5000 µHys
H	Inductors. Hermetically sealed inductor to MIL-T-27D Grades 4 & 5.	.017A to 30A*	0.4 mHy to 450 Hys†
H	Hermetically sealed to MIL-T-27D. Grades 4 & 5. Transistor, filament, inverter and plate type. Metal clad & molded.	50 Hz to 2500 Hz	1.2 VA to 5.0 KVA
HIT	Ultra-shielded power line isolation transformers. Hermetically sealed to MIL-T-27D. Grade 4. 0.1 mfd or less, effective coupling.	50 Hz to 400 Hz	50W to 1200W
MET	Hermetically sealed metal clad to MIL-T-27D Grade 4. For 400 Hz application to give min. size. Transistor, filament, universal types.	380 Hz to 2400 Hz	1.4W to 240W
N	Mil. St'd. filament & plate transformers per MIL-T-27D. Grade 4 (ruggedized) construction.	50 Hz to 400 Hz	7.5W to 125W
NV	Inverter transformer, miniature. Hermetically sealed to MIL-27D, Grade 4, Class V. Multiple outputs.	10 kHz, 20 kHz, 50 kHz	32.5 VA to 89 VA
PH/PV	MIL-T-27 3-phase transformers; Grades 4 & 5. Electrostatically shielded isolation and multi-output transformers.	50/60 Hz	25W-360W
SRA	Low inductance, high current miniature molded inductors.	up to 100 kHz up to 15A	8 µHys to 1250 µHys†
SRB	Low inductance, high current miniature molded inductors.	up to 100 kHz up to 15A	20 µHys to 3000 µHys†
SRC	Low inductance, high current miniature molded inductors.	up to 100 kHz up to 13.6A	60 µHys to 10,000 µHys†
SRD	High current, molded inductors.	Up to 100 kHz up to 13A	500 µHys to 5.6 Hys
TPC	Plug-in power transformers, MIL-T-27D Grade 5, Class S, low voltage, high current.	50/60 Hz	1.7 VA to 12 VA
Industrial Types			
CG	High quality. Plate Transformers. Designed to AIEE. Rugged drawn steel cases. Vacuum impregnated & compound filled.	50/60 Hz	100 VA to 4950 VA
FT	Channel frame, filament/transistor transformers. For 2.5 VCT to 48 VCT. From .04A to 10A.	50/60 Hz	7.5 VA to 48 VA
PF	For photoflash and similar applications. Line and transistor inputs. Power, inverter & trigger types.	Trigger DC Inverter 4½ VDC 50/60 Hz	6 KV pulse to 15 KV pulse 40 Watt-Sec
R	(Inductors). Replacement types, channel frame construction. Vacuum sealed to prevent corrosion.	30 mA to 5A	2 mHys to 5 Hys†
R	Replacement type line isolation transformers. High reliability. Vacuum sealed to prevent corrosion. Housed in protective shells.	50/60 Hz	50 VA to 2500 VA

STANDARD PULSE TRANSFORMERS

Type No.	Ratio	Pulse Width Micro-seconds	Rise Time Micro-seconds	Droop in %	Hi-Pot Volt-age RMS	MIL Type Designation	Service
BIT-P	4:4:1	.05-100	.01-40	0-30	200	TP6RX4410CZ	Coupling and Blocking Oscillator
PIP	4:4:1 & 5:3:1	.05-10	.01-.40	0-15	100	TP6RX4410CZ TP6RX5310CZ	Coupling and Blocking Oscillator
PCH-60 to PCH-68	4:4:1	.05-10	.012-.40	0-25	100	TP7SX4410AZ	Coupling and Blocking Oscillator
PCH-45 to PCH-57	1:1:1	.05-25	.01-2	0-30	1250	TP7SX1110	Coupling and Blocking Oscillator Higher Voltage, Tube, SCR, etc.
MPX100 MPX200 MPX300	1CT:1CT 1.41CT: 1CT 1.25CT: 1CT	Manchester II (Bi-phase) 1 MHz Clock	0.1	20	100	TF7SX( )KZ	MIL-STD-1553B Command/Response Multiplex Data Bus

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

DO-T® Transistor Transformers and Inductors

AUDIO

PACKAGING

Hermetically sealed. A TRW Inductive Products pioneered structure. The bobbin is completely rigid eliminating stress and wire movement. The turns are circular in shape rather than square, eliminating turn corner stress and effecting uniform wire lay. No tapes are employed in connecting coil wire and external leads. They are rigidly anchored in secure terminal board fashion providing strain relief.

The leads used on the stock DO-T transformers are insulated solid .016 diameter Dumet leads. For plug-in type see page 9.

MIL SPECS To complete MIL-T-27D Specs. Units are fully ruggedized, hermetically sealed, **metal cased** to MIL Grade 5, Class R.

ALTITUDE 150,000 ft. max.

PERFORMANCE

The radically designed TRW DO-T Family (see pages 7-14) transistor transformers provide unprecedented power handling capacity and reliability, coupled with small size. Electrical parameters and areas of application exceed conventional transformer capabilities.

Curves on this page and on pages 10 & 11 indicate their performance compared to that of similar size units now on the market. These curves show representative performance of all DO-T's and DI-T's except 200,000 ohm units. Higher performance is obtained when used in push-pull with balanced DC. Other manufacturers' comparative performance is shown on these curves to put unjustified claims in perspective. For example, the TRW DO-T10 delivers 100 mW @ 5% distortion @ 300 Hz. **Identical measurements** were made on contemporary manufacturers' equivalent, rated at 50 mW @ 300 Hz. Actual delivered power was under **1 mW @ 7½% distortion @ 300 Hz.**

FREQUENCY RESPONSE ±3 db, 300 Hz to 20 kHz at 1 mw.

WORKING VOLTAGE 50 volts peak.

APPLICATION

Units can be used for different impedances from those shown, keeping in mind that impedance ratio is constant. Lower source impedance will improve low frequency response and level ratings . . . higher source will reduce them. Units may be used reversed, input to secondary. The frequency response curve on this page is shown to 20 kHz. This descriptive curve is not meant to be restrictive. Units can be used at frequencies well above 20 kHz. Satisfactory applications for frequencies up to and above 250 kHz have been developed.

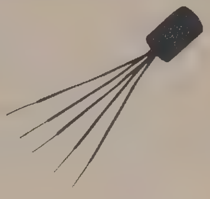
PULSE APPLICATION In pulse coupling impedance matching applications, (when measured with a 30 microsecond input pulse voltage wave), typical values for these transformers are: 5% or less droop, zero overshoot and less than 10% backswing.

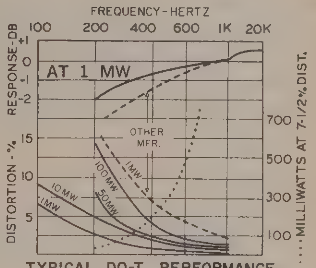
RELIABILITY The exceptional reliability of DO-T family units, inherent in their unique structure, has been dynamically proven in the field.

SHIELDING Hipermalloy electromagnetic shield available from stock for all DO-T family units. Order TRW P/N DOT-SH, or DIT-SH.

DILESIL HIGH TECHNOLOGY DO-T FAMILY TRANSFORMER

- A High Reliability version of the DO-T and DI-T line is available on special order. This alternate construction is designated DILESIL.
- DILESIL construction is intended for fine wire DO-T, DI-T transformers which are used in environments that produce prolonged thermal stress, far exceeding the thermal cycling specification requirements of MIL-T-27.
- DILESIL DO-T's have been approved and qualified by Defense Electronic Supply Command and appear on QPL-27 for MIL-T-27D.
- DILESIL construction is recommended for applications requiring extreme reliability under thermal stress. Thousands of these parts have been used in Hi-Rel Military and NASA applications for the past fifteen years.
- DILESIL DO-T and DI-T transformers are electrically identical to standard DO-T and DI-T parts. However, DILESIL parts are slightly larger than equivalent DO-T and DI-T parts.
- Contact the TRW engineering department for more detailed information.





TYPICAL DO-T PERFORMANCE
SOURCE: RATED PRI. IMP. AND D.C.
LOAD : RATED SEC. IMP.

SPECIALS

For indication of possibilities of DO-T Family units custom built to your special requirements, contact the TRW Inductive Products engineering department.

The stock DO-T Family are Grade 5, Class R units, for a maximum operating temperature of 105°C in accordance with MIL-T-27D Specs. On special order they can be designed to Class S requirements of MIL-T-27D (130°C maximum operating temperature). No additional life expectancy is gained by ordering Class S insulation systems for applications in the vicinity of Class R temperatures. Where the operating temperatures are above 105°C, the use of Class S insulations will afford greater life expectancy.

Special units with electrical modifications of changed lead lengths, modified impedance ratios, and additions of electrostatic shields, etc., are available for all DO-T Family units.

Stock units cover general purpose applications. For specific applications cost reductions may be effected.

INDUCTOR DO-T™ LISTING

Type No.	MIL Type		
DO-T50 (2 Wdgs)	TF5R20ZZ	Series connection: .075 Hy @ 10 ma DC, .06 Hy @ 30 ma DC, DCR 10.5 ohms Parallel connection: .018 Hy @ 20 ma DC, .015 Hy @ 60 ma DC, DCR 2.6 ohms	
DO-T28	TF5R20ZZ	.3 Hy @ 4 ma DC, .15 Hy @ 20 ma DC	DCR 25 ohms
DO-T27	TF5R20ZZ	1.25 Hys @ 2 ma DC, .5 Hy @ 11 ma DC	DCR 100 ohms
DO-T8	TF5R20ZZ	3.5 Hys @ 2 ma DC, 1 Hy @ 5 ma DC	DCR 560 ohms
DO-T26	TF5R20ZZ	6 Hys @ 2 ma DC, 1.5 Hys @ 5 ma DC	DCR 2100 ohms
DO-T49 (2 Wdgs)	TF5R20ZZ	Series connection: 20 Hys @ 1 ma DC, 8 Hys @ 3 ma DC, DCR 5100 ohms Parallel connection: 5 Hys @ 2 ma DC, 2 Hys @ 6 ma DC, DCR 1275 ohms	

For Power DO-T Transformers (DO-T400 Series) See Catalog page 34.

The BIT-250™ Line—An Advanced Development in Transformer Technology

TRW
AUDIO

PACKAGING

Size reduction without loss of performance is achieved by major reduction of air gaps in the magnetic circuit. Core permeability closely approaches the theoretical maximum for material and structure.

Materials, dimensions, and surface finish are identical with IC Flat Pack standards. Removable support protects terminal alignment prior to final assembly. This insulated support allows testing in conventional jigs.

RELIABILITY

Cylindrical bobbin-winding techniques eliminate corner stress normally found in fine-wire windings of conventional rectangular structures.

Lead arrangements and terminations have been designed to maximum reliability under thermal shock and temperature cycling.

FLEXIBILITY

The stock units shown on facing page are designed to afford maximum flexibility of application.

Transformers are 7-terminal types, with center-tapped primaries and split secondaries. When connected in parallel, split-winding secondaries provide ¼ the impedance and twice the DC current capability as series connections.

Inductors in the stock line include both single-winding and split-winding types.

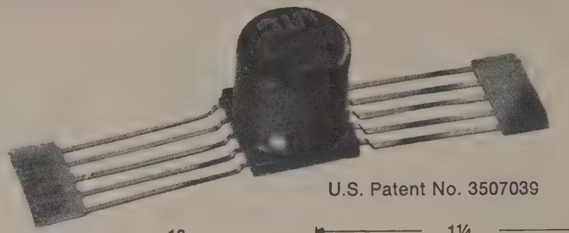
SPECIALS

BIT-250's not found in the stock line will be designed to customer's requirements.

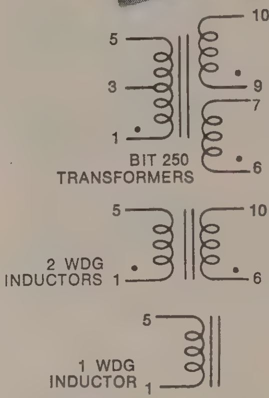
- Special electrical parameters
- 10 or more leads
- Operation to 130°C per MIL Class S.

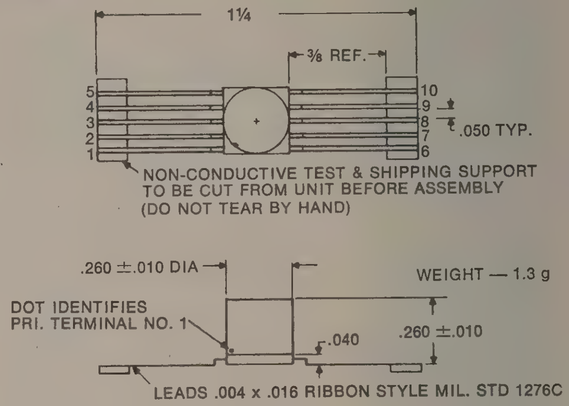
NOTES

- **FREQUENCY RESPONSE** ±2 db, 300 Hz — 250,000 Hz, @ 1 MW Ref. level.
- **DIELECTRIC STRENGTH** tested @ 200 V RMS.
- **MIL SPECS** To complete MIL-T-27D Specs. Metal encased, ruggedized, Grade 5, Class R.
- **SHIELDING** All units electromagnetically self-shielded.
- **LEAD MATERIAL** Tinned ribbon-style, solderable and weldable — MIL-STD-1276C.



U.S. Patent No. 3507039





TRANSFORMERS

BIT-250 Type No.	MIL Part No.	Pri Imp Ω (CT)	Sec Imp Ω (Split Wdg) Series/Par	Power Level mW for 5% Max Dist @ 1 KHz	Pri DCR Ω	(Series Conn.) Sec DCRΩ	Turns Ratio		Typical Application
							Pri/ Sec/ Sec	Pri./ Overall Sec	
BIT-250-14	M27/173-03	150	12/3	80	16	1.85	7.1:1:1	3.54:1	Output
BIT-250-18	M27/173-04	300	600/150	80	30	65	1.4:1:1	1:1.4	Output or Matching
BIT-250-20	M27/173-05	400	400/100	80	45	45	2:1:1	1:1	Matching or Interstage
BIT-250-26	M27/173-06	500	50/12.5	80	58	5.5	6.32:1:1	3.16:1:1	Output
BIT-250-30	M27/173-07	600	600/150	80	65	65	2:1:1	1:1	Isolation or Matching
BIT-250-36	M27/173-08	1000	1000/250	80	110	100	2:1:1	1:1	Output or Matching
BIT-250-40	M27/173-02	1500	600/150	75	150	65	3.16:1:1	1.58:1	Output
BIT-250-48	M27/173-09	2000	8000/2000	75	177	745	1:1:1	1:2	Isolation or Interstage
BIT-250-56	M27/173-10	10K	500/125	75	900	45	8.92:1:1	4.46:1	Output or Driver
BIT-250-60	M27/173-11	10K	1200/300	75	900	100	5.78:1:1	2.89:1	Driver
BIT-250-64	M27/173-12	10K	2000/500	75	900	160	4.48:1:1	2.24:1	Interstage
BIT-250-70	M27/173-13	10K	10K/2500	75	900	750	2:1:1	1:1	Isolation or Interstage
BIT-250-90	M27/173-01	25K	1000/250	40	2400	78	10:1:1	5:1	Interstage

INDUCTORS

BIT-250 Type No.	MIL-Type	Connections	Inductance Hys Min @ 1 KHz 5 V	@ ma DC	DC Res Ω	Ratio of Wdgs.
BIT-250-03 (2 Wdgs)	TF5R20ZZ	Series	8.6 2.5	0 2	2260	1:1
		Parallel	2.4 .63	0 4	565	
BIT-250-05 (1 Wdg)	TF5R20ZZ		5.5 1.5	0 2	1000	
BIT-250-06 (1 Wdg)	TF5R20ZZ		.80 .25	1 6	250	
BIT-250-09 (2 Wdgs)	TF5R20ZZ	Series	.60 .15	0 5	146	1:1
		Parallel	.15 .038	0 10	37	

DO-T® Transistor Transformers and Inductors

TRW
AUDIO

TRANSFORMER DO-T™ LISTING

Locating Line	Type No.	MIL Part No.	Pri. Imp. Ω	DC ma‡ in Pri.	Sec. Imp. Ω	P. Max in mW @ 1 kHz 5% Dist.	DCR ±25% Pri.	DCR ±25% Sec. Ser. Conn.	Turns Ratio ±3% Pri.	Turns Ratio ±3% Sec. Ser. Conn.
1	**DO-T44**	M27/172-01	80 CT 100 CT	12 10	32 split 40 split	600	9 8	6	1 58	1
2	**DO-T29**	M27/172-02	120 CT 150 CT	10 10	3 2 4	600	10	.46	6 12	1
3	**DO-T12**	M27/172-03	150 CT 200 CT	10 10	12 16	600	11	1.5	3 54	1
4	**DO-T13**	M27/172-04	300 CT 400 CT	7 7	12 16	600	20	1 63	5	1
5	**DO-T19**	M27/172-05	300 CT	7	600	600	19	89	1	1.41
6	**DO-T30**	M27/172-06	320 CT 400 CT	7 7	3.2 4	600	20	46	10	1
7	**DO-T43**	M27/172-07	400 CT 500 CT	8 6	40 split 50 split	600	46	8	3.16	1
8	**DOT-42**	M27/172-08	400 CT 500 CT	8 6	120 split 150 split	600	46	26	1.82	1
9	**DO-T41**	M27/172-09	400 CT 500 CT	8 6	400 split 500 split	600	46	74	1	1
10	**DO-T53**	M27/172-10	400 CT 500 CT	8 6	4000 CT 5000 CT	600	46	550	1	3 33
11	**DO-T2**	M27/172-11	500 600	3 3	50 60	100	60	8	3 16	1
12	**DO-T20**	M27/172-12	500 CT	5.5	600	600	31	90	1	1.1
13	**DO-T4**	M27/172-13	600	3	3.2	100	60	58	13.7	1
14	**DO-T55**	TF5R21ZZ	600 CT	4	600 CT	600	47	47	1	1
15	**DO-T14**	M27/172-14	600 CT 800 CT	5 5	12 16	600	43	1 5	7.07	1
16	**DO-T31**	M27/172-15	640 CT 800 CT	5 5	3.2 4	600	43	.46	14.1	1
17	**DO-T32**	M27/172-16	800 CT 1000 CT	4 4	3 2 4	600	51	.46	15 8	1
18	**DO-T15**	M27/172-17	800 CT 1070 CT	4 4	12 16	600	51	1.5	8 15	1
19	**DO-T21**	M27/172-18	900 CT	4	600	600	53	89	1.22	1
20	**DO-T3**	M27/172-19	1000 1200	3 3	50 60	100	115	8	4.46	1
21	**DO-T45**	M27/172-20	1000 CT 1250 CT	3 5 3 5	16,000 split 20,000 split	100	120	940	1	4
22	**DO-T16**	M27/172-21	1000 CT 1330 CT	3.5 3.5	12 16	600	71	1 5	9.15	1
23	**DO-T33**	M27/172-22	1060 CT 1330 CT	3.5 3.5	3 2 4	600	71	46	18.2	1
24	**DO-T5**	M27/172-23	1200	2	3.2	100	105	.58	19 35	1
25	**DO-T17**	M27/172-24	1500 CT 2000 CT	3 3	12 16	600	108	1 5	11 2	1
26	**DO-T22**	M27/172-25	1500 CT	3	600	600	86	89	1 58	1
27	**DO-T34**	M27/172-26	1600 CT 2000 CT	3 3	3.2 4	600	109	.46	22 4	1
28	**DO-T51**	M27/172-27	2000 CT 2500 CT	3 3	2000 split 2500 split	100	195	125	1	1
29	**DO-T37**	M27/172-28	2000 CT 2500 CT	3 3	8000 split 10,000 split	100	195	455	1	2
30	**DO-T52***	TF5R21ZZ	4000 CT 5000 CT	2 2	8000 CT 10,000 CT	100	320	590	1	1.41
31	**DO-T18**	M27/172-29	7500 CT 10,000 CT	1 1	12 16	100	505	1 6	25	1
32	**DO-T35**	M27/172-30	8000 CT 10,000 CT	1 1	3.2 4	100	505	.46	50	1
33	**DO-T48***	TF5R21ZZ	8000 CT 10,000 CT	1 1	1200 CT 1500 CT	100	640	110	2.58	1
34	**DO-T47***	TF5R21ZZ	9000 CT 10,000 CT	1 1	9000 CT 10,000 CT	100	850	1080	1	1
35	**DO-T6**	M27/172-31	10,000	1	3 2	100	790	.68	55 7	1
36	**DO-T9**	M27/172-32	10,000 12,000	1 1	500 CT 600 CT	100	780	50	4 48	1
37	**DO-T10**	M27/172-33	10,000 12,500	1 1	1200 CT 1500 CT	100	780	115	2 89	1
38	**DO-T25**	M27/172-34	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	100	780	126	2.58	1
39	**DO-T38**	M27/172-35	10,000 CT 12,000 CT	1 1	2000 split 2400 split	100	560	230	2.24	1
40	**DO-T11**	M27/172-36	10,000 12,500	1 1	2000 CT 2500 CT	100	780	190	2.24	1
41	**DO-T36**	M27/172-37	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	100	975	1175	1	1
42	**DO-T1**	M27/172-38	20,000 30,000	.5 .5	800 1200	50	830	115	5	1
43	**DO-T23**	M27/172-39	20,000 CT 30,000 CT	.5 5	800 CT 1200 CT	50	830	115	5	1
44	**DO-T39**	M27/172-40	20,000 CT. 30,000 CT	.5 .5	1000 split 1500 split	50	800	113	4.47	1
45	**DO-T40**	M27/172-41	40,000 CT 50,000 CT	.25 .25	400 split 500 split	50	1700	60	10	1
46	**DO-T54**	M27/172-42	40,000 CT 50,000 CT	.25 .25	4000 CT 5000 CT	50	1700	450	3.33	1
47	**DO-T46***	TF5R21ZZ	100,000 CT	0	500 CT	25	7900	85	14.14	1
48	**DO-T7**	M27/172-43	200,000	0	1000	25	8500	100	14.14	1
49	**DO-T24**	M27/172-44	200,000 CT	0	1000 CT	25	8500	100	14 14	1
	DO-TSH	Drawn Hipermalloy shield and cover for DO-T's provides 20 to 30 db shielding. .55″ h x 36″ dia ⅛″ hole in cover.								
	DO-TSH-2†	Drawn Hipermalloy shield and cover for DO-T's provides 20 to 30 db shielding. .64″ h x 383″ dia. ⅛″ hole in cover								

See Catalog page 34 for TRW Inductive Product's line of 400 cycle DO-T Transformers.

‡ maDC shown is for single ended usage. For push-pull, maDC can be any balanced value taken by 5W transistors

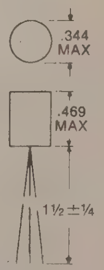
Where windings are listed as split, ¼ of the listed impedance is available by paralleling the winding

* Includes electrostatic shield

† DO-TSH2 fits over DO-TSH

Unit Locating Key

Type No.	Located on Line
DO-T1	42
DO-T2	11
DO-T3	20
DO-T4	13
DO-T5	24
DO-T6	35
DO-T7	48
DO-T8	Pg. 6
DO-T9	36
DO-T10	37
DO-T11	40
DO-T12	3
DO-T13	4
DO-T14	15
DO-T15	18
DO-T16	22
DO-T17	25
DO-T18	31
DO-T19	5
DO-T20	12
DO-T21	19
DO-T22	26
DO-T23	43
DO-T24	49
DO-T25	38
DO-T26	Pg. 6
DO-T27	Pg. 6
DO-T28	Pg. 6
DO-T29	2
DO-T30	6
DO-T31	16
DO-T32	17
DO-T33	23
DO-T34	27
DO-T35	32
DO-T36	41
DO-T37	29
DO-T38	39
DO-T39	44
DO-T40	45
DO-T41	9
DO-T42	8
DO-T43	7
DO-T44	1
DO-T45	21
DO-T46	47
DO-T47	34
DO-T48	33
DO-T49	Pg. 6
DO-T50	Pg. 6
DO-T51	28
DO-T52	30
DO-T53	10
DO-T54	46
DO-T55	14

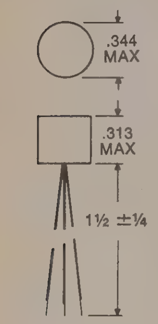


WEIGHT 1/10 OZ

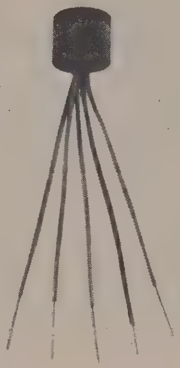
DI-T® Transistor Transformers and Inductors

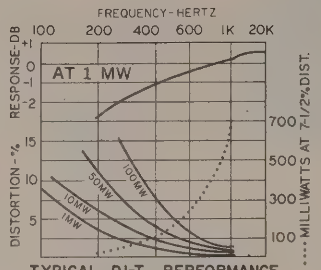
TRW

AUDIO



WEIGHT 1/15 OZ.





TYPICAL DI-T PERFORMANCE
SOURCE: RATED PRI. IMP. AND D.C.
LOAD : RATED SEC. IMP.

FREQUENCY RESPONSE ±3 db, 400 Hz to 100 kHz at 1 mW.

UNIT LOCATION KEY

Type No.	Located on Line	Type No.	Located on Line
DI-T1	23	DI-T26	28
DI-T2	7	DI-T27	26
DI-T3	11	DI-T28	25
DI-T5	12	DI-T36	22
DI-T8	27	DI-T37	15
DI-T9	17	DI-T38	20
DI-T10	18	DI-T41	5
DI-T11	21	DI-T43	4
DI-T19	3	DI-T44	1
DI-T20	8	DI-T51	14
DI-T21	10	DI-T52	16
DI-T22	13	DI-T53	6
DI-T23	24	DI-T55	9
DI-T25	19	DI-T56	2

PACKAGING DO-T family; see Cat. p. 8.

MIL SPECS To complete MIL-T-27D Specs. Grade 5. Class R.

Locating Line	Type No.	MIL Type	Pri. Imp. Ω	ma D.C.‡ In Pri.	Sec. Imp. Ω	Pri. DCR Ω	mw Level*	Application
1	**DI-T44**	TF5R21ZZ	80 CT 100 CT	12 10	32 split 40 split	11.5	500	Interstage
2	**DI-T56**	TF5R21ZZ	150 CT	10	150 CT	14	500	Coupling
3	**DI-T19**	TF5R21ZZ	300 CT	7	600	20	500	Output to line
4	**DI-T43**	TF5R21ZZ	400 CT 500 CT	8 6	40 split 50 split	50	500	Interstage
5	**DI-T41**	TF5R21ZZ	400 CT 500 CT	8 6	400 split 500 split	50	500	Interstage or output (Ratio 2:1:1) also wide pulse application
6	**DI-T53**	TF5R21ZZ	400 CT 500 CT	8 6	4000 CT 5000 CT	33	500	Input or driver to low noise transistor
7	**DI-T2**	TF5R21ZZ	500 600	3 3	50 60	65	100	Output
8	**DI-T20**	TF5R21ZZ	500 CT	5.5	600	32	500	Output or line to line or mixing
9	**DI-T55**	TF5R21ZZ	600 CT	4	600 CT	47	500	Isolation or Interstage (Ratio 1:1) also wide pulse application
10	**DI-T21**	TF5R21ZZ	900 CT	4	600	53	500	Output to line
11	**DI-T3**	TF5R21ZZ	1000 1200	3 3	50 60	110	100	Output
12	**DI-T5**	TF5R21ZZ	1200	2	3.2	110	100	Output
13	**DI-T22**	TF5R21ZZ	1500 CT	3	600	87	500	Output to line
14	**DI-T51**	TF5R21ZZ	2000 CT 2500 CT	3 3	2000 split 2500 split	180	100	Isolation or Interstage (Ratio 2:1:1) also wide pulse application
15	**DI-T37**	TF5R21ZZ	2000 CT 2500 CT	3 3	8000 split 10,000 split	180	100	Isolation or Interstage (Ratio 1:1:1) also wide pulse application
16	**DI-T52**	TF5R21ZZ	4000 CT 5000 CT	2 2	8000 CT 10,000 CT	300	100	Interstage Includes electrostatic shield
17	**DI-T9**	TF5R21ZZ	10,000 12,000	1 1	500 CT 600 CT	870	100	Output or driver
18	**DI-T10**	TF5R21ZZ	10,000 12,500	1 1	1200 CT 1500 CT	870	100	Driver
19	**DI-T25**	TF5R21ZZ	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	870	100	Interstage
20	**DI-T38**	TF5R21ZZ	10,000 CT 12,000 CT	1 1	2000 split 2400 split	620	100	Interstage
21	**DI-T11**	TF5R21ZZ	10,000 12,500	1 1	2000 CT 2500 CT	870	100	Driver
22	**DI-T36**	TF5R21ZZ	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	970	100	Isolation or Interstage (Ratio 1:1) also wide pulse application
23	**DI-T1**	TF5R21ZZ	20,000 30,000	.5 .5	800 1200	815	50	Interstage
24	**DI-T23**	TF5R21ZZ	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	815	50	Interstage
25	**DI-T28**	TF5R20ZZ	.1 Hy @ 4 ma DC, .08 Hy @ 10 ma DC			25		Inductor
26	**DI-T27**	TF5R20ZZ	.9 Hy @ 2 ma DC, .5 Hy @ 6 ma DC			105		Inductor
27	**DI-T8**	TF5R20ZZ	2.5 Hys @ 2 ma DC, .9 Hy @ 4 ma DC			630		Inductor
28	**DI-T26**	TF5R20ZZ	4.5 Hys @ 2 ma DC, 1.2 Hys @ 4 ma DC			2300		Inductor
29	**DI-TSH**	Drawn Hipermalloy shield and cover for DI-T's provides 20 to 30 db shielding .390″ h x .359″ dia. ⅛″ hole in cover.						

* For 5% maximum distortion @ 1 kHz.

‡ ma DC shown is for single ended usage. For push-pull, ma DC can be any balanced value taken by .5W transistors.
Where windings are listed as split, ¼ of the listed impedance is available by paralleling the winding.

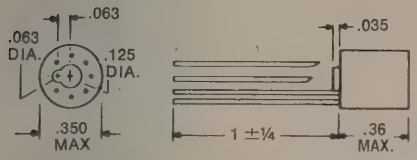
INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

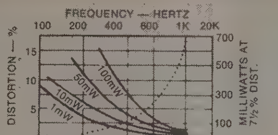
DO-T200 and DI-T200 Series Transformers and Inductors

TRW

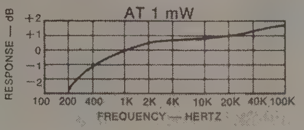
AUDIO

HEIGHT .562 FOR DO-T
Weight: 1/15 OZ. DI-T
1/8 OZ. DO-T





TYPICAL DI-T200 PERFORMANCE
SOURCE: RATED PRI. IMP. AND DC
LOAD : RATED SEC IMP.



PACKAGING Metal encased. DO-T family unit. See Catalog page 6.

MIL SPECS To complete MIL-T-27D Specs. Ruggedized, metal encased to MIL Grade 5, Class R.

FREQUENCY RESPONSE At 1 mW ±3 db, 300 Hz to 20 kHz, DO Type; ±3 db, 400 Hz to 100 kHz, DI Type.

TERMINALS Leads are .016 Dumet wire, tinned, and may be either welded or soldered. They are uninsulated and are spaced on a .1″ radius circle, conforming to the termination pattern of the "TO-76" cased semiconductors and micrologic elements.

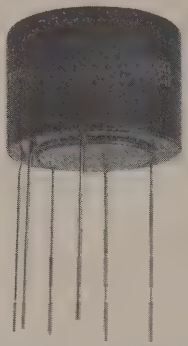
Type No.	MIL Part No.	Pri. Imp.Ω	ma D.C.‡ In Pri.	Sec. Imp. Ω	Pri. DCR Ω	mw Level*	Application
DO-T255	M27/76-07	1000 CT 1200 CT	3 3	50 60	115	100	Output or matching
DO-T275	M27/76-06	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	780	100	Interstage
DO-T277	M27/76-05	10,000 CT 12,000 CT	1 1	2000 split 2400 split	560	100	Interstage
DO-T278	M27/76-04	10,000 12,500	1 1	2000 CT 2500 CT	780	100	Driver
DO-T283	M27/76-03	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	975	100	Isolation or Interstage (Ratio 1:1) also pulse application
DO-T288	M27/76-02	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	830	50	Interstage
DO-T297	M27/76-01	200,000 CT	0	1000 CT	8500	25	Input and Chopper
DO-T200SH	Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case, .578″ h x .375″ dia. no cover.						
DI-T225	M27/103-15	80 CT 100 CT	12 10	32 split 40 split	11.5	500	Interstage
DI-T227	TF5R21ZZ	150 CT	10	150 CT	14	500	Coupling
DI-T230	M27/103-14	300 CT	7	600 CT	20	500	Output or line to line or matching
DI-T235	M27/103-13	400 CT 500 CT	8 6	40 split 50 split	50	500	Interstage
DI-T240	M27/103-12	400 CT 500 CT	8 6	400 split 500 split	50	500	Interstage or output (Ratio 2:1:1) also wide pulse application
DI-T245	M27/103-11	500 CT 600 CT	3 3	50 CT 60 CT	65	500	Output or matching
DI-T250	M27/103-10	500 CT	5.5	600 CT	32	500	Output or line to line or mixing or matching
DI-T228	TF5R21ZZ	600 CT	3	75 CT	56	500	Output or line to line matching
DI-T255	M27/103-09	1000 CT 1200 CT	3 3	50 CT 60 CT	110	500	Output or matching
DI-T260	M27/103-08	1500 CT	3	600 CT	87	500	Output to line or matching
DI-T265	M27/103-07	2000 CT 2500 CT	3 3	8000 split 10,000 split	180	100	Isolation or Interstage (Ratio 1:1:1) also wide pulse application
DI-T270	M27/103-06	10,000 CT 12,000 CT	1 1	500 CT 600 CT	870	100	Output or driver
DI-T273	M27/103-05	10,000 CT 12,500 CT	1 1	1200 CT 1500 CT	870	100	Output or driver
DI-T276	M27/103-04	10,000 CT 12,000 CT	1 1	2000 CT 2400 CT	870	100	Interstage or driver
DI-T278	M27/103-03	10,000 CT 12,500 CT	1 1	2000 split 2500 split	620	100	Interstage or driver
DI-T283	M27/103-01	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	970	100	Isolation or Interstage (Ratio 1:1) also wide pulse application
DI-T288	M27/103-02	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	815	50	Interstage or driver
DI-T290	M27/103-16	600 CT	4	600 CT	47	500	Isolation or Interstage (Ratio 1:1) also wide pulse application
DI-T204	TF5R20ZZ	Split Inductor (2 wdgs) Series connected: .1 Hy @ 4 ma DC, .08 Hy @ 10 ma DC, DCR 25 ohms Parallel connected: .025 Hy @ 8 ma DC, .02 Hy @ 20 ma DC, DCR 6 ohms					
DI-T208	TF5R20ZZ	Split Inductor (2 wdgs) Series connected: .9 Hy @ 2 ma DC, .5 Hy @ 6 ma DC, DCR 105 ohms Parallel connected: .2 Hy @ 4 ma DC, .1 Hy @ 12 ma DC, DCR 26 ohms					
DI-T212	TF5R20ZZ	Split Inductor (2 wdgs) Series connected: 2.5 Hys @ 2 ma DC, .9 Hy @ 4 ma DC, DCR 630 ohms Parallel connected: .6 Hy @ 4 ma DC, .2 Hy @ 8 ma DC, DCR 157 ohms					
DI-T216	TF5R20ZZ	Split Inductor (2 wdgs) Series connected: 4.5 Hys @ 2 ma DC, 1.2 Hys @ 4 ma DC, DCR 2300 ohms Parallel connected: 1.1 Hys @ 4 ma DC, .3 Hy @ 8 ma DC, DCR 575 ohms					
DI-T200SH	Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case. .421″ h x .375″ dia. no cover.						

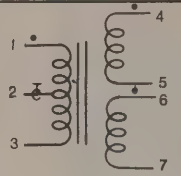
* For 5% maximum distortion @ 1 kHz ‡ ma DC shown is for single ended usage. For push-pull, ma DC can be any balanced value taken by .5W transistors.
Where windings are listed as split, ¼ of the listed impedance is available by paralleling the winding.

TRW

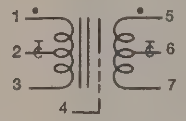
TOP Transistor Transformers

AUDIO

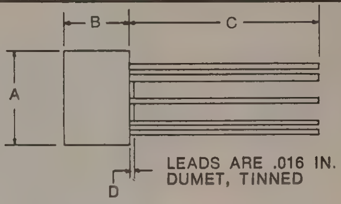


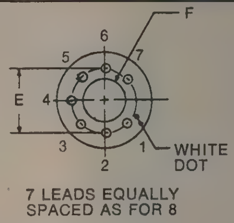


SPLIT SEC. PARTS



C.T. PARTS
WITH E.S. SHIELD





DIMENSIONS

	A MAX.	B MAX.	C ±.25	D ±.010	E ±.010	F ±.010
TOP-1000 SERIES	.5	.35	1.0	.020	.35	.218
TOP-2000 SERIES	.5	.50	1.0	.020	.35	.218
TOP-3000 SERIES	.75	.52	1.0	.020	.60	.475

TOP-1000 Series (TF5S21ZZ) **FREQUENCY RESPONSE** ±3 DB 300 Hz-75 KHz at 1 mW

Type No.	Pri. Imp. (Ω)	ma DC in Pri.	Sec. Imp. (Ω)	Power (Watts)† at 1 kHz & Higher	at 400 Hz	at 300 Hz	DCR Pri./Sec. (±25%)	Turns Ratio Pri./Sec.
TOP-1265	150 CT	11	150 Split	.6	.3	.16	13/18.3	1/1
TOP-1270	150 CT	11	600 Split	.6	.3	.16	13/75	1/2
TOP-1380	600 CT	5.5	600 Split	.6	.3	.16	57/79	1/1
TOP 1385*	600 CT	5.5	600 CT	.6	.3	.16	53/75	1/1
TOP-1387	600 CT	5.5	1200 Split	.6	.3	.16	53/105	1/1.41
TOP-1490*	2000 CT	3	2000 CT	.6	.3	.16	198/218	1/1
TOP-1495	2000 CT	3	8000 Split	.6	.3	.16	198/850	1/2
TOP-1640	10,000 CT	1.4	10,000 Split	.6	.3	.16	865/1215	1/1
TOP-1645*	10,000 CT	1.4	10,000 CT	.6	.3	.16	1060/1215	1/1
TOP-1655	15,000 CT	1	600 Split	.6	.3	.16	1305/72.5	5/1

TOP-1000SH Drawn Hipermalloy Shield — .53 O.D. x .40 H

TOP-2000 Series (TF5S21ZZ) **FREQUENCY RESPONSE** ±3 DB 150 Hz-75 KHz at 1 mW

Type No.	Pri. Imp. (Ω)	ma DC in Pri.	Sec. Imp. (Ω)	Power (Watts)† at 1 kHz & Higher	at 400 Hz	at 150 Hz	DCR Pri./Sec. (±25%)	Turns Ratio Pri./Sec.
TOP-2265	150 CT	8	150 Split	1	.75	.075	12/20	1/1
TOP-2270	150 CT	8	600 Split	1	.75	.075	12/82	1/2
TOP-2380	600 CT	4	600 Split	1	.75	.075	60/66	1/1
TOP-2385*	600 CT	4	600 CT	1	.75	.075	60/68	1/1
TOP-2387	600 CT	4	1200 Split	1	.75	.075	60/116	1/1.41
TOP-2490*	2000 CT	2	2000 CT	1	.75	.075	175/240	1/1
TOP-2495	2000 CT	2	8000 Split	1	.75	.075	185/1015	1/2
TOP-2640	10,000 CT	1	10,000 Split	1	.75	.075	780/1075	1/1
TOP-2645*	10,000 CT	1	10,000 CT	1	.75	.075	715/985	1/1
TOP-2655	15,000 CT	.8	600 Split	.66	.66	.075	1165/80	5/1
TOP-2695	20,000 CT	.7	1000 Split	.5	.5	.075	1750/135	4.47/1
TOP-2814	100,000 CT	.3	2000 Split	.1	.1	.075	10,000/248	7.07/1

TOP-2000SH Drawn Hipermalloy Shield — .53 O.D. x .55 H

TOP-3000 Series (TF5S21ZZ) **FREQUENCY RESPONSE** ±3 DB 50 Hz-30 KHz at 1 mW

Type No.	Pri. Imp. (Ω)	ma DC in Pri.	Sec. Imp. (Ω)	Power (Watts)† at 1 kHz & Higher	at 400 Hz	at 50 Hz	DCR Pri./Sec. (±25%)	Turns Ratio Pri./Sec.
TOP-3065	150 CT	8	150 Split	2	1.5	.03	12/16.5	1/1
TOP-3070	150 CT	8	600 Split	2	1.5	.03	12/66	1/2
TOP-3180	600 CT	4	600 Split	2	1.5	.03	48/66	1/1
TOP-3185*	600 CT	4	600 CT	2	1.5	.03	48/66	1/1
TOP-3187	600 CT	4	1200 Split	2	1.5	.03	48/132	1/1.41
TOP-3290*	2000 CT	2.2	2000 CT	2	1.5	.03	160/220	1/1
TOP-3295	2000 CT	2.2	8000 Split	2	1.5	.03	160/880	1/2
TOP-3440	10,000 CT	1	10,000 Split	1	1	.03	800/1100	1/1
TOP-3445*	10,000 CT	1	10,000 CT	1	1	.03	800/1100	1/1
TOP-3455	15,000 CT	.8	600 Split	.66	.66	.03	1200/66	5/1
TOP-3495	20,000 CT	.7	1000 Split	.5	.5	.03	1600/110	4.47/1
TOP-3614	100,000 CT	.3	2000 Split	.1	.1	.03	8000/220	7.07/1

TOP-3000SH Drawn Hipermalloy Shield — .78 O.D. x .57 H
* Includes Electrostatic Shield.

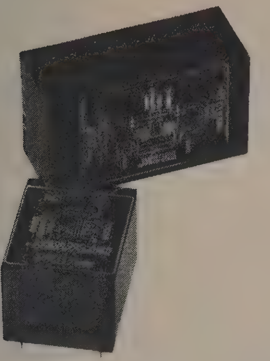
† For 5% Dist at Rated Frequency.

Telephone Interconnect Transformers

TRW

AUDIO

MTC Series



APPLICATIONS MTC (MIL-T-27D) transformers, designed for coupling applications feature unbalanced DC current ratings of up to 120 mA — higher than competitive units — while longitudinal balance per FCC 68.310 specification is greater than 60 dB.

The 2-wire to 4-wire hybrid transformer is noteworthy in that it can carry up to 100 mA unbalanced DC current through its primary, and has greater than 60 dB trans-hybrid loss over the 300-Hz to 4-kHz frequency band.

Dielectric strength exceeds 1500 volts AC.

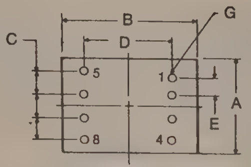


FIGURE 1

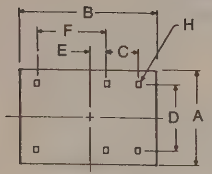


FIGURE 2

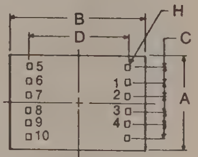
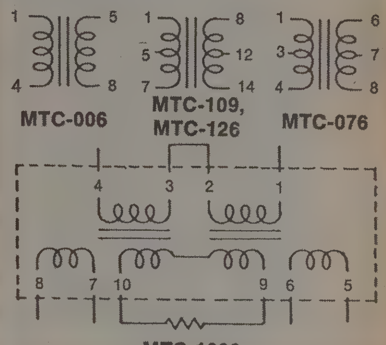


FIGURE 3

SCHEMATICS



MTC-1006

Type	A	B	Unit Height	C ±.010	D ±.010	E ±.010	F ±.010	G, Dia. ±.005	H, Sq. ±.005	Pin Ht. ±.030
MTC-006	.875	1.093	.719	.20	.50	.15	—	.025	—	.125
MTC-076	1.562	1.875	.750	.25	1.00	.375	.75	—	.025	.156
MTC-109	1.562	1.875	1.156	.40	1.00	.20	.80	—	.025	.343
MTC-126	1.562	1.875	1.156	.40	1.00	.20	.80	—	.025	.343
MTC-1006	1.625	2.812	1.156	.20	2.30	—	—	—	.025	.125

Type No.	Application	Primary Impedance (Ohms)	DCR	Max Unbalanced DC Current (mA)	Secondary Impedance (Ohms)	DCR	Size
MTC-006	Coupling	600	33	0	600	35	Figure 1
MTC-076	Coupling	600 CT	44	70	600 CT	51	Figure 2
MTC-109	Coupling	900 CT	32	100	600 CT	21	Figure 2
MTC-126	Coupling	600 CT	22	120	600 CT	21	Figure 2
MTC-1006	Hybrid	600 Split		100‡	600/600		Figure 3

Series	Frequency Response	Max. Power Level	Longitudinal Balance	Maximum Distortion	Impedance Matching	Return Loss	Hybrid-trans-Hybrid Loss
MTC-006	±.50 dB, 300 Hz-4 kHz	+7 dBm	60 dB min.	0.5%	—	26 dB min.*	—
MTC-076	±.75 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	10 dB min.*	—
MTC-109	±.75 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	10 dB min.*	—
MTC-126	±.75 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	10 dB min.*	—
MTC-1006	±.50 dB, 300 Hz-4 kHz	+10 dBm	60 dB min.	0.5%	—	11 dB min.*	60 dB min.

* Return loss figures are lowest readings over the frequency range as measured per MIL-STD-188C. For industrial use, return loss is greater than 22 dB. ‡ In 2-wire port.

TC Series

APPLICATIONS The TC Series of plug-in transformers is ideally suited for telephone interconnection applications. These low-profile units meet or exceed all modem and voice transmission impedance-matching requirements. They feature low distortion and wide frequency response, and are specially designed for wave soldering to printed circuit boards.

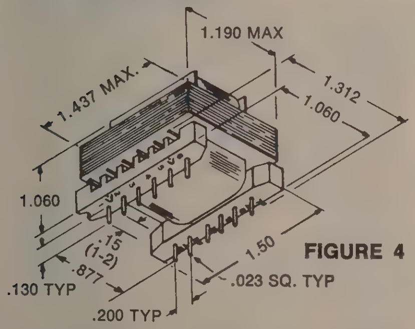


FIGURE 4

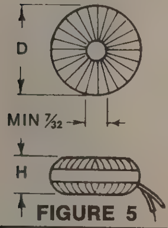


FIGURE 5

SIZE SERIES	D	H	WT. OZ.
TC-L-2	1	13/32	3/4
TC-L-3	1¼	5/8	2

HIGH-Q-TOROID
MICROCRYSTALLINE
WAX IMPREGNATED
SUPPLIED WITH
4″ LEADS

Type No.	Application	Primary Impedance (Ohms)	Max Unbalanced DC Current (mA)	Secondary Impedance (Ohms)	Size
TC-0-30	Coupling	600 Split	—	600 Split	Same as PC-0, Pg. 19
TC-0-20	Coupling	600 Split	—	1500 CT	Same as PC-0, Pg. 19
TC-SO-15	Coupling	600 Split	—	600 Split	Same as PC-SO, Pg. 21
TC-SO-22	Coupling	600 Split	—	1500 CT	Same as PC-SO, Pg. 21
TC-SSO-33	Coupling	600 Split	—	600 Split	Same as PC-SSO, Pg. 24
TC-SSO-20	Coupling	600 Split	—	1500 CT	Same as PC-SSO, Pg. 24
TC-F-1*	Coupling	900/600 Split	60/75	600 CT	Figure 4
TC-0-37	Bridging	4000 Split	—	600 Split	Same as PC-0, Pg. 19
TC-SO-23	Bridging	4000 Split	—	600 Split	Same as PC-SO, Pg. 21
TC-SSO-27	Bridging	4000 Split	—	600 Split	Same as PC-SSO, Pg. 24
TC-0-35†	Hybrid	600	—	600/600	Same as PC-0, Pg. 19
TC-SSO-32†	Hybrid	600	—	600/600	Same as PC-SSO, Pg. 24
TC-D-1†	Hybrid	600	—	600/600 0 dBm level	Same as DO-T Pg. 9
TC-L-1	Holding Coil	2 Hy @ 60 mA DC; 1.3 Hy @ 100 mA DC; 180 ohm			Figure 4
TC-L-2	Holding Coil	1 Hy @ 0 mA DC; .8 Hy @ 25 mA DC; 225 ohm			Figure 5
TC-L-3	Holding Coil	1 Hy @ 0 mA DC; .8 Hy @ 40 mA DC; 113 ohm			Figure 5
PC-0-17	Hipermalloy shield, slip fit over TC-0 units				
PC-SO-SH	Hipermalloy shield, slip fit over TC-SO units				
PC-SSO-SH	Hipermalloy shield, slip fit over TC-SSO units				
DOT-SH	Hipermalloy shield, slip fit over TC-D-1 units				

Series	Frequency Response	Max. Power Level	Longitudinal Balance	Maximum Distortion	Impedance Matching	Return Loss	Hybrid-trans-Hybrid Loss
TC-0	±.50 dB, 100 Hz-10 kHz	+10 dBm	50 dB min.	0.5%	±10%	26 dB min.	50 dB min.
TC-SO	±.50 dB, 200 Hz-10 kHz	+10 dBm	50 dB min.	0.5%	±10%	26 dB min.	50 dB min.
TC-SSO	±.50 dB, 275 Hz-10 kHz	+10 dBm	50 dB min.	0.5%	±10%	26 dB min.	50 dB min.

* Frequency response ±2 dB, 300 Hz to 10 kHz, flat pack design. † Two units required for 2-wire to 4-wire hybrid.

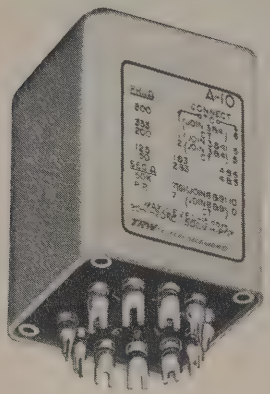
INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

Compact™ Audio Transformers and Inductors

TRW

AUDIO

Ultra-Compact™ Audio



PACKAGING High quality rugged die cast zinc alloy case with both top and bottom mounting facilities. Asterisked items (see Type No.) have multiple alloy shield.

APPLICATIONS Compact commercial amplifiers and equipments.

APPLICATION NOTE Included in line are filament/transistor supply units.

FOR HERMETIC METAL CASED MIL TYPES See page 17.

NOTE All units except those carrying DC in primary employ a true humbucking coil structure, which provides electrical balance and effects good inductive shielding.

TYPE A CASE

1½″ x 1½″ x 2″ h
Unit Weight: ½ lb.
Mounting Holes 1 5/32″ sq.
Screws: 4-40
Cutout: 1⅜″ dia.

INPUT AND MATCHING TRANSFORMERS

Type No.	Application	Primary Imp. Ohms	Unbal DC	Secondary Imp. Ohms	Response ±2 db (Hz)	Pri. Res. Ohms	Max. Level	
							dbm	mw
A-10	Low impedance to grid	50, 125/150, 200/250, 333, 500/600	0	50,000 split	20-20,000	59	+15	30
A-11*	Low impedance to 1 or 2 grids	50, 200, 500	0	50,000 CT	20-20,000	52	+ 5	3
A-12	Low impedance to PP grids	50, 125/150, 200/250, 333, 500/600	0	80,000 split	20-20,000	60	+15	30
A-20†	Mixing, matching	50, 125/150, 200/250, 333, 500/600	0	50, 125/150, 200/250, 333, 500/600	10-50,000	64	+15	30
A-21*†	Mixing, matching	50, 200/250, 500/600	0	50, 200/250, 500/600	30-30,000	28	+15	30
A-27	Xtal/hi. impedance to line	100,000 split	0	50, 125/150, 200/250, 333, 500/600	30-20,000 meas. with res. source	3700	+15	30
A-39*	Line to transistor	600/150 split	0	2000/500 split	20-20,000	70	+10	10
A-43†	Mixing, matching line or transistor to 2 simultaneously loaded lines or transistors	600/150 split	0	2 secondaries each 600/150 split	20-30,000	45	+15	30

* Multiple alloy shield for extremely low hum pickup † High electrostatic shielding

Interstage and Output Transformers

Type No.	Application	Primary Imp. Ohms	Unbal DC	Secondary Imp. Ohms	Response ±2 db (Hz)	Pri Res. Ohms	Max. Level	
							dbm	mw
A-15	Transistor Interstage	10,000/2500 split	8 ma	2000/500 split	40-20,000	600	–	1w
A-16	Plate to grid	15,000	0	60,000	20-20,000	800	+15	30
A-18	Single or PP plates to PP grids	15,000 split	0	80,000 split	20-20,000	1040	+15	30
A-19	Plate to PP grids	15,000	8 ma	80,000 split	40-20,000	2900	+15	30
A-22	Tr. Intstg. or output	500 CT	20 ma	500/125 split	40-20,000	36	–	1w
A-23	Tr. Intstg. or output	500 CT	20 ma	16/4 split	40-20,000	36	–	1w
A-24	Single or PP plates to line	15,000 split	0	50, 125/150, 200/250, 333, 500/600	20-40,000	1430	+15	30
A-25	Plate to line	15,000	8 ma	50, 125/150, 200/250, 333, 500/600	40-20,000	1580	+15	30
A-26	Single or PP plates to line	30,000 split	0	50, 125/150, 200/250, 333, 500/600	20-40,000	2520	+15	30
A-28	Transistor to V.C.	48 CT	750 ma Bal	16 split, 8, 4	40-20,000	5	–	5w
A-34	Transistor Interstage	25,000/6250 split	3 ma	500/125 split	30-20,000	1620	–	1w
A-35	Transistor Interstage	10,000/2500 split	8 ma	500/125 split	30-20,000	610	–	1w
A-36	Transistor Interstage	500/125 split	20 ma	150/37.5 split	40-20,000	36	–	1w
A-37	Transistor Interstage	500/125 split	20 ma	50/12.5 split	40-20,000	36	–	1w
A-38	Transistor Interstage	100/25 split	40 ma	40/10 split	40-20,000	6.2	–	1w
A-44	Tr. Intstg. or output	4K / 1K split	12 ma	600/150 split	30-20,000	310	–	1w

O, PC-O
Performance Characteristics

TRW
AUDIO

WORKING VOLTAGE: 175 V PEAK ALL UNITS

Type No. O-#	Type No. PC-O-#	Application	Pri. Imp. Ω	Unbal. ma DC/Pri.	Sec. Imp. Ω	DCR ±20%		Turns Ratio ±3%		Max. Level		Schem. Diag. Fig. No.	Freq. Resp. ±1 db (Hz)	Term. w/Same Polarity
						Pri.	Sec. Ser. Conn.	Total Pri.	Total Sec.	dbm	mw			
1	1	Low input imp. to grid	50, 200/250, 500/600		50K	52	3900	1	10	+8	6.3	13	30-20K	1,6
2	2	Low input imp. to PP grids	50, 200/250, 500/600		50K CT	52	3900	1	10	+8	6.3	2	30-20K	1,6
3	3	Low input imp. to grid	7.5/30		50K	4.5		1	40.9	+8	6.3	14	30-20K	
4	4	Plate to grid	15K		60K	710	3200	1	2	+8	6.3	1	30-20K	1,3
5	5	Plate to grid	15K	4	60K	710	3200	1	2	+8	6.3	1	200-10K	1,3
6	6	Plate to PP grids	15K		95K CT	690	3900	1	2.5	+8	6.3	3	30-20K	1,6
7	7	Plate to PP grids	15K	4	95K CT	690	3900	1	2.5	+8	6.3	3	200-10K	1,6
8	8	Plate to line	15K		50, 200/250, 500/600	950	48	5.49	1	+8	6.3	4	30-20K	1,6
9	9	Plate to line	15K	4	Same as 0-8	950	48	5.49	1	+8	6.3	4	200-10K	
10	10	PP to line	30K CT		Same as 0-8	1300	52	7.7	1	+8	6.3	5	30-20K	1,8
11	11	Crystal to line or transistor	50K		Same as 0-8	3900	53	10	1	+8	6.3	4	30-20K	1,6
12	12	Mixing matching	50, 200/250		Same as 0-8	12	45	1	1.58	+8	6.3	5	30-20K	1,6
13	13	Inductor	300 Hys @ 0 DC; 50 Hys @ 3 ma DC; 6000 ohms				—	—	—			11		
15	15	10:1 plate to grid	10K		1 Megohm	330	4875	1	10	+8	6.3	1	50-5K	1,3
16*		Low imp. to grid	250 CT		50K	40	1900	1	14	+8	6.3		30-20K	
17		Hipermalloy shield, slip fit over ouncer, 1″ dia. provides 25 db shielding					—	—	—					
	17	Hipermalloy shield, slip fit over PC-O unit, 1$\frac{1}{16}$″ max. x 1⅛″ max. x $\frac{25}{32}$″ max. H												
18	18	Transistor interstage	10/2.5K split	4	2K/500 split	800	204	2.24	1	+20	100	7	100-20K	1,2,5,6
19	19	Transistor interstage	10/2.5K split	4	4K/1K split	800	353	1.58	1	+20	100	7	100-20K	1,2,5,6
20	20	Transistor to line	1500 CT	8	500/125 split	100	35	1.73	1	+20	100	9	100-20K	1,4
21	21	Transistor to voice coil	2000/4000 CT	4	8/16	200	.9	15.8	1	+20	100	6	100-20K	6,1
22	22	Transistor to voice coil	400/500 CT	20	3.2/4	35	.45	11	1		1W†	6	100-20K	6,1
24	24	Inductor	1.6 Hys @ 3 ma DC; .8 Hys @ 10 ma DC; 25 ohms				—	—	—			11		
25	25	Transistor input	600/150 split		2K/500 split	70	280	1	1.83	+15	30	7	50-15K	1,2,5,6
26	26	Transistor interstage	10K CT	4	10K CT	700	1000	1	1	+20	100	8	100-20K	1,4
27	27	Transistor interstage	10K CT	4	500/125 split	750	52	4.5	1	+20	100	9	100-20K	1,4,5
28	28	Transistor interstage	50K CT	2	500/125 split	3200	64	10	1	+20	100	9	100-20K	1,4,5
29	29	Transistor interstage or chopper	100K CT	1	500/125 split	3200	35	14	1	+20	100	9	100-20K	1,4,5
30	30	Transistor interstage	500/125 split	20	500/125 split	37	67	1	1		1W†	10	100-20K	1,2,5,6
31	31	Transistor interstage	500/125 split	20	150/37.5 split	35	16	1.8	1		1W†	10	100-20K	1,2,5,6
32	32	Transistor interstage	500/125 split	20	50/12.5 split	37	7	3.16	1		1W†	10	100-20K	1,2,5,6
33	33	Transistor interstage	100/25 split	40	40/10 split	9	5	1.58	1		1W†	7	100-20K	1,2,5,6
35	35	Hybrid	600		600/600 CT	95 ea.	1:1:1 3 equal windings				250	12	100-20K	1,3,6
36	36	Split inductor	Series connection: 1 Hy 20 ma DC; 60 ohms Parallel connection: 25 Hys 40 ma DC; 15 ohms				—	—	—					
37	37	Transistor to line	4K/1K split	4	600/150 split	395	57	2.58	1		1W†	7	100-20K	1,2,5,6

* Uses two heavy gauge hipermalloy shields for very low hum pickup plus orientable mounting.
Primary CT is balanced to 1% can be used for 150, 200, 250, 500 or 600 ohm source . . . 200:1 imped. ratio. 3 oz.

† At 200 Hz, ¼ watt at 100 Hz.

O, PC-O
Performance Characteristics

TRW
AUDIO

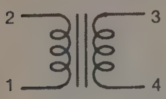


FIG. 1

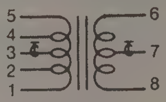


FIG. 2

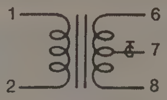


FIG. 3

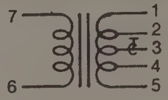


FIG. 4

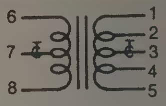


FIG. 5

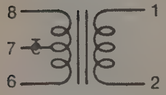


FIG. 6

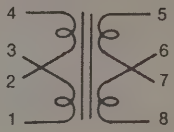


FIG. 7

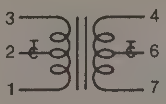


FIG. 8

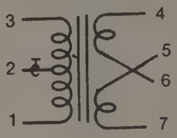


FIG. 9

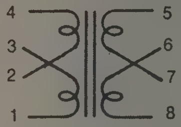


FIG. 10

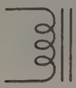


FIG. 11

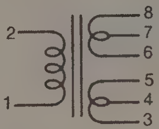


FIG. 12

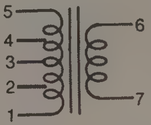


FIG. 13

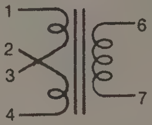
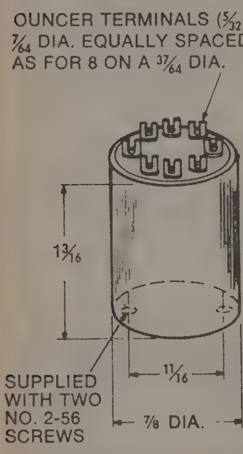
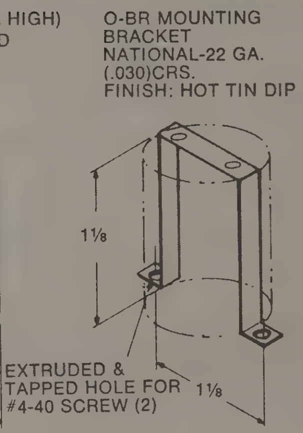


FIG. 14

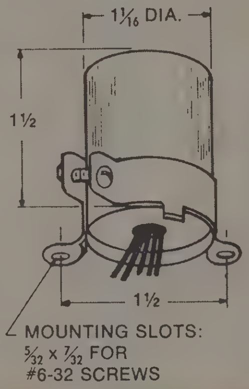
O-LINE UNIT


OUNCER TERMINALS (5/32 HIGH)
7/64 DIA. EQUALLY SPACED
AS FOR 8 ON A 37/64 DIA.
1 3/16
11/16
7/8 DIA.
SUPPLIED WITH TWO NO. 2-56 SCREWS

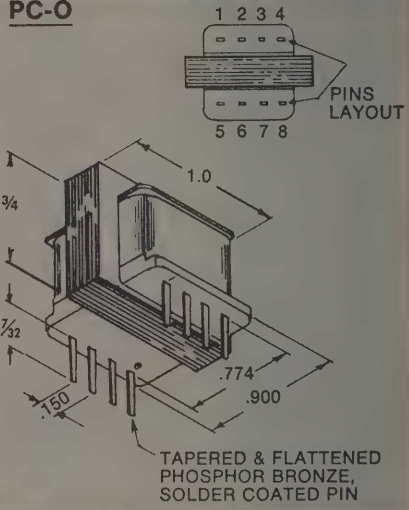
O-BR


O-BR MOUNTING BRACKET
NATIONAL-22 GA. (.030)CRS.
FINISH: HOT TIN DIP
1 1/8
1 1/8
EXTRUDED & TAPPED HOLE FOR #4-40 SCREW (2)

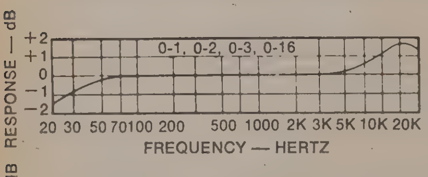
O-16 UNIT

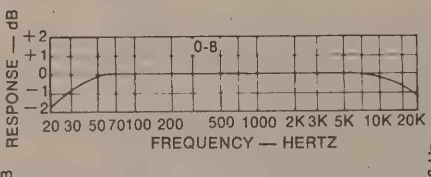

1 1/16 DIA.
1 1/2
1 1/2
MOUNTING SLOTS:
5/32 x 7/32 FOR
#6-32 SCREWS

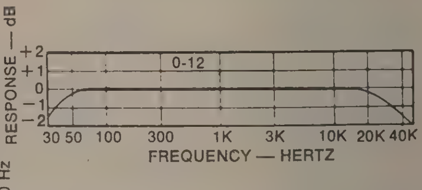
PC-O

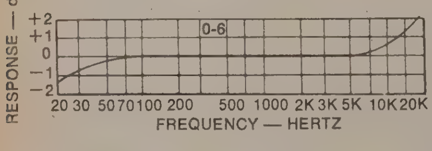

1 2 3 4
5 6 7 8
PINS LAYOUT
1.0
3/4
7/32
.150
.774
.900
TAPERED & FLATTENED PHOSPHOR BRONZE, SOLDER COATED PIN

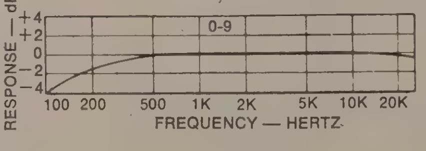
TYPICAL O-LINE RESPONSE CURVES

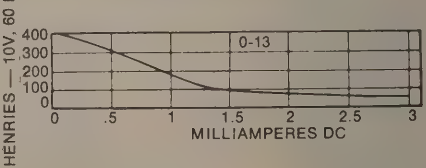


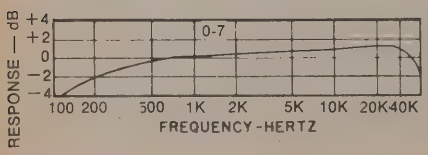


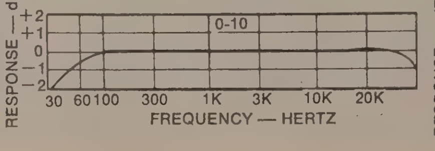


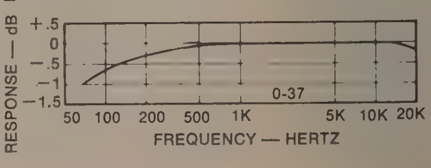












SO, PC-SO, SO-P
Performance Characteristics

AUDIO

Input Winding — Frequency Response 200 Hz - 20 kHz — Working Voltage: 175 Peak

Line	Type No. SO	Type No. PC-SO	Type No. SO-P	MIL Part No. for Type SO-P	E. T. Product Millivolt Sec.	Unbal. DC ma in Winding	Input-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary (Ohms)	Maximum Level		Series Connected DCR ±25% Ohms		Turns Ratio ±3%		Schem. PC/P	Pins Arrange PC/P
									DBM	M.W	In Pri.	Out Sec.	Pri.	Sec.		
1	9	9	9	M27/165-06	1.5	0	3.2	500 CT	+24	250	0.35	15	1	12.5	20/9	E/C
3	10	10	10	M27/165-09	4.6	60	8 16	2000 CT 4000 CT	+24	250	2	290	1	15.9	20/9	E/C
4	14	14	14	M27/165-01	5.2	10	32 split 40 split	80 CT 100 CT	+24	250	3.2	4.9	1	1.58	5/11	E/D
5	13	13	13	M27/165-03	5.8	2.5	40 split 50 split	400 CT 500 CT	+24	250	4.5	20	1	3.16	5	E
6	4	4	4	M27/165-16	3.7	24	50	30K	+23	200	3.8	1850	1	24.5	10	E
7	6	6	6	M27/165-18	3.2	20	60	100K	+23	200	3.7	3400	1	40	10	E
8	14	14	14	M27/165-01	8.3	16	80 CT 100 CT	32 split 40 split	+24	250	4.9	3.2	1.58	1	5/11	E/D
9	12	12	12	M27/165-04	10	14	120 split 150 split	400 CT 500 CT	+24	250	12.6	20	1	1.82	5	E
10	1	1	1	M27/165-02	1.2	0	200 50	250K 62.5K	+10	10	16	2500	1	35	10	E
11	3	3	3	M27/165-11	10	21 10	200 500	10K 25K	+23	200	30	1225	1	7.1	10/1	E/A
13	13	13	13	M27/165-03	18	8	400 CT 500 CT	40 split 50 split	+24	250	20	4.5	3.16	1	5	E
14	12	12	12	M27/165-04	18	8	400 CT 500 CT	120 split 150 split	+24	250	20	12.5	1.82	1	5	E
15	11	11	11	M27/165-05	18	8	400 CT 500 CT	400 split 500 split	+24	250	20	45	1	1	5	E
16	9	9	9	M27/165-06	19	0	500 CT	3.2	+24	250	15	.35	12.5	1	20/9	E/C
17	15	15	15	M27/165-07	23	6	600 CT	600 split	+24	250	35	60	1	1	5/11	E/D
18	22	22	22	TF5R21ZZ	28	5	900 split	600 split	+24	250	72	44	1.22	1	7	E
19	20	20	20	M27/165-08	32	4	600 split†	10K CT	+23	200	80	1050	1	4.08	6	E
20	18	18	18	M27/165-17	23	9	600 split	50K CT	+24	250	63	2400	1	9.1	5/11	E/D
21	7	7	7	M27/165-15	9.2	2.5	800 1200	20K 30K	+23	200	32	450	1	5	10/1	E/A
22	22	22	22	TF5R21ZZ	23	6	600 split	900 split	+24	250	44	72	1	1.22	7	E
23	10	10	10	M27/165-09	7.4	4 2	2K CT 4K CT	8 16	+24	250	290	2	15.9	1	20/9	E/C
24	8	8	8	M27/165-12	15	2.2	2K CT	10K	+23	200	40	1000	1	2.23	2/3	E/B
25	16	16	16	M27/165-10	46	4	2500 CT	2500 split	+24	250	140	300	1	1	5	E
26	3	3	3	M27/165-11	74	3 1.5	10K 25K	200 500	+23	200	1225	30	7.1	1	10/1	E/A
27	20	20	20	M27/165-08	133	1	10K CT†	600 split	+23	200	1050	80	4.08	1	6	E
28	8	8	8	M27/165-12	34	1	10K	2000 CT	+23	200	1000	40	2.23	1	2/3	E/B
29	21	21	21	M27/165-13	111	1	10K CT† 12K CT†	10K split 12K split	+23	200	855	1080	1	1	6	E
30	2	2	2	M27/165-14	10	.25	10K	90K	+20	100	215	1850	1	3	10/1	E/A
31	7	7	7	M27/165-15	46	.5	20K 30K	800 1200	+23	200	450	32	5	1	10/1	E/A
32	4	4	4	M27/165-16	91	1	30K	50	+23	200	1850	3.8	24.5	1	10	E
33	18	18	18	M27/165-17	100	1	50K CT	600 split	+24	250	2400	63	9.1	1	5/11	E/D
34	2	2	2	M27/165-14	29	0	90K	10K	+20	100	1850	215	3	1	10/1	E/A
35	6	6	6	M27/165-18	130	.5	100K	60	+23	200	3400	3.7	40	1	10	E
36	1	1	1	M27/165-02	44	0	250K 62.5K	200 50	+10	10	2500	16	35	1	10	E

† Electrostatic Shield.

Key to SO Line

SO-Type	Line Number
1	10-36
2	30-34
3	11-26
4	6-32
5	37-38
6	7-35
7	21-31
8	24-28
9	1-16
10	3-23
11	15
12	9-14
13	5-13
14	4-8
15	17
16	25
18	20-33
20	19-27
21	29
22	18-22

INDUCTORS

37	SO-5	Inductor, 50 Hys @ 1 maDC, 2675 ohms DC res.		
38	SO-5P PC-SO5	Split Series: 40 Hys @ 1 maDC, 20 Hys @ 2 maDC, 2675 ohms Inductor Parallel: 10 Hys @ 2 maDC, 5 Hys @ 4 maDC, 670 ohms	13/12	E/A

SHIELDS
Drawn Hipermalloy Shield provides 20 db Shielding

PC-SO-SH	3 1/32″ Sq x 5/8″ H
SO-P-SH	1 1/16″ L x 13/16″ W x 47/64″ H

TRW
AUDIO

Subouncer™ Transformers

TYPES

SO—Open frame type with flexible leads.

PC-SO—Printed circuit board mounting open frame (new item).

SO-P—Hermetically sealed type to complete MIL-T-27D Specs, Grade 5, Class R.

NOTES

ON PERFORMANCE CHARACTERISTICS

- To present the widest range of application, matching impedance values are listed in order of increasing impedance value without regard to the traditional designation of primary or secondary winding.
- The primary and secondary winding can be used arbitrarily as the input or output.
- Impedance values written one above the other indicate a range of matching impedances over which the parts will give satisfactory performance as long as the impedance ratio is maintained.
- Impedance values separated by a slash indicate the series and parallel connected impedance value of the windings.
- PC-SO Types have terminal arrangements that permit the connection of series or parallel windings by bridging adjacent terminals (see Fig. 14). This eliminates unwanted cross overs on the PC board when split is available.

(E.T. is the maximum voltage, time product for a single pulse applied to the winding.)

PIN ARRANGEMENT (Pins not used are removed. These are indicated by "x.")

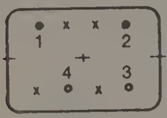


FIG. A

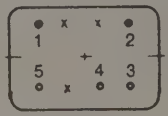


FIG. B

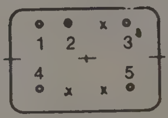


FIG. C

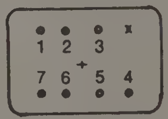


FIG. D

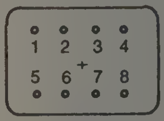
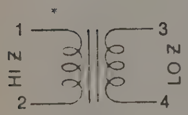


FIG. E†


*
1
2
3
4
HI Z
LO Z
FIG. 1

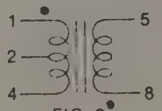


FIG. 2

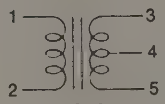


FIG. 3

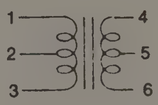


FIG. 4

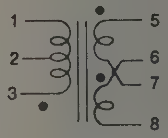


FIG. 5

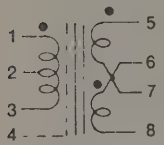
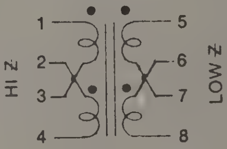


FIG. 6


HI Z
1
2
3
4
5
6
7
8
LOW Z
FIG. 7

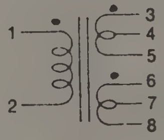


FIG. 8

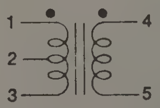
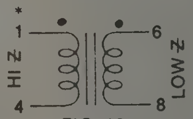


FIG. 9


*
HI Z
1
4
6
8
LOW Z
FIG. 10

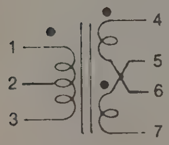


FIG. 11

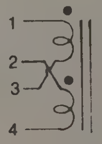


FIG. 12

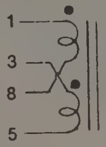
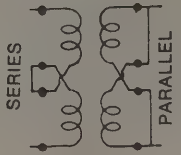


FIG. 13


SERIES
PARALLEL
FIG. 14

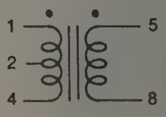
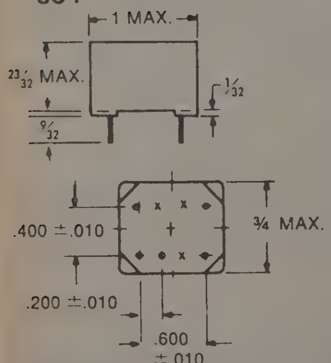
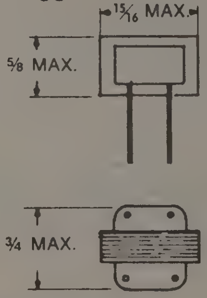


FIG. 20

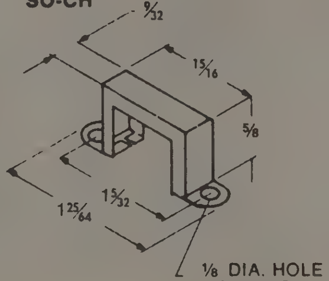
SO-P


1 MAX.
23/32 MAX.
1/32
9/32
.400 ±.010
3/4 MAX.
.200 ±.010
.600 ±.010
.040 DIA. PIN
UP TO 8
.200 APART

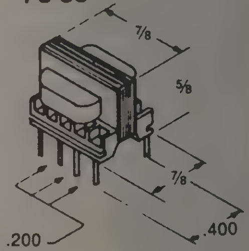
SO


15/16 MAX.
5/8 MAX.
3/4 MAX.
WEIGHT: .03 LBS.
LEADS: 4" LONG
FINISH: BLACK

SO-CH


9/32
15/16
5/8
1 25/64
1 5/32
1/8 DIA. HOLE
2 PLACES

PC-SO


7/8
5/8
7/8
.200
.400
.040 DIA. PINS
AS REQUIRED
UP TO 8

† Pin numbers not shown in schematic will be missing.

* On PC-SO-2 and SO-2P, Hi Z and Lo Z are reversed.

SSO, PC-SSO, SSO-P Performance Characteristics

AUDIO

Input Winding								300 Hz - 20 kHz — Working Volts: 175 Peak							
								Maximum Level		Series Connected DCR ±25% Ohms		Turns Ratio ±3%			
Line	Type No. SSO	Type No. PC-SSO	Type No. SSO-P	E.T. Product Millivolt Sec.	Unbal. DC ma In Winding	Jnput-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary(Ohms)	DBM	M.W.	In Pri.	Out Sec.	Pri.	Sec.	Schematic Catalog Pg. 24 PC/P	Pins Arrangement Catalog Pg. 24 PC/P
1	16	16	16	1.2	54	3.2 4.0	1200 1500	+20	100	.45	70	1	18.1	10	F
2	10	10	10	1.5	54	3.2	10K	+20	100	.65	800	1	55.5	10	F
3	29	29	29	2.5	26	12.8/3.2 split* 16.0/4 split*	500/125 split* 600/150 split*	+20	100	1.5	36.2	1	6.11	7	F
4	36	36	36	2.5	26	12.8/3.2 split* 16.0/4 split*	4K/1K split 5K/1.25K split	+20	100	1.5	327	1	17.6	7	F
5	38	38	38	2.5	26	12.8/3.2 split* 16.0/4 split*	8K/2K split 10K/2.5K split	+20	100	1.5	600	1	25	7	F
6	9	9	9	3.3	26	16	10K	+20	100	2.7	800	1	25	10	F
7	11	11	11	2.5	11	50 60	500 600	+20	100	5	50	1	3.16	10	F
8	30	30	30	2.5	11	50/12 split* 60/15 split*	500/125 split* 600/150 split*	+20	100	6.5	36	1	3.16	7	F
9	12	12	12	2.5	11	50 60	1000 1200	+20	100	5.0	90	1	4.45	10	F
10	4	4	4	2.6	11	50	30K	+20	100	4.6	2875	1	24.5	10	F
11	6	6	6	2.0	15	60	100K	+20	100	3.3	3500	1	40	10	F
12	28	28	28	5.5	10	48/12 split* 100/25 split*	48/12 split* 100/25 split*	+20	100	5.9	6.9	1	1	7	F
13	44	44	44	1.2	0	100/25 split*† 200/50 split*†	100K CT 200K CT	+7	5	4.1	3290	1	31.6	6	F
14	34	34	34	10	0	200/50 split* 240/60 split*	1K/250 split* 1200/300 split*	+20	100	19	102	1	2.23	7	F
15	3	3	3	7.7	10 5	200 500	10K 25K	+20	100	34	2500	1	7.1	10/1	F/A
16	14	14	14	4.7	14 7	200 CT 500 CT	10K CT 25K CT	+20	100	22	560	1	7.07	14/4	F/C
17	39	39	39	7.7	10 5	200/50 split 500/125 split	10K/2.5K split 25K/6.25K split	+20	100	34	2500	1	7.1	7	F
18	26	26	26	5.7	12	400/100 split 500/125 split	40K CT 50K CT	+20	100	43	1900	1	10	5	F
19	43	43	43	5.7	12	400/100 split 500/125 split	40K/10K split 50K/12.5K split	+20	100	43	1900	1	10	7	F
20	29	29	29	5.3	8	500/125 split* 600/150 split*	12.8/3.2 split* 16/4 split*	+20	100	36.2	1.5	6.11	1	7	F
21	11	11	11	2.6	3.5	500 600	50 60	+20	100	50	5	3.16	1	10	F
22	30	30	30	2.6	3.5	500/125 split* 600/150 split*	50/12.5 split* 60/15 split*	+20	100	36	6.5	3.16	1	7	F
23	19	19	19	13	10	500 CT	600 CT	+20	100	26	70	1	1.1	14/4	F/C
24	31	31	31	13	10	500/125 split*	600/150 split*	+20	100	30	42	1	1.1	7	F
25	32	32	32	Hybrid, 3 equal windings Center Tapped-Trifilar		500 600	500 CT 500 CT 600 CT 600 CT	+14	25	50	50 50	1:1:1		8	F
26	17	17	17	18	8	500 CT 600 CT	10K 12K	+20	100	95	800	1	4.45	13	F
27	40	40	40	18	8	500/125 split* 600/150 split*	10K/2.5K split 12K/3.0K split	+20	100	98	1200	1	4.48	7	F
28	19	19	19	15	10	600 CT	500 CT	+20	100	70	26	1.1	1	14/4	F/C
29	31	31	31	15	10	600/150 split*	500/125 split*	+20	100	40.3	32.9	1.1	1	7	F
30	33	33	33	13	10	600/150 split*†	600 CT	+20	100	29	42	1	1	6	F
31	46	46	46	15	10	600/150 split*	900/225 split*	+20	100	43	50	1	1.22	7	F
32	20	20	20	15	11	600 CT	1500 CT	+20	100	65	70	1	1.58	14/4	F/C
33	35	35	35	13	5	600/150 split*	2K/500 split*	+20	100	40	113	1.82	1	7	F
34	27	27	27	6.8	11	600/150 split	4K CT	+20	100	47	155	1	2.68	5/11	F/E
35	37	37	37	8.5	3.2	600/150 split*†	8K CT	+10	50	55	484	1	3.65	6	F
36	7	7	7	8.5	2.5	800 1200	20K 30K	+20	100	110	800	1	5	10	F
37	15	15	15	8.5	5	800 CT 1200 CT	20K CT 30K CT	+20	100	110	800	1	5	12/4	F/D
38	42	42	42	8.5	5	800/200 split 1200/300 split	20K/5K split 30K/7.5K split	+17	50	110	800	1	5	7	F
39	46	46	46	18	8	900/225 split*	600/150 split*	+20	100	50	43	1.22	1	7	F
40	12	12	12	11	3	1000 1200	50 60	+20	100	5	90	4.45	1	10	F
41	34	34	34		6	1K/25 split* 1200/300 split*	200/50 split* 240/60 split*	+20	100	102	19	2.23	1	7	F

† Electrostatic Shield * Bifilar

Key

SSO	Line
2	64, 71
3	15, 55
4	10, 68
5	Pg. 24
6	11, 72
7	36, 65
8	49, 60
9	6, 54
10	2
11	7, 21
12	9, 40
13	42, 74
14	16, 57
15	37, 66
16	1, 45
17	26, 58
19	23, 28
20	32, 46
21	43, 75
22	47, 61
23	Pg. 24
24	Pg. 24
25	62
26	18, 69
27	34, 50
28	12
29	3, 20
30	8, 22
31	24, 29
32	25
33	30
34	14, 41
35	33, 48
36	4, 51
37	35, 53
38	5, 52
39	17, 56
40	27, 59
41	63
42	38, 67
43	19, 70
44	13, 73
45	44, 76
46	31, 39

SHIELDS-DRAWN HIPERMALLOY SHIELD PROVIDES 20 db SHIELDING

PC-SSO-SH	2 7/32″ Sq x ½″ H
SSO-P-SH	1″ L x 13/16″ W x 19/32″ H

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

SSO, PC-SSO, SSO-P
Performance Characteristics

TRW AUDIO

Input Winding								300 Hz - 20 kHz — Working Volts: 175 Peak							
Line	Type No. SSO	Type No. PC-SSO	Type No. SSO-P	E.T. Product Millivolt Sec.	Unbal. DC ma In Winding	Input-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary (Ohms)	Maximum Level		Series Connected DCR ±25% Ohms		Turns Ratio ±3%		Schematic Catalog Pg. 24 PC/P	Pins Arrangement Catalog Pg. 24 PC/P
								DBM	M.W.	In Pri.	Out Sec.	Pri.	Sec.		
42	13	13	13	3.2	0	1000	200K	+7	5	190	4000	1	14.4	10	F
43	21	21	21	3.2	0	1000 CT	200K CT	+7	5	200	4000	1	14.4	14/4	F/C
44	45	45	45	3.25	0	1000/250 split†	200K CT	+7	5	200	4000	1	14.4	6	F
45	16	16	16	22	3	1200 1500	3.2 40	+20	100	70	.45	18.1	1	10	F
46	20	20	20	23	7	1.5K CT	600 CT	+20	100	70	65	1.58	1	14/4	F/C
47	22	22	22	32	7	1500 CT 1800 CT	10K CT 12K CT	+20	100	300	800	1	2.58	12/4	F/D
48	35	35	35	25	2.5	2K/500 split*	600/150 split*	+20	100	113	40	1.82	1	7	F
49	8	8	8	10	2.2	2K CT	10K	+20	100	45	1200	1	2.23	13/3	F/B
50	27	27	27	16	2.5	4K CT	600 split	+20	100	155	47	2.58	1	5/11	F/E
51	36	36	36	44	2.6	4K/1K split 5K/125 split	12.8/3.2 split* 16/4 split*	+20	100	327	1.5	17.6	1	7	F
52	38	38	38	63	2	8K/2K split 10/2.5K split	12.8/3.2 split* 16/4 split*	+20	100	600	1.5	25	1	7	F
53	37	37	37	30	.6	8K CT†	600/150 split*	+7	50	484	55	3.65	1	6	F
54	9	9	9	82	2	10K	16	+20	100	800	2.7	25	1	10	F
55	3	3	3	55	3 1.5	10K 25K	200 500	+20	100	2500	34	7.1	1	10/1	F/A
56	39	39	39	55	3 1.5	10K/2.5K split 25K/6.25K split	200/50 split 500/125 split	+20	100	2500	34	7.1	1	7	F
57	14	14	14	33	2 1	10K CT 25K CT	200 CT 500 CT	+20	100	560	22	7.07	1	14/4	F/C
58	17	17	17	82	2	10K 12K	500 CT 600 CT	+20	100	800	95	4.48	1	13	F
59	40	40	40	82	4	10K/2.5 split 12K/3.0K split	500/125 split 600/150 split	+20	100	1200	98	4.48	1	7	F
60	8	8	8	23	1	10K	2K CT	+20	100	1200	45	2.23	1	13/3	F/B
61	22	22	22	82	4	10K CT 12K CT	1500 CT 1800 CT	+20	100	800	300	2.58	1	12/4	F/D
62	25	25	25	60	1	10K CT 12K CT	10K split‡ 12K split‡	+20	100	560	650	1	1	5/11	F/E
63	41	41	41	60	1	10K/2.5K split 12K/3.0K split	10K/2.5K split 12K/3.0K split	+20	100	560	650	1	1	7	F
64	2	2	2	13	.25	10K	90K	+15	30	710	3150	1	3	10	F
65	7	7	7	42	.5	20K 30K	800 1200	+20	100	800	110	5	1	10	F
66	15	15	15	42	1	20K CT 30K CT	800 CT 1200 CT	+20	100	800	110	5	1	12/4	F/D
67	42	42	42	42	1	20K/5K split 30K/7.5K split	800/200 split 1200/300 split	+17	50	800	110	5	1	7	F
68	4	4	4	64	1	30K	50	+20	100	2875	4.6	24.5	1	10	F
69	26	26	26	57	.5	40K CT 50K CT	400/100 split 500/125 split	+20	100	1900	43	10	1	5	F
70	43	43	43	57	.5	40K/10K split 50K/12.5K split	400/100 split 500/125 split	+20	100	1900	43	10	1	7	F
71	2	2	2	38		90K	10K	+15	30	3150	710	3	1	10	F
72	6	6	6	79	.5	100K	60	+20	100	3500	3.3	40	1	10	F
73	44	44	44	40	0	100K CT† 200K CT†	100/25 split 200/50 split	+7	5	3290	4.1	31.6	1	6	F
74	13	13	13	48	0	200K	1000	+7	5	4000	190	1	14.4	10	F
75	21	21	21	48	0	200K CT	1K CT	+7	5	4000	200	14.1	1	14/4	F/C
76	45	45	45	48	0	200K CT†	1K/250 split	+7	5	4000	200	14.4	1	6	F

† Electrostatic Shield * Bifilar ‡ Secondary is not split for SSO-25
Magnetic Shields on Catalog page 22

Key

SSO	Line
2	64, 71
3	15, 55
4	10, 68
5	Pg. 24
6	11, 72
7	36, 65
8	49, 60
9	6, 54
10	2
11	7, 21
12	9, 40
13	42, 74
14	16, 57
15	37, 66
16	1, 45
17	26, 58
19	23, 28
20	32, 46
21	43, 75
22	47, 61
23	Pg. 24
24	Pg. 24
25	62
26	18, 69
27	34, 50
28	12
29	3, 20
30	8, 22
31	24, 29
32	25
33	30
34	14, 41
35	33, 48
36	4, 51
37	35, 53
38	5, 52
39	17, 56
40	27, 59
41	63
42	38, 67
43	19, 70
44	13, 73
45	44, 76
46	31, 39

SSO, PC-SSO, SSO-P Performance Characteristics

TRW
AUDIO

INDUCTORS

		Pri.	Sch.	Pin Diag.
SSO-5	50 Hys at 1 ma DC, 4400 ohms DC res.	Blk Blk		
SSO-23	8 Hys at 2 ma DC, 4 Hys at 5 ma DC, 650 ohms	Rd Gn		
SSO-24	3.5 Hys at 2 ma DC, 1.5 Hys at 5 ma DC, 160 ohms	Rd Blue		
PC-SSO-5 **SSO-5P**	Split Series: 100 Hys @ 0 ma DC, 50 Hys @ 1 ma DC, 4400 ohms Parallel: 25 Hys @ 0 ma DC, 12 Hys @ 2 ma DC, 1100 ohms		16/ /15	F/ /A
PC-SSO-23 **SSO-23P**	Split Series: 8 Hys @ 2 ma DC, 4 Hys @ 5 ma DC, 600 ohms Parallel: 2 Hys @ 4 ma DC, 1 Hy @ 10 ma DC, 150 ohms		16/ /15	F/ /A
PC-SSO-24 **SSO-24P**	Split Series: 3.5 Hys @ 2 ma DC, 1.5 Hys @ 5 ma DC, 160 ohms Parallel: 0.9 Hy @ 4 ma DC, 0.4 Hy @ 10 ma DC, 40 ohms		16/ /15	F/ /A

MIL-PART NUMBER DESIGNATIONS

Type No.	Designation	Type No.	Designation	Type No.	Designation	Type No.	Designation	Type No.	Designation
SSO-1P	M27/167-02	**SSO-10P**	M27/167-20	**SSO-19P**	M27/167-07	**SSO-28P**	M27/167-03	**SSO-37P**	M27/167-12
SSO-2P	M27/167-32	**SSO-11P**	M27/167-05	**SSO-20P**	M27/167-17	**SSO-29P**	M27/167-04	**SSO-38P**	M27/167-21
SSO-3P	M27/167-01	**SSO-12P**	M27/167-14	**SSO-21P**	M27/167-41	**SSO-30P**	M27/167-06	**SSO-39P**	M27/167-24
SSO-4P	M27/167-35	**SSO-13P**	M27/167-40	**SSO-22P**	M27/167-29	**SSO-31P**	M27/167-08	**SSO-40P**	M27/167-27
SSO-5P	TF5R20ZZ	**SSO-14P**	M27/167-25	**SSO-23P**	TF5R20ZZ	**SSO-32P**	M27/167-11	**SSO-41P**	M27/167-31
SSO-6P	M27/167-38	**SSO-15P**	M27/167-34	**SSO-24P**	TF5R20ZZ	**SSO-33P**	M27/167-09	**SSO-42P**	M27/167-13
SSO-7P	M27/167-33	**SSO-16P**	M27/167-16	**SSO-25P**	M27/167-30	**SSO-34P**	M27/167-15	**SSO-43P**	M27/167-37
SSO-8P	M27/167-28	**SSO-17P**	M27/167-26	**SSO-26P**	M27/167-36	**SSO-35P**	M27/167-10	**SSO-44P**	M27/167-39
SSO-9P	M27/167-22	**SSO-18P**	M27/167-23	**SSO-27P**	M27/167-18	**SSO-36P**	M27/167-19	**SSO-45P**	M27/167-42

PIN ARRANGEMENT (Pins not used are removed. These are indicated by "x.")

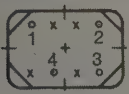


FIG. A

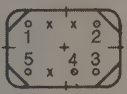


FIG. B

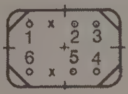


FIG. C

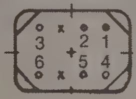


FIG. D

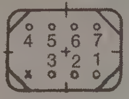


FIG. E

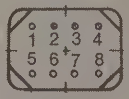


FIG. F†

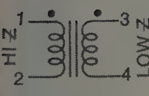

1
2
3
4
HI Z
LOW Z

FIG. 1

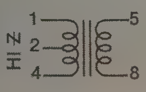


FIG. 2

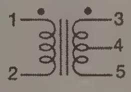


FIG. 3

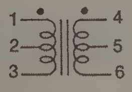


FIG. 4

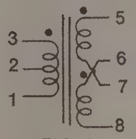


FIG. 5

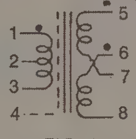


FIG. 6

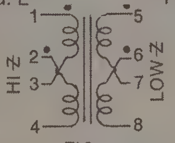

HI Z
1
2
3
4
5
6
7
8
LOW Z

FIG. 7

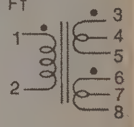


FIG. 8

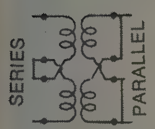

SERIES
PARALLEL

FIG 9

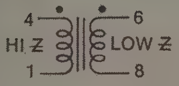

4
HI Z
1
6
LOW Z
8

FIG. 10

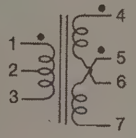


FIG. 11

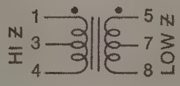

HI Z
1
3
4
5
7
8
LOW Z

FIG. 12

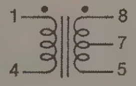


FIG. 13

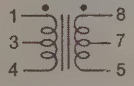


FIG. 14

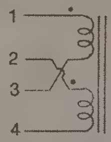


FIG. 15

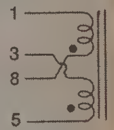
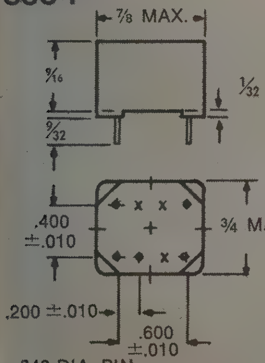


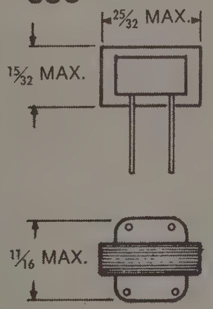
FIG. 16

SSO-P


7/8 MAX.
9/16
1/32
9/32
.400 ±.010
3/4 MAX.
.200 ±.010
.600 ±.010

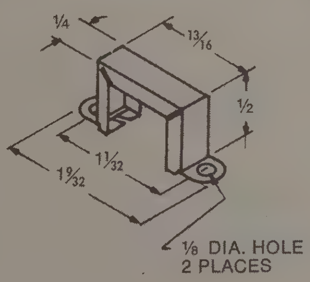
.040 DIA. PIN
UP TO 8
.200 APART (TYP.)

SSO

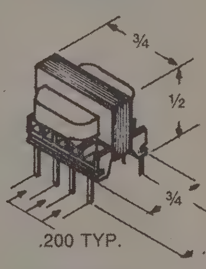

25/32 MAX.
15/32 MAX.
11/16 MAX.

WEIGHT: .02 LBS.
LEADS: 4" LONG
FINISH: BLACK

SSO-CH


1/4
13/16
1/2
1 1/32
1 9/32
1/8 DIA. HOLE
2 PLACES

PC-SSO

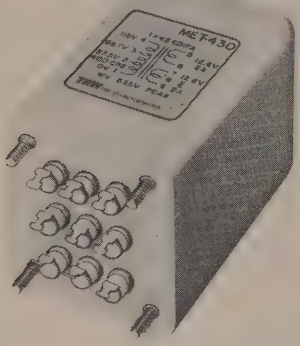

3/4
1/2
3/4
.200 TYP.
.400

.040 DIA. PINS
AS REQUIRED
UP TO 8

†Pin numbers not shown in schematic will be missing.

Universal Transistor Supply Transformers

TRW
POWER

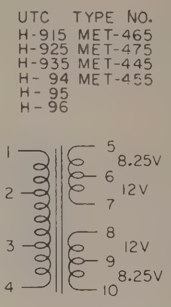


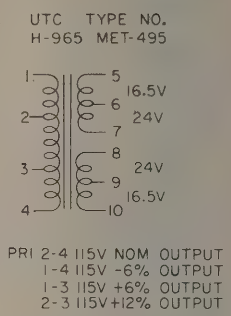
PACKAGING Hermetically sealed. Drawn metal case to MIL Grade 4.

MIL SPECS To complete MIL-T-27D Specs. MIL Type TF4S03 plus two letter case code. H-915 is qualified as M27/184-01. H-935 is qualified as M27/157-01. H-925 is qualified as M27/156-01.

NOTES: Chart below shows the secondary AC voltages available, and the approximate DC voltages resulting, in typical capacitive filter silicon rectifier circuits (at the indicated currents). Since the capacitor following the rectifier affects the DC, voltage values used (in 1000 mfd) are shown in parenthesis ( ) after each current rating.

Primary taps can modify nominal AC voltages by −6%, +6%, and +12%.





INCLUDING MET™ SERIES

Primary 115 Volts, 50/60 Hz Nominal Secondary Volts, 8.25 to 40.5

Type No.	MIL DC Range	Industrial DC Range	MIL Case
H-915	6V-.065A to 53V-.02A	**6V-.085A to 53V-.025A**	AH
H-925	6V-.22A to 53V-.07A	**6V-.28A to 53V-.085A**	AJ
H-935	6V-1.2A to 53V-.4A	**6V-1.52A to 53V-.48A**	FA
H-94	6V-3A to 53V-1A	**6V-3.8A to 53V-1.2A**	HA
H-95	6V-7.5A to 53V-2.5A	**6V-9A to 53V-3A**	KA
H-96	6V-18A to 53V-6A	**6V-23A to 53V-7.5A**	OA

Primary 115 Volts, 50/60 Hz Nominal Secondary Volts, 16.5 to 81

H-965	12V-1.5A to 106V-.5A	**12V-1.9A to 106V-.6A**	HA

Primary 115 Volts, 400 Hz Nominal Secondary Volts, 8.25 to 40.5

Type No.	MIL DC Range	Industrial DC Range	MIL Case
MET-445	6V-.6A to 53V-.2A	**6V-.75A to 53V-.25A**	AH
MET-455	6V-1.2A to 53V-.4A	**6V-1.25A to 53V-.48A**	AJ
MET-465	6V-3A to 53V-1A	**6V-3.8A to 53V-1.2A**	FA
MET-475	6V-7.5A to 53V-2.5A	**6V-9A to 53V-3A**	HA

Primary 115 Volts, 400 Hz Nominal Secondary Volts, 16.5 to 81

MET-495	12V-.6A to 106V-.2A	**12V-.76A to 106V-.24A**	AJ

DC Output for 16.5- to 81-Volt Secondaries

Nominal AC Voltage	Approx. DC Voltage	DC Current in Amperes (Capacitance in 1000 mfd in Parentheses) 60-Hz Type H-965	400-Hz Type MET-495
Full Wave Bridge Silicon Rectifier			
16.5	12	1.5 (.5)	0.6 (.06)
24	24	1.25 (.5)	0.5 (.06)
33	36	0.75 (.25)	0.3 (.06)
40.5	48	1.0 (.25)	0.4 (.06)
48	50	0.65 (.125)	0.26 (.04)
57	68	0.60 (.125)	0.24 (.04)
64.5	82	0.55 (.125)	0.22 (0.4)
81	106	0.50 (.125)	0.20 (.04)
Full Wave CT			
33 CT	13	1.15 (.5)	0.46 (.06)
48 CT	24	0.90 (.25)	0.36 (.06)
81 CT	48	0.75 (.25)	0.30 (.06)

DC OUTPUT FOR 8.25- TO 40.5-VOLT SECONDARIES

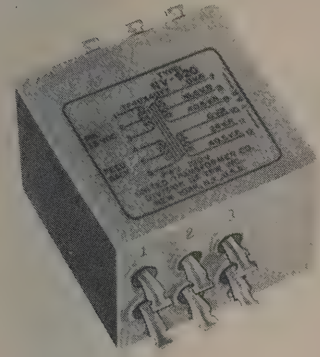
Nominal AC Voltage	Approx. DC Voltage	DC Current in Amperes (Capacitance in 1000 mfd in Parentheses)									
				60-Hz Types				400-Hz Types			
		H-915	H-925	H-935	H-94	H-95	H-96	MET-445	MET-455	MET-465	MET-475
Full Wave Bridge Silicon Rectifier											
8.25	6	.065 (.2)	.22 (.2)	1.2 (2)	3.0 (2)	7.5 (4)	18 (12)	.6 (.5)	1.2 (.5)	3.0 (.5)	7.5 (1)
12	12	.055 (.2)	.18 (.2)	1.0 (2)	2.5 (2)	6.0 (4)	15 (12)	.5 (.5)	1.0 (.5)	2.5 (.5)	6.0 (1)
16.5	18	.035 (.2)	.11 (.2)	.6 (1)	1.5 (1)	3.7 (2)	9 (6)	.3 (.25)	.6 (.25)	1.5 (.25)	3.7 (.5)
20.25	24	.042 (.2)	.14 (.2)	.8 (1)	2.0 (1)	5.0 (2)	12 (6)	.4 (.25)	.8 (.25)	2.0 (.25)	5.0 (.5)
24	25	.027 (.2)	.09 (.1)	.52 (.5)	1.3 (.5)	3.5 (1)	8 (4)	.26 (.15)	.52 (.15)	1.3 (.15)	3.5 (.25)
28.5	34	.025 (.1)	.085 (.1)	.48 (.5)	1.2 (.5)	3.0 (1)	7.5 (4)	.25 (.15)	.48 (.15)	1.2 (.15)	3.0 (.25)
32.25	41	.023 (.1)	.08 (.1)	.44 (.5)	1.1 (.5)	3.0 (1)	7 (4)	.22 (.15)	.44 (.15)	1.1 (.15)	3.0 (.25)
40.5	53	.020 (.1)	.07 (.1)	.40 (.5)	1.0 (.5)	2.5 (1)	6 (4)	.20 (.15)	.40 (.15)	1.0 (.15)	2.5 (.25)
Full Wave CT											
16.5 CT	6.6	.055 (.2)	.17 (.2)	.92 (2)	2.3 (2)	5.5 (4)	13.5 (12)	.46 (.5)	.92 (.5)	2.3 (.5)	5.5 (1)
24 CT	12	.040 (.2)	.13 (.2)	.72 (1)	1.8 (1)	4.5 (2)	11 (6)	.36 (.25)	.72 (.25)	1.8 (.25)	4.5 (.5)
40.5 CT	24	.035 (.2)	.11 (.2)	.60 (1)	1.5 (1)	3.7 (2)	9 (6)	.30 (.25)	.60 (.25)	1.5 (.25)	3.7 (.5)

Industrial Rating — Multiply D.C. Current By Approx. 1.25

Universal High Frequency Inverter and Converter Transformers

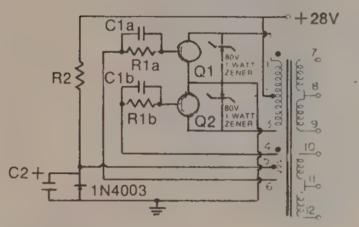
TRW
POWER

NV™ Series



CIRCUIT

CIRCUIT FOR NV UNITS



R1a, R1b = 10Ω 1 WATT, R2 = 15K= 1 WATT
S1a, C1b = 43pf, C2 = 50 µf 6V
Q1, Q2 = TRW 2N5326

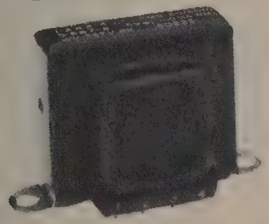
- Hermetically sealed.
- Made to complete MIL-T-27D specs; Grade 4, Class V.
- High efficiency.
- Advanced winding coupling technique.
- Reduced spiking assures transistor reliability.
- Miniaturization due to the use of high efficiency core material.
- Ease of rectifier filtering at high operating frequencies.

DIMENSIONS

NV-520, NV-720: 1 3/16″ sq x 13/16″ high max.
NV-530, NV-730: 1 9/16″ sq x 13/16″ high max.
Approximate weights: 1.5 oz. and 2.5 oz.

0 to Peak Volts		FULL WAVE BRIDGE								FULL WAVE CT		
		81	64.5	57	48	40.5	33	24	16.5	81 CT	48 CT	33 CT
Type No.	Freq. (kHz)			Current in amperes RMS, at above voltages								
NV-520	10	.4	.45	.5	.55	.8	.6	1.05	1.2	.55	.65	.85
NV-530	10	.8	.9	1	1.1	1.6	1.2	2.1	2.4	1.1	1.3	1.7
NV-720	20	.55	.6	.65	.70	1.1	.8	1.3	1.6	.70	.85	1.05
NV-730	20	1.1	1.2	1.3	1.4	2.2	1.60	2.6	3.2	1.4	1.7	2.1

Plug-In IC Power Transformers TPC Series

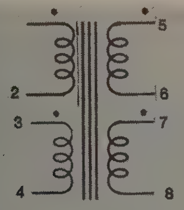


APPLICATIONS The TPC Series of plug-in power transformers is ideally suited for low-voltage, high-current IC feed applications. These units are also recommended for use in full-wave centertap and full-wave bridge rectifier circuits.

MIL SPECS To complete MIL-T-27D Specs, Grade 5, Class S.

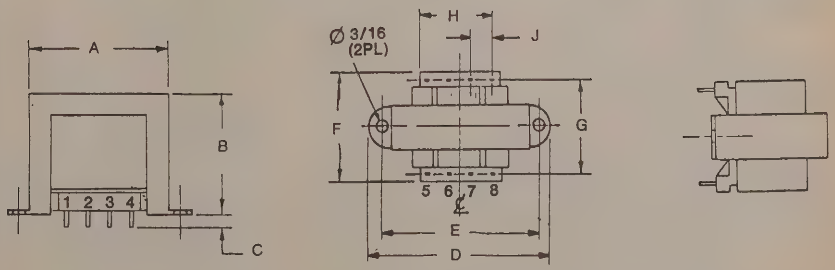
RATINGS Based on approximately 20% regulation from no-load to full-load RMS conditions.

Type No.	Power Rating (VA)	Series Connections Primary Input: 230 volts, 50/60 Hz		Parallel Connections Primary Input: 115 volts, 50/60 Hz	
		Secondary Voltage (volts)	Max. Secondary Current (mA)	Secondary Voltage (volts)	Max. Secondary Current (mA)
TPC-10-170	1.7	10 CT	170	5	340
TPC-12-135	1.7	12 CT	135	6.3	270
TPC-16-110	1.7	16 CT	110	8	220
TPC-24-70	1.7	24 CT	70	12	140
TPC-28-60	1.7	28 CT	60	14	120
TPC-34-50	1.7	34 CT	50	17	100
TPC-40-40	1.7	40 CT	40	20	80
TPC-120-14	1.7	120 CT	14	60	28
TPC-10-530	5.3	10 CT	530	5	1060
TPC-12-420	5.3	12 CT	420	6.3	840
TPC-16-330	5.3	16 CT	330	8	660
TPC-24-220	5.3	24 CT	220	12	440
TPC-28-190	5.3	28 CT	190	14	380
TPC-34-155	5.3	34 CT	155	17	310
TPC-40-130	5.3	40 CT	130	20	260
TPC-120-45	5.3	120 CT	45	60	90
TPC-10-1200	12.0	10 CT	1200	5	2400
TPC-12-950	12.0	12 CT	950	6.3	1900
TPC-16-750	12.0	16 CT	750	8	1500
TPC-24-500	12.0	24 CT	500	12	1000
TPC-28-430	12.0	28 CT	430	14	860
TPC-34-350	12.0	34 CT	350	17	700
TPC-40-300	12.0	40 CT	300	20	600
TPC-120-100	12.0	120 CT	100	60	200



Series Connections
Join 2 and 3 for 230-volt Input
Join 6 and 7 for CT output

Parallel Connections
Join 1 and 3, 2 and 4 for 115-volt Input
Join 5 and 7, 6 and 8 for high-current output



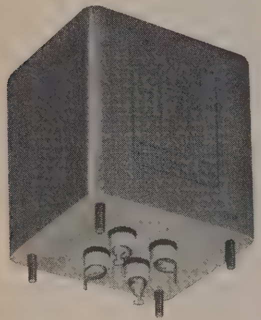
Power Rating	A Max.	B Max.	C ±.020	D Max.	E	F Max.	G ±.032	H ±.010	J Typ.	Weight, lbs.
1.7 VA	1.50	1.25	.15	2.125	1.750	1.344	1.00	.60	.20	.20
5.3 VA	1.75	1.50	.15	2.375	2.000	1.469	1.10	.75	.25	.32
12.0 VA	2.00	1.75	.15	2.875	2.375	1.625	1.30	.75	.25	.58

Filter Inductors

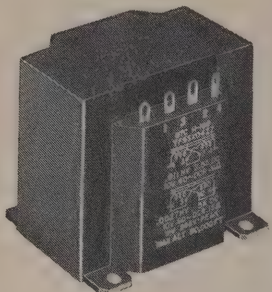
TRW

POWER

METAL CASED



MOLDED



PACKAGING Hermetically sealed. H-70 group — Metal encased. H-105 group — molded.

APPLICATIONS Transistor supply units have two windings for wide flexibility. All are swinging types to enhance power supply regulation.

CONSTRUCTION Grain-oriented core materials impart highest permeabilities, producing exceptionally high inductance for size.

MIL SPECS To complete MIL-T-27D Specs. H-70 group (metal cased) Grade 4, Class S. H-105 group (molded) Grade 5, Class S.

METAL CASED MIL-T-27D RATINGS IN REGULAR TYPE, **INDUSTRIAL RATINGS IN BOLD TYPE**

Type No.	MIL Type	Ind. @	ma	Ind. @	ma	Ind. @	ma	Ind. @	ma	Res. Ohms	Max. DCV Ch. Input	Test V RMS	MIL Case
		Hys.	DC	Hys.	DC	Hys.	DC	Hys.	DC				
H-70	TF4S04AH	20	20	18	25	14.5	30	10	35	925	350	1000	AH
H-71	TF4S04FB	20	40	18.5	50	15.5	60	10	70	350	500	2500	FB
H-72	TF4S04GB	13	70	11.5	85	9.5	105	7	125	215	500	2500	GB
H-73	TF4S04HB	11	100	9.5	125	7.5	150	5.5	175	150	700	2500	HB
H-74	TF4S04JB	11	150	10	170	8.5	195	**6.5**	**215**	135	700	2500	JB
H-75	TF4S04KB	11	200	10	230	8.5	250	**6.5**	**300**	90	700	2500	KB
H-76	M27/174-01	11	200	10	230	8.5	250	**6.5**	**300**	85	1500	4500	LB
H-77	TF4S04MB	10	300	9	350	**8**	**390**	**6.5**	**435**	60	2000	5500	MB
H-78	TF4S040A	7	400	**6.5**	**430**	**6**	**465**	**5.5**	**500**	48	2500	7000	0A
H-164† *	M27/171-01 (2 Wdgs.)	45‡ 11.25‡	35 70	40‡ 10‡	75 150	18‡ 4.5‡	350 700	9‡ 2.25‡	750 1.5A	1.2 .295		500	AG
H-166† *	TF4S04AH (2 Wdgs.)	125‡ 31‡	50 100	80‡ 20‡	100 200	20‡ 5‡	500 1 A	12‡ 3‡	1 A 2 A	1.2 .3		500	AH
H-168† *	TF4S04AJ (2 Wdgs.)	68‡ 17‡	100 200	52‡ 13‡	200 400	20‡ 5‡	1 A 2 A	14‡ 3.5‡	2 A 4 A	.8 .2		750	AJ
H-170† *	TF4S04GB (2 Wdgs.)	180‡ 45‡	125 250	140‡ 35‡	250 500	25‡ 6.2‡	1.25A 2.5 A	11‡ 2.7‡	2.5A 5 A	.6 .15		1000	GB
H-171† *	TF4S04JA (2 Wdgs.)	9‡ 2.25‡	.75A 1.25A	5‡ 1.25‡	1.5A 3 A	2.2‡ .55‡	7.5 A 15 A	1.6‡ .4‡	15 A 30 A	.03 .0075		1000	JA
H-172† *	TF4S04HA (2 Wdgs.)	70‡ 17.5‡	.25A .5 A	65‡ 16‡	.4A .8A	20‡ 5‡	2 A 4 A	9‡ 2.25‡	4 A 8 A	.22 .055		1000	HA
H-173† *	TF4S04KA (2 Wdgs.)	80‡ 20‡	.5 A 1 A	72‡ 18‡	.8A 1.6A	16.5‡ 4.1‡	4 A 8 A	8.2‡ 2.1‡	8 A 16 A	.15 .038		1000	KA
H-174† *	TF4S04MB (2 Wdgs.)	50‡ 12.5‡	.65A 1.3 A	45‡ 11‡	1.3A 2.6A	10‡ 2.5‡	6.5 A 13 A	6.5‡ 1.6‡	13 A 26 A	.08 .02		1000	MB

MOLDED

Type No.	MIL Part No.	Inductance - Henries @ ma DC	DCR Ohms	Test Volts	L	W	H	Mtg. Dim. and Studs	Wgt. Lbs.
H-105	M27/149-01	2.5 @ 25 ma, 2 @ 35 ma, 1.5 @ 45 ma	225	1000	1¼	15/16	15/16	9/16 x 7/8 two #4-40 Taps, Diag.	.1
H-106	M27/159-01	2.25 @ 60 ma, 1.75 @ 80 ma, 125 @ 100 ma	110	1000	1⅝	1 5/16	1⅜	1 5/16 x 1 5/16 ⅛ Dia. 4 holes	.28
H-107	M27/160-01	2 @ 120 ma, 1.5 @ 160 ma, 1 @ 200 ma	55	2500	2⅛	1¾	1 55/64	1¾ x 1 11/32 5/32 Dia. 4 holes	.9
H-108	M27/179-01	2 @ 220 ma, 1.5 @ 270 ma, 1 @ 325 ma	35	2500	2⅞	2½	2 17/32	2 3/16 x 2 1/16 5/32 x 7/32 4 slots	1.7
H-109† (2 wdgs)*	TF5S04ZZ	.2 @ 125 ma, .025 @ 1.25A, .011 @ 2.5A .055 @ 250 ma, .00625 @ 2.5A, .0027 @ 5A	.6 .15	750	2⅞	2½	2 17/32	2 3/16 x 2 1/16 5/32 x 7/32 4 slots	1.7

† Split winding in series. * Split winding in parallel. ‡ Rated in millihenries. ¶ Terminals opposite mounting.

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

400 Hz Transformers

TRW
POWER

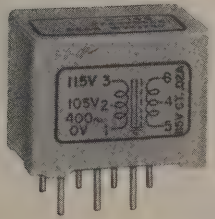
PACKAGING Hermetically sealed. DO-T's and MET's metal encased. H-101 group — molded.

APPLICATION Transistor/filament and isolation.
SHIELDING All isolation transformers electrostatically shielded.

MIL SPECS To complete MIL-T-27D Specs. DO-T's: Grade 5, Class R. MET's: Grade 4, Class S. Molded units: Grade 5, Class S.

Molded Types, Grade 5

H-101
thru
H-104



H-118
H-148
H-149

Primary: 105/115 Volts 380-1000 Hz
Secondary: 6.3 VCT 2500V RMS Test

Type No.	MIL-Type	Sec. Amp.	L In.	W In.	H In.	Mtg. Dim.	Wt. Lbs.
H-101	TF5S03ZZ	3.5	1 25/32	1 21/32	2	1⅛ x 1 5/32	.3
H-102	M27/202-01	5.5	1¾	2	2¼	1⅛ x 1 9/32	.44
H-103	M27/158-01	10	2 5/16	2⅛	2½	1 11/16 x 1 13/32	.8
H-104	M27/201-01	25	2⅞	2½	3 1/32	2 3/16 x 1 17/32	1.5

H-101 thru H-104 mounted by 4 holes .157D

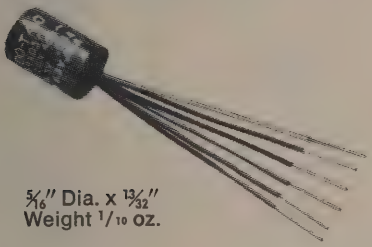
500V RMS TEST

Type No.	H-118	H-148‡	H-149
Application	Supply	Isolation	Supply
Primary	105/115V 380-1000 Hz	105/115V 400 Hz	28V 380-1000 Hz
Secondary	6.3V CT — .3A	115V CT-.02A	1) 6.3V-.08A 2) 6.3V-.08A 12.6V-.08A* 6.3V-.16A†
MIL-Type	TF5S03ZZ	TF5S03ZZ	TF5S03ZZ
Case Type (See pgs. 21 & 24)	SO-#P	SO-#P	SSO-#P

* Series Connected. † Parallel Connected. ‡ ELECTROSTATICALLY SHIELDED.

Metal Encased Types, Grade 5 DO-T400™ Series

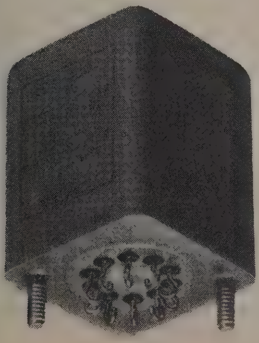
MIL TYPE TF5R03ZZ



5/16" Dia. x 13/32"
Weight 1/10 oz.

Type No.	Application	Primary	Secondary	Rated Heat Rise
DO-T400	Isolation transformer	28V, 400 Hz	6.3V @ 60 mA	40°C
DO-T410	Isolation transformer	28V, 400 Hz	(2 secs.) 6.3V @ 30 mA, 6.3V @ 30 mA	40°C
DO-T415	Isolation transformer	28V, 400 Hz	(2 secs.) 12.6V @ 15 mA, 12.6V @ 15 mA	40°C
DO-T420	Electrostatically shielded isolation transformer	28V, 400 Hz	28V @ 10 mA	40°C
DO-T430	3-watt autotransformer	28V, 400 Hz	12.6V - 0 - 12.6V @ 120 mA	40°C
DO-T440	¾-watt autotransformer	28V, 400 Hz	6.3V - 0 - 6.3V @ 60 mA	40°C
DO-TSH **DO-TSH2**	Drawn Hipermalloy shields provide 20 to 40 dB shielding, each. See Catalog page 9 for dimensions			

MET™ Series



Type No.	MIL Type Pri. Volt	Sec. Volts	Amps. (MIL)	Amps (Industrial)	Sec. Test Volts RMS	MIL Case
MET-400‡	TF4S03AH 380-1000 Hz 105/115/125V	115 CT 115 CT 230* 115†	.06 .06 .06 .12	**.072** **.072** **.072** **.144**	1000	AH
MET-405‡	TF4S03EA 380-1000 Hz 105/115/125V	115 CT 115 CT 230* 115†	0.2 0.2 0.2 0.4	**.24** **.24** **.24** **.48**	1000	EA
MET-410	TF4S03YY 115V, 400 Hz	6.3	0.6	**.75**	500	RC-25 (Pg. 15)
MET-420	TF4S03AH 380-1000 Hz 105/115/125V	6.3 CT	2	**2.5**	1500	AH
MET-430¶	M27/180-01 400 Hz 57.5, 99.6, 115V	12.6 CT 12.6	2 2	**2.5** **2.5**	1500	FA

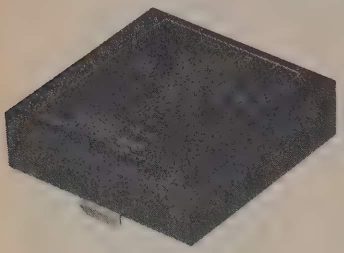
* Series Connected. † Parallel Connected. ‡ ELECTROSTATICALLY SHIELDED.
¶ Two MET-430's Scott connected provide 26 volt two phase from 115 V. three phase 400 Hz input.

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

400 Hz Power Transformers
Low Profile MIL-T-27 Grade 5 Class S

TRW
POWER

FP Series



APPLICATION Offering significant cost and size advantages over competitive low-voltage, high-current toroids, FP Series 400 Hz power transformers are wide applicability types which will fit many modern circuit needs.

RATINGS Three power levels are available: 10, 20 and 30 watts. Within each power rating, three different winding and secondary tap arrangements are provided to cover a total voltage range from 2 to 30 volts. Since performance specifications are based on maximum-voltage, full-winding use, slight power derating is required when employing lower voltage taps, to keep current density normal.

CONSTRUCTION FP transformers feature a semi-toroidal, hum-bucking, self-shielding construction. Integral electrostatic shields are terminated in two unique mounting tabs. The units are of a low-profile design — .62 inches high — to fit "sandwich board" shallow drawer requirements. "PC" terminal types on all units.

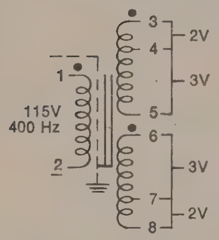
MIL SPECS To complete MIL-T-27D specifications. MIL Type No. TF5SO3ZZ.

SPECIFICATIONS

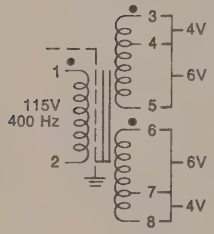
Type No.	Power Rating (Watts)	Primary Voltage (Volts)	Secondary Voltages (Volts)	Weight Lb. (Gms.)
FP-011	10	115	2, 3, 4, 5, 6, 7, 8, 10	.125 (56.7)
FP-021	10	115	4, 6, 8, 10, 12, 14, 16, 20	.125 (56.7)
FP-031	10	115	6, 9, 12, 15, 18, 21, 24, 30	.125 (56.7)
FP-012	20	115	2, 3, 4, 5, 6, 7, 8, 10	.25 (114)
FP-022	20	115	4, 6, 8, 10, 12, 14, 16, 20	.25 (114)
FP-032	20	115	6, 9, 12, 15, 18, 21, 24, 30	.25 (114)
FP-013	30	115	2, 3, 4, 5, 6, 7, 8, 10	.38 (172)
FP-023	30	115	4, 6, 8, 10, 12, 14, 16, 20	.38 (172)
FP-033	30	115	6, 9, 12, 15, 18, 21, 24, 30	.38 (172)

SCHEMATICS

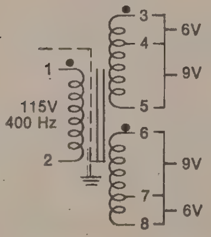
FP-011
FP-012
FP-013

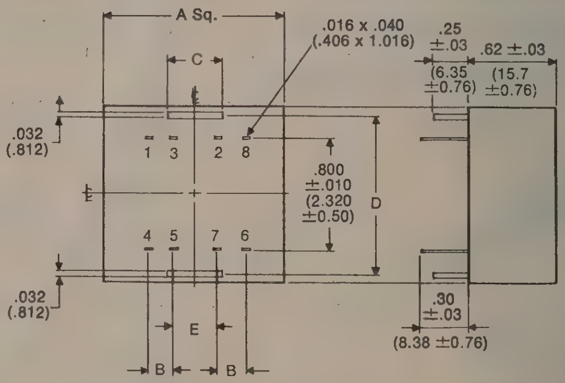


FP-021
FP-022
FP-023



FP-031
FP-032
FP-033





DIMENSIONS

Type No.	Case Width "A" ±.03 in. (±.76mm)	Case Height ±.03 in. (±.76mm)	Terminal Spacing "B" ±.005 in. (±.12mm)	Tab Width "C" ±.02 in. (±.50mm)	Tab Spacing "D" ±.01 in. (±.25mm)	A ±.03 in. (±0.76mm)	B ±.005 in. (±0.12mm)	C ±.02 in. (±0.50mm)	D ±.010 in. (±0.25mm)	E ±.005 in. (±0.12mm)
FP-011	1.24 sq. (31.49)	.62 (15.7)	.200 (5.08)	.38 (9.65)	1.128 (28.65)	1.24 (31.49)	.200 (5.08)	.38 (9.65)	1.128 (28.65)	.300 (7.62)
FP-021	1.24 sq. (31.49)	.62 (15.7)	.200 (5.08)	.38 (9.65)	1.128 (28.65)	1.24 (31.49)	.200 (5.08)	.38 (9.65)	1.128 (28.65)	.300 (7.62)
FP-031	1.24 sq. (31.49)	.62 (15.7)	.200 (5.08)	.38 (9.65)	1.128 (28.65)	1.24 (31.49)	.200 (5.08)	.38 (9.65)	1.128 (28.65)	.300 (7.62)
FP-012	1.75 sq. (44.45)	.62 (15.7)	.400 (10.16)	.38 (9.65)	1.625 (41.27)	1.75 (44.45)	.400 (10.16)	.38 (9.65)	1.625 (41.27)	.350 (8.89)
FP-022	1.75 sq. (44.45)	.62 (15.7)	.400 (10.16)	.38 (9.65)	1.625 (41.27)	1.75 (44.45)	.400 (10.16)	.38 (9.65)	1.625 (41.27)	.350 (8.89)
FP-032	1.75 sq. (44.45)	.62 (15.7)	.400 (10.16)	.38 (9.65)	1.625 (41.27)	1.75 (44.45)	.400 (10.16)	.38 (9.65)	1.625 (41.27)	.350 (8.89)
FP-013	2.25 sq. (57.15)	.62 (15.7)	.600 (15.24)	.50 (12.7)	2.132 (54.15)	2.25 (57.15)	.600 (15.24)	.50 (12.7)	2.132 (54.15)	.400 (10.16)
FP-023	2.25 sq. (57.15)	.62 (15.7)	.600 (15.24)	.50 (12.7)	2.132 (54.15)	2.25 (57.15)	.600 (15.24)	.50 (12.7)	2.132 (54.15)	.400 (10.16)
FP-033	2.25 sq. (57.15)	.62 (15.7)	.600 (15.24)	.50 (12.7)	2.132 (54.15)	2.25 (57.15)	.600 (15.24)	.50 (12.7)	2.132 (54.15)	.400 (10.16)

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

Supply and Ultrashielded Transformers

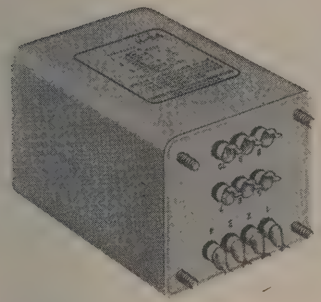
ALL HERMETICALLY SEALED, all to complete MIL-T-27D Specs.

TRW
POWER

Transistor/Filament Supply Transformers

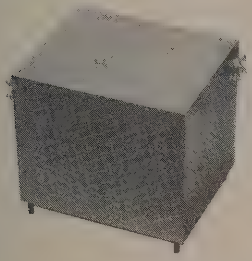
Primary: 105/115/210/220 volts, 50/60 Hz, except H-119, H-130, H-137, H-138, (115 V) and H-131 (115/220 V). All units designed for 50/60 Hz also suited for 400/1000 Hz service.

MIL-T-27D RATINGS IN REGULAR TYPE, **INDUSTRIAL RATINGS IN BOLD TYPE.**



Type No.	MIL Type	Sec. Volts	Amps (MIL)	Amps (Indust.)	Sec. Test Volts RMS	MIL Case
H-124	TF4S03FB	5	3	**3.8**	2000	FB
H-125	M27/151-01	5	10	**12**	10000	KB
H-119	TF4S03AH	6.3 CT	.3	**.38**	1500	AH
H-130	TF4S03AJ	6.3 CT	.6	**.75**	1500	AJ
H-131	M27/153-01	6.3 CT	2	**2.5**	2500	FB
H-132	TF4S03JA	6.3 CT 6.3 CT	6 6	**7** **7**	2500	JA
H-133	TF4S03HB	6.3 CT	7	**8**	2500	HB
H-134	TF4S03HA	6.3 CT	10	**12**	2500	HA
H-135	TF4S03JB	10 CT	10	**13**	2500	JB
H-137	TF4S03EB	6.3 6.3	.6 .6	**.75** **.75**	1500	EB
H-138	TF4S03GA	12.6 12.6	2 2	**2.5** **2.5**	1500	GA

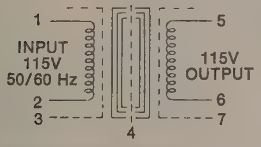
HIT™ Series Ultrashielded Power-Line Isolation Transformers



SIMULATES BATTERY OPERATION FOR CRITICAL CIRCUITS REQUIRING EXTREME ISOLATION FOR POWER LINE.

The effective capacity coupling between primary and secondary windings is less than 0.1 pf. Individually terminated shields allow maximum circuit design flexibility to further reduce this minute capacitance. Input and output terminals are on opposite sides of housing for excellent line/load isolation.

MIL-T-27D RATINGS IN REGULAR TYPE, **INDUSTRIAL RATINGS IN BOLD TYPE.**

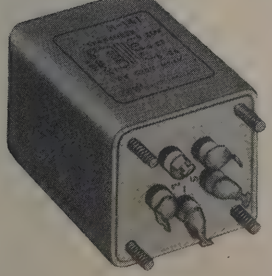


Primary 115 V 50/60 Hz, Secondary 115 V.

Type No.	Power Watts	Power Watts	Max. Case Size	Mounting Dim. and Studs	Wt. Lbs.	MIL Part No.
HIT-1	50	**60**	4 1/32 x 4 1/32 x 3 1/32 h	3⅜ x 3⅜ 10-32 x ½ long	5½	M27/235-02
HIT-15	120	**150**	5 11/32 x 5 x 3½ h	4⅝ x 4 5/16 10-32 x ½ long	13	M27/235-03
HIT-2	160	**200**	5 17/32 x 5 17/32 x 4 17/32 h	4 13/16 x 4 13/16 10-32 x ½ long	15½	M27/235-04
HIT-3	400	**480**	8 x 6 17/32 x 5 17/32 h	7 1/16 x 5⅝ 5/16-18 x 13/16 long	35	M27/235-01
HIT-4	1000	**1200**	9 x 7½ x 7½ h	8 x 6½ 5/16-18 x 15/16 long	60	M27/235-05

Transistor Supply Transformers

Primary 115 V 50/60 Hz (tapped on H-143 thru H-146 for dual secondary voltages). DC ratings are approximate, based on silicon bridge rectifier (except H-141, H-142 also shown F.W.C.T.). Choke input DCV is based on 10% voltage drop in choke. Condenser value, C, is in 1000 mfd. H-141, H-142, H-147 listing under "Secs in parallel" is single winding.

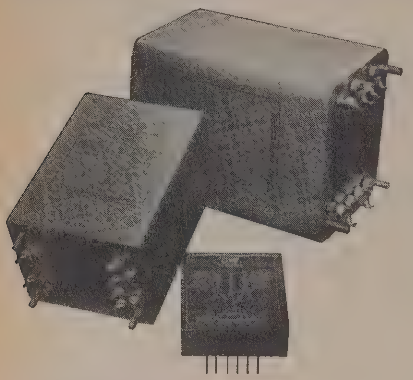


Type No.	MIL Part No.	Sec. V RMS	Sec. A RMS	Sec. in Parallel Choke DCV	Sec. in Parallel Input DCA	Sec. in Parallel Cond. DCV	Sec. in Parallel Input DCA	Sec. in Parallel C	Sec. in Series Choke DCV	Sec. in Series Input DCA	Sec. in Series Cond. DCV	Sec. in Series Input DCA	Sec. in Series C	MIL Case
H-141	M27/154-01 Full wave CT	20 CT	.3	16.5 8	.3 .43	26 12	.2 .3	.2 .5						EB
H-142	M27/155-01 Full wave CT	20 CT	.6	16.5 9	.6 .85	26 13	.4 .6	.4 1						EA
H-143	TF4S03HA	17/21.5 17/21.5	1.5 1.5	14/17.5	3	18.5/25	2	1	28/35	1.5	43/56	1	.5	HA
H-144	TF4S03LA	17/21.5 17/21.5	4 4	14/17.5	8	18.5/25	5	2	28/35	4	43/56	2.5	1	LA
H-145	TF4S03YY	17/21.5 17/21.5	9 9	14/17.5	18	18.5/25	12	6	28/35	9	43/56	6	4	RC-175*
H-146	TF4S03YY	34/43 34/43	4.5 4.5	28/35	9	43/56	6	4	56/70	4.5	85/110	3	1	RC-175*
H-147	TF4S03KA	10	20	8.2	20	10	13	12						KA

* See Catalog page 32 for dimensions.

PH and PV Universal Three-Phase Transformers

TRW
POWER



PH Series three-phase transformers are electrostatically shielded isolation transformers constructed to MIL-T-27 specifications.

Two Grade 4 metal-cased PH units are intended for 50/60-Hz, 120/208-volt Wye or 120-volt Delta inputs. One is rated at 65 watts, the other at 360 watts.

A 25-watt, molded Grade 5 PH unit is designed for 400-Hz, 115/200-volt Wye or 115-volt Delta inputs. All PH Series primaries and secondaries can be connected in either Wye or Delta.

PV Series three-phase transformers are identically packaged and suggested for similar inputs, but feature windings arranged and tapped to provide low-voltage, high-current inputs for full-wave bridge circuits.

Two Grade 4 metal-cased PV units for 50/60-Hz inputs provide 3.1 to 48 volts DC in 27 different voltage combinations, at currents ranging from 1.25 to 12.5 amps DC.

A Grade 5 molded PV transformer for 400-Hz use has the same voltage capabilities, but yields bridge circuit currents from 0.5 to 0.87 amp DC.

PH SPECIFICATIONS

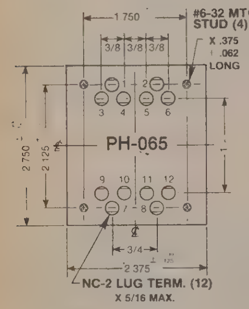
Type No.	Application	AC Input	Nominal AC Output
PH-065	Isolation	120 V, 50/60 Hz Delta	120 V @ 0.31 A/line
		208 V, 50/60 Hz Wye	208 V @ 0.18 A/line
PH-360	Isolation	120 V, 50/60 Hz Delta	120 V @ 1.73 A/line
		208 V, 50/60 Hz Wye	208 V @ 1.00 A/line
PH-425	Isolation	115 V, 400 Hz Delta	115 V @ 0.13 A/line
		200 V, 400 Hz Wye	200 V @ 0.07 A/line

PV SPECIFICATIONS

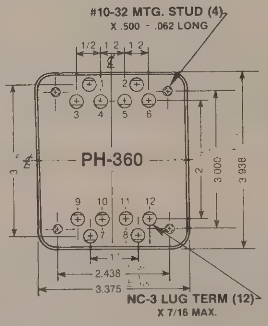
	Max. DC Rectified Current	
Type No.	Delta	Wye
PV-100	2.15 A	1.25 A
PV-105	12.5 A	7.2 A
PV-400	0.87 A	0.5 A

			Nominal DC Output in 3-Phase Full-Wave Bridge Rectifier Circuit*					
			Secondary					
Type No.	Application	AC Input	Full Delta	⅓ Delta	⅔ Delta	Full Wye	⅓ Wye	⅔ Wye
PV-100 and PV-105	Full-Wave Bridge Circuit	208 V, 50/60 Hz Delta	28 V	9.3 V	18.7 V	48 V or ±24 V	16 V or ±8 V	32 V or ±16 V
		120 V, 50/60 Hz L-N Wye 208 V, 50/60 Hz L-L Wye 120 V, 50/60 Hz Delta	16.2 V	5.4 V	10.8 V	28 V or ±14 V	9.3 V or ±4.65 V	18.6 V or ±9.3 V
		120 V, 50/60 Hz L-L Wye	9.36 V	3.1 V	6.2 V	16.2 V or ±8.1 V	5.4 V or ±2.7 V	10.8 V or ±5.4 V
PV-400	Full-Wave Bridge Circuit	200 V, 400 Hz Delta	28 V	9.3 V	18.7 V	48 V or ±24 V	16 V or ±8 V	32 V or ±16 V
		115 V, 400 Hz L-N Wye 200 V, 400 Hz L-L Wye 115 V, 400 Hz Delta	16.2 V	5.4 V	10.8 V	28 V or ±14 V	9.3 V or ±4.65 V	18.6 V or ±9.3 V
		115 V, 400 Hz L-L Wye	9.36 V	3.1 V	6.2 V	16.2 V or ±8.1 V	5.4 V or ±2.7 V	10.8 V or ±5.4 V

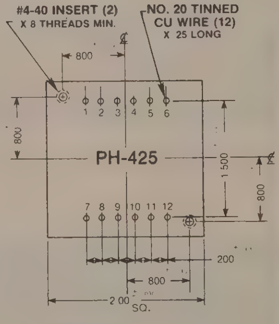
* Diode drops neglected.


PH-065
1.750
#6-32 MTG. STUD (4)
X .375 + .062 LONG
3/8
3/8
3/8
1
2
3
4
5
6
9
10
11
12
7
8
2 750
2 125
3/4
2 375
NC-2 LUG TERM. (12)
X 5/16 MAX.

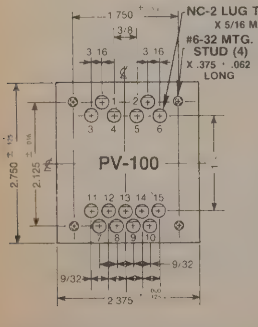
CASE HEIGHT = 3.812 + .000, - .188


PH-360
#10-32 MTG. STUD (4)
X .500 - .062 LONG
1/2
1 2
1 2
1
2
3
4
5
6
9
10
11
12
7
8
3
2
3 000
3 938
2.438
3.375
NC-3 LUG TERM (12)
X 7/16 MAX.

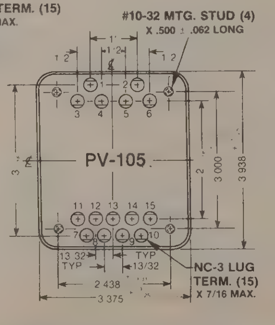
CASE HEIGHT = 5.250 + .000, - .188


PH-425
#4-40 INSERT (2)
X 8 THREADS MIN.
NO. 20 TINNED CU WIRE (12)
X 25 LONG
800
1
2
3
4
5
6
7
8
9
10
11
12
800
1 500
800
200
800
2 00
SQ.

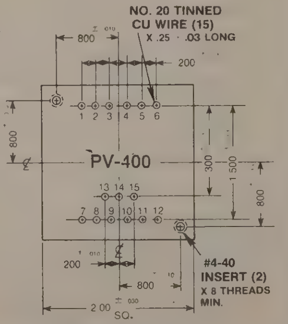
CASE HEIGHT = .75 ± .03


PV-100
1 750
NC-2 LUG TERM. (15)
X 5/16 MAX.
#6-32 MTG. STUD (4)
X .375 + .062 LONG
3/8
3 16
3 16
1
2
3
4
5
6
11
12
13
14
15
7
8
9
10
2.750
2.125
9/32
9/32
2 375

CASE HEIGHT = 3.812 + .000, - .188

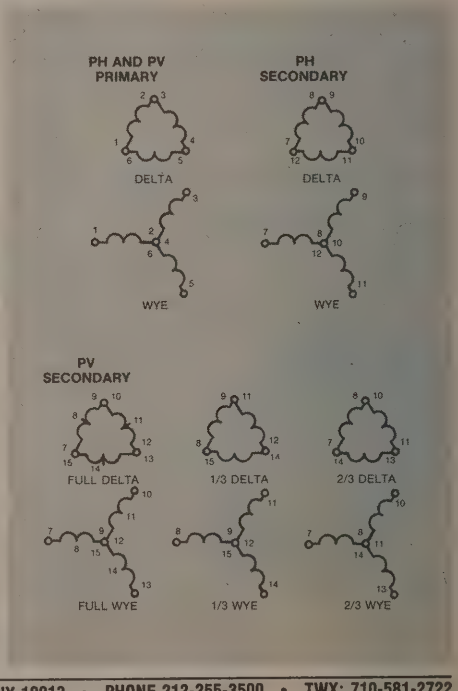

PV-105
#10-32 MTG. STUD (4)
X .500 ± .062 LONG
1'
1 2
1'2
1 2
1
2
3
4
5
6
11
12
13
14
15
7
8
9
10
3
2
3 000
3 938
13 32 TYP
TYP 13/32
2 438
3 375
NC-3 LUG TERM. (15)
X 7/16 MAX.

CASE HEIGHT = 5.250 + .000, - .188


PV-400
NO. 20 TINNED CU WIRE (15)
X .25 · .03 LONG
800
200
1
2
3
4
5
6
13
14
15
7
8
9
10
11
12
800
300
1 500
800
200
800
2 00
SQ.
#4-40 INSERT (2)
X 8 THREADS MIN.

CASE HEIGHT = .75 ± .03

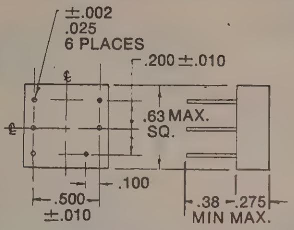
SCHEMATICS

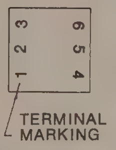

PH AND PV PRIMARY
DELTA
WYE
PH SECONDARY
DELTA
WYE
PV SECONDARY
FULL DELTA
1/3 DELTA
2/3 DELTA
FULL WYE
1/3 WYE
2/3 WYE

Multiplex Data Bus MIL Std. 1553B Pulse Transformers

TRW

PULSE





TERMINAL MARKING

Type No.	Application	Ratio*
MPX-100	Isolation Transformer	1 CT: 1 CT
MPX-200	Coupling Transformer	1.41 CT: 1 CT
MPX-300	Coupling Transformer	1.25 CT: 1 CT

* Other ratios available on special order.

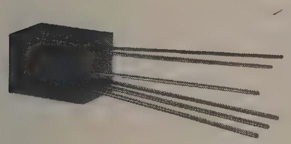
MIL SPECS MPX pulse transformers fully meet MIL STD 1553B Command/Response Multiplex Data Bus requirements. They also meet MIL-T-21038D Pulse Transformer Specs. MIL Type No. TP7SX( ) KZ.

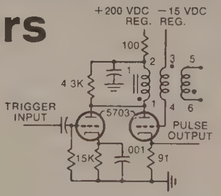
PERFORMANCE MPX pulse transformers feature a high efficiency design for minimum losses. Common mode rejection ratio is greater than 45 db at 1 MHz. Input impedance is greater than 3000 ohms over the band from 75 KHz to 1 MHz at 1V rms. This series possesses exceptional waveform integrity: Rise time and fall time is less than 100 nanoseconds. Overshoot and ringing is less than ±1V peak. Droop is less than 20%.

CONSTRUCTION All windings are centertapped for greater circuit application flexibility. The series is packaged in a printed circuit style configuration, with a low profile configuration of 0.275 inches maximum height.

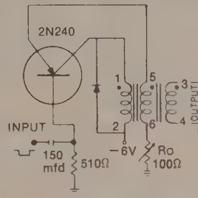
Dielectric withstanding voltage is tested at 100 Vrms.

Plug-in Precision Miniature Wide Application Pulse Transformers





TEST CIRCUIT FOR PCH-45 TO PCH-57



TEST CIRCUIT FOR PCH-60 TO PCH-68

PCH pulse transformers are plug-in versions of our MIL-T-21038 line of pulse transformers H45 to H57 and H60 to H68.

PACKAGING Hermetically sealed. Epoxy cased.

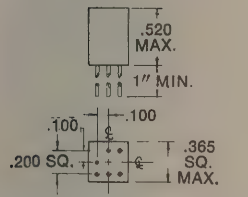
CONSTRUCTION Designed to be used on PC boards with 0.1″ pin spacings. The pins are in a non-symmetrical pattern to provide foolproof insertion.

MIL SPECS Meet MIL-T-21038D Specs. All units are Grade 7, Class S, Life X.

APPLICATIONS Transistor blocking oscillators, SCR drivers, coupling and isolation. The PCH-45 through PCH-57 also can be used in transistor circuits.

NOTE The units are individually adjusted in the circuit shown for each group. Parameters are checked to give the required pulse widths.

FIG 1



Pin Size Equals .025 Dia. ±.002

FIG 2

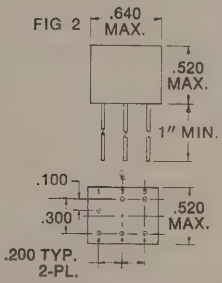
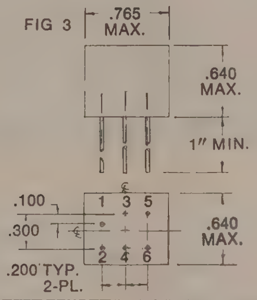


FIG 3



Type No.	Approx. DCR, Ohms			Blocking Oscillator Pulse					Coupling Circuit Characteristics							Frequency Response within 2 db†	Size
	1-2	3-4	5-6	P Width µSec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width µ Sec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* ohms		
RATIO 1:1:1 MIL TYPE DESIGNATION TP7SX1110KZ																	
PCH-45	3	3.5	4	.05	.022	0	20	10	.05	17	.01	20	0	35	250	260 kHz-34 MHz	Fig. 1
PCH-46	5.5	6.5	7	.10	.024	0	25	10	.10	19	.01	30	10	50	250	220 kHz-34 MHz	Fig. 1
PCH-47	3.7	4.0	4	.20	.026	0	25	8	.20	18	.01	30	15	65	500	260 kHz-93 MHz	Fig. 2
PCH-48	5.5	5.8	6	.50	.03	0	20	5	.50	20	.01	30	20	65	500	85 kHz-73 MHz	Fig. 2
PCH-49	8	8.5	9	1	.04	0	20	10	1	24	.02	15	15	65	500	50 kHz-62.5 MHz	Fig. 2
PCH-50	20	21	22	2	.05	0	20	10	2	27	.05	10	15	35	500	24.5 kHz-49 MHz	Fig. 2
PCH-51	28	31	33	3	.10	1	20	8	3	26	.07	10	10	35	500	12.6 kHz-5.65 MHz	Fig. 2
PCH-52	36	41	44	5	.13	1	25	8	5	23	.15	10	10	45	1000	13 kHz-3.465 MHz	Fig. 2
PCH-53	37	44	49	7	.28	0	25	8	7	24	.20	10	10	50	1000	9.5 kHz-6.3 MHz	Fig. 3
PCH-54	50	58	67	10	.30	0	20	8	10	24	.25	10	10	50	1000	7.1 kHz-1.35 MHz	Fig. 3
PCH-55	78	96	112	16	.75	0	20	10	16	23	.40	5	15	20	1000	1.65 kHz-3.05 MHz	Fig. 3
PCH-56	93	116	138	20	1.25	0	25	10	20	23	.6	5	10	10	1000	2.15 kHz-285 kHz	Fig. 3
PCH-57	104	135	165	25	2.0	0	30	10	25	24	1.5	5	10	10	1000	1.7 kHz-315 kHz	Fig. 3
RATIO: 4:4:1 MIL TYPE DESIGNATION TP7SX4410KZ																	
PCH-60	.124	.14	.05	.05	.016	0	0	30	.05	9.3	.012	0	0	20	50	550 kHz-43 MHz	Fig. 1
PCH-61	.41	.48	.19	.1	.016	0	0	30	.1	8.2	.021	0	0	15	50	95 kHz-17 MHz	Fig. 1
PCH-62	.78	.94	.33	.2	.022	0	0	18	.2	7.4	.034	0	5	12	100	60 kHz-14.5 MHz	Fig. 1
PCH-63	1.86	2.26	.70	.5	.027	2	10	20	.5	7.5	.045	0	20	25	100	22 kHz-3.7 MHz	Fig. 1
PCH-64	3.73	4.4	1.33	1	.033	0	12	25	1	7	.078	0	15	23	100	12 kHz-2.3 MHz	Fig. 1
PCH-65	6.2	7.3	2.22	2	.066	0	15	25	2	6.6	.14	0	10	20	100	8.5 kHz-1.675 MHz	Fig. 1
PCH-66	10.2	12	3.6	3	.087	0	18	30	3	6.8	.17	0	10	20	100	3.9 kHz-950 kHz	Fig. 1
PCH-67	14.5	17.5	5.14	5	.097	0	23	28	5	7.9	.2	0	18	28	200	3.6 kHz-840 kHz	Fig. 1
PCH-68	42.3	52.1	14.8	10	.14	0	15	28	10	6.5	.4	0	15	30	200	1.1 kHz-400 kHz	Fig. 1

* Input winding terminals 1-2; output winding terminals 3-4; terminals 5-6 open.
† Per coupling circuit Z in/out, 1 V input.

INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

BIT-P™ High Performance Pulse Transformers

TRW

PULSE

Size - See Page 7.

PACKAGING

Size reduction without loss of performance is achieved by major reduction of air gaps in the magnetic circuit. Core permeability closely approaches the theoretical maximum for material and structure.

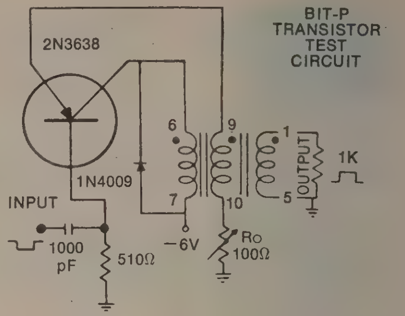
Materials, dimensions, and surface finish are identical with IC Flat Pack standards. Removable support protects terminal alignment prior to final assembly. This insulated support allows testing in conventional jigs.

FLEXIBILITY

Stock units are designed for the standard blocking oscillator circuit shown as well as for coupling application. By interconnecting windings, a variety of primary to secondary ratios may be obtained.

NOTES

- **PULSE WIDTH** .05 μsec-100 μsec
- **DIELECTRIC STRENGTH** tested @ 200 VRMS
- **MIL SPECS** To complete MIL-T-21038D Metal encased, ruggedized Grade 6, Class R, Life X.
- **SHIELDED** All units electromagnetically self-shielded
- **LEAD MATERIAL** Ribbon-style, solderable to MIL-STD 1276C.

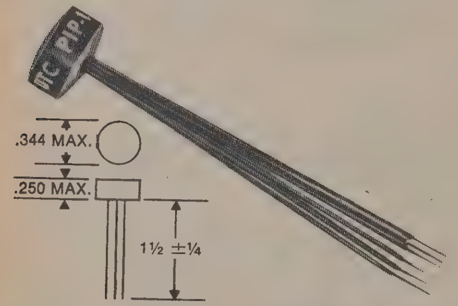


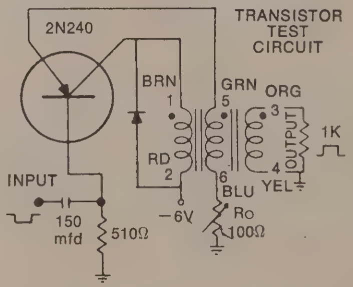
RATIO 4:4:1 MIL TYPE DESIGNATION TP6RX4410CZ

Type No.	Approx. DCR, Ohms			Block Oscillator Pulse					Coupling Circuit Characteristics						
	1 & 5	6 & 7	9 & 10	P Width μSec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width μSec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp.* in/out
BIT-P21	.32	.29	.28	.05	.01	0	0	35	.05	0.2	.01	0	0	20	50
BIT-P22	.33	.32	.29	.1	.012	0	0	25	.1	0.5	.015	0	0	20	50
BIT-P23	.38	.37	.3	.2	.02	0	0	15	.2	1.2	.02	0	0	20	100
BIT-P24	.5	.48	.32	.5	.023	0	5	15	.5	1.5	.022	0	5	25	100
BIT-P25	.62	.57	.35	1	.03	0	10	14	1	1.5	.025	0	20	28	100
BIT-P26	.7	.64	.4	2	.035	0	12	15	2	1.5	.028	0	15	23	100
BIT-P27	.85	.76	.48	3	.04	0	13	15	3	1.5	.032	0	18	28	100
BIT-P28	.96	.86	.52	5	.045	0	15	14	5	2	.035	0	20	20	200
BIT-P29	1.4	1.1	.57	10	.065	0	15	10	10	2	.05	0	25	25	200
BIT-P30	2.1	1.7	.8	15	.07	0	15	13	15	2	.06	0	27	18	200
BIT-P31	2.7	2.1	.97	25	.08	0	15	13	25	3	.1	0	30	30	500
BIT-P32	20	15	6	50	.2	0	10	5	50	3	.3	0	22	20	500
BIT-P33	42	32	12	100	.35	0	11	13	100	6	.4	0	15	18	500

* Input winding terminals 1 & 5, output winding terminals 6 & 7, terminals 9 & 10 open.

Precision Miniature Wide Application Pulse Transformers





PACKAGING

Hermetically sealed. DO-T family construction. See Catalog page 8.

MIL SPECS

To complete MIL-T-21038D Specs. Grade 6, Class R, Life X.

APPLICATION

Transistor. D.W.V. Test = 100V.

NOTE

All individually adjusted to parameters shown and checked in test circuit to give required pulse width.

RATIO 4:4:1 MIL TYPE DESIGNATION TP6RX4410CZ

Type No.	Military Part No.	Approx. DCR, Ohms			Blocking Oscillator Pulse					Coupling Circuit Characteristics							Frequency Response Within 2 db†
		1-Brn 2-Rd	3-Org 4-Yel	5-Grn 6-Blu	P Width μ Sec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width μ Sec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* Ohms	
PIP-1	——	.21	.23	.13	.05	.02	0	0	37	.05	9	.018	0	0	12	50	150 kHz-29 MHz
PIP-2	——	.47	.56	.22	.1	.025	0	0	25	.1	8	.02	0	0	5	50	100 kHz-17 MHz
PIP-3	——	1.01	1.25	.37	.2	.030	2	0	15	.2	7	.035	0	0	5	100	16 kHz-9.5 MHz
PIP-4	——	1.5	1.85	.54	.5	.05	0	0	15	.5	7	.06	0	0	0	100	7 kHz-3.25 MHz
PIP-5	——	2.45	3.1	.9	1	.08	0	0	14	1	6.8	.15	0	0	5	100	7.5 kHz-2.25 MHz
PIP-6	——	3.0	3.7	1.1	2	.10	0	0	15	2	6.6	.18	0	2	10	100	2.2 kHz-1.32 MHz
PIP-7	——	4.9	6.05	1.8	3	.20	0	0	14	3	6.8	.20	0	2	10	100	1.7 kHz-1.5 MHz
PIP-8	——	8.0	9.7	2.9	5	.30	0	0	3	5	7.9	.22	0	13	25	200	1.8 kHz-1.45 MHz
PIP-9	M21038/6	13.1	15.9	4.7	10	.35	0	5	12	10	6.5	.4	0	15	20	200	1.5 kHz-1.14 MHz

RATIO 5:3:1 MIL TYPE DESIGNATION TP6RX5310CZ

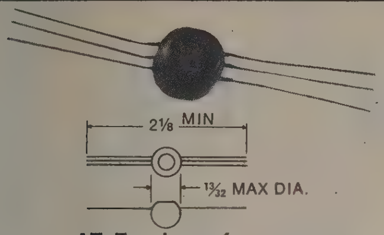
PIP-10	——	.55	.41	.15	.1	.01	0	0	20	.1	8	.01	0	0	5	140/50	170 kHz-32 MHz
PIP-11	——	2.9	2.2	8.2	1	.02	4	4	6	1	6.6	.05	0	6	12	280/100	12.5 kHz-3.25 MHz
PIP-12	M21038/7	9.4	7.1	2.6	5	.05	0	12	12	5	8	.09	2	12	25	560/200	15 kHz-4 MHz
PIP-SH	——	Drawn Hipermalloy shield and cover for PIP's provides 20 to 30 db shielding .281″ h x .359″ dia., ⅛″ hole in cover.															

* Input winding leads Brn-Rd (1-2); output winding leads Org-Yel (3-4); leads Grn-Blu (5-6) open.
† Per coupling circuit Z in/out, 1 V input.

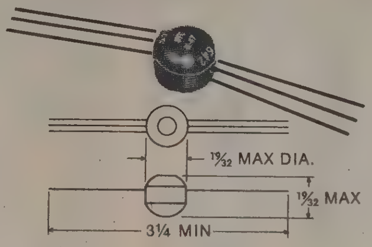
Precision Miniature Wide Application Pulse Transformers

TRW

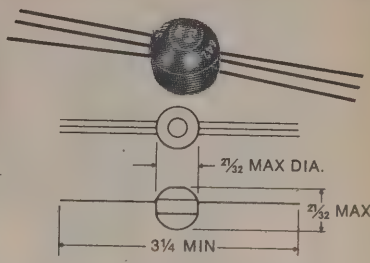
PULSE



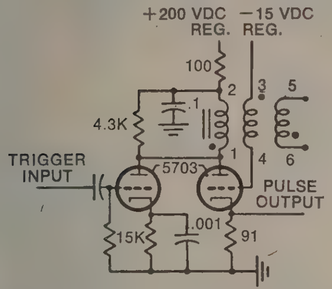
AZ Envelope, 1 gram



AC Envelope, 4 grams



AN Envelope, 6 grams



STANDARD TEST CIRCUIT

PACKAGING Hermetically sealed. Vacuum molded.

SERVICE −70°C to +130°C.

MIL SPECS To complete MIL-T-21038D Specs. Grade 7, Class S, Life X.

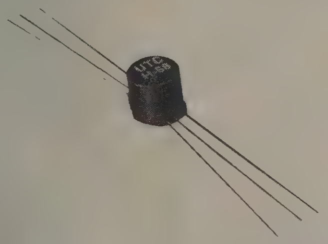
APPLICATION Tube, SCR and transistor Test Voltage 1250 V RMS.

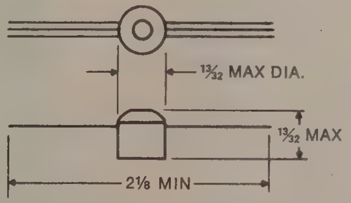
NOTE All individually adjusted to parameters shown and checked in test circuit to given required pulse width.

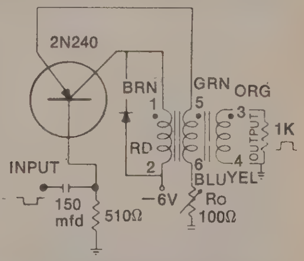
RATIO 1:1:1 MIL TYPE DESIGNATION TP7SX1110(††)

Type No.	Military Part No.	Approx. DCR, Ohms			Blocking Oscillator Pulse					Coupling Circuit Characteristics							Frequency Response within 2 db†	†† Style & Env.
		1-2	3-4	5-6	P Width μSec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width μSec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* ohms		
H-45	M21038/8-001	3	3.5	4	.05	.022	0	20	10	.05	17	.01	20	0	35	250	260 kHz-34 MHz	AZ
H-46	M21038/8-002	5.5	6.5	7	.10	.024	0	25	10	.10	19	.01	30	10	50	250	220 kHz-34 MHz	AZ
H-47	M21038/9-001	3.7	4.0	4	.20	.026	0	25	8	.20	18	.01	30	15	65	500	260 kHz-93 MHz	AC
H-48	M21038/9-002	5.5	5.8	6	.50	.03	0	20	5	.50	20	.01	30	20	65	500	85 kHz-73 MHz	AC
H-49	M21038/9-003	8	8.5	9	1	.04	0	20	10	1	24	.02	15	15	65	500	50 kHz-62.5 MHz	AC
H-50	M21038/9-004	20	21	22	2	.05	0	20	10	2	27	.05	10	15	35	500	24.5 kHz-49 MHz	AC
H-51	M21038/9-005	28	31	33	3	.10	1	20	8	3	26	.07	10	10	35	500	12.6 kHz-5.65 MHz	AC
H-52	M21038/9-006	36	41	44	5	.13	1	25	8	5	23	.15	10	10	45	1000	13 kHz-3.465 MHz	AC
H-53	——	37	44	49	7	.28	0	25	8	7	24	.20	10	10	50	1000	9.5 kHz-6.3 MHz	AN
H-54	M21038/10-001	50	58	67	10	.30	0	20	8	10	24	.25	10	10	50	1000	7.1 kHz-1.35 MHz	AN
H-55	M21038/10-002	78	96	112	16	.75	0	20	10	16	23	.40	5	15	20	1000	1.65 kHz-3.05 MHz	AN
H-56	——	93	116	138	20	1.25	0	25	10	20	23	.6	5	10	10	1000	2.15 kHz-285 kHz	AN
H-57	M21038/10-003	104	135	165	25	2.0	0	30	10	25	24	1.5	5	10	10	1000	1.7 kHz-315 kHz	AN

* Input winding terminals 1-2; output winding terminals 3-4; terminals 5-6 open.
† Per coupling circuit Z in/out, 1 V input.







RATIO 4:4:1 MIL TYPE DESIGNATION TP7SX4410AZ

DWV TEST = 100 VRMS

TRANSISTOR TEST CIRCUIT

Type No.	Military Part No.	Approx. DCR, Ohms			Blocking Oscillator Pulse					Coupling Circuit Characteristics							Frequency Response within 2 db†
		1-2	3-4	5-6	P Width μ Sec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width μ Sec.	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. in/out,* ohms	
H-60	——	.124	.14	.05	.05	.016	0	0	30	.05	9.3	.012	0	0	20	50	550 kHz-43 MHz
H-61	——	.41	.48	.19	.1	.016	0	0	30	.1	8.2	.021	0	0	15	50	95 kHz-17 MHz
H-62	——	.78	.94	.33	.2	.022	0	0	18	.2	7.4	.034	0	5	12	100	60 kH-14.5 MHz
H-63	——	1.86	2.26	.70	.5	.027	2	10	20	.5	7.5	.045	0	20	25	100	22 kHz-3.7 MHz
H-64	——	3.73	4.4	1.33	1	.033	0	12	25	1	7	.078	0	15	23	100	12 kHz-2.3 MHz
H-65	——	6.2	7.3	2.22	2	.066	0	15	25	2	6.6	.14	0	10	20	100	8.5 kHz-1.675 MHz
H-66	——	10.2	12	3.6	3	.087	0	18	30	3	6.8	.17	0	10	20	100	3.9 kHz-950 kHz
H-67	——	14.5	17.5	5.14	5	.097	0	23	28	5	7.9	.2	0	18	28	200	3.6 kHz-840 kHz
H-68	M21038/11	42.3	52.1	14.8	10	.14	0	15	28	10	6.5	.4	0	15	30	200	1.1 kHz-400 kHz

* Input winding terminals 1-2; output winding terminals 3-4; terminals 5-6 open.
† Per coupling circuit Z in/out, 1 V input.

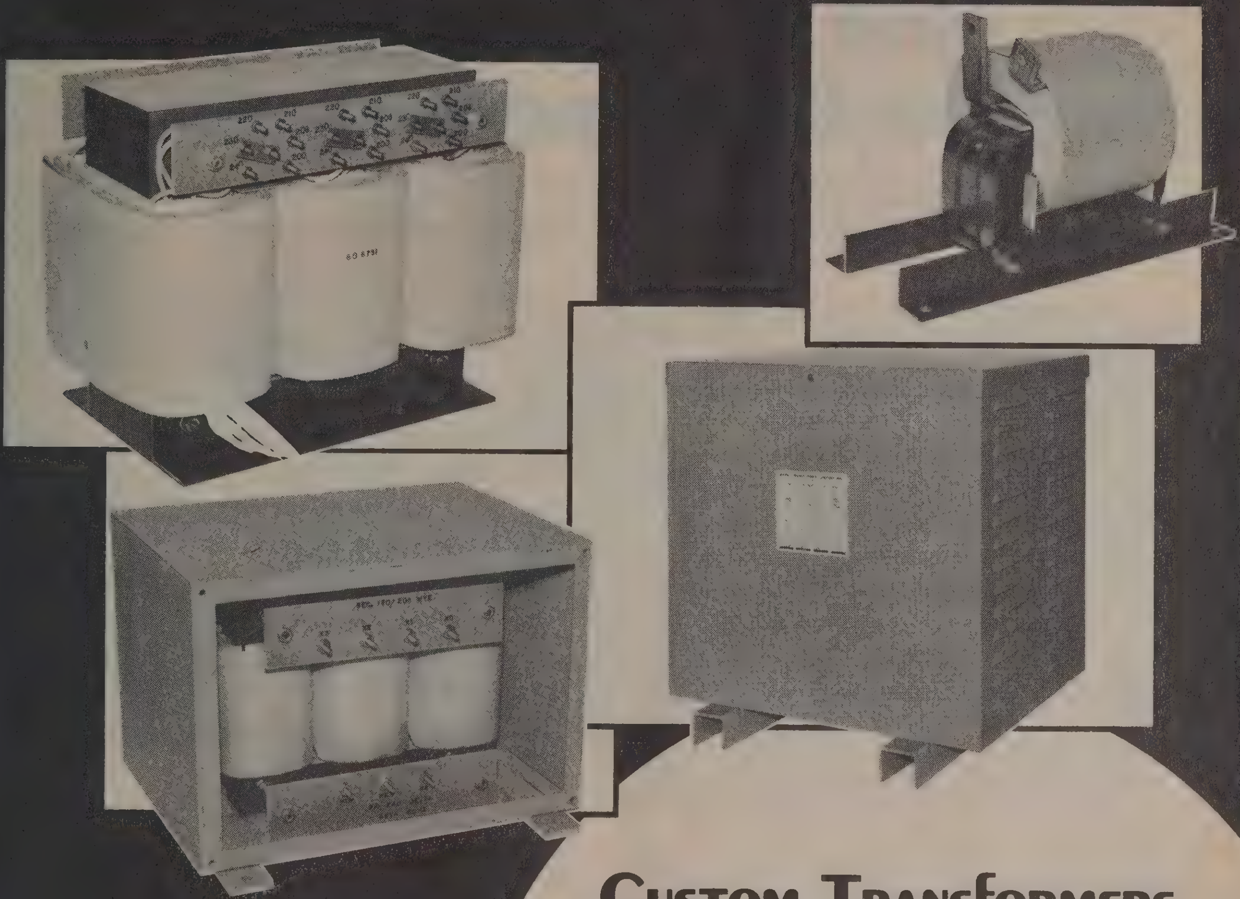
INDUCTIVE PRODUCTS DIVISION, TRW ELECTRONIC COMPONENTS GROUP, 150 VARICK STREET, NEW YORK, NY 10013 • PHONE 212-255-3500 • TWX: 710-581-2722

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 84/85 EDITION OF EEM

Abbreviations/Acronyms .... 1A•1137, 1B•1035, 2•1014, 3•1014
ASCII Code .... 3•1103
Batteries, Product Selection Guide .... 3•1399
Cabinets, Enclosures, Racks, & Chassis, Product Selection Guide .... 2•1003
Capacitors, Basic Formulas .... 1A•1093
Capacitors, Miniglossary .... 1A•1069
Capacitors, Product Selection Guide .... 1A•1003
Circuit Boards (Printed), Product Selection Guide .... 2•1089
Coils, Chokes, & Inductors, Product Selection Guide .... 1A•1219
Connectors, Miniglossary .... 2•1264
Connectors, Terminals, & Sockets, Product Selection Guide .... 2•1097
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide .... 1A•1309
Delay Lines, Product Selection Guide .... 1A•1445
Discrete Semiconductors, Product Selection Guide .... 1A•2087
Displays, Readouts, Lamps, & Lights, Product Selection Guide .... 1B•1021
EBCDIC Code .... 3•1153
Encapsulation, Miniglossary .... 2•1082
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide .... 2•1801
Filters, Product Selection Guide .... 1A•1577
Instruments, Graphic Recording, Product Selection Guide .... 3•1381
Instruments, Panel Meters, Product Selection Guide .... 3•1321
Instruments, Test & Measuring, Product Selection Guide .... 3•1182
Interconnection Systems, Product Selection Guide .... 2•1873
Keyboards & Keypads, Product Selection Guide .... 1B•1759
Microwave Components, Product Selection Guide .... 1A•1685
Military Qualified Products Lists .... 1B•1003
Motors, Drives, & Rotating Components, Product Selection Guide .... 1B•1121
Opto Semiconductors, Miniglossary .... 1B•1218
Oscilloscopes, Product Selection Guide .... 3•1361
Panel Hardware, Product Selection Guide .... 2•1757
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide .... 1A•2017
Power Supplies, Miniglossary .... 3•1455
Power Supplies, AC, Product Selection Guide .... 3•1815
Power Supplies, DC, Product Selection Guide .... 3•1439
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide .... 1B•1255
Relay Contact Forms .... 1B•1317
Relays, Electromechanical, Miniglossary .... 1•B1292
Relays, Product Selection Guide .... 1B•1289
Resistor Color Codes .... 1A•1791
Resistors, Product Selection Guide .... 1A•1789
Servo Components, Miniglossary .... 3•1935
Solenoids, Product Selection Guide .... 1B•1481
Switches, Product Selection Guide .... 1B•1499
Thyristors/High Power Diodes, Miniglossary .... 1A•1652
Transducers & Encoders, Product Selection Guide .... 1B•1827
Transformers, Product Selection Guide .... 1A•2115
Wire & Cable, Product Selection Guide .... 2•1935



CUSTOM TRANSFORMERS

Power • Constant Voltage • Step-up • Step-down • Isolation • High Voltage • Filament • High Current • Plate • Output

Wayne Transformer designs and produces custom transformers to your most critical and demanding requirements. Wayne's years of experience added to its design and fabricating flexibility gives you custom transformers at production prices -- in a minimum of time, from 1 to 500 K.V.A., commercial and military.

Prototypes and short run lots available.

Come and visit our plant, or write for FREE literature: **WAYNE TRANSFORMER COMPANY, INC.**, 99 Hazel Street, Paterson, N. J. 07503.

DESIGNERS &
MANUFACTURERS
OF CUSTOM
TRANSFORMERS
Call Today for quick quote
(201) 278-7674

"SERVING THE INDUSTRY WITH QUALITY AND PERFORMANCE!"

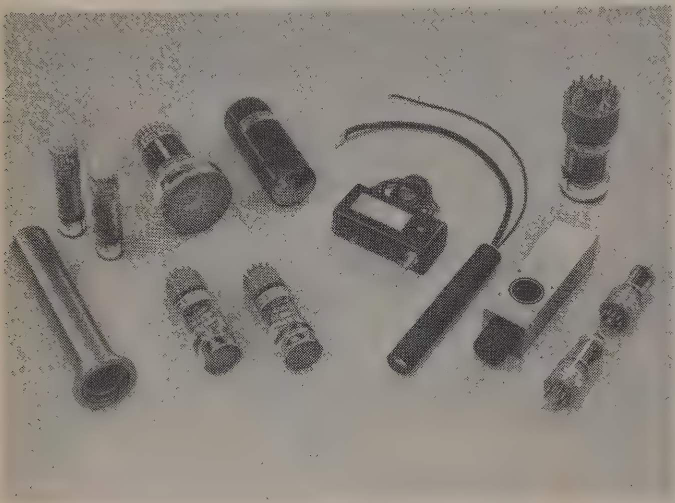
WAYNE TRANSFORMER COMPANY, INC.

99 Hazel Street, Paterson, New Jersey 07503 • (201) 278-7674

THORN EMI

Photomultiplier Tubes and Accessories for OEM Applications

Leading manufacturer of high-quality, reliable PMTs and accessories for industrial and medical applications. Most models available for same-day shipment.



- **R.I.A. INSTRUMENTS**
- **POLLUTION MONITORS**
- **SPECTRUM ANALYZERS**
- **MEDICAL INSTRUMENTATION**
- **PHOTOMETERS**
- **QUALITY CONTROL INSTRUMENTS**
- **SPECTROFLUOROMETERS**
- **GAMMA CAMERAS**
- **T.L.D.**
- **SCINTILLATION COUNTERS**

PARTIAL LISTING*

Tube Type	Diameter (Inches)	Description and/or OEM Application
9826	¾	Small, fast, high-gain. For compact monitors and probes. Can be provided in a 1-inch dia. assembly including voltage divider network and magnetic shield.
9781	1⅛	General-purpose side-window.
9924	1⅛	Low-cost, compact, bialkali. Low-noise, high sensitivity & stability make it particularly useful in R.I.A. and photon counting equipment.
9798	1⅛	Red-sensitive, S-20 version of the 9924, both electrically and mechanically identical. Used in comb. with 9924 in 3-color film scanners and spectrum analyzers.
9943KB	1½	Low-cost, circular focus, low-noise, general-purpose. Especially suited for R.I.A. and scintillation counters.
9902KB	1½	CsSb version of 9903KB.
9903KB	1½	BeCu linear focus version of 9943KB.
9772K	2	Replacement for RCA 6342A.
9849	2	Curved window for liquid scintillation counters.
9956	2	General-purpose. Particularly suited for scintillation applications.
9758	3	For general scintillation, gamma counting applications.
9858	3	BeCu dynodes and focus for gamma cameras.

ACCESSORIES Model	Description and/or OEM Application
RFI/S-MKII	Housing for all side-window PMTs.
RFI/QL-30F	Housing for ¾-inch and 1-inch diameter PMTs. Facilitates easy field replacement of tubes.
RFI/B-2F	Housing for 2-inch dia. PMTs. Comes in 4 sizes with bayonet lock end-cap.
Dynode Chains	Low-cost, custom-design dynode chains.
MPS-1600	Low-cost, 500-to 1600-volt PMT power supply. Pos. or neg. polarity.
MPS-2000	Compact 0-to 2000-volt PMT power supply. Pos. or neg. polarity, with 2 voltage input options.
HM Series	Modular PMT power supplies for applications requiring up to 5000 volts output.
C-10/AD-100	Low-cost photon counter with 4 output modes, including computer interface and 8-digit L.E.D. Perfect for interfacing with photometers, fluorometers, etc.
Plastic Scintillator	The complete range of Nuclear Enterprise organic plastic scintillators can be supplied coupled to the PMT of your choice, or as a separate item.
PMT Assemblies	PMT/dynode chain/power supply assemblies. Supplied completely potted with magnetic shield, tested to customer specs. Perfect for instruments requiring field replacements.

* Send for complete catalog.

THORN EMI

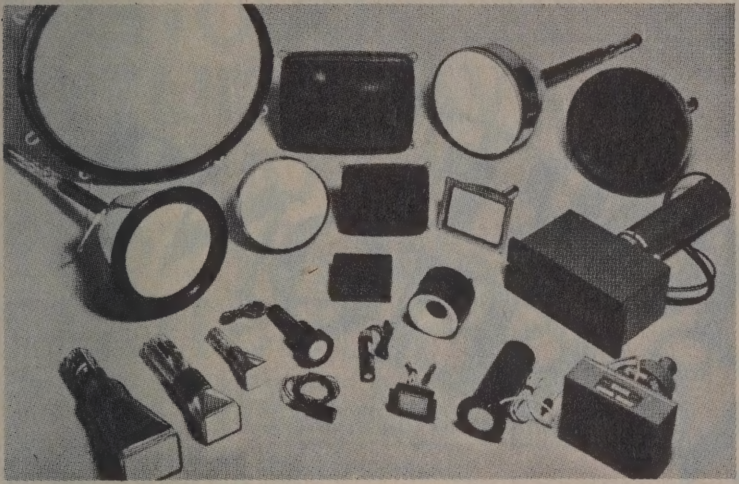
THORN EMI Gencom Inc.

23 Madison Road, Fairfield, New Jersey 07006 • 516 433-5900

THORN EMI

Brimar High-Technology CRTs and Wound Components

THORN EMI Brimar is Britain's largest manufacturer of high-quality CRTs for every kind of information display and instrumentation.



- **INDUSTRIAL**—Oscilloscopes; Waveform Monitors; NDT Instruments
- **AVIONICS**—Color Penetration; Plasma Matrix Displays; Head-Up and Head-Down Displays; Helmet Mounted Displays
- **RADAR**
- **COMPUTERS**—CAD/CAM
- **PHOTOTYPESETTING**
- **MILITARY**—Tank Sights; Ruggedized Monitors
- **PROJECTION SYSTEMS AND SIMULATORS**

PARTIAL LISTING*

Selected Types	Description and / or Application	Diag. (In.)	Face Shape	Minimum Useful Screen Area (Inches)
INSTRUMENT TUBES				
D7-200	Low-cost, general-purpose, CRT for small oscilloscopes and wave form monitors.	3	▬	2x1.6
D7-201	Similar to D7-200, with low-power heater for portable instrumentation.	3	▬	2x1.6
D7-231	Similar to D7-201, with flat faceplate.	3	▬	2x1.6
MONITOR / DATA DISPLAY TUBES				
M17-10	7″ diag., 70°, general-purpose monitor CRT.	7	▬	5.2x3.9
M17-15	Similar to M17-10, with laminated faceplate and mounting frame.	7	▬	5.2x3.9
M19-100	7.5″ diag., 70°, general-purpose monitor CRT.	7.5	▬	5.7x4.5
M19-101	Similar to M19-100, with laminated faceplate.	7.5	▬	5.7x4.5
M19-110	Ruggedized version of M19-101, with 1000-line data display.	7.5	▬	5.7x4.5
M23-113	9″ diag., 90°, 1000-line data display CRT with mounting lugs, laminated faceplate and A-R coating.	9	▬	7.2x5.5
M23-130	Similar to M23-113, with implosion protection, green filter, and 2000-line resolution.	9	▬	7.2x5.5
M24-120	9.5″ diag., 90°, 2000-line monitor with rimguard.	9.5	▬	7.6x5.7
M28-132	11″ diag., 90°, 2000-line monitor with laminated faceplate, A-R coating and rimguard.	11	▬	9x6.7
M31-191	12″ diag., 90°, 1000-line monitor with laminated faceplate, A-R coating and mounting lugs.	12	▬	10x7.7
M38-101	15″ diag., 90°, 6000-character data display tube.	15	▬	12.1x9
M38-341	15″ diag., 110°, high resolution, 8000-line, data display tube with laminated faceplate.	15	▬	12.1x9
M50-120	20″ diag., 110° monitor tube with rimguard and mounting lugs.	20	▬	15.5x12.1
AVIONIC DISPLAYS				
02B / 97	HUD CRT package with shield and yoke. Features high resolution and high-brightness.	1	●	0.8
02D/50410	Helmet-mounted display CRT package with very high resolution and brightness.	1	●	0.8
06A/1049	2.5″ dia., high-resolution / high-brightness HUD.	2.5	●	1.85
DE 2025	HUD CRT package with shield and coil.	2.5	●	1.85
Plasma Matrix	Up to 15 rows x 22 characters, high-brightness, rugged, wide angle viewing, low power d.c. Also graphics display.		▬	

Selected Types	Description and / or Application	Diag. (In.)	Face Shape	Minimum Useful Screen Area (Inches)
MILITARY DISPLAYS				
02B/1221	For spot injection / thermal imaging applications including tank sights. High-brightness / high-resolution, rugged CRT package with shield and coil.	1	●	0.8
02F/1101	Similar to 02B/1221 with fiber optic faceplate.	1.	●	0.8
03C/50408	Electrostatic deflection and focus. High-resolution / high-brightness package for spot injection / thermal imaging.	1	●	0.8
06C/1091	Compact, rugged CRT package for military vehicle displays where resolution is critical.	2.75	●	0.8
PHOTOTYPESETTING				
02B/50482	High-resolution / light-output package.	1	●	0.8
06B/127	High-resolution and brightness package.	2	●	1.6
13G/75	Ultra-high resolution (0.0008″ spot size).	5	●	4.1
DE 2058	Package with fiber optic faceplate.	10	▬	8x1.34
SIMULATION / PROJECTION SYSTEMS				
03B/1198	High-brightness / resolution, compact CRT package.	1.2	●	1.2
09K/1034	High-brightness / resolution CRT package.	3.7	●	3.2
06D/130	Schmidt optics, forced-air cooled.	2.5	●	2.25
13I/00	Schmidt optics, forced-air cooled.	5	●	4.7
DEFLECTION YOKES / FOCUS COILS				
DY-100 Series	Suitable for high-speed random access and precision displays 37mm neck, 52°C deflection.			
DY-310 Series	For airborne displays, 28mm neck, 70°C deflection, inductance 20uH to 24mH.			
DY-330 Series	For airborne displays, 23mm neck, 70°C deflection, inductance 22uH to 10mH.			
DY-360 Series	For airborne displays, 23mm neck, 52°C deflection, inductance 45uH to 3.2mH.			
DY-380 Series	For computer displays, 28mm neck, 90°/110° deflection, inductance 56uH to 24mH.			
DY-600 Series	Designed for the highest precision system. 37mm neck, 40° deflection.			
FC52	Focus coil for 23mm neck CRT, 350mA/31 ohm main focus.			
FC55, FC58	Focus coils for 37mm neck CRT, 450mA/27 ohm main focus, with dynamic focus.			
FC-61	Astigmatisim correction coil for FC-59 focus coil.			
MICROSPOT ANALYZER				
MA-100	Microspot analyzer for precision CRT testing.			

***Send for complete catalog.**

THORN EMI

THORN EMI Gencom Inc.

23 Madison Road, Fairfield, New Jersey 07006 • 516 433-5900

NEED MORE INFORMATION?

USE ONE OF THE NEW

EEMEDIATE ACTION CARDS

INSIDE THE BACK COVER OF VOLUMES 1A, 1B & 2

SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?

CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?
AVAILABILITY?
LOCAL SOURCE?
MIL SPECS?
CUSTOM?
COMPATIBILITY?
SPECS?
DRAWINGS?
LIFE TEST?
QUOTES?

EEMEDIATE ACTION CARDS

Use one of these cards to request more information about something you have seen in EEM. Fill out the card completely and, PLEASE!, print everything. Give the computer operator a break.

EEM will forward the card to the appropriate manufacturer and send you a replacement card.

EEMEDIATE ACTION CARD.....Use this card for more data!

From: (Your Name) ____________________
Title ____________________
Company ____________________
Div. of ____________________
Address ____________________ Mail stop ____________
City ____________________ State ____________ Zip ____________
Phone: Area code (________) ________-____________ Exten. ____________
I need more information about:
Mfr. ____________________ EEM Pg. ____________
Here's what I need ____________________
____
____
____

EEMEDIATE ACTION CARDS

Use one of these cards to request more information about something you have seen in EEM. Fill out the card completely and, PLEASE!, print everything. Give the computer operator a break.

EEM will forward the card to the appropriate manufacturer and send you a replacement card.

EEMEDIATE ACTION CARD.....Use this card for more data!

From: (Your Name) ____________________
Title ____________________
Company ____________________
Div. of ____________________
Address ____________________ Mail stop ____________
City ____________________ State ____________ Zip ____________
Phone: Area code (________) ________-____________ Exten. ____________
I need more information about:
Mfr. ____________________ EEM Pg. ____________
Here's what I need ____________________
____
____
____

EEMEDIATE ACTION CARDS

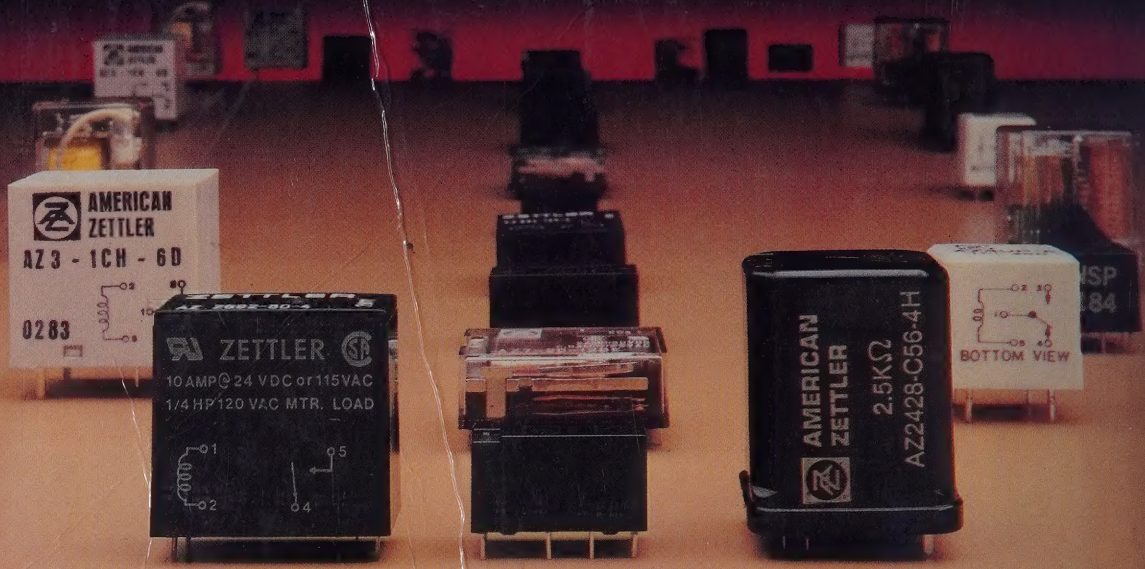
Use one of these cards to request more information about something you have seen in EEM. Fill out the card completely and, PLEASE!, print everything. Give the computer operator a break.

EEM will forward the card to the appropriate manufacturer and send you a replacement card.

EEMEDIATE ACTION CARD.....Use this card for more data!

From: (Your Name) ____________________
Title ____________________
Company ____________________
Div. of ____________________
Address ____________________ Mail stop ____________
City ____________________ State ____________ Zip ____________
Phone: Area code (________) ________-____________ Exten. ____________
I need more information about:
Mfr. ____________________ EEM Pg. ____________
Here's what I need ____________________
____
____
____

RELAYS FROM "A-Z"



MINIATURE POWER RELAYS LOW PROFILE RELAYS GENERAL PURPOSE RELAYS

American Zettler's broad line of quality relays makes it easy to find the relay that meets your specific needs. We've got the types, package styles, power ratings and sensitivities for your most demanding applications.

All types of American Zettler relays are available in Sealpak® epoxy-sealed versions. We lead the field in sealed relays—more than half of our total production consists of these tough, process-proof units.

General Purpose Relays for Many Applications
These versatile relays feature dry circuit to high current switching in many contact configurations, with coil sensitivity down to 40mW. A multitude of mounting options, including sockets are available.

Miniature Power Relays for High Current, Low Cost Switching
Capable of switching up to 10 Amp @ 120 VAC with only 100mW coil power, these compact relays are ideal for motor controllers and other high-power applications. Some types are designed to meet European Codes such as 4000 VRMS coil to contact. They're available with up to 4 PDT with a variety of terminations and sockets. When board space is at a premium, choose a compact, narrow Slimpak™ version.

Low Profile Relays for PC Board Applications
With a seated height of less than one-half inch, these Thinpak® relays are ideal for use where space is a consideration. They mount directly on PC boards and feature contact load up to 10 Amp @ 120 VAC. For telecommunications applications we offer models with bifurcated contacts and FCC 1500V surge (part 68) versions.

Find out more
To get complete information on the full line of American Zettler relays and receive a free copy of our "Relay Selection Guide," call Dave White toll-free at **(800) 854-8474.** In California call **(714) 660-1670.** Or write American Zettler, 16881 Hale Avenue, Irvine, California 92714.

AMERICAN ZETTLER, INC.

SEE OUR PAGES IN VOLUME 1B (1B•1520 THROUGH 1B•1530)